FINAL

Baseline Monitoring Document and As-Built Baseline Report

Browns Summit Creek Restoration Project

Guilford County, North Carolina

DMS Project ID No. 96313, DEQ Contract No. 5792

Permits: SAW-2014-01642, DWR#14-0332

Cape Fear River Basin: 03030002-010020

Submitted to/Prepared for:

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

Data Collection Period: February - March 2017

Submission Date: November 2017

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Michael Baker
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September 15, 2017

Jeff Schaffer
NCDENR, Division of Mitigation Services
1652 Mail Service Center
Raleigh, NC 27699-1652

Subject: Response to Task 6 Draft As-Built Baseline Report Comments dated August 28, 2017
Browns Summit Creek Mitigation Project, Guilford County
Cape Fear Cataloging Unit 03030002
USACE AID SAW 2014-01642, CMS Project #96313

Dear Mr. Schaffer:

Please find enclosed our responses to the As-Built Baseline Report Comments dated August 28, 2017 in reference to the Browns Summit As-Built Baseline Report. We have revised the As-Built Baseline Report document in response to this review.

1. Digital data/drawings: Ensure all digital data/drawings are provided in accordance with Format, Data Requirements, and Content Guidance for Electronic Drawings Submitted to EEP version 1.0 (03/27/08) as required by contract.
a. Endure all CADD and GIS files are correctly georeferenced using the state plane coordinates system (NAD 83).
b. While not required, DMS would prefer to receive shapefiles for all features listed in the above referenced guidance.
Response: Digital data/draws will be submitted as requested.

2. Section 1.0, page 1-1: The numbers provided for the linear footage of restored and enhanced stream and the acreage of restored wetlands match the mitigation plan, but not those in Table 1 of this document. Determine which are the correct numbers and use them.
Response: Numbers referenced have been revised to match the table and As-Built Plan set.

3. Section 1.3, page 1-2: In first sentence, delete "proposed" since these have been restored. Instances of this issue are seen multiple times throughout the document and should be updated.
Response: "Proposed" language has been removed from the document.

4. Section 1.4, page 1-2: In first sentence, it is assumed Baker intended this to read "mitigating factors" versus "mitigation factors".
Response: Revised.

5. Section 3.2.1, page 3-3: In next to last sentence provide wetland types that were rehabilitated. (i.e. Wetland Type 1, 2, 3, etc.).
Response: Additional text added per request.

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6. Section 3.2.1, page 3-3: Clarify whether the replacement of the culvert at downstream end of Reach R1 is considered a geomorphic upgrade. If so please emphasize the improvement.
Response: Additional text added per request.

7. Section 3.2.1, pages 3-2 to 3-5: In each reach section, list the linear footage for each channel/valley.
Response: Lengths have been added as requested.

8. Section 3.2.11, page 3-6: List the total wetland acreage restored.
Response: Acerage has been added as requested.

9. Section 3.2.2, page 3-3: In first sentence of last paragraph, provide wetland types that were re-established. (i.e. Wetland Type 1, 2, 3, etc.).
Response: Additional text added per request.

10. Section 3.2.3, page 3-4: in the last paragraph, provide statement about whether or not any of the jurisdictional wetlands will be used for credit.
Response: Additional text added per request.

11. Section 3.2.6, page 3-4: Baker needs to ensure it is perfectly clear that this "BMP" feature is not a true stormwater BMP but was installed to treat water before entering the mainstem of the stream and that it is anticipated the feature will morph into a headwater wetland and that NO maintenance will be done on this except as stated in the mitigation plan. See section 9.4 in the mitigation plan.
Response: Additional text added to the next to last paragraph discussing naturalization and no maintenance after stabilization.

12. Section 3.2.10, page 3-5: Again, Baker needs to ensure it is perfectly clear that this "BMP" feature is not a true stormwater BMP but was installed to treat water before entering the mainstem of the stream and that it is anticipated the feature will morph into a headwater wetland and that NO maintenance will be done on this except as stated in the mitigation plan. See section 9.4 in the mitigation plan.
Response: Additional text added to the paragraph regarding no maintenance following monitoring.

13. Section 3.2.11, page 3-6: Provide wetland types that were rehabilitated and re-established. (i.e. Wetland Type 1, 2, 3, etc.)
Response: Additional text added to 3.2.11 describing the wetland types and locations.

14. Section 4.1.1, page 4-1: Indicate the elevation at which the gage first starts recording. Verify that it is set sufficiently low enough that it captures the bankfull stage or indicate if it is the recording elevation some distance above bankfull.
Response: Added text describing the gage being set at bankfull elevation.

15. Section 4.1.2, page 4-1: In the second paragraph, R4 is referred to as an intermittent reach. Verify that this is the correct reach for this statement.
Response: Removed the word intermittent from the text, but yes part of R4 was called as intermittent. R4, T1 and T3 are the correct reaches to be monitored.

16. Appendix A, Table 1:
a. Overall, Baker needs to explain the differences between linear footage and SMUs between Mitigation Plan and As-Built. Provide information on how were stream lengths measured (centerline or thalweg). DMS will need a memo/letter detailing the reasons for each change.

Response: Lengths have been revised and verified with As Built Plans. A memorandum is included to address changes in SMUs and WMUs.

b. In the Mitigation Credits section of Table 1, provide the Riparian Wetland credits.
Response: Revised per request.

c. In the Mitigation Credits section of Table 1, when totaling the credits assigned to each reach in the table, DMS came up with 5,234 SMU and not 5,728 SMU as shown.
Response: Lengths have been revised and verified with As Built Plans.

d. In addition, the total SMUs determined by DMS is 266 SMU below the contracted amount of 5,500 SMUs. Unless Baker can prove that assets are at or above contracted amount, the contract value would need to be reduced $89,110.00 based on the shortfall of SMUs. To reconcile the difference resulting from the 266 SMU shortfall, please adjust the Task 6 payment downward to a revised amount of $132,917.50. The remaining future milestone invoice amounts will be revised as shown in the table below.
Response: Lengths have been revised and verified with As Built Plans. Michael Baker is providing 5,323 of the 5,500 SMUs and all of the WMUs. The contract should be reduced by $59,268.42. Please let me know how you would like for the payment table to be adjusted.

17. Appendix A, Table 4:
a. Explain why no reach summary information is provided for reaches T1, T2, T3 and T4.
Response: The table repeats starting at Parameters (it is actually in bold, but it is still a little difficult to see), so there is a section for Reach R1 through Reach R5 and a section below for Reach R6 through Reach T4.

b. The reach lengths for R1, R2, R3, R4 and R5 are from the mitigation plan and do not reflect the as-built length as determined from information in Table 1.
Response: Revised.

18. Appendix B, Cross-Section 3: The graph appears to be from Cross-Section 1.
Response: Revised.

19. Appendix D, Sheet 18: This sheet appears to be a duplicate of Sheet 17.
Response: Removed.

20. Appendix E, Photo Log: Label the Reach 6 photos as BMPs.
Response: Added "BMP" or "Step Pools" to Reach 6 photos.

If you have any questions concerning the As-Built Baseline Report, please contact me at 919-805-1750 or via email at Katie.McKeithan@mbakerintl.com.

Sincerely,

Kathleen McKeithan

Kathleen McKeithan, PE, CPESC, CPSWQ, CFM

Michael Baker Engineering, Inc.

Michael Baker
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Innovation Done Right...We Make a Difference

November 30, 2017

Jeff Schaffer
NCDENR, Division of Mitigation Services
1652 Mail Service Center
Raleigh, NC 27699-1652

Subject: Response to Task 6 Draft As-Built Baseline Report Comments dated October 31, 2017
Browns Summit Creek Mitigation Project, Guilford County
Cape Fear Cataloging Unit 03030002
USACE AID SAW 2014-01642, CMS Project #96313

Dear Mr. Schaffer:

Please find enclosed our responses to the As-Built Baseline Report Comments dated August 28, 2017 in reference to the Browns Summit As-Built Baseline Report. We have revised the As-Built Baseline Report document in response to this review.

1. Digital files - The digital data and drawings have been reviewed by DMS and appear to meet DMS requirements, therefore when resubmitting the electronic files just resubmit any needing revision based on the comments contained in this letter.
Response: The digital submittal has been revised per comments below and provided in the same format as previously submitted.

2. Section 1.0, 1st and 3rd sentences of paragraph 1: delete "stormwater". It is DMS's opinion that referring to these features as "stormwater" BMPs gives the IRT the wrong impression of what these are intended to be functionally.
Response: "Stormwater" has been removed from both places as requested. Also removed from 4.4's first sentence, "This project includes the implementation of two stormwater BMPs" and second sentence, "The Stormwater BMPs success…"

3. Section 1.1, 5th objective: same comment and #2 above.
Response: "Stormwater" has been removed from 5th objective under 1.1.

4. Section 2.2, 5th objective: same comment and #2 above.
Response: "Stormwater" has been removed from 5th objective under 2.2.

5. Section 3.2.10, 1st sentence of paragraph 1: same comment and #2 above.
Response: "Stormwater" has been removed from 3.2.10's first sentence.

6. Appendix A, Table 1:
a. During review, the DMS project manager noticed that stream footage and/or credits changed from the first draft of the as-built baseline document and the revised submittal. DMS PM called Baker PM for an explanation

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and was told that the Baker PM was not satisfied with the initial survey and had a new one done. Please explain why this new survey was not done prior to submittal of the first draft.

Response: We provided the topographical survey we had at the time. It was discovered later that there was missing topographic data and breaklines in the survey provided by Riverworks and their subconsultant surveyor. Additional data was collected and has been provided in the subsequent submittal to ensure that the sheets reflect the as-built condition.

b. Overall, Baker needs to provide specific and detailed explanations of the differences between linear footage and SMUs between Mitigation Plan and As-Built. Provide specific information on how the stream lengths were measured (centerline or thalweg). DMS will need a memo/letter listing each change along with the **detailed** explanation for each change.

Response: See Appendix F for the Baseline Report.

c. SMUs for Reach R3 (downstream) (234.667) should round up to 235, which would then equal the mitigation plan numbers for this reach. This change would also increase the total SMUs to 5,324.

Response: The final Mitigation Plan dated January 2016 had 234 SMUs for R3 in Table ES.1 and Table 5.1, so I have left the table at 234 SMUs.

d. Wetland area and credits for Wetland Types 1, 2, 3 and 4 all decreased from mitigation plan to version 2 of the Draft As-Built Baseline report. Please explain the reason behind these changes in the revised Task 6 deliverable as well as in the memo/letter requested in 6.a. above. Typically, these numbers do not change.

Response: The wetland existing acreage and restoration acreage columns were switched in the Mitigation Plan which was carried into the draft submittal. The columns have been corrected.

e. The total linear footage for Reaches R6 and T4 is 559 lf making the total lf for Enhancement I 1,528 (969+559). Make this change to the Enhancement I line in the component summation.

Response: Enhancement I summation has been added to the table per the revised table (R6 + T4 = 442 + 117 = 559 & R2 upstream + R3 downstream 614 + 352 = 966 for a total of 559 + 966 = 1,525).

f. Based on recent discussions between the IRT and DMS regarding credit release for instrument projects, if the provider desires to change the credit from mitigation plan to as-built, the provider must submit a written request to modify the mitigation plan to include any revisions to figures, drawings and narrative. See attached memo from Todd Tugwell.

Response: Andrea Hughes (Mitigation Project Manager with the Wilmington District Regulatory Division) has been notified by personal conversation with Jake Byers and by letter dated November 2, 2017 Subject: Credit Revisions (Mitigation Plan Vs. As-built) carbon copied to your attention.

g. In addition, the total SMUs determined by DMS is 176 SMU below the contracted amount of 5,500 SMUs. Unless Baker can prove that assets are at or above contracted amount, the contract value would need to be reduced $58,960.00 from $1,997,500.00 to $1,938,540.00 based on the shortfall of SMUs. To reconcile the overpayment for Task 1 through 5 resulting from the 176 SMU shortfall, please adjust the Task 6 payment downward to a revised amount of $155,530.00. The remaining future milestone invoice amounts will be revised as shown in the table below.

Browns Summit #96313						
Revised Payment Schedule based on 176 SMU Shortfall of Below Contracted Amt						
			SMU Shortfall	Unit Cost	Contract Redux	
			176	$335.00	$58,960.00	
Task	Deliverable	Payment	Original Contract $1,997,500.00	Revised Contract $1,938,540.00	Overage	Proposed Schedule
1	Cat Ex	5%	$99,875.00	$96,927.00	$2,948.00	$99,875.00
2	Cons Ease	20%	$399,500.00	$387,708.00	$11,792.00	$399,500.00
3	Mit Plan	15%	$299,625.00	$290,781.00	$8,844.00	$299,625.00
4	Grading	15%	$299,625.00	$290,781.00	$8,844.00	$299,625.00
5	Planting	10%	$199,750.00	$193,854.00	$5,896.00	$199,750.00
sub-Total (tasks 1-5)			$1,298,375.00	$1,260,051.00	$38,324.00	$1,298,375.00
6	Baseline	10%	$199,750.00	$193,854.00		$155,530.00
7	MY 1	5%	$99,875.00	$96,927.00		$96,927.00
8	MY 2	2%	$39,950.00	$38,770.80		$38,770.80
9	MY 3	2%	$39,950.00	$38,770.80		$38,770.80
10	MY 4	2%	$39,950.00	$38,770.80		$38,770.80
11	MY 5	2%	$39,950.00	$38,770.80		$38,770.80
12	MY 6	2%	$39,950.00	$38,770.80		$38,770.80
13	MY 7	10%	$199,750.00	$193,854.00		$193,854.00
sub-Total (tasks 7-13)			$699,125.00	$678,489.00		$640,165.00
Total			$1,997,500.00	$1,938,540.00		$1,938,540.00

Response: Per Jake Byers's conversation with you and Andrea, the credits have been revised to provide 5,299 SMUs, thus there will be a 201 SMU shortfall. The Baseline report should be billed by the following table (utilized the same logic you have proposed above, just changed the SMU shortfall to 201):

Browns Summit #96313						
Revised Payment Schedule based on SMU shortfall						
			SMU Shortfall	Unit Cost	contract redux	
			201	335	$67,335.00	
Task	Deliverable	Payment	Orginal Contract	Revised Contract	Overage	Proposed Schedule
			$1,997,500.00	$1,930,165.00		
1	Cat Ex	5%	$ 99,875.00	$ 96,508.25	$ 3,366.75	$ 99,875.00
2	Cons Ease	20%	$ 399,500.00	$ 386,033.00	$13,467.00	$ 399,500.00
3	Mit Plan	15%	$ 299,625.00	$ 289,524.75	$10,100.25	$ 299,625.00
4	Grading	15%	$ 299,625.00	$ 289,524.75	$10,100.25	$ 299,625.00
5	Planting	10%	$ 199,750.00	$ 193,016.50	$ 6,733.50	$ 199,750.00
sub-total			$1,298,375.00	$1,254,607.25	$43,767.75	$ 1,298,375.00
6	Baseline	10%	$ 199,750.00	$ 193,016.50	$ 6,733.50	$ 149,248.75
7	MY 1	5%	$ 99,875.00	$ 96,508.25	$ 3,366.75	$ 96,508.25
8	MY 2	2%	$ 39,950.00	$ 38,603.30	$ 1,346.70	$ 38,603.30
9	MY 3	2%	$ 39,950.00	$ 38,603.30	$ 1,346.70	$ 38,603.30
10	MY 4	2%	$ 39,950.00	$ 38,603.30	$ 1,346.70	$ 38,603.30
11	MY 5	2%	$ 39,950.00	$ 38,603.30	$ 1,346.70	$ 38,603.30
12	MY 6	2%	$ 39,950.00	$ 38,603.30	$ 1,346.70	$ 38,603.30
13	MY 7	10%	$ 199,750.00	$ 193,016.50	$ 6,733.50	$ 193,016.50
Total						$ 1,930,165.00

7. Appendix A, Table 4: The reach lengths for R1, R2, R3, T2 and T3 are from the mitigation plan and do not reflect the as-built length as determined from information in Table 1.
Response: Table 4 has been revised.

8. Appendix C, Table 8: Total stem counts for each plot have been provided but not the breakdown by species. Please provide species breakdown per plot.
Response:
Per Jeff Schaffer's conversation with Jake Byers, a detailed breakdown will be provided in MY1 as seedlings were not leaf bearing at the time of inspection.

9. Appendix D:
a. Record/Red Line Drawings: Given that there have been changes to the project during construction, please explain why there are no red mark-ups. Also, the broken out Red Line drawings in the "Support Files" are not signed and sealed and do not have red mark-ups either.
Response: Color copies of the sealed As-Builts are included within the submittal (see page 10 for redlines). Sealed surveys and Redlines (in color) are provided in the Support Files.

b. As-Built Survey: Must be signed and sealed by Professional Land Surveyor.
Response: Sealed survey is provided.

10. Appendix E, Photo Log: Label the Reach 6 photos as BMPs.
Response: Photos have been re-labeled per request.

11. Credit Revision Memo, Table 1
a. Provide more specific explanations for each revision.
Response: Memo has been revised and followed up with additional correspondence with Andrea Hughes. See Appendix F of the Baseline Report.

b. The mitigation plan acreage is not the same as what was in the asset table of the final mitigation plan. Provide a detailed explanation of changes. (i.e. the existing acreage and restoration acreage in Table 5.1 in the mitigation plan were reversed).
Response: The restoration acreage and existing acreage in the Mitigation Plan's Table 5.1 were indeed reversed. The As-Built numbers match the (reversed) numbers. No changes were made to the WMUs.

If you have any questions concerning the As-Built Baseline Report, please contact me at 919-805-1750 or via email at Katie.McKeithan@mbakerintl.com.

Sincerely,

Kathleen McKeithan

Kathleen McKeithan, PE, CPESC, CPSWQ, CFM

Michael Baker Engineering, Inc.

Final

Baseline Monitoring Document and As-Built Baseline Report
Browns Summit Creek Restoration Project

Guilford County, North Carolina
DMS Project ID No. 96313, DEQ Contract No. 5792
Permits: SAW-2014-01642, DWR#14-0332
Cape Fear River Basin: 03030002-010020

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Prepared by:

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

1.0 EXECUTIVE SUMMARY

Michael Baker Engineering, Inc. (Baker) restored approximately 3,923 linear feet (LF) of jurisdictional stream and enhanced 2,484 LF of stream (of which 559 is for Best Management Practices (BMPs)) along unnamed tributaries (UT) to the Haw River (existing channel lengths) and restored over 4.44 acres of wetland. The unnamed tributary (mainstem) has been referred to as Browns Summit Creek for this project. In addition, Baker constructed two BMPs within the conservation easement boundary. The Browns Summit Creek Restoration Project (project) is located in Guilford County, North Carolina (NC) (Figure 1) approximately three miles northwest of the Community of Browns Summit. The project is located in the NC Division of Water Resources (NCDWR) subbasin 03-06-01 and the NC Division of Mitigation Services (NCDMS) Targeted Local Watershed (TLW) 03030002-010020 (the Haw River Headwaters) of the Cape Fear River Basin. The purpose of the project is to restore and/or enhance the degraded stream, wetland, and riparian buffer functions within the site. A recorded conservation easement consisting of 20.24 acres (Figure 2) will protect all stream reaches, wetlands, and riparian buffers in perpetuity. Examination of the available hydrology and soil data indicate the project will potentially provide numerous water quality and ecological benefits within the Haw River watershed, and the Cape Fear River Basin.

Based on the NCDMS 2009 Cape Fear River Basin Restoration Priority (RBRP) Plan, the Browns Summit Creek Restoration Project area is located in an existing targeted local watershed (TLW) within the Cape Fear River Basin (2009 Cape Fear RBRP), but is not located in a Local Watershed Planning (LWP) area. The restoration strategy for the Cape Fear River Basin targets specific projects, which focuses on developing creative strategies for improving water quality flowing to the Haw River in order to reduce non-point source (NPS) pollution to Jordan Lake.

1.1 Goals and Objectives

The primary goals of the project, set in the Mitigation Plan, are to improve ecologic functions and to manage nonpoint source loading to the riparian system as described in the NCDMS 2009 Cape Fear RBRP. These goals are identified below:

- Create geomorphically stable conditions along the unnamed tributaries across the site,
- Implement agricultural BMPs to reduce nonpoint source inputs to receiving waters,
- Address known and obvious water quality and habitat stressors present on site,
- Restore stream and floodplain connectivity, and
- Restore and protect riparian buffer functions and corridor habitat.

To accomplish these goals, the following objectives were identified:

- Restore existing incised, eroding, and channelized streams by creating stable dimension and connecting them to their relic floodplains;
- Re-establish and rehabilitate site wetlands that have been impacted by cattle, spoil pile disposal, channelization, subsequent channel incision, and wetland vegetation loss;
- Prevent cattle from accessing the conservation easement boundary by installing permanent fencing and thus reduce excessive stream bank erosion and undesired nutrient inputs;
- Increase aquatic habitat value by improving bedform diversity, riffle substrate and in-stream cover; creating natural scour pools; adding woody debris and reducing sediment loading from accelerated stream bank erosion;

- Construct a wetland BMP on the upstream extent of Reach R6 to capture and retain run-off from adjacent cattle pastures to allow for the biological removal of nutrient pollutant loads and for sediment to settle out of the water column;
- Construct a step pool BMP channel to capture and disperse stormwater volumes and velocities by allowing stormwater discharge from a low density residential development to spread across the floodplain of Reach R4; thereby, diffusing energies and promoting nutrient uptake within the riparian buffer;
- Plant native species within the riparian corridor to increase stormwater runoff filtering capacity, improve stream bank stability and riparian habitat connectivity, and shade the stream to decrease water temperature;
- Control invasive species vegetation within the project area and, if necessary, continue treatments during the monitoring period; and
- Establish a conservation easement to protect the project area in perpetuity.

1.2 Overall Restoration Approach Versus As-Built

The As-Built follows the overall restoration approach presented in the approved Final Stream and Wetland Mitigation Plan. No major alignment changes were made during construction. Due to significant storm events throughout the construction period, several constructed riffles were added to the mainstem.

Discrepancies between the approved Mitigation Plan's footages and the As-Built survived footages have been documented and approved by the USACE. R1 will provide 1,290 credits (57 additional credits from approved Mitigation Plan) and R2 downstream will provide 54 credits (22 less credits than the approved Mitigation Plan). See Appendix F for correspondence.

1.3 Monitoring Duration

Geomorphic monitoring of the restoration reaches will be conducted once a year for five to seven years following the completion of construction to evaluate the effectiveness of the restoration practices. Two bankfull flow events must be documented within the seven-year monitoring period. The two bankfull events must occur in separate years; otherwise, the monitoring will continue until two bankfull events have been documented in separate years. If a normal year of precipitation does not occur during the first seven years of monitoring, flow conditions will continue to be monitored on the site until it documents that the intermittent streams have been flowing during the appropriate times of the year. Vegetation plots shall be monitored for seven years in years 1, 2, 3, 5 and 7 or until the final success criteria are achieved. Wetland hydrology will be evaluated during each growing season for seven years of hydrologic monitoring, or until success criteria have been met, whichever occurs later.

1.4 Issues

No issues or mitigating factors have been noted at the site for recording at this time.

This report documents the completion of the restoration and enhancement construction activities and presents as-built monitoring data for the post-construction monitoring period. Table 1 summarizes project conditions before and after restoration and enhancement, as well as the conditions predicted in the previously approved project Mitigation Plan. Table 1 is located in Appendix A.

2.0 PROJECT GOALS, BACKGROUND AND ATTRIBUTES

2.1 Project Location and Setting

The site is located in the NCDWR subbasin 03-06-01 of the Cape Fear River Basin. The site includes an UT to the Haw River (Browns Summit Creek) and several smaller channels connecting to it. Soils information indicates that the area contains primarily Codorus loam, Poplar Forest clay loam, and Clifford sandy loam. The Codorus mapping unit is classified as hydric by the NRCS for Guilford County and contains inclusions of Hatboro loam in the floodplain. Hatboro soils are also classified as hydric by the NRCS. The area of wetland restoration is along the floodplain of Reach R1 and R4. This area had been heavily manipulated and degraded and is mapped as hydric soils, including the Codorus and Hatborosoils as described above.

The project site is located in the Charlotte Belt, which is part of the Charlotte and Milton Group. The project site includes rock from the Churchland Plutonic Suite (Western group) which is intrusive, granitic igneous rock. Observations by field staff in the watershed indicate that the project area has very few bedrock outcrops. It appears to weather to gravel because that is the coarsest particle found in the stream substrate.

Site Directions

The Browns Summit Creek Restoration Project site (site) is located in Guilford County, NC, approximately three miles northwest of the Community of Browns Summit, as shown on the Project Site Vicinity Map (Figure 1). To access the site from Raleigh, take Interstate 40 and head west on I-40 towards Greensboro, for approximately 68 miles. Take the exit ramp to E. Lee Street (exit 224) towards Greensboro and continue for 2 miles before turning onto U.S. Highway 29 North. Once on U.S. Highway 29 North, travel north for approximately 10 miles before exiting and turning on to NC-150 West. Continue west on NC-150 for 5 miles. The project site is located along and between NC-150 and Spearman Road, with access points through residences on Middleland Drive and Broad Ridge Court.

2.2 Project Goals and Objectives

The primary goals of the project are to improve ecologic functions and to manage nonpoint source loading to the riparian system as described in the NCDMS 2009 Cape Fear RBRP. These are identified below:

- Create geomorphically stable conditions along the unnamed tributaries across the site,
- Implement agricultural BMPs to reduce nonpoint source inputs to receiving waters,
- Address known and obvious water quality and habitat stressors present on site,
- Restore stream and floodplain connectivity, and
- Restore and protect riparian buffer functions and corridor habitat.

To accomplish these goals, the following objectives have been identified:

- Restore existing incised, eroding, and channelized streams by creating stable dimension and connecting them to their relic floodplains,
- Re-establish and rehabilitate site wetlands that have been impacted by cattle, spoil pile disposal, channelization, subsequent channel incision, and wetland vegetation loss,
- Prevent cattle from accessing the conservation easement boundary by installing permanent fencing and thus reduce excessive stream bank erosion and undesired nutrient inputs,

- Increase aquatic habitat value by improving bedform diversity, riffle substrate, and in-stream cover, creating natural scour pools, adding woody debris, and reducing sediment loading from accelerated stream bank erosion,
- Construct a wetland BMP on the upstream extent of Reach R6 to capture and retain run-off from adjacent cattle pastures to allow for the biological removal of nutrient pollutant loads and for sediment to settle out of the water column,
- Construct a step pool BMP channel to capture and disperse stormwater volumes and velocities by allowing stormwater discharge from a low density residential development to spread across the floodplain of Reach R4; thereby, diffusing energies and promoting nutrient uptake within the riparian buffer,
- Plant native species within the riparian corridor to increase stormwater runoff filtering capacity, improve stream bank stability and riparian habitat connectivity, and shade the stream to decrease water temperature,
- Control invasive species vegetation within the project area and, if necessary, continue treatments during the monitoring period, and
- Establish a conservation easement to protect the project area in perpetuity.

3.0 PROJECT STRUCTURE, RESTORATION TYPE AND APPROACH

3.1 Project Structure

The project area consists of the restoration and enhancement of UTs to the Haw River, referred to as Brown Summit Creek and UTs. The site is located in the Piedmont physiographic region. For assessment and design purposes, the UTs were divided into individual Reaches (R1, R2, R3, R4, R5, R6, T1, T2, T3 and T4). Native species of riparian buffer vegetation were established and/or protected at least 50 feet from the top of both bank along all project reaches. Lastly, cattle were excluded along all project reaches through permanent fencing outside of the conservation easement. See Appendix A for Table 1 Project Components and Figure 2 for Restoration Summary Map located in Appendix A.

3.2 Restoration Type and Approach

Historically, the Browns Summit site has been utilized for agriculture. Cattle have had direct access to the entire site. Ponds were located throughout the project, including within the alignment of R1, R3, R4, and R6. Channelization was clearly confirmed by the historical aerial photo from 1937 and spoil piles were found along several of the reaches.

3.2.1 Reach R1 Restoration

Priority Level I restoration was constructed for the entire 1,290 LF reach following a natural channel pattern through the valley. The work involved establishing a bank height ratio of 1.0 throughout the reach and stabilizing isolated eroding banks. The restoration approach in this area will promote more frequent over bank flooding into the hydric soils area; thereby, creating increased opportunity for wetland rehabilitation.

The restored channel was constructed off-line as much as possible throughout the existing pasture, and was designed as a Rosgen E type channel. This approach minimized the number of existing trees that had to be removed to construct the project. In-stream structures such as log rollers, log J-hook vanes, grade control log jams, and constructed riffles were installed to control grade, dissipate scour energies, and eliminate the potential for upstream channel incision. Additionally, geolifts with brush toe were incorporated for bank stability and habitat diversity.

The existing, unstable channel was partially to completely filled along its length utilizing suitable fill material excavated from construction of the restored channel.

Riparian buffers in excess of 50 feet were restored and protected along all of Reach R1. In fact, because extra property was required to secure the easement, the riparian buffer averages approximately 100 feet on each bank of Reach R1. No stream crossings or other breaks in the easement are along this reach and permanent fencing was installed to exclude cattle from the entire reach. The culvert below R1 (outside of the easement) was upgraded to provide a stable crossing appropriately sized for the reach. The previous crossing was actively eroding and in the process of failure.

The riparian area along the entire length of Reach R1 provides wetland rehabilitation (type 1, 2 and 3).

The culvert at the downstream end of Reach R1 was replaced with a two corrugated metal pipes.

3.2.2 Reach R2 Enhancement

Due to its partially degraded nature, an Enhancement Level I approach was implemented to provide functional uplift to the 617 LF (614 LF utilized in credit calculation to match Mitigation Plan) upper section of Reach R2 at a 1.5:1 credit ratio. The lower end downstream from the property line was limited to Enhancement Level II at a 2.5:1 credit ratio. In the 134 LF lower segment, improvements

were limited to cattle exclusion and invasive species control. Supplemental buffer planting was not planned in the lower segment because the existing vegetation was satisfactory.

In the upper segment of Reach R2 below the easement break/crossing, a floodplain bench was cut along the left bank to increase the entrenchment ratio to greater than 2.0 and provide flooding to the floodplain. Additionally, two locations in the existing channel have riffles that are oriented up valley; just upstream from this the flow vectors are pointed into vertical streambanks and the stream has nowhere to go without causing significant erosion. The channel was realigned in these two areas to redirect the streamflow down valley and eliminate the vertical eroding banks.

Additionally, the channel was raised to encourage floodplain access. Spoil piles along the right bank of middle Reach R2 were removed, except where mature woody vegetation would be impacted, to reconnect the channel with its floodplain and re-establish wetlands in this area.

This reach section was enhanced through the appropriate use of in-stream structures to control grade, dissipate energies, and eliminate the potential for upstream channel incision. Channel banks were graded to stable slopes, and the historic floodplain connection was reestablished in the vicinity of the spoil piles to further promote stability and re-establishment of riparian vegetation.

Riparian buffers in excess of 50 feet were restored and protected along all of Reach R2. As with Reach R1, the lower 300 feet has riparian buffers that, on average, exceed 100 feet on each bank. Additionally, permanent fencing was installed to exclude cattle. Invasive species, such as Chinese privet, were treated.

Mapped jurisdictional wetlands in the upper Reach R2 floodplain were re-established by removing spoil piles and reconnecting the floodplain (type 4). Additionally, wetland vegetation was improved.

3.2.3 Reach R3 Restoration and Enhancement

Work along Reach R3 involved Priority Level I restoration continuing from Reach R4 to provide floodplain reconnection and long-term channel stability. The upstream section of Reach R3 is 1,104 LF (1,102 LF utilized in credit calculation to match Mitigation Plan). Below the easement break/stream crossing toward the downstream end of Reach R3, an Enhancement Level I approach was implemented, as described above for upper Reach R2. The downstream section of Reach R3 is 352 LF after removing the approximate 60 LF crossing (due to the skew, over 60 LF was removed from the stream alignment/stationing).

Reach R3 begins at the confluence Reaches R4 and T3 just above the former farm pond. The farm pond was removed as part of the channel restoration. Below the pond, larger trees were avoided as much as feasible.

This reach was designed as a Rosgen E type channel with a width-to-depth ratio of 11. The employed techniques allowed restoration of a stable channel form with appropriate bedform diversity, as well as improved channel function through improved aquatic habitat, active floodplain connection, restoration of riparian and terrestrial habitats, exclusion of cattle, and decreased erosion and sediment loss from bank erosion.

An easement break was provided toward the downstream end of Reach R3. The easement break is approximately 60 feet wide to allow for future access to the land west of the stream project, but the culvert crossing is approximately 32 LF.

Below this crossing in the lower segment of Reach R3, a floodplain bench was cut along the left bank to increase the entrenchment ratio to greater than 2.0 and provide an area for bankfull flooding. This removed vertical, eroding streambanks and allowed flood flows to access the floodplain.

Since the primary source of impairment for Reach R3 was direct cattle access and channel incision, wood structures were incorporated into the channel, where appropriate, to promote stable bedform

sequences and habitat diversity. Riparian buffers in excess of 50 feet were restored along all of Reach R3 and cattle are excluded.

Mapped jurisdictional wetlands limited to lower Reach R3 were protected during the construction process. Wetland vegetation was improved in the jurisdictional areas. Additionally, new wetlands may be created along upper Reach R3 by raising the stream bed as part of Priority 1 restoration. Invasive species were treated throughout the site including along Reach R3. These areas are not being utilized for wetland credits.

3.2.4 Reach R4 Restoration

Work along 1,296 LF of Reach R4 involved a Priority Level I Restoration approach. The channel begins just upstream from a former farm pond at the confluence of Reaches R5 and R6. The farm pond along Reach R4 was removed, and the channel bed elevation downstream was raised so that the bank height ratio is 1.0. The failed pond dam was removed to provide a higher functioning floodplain connection. The trees on the east side of the existing channel were preserved to be part of the restored channel buffer.

Below the residential development, Priority Level I restoration continues by meandering through the area with the mature trees. The existing channel was plugged and targeted for vernal pools where runoff concentrates.

A width-to-depth ratio of 13 was utilized for the entire reach, which will reduce shear stress by providing shallower bankfull depths to compensate for steeper valley slopes. The C channel meanders through the available floodplain.

Cattle were excluded from all of Reach R4 and riparian buffers of at least 50 feet were established. No channel crossings are on Reach R4. Invasive species were treated.

3.2.5 Reach R5 Enhancement

Work along 536 LF of Reach R5 involved Enhancement Level II practices to maintain stability of the channel. The existing channel was incised but bank erosion was isolated and limited. Consequently, Baker installed grade control structures, planted a riparian buffer, and permanently excluded livestock. The spring at the head of the reach is incorporated in the project area.

Livestock were excluded and the buffer was planted. The riparian buffer is 50 feet wide or greater. Invasive species control was implemented.

3.2.6 Reach R6 BMP Enhancement

Work along Reach R6 involved an Enhancement Level I/non-traditional BMP approach to remove an existing non-jurisdiction farm pond and re-establish and stabilize the eroding channel below it. The pond was converted to a constructed headwater wetland feature with a low-maintenance, stone weir outlet. The wetland was designed following the NCDWR BMP manual with the exception of the outlet, due to the low/no maintenance requirement (maintenance only within monitoring period as detailed in the Mitigation Plan). Thus, it features diverse topography and vegetation, as well as a forebay and pools. The channel leading into and out of the wetland features step pools. The upstream segment incorporates bench features where even small storm flows will interact with the floodplain, thereby dissipating energy.

The constructed wetland was designed to detain discharge quantities from the 1-inch rainfall event. A natural stone weir was designed to slowly release discharges over a 48 hour period thereby reducing downstream discharge velocities. The extended draw down time will also allow for sediments to settle out of the water column and for the uptake of nutrients from wetland plantings. The constructed wetland was designed to meet stormwater pollutant removal rates using the design parameters outlined in the NCDENR BMP Manual. Design elements for the constructed wetland included the following

wetland zones: deep pools, non-forebay, forebay, shallow water (low marsh), shallow land (high marsh), and upland.

The conservation easement and buffer plantings were extended approximately 15 - 30 feet beyond the footprint of the BMP to allow the buffer vegetation to act as pre-treatment feature for runoff entering the BMP. All areas within the conservation easement were planted. The non-traditional BMP is intended to naturalize into a wetland feature treating water off the fields through its buffer and varying topography features hosting wetland plants and providing shallow and deep areas. No maintenance is anticipated following the monitoring described within the Mitigation Plan and this document.

A 1.5:1 credit ratio for the valley length will be utilized for this BMP feature. The valley length is 442 LF.

3.2.7 Reach T1 Restoration

Work on 145 LF of Reach T1 involved a Priority Level I restoration approach. Priority Level II restoration was only needed for a short distance to transition/raise the streambed to a Priority Level I depth. The restored channel follows the low point of the valley, as it previously did not, and it ties in to Reach R2 at its newly restored elevation. The primary source of impairment was livestock access and permanent exclusion fencing has now excluded livestock.

Rock and wood structures were incorporated into the channel where appropriate to promote stable bedform sequences and habitat diversity. A native riparian buffer was planted in excess of 50 feet. Invasive species control was conducted along Reach T1.

3.2.8 Reach T2 Enhancement

Work on 283 LF of Reach T2 involved an Enhancement Level II approach to stabilize the channel through planting and livestock exclusion. A grade control structure was incorporated to prevent a headcut that had formed near the confluence with Reach R2/R3 from continuing up the reach.

Riparian buffers in excess of 50 feet were established along all of Reach T2. Invasive species control was implemented and cattle exclusion fencing has been installed.

3.2.9 Reach T3 Restoration

Work on 88 LF of Reach T3 involved a Priority Level I restoration to connect with the restored main channel at the interface of Reaches R3 and R4. The targeted section of Reach T3 was extremely incised from a headcut that had migrated from the main channel through the reach. The bed elevation was raised so that it ties to the restored main channel. Structures were incorporated to provide bedform diversity and prevent future headcutting. Riparian buffers in excess of 50 feet were established along all of Reach T3.

3.2.10 Reach T4 BMP Enhancement

A second non-traditional BMP feature was created to stabilize a migrating headcut on Reach T4 that was located at the outfall of a 30-inch stormwater culvert, which drains much of the Broad Ridge Court subdivision. The rock-lined step-pool channel has been constructed to bring the stormwater runoff from the outlet to the floodplain elevation. As shown in the approved mitigation plan, a 1.5:1 credit ratio for the valley length of this BMP, similar to the BMP along Reach R6 is being used. The valley length of this BMP is 117 LF. The Reach T4 treatment was installed to convey and potentially treat water before entering the mainstem of the stream. As a stable step-pool channel, no maintenance is anticipated following the monitoring described within this document.

3.2.11 Wetlands

The forested area in the downstream valley along Reach R1 is predominantly a large wetland area, which was divided into sub-areas that have been impacted to various degrees by human and/or animal

activity and had differing levels of pre-restoration wetland function. The wetland mitigation types along R1 include rehabilitation approaches: functioning wetlands (type 1), degraded wetlands (type 2), and partially functioning wetlands (type 3). Reach R1 was straightened and slightly incised, both of which impact the drainage and flooding patterns of the area as a whole. To improve wetland hydrology functions to the site, the pre-restoration straightened stream channel was abandoned and replaced by a new, more sinuous channel built at the appropriate floodplain elevation, with correct bankfull geometry thereby restoring their historical connection and improving flow dynamics between the stream and wetland complex. The abandoned sections of channelized stream were fully to partially filled to eliminate the drainage effect caused by these features. Type 1 functioning wetlands are 1.53 acres, type 2 degraded wetlands are 0.43 acres, and type 3 partially functioning wetlands are 1.75 acres.

A wetland area along Reach R2 was filled (type 4) and has been re-established by raising the stream bed, cutting back stream banks prone to erosion to restore natural benching features, and spoil removal. Type 4 filled wetlands are 0.46 acres.

The third wetland area is along lower Reach R4 required hydrologic reestablishment (type 5). The type 5 wetland is 0.27 acres. There were hydric soils situated on an abandoned floodplain and the pre-restoration channel was severely incised approximately 6-8 feet below the floodplain. Priority Level I restoration raised the channel bed to reconnect the stream to the historic floodplain. The existing channel has been filled. These measures will restore wetland hydrology to this section of the project.

Grading activities focused on restoring pre-disturbance valley topography by removing the numerous spoil piles, surface drains/swales, and some filled areas located in this area.

The restoration design for the wetland was based on a targeted "Piedmont Alluvial Forest" riparian wetland type, as identified by Schafale and Weakley (1990). Hydrology of this system will be palustrine and intermittently, temporarily, or seasonally flooded, as the restored channel was designed to carry the bankfull flow and to flood at discharges greater than bankfull.

See Table 1 for project components including mitigation approach and wetland types. For more information on wetland rehabilitation, re-establishment and wetland area types, see the Final Mitigation Plan.

3.3 Project History, Contacts, and Attribute Data

Baker implemented the project under a full delivery contract with NCDMS to provide stream and wetland mitigation credits in the Cape Fear River Basin. The chronology of the project is presented in Table 2. The contact information for all designers, contractors, and relevant suppliers is presented in Table 3. Relevant project background information is presented in Table 4. Tables 2, 3, and 4 are located in Appendix A of this report. As-built stationing is outlined in the Construction Summary, below, and in Table 1 in Appendix A.

3.3.1 Construction Summary

In accordance with the approved Mitigation Plan and regulatory permits, site preparation activities began on October 10, 2016 with the installation of sedimentation and erosion control measures, and the establishment of staging areas, haul roads, and stockpile areas. The construction contractor for the project was River Works, Inc. (River Works). The as-built plan sheets/record drawings depict actual surveyed areas within the project area and depict any changes from the final design plans to what was implemented on-site during construction. The as-built plan sheets/record drawings are located in Appendix C.

Channel construction begin in October at the upstream extent of the site and worked in the downstream direction (begin on Reach R6 and ended with Reach R1). The construction was completed on March 8, 2017. Planting was installed as major reaches were completed and finalized by March 10, 2017.

Approximately 9,880 feet of permanent cattle exclusion fencing (woven wire with one strand of barbed wire) was installed outside the conservation easement boundary along all non-residential conservation easement borders, with access gates and rock crossings as shown on the as-built plan sheets. In addition, Baker worked with the landowners to install a new groundwater wells and permanent watering stations for the cattle outside of the project boundary.

Upon completion of stream work within the Site, sedimentation and erosion control measures such as temporary stream crossings, rock check dams, and silt fence were removed. Coir fiber matting was installed along both stream banks, and all disturbed areas were stabilized with temporary and permanent seed and mulch before de-mobilizing from the Site. Baker and River Works met on site February 16, 2017 and conducted a preliminary final walk through inspection, and generated a punch-list of final items to be completed. River Works completed this punch list and demobilized in March of 2017.

The planting of live-stakes and bare-root trees and shrubs was conducted as the project progressed for the entire project. The planting crew also searched for and treated any invasive species identified within the conservation easement. Chinese privet (*Ligustrum sinense*), tree-of-heaven (*Ailanthus altissima*), multiflora rose (*Rosa multiflora*), and princess tree (*Paulownia tomentosa*) were treated. Further invasive species inspections will be conducted again each year during the monitoring phase.

4.0 SUCCESS CRITERIA

4.1 Stream Monitoring

Geomorphic monitoring of the restoration and enhancement level I reaches will be conducted once a year for five to seven years following the completion of construction to evaluate the effectiveness of the restoration practices. These parameters include stream dimension (cross sections), pattern (planimetric survey), profile (longitudinal profile survey), and visual observation with photographic documentation. The success criteria for the Enhancement Level II reaches/sections will follow the methods described under Photo Reference Stations and Vegetation Monitoring. The methods used and related success criteria are described below for each parameter. All monitoring features are shown in Figure 4 (Appendix A) as well as in the as-built plan sheets (Appendix D).

4.1.1 Bankfull Events and Flooding Functions

The occurrence of bankfull events within the monitoring period will be documented by the use of a manual crest gage and photographs. The crest gage was installed within the floodplain of R3 approximately five to ten feet (horizontal) of the restored channel at bankfull elevation. Installing the instruments on the floodplain reduces the risk of damage by stormflow. The crest gage will record the highest watermark between site visits, and the gage will be checked at each site visit to determine if a bankfull event has occurred. Photographs will be used to document the occurrence of debris lines and sediment deposition on the floodplain during monitoring site visits.

Two bankfull flow events must be documented within the seven-year monitoring period. The two bankfull events must occur in separate years; otherwise, the monitoring will continue until two bankfull events have been documented in separate years.

4.1.2 Flow Documentation

Monitoring of flow will be conducted to demonstrate that the restored stream system classified as intermittent exhibits base flow for some portion of the year during a year with normal rainfall conditions. In order to determine if rainfall amounts are normal for the given year, precipitation amounts using tallied data obtained from the Piedmont Triad International Airport (KGSO) ASOS station approximately 12 miles to the southwest will be analyzed. Data from the weather station can be obtained from the CRONOS Database located on the State Climate Office of North Carolina's website. If a normal year of precipitation does not occur during the first seven years of monitoring, flow conditions will continue to be monitored on the site until it documents that the intermittent streams have been flowing during the appropriate times of the year.

The monitoring of each restored intermittent reach will include the documentation of a combination of photographic and baseflow monitoring data. More specifically, the longitudinal photos should indicate the presence of flow within the channel in order to discern water levels within the pools and riffles. The visual monitoring effort, including the photo locations with descriptions, will be included with NCDMS's annual monitoring reports. A pressure transducer has been installed near the downstream portion of restored reaches: R4, T1 and T3. The device will be inspected on a quarterly/semi-annual basis to document surface hydrology and provide a basis for evaluating general flow response to rainfall events and surface runoff during various water tables levels throughout the monitoring period. Success criteria will include 30 days of consecutive baseflow for monitoring wells installed during a normal rainfall year.

4.1.3 Cross Sections

Permanent cross sections have been installed at an approximate rate of one cross section per twenty bankfull widths or an average distance interval (not to exceed 500 LF) of restored stream, with twelve (12) cross sections located at riffles, and five (5) located at pools. Each cross section is marked on both streambanks with permanent monuments using rebar cemented in place to establish the exact transect used. A common benchmark will be used for cross sections and to facilitate easy comparison of year-to-year data. The cross-section surveys will occur in years one, two, three, five, and seven, and must include measurements of Bank Height Ratio (BHR) and Entrenchment Ratio (ER). The monitoring survey will include points measured at all breaks in slope, including top of streambanks, bankfull, inner berm, edge of water, and thalweg, if the features are present. Riffle cross sections will be classified using the Rosgen Stream Classification System.

There should be little change in as-built cross sections. If changes do take place, they will be documented in the survey data and evaluated to determine if they represent a movement toward a more unstable condition (e.g., down-cutting or erosion) or a movement toward increased stability (e.g., settling, vegetative changes, deposition along the streambanks, or decrease in width/depth ratio). Using the Rosgen Stream Classification System, all monitored cross sections should fall within the quantitative parameters (i.e. BHR no more than 1.2 and ER no less than 2.2 for 'C' stream types) defined for channels of the design stream type. Given the smaller channel sizes and meander geometry of the streams, bank pins will not be installed unless monitoring results indicate active lateral erosion.

Reference photo transects will be taken at each permanent cross section. Lateral photos should not indicate excessive erosion or continuing degradation of the streambanks. Photographs will be taken of both streambanks at each cross section. The survey tape will be centered in the photographs of the streambanks. The water line will be located in the lower edge of the frame, and as much of the streambank as possible will be included in each photo. Photographers shall make a consistent effort to maintain the same area in each photo over time.

4.1.4 Pattern

The plan view measurements such as sinuosity, radius of curvature, meander width ratio will be taken on newly constructed meanders during baseline (Monitoring Year 0) only. Subsequent visual monitoring will be conducted twice a year, at least five months apart, to document any changes or excessive lateral movement in the plan view of the restored channel.

4.1.5 Longitudinal Profile

A longitudinal profile has been surveyed for the entire length of restored channel immediately after construction to document as-built baseline conditions . The survey is tied to a permanent benchmark and measurements includes thalweg, water surface, bankfull, and top of low bank. Each of these measurements was taken at the head of each feature (e.g., riffle, pool) and at the maximum pool depth. The longitudinal profile should show that the bedform features installed are consistent with intended design stream type. The longitudinal profiles will not be taken during subsequent monitoring years unless vertical channel instability has been documented or remedial actions/repairs are deemed necessary.

4.1.6 Bed Material Analyses

After construction, there should be minimal change in the bulk sample data over time given the current watershed conditions and sediment supply regime. Significant changes in particle sizes or size distribution in otherwise stable riffles and pools could warrant additional sediment transport analyses and calculations. A substrate sample will be collected where certain constructed riffles are installed as part of the project. One constructed riffle substrate sample will be compared to existing riffle substrate data collected during the design phase and any significant changes (i.e.; aggradation, degradation) will

be noted after streambank vegetation becomes established and a minimum of two bankfull flows or greater have been documented.

4.1.7 Visual Assessment

Visual monitoring assessments of all stream sections will be conducted by qualified personnel twice per monitoring year with at least five months in between each site visit. Photographs will be used to visually document system performance and any areas of concern related to streambank stability, condition of in-stream structures, channel migration, headcuts, live stake mortality, impacts from invasive plant species or animal species, and condition of pools and riffles. The photo locations and descriptions will be shown on a plan view map per NCDMS's monitoring report guidance (v1.5, June 2012).

The photographs will be taken from a height of approximately five to six feet to ensure that the same locations (and view directions) at the site are documented in each monitoring period. A series of photos over time will be also be used to subjectively evaluate channel aggradation (bar formations) or degradation, streambank erosion, successful maturation of riparian vegetation, and effectiveness of sedimentation and erosion control measures if necessary.

4.2 Vegetation Monitoring

In order to determine if the criteria are achieved, vegetation-monitoring quadrants have been installed and will be monitored across the restoration site in accordance with the CVS-NCDMS Protocol for Recording Vegetation, Version 4.1 (Lee at al., 2007). The vegetation monitoring plots are a minimum of 2% of the planted portion of the site with a minimum of five (5) plots established randomly within the planted buffer areas per Monitoring Levels 1 and 2. No monitoring quadrants were established within the undisturbed wooded areas of Reaches R3, R4, R5, and R6. The size of individual quadrants will be 100 square meters. Fourteen plots were established.

Vegetation monitoring will occur in the fall, prior to the loss of leaves. Individual quadrant data will be provided and will include species diameter, height, density, and coverage quantities. Relative values will be calculated, and importance values will be determined. Individual seedlings will be marked such that they can be found in succeeding monitoring years. Mortality will be determined from the difference between the previous year's living, planted seedlings and the current year's living, planted seedlings.

At the end of the first full growing season (from baseline/year 0) or after 180 days between March 1st and November 30th, species composition, stem density, height, and survival will be evaluated. For each subsequent year, vegetation plots shall be monitored for seven years in years 1, 2, 3, 5 and 7 or until the final success criteria are achieved. The restored site will be evaluated between March and November. The interim measure of vegetative success for the site will require the survival of at least 320, 3-year old, planted trees per acre at the end of year three of the monitoring period. At year five, density must be no less than 260, 5-year old, planted trees per acre. The final vegetative success criteria will be the survival of 210, 7-year old, planted trees per acre. Additionally, the average height of the 7-year old planted trees will range from 7 feet to 10 feet tall. Certain native species, which are appropriate to plant on-site to provide a diverse vegetation community, do not typically grow to these heights in 7 years and will be excluded from the height performance standard. These excluded species composed primarily of understory species are Persimmon, American Hornbeam, American Holly, Witchhazel, Strawberry Bush, Black Gum, and Winterberry. If the performance standards are met by year 5 and stem densities are greater than 260, 5-year old stems/acre, vegetation monitoring may be terminated with approval by the USACE and the NCIRT.

While measuring species density and height is the current accepted methodology for evaluating vegetation success on mitigation projects, species density and height alone may be inadequate for assessing plant community health. For this reason, the vegetation monitoring plan will incorporate the evaluation of

additional plant community indices, native volunteer species, and the presence of invasive species vegetation to assess overall vegetative success.

Baker will provide required remedial action on a case-by-case basis, such as: replanting more wet/drought tolerant species vegetation, conducting beaver management/dam removal, and removing undesirable/ invasive species vegetation, and will continue to monitor vegetation performance until the corrective actions demonstrate that the site is trending towards or meeting the standard requirement. Existing mature woody vegetation will be visually monitored during annual site visits to document any mortality, due to construction activities or changes to the water table, that negatively impact existing forest cover or favorable buffer vegetation.

Additionally, herbaceous vegetation, primarily native species grasses, have been seeded/planted throughout the site.

4.3 Wetland Monitoring

4.3.1 Groundwater Data Collection

Seven (7) groundwater monitoring wells were installed in the wetland mitigation area to document hydrologic conditions of the restored wetland area. These wells will be used to evaluate wetland hydrology during each growing season for seven years of hydrologic monitoring, or until success criteria have been met, whichever occurs later. To meet the hydrologic success criteria, the monitoring gage data must show that for each normal year within the monitoring period, the site has been inundated or saturated for a certain hydroperiod. The targeted hydroperiod will be based on the range of wetness conditions for the type of wetland system to be restored and will be compared to hydrology data collected from the reference wetland site during the same monitoring period.

4.3.2 Hydrology

In order to determine if the hydrologic success criteria are achieved, automated groundwater-monitoring stations have been installed across the restored site and will be monitored year-round. Groundwater monitoring stations will follow the USACE standard methods found in the WRP Technical Notes ERDC TN-WRAP-00-02, (July 2000). In the event that there are years of normal precipitation during the monitoring period, and the data for those years do not show that the site has been inundated or saturated for the appropriate hydroperiod during the normal precipitation year, the review agencies may require remedial action. Baker will provide any required remedial action and continue to monitor hydrology on the site until it displays that the site has been inundated or saturated for the appropriate hydroperiod.

The objective is for the monitoring data to show the site exhibits an increased frequency of flooding. Groundwater levels will be compared to pre-restoration conditions and reference conditions. The success criteria for wetland hydrology will follow a range from 9-12 percent, depending on the specific wetland location and the mitigation activity. The wetland areas along Reach R1 and the large bend of Reach 2 will meet success criteria for wetland hydrology when the soils are saturated within 12 inches of the soil surface for 12 percent of the growing season or twenty eight (28) or more consecutive days during the growing season (236 days). The saturated conditions should occur during a period when antecedent precipitation has been normal or drier than normal for a minimum frequency of 5 years in 10 (USACE, 2005 and 2010b). Note the number of growing days was increased from 229 days to 236 days (March 22nd through November 13th) between the Mitigation Plan and Baseline Monitoring Report due to the publication of recent data for the WETS Station: Greensboro AP, NC (years utilized for 50 percent probability of a 28 degree or higher day: 1971-2015).

The hydroperiod for success for the wetlands located along lower Reach R4 will be 9 percent of the growing season or twenty-one (21) or more consecutive days.

In order to determine if the rainfall is normal for the given year, precipitation amounts using tallied data obtained from the Piedmont Triad International Airport (KGSO) ASOS station approximately 12 miles to the southwest will be analyzed. Data from this station can be obtained from the CRONOS Database located on the State Climate Office of North Carolina's website. If a normal year of precipitation does not occur during the first seven years of monitoring, Baker will continue to monitor hydrology on the site until it documents that the site has been inundated or saturated for the appropriate hydroperiod.

If the rainfall data for any given year during the monitoring period are abnormal, it is possible that the desired hydrology for the site may not meet specific success criteria. However, reference wetland data will be assessed to determine if there is a positive correlation between the underperformance of the project site and the natural hydrology of the reference site.

4.4 BMP Monitoring

This project includes the implementation of two BMPs. A constructed wetland, which will function as a headwater wetland, was installed along Reach R6, and a rock lined step-pool channel stormwater control measure was installed along Reach T4. Both BMPs will be visually monitored semi-annually for vegetative survival, outlet stability, and storage capacity using photo documentation during the 7-Year monitoring period. A vegetation plot will also be established along the planted portion of Reach R6 and will be included as part of the vegetation monitoring outlined above. Maintenance measures will be implemented during the monitoring period to replace dead vegetative material and to remove excess sedimentation, as needed, from the forebay of the constructed wetland and its permanent pool, as well as the plunge pools along Reach T4. Should the outlet of the constructed wetland become unstable during the 7-Year monitoring period, corrective measures will be implemented to rectify the instability issues.

The BMPs success criteria will include the following:

- step-pool channels (R6 outlet and T4) are considered successful if stability has been attained as agreed upon by the IRT at closeout.
- Constructed Wetland (R6) vegetation will be considered successful with a visual assessment of 70 percent native vegetation coverage as defined in the NCDWR BMP manual (page 9-21 of the NCDWR BMP manual). Native volunteers can be included within the visual assessment. The vegetation plot in the buffer area of the BMP with planted stems will have the same standard success criteria as other veg plots. All yearly maintenance and repairs, photo points, re-plantings, and invasive treatments will be documented in the monitoring reports. Sediment buildup should be minimal and not require repeated maintenance at closeout as agreed upon by the IRT for the constructed wetland to be considered successful.
- NCDWR BMP field inspection - One field visit by NCDWR should be conducted between years 2-5 to inspect the BMPs. Baker will invite NCDWR staff to the site. Annual monitoring may be requested by Baker instead of bi-annual monitoring for the BMPs after five years until closeout if the stormwater control measure structures are stable and have not required maintenance in the past year.

Long-term management of the BMP structures is not anticipated by USACE provided the structures remain stable and functioning throughout the 7-year monitoring period.

5.0 MAINTENANCE AND CONTINGENCY PLANS

Maintenance requirements vary from site to site and are generally driven by the following conditions:

- Projects without established, woody floodplain vegetation are more susceptible to erosion from floods than those with a mature, hardwood forest.
- Projects with sandy, non-cohesive soils are more prone to bank erosion than cohesive soils or soils with high gravel and cobble content.
- Alluvial valley channels with access to their floodplain are less vulnerable to erosion than channels that have been disconnected from their floodplain.
- Wet weather during construction can make accurate channel and floodplain excavations difficult.
- Extreme and/or frequent flooding can cause floodplain and channel erosion.
- Extreme hot, cold, wet, or dry weather during and after construction can limit vegetation growth, particularly temporary and permanent seed.
- The presence and aggressiveness of invasive vegetation species can affect the extent to which a native species vegetation buffer can be established.
- The presence of beaver can affect vegetation survivability and stream function.

The Site will be monitored on a regular basis and as well as a physical inspection of the Site at least twice a year throughout the post-construction monitoring period until performance standards are met. These site inspections may identify site components and features that require routine maintenance. Maintenance issues and recommended remediation measures will be detailed and documented in the post-construction monitoring reports. Factors that may have caused any maintenance needs, including any of the conditions listed above, shall be discussed. Routine maintenance, if required, will be most likely be needed in the first two years following site construction and may include the following components as described below.

5.1 Streams

Routine channel maintenance and repair activities may include modifying in-stream structures to prevent piping, securing loose coir matting, and supplemental installations of live stakes and other target vegetation along the project reaches. Areas of concentrated stormwater and floodplain flows that intercept the channel may also require maintenance to prevent stream bank failures and head-cutting until vegetation becomes established.

5.2 Wetland

Wetland maintenance and repair activities may include repairing any erosional issues to prevent any drainage ditches from forming.

5.3 Vegetation

Vegetation will be maintained to ensure the health and vigor of the targeted plant community. Routine vegetation maintenance and repair activities may include supplemental planting, pruning, and fertilizing. Exotic invasive plant species will treated by mechanical and/or chemical methods. Any invasive plant species control requiring herbicide application will be performed in accordance with NC Department of Agriculture (NCDA) rules and regulations.

5.4 Site Boundary

Site boundaries have been demarcated in the field to ensure clear distinction between the mitigation site and adjacent properties. Boundary markers disturbed, damaged, or destroyed will be repaired and/or replaced on an as needed basis.

5.5 Farm Road Crossing

The farm road crossings within the Site may be maintained only as allowed by the recorded Conservation Easement, deed restrictions, rights of way, or corridor agreements.

5.6 Beaver Management

Routine maintenance and repair activities caused by beaver activity may include supplemental planting, pruning, and dam breeching/dewatering and/or removal. Beaver management will be performed in accordance with US Department of Agriculture (USDA) rules and regulations using accepted trapping and removal techniques only within the project boundary on an as-needed basis.

6.0 AS-BUILT DATA DOCUMENTATION

The specific locations of vegetation plots, flow/crest gauges, and cross-sections are shown on the as-built plan sheets located in Appendix D.

6.1 Stream Data

One manual crest gauge was installed at the bankfull elevation along the restored channel of Reach R1 and will be used to document the occurrence of bankfull events on the Site. Additionally, three in-channel pressure transducers were installed in Reach 4, T3 and T1. The in-channel pressure transducers will record water depth and flow duration within the channels as well as document bankfull events in the respective reaches. Photographs will also be used to document the occurrence of debris lines and sediment deposition on the floodplain during monitoring site visits.

For monitoring stream success criteria, seventeen permanent cross-sections were installed along all restored reaches on the Site. The permanent cross-sections will be used to monitor channel dimension and bank stability over time.

In addition, a longitudinal survey was completed for all reaches to provide a baseline for evaluating changes in bed conditions over time. The permanent as-built cross-sections (with photos), the as-built longitudinal data, the quantitative pre-construction, reference reach, and design data used to determine restoration approach, as well as other as-built data will be used for comparison to post-construction monitoring data. The locations of the permanent cross-sections and the crest gauges are shown in Figure 4 in Appendix A, and on the as-built plan sheets in Appendix D. Photographs of the selected portions of the restored reaches are provided in Appendix E.

6.2 Vegetation Data

Bare-root trees and shrubs were planted within the conservation easement. A minimum 50-foot buffer was established and/or protected along both banks of all stream reaches. Planting of bare-root trees and shrubs and live stakes was completed in March of 2017.

The Mitigation Plan for the Site specifies that the number of quadrants required shall be based on the CVS-NCDMS monitoring guidance (2007). The total number of quadrants was calculated using the CVS-NCDMS Entry Tool Database version 2.2.7 (CVS-NCDMS, 2007). The sizes of individual quadrants are 100 square meters. A total of fourteen vegetation plots were installed throughout the Site. The initial planted density within each of the vegetation monitoring plots is provided in Table 8. The average density of planted bare root stems, based on the data from the fourteen vegetation monitoring plots, is 766 stems per acre. The locations of the vegetation plots are shown on the as-built plan sheets in Appendix D and on Figure 4.

6.3 Wetland Data

Seven (7) groundwater monitoring wells were installed in the wetland mitigation area to document hydrologic conditions of the restored wetland area.

6.4 Areas of Concern

No areas of concern were identified post-construction for the site.

7.0 REFERENCES

Carolina Vegetation Survey (CVS) and NC Ecosystem Enhancement Program (NCDMS). 2007. CVS-NCDMS Data Entry Tool v. 2.2.7. University of North Carolina, Raleigh, NC.

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

North Carolina Division of Mitigation Services. 2011. Monitoring Requirements and Performance Standards for Stream and/or Wetland Mitigation. November 7, 2011.

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

Rosgen, D.L. 1996. Applied River Morphology – Second Edition. Wildland Hydrology Books, Pagosa Springs, Colo.

Schafale, M. P., and A. S. Weakley. 1990. Classification of the natural communities of North Carolina, third approximation. North Carolina Natural Heritage Program. Division of Parks and Recreation, NCDENR. Raleigh, NC.

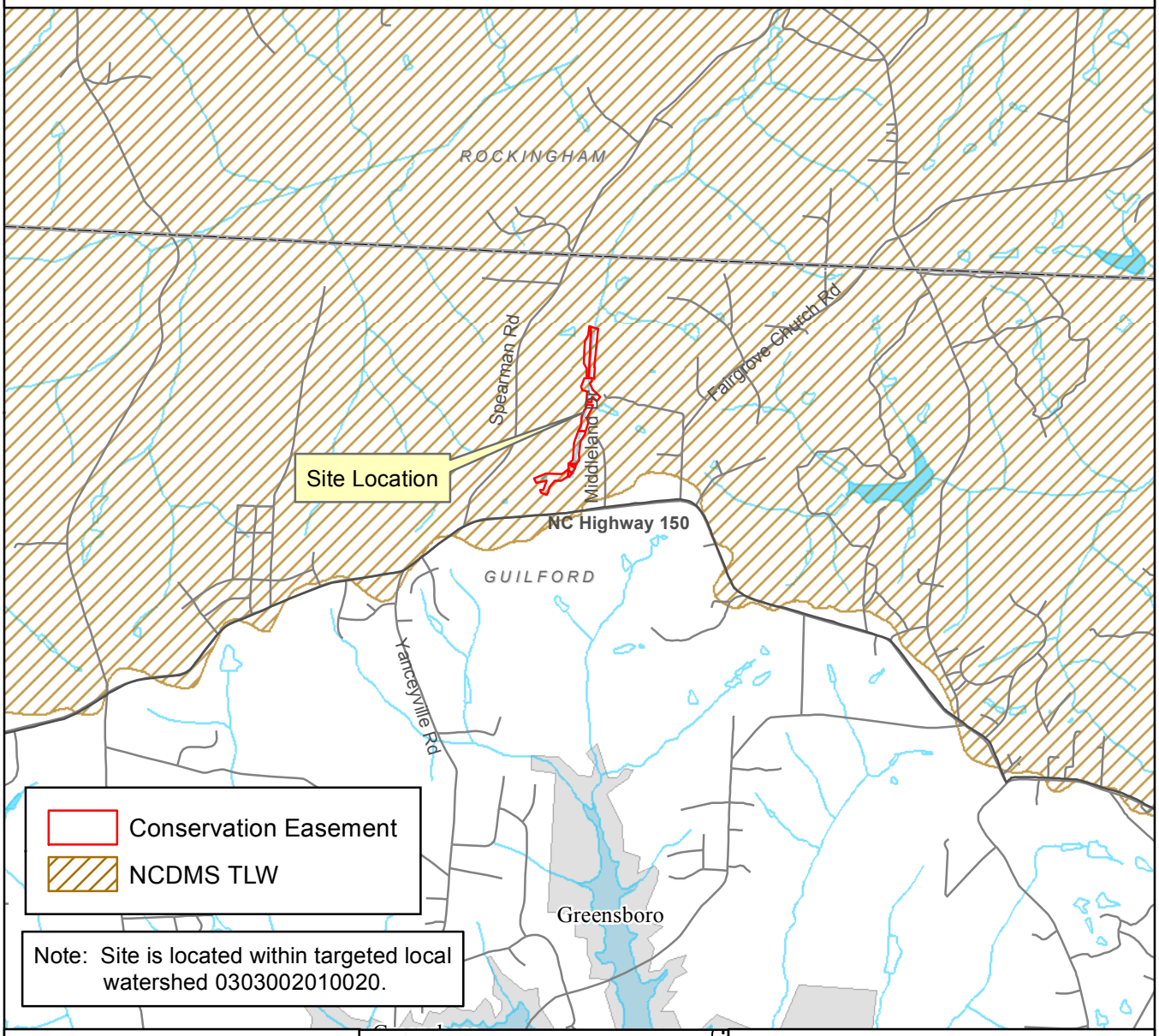
United States Army Corps of Engineers. 1987. Corps of Engineers Wetlands Delineation Manual. Technical Report Y-87-1. Environmental Laboratory. US Army Engineer Waterways Experiment Station. Vicksburg, MS.

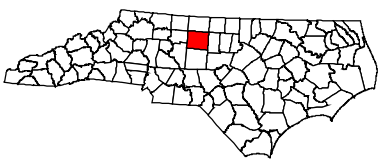
___. 2003. Stream Mitigation Guidelines, April 2003, U.S. Army Corps of Engineers. Wilmington District.

APPENDIX A

Figures 1 – 4-2, Tables 1 - 4

To access the site from Raleigh, take Interstate 40 and head west on I-40 towards Greensboro, for approximately 68 miles. Take the exit ramp to E. Lee St. (exit 224) towards Greensboro and continue for 2 miles before turning onto U.S. Highway 29 North. Once on U.S. Highway 29 North, travel north for approximately 10 miles before exiting and turning on to NC-150 West. Continue west on NC-150 for 5 miles. The project site is located along and between NC-150 and Spearman Rd., with access points through residences on Middleland Dr. and Broad Ridge Ct. The subject project site is an environmental restoration site of the NCDEQ Division of Mitigation Services (DMS) and is encompassed by a recorded conservation easement, but is bordered by land under private ownership. Accessing the site may require traversing areas near or along the easement boundary and therefore access by the general public is not permitted. Access by authorized personnel of state and federal agencies or their designees/contractors involved in the development, oversight and stewardship of the restoration site is permitted within the terms and timeframes of their defined roles. Any intended site visitation or activity by any person outside of these previously sanctioned roles and activities requires prior coordination with DMS.





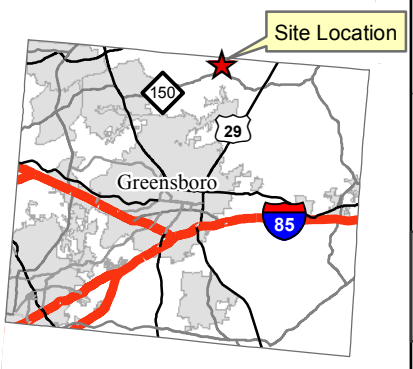
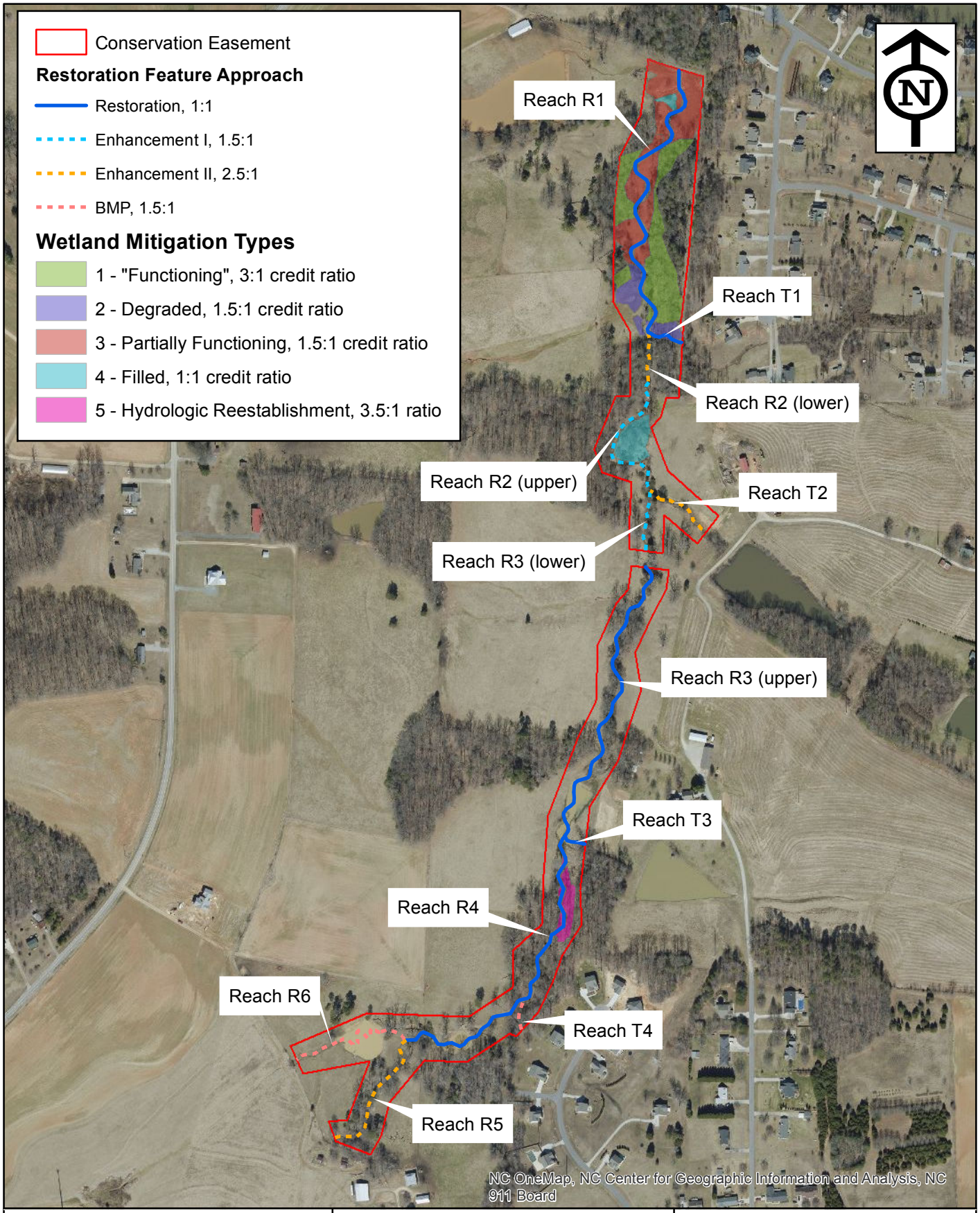


Figure 1
Project Vicinity Map
Browns Summit (DMS# 96313)

NCDEQ - Division of Mitigation Services

Michael Baker INTERNATIONAL

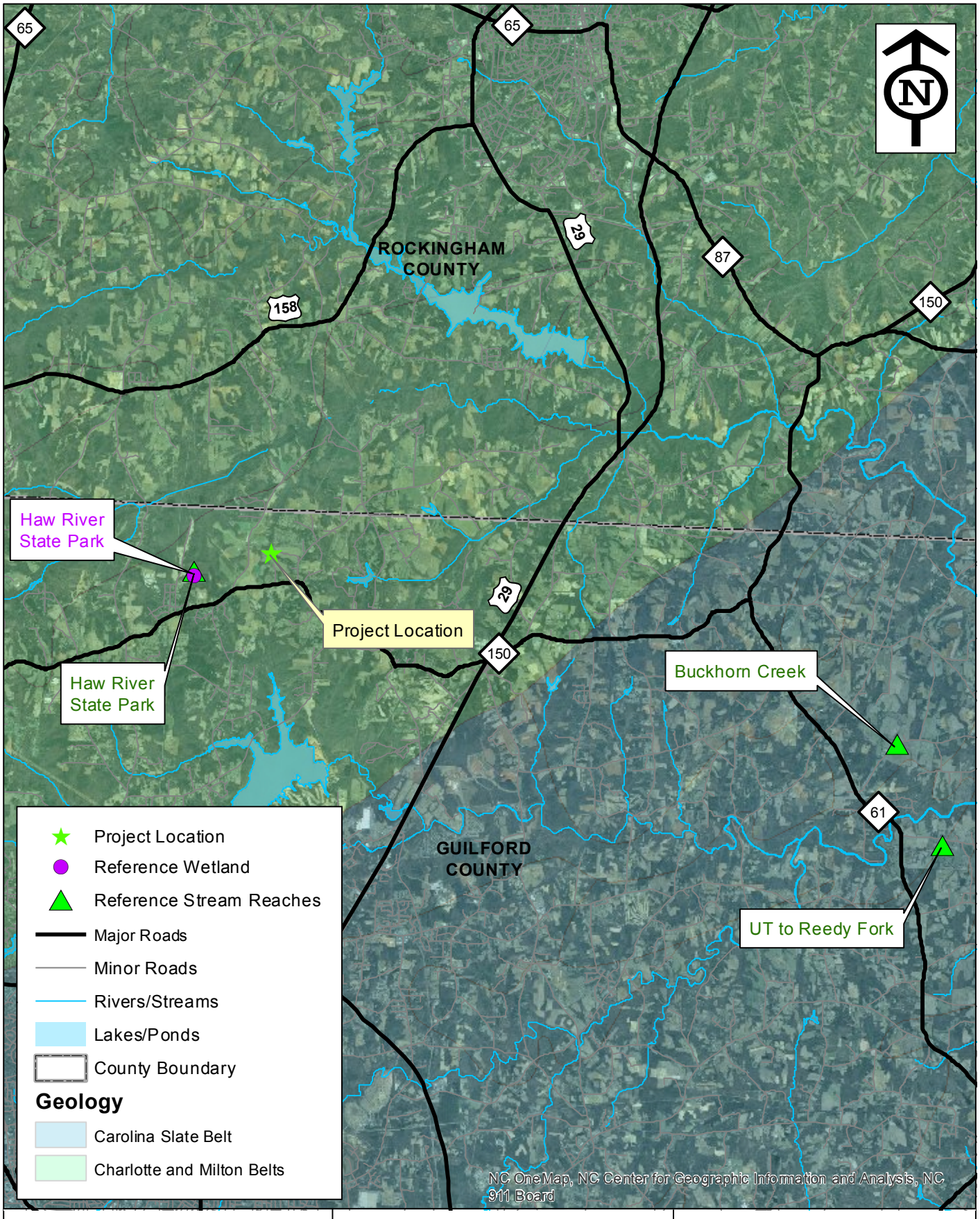
0.5 0 0.5 Miles



Michael Baker INTERNATIONAL

0 250 500 1,000
Feet

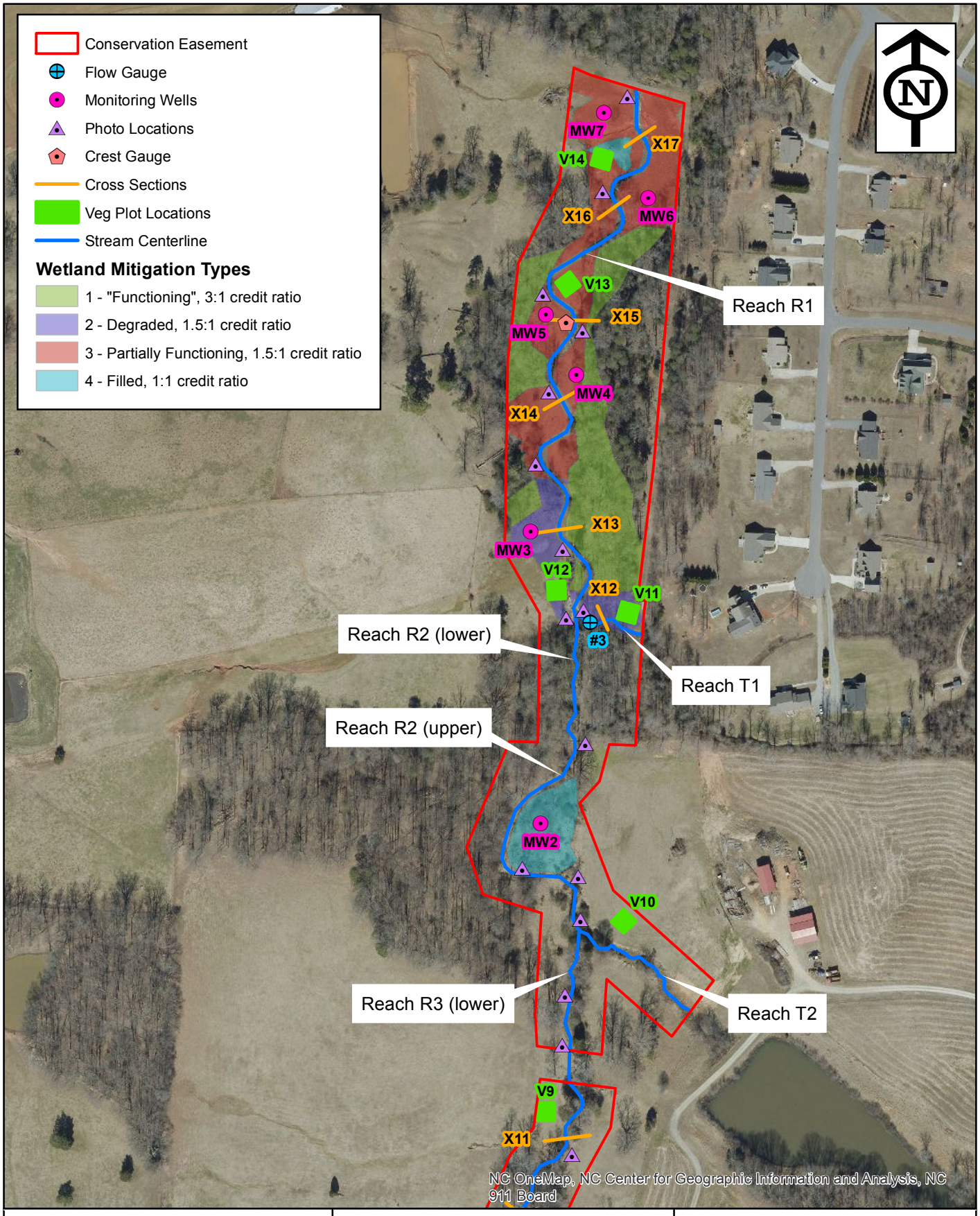
Figure 2
Restoration Summary Map
Browns Summit Site
(DMS #96313)



Michael Baker
INTERNATIONAL

2 1 0 2
Miles

Figure 3
Reference Stream Locations Map
Browns Summit Site

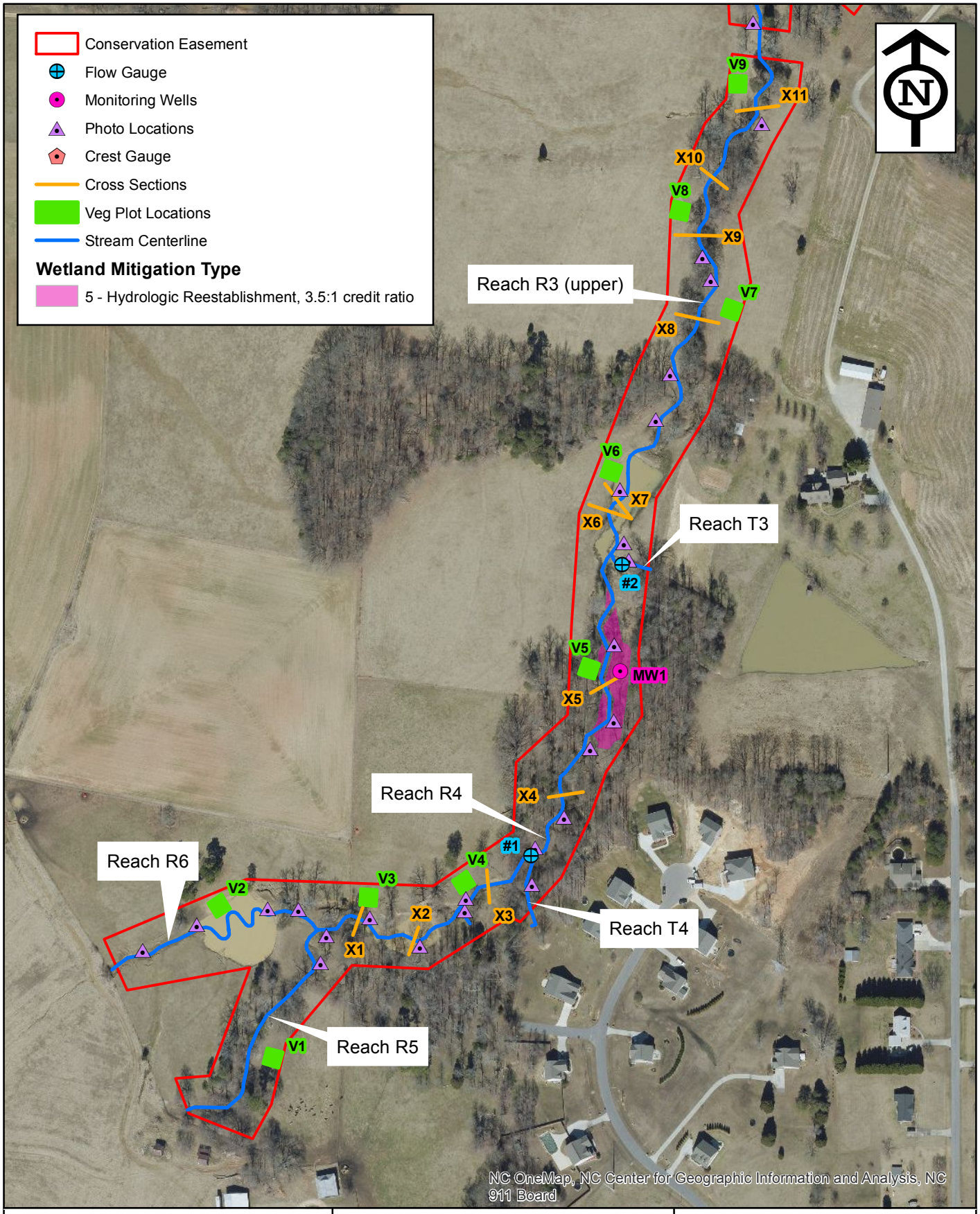


Michael Baker INTERNATIONAL

0 125 250 500

Feet

Figure 4.1
Monitoring Features Overview Map
Browns Summit Site
(DMS #96313)



Michael Baker INTERNATIONAL

0 125 250 500

Feet

Figure 4.2
Monitoring Features Overview Map
Browns Summit Site
(DMS #96313)

Table 1. Project Components and Mitigation Credits

Browns Summit Creek Restoration Project: DMS Project No ID. 96313

Mitigation Credits

	Stream	Riparian Wetland		Non-riparian Wetland		Buffer	Nitrogen Nutrient Offset	Phosphorus Nutrient Offset
Type	R, E1, EII, BMP	R	E					
Totals	5,299 SMU	2.51 WMU (2.50 WMU requested)	0.0					

Project Components

Project Component or Reach ID	Stationing/ Location (As-Built)*	Existing Footage/ Acreage (LF/AC)*	Approach	Restoration/ Restoration Equivalent (SMU/WMU)	Restoration Footage or Acreage (LF/AC)	Mitigation Ratio
R1**	51+00.00 - 63+89.87	1,217	Restoration	1,290	1,290	1:1
R2** (downstream section)	49+65.28 - 51+00.00	167	Enhancement II	54	134	2.5:1
R2 (upstream section)	43+48.17 - 49+65.28	701	Enhancement I	409	614	1.5:1
R3 (downstream section) 60' easement break subtracted from stream lengths	39+35.73 - 43+48.17 (CE 40+45.09 - 41+05.52)	362	Enhancement I	235	352	1.5:1
R3 (upstream section)	28+31.92 - 39+35.73	1,224	Restoration	1,102	1,102	1:1
R4	15+35.86 - 28+31.92	1,350	Restoration	1,296	1,296	1:1
R5	10+00 - 15+35.86	536	Enhancement II	214	536	2.5:1
R6	10+00 - 15+19.39	536	Enhancement I/BMP	294	442 LF (valley length)	1.5:1
T1	10+00 - 11+44.99	121	Restoration	145	145	1:1
T2	10+00 - 12+85.21	283	Enhancement II	113	283	2.5:1
T3	10+04.88 - 10+92.84	83	Restoration	70	70	1:1
T4	10+30.18 - 11+49.36	47	Enhancement I/BMP	78	117 LF (valley length)	1.5:1
Wetland Area - Type 1	See Figures	1.57	Rehabilitation	0.51	1.53	3:1
Wetland Area - Type 2	See Figures	0.49	Rehabilitation	0.29	0.43	1.5:1
Wetland Area - Type 3	See Figures	2.06	Rehabilitation	1.17	1.75	1.5:1
Wetland Area - Type 4	See Figures	0.49	Re-establishment	0.46	0.46	1:1
Wetland Area - Type 5	See Figures	0.27	Re-establishment	0.08	0.27	3.5:1

*Wetland existing acrage and restoration acrages were swapped in Table 5.1 of the Mitigation Plan.

**Stations and lengths are taken from the 2017 As-Built survey and may thus differ slightly from the Mitigation Plan. See Appendix F for coorespondence.

Component Summation

Restoration Level	Stream (LF)	Riparian Wetland (AC)		Non-riparian Wetland (AC)	Buffer (SF)	Upland (AC)
Restoration	3,903	4.44				
Enhancement I	1,525					
Enhancement II	953					

BMP Elements

Element	Location	Purpose/Function	Notes

BMP Elements: BR= Bioretention Cell; SF= Sand Filter; SW= Stormwater Wetland; WDP= Wet Detention Pond; DDP= Dry Detention Pond; FS= Filter Strip; S= Grassed Swale; LS= Level Spreader; NI=Natural Infiltration Area

Table 2. Project Activity and Reporting History			
Browns Summit Creek Restoration Project: DMS Project No ID. 96313			
Activity or Report	**Scheduled Completion**	**Data Collection Complete**	**Actual Completion or Delivery**
Mitigation Plan Prepared	not specified in proposal	Summer 2015	May 1, 2015
Mitigation Plan Amended	not specified in proposal	Summer 2015	September 17, 2015
Mitigation Plan Approved	December 4, 2014	Winter 2015	November 2, 2015
Final Mitigation Plan with PCN (minor revisions requested in approval letter)	not specified in proposal	Winter 2015	January 29, 2016
Final Design – (at least 90% complete)	not specified in proposal		September 20, 2016
Construction Begins	not specified in proposal		October 10, 2016
Temporary S&E mix applied to entire project area	June 1, 2015		March 10, 2017
Permanent seed mix applied to entire project area	June 2, 2015		March 10, 2017
Planting of live stakes	June 3, 2015		March 10, 2017
Planting of bare root trees	June 3, 2015		March 10, 2017
End of Construction	May 4, 2015		March 8, 2017
Survey of As-built conditions (Year 0 Monitoring-baseline)	June 3, 2015	Spring 2017	July 1, 2017
Baseline Monitoring Report*	May 7, 2017	Spring 2017	November 10, 2017
Year 1 Monitoring	December 1, 2017		
Year 2 Monitoring	December 1, 2018		
Year 3 Monitoring	December 1, 2019		
Year 4 Monitoring	December 1, 2020		
Year 5 Monitoring	December 1, 2021		
Year 6 Monitoring	December 1, 2022		
Year 7 Monitoring	December 1, 2023		
* Monitoring schedule completion dates updated based on completion of construction.			

Table 3. Project Contacts **Browns Summit Creek Restoration Project: DMS Project No ID. 96313**	
Designer	
Michael Baker Engineering, Inc.	8000 Regency Parkway, Suite 600 Cary, NC 27518 Contact: Katie McKeithan, Tel. 919-481-5703
Construction Contractor	
River Works, Inc.	6105 Chapel Hill Road Raleigh, NC 27607 Contact: Bill Wright, Tel. 919-818-6686
Planting Contractor	
River Works, Inc.	6105 Chapel Hill Road Raleigh, NC 27607 Contact: Bill Wright, Tel. 919-818-6686
Seeding Contractor	
River Works, Inc.	6105 Chapel Hill Road Raleigh, NC 27607 Contact: Bill Wright, Tel. 919-818-6686
Seed Mix Sources	Green Resources, Rodney Montgomery 336-215-3458
Nursery Stock Suppliers	Dykes and Son, 931-668-8833 Mellow Marsh Farm, 919-742-1200 ArborGen, 843-528-3204
Live Stakes Suppliers	Foggy Mountain Nursery, 336-384-5323
Monitoring Performers	
Michael Baker Engineering, Inc.	8000 Regency Parkway, Suite 600 Cary, NC 27518 Contact:
Stream Monitoring Point of Contact	Katie McKeithan, Tel. 919-481-5703
Vegetation Monitoring Point of Contact	Katie McKeithan, Tel. 919-481-5703

Table 4. Project Attributes
Browns Summit Creek Restoration Project: DMS Project No ID. 96313

Project Information					
Project Name	Browns Summit Creek Restoration Project				
County	Guilford				
Project Area (acres)	20.2				
Project Coordinates (latitude and longitude)	36.237 N, -79.749 W				
Project Watershed Summary Information					
Physiographic Province	Piedmont				
River Basin	Cape Fear				
USGS Hydrologic Unit 8-digit and 14-digit	03030002 / 03030002010020				
NCDWR Sub-basin	3/6/2001				
Project Drainage Area (acres)	438				
Project Drainage Area Percent Impervious	1%				
CGIA Land Use Classification	2.01.01.01, 2.03.01, 2.99.01, 3.02 / Forest (53%) Agriculture (39%) Impervious Cover (1%) Unclassified (7%)				
Reach Summary Information					
Parameters	**Reach R1**	**Reach R2**	**Reach R3**	**Reach R4**	**Reach R5**
Length of Reach (linear feet)	1,290	748	1,454	1,296	536
Valley Classification (Rosgen)	VII	VII	VII	VII	VII
Drainage Area (acres)	438	299	242	138/95	24
NCDWR Stream Identification Score	35.5	35.5	41.5	41.5/25	28.5
NCDWR Water Quality Classification	C; NSW				
Morphological Description (Rosgen stream type)	E	Bc incised	Bc incised	Gc	Bc
Evolutionary Trend	Incised E→Gc→F	Bc→G→F	Bc→G→F	G→F	Bc→G
Underlying Mapped Soils	CnA	CnA	CnA, PpE2	CnA, CkC	CkC
Drainage Class	Somewhat Poorly Drained	Somewhat Poorly Drained	Somewhat Poorly Drained and Well Drained	Somewhat Poorly Drained and Well Drained	Well Drained
Soil Hydric Status	Hydric	Hydric	Partially Hydric	Partially Hydric	Upland
Average Channel Slope (ft/ft)	0.0069	0.0068	0.0095	0.017	0.023
FEMA Classification	N/A	N/A	N/A	N/A	N/A
Native Vegetation Community	Piedmont Headwater Stream Forest				
Percent Composition of Exotic/Invasive Vegetation	25%	15%	5%	<5%	<5%
Parameters	**Reach R6**	**Reach T1**	**Reach T2**	**Reach T3**	**Reach T4**
Length of Reach (linear feet)	442 LF (valley length)	145	283	70	117 LF (valley length)
Valley Classification (Rosgen)	VII	VII	VII	VII	VII
Drainage Area (acres)	61	55	47	41	10
NCDWR Stream Identification Score	18	26.75	27.25	19	-
NCDWR Water Quality Classification	C; NSW				
Morphological Description (Rosgen stream type)	Bc incised	E incised	F	E incised	-
Evolutionary Trend	Bc→G→F	E→G→F	Bc→G→F	E→G→F	
Underlying Mapped Soils	CkC	CnA	CnA, PpE2	CnA	CkC
Drainage Class	Well Drained	Somewhat Poorly Drained	Somewhat Poorly Drained and Well Drained	Somewhat Poorly Drained	Well Drained
Soil Hydric Status	Upland	Hydric	Partially Hydric	Hydric	Upland
Average Channel Slope (ft/ft)	0.014	0.024	0.022	0.02	-
FEMA Classification	N/A	N/A	N/A	N/A	N/A
Native Vegetation Community	Piedmont Headwater Stream Forest				
Percent Composition of Exotic/Invasive Vegetation	5%	10%	10%	10%	10%

Regulatory Considerations			
Regulation	**Applicable**	**Resolved**	**Supporting Documentation**
Waters of the United States – Section 404	Yes	Yes	Categorical Exclusion (Appendix B)
Waters of the United States – Section 401	Yes	Yes	Categorical Exclusion (Appendix B)
Endangered Species Act	No	N/A	Categorical Exclusion (Appendix B)
Historic Preservation Act	No	N/A	Categorical Exclusion (Appendix B)
Coastal Area Management Act (CAMA)	No	N/A	Categorical Exclusion (Appendix B)
FEMA Floodplain Compliance	No	N/A	Categorical Exclusion (Appendix B)
Essential Fisheries Habitat	No	N/A	Categorical Exclusion (Appendix B)

APPENDIX B

Morphological Summary Data (Tables 5 and 6)
and Profile and Cross-Section Graphs

Table 5. Baseline Stream Summary
Browns Summit Creek Restoration Project: DMS Project No ID. 96313

Reach 1

Parameter	USGS Gauge	Regional Curve*			Pre-Existing Condition						Reference Reach(es) Data						Design						As-built					
											Composite																	
Dimension and Substrate - Riffle		LL	UL	Eq.	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
BF Width (ft)	-----	-----	-----	-----	-----	12.3	-----	-----		-----	-----	-----	-----	-----	-----	-----	-----	12.9	----	----	-----	-----	12.6	13.0	12.6	13.8	0.6	3.0
Floodprone Width (ft)	-----	-----	-----	-----	-----	>100	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	>100	----	----	-----	-----	100.0	100.0	100.0	100.0	0.0	3.0
BF Mean Depth (ft)	-----	-----	-----	-----	-----	1.3	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.2	----	----	-----	-----	0.9	1.1	1.1	1.2	0.1	3.0
BF Max Depth (ft)	-----	-----	-----	-----	-----	2.1	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.5	----	----	-----	-----	1.7	1.7	1.7	1.7	0.0	3.0
BF Cross-sectional Area (ft^2)	-----	12.0	16.5	-----	-----	16.3	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	15.2	----	----	-----	-----	12.5	13.4	13.2	14.5	0.8	3.0
Width/Depth Ratio	-----	-----	-----	-----	-----	9.3	-----	-----	-----	-----	10	-----	-----	12	-----	-----	-----	11.0	----	----	-----	-----	10.9	12.7	12.0	15.2	1.8	3.0
Entrenchment Ratio	-----	-----	-----	-----	-----	8.7	-----	-----	-----	-----	-----	-----	-----	>2.2	-----	-----	-----	>6.7	----	----	-----	-----	5.3	5.5	5.4	5.7	0.2	3.0
Bank Height Ratio	-----	-----	-----	-----	-----	1.0	-----	-----	-----	-----	1.0	-----	-----	1.1	-----	-----	-----	1.0	----	----	-----	-----	1.0	1.0	1.0	1.0	0.0	3.0
d50 (mm)	-----	-----	-----	-----	-----	0.8	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pattern																												
Channel Beltwidth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	50.0	-----	-----	75.0	-----	-----	72.6	88.2	75.3	136.9	24.7	5.0
Radius of Curvature (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	26.0	-----	-----	39.0	-----	-----	25.9	34.5	35.4	42.0	5.3	7.0
Rc:Bankfull width (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2	-----	-----	3	-----	-----	2.0	-----	-----	3.0	-----	-----	2.0	2.7	2.7	3.2	0.4	7.0
Meander Wavelength (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	140	-----	-----	170	-----	-----	130.2	162.0	161.3	190.9	24.9	5.0
Meander Width Ratio	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	3.5	-----	-----	10	-----	-----	4	-----	-----	6		-----	5.6	6.8	5.8	10.5	1.9	5.0
Profile																												
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	5.4	20.5	13.0	47.7	14.6	13.0
Riffle Slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.013	-----	-----	-----	-----	0.001	0.019	0.010	0.091	0.023	13.0
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool to Pool Spacing (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	50	-----	-----	87	-----	-----	41.4	63.2	59.1	100.8	18.2	12.0
Pool Max Depth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.2	-----	-----	2.5	-----	-----	-----	2.7	-----	-----	-----	-----	2.8	2.8	2.8	2.8	0.0	2.0
Pool Volume (ft^3)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Substrate and Transport Parameters																												
Ri% / Ru% / P% / G% / S%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----
SC% / Sa% / G% / B% / Be%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----			0.3/0.5/0.8/5.8/10.2																					
Reach Shear Stress (competency) lb/ft	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Max part size (mm) mobilized at bankfull (Rosgen Curve	-----	-----	-----	-----	-----	114	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	88	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Stream Power (transport capacity) W/m	-----	-----	-----	-----	-----	25.7	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	20.3	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Additional Reach Parameters																												
Drainage Area (SM)	-----	-----	0.68	-----	-----	-----	-----	0.68	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.68	-----	-----	-----	-----	-----	0.68	-----	-----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rosgen Classification	-----	-----	-----	-----	-----	E	-----	-----	-----	-----	-----	E5	-----	-----	-----	-----	-----	E5	-----	-----	-----	-----	-----	-----	-----	C	-----	-----
BF Velocity (fps)	-----	3.6	4.1	-----	-----	3.56	-----	-----	-----	-----	4	-----	-----	6	-----	-----	-----	3.20	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF Discharge (cfs)	-----	43.2	67.4	-----	-----	58	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	49	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Valley Length	-----	-----	-----	-----	-----	-----	-----	1086.6	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1036.3	-----	-----
Channel length (ft)	-----	-----	-----	-----	-----	-----	-----	1217	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1279.7	-----	-----
Sinuosity	-----	-----	-----	-----	-----	1.12	-----	-----	-----	-----	1.3	-----	-----	1.6	-----	-----	-----	1.40	-----	-----	-----	-----	-----	-----	-----	1.2	-----	-----
Water Surface Slope (Channel) (ft/ft)	-----	-----	-----	-----	-----	0.0058	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.0058	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.0043	-----	-----
Bankfull Floodplain Area (acres)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BEHI VL% / L% / M% / H% / VH% / E%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Channel Stability or Habitat Metric	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Biological or Other	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

* 1999 Regional Cruve and Esitmate from Revised Regional Curve. See Mitigation Plan for more information.

Table 5 continued. Baseline Stream Summary
Browns Summit Creek Restoration Project: DMS Project No ID. 96313

Reach 2

Parameter	USGS Gauge	Regional Curve*			Pre-Existing Condition						Reference Reach(es) Data						Design						As-built					
											Composite																	
		LL	UL	Eq.	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
Dimension and Substrate - Riffle																												
BF Width (ft)	-----	-----	-----	-----	-----	10.06	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	11.0	----	----	-----	-----	-----	-----	-----	-----	-----	-----
Floodprone Width (ft)	-----	-----	-----	-----	-----	22.1	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	-----	-----	-----	-----	-----	-----	-----	-----
BF Mean Depth (ft)	-----	-----	-----	-----	-----	1.1	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.0	----	----	-----	-----	-----	-----	-----	-----	-----	-----
BF Max Depth (ft)	-----	-----	-----	-----	-----	2.0	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.3	----	----	-----	-----	-----	-----	-----	-----	-----	-----
BF Cross-sectional Area (ft^2)	-----	-----	-----	-----	-----	11.1	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	11.1	----	----	-----	-----	-----	-----	-----	-----	-----	-----
Width/Depth Ratio	-----	-----	-----	-----	-----	9.1	-----	-----	-----	-----	10	-----	-----	12	-----	-----	-----	11	----	----	-----	-----	-----	-----	-----	-----	-----	-----
Entrenchment Ratio	-----	-----	-----	-----	-----	2.2	-----	-----	-----	-----	-----	-----	-----	>2.2	-----	-----	-----	-----	----	----	-----	-----	-----	-----	-----	-----	-----	-----
Bank Height Ratio	-----	-----	-----	-----	-----	2.3	-----	-----	-----	-----	1.0	-----	-----	1.1	-----	-----	-----	1.0	----	----	-----	-----	-----	-----	-----	-----	-----	-----
d50 (mm)	-----	-----	-----	-----	-----	0.6	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pattern																												
Channel Beltwidth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Radius of Curvature (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	22	-----	-----	33.0	-----	-----	-----	-----	-----	-----	-----	-----
Rc:Bankfull width (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2	-----	-----	3	-----	-----	2	-----	-----	3.0	-----	-----	-----	-----	-----	-----	-----	-----
Meander Wavelength (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Meander Width Ratio	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	3.5	-----	-----	10	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Profile																												
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Riffle Slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Pool to Pool Spacing (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Max Depth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.2	-----	-----	2.5	-----	-----	-----	2.2	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Volume (ft^3)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Substrate and Transport Parameters																												
Ri% / Ru% / P% / G% / S%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----
SC% / Sa% / G% / B% / Be%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----			0.2/0.4/0.6/2.9/6.9																					
Reach Shear Stress (competency) lb/ft	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Max part size (mm) mobilized at bankfull (Rosgen Curve	-----	-----	-----	-----	-----	100.0	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	90	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Stream Power (transport capacity) W/m	-----	-----	-----	-----	-----	20.4	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	19.1	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Additional Reach Parameters					-----																							
Drainage Area (SM)	-----	-----	0.47	-----	-----	-----	-----	0.47	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.47	-----	-----	-----	-----	-----	0.47	-----	-----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rosgen Classification	-----	-----	-----	-----	-----	Bc	-----	-----	-----	-----	-----	E5	-----	-----	-----	-----	-----	E5	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF Velocity (fps)	-----	3.50	4.03	-----	-----	3.87	-----	-----	-----	-----	4	-----	-----	6	-----	-----	-----	2.91	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF Discharge (cfs)	-----	32.4	51.6	-----	-----	43	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	32.3	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Valley Length	-----	-----	-----	-----	-----	-----	-----	643.0	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Channel length (ft)	-----	-----	-----	-----	-----	-----	-----	868.0	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Sinuosity	-----	-----	-----	-----	-----	1.35	-----	-----	-----	-----	1.3	-----	-----	1.6	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Water Surface Slope (Channel) (ft/ft)	-----	-----	-----	-----	-----	0.0054	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.0054	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Bankfull Floodplain Area (acres)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BEHI VL% / L% / M% / H% / VH% / E%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Channel Stability or Habitat Metric	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Biological or Other	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

* 1999 Regional Cruve and Esitmate from Revised Regional Curve. See Mitigation Plan for more information.

Table 5 continued. Baseline Stream Summary
Browns Summit Creek Restoration Project: DMS Project No ID. 96313

Reach 3

Parameter	USGS Gauge	Regional Curve*			Pre-Existing Condition						Reference Reach(es) Data						Design						As-built					
											Composite																	
Dimension and Substrate - Riffle		LL	UL	Eq.	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
BF Width (ft)	-----	-----	-----	-----	-----	8.5	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	10.3	----	----	-----	-----	9.3	10.7	10.9	11.6	0.9	4.0
Floodprone Width (ft)	-----	-----	-----	-----	-----	17.8	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	>23	----	----	-----	-----	51.6	73.4	76.1	89.9	15.7	4.0
BF Mean Depth (ft)	-----	-----	-----	-----	-----	1.15	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.9	----	----	-----	-----	0.6	0.8	0.8	0.9	0.2	4.0
BF Max Depth (ft)	-----	-----	-----	-----	-----	1.8	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.2	----	----	-----	-----	1.1	1.3	1.3	1.3	0.1	4.0
BF Cross-sectional Area (ft^2)	-----	6.5	9.3	-----	-----	9.7	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	9.7	----	----	-----	-----	6.8	7.9	7.6	9.8	1.2	4.0
Width/Depth Ratio	-----	-----	-----	-----	-----	7.15	-----	-----	-----	-----	10	-----	-----	12	-----	-----	-----	11.0	----	----	-----	-----	10.8	15.0	15.1	19.2	3.9	4.0
Entrenchment Ratio	-----	-----	-----	-----	-----	2.0	-----	-----	-----	-----	-----	-----	-----	>2.2	-----	-----	-----	>2.2	-----	----	-----	-----	4.4	6.9	7.5	8.2	1.5	4.0
Bank Height Ratio	-----	-----	-----	-----	-----	2.1	-----	-----	-----	-----	1.0	-----	-----	1.1	-----	-----	-----	1.0	-----	----	-----	-----	1.0	1.0	1.0	1.0	0.0	4.0
d50 (mm)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Pattern																												
Channel Beltwidth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	35	-----	-----	56.0	-----	-----	37.4	54.0	59.9	64.7	11.9	3.0
Radius of Curvature (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	20	-----	-----	30.0	-----	-----	20.0	27.8	25.8	37.2	6.3	10.0
Rc:Bankfull width (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2	-----	-----	3	-----	-----	2	-----	-----	3.0	-----	-----	1.9	2.6	2.4	3.5	0.6	10.0
Meander Wavelength (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	90	-----	-----	130.0	-----	-----	90.4	108.9	101.0	137.2	17.2	5.0
Meander Width Ratio	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	3.5	-----	-----	10	-----	-----	-----	-----	-----	----	-----	-----	3.5	5.1	5.6	6.1	1.1	3.0
Profile																												
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Riffle Slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.018	-----	----	-----	-----	0.005	0.021	0.019	0.040	0.010	13.0
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Pool to Pool Spacing (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	47	-----	-----	70.0	-----	-----	20.1	55.2	59.2	81.3	18.3	13.0
Pool Max Depth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.2	-----	-----	2.5	-----	-----	-----	2	-----	----	-----	-----	1.3	1.8	1.8	2.2	0.5	2.0
Pool Volume (ft^3)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Substrate and Transport Parameters																												
Ri% / Ru% / P% / G% / S%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----
SC% / Sa% / G% / B% / Be%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----			0.1/0.2/0.4/10.4/22.4																					
Reach Shear Stress (competency) lb/ft	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Max part size (mm) mobilized at bankfull (Rosgen Curve	-----	-----	-----	-----	-----	141	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	116	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Stream Power (transport capacity) W/m²	-----	-----	-----	-----	-----	30.7	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	26.2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Additional Reach Parameters					-----																							
Drainage Area (SM)	-----	-----	0.38	-----	-----	-----	-----	0.38	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.38	-----	-----	-----	-----	-----	0.38	-----	-----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rosgen Classification	-----	-----	-----	-----	-----	Bc	-----	-----	-----	-----	-----	E5	-----	-----	-----	-----	-----	E5	-----	-----	-----	-----	-----	-----	-----	C	-----	-----
BF Velocity (fps)	-----	3.42	3.97	-----	-----	3.5	-----	-----	-----	-----	4	-----	-----	6	-----	-----	-----	3.3	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF Discharge (cfs)	-----	25.7	41.7	-----	-----	34.5	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	31.9	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Valley Length	-----	-----	-----	-----	-----	-----	-----	1441.8	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1323.2	-----	-----
Channel length (ft)	-----	-----	-----	-----	-----	-----	-----	1586.0	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1495.2	-----	-----
Sinuosity	-----	-----	-----	-----	-----	1.10	-----	-----	-----	-----	1.3	-----	-----	1.6	-----	-----	-----	1.20	-----	-----	-----	-----	-----	-----	-----	1.13	-----	-----
Water Surface Slope (Channel) (ft/ft)	-----	-----	-----	-----	-----	0.0082	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.0082	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.010	-----	-----
Bankfull Floodplain Area (acres)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BEHI VL% / L% / M% / H% / VH% / E%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Channel Stability or Habitat Metric	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Biological or Other	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

* 1999 Regional Cruve and Esitmate from Revised Regional Curve. See Mitigation Plan for more information.

Table 5 continued. Baseline Stream Summary
Browns Summit Creek Restoration Project: DMS Project No ID. 96313

Reach 4

Parameter	USGS Gauge	Regional Curve*			Pre-Existing Condition						Reference Reach(es) Data						Design (lower/upper)						As-built					
											Composite																	
Dimension and Substrate - Riffle		LL	UL	Eq.	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
BF Width (ft)	-----	-----	-----	-----	-----	7.60	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	9.2 / 8.1	-----	-----	-----	-----	7.2	9.3	9.1	11.8	1.7	4.0
Floodprone Width (ft)	-----	-----	-----	-----	-----	9.1	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	>19 / >17	-----	-----	-----	-----	31.3	57.9	66.0	68.1	15.4	4.0
BF Mean Depth (ft)	-----	-----	-----	-----	-----	0.86	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.7 / 0.6	-----	-----	-----	-----	0.5	0.8	0.9	1.1	0.2	4.0
BF Max Depth (ft)	-----	-----	-----	-----	-----	1.39	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.9 / 0.8	-----	-----	-----	-----	0.8	1.4	1.5	1.7	0.3	4.0
BF Cross-sectional Area (ft^2)	-----	-----	-----	-----	-----	6.5	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	6.5 / 5.0	-----	-----	-----	-----	3.3	7.7	7.4	12.7	3.4	4.0
Width/Depth Ratio	-----	-----	-----	-----	-----	8.8	-----	-----	-----	-----	10.0	-----	-----	14.0	-----	-----	-----	13.0	-----	----	-----	-----	11.0	12.3	11.3	15.4	1.8	4.0
Entrenchment Ratio	-----	-----	-----	-----	-----	1.2	-----	-----	-----	-----	-----	-----	-----	>2.2	-----	-----	-----	>2.2	-----	----	-----	-----	4.4	5.9	5.8	7.6	1.3	3.0
Bank Height Ratio	-----	-----	-----	-----	-----	6.8	-----	-----	-----	-----	1.0	-----	-----	1.1	-----	-----	-----	1.0	-----	----	-----	-----	1.0	1.0	1.0	1.0	0.0	3.0
d50 (mm)	-----	-----	-----	-----	-----	0.4	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pattern																												
Channel Beltwidth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	30-42/22-43	-----	----	-----	-----	36.9	43.0	42.8	49.7	4.7	4.0
Radius of Curvature (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2	-----	-----	3	-----	-----	-----	18-28/16-25	-----	-----	-----	-----	17.2	24.5	25.1	34.3	4.9	10.0
Rc:Bankfull width (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	3.1 / 2.0	-----	-----	-----	-----	1.8	2.6	2.7	3.7	0.5	10.0
Meander Wavelength (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	120.0 / 80.0	-----	-----	-----	-----	63.1	94.5	93.0	123.0	20.2	9.0
Meander Width Ratio	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	3.5	-----	-----	8	-----	-----	-----	12.0 / 2.7	-----	-----	-----	-----	4.0	4.6	4.6	5.3	0.5	4.0
Profile																												
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Riffle Slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.019	-----	----	-----	-----	0.013	0.021	0.018	0.036	0.008	7.0
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Pool to Pool Spacing (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	36-64/29-52	-----	----	-----	-----	31.2	58.1	56.1	87.8	18.7	6.0
Pool Max Depth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2.0 / 1.9	-----	----	-----	-----	2.0	2.0	2.0	2.0	0.0	1
Pool Volume (ft^3)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Substrate and Transport Parameters																												
Ri% / Ru% / P% / G% / S%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----
SC% / Sa% / G% / B% / Be%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----			0.2/0.3/0.4/0.9/1.8																					
Reach Shear Stress (competency) lb/ft	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Max part size (mm) mobilized at bankfull (Rosgen Curve	-----	-----	-----	-----	-----	-----	208	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	141	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Stream Power (transport capacity) W/m	-----	-----	-----	-----	-----	-----	45.1	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	30.7	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Additional Reach Parameters					-----						-----																	
Drainage Area (SM)	-----	-----	0.22	-----	-----	-----	-----	0.22	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.22	-----	-----	-----	-----	-----	0.22	-----	-----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rosgen Classification	-----	-----	-----	-----	-----	Gc	-----	-----	-----	-----	-----	C5	-----	-----	-----	-----	-----	C5	-----	-----	-----	-----	-----	-----	-----	E	-----	-----
BF Velocity (fps)	-----	3.29	3.90	-----	-----	3.69	-----	-----	-----	-----	3.5	-----	-----	5.0	-----	-----	-----	3.8 / 4.1	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF Discharge (cfs)	-----	17.9	29.8	-----	-----	24	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	24.8 / 21.1	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Valley Length	-----	-----	-----	-----	-----	-----	-----	1173.9	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1173.9	-----	-----
Channel length (ft)	-----	-----	-----	-----	-----	-----	-----	1350.0	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1263.4	-----	-----
Sinuosity	-----	-----	-----	-----	-----	1.15	-----	-----	-----	-----	1.2	-----	-----	1.5	-----	-----	-----	1.13/1.22	-----	-----	-----	-----	-----	-----	-----	1.08	-----	-----
Water Surface Slope (Channel) (ft/ft)	-----	-----	-----	-----	-----	0.016	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.011 / 0.016	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.0	-----	-----
Bankfull Floodplain Area (acres)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BEHI VL% / L% / M% / H% / VH% / E%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Channel Stability or Habitat Metric	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Biological or Other	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

* 1999 Regional Cruve and Esitmate from Revised Regional Curve. See Mitigation Plan for more information.

Table 5 continued. Baseline Stream Summary
Browns Summit Creek Restoration Project: DMS Project No ID. 96313

Reach 5

Parameter	USGS Gauge	Regional Curve*			Pre-Existing Condition						Reference Reach(es) Data Composite						Design						As-built					
		LL	UL	Eq.	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
Dimension and Substrate - Riffle																												
BF Width (ft)	-----	-----	-----	-----	-----	7.38	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Floodprone Width (ft)	-----	-----	-----	-----	-----	11.8	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
BF Mean Depth (ft)	-----	-----	-----	-----	-----	0.44	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
BF Max Depth (ft)	-----	-----	-----	-----	-----	0.67	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
BF Cross-sectional Area (ft^2)	-----	-----	-----	-----	-----	3.2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Width/Depth Ratio	-----	-----	-----	-----	-----	16.77	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Entrenchment Ratio	-----	-----	-----	-----	-----	1.6	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Bank Height Ratio	-----	-----	-----	-----	-----	5.8	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
d50 (mm)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Pattern																												
Channel Beltwidth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Radius of Curvature (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Rc:Bankfull width (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Meander Wavelength (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Meander Width Ratio	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Profile																												
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Riffle Slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Pool to Pool Spacing (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Max Depth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Volume (ft^3)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Substrate and Transport Parameters																												
Ri% / Ru% / P% / G% / S%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	----
SC% / Sa% / G% / B% / Be%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	----
Reach Shear Stress (competency) lb/ft	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Max part size (mm) mobilized at bankfull (Rosgen Curve	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Stream Power (transport capacity) W/m	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Additional Reach Parameters					-----						-----																	
Drainage Area (SM)	-----	-----	0.04	-----	-----	-----	-----	0.04	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.04	-----	-----	-----	-----	-----	0.04	-----	-----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Rosgen Classification	-----	-----	-----	-----	-----	Bc	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
BF Velocity (fps)	-----	-----	-----	-----	-----	3.97	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
BF Discharge (cfs)	-----	-----	-----	-----	-----	12.7	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Valley Length	-----	-----	-----	-----	-----	-----	-----	470.2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	470	-----	-----
Channel length (ft)	-----	-----	-----	-----	-----	-----	-----	536.0	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	520	-----	-----
Sinuosity	-----	-----	-----	-----	-----	1.14	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	1.11	-----	-----
Water Surface Slope (Channel) (ft/ft)	-----	-----	-----	-----	-----	0.017	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
BF slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Bankfull Floodplain Area (acres)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
BEHI VL% / L% / M% / H% / VH% / E%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Channel Stability or Habitat Metric	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Biological or Other	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----

* 1999 Regional Cruve and Esitmate from Revised Regional Curve. See Mitigation Plan for more information.

Table 5 continued. Baseline Stream Summary
Browns Summit Creek Restoration Project: DMS Project No ID. 96313

Reach 6

Parameter	USGS Gauge	Regional Curve*			Pre-Existing Condition						Reference Reach(es) Data						Design						As-built					
											Composite																	
Dimension and Substrate - Riffle		LL	UL	Eq.	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
BF Width (ft)	-----	-----	-----	-----	-----	9.09	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	6.1	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Floodprone Width (ft)	-----	-----	-----	-----	-----	12.7	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	13.0	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
BF Mean Depth (ft)	-----	-----	-----	-----	-----	0.48	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.5	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
BF Max Depth (ft)	-----	-----	-----	-----	-----	0.8	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.6	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
BF Cross-sectional Area (ft²)	-----	-----	-----	-----	-----	4.4	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	3.1	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Width/Depth Ratio	-----	-----	-----	-----	-----	18.94	-----	-----	-----	-----	12.0	-----	-----	18.0	-----	-----	-----	14.0	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Entrenchment Ratio	-----	-----	-----	-----	-----	1.4	-----	-----	-----	-----	1.4	-----	-----	2.2	-----	-----	-----	<2.2	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Bank Height Ratio	-----	-----	-----	-----	-----	5.2	-----	-----	-----	-----	1.0	-----	-----	1.1	-----	-----	-----	1.0	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
d50 (mm)	-----	-----	-----	-----	-----	0.4	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pattern																												
Channel Beltwidth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Radius of Curvature (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Rc:Bankfull width (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Meander Wavelength (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Meander Width Ratio	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Profile																												
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Riffle Slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.06	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Pool to Pool Spacing (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	30	-----	-----	54.0	-----	-----	-----	-----	-----	-----	-----	-----
Pool Max Depth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.7	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Volume (ft³)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Substrate and Transport Parameters																												
Ri% / Ru% / P% / G% / S%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	----
SC% / Sa% / G% / B% / Be%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----			0.2/0.3/0.4/0.9/1.8																					
Reach Shear Stress (competency) lb/ft²	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Max part size (mm) mobilized at bankfull (Rosgen Curve	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Stream Power (transport capacity) W/m²	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Additional Reach Parameters					-----						-----																	
Drainage Area (SM)	-----	-----	0.10	-----	-----	-----	-----	0.10	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.10	-----	-----	-----	-----	-----	0.10	-----	-----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Rosgen Classification	-----	-----	-----	-----	-----	Bc	-----	-----	-----	-----	-----	B5c	-----	-----	-----	-----	-----	B5c	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
BF Velocity (fps)	-----	-----	-----	-----	-----	3.75	-----	-----	-----	-----	4	-----	-----	6.0	-----	-----	-----	5.2	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
BF Discharge (cfs)	-----	-----	-----	-----	-----	16.5	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	16	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Valley Length	-----	-----	-----	-----	-----	-----	-----	468.2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Channel length (ft)	-----	-----	-----	-----	-----	-----	-----	501.0	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	468.2	-----	-----
Sinuosity	-----	-----	-----	-----	-----	1.07	-----	-----	-----	-----	1.1	-----	-----	1.3	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Water Surface Slope (Channel) (ft/ft)	-----	-----	-----	-----	-----	0.014	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.016	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
BF slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Bankfull Floodplain Area (acres)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
BEHI VL% / L% / M% / H% / VH% / E%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Channel Stability or Habitat Metric	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Biological or Other	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----

* 1999 Regional Cruve and Esitmate from Revised Regional Curve. See Mitigation Plan for more information.

Table 5 continued. Baseline Stream Summary
Browns Summit Creek Restoration Project: DMS Project No ID. 96313

Reach T1

Parameter	USGS Gauge	Regional Curve*			Pre-Existing Condition						Reference Reach(es) Data						Design						As-built					
											Composite																	
Dimension and Substrate - Riffle		LL	UL	Eq.	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
BF Width (ft)	-----	-----	-----	-----	-----	6.80	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	7.0	-----	----	-----	-----	7.7	7.7	7.7	7.7	0.0	1.0
Floodprone Width (ft)	-----	-----	-----	-----	-----	89.1	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	39.9	39.9	39.9	39.9	0.0	1.0
BF Mean Depth (ft)	-----	-----	-----	-----	-----	0.67	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.5	-----	----	-----	-----	0.7	0.7	0.7	0.7	0.0	1.0
BF Max Depth (ft)	-----	-----	-----	-----	-----	1.53	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.7	-----	----	-----	-----	1.2	1.2	1.2	1.2	0.0	1.0
BF Cross-sectional Area (ft^2)	-----	-----	-----	-----	-----	4.5	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	3.8	-----	----	-----	-----	5.1	5.1	5.1	5.1	0.0	1.0
Width/Depth Ratio	-----	-----	-----	-----	-----	10.15	-----	-----	-----	-----	10.0	-----	-----	14.0	-----	-----	-----	13.0	-----	----	-----	-----	11.7	11.7	11.7	11.7	0.0	1.0
Entrenchment Ratio	-----	-----	-----	-----	-----	13.1	-----	-----	-----	-----	-----	-----	-----	>2.2	-----	-----	-----	-----	-----	----	-----	-----	5.2	5.2	5.2	5.2	0.0	1.0
Bank Height Ratio	-----	-----	-----	-----	-----	1.6	-----	-----	-----	-----	1.0	-----	-----	1.1	-----	-----	-----	-----	-----	----	-----	-----	1.0	1.0	1.0	1.0	0.0	1.0
d50 (mm)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Pattern																												
Channel Beltwidth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	29.6	29.6	29.6	29.6	0.0	1.0
Radius of Curvature (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	14	-----	-----	21.0	-----	-----	16.3	17.4	17.4	18.5	1.1	2.0
Rc:Bankfull width (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2	-----	-----	3	-----	-----	-----	-----	-----	----	-----	-----	2.1	2.3	2.3	2.4	0.1	2.0
Meander Wavelength (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	60.0	-----	----	-----	-----	56.0	57.9	57.9	59.7	1.8	2.0
Meander Width Ratio	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	3.5	-----	-----	8	-----	-----	-----	4.0	-----	----	-----	-----	3.8	3.8	3.8	3.8	0.0	1.0
Profile																												
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Riffle Slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.029	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Pool to Pool Spacing (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	27	-----	-----	35.0	-----	-----	18.2	23.8	26.6	34.6	7.6	3
Pool Max Depth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.2	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Volume (ft^3)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Substrate and Transport Parameters																												
Ri% / Ru% / P% / G% / S%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----
SC% / Sa% / G% / B% / Be%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----																		
Reach Shear Stress (competency) lb/ft	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Max part size (mm) mobilized at bankfull (Rosgen Curve	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Stream Power (transport capacity) W/m	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Additional Reach Parameters					-----						-----																	
Drainage Area (SM)	-----	-----	0.09	-----	-----	-----	-----	0.09	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.09	-----	-----	-----	-----	-----	0.09	-----	-----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rosgen Classification	-----	-----	-----	-----	-----	E	-----	-----	-----	-----	-----	C5	-----	-----	-----	-----	-----	C5	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF Velocity (fps)	-----	-----	-----	-----	-----	3.76	-----	-----	-----	-----	3.5	-----	-----	5.0	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF Discharge (cfs)	-----	-----	-----	-----	-----	16.9	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Valley Length	-----	-----	-----	-----	-----	-----	-----	114.2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	114.2	-----	-----
Channel length (ft)	-----	-----	-----	-----	-----	-----	-----	121.0	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	139.6	-----	-----
Sinuosity	-----	-----	-----	-----	-----	1.06	-----	-----	-----	-----	1.2	-----	-----	1.5	-----	-----	-----	1.12	-----	-----	-----	-----	-----	-----	-----	1.22	-----	-----
Water Surface Slope (Channel) (ft/ft)	-----	-----	-----	-----	-----	0.024	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.019	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Bankfull Floodplain Area (acres)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BEHI VL% / L% / M% / H% / VH% / E%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Channel Stability or Habitat Metric	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Biological or Other	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

* 1999 Regional Cruve and Esitmate from Revised Regional Curve. See Mitigation Plan for more information.

Table 5 continued. Baseline Stream Summary
Browns Summit Creek Restoration Project: DMS Project No ID. 96313

Reach T2

Parameter	USGS Gauge	Regional Curve*			Pre-Existing Condition						Reference Reach(es) Data						Design						As-built					
											Composite																	
Dimension and Substrate - Riffle		LL	UL	Eq.	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
BF Width (ft)	-----	-----	-----	-----	-----	18.00	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Floodprone Width (ft)	-----	-----	-----	-----	-----	23.4	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
BF Mean Depth (ft)	-----	-----	-----	-----	-----	0.22	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
BF Max Depth (ft)	-----	-----	-----	-----	-----	0.78	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
BF Cross-sectional Area (ft^2)	-----	-----	-----	-----	-----	4.0	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Width/Depth Ratio	-----	-----	-----	-----	-----	81.82	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Entrenchment Ratio	-----	-----	-----	-----	-----	1.3	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Bank Height Ratio	-----	-----	-----	-----	-----	3.0	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
d50 (mm)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Pattern																												
Channel Beltwidth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Radius of Curvature (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Rc:Bankfull width (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Meander Wavelength (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Meander Width Ratio	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Profile																												
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Riffle Slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Pool to Pool Spacing (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Max Depth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Volume (ft^3)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Substrate and Transport Parameters																												
Ri% / Ru% / P% / G% / S%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	----
SC% / Sa% / G% / B% / Be%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----																		
Reach Shear Stress (competency) lb/ft	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Max part size (mm) mobilized at bankfull (Rosgen Curve	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Stream Power (transport capacity) W/m	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Additional Reach Parameters					-----						-----																	
Drainage Area (SM)	-----	-----	0.07	-----	-----	-----	-----	0.07	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.07	-----	-----	-----	-----	-----	0.07	-----	-----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Rosgen Classification	-----	-----	-----	-----	-----	F	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
BF Velocity (fps)	-----	-----	-----	-----	-----	3.6	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
BF Discharge (cfs)	-----	-----	-----	-----	-----	14.4	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Valley Length	-----	-----	-----	-----	-----	-----	-----	252.7	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	252.7	-----	-----
Channel length (ft)	-----	-----	-----	-----	-----	-----	-----	283.0	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	284.2	-----	-----
Sinuosity	-----	-----	-----	-----	-----	1.12	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	1.12	-----	-----
Water Surface Slope (Channel) (ft/ft)	-----	-----	-----	-----	-----	0.022	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
BF slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Bankfull Floodplain Area (acres)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
BEHI VL% / L% / M% / H% / VH% / E%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Channel Stability or Habitat Metric	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Biological or Other	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----

* 1999 Regional Cruve and Esitmate from Revised Regional Curve. See Mitigation Plan for more information.

Table 5 continued. Baseline Stream Summary
Browns Summit Creek Restoration Project: DMS Project No ID. 96313

Reach T3

Parameter	USGS Gauge	Regional Curve*			Pre-Existing Condition						Reference Reach(es) Data Composite						Design						As-built					
		LL	UL	Eq.	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
Dimension and Substrate - Riffle																												
BF Width (ft)	-----	-----	-----	-----	-----	2.93	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	5.8	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Floodprone Width (ft)	-----	-----	-----	-----	-----	66.5	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	15.0	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
BF Mean Depth (ft)	-----	-----	-----	-----	-----	1.12	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.5	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
BF Max Depth (ft)	-----	-----	-----	-----	-----	1.76	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.6	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
BF Cross-sectional Area (ft²)	-----	-----	-----	-----	-----	3.3	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2.8	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Width/Depth Ratio	-----	-----	-----	-----	-----	2.62	-----	-----	-----	-----	12.0	-----	-----	18.0	-----	-----	-----	12.0	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Entrenchment Ratio	-----	-----	-----	-----	-----	22.7	-----	-----	-----	-----	1.4	-----	-----	2.2	-----	-----	-----	<2.2	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Bank Height Ratio	-----	-----	-----	-----	-----	1.7	-----	-----	-----	-----	1.0	-----	-----	1.1	-----	-----	-----	1.0	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
d50 (mm)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Pattern																												
Channel Beltwidth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Radius of Curvature (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Rc:Bankfull width (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2	-----	-----	3.0	-----	-----	-----	-----	-----	-----	-----	-----
Meander Wavelength (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Meander Width Ratio	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Profile																												
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Riffle Slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.033	-----	----	-----	-----	0.017	0.025	0.017	0.017	0.007	2
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Pool to Pool Spacing (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	36	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Max Depth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.9	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Volume (ft³)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Substrate and Transport Parameters																												
Ri% / Ru% / P% / G% / S%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----
SC% / Sa% / G% / B% / Be%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----																		
Reach Shear Stress (competency) lb/ft²	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Max part size (mm) mobilized at bankfull (Rosgen Curve)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Stream Power (transport capacity) W/m²	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Additional Reach Parameters											-----																	
Drainage Area (SM)	-----	-----	0.06	-----	-----	-----	-----	0.06	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.06	-----	-----	-----	-----	-----	0.06	-----	-----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rosgen Classification	-----	-----	-----	-----	-----	E	-----	-----	-----	-----	-----	B5c	-----	-----	-----	-----	-----	B5c	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF Velocity (fps)	-----	-----	-----	-----	-----	3.6	-----	-----	-----	-----	4	-----	-----	6.0	-----	-----	-----	2.3	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF Discharge (cfs)	-----	-----	-----	-----	-----	11.7	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	6.4	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Valley Length	-----	-----	-----	-----	-----	-----	-----	44.3	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	80.5	-----	-----
Channel length (ft)	-----	-----	-----	-----	-----	-----	-----	47.0	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	88.0	-----	-----
Sinuosity	-----	-----	-----	-----	-----	1.06	-----	-----	-----	-----	1.1	-----	-----	1.3	-----	-----	-----	1.20	-----	-----	-----	-----	-----	-----	-----	1.09	-----	-----
Water Surface Slope (Channel) (ft/ft)	-----	-----	-----	-----	-----	0.02	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.014	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Bankfull Floodplain Area (acres)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BEHI VL% / L% / M% / H% / VH% / E%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Channel Stability or Habitat Metric	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Biological or Other	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

* 1999 Regional Cruve and Esitmate from Revised Regional Curve. See Mitigation Plan for more information.

Table 5 continued. Baseline Stream Summary
Browns Summit Creek Restoration Project: DMS Project No ID. 96313

Reach T4

Parameter	USGS Gauge	Regional Curve*			Pre-Existing Condition						Reference Reach(es) Data Composite						Design						As-built					
		LL	UL	Eq.	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
Dimension and Substrate - Riffle																												
BF Width (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	5.8	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Floodprone Width (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	12.0	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
BF Mean Depth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.5	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
BF Max Depth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.6	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
BF Cross-sectional Area (ft²)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2.8	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Width/Depth Ratio	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	12.0	-----	-----	18.0	-----	-----	-----	12.0	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Entrenchment Ratio	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.4	-----	-----	2.2	-----	-----	-----	<2.2	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Bank Height Ratio	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.0	-----	-----	1.1	-----	-----	-----	1.0	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
d50 (mm)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Pattern																												
Channel Beltwidth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Radius of Curvature (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Rc:Bankfull width (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Meander Wavelength (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Meander Width Ratio	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Profile																												
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Riffle Slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.051	-----	----	-----	-----	0.007	0.047	0.048	0.072	0.023	11
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Pool to Pool Spacing (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	14	-----	----	-----	-----	12.3	16.1	14.6	21.6	3.5	11
Pool Max Depth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.9	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Volume (ft³)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Substrate and Transport Parameters																												
Ri% / Ru% / P% / G% / S%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	----
SC% / Sa% / G% / B% / Be%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----																		
Reach Shear Stress (competency) lb/ft²	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Max part size (mm) mobilized at bankfull (Rosgen Curve)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Stream Power (transport capacity) W/m²	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Additional Reach Parameters																												
Drainage Area (SM)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Rosgen Classification	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	B5c	-----	-----	-----	-----	-----	B5c	-----	----	-----	-----	-----	-----	-----	B5c	-----	-----
BF Velocity (fps)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	4	-----	-----	6.0	-----	-----	-----	3.7	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
BF Discharge (cfs)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	10.4	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Valley Length	-----	-----	-----	-----	-----	-----	-----	117.0	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	143.34	-----	-----
Channel length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	119.18	-----	-----
Sinuosity	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.1	-----	-----	1.3	-----	-----	-----	1.20	-----	----	-----	-----	-----	-----	-----	0.8314497	-----	-----
Water Surface Slope (Channel) (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.047	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
BF slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Bankfull Floodplain Area (acres)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
BEHI VL% / L% / M% / H% / VH% / E%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Channel Stability or Habitat Metric	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----
Biological or Other	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	-----	-----

* 1999 Regional Cruve and Esitmate from Revised Regional Curve. See Mitigation Plan for more information.

Table 6. Morphology and Hydraulic Monitoring Summary
Browns Summit Creek Restoration Project: DMS Project No ID. 96313

Stream Reach	Reach 4																									
	Cross-section X-1 (Riffle)							Cross-section X-2 (Pool)							Cross-section X-3 (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+					
Based on fixed baseline bankfull elevation																										
BF Width (ft)	7.2							11.6							9.5											
BF Mean Depth (ft)	0.5							0.9							0.9											
Width/Depth Ratio	15.4							12.7							11											
BF Cross-sectional Area (ft^2)	3.3							10.5							8.2											
BF Max Depth (ft)	0.8							2							1.6											
Width of Floodprone Area (ft)	31.3							-							66.2											
Entrenchment Ratio	4.4							-							7.0											
Bank Height Ratio	1							1							1											
Wetted Perimeter (ft)	7.4							12.6							10.1											
Hydraulic Radius (ft)	0.5							0.8							0.80											
Cross Sectional Area between end pins (ft^2)	-							-							-											
d50 (mm)	-							-							-											

Stream Reach	Reach 4														Reach 3											
	Cross-section X-4 (Riffle)							Cross-section X-5 (Riffle)							Cross-section X-6 (Pool)							Cross-section X-7 (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)	8.7							11.8							12.5							11.2						
BF Mean Depth (ft)	0.8							1.1							0.9							0.6						
Width/Depth Ratio	11.6							1.7							14							18.6						
BF Cross-sectional Area (ft^2)	6.6							12.7							11.2							6.8						
BF Max Depth (ft)	1.4							1.7							1.3							1.1						
Width of Floodprone Area (ft)	65.8							68.1							-							89.9						
Entrenchment Ratio	7.6							5.8							-							8						
Bank Height Ratio	1							1							1							1						
Wetted Perimeter (ft)	9.4							12.8							13.0							11.6						
Hydraulic Radius (ft)	0.7							1.0							0.9							0.6						
Cross Sectional Area between end pins (ft^2)	-							-							-							-						
d50 (mm)	-							-							-							-						

Stream Reach	Reach 3																									
	Cross-section X-8 (Riffle)							Cross-section X-9 (Pool)							Cross-section X-10 (Riffle)							Cross-section X-11 (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)	10.60							17.60							11.60							9.30						
BF Mean Depth (ft)	0.90							1.00							0.60							0.90						
Width/Depth Ratio	11.5							17.7							19.2							10.8						
BF Cross-sectional Area (ft^2)	9.8							17.5							7.0							8.1						
BF Max Depth (ft)	1.30							2.20							1.30							1.30						
Width of Floodprone Area (ft)	86.6							-							51.6							65.6						
Entrenchment Ratio	8.2							-							4.4							7.0						
Bank Height Ratio	1.0							1.0							1.0							1.0						
Wetted Perimeter (ft)	11.2							18.2							12.0							9.9						
Hydraulic Radius (ft)	0.9							1.0							0.6							0.8						
Cross Sectional Area between end pins (ft^2)	-							-							-							-						
d50 (mm)	-							-							-							-						

Table 6. Morphology and Hydraulic Monitoring Summary
Browns Summit Creek Restoration Project: DMS Project No ID. 96313

Stream Reach	**Reach T1**							**Reach 1**																		
	Cross-section X-12 (Riffle)							**Cross-section X-13 (Pool)**							**Cross-section X-14 (Riffle)**							**Cross-section X-15 (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)	7.70							19.60							13.80							29.40						
BF Mean Depth (ft)	0.70							1.20							0.90							1.10						
Width/Depth Ratio	11.7							16.4							15.2							26.1						
BF Cross-sectional Area (ft^2)	5.1							23.5							12.5							33.2						
BF Max Depth (ft)	1.20							2.80							1.70							2.80						
Width of Floodprone Area (ft)	39.9							-							100.0							100.0						
Entrenchment Ratio	5.2							-							5.3							2.7						
Bank Height Ratio	1.0							1.0							1.0							1.0						
Wetted Perimeter (ft)	8.5							21.0							14.4							30.5						
Hydraulic Radius (ft)	0.6							1.1							0.9							1.1						
Cross Sectional Area between end pins (ft^2)	-							-							-							-						
d50 (mm)	-							-							-							-						

Stream Reach	**Reach 1**																									
	Cross-section X-16 (Riffle)							**Cross-section X-17 (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)	12.60							12.60																		
BF Mean Depth (ft)	1.10							1.20																		
Width/Depth Ratio	12.0							10.9																		
BF Cross-sectional Area (ft^2)	13.2							14.5																		
BF Max Depth (ft)	1.70							1.70																		
Width of Floodprone Area (ft)	100.0							100.0																		
Entrenchment Ratio	5.7							5.4																		
Bank Height Ratio	1.0							1.0																		
Wetted Perimeter (ft)	13.5							13.3																		
Hydraulic Radius (ft)	1.0							1.1																		
Cross Sectional Area between end pins (ft^2)	-							-																		
d50 (mm)	-							-																		

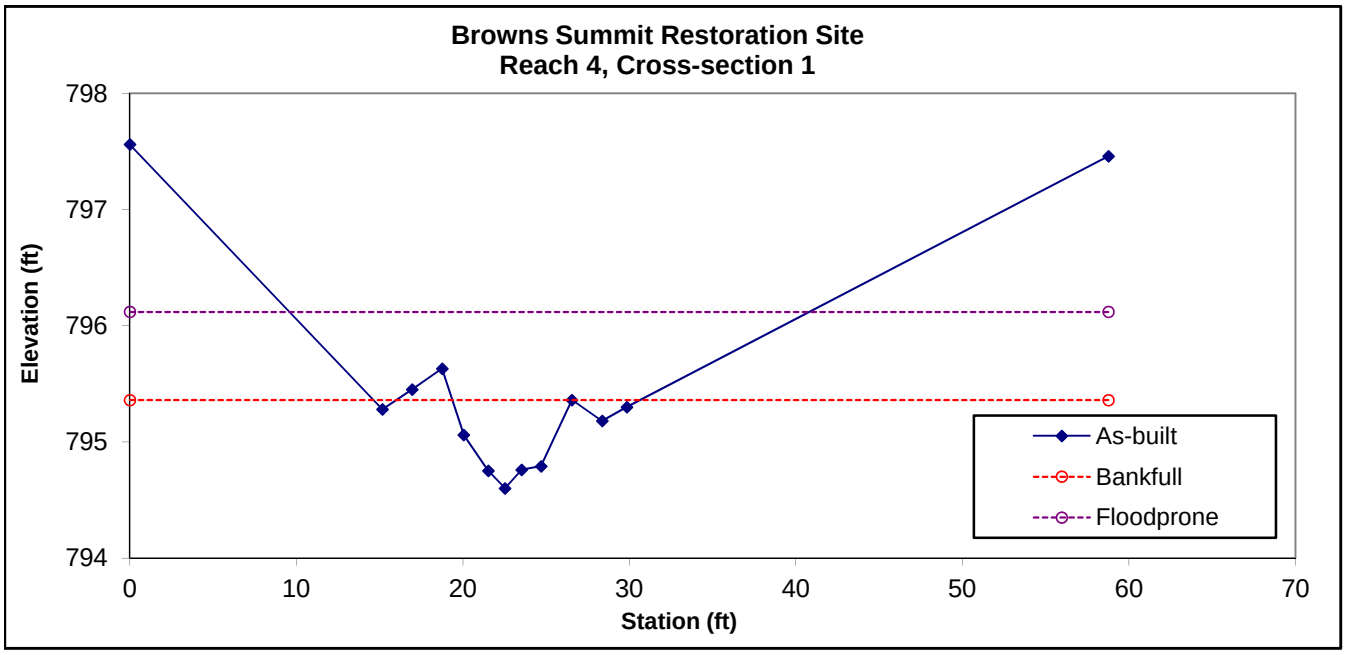
Permanent Cross-section 1

(As-built Data - Collected March 2017)

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	TOB Elev
Riffle	C	3.3	7.2	0.5	0.8	15.4	1	4.4	795.36	795.36



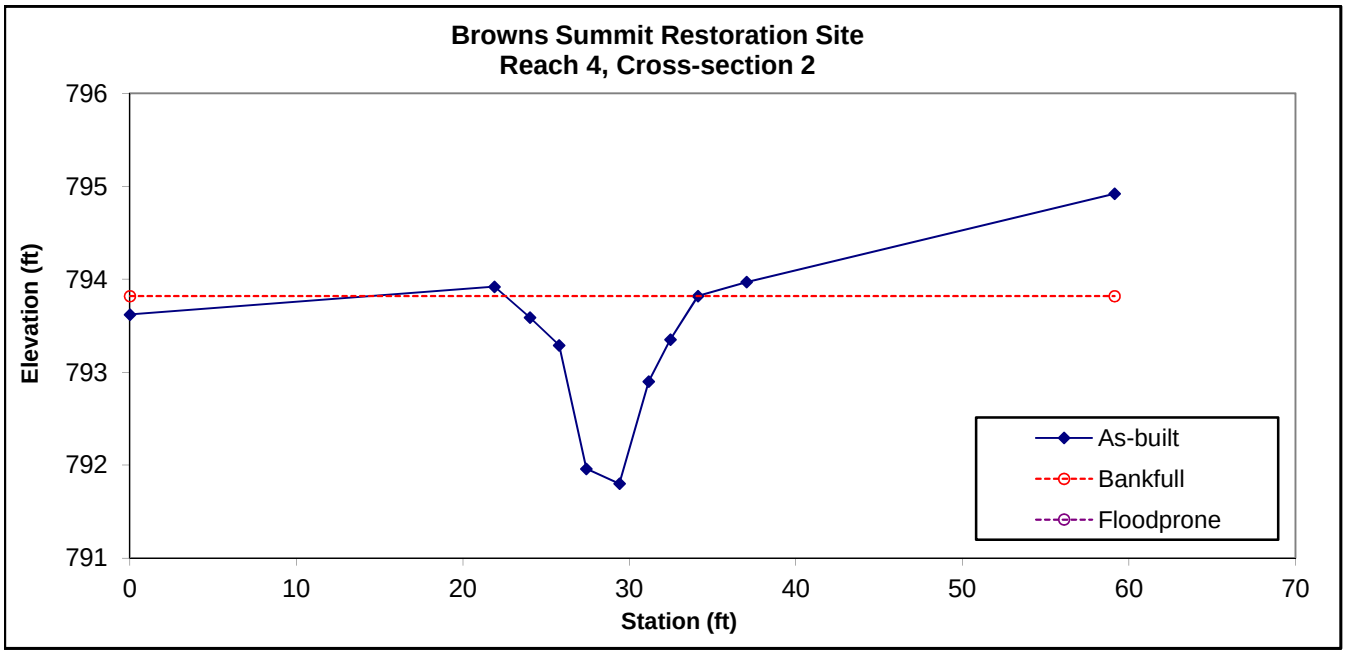
Permanent Cross-section 2

(As-built Data - Collected March 2017)

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	TOB Elev
Pool	C	10.5	11.6	0.9	2.0	12.7	1	--	793.82	793.82



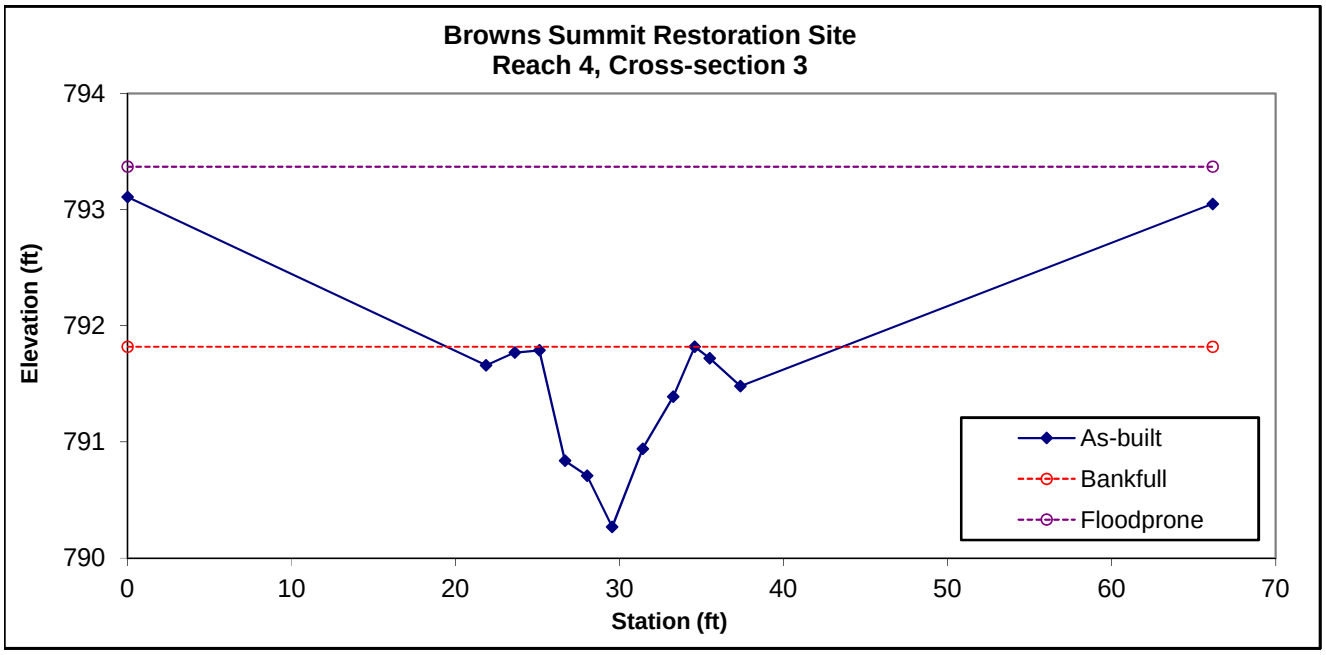
Permanent Cross-section 3

(As-built Data - Collected March 2017)

Looking at the Left Bank

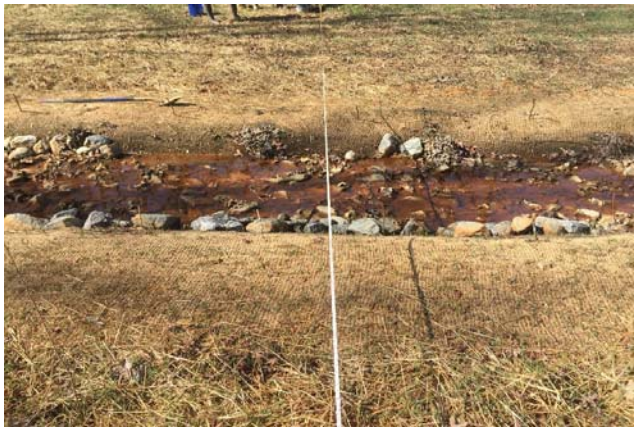
Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	E	8.2	9.5	0.9	1.6	11	1	7	791.82	791.82



Permanent Cross-section 4

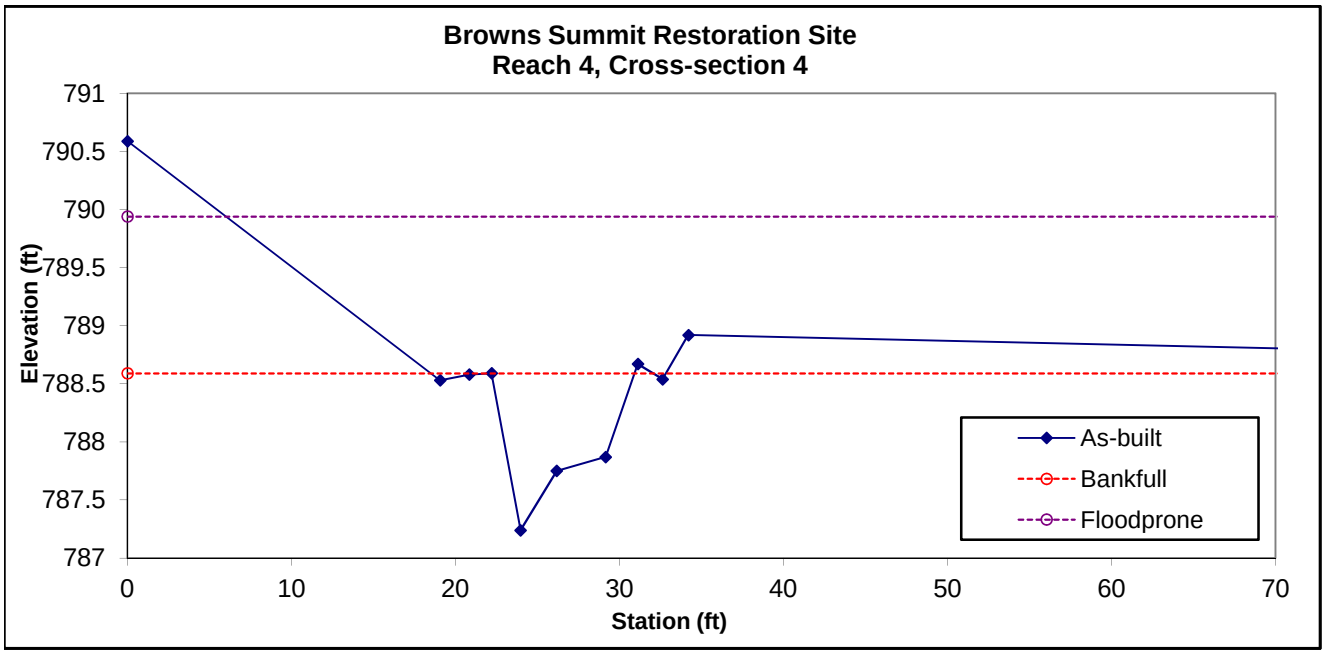
(As-built Data - Collected March 2017)



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	TOB Elev
Riffle	C	6.6	8.7	0.8	1.4	11.6	1	7.6	788.59	788.59



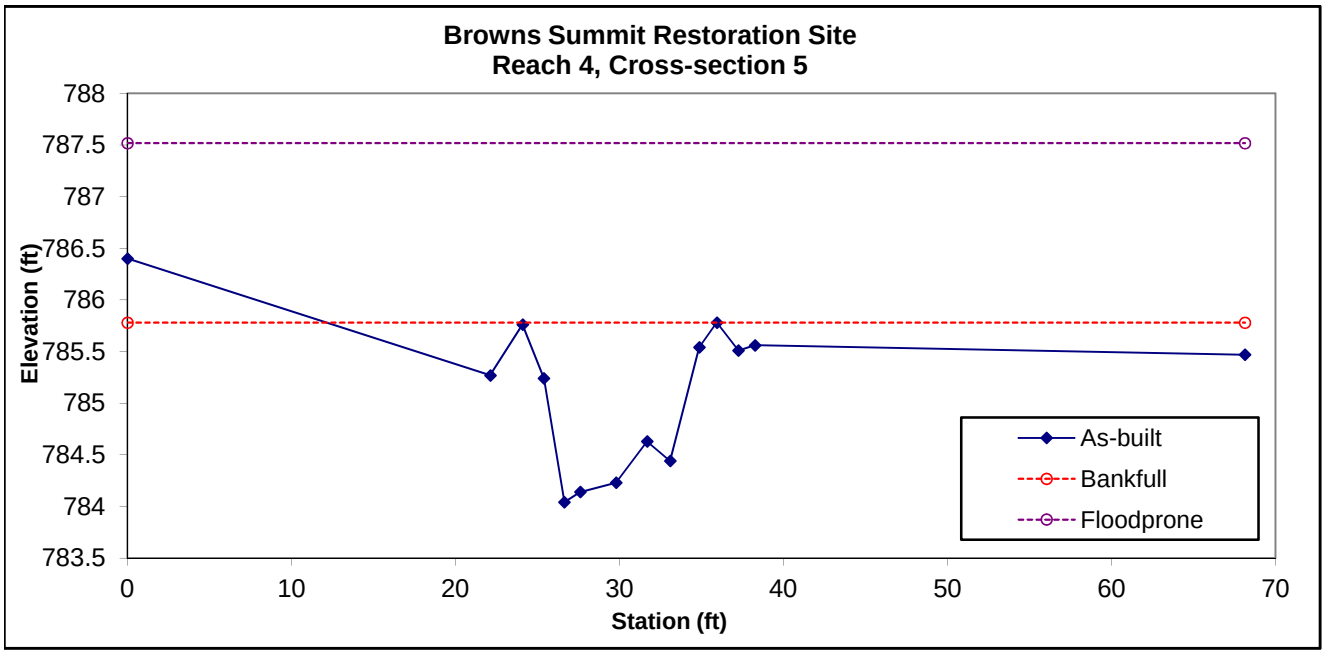
Permanent Cross-section 5

(As-built Data - Collected March 2017)

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	TOB Elev
Riffle	E	12.7	11.8	1.1	1.7	11	1	5.8	785.78	785.78



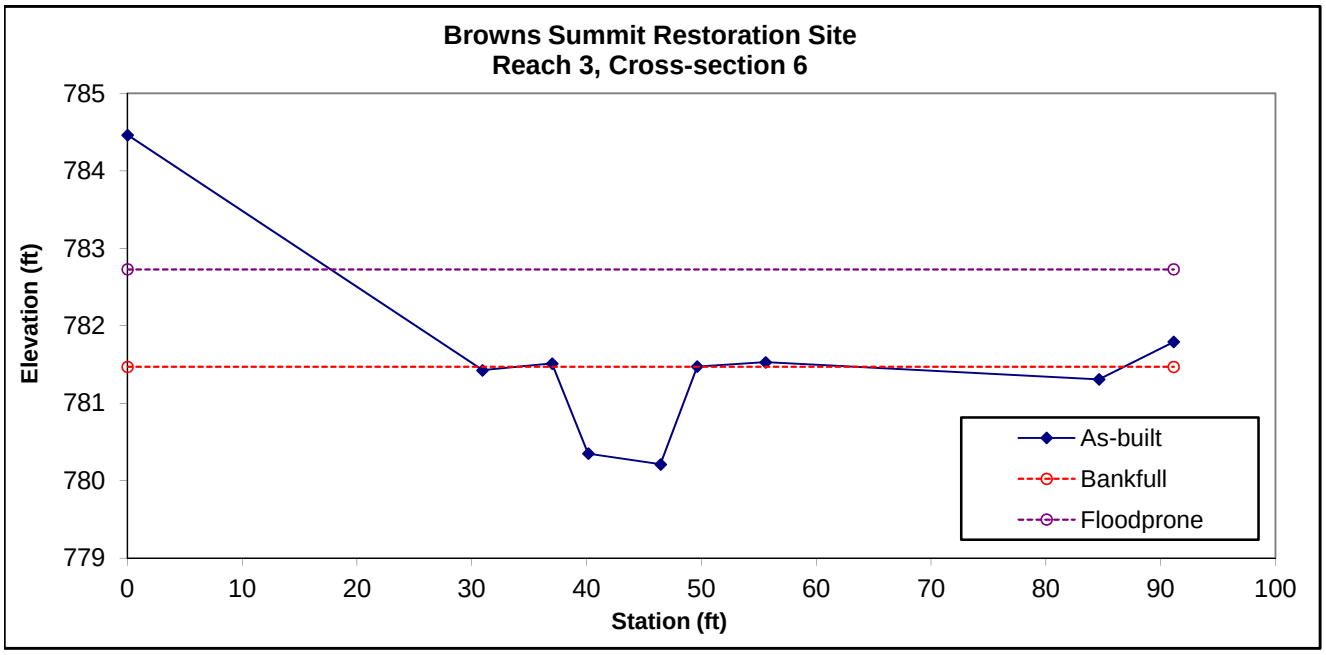
Permanent Cross-section 6

(As-built Data - Collected March 2017)

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	TOB Elev
Pool	C	11.2	12.5	0.9	1.3	14	1		781.47	781.47



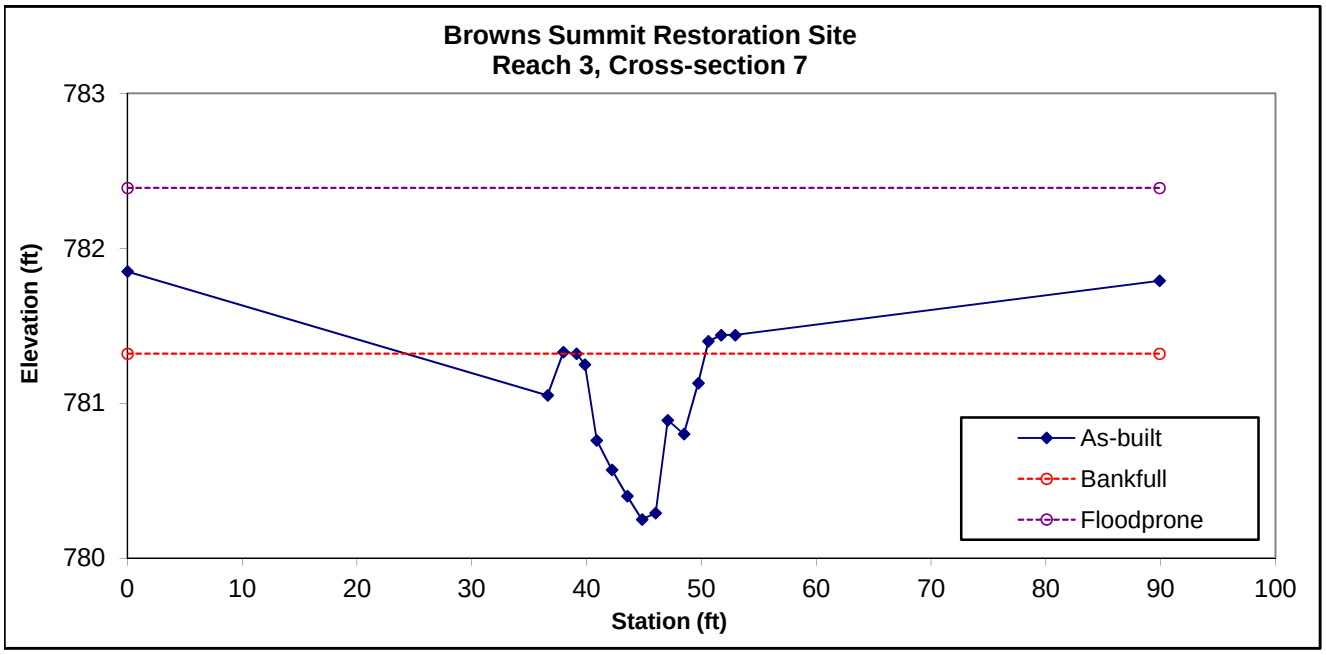
Permanent Cross-section 7

(As-built Data - Collected March 2017)

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	TOB Elev
Riffle	C	6.8	11.2	0.6	1.1	18.6	1	8	781.32	781.32



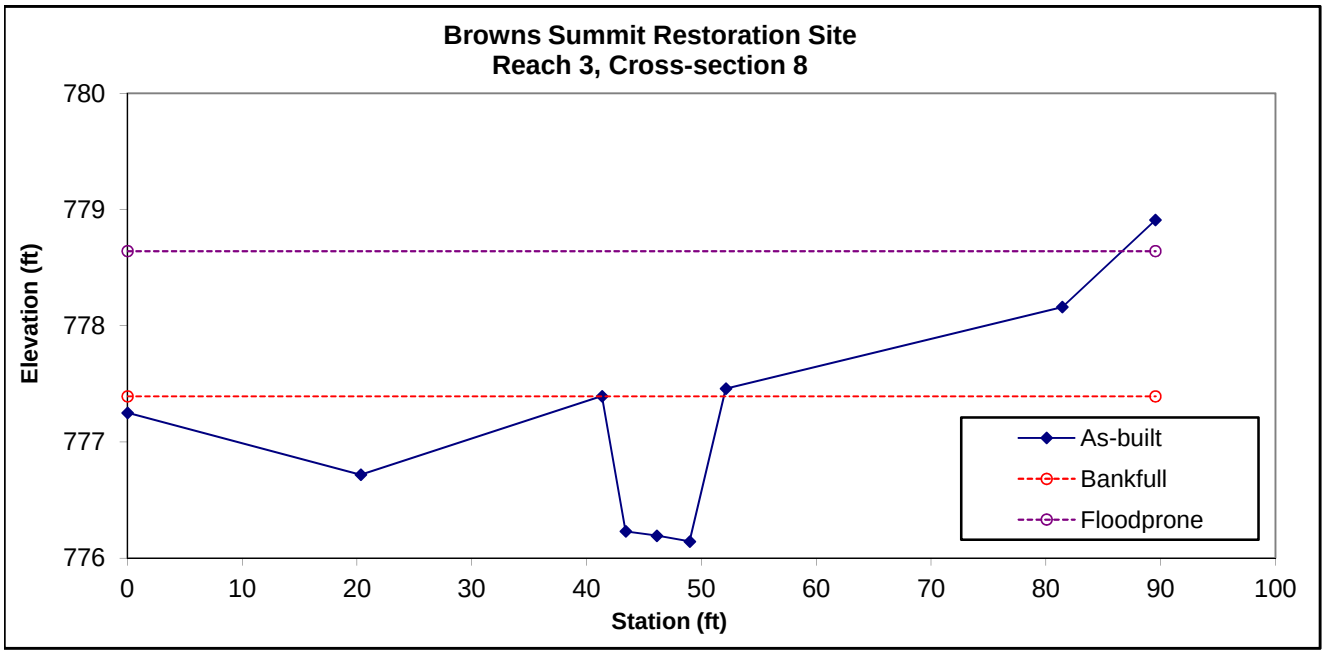
Permanent Cross-section 8

(As-built Data - Collected March 2017)

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	TOB Elev
Riffle	E	9.8	10.6	0.9	1.3	11.5	1	8.2	777.39	777.39



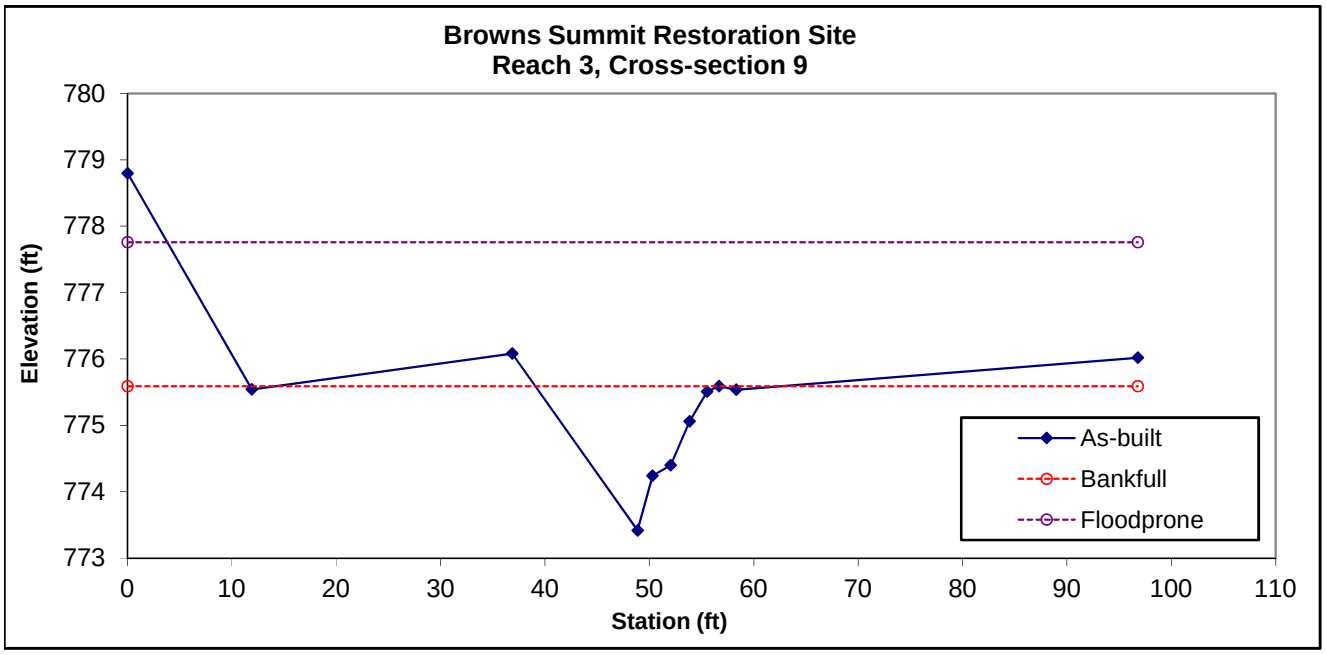
Permanent Cross-section 9

(As-built Data - Collected March 2017)

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	TOB Elev
Pool	C	17.5	17.6	1	2.2	17.7	1		775.59	775.59



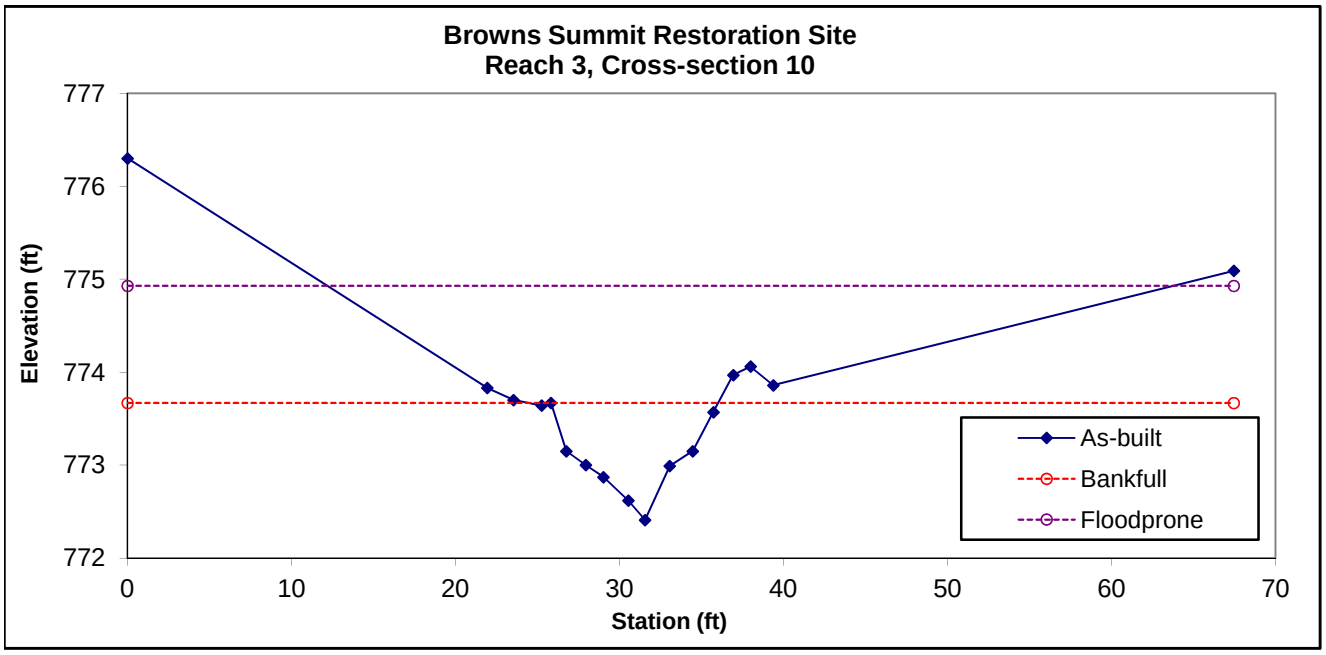
Permanent Cross-section 10

(As-built Data - Collected March 2017)

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	TOB Elev
Riffle	C	7	11.6	0.6	1.3	19.2	1	4.4	773.67	773.67



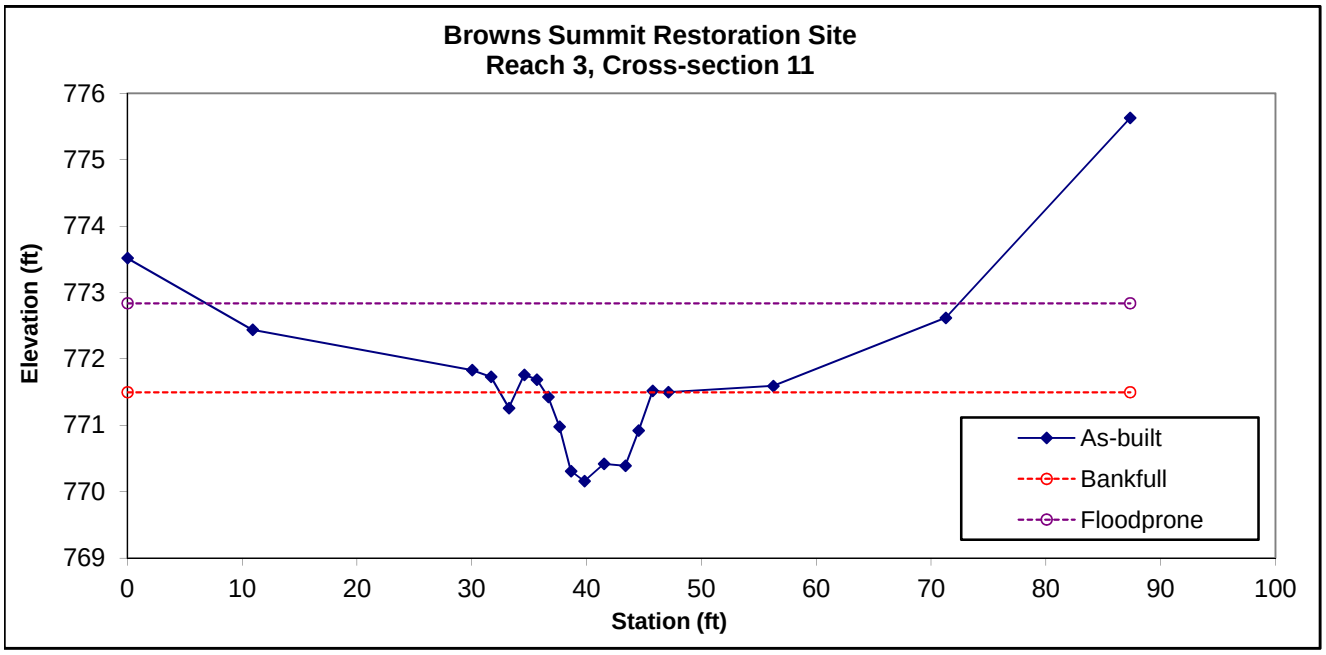
Permanent Cross-section 11

(As-built Data - Collected March 2017)

Looking at the Left Bank

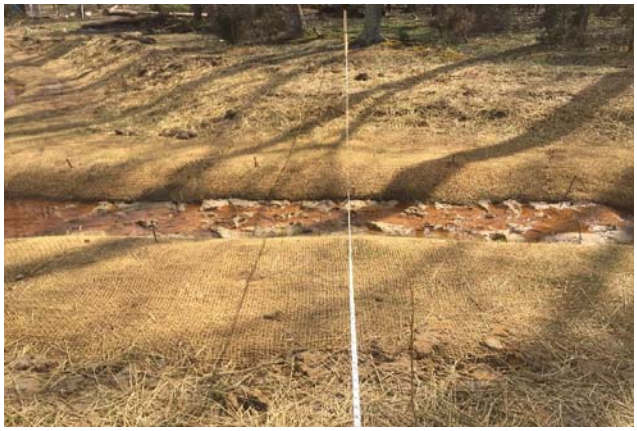
Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	E	8.1	9.3	0.9	1.3	10.8	1	7	771.5	771.5



Permanent Cross-section 12

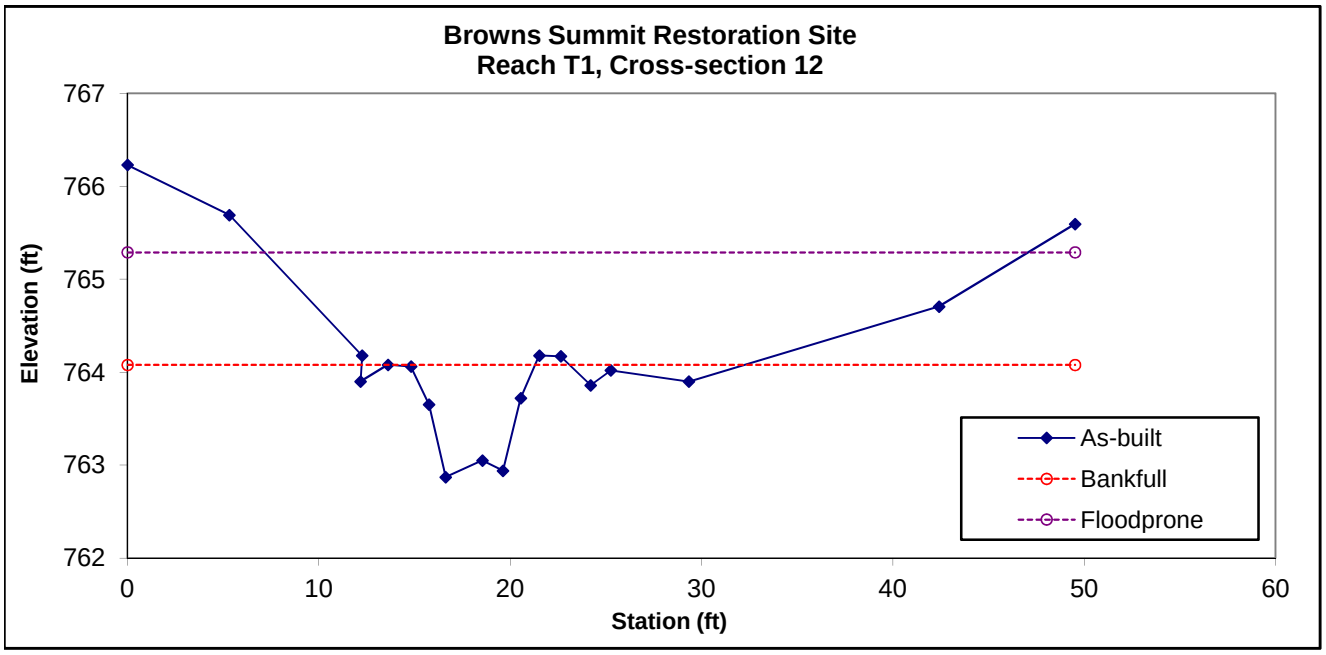
(As-built Data - Collected March 2017)



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	TOB Elev
Riffle	E	5.1	7.7	0.7	1.2	11.7	1	5.2	764.08	764.08



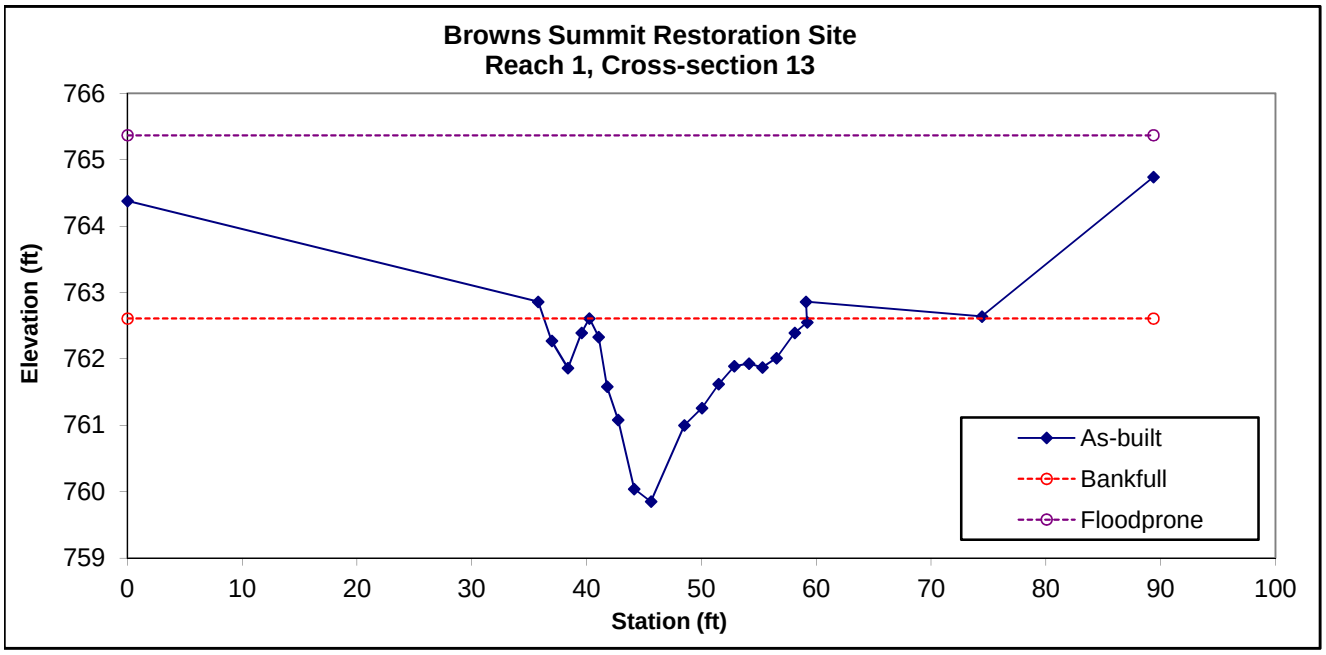
Permanent Cross-section 13

(As-built Data - Collected March 2017)

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	TOB Elev
Pool	C	23.5	19.6	1.2	2.8	16.4	1		762.61	762.61



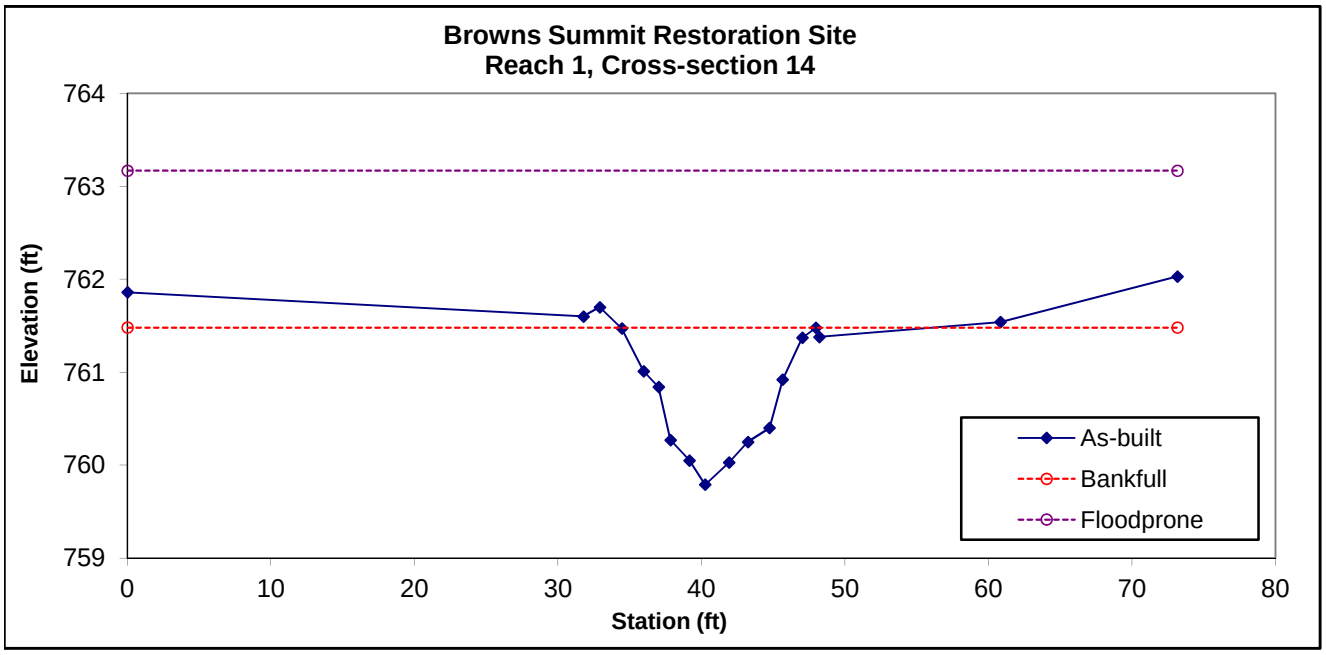
Permanent Cross-section 14

(As-built Data - Collected March 2017)

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	TOB Elev
Riffle	C	12.5	13.8	0.9	1.7	15.2	1	5.3	761.48	761.48



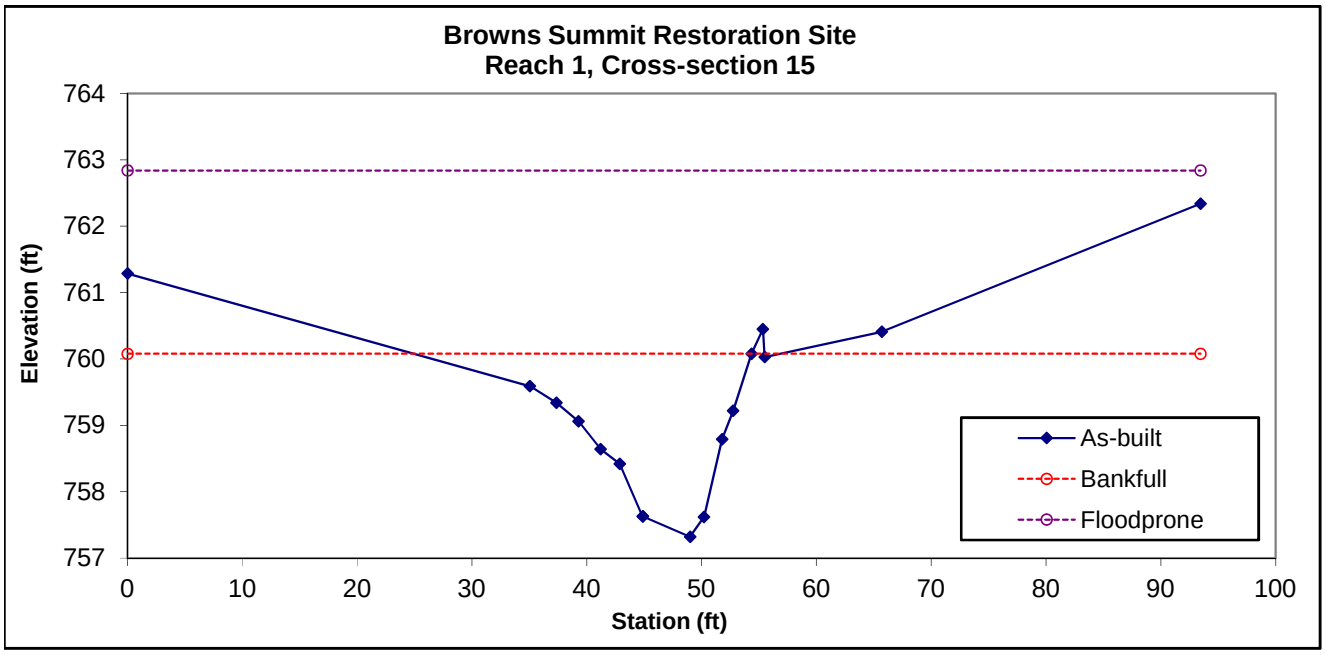
Permanent Cross-section 15

(As-built Data - Collected March 2017)

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	TOB Elev
Pool	C	33.2	29.4	1.1	2.8	26.1	1	2.7	760.08	760.08



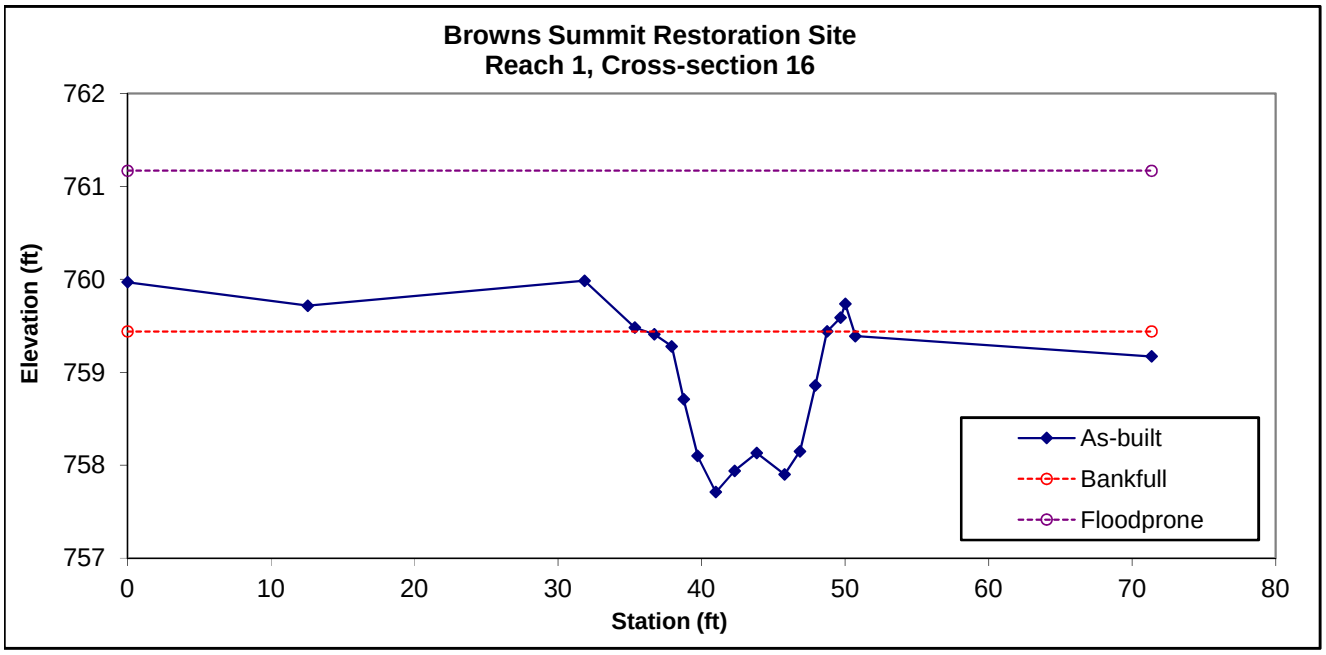
Permanent Cross-section 16

(As-built Data - Collected March 2017)

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	TOB Elev
Riffle	E	13.2	12.6	1.1	1.7	12	1	5.7	759.44	759.44



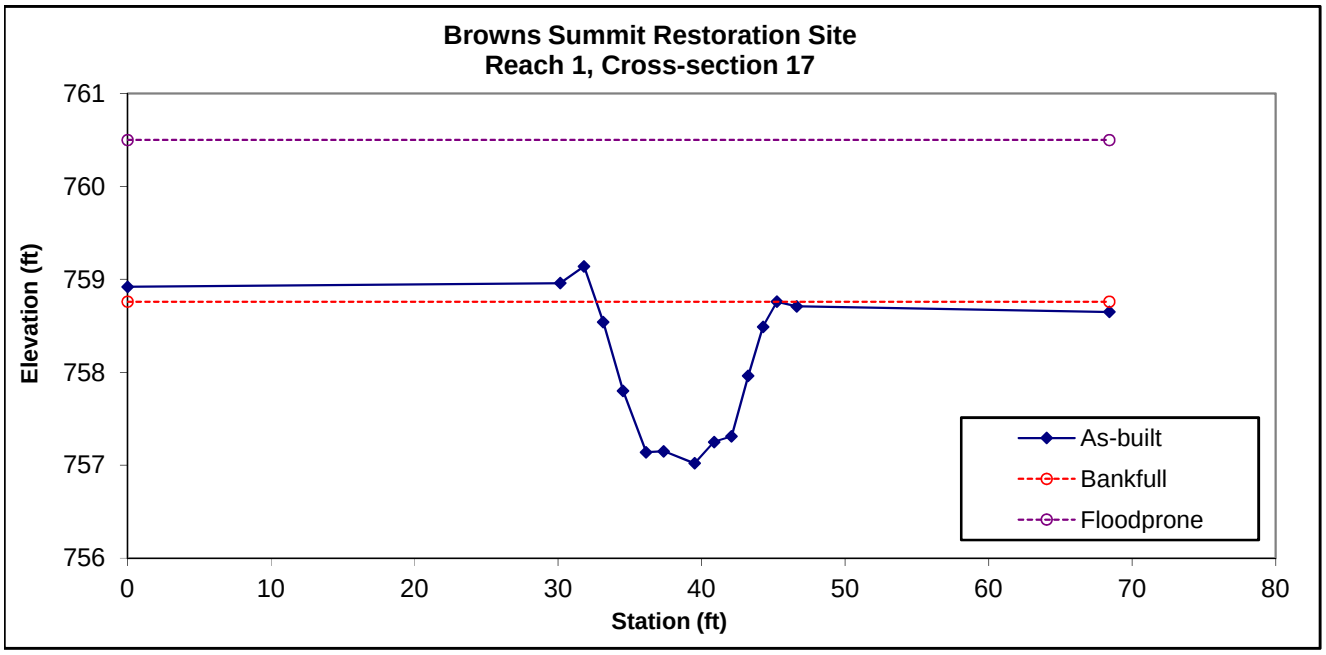
Permanent Cross-section 17

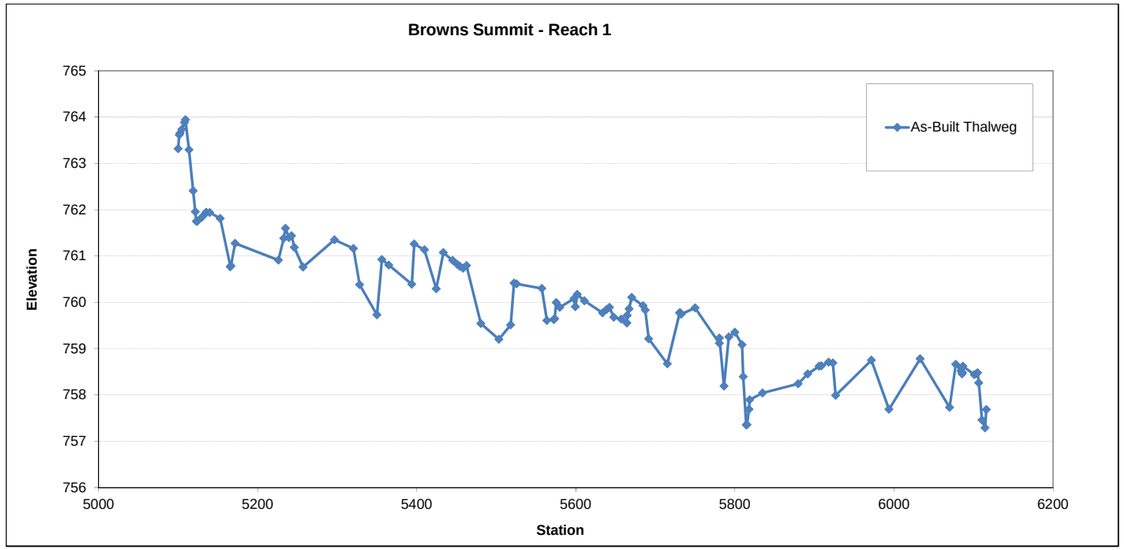
(As-built Data - Collected March 2017)

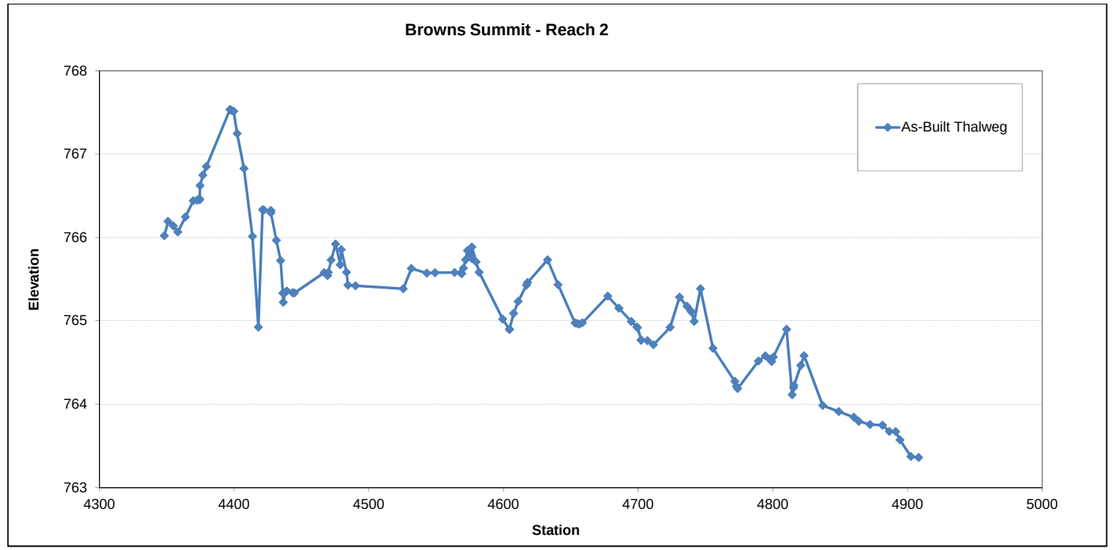
Looking at the Left Bank

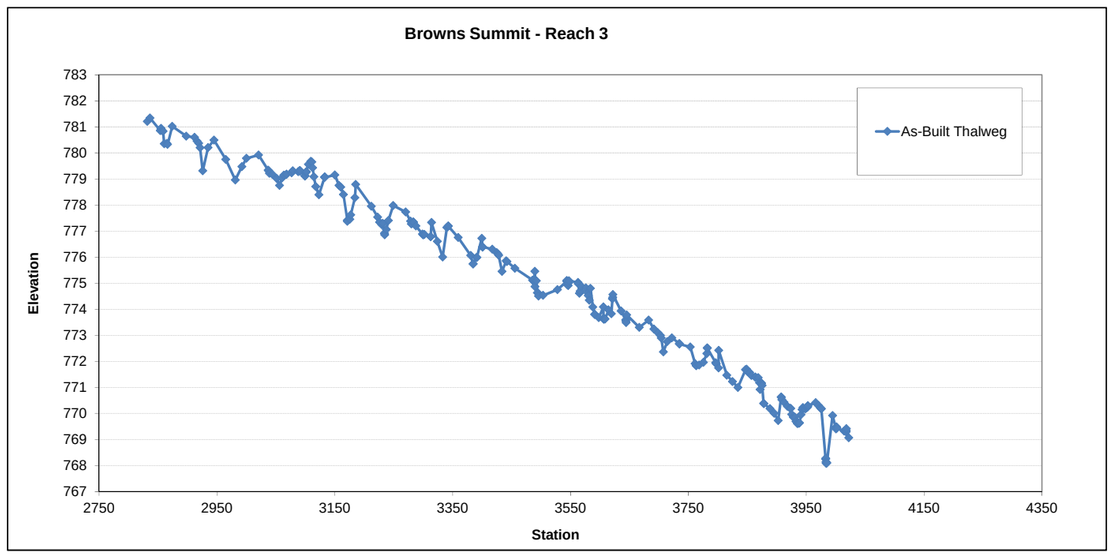
Looking at the Right Bank

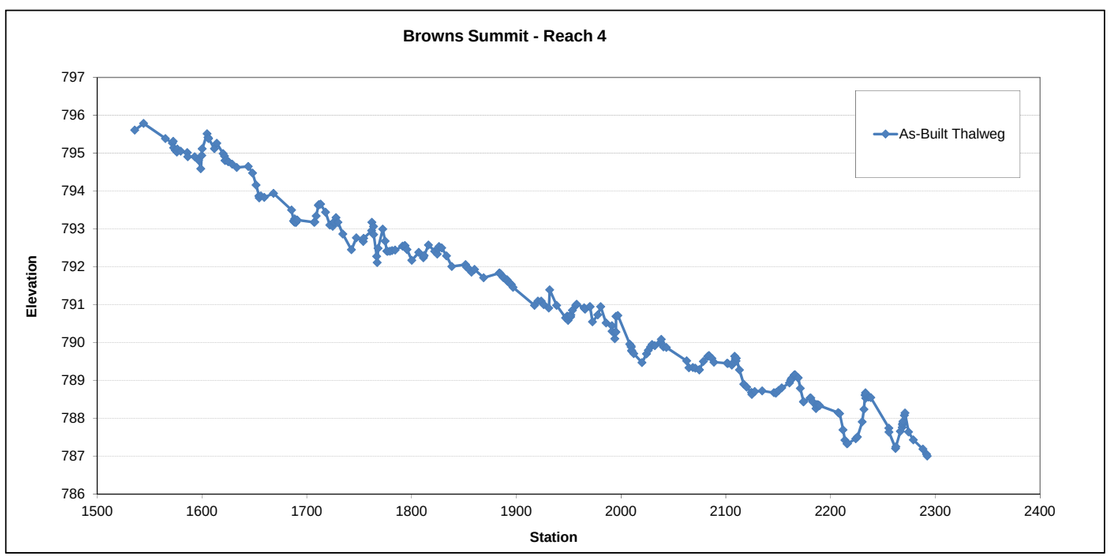
Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	C	14.5	12.6	1.2	1.7	10.9	1	5.4	758.76	758.76

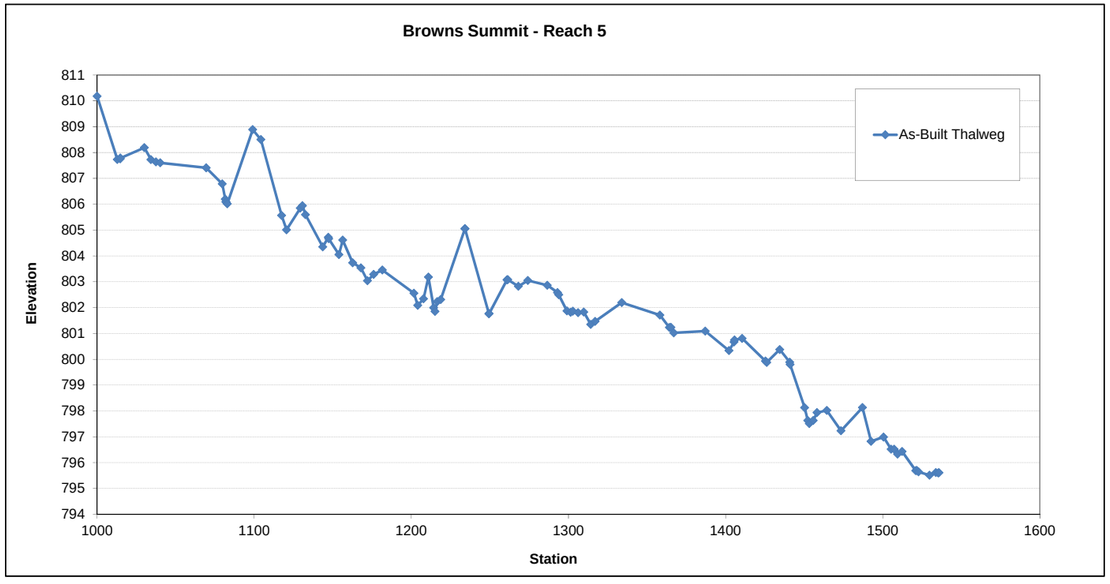



Browns Summit - Reach 1
765
764
763
762
761
760
759
758
757
756
Elevation
5000
5200
5400
5600
5800
6000
6200
Station
As-Built Thalweg


Browns Summit - Reach 2
768
767
766
765
764
763
Elevation
4300
4400
4500
4600
4700
4800
4900
5000
Station
As-Built Thalweg


Browns Summit - Reach 3
783
782
781
780
779
778
777
776
775
774
773
772
771
770
769
768
767
Elevation
2750
2950
3150
3350
3550
3750
3950
4150
4350
Station
As-Built Thalweg


Browns Summit - Reach 4
797
796
795
794
793
792
791
790
789
788
787
786
Elevation
1500
1600
1700
1800
1900
2000
2100
2200
2300
2400
Station
As-Built Thalweg


Browns Summit - Reach 5
Elevation
Station
As-Built Thalweg
811
810
809
808
807
806
805
804
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802
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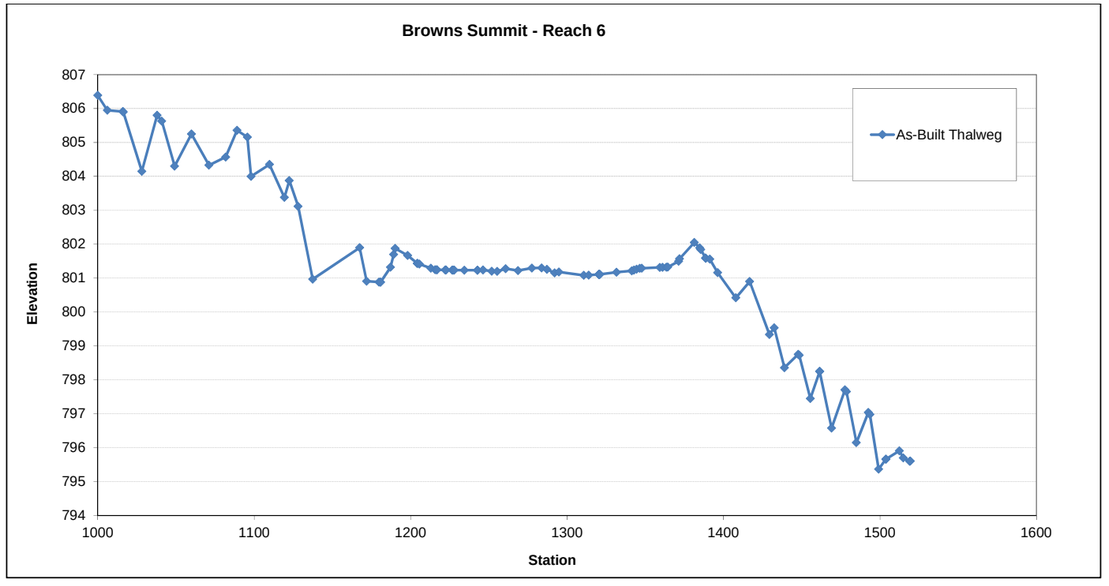
794
1000
1100
1200
1300
1400
1500
1600


Browns Summit - Reach 6
Elevation
Station
As-Built Thalweg
807
806
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804
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802
801
800
799
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794
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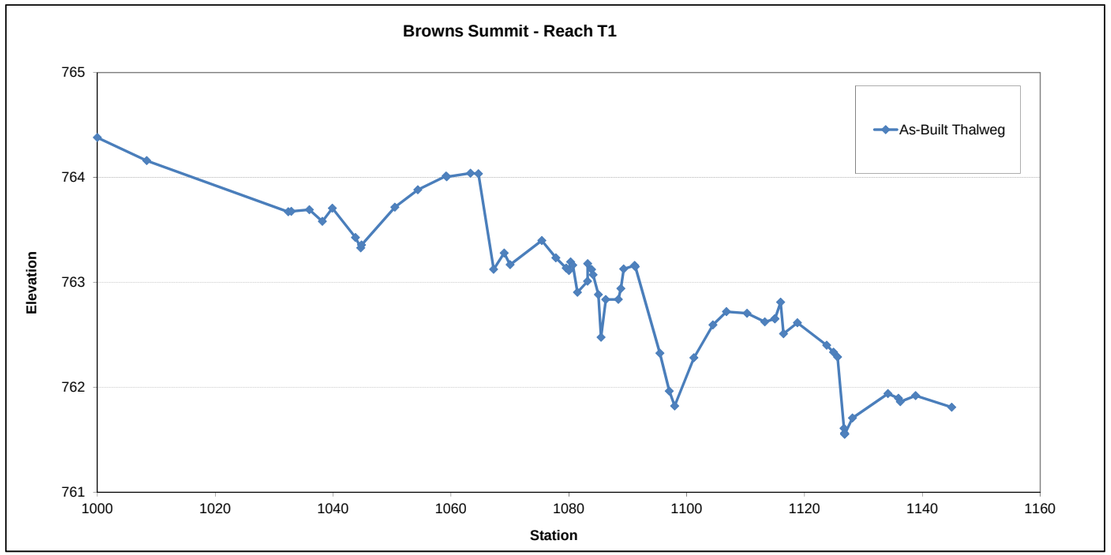
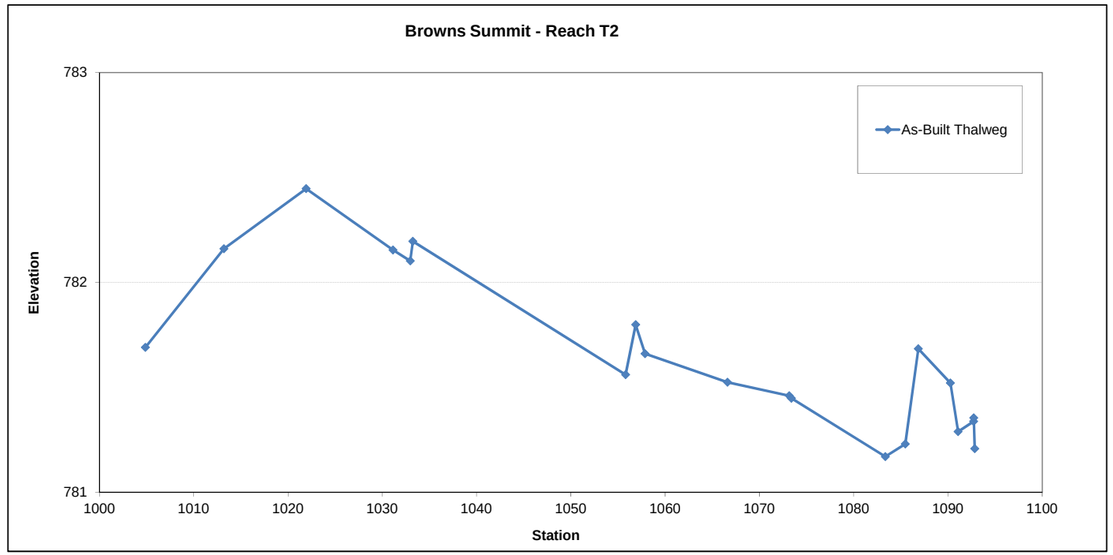
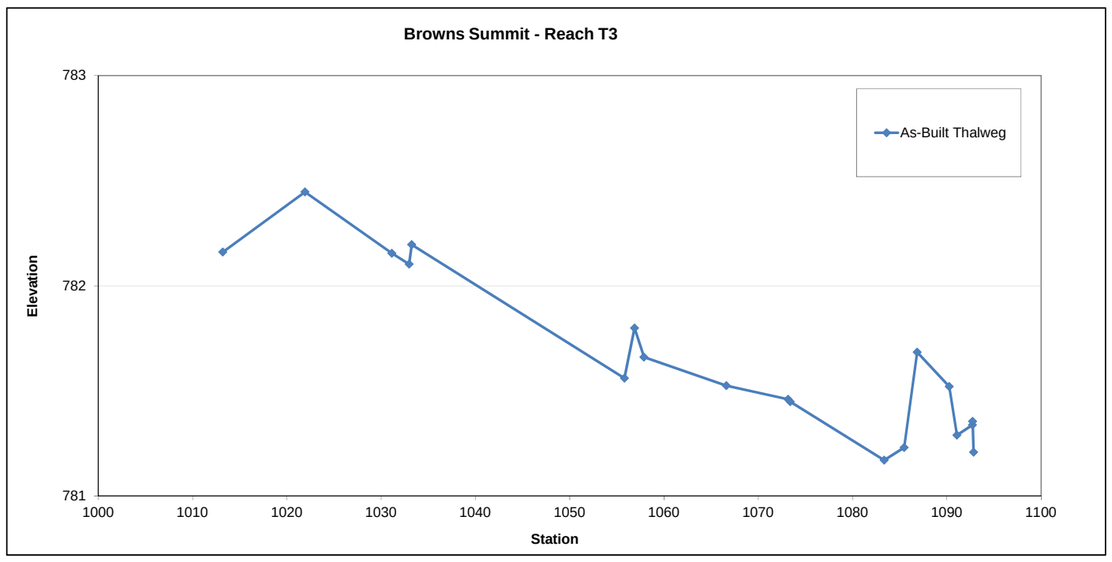
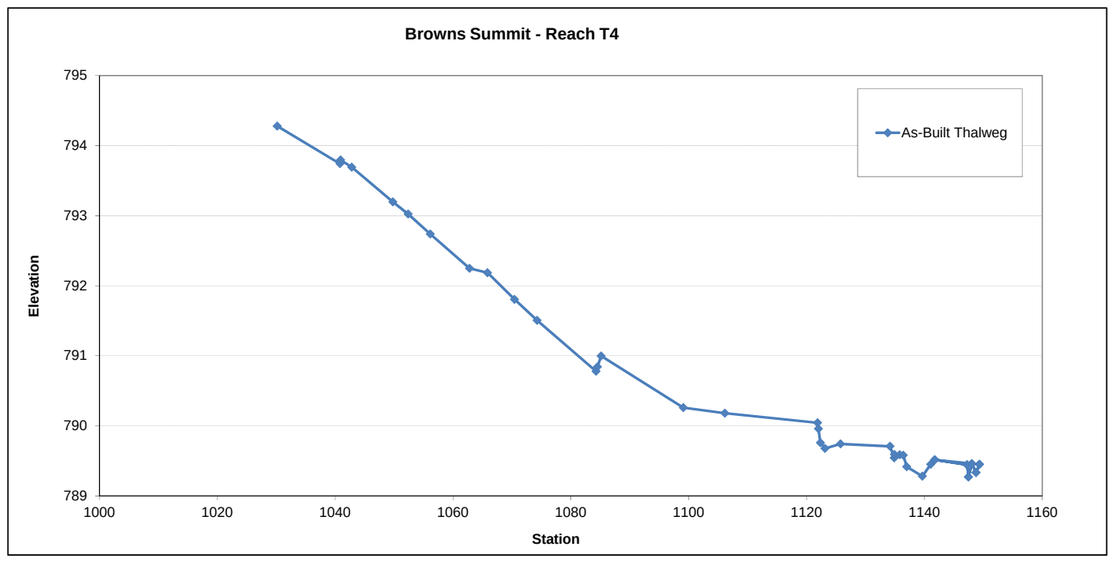
1100
1200
1300
1400
1500
1600


Browns Summit - Reach T1
765
764
763
762
761
Elevation
1000
1020
1040
1060
1080
1100
1120
1140
1160
Station
As-Built Thalweg


Browns Summit - Reach T2
783
782
781
Elevation
1000
1010
1020
1030
1040
1050
1060
1070
1080
1090
1100
Station
As-Built Thalweg


Browns Summit - Reach T3
783
782
781
Elevation
1000
1010
1020
1030
1040
1050
1060
1070
1080
1090
1100
Station
As-Built Thalweg


Browns Summit - Reach T4
795
794
793
792
791
790
789
Elevation
1000
1020
1040
1060
1080
1100
1120
1140
1160
Station
As-Built Thalweg

APPENDIX C

Vegetation Summary Data

(Tables 7 and 8)

Table 7. Vegetation Species Planted Across the Restoration Site
Browns Summit Creek Restoration Project: DMS Project No ID. 96313

Botanical Name	Common Name	% Planted by Species	Total Number of Stems
Riparian Buffer Plantings			
Fraxinus pennsylvanica	Green Ash	10%	1200
Betula nigra	River Birch	10%	1200
Liriodendron tulipifera	Tulip poplar	5%	600
Quercus michauxii	Swamp Chestnut oak	5%	600
Diospyros virginiana	Persimmon	2%	300
Platanus occidentalis	Sycamore	11%	1300
Ulmus americana	American elm	2%	300
Quercus lyrata	Overcup oak	6%	700
Acer negundo	Box elder	5%	600
Celtis laevigata	Sugarberry	2%	300
Nyssa sylvatica	Black gum	2%	300
Riparian Buffer Plantings - Understory			
Carpinus carolinianum	Ironwood	11%	1300
Ilex opaca	American holly	3%	400
Hamamalis virginiana	witchhazel	3%	400
Viburnum dentatum	Arrowwood	4%	500
Euonymus americanus	Heart-a-busting	4%	500
Alnus serrulata	Tag alder	5%	600
Ilex verticillata	Winterberry	5%	600
Viburnum nudum	Possomhaw	5%	600
Riparian Live Stake Plantings			
Salix sericea	Silky Willow	25%	NA
Sambucus canadensis	Elderberry	25%	NA
Physocarpus opulifolius	Ninebark	15%	NA
Cornus amomum	Silky Dogwood	25%	NA
Salix nigra	Black Willow	10%	NA

Table 8. Stem Count for Each Species Arranged by Plot
Browns Summit Creek Restoration Project: DMS Project No ID. 96313

Botanical Name	Common Name	Browns Summit Creek Vegetation Plots													
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
Tree Species															
Fraxinus pennsylvanica	Green Ash														
Betula nigra	River Birch														
Liriodendron tulipifera	Tulip poplar														
Quercus michauxii	Swamp Chestnut oak														
Diospyros virginiana	Persimmon														
Platanus occidentalis	Sycamore														
Ulmus americana	American elm														
Quercus lyrata	Overcup oak														
Acer negundo	Box elder														
Celtis laevigata	Sugarberry														
Nyssa sylvatica	Black gum														
Shrub Species															
Carpinus carolinianum	Ironwood														
Ilex opaca	American holly														
Hamamalis virginiana	witchhazel														
Viburnum dentatum	Arrowwood														
Euonymus americanus	Heart-a-busting														
Alnus serrulata	Tag alder														
Ilex verticillata	Winterberry														
Viburnum nudum	Possomhaw														
Initial count of planted bareroot material, species TBD		18	22	24	17	18	19	18	19	18	20	17	16	21	18
Stems/plot		18	22	24	17	18	19	18	19	18	20	17	16	21	18
Stems/acre		728	890	971	688	728	769	728	769	728	809	688	648	850	728
Average Stems/ Acre for Year 0 As-Built (Baseline Data)		**766**													

APPENDIX D

As-Built Plan Sheets/Record Drawings

STATE	BAKER PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
NC	140048	1	23
NCDMS ID No. 96313			

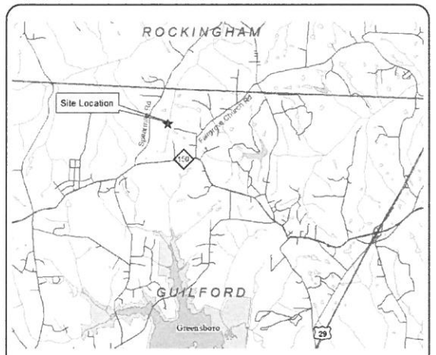
NORTH CAROLINA
DIVISION OF MITIGATION SERVICES

GUILFORD COUNTY

LOCATION: APPROX. 3 MILES NORTHWEST OF BROWNS SUMMIT
TYPE OF WORK: AS-BUILT SURVEY /RECORD DRAWINGS

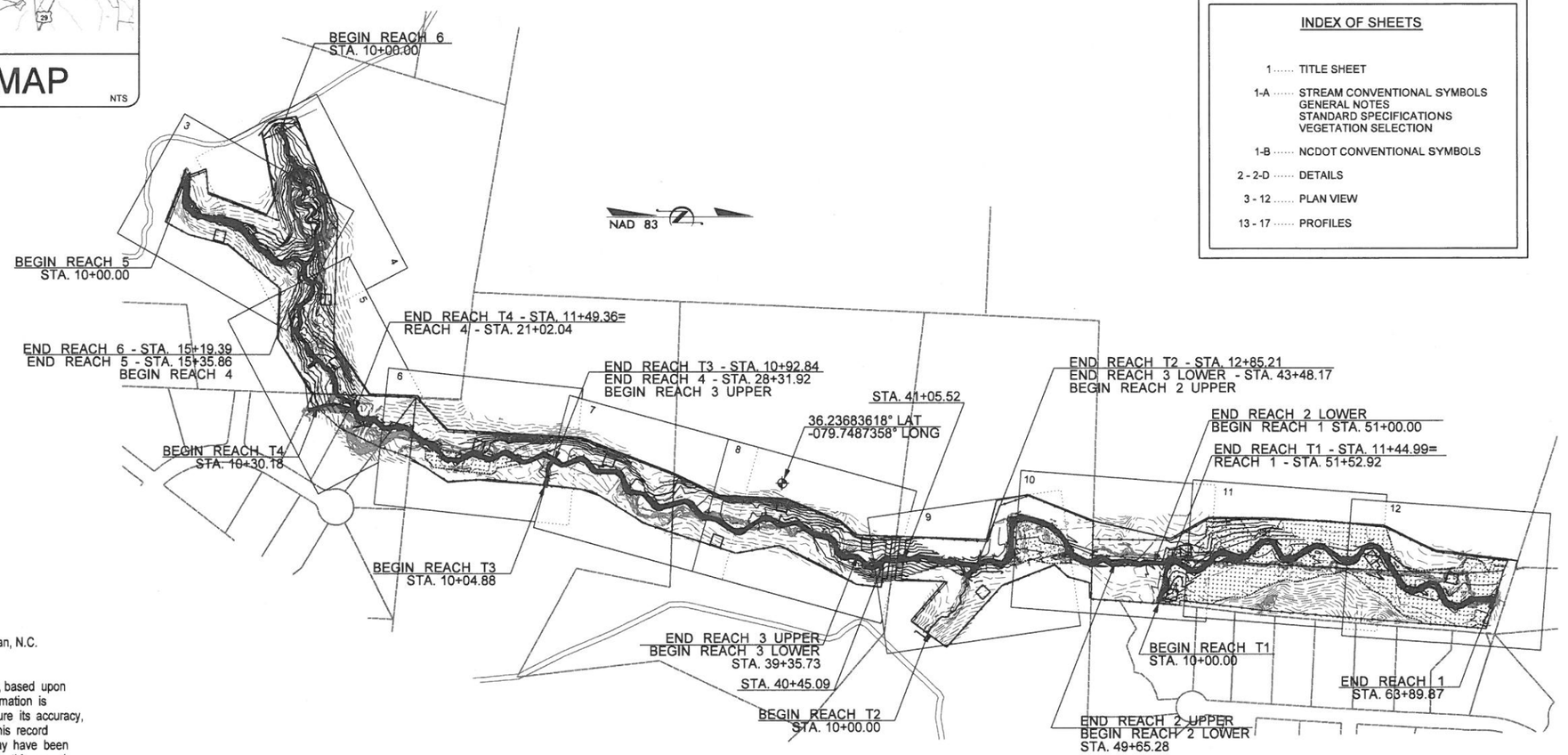
BROWNS SUMMIT

PROJECT: 140048



VICINITY MAP

NTS



INDEX OF SHEETS

AS-BUILT SURVEY PREPARED BY:
LEVEL CROSS SURVEYING, PLLC - Randleman, N.C.

RECORD DRAWINGS

This record drawing has been prepared in part, based upon information furnished by others. While this information is believed to be reliable, the Engineer cannot assure its accuracy, and this is not responsible for the accuracy of this record drawing or for any errors or omissions which may have been incorporated into it as a result. Those relying on this record document are advised to obtain independent verification of its accuracy before applying for any purpose.

GRAPHIC SCALES

20 0 20 40
PLANS

20 0 20 40
PROFILE (HORIZONTAL)

4 0 4 8
PROFILE (VERTICAL)

DESIGN SUMMARY

REACH NAME	PROPOSED LENGTH (LF)	AS-BUILT LENGTH (LF)
REACH 1	1,233	1,290
REACH 2	805	752
REACH 3	1,469	1,456
REACH 4	1,296	1,296
REACH 5	562	536
REACH 6	454	442
T1	145	145
T2	283	285
T3	70	88
T4	117	119
TOTAL	6,345	6,409

PREPARED FOR THE OFFICE OF:

NCDENR
DIVISION OF MITIGATION SERVICES
1652 MAIL SERVICE CENTER
RALEIGH, NC 27699-1652

CONTACT: JEFF SCHAFFER
PROJECT MANAGER

PREPARED IN THE OFFICE OF:

Michael Baker INTERNATIONAL
Michael Baker Engineering Inc.
8000 Regency Parkway, Suite 600
Cary, NORTH CAROLINA 27518
Phone: 919.463.5488
Fax: 919.463.5490
License #: F-1084

LETTING DATE:

KATHLEEN M. McKEITHAN, PE
PROJECT ENGINEER / MANAGER

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 028432 KATHLEEN M. McKEITHAN

9.8.2017

SIGNATURE: P.E.

2/26/03

STREAM CONVENTIONAL SYMBOLS
SUPERCEDES SHEET 1-B

- ROCK J-HOOK
- ROCK VANE
- ROCK CROSS VANE
- LOG J-HOOK
- LOG VANE
- LOG WEIR
- LOG STEP POOL
- GRADE CONTROL LOG JAM
- CONSTRUCTED RIFFLE
- ROCK STEP POOL
- PHOTO POINT
- MONITORING WELL
- FLOW GAUGE
- CREST GAUGE
- SAFETY FENCE
- TAPE FENCE
- 100 YEAR FLOOD PLAIN
- CONSERVATION EASEMENT
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- LIMITS OF DISTURBANCE
- PROPERTY LINE
- FOOT BRIDGE
- TEMPORARY STREAM CROSSING
- PERMANENT STREAM CROSSING
- TRANSPLANTED VEGETATION
- DITCH PLUG
- CHANNEL FILL
- BRUSH MATTRESS
- GEOLIFT WITH BRUSH TOE

**NOTE: ALL ITEMS ABOVE MAY NOT BE USED ON THIS PROJECT

GENERAL NOTES

1. THE CONTRACTOR IS REQUIRED TO INSTALL IN-STREAM STRUCTURES USING A TRACK HOE WITH A HYDRAULIC THUMB OF SUFFICIENT SIZE TO PLACE BOULDERS (3'x2'x2'), LOGS AND ROOTWADS.
2. WORK IS BEING PERFORMED AS AN ENVIRONMENTAL RESTORATION PLAN. THE CONTRACTOR SHOULD MAKE ALL REASONABLE EFFORTS TO REDUCE SEDIMENT LOSS AND MINIMIZE DISTURBANCE OF THE SITE WHILE PERFORMING THE CONSTRUCTION WORK.
3. CONSTRUCTION IS SCHEDULED TO BEGIN SUMMER OF 2015.
4. CONTRACTOR SHOULD CALL NORTH CAROLINA "ONE-CALL" BEFORE EXCAVATION STARTS. (1-800-632-4949)
5. ENGINEER WILL FLAG TREES TO BE SAVED PRIOR TO CONSTRUCTION.

STANDARD SPECIFICATIONS

NORTH CAROLINA
EROSION AND SEDIMENT CONTROL PLANNING AND DESIGN MANUAL
MARCH 2009 (REV 2013)

6.05 TREE PROTECTION
6.06 TEMPORARY GRAVEL CONSTRUCTION ENTRANCE
6.24 RIPARIAN AREA SEEDING
6.60 TEMPORARY SEDIMENT TRAP
6.62 TEMPORARY SILT FENCE
6.63 TEMPORARY ROCK DAM
6.70 TEMPORARY STREAM CROSSING

PROJECT REFERENCE NO.	SHEET NO.
140048	1-A

PROJECT ENGINEER

KWKeithman

APPROVED BY:

9.8.17

DATE:

Michael Baker INTERNATIONAL
Michael Baker Engineering Inc.
8000 Regency Parkway, Suite 600
Cary, NORTH CAROLINA 27518
Phone: 919.463.5488
Fax: 919.463.5490
License #: F-1084

NCDMS ID No. 96313

AS-BUILT SURVEY PREPARED BY:
LEVEL CROSS SURVEYING, PLLC - Randleman, N.C.

RECORD DRAWINGS
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VEGETATION SELECTION

Proposed Plug Species for Reach R6 Constructed Wetland
Browns Summit Creek Restoration Project

Botanical Name	Common Name	% Planted by Species	Wetland Tolerance
Deep Pool Plantings			
Four Cubic Inch Herbaceous Plugs to be Installed 4' On Center			
Lemna spp.	Duckweed	25%	OBL
Nuphar lutea ssp. Advena	Yellow pond-lily	25%	OBL
Nelumbo lutea	American lotus	25%	OBL
Eleocharis acicularis	Needle spikerush	25%	OBL
High Marsh Plantings			
Four Cubic Inch Herbaceous Plugs to be Installed 3' On Center			
Lobelia cardinalis	Cardinal Flower	10%	FACW
Eupatoriadelphus fistulosus	Joe Pye Weed	15%	FACW
Hibiscus coccineus	Scarlet Rose Mallow	15%	OBL
Lobelia elongata	Longleaf lobelia	15%	OBL
Rhynchospora colorata	Starrush whitetop	20%	FACW
Carex tenera	Quill sedge	25%	FAC
Low Marsh Plantings			
Four Cubic Inch Herbaceous Plugs to be Installed 3' On Center			
Sagittaria lancifolia	Bulltongue	10%	OBL
Iris pseudacorus	Yellow Flag	15%	OBL
Acorus americanus	Sweetflag	15%	OBL
Peltandra virginica	Arrow arum	15%	OBL
Pontederia cordata	Pickerelweed	20%	OBL
Scirpus cyperinus	Woolgrass	25%	FACW

Proposed Permanent Seed Mixture
Browns Summit Creek Restoration Project

Botanical Name	Common Name	% Planted by Species	Density (lbs/ac)	Wetland Tolerance
Andropogon gerardii	Big blue stem	10%	1.5	FAC
Dichanthelium clandestinum	Deer tongue	15%	2.25	FAC
Carex crinita	Fringed sedge	10%	1.5	OBL
Elymus virginicus	Virginia wild rye	10%	1.5	FACW
Juncus effusus	Soft rush	10%	1.5	FACW
Panicum virgatum	Switchgrass	15%	2.25	FAC
Schizachyrium scoparium	Little blue stem	10%	1.5	FACU
Sorghastrum nutans	Indiangrass	10%	1.5	FACU
Impatiens capensis	Jewelweed	10%	1.5	FACW
	Total	100%	15	

Note: Final species selection may change due to refinement or availability at the time of planting. If species substitution is required, the planting Contractor will submit a revised planting list to Baker for approval prior to the procurement of plant stock.

Proposed Bare-Root and Livestake Species
Browns Summit Creek Restoration Project

Botanical Name	Common Name	% Planted by Species	Wetland Tolerance
Riparian Buffer Plantings – Overstory (For all reaches except R1, R2) 8' x 8' spacing - 680 stems/Acre			
Fraxinus pennsylvanica	Green Ash	10%	FACW
Betula nigra	River Birch	10%	FACW
Liriodendron tulipifera	Tulip Poplar	10%	FAC
Quercus michauxii	Swamp Chestnut Oak	10%	FACW
Diospyros virginiana	Persimmon	5%	FAC
Platanus occidentalis	American Sycamore	10%	FACW
Ulmus americana	American Elm	5%	FACW
Riparian Buffer Plantings – Understory (For all reaches except R1, R2) 8' x 8' spacing - 680 stems/Acre			
Carpinus caroliniana	American Hornbeam	10%	FAC
Ilex opaca	American Holly	8%	FAC
Hamamelis virginiana	Witchhazel	6%	FACU
Viburnum dentatum	Arrowwood Viburnum	8%	FAC
Euonymus americanus	Strawberry Bush	8%	FAC

Wetland Buffer Plantings – Overstory (For Reaches R1, R2) 8' x 8' spacing - 680 stems/Acre			
Fraxinus pennsylvanica	Green Ash	10%	FACW
Betula nigra	River Birch	10%	FACW
Quercus lyrata	Overcup Oak	10%	OBL
Acer negundo	Box Elder	10%	FACW
Platanus occidentalis	American Sycamore	10%	FACW
Celtis laevigata	Sugarberry	5%	FACW
Nyssa sylvatica	Black gum	5%	FAC
Wetland Buffer Plantings – Understory (For Reaches R1, R2) 8' x 8' spacing - 680 stems/Acre			
Carpinus caroliniana	American Hornbeam	10%	FAC
Alnus serrulata	Tag Alder	10%	OBL
Ilex verticillata	Winterberry	10%	FACW
Viburnum nudum	Possumhaw	10%	OBL
Riparian Live Stake Plantings			
Salix sericea	Silky Willow	25%	OBL
Sambucus canadensis	Elderberry	25%	FACW
Cephalanthus occidentalis	Buttonbush	15%	OBL
Cornus amomum	Silky Dogwood	25%	FACW
Salix nigra	Black Willow	10%	OBL

Note: Final species selection may change due to refinement or availability at the time of planting. If species substitution is required, the planting contractor will submit a revised planting list to Baker for approval prior to the procurement of plant stock.

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2/26/03

PROJECT REFERENCE NO.	SHEET NO.
140048	1-B
NCDMS ID No. 96313	

*S.U.E = SUBSURFACE UTILITY ENGINEER

STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS

CONVENTIONAL SYMBOLS

BOUNDARIES AND PROPERTY:

- State Line
- County Line
- Township Line
- City Line
- Reservation Line
- Property Line
- Existing Iron Pin — EIP
- Property Corner
- Property Monument — EOM
- Parcel/Sequence Number — 123
- Existing Fence Line
- Proposed Woven Wire Fence
- Proposed Chain Link Fence
- Proposed Barbed Wire Fence
- Existing Wetland Boundary — WLB
- Proposed Wetland Boundary — WLB
- Existing Endangered Animal Boundary — EAB
- Existing Endangered Plant Boundary — EPB

BUILDINGS AND OTHER CULTURE:

- Gas Pump Vent or U/G Tank Cap
- Sign — S
- Well — W
- Small Mine
- Foundation
- Area Outline
- Cemetery
- Building
- School
- Church
- Dam

HYDROLOGY:

- Stream or Body of Water
- Hydro, Pool or Reservoir
- Jurisdictional Stream — JS
- Buffer Zone 1 — BZ 1
- Buffer Zone 2 — BZ 2
- Flow Arrow
- Disappearing Stream
- Spring
- Wetland
- Proposed Lateral, Tail, Head Ditch — FLOW
- False Sump

RAILROADS:

- Standard Gauge — CSX TRANSPORTATION
- RR Signal Milepost — MILEPOST 35
- Switch — SWITCH
- RR Abandoned
- RR Dismantled

RIGHT OF WAY:

- Baseline Control Point
- Existing Right of Way Marker
- Existing Right of Way Line
- Proposed Right of Way Line — RW
- Proposed Right of Way Line with Iron Pin and Cap Marker — RW
- Proposed Right of Way Line with Concrete or Granite Marker — RW
- Existing Control of Access — CA
- Proposed Control of Access — CA
- Existing Easement Line — E
- Proposed Temporary Construction Easement — E
- Proposed Temporary Drainage Easement — TDE
- Proposed Permanent Drainage Easement — PDE
- Proposed Permanent Utility Easement — PUE
- Proposed Temporary Utility Easement — TUE
- Proposed Permanent Easement with Iron Pin and Cap Marker

ROADS AND RELATED FEATURES:

- Existing Edge of Pavement
- Existing Curb
- Proposed Slope Stakes Cut — C
- Proposed Slope Stakes Fill — F
- Proposed Wheel Chair Ramp — WCR
- Existing Metal Guardrail
- Proposed Guardrail
- Existing Cable Guiderail
- Proposed Cable Guiderail
- Equality Symbol
- Pavement Removal

VEGETATION:

- Single Tree
- Single Shrub
- Hedge
- Woods Line
- Orchard
- Vineyard — Vineyard

EXISTING STRUCTURES:

MAJOR:

- Bridge, Tunnel or Box Culvert — CONC
- Bridge Wing Wall, Head Wall and End Wall — CONC WW

MINOR:

- Head and End Wall — CONC HW
- Pipe Culvert
- Footbridge
- Drainage Box: Catch Basin, DI or JB — CB
- Paved Ditch Gutter
- Storm Sewer Manhole — S
- Storm Sewer — S

UTILITIES:

POWER:

- Existing Power Pole
- Proposed Power Pole
- Existing Joint Use Pole
- Proposed Joint Use Pole
- Power Manhole — P
- Power Line Tower
- Power Transformer
- U/G Power Cable Hand Hole — HH
- H-Frame Pole
- Recorded U/G Power Line — P
- Designated U/G Power Line (S.U.E.*) — P

TELEPHONE:

- Existing Telephone Pole
- Proposed Telephone Pole
- Telephone Manhole — T
- Telephone Booth
- Telephone Pedestal — T
- Telephone Cell Tower
- U/G Telephone Cable Hand Hole — HH
- Recorded U/G Telephone Cable — T
- Designated U/G Telephone Cable (S.U.E.*) — T
- Recorded U/G Telephone Conduit — TC
- Designated U/G Telephone Conduit (S.U.E.*) — TC
- Recorded U/G Fiber Optics Cable — T FO
- Designated U/G Fiber Optics Cable (S.U.E.*) — T FO

WATER:

- Water Manhole — W
- Water Meter
- Water Valve
- Water Hydrant
- Recorded U/G Water Line — W
- Designated U/G Water Line (S.U.E.*) — W
- Above Ground Water Line — A/G Water

TV:

- TV Satellite Dish
- TV Pedestal — C
- TV Tower
- U/G TV Cable Hand Hole — HH
- Recorded U/G TV Cable — TV
- Designated U/G TV Cable (S.U.E.*) — TV
- Recorded U/G Fiber Optic Cable — TV FO
- Designated U/G Fiber Optic Cable (S.U.E.*) — TV FO

GAS:

- Gas Valve
- Gas Meter
- Recorded U/G Gas Line — G
- Designated U/G Gas Line (S.U.E.*) — G
- Above Ground Gas Line — A/G Gas

SANITARY SEWER:

- Sanitary Sewer Manhole — SS
- Sanitary Sewer Cleanout
- U/G Sanitary Sewer Line — SS
- Above Ground Sanitary Sewer — A/G Sanitary Sewer
- Recorded SS Forced Main Line — FSS
- Designated SS Forced Main Line (S.U.E.*) — FSS

MISCELLANEOUS:

- Utility Pole
- Utility Pole with Base
- Utility Located Object
- Utility Traffic Signal Box — S
- Utility Unknown U/G Line — ?UTL
- U/G Tank; Water, Gas, Oil
- A/G Tank; Water, Gas, Oil
- U/G Test Hole (S.U.E.*)
- Abandoned According to Utility Records — AATUR
- End of Information — E.O.I.

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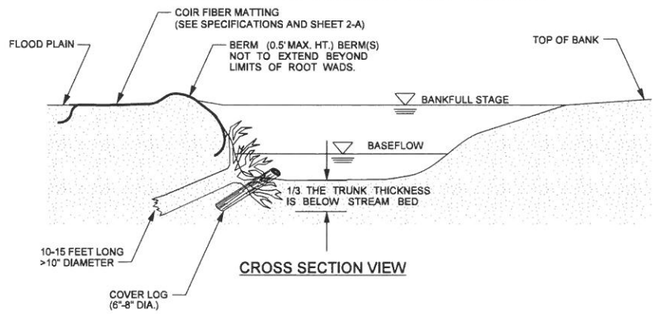
Revised 02/02/00

2/26/03

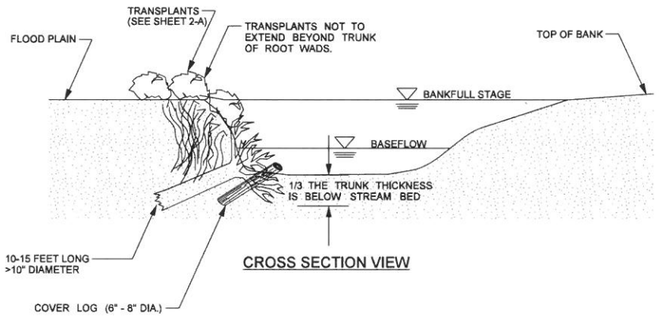
ROOT WADS

ROOT WADS WITHOUT TRANSPLANTS
USE IF TRANSPLANTS ARE NOT AVAILABLE ON-SITE



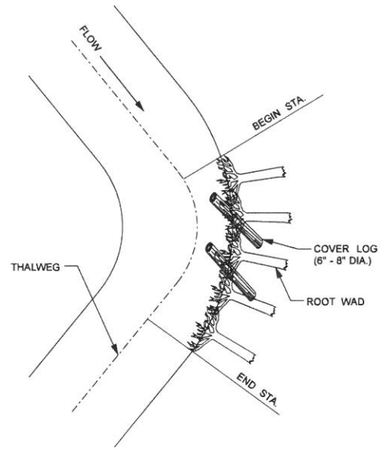
CROSS SECTION VIEW

ROOT WADS WITH TRANSPLANTS
USE IF TRANSPLANTS ARE AVAILABLE ON-SITE



CROSS SECTION VIEW

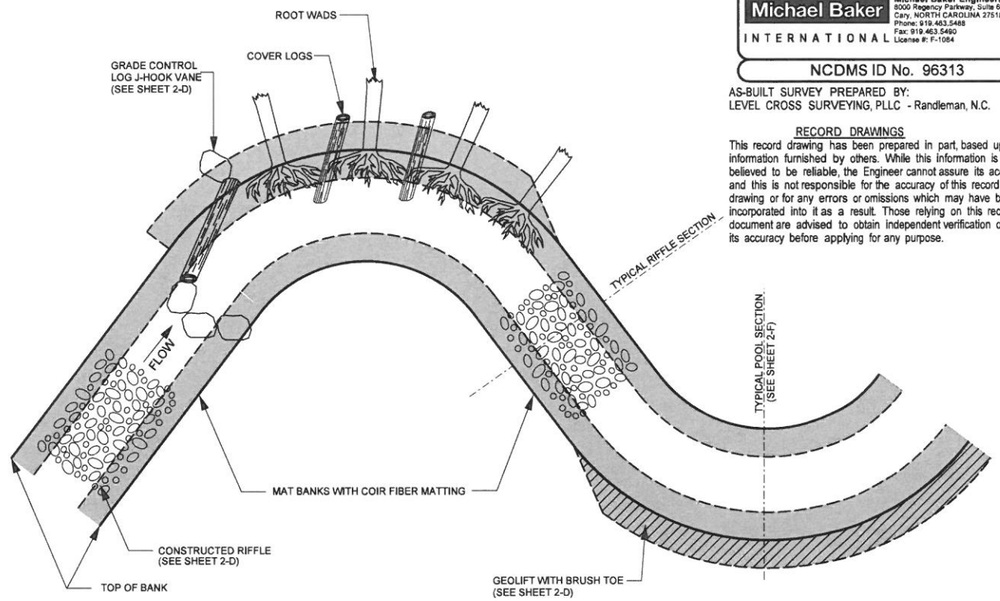
PLAN VIEW



NOTES:
1. INSTALLATION USING THE TRENCHING METHOD REQUIRES THAT A TRENCH BE EXCAVATED FOR THE LOG PORTION OF THE ROOT WAD. ONE-THIRD OF THE ROOT WAD SHOULD REMAIN BELOW NORMAL BASE FLOW CONDITIONS OR CHANNEL BOTTOM.
2. THE NUMBER OF ROOTWADS ESTIMATED MAY VARY DEPENDING ON THE ROOTMASS SIZE. IN GENERAL, ROOTWADS SHOULD PROTECT THE OUTER MEANDER BEND AS SHOWN. SEE STRUCTURE TABLE FOR APPROXIMATE STATION AND LOCATION.
3. INSTALL COVER LOGS BETWEEN ROOTWADS TO PROVIDE HABITAT ONLY WHEN AVAILABLE FROM ON-SITE HARVESTING.

TYPICAL STRUCTURE PLACEMENT

STRUCTURE NOTES:
1. GENERALLY CONSTRUCTED RIFFLES, ROOT WADS, LOG VANES AND COIR FIBER MATTING WILL BE INSTALLED IN THE LOCATION AND SEQUENCE AS SHOWN.
2. ANY CHANGES TO NUMBER OR LOCATION OF STRUCTURES DURING CONSTRUCTION MUST BE APPROVED BY THE DESIGN ENGINEER.
3. COIR FIBER MATTING TO BE INSTALLED ON ALL RESTORED STREAMBANKS, FLOODPLAIN BENCHING, AND TERRACE SLOPES AS DESCRIBED IN THE TECHNICAL SPECIFICATIONS.



BAKER PROJECT REFERENCE NO.	SHEET NO.
140048	2

PROJECT ENGINEER

K. McKeithan

APPROVED BY:

9.8.17

DATE:

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License #: F-1084

NCDMS ID No. 96313

AS-BUILT SURVEY PREPARED BY:
LEVEL CROSS SURVEYING, PLLC - Randleman, N.C.

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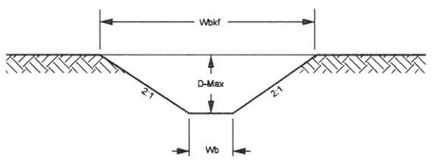
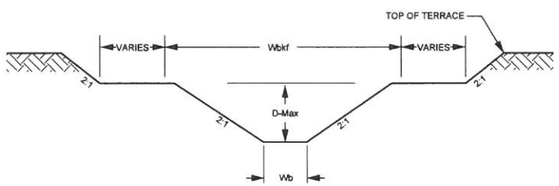
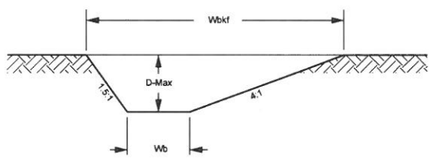
TYPICAL RIFFLE, POOL, AND BANKFULL BENCH CROSS-SECTIONS



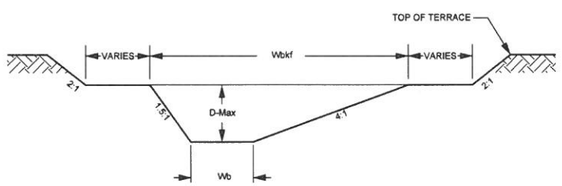
RIFFLE



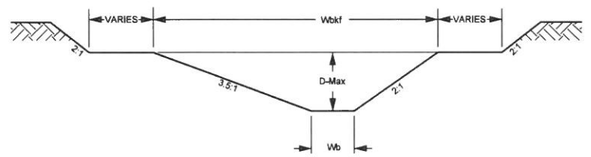
RIFFLE WITH BANKFULL BENCH



POOL



POOL WITH BANKFULL BENCH



STEP - POOL

R1		R2		R3		
RIFFLE	POOL	RIFFLE	POOL	RIFFLE	POOL	
12.9	17.4	11.0	14.9	10.3	13.9	WIDTH OF BANKFULL (Wbkf)
1.5	2.7	1.3	2.2	1.2	2.0	MAXIMUM DEPTH (D-Max)
11.0	11.2	11.0	11.4	11.0	11.5	WIDTH TO DEPTH RATIO (Wbkf / D)
15.2	26.9	11.1	19.5	9.7	16.8	BANKFULL AREA (Abkf)
6.8	2.6	5.8	2.8	5.4	2.9	BOTTOM WIDTH (Wb)

R4 - UPPER		R4 - LOWER		R6 Bc STREAM		
RIFFLE	POOL	RIFFLE	POOL	RIFFLE	POOL	
8.1	10.9	9.2	12.4	7.0	10.0	WIDTH OF BANKFULL (Wbkf)
0.8	1.5	0.9	1.8	0.6	1.5	MAXIMUM DEPTH (D-Max)
13.0	11.7	13.0	11.5	14.0	12.4	WIDTH TO DEPTH RATIO (Wbkf / D)
5.0	10.2	6.5	13.4	3.5	8.0	BANKFULL AREA (Abkf)
5.0	2.7	5.7	2.5	4.6	3.4	BOTTOM WIDTH (Wb)

R6 C/E STREAM		T1		T3 / T4		
RIFFLE	POOL	RIFFLE	POOL	RIFFLE	POOL	
6.1	7.9	7.0	9.5	5.8	7.5	WIDTH OF BANKFULL (Wbkf)
0.6	0.9	0.7	1.2	0.6	0.9	MAXIMUM DEPTH (D-Max)
12.0	12.8	13.0	12.1	12.0	12.4	WIDTH TO DEPTH RATIO (Wbkf / D)
3.1	4.9	3.8	7.4	2.8	4.5	BANKFULL AREA (Abkf)
3.5	3.0	4.4	2.9	3.3	2.6	BOTTOM WIDTH (Wb)

NOTES:
1. DURING CONSTRUCTION CORNERS OF DESIGN CHANNEL WILL BE ROUNDED AND A THALWEG WILL BE SHAPED PER DIRECTION OF ENGINEER.
2. POOLS SHOWN ABOVE ARE LEFT POOLS FOR MEANDER CHANNELS.

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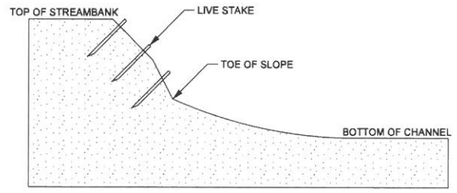
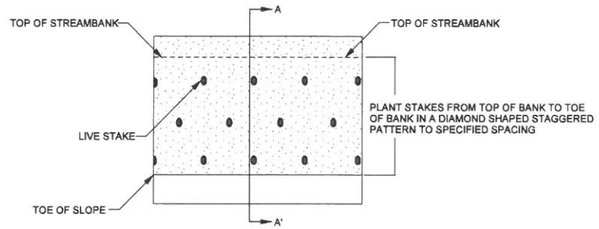
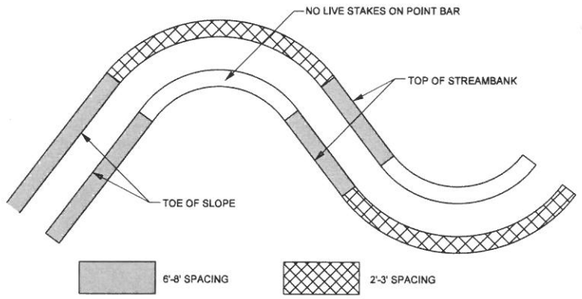
LIVE STAKING



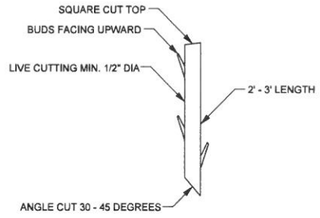
SECTION A - A'



PLAN VIEW



LIVE STAKE SPACING PLAN VIEW

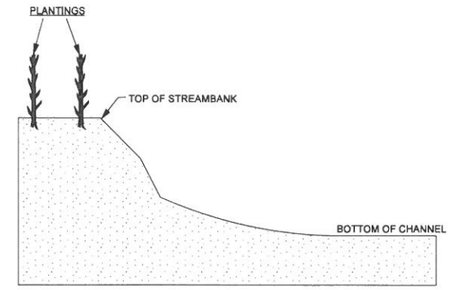


LIVE STAKE DETAIL

NOTES:

1. STAKES SHOULD BE CUT AND INSTALLED ON THE SAME DAY.
2. DO NOT INSTALL STAKES THAT HAVE BEEN SPLIT.
3. STAKES MUST BE INSTALLED WITH BUDS POINTING UPWARDS.
4. STAKES SHOULD BE INSTALLED PERPENDICULAR TO BANK.
5. STAKES SHOULD BE 1/2 TO 2 INCHES IN DIAMETER AND 2 TO 3 FT LONG.
6. STAKES SHOULD BE INSTALLED LEAVING 1/5 OF STAKE ABOVE GROUND.

PLANTING SPECIFICATIONS



CROSS SECTION VIEW OF BARE ROOT PLANTING

NOTES:

1. PLANT BARE ROOT SHRUBS AND TREES TO THE WIDTH OF THE BUFFER/PLANTING ZONE AS SHOWN ON THE PLANS.
2. ALLOW FOR 6-10 FEET BETWEEN PLANTINGS, DEPENDING ON SIZE.
3. LOOSEN COMPACTED SOIL.
4. PLANT IN HOLES MADE BY A MATTOCK, DIBBLE, PLANTING BAR, OR OTHER APPROVED MEANS.
5. PLANT IN HOLES DEEP AND WIDE ENOUGH TO ALLOW THE ROOTS TO SPREAD OUT AND DOWN WITHOUT J-ROOTING.
6. KEEP ROOTS MOIST WHILE DISTRIBUTING OR WAITING TO PLANT BY MEANS OF WET CANVAS, BURLAP, OR STRAW.
7. HEEL-IN PLANTS IN MOIST SOIL OR SAWDUST IF NOT PROMPTLY PLANTED UPON ARRIVAL TO PROJECT SITE.

BAKER PROJECT REFERENCE NO.	SHEET NO.
140048	2-A

PROJECT ENGINEER

K.McKeithan

APPROVED BY:

9.8.17

DATE:

NORTH CAROLINA 028432 ENGINEER KATHLEEN M. McKEITHAN 9-8-17

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AS-BUILT SURVEY PREPARED BY:
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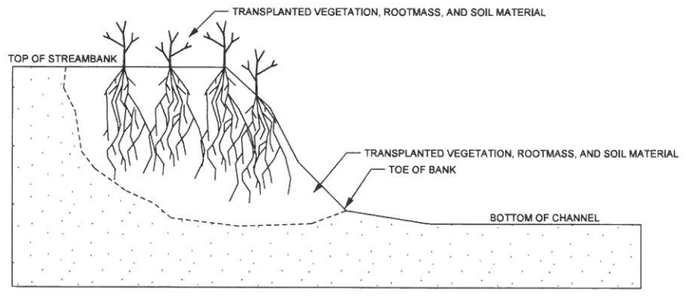
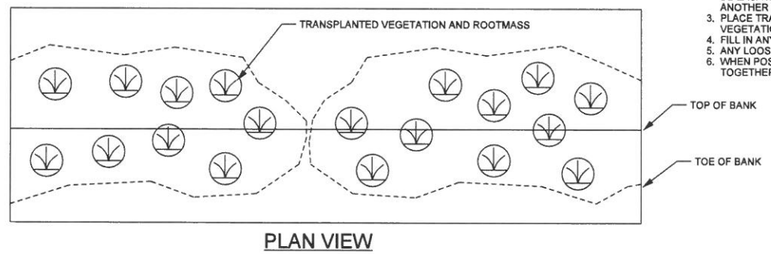
TRANSPLANTED VEGETATION



CROSS SECTION VIEW

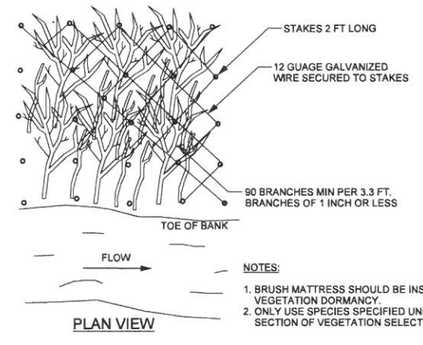


PLAN VIEW

NOTES:

1. EXCAVATE A HOLE IN THE BANK TO BE STABILIZED THAT WILL ACCOMMODATE THE SIZE OF TRANSPLANT TO BE PLACED. BEGIN EXCAVATION AT THE TOE OF THE BANK.
2. EXCAVATE THE ENTIRE ROOT MASS AND AS MUCH ADDITIONAL SOIL MATERIAL AS POSSIBLE. IF ENTIRE ROOT MASS CAN NOT BE EXCAVATED AT ONCE, THE TRANSPLANT IS TOO LARGE AND ANOTHER SHOULD BE SELECTED.
3. PLACE TRANSPLANT IN THE BANK TO BE STABILIZED SO THAT VEGETATION IS ORIENTATED VERTICALLY.
4. FILL IN ANY HOLES AROUND THE TRANSPLANT AND COMPACT.
5. ANY LOOSE SOIL LEFT IN THE STREAM SHOULD BE REMOVED.
6. WHEN POSSIBLE, PLACE MULTIPLE TRANSPLANTS CLOSE TOGETHER SUCH THAT THEY TOUCH.

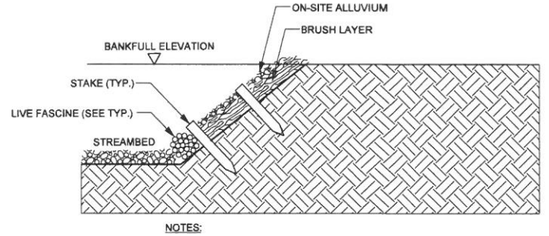
BRUSH MATTRESS



PLAN VIEW

NOTES:

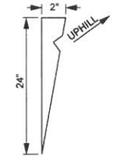
1. BRUSH MATTRESS SHOULD BE INSTALLED DURING VEGETATION DORMANCY.
2. ONLY USE SPECIES SPECIFIED UNDER LIVE STAKES SECTION OF VEGETATION SELECTION.



NOTES:

1. CREATE 12" DEEP TRENCH
2. STAKE AND WIRE BRUSH LAYER INTO TRENCH
3. BACK FILL 3" OF ON-SITE ALLUVIUM OVER BRUSH LAYER

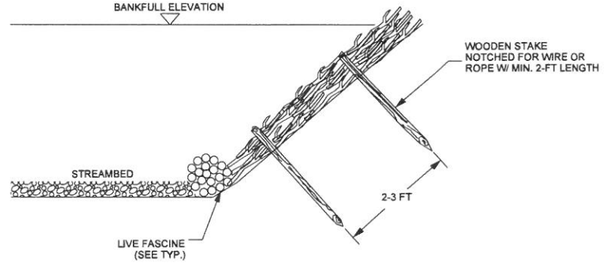
CROSS SECTION



TYPICAL STAKE

NOTES:

1. BOARD FOR STAKE SHOULD BE 2" x 4" x 24".
2. SAW 2" x 4" TIMBER DIAGONALLY TO PRODUCE 2 DEAD STOUT STAKES.



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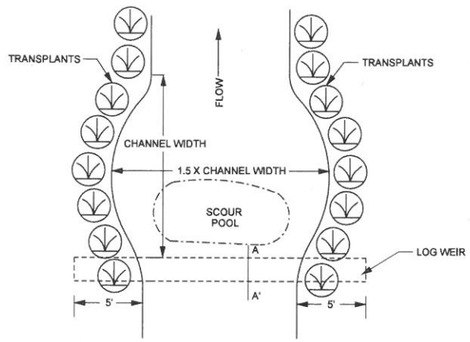
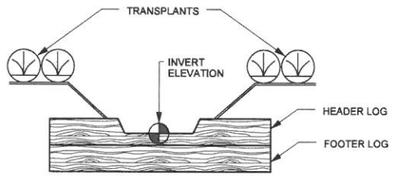
2/26/03

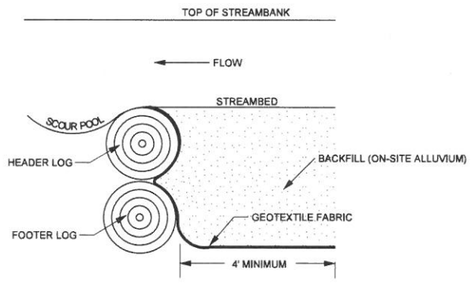
LOG WEIR



PLAN VIEW



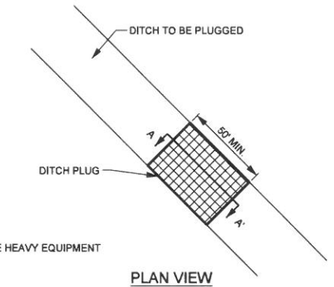
CROSS SECTION VIEW



SECTION A-A'

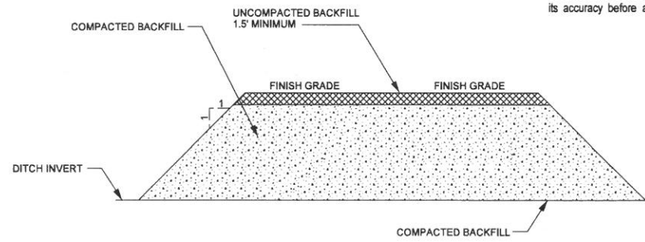
NOTES:
1. LOGS SHOULD BE AT LEAST 12 INCHES IN DIAMETER, RELATIVELY STRAIGHT, HARDWOOD, AND RECENTLY HARVESTED.
2. LOGS >24 INCHES IN DIAMETER MAY BE USED ALONE WITHOUT AN ADDITIONAL LOG. GEOTEXTILE FABRIC SHOULD STILL BE USED TO SEAL AROUND LOG
3. PLACE FOOTER LOGS FIRST AND THEN HEADER (TOP) LOG. SET HEADER LOG APPROXIMATLEY 3 INCHES ABOVE THE INVERT ELEVATION.
4. CUT A NOTCH IN THE HEADER LOG APPROXIMATLEY 50 PERCENT OF THE CHANNEL BOTTOM WIDTH AND EXTENDING DOWN TO THE INVERT ELEVATION.
5. USE GEOTEXTILE FABRIC TO SEAL GAPS BETWEEN LOGS.
6. PLACE TRANSPLANTS FROM TOE OF STREAMBANK TO TOP OF STREAMBANK.

DITCH PLUG



NOTE:
COMPACT BACKFILL USING ON-SITE HEAVY EQUIPMENT IN 10 INCH LIFTS.

PLAN VIEW



SECTION A - A'

BAKER PROJECT REFERENCE NO.	SHEET NO.
140048	2-B

PROJECT ENGINEER

NORTH CAROLINA
028432
ENGINEER
KATHLEEN M. McKEITHAN
9-8-17

K McKeithan

APPROVED BY:

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License #: F-1084

NCDMS ID No. 96313

AS-BUILT SURVEY PREPARED BY:
LEVEL CROSS SURVEYING, PLLC - Randleman, N.C.

RECORD DRAWINGS
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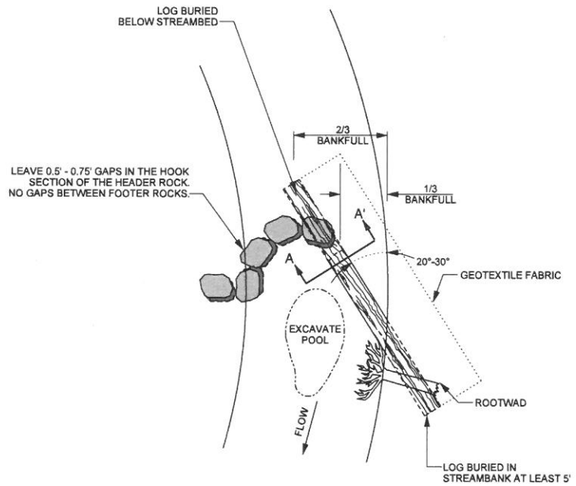
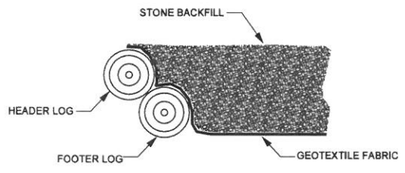
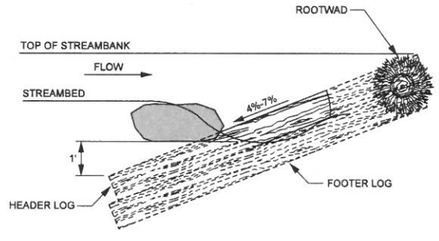
GRADE CONTROL LOG J-HOOK VANE



PLAN VIEW



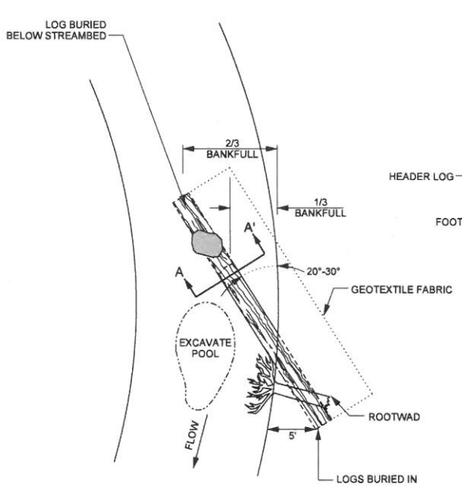
SECTION A - A'



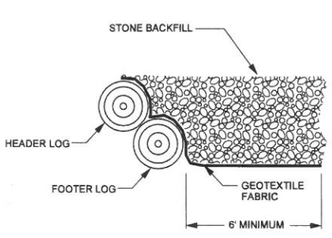
PROFILE VIEW

NOTES:
1. LOGS SHOULD BE AT LEAST 10" IN DIAMETER, RELATIVELY STRAIGHT, HARDWOOD, AND RECENTLY HARVESTED.
2. BOULDERS MUST BE AT LEAST 3' x 2' x 2'.
3. SOIL SHOULD BE COMPACTED WELL AROUND BURIED PORTIONS OF LOG.
4. ROOTWADS SHOULD BE PLACED BENEATH THE HEADER LOG AND PLACED SO THAT IT LOCKS THE HEADER LOG INTO THE BANK. SEE ROOTWAD DETAIL.
5. BOULDERS SHOULD BE PLACED ON TOP OF HEADER LOG FOR ACHORING.
6. HEADER BOULDERS TO BE PLACED 0.5 TO 0.75 FEET APART.
7. GEOTEXTILE FABRIC SHOULD BE NAILED TO THE LOG BELOW THE BACKFILL.
8. TRANSPLANTS CAN BE USED INSTEAD OF ROOWADS, PER DIRECTION OF ENGINEER.

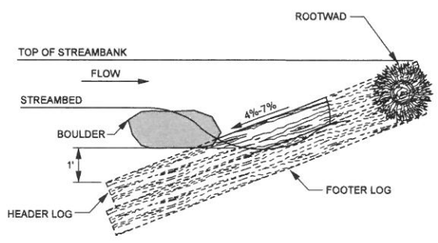
LOG VANE



PLAN VIEW



SECTION A - A'



PROFILE VIEW

NOTES:
1. LOGS SHOULD BE AT LEAST 10" IN DIAMETER, RELATIVELY STRAIGHT, HARDWOOD, AND RECENTLY HARVESTED.
2. BOULDERS MUST BE OF SUFFICIENT SIZE TO ANCHOR LOGS.
3. SOIL SHOULD BE COMPACTED WELL AROUND BURIED PORTIONS OF LOGS.
4. ROOTWADS SHOULD BE PLACED BENEATH THE HEADER LOG AND PLACED SO THAT IT LOCKS THE HEADER LOG INTO THE BANK. SEE ROOTWAD DETAIL.
5. BOULDER SHOULD BE PLACED ON TOP OF HEADER LOG FOR ANCHORING.
6. GEOTEXTILE FABRIC SHOULD BE NAILED TO THE LOG BELOW THE BACKFILL.
7. TRANSPLANTS CAN BE USED INSTEAD OF ROOTWADS, PER DIRECTION OF ENGINEER.

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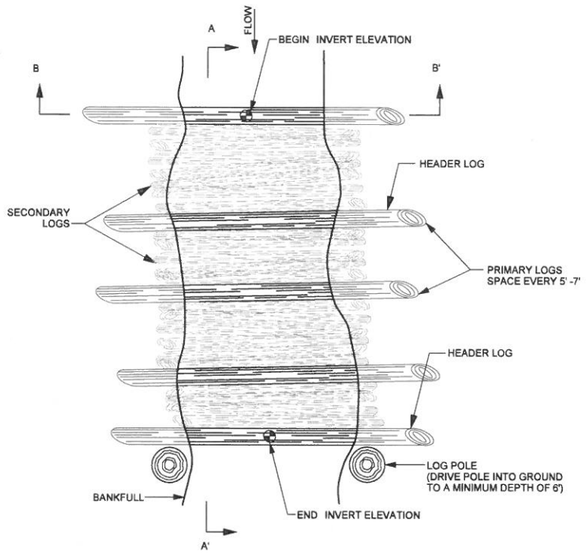
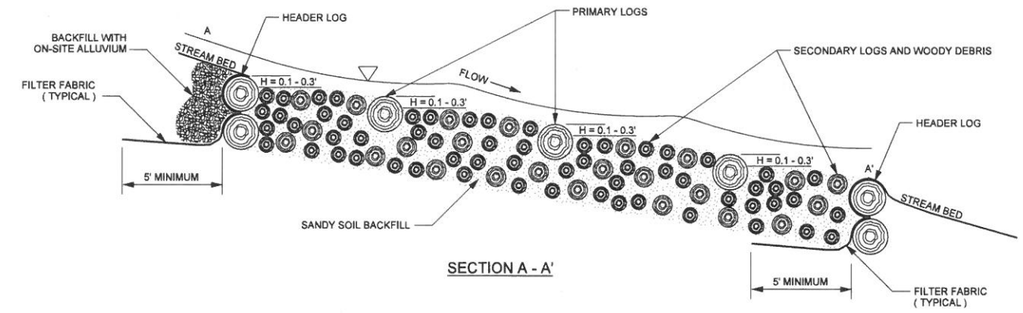
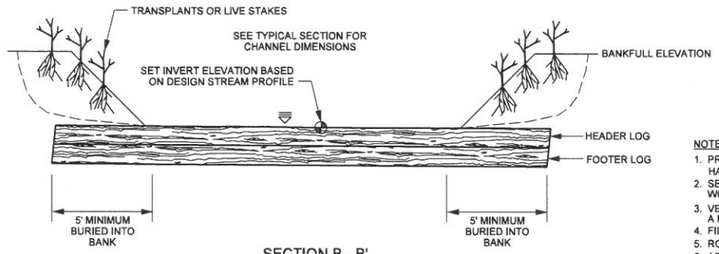
GRADE CONTROL LOG JAM



PLAN VIEW



SECTION A - A'



SECTION B - B'

NOTES:

1. PRIMARY LOGS SHOULD BE AT LEAST 10" OR MORE IN DIAMETER, RELATIVELY STRAIGHT, HARDWOOD PREFERRED, AND RECENTLY HARVESTED AND EXTENDING INTO THE BANK 5' ON EACH SIDE.
2. SECONDARY LOGS SHOULD BE AT LEAST 1' IN DIAMETER AND NO LARGER THAN 10", AND EXTEND INTO THE BANK 2 FEET ON EACH SIDE. WOOD MATERIAL SHALL BE VARYING DIAMETER TO ALLOW MATERIAL TO BE COMPACTED.
3. VERTICAL POSTS SHOULD BE AT LEAST 10" IN DIAMETER AND SHOULD BE DRIVEN INTO THE GROUND A MINIMUM OF 6'.
4. FILTER FABRIC SHOULD BE NAILED TO THE HEADER LOG BELOW THE BACKFILL.
5. ROOTWADS AND COIR FIBER MATTING CAN BE USED INSTEAD OF TRANSPLANTS OR LIVE STAKES, PER DIRECTION OF ENGINEER.
6. AFTER TRENCH HAS BEEN EXCAVATED A LAYER OF SECONDARY LOGS AND WOODY DEBRIS SHOULD BE PLACED WITH MINIMAL GAPS. A LAYER OF ON-SITE ALLUVIUM SHOULD BE APPLIED TO FILL VOIDS BETWEEN SECONDARY LOGS BEFORE ADDITIONAL LAYERS ARE PLACED.

BAKER PROJECT REFERENCE NO.	SHEET NO.
140048	2-C

PROJECT ENGINEER

NORTH CAROLINA 28432 ENGINEER KATHLEEN M. McKEETHAN

KMcKeethan

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9.8.17

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License #: F-1084

NCDMS ID No. 96313

AS-BUILT SURVEY PREPARED BY:
LEVEL CROSS SURVEYING, PLLC - Randleman, N.C.

RECORD DRAWINGS

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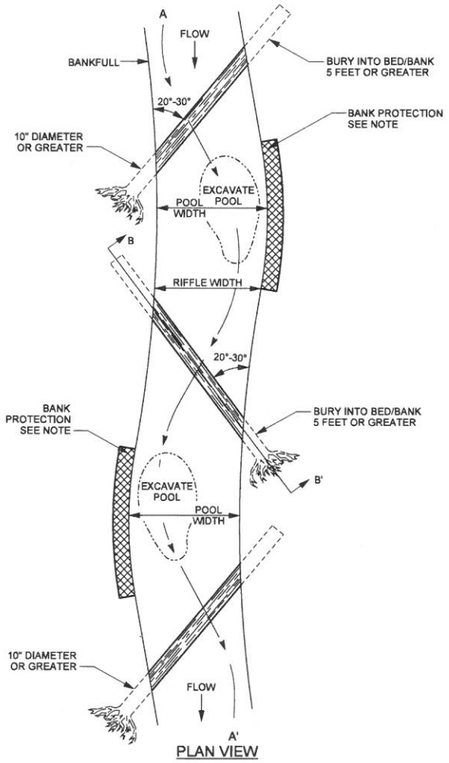
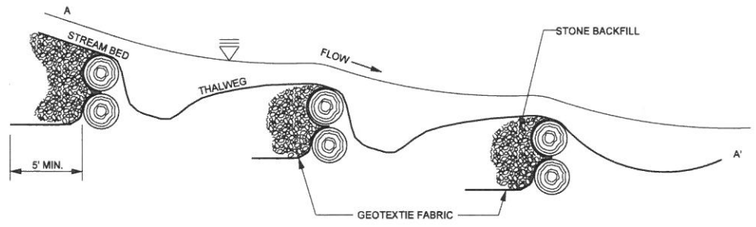
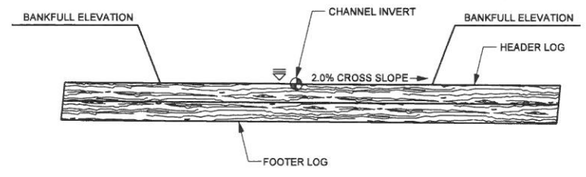
LOG STEP-POOL



PLAN VIEW



SECTION A - A'



SECTION B - B'

NOTES:

1. LOGS WITHOUT ROOT MASS MAY BE USED IF APPROVED BY PROJECT ENGINEER.
2. FOR BANK PROTECTION, USE ROOT WADS, TOE WOOD, GEOLIFTS, TRANSPLANTS, OR BOULDERS.
3. SEE NOTES FOR LOG WEIR MINUS NOTCHING.
4. SOIL SHOULD BE COMPACTED WELL AROUND BURIED PORTIONS OF LOG.

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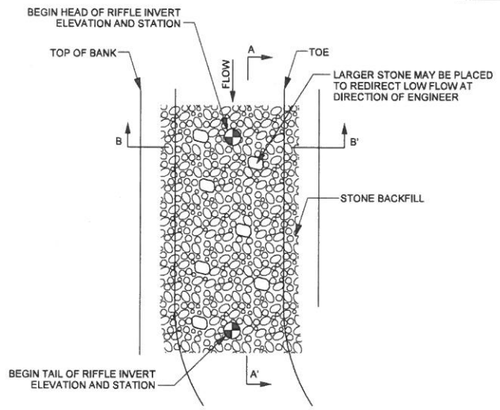
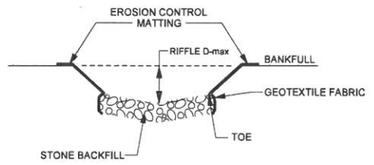
2/26/03

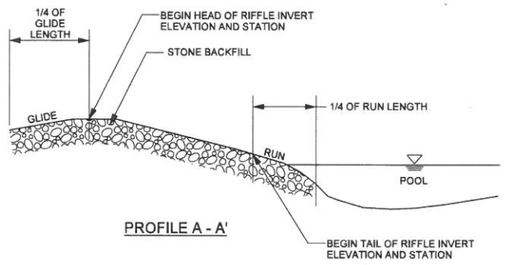
CONSTRUCTED RIFFLE



PLAN VIEW



SECTION B - B'



PROFILE A - A'

NOTES:

1. UNDERCUT CHANNEL BED ELEVATION AS NEEDED TO ALLOW FOR LAYERS OF STONE TO ACHIEVE FINAL GRADE.
2. INSTALL EROSION CONTROL MATTING ALONG COMPLETED BANKS SUCH THAT THE EROSION CONTROL MATTING AT THE TOE OF THE BANK EXTENDS DOWN TO THE UNDERCUT ELEVATION.
3. INSTALL STONE BACKFILL, COMPACTED TO GRADE.
4. FINAL CHANNEL BED SHAPE SHOULD BE ROUNDED, SMOOTH, AND CONCAVE, WITH THE ELEVATION OF THE BED 0.2 FT DEEPER IN THE CENTER THAN AT THE EDGES.

GEOLIFT WITH BRUSH TOE

AS-BUILT SURVEY PREPARED BY:
LEVEL CROSS SURVEYING, PLLC - Randleman, N.C.

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NOTES:

1. LIVE BRANCH CUTTINGS SHALL BE THE SAME SPECIES AS THE LIVE STAKES AND SHALL BE INSTALLED DURING VEGETATION DORMANCY.
2. LIVE BRANCH CUTTINGS SHALL BE INSTALLED AT A DENSITY OF 20-30 CUTTINGS PER LINEAR FOOT AND A MAXIMUM DIAMETER OF 2.5 INCHES.
3. NUMBER OF SOIL LIFTS MAY VARY, IN GENERAL LIFTS SHALL EXTEND TO THE TOP OF BANK OR BANKFULL STAGE.
4. GEOLIFTS TO BE INSTALLED IN CHANNEL SECTIONS ALONG SIDE SLOPES STEEPER THAN 2:1 AND/OR ADJACENT TO HILL SLOPES.

BAKER PROJECT REFERENCE NO.	SHEET NO.
140048	2-D

PROJECT ENGINEER

K. McKeithan

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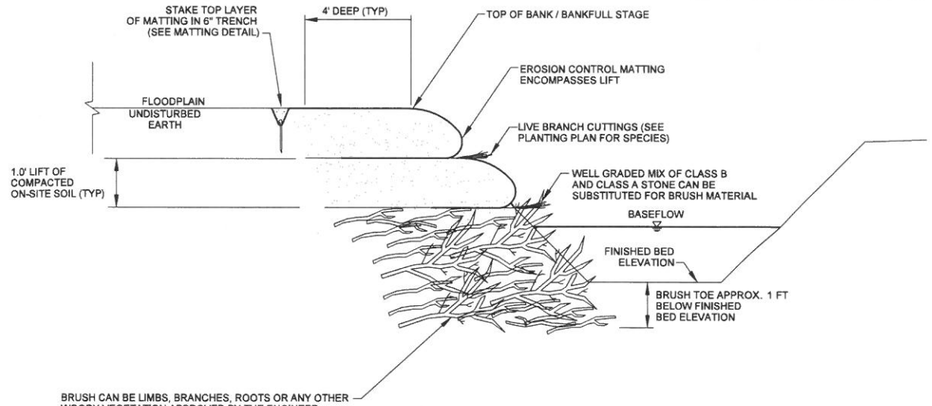
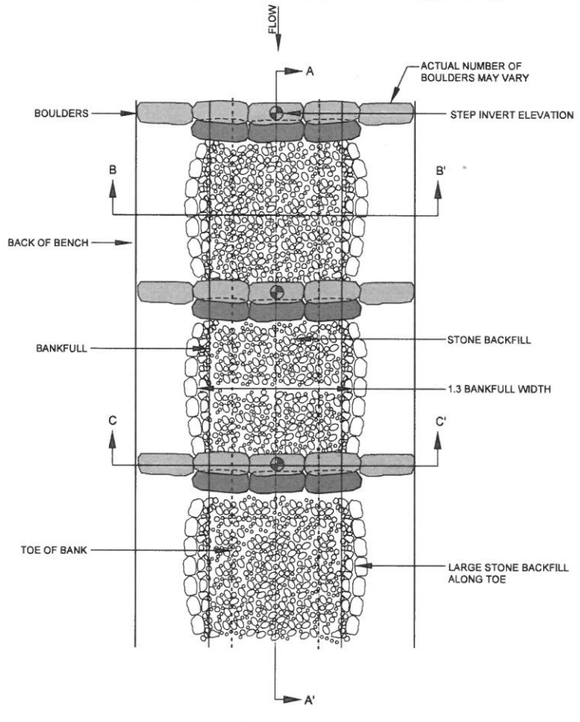
NCDMS ID No. 96313

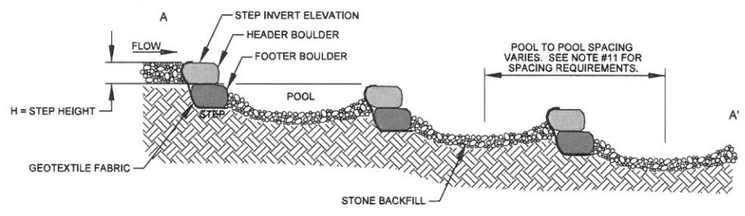


NOTES:
1. WHEN GEOLIFTS ARE BUILT ABOVE ROOTWAD CLUSTER, USE LARGE STONE BACKFILL BEHIND ROOT MASS TO BUILT FOUNDATION.

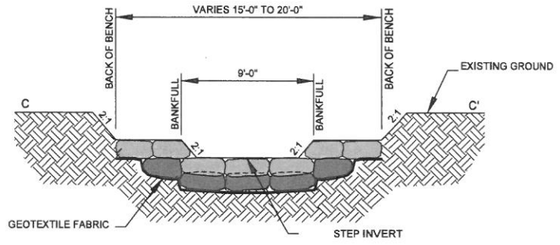
ROCK STEP POOL CHANNEL



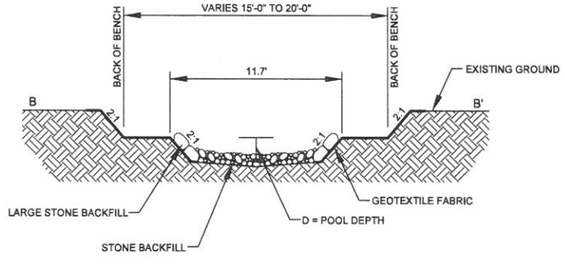
PLAN VIEW



PROFILE VIEW A-A'



POOL CROSS SECTION C-C'



POOL CROSS SECTION B-B'

NOTES:

1. BOULDERS MUST BE AT LEAST 2' X 2' X 3' AND NOT EXCEED 4' X 3' X 2'.
2. FOOTERS SHALL BE INSTALLED SUCH THAT 1/4 TO 1/3 OF THE LENGTH IS DOWNSTREAM OF THE HEADER.
3. SOIL SHALL BE WELL COMPACTED AROUND BURIED PORTION OF FOOTERS WITH BUCKET OF TRACK HOE.
4. INSTALL COIR FIBER MATTING UNDERNEATH FOOTER BOULDERS.
5. UNDERCUT POOL BED ELEVATION 8 INCHES TO ALLOW FOR LAYER OF STONE.
6. INSTALL COIR FIBER MATTING ALONG COMPLETED BANKS SUCH THAT THE GEOTEXTILE FABRIC AT THE TOE OF THE BANK EXTENDS DOWN TO THE UNDERCUT ELEVATION.
7. INSTALL LARGE STONE BACKFILL ALONG SIDE SLOPES.
8. FINAL CHANNEL BED SHAPE SHOULD BE ROUNDED, COMPACTED, AND CONCAVE, WITH THE ELEVATION OF THE BED APPROXIMATELY 0.5 FT DEEPER IN THE CENTER THAN AT THE EDGES.
9. STEP HEIGHT (H) SHALL NOT EXCEED 0.8 FT.
10. MINIMUM POOL DEPTH (D) SHALL BE NO LESS THAN 1.7 FT.
11. IN GENERAL, POOL TO POOL SPACING SHALL BE NO LESS THAN 9 FT AND NO GREATER THAN 37 FT BASED ON EXISTING CONDITIONS SUCH AS SLOPE AND SUITABLE FILL MATERIAL. CONSTRUCTED RIFFLES MAY BE SUBSTITUTED IN AREAS WHERE EXISTING SLOPES EXCEED 10% AS DETERMINED IN THE FIELD BY THE CONTRACTOR AND ENGINEER.

5/8/2017
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mcpeak

2/26/03

AS-BUILT SURVEY PREPARED BY:
LEVEL CROSS SURVEYING, PLLC - Randleman, N.C.

RECORD DRAWINGS
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BAKER PROJECT REFERENCE NO.	SHEET NO.
140048	3

PROJECT ENGINEER

NORTH CAROLINA SEAL 032432 ENGINEER KATHLEEN M. McKETHAN

APPROVED BY:

9-8-17

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License #: F-1084

NCDMS ID NO. 96313

BEGIN REACH 5
STA. 10+00.00

REACH 5

AS-BUILT THALWEG (TYP.)

AS-BUILT TOP OF BANK (TYP.)

LOG STEP POOL

VEG PLOT #1

MATCH LINE - SHEET 4

NAD 83

10+00 11+00 12+00 13+00 14+00

805 810

39

BROWNS SUMMIT AS-BUILT PLAN VIEW

20 0 20 40
SCALE (FT)

2/26/03

AS-BUILT SURVEY PREPARED BY:
LEVEL CROSS SURVEYING, PLLC - Randleman, N.C.

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BAKER PROJECT REFERENCE NO.	SHEET NO.
140048	4

PROJECT ENGINEER
K. McKeithan
APPROVED BY:
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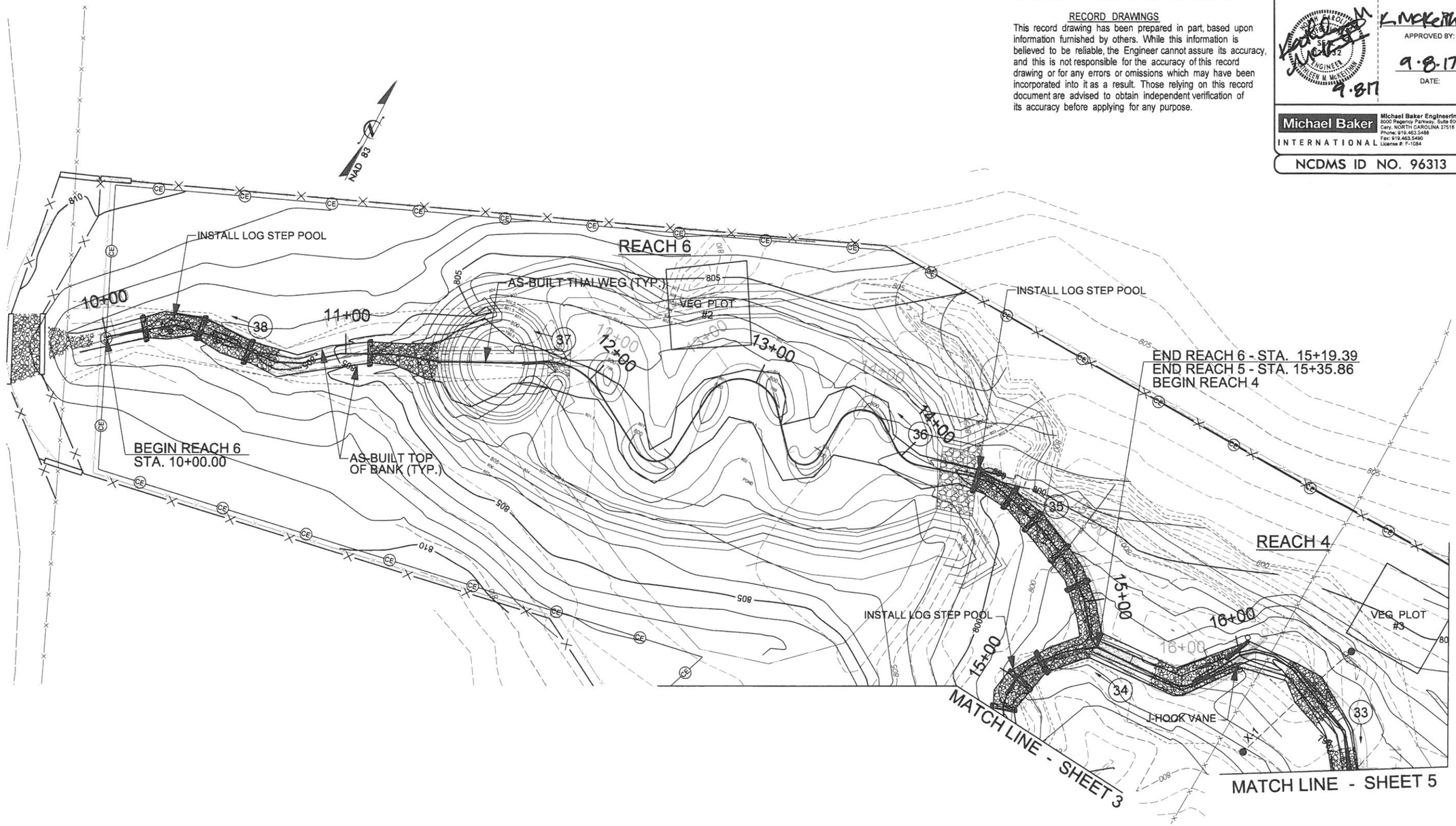
NCDMS ID NO. 96313



BROWNS SUMMIT
AS-BUILT PLAN VIEW

20 0 20 40
SCALE (FT)

9/7/2017
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2/26/03

AS-BUILT SURVEY PREPARED BY:
LEVEL CROSS SURVEYING, PLLC - Randleman, N.C.

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BAKER PROJECT REFERENCE NO.	SHEET NO.
140048	5

PROJECT ENGINEER

NORTH CAROLINA REGISTERED 032432 ENGINEER KATHLEEN M. McKEITHAN
9.8.17

K. McKeithan

APPROVED BY:

9.8.17

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License #: F-1084

NCDMS ID NO. 96313

NAD 83

MATCH LINE - SHEET 4

MATCH LINE - SHEET 6

REACH 4

AS-BUILT TOP OF BANK (TYP.)

VEG PLOT #4

FLOW GAUGE #1

LOG WEIR (TYP.)

J-HOOK VANE (TYP.)

GEOLIFT WITH BRUSH TOE (TYP.)

AS-BUILT THALWEG (TYP.)

LOG VANE

LOG STEP POOL INLET PROTECTION

LOG STEP POOL

17+00 18+00 19+00 20+00 21+00 22+00

10+00 11+00

X-1 X-2 X-3 X-4

27 28 29 30 31 32

END REACH T4 - STA. 11+49.36=
REACH 4 - STA. 21+02.04

BEGIN REACH T4
STA. 10+30.18

BROWNS SUMMIT AS-BUILT PLAN VIEW

20 0 20 40
SCALE (FT)

9/7/2017
R:\140048_BrownsSummit\FD\Design\As-Built\Plans\140048_ASB-PSH_05.dgn
mlarsen

2/26/03

AS-BUILT SURVEY PREPARED BY:
LEVEL CROSS SURVEYING, PLLC - Randleman, N.C.

RECORD DRAWINGS

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NAD 83

BAKER PROJECT REFERENCE NO.	SHEET NO.
140048	6

PROJECT ENGINEER

K. McKeithan

APPROVED BY:

9.8.17

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NCDMS ID NO. 96313

MATCH LINE - SHEET 5

END REACH T3 - STA. 10+92.84
END REACH 4 - STA. 28+31.92
BEGIN REACH 3 UPPER

REACH 4 LOWER

AS-BUILT THALWEG (TYP.)

AS-BUILT WETLAND (TYP.)

J- HOOK VANE (TYP.)

VEG. PLOT #5

GEOLIFT WITH BRUSH TOE (TYP.)

MW #1

LOG ROLLER (TYP.)

AS-BUILT TOP OF BANK (TYP.)

AS-BUILT WETLAND (TYP.)

FLOW GAUGE #2

MATCH LINE SHEET 7

BEGIN REACH T3
STA. 10+04.88

BROWNS SUMMIT AS-BUILT PLAN VIEW

20 0 20 40
SCALE (FT)

9/7/2017
R:\140048_BrownsSummit\FD\Design\As-Built\Plans\140048_ASB-PSH_06.dgn
mcDERK

2/26/03

AS-BUILT SURVEY PREPARED BY:
LEVEL CROSS SURVEYING, PLLC - Randleman, N.C.

RECORD DRAWINGS
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BAKER PROJECT REFERENCE NO.	SHEET NO.
140048	7

PROJECT ENGINEER

KMcKeithan

APPROVED BY:

9.8.17

DATE:

NORTH CAROLINA 28432 ENGINEER KATHLEEN M. McKEITHAN 9.8.17

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NCDMS ID NO. 96313

NAD 83

VEG PLOT #6

AS-BUILT THALWEG (TYP.)

REACH 3

J-HOOK VANE (TYP.)

LOG VANE (TYP.)

GEOLIFT WITH BRUSH TOE (TYP.)

LOG ROLLER (TYP.)

AS-BUILT TOP OF BANK (TYP.)

BENCH LIMITS

VEG PLOT #7

MATCH LINE SHEET 6

MATCH LINE - SHEET 8

29+00 30+00 31+00 32+00 33+00 34+00

X-6 X-7 X-8

785 780 775

BROWNS SUMMIT AS-BUILT PLAN VIEW

20 0 20 40
SCALE (FT)

9/7/2017
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mcarroll

2/26/03

AS-BUILT SURVEY PREPARED BY:
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NAD 83

BAKER PROJECT REFERENCE NO.	SHEET NO.
140048	8

PROJECT ENGINEER

NORTH CAROLINA 032432 ENGINEER KATHLEEN M. McKEITHAN

K. McKeithan

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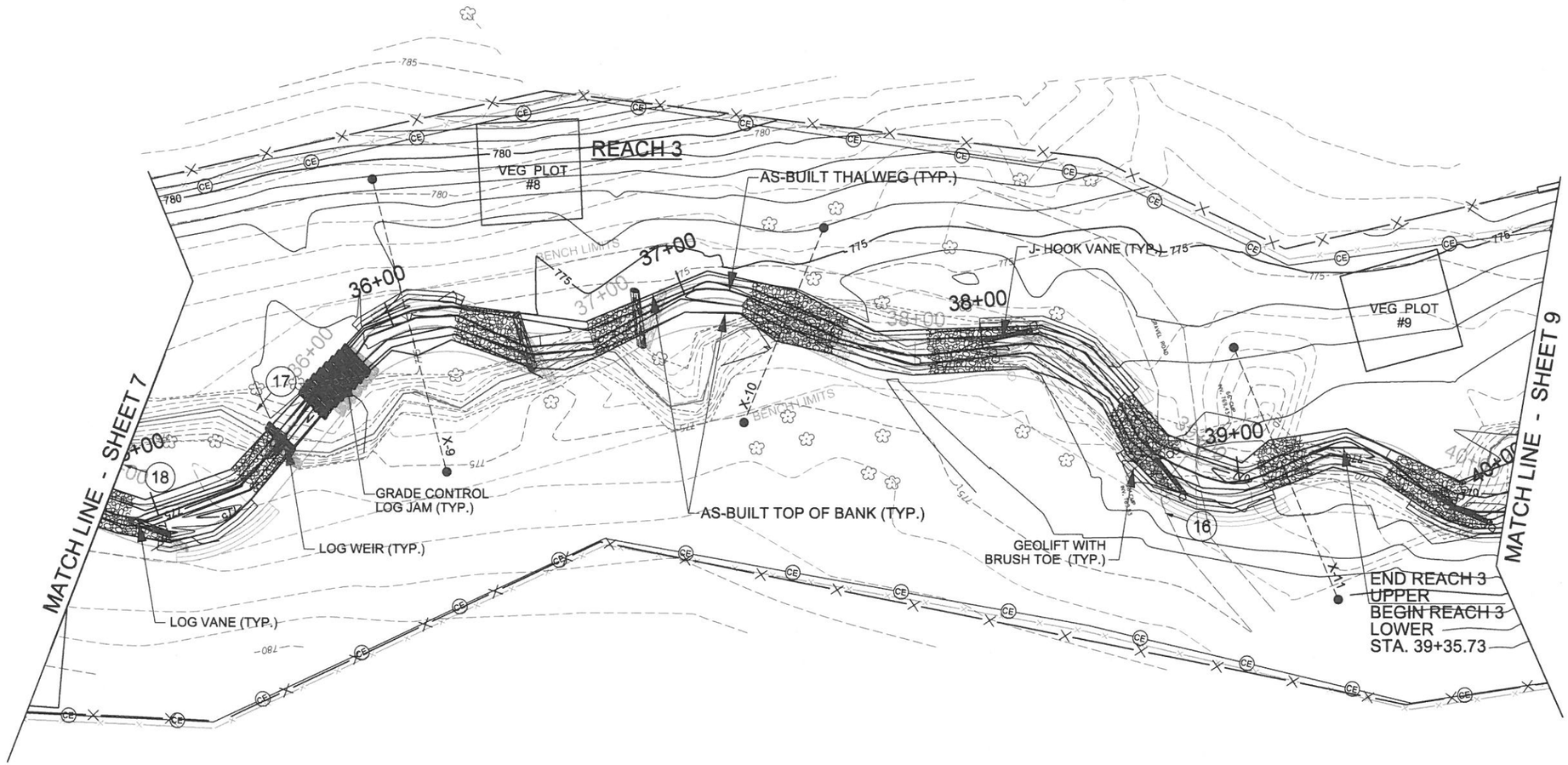
NCDMS ID NO. 96313



BROWNS SUMMIT AS-BUILT PLAN VIEW

20 0 20 40
SCALE (FT)

9/7/2017
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mgoell

AS-BUILT SURVEY PREPARED BY:
LEVEL CROSS SURVEYING, PLLC - Randleman, N.C.

RECORD DRAWINGS

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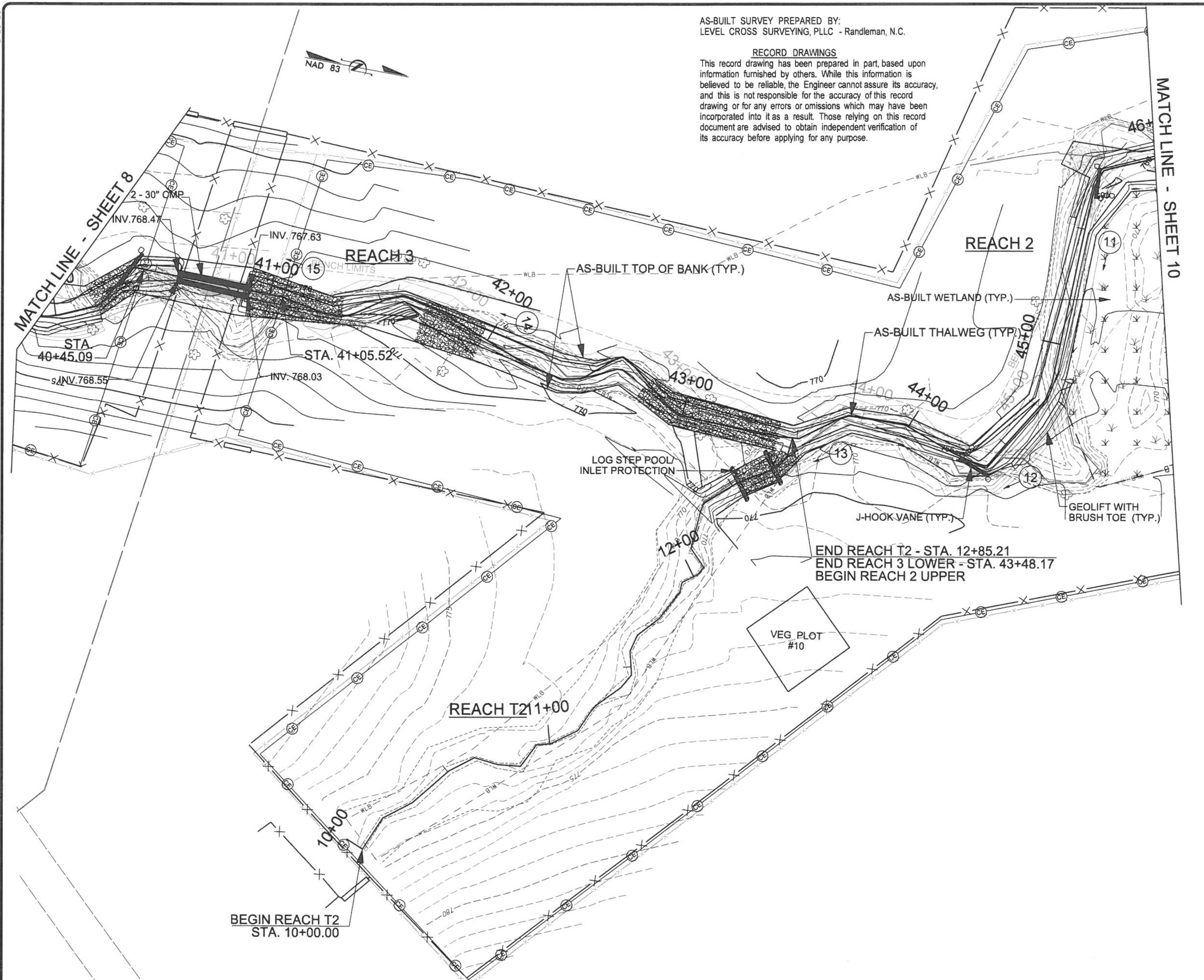

BAKER PROJECT REFERENCE NO.	SHEET NO.
140048	9

PROJECT ENGINEER

K. McKeithan

APPROVED BY:

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NCDMS ID NO. 96313

BROWNS SUMMIT AS-BUILT PLAN VIEW

SCALE (FT) 20 0 20 40

2/26/03

8/7/2017
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2/26/03

AS-BUILT SURVEY PREPARED BY:
LEVEL CROSS SURVEYING, PLLC - Randleman, N.C.

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BAKER PROJECT REFERENCE NO.	SHEET NO.
140048	10

PROJECT ENGINEER

NORTH CAROLINA REGISTERED SEAL 036432 ENGINEER KATHLEEN M. McKETHAN

APPROVED BY: 9.8.17

DATE: 9.8.17

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NCDMS ID NO. 96313

NAD 83

GEOLIFT WITH BRUSH TOE (TYP.)

AS-BUILT WETLAND (TYP.)

LOG ROLLER (TYP.)

AS-BUILT TOP OF BANK (TYP.)

REACH 2

MATCH LINE - SHEET 9

MW #2

AS-BUILT THALWEG (TYP.)

STRUCTURES OMITTED AND DITCH PLUGGED DURING CONSTRUCTION

END REACH 2 UPPER
BEGIN REACH 2 LOWER
STA. 49+65.28

END REACH 2 LOWER
BEGIN REACH 1
STA. 51+00.00

END REACH T1 - STA. 11+44.99=
REACH 1 - STA. 51+52.92

AS-BUILT WETLAND (TYP.)

J- HOOK VANE (TYP.)

VEG PLOT #12

LOG STEP POOL/ INLET PROTECTION

FLOW GAUGE #3

AS-BUILT WETLAND (TYP.)

LOG WEIR (TYP.)

REACH T1

VEG PLOT #11

BEGIN REACH T1
STA. 10+00.00

MATCH LINE - SHEET 11

47+00 48+00 49+00 50+00 51+00 52+00 11+00 10+00

8 9 10

X-12

BROWNS SUMMIT
AS-BUILT PLAN VIEW

20 0 20 40
SCALE (FT)

9/7/2017
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mcrow

2/26/03

AS-BUILT SURVEY PREPARED BY:
LEVEL CROSS SURVEYING, PLLC - Randleman, N.C.

RECORD DRAWINGS

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BAKER PROJECT REFERENCE NO.	SHEET NO.
140048	11

PROJECT ENGINEER

K. McKeithan

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NCDMS NO. 96313

NAD 83

AS-BUILT WETLAND (TYP.)
REACH 1
AS-BUILT THALWEG (TYP.)
AS-BUILT TOP OF BANK (TYP.)
LOG VANE (TYP.)
J- HOOK VANE (TYP.)
MW #3
MW #5
MW #4
CREST GAUGE
VEG PLOT #14
INSTALL LOG ROLLER (TYP.)
GROUTED BOULDER STEP (TYP.)
GROUTED BOULDER STEP WITH BRUSH TOE (TYP.)
53+00
54+00
55+00
56+00
57+00
58+00
MATCH LINE - SHEET 10
MATCH LINE - SHEET 12

BROWNS SUMMIT AS-BUILT PLAN VIEW

20 0 20 40
SCALE (FT)

9/1/2017
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mcgee

2/26/03

AS-BUILT SURVEY PREPARED BY:
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RECORD DRAWINGS
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BAKER PROJECT REFERENCE NO.	SHEET NO.
140048	12

PROJECT ENGINEER
NORTH CAROLINA REGISTERED 028432 ENGINEER KATHLEEN M. McKEITHAN
K. McKeithan
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NCDMS ID NO. 96313

NAD 83

MATCH LINE - SHEET 11

AS-BUILT THALWEG (TYP.)

LOG ROLLER (TYP.)

GRADE CONTROL LOG JAM (TYP.)

REACH 1

AS-BUILT WETLAND (TYP.)

TIES TO EXISTING FENCE

VEG PLOT #14

VEG PLOT #4

MW #7

MW #6

AS-BUILT TOP OF BANK (TYP.)

INV. 758.65

2 - 36" CMP

INV. 756.70

INV. 757.14

INV. 756.57

59+00

60+00

61+00

62+00

63+00

GEOLIFT WITH BRUSH TOE (TYP.)

LOG VANE (TYP.)

END REACH 1
STA. 63+89.87

AS-BUILT WETLAND (TYP.)

BROWNS SUMMIT AS-BUILT PLAN VIEW

20 0 20 40
SCALE (FT)

9/1/2017
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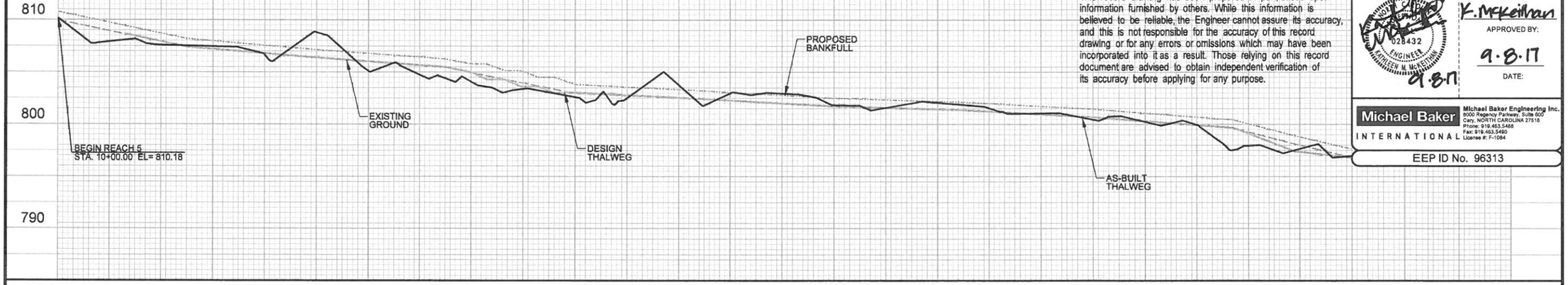
mcgrath

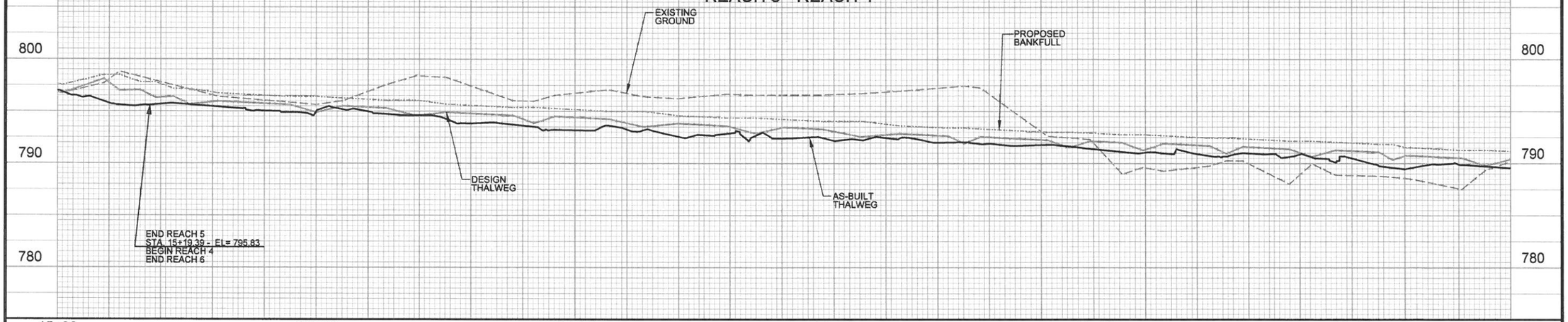
2/26/03

REACH 5



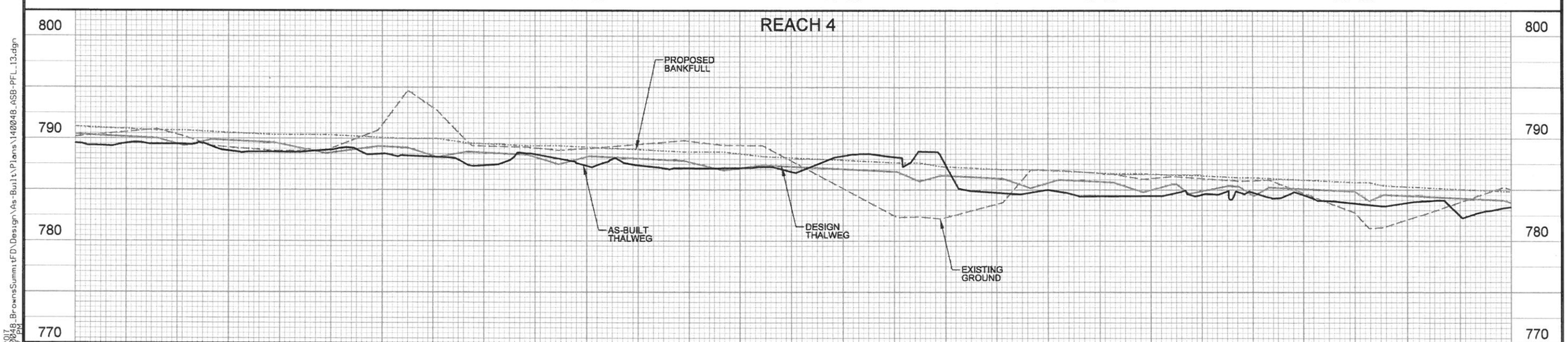
10+00 11+00 12+00 13+00 14+00 15+00

REACH 5 - REACH 4



15+00 16+00 17+00 18+00 19+00 20+00

REACH 4



21+00 22+00 23+00 24+00 25+00 26+00

AS-BUILT SURVEY PREPARED BY:
LEVEL CROSS SURVEYING, PLLC - Randleman, N.C.

RECORD DRAWINGS

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BAKER PROJECT REFERENCE NO.	SHEET NO.
140048	13

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL 028432 ENGINEER KATHLEEN M. McKEITHAN

K. McKeithan

APPROVED BY:

9.8.17

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EEP ID No. 96313

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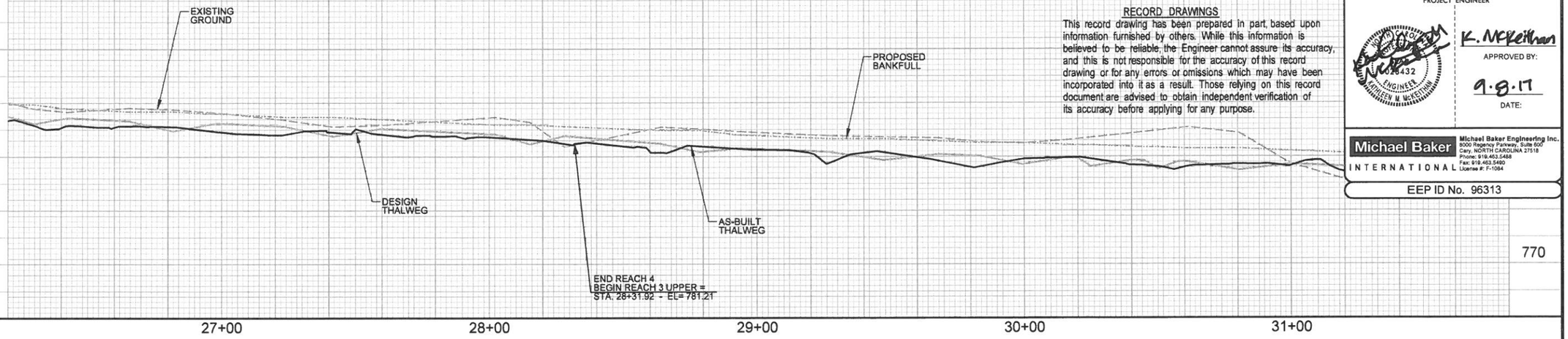
11:47 PM

2/26/03

REACH 4 - REACH 3



AS-BUILT SURVEY PREPARED BY:
LEVEL CROSS SURVEYING, PLLC - Randleman, N.C.

RECORD DRAWINGS

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BAKER PROJECT REFERENCE NO.	SHEET NO.
140048	14

PROJECT ENGINEER

NORTH CAROLINA 028432 ENGINEER KATHLEEN M. McKEITHAN

K. McKeithan

APPROVED BY:

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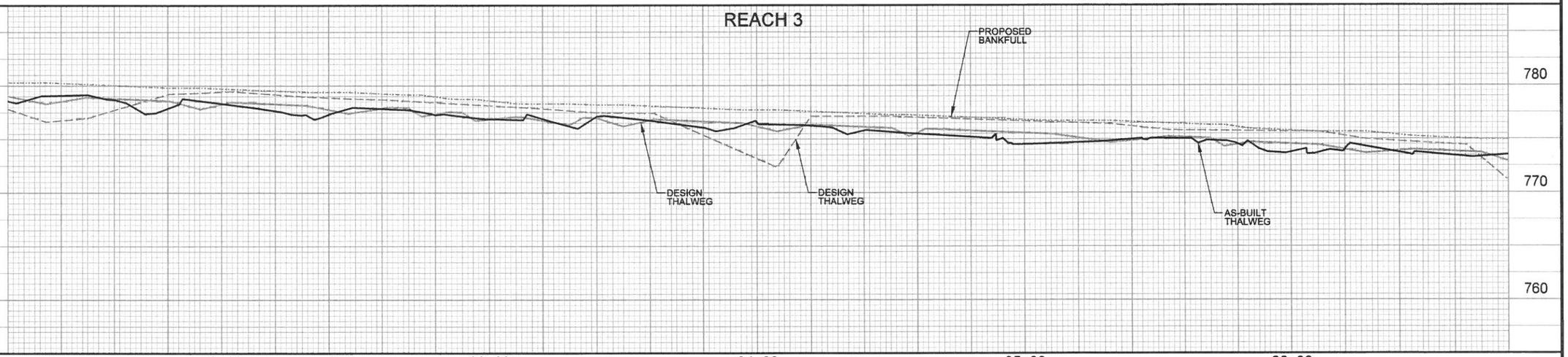
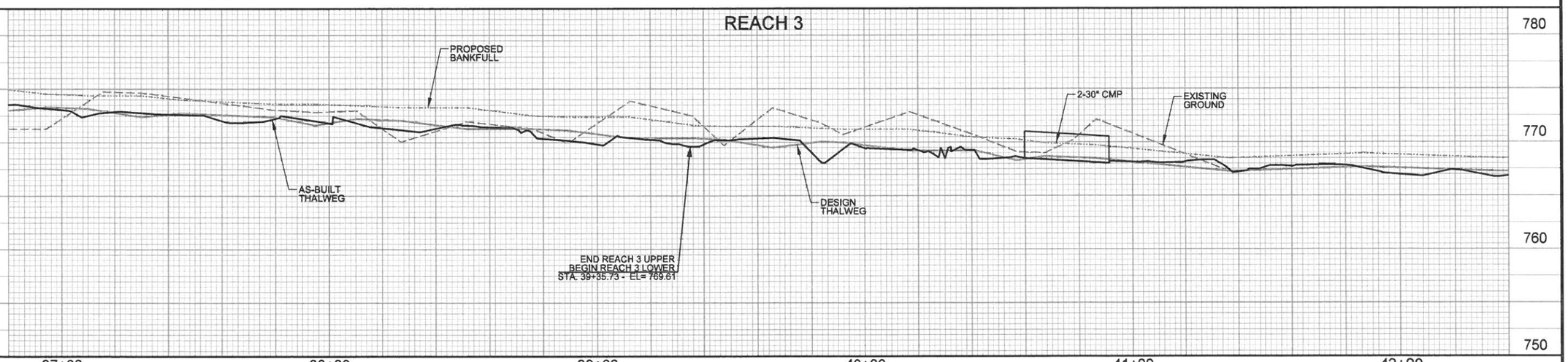
EEP ID No. 96313

REACH 3



REACH 3



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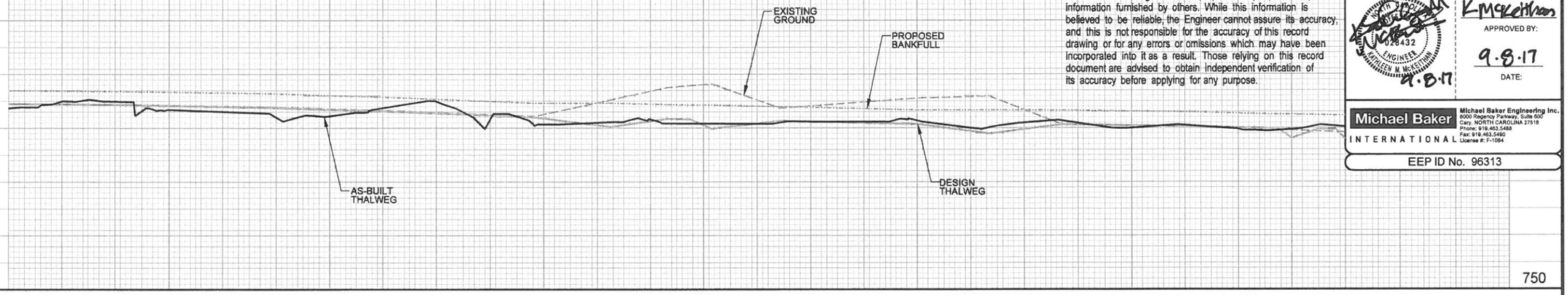
tlaird PM

2/26/03

REACH 3 - REACH 2



AS-BUILT SURVEY PREPARED BY:
LEVEL CROSS SURVEYING, PLLC - Randleman, N.C.

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BAKER PROJECT REFERENCE NO.	SHEET NO.
140048	15

PROJECT ENGINEER

NORTH CAROLINA 028432 ENGINEER KATHLEEN M. McKEITHAN

K McKeithan

APPROVED BY:

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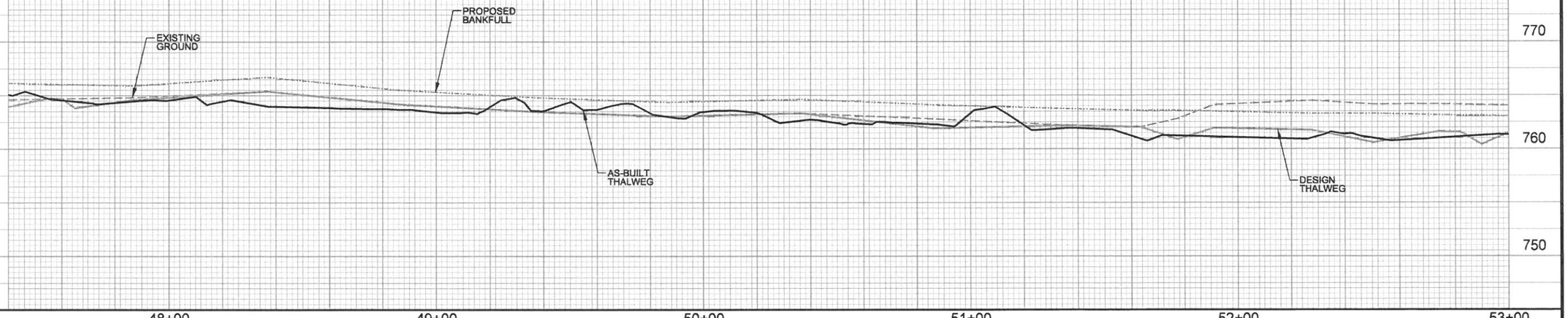
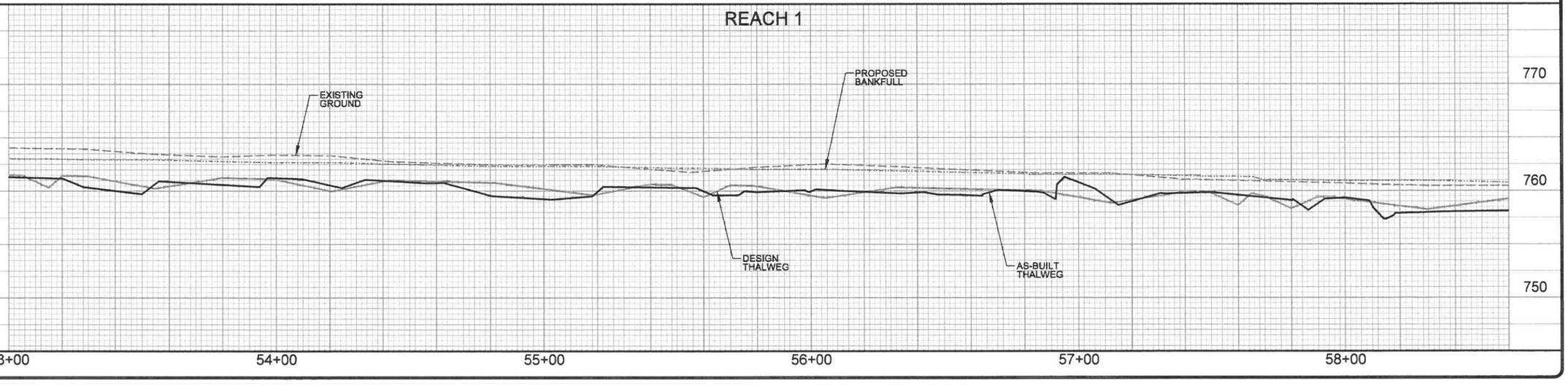
EEP ID No. 96313

REACH 2 - REACH 1



REACH 1



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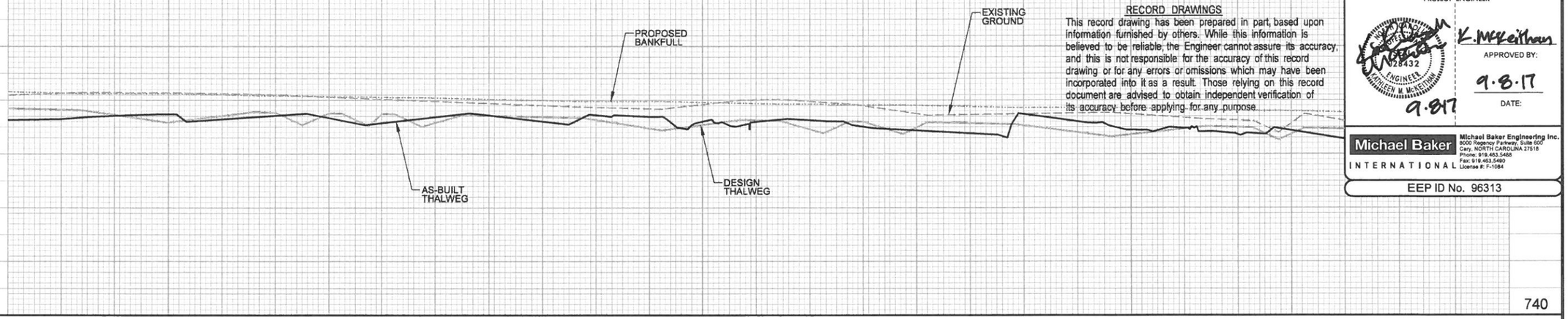
2/26/03

REACH 1



AS-BUILT SURVEY PREPARED BY:
LEVEL CROSS SURVEYING, PLLC - Randleman, N.C.

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BAKER PROJECT REFERENCE NO.	SHEET NO.
140048	16

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 028432 KATHLEEN M. McKEITHAN

K. McKeithan

APPROVED BY:

9.8.17

DATE:

9.8.17

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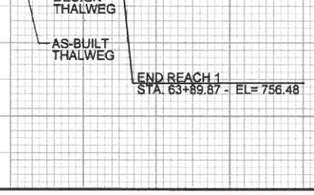
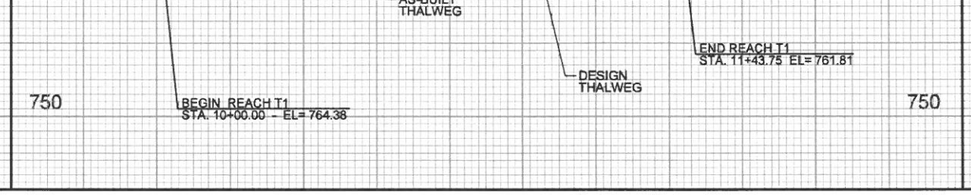
EEP ID No. 96313

REACH 1



REACH T1



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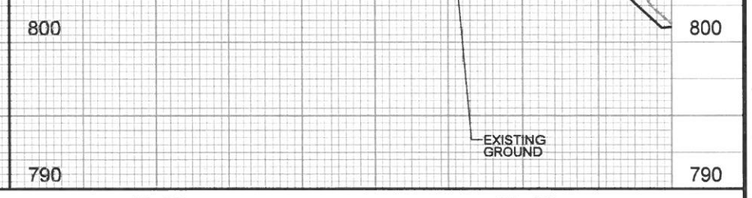

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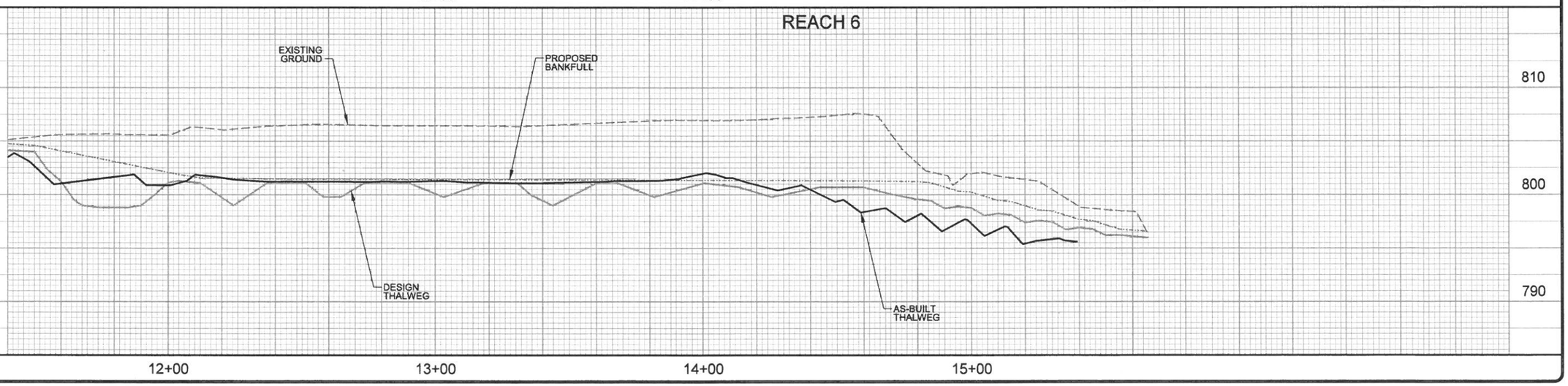

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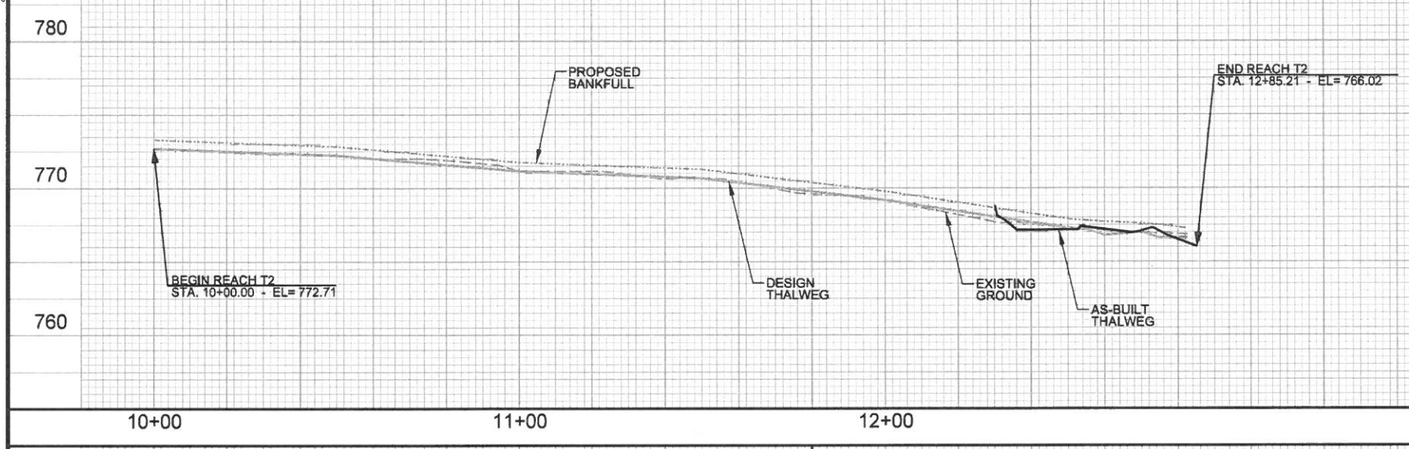
2/26/03

REACH T2



AS-BUILT SURVEY PREPARED BY:
LEVEL CROSS SURVEYING, PLLC - Randleman, N.C.

RECORD DRAWINGS

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BAKER PROJECT REFERENCE NO.	SHEET NO.
140048	17

PROJECT ENGINEER

NORTH CAROLINA 032 ENGINEER KATHLEEN M. McKEITHAN

K. McKeithan

APPROVED BY:

9.8.17

DATE:

9.8.17

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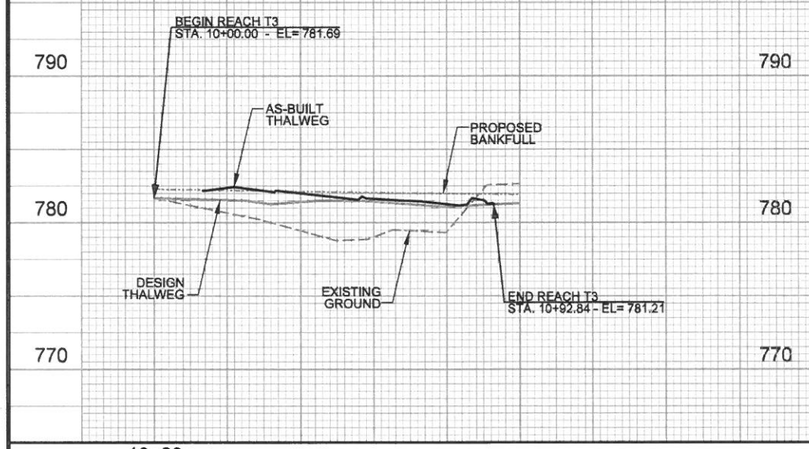
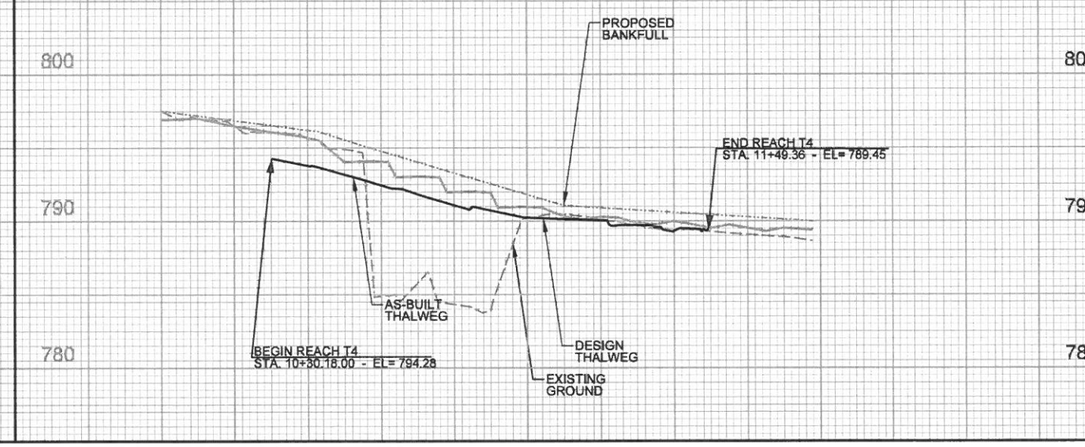
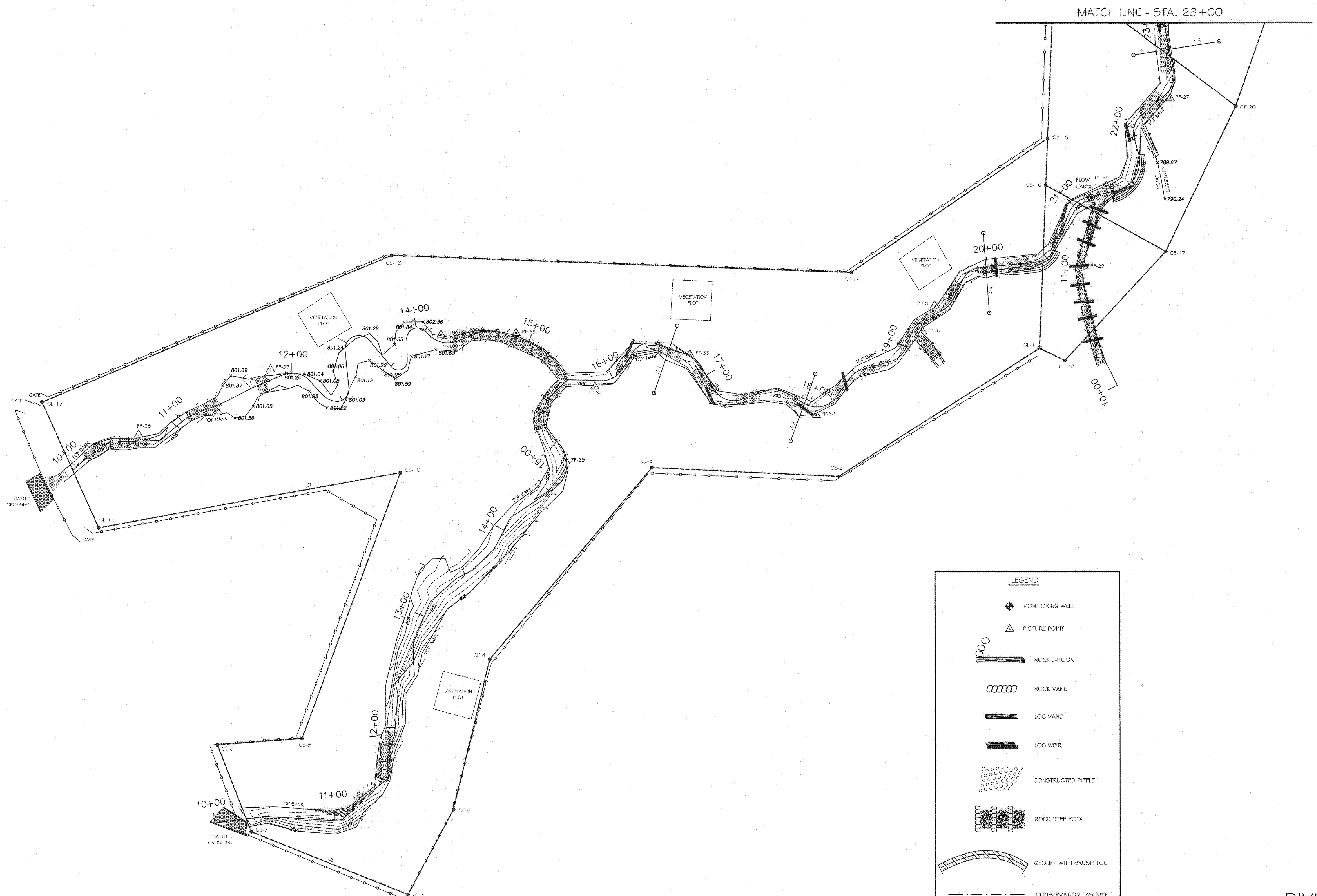
EEP ID No. 96313

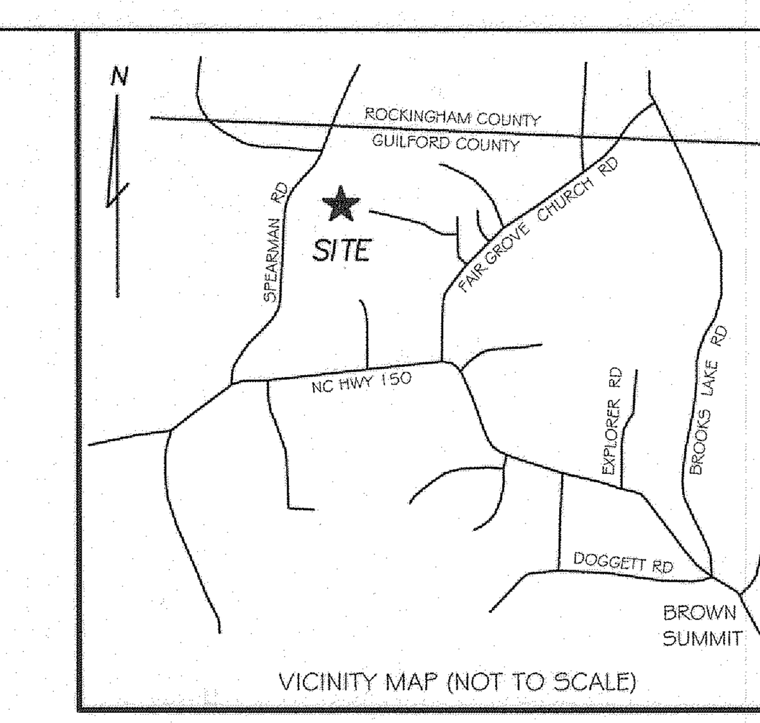
REACH T3



REACH T4







NC GRID - NAD 83(2011)

LEGEND

- MONITORING WELL
- PICTURE POINT
- ROCK J-HOOK
- ROCK VANE
- LOG VANE
- LOG WEIR
- CONSTRUCTED RIFFLE
- ROCK STEP POOL
- GEOLIFT WITH BRUSH TOE
- CONSERVATION EASEMENT
- FENCE
- CROSS SECTION
- CE CONSERVATION EASEMENT
- REBAR WITH CAP
- EXISTING IRON PIPE

I, WILLIAM S. DURHAM, JR., HEREBY CERTIFY THAT THIS TOPOGRAPHIC AND AS-BUILT SURVEY WAS DRAWN UNDER MY SUPERVISION FROM AN ACTUAL SURVEY MADE UNDER MY SUPERVISION. THE INFORMATION BEING SHOWN HEREON. WITNESS MY ORIGINAL SIGNATURE, LICENSE NUMBER AND SEAL THIS 30th DAY OF OCTOBER, 2017.

11/3/2017

WILLIAM S. DURHAM, JR. L-4091
PROFESSIONAL LAND SURVEYOR

NORTH CAROLINA PROFESSIONAL SEAL L-4091 LAND SURVEYOR WILLIAM S. DURHAM, JR. 11/3/2017

NOTES:

1. ALL DISTANCES SHOWN ARE HORIZONTAL GROUND DISTANCES IN U.S. SURVEY FEET. (UNLESS OTHERWISE STATED)
2. ALL AREAS ARE BY THE COORDINATE METHOD.
3. THIS SURVEY PERFORMED AND MAP PREPARED WITHOUT THE BENEFIT OF A TITLE REPORT. THIS SURVEY IS SUBJECT TO ANY FACTS AND EASEMENTS WHICH MAY BE DISCLOSED BY A FULL AND ACCURATE TITLE SEARCH.

LEVEL CROSS SURVEYING, PLLC
PO Box 929
Liberty, NC 27298
Ph. (336) 495-1713

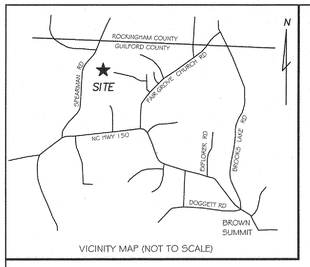
TOPOGRAPHIC & AS-BUILT SURVEY

DIVISION OF MITIGATION SERVICES
GUILFORD COUNTY

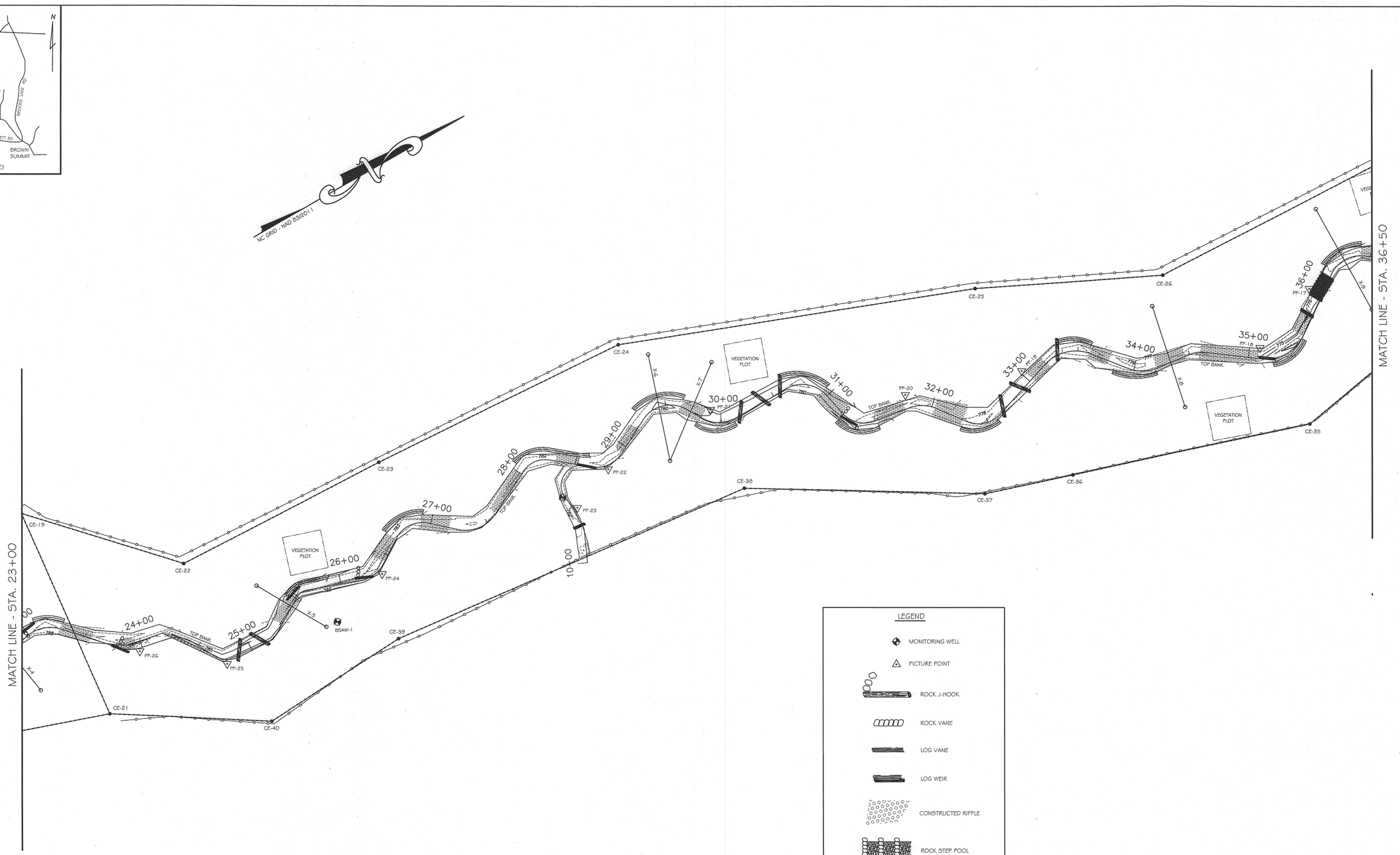
NCDMS ID NO. 96313
BAKER PROJECT NO. 140048
GUILFORD COUNTY, NC

BAR GRAPH
0 20' 40' 80' 120' 160'
1" = 40'

SURVEY DATES: FEBRUARY THROUGH SEPTEMBER, 2017



VICINITY MAP (NOT TO SCALE)



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11/3/2017
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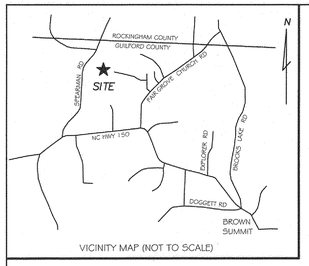

VICINITY MAP (NOT TO SCALE)

NC GRID - NAD 83/2011

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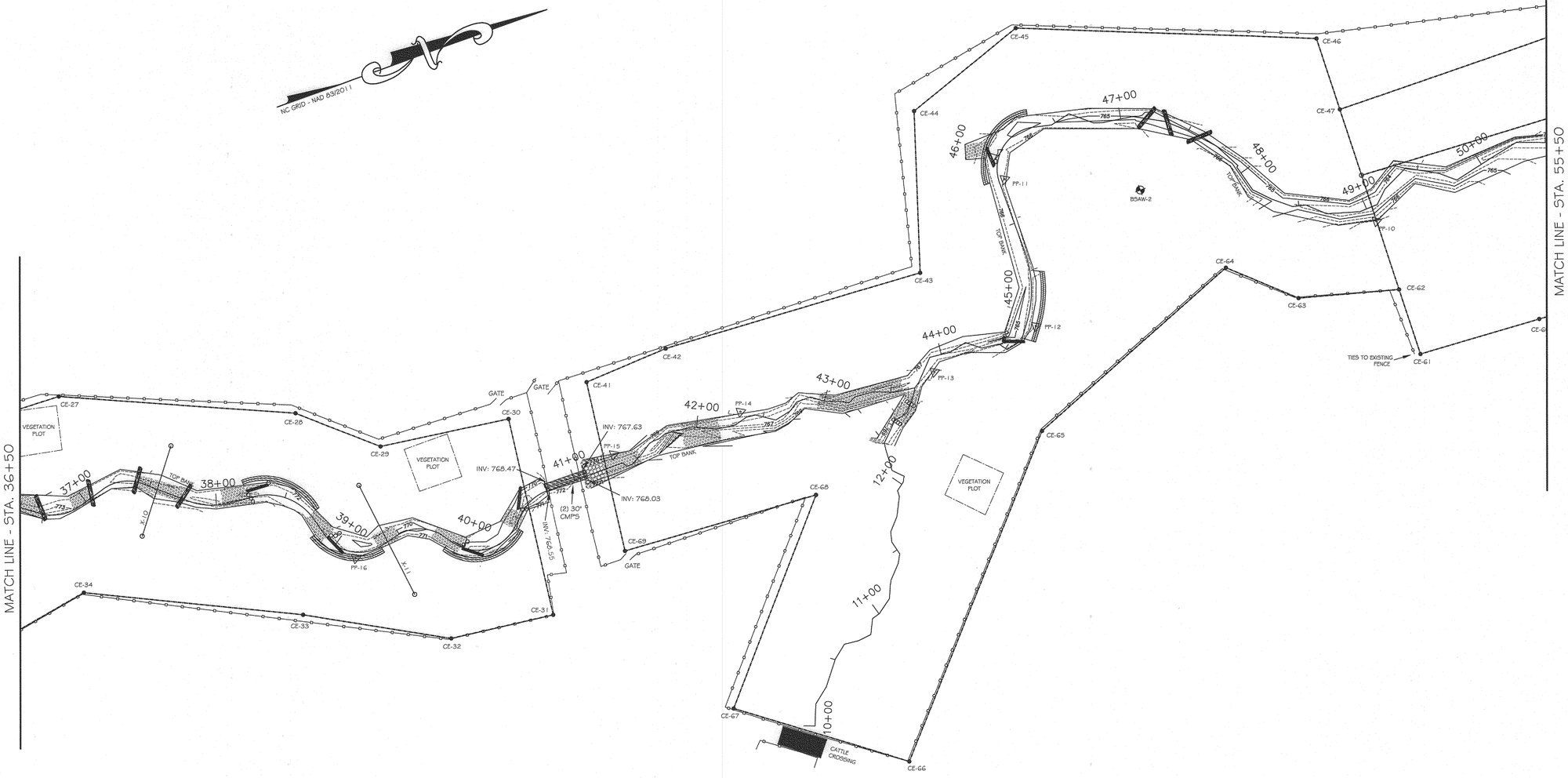

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4/3/2017

WILLIAM S. DURHAM, JR. L-4091
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NORTH CAROLINA PROFESSIONAL SEAL L-4091 LAND SURVEYOR WILLIAM S. DURHAM

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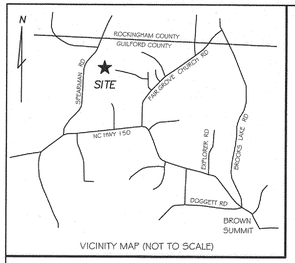
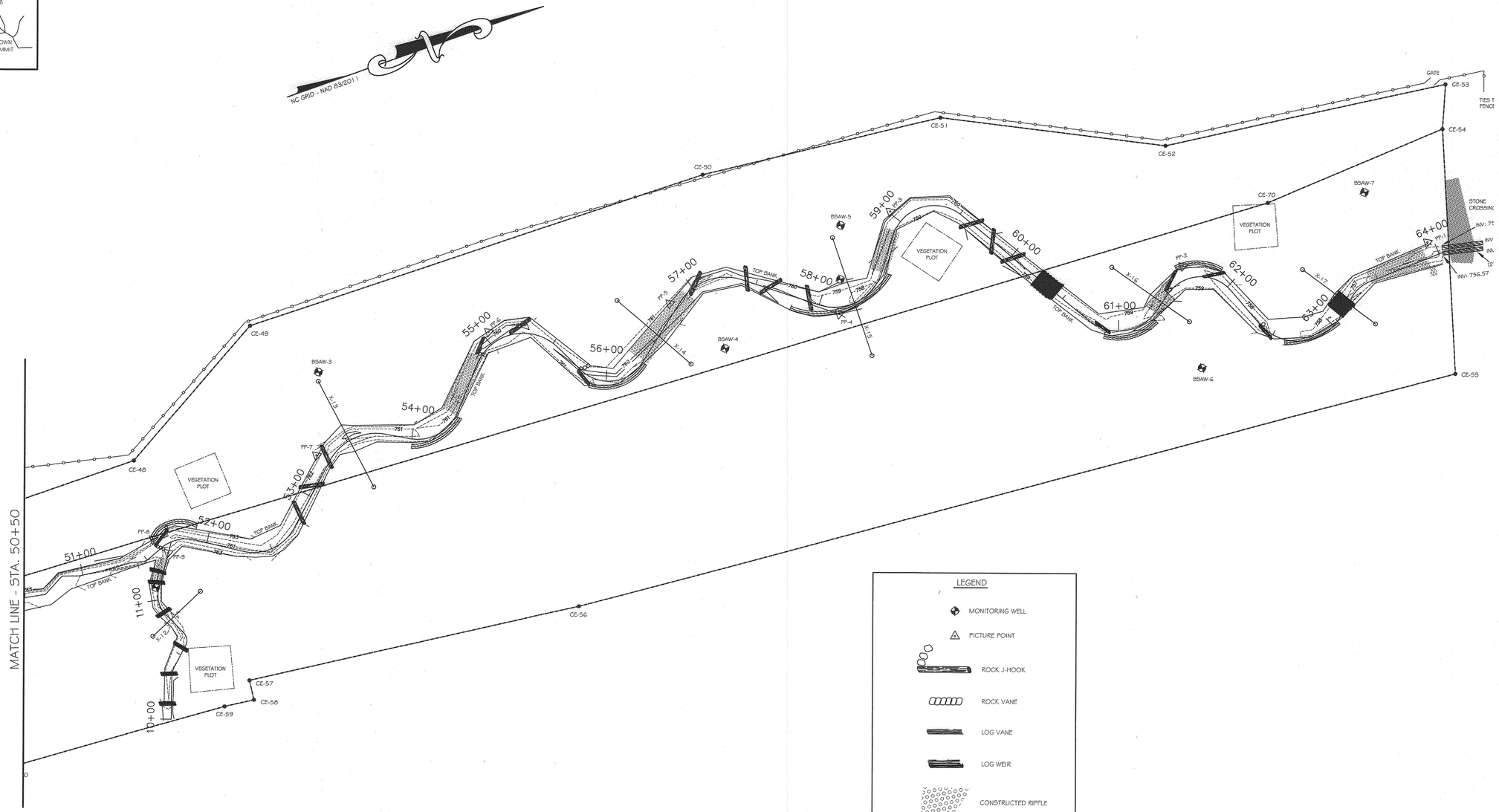


VICINITY MAP (NOT TO SCALE)

NC GRID - NAD 83/2011



LEGEND

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GUILFORD COUNTY
NCDMS ID NO. 96313
BAKER PROJECT NO. 140048
GUILFORD COUNTY, NC

BAR GRAPH
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1" = 40'

SURVEY DATES: FEBRUARY THROUGH SEPTEBBER, 2017

APPENDIX E

Photo Log

Browns Summit Creek Restoration Project – Vegetation Plot Photo Stations
Photos take March 22, 2017

Vegetation Plot 1

Vegetation Plot 2

Vegetation Plot 3

Vegetation Plot 4

Vegetation Plot 5

Vegetation Plot 6

Browns Summit Creek Restoration Project – Vegetation Plot Photo Stations
Photos take March 22, 2017

Vegetation Plot 7

Vegetation Plot 8

Vegetation Plot 9

Vegetation Plot 10

Vegetation Plot 11

Vegetation Plot 12

Browns Summit Creek Restoration Project – Vegetation Plot Photo Stations
Photos take March 22, 2017

Vegetation Plot 13

Vegetation Plot 14

Browns Summit Creek Restoration Project – Longitudinal Stream Photo Stations
Photos take March 9, 2017 (All photos are viewing upstream)

Photo Point 1 – Station 63+75, Reach 1

Photo Point 2 – Station 61+50, Reach 1

Photo Point 3 – Station 58+75, Reach 1

Photo Point 4 – Station 57+85, Reach 1

Photo Point 5 – Station 56+75, Reach 1

Photo Point 6 – Station 55+00, Reach 1

Browns Summit Creek Restoration Project – Longitudinal Stream Photo Stations
Photos take March 9, 2017 (All photos are viewing upstream)

Photo Point 7 – Station 53+50, Reach 1

Photo Point 8 – Station 51+75, Reach 1

Photo Point 9 – Station 11+25, Reach T1

Photo Point 10 – Station 49+00, Reach 2

Photo Point 11 – Station 46+00, Reach 2

Photo Point 12 – Station 44+75, Reach 2

Browns Summit Creek Restoration Project – Longitudinal Stream Photo Stations
Photos take March 9, 2017 (All photos are viewing upstream)

Photo Point 13 – Station 43+75, Reach 2/Reach T2

Photo Point 14 – Station 42+25, Reach 3

Photo Point 15 – Station 41+50, Reach 3

Photo Point 16 – Station 36+25, Reach 3

Photo Point 17 – Station 36+00, Reach 3

Photo Point 18 – Station 35+00, Reach 3

Browns Summit Creek Restoration Project – Longitudinal Stream Photo Stations
Photos take March 9, 2017 (All photos are viewing upstream)

Photo Point 19 – Station 33+00, Reach 3

Photo Point 20 – Station 32+00, Reach 3

Photo Point 21 – 31+50, Reach 3

Photo Point 22 – Station 28+75, Reach 3/T3

Photo Point 23 – Station 10+25, Reach T3

Photo Point 24 – Station 26+50, Reach 4

Browns Summit Creek Restoration Project – Longitudinal Stream Photo Stations
Photos take March 9, 2017 (All photos are viewing upstream)

Photo Point 25 – Station 24+50, Reach 4

Photo Point 26 – Station 24+00, Reach 4

Photo Point 27 – Station 22+50, Reach 4

Photo Point 28 – Station 21+50, Reach 4/T4

Photo Point 29 – Station 11+00, Reach T4

Photo Point 30 – Station 19+50, Reach 4

Browns Summit Creek Restoration Project – Longitudinal Stream Photo Stations
Photos take March 9, 2017 (All photos are viewing upstream)

Photo Point 31 – Station 19+10, Step Pools

Photo Point 32 – Station 18+00, Reach 4

Photo Point 33 – Station 16+75, Reach 4

Photo Point 34 – Sta. 15+75, Reaches 4, 5 and 6

Photo Point 35 – Station 15+00, Reach 6, BMP

Photo Point 36 – Station 14+50, Reach 6, BMP

Browns Summit Creek Restoration Project – Longitudinal Stream Photo Stations
Photos take March 9, 2017 (All photos are viewing upstream)

Photo Point 37 – Station 11+90, Reach 6, BMP

Photo Point 38 – Station 10+50, Reach 6, BMP

Photo Point 39 – Station 15+00, Reach 5

Browns Summit Creek Restoration Project – Hydrology Monitoring Stations
Photos take March 9, 2017

Wetland Well 1 – Reach 4, Station 25+00

Wetland Well 2 – Reach 2, Station 47+00

Wetland Well 3 – Reach 1, Station 52+00

Wetland Well 4 – Reach 1, Station 55+00

Wetland Well 5 – Reach 1, Station 58+00

Wetland Well 6 – Reach 1, Station 61+00

Browns Summit Creek Restoration Project – Hydrology Monitoring Stations
Photos take March 9, 2017

Wetland Well 7 – Reach 1, Station 63+50

Automated Flow Gauge 1 – Reach 4

Automated Flow Gauge 2 – Reach T3

Automated Flow Gauge 3 – Reach T1

Manual Crest Gauge – Reach 1, Left Bank

APPENDIX F

USACE Correspondence

McKeithan, Katie

From: Hughes, Andrea W CIV USARMY CESAW (US) <Andrea.W.Hughes@usace.army.mil>
Sent: Wednesday, November 29, 2017 8:25 AM
To: Byers, Jake
Cc: Schaffer, Jeff; McKeithan, Katie; Tugwell, Todd J CIV USARMY CESAW (US); Browning, Kimberly D CIV USARMY CESAW (US)
Subject: RE: Brown Summit Credit Change Memo SAW 2014-01642

Hi Jake,

I apologize for not getting back with you sooner. Yes, we reviewed the information and we are okay with the proposed as-built stream credits.
Thanks for your patience.

Andrea

Andrea W. Hughes
Mitigation Project Manager
Regulatory Division, Wilmington District
3331 Heritage Trade Drive, Suite 107
Wake Forest, North Carolina 27587
Phone: (919) 554-4884 x 59

-----Original Message-----
From: Byers, Jake [mailto:JByers@mbakerintl.com]
Sent: Thursday, November 02, 2017 9:21 AM
To: Hughes, Andrea W CIV USARMY CESAW (US) <Andrea.W.Hughes@usace.army.mil>
Cc: Schaffer, Jeff <jeff.schaffer@ncdenr.gov>; McKeithan, Katie <Katie.McKeithan@mbakerintl.com>
Subject: [EXTERNAL] Brown Summit Credit Change Memo SAW 2014-01642

Andrea,

Please find attached a memo describing the discrepancies between the mitigation plan stream footage/credits and the as-built (MY0) stream footage/credits for the Brown Summit Creek Mitigation project. Please let me know if you have any questions or I can provide any additional information.

Thanks for your consideration on this matter.

-Jake

Jacob "Jake" Byers, PE | NC Ecosystem Services Manager | Michael Baker Engineering, Inc., a unit of Michael Baker International
797 Haywood Road, Suite 201 | Asheville, North Carolina 28806 | [O] 828-412-6101 | [M] 919-259-4814
jbyers@mbakerintl.com <mailto:jbyers@mbakerintl.com> | Blockedwww.mbakerintl.com <Blockedhttp://www.mbakerintl.com/>

<Blockedhttp://www.mbakerintl.com/>

Michael Baker
INTERNATIONAL

Innovation Done Right...We Make a Difference

November 2, 2017

Andrea Hughes
Mitigation Project Manager
Regulatory Division, Wilmington District
3331 Heritage Trade Drive, Suite 107
Wake Forest, NC 27587

Subject: Credit Revisions (Mitigation Plan Vs. As-built)
Browns Summit Creek Mitigation Project, Guilford County
Cape Fear Cataloging Unit 03030002
USACE AID SAW 2014-01642, DMS Project #96313

Dear Ms. Hughes:

As we discussed in our phone conversation on October 31st, discrepancies exist between the footage provided in the approved mitigation plan and the footage that was surveyed along the centerline of the stream channel during the as-built phase. These differences are minor (1-2 linear feet) on all reaches except for Reach 1 and Reach 2 Downstream. The minor differences along the other reaches will be disregarded and the creditable lengths will revert to the approved mitigation plan. The table below shows the values for stream lengths, and credits for R1 and R2 Downstream (DS) as provided in the mitigation plan and as determined from as-built survey of the stream centerline.

Mitigation Plan				As-Built				AB-Mitigation Plan
Reach	LF	Ratio	Credits	Reach	LF	Ratio	Credits	
R1	1233	1:1	1233	R1	1290	1:1	1290	57
R2 DS	191	2.5:1	76	R2 DS	134	2.5:1	54	-22

Regarding R1, field conditions such as extremely wet soil caused variations in the constructed stream centerline and top of banks as compared to what was shown in the mitigation plan. The surveyed stream centerline can be seen on the attached figures. Stream top of bank and toe of bank/edge of channel lines have also been added for reference. The surveyed centerline data was gathered at the best professional judgement of the licensed surveyor. While I realize that the centerline along Reach R1 may not be perfectly in the center in all locations, it is very close. The survey resulted in a stream length of 1,290 feet, which is 57 feet longer than the length stated in the mitigation plan.

The centerline for Reach R2 DS was, coincidentally, 57 feet shorter in the surveyed as-built condition than what was proposed in the mitigation plan. This discrepancy primarily comes from the fact that during the

Michael Baker Engineering, Inc.
8000 Regency Parkway, Suite 600, Cary NC 27518
Office: 919.463.5488 | Fax: 919.463.5490

mitigation plan stage, the existing thalweg that was surveyed during the original project survey was used as the alignment of this enhancement reach (no proposed alignment changes) which was in line with the current methodology at the time. Since that time, the USACE, through NCDMS has issued further guidance on calculating credit based on centerline lengths and finalized this guidance on 10/5/17. (See Credit Reporting Memo, Todd Tugwell, 10/5/17). Based upon this recent methodology, the centerline of the enhancement reach R2 DS was surveyed and drawn and this resulted in a shorter reach length than what was stated in the mitigation plan.

Michael Baker proposes to utilize the numbers presented herein and derived from the as-built survey to calculate the credits provided by this project at the baseline stage. Michael Baker also proposes to utilize this memo and maps as a mitigation plan addenda if the IRT deems it necessary.

This memo and correspondence back from the USACE will be included in the baseline monitoring report and serve as a record of this conversation.

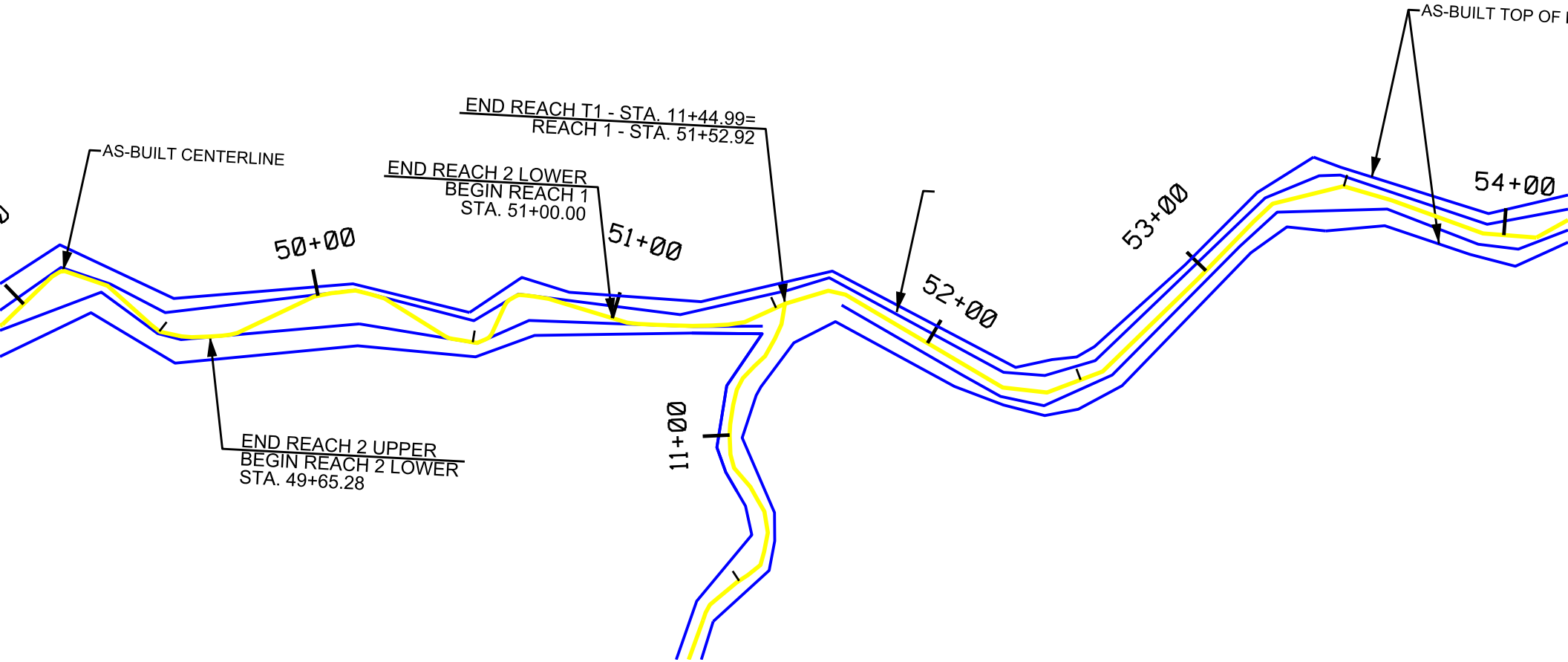
If you have any questions concerning the mitigation units, please contact me at 828-412-6101.

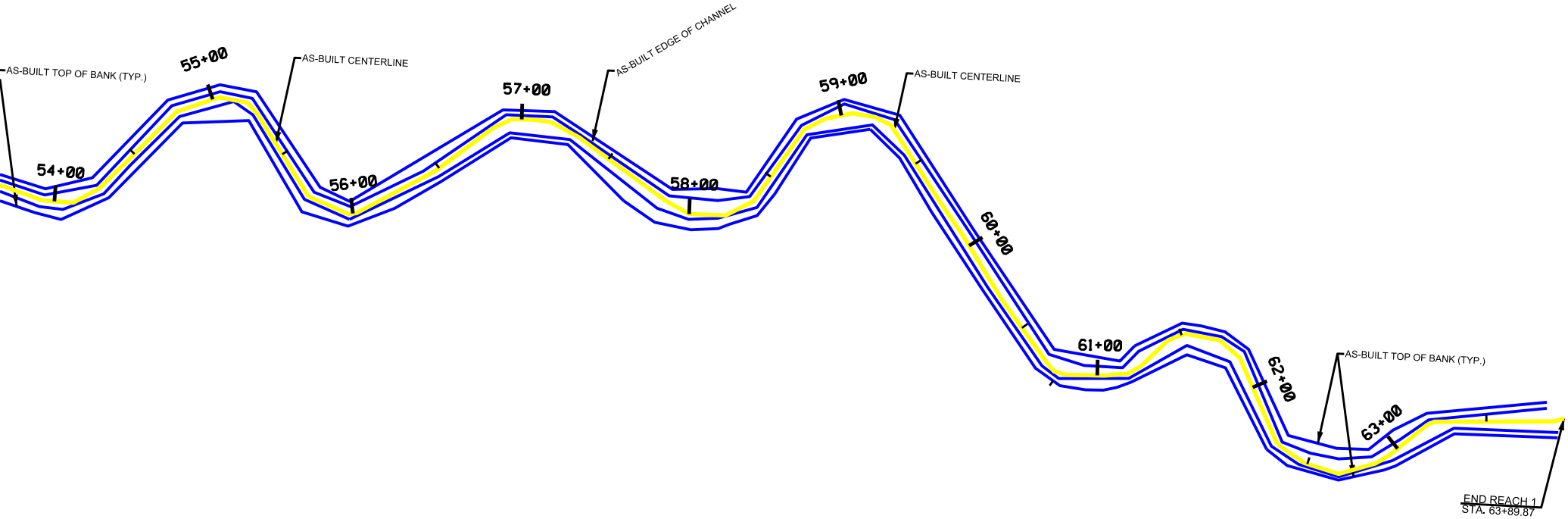
Sincerely,

Jake Byers, PE

CC: Jeff Schaffer, DMS

Katie McKeithan, Michael Baker


AS-BUILT CENTERLINE
END REACH T1 - STA. 11+44.99=
REACH 1 - STA. 51+52.92
END REACH 2 LOWER
BEGIN REACH 1
STA. 51+00.00
END REACH 2 UPPER
BEGIN REACH 2 LOWER
STA. 49+65.28
50+00
51+00
52+00
53+00
54+00
11+00


AS-BUILT TOP OF BANK (TYP.)
54+00
55+00
AS-BUILT CENTERLINE
56+00
57+00
AS-BUILT EDGE OF CHANNEL
58+00
59+00
AS-BUILT CENTERLINE
60+00
61+00
62+00
AS-BUILT TOP OF BANK (TYP.)
63+00
END REACH 1
STA. 63+89.87