STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

ROY COOPER
GOVERNOR

J. ERIC BOYETTE
SECRETARY

October 19, 2022

U. S. Army Corps of Engineers
Regulatory Field Office
151 Patton Avenue, Room 208
Asheville, NC 28801-5006

ATTN: Mr. Eric Alsmeyer
NCDOT Coordinator

Subject: **Application for Modification to the Section 404 Individual Permit and Section 401 Water Quality Certification** for Section D and E of the proposed US 74 Shelby Bypass in Cleveland County from just east of the NC 150 Interchange to west of SR 1001. WBS Number 34497.1.F56, Division 12, TIP Nos. R-2707D and R-2707E. Debit $570 from WBS Number 34497.1.F56.

Reference: USACE Individual 404 Permit Action ID SAW-2009-01449, issued April 12, 2013.
NCDWR Project No. 20120673 Certification No. 3941, issued September 18, 2012.
Individual 404 Permit Modification issued October 23, 2013.
401 Water Quality Certification Modification issued August 9, 2013.
Individual 404 Permit Modification issued March 31, 2017
401 Water Quality Certification Modification issued April 4, 2017
Amended Biological Opinion issued November 9, 2012.

Dear Sir:

The purpose of this letter is to submit the final design and revised impact calculations for modification of the Clean Water Act (CWA) Section 404 Individual Permit and Section 401 Certification for the above referenced project. Included in this application package are the following: stream and wetland reverification information, permit drawing review minutes (Merger Concurrence Points 4B and 4C), stormwater management plan (SMP), updated permit drawings, stream relocation plan, roadway plans and utility drawings. A revised NC Division of Mitigation Services Acceptance Letter will be forthcoming.

The original 2012 permit application (submitted July 9, 2012) and subsequent permits (referenced above) presented final impacts for R-2707A, R-2707B, R-2707C and preliminary impacts for R-2707D and R-2707E. This modification presents the final design impacts for R-2707D and R2707E.

The following tables include a summary of wetland and stream impacts for the completed R-2707A and R2707B sections and for R-2707C which is currently under construction. The table also includes an updated summary of the R2707D and R2707E impacts based on the final design.

Table 1 – Updated Summary of Wetland Impacts for R-2707

Section	Wetlands (ac)			Ponds Perm/ Temp (ac)	Streams (lf)		
	Perm Fill	Excavation	Mech Clearing		Perm	Temp (lf)/(ac)	Relocation
R-2707A	**0.35**	**0.03**	**0.05**	**--**	**1,570**	**173 / 0.03**	
R-2707B	**3.37**	**--**	**0.25**	**--**	**3680**	**214 / 0.02**	
R-2707C	**0.91**	**0.01**	**0.02**	**2.43**	**7,681**	**621 / 0.08**	
R-2707D	**1.11**	**<0.01**	**0.17**	**0.00/0.87**	**10,062**	**478 / 0.10**	**2,678**
R-2707E	**0.13**	**0.14**	**0.03**	**0.06 / 0.87**	**1,464**	**92 / 0.01**	
Total	**5.87**						

NEPA DOCUMENT STATUS

The Final Environmental Impact Statement (FEIS) for the US 74 Shelby Bypass (R-2707) was approved January 25, 2008 and the Record of Decision (ROD) approved December 1, 2008. A Right of Way Consultation for Sections D and E was completed in April 2018. Additional copies will be provided upon request.

In compliance with the NEPA/404 Merger Process, Concurrence Point 4B was reached for R-2707D and R-2707E on February 7, 2018. Concurrence Point 4C for R-2707D was reached August 8, 2018 and on July 19, 2018 for R-2707E. Additional correspondence title 2019 Memo was provided the merger team with updates to jurisdictional waters and an evaluation of alternatives (dated May 2019).

PROJECT SCHEDULE

The project is permitted in phases due to project size, funding and TIP schedule (see Table 3). Sections A and B were permitted together in 2013. Section C was permitted in 2017. Section D and E are scheduled to let on July 18, 2023, with a review date of January 2023 and is covered in this phased permit modification request.

Table 3 – Project phasing for US 221 Widening (R-2707)

Section	Approximate Section Limits	Approximate Length	Construction Begins
R-2707 A	West of SR 1162 to west of SR 1314	3.93 miles	July 2014
R-2707 B	West of SR 1314 to west of NC 226	3.17 miles	July 2014
R-2707 C	West of NC 226 to east of NC 150	4.79 miles	January 2017
R-2707 D	East of NC 150 to existing US 74 west of SR 2238	4.09 miles	Aug 2023
R-2707 E	Existing US 74 west of SR2238 to west of SR 1001	2.64 miles	Aug 2023
	TOTAL	**18.62 miles**	

IMPACTS TO WATERS OF THE U.S.

Summary of R-2707D and R-2707E Jurisdictional Impacts:
The preliminary design impacts projected from the 2012 permit application for R-2707D were 5,916 linear feet of permanent stream impacts, 0.40 acres permanent impacts to wetlands and 0.07 acres of temporary stream impacts. Final design impacts for R-2707D are 10,062 linear feet of permanent impacts to streams, 1.28 acres of permanent impacts to wetlands and 0.10 acres of temporary stream impacts. There are 0.87 acres of surface water impacts to a pond. This section also includes 2,678 linear feet of natural channel stream design.

The preliminary design impacts projected from the 2012 permit application for R-2707E were 2,844 linear feet of permanent stream impacts, 0.67 acres permanent impacts to wetlands and 0.01 acres of temporary stream impacts. Final design impacts for R-2707E are 1,464 permanent impacts to streams, 0.16 acres of permanent impacts to wetlands and 0.01 acres of temporary stream water impacts. There are 0.06 acres of permanent and 0.83 acres of temporary surface water impacts to a pond.

A number of changes led to an increase or decrease in impacts as noted below:

1. Changes to jurisdictional waters based on a reverification conducted in 2017 and 2019. Changes led to:
    a. Decrease in impacts due to new stream origin at R-2707D Site 10
    b. Impacts resulting from addition of wetland at R-2707D Site 12 and 12A
    c. Impacts resulting from addition of stream at R-2707D Site 16
    d. Impacts resulting from new stream origin at R-2707E Site 4B
2. Addition of two service roads not included in the preliminary design led to an increase in impacts at R-2707D Sites 11A and 11B (stream and pond impacts).
3. Bank stabilization impacts not included in preliminary design were added to seven sites on R-2707D including bridges over Buffalo Creek.
4. Inlet and/or outlet channel impacts associated with culverts not included in preliminary design were added to seven sites on R-2707D and three sites on R-2707E.
5. Interchange relocated from Bethlehem Rd approximately 1,100 feet west led to decrease of impacts at R-2707E Site 3 and 4. The original Site 5 impact was eliminated. New interchange location impacts a pond labeled as R-2707E Site 5.
6. Channel relocation was identified for R-2707D Sites 3-6. Preliminary design only noted impact areas and did not include the impacts associated with reconnecting the channel pieces and providing a stable channel based on natural channel design principles. This led to an increase in stream impacts. A mitigation plan for this area provides information on impacts and ecological uplift of the stream and its tributaries (included in this permit application package).

Tables 4 through 7 summarize the impacts to jurisdictional water resources for the final design of R-2707D and R2707E. Site numbers correspond with the permit drawings included in this application. The stream and wetland numbers correspond to the 2009/2019 reverification information included in this application.

Summary of Utility Impacts:
There is one impact on Section E at Site 3E associated with clearing in a wetland for a relocated utility line. Other locations where utilities cross under or over streams are summarized here and noted on the

plans however, no one results in additional impacts other than those already noted from pipe installation. Section D includes a water line (site 16) and a gas line (site 11B) both to be installed under streams impacted by pipe installation leading to no additional impact. Overhead utilities will be installed near Site 14B however no in water work is allowed. A gas line will be installed near Site 14C under Buffalo Creek. Section E sites 3B and 4A have utilities crossing streams in areas already impacted by pipe installation. There will be no permanent impacts associated with utility relocations.

Table 4 – R-2707D Wetland Impacts

Site	Wetland Number[1]	Permanent Fill in Wetlands (ac)	Excavation (ac)	Mechanized Clearing (ac)	Hand Clearing (ac)
2	42	0.045	--	--	--
7	46A, 46B	0.017	--	0.005	--
8	47D	0.005	--	--	--
10	51A-B	0.049	0.004	0.021	--
11A	53	0.223	--	--	--
12A	54A-B	0.121	--	0.012	--
12B	54A-B	0.646	--	0.130	--
Total Impacts		**1.106**	**0.004**	**0.168**	--

[1] All wetlands impacted are riparian

Table 5 – R-2707E Wetland Impacts

Site	Wetland Number	Permanent Fill in Wetlands (ac)	Excavation (ac)	Mechanized Clearing (ac)	Hand Clearing (ac)
1B[2]	55[1]		0.015		
2	56A-B	0.009			
3A	57A-B	0.022			
3B**	58A	0.083	0.117		
3E	58B	0.013	0.005	0.022	0.033
4A	60		0.002	0.010	
Total Impacts		**0.127**	**0.139**	**0.032**	**0.033**

[1] Wetland 55 is non-riparian. All other wetlands impacted are riparian
[2] Total take wetlands

Table 6 – R-2707D Surface Waters Impacts

Site	Stream Name & Intermittent (I) or Perennial (P)	Surface Waters ID	Permanent Impacts (ft)	Permanent Impacts (ac)	Temporary Impacts (ft)	Temporary Impacts (ac)	Natural Stream Design (ft)
1	UT to Kings Mountain Reservoir – (P)	6-14B	619	0.058	20	0.002	--
2	UT to Kings Mountain Reservoir(I/P)	6-17A, 6-17B	570	0.039	20	0.001	--
3	UT to Buffalo Creek (P/I)	7-1,7-2	683	0.095	52	0.006	--
4A	UT to Buffalo Creek (P)	7-1	806	0.151	20	0.004	621

Site	Stream Name & Intermittent (I) or Perennial (P)	Surface Waters ID	Permanent Impacts (ft)	Permanent Impacts (ac)	Temporary Impacts (ft)	Temporary Impacts (ac)	Natural Stream Design (ft)
4B	UT to Buffalo Creek (P)	7-3	109	0.005	15	0.001	199
5A	UT to Buffalo Creek (P)	7-1	664	0.161	40	0.008	530
5B	UT to Buffalo Creek (I)	7-4	186	0.012	15	0.001	134
6A	UT to Buffalo Creek (P)	7-1, 7-5	1178	0.301	56	0.016	878
6B	UT to Buffalo Creek (P)	7-5	468	0.118	--	--	316
6C	UT to Buffalo Creek (P)	7-5	647	0.176	40	0.005	--
7	UT to Buffalo Creek (P)	7-12	308	0.021	20	0.002	--
8	UT to Buffalo Creek (P)	7-14B	535	0.036	20	0.002	--
9	UT to Buffalo Creek (P)	7-17	423	0.071	85	0.016	--
11A	UT to Buffalo Creek (P)	7-21, Pond 8	458	0.923	29	0.003	--
11B	UT to Buffalo Creek (P)	7-22	159	0.018	17	0.002	--
12A	UT to Buffalo Creek (I)	7-23	682	0.047	14	0.001	--
13	UT to Buffalo Creek (P)	7-26	842	0.096	--	--	--
14A	Buffalo Creek (P)	7-27	35	0.004	--	--	--
14B	UT to Buffalo Creek; Buffalo Creek (P)	7-26, 7-27	250	0.033	--	0.027	--
14C	Buffalo Creek (P)	7-27	15	0.002	--	--	--
15	UT to Kings Mountain Reservoir – (P)	6-15	--	--	15	0.001	--
16	UT to Kings Mountain Reservoir – (I)	6-16	425	0.029	15	0.001	--
Total Impacts			**10062**	**2.40**	**493**	**0.10**	**2678**

Table 7. R2707E Surface Waters Impacts

Site	Stream Name & Intermittent (I) or Perennial (P)	urface Waters ID	Permanent Impacts (ft)	Permanent Impacts (ac)	Temporary Impacts (feet)	Temporary Impacts (ac)	Natural Stream Design (ft)
1A	UT to Buffalo Creek (I)	7-30[1]	336	0.031	28	0.003	--
2	UT to Buffalo Creek (I)	7-30[1]	253	0.023	10	0.001	--
3A	UT to Potts Creek (I)	8-2	213	0.014	14	0.001	--
3B	UT to Potts Creek (I)	8-7, 8-5[1], 8-4[1]	198	0.014	19	0.002	--
3C	UT to Potts Creek (I)	8-3[1]	43	0.003	--	--	--
3D	UT to Potts Creek (I)	8-5[1]	159	0.011	--	--	--
3E	UT to Potts Creek (P)	8-6, 8-8	33	0.003	10	0.001	--
4A	UT to Potts Creek (I)	8-10A	213	0.015	11	0.001	--
4B	UT to Potts Creek (I)	8-10A	16	0.001	--	--	--
5	UT to Buffalo Creek	Pond 10		0.062	--	0.866	--
Total Impacts			**1464**	**0.18**	**92**	**0.88**	

[1] These streams had an overall score of LOW when rated using the North Carolina Stream Assessment Method (NCSAM)

FEDERALLY PROTECTED SPECIES

As of September 1, 2022, the USFWS lists two federally protected species within the project boundary, the northern long-eared bat (*Myotis septentrionalis*) and dwarf-flowered heartleaf *(Hexastylis naniflora)*. The northern long-eared bat was not included in the 2012 permit application. A memo was sent to USFWS on June 15, 2016 indicating that NCDOT is in compliance with 4(d) requirements. The project continues to be consistent with the 4(d) requirements, however reinitiation of Section 7 will occur once a final decision is made on the listing status of the northern long-eared bat and the 4d is no longer valid.

An Amended Biological Opinion for the dwarf-flowered heartleaf issued by the USFWS on November 9, 2012 confirmed the original 2004 Biological Opinion of Not Likely to Jeopardize the Continued Existence of the dwarf-flower heartleaf. Section 7 has been satisfied for this project. Project green sheet

commitments regarding the dwarf-flowered heartleaf have been updated to reflect changes in preservation area and purchase of conservation easements.

MITIGATION OPTIONS

The NCDOT is committed to incorporating all reasonable and practicable design features to avoid and minimize jurisdictional impacts, and to provide full compensatory mitigation of all remaining, unavoidable jurisdictional impacts. Avoidance measures were taken during the planning and NEPA compliance stages and minimization measures were incorporated as part of the project design.

7C Avoidance and Minimization:
NCDOT has avoided impacting many wetlands and streams and reduced impacts to wetlands and streams to the greatest extent practicable. In addition to the measures listed in the 2013 phased permit application, other specific examples of avoidance and minimization measures include:

Section D:

- 2:1 slopes will be used in fill areas to reduce impacts to surrounding wetlands and jurisdictional streams.
- The Buffalo Creek Bridge will not discharge deck drains over open water and will utilize deck drain dissipator pads in the overbanks to prevent erosion
- The three box culverts will use sills and baffles, be backfilled with native material and maintain existing bed geometry.
- Hazardous spill basins will be installed in areas that are within 1 mile and drain to Kings Mountain Reservoir (643+00 -L- LT, 648+00 -L- RT, 652+00 -L- RT, 656+00 -L- LT, 668+00 -L- LT, 682+50 -L- RT, and 687+00 -L- LT)
- Dissipator basins will be installed in five locations (726+50 -L- RT, 730+50 -L- LT, 734+50 -L- LT, 741+08 -L- LT, and 24+46 -Ramp A- RT)
- Four dry detention basins will be utilized to attenuate increased peak flows and provide treatment (643+00 -L- LT, 668+00 -L- LT, 781+50 -L- RT, and 813+50 -L- LT).

Section E:

- 2:1 and 1.5:1 slopes will be used in fill areas to reduce impacts to surrounding wetlands and jurisdictional streams.
- Three dry detention basins will be utilized to attenuate increased peak flows and provide treatment (19+22 – Y42RPB-LT, 20+25-Y42RPC-RT, 896+75 -L- RT)

Summary of Mitigation:
The NCDOT has avoided and minimized impacts to jurisdictional resources to the greatest extent practicable as described above. R-2707D will permanently impact 1.28 acre of wetlands and 10,062 linear feet of streams while R-2707E will permanently impact 0.3 acre of wetlands and 1,464 linear feet of stream. Mitigation for impacts resulting from the Section D and E will be provided by DMS.

Onsite stream relocation using natural channel design was incorporated on Section D in the area identified in the 2012 permit and is not included in the total mitigable impacts.

Streams impacted at Sites 1A, 2, 3B, 3C, 3D on the Section E were identified as low quality using the North Carolina Stream Assessment Method (NCSAM). Mitigation is being requested at a reduced ratio for these impacts (989 linear feet of intermittent stream).

REGULATORY APPROVALS

Section 404: We are hereby requesting a modification to the USACE Individual 404 Permit as required for the above-described activities.

Section 401: We are hereby requesting a modification to the 401 Water Quality Certification from the N. C. Division of Water Resources.

A copy of this application and distribution list will also be posted on the NCDOT website at: http://connect.ncdot.gov/resources/Environmental. If you have any questions or need additional information, please contact Jeff Wyatt at jlwyatt@ncdot.gov or (980) 552-4219.

Sincerely,

Jeffrey L. Wyatt
Division 12 Environmental Supervisor

ROY COOPER
Governor
ELIZABETH S. BISER
Secretary
MARC RECKTENWALD
Director

NORTH CAROLINA
Environmental Quality

October 18, 2022

Mr. Jeff Wyatt
NCDOT Division 12 Environmental Supervisor
North Carolina Department of Transportation
P. O. Box 47
Shelby, North Carolina 28151-0047

Dear Mr. Wyatt:

Subject: Mitigation Acceptance Letter: **R-2707D**, Shelby Bypass, Cleveland County

The purpose of this letter is to notify you that the North Carolina Department of Environmental Quality – Division of Mitigation Services (NCDEQ-DMS) will provide the stream and wetland mitigation for the subject project. Based on the information received from you on October 18, 2022, the impacts are located in CU 03050105 of the Broad River basin in the Southern Piedmont (SP) Eco-Region, and are as follows:

Broad 03050105	Stream			Wetlands			Buffer (Sq. Ft.)	
	Cold	Cool	Warm	Riparian	Non-Riparian	Coastal Marsh	Zone 1	Zone 2
Impacts (feet/acres)	0	0	10,062.000	1.280	0	0	0	0

NCDEQ-DMS will commit to implement sufficient compensatory mitigation credits to offset the impacts associated with this project as determined by the regulatory agencies in accordance with the In-Lieu Fee Instrument dated July 28, 2010. If the above referenced impact amounts are revised, then this mitigation acceptance letter will no longer be valid and a new mitigation acceptance letter will be required.

If you have any questions or need additional information, please contact Ms. Beth Harmon at 919-707-8420.

Sincerely,

Elizabeth Harmon

for James B. Stanfill
DMS Deputy Director

cc: Mr. Eric Alsmeyer, USACE – Raleigh Regulatory Field Office
Ms. Amy Chapman, NCDWR
Mr. Brad Chilton, NCDOT – EAU
File: R-2707D

North Carolina Department of Environmental Quality | Division of Mitigation Services
217 West Jones Street | 1652 Mail Service Center | Raleigh, North Carolina 27699-1652
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NORTH CAROLINA
Environmental Quality

October 18, 2022

Mr. Jeff Wyatt
NCDOT Division 12 Environmental Supervisor
North Carolina Department of Transportation
P. O. Box 47
Shelby, North Carolina 28151-0047

Dear Mr. Wyatt:

Subject: Mitigation Acceptance Letter: **R-2707E**, Shelby Bypass, Cleveland County

The purpose of this letter is to notify you that the North Carolina Department of Environmental Quality – Division of Mitigation Services (NCDEQ-DMS) will provide the stream and wetland mitigation for the subject project. Based on the information received from you on October 18, 2022, the impacts are located in CU 03050105 of the Broad River basin in the Southern Piedmont (SP) Eco-Region, and are as follows:

Broad 03050105	Stream			Wetlands			Buffer (Sq. Ft.)	
	Cold	Cool	Warm	Riparian	Non-Riparian	Coastal Marsh	Zone 1	Zone 2
Impacts (feet/acres)	0	0	1,464.000	0.285	0.015	0	0	0

Non-riparian wetland mitigation credits are not available in this service area. In accordance with the directive from the February 8, 2011, IRT meeting, non-riparian wetland impacts located in the mountain and piedmont areas of North Carolina can be accepted as requested but mitigated for utilizing riparian wetland mitigation credits in the cataloging unit. NCDEQ-DMS will commit to implement sufficient compensatory mitigation credits to offset the impacts associated with this project as determined by the regulatory agencies in accordance with the In-Lieu Fee Instrument dated July 28, 2010. If the above referenced impact amounts are revised, then this mitigation acceptance letter will no longer be valid and a new mitigation acceptance letter will be required.

If you have any questions or need additional information, please contact Ms. Beth Harmon at 919-707-8420.

Sincerely,

Elizabeth Harmon

for James B. Stanfill
DMS Deputy Director

cc: Mr. Eric Alsmeyer, USACE – Raleigh Regulatory Field Office
Ms. Amy Chapman, NCDWR
Mr. Brad Chilton, NCDOT – EAU
File: R-2707E

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

ROY COOPER
GOVERNOR

JAMES H. TROGDON, III
SECRETARY

February 18, 2019

Steve Kichefski
US Army Corps of Engineers
Wilmington District, Asheville Field Office
151 Patton Avenue, Suite 208
Asheville, North Carolina 28801

Reference: Jurisdictional Determination Update for Proposed Sections D and E of the Shelby Bypass (TIP No. R-2707D&E)

Dear Mr. Kifcheski,

Please find the attached updated Preliminary Jurisdictional Determination maps and information for NCDOT STIP Project U-2707D and E in Cleveland County, North Carolina. The North Carolina Department of Transportation (NCDOT) proposes the construction of the remaining two sections of the US74 Bypass around the Town of Shelby (Figure 1). These sections extend from just east of the NC 150 Interchange to west of SR 1001 on the existing US74 corridor.

Stantec has been retained by the NCDOT to verify and update the Waters of the US found within the project site. This letter and the attached maps and information serve as an update to the June 2009 Jurisdictional Delineation Update which updated the original 2000 Wetland and Stream Evaluation.

Stantec reviewed the 2009 delineation maps and visited all jurisdictional areas identified from that time period to verify current jurisdictional status. The stream and wetland numbers assigned during the 2009 verification have been used on updated maps and tables. The updated maps show new areas or areas where a change occurred. Table 1 and 2 from the 2009 JD have been included and additional notes have been added.

The origin of two channels was changed and one new channel was added (changes highlighted in Table 2). These changes were verified with USACE and NCDWR staff during a site visit in November 2017.

In addition, since 2009, the design plans for the project have advanced and additional areas outside of the original corridor will be affected by construction. Final right-of-way along with all easement areas (construction, utility, drainage) was used to define the new study area. The new study area generally falls within the original corridor however there are a number of exceptions. Additional

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work will occur along existing roadways in the vicinity of the bypass leading to an extension of the study area along these roads. No stream or wetland features were located within these areas. Second, the interchange between the new location portion of the bypass and existing US74 just west of Buffalo Creek is slightly larger. A large floodplain wetland was identified in this area as an extension of wetland 54AB. While a portion of this area was within the existing study area it had not previously been identified as a wetland.

Finally, a number of parcels were identified for preservation and are included as right-of-way for the project. Two of these preservation areas are located outside of the original corridor. A detailed delineation was not conducted on these areas since no construction work will occur in order to preserve the dwarf-flowered heartleaf. These areas are excluded from this PJD request (Figure 2-2 and 2-3).

Select streams were assessed using the North Carolina Stream Assessment Methodology (NCSAM). NCSAM scores for these streams are included in the comments section of Table 1.

The attachments include a project area and vicinity map, a USGS topographic map, potential jurisdictional features map, wetland determination data form for the expanded 54AB wetland, and NCSAM forms for select channels. Please feel free to contact me if you have any questions.

Thank you for your assistance.

Sincerely,

Trish Beam
Division 12 Environmental Program
NCDOT

Attachments:
Summary Tables 1 and 2
Vicinity & Project Area Map
USGS Topography Map
Potential Jurisdictional Features Map
Wetland Determination Data Forms
NCSAM Forms

A, B, C Sections excluded from 2017 verification

Shelby Wetlands						
Wetland Number	Flag Sequence	Riparian Wetland (Y/N)[a]	Wetland Type[b]	COWARDIN BASED ON Data Forms, Aerial	Wetland Quality Rating	Notes
1	CA	N	PSS1	PSS1	16	
2 A-D	WA-WD	N	PFO1	PFO1	16	
3 A-B	WE/PA	Y	n/a	PSS	54	REMOVED Part of New Wetland #71
4	WF	Y	PFO1	PFO1	31	Cowardin based on wetland, not pond
5 A -D	CB/FA/FB/FC	N	PFO1	PFO1	32	
6 A	CC	N	PFO1	PFO1	32	
6 B	WWA	N	PFO1	PFO1	32	
7 A-C	CD	Y	PSS1	PFO1	22	
8 A-B	AD/AB	Y	PSS1	PSS1	47	
9	AE	Y	PFO1	PFO1	20	
10	AF	Y	PEM1	PEM1	13	
11	AG	Y	PFO1	PFO1	13	
12 A-G	CT-CZ	Y	PEM1	PEM1	13	
13	WL	Y	PFO1	PFO1	28	
14 A	WM	Y	PFO1	PFO1	15	
14 B	WN	Y	PFO1	PFO1	15	
15 A-B	WO/WQ	Y	PSS1	PSS1	37	
16 A-B	WP	N	PFO1	PSS1	41	
17	WR		n/a	PFO1	29	REMOVED lack of hydrology
18 A	BA/PA	N	PEM1	PEM1	13	
18 B	PB	Y	PEM1	PEM1	13	
19 A-D	BBM-BBP	Y	PSS1	PSS1	40	
20	(A) BBI	Y	PFO1	PSS	34	
21	BBL	Y	PFO1	PSS1	19	
22	PC	Y	PSS1	PFO1	57	Replaced OLD Wetlands 22A-B
23	PA	N	PEM2	PSS	20	
24	(A) BE	Y	PFO1	PFO1	23	
25 A	BEA	Y	PFO1	PFO1	23	
25 B-D	BEA/BF-BI	Y	PFO1	PSS	23	
26 A	BXA	Y	PFO1	PFO1	27	

Table A-1 continues.

a Riparian wetlands are those wetlands that are subject to overbank flooding from streams, creeks, or rivers.
Non-riparian wetlands are those wetlands that are not subject to overbank flooding from streams, creeks, or rivers.
b Wetland Type: PFO - palustrine, forested; PEM - palustrine emergent; PSS - palustrine, scrub-shrub; PUB - palustrine, unconsolidated bottom

Yellow highlighting - 2009 edits
Orange hghlighting - 2017 edits

Table A-1. Wetlands
Table A-1 continued.

D A, B, C Sections excluded from 2017 verification

Wetland Number	Flag Sequence	Riparian Wetland (Y/N)[a]	Wetland Type[b]	COWARDIN BASED ON Data Forms, Aerial	Wetland Quality Rating	Notes
26 B	BWO	Y	PFO1	PSS	27	
27 A	BXB	N	PFO1	PFO1	15	
27 B	BWWA	Y	PFO1	PFO1	15	
28	BWB	Y	PFO1	PFO1	19	
28A	BWA	Y	PSS1	PSS1	19	
29 A,B	BXC/BXD		PFO1	PFO1	12	REMOVED 2009
30	BXE/BXF	Y	PEM1	PSS1	27	POND NO LONGER EXISTS 2009
31 A-C	BWC-BWE	Y	PEM1	PSS1	21	
32 A-D	BWF/BWG/BXF-BXH	Y	PFO1	PFO1	32	
33	BWJ	Y	PFO1	PFO1	28	
34 A	BWI	Y	PFO1	PFO1	19	
34 B	BWK	Y	PFO1	PFO1	19	
34 C	BBD	Y	PFO1	PFO1	19	
34 D	BBE	Y	PFO1	PFO1	19	
35 A-C	BXI/BWS/BWT	Y	PSS1	PSS1	23	
36	BBA		PUB	PEM1	28	REMOVED; Part of Pond 2009
37	BBB/BBC	Y	PFO1	PFO1	19	
38	BWL	Y	PFO1	PSS1	34	
39	BWM	Y	PFO1	PSS1	24	
40	BLA	Y	PFO1	PSS1	28	
41	BWN	Y	PFO1	PFO1	32	
42	BTB	Y	PSS1	PSS1	19	
43	CPA		PFO1		19	REMOVED 2009
44	CBA	Y	PEM1	PEM1	24	
45	CPC/CBC	Y	PSS1	PEM1	24	
46 A	CBE/CBF	Y	PEM1	PEM1	19	
46 B	CPD	Y	PFO1	PFO1	19	
47A	CBFB	Y	PEM1	PEM1	24	

Table A-1 continues.

a Riparian wetlands are those wetlands that are subject to overbank flooding from streams, creeks, or rivers.
Non-riparian wetlands are those wetlands that are not subject to overbank flooding from streams, creeks, or rivers.
b Wetland Type: PFO - palustrine, forested; PEM - palustrine emergent; PSS - palustrine, scrub-shrub; PUB - palustrine, unconsolidated bottom

Yellow highlighting - 2009 edits
Orange hghlighting - 2017 edits

Table A-1. Wetlands
Table A-1 continued.

Wetland Number	Flag Sequence	Riparian Wetland (Y/N)[a]	Wetland Type[b]	COWARDIN BASED ON Data Forms, Aerial	Wetland Quality Rating	Notes
47 B-C	CBG/CBH	Y	PEM1	PEM1	24	
47D	CBI	Y	PEM1	PEM1	24	
48 A	CBM	Y	PEM1	PEM1	20	
48 B	CBN	Y	PFO1	PFO1	20	
49	CCB	N	PFO1	PSS1	20	
50	CBK	Y	PFO1	PFO1	24	
51 A-B	CBJ/CZC	N	PFO1	PFO1	24	
52	CBL	Y	PFO1	PSS	24	
53	CPE/CBP/CPA	Y	PEM1	PFO	38	
54 A	CTA	Y	PSS1	PSS1	29	Expanded 2019 onto Buffalo Creek floodplain, WAM and wetland forms attached,, see Figure 2-4
54 B	CTB	Y	PFO1	PSS1	29	
55	CQD	N	PFO1	PFO1	18	
56 A	CLD	Y	PSS1	PFO1	29	
56 B	CLE/CLF	Y	PSS1	PSS1	29	
57 A-B	CQA/CBR	Y	PFO1	PFO1	28	
58 A	CZG/CZI	Y	PSS1	PSS1	28	Pond included
58 B	CZH	Y	PSS1	PSS1	28	
59	SPC	Y	PFO1	PSS	28	Changed to Stream 8-14 2009
60	CZO	Y	PEM1	PEM1	28	
61 A-B	CBT-CBW	Y	PEM1	PEM1	28	
61 C	CBY	Y	PEM1	PEM1	28	
62	CBZ	Y	PFO1	PEM1	28	
63	CZE/CZF/CBX	Y	PFO1	PEM1	33	
64	CBZE		PEM1	PEM1	33	REMOVED part of Stream 8-9 2009
65	CZJ/CZK	Y	PEM1	PEM1	28	
66	CBZG/CBZF	Y	PFO1	PEM1	33	
67	CZL/CZN	Y	PFO1	PEM1	28	
68	CBZH	Y	PFO1	PEM1	33	
69 A	CZM	N	PFO1	PFO1	17	
69 B	CZN	N	PFO1	PFO1	17	
70	CZP/CZQ	Y	PFO1	PFO	28	
71	PA	Y	PEM1	PEM1	8	NEW WETLAND ADJACENT TO POND 2009
72	QA	Y	PFO1	PFO1	34	NEW WETLAND 2009

a Riparian wetlands are those wetlands that are subject to overbank flooding from streams, creeks, or rivers.
Non-riparian wetlands are those wetlands that are not subject to overbank flooding from streams, creeks, or rivers.
b Wetland Type: PFO - palustrine, forested; PEM - palustrine emergent; PSS - palustrine, scrub-shrub; PUB - palustrine, unconsolidated bottom

Yellow highlighting - 2009 edits
Orange highlighting - 2017 edits

A, B, C Sections excluded from 2017 verification

Shelby Streams									
Stream Segment[a]	Stream Number		Flag Sequence	Perennial/Intermittent	Mitigation Required[b]	DWQ Score	USACE Score	OLD P/I[c]	NOTES
Watershed 1. Sandy Run Creek Stream Index Number (SIN) **9-46-(3.5),** Best Usage Classification (BUC) **WS-IV**									
	1-1	Sandy Run	SZA/SRG	Perennial	Yes	52.5	65	P	
	1-2	UT to 1-1	SCA/SCB	Perennial	Yes	32	43	I	
	1-3	UT to 1-1	SZC	Perennial	Yes	49	51	P	
	1-4	UT to 1-3	SCD	Intermittent	Yes	25	42	P	
Watershed 2. Beaverdam Creek SIN **9-50-32,** BUC **C**									
	2-1	UT to 2-11	SPA	Perennial	Yes	21.5	17	I	Perennial status/Mitigation based on DWQ/USACE call.
	2-2	UT to 2-1	SWA	Intermittent	No	24	21	I	
	2-3	n/a	n/a	n/a	n/a	n/a	n/a	n/a	REMOVED now is part of the pond and wetland 2009
a	2-4	Upper Segment of 2-5	SPC	Intermittent	Yes	27	52	P	
a	2-5	UT to 2-11	SPD	Perennial	Yes	34.5	58	P	
	2-6	UT to 2-5	SWB	Perennial	Yes	32	48	P	
b	2-7	UT to 2-5	SWD	Perennial	Yes	32	54	P	
b	2-8	Upper Segment of 2-7	SWE	Perennial	Yes	32	54	P	
	2-9	UT to 2-8	SWF	Perennial	Yes	29.5	47	I	
b	2-10	Upper Segment of 2-8	SWG	Perennial	Yes	32	54	I	
	2-11	Beaverdam Creek	SPE/SCC	Perennial	Yes	40.5	47	P	
c	2-12	UT to 2-11	SPF	Intermittent	Yes	24	35	I	
c	2-13	Upper Segment of 2-12	SWM	Intermittent	Yes	26.5	40	P	
d	2-14	UT to 2-11	SWN	Perennial	Yes	33	44	P	
d	2-15a	Upper Segment of 2-15b	SCT	Perennial	Yes	29	39	P	impacted by cow and agriculture
d	2-15b	Upper Segment of 2-14	SLA	Perennial	Yes	41.5	52	P	
	2-16	UT to 2-14	SWP	Intermittent	Yes	19.75	40	I	
	2-17	UT to 2-15	SWR/SWS	Intermittent	Yes	26	43	P	
	2-18	UT to 2-20	SCY	Intermittent	Yes	25	32	I	
	2-19	UT to 2-15	SWT	Intermittent	Yes	27.5	48	I	
	2-20	UT to 2-15	SCZ	Intermittent	Yes	22.5	40	I	
e	2-21	Upper Segment of 2-23	SWH	Intermittent	Yes	26	39	I	
	2-22	UT to 2-21	SWI	Intermittent	Yes	28.5	43	I	
e	2-23	UT to 2-27	SZE	Perennial	Yes	34.5	60	P	
	2-24	UT to 2-23	SZF	Intermittent	Yes	24	39	I	
	2-25	UT to 2-27	SWJ	Perennial	Yes	35.5	53	P	
	2-26	UT to 2-27	SZH	Intermittent	Yes	21	29	I	
	2-27	UT to 2-11	SZG	Perennial	Yes	38.5	44	P	
	2-28	UT to 2-25	SZJ	Intermittent	No	22	26	I	
	2-29	UT to 2-27	SZI	Intermittent	Yes	23	44	I	
	2-30	UT to 2-5	SWC	Intermittent	Yes	28	52	n/a	
	2-31	UT to 2-7	WJ	Intermittent	Yes	25.5	56	n/a	

Table A-2 continues.

a a-x labels constitute segments that are part of the same stream channel
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c 2000 Perennial/Intermittent calls

Yellow highlighting - 2009 edits
Orange hghlighting - 2017 edits

Table A-2. Streams

Table A-2 continued.

	Stream Number		Flag Sequence	Perennial/Intermittent	Mitigation Required[b]	DWQ Score	USACE Score	OLD P/I[c]	NOTES
Watershed 3. Brushy Creek SIN **9-50-29**, BUC **C**									
	3-1	UT to 3-9	SCE/SPI/SFB	Intermittent	Yes	28	50	I	
	3-2	UT to 3-9	SPG/SCD/SFC	Perennial	Yes	40	51	P	
	3-3	UT to 3-2	SPH	Intermittent	Yes	19	37	I	
	3-4	UT to 3-5	SBA	Intermittent	Yes	21.5	31	I	
	3-5	UT to 3-9	SPJ	Perennial	Yes	35	54	P	
	3-6	UT to 3-9	SPK	Perennial	Yes	29.5	49	P	
	3-7	UT to 3-6	SBB	Perennial	Yes	36	50	I	Stream extended upstream from original origin
	3-8	UT to 3-9	SPL/SBC	Perennial	Yes	36	61	I	
	3-9	Brushy Creek	SPM/SPN	Perennial	Yes	52	69	P	
	3-10	UT to 3-9	SPO	Perennial	Yes	32	37	P	
	3-11	UT to 3-9	SWWC	Perennial	Yes	49.5	66	P	
	3-12	UT to 3-9	SPC	Intermittent	Yes	25.5	60	n/a	NEW STREAM impounded by beaver dam 2009
Watershed 4. First Broad River SIN **9-50-(19.5)**, BUC **WS-IV**									
	4-1	UT to 4-2	BSYC	Intermittent	Yes	28	53	I	
	4-2	UT to 4-7	BSXA/SFF	Perennial	Yes	31.5	55	I	
	4-3	UT to 4-2	BSYB	Perennial	Yes	32.5	60	I	
	4-4	UT to 4-7	BSYA	Perennial	Yes	32.5	59	P	
	4-5	UT to 4-4	BSYD	Intermittent	Yes	26	39	I	
	4-6	UT to 4-7	BSXB	Intermittent	Yes	18	31	I	seep
	4-7	First Broad River	BSYE	Perennial	Yes	54.5	70	P	
	4-8	UT to 4-7	SFI	Intermittent	Yes	26.5	49	I	
	4-9	UT to 4-7	BSXC	Perennial	Yes	46.5	65	P	
	4-10	UT to 4-9	BSZA	Perennial	Yes	43.5	64	P	
	4-11	UT to 4-9	BSXD	Perennial	Yes	36.5	49	P	
	4-12	UT to 4-11	BSXE	Perennial	Yes	25	49	P	caddisflies used for perennial determination
	4-13	UT to 4-9	BSWC/BSYF	Perennial	Yes	41.5	68	P	
	4-14	UT to 4-13	BSXF	Perennial	Yes	34.5	64	I	
	4-15	UT to 4-9	BSWA	Perennial	Yes	33.5	63	P	
	4-16	UT to 4-15	BSWB	n/a	n/a	11	n/a	I	REMOVED ephemeral channel; non-jurisdictional 2009
	4-17	UT to 4-9	BSZB	Perennial	Yes	42	68	P	
	4-18	UT to 4-17	BSZC	Intermittent	Yes	27	52	I	
	4-19	UT to 4-17	BSWD	n/a	n/a	16	n/a	I	REMOVED ephemeral channel; non-jurisdictional 2009
	4-20	UT to 4-9	BSYG/SQA	Intermittent	Yes	27.5	49	I	Stream extended upstream from original origin
	4-21	UT to 4-22	BSYH	Perennial	Yes	37	51	I	
	4-22	UT to 4-9	BSYI/BSYJ	Perennial	Yes	38	65	P	
	4-23	UT to 4-22	BSXH/BSXG	Perennial	Yes	29	60	I	

Table A-2 continues.

A, B, C Sections excluded from 2017 verification

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c 2000 Perennial/Intermittent calls

Yellow highlighting - 2009 edits
Orange hghlighting - 2017 edits

Table A-2. Streams

Table A-2 continued.

A, B, C Sections excluded from 2017 verification

	Stream Number		Flag Sequence	Perennial/Intermittent	Mitigation Required[a]	DWQ Score	USACE Score	OLD P/I[c]	NOTES
Watershed 4 continued. First Broad River SIN **9-50-(18.5)**, BUC **WS-IV**									
f	4-24a	Upper Segment of 4-24b	BSYK	Intermittent	Yes	21.5	52	P	
f	4-24b	UT to 4-22	BSYK	Perennial	Yes	32	46	P	
	4-25	UT to 4-22	BSZD	Perennial	Yes	34	54	P	
	4-26	UT to 4-22	SRA	Intermittent	No	37	52	n/a	NEW STREAM; Determination/No Mitigation based on DWQ/USACE call. 2009
	4-27	UT to 4-21	BSCB	Intermittent	Yes	27	48	n/a	
	4-28	UT to 4-27	BSBA	Intermittent	Yes	23.5	43	n/a	
Watershed 5. Hickory Creek SIN **9-50-30**, BUC **C**									
g	5-1	Upper Segment of 5-3	BSZF/BSPC	Perennial	Yes	30	59	I	
	5-2	UT to 5-3	BSWE	Intermittent	Yes	26	33	I	
g	5-3	UT to 5-7	BSZE	Perennial	Yes	30	59	P	
	5-4	UT to 5-3	BSZG	Intermittent	No	18	26	I	
	5-5	UT to 5-3	BSZJ	Intermittent	Yes	28	35	I	
	5-6	UT to 5-1	BSAA	Intermittent	Yes	25	50	I	
	5-7	Hickory Creek	BSYL	Perennial	Yes	46.5	62	P	
h	5-8	UT to 5-7	BSXJ	Perennial	Yes	33	55	I	
	5-9	UT to 5-7	BSYM	Perennial	Yes	40	61	P	
h	5-10	Upper Segment of 5-8	BSXI	Intermittent	Yes	25	49	I	
	5-11	UT to 5-7	BSQB	Perennial	Yes	28	60	I	Perennial due to flow from headwater wetland
Watershed 6. Kings Mountain Reservoir (KMR) SIN **9-53-(2.9)**, BUC **WS-III; CA**									
i	6-1	Upper Segment of 6-2	BSPA	Intermittent	Yes	25	34	I	Stream reflagged due to extensive channel disturbance upstream from pond 6
i	6-2	UT to KMR	BSPB	Intermittent	Yes	20.75	38	P	
	6-3	UT to KMR	BSLA	Perennial	Yes	32	65	P	
	6-4	UT to 6-3	BSQA	Intermittent	Yes	20	31	I	
	6-5	UT to 6-3	BSLB	n/a	n/a	17	n/a	I	REMOVED ephemeral channel; non-jurisdictional 2009
	6-6	UT to 6-3	BSWG	Intermittent	Yes	24	56	I	
	6-7	UT to 6-3	BSWF	Intermittent	Yes	22	45	I	
D j	6-8a	Upper Segment of 6-8b	BSTA	Intermittent	Yes	24.5	37	I	
j	6-8b	UT to 6-14	BSTA	Perennial	Yes	34	47	I	
	6-9	UT to 6-8	BSLD	Intermittent	Yes	22	32	I	
	6-10	UT to 6-8	BSLE	Intermittent	Yes	21	28	I	
	6-11	UT to 6-14	BSLC	Perennial	Yes	22.5	52	I	caddisfly cases used for perennial determination
	6-12	UT to 6-14	BSLF	Intermittent	Yes	23	38	I	
	6-13	UT to 6-14	BSWH	Perennial	Yes	34	62	P	
k	6-14a	Upper Segment of 6-14b	BSQD	Intermittent	Yes	26	54	P	
k	6-14b	UT to KMR	BSQD	Perennial	Yes	32	63	P	
	6-15	UT to 6-15	BSQL	Perennial	Yes	29	45	I	
	6-16	UT to KMR	BSLG	n/a	n/a	17	n/a	I	REMOVED ephemeral channel; non-jurisdictional 2009, added back 2017 see Figure 2-2

Table A-2 continues.

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c 2000 Perennial/Intermittent calls

Yellow highlighting - 2009 edits
Orange hghlighting - 2017 edits

Table A-2 continued.

	Stream Number		Flag Sequence	Perennial/Intermittent	Mitigation Required[a]	DWQ Score	USACE Score	OLD P/I[c]	NOTES
l	6-17a	Upper Segment of 6-17b	BSLH	Intermittent	Yes	27	44	I	Upper reaches of 6-17a are ephemeral & non-juris. 2009
l	6-17b	UT to 6-15	BSLH	Perennial	Yes	33.5	51	I	
	6-18	UT to 6-2	SQC	Intermittent	Yes	22.5	45	n/a	NEW STREAM 2009
	6-19	UT to 6-17b	BSQE	Intermittent	Yes	22.5	39	n/a	
Watershed 7. Buffalo Creek SIN **9-53-(5)**, BUC **C**									
	7-1	UT to 7-5	CSZD	Perennial	Yes	41	59	P	
	7-2	UT to 7-1	CSPD	Intermittent	Yes	24	28	I	
	7-3	UT to 7-1	CSPC/CSBA	Perennial	Yes	29.5	38	I	
	7-4	UT to 7-1	CSPB	Intermittent	Yes	26	36	I	
m	7-5	Upper Segment of 7-7	CSPA	Perennial	Yes	51.5	47	P	
	7-6	UT to 7-5	CSZA	Intermittent	Yes	21	39	P	
m	7-7	Upper Segment of 7-10	CSZB	Perennial	Yes	43	51	P	
	7-8	UT to 7-7	CSZC	Intermittent	Yes	17	39	I	seep
	7-9	Side Channel of 7-10	CSZF	Perennial	Yes	31.5	51	I	
m	7-10	Upper Segment of 7-16	CSZE	Perennial	Yes	43	51	I	
n	7-11	Upper Segment of 7-12	CSZK	Perennial	Yes	34.5	59	I	
n	7-12	Upper Segment of 7-13	CSPE	Perennial	Yes	34.5	59	P	
n	7-13	UT to 7-16	CSZG	Perennial	Yes	34.5	59	I	
o	7-14a	Upper Segment of 7-14b	CSZI1	Intermittent	Yes	29.5	47	I	
o	7-14b	UT to 7-16	CSZI1	Perennial	Yes	36	58	I	
	7-15	UT to 7-14	CSZJ	Intermittent	Yes	25.5	44	I	
	7-16	UT to 7-27	CSZH	Perennial	Yes	40.5	70	P	
	7-17	UT to 7-16	CSPF	Perennial	Yes	45.5	77	P	
	7-18	UT to 7-17	CSPG	Perennial	Yes	29	61	I	
p	7-19a	Upper Segment of 7-19b	CSPH	Intermittent	Yes	26.5	49	I	REMOVED ephemeral channel; non-jurisdictional; Figure 2-4
p	7-19b	UT to 7-16	CSZI	Perennial	Yes	31.5	59		Adjusted origin to headcut; Figure 2-4
	7-20	UT to 7-19	CSZL	Intermittent	Yes	28	57	I	REMOVED ephemeral channel; non-jurisdictional; Figure 2-4
q	7-21	Upper Segment of 7-22	CSPI	Perennial	Yes	31.5	58	P	
q	7-22	UT to 7-27	CSZM	Perennial	Yes	29.5	54	P	Extended stream expanded study area; Figure 2-4
	7-23	UT to 7-27	CSQA	Intermittent	Yes	24.5	51	I	Extended stream expanded study area; Figure 2-4
r	7-24	Upper Segment of 7-26	CSLI	Intermittent	Yes	20.5	36	I	
	7-25	UT to 7-26	CSLL	n/a	n/a	17	n/a	I	REMOVED ephemeral channel; non-jurisdictional 2009
r	7-26	UT to 7-27	CSTC	Perennial	Yes	29.75	50	I	
	7-27	Buffalo Creek	CSLJ	Perennial	Yes	53	73	P	
	7-28	Side channel of Buffalo Crk	CSLK	n/a	n/a	16	n/a	I	REMOVED ephemeral channel; non-jurisdictional 2009
	7-29	UT to 7-27	CSQB	Perennial	Yes	29	43	P	

D

Table A-2 continues.

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c 2000 Perennial/Intermittent calls

Yellow highlighting - 2009 edits
Orange hghlighting - 2017 edits

Table A-2. Streams

Table A-2 continued.

	Stream Number		Flag Sequence	Perennial/Intermittent	Mitigation Required[a]	DWQ Score	USACE Score	OLD P/I[c]	NOTES
Watershed 7 continued. Buffalo Creek SIN 9-53-(5), BUC C									
s	7-30	Upper Segment of 7-31	CSQC/CSLN	~~Perennial~~ INT	Yes	21 ~~27~~	40	P	~~caddisflies used for perennial determination~~ SA M score - LOW
s	7-31	UT to 7-27	CSLR	Perennial	Yes	31	48	P	
Watershed 8. Potts Creek SIN 9-53-6-3, BUC C									
	8-1	UT to 8-2	CSPJ	n/a	n/a	27	27	I	REMOVED determined to be ephemeral during Agency review; non-juris. 2009
t	8-2	Upper Segment of 8-4	CSQD	Intermittent	Yes	26.5	50	P	
	8-3	UT to 8-5	CSBB	Intermittent	Yes	27.5	35	I	SA M score -LOW
t	8-4	UT to 8-5	CSBC	Intermittent	Yes	26.5	50	I	SA M score -LOW
u	8-5	Upper Segment of 8-7	CSBA	Intermittent	Yes	25	36	I	SA M score -LOW
	8-6	UT to 8-8	CSLQ	Perennial	Yes	33	46	I	
u	8-7	UT to 8-8	CSBD	Intermittent	Yes	26.5	47	I	
	8-8	UT to 8-9	CSLP	Perennial	Yes	35.5	56	P	
	8-9	UT to Potts Creek	CSLO/CSZO	Perennial	Yes	32.5	56	P	
v	8-10a	Upper Segment of 8-10b	CSPK	Intermittent	Yes	27.5	42	I	Extended stream origin to south side of existing roadway; Figure 2-5
v	8-10b	UT to 8-9	CSZN/CSPK	Perennial	Yes	34	53	I	
	8-11	UT to 8-10b	CSWA	Intermittent	Yes	21	57	I	
w	8-12a	Upper Segment of 8-12b	CSQF	Intermittent	Yes	24.5	51	I	
w	8-12b	UT to 8-11	CSQF	Perennial	Yes	34	57	I	
	8-13	UT to 8-11	CSBE	Intermittent	Yes	22	46	I	
	8-14	UT to 8-8	SRB	Intermittent	Yes	28	54	n/a	Changed from wetland 59 to stream 8-14 2009
	8-15	UT to 8-9	CSPL	Perennial	Yes	30	45	n/a	
Watershed 9. Beason Creek SIN 9-53-8, BUC C									
	9-1	UT to Beason Creek	CSZP	Intermittent	Yes	25.5	47	I	
	9-2	UT to Beason Creek	CSZQ	Intermittent	Yes	24	56	I	

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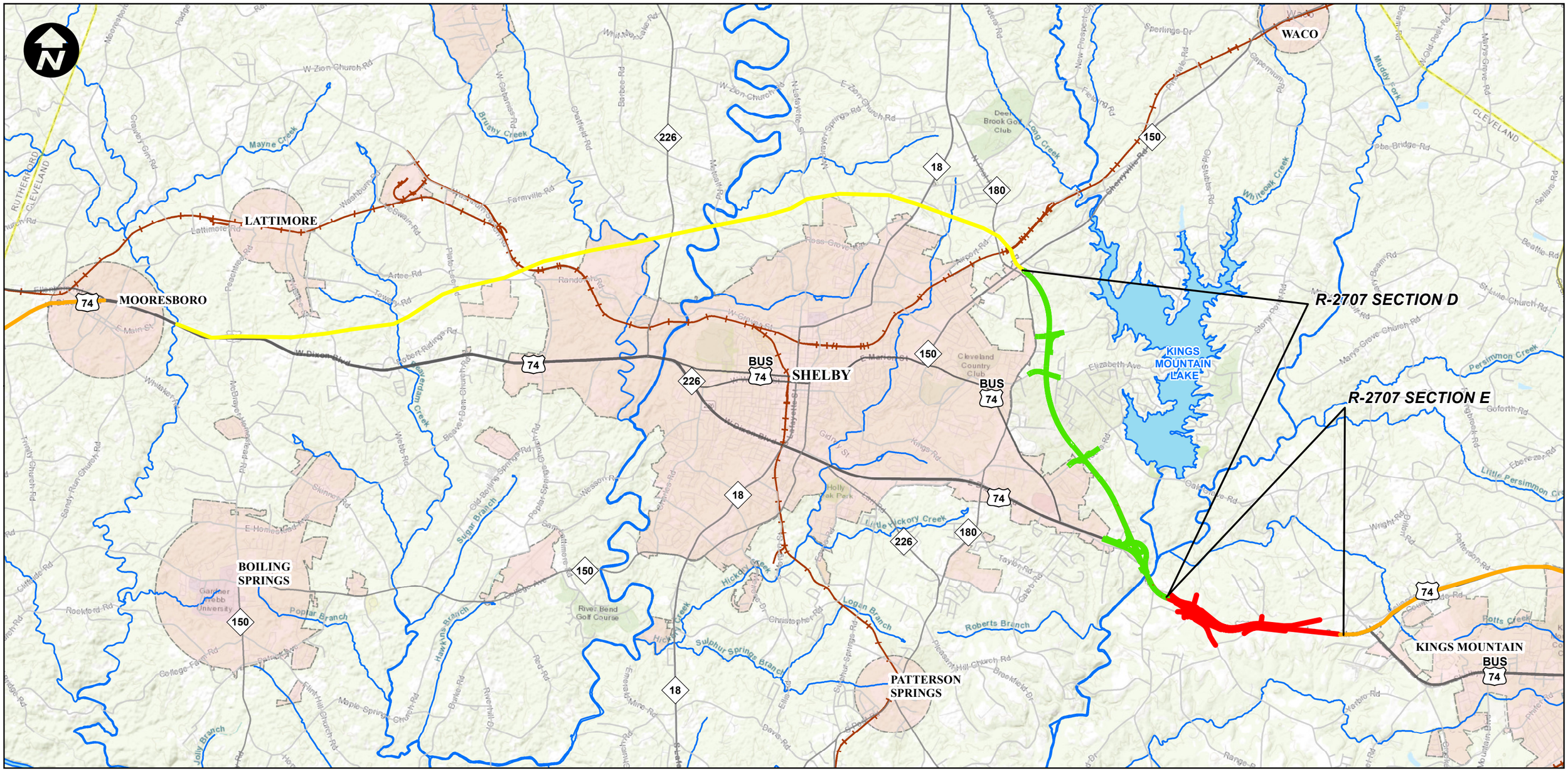
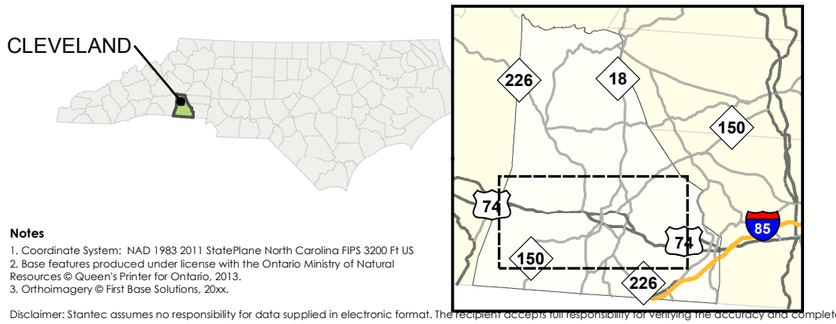
c 2000 Perennial/Intermittent calls

Yellow highlighting - 2009 edits
Orange hghlighting - 2017 edits





Notes

1. Coordinate System: NAD 1983 2011 StatePlane North Carolina FIPS 3200 Ft US
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0 1 2 3 4 Miles

LEGEND

- Existing Freeway
- Other Roads
- Railroad Tracks
- County Boundary
- Hydrologic Features
- MunicipalBoundaries

STIP Project R-2707

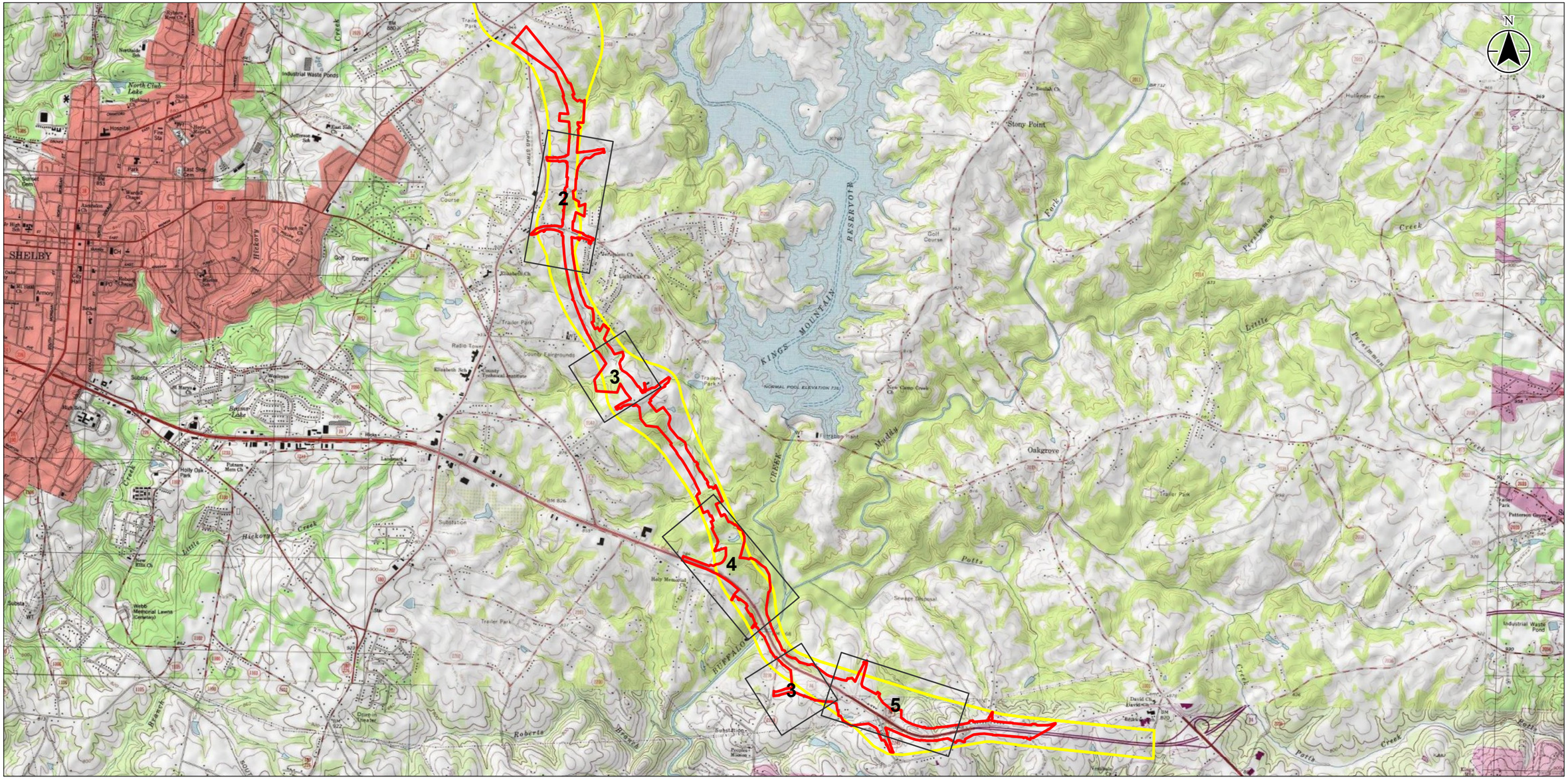
- Section A/B/C
- Section D
- Section E

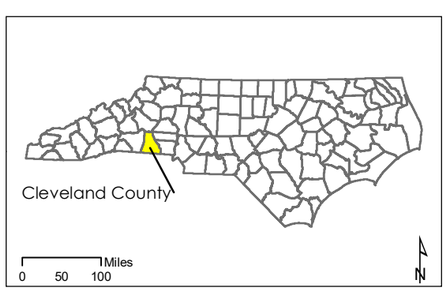
Project Location
Cleveland County

Client/Project
NCDOT Division 12
STIP Project R-2707D/E
Concurrence Point 4B Meeting

Figure No.
1

Title
Vicinity Map





NC DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
DIVISION 12

0 4,000 8,000 Feet

1:42,000 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 StatePlane North Carolina FIPS 3200 Feet
2. Orthoimagery © NCOneMap, 2015.

Legend

- Project Study Area 2017
- Project Study Area 2009

Project Location
Kings Mountain/Shelby
Cleveland County, NC

171001847
Prepared by JPA on 2019-02-11
Technical Review by MMR on 2019-02-11
Independent Review by ALC on 2019-02-11

Client/Project
NCDOT - Division 12
Shelby Bypass
TIP R-2707D&E

Figure No.
2-1

Title
Potential Jurisdictional Features Map

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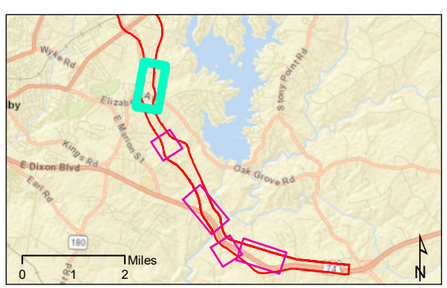

NC DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
DIVISION 12

0 300 600 Feet

1:3,600 (At original document size of 11x17)

Notes
1. Coordinate System: NAD 1983 StatePlane North Carolina FIPS 3200 Feet
2. Orthoimagery © NCOneMap, 2015.

Legend
- Select Culverts
- Jurisdictional Streams
- Jurisdictional Wetlands
- Open Water
- Project Study Area 2017
- Preservation Areas (excluded from JD)
- Project Study Area 2009

Project Location
Kings Mountain/Shelby
Cleveland County, NC

171001847
Prepared by JPA on 2019-02-11
Technical Review by MMR on 2019-02-11
Independent Review by ALC on 2019-02-11

Client/Project
NCDOT - Division 12
Shelby Bypass
TIP R-2707D&E

Figure No.
2-2

Title
Potential Jurisdictional Features Map

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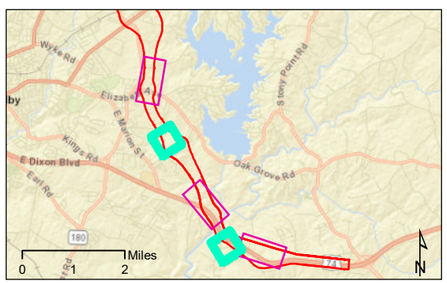

NC DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
DIVISION 12

0 300 600 Feet

1:3,600 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 StatePlane North Carolina FIPS 3200 Feet
2. Orthoimagery © NCOneMap, 2015.

Legend

- Select Culverts
- Jurisdictional Streams
- Jurisdictional Wetlands
- Open Water
- Project Study Area 2017
- Preservation Areas (excluded from JD)
- Project Study Area 2009

Project Location
Kings Mountain/Shelby
Cleveland County, NC

171001847
Prepared by JPA on 2019-02-11
Technical Review by MMR on 2019-02-11
Independent Review by ALC on 2019-02-11

Client/Project
NCDOT - Division 12
Shelby Bypass
TIP R-2707D&E

Figure No.
2-3

Title
Potential Jurisdictional Features Map

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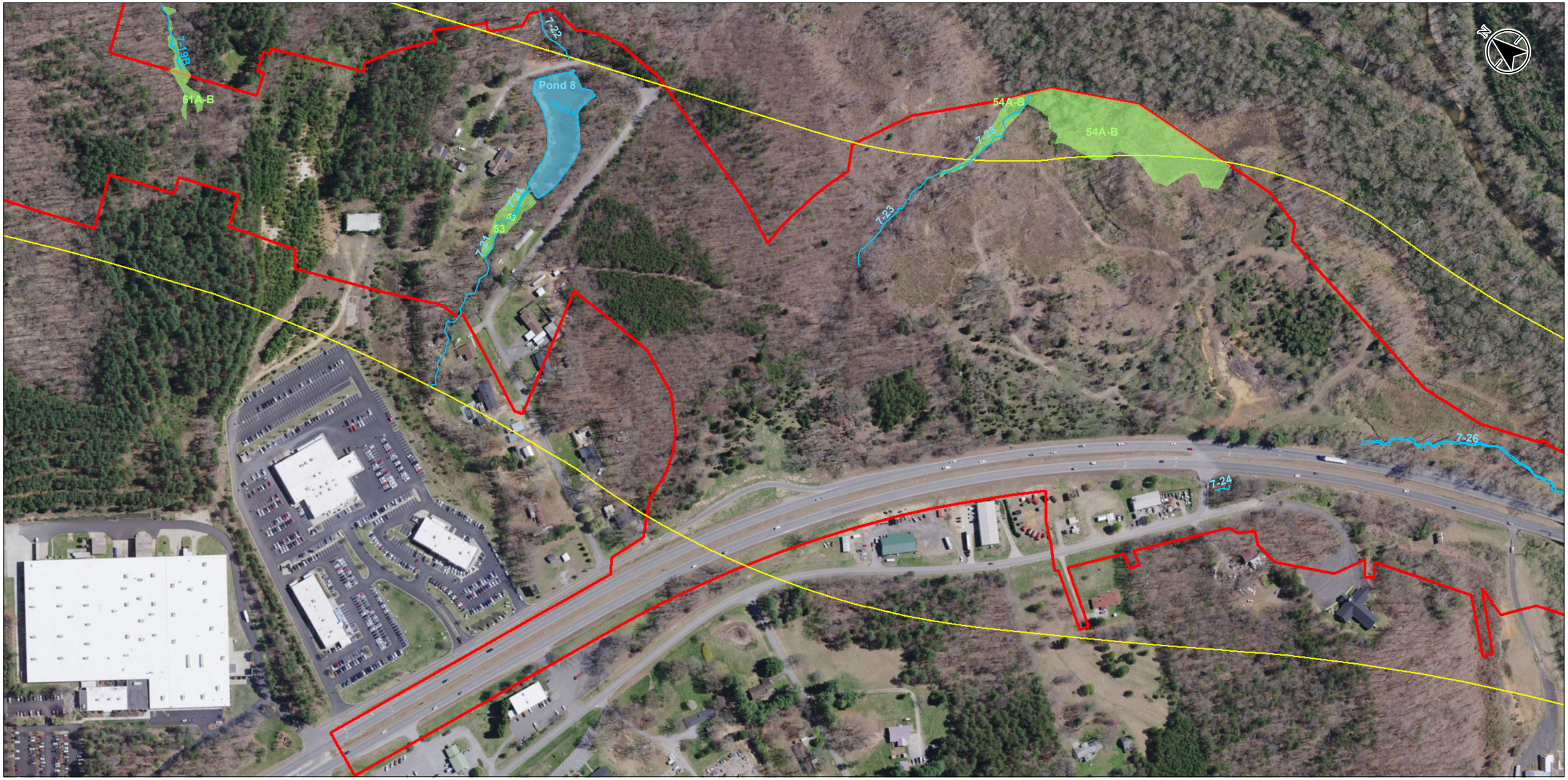

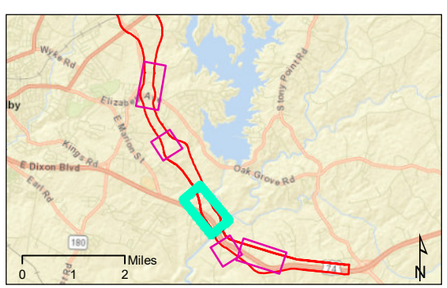

NC DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
DIVISION 12

0 300 600 Feet

1:3,600 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 StatePlane North Carolina FIPS 3200 Feet
2. Orthoimagery © NCOneMap, 2015.

Legend

- Select Culverts
- Jurisdictional Streams
- Jurisdictional Wetlands
- Open Water
- Project Study Area 2017
- Preservation Areas (excluded from JD)
- Project Study Area 2009

Project Location
Kings Mountain/Shelby
Cleveland County, NC

171001847
Prepared by JPA on 2019-02-11
Technical Review by MMR on 2019-02-11
Independent Review by ALC on 2019-02-11

Client/Project
NCDOT - Division 12
Shelby Bypass
TIP R-2707D&E

Figure No.
2-4

Title
Potential Jurisdictional Features Map

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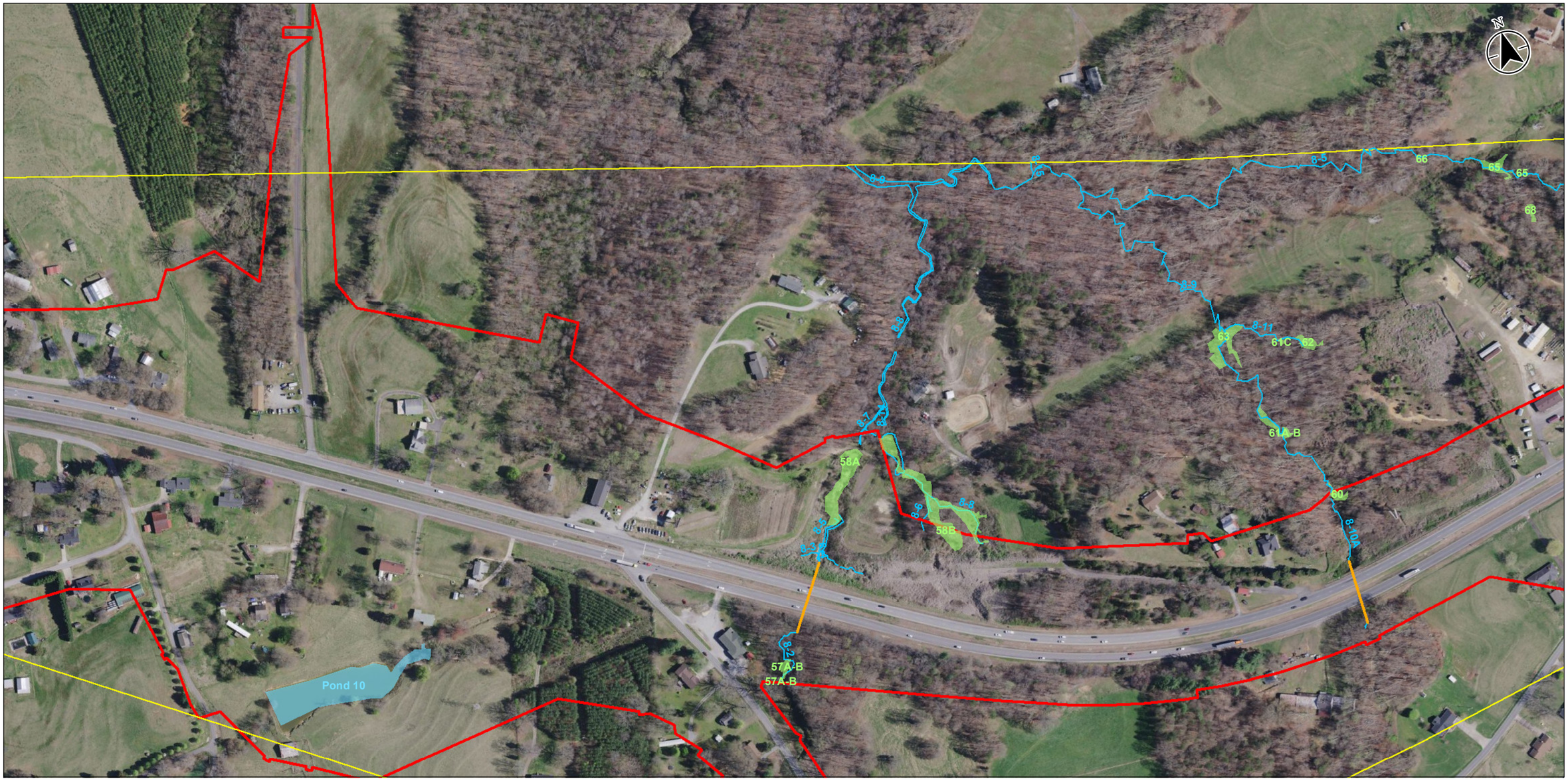

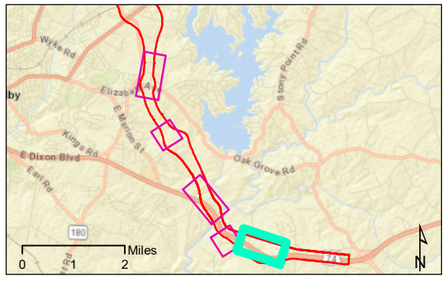

NC DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
DIVISION 12

0 300 600 Feet

1:3,600 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 StatePlane North Carolina FIPS 3200 Feet
2. Orthoimagery © NCOneMap, 2015.

Legend

- Select Culverts
- Jurisdictional Streams
- Jurisdictional Wetlands
- Open Water
- Project Study Area 2017
- Preservation Areas (excluded from JD)
- Project Study Area 2009

Project Location
Kings Mountain/Shelby
Cleveland County, NC

171001847
Prepared by JPA on 2019-02-11
Technical Review by MMR on 2019-02-11
Independent Review by ALC on 2019-02-11

Client/Project
NCDOT - Division 12
Shelby Bypass
TIP R-2707D&E

Figure No.
2-5

Title
Potential Jurisdictional Features Map

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WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Expanded 54AB

Project/Site: R-2707DE Shelby Bypass | City/County: King's Mountain/Cleveland | Sampling Date: 2/7/2019

Applicant/Owner: NCDOT | State: NC | Sampling Point: WA - Wet

Investigator(s): Justin Ahn | Section, Township, Range: N/A

Landform: (hillslope, terrace, etc.) Depression | Local Relief (concave, convex, none): Concave | Slope (%): 1%

Subregion (LRR or MLRA) LRR P | Lat: 35.261137 | Long: -81.458889 | Datum: NAD83

Soil Map Unit Name: Grover gravelly sandy loam, 15 to 30 percent slopes, rocky | NWI Classification: N/A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ☑ No ☐ (no, explain in Remarks.)

Are Vegetation ☐, Soil ☐, or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ☐ No ☑

Are Vegetation ☐, Soil ☐, or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☑	No ☐	Is the Sampled Area within a wetland?	Yes ☑	No ☐
Hydric Soil Present?	Yes ☑	No ☐			
Wetland Hydrology Present?	Yes ☑	No ☐			

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply):

- ☑ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☑ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☑ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Much Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☑ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ☑	No ☐	Depth (inches):	4	
Water Table Present?	Yes ☑	No ☐	Depth (inches):	14	
Saturation Present? (includes capillary fringe)	Yes ☑	No ☐	Depth (inches):	14	

Wetland Hydrology Present? **Yes** ☑ **No** ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five Strata) - Use scientific names of plants.

Sampling Point: WA - Wet

		Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 30 ft radius)				
1.				
2.				
3.				
4.				
5.				
6.				
7.				
		0	= Total Cover	
	50% of total cover:		20% of total cover:	
Sapling Stratum (Plot size: 30 ft radius)				
1.	*Carpinus caroliniana*	15	Y	FAC
2.				
3.				
4.				
5.				
6.				
7.				
		15	= Total Cover	
	50% of total cover:		20% of total cover:	
Shrub Stratum (Plot size: 30 ft radius)				
1.	*Rubus argutus*	15	Y	FACU
2.	*Acer rubrum*	10	Y	FAC
3.				
4.				
5.				
6.				
7.				
		25	= Total Cover	
	50% of total cover:		20% of total cover:	
Herb Stratum (Plot size: 30 ft radius)				
1.	*Arundinaria gigantea*	25	Y	FACW
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
		25	= Total Cover	
	50% of total cover:		20% of total cover:	
Woody Vine Stratum (Plot size: 30 ft radius)				
1.	*Lonicera japonica*	5	Y	FACU
2.				
3.				
4.				
5.				
		5	= Total Cover	
	50% of total cover:		20% of total cover:	

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	3	(A)
Total Number of Dominant Species Across All Strata:	5	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	60%	(A/B)

Prevalence Index worksheet:

OBL species	0	x 1 =	0
FACW species	25	x 2 =	50
FAC species	25	x 3 =	75
FACU species	20	x 4 =	80
UPL species	0	x 5 =	0
Column Totals:	70 (A)		205 (B)

Prevalence Index = B/A = 2.9

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is > 50%
- ☑ 3 - Prevalence Index is ≤ 3.0[1]
- ☐ 4 - Problematic Hydrophytic Vegetation[1] (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic

Definitions of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? **Yes** ☑ **No** ☐

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: WA - Wet

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-4	10YR 5/2	90	5YR 5/6	10	C	PL	SiC	Silty Clay
4-16	10YR 4/2	90	5YR 5/6	10	C	PL	SiCL	Silty Clay Loam

[1]Type C = Concentration, D = depletion, RM = Reduced Matrix, CS = Covered or Coated Sand Grains

[2]Location: PL = Pore Lining, M = Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) **(LRR N)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ☐ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ☐ Umbric Surface (F13) **(MLRA 136, 122)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ☐ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Coast Prairie Redox (A16) **(MLRA 136, 147)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ☐ Very Shallow Dark Surface (TF12) **(LRR T,U)**
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):
Type:
Depth (inches)

Hydric Soil Present? **Yes** ☑ **No** ☐

Remarks:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: R-2707DE Shelby Bypass | City/County: King's Mountain/Cleveland | Sampling Date: 2/7/2019
Applicant/Owner: NCDOT | State: NC | Sampling Point: WA - Up
Investigator(s): Justin Ahn | Section, Township, Range: N/A
Landform: (hillslope, terrace, etc.) Toe Slope | Local Relief (concave, convex, none): Concave | Slope (%): 5%
Subregion (LRR or MLRA) LRR P | Lat: 35.261137 | Long: -81.458889 | Datum: NAD83
Soil Map Unit Name: Grover gravelly sandy loam, 15 to 30 percent slopes, rocky | NWI Classification: N/A
Are climatic/hydrologic conditions on the site typical for this time of year? Yes ☑ No ☐ (no, explain in Remarks.)
Are Vegetation ☐, Soil ☐, or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ☐ No ☑
Are Vegetation ☐, Soil ☐, or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☐	No ☑	Is the Sampled Area within a wetland?	Yes ☐ No ☑
Hydric Soil Present?	Yes ☐	No ☑		
Wetland Hydrology Present?	Yes ☐	No ☑		

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply):

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Much Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ☐	No ☑	Depth (inches):	
Water Table Present?	Yes ☐	No ☑	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ☐	No ☑	Depth (inches):	

Wetland Hydrology Present? **Yes** ☐ **No** ☑

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five Strata) - Use scientific names of plants.

Sampling Point: WA - Up

		Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 30 ft radius)				
1.	*Acer rubrum*	20	Y	FAC
2.				
3.				
4.				
5.				
6.				
7.				
		20 = Total Cover		
	50% of total cover: 10	20% of total cover: 4		
Sapling Stratum (Plot size:)				
1.				
2.				
3.				
4.				
5.				
6.				
7.				
		0 = Total Cover		
	50% of total cover:	20% of total cover:		
Shrub Stratum (Plot size: 30 ft radius)				
1.	*Ligustrum sinense*	15	Y	FACU
2.	*Rubus argutus*	10	Y	FACU
3.				
4.				
5.				
6.				
7.				
		25 = Total Cover		
	50% of total cover: 12.5	20% of total cover: 5		
Herb Stratum (Plot size: 30 ft radius)				
1.	*Polystichum acrostichoides*	15	Y	FACU
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
		15 = Total Cover		
	50% of total cover: 7.5	20% of total cover: 3		
Woody Vine Stratum (Plot size: 30 ft radius				
1.	*Lonicera japonica*	10	Y	FACU
2.				
3.				
4.				
5.				
		10 = Total Cover		
	50% of total cover: 5	20% of total cover: 2		

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 20% (A/B)

Prevalence Index worksheet:

OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	20	x 3 =	60
FACU species	50	x 4 =	200
UPL species	0	x 5 =	0
Column Totals:	70 (A)		260 (B)

Prevalence Index = B/A = 3.7

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☐ 2 - Dominance Test is > 50%
- ☐ 3 - Prevalence Index is ≤ 3.0[1]
- ☐ 4 - Problematic Hydrophytic Vegetation[1] (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic

Definitions of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ☐ No ☑

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: WA - Up

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-16	7.5YR 4/6	100					SL	Sandy Loam, Mica present

[1]Type C = Concentration, D = depletion, RM = Reduced Matrix, CS = Covered or Coated Sand Grains

[2]Location: PL = Pore Lining, M = Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) **(LRR N)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ☐ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ☐ Umbric Surface (F13) **(MLRA 136, 122)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ☐ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Coast Prairie Redox (A16) **(MLRA 136, 147)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ☐ Very Shallow Dark Surface (TF12) **(LRR T,U)**
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):
Type:
Depth (inches)

Hydric Soil Present? **Yes** ☐ **No** ☑

Remarks:

NC SAM FIELD ASSESSMENT RESULTS
Accompanies User Manual Version 2.1

USACE AID #: NCDWR #:

INSTRUCTIONS: Attach a sketch of the assessment area and photographs. Attach a copy of the USGS 7.5-minute topographic quadrangle, and circle the location of the stream reach under evaluation. If multiple stream reaches will be evaluated on the same property, identify and number all reaches on the attached map, and include a separate form for each reach. See the NC SAM User Manual for detailed descriptions and explanations of requested information. Record in the "Notes/Sketch" section if supplementary measurements were performed. See the NC SAM User Manual for examples of additional measurements that may be relevant.

NOTE EVIDENCE OF STRESSORS AFFECTING THE ASSESSMENT AREA (do not need to be within the assessment area).

PROJECT/SITE INFORMATION:

1. Project name (if any): R2707
2. Date of evaluation: 11/10/2017
3. Applicant/owner name: NCDOT
4. Assessor name/organization: Melissa Ruiz, Alex Baldwin, Stnatec
5. County: Cleveland
6. Nearest named water body on USGS 7.5-minute quad: Buffalo Creek
7. River basin: Broad
8. Site coordinates (decimal degrees, at lower end of assessment reach): 35.253162, -81.455705

STREAM INFORMATION: (depth and width can be approximations)

9. Site number (show on attached map): 7-30 DS
10. Length of assessment reach evaluated (feet): 100
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 15 ☐Unable to assess channel depth.
12. Channel width at top of bank (feet): 15
13. Is assessment reach a swamp steam? ☐Yes ☐No
14. Feature type: ☐Perennial flow ☒Intermittent flow ☐Tidal Marsh Stream

STREAM CATEGORY INFORMATION:

15. NC SAM Zone: ☐ Mountains (M) ☒ Piedmont (P) ☐ Inner Coastal Plain (I) ☐ Outer Coastal Plain (O)
16. Estimated geomorphic valley shape (**skip for Tidal Marsh Stream**):
☐A (more sinuous stream, flatter valley slope)
☒B (less sinuous stream, steeper valley slope)
17. Watershed size: **(skip for Tidal Marsh Stream**) ☒Size 1 (< 0.1 mi^2) ☐Size 2 (0.1 to < 0.5 mi^2) ☐Size 3 (0.5 to < 5 mi^2) ☐Size 4 (≥ 5 mi^2)

ADDITIONAL INFORMATION:

18. Were regulatory considerations evaluated? ☒Yes ☐No If Yes, check all that apply to the assessment area.
☐Section 10 water ☐Classified Trout Waters ☐Water Supply Watershed (☐I ☐II ☐III ☐IV ☐V)
☐Essential Fish Habitat ☐Primary Nursery Area ☐ High Quality Waters/Outstanding Resource Waters
☐Publicly owned property ☐NCDWR Riparian buffer rule in effect ☐Nutrient Sensitive Waters
☐Anadromous fish ☐303(d) List ☐CAMA Area of Environmental Concern (AEC)
☐Documented presence of a federal and/or state listed protected species within the assessment area.
List species:
☐Designated Critical Habitat (list species)
19. Are additional stream information/supplementary measurements included in "Notes/Sketch" section or attached? ☐Yes ☒No

1. Channel Water – assessment reach metric (skip for Size 1 streams and Tidal Marsh Streams)
☐A Water throughout assessment reach.
☒B No flow, water in pools only.
☐C No water in assessment reach.

2. Evidence of Flow Restriction – assessment reach metric
☐A At least 10% of assessment reach in-stream habitat or riffle-pool sequence is severely affected by a flow restriction or fill to the point of obstructing flow or a channel choked with aquatic macrophytes or ponded water or impoundment on flood or ebb within the assessment reach (examples: undersized or perched culverts, causeways that constrict the channel, tidal gates, debris jams, beaver dams).
☒B Not A

3. Feature Pattern – assessment reach metric
☒A A majority of the assessment reach has altered pattern (examples: straightening, modification above or below culvert).
☐B Not A

4. Feature Longitudinal Profile – assessment reach metric
☒A Majority of assessment reach has a substantially altered stream profile (examples: channel down-cutting, existing damming, over widening, active aggradation, dredging, and excavation where appropriate channel profile has not reformed from any of these disturbances).
☐B Not A

5. Signs of Active Instability – assessment reach metric
Consider only current instability, not past events from which the stream has currently recovered. Examples of instability include active bank failure, active channel down-cutting (head-cut), active widening, and artificial hardening (such as concrete, gabion, rip-rap).
☐A < 10% of channel unstable
☐B 10 to 25% of channel unstable
☒C > 25% of channel unstable

6. Streamside Area Interaction – streamside area metric
Consider for the Left Bank (LB) and the Right Bank (RB).

LB	RB	
☐A	☐A	Little or no evidence of conditions that adversely affect reference interaction
☐B	☐B	Moderate evidence of conditions (examples: berms, levees, down-cutting, aggradation, dredging) that adversely affect reference interaction (examples: limited streamside area access, disruption of flood flows through streamside area, leaky or intermittent bulkheads, causeways with floodplain constriction, minor ditching [including mosquito ditching])
☒C	☒C	Extensive evidence of conditions that adversely affect reference interaction (little to no floodplain/intertidal zone access [examples: causeways with floodplain and channel constriction, bulkheads, retaining walls, fill, stream incision, disruption of flood flows through streamside area] or too much floodplain/intertidal zone access [examples: impoundments, intensive mosquito ditching]) or floodplain/intertidal zone unnaturally absent or assessment reach is a man-made feature on an interstream divide

7. Water Quality Stressors – assessment reach/intertidal zone metric
Check all that apply.

- ☐A Discolored water in stream or intertidal zone (milky white, blue, unnatural water discoloration, oil sheen, stream foam)
- ☐B Excessive sedimentation (burying of stream features or intertidal zone)
- ☐C Noticeable evidence of pollutant discharges entering the assessment reach and causing a water quality problem
- ☐D Odor (not including natural sulfide odors)
- ☐E Current published or collected data indicating degraded water quality in the assessment reach. Cite source in "Notes/Sketch" section.
- ☐F Livestock with access to stream or intertidal zone
- ☐G Excessive algae in stream or intertidal zone
- ☐H Degraded marsh vegetation in the intertidal zone (removal, burning, regular mowing, destruction, etc)
- ☒I Other: _____ (explain in "Notes/Sketch" section)
- ☐J Little to no stressors

8. Recent Weather – watershed metric (skip for Tidal Marsh Streams)
For Size 1 or 2 streams, D1 drought or higher is considered a drought; for Size 3 or 4 streams, D2 drought or higher is considered a drought.

- ☐A Drought conditions and no rainfall or rainfall not exceeding 1 inch within the last 48 hours
- ☐B Drought conditions and rainfall exceeding 1 inch within the last 48 hours
- ☒C No drought conditions

9. Large or Dangerous Stream – assessment reach metric
☐Yes ☒No Is stream is too large or dangerous to assess? If Yes, skip to Metric 13 (Streamside Area Ground Surface Condition).

10. Natural In-stream Habitat Types – assessment reach metric
10a. ☒Yes ☐No Degraded in-stream habitat over majority of the assessment reach (examples of stressors include excessive sedimentation, mining, excavation, in-stream hardening [for example, rip-rap], recent dredging, and snagging) **(evaluate for Size 4 Coastal Plain streams only, then skip to Metric 12)**

10b. **Check all that occur** (occurs if > 5% coverage of assessment reach) **(skip for Size 4 Coastal Plain streams)**

- ☐A Multiple aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
- ☐B Multiple sticks and/or leaf packs and/or emergent vegetation
- ☐C Multiple snags and logs (including lap trees)
- ☐D 5% undercut banks and/or root mats and/or roots in banks extend to the normal wetted perimeter
- ☒E Little or no habitat

Check for Tidal Marsh Streams Only

- ☐F 5% oysters or other natural hard bottoms
- ☐G Submerged aquatic vegetation
- ☐H Low-tide refugia (pools)
- ☐I Sand bottom
- ☐J 5% vertical bank along the marsh
- ☐K Little or no habitat

**************************************REMAINING QUESTIONS ARE NOT APPLICABLE FOR TIDAL MARSH STREAMS*********************************

11. Bedform and Substrate – assessment reach metric (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)

11a. ☐Yes ☒No Is assessment reach in a natural sand-bed stream? **(skip for Coastal Plain streams)**

11b. Bedform evaluated. **Check the appropriate box(es).**

- ☒A Riffle-run section **(evaluate 11c)**
- ☐B Pool-glide section **(evaluate 11d)**
- ☐C Natural bedform absent **(skip to Metric 12, Aquatic Life)**

11c. In riffle sections, check all that occur below the normal wetted perimeter of the assessment reach – whether or not submerged. **Check at least one box in each row (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)**. Not Present (NP) = absent, Rare (R) = present but ≤ 10%, Common (C) = > 10-40%, Abundant (A) = > 40-70%, Predominant (P) = > 70%. Cumulative percentages should not exceed 100% for each assessment reach.

NP	R	C	A	P	
☒	☐	☐	☐	☐	Bedrock/saprolite
☒	☐	☐	☐	☐	Boulder (256 – 4096 mm)
☐	☐	☒	☐	☐	Cobble (64 – 256 mm)
☐	☐	☒	☐	☐	Gravel (2 – 64 mm)
☐	☐	☐	☒	☐	Sand (.062 – 2 mm)
☒	☐	☐	☐	☐	Silt/clay (< 0.062 mm)
☒	☐	☐	☐	☐	Detritus
☒	☐	☐	☐	☐	Artificial (rip-rap, concrete, etc.)

11d. ☐Yes ☐No Are pools filled with sediment? (**skip for Size 4 Coastal Plain streams and Tidal Marsh Streams**)

12. Aquatic Life – assessment reach metric (skip for Tidal Marsh Streams)

12a. ☒Yes ☐No Was an in-stream aquatic life assessment performed as described in the User Manual?
If No, select one of the following reasons and skip to Metric 13. ☐No Water ☐Other: _____

12b. ☐Yes ☒No Are aquatic organisms present in the assessment reach (look in riffles, pools, then snags)? If Yes, check all that apply. If No, skip to Metric 13.

1	>1	Numbers over columns refer to "individuals" for Size 1 and 2 streams and "taxa" for Size 3 and 4 streams.
☐	☐	Adult frogs
☐	☐	Aquatic reptiles
☐	☐	Aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
☐	☐	Beetles
☐	☐	Caddisfly larvae (T)
☐	☐	Asian clam (*Corbicula*)
☐	☐	Crustacean (isopod/amphipod/crayfish/shrimp)
☐	☐	Damselfly and dragonfly larvae
☐	☐	Dipterans
☐	☐	Mayfly larvae (E)
☐	☐	Megaloptera (alderfly, fishfly, dobsonfly larvae)
☐	☐	Midges/mosquito larvae
☐	☐	Mosquito fish (*Gambusia*) or mud minnows (*Umbra pygmaea*)
☐	☐	Mussels/Clams (not *Corbicula*)
☐	☐	Other fish
☐	☐	Salamanders/tadpoles
☐	☐	Snails
☐	☐	Stonefly larvae (P)
☐	☐	Tipulid larvae
☐	☐	Worms/leeches

13. Streamside Area Ground Surface Condition – streamside area metric (skip for Tidal Marsh Streams and B valley types)
Consider for the Left Bank (LB) and the Right Bank (RB). Consider storage capacity with regard to both overbank flow and upland runoff.

LB	RB	
☐A	☐A	Little or no alteration to water storage capacity over a majority of the streamside area
☐B	☐B	Moderate alteration to water storage capacity over a majority of the streamside area
☒C	☒C	Severe alteration to water storage capacity over a majority of the streamside area (examples: ditches, fill, soil compaction, livestock disturbance, buildings, man-made levees, drainage pipes)

14. Streamside Area Water Storage – streamside area metric (skip for Size 1 streams, Tidal Marsh Streams, and B valley types)
Consider for the Left Bank (LB) and the Right Bank (RB) of the streamside area.

LB	RB	
☐A	☐A	Majority of streamside area with depressions able to pond water ≥ 6 inches deep
☐B	☐B	Majority of streamside area with depressions able to pond water 3 to 6 inches deep
☒C	☒C	Majority of streamside area with depressions able to pond water < 3 inches deep

15. Wetland Presence – streamside area metric (skip for Tidal Marsh Streams)
Consider for the Left Bank (LB) and the Right Bank (RB). Do not consider wetlands outside of the streamside area or within the normal wetted perimeter of assessment reach.

LB	RB	
☐Y	☐Y	Are wetlands present in the streamside area?
☒N	☒N	

16. Baseflow Contributors – assessment reach metric (skip for Size 4 streams and Tidal Marsh Streams)
Check all contributors within the assessment reach or within view of <u>and</u> draining to the assessment reach.

- ☐A Streams and/or springs (jurisdictional discharges)
- ☐B Ponds (include wet detention basins; do not include sediment basins or dry detention basins)
- ☐C Obstruction passing flow during low-flow periods within the assessment area (beaver dam, leaky dam, bottom-release dam, weir)
- ☐D Evidence of bank seepage or sweating (iron in water indicates seepage)
- ☐E Stream bed or bank soil reduced (dig through deposited sediment if present)
- ☒F None of the above

17. Baseflow Detractors – assessment area metric (skip for Tidal Marsh Streams)
Check all that apply.

- ☐A Evidence of substantial water withdrawals from the assessment reach (includes areas excavated for pump installation)
- ☐B Obstruction not passing flow during low-flow periods affecting the assessment reach (ex: watertight dam, sediment deposit)
- ☒C Urban stream (≥ 24% impervious surface for watershed)
- ☒D Evidence that the streamside area has been modified resulting in accelerated drainage into the assessment reach
- ☐E Assessment reach relocated to valley edge
- ☐F None of the above

18. Shading – assessment reach metric (skip for Tidal Marsh Streams)
Consider aspect. Consider "leaf-on" condition.

- ☐A Stream shading is appropriate for stream category (may include gaps associated with natural processes)
- ☒B Degraded (example: scattered trees)
- ☐C Stream shading is gone or largely absent

19. Buffer Width – streamside area metric (skip for Tidal Marsh Streams)

Consider "vegetated buffer" and "wooded buffer" separately for left bank (LB) and right bank (RB) starting at the top of bank out to the first break.

Vegetated		Wooded		
LB	RB	LB	RB	
☒A	☐A	☐A	☐A	≥ 100 feet wide or extends to the edge of the watershed
☐B	☒B	☐B	☐B	From 50 to < 100 feet wide
☐C	☐C	☐C	☐C	From 30 to < 50 feet wide
☐D	☐D	☒D	☐D	From 10 to < 30 feet wide
☐E	☐E	☐E	☒E	< 10 feet wide or no trees

20. Buffer Structure – streamside area metric (skip for Tidal Marsh Streams)

Consider for left bank (LB) and right bank (RB) for Metric 19 ("Vegetated" Buffer Width).

LB	RB	
☐A	☐A	Mature forest
☐B	☐B	Non-mature woody vegetation or modified vegetation structure
☒C	☒C	Herbaceous vegetation with or without a strip of trees < 10 feet wide
☐D	☐D	Maintained shrubs
☐E	☐E	Little or no vegetation

21. Buffer Stressors – streamside area metric (skip for Tidal Marsh Streams)

Check all appropriate boxes for left bank (LB) and right bank (RB). Indicate if listed stressor abuts stream (Abuts), does not abut but is within 30 feet of stream (< 30 feet), or is between 30 to 50 feet of stream (30-50 feet).

If none of the following stressors occurs on either bank, check here and skip to Metric 22: ☒

Abuts		< 30 feet		30-50 feet		
LB	RB	LB	RB	LB	RB	
☐A	☐A	☐A	☐A	☐A	☐A	Row crops
☐B	☐B	☐B	☐B	☐B	☐B	Maintained turf
☐C	☐C	☐C	☐C	☐C	☐C	Pasture (no livestock)/commercial horticulture
☐D	☐D	☐D	☐D	☐D	☐D	Pasture (active livestock use)

22. Stem Density – streamside area metric (skip for Tidal Marsh Streams)

Consider for left bank (LB) and right bank (RB) for Metric 19 ("Wooded" Buffer Width).

LB	RB	
☐A	☐A	Medium to high stem density
☒B	☒B	Low stem density
☐C	☐C	No wooded riparian buffer or predominantly herbaceous species or bare ground

23. Continuity of Vegetated Buffer – streamside area metric (skip for Tidal Marsh Streams)

Consider whether vegetated buffer is continuous along stream (parallel). Breaks are areas lacking vegetation > 10 feet wide.

LB	RB	
☒A	☒A	The total length of buffer breaks is < 25 percent.
☐B	☐B	The total length of buffer breaks is between 25 and 50 percent.
☐C	☐C	The total length of buffer breaks is > 50 percent.

24. Vegetative Composition – streamside area metric (skip for Tidal Marsh Streams)

Evaluate the dominant vegetation within 100 feet of each bank or to the edge of the watershed (whichever comes first) as it contributes to assessment reach habitat.

LB	RB	
☐A	☐A	Vegetation is close to undisturbed in species present and their proportions. Lower strata composed of native species, with non-native invasive species absent or sparse.
☒B	☒B	Vegetation indicates disturbance in terms of species diversity or proportions, but is still largely composed of native species. This may include communities of weedy native species that develop after clear-cutting or clearing or communities with non-native invasive species present, but not dominant, over a large portion of the expected strata or communities missing understory but retaining canopy trees.
☐C	☐C	Vegetation is severely disturbed in terms of species diversity or proportions. Mature canopy is absent or communities with non-native invasive species dominant over a large portion of expected strata or communities composed of planted stands of non-characteristic species or communities inappropriately composed of a single species or no vegetation.

25. Conductivity – assessment reach metric (skip for all Coastal Plain streams)

25a. ☐Yes ☒No Was conductivity measurement recorded?
If No, select one of the following reasons. ☒No Water ☐Other: _____

25b. Check the box corresponding to the conductivity measurement (units of microsiemens per centimeter).
☐A < 46 ☐B 46 to < 67 ☐C 67 to < 79 ☐D 79 to < 230 ☐E ≥ 230

Notes/Sketch:

Draft NC SAM Stream Rating Sheet
Accompanies User Manual Version 2.1

Stream Site Name	R2707	Date of Assessment	11/10/2017
Stream Category	Pb1	Assessor Name/Organization	Melissa Ruiz, Alex Baldwin, Stnatec

Notes of Field Assessment Form (Y/N)	NO
Presence of regulatory considerations (Y/N)	NO
Additional stream information/supplementary measurements included (Y/N)	NO
NC SAM feature type (perennial, intermittent, Tidal Marsh Stream)	Intermittent

Function Class Rating Summary	USACE/ All Streams	NCDWR Intermittent
(1) Hydrology	**LOW**	**LOW**
(2) Baseflow	**LOW**	**LOW**
(2) Flood Flow	**LOW**	**LOW**
(3) Streamside Area Attenuation	**LOW**	**LOW**
(4) Floodplain Access	**LOW**	**LOW**
(4) Wooded Riparian Buffer	**LOW**	**LOW**
(4) Microtopography	NA	NA
(3) Stream Stability	**LOW**	**LOW**
(4) Channel Stability	**LOW**	**LOW**
(4) Sediment Transport	**MEDIUM**	**MEDIUM**
(4) Stream Geomorphology	**LOW**	**LOW**
(2) Stream/Intertidal Zone Interaction	NA	NA
(2) Longitudinal Tidal Flow	NA	NA
(2) Tidal Marsh Stream Stability	NA	NA
(3) Tidal Marsh Channel Stability	NA	NA
(3) Tidal Marsh Stream Geomorphology	NA	NA
(1) Water Quality	**LOW**	**LOW**
(2) Baseflow	**LOW**	**LOW**
(2) Streamside Area Vegetation	**MEDIUM**	**MEDIUM**
(3) Upland Pollutant Filtration	**MEDIUM**	**MEDIUM**
(3) Thermoregulation	**MEDIUM**	**MEDIUM**
(2) Indicators of Stressors	**YES**	**YES**
(2) Aquatic Life Tolerance	**HIGH**	**NA**
(2) Intertidal Zone Filtration	NA	NA
(1) Habitat	**LOW**	**LOW**
(2) In-stream Habitat	**LOW**	**LOW**
(3) Baseflow	**LOW**	**LOW**
(3) Substrate	**MEDIUM**	**MEDIUM**
(3) Stream Stability	**LOW**	**LOW**
(3) In-stream Habitat	**LOW**	**LOW**
(2) Stream-side Habitat	**LOW**	**LOW**
(3) Stream-side Habitat	**LOW**	**LOW**
(3) Thermoregulation	**LOW**	**LOW**
(2) Tidal Marsh In-stream Habitat	NA	NA
(3) Flow Restriction	NA	NA
(3) Tidal Marsh Stream Stability	NA	NA
(4) Tidal Marsh Channel Stability	NA	NA
(4) Tidal Marsh Stream Geomorphology	NA	NA
(3) Tidal Marsh In-stream Habitat	NA	NA
(2) Intertidal Zone	NA	NA
Overall	**LOW**	**LOW**

NC SAM FIELD ASSESSMENT RESULTS
Accompanies User Manual Version 2.1

USACE AID #: NCDWR #:

INSTRUCTIONS: Attach a sketch of the assessment area and photographs. Attach a copy of the USGS 7.5-minute topographic quadrangle, and circle the location of the stream reach under evaluation. If multiple stream reaches will be evaluated on the same property, identify and number all reaches on the attached map, and include a separate form for each reach. See the NC SAM User Manual for detailed descriptions and explanations of requested information. Record in the "Notes/Sketch" section if supplementary measurements were performed. See the NC SAM User Manual for examples of additional measurements that may be relevant.

NOTE EVIDENCE OF STRESSORS AFFECTING THE ASSESSMENT AREA (do not need to be within the assessment area).

PROJECT/SITE INFORMATION:

1. Project name (if any): R2707
2. Date of evaluation: 11/10/2017
3. Applicant/owner name: NCDOT
4. Assessor name/organization: Melissa Ruiz, Alex Baldwin, Stantec
5. County: Cleveland
6. Nearest named water body on USGS 7.5-minute quad: Buffalo Creek
7. River basin: Broad
8. Site coordinates (decimal degrees, at lower end of assessment reach): 35.252177, -81.453126

STREAM INFORMATION: (depth and width can be approximations)

9. Site number (show on attached map): 7-30 DS
10. Length of assessment reach evaluated (feet): 100
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 15 ☐Unable to assess channel depth.
12. Channel width at top of bank (feet): 15
13. Is assessment reach a swamp steam? ☐Yes ☐No
14. Feature type: ☐Perennial flow ☒Intermittent flow ☐Tidal Marsh Stream

STREAM CATEGORY INFORMATION:

15. NC SAM Zone: ☐ Mountains (M) ☒ Piedmont (P) ☐ Inner Coastal Plain (I) ☐ Outer Coastal Plain (O)
16. Estimated geomorphic valley shape (**skip for Tidal Marsh Stream**):
☒A (more sinuous stream, flatter valley slope)
☐B (less sinuous stream, steeper valley slope)
17. Watershed size: **(skip for Tidal Marsh Stream**) ☒Size 1 (< 0.1 mi^2) ☐Size 2 (0.1 to < 0.5 mi^2) ☐Size 3 (0.5 to < 5 mi^2) ☐Size 4 (≥ 5 mi^2)

ADDITIONAL INFORMATION:

18. Were regulatory considerations evaluated? ☒Yes ☐No If Yes, check all that apply to the assessment area.
☐Section 10 water ☐Classified Trout Waters ☐Water Supply Watershed (☐I ☐II ☐III ☐IV ☐V)
☐Essential Fish Habitat ☐Primary Nursery Area ☐ High Quality Waters/Outstanding Resource Waters
☐Publicly owned property ☐NCDWR Riparian buffer rule in effect ☐Nutrient Sensitive Waters
☐Anadromous fish ☐303(d) List ☐CAMA Area of Environmental Concern (AEC)
☐Documented presence of a federal and/or state listed protected species within the assessment area.
List species:
☐Designated Critical Habitat (list species)
19. Are additional stream information/supplementary measurements included in "Notes/Sketch" section or attached? ☐Yes ☒No

1. Channel Water – assessment reach metric (skip for Size 1 streams and Tidal Marsh Streams)

☐A Water throughout assessment reach.
☐B No flow, water in pools only.
☒C No water in assessment reach.

2. Evidence of Flow Restriction – assessment reach metric

☐A At least 10% of assessment reach in-stream habitat or riffle-pool sequence is severely affected by a flow restriction or fill to the point of obstructing flow or a channel choked with aquatic macrophytes or ponded water or impoundment on flood or ebb within the assessment reach (examples: undersized or perched culverts, causeways that constrict the channel, tidal gates, debris jams, beaver dams).
☒B Not A

3. Feature Pattern – assessment reach metric

☒A A majority of the assessment reach has altered pattern (examples: straightening, modification above or below culvert).
☐B Not A

4. Feature Longitudinal Profile – assessment reach metric

☒A Majority of assessment reach has a substantially altered stream profile (examples: channel down-cutting, existing damming, over widening, active aggradation, dredging, and excavation where appropriate channel profile has not reformed from any of these disturbances).
☐B Not A

5. Signs of Active Instability – assessment reach metric

Consider only current instability, not past events from which the stream has currently recovered. Examples of instability include active bank failure, active channel down-cutting (head-cut), active widening, and artificial hardening (such as concrete, gabion, rip-rap).

☐A < 10% of channel unstable
☐B 10 to 25% of channel unstable
☒C > 25% of channel unstable

6. Streamside Area Interaction – streamside area metric
Consider for the Left Bank (LB) and the Right Bank (RB).

LB	RB	
☐A	☐A	Little or no evidence of conditions that adversely affect reference interaction
☐B	☐B	Moderate evidence of conditions (examples: berms, levees, down-cutting, aggradation, dredging) that adversely affect reference interaction (examples: limited streamside area access, disruption of flood flows through streamside area, leaky or intermittent bulkheads, causeways with floodplain constriction, minor ditching [including mosquito ditching])
☒C	☒C	Extensive evidence of conditions that adversely affect reference interaction (little to no floodplain/intertidal zone access [examples: causeways with floodplain and channel constriction, bulkheads, retaining walls, fill, stream incision, disruption of flood flows through streamside area] or too much floodplain/intertidal zone access [examples: impoundments, intensive mosquito ditching]) or floodplain/intertidal zone unnaturally absent or assessment reach is a man-made feature on an interstream divide

7. Water Quality Stressors – assessment reach/intertidal zone metric
Check all that apply.

- ☐A Discolored water in stream or intertidal zone (milky white, blue, unnatural water discoloration, oil sheen, stream foam)
- ☐B Excessive sedimentation (burying of stream features or intertidal zone)
- ☐C Noticeable evidence of pollutant discharges entering the assessment reach and causing a water quality problem
- ☐D Odor (not including natural sulfide odors)
- ☐E Current published or collected data indicating degraded water quality in the assessment reach. Cite source in "Notes/Sketch" section.
- ☐F Livestock with access to stream or intertidal zone
- ☐G Excessive algae in stream or intertidal zone
- ☐H Degraded marsh vegetation in the intertidal zone (removal, burning, regular mowing, destruction, etc)
- ☒I Other: _____ (explain in "Notes/Sketch" section)
- ☐J Little to no stressors

8. Recent Weather – watershed metric (skip for Tidal Marsh Streams)
For Size 1 or 2 streams, D1 drought or higher is considered a drought; for Size 3 or 4 streams, D2 drought or higher is considered a drought.

- ☐A Drought conditions and no rainfall or rainfall not exceeding 1 inch within the last 48 hours
- ☐B Drought conditions and rainfall exceeding 1 inch within the last 48 hours
- ☒C No drought conditions

9. Large or Dangerous Stream – assessment reach metric
☐Yes ☒No Is stream is too large or dangerous to assess? If Yes, skip to Metric 13 (Streamside Area Ground Surface Condition).

10. Natural In-stream Habitat Types – assessment reach metric
10a. ☒Yes ☐No Degraded in-stream habitat over majority of the assessment reach (examples of stressors include excessive sedimentation, mining, excavation, in-stream hardening [for example, rip-rap], recent dredging, and snagging) **(evaluate for Size 4 Coastal Plain streams only, then skip to Metric 12)**

10b. **Check all that occur** (occurs if > 5% coverage of assessment reach) **(skip for Size 4 Coastal Plain streams)**

- ☐A Multiple aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
- ☒B Multiple sticks and/or leaf packs and/or emergent vegetation
- ☐C Multiple snags and logs (including lap trees)
- ☐D 5% undercut banks and/or root mats and/or roots in banks extend to the normal wetted perimeter
- ☐E Little or no habitat

Check for Tidal Marsh Streams Only

- ☐F 5% oysters or other natural hard bottoms
- ☐G Submerged aquatic vegetation
- ☐H Low-tide refugia (pools)
- ☐I Sand bottom
- ☐J 5% vertical bank along the marsh
- ☐K Little or no habitat

**************************************REMAINING QUESTIONS ARE NOT APPLICABLE FOR TIDAL MARSH STREAMS*********************************

11. Bedform and Substrate – assessment reach metric (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)

11a. ☐Yes ☒No Is assessment reach in a natural sand-bed stream? **(skip for Coastal Plain streams)**

11b. Bedform evaluated. **Check the appropriate box(es).**

- ☒A Riffle-run section **(evaluate 11c)**
- ☐B Pool-glide section **(evaluate 11d)**
- ☐C Natural bedform absent **(skip to Metric 12, Aquatic Life)**

11c. In riffle sections, check all that occur below the normal wetted perimeter of the assessment reach – whether or not submerged. **Check at least one box in each row (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)**. Not Present (NP) = absent, Rare (R) = present but ≤ 10%, Common (C) = > 10-40%, Abundant (A) = > 40-70%, Predominant (P) = > 70%. Cumulative percentages should not exceed 100% for each assessment reach.

NP	R	C	A	P	
☐	☐	☒	☐	☐	Bedrock/saprolite
☒	☐	☐	☐	☐	Boulder (256 – 4096 mm)
☐	☐	☐	☒	☐	Cobble (64 – 256 mm)
☐	☐	☐	☒	☐	Gravel (2 – 64 mm)
☒	☐	☐	☐	☐	Sand (.062 – 2 mm)
☒	☐	☐	☐	☐	Silt/clay (< 0.062 mm)
☒	☐	☐	☐	☐	Detritus
☒	☐	☐	☐	☐	Artificial (rip-rap, concrete, etc.)

11d. ☐Yes ☐No Are pools filled with sediment? (**skip for Size 4 Coastal Plain streams and Tidal Marsh Streams**)

12. Aquatic Life – assessment reach metric (skip for Tidal Marsh Streams)

12a. ☐Yes ☒No Was an in-stream aquatic life assessment performed as described in the User Manual?
If No, select one of the following reasons and skip to Metric 13. ☒No Water ☐Other: _____

12b. ☐Yes ☒No Are aquatic organisms present in the assessment reach (look in riffles, pools, then snags)? If Yes, check all that apply. If No, skip to Metric 13.

1	>1	Numbers over columns refer to "individuals" for Size 1 and 2 streams and "taxa" for Size 3 and 4 streams.
☐	☐	Adult frogs
☐	☐	Aquatic reptiles
☐	☐	Aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
☐	☐	Beetles
☐	☐	Caddisfly larvae (T)
☐	☐	Asian clam (*Corbicula*)
☐	☐	Crustacean (isopod/amphipod/crayfish/shrimp)
☐	☐	Damselfly and dragonfly larvae
☐	☐	Dipterans
☐	☐	Mayfly larvae (E)
☐	☐	Megaloptera (alderfly, fishfly, dobsonfly larvae)
☐	☐	Midges/mosquito larvae
☐	☐	Mosquito fish (*Gambusia*) or mud minnows (*Umbra pygmaea*)
☐	☐	Mussels/Clams (not *Corbicula*)
☐	☐	Other fish
☐	☐	Salamanders/tadpoles
☐	☐	Snails
☐	☐	Stonefly larvae (P)
☐	☐	Tipulid larvae
☐	☐	Worms/leeches

13. Streamside Area Ground Surface Condition – streamside area metric (skip for Tidal Marsh Streams and B valley types)
Consider for the Left Bank (LB) and the Right Bank (RB). Consider storage capacity with regard to both overbank flow and upland runoff.

LB	RB	
☐A	☐A	Little or no alteration to water storage capacity over a majority of the streamside area
☐B	☐B	Moderate alteration to water storage capacity over a majority of the streamside area
☒C	☒C	Severe alteration to water storage capacity over a majority of the streamside area (examples: ditches, fill, soil compaction, livestock disturbance, buildings, man-made levees, drainage pipes)

14. Streamside Area Water Storage – streamside area metric (skip for Size 1 streams, Tidal Marsh Streams, and B valley types)
Consider for the Left Bank (LB) and the Right Bank (RB) of the streamside area.

LB	RB	
☐A	☐A	Majority of streamside area with depressions able to pond water ≥ 6 inches deep
☐B	☐B	Majority of streamside area with depressions able to pond water 3 to 6 inches deep
☒C	☒C	Majority of streamside area with depressions able to pond water < 3 inches deep

15. Wetland Presence – streamside area metric (skip for Tidal Marsh Streams)
Consider for the Left Bank (LB) and the Right Bank (RB). Do not consider wetlands outside of the streamside area or within the normal wetted perimeter of assessment reach.

LB	RB	
☐Y	☐Y	Are wetlands present in the streamside area?
☒N	☒N	

16. Baseflow Contributors – assessment reach metric (skip for Size 4 streams and Tidal Marsh Streams)
Check all contributors within the assessment reach or within view of <u>and</u> draining to the assessment reach.

- ☐A Streams and/or springs (jurisdictional discharges)
- ☐B Ponds (include wet detention basins; do not include sediment basins or dry detention basins)
- ☐C Obstruction passing flow during low-flow periods within the assessment area (beaver dam, leaky dam, bottom-release dam, weir)
- ☐D Evidence of bank seepage or sweating (iron in water indicates seepage)
- ☒E Stream bed or bank soil reduced (dig through deposited sediment if present)
- ☐F None of the above

17. Baseflow Detractors – assessment area metric (skip for Tidal Marsh Streams)
Check all that apply.

- ☐A Evidence of substantial water withdrawals from the assessment reach (includes areas excavated for pump installation)
- ☐B Obstruction not passing flow during low-flow periods affecting the assessment reach (ex: watertight dam, sediment deposit)
- ☐C Urban stream (≥ 24% impervious surface for watershed)
- ☒D Evidence that the streamside area has been modified resulting in accelerated drainage into the assessment reach
- ☐E Assessment reach relocated to valley edge
- ☐F None of the above

18. Shading – assessment reach metric (skip for Tidal Marsh Streams)
Consider aspect. Consider "leaf-on" condition.

- ☐A Stream shading is appropriate for stream category (may include gaps associated with natural processes)
- ☒B Degraded (example: scattered trees)
- ☐C Stream shading is gone or largely absent

19. Buffer Width – streamside area metric (skip for Tidal Marsh Streams)

Consider "vegetated buffer" and "wooded buffer" separately for left bank (LB) and right bank (RB) starting at the top of bank out to the first break.

Vegetated		Wooded		
LB	RB	LB	RB	
☐A	☐A	☐A	☐A	≥ 100 feet wide or extends to the edge of the watershed
☐B	☐B	☐B	☐B	From 50 to < 100 feet wide
☒C	☒C	☐C	☐C	From 30 to < 50 feet wide
☐D	☐D	☐D	☐D	From 10 to < 30 feet wide
☐E	☐E	☒E	☒E	< 10 feet wide or no trees

20. Buffer Structure – streamside area metric (skip for Tidal Marsh Streams)

Consider for left bank (LB) and right bank (RB) for Metric 19 ("Vegetated" Buffer Width).

LB	RB	
☐A	☐A	Mature forest
☐B	☐B	Non-mature woody vegetation or modified vegetation structure
☒C	☒C	Herbaceous vegetation with or without a strip of trees < 10 feet wide
☐D	☐D	Maintained shrubs
☐E	☐E	Little or no vegetation

21. Buffer Stressors – streamside area metric (skip for Tidal Marsh Streams)

Check all appropriate boxes for left bank (LB) and right bank (RB). Indicate if listed stressor abuts stream (Abuts), does not abut but is within 30 feet of stream (< 30 feet), or is between 30 to 50 feet of stream (30-50 feet).

If none of the following stressors occurs on either bank, check here and skip to Metric 22: ☒

Abuts		< 30 feet		30-50 feet		
LB	RB	LB	RB	LB	RB	
☐A	☐A	☐A	☐A	☐A	☐A	Row crops
☐B	☐B	☐B	☐B	☐B	☐B	Maintained turf
☐C	☐C	☐C	☐C	☐C	☐C	Pasture (no livestock)/commercial horticulture
☐D	☐D	☐D	☐D	☐D	☐D	Pasture (active livestock use)

22. Stem Density – streamside area metric (skip for Tidal Marsh Streams)

Consider for left bank (LB) and right bank (RB) for Metric 19 ("Wooded" Buffer Width).

LB	RB	
☐A	☐A	Medium to high stem density
☒B	☒B	Low stem density
☐C	☐C	No wooded riparian buffer or predominantly herbaceous species or bare ground

23. Continuity of Vegetated Buffer – streamside area metric (skip for Tidal Marsh Streams)

Consider whether vegetated buffer is continuous along stream (parallel). Breaks are areas lacking vegetation > 10 feet wide.

LB	RB	
☒A	☒A	The total length of buffer breaks is < 25 percent.
☐B	☐B	The total length of buffer breaks is between 25 and 50 percent.
☐C	☐C	The total length of buffer breaks is > 50 percent.

24. Vegetative Composition – streamside area metric (skip for Tidal Marsh Streams)

Evaluate the dominant vegetation within 100 feet of each bank or to the edge of the watershed (whichever comes first) as it contributes to assessment reach habitat.

LB	RB	
☐A	☐A	Vegetation is close to undisturbed in species present and their proportions. Lower strata composed of native species, with non-native invasive species absent or sparse.
☒B	☒B	Vegetation indicates disturbance in terms of species diversity or proportions, but is still largely composed of native species. This may include communities of weedy native species that develop after clear-cutting or clearing or communities with non-native invasive species present, but not dominant, over a large portion of the expected strata or communities missing understory but retaining canopy trees.
☐C	☐C	Vegetation is severely disturbed in terms of species diversity or proportions. Mature canopy is absent or communities with non-native invasive species dominant over a large portion of expected strata or communities composed of planted stands of non-characteristic species or communities inappropriately composed of a single species or no vegetation.

25. Conductivity – assessment reach metric (skip for all Coastal Plain streams)

25a. ☐Yes ☒No Was conductivity measurement recorded?
If No, select one of the following reasons. ☒No Water ☐Other: _____

25b. Check the box corresponding to the conductivity measurement (units of microsiemens per centimeter).
☐A < 46 ☐B 46 to < 67 ☐C 67 to < 79 ☐D 79 to < 230 ☐E ≥ 230

Notes/Sketch:

Draft NC SAM Stream Rating Sheet
Accompanies User Manual Version 2.1

Stream Site Name	R2707	Date of Assessment	11/10/2017
Stream Category	Pa1	Assessor Name/Organization	Melissa Ruiz, Alex Baldwin, Stantec

Notes of Field Assessment Form (Y/N)	NO
Presence of regulatory considerations (Y/N)	NO
Additional stream information/supplementary measurements included (Y/N)	NO
NC SAM feature type (perennial, intermittent, Tidal Marsh Stream)	Intermittent

Function Class Rating Summary	USACE/ All Streams	NCDWR Intermittent
(1) Hydrology	**LOW**	**LOW**
(2) Baseflow	**MEDIUM**	**MEDIUM**
(2) Flood Flow	**LOW**	**LOW**
(3) Streamside Area Attenuation	**LOW**	**LOW**
(4) Floodplain Access	**LOW**	**LOW**
(4) Wooded Riparian Buffer	**LOW**	**LOW**
(4) Microtopography	**LOW**	**LOW**
(3) Stream Stability	**LOW**	**LOW**
(4) Channel Stability	**LOW**	**LOW**
(4) Sediment Transport	**HIGH**	**HIGH**
(4) Stream Geomorphology	**LOW**	**LOW**
(2) Stream/Intertidal Zone Interaction	NA	NA
(2) Longitudinal Tidal Flow	NA	NA
(2) Tidal Marsh Stream Stability	NA	NA
(3) Tidal Marsh Channel Stability	NA	NA
(3) Tidal Marsh Stream Geomorphology	NA	NA
(1) Water Quality	**LOW**	**LOW**
(2) Baseflow	**MEDIUM**	**MEDIUM**
(2) Streamside Area Vegetation	**MEDIUM**	**MEDIUM**
(3) Upland Pollutant Filtration	**MEDIUM**	**MEDIUM**
(3) Thermoregulation	**MEDIUM**	**MEDIUM**
(2) Indicators of Stressors	**YES**	**YES**
(2) Aquatic Life Tolerance	**OMITTED**	**NA**
(2) Intertidal Zone Filtration	NA	NA
(1) Habitat	**MEDIUM**	**MEDIUM**
(2) In-stream Habitat	**HIGH**	**HIGH**
(3) Baseflow	**MEDIUM**	**MEDIUM**
(3) Substrate	**HIGH**	**HIGH**
(3) Stream Stability	**LOW**	**LOW**
(3) In-stream Habitat	**HIGH**	**HIGH**
(2) Stream-side Habitat	**LOW**	**LOW**
(3) Stream-side Habitat	**LOW**	**LOW**
(3) Thermoregulation	**LOW**	**LOW**
(2) Tidal Marsh In-stream Habitat	NA	NA
(3) Flow Restriction	NA	NA
(3) Tidal Marsh Stream Stability	NA	NA
(4) Tidal Marsh Channel Stability	NA	NA
(4) Tidal Marsh Stream Geomorphology	NA	NA
(3) Tidal Marsh In-stream Habitat	NA	NA
(2) Intertidal Zone	NA	NA
Overall	**LOW**	**LOW**

NC SAM FIELD ASSESSMENT RESULTS
Accompanies User Manual Version 2.1

USACE AID #: NCDWR #:

INSTRUCTIONS: Attach a sketch of the assessment area and photographs. Attach a copy of the USGS 7.5-minute topographic quadrangle, and circle the location of the stream reach under evaluation. If multiple stream reaches will be evaluated on the same property, identify and number all reaches on the attached map, and include a separate form for each reach. See the NC SAM User Manual for detailed descriptions and explanations of requested information. Record in the "Notes/Sketch" section if supplementary measurements were performed. See the NC SAM User Manual for examples of additional measurements that may be relevant.

NOTE EVIDENCE OF STRESSORS AFFECTING THE ASSESSMENT AREA (do not need to be within the assessment area).

PROJECT/SITE INFORMATION:

1. Project name (if any): R2707
2. Date of evaluation: 11/10/2017
3. Applicant/owner name: NCDOT
4. Assessor name/organization: Melissa Ruiz, Alex Baldwin, Stnatec
5. County: Cleveland
6. Nearest named water body on USGS 7.5-minute quad: Buffalo Creek
7. River basin: Broad
8. Site coordinates (decimal degrees, at lower end of assessment reach): 35.247951, -81.443562

STREAM INFORMATION: (depth and width can be approximations)

9. Site number (show on attached map): **8-**3, 8-4, 8-5
10. Length of assessment reach evaluated (feet): 100
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 15 ☐Unable to assess channel depth.
12. Channel width at top of bank (feet): 15
13. Is assessment reach a swamp steam? ☐Yes ☐No
14. Feature type: ☐Perennial flow ☒Intermittent flow ☐Tidal Marsh Stream

STREAM CATEGORY INFORMATION:

15. NC SAM Zone: ☐ Mountains (M) ☒ Piedmont (P) ☐ Inner Coastal Plain (I) ☐ Outer Coastal Plain (O)
16. Estimated geomorphic valley shape (**skip for Tidal Marsh Stream**):
☒A (more sinuous stream, flatter valley slope)
☐B (less sinuous stream, steeper valley slope)
17. Watershed size: **(skip for Tidal Marsh Stream**) ☒Size 1 (< 0.1 mi^2) ☐Size 2 (0.1 to < 0.5 mi^2) ☐Size 3 (0.5 to < 5 mi^2) ☐Size 4 (≥ 5 mi^2)

ADDITIONAL INFORMATION:

18. Were regulatory considerations evaluated? ☒Yes ☐No If Yes, check all that apply to the assessment area.
☐Section 10 water ☐Classified Trout Waters ☐Water Supply Watershed (☐I ☐II ☐III ☐IV ☐V)
☐Essential Fish Habitat ☐Primary Nursery Area ☐ High Quality Waters/Outstanding Resource Waters
☐Publicly owned property ☐NCDWR Riparian buffer rule in effect ☐Nutrient Sensitive Waters
☐Anadromous fish ☐303(d) List ☐CAMA Area of Environmental Concern (AEC)
☐Documented presence of a federal and/or state listed protected species within the assessment area.
List species:
☐Designated Critical Habitat (list species)
19. Are additional stream information/supplementary measurements included in "Notes/Sketch" section or attached? ☐Yes ☒No

1. Channel Water – assessment reach metric (skip for Size 1 streams and Tidal Marsh Streams)

☒A Water throughout assessment reach.
☐B No flow, water in pools only.
☐C No water in assessment reach.

2. Evidence of Flow Restriction – assessment reach metric

☒A At least 10% of assessment reach in-stream habitat or riffle-pool sequence is severely affected by a flow restriction or fill to the point of obstructing flow or a channel choked with aquatic macrophytes or ponded water or impoundment on flood or ebb within the assessment reach (examples: undersized or perched culverts, causeways that constrict the channel, tidal gates, debris jams, beaver dams).
☐B Not A

3. Feature Pattern – assessment reach metric

☒A A majority of the assessment reach has altered pattern (examples: straightening, modification above or below culvert).
☐B Not A

4. Feature Longitudinal Profile – assessment reach metric

☒A Majority of assessment reach has a substantially altered stream profile (examples: channel down-cutting, existing damming, over widening, active aggradation, dredging, and excavation where appropriate channel profile has not reformed from any of these disturbances).
☐B Not A

5. Signs of Active Instability – assessment reach metric

Consider only current instability, not past events from which the stream has currently recovered. Examples of instability include active bank failure, active channel down-cutting (head-cut), active widening, and artificial hardening (such as concrete, gabion, rip-rap).

☒A < 10% of channel unstable
☐B 10 to 25% of channel unstable
☐C > 25% of channel unstable

6. Streamside Area Interaction – streamside area metric
Consider for the Left Bank (LB) and the Right Bank (RB).

LB	RB	
☐A	☐A	Little or no evidence of conditions that adversely affect reference interaction
☐B	☐B	Moderate evidence of conditions (examples: berms, levees, down-cutting, aggradation, dredging) that adversely affect reference interaction (examples: limited streamside area access, disruption of flood flows through streamside area, leaky or intermittent bulkheads, causeways with floodplain constriction, minor ditching [including mosquito ditching])
☒C	☒C	Extensive evidence of conditions that adversely affect reference interaction (little to no floodplain/intertidal zone access [examples: causeways with floodplain and channel constriction, bulkheads, retaining walls, fill, stream incision, disruption of flood flows through streamside area] or too much floodplain/intertidal zone access [examples: impoundments, intensive mosquito ditching]) or floodplain/intertidal zone unnaturally absent or assessment reach is a man-made feature on an interstream divide

7. Water Quality Stressors – assessment reach/intertidal zone metric
Check all that apply.

- ☐A Discolored water in stream or intertidal zone (milky white, blue, unnatural water discoloration, oil sheen, stream foam)
- ☒B Excessive sedimentation (burying of stream features or intertidal zone)
- ☐C Noticeable evidence of pollutant discharges entering the assessment reach and causing a water quality problem
- ☐D Odor (not including natural sulfide odors)
- ☐E Current published or collected data indicating degraded water quality in the assessment reach. Cite source in "Notes/Sketch" section.
- ☐F Livestock with access to stream or intertidal zone
- ☐G Excessive algae in stream or intertidal zone
- ☐H Degraded marsh vegetation in the intertidal zone (removal, burning, regular mowing, destruction, etc)
- ☐I Other: _____ (explain in "Notes/Sketch" section)
- ☐J Little to no stressors

8. Recent Weather – watershed metric (skip for Tidal Marsh Streams)
For Size 1 or 2 streams, D1 drought or higher is considered a drought; for Size 3 or 4 streams, D2 drought or higher is considered a drought.

- ☐A Drought conditions and no rainfall or rainfall not exceeding 1 inch within the last 48 hours
- ☐B Drought conditions and rainfall exceeding 1 inch within the last 48 hours
- ☒C No drought conditions

9. Large or Dangerous Stream – assessment reach metric
☐Yes ☒No Is stream is too large or dangerous to assess? If Yes, skip to Metric 13 (Streamside Area Ground Surface Condition).

10. Natural In-stream Habitat Types – assessment reach metric
10a. ☒Yes ☐No Degraded in-stream habitat over majority of the assessment reach (examples of stressors include excessive sedimentation, mining, excavation, in-stream hardening [for example, rip-rap], recent dredging, and snagging) **(evaluate for Size 4 Coastal Plain streams only, then skip to Metric 12)**

10b. **Check all that occur** (occurs if > 5% coverage of assessment reach) **(skip for Size 4 Coastal Plain streams)**

- ☐A Multiple aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
- ☒B Multiple sticks and/or leaf packs and/or emergent vegetation
- ☐C Multiple snags and logs (including lap trees)
- ☐D 5% undercut banks and/or root mats and/or roots in banks extend to the normal wetted perimeter
- ☒E Little or no habitat

Check for Tidal Marsh Streams Only

- ☐F 5% oysters or other natural hard bottoms
- ☐G Submerged aquatic vegetation
- ☐H Low-tide refugia (pools)
- ☐I Sand bottom
- ☐J 5% vertical bank along the marsh
- ☐K Little or no habitat

**************************************REMAINING QUESTIONS ARE NOT APPLICABLE FOR TIDAL MARSH STREAMS*****************************

11. Bedform and Substrate – assessment reach metric (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)

11a. ☐Yes ☒No Is assessment reach in a natural sand-bed stream? **(skip for Coastal Plain streams)**

11b. Bedform evaluated. **Check the appropriate box(es).**

- ☒A Riffle-run section **(evaluate 11c)**
- ☐B Pool-glide section **(evaluate 11d)**
- ☒C Natural bedform absent **(skip to Metric 12, Aquatic Life)**

11c. In riffle sections, check all that occur below the normal wetted perimeter of the assessment reach – whether or not submerged. **Check at least one box in each row (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)**. Not Present (NP) = absent, Rare (R) = present but ≤ 10%, Common (C) = > 10-40%, Abundant (A) = > 40-70%, Predominant (P) = > 70%. Cumulative percentages should not exceed 100% for each assessment reach.

NP	R	C	A	P	
☐	☐	☒	☐	☐	Bedrock/saprolite
☒	☐	☐	☐	☐	Boulder (256 – 4096 mm)
☐	☐	☐	☒	☐	Cobble (64 – 256 mm)
☐	☐	☐	☒	☐	Gravel (2 – 64 mm)
☒	☐	☐	☐	☐	Sand (.062 – 2 mm)
☒	☐	☐	☐	☐	Silt/clay (< 0.062 mm)
☒	☐	☐	☐	☐	Detritus
☒	☐	☐	☐	☐	Artificial (rip-rap, concrete, etc.)

11d. ☐Yes ☐No Are pools filled with sediment? (**skip for Size 4 Coastal Plain streams and Tidal Marsh Streams**)

12. Aquatic Life – assessment reach metric (skip for Tidal Marsh Streams)

12a. ☒Yes ☐No Was an in-stream aquatic life assessment performed as described in the User Manual?
If No, select one of the following reasons and skip to Metric 13. ☒No Water ☐Other: _____

12b. ☐Yes ☒No Are aquatic organisms present in the assessment reach (look in riffles, pools, then snags)? If Yes, check all that apply. If No, skip to Metric 13.

1	>1	Numbers over columns refer to "individuals" for Size 1 and 2 streams and "taxa" for Size 3 and 4 streams.
☐	☐	Adult frogs
☐	☐	Aquatic reptiles
☐	☐	Aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
☐	☐	Beetles
☐	☐	Caddisfly larvae (T)
☐	☐	Asian clam (*Corbicula*)
☐	☐	Crustacean (isopod/amphipod/crayfish/shrimp)
☐	☐	Damselfly and dragonfly larvae
☐	☐	Dipterans
☐	☐	Mayfly larvae (E)
☐	☐	Megaloptera (alderfly, fishfly, dobsonfly larvae)
☐	☐	Midges/mosquito larvae
☐	☐	Mosquito fish (*Gambusia*) or mud minnows (*Umbra pygmaea*)
☐	☐	Mussels/Clams (not *Corbicula*)
☐	☐	Other fish
☐	☐	Salamanders/tadpoles
☐	☐	Snails
☐	☐	Stonefly larvae (P)
☐	☐	Tipulid larvae
☐	☐	Worms/leeches

13. Streamside Area Ground Surface Condition – streamside area metric (skip for Tidal Marsh Streams and B valley types)
Consider for the Left Bank (LB) and the Right Bank (RB). Consider storage capacity with regard to both overbank flow and upland runoff.

LB	RB	
☐A	☐A	Little or no alteration to water storage capacity over a majority of the streamside area
☒B	☒B	Moderate alteration to water storage capacity over a majority of the streamside area
☐C	☐C	Severe alteration to water storage capacity over a majority of the streamside area (examples: ditches, fill, soil compaction, livestock disturbance, buildings, man-made levees, drainage pipes)

14. Streamside Area Water Storage – streamside area metric (skip for Size 1 streams, Tidal Marsh Streams, and B valley types)
Consider for the Left Bank (LB) and the Right Bank (RB) of the streamside area.

LB	RB	
☐A	☐A	Majority of streamside area with depressions able to pond water ≥ 6 inches deep
☐B	☐B	Majority of streamside area with depressions able to pond water 3 to 6 inches deep
☒C	☒C	Majority of streamside area with depressions able to pond water < 3 inches deep

15. Wetland Presence – streamside area metric (skip for Tidal Marsh Streams)
Consider for the Left Bank (LB) and the Right Bank (RB). Do not consider wetlands outside of the streamside area or within the normal wetted perimeter of assessment reach.

LB	RB	
☐Y	☐Y	Are wetlands present in the streamside area?
☒N	☒N	

16. Baseflow Contributors – assessment reach metric (skip for Size 4 streams and Tidal Marsh Streams)
Check all contributors within the assessment reach or within view of <u>and</u> draining to the assessment reach.

- ☐A Streams and/or springs (jurisdictional discharges)
- ☐B Ponds (include wet detention basins; do not include sediment basins or dry detention basins)
- ☐C Obstruction passing flow during low-flow periods within the assessment area (beaver dam, leaky dam, bottom-release dam, weir)
- ☐D Evidence of bank seepage or sweating (iron in water indicates seepage)
- ☒E Stream bed or bank soil reduced (dig through deposited sediment if present)
- ☒F None of the above

17. Baseflow Detractors – assessment area metric (skip for Tidal Marsh Streams)
Check all that apply.

- ☐A Evidence of substantial water withdrawals from the assessment reach (includes areas excavated for pump installation)
- ☐B Obstruction not passing flow during low-flow periods affecting the assessment reach (ex: watertight dam, sediment deposit)
- ☐C Urban stream (≥ 24% impervious surface for watershed)
- ☒D Evidence that the streamside area has been modified resulting in accelerated drainage into the assessment reach
- ☐E Assessment reach relocated to valley edge
- ☒F None of the above

18. Shading – assessment reach metric (skip for Tidal Marsh Streams)
Consider aspect. Consider "leaf-on" condition.

- ☐A Stream shading is appropriate for stream category (may include gaps associated with natural processes)
- ☐B Degraded (example: scattered trees)
- ☒C Stream shading is gone or largely absent

19. Buffer Width – streamside area metric (skip for Tidal Marsh Streams)

Consider "vegetated buffer" and "wooded buffer" separately for left bank (LB) and right bank (RB) starting at the top of bank out to the first break.

Vegetated		Wooded		
LB	RB	LB	RB	
☒A	☒A	☐A	☐A	≥ 100 feet wide or extends to the edge of the watershed
☐B	☐B	☐B	☐B	From 50 to < 100 feet wide
☐C	☐C	☐C	☐C	From 30 to < 50 feet wide
☐D	☐D	☐D	☐D	From 10 to < 30 feet wide
☐E	☐E	☒E	☒E	< 10 feet wide or no trees

20. Buffer Structure – streamside area metric (skip for Tidal Marsh Streams)

Consider for left bank (LB) and right bank (RB) for Metric 19 ("Vegetated" Buffer Width).

LB	RB	
☐A	☐A	Mature forest
☐B	☐B	Non-mature woody vegetation or modified vegetation structure
☒C	☒C	Herbaceous vegetation with or without a strip of trees < 10 feet wide
☐D	☐D	Maintained shrubs
☐E	☐E	Little or no vegetation

21. Buffer Stressors – streamside area metric (skip for Tidal Marsh Streams)

Check all appropriate boxes for left bank (LB) and right bank (RB). Indicate if listed stressor abuts stream (Abuts), does not abut but is within 30 feet of stream (< 30 feet), or is between 30 to 50 feet of stream (30-50 feet).

If none of the following stressors occurs on either bank, check here and skip to Metric 22: ☒

Abuts		< 30 feet		30-50 feet		
LB	RB	LB	RB	LB	RB	
☐A	☐A	☐A	☐A	☐A	☐A	Row crops
☐B	☐B	☐B	☐B	☐B	☐B	Maintained turf
☐C	☐C	☐C	☐C	☐C	☐C	Pasture (no livestock)/commercial horticulture
☐D	☐D	☐D	☐D	☐D	☐D	Pasture (active livestock use)

22. Stem Density – streamside area metric (skip for Tidal Marsh Streams)

Consider for left bank (LB) and right bank (RB) for Metric 19 ("Wooded" Buffer Width).

LB	RB	
☐A	☐A	Medium to high stem density
☐B	☐B	Low stem density
☒C	☒C	No wooded riparian buffer or predominantly herbaceous species or bare ground

23. Continuity of Vegetated Buffer – streamside area metric (skip for Tidal Marsh Streams)

Consider whether vegetated buffer is continuous along stream (parallel). Breaks are areas lacking vegetation > 10 feet wide.

LB	RB	
☒A	☒A	The total length of buffer breaks is < 25 percent.
☐B	☐B	The total length of buffer breaks is between 25 and 50 percent.
☐C	☐C	The total length of buffer breaks is > 50 percent.

24. Vegetative Composition – streamside area metric (skip for Tidal Marsh Streams)

Evaluate the dominant vegetation within 100 feet of each bank or to the edge of the watershed (whichever comes first) as it contributes to assessment reach habitat.

LB	RB	
☐A	☐A	Vegetation is close to undisturbed in species present and their proportions. Lower strata composed of native species, with non-native invasive species absent or sparse.
☐B	☐B	Vegetation indicates disturbance in terms of species diversity or proportions, but is still largely composed of native species. This may include communities of weedy native species that develop after clear-cutting or clearing or communities with non-native invasive species present, but not dominant, over a large portion of the expected strata or communities missing understory but retaining canopy trees.
☒C	☒C	Vegetation is severely disturbed in terms of species diversity or proportions. Mature canopy is absent or communities with non-native invasive species dominant over a large portion of expected strata or communities composed of planted stands of non-characteristic species or communities inappropriately composed of a single species or no vegetation.

25. Conductivity – assessment reach metric (skip for all Coastal Plain streams)

25a. ☐Yes ☒No Was conductivity measurement recorded?
If No, select one of the following reasons. ☒No Water ☐Other: _____

25b. Check the box corresponding to the conductivity measurement (units of microsiemens per centimeter).
☐A < 46 ☐B 46 to < 67 ☐C 67 to < 79 ☐D 79 to < 230 ☐E ≥ 230

Notes/Sketch:

Draft NC SAM Stream Rating Sheet
Accompanies User Manual Version 2.1

Stream Site Name	R2707	Date of Assessment	11/10/2017
Stream Category	Pa1	Assessor Name/Organization	Melissa Ruiz, Alex Baldwin, Stnatec

Notes of Field Assessment Form (Y/N)	NO
Presence of regulatory considerations (Y/N)	NO
Additional stream information/supplementary measurements included (Y/N)	NO
NC SAM feature type (perennial, intermittent, Tidal Marsh Stream)	Intermittent

Function Class Rating Summary	USACE/ All Streams	NCDWR Intermittent
(1) Hydrology	**LOW**	**LOW**
(2) Baseflow	**HIGH**	**HIGH**
(2) Flood Flow	**LOW**	**LOW**
(3) Streamside Area Attenuation	**LOW**	**LOW**
(4) Floodplain Access	**LOW**	**LOW**
(4) Wooded Riparian Buffer	**LOW**	**LOW**
(4) Microtopography	**MEDIUM**	**MEDIUM**
(3) Stream Stability	**LOW**	**LOW**
(4) Channel Stability	**HIGH**	**HIGH**
(4) Sediment Transport	**LOW**	**LOW**
(4) Stream Geomorphology	**LOW**	**LOW**
(2) Stream/Intertidal Zone Interaction	NA	NA
(2) Longitudinal Tidal Flow	NA	NA
(2) Tidal Marsh Stream Stability	NA	NA
(3) Tidal Marsh Channel Stability	NA	NA
(3) Tidal Marsh Stream Geomorphology	NA	NA
(1) Water Quality	**HIGH**	**HIGH**
(2) Baseflow	**HIGH**	**HIGH**
(2) Streamside Area Vegetation	**LOW**	**LOW**
(3) Upland Pollutant Filtration	**MEDIUM**	**MEDIUM**
(3) Thermoregulation	**LOW**	**LOW**
(2) Indicators of Stressors	**NO**	**NO**
(2) Aquatic Life Tolerance	**HIGH**	**NA**
(2) Intertidal Zone Filtration	NA	NA
(1) Habitat	**LOW**	**LOW**
(2) In-stream Habitat	**LOW**	**LOW**
(3) Baseflow	**HIGH**	**HIGH**
(3) Substrate	**LOW**	**LOW**
(3) Stream Stability	**MEDIUM**	**MEDIUM**
(3) In-stream Habitat	**LOW**	**LOW**
(2) Stream-side Habitat	**LOW**	**LOW**
(3) Stream-side Habitat	**LOW**	**LOW**
(3) Thermoregulation	**LOW**	**LOW**
(2) Tidal Marsh In-stream Habitat	NA	NA
(3) Flow Restriction	NA	NA
(3) Tidal Marsh Stream Stability	NA	NA
(4) Tidal Marsh Channel Stability	NA	NA
(4) Tidal Marsh Stream Geomorphology	NA	NA
(3) Tidal Marsh In-stream Habitat	NA	NA
(2) Intertidal Zone	NA	NA
Overall	**LOW**	**LOW**

Minutes from the Interagency 4B Hydraulic Design Review Meeting
R-2707D - Cleveland County
NCDOT Structure Design Conf. Room C
February 7, 2018

Team Members:

Steve Kichefski, USACE	(present)
Monte Matthews, USACE	(present)
Brian Roden-Reynolds, USACE	(present)
Donna Hood, NCDWR	(present)
Marella Buncick, USFWS	(present)
Randi Gates, GCL MPO	(not present)
Renee Gledhill-Earley, SHPO	(not present)
Marla Chambers, NCWRC	(not present)
Chris Militscher, USEPA	(not present)
Donnie Brew, FHWA	(not present)

Participants:
Jackie McSwain, Div. 12 Project Lead
Thad Duncan, Div. 12 Project Manager
Trish Beam, Div. 12 Env. Supervisor
Michael Poe (Phone), Div. 12
Stephen Morgan, NCDOT Hydraulics
Brian Lipscomb, NCDOT Hydraulics
Joe Kelvington, Stantec
Jeanie Tyson, Stantec
Michael Wray, Stantec
Andrea Dvorak-Grantz, Stantec
Melissa Ruiz, Stantec
Josh Gillman, Stantec
Brian Elam, Sungate Design Group
David Talbert , Sungate Design Group
Jeff Hemphill, EAU
Brett Feulner, EAU
Byron Moore, EAU
James Tortorella, NCDOT Support Services
Wilson Stroud, NCDOT PDU

Minutes:

Steve Kichefski opened the meeting by expressing the merger teams concerns with changes to the project that have occurred since concurrence point 4A.

Introductions were made by all in attendance.

Andrea Dvorak-Grantz proceeded with a merger team update presentation, detailing the recent project design revisions and their effects on project impacts.

Project History: ROD Signed in 2008, Project Permitted in 2012

General Updates to Project Design

- R-2707D
    - Added Service Roads 4 and 5 to provide access to parcels/properties cut off by alignment of the bypass.
    - Additional service roads minimize impacts on the environment
    - Current design does add impacts to 2 streams

- R-2707E

    - Reduced stream and wetland impacts
    - Reduced cumulative length of service road network
    - Moved location of the Bethlehem Rd. interchange approximately 1000 ft. to the west
    - Dwarf Flower Heartleaf (DFH) protection and impact areas changed
- Summary of the changes brought about by current design were provided in prior distributions before the merger meeting. These were briefly reviewed during the merger meeting. These summaries provide comparisons of impacts to DFH populations brought about by design changes

Brian Elam proceeded through the project plan sheets:

General

- Project is steep. Water flows generally from west to east. Use of drop boxes has been minimized.

- Design makes extensive use of basins for hazardous spills and attenuation of storm water discharges.

- A discussion was held regarding the use of class 'II' rip rap in constructed channels. Donna Hood and Trish Beam requested that class 'II' rip rap be utilized in all jurisdictional areas to prevent stone from migrating downstream. Stephen Morgan expressed feasibility concerns with forming a base channel lined with class 'II' sized stone and the probability of the stream undercutting due to voids in the rip rap. It was generally agreed upon that class 'II' lined channels will be detailed as "Embedded", where voids are to be filled with native materials.

- USFWS noted that orange construction fencing should be used where applicable for protected species, as well as the need to confine impacts within those shown in the Biological Opinion.

Plan Sheet 4:

- No Comment

Plan Sheet 5:

- Steve Kichefski asked why the 48" cross pipe (645+79 -L-) outlet did not appear to line up with the JS line. Brian Elam replied that the JS line at this site is GPS located rather than a surveyed line, therefore approximate.

- There was some concern regarding the alignment of the lateral channel upstream of the 48" cross pipe (645+79 -L-). Steve Kichefski asked whether it would be

better to move the pipe back to the JS line on the upstream end. After discussion, it was decided to leave the pipe inlet as it was and better align the upstream lateral channel to tie to JS and pipe inlet.

- 48" cross pipe (645+79 -L-): Inverts will not to be buried due to the steep slope and rip rap will be used in the downstream channel to dissipate energy.

- Protection is necessary for DFH @ outlet end of 48" pipe near Sta. 647+00. Orange construction fencing is to be provided. There are general concerns about proximity of pipe outlets and energy dissipation structure close to the DFH population.

- Special detail or a special provision will be needed for the Embedded Rip Rap.

Plan Sheet 6:

- 48" cross pipe (669+85 -L-): Inverts will not be buried due to the steep slope and rip rap will be used in the upstream and downstream channels for stabilization. Also, due to the low quality of the upstream JS, a junction box will be used as a drop structure to reduce outflow velocity.

- Stream @ 669+85 -L- has been in and out of JS status since 2008. Banks are not stable and soils are highly erodible.

- Stephen Morgan asked about utilizing the hazardous spill basin (668+00 -L- Lt) as a dry detention basin. HSB will be reviewed for feasibility of dual purpose basin.

Plan Sheet 7 & 8:

- 42" cross pipe (684+10 -L): Inverts will not be buried due to the steep slope and rip rap will be used in the upstream and downstream channel for stabilization and to dissipate energy at outlet.

- Stephen Morgan expressed accessibility concerns with the hazardous spill basin location (684+50 -L- Lt). There were also concerns that construction of the basin may create additional disturbance within the endangered plant boundary, in addition to the pipe that passes through the preservation area. After discussion, it was Stephen Morgan's position that the hazardous spill basin at this site be removed from the proposed design and storm water re-routed. However, Donna Hood indicated that removal of the HSB may compromise the 401 permit if sufficient justification was not provided. This site will be reviewed for alternative options. Use of 1.5:1 roadway fill slopes to be considered in design.

Plan Sheet 9:

- No Comment

Plan Sheet 10:

- 1@7'x7' RCBC: Inverts will be buried 1ft. Sills and baffles will be used throughout the culvert to retain bed material. No additional comments.

- Stream relocation: NCDOT wants all of stream relocation and natural channel design within the C/A or R/W to gain credit for ecological uplift. There are risks to DOT as the relocated stream must be monitored and approved. DOT wants to avoid penalties for any loss in length. The stream will be included in permit modification as uplift. A meeting will be held prior to submittal to review design. A work code will be needed in the Contract to require prequalified contractors performing stream relocation construction.

Plan Sheet 11:

- Stephen Morgan asked if the JS reach (approx. 725+00 to 728+00 -L- Lt) needed to be within the controlled access right of way and possibly be used to generate additional uplift along with the stream relocation. It was discussed, by placing this section of stream within permanent right of way a buffer could be maintained, however no determination was made as to whether the right of way should be changed. C/A and R/W are shown as they are to provide protection for DFH. Biological Assessment shows these approximate limits for DFH preservation.

Plan Sheet 12:

- Division 12 inquired about the condition of the existing stream. Photos were viewed and the condition was discussed. There appeared to be some excessive downstream sedimentation and banks were incised. The condition could partially be attributed to urbanization and land disturbance within the upstream drainage area.

- 2@8'x8' RCBC: Culvert will have a low flow barrel with a 1ft tall sill and a high flow barrel with a 2ft tall sill. Stephen Morgan is ok with the size but asked if a 12ft wide single box would work. Marella expressed concern about over widening the channel with a single box and suggested not changing the 2 barrel design.

After the meeting Brian Elam investigated whether a single box was hydraulically a feasible option and the determination was that it was not. A single box would need to be 1@15'x8' RCBC.

- No additional comments.

12:15pm Lunch Break

Plan Sheet 13:

- 54" cross pipe (764+11 -L-): The inverts were initially to be buried 1ft with no rip rap in bed. After review of pipe slope (3.8%) and outlet velocity (18.4ft/s), Donna Hood asked that rip rap be used to armor the bed at the pipe outlet and Steve Kichefski suggested we ask for a non-burial waiver. The pipe inverts will not be buried and rip rap will be used in the downstream bed. Waiver should state justification, or notes in merger meeting minutes should provide justification for waivers.

Plan Sheet 14:

- 60" cross pipe (777+45 -L-): The upstream invert was initially to be buried 1ft with no rip rap in bed, since the upstream slope is relatively flat. After review of pipe slope (4.9%), it was discussed and agreed to by Steve Kichefski and Donna Hood that the pipe should not be buried on either end and a waiver be requested. The pipe inverts will not be buried and rip rap will be used in the downstream bed. Waiver should state justification, or notes in merger meeting minutes should provide justification for waivers.

Plan Sheet 15:

- No Comment

- 1.5: 1 roadway fill slopes are to be used, will be used from stations 787+00 to 790+00 -L- Lt, to clear top of existing stream bank. Merger team requests space between the toe of embankment fill and the top of bank be provided to clear the stream.

Plan Sheet 16:

- 2@6'x6' RCBC: Culvert was to have a low flow barrel with a 1ft tall sill and a high flow barrel with a 2ft tall sill. Stephen Morgan asked that the RCBC be changed to a single box (1@12'x6') with sills and baffles, to provide better access for maintenance and reduce debris potential. Marella and Donna preferred to leave the culvert as 2@6'x6', as to not over widen the channel inside the culvert. If a single 1@12'x6' RCBC is proposed, alternating baffles within the culvert will be utilized to maintain a low flow meandering channel. Inlet is close to a DFH preservation area. Fencing will be needed to protect the site. Design team needs to look at the R/W line near the inlet of the culvert. There is concern not all R/W as shown in plans can be condemned.

- 18" pipe routed through a DHF preservation area (Area 28). Relocation of the pipe will be considered to minimize impacts to the site.

- Marella expressed concern with proximity of bank stabilization to endangered plant boundary. Bank stabilization extent will be reviewed and adjusted if necessary.

- Upon reviewing the proposed storm drain system outlet at station 797+50 -L- Lt (See note concerning Area 28), concerns were raised about potential additional impacts to the endangered plant boundary. The system layout was discussed, and it was decided that the outlet should be moved to the proposed lateral ditch at station 793+00 -L- Rt.

- 24" pipe outlet (804+55 -L- Lt): Junction box to be used as drop structure and rip rap utilized in outlet channel to reduce outflow velocities into wetland.

Plan Sheet 17:

- 66" cross pipe (815+06 -L- / 17+14 -SRVRD_4-): Concerns with stability were raised regarding the 30ft open channel between the outlet of the service road 4 pipe and inlet of the main line pipe. Donna Hood asked that this short section of open channel be piped to eliminate the instability risk. Steve Kichefski indicated that he was ok with the piping option. Trish Beam stated that a non-burial waiver will be requested due to the relatively steep pipe slope and length. The piping option was further discussed, and Stephen Morgan requested that discussion be continued outside of the meeting. Roadway design (Stantec) will flatten fill slopes to cover if pipe vs. open channel is selected.

Plan Sheet 17A:

- 66” cross pipe (19+50 -SRVRD_5-): Inverts will not be buried due to the steep slope and rip rap will be used in the upstream and downstream channel for stabilization and to dissipate energy at outlet. Stream bank reforestation will be provided for the proposed channel in the area of the former pond.

Plan Sheet 18:

- Spring Box is required, at approximate station 29+65 -RAMP A- Rt, at existing spring location under Ramp A fill. Outlet ground water in ditch at toe of slope. If possible, ditch discharging to wetland at station 29+50 -Ramp A- Rt, should be flattened at outlet to reduce velocities.

- Existing 42” RCP (11+50 -RAMP_D- Lt): Preference from NCDOT and merger team is to leave the pipe system open. Roadway (Stantec) is to engineer slopes to keep fills out of the depression and away from existing pipes.

- Question was posed about integrity of existing pipes. Are they structurally sound? If pipes are to be strengthened, no live stream flow will be permitted through pipe as it is being retrofitted.

Plan Sheet 19:

- Steve Kichefski will meet with design group to discuss pursuing natural channel design at the stream relocation site from approximate stations 846+00 to 849+00 - L- Lt. Proposed design of channel (3% slope) in floodplain is to be rip rap. There is some potential for relocation here if natural channel design is used in place of rip rap. To obtain credit a 30-foot buffer will be required. Additional off-line discussion is required.

Plan Sheets 20 - 26:

- At Buffalo Creek crossing, no utilities and no greenway facility is to be accommodated in design.

- For Buffalo Creek, there is to be no permanent deck drainage in the center span of the bridge. Permanent Deck drains are not to discharge directly onto stream bank. Hydraulics is to investigate need for splash pads under the deck drains.

- No other comments

Minutes from the Interagency 4C Permit Drawing Review Meeting
R-2707D - Cleveland County
NCDOT Structure Design Conf. Room C
August 8, 2018

Team Members:

Steve Kichefski, USACE	(present)
Nicholle Braspennickx, USACE	(present)
Donna Hood, NCDWR	(present)
Robert Patterson, NCDWR	(present)
Marella Buncick, USFWS	(present)
Claire Ellwanger, USFWS	(present)
Marla Chambers, NCWRC	(present)
Donnie Brew, FHWA	(Phone)
Randi Gates, GCL MPO	(not present)
Renee Gledhill-Earley, SHPO	(not present)
Chris Militscher, USEPA	(not present)

Participants:
Jackie McSwain, Div. 12 Project Lead
Trish Beam, Div. 12 Env. Supervisor
Michael Poe (Phone), Div. 12
Michael Wray, Stantec
Andrea Dvorak-Grantz, Stantec
Melissa Ruiz, Stantec
Jeannie Tyson, Stantec
Joe Kelvington, Stantec
Liz Paden, Stantec
Brian Elam, Sungate Design Group
David Talbert , Sungate Design Group
Jeff Hemphill, EAU
James Tortorella, NCDOT Support Services
Wilson Stroud, NCDOT PDU
Chris Underwood, EAU
Tim Bassette, EAU
Dennis G Li, NCDOT
Byron Moore, EAU

Minutes:

Introductions were made by all in attendance and on the conference call.

Brian Elam proceeded through the permit drawing plan sheets:

General Comments:

Non-burial waiver should be requested at each site, where applicable.

Wetland and stream impacts, associated with the same permit site, should be quantified on separate lines in the impact summary.

Project description text on the storm water management plan should be formatted to fit within designated boxes.

Permit Sheet 8:

Site 1: Jeff Hemphill (EAU) asked whether impacts upstream of the proposed fill slope should be associated with the pipe or broken out as an inlet channel impact.

It was agreed that it should be separated in the summary as an inlet channel impact.

Marla Chambers (NCWRC) indicated that she would be ok with the use of a dissipator basin or drop box at this location, since the pipe was likely too steep for wildlife passage. Options were discussed, and it was decided that the rip rap lined channel was preferred.

Marella Buncick (USFWS) asked that the ROW fence location be reviewed and moved out of the EPB boundary.

Site 15: Temporary construction impact added.

Discussion regarding fencing around DFHL populations. Location is undetermined at this time, but it will not go through the populations.

Permit Sheet 14:

Site 2: Wetland impacts will be separated from stream impacts in the summary.

Permit Sheet 17:

Site 3: It was agreed that impacts to the proposed relocated stream, associated with bank and channel stabilization at culvert outlet, will not be counted as an additional impact, only noted in the summary.

Permit Sheets 17 – 22 (Stream Relocation):

Site 4, 5, 6A & 6B: Marella (USFWS) had concerns with the stability of the relocated stream at the stormwater discharge points. These areas were discussed in detail and it was decided that the discharge points were ok, however each site should be routinely monitored during and post construction. Relocation plan will have monitoring protocol and adaptive management sections. A permit modification will be required if repair is necessary that impacts the proposed stream.

It was agreed that the stream should be constructed and stabilized as early as possible prior to roadway construction. Stormwater ditches planned for floodplain will have varying slope. The tie in to the relocated stream will be field fit once the roadway drainage has been completed. There was a discussion about creating wetlands out of basins used for sediment and erosion control during construction.

Additional impacts to DFHL population were noted. Marella Buncick (USFWS) noted that preservation and impacts were cumulative.

Permit Sheet 22:

Site 6C: It was agreed that impacts to the proposed relocated stream, associated with bank stabilization at culvert outlet, will not be counted as an additional impact, only noted in the summary.

It was agreed that additional stabilization upstream of the culvert would not be included in the design.

Permit Sheet 25:

Site 7: Wetland impacts will be separated from stream impacts in the summary.

The limits of mechanized clearing, upstream of the pipe crossing, were discussed and ultimately decided they would be left as is. Additional impacts, during construction, will be handled as needed.

Permit Sheet 28:

Site 8: Wetland impacts will be separated from stream impacts in the summary.

Permit Sheet 30:

Site 9: Donna Hood (NCDWR) and Trish Beam (Div 12) requested that rip rap be shown on the upstream floodplain bench, where the lateral ditch discharges.

Site 10: No comment.

Permit Sheet 34:

Site 11: Pond site will be noted as an open water impact and wetland impacts will be separated from stream impacts in the summary.

Donna Hood (NCDWR) noted the rate of pumping water to drain the pond should be monitored. A silt bag and filter bucket may be required in the permit conditions.

Permit Sheet 41:

Site 12: The possibility of multiple springs at this site were discussed. After discussion, it was decided that they would be addressed in the field as needed.

Wetland impacts will be separated from stream impacts in the summary.

Permit Sheet 45:

Site 13: No comment.

Site 14: Add square footage impact, in the notes section of the summary, for any proposed piers located in Buffalo Creek.

It was agreed riprap around the column for scour protection was not needed due to depth of column. Piers in channel are unavoidable due to the length of the span.

Meeting adjourned.

Minutes from the Interagency 4C Permit Drawing Review Meeting
R-2707E - Cleveland County
NCDOT Structure Design Conf. Room C
July 19, 2018

Team Members:

Steve Kichefski, USACE	(phone)
Monte Matthews, USACE	(present)
Nicholle Braspennickx	(present)
Donna Hood, NCDWR	(present)
Marella Buncick, USFWS	(present)
Marla Chambers, NCWRC	(present)
Donnie Brew, FHWA	(phone)
Randi Gates, GCL MPO	(not present)
Renee Gledhill-Earley, SHPO	(not present)
Chris Militscher, USEPA	(not present)

Participants:
Jackie McSwain, Div. 12 Project Lead
Trish Beam, Div. 12 Env. Supervisor
Michael Poe (Phone), Div. 12
Bill Elam, NCDOT Hydraulics
Michael Wray, Stantec
Andrea Dvorak-Grantz, Stantec
Melissa Ruiz, Stantec
Brian Elam, Sungate Design Group
David Talbert , Sungate Design Group
Jeff Hemphill, NCDOT EAU
Chris Underwood, NCDOT EAU
Tim Bassette, NCDOT BSG
Jared Gray, NCDOT BSG
Marissa Cox, NCDOT BSG
James Tortorella, NCDOT Support Services
Wilson Stroud, NCDOT PDU
Katina Lucas, NCDOT STIP

Minutes:

Introductions were made by all in attendance and on the conference call.

Brian Elam proceeded through the permit drawing plan sheets:

Permit Sheet 5:

Site 1A: Steve Kichefski (USACE) inquired about the stability of the receiving channel (approx. Sta. 852+00 -L- LT) and whether an end wall was being added that may create stream impacts. The end wall shown in the plans is existing and the receiving channel appears to be stable with existing stone and bedrock, therefore no impacts are anticipated.

Site 1B: Since wetland is a total take, it should be completely hatched as "Excavation in Wetlands" and updated in impact summary accordingly.

Permit Sheet 8:

Site 2: No comment.

Permit Sheet 11:

Site 3A: The Existing Channel Impact lengths are missing for the 48" pipe and bank stabilization.
Impact length for 48" pipe = 193ft
Bank Stabilization Impact length = 20ft

Site 3B: It's difficult to tell which impacts are associate with which site numbers in the plan view. Arrows will be included in the impact drawings to clarify.

Since the wetland impacts are a total take, it needs to be noted in the "notes" section of the impact summary and should be completely hatched as "Excavation in Wetlands".

Review the side slops of the proposed 4' outlet channel and flatten to 3:1's if construction is feasible within proposed PDE.

Steve (USACE) asked if the proposed rip rap outlet channel was necessary and if a stable outlet could be achieved by using a series of grade control structures. After the existing conditions were discussed and site photos reviewed, it was decided that the rip rap outlet channel was necessary.

Site 3C: No comment.

Site 5: Jeff Hemphill (EAU) indicated that bank stabilization impacts did not apply at this site and that all permanent impacts should fall under the same "Impacts in Surface Water Pond" category.

The proposed C/A fence is to be moved closer to fill line to avoid additional permanent impacts to the existing pond.

After discussion, it was decided that the remaining area of the pond should be shown as temporary impacts, since construction related activity may warrant draining and/or silt removal.

Permit Sheet 17:

Site 3D: To avoid confusion, change "Fill Existing Channel" note to "Grade to Drain".

Site 3E: Steve (USACE) inquired about potential impacts associated with utility relocations and permanently maintained utility easements. Site 3E was discussed as the only potential site where clearing in the wetlands may be needed for overhead utilities. The permit application will likely be submitted with

approximate utility impacts that may require modification. Prior to submittal, Stantec will seek input from USACE to determine if utility impact is a conversion impact.

Permit Sheet 19:

Site 4A: No comment.

Site 4B: No comment.

General Discussion Points:
There was a general discussion about verbiage regarding embedded riprap. One thought is to specify the grade level that is desired. Steve Kichefski is to send draft language to the Division. The goal is to prevent water passing below the riprap.

There was a discussion about dwarf flower heartleaf (DFHL). Tim Bassette noted the field work had been completed to update the indirect and cumulative effects analysis. He will prepare a memo to note the changes compared to the 2012 amended biological opinion. He will also update the commitments concerning DFHL. It was determined this will be sufficient and there is no need to reopen consultation. The DFHL populations will be labeled for the Section D 4C meeting.

4B meeting minutes have been posted to the merger meeting folder.

Agencies requested a table showing changes from impacts noted in the 2012 permit compared to impacts for proposed permit modification.

Meeting adjourned.

US 74 Shelby Bypass

Cleveland County

STIP Project R-2707D/E

Merger Team Update

May 2019

1.0 Introduction and Project Overview

1.1 Purpose of the Update

The purpose of this update is to provide the merger project team with information regarding changes to jurisdictional wetland impacts following the identification of an additional wetland area in Section D of the Shelby Bypass Project (R-2707).

The North Carolina Department of Transportation (NCDOT) is constructing a four-lane, new location freeway from east of Mooresboro to west of Stony Point Road at US 74 Business in Kings Mountain. The project is approximately 18.5 miles long and is included in the 2018 – 2027 NCDOT State Transportation Improvement Program. This update specifically refers to R-2707 Sections D and E as described below (Figure 1).

- Section D: 4.1-mile long section from west of NC 150 to US 74 west of SR 2238 (Long Branch Road)
- Section E: 2.6-mile long section from US 74 west of Long Branch Road to west of Stony Point Road (SR 1001) at US 74 Business in Kings Mountain.

Right of Way plans have been approved and acquisition is in process. During this process, a previously unidentified wetland was discovered in February 2019 near Sta. 24+00 Ramp A to 28+00 Ramp A in the Buffalo Creek floodplain, west of Buffalo Creek (Figure 2). A site visit conducted with United States Army Corps of Engineers (USACE) and North Carolina Division of Water Resources (NCDWR) personnel confirmed that the wetland was jurisdictional. With the addition of this wetland, impacts to jurisdictional waters increased above the impact estimates presented at the 4C meeting.

The following sections discuss project schedule, selection of the least environmentally damaging preferred alternative (LEDPA), and avoidance and minimization efforts taken since the discovery of the additional wetland.

1.2 Project History and Current Status

October 1998	Draft Environmental Impact Statement Approved
March 1999	Section 404 Permit Application
May 1999	Concurrence Point 3 (LEDPA) – Alternative 21
May 2001	Concurrence Point 4A (Avoidance and Minimization)
January 2008	Final Environmental Impact Statement Approved
December 2008	Record of Decision Approved
July 2012	Section 404 Permit Application

July 2014	Construction Begins (Section AB and B)
July 2016	Construction Begins (Section AA)
January 2017	Construction Begins (Section C)
February 7, 2018	Concurrence Point 4B (Section D/E)
February 8, 2018	Public Meeting (Section D/E)
June 2018	Concurrence Point 4C (Section D/E)

FY 2019	Right of Way (Section D/E)
FY 2020	Construction (Section D/E)

2.0 Study Alternatives and LEDPA

Tier 1 and Tier 2 study alternatives were evaluated in detail in the 2008 FEIS.

The Tier 1 study alternatives (Figure 3) included an upgrade existing alternative, a northern corridor, a southern corridor and five crossover or blended alternatives, resulting in a total of 25 possible alternatives. Four of the crossover alternatives occurred west of NC 150 in the sections either already constructed (Section A and B) or currently under construction (Section C). Crossover N-P, the upgrade alternative, and the southern corridor come together west of Buffalo Creek where the 2019 wetland was found and then follow the same route to the end of the project near SR1001. The northern corridor crosses the Buffalo Creek floodplain approximately a half mile to the north of the 2019 wetland.

Ten alternatives (Tier 2) were selected for further analysis. Five follow the southern corridor and the other five follow the northern corridor between NC150 and SR1001 (Figure 4).

Alternative 21 (part of the Tier 2 alternatives) was identified as the LEDPA in 1999. This alternative follows the southern route. According to the FEIS, Alternative 21 was selected by the merger team as the preferred alternative or LEDPA for the following reasons:

- Fewer prime farmland impacts
- Fewer wetland impacts
- Fewer noise impacts
- Lesser construction cost
- Consistency with town and county land use plans and policies

The addition of the wetland identified in 2019 near Sta. 24+00 Ramp A to 28+00 Ramp A in the Buffalo Creek floodplain would not likely have changed the LEDPA selection. According to the FEIS, wetland impacts for the ten alternatives were calculated using a generalized determination method and prorating of corridor-wide impacts to approximate right-of-way width. Using this methodology, wetland impacts ranged from 0 to 0.526 acres. The routes using the southern corridor (M-N-S) (Figure 4) had zero impacts and the northern corridor alternatives (M-N-P-S) had 0.526 acres of impacts. The 2019 identified wetland will contribute approximately 0.6 acres of additional wetland impact to the LEDPA as well as the other four alternatives lying within the southern corridor. With this addition, wetland impacts for all ten alternatives would have been similar (0.6 for southern corridor alternatives and 0.526 for northern corridor alternatives)[i]. Additionally, if any of the alternatives lying within the D and E sections of the northern corridor had been selected LEDPA, this would have resulted in an:

- increase in stream crossings including bridging of Buffalo Creek and Muddy Creek on new location, in place of widening the existing bridges over Buffalo Creek;

- increase of 1.214 acres of streams impacted (between NC150 to SR1001)
- increase in area of floodplain encroachments
- increase of 49 acres of forest land impacted.

3.0 Avoidance and Minimization

When the 2019 wetland was identified and mapped, a new impact was quantified. This new impact included additional permanent and temporary impacts to jurisdictional waters.

To address this new impact a number of avoidance and minimization measures were considered by the design team. These measures included the following:

1. Shift the interchange to the south:

   A shift of the interchange to the south would result in less impacts to the new wetland area. However, a shift would impact businesses and residential dwellings located along Hoey Church Road and Johnson Road. To avoid additional relocations, the interchange has not been altered.

2. Alter the geometry of the interchange:

   The curve radii for ramp A of the interchange have been maximized based on the design speed of the off ramp and the guidelines in chapter 8 of the NCDOT Roadway Design Manual. Changing the curve would lead to unsafe conditions. The existing curve geometry will remain.

3. Alter the fill slope:

   The fill slope along ramp A that will impact the new wetland area is designed as a 2:1 fill slope. A 1.5:1 reinforced soil slope or rock plated slope was analyzed as an alternative to minimize impacts to the new wetland area. A slope stability analysis yielded a Factor of Safety of 1.1 which is considered unsatisfactory. The fill height of the reinforced soil slope would be approximately 50' and based on NCDOT design standards this type of slope cannot exceed a height of 36'. Stormwater flow over the reinforced slope will enter directly into the wetland without filtration since the slope is void of vegetation. The reinforced slope will require periodic maintenance which would include temporary impacts to wetlands as machinery would need to access the base of the slope. The 2:1 fill slope will not require maintenance and will eventually be covered in vegetation creating a buffer between the road and the wetland that can slow stormwater flows. Based on these considerations, the 1.5:1 reinforced soil slope is not considered feasible and the 2:1 slope will remain.

4. Minimize impacts from utilities:

   A utility pole was to be installed prior to the identification of the 2019 wetland area. The pole has been relocated to an area outside of jurisdictional waters.

5. Minimize temporary impacts:

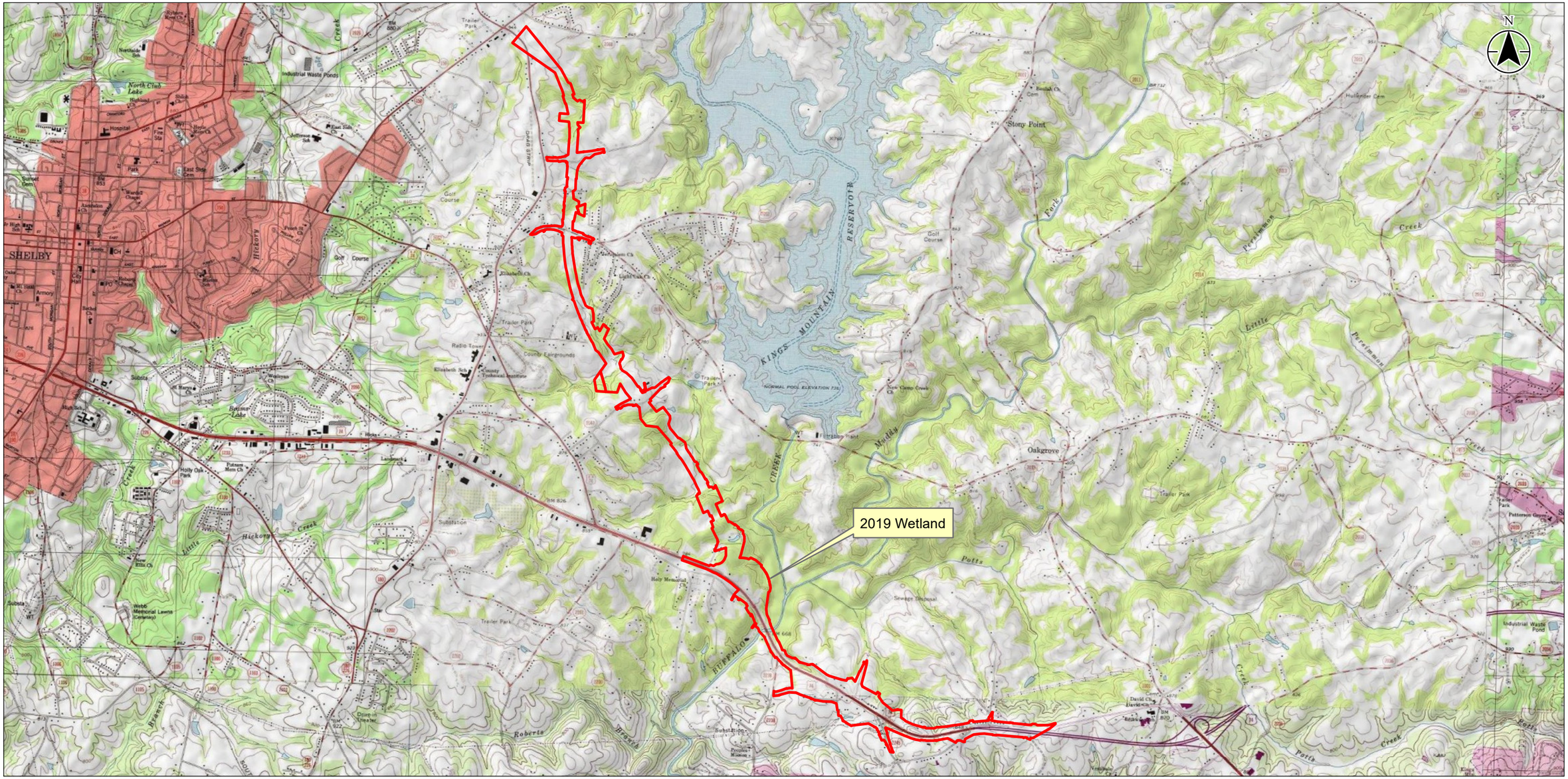
   The erosion control plans for this area included a number of sediment basins at the foot of the fill slope. To minimize temporary impacts to wetlands, these basins will be relocated outside of jurisdictional waters.

6. Stormwater outfall:

   A stormwater outfall will discharge stormwater at the toe of slope into the wetland. Alternatives locations were examined in an effort to have the stormwater discharge to an upland area, including an ephemeral draw near the pipe's current discharge location.

However, due to the steepness of the slope, a discharge in the ephemeral draw or further up the slope will have erosive velocities and will cause instability around the discharge as well as further downstream. Therefore, the outfall will remain in its original location.

[i] After LEDPA selection in 1999, detailed delineations were conducted within the Alternative 21 corridor. The delineation surveys resulted in the identification of new wetland areas and an additional 3.11 acres of wetland impact. The assumption at the time, which was endorsed by the Merger Team and reported in the 2008 FEIS, was that detailed delineations of the other corridors would have resulted in a similar increase of wetland area.



NC DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
DIVISION 12

0 4,000 8,000 Feet

1:42,000 (At original document size of 11x17)

Legend

Project Study Area 2017

Notes

1. Coordinate System: NAD 1983 StatePlane North Carolina FIPS 3200 Feet
2. Orthoimagery © NCOneMap, 2015.

Project Location
Kings Mountain/Shelby
Cleveland County, NC

171001847
Prepared by JPA on 2019-02-11
Technical Review by MMR on 2019-02-11
Independent Review by ALC on 2019-02-11

Client/Project
NCDOT - Division 12
Shelby Bypass
TIP R-2707D&E

Figure No.
1

Title
Vicinity Map

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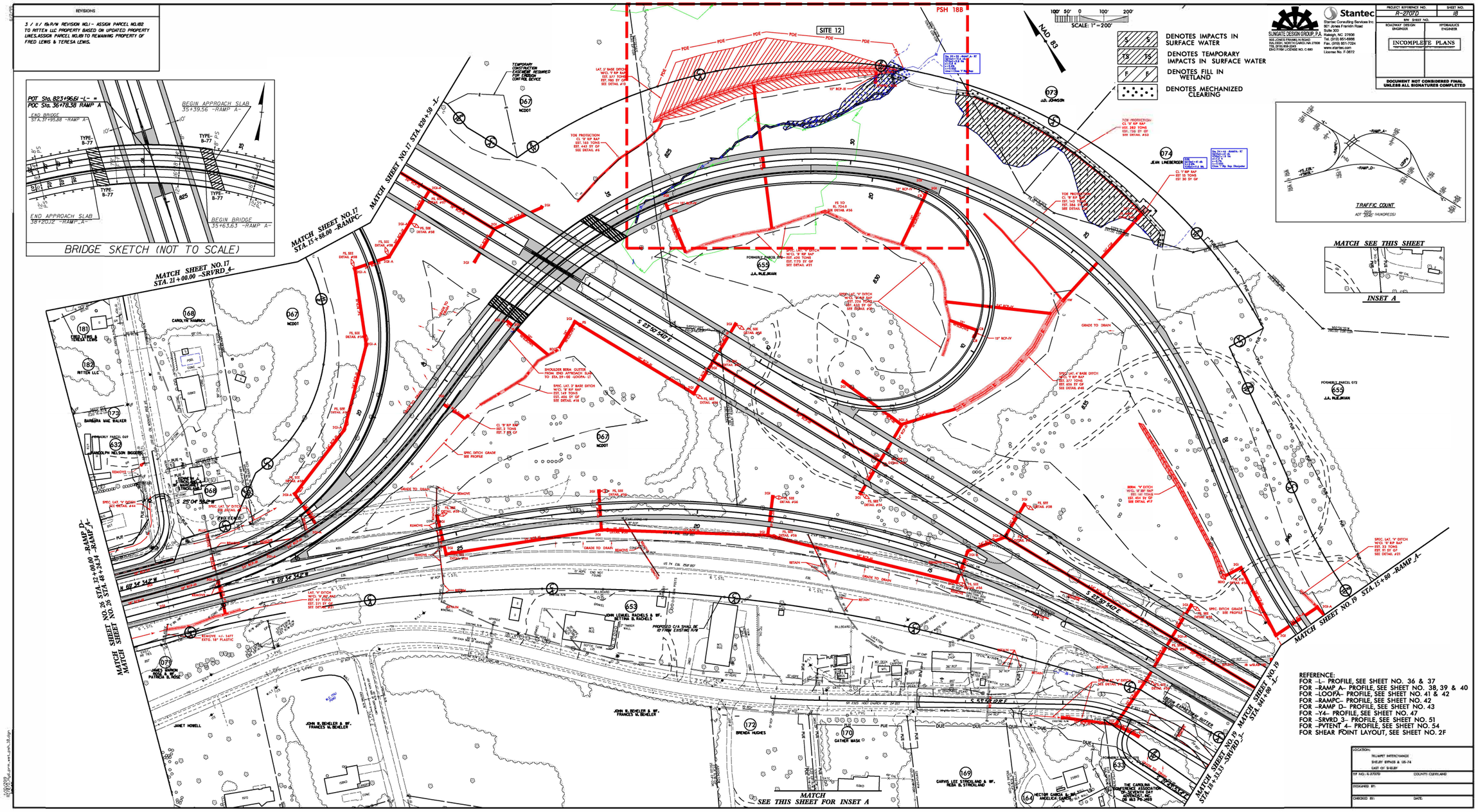
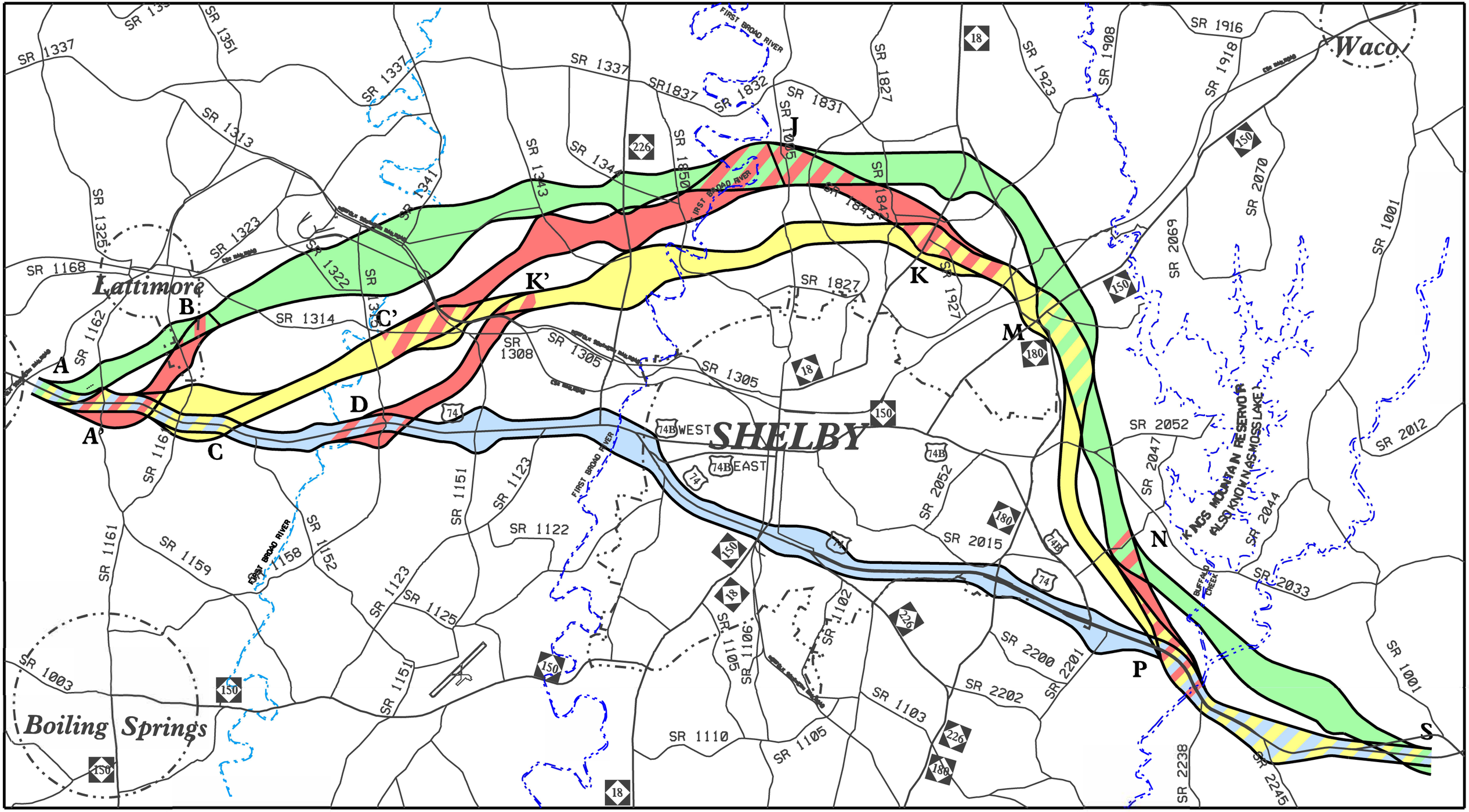
2019 Memo Update Figure 2 Impact Map with 2019 Wetland



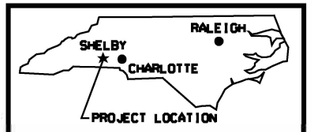


LEGEND

- NORTHERN CORRIDOR
- SOUTHERN CORRIDOR
- UPGRADE ALTERNATIVE
- CROSSOVER CORRIDOR

N

1" = 5000'
APPROXIMATE SCALE

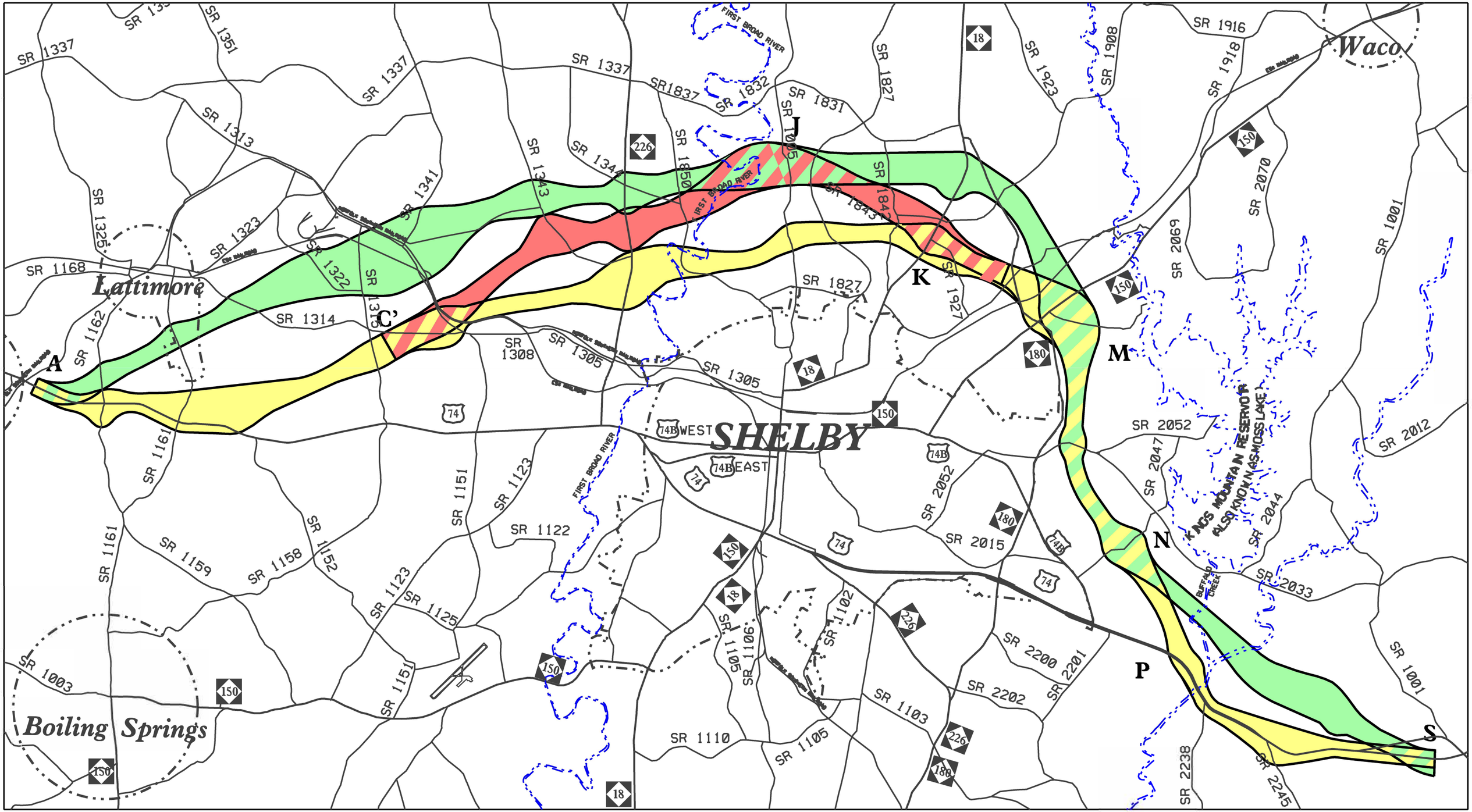


LOCATION MAP

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
ENVIRONMENTAL IMPACT STUDY
US 74 SHELBY BYPASS (R-2707)
CLEVELAND COUNTY, NORTH CAROLINA

EXHIBIT 2-9 TIER 1 DETAILED STUDY ALTERNATIVE CORRIDORS

2019 Memo Update Figure 3



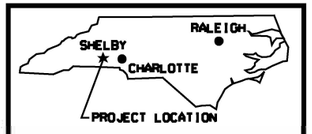
LEGEND

- NORTHERN CORRIDOR
- SOUTHERN CORRIDOR
- CROSSOVER CORRIDOR

NOTE: SEE TABLE 2-5 FOR SEGMENT DEFINITIONS FOR THE 10 TIER 2 DETAILED STUDY ALTERNATIVES.

N

1" = 5000'
APPROXIMATE SCALE



LOCATION MAP

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
ENVIRONMENTAL IMPACT STUDY
US 74 SHELBY BYPASS (R-2707)
CLEVELAND COUNTY, NORTH CAROLINA

EXHIBIT 2-14 TIER 2 DETAILED STUDY ALTERNATIVES

2019 Memo Update Figure 4

North Carolina Department of Transportation

Highway Stormwater Program

STORMWATER MANAGEMENT PLAN

FOR NCDOT PROJECTS

(Version 2.07; Released October 2016)

WBS Element:	34497.1.F56	TIP No.:	R-2707D	County(ies):	Cleveland	Page	1	of	5

General Project Information

WBS Element:	34497.1.F56	**TIP Number:**	R-2707D	**Project Type:**	New Location	**Date:**	12/18/2018
NCDOT Contact:	Paul Atkinson, PE			**Contractor / Designer:**	Brian Elam, PE		
Address:	NCDOT Hydraulics Unit 1590 Mail Service Raleigh, NC 27699-1590			**Address:**	Sungate Design Group, PA 905 Jones Franklin Road Raleigh, NC 27606		
Phone:	919-707-6707			**Phone:**	919-859-2243 ext. 207		
Email:	patkinson@ncdot.gov			**Email:**	belam@sungatedesign.com		
City/Town:	Shelby			**County(ies):**	Cleveland		
River Basin(s):	Broad			**CAMA County?**	No		
Wetlands within Project Limits?	Yes						

Project Description

Project Length (lin. miles or feet):	4.09	**Surrounding Land Use:**	Urban, Residential, Light Industrial

	Proposed Project	Existing Site
Project Built-Upon Area (ac.)	62.0 ac.	11.9 ac.
Typical Cross Section Description:	-L-: 34' grassed ditch median with 6:1 side slopes. 2 paved lanes (total 24' wide) with 12' outside shoulder (15' with guardrail, 10' paved) and 6' inside shoulder (4' paved) in each direction. Varying fill and cut slopes (see project XSC's for detailed information). -Y1-: 2-12' lanes with 6' shoulders (9' with guardrail, 2' paved) -Y2-: 2-12' lanes with 8' shoulders (11' with guardrail, 4' paved) -Y3-: 2-12' lanes with 8' shoulders (11' with guardrail, 4' paved)	Existing US 74 (-L-): 2 paved lanes (total 24') with 15' grassed median, 10' outside and 6' insides shoulders -Y1-: 2-9' lanes with 2' grassed shoulders -Y2-: 2-11' lanes with 2' grassed shoulders -Y3-: 2-10' lanes with 2' grassed shoulders
Annual Avg Daily Traffic (veh/hr/day):	Design/Future: 59,200 Year: 2040	Existing: 41,600 Year: 2019
General Project Narrative: (Description of Minimization of Water Quality Impacts)	The R-2707D project involves constructing the section of proposd US 74 (Shelby bypass) from East of NC 150 to Existing US 74, West of SR 2238 (Long Branch Rd). There are four proposed major structures involved with the construction of R-2707D, one is a bridge replacement over Buffalo Creek and the other 3 are box culverts at new locations. The proposed structure, over Buffalo Creek, is a multiple span, dual bridge. The bridge is a 3 span (1@110', 1@130', 1@80'), 72" pre-stressed concrete girders with 4' end bent caps. The proposed bridge will have spill through rip rap abutments. In the project limits, Buffalo Creek is a FEMA detailed studied stream with non-encroachment widths established. This structure will not discharge deck drains over open water and will utilize deck drain dissipator pads int he overbanks to prevent erosion. The three box culverts (1@7'x7', 2@8'x8' and 1@12'x6') will utilize sills and baffles and be backfilled with native material and maintain existing bed geomentry. Hazardous spill basins will be utilized for -L- line roadway runoff in areas that are within 1 mile and drain to Kings Mountain Reservoir (Begin Project to 691+00 -L-). Dry detention basins are utilized at locations throughout the project to attenuate increased peak flows and provide treatment. 2:1 slopes will be used in areas to reduce impacts to surrounding wetlands and jurisdictional streams.	

Waterbody Information

Surface Water Body (1):	Buffalo Creek (Kings Mountain Resevoir)		**NCDWR Stream Index No.:**	9-53-(2.9)	
NCDWR Surface Water Classification for Water Body		**Primary Classification:**	Water Supply III (WS-III)	CA	
		Supplemental Classification:	None		
Other Stream Classification:	None				
Impairments:	None				
Aquatic T&E Species?		Comments:			
NRTR Stream ID:				**Buffer Rules in Effect:**	N/A
Project Includes Bridge Spanning Water Body?	No	**Deck Drains Discharge Over Buffer?**	N/A	**Dissipator Pads Provided in Buffer?**	N/A
Deck Drains Discharge Over Water Body?	No	(If yes, provide justification in the General Project Narrative)		(If yes, describe in the General Project Narrative; if no, justify in the General Project Narrative)	
(If yes, provide justification in the General Project Narrative)					

North Carolina Department of Transportation

Highway Stormwater Program

STORMWATER MANAGEMENT PLAN

FOR NCDOT PROJECTS

(Version 2.07; Released October 2016)

Additional Waterbody Information

Surface Water Body (2):	Buffalo Creek		**NCDWR Stream Index No.:**	9-53-(5)		
NCDWR Surface Water Classification for Water Body		**Primary Classification:**	Class C			
		Supplemental Classification:	None			
Other Stream Classification:	None					
Impairments:	None					
Aquatic T&E Species?		Comments:				
NRTR Stream ID:				**Buffer Rules in Effect:**	N/A	
Project Includes Bridge Spanning Water Body?	Yes	**Deck Drains Discharge Over Buffer?**	No	**Dissipator Pads Provided in Buffer?**	N/A	
Deck Drains Discharge Over Water Body?	No	(If yes, provide justification in the General Project Narrative)		(If yes, describe in the General Project Narrative; if no, justify in the General Project Narrative)		
(If yes, provide justification in the General Project Narrative)						

North Carolina Department of Transportation

Highway Stormwater Program

STORMWATER MANAGEMENT PLAN

FOR NCDOT PROJECTS

(Version 2.07; Released October 2016)

WBS Element: **TIP No.:** R-2707D **County(ies):** Cleveland

Preformed Scour Holes and Energy Dissipators

Sheet No.	Station & Coordinates (Road and Non Road Projects)	Surface Water Body	Energy Dissipator Type	Riprap Type	Drainage Area (ac)	Conveyance Structure	Pipe/Structure Dimensions (in)	Q10 (cfs)	V10 (fps)	BMP Associated w/ Buffer Rules?
11	726+50 -L- LT 35.284733 / -81.479709	(2)Buffalo Creek	Riprap Energy Dissipator Basin	Class I	1.0	Pipe	15	4.0	1.1	No
11	730+50 -L- LT 35.283796 / -81.479035	(2)Buffalo Creek	Riprap Energy Dissipator Basin	Class I	1.0	Pipe	15	4.0	1.1	No
11	734+50 -L- LT 35.282878 / -81.478341	(2)Buffalo Creek	Riprap Energy Dissipator Basin	Class I	1.0	Pipe	15	4.0	1.1	No
12	741+08 -L- LT 35.281532 / -81.476951	(2)Buffalo Creek	Riprap Energy Dissipator Basin	Class I	1.4	Pipe	18	5.8	1.3	No
18	24+46 -Ramp A- RT 35.260744 / -81.458548	(2)Buffalo Creek	Riprap Energy Dissipator Basin	Class I	14.3	Pipe	36	41.0	2.5	No

Additional Comments

* Refer to the NCDOT Best Management Practices Toolbox (2014), NCDOT Standards, the Federal Highway Administration (FHWA) Hydraulic Engineering Circular No. 14 (HEC-14), Third Edition, Hydraulic Design of Energy Dissipators for Culverts and Channels (July 2006), as applicable, for design guidance and criteria.

North Carolina Department of Transportation

Highway Stormwater Program

STORMWATER MANAGEMENT PLAN

FOR NCDOT PROJECTS

(Version 2.07; Released October 2016)

WBS Element: 34497.1.F56 **TIP No.:** R-2707D **County(ies):** Cleveland

Level Spreaders, Hazardous Spill Basins, and Forebays

Sheet No.	Station & Coordinates (Road and Non Road Projects)	Surface Water Body	Level Spreader, Hazardous Spill Basin, or Forebay?	Drainage Area (ac)	New Built-Upon Area (ac)	Required / Minimum Treatment			Treatment Achieved		BMP Associated w/ Buffer Rules?
4	643+00 -L- LT 35.307491 / -81.483125	(1)Buffalo Creek (Kings	Hazardous Spill Basin	9.20	3.30	2yr, tc=10 min, td= 5 min storm runoff + 1,550 cf (cf)	8260.0	cf	See Other BMP's	cf	No
5	648+00 -L- RT 35.305766 / -81.483285	(1)Buffalo Creek (Kings	Hazardous Spill Basin	2.10	1.10	2yr, tc=10 min, td= 5 min storm runoff + 1,550 cf (cf)	3278.0	cf	3297.0	cf	No
5	652+00 -L- RT 35.304594 / -81.483061	(1)Buffalo Creek (Kings	Hazardous Spill Basin	14.70	0.70	2yr, tc=10 min, td= 5 min storm runoff + 1,550 cf (cf)	9488.0	cf	13153.0	cf	No
6	656+00 -L- LT 35.303695 / -81.481991	(1)Buffalo Creek (Kings	Hazardous Spill Basin	6.80	1.70	2yr, tc=10 min, td= 5 min storm runoff + 1,550 cf (cf)	5762.0	cf	5765.0	cf	No
6	668+00 -L- LT 35.300142 / -81.482252	(1)Buffalo Creek (Kings	Hazardous Spill Basin	5.10	2.10	2yr, tc=10 min, td= 5 min storm runoff + 1,550 cf (cf)	5438.0	cf	See Other BMP's	cf	No
7	682+50 -L- RT 35.296267 / -81.483281	(1)Buffalo Creek (Kings	Hazardous Spill Basin	3.10	1.30	2yr, tc=10 min, td= 5 min storm runoff + 1,550 cf (cf)	3980.0	cf	4068.0	cf	No
8	687+00 -L- LT 35.295046 / -81.482550	(1)Buffalo Creek (Kings	Hazardous Spill Basin	3.00	1.20	2yr, tc=10 min, td= 5 min storm runoff + 1,550 cf (cf)	3751.0	cf	3768.0	cf	No

*Hazardous spill basins are pollution prevention measures designed for spill containment rather than stormwater treatment. Under Required / Minimum Treatment and Treatment Achieved, provide the minimum required volume and the actual HSB volume, respectively. Refer to the NCDOT Stormwater Best Management Practices Toolbox (2014) for design guidance.

Additional Comments

North Carolina Department of Transportation

Highway Stormwater Program

STORMWATER MANAGEMENT PLAN

FOR NCDOT PROJECTS

(Version 2.07; Released October 2016)

WBS Element: 34497.1.F56 **TIP No.:** R-2707D **County(ies):** Cleveland

Other Best Management Practices

Sheet No.	Station & Coordinates (Road and Non Road Projects)	Surface Water Body	BMP Type	Drainage Area (ac)	New Built-Upon Area (ac)	Volume Treated (ac-ft)	Precipitation Depth Treated over NBUA (in)	BMP Associated w/ Buffer Rules?
4	643+00 -L- LT 35.307491 / -81.483125	(1)Buffalo Creek (Kings Mountain	Dry Detention Basin	9.2	3.3	1.05	4.02	No
6	668+00 -L- LT 35.300142 / -81.482252	(1)Buffalo Creek (Kings Mountain	Dry Detention Basin	5.1	2.1	0.34	2.04	No
15	781+50 -L- RT 35.272796 / -81.469190	(2)Buffalo Creek	Dry Detention Basin	10.1	3.6	1.02	3.58	No
17	813+50 -L- LT 35.265225 / -81.462792	(2)Buffalo Creek	Dry Detention Basin	14.4	6.5	1.86	3.61	No

Additional Comments

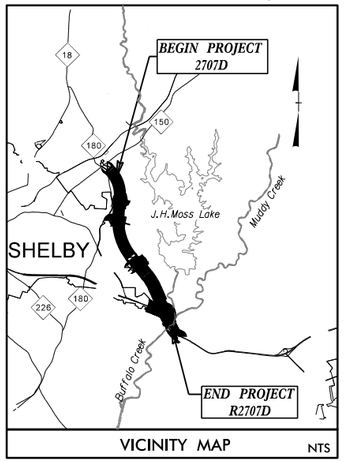
09/08/99

TIP PROJECT: R-2707D

CONTRACT:

$$$$SYSTIME$$$$
$$$$USERNAME$$$$
$$$$DGN$$$$

See Sheet 1A For Index of Sheets
See Sheet 1B For Conventional Symbols



VICINITY MAP NTS

75% APPROVED PLANS

STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS

PERMIT DRAWING
SHEET 1 OF 50

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	R-2707D	1	

STATE PROJ. NO.	F. A. PROJ. NO.	DESCRIPTION
34497.1.F56	N/A	P.E.
34497.1.F56	N/A	R/W & UTIL

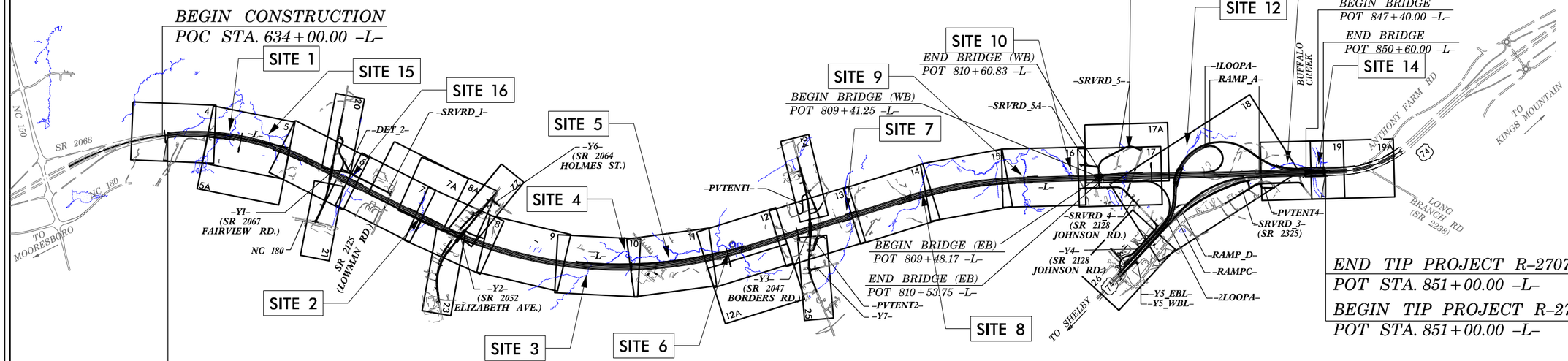
PART 1

CLEVELAND COUNTY

LOCATION: US 74, SHELBY BYPASS FROM EAST OF NC 150 TO EXISTING US 74, WEST OF SR 2238 (LONG BRANCH ROAD)

TYPE OF WORK: GRADING, DRAINAGE, PAVING, SIGNING & STRUCTURES

WETLAND AND SURFACE WATER IMPACTS PERMIT 8-31-2022



END TIP PROJECT R-2707C
POC STA. 635+00.00 -L-

BEGIN TIP PROJECT R-2707D
POC STA. 635+00.00 -L-

END TIP PROJECT R-2707D
POT STA. 851+00.00 -L-

BEGIN TIP PROJECT R-2707E
POT STA. 851+00.00 -L-

THIS PROJECT IS NOT WITHIN ANY CITY LIMITS

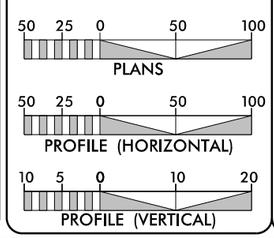
THIS IS A CONTROLLED ACCESS PROJECT WITH ACCESS BEING LIMITED TO INTERCHANGES

CLEARING FOR THIS PROJECT SHALL BE PERFORMED TO THE LIMITS ESTABLISHED BY METHOD III.

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

GRAPHIC SCALES



DESIGN DATA

ADT 2019 = 41,600
ADT 2040 = 59,200
K = 11 %
D = 55 %
T = 15 % *
V = 70 MPH
* TTST = 10% DUAL 5%

FUNC CLASS = FREEWAY

PROJECT LENGTH

LENGTH OF ROADWAY TIP PROJECT R-2707D = 4.008 MI.
LENGTH OF STRUCTURE TIP PROJECT R-2707D = 0.083 MI.
TOTAL LENGTH OF TIP PROJECT R-2707D = 4.091 MI.

STRUCTURE LENGTHS BASED ON WB LANES

PREPARED IN THE OFFICE OF:

Stantec
Stantec Consulting Services Inc. Tel. (919) 851-6866
801 Jones Franklin Road Fax. (919) 851-7024
Suite 300 www.stantec.com
Raleigh, NC 27606 License No. F-0672

SUNGATE DESIGN GROUP, P.A.
905 JONES FRANKLIN ROAD
RALEIGH, NORTH CAROLINA 27606
TEL (919) 859-2243
ENG FIRM LICENSE NO. C-890

FOR THE NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

2018 STANDARD SPECIFICATIONS

RIGHT OF WAY DATE:
01/10/2019

LETTING DATE:
07/18/2023

JOSEPH T. KELVINGTON, P.E.
PROJECT ENGINEER

MICHAEL LINDGREN, P.E.
PROJECT DESIGN ENGINEER

THAD DUNCAN, P.E.
NCDOT DIVISON 12

HYDRAULICS ENGINEER

P.E.
SIGNATURE:

ROADWAY DESIGN ENGINEER

P.E.
SIGNATURE:

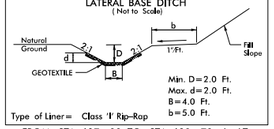
STATE OF NORTH CAROLINA • DEPARTMENT OF TRANSPORTATION •

5/14/99

PERMIT DRAWING
SHEET 2 OF 50

PROJECT REFERENCE NO.	SHEET NO.
R-2707D	2D-1
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

DETAIL #1
LATERAL BASE DITCH
(Not to Scale)

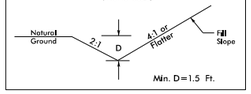


Min. D=2.0 Ft.
Max. d=2.0 Ft.
B=3.0 Ft.
b=5.0 Ft.

Type of Liner= Class 'I' Rip-Rap

FROM STA. 637+00 TO STA. 639+70 –L– LT
FROM STA. 644+00 TO STA. 645+00 –L– RT
FROM STA. 714+00 TO STA. 715+00 –L– LT
FROM STA. 741+00 TO STA. 743+65 –L– RT

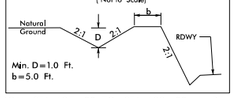
DETAIL #2
SPECIAL LATERAL 'V' DITCH
(Not to Scale)



Min. D=1.5 Ft.

FROM STA. 635+50 TO STA. 637+00 –L– RT
FROM STA. 817+50 TO STA. 818+00 –L– RT
FROM STA. 10+00 TO STA. 14+25 –Y1– RT
FROM STA. 23+73 TO STA. 25+25 –Y1– RT
FROM STA. 11+00 TO STA. 13+00 **–Y2–** RT
FROM STA. 32+50 TO STA. 36+50 –Y5– LT
FROM STA. 44+50 TO STA. 46+50 –RAMP_A– RT
FROM STA. 47+50 TO STA. 48+74 –RAMP_A– LT
FROM STA. 14+00 TO STA. 15+45 –SRVRD_1– RT
FROM STA. 14+30 TO STA. 16+00 **–**SRVRD_3**–** RT
FROM STA. 23+00 TO STA. 24+00 **–**SRVRD_3**–** LT

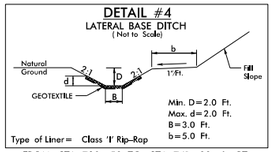
DETAIL #3
BERM 'V' DITCH
(Not to Scale)



Min. D=1.0 Ft.
b=5.0 Ft.

FROM STA. 637+00 TO STA. 638+00 **–L–** RT
FROM STA. 664+00 TO STA. 665+70 **–L–** RT
FROM STA. 674+00 TO STA. 675+50 **–L–** RT
FROM STA. 690+00 TO STA. 691+00 –L– RT
FROM STA. 751+00 TO STA. 754+00 –L– RT
FROM STA. 14+50 TO STA. 16+75 –SRVRD_5– RT

DETAIL #4
LATERAL BASE DITCH
(Not to Scale)

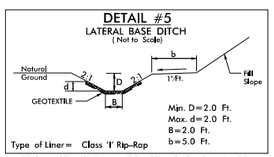


Min. D=2.0 Ft.
Max. d=2.0 Ft.
B=3.0 Ft.
b=5.0 Ft.

Type of Liner= Class 'I' Rip-Rap

FROM STA. 739+50 TO STA. 741+00 –L– RT
FROM STA. 742+60 TO STA. 743+50 –L– LT
FROM STA. 777+50 TO STA. 779+75 –L– RT
FROM STA. 787+50 TO STA. 789+40 –L– RT
FROM STA. 795+50 TO STA. 796+90 **–L–** RT

DETAIL #5
LATERAL BASE DITCH
(Not to Scale)

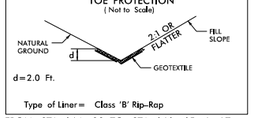


Min. D=2.0 Ft.
Max. d=2.0 Ft.
B=3.0 Ft.
b=5.0 Ft.

Type of Liner= Class 'I' Rip-Rap

FROM STA. 645+00 TO STA. 646+60 –L– RT
FROM STA. 655+80 TO STA. 658+50 **–L–** LT

DETAIL #6
TOE PROTECTION
(Not to Scale)

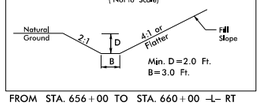


d=2.0 Ft.

Type of Liner= Class 'B' Rip-Rap

FROM STA. 644+30 TO STA. 646+65 –L– LT
FROM STA. 682+70 TO STA. 684+55 –L– RT
FROM STA. 683+40 TO STA. 684+00 **–L–** LT
FROM STA. 684+70 TO STA. 686+50 **–L–** RT
FROM STA. 721+50 TO STA. 725+00 –L– RT
FROM STA. 743+50 TO STA. 744+50 –L– LT
FROM STA. 744+00 TO STA. 745+00 –L– RT
FROM STA. 776+50 TO STA. 778+35 –L– LT
FROM STA. 776+70 TO STA. 777+50 **–L–** RT
FROM STA. 797+05 TO STA. 798+00 **–L–** RT
FROM STA. 13+30 TO STA. 14+25 –RAMP_A– RT
FROM STA. 33+50 TO STA. 35+55 –RAMP_A– RT
FROM STA. 16+50 TO STA. 17+20 –SRVRD_4– RT
FROM STA. 19+60 TO STA. 20+50 –SRVRD_5– LT

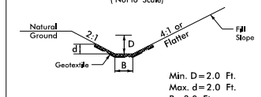
DETAIL #7
SPECIAL LATERAL BASE DITCH
(Not to Scale)



Min. D=2.0 Ft.
B=3.0 Ft.

FROM STA. 656+00 TO STA. 660+00 –L– RT

DETAIL #8
SPECIAL LATERAL BASE DITCH
(Not to Scale)

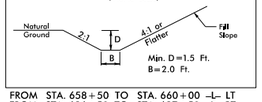


Min. D=2.0 Ft.
Max. d=2.0 Ft.
B=3.0 Ft.

Type of Liner= Class 'B' Rip-Rap

FROM STA. 655+20 TO STA. 656+00 –L– RT

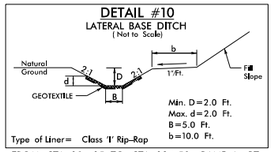
DETAIL #9
SPECIAL LATERAL BASE DITCH
(Not to Scale)



Min. D=1.5 Ft.
B=2.0 Ft.

FROM STA. 658+50 TO STA. 660+00 –L– LT
FROM STA. 686+50 TO STA. 687+50 –L– RT
FROM STA. 725+00 TO STA. 728+50 **–L–** RT

DETAIL #10
LATERAL BASE DITCH
(Not to Scale)

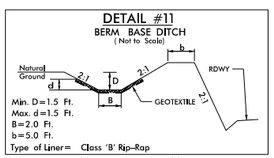


Min. D=2.0 Ft.
Max. d=2.0 Ft.
B=5.0 Ft.
b=10.0 Ft.

Type of Liner= Class 'I' Rip-Rap

FROM STA. 29+35 TO STA. 33+50 –RAMP_A– RT

DETAIL #11
BERM BASE DITCH
(Not to Scale)

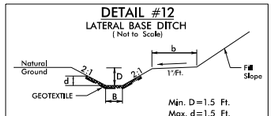


Min. D=1.5 Ft.
Max. d=1.5 Ft.
B=2.0 Ft.
b=5.0 Ft.

Type of Liner= Class 'B' Rip-Rap

FROM STA. 667+00 TO STA. 668+50 –L– RT
FROM STA. 718+00 TO STA. 718+50 **–L–** RT
FROM STA. 729+50 TO STA. 732+00 **–L–** RT
FROM STA. 734+50 TO STA. 739+50 –L– RT

DETAIL #12
LATERAL BASE DITCH
(Not to Scale)

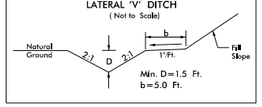


Min. D=1.5 Ft.
Max. d=1.5 Ft.
B=2.0 Ft.
b=5.0 Ft.

Type of Liner= Class 'B' Rip-Rap

FROM STA. 668+50 TO STA. 669+85 –L– RT
FROM STA. 715+75 TO STA. 718+00 –L– RT

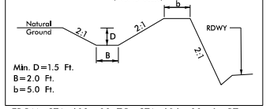
DETAIL #13
LATERAL 'V' DITCH
(Not to Scale)



Min. D=1.5 Ft.
b=5.0 Ft.

FROM STA. 669+85 TO STA. 671+00 **–L–** RT
FROM STA. 21+10 TO STA. 22+00 –Y1– RT

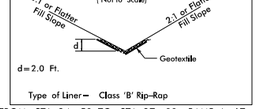
DETAIL #14
BERM BASE DITCH
(Not to Scale)



Min. D=1.5 Ft.
B=2.0 Ft.
b=5.0 Ft.

FROM STA. 692+00 TO STA. 696+00 –L– RT

DETAIL #15
TOE PROTECTION
(Not to Scale)

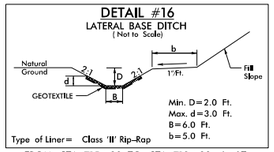


d=2.0 Ft.

Type of Liner= Class 'B' Rip-Rap

FROM STA. 24+50 TO STA. 27+00 –RAMP_A– LT

DETAIL #16
LATERAL BASE DITCH
(Not to Scale)

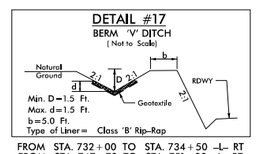


Min. D=2.0 Ft.
Max. d=3.0 Ft.
B=6.0 Ft.
b=5.0 Ft.

Type of Liner= Class 'II' Rip-Rap

FROM STA. 715+00 TO STA. 719+00 –L– LT

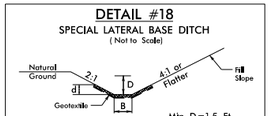
DETAIL #17
BERM 'V' DITCH
(Not to Scale)



Min. D=1.5 Ft.
Max. d=1.5 Ft.
b=5.0 Ft.
Type of Liner= Class 'B' Rip-Rap

FROM STA. 732+00 TO STA. 734+50 –L– RT
FROM STA. 747+70 TO STA. 751+00 –L– RT
FROM STA. 805+00 TO STA. 807+00 –L– RT
FROM STA. 17+50 TO STA. 21+00 –RAMP_A– LT
FROM STA. 21+50 TO STA. 24+00 **–**SRVRD_3**–** RT
FROM STA. 11+80 TO STA. 12+50 **–**SRVRD_4**–** RT

DETAIL #18
SPECIAL LATERAL BASE DITCH
(Not to Scale)

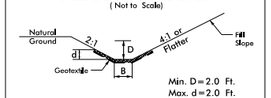


Min. D=1.5 Ft.
Max. d=1.5 Ft.
B=2.0 Ft.

Type of Liner= Class 'B' Rip-Rap

FROM STA. 728+50 TO STA. 729+50 –L– RT
FROM STA. 16+00 TO STA. 16+80 –Y3– RT
FROM STA. 18+00 TO STA. 20+20 –SRVRD_4– LT
FROM STA. 38+00 TO STA. 40+00 –RAMP_A– LT

DETAIL #19
SPECIAL LATERAL BASE DITCH
(Not to Scale)

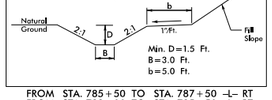


Min. D=2.0 Ft.
Max. d=2.0 Ft.
B=3.0 Ft.

Type of Liner= Class 'I' Rip-Rap

FROM STA. 13+70 TO STA. 16+00 **–**Y3**–** RT
FROM STA. 14+00 TO STA. 16+20 –LOOP_A– RT

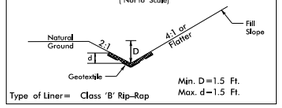
DETAIL #20
LATERAL BASE DITCH
(Not to Scale)



Min. D=1.5 Ft.
B=3.0 Ft.
b=5.0 Ft.

FROM STA. 785+50 TO STA. 787+50 –L– RT
FROM STA. 793+00 TO STA. 795+50 **–L–** RT

DETAIL #21
SPECIAL LATERAL 'V' DITCH
(Not to Scale)

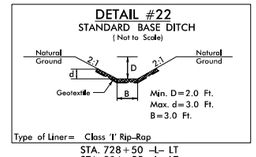


Min. D=1.5 Ft.
Max. d=1.5 Ft.

Type of Liner= Class 'B' Rip-Rap

FROM STA. 25+25 TO STA. 29+00 –Y1– RT
FROM STA. 16+00 TO STA. 16+50 –RAMP_A– RT
FROM STA. 27+50 TO STA. 34+00 –RAMP_A– LT
FROM STA. 46+00 TO STA. 47+50 **–**RAMP_A**–** LT
FROM STA. 14+50 TO STA. 18+00 –LOOP_A– LT

DETAIL #22
STANDARD BASE DITCH
(Not to Scale)

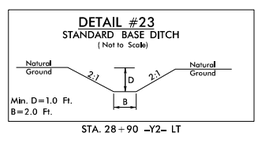


Min. D=2.0 Ft.
Max. d=3.0 Ft.
B=3.0 Ft.

Type of Liner= Class 'I' Rip-Rap

STA. 728+50 –L– LT
STA. 804+55 –L– LT
STA. 791+60 **–L–** LT
FROM STA. 847+75 TO STA. 848+55 **–L–** RT
FROM STA. 849+30 TO STA. 850+60 –L– RT
STA. 19+30 –SRVRD_5– RT

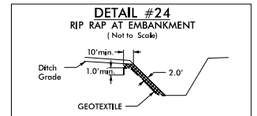
DETAIL #23
STANDARD BASE DITCH
(Not to Scale)



Min. D=1.0 Ft.
B=2.0 Ft.

STA. 28+90 **–**Y2**–** LT

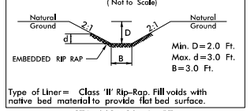
DETAIL #24
RIP RAP AT EMBANKMENT
(Not to Scale)



Type of Liner= Class 'II' Rip Rap

STA. 848+55 –L– RT
STA. 849+25 –L– RT

DETAIL #25
STANDARD BASE CHANNEL
(Not to Scale)

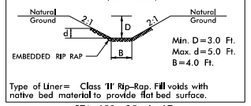


Min. D=2.0 Ft.
Max. d=3.0 Ft.
B=3.0 Ft.

Type of Liner= Class 'II' Rip-Rap. Fill voids with native bed material to provide flat bed surface.

STA. 669+80 –L– RT
STA. 684+60 –L– RT
STA. 764+43 **–L–** LT

DETAIL #26
STANDARD BASE CHANNEL
(Not to Scale)

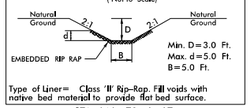


Min. D=3.0 Ft.
Max. d=5.0 Ft.
B=4.0 Ft.

Type of Liner= Class 'II' Rip-Rap. Fill voids with native bed material to provide flat bed surface.

STA. 653+25 –L– LT
STA. 683+30 –L– LT
STA. 778+40 –L– LT
STA. 18+50 –SRVRD_1– LT

DETAIL #27
STANDARD BASE CHANNEL
(Not to Scale)

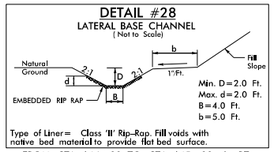


Min. D=3.0 Ft.
Max. d=5.0 Ft.
B=5.0 Ft.

Type of Liner= Class 'II' Rip-Rap. Fill voids with native bed material to provide flat bed surface.

STA. 646+70 **–L–** LT
STA. 815+60 **–L–** LT
FROM STA. 843+50 TO STA. 849+40 –L– LT
STA. 19+50 –SRVRD_5– LT

DETAIL #28
LATERAL BASE CHANNEL
(Not to Scale)

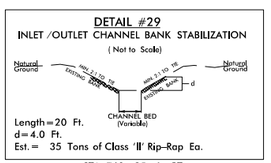


Min. D=2.0 Ft.
Max. d=2.0 Ft.
B=4.0 Ft.
b=5.0 Ft.

Type of Liner= Class 'II' Rip-Rap. Fill voids with native bed material to provide flat bed surface.

FROM STA. 644+00 TO STA. 645+00 –L– RT

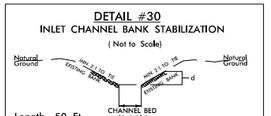
DETAIL #29
INLET /OUTLET CHANNEL BANK STABILIZATION
(Not to Scale)



Length=20 Ft.
d=4.0 Ft.
Est.= 35 Tons of Class 'II' Rip-Rap Ea.

STA. 763+85 **–L–** RT
STA. 776+65 –L– RT
STA. 17+40 –SRVRD_4– RT
STA. 12+65 –DET_2– LT

DETAIL #30
INLET CHANNEL BANK STABILIZATION
(Not to Scale)



Length=50 Ft.
d=5.0 Ft.
Est.= 200 Tons of Class 'II' Rip-Rap

STA. 719+00 –L– LT

SYSTIME=$$$

5/14/99

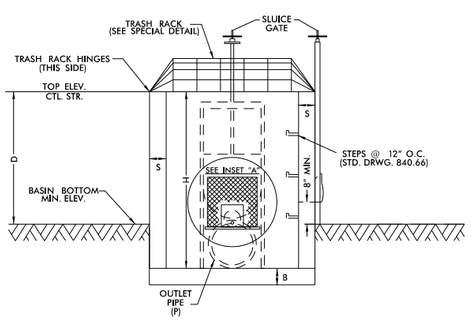
PERMIT DRAWING
SHEET 3 OF 50

PROJECT REFERENCE NO.	SHEET NO.
R-2707D	2D-2
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

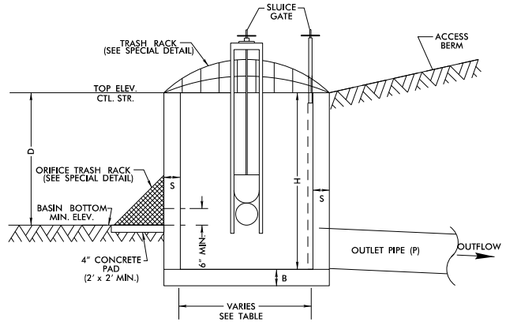
DETAIL #31

DRY DETENTION/HAZARDOUS SPILL BASIN DRAWDOWN STRUCTURE

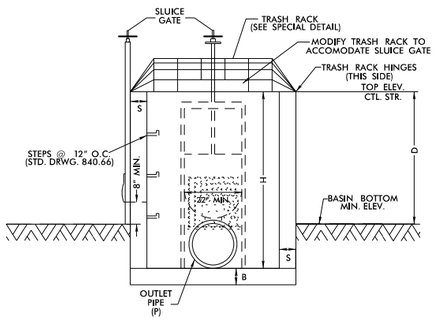
NOT TO SCALE



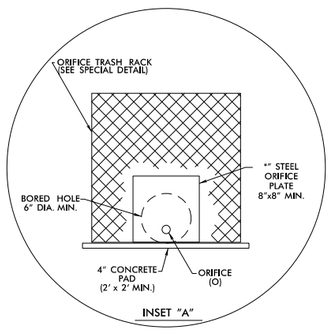
SIDE 1



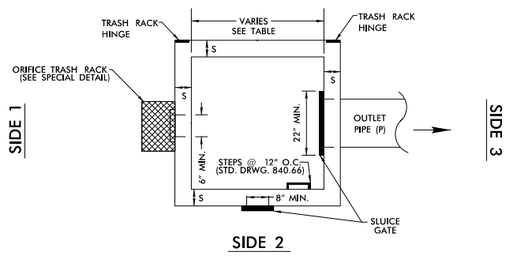
SIDE 2



SIDE 3



INSET "A"



SIDE 2

PLAN VIEW

TRASH RACK NOT SHOWN FOR CLARITY

NOTES:
1. THE BASIN SHOULD BE DESIGNED TO HOLD THE HAZARDOUS SPILL VOLUME ABOVE THE WATER QUALITY VOLUME (WQv) ELEVATION.
2. TOP ELEVATION OF CONTROL STRUCTURE (WEIR ELEVATION) SHOULD BE SET AT THE WQv ELEVATION.
3. 15" MINIMUM DIAMETER FOR OUTLET PIPE.
4. 2" MINIMUM DIAMETER ORIFICE. IF ORIFICE IS GREATER THAN 6", A STEEL PLATE IS NOT REQUIRED.
5. NO BEDDING MATERIAL TO BE USED. THEREFORE, DO NOT FOLLOW STANDARD DRAWINGS FOR METHOD OF PIPE INSTALLATION FOR OUTLET PIPE THROUGH EMBANKMENT.
6. 8" MIN. SLUICE GATE IS FOR MAINTENANCE AND SHOULD REMAIN CLOSED DURING NORMAL OPERATION. A GATE VALVE MAY BE USED IN LIEU OF THE 8" SLUICE GATE.
7. 22" MIN. SLUICE GATE AT THE OUTLET PIPE IS FOR SPILL CONTAINMENT AND SHOULD REMAIN OPEN DURING NORMAL OPERATION.
8. SLUICE GATE SHALL PROVIDE WATERTIGHT SEAL. PROVIDE ADEQUATE CLEARANCE FOR GATE OPERATION AND FOR PROPER SEATING OF GATE OVER PIPE.
9. SELECT BOX STANDARD AS REQUIRED TO ACCOMMODATE SLUICE GATE AND ORIFICE TRASH RACK WIDTH.
10. ENSURE TRASH RACK OPENS FREELY AND WITHOUT INTERFERENCE WITH SLUICE GATES.
11. ADJUST FOOTER DIMENSIONS AS NEEDED FOR ANTI-FLOTATION.
12. PAYMENT OF TRASH RACKS ARE INCIDENTAL TO BASIN DRAWDOWN STRUCTURE.

MINIMUM DIMENSIONS FOR DRY DETENTION BASIN DRAWDOWN STRUCTURE

STATION	STRUCTURE NUMBER	S (INCHES) 6" MIN.	B (INCHES) 6" MIN.	BASIN BOTTOM MINIMUM ELEV.	TOP ELEVATION CONTROL STRUCTURE	MAX. STORAGE DEPTH(D) FEET	INV. ELEV. CTL. STR.	CTL. STR. DIMENSIONS (W x L x H)	ORIFICE DIAMETER (O) INCHES	ORIFICE INV. ELEV.	OUTLET PIPE DIAMETER(P) INCHES
641+74 -L- LT	0406	6"	18"	854.0	858.0	4.0'	852.0	5.0' X 5.0' X 6.0'	2.5"	854.0	30"
668+44 -L- LT	0615	6"	18"	867.0	870.0	3.0'	865.0	5.0' X 5.0' X 5.0'	2.0"	867.0	24"

$$$$$$$$SKETCHES$$$$$$$$
$$$$$$$$DESIGNS$$$$$$$$
$$$$$$$$DRAWINGS$$$$$$$$

5/14/99

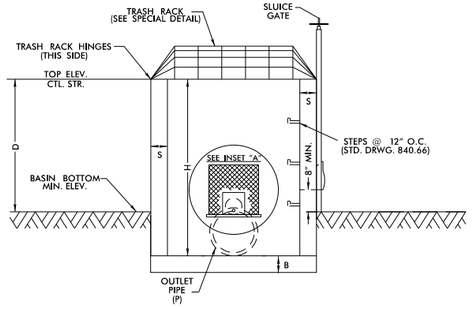
PERMIT DRAWING
SHEET 4 OF 50

PROJECT REFERENCE NO.	SHEET NO.
R-2707D	2D-3
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

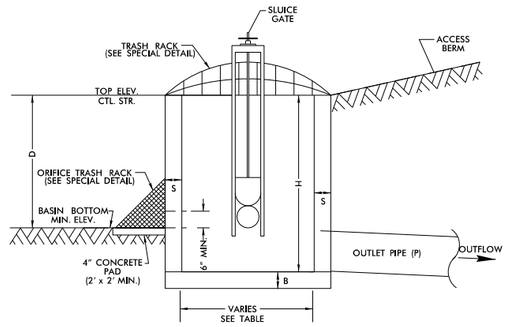
DETAIL #32

DRY DETENTION BASIN DRAWDOWN STRUCTURE

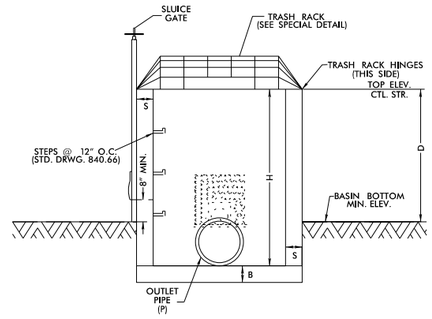
NOT TO SCALE



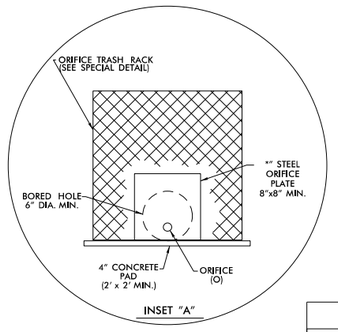
SIDE 1



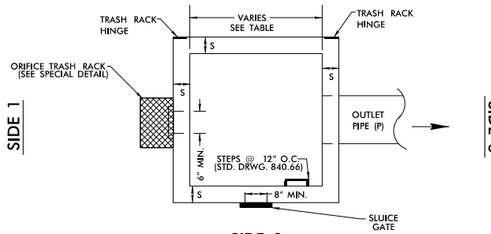
SIDE 2



SIDE 3



INSET "A"



SIDE 2

PLAN VIEW

TRASH RACK NOT SHOWN FOR CLARITY

NOTES:
1. TOP ELEVATION OF CONTROL STRUCTURE (WEIR ELEVATION) SHOULD BE SET AT THE WQv ELEVATION.
2. 15" MINIMUM DIAMETER FOR OUTLET PIPE.
3. 2" MINIMUM DIAMETER ORIFICE. IF ORIFICE IS GREATER THAN 6", A STEEL PLATE IS NOT REQUIRED.
4. NO BEDDING MATERIAL TO BE USED. THEREFORE, DO NOT FOLLOW STANDARD DRAWINGS FOR METHOD OF PIPE INSTALLATION FOR OUTLET PIPE THROUGH EMBANKMENT.
5. SLUICE GATE IS FOR MAINTENANCE AND SHOULD REMAIN CLOSED DURING NORMAL OPERATION. A GATE VALVE MAY BE USED IN LIEU OF THE 8" SLUICE GATE.
6. SLUICE GATE SHALL PROVIDE WATERTIGHT SEAL. PROVIDE ADEQUATE CLEARANCE FOR GATE OPERATION AND FOR PROPER SEATING OF GATE OVER PIPE.
7. SELECT BOX STANDARD AS REQUIRED TO ACCOMMODATE SLUICE GATE AND ORIFICE TRASH RACK WIDTH.
8. ENSURE TRASH RACK OPENS FREELY AND WITHOUT INTERFERENCE WITH SLUICE GATE.
9. ADJUST FOOTER DIMENSIONS AS NEEDED FOR ANTI-FLOTATION.
10. PAYMENT OF TRASH RACKS ARE INCIDENTAL TO BASIN DRAWDOWN STRUCTURE.

MINIMUM DIMENSIONS FOR DRY DETENTION BASIN DRAWDOWN STRUCTURE

STATION	STRUCTURE NUMBER	S (INCHES) 6" MIN.	B (INCHES) 6" MIN.	BASIN BOTTOM MINIMUM ELEV.	TOP ELEVATION CONTROL STRUCTURE	MAX. STORAGE DEPTH(D) FEET	INV. ELEV. CTL. STR.	CTL. STR. DIMENSIONS (W x L x H)	ORIFICE DIAMETER (O) INCHES	ORIFICE INV. ELEV.	OUTLET PIPE DIAMETER(P) INCHES
780+44 -L- RT	1511	6"	18"	726.0	730.0	4.0'	724.0	5.0' X 5.0' X 6.0'	2.5"	726.0	30"
813+94 -L- LT	1728	6"	18"	714.0	719.0	5.0'	712.0	5.0' X 5.0' X 7.0'	3.0"	714.0	36"

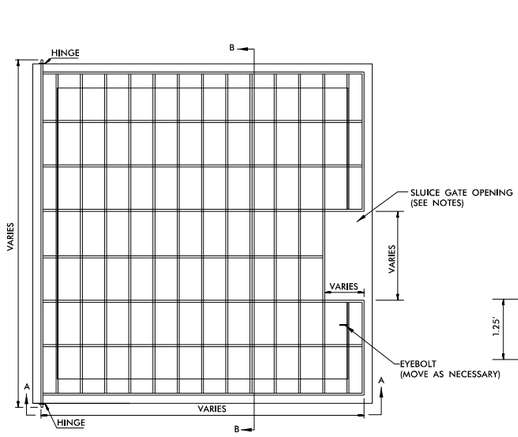
$$$$SYSTIME$$$$
$$$$SYSNAME$$$$
$$$$USERNAME$$$$
$$$$DGNFILE$$$$
$$$$DATE$$$$
$$$$DGNS$$$$

5/14/99

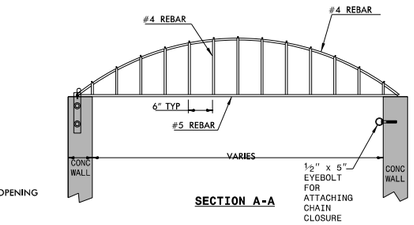
PERMIT DRAWING
SHEET 5 OF 50

PROJECT REFERENCE NO.	SHEET NO.
R-2707D	2D-4
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

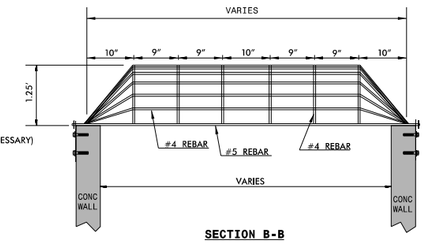
DETAIL #33
REMOVABLE ORIFICE TRASH RACK
NOT TO SCALE



PLAN



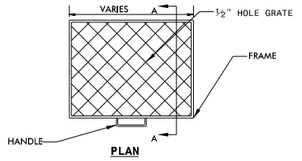
SECTION A-A



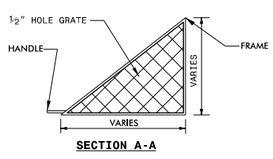
SECTION B-B

REBAR TRASH RACK
NOT TO SCALE

RISER TRASH RACK NOTES:
1. ALL JOINTS SHALL BE FULLY WELDED AROUND JOINT WITH A MINIMUM OF A 1/4" BEAD.
2. IF BOLTS ARE ANCHORED IN CONCRETE, FOLLOW STD. DWG. 862.03 AND 862.04 FOR ANCHORING PROCEDURE.
3. EYEBOLT FOR CHAIN CLOSURE SHALL BE INSTALLED BY THE SAME METHOD AS THE HINGE PLATE BOLTS.
4. RACK AND HARDWARE SHALL BE ALUMINUM OR REBAR AND GALVANIZED IN ACCORDANCE WITH ASTM A-153.
5. PROVIDE OPENING IN TRASH RACK TO ACCOMODATE SLUICE GATE ON THE OUTLET PIPE. ENSURE TRASH RACK OPENS FREELY AND WITHOUT INTERFERENCE WITH SLUICE GATES.



PLAN



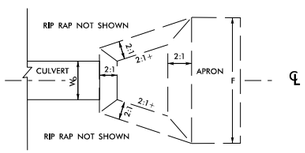
SECTION A-A

ORIFICE TRASH RACK NOTES:
1. ALL JOINTS SHALL BE FULLY WELDED AROUND JOINT WITH A MINIMUM OF A "" BEAD.
2. IF BOLTS ARE ANCHORED IN CONCRETE, FOLLOW STD. DWG. 862.03 AND 862.04 FOR ANCHORING PROCEDURE.
3. REMOVEABLE ORIFICE TRASH RACK SHALL BE ATTACHED TO CONCRETE BOX BY HINGE OR SLIDE RAIL SYSTEM.
4. RACK AND HARDWARE SHALL BE ALUMINUM OR GALVANIZED IN ACCORDANCE WITH ASTM A-153.

DETAIL #34
RIP-RAPPED ENERGY DISSIPATOR BASIN
(OUTLET TO NATURAL GROUND)

DIM. (ft)	RIP RAP BASIN # 1	2	3	4	5
A	2.0'				
B	1.5'				
C	1.5'				
D	1.0'				
E	4.0'				
F	12.0'				
G	10.0'				

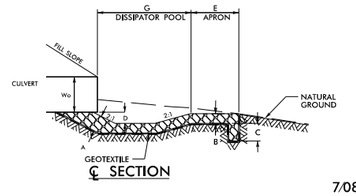
ALL DIMENSIONS APPROXIMATE



PLAN

BASIN #	LOCATION (AT OUTLET)
1	726+50 -L- LT

BASIN(S) #1
CLASS 'I' RIP RAP
EST. 30 TONS
EST. 50 SY GF
EST. 20 CY DDE



℄ SECTION

7/08

DETAIL #35
(NOT TO SCALE)

SINGLE BARREL CULVERT SKEWED W/SILLS AND BAFFLES

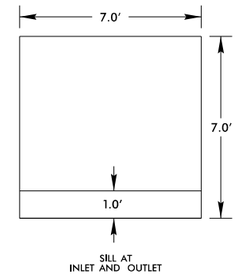
*NOTES:

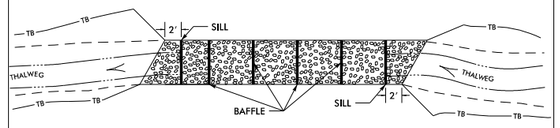
1) NATIVE MATERIAL BETWEEN SILLS/BAFFLES IN THE CULVERT SHALL PROVIDE A CONTINUOUS LOW FLOW CHANNEL. NATIVE MATERIAL CONSISTS OF MATERIAL THAT IS EXCAVATED FROM THE THE STREAM OR FLOODPLAIN AT THE PROJECT SITE DURING CONSTRUCTION. ONLY MATERIAL THAT IS EXCAVATED FROM THE STREAM BED MAY BE USED TO LINE THE CULVERT BARREL. NATIVE MATERIAL IS SUBJECT TO APPROVAL BY THE ENGINEER AND MAY BE SUBJECT TO PERMIT CONDITIONS.

2) SILLS/BAFFLES ARE TO BE 1.0 FT. WIDE, CAST SEPARATELY AND ATTACHED BY DOWELS.

3) TOP OF LOW FLOW SILLS/BAFFLES SHOULD MATCH STREAM BED ELEVATION IN LOW FLOW CHANNEL OF STREAM. (THALWEG)

4) NUMBER OF SILL/BAFFLES DETERMINED BY THE ENGINEER.





NUMBER OF BAFFLES = 30
ON 12 FT CENTERS FROM DOWNSTREAM SILL
(SEE STRUCTURE PLANS)

PLAN VIEW

9/13

1@7' X 7' RCBC AT STA. 717+13 -L-

$$$$$$SYTMES$$$$$
$$$$$$SYSTEMS$$$$$
$$$$$$ENGINEERING$$$$$

5/14/99

PERMIT DRAWING
SHEET 6 OF 50

PROJECT REFERENCE NO.	SHEET NO.
R-2707D	2D-5
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

DETAIL #36
(NOT TO SCALE)

SKEWED MULTI–BARREL CULVERT LOW FLOW CHANNEL,SILLS AND FLOOD PLAIN

*NOTES:

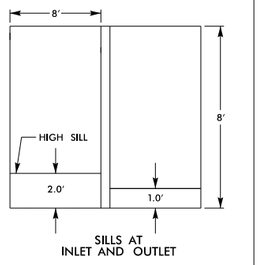
1) NATIVE MATERIAL BETWEEN SILLS/BAFFLES IN THE CULVERT SHALL PROVIDE A CONTINUOUS LOW FLOW CHANNEL. NATIVE MATERIAL CONSISTS OF MATERIAL THAT IS EXCAVATED FROM THE THE STREAM OR FLOODPLAIN AT THE PROJECT SITE DURING CONSTRUCTION. ONLY MATERIAL THAT IS EXCAVATED FROM THE STREAM BED MAY BE USED TO LINE THE LOW FLOW CULVERT BARREL. RIP–RAP MAY BE USED TO SUPPLEMENT THE NATIVE MATERIAL IN THE HIGH FLOW CULVERT BARREL(S). IF RIP–RAP IS USED TO LINE THE HIGH FLOW CULVERT BARREL(S), NATIVE MATERIAL SHOULD BE PLACED ON TOP TO FILL VOIDS AND PROVIDE A FLAT SURFACE FOR ANIMAL PASSAGE. NATIVE MATERIAL IS SUBJECT TO APPROVAL BY THE ENGINEER AND MAY BE SUBJECT TO PERMIT CONDITIONS.

2) SILLS/BAFFLES ARE TO BE 1.0 FT. WIDE, CAST SEPARATELY AND ATTACHED BY DOWELS.

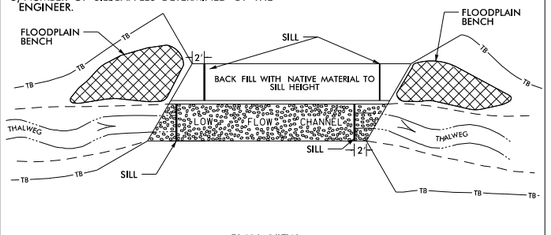
3) TOP OF LOW FLOW SILLS/BAFFLES SHOULD MATCH STREAM BED ELEVATION IN LOW FLOW CHANNEL OF STREAM. (THALWEG)

4) DO NOT SET ELEVATION OF HIGH SILL/BAFFLES ABOVE BANK FULL.

5) NUMBER OF SILL/BAFFLES DETERMINED BY THE ENGINEER.



SILLS AT
INLET AND OUTLET



PLAN VIEW

9/13

2@8' X 8' RCBC AT STA. 743+19 –L–

DETAIL #38
(NOT TO SCALE)

SINGLE BARREL CULVERT LOW FLOW CHANNEL AND SILLS

*NOTES:

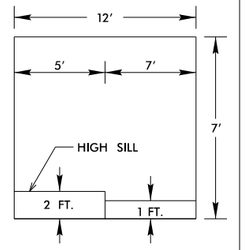
1) NATIVE MATERIAL BETWEEN SILLS/BAFFLES IN THE CULVERT SHALL PROVIDE A CONTINUOUS LOW FLOW CHANNEL. NATIVE MATERIAL CONSISTS OF MATERIAL THAT IS EXCAVATED FROM THE STREAM BED AT THE PROJECT SITE DURING CONSTRUCTION. NATIVE MATERIAL IS SUBJECT TO APPROVAL BY THE ENGINEER AND MAY BE SUBJECT TO PERMIT CONDITIONS.

2) SILLS/BAFFLES ARE TO BE 1.0 FT. WIDE, CAST SEPARATELY AND ATTACHED BY DOWELS.

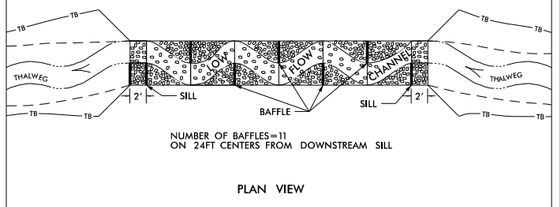
3) TOP OF LOW FLOW SILLS/BAFFLES SHOULD MATCH STREAM BED ELEVATION IN LOW FLOW CHANNEL OF STREAM. (THALWEG)

4) DO NOT SET ELEVATION OF HIGH SILL/BAFFLES ABOVE BANK FULL.

5) NUMBER OF SILL/BAFFLES DETERMINED BY THE ENGINEER.



SILLS AT
INLET AND OUTLET



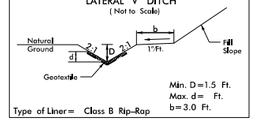
NUMBER OF BAFFLES=11
ON 24FT CENTERS FROM DOWNSTREAM SILL

PLAN VIEW

9/13

1@12' X 7' RCBC AT STA. 796+86 –L–

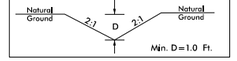
DETAIL #42
LATERAL 'V' DITCH
(Not to Scale)



Type of Liner= Class B Rip–Rap

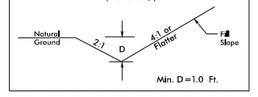
FROM STA. 17+00 TO STA. 18+50 –Y1– RT
FROM STA. 23+00 TO STA. 25+20 –SRVRD_1– LT
FROM STA. 21+35 TO STA. 22+50 –Y2– LT

DETAIL #43
STANDARD 'V' DITCH
(Not to Scale)



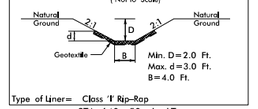
STA. 16+70 –Y1– LT

DETAIL #44
SPECIAL LATERAL 'V' DITCH
(Not to Scale)



FROM STA. 26+50 TO STA. 29+00 –Y1– LT
FROM STA. 24+50 TO STA. 26+30 –Y2– RT
FROM STA. 26+60 TO STA. 29+25 –Y2– RT
FROM STA. 26+60 TO STA. 29+00 –Y2– LT
FROM STA. 28+00 TO STA. 30+00 –Y3– LT
FROM STA. 28+00 TO STA. 32+00 –Y3– RT
FROM STA. 9+90 TO STA. 13+00 –Y4– RT
FROM STA. 20+00 TO STA. 21+00 –SRVRD_1– RT

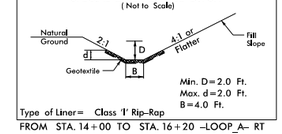
DETAIL #45
STANDARD BASE DITCH
(Not to Scale)



Type of Liner= Class 'I' Rip–Rap

STA. 640+50 –L– LT

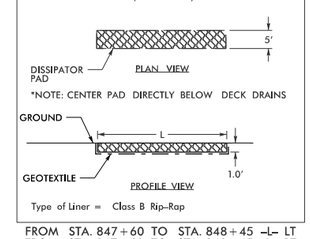
DETAIL #48
SPECIAL LATERAL BASE DITCH
(Not to Scale)



Type of Liner= Class 'I' Rip–Rap

FROM STA. 14+00 TO STA. 16+20 –LOOP_A– RT

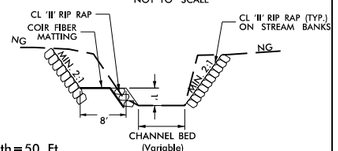
DETAIL #49
DECK DRAIN DISSIPATOR PAD
(Not to Scale)



Type of Liner = Class B Rip–Rap

FROM STA. 847+60 TO STA. 848+45 –L– LT
FROM STA. 847+60 TO STA. 848+45 –L– RT
FROM STA. 847+97 TO STA. 848+33 –L– MED LT
FROM STA. 847+97 TO STA. 848+33 –L– MED RT
FROM STA. 850+11 TO STA. 850+37 –L– MED LT
FROM STA. 850+11 TO STA. 850+37 –L– MED RT
FROM STA. 850+11 TO STA. 850+37 –L– LT
FROM STA. 850+11 TO STA. 850+37 –L– RT

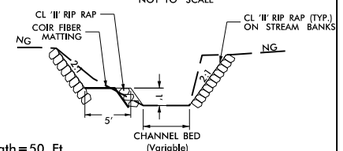
DETAIL #37
INLET /OUTLET CHANNEL DETAIL
NOT TO SCALE



Length=50 Ft.
Est.= 110 Tons of Class 'II' Rip–Rap

STA. 742+50 –L– LT
STA. 743+50 –L– RT

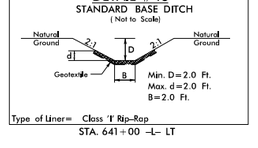
DETAIL #39
INLET /OUTLET CHANNEL DETAIL
NOT TO SCALE



Length=50 Ft.
Est.= 110 Tons of Class 'II' Rip–Rap

STA. 796+75 –L– LT
STA. 796+95 –L– RT

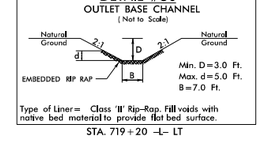
DETAIL #46
STANDARD BASE DITCH
(Not to Scale)



Type of Liner= Class 'I' Rip–Rap

STA. 641+00 –L– LT

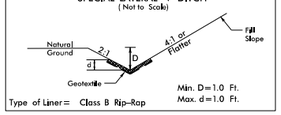
DETAIL #50
OUTLET BASE CHANNEL
(Not to Scale)



Type of Liner= Class 'II' Rip–Rap. Fill voids with native bed material to provide flat bed surface.

STA. 719+20 –L– LT

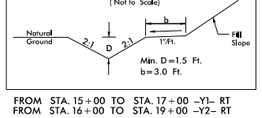
DETAIL #40
SPECIAL LATERAL 'V' DITCH
(Not to Scale)



Type of Liner= Class B Rip–Rap

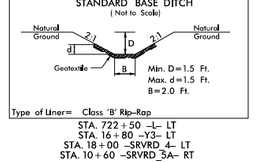
FROM STA. 10+00 TO STA. 12+75 –Y1– LT
FROM STA. 20+00 TO STA. 23+00 –SRVRD_1– LT
FROM STA. 18+50 TO STA. 20+20 –SRVRD_4– RT

DETAIL #41
LATERAL 'V' DITCH
(Not to Scale)



FROM STA. 15+00 TO STA. 17+00 –Y1– RT
FROM STA. 16+00 TO STA. 19+00 –Y2– RT

DETAIL #47
STANDARD BASE DITCH
(Not to Scale)



Type of Liner= Class 'B' Rip–Rap

STA. 722+50 –L– LT
STA. 16+80 –Y3– LT
STA. 18+00 –SRVRD_4– LT
STA. 10+60 –SRVRD_3A– RT

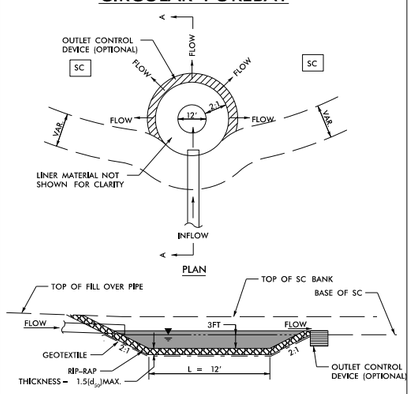
$$$$SYSTIME$$$$
$$$$SYSNAME$$$$
$$$$FRAME$$$$
$$$$DGN$$$$

5/14/99

PERMIT DRAWING
SHEET 7 OF 50

PROJECT REFERENCE NO.	SHEET NO.
R-2707D	2D-6
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

DETAIL #51
CIRCULAR FOREBAY

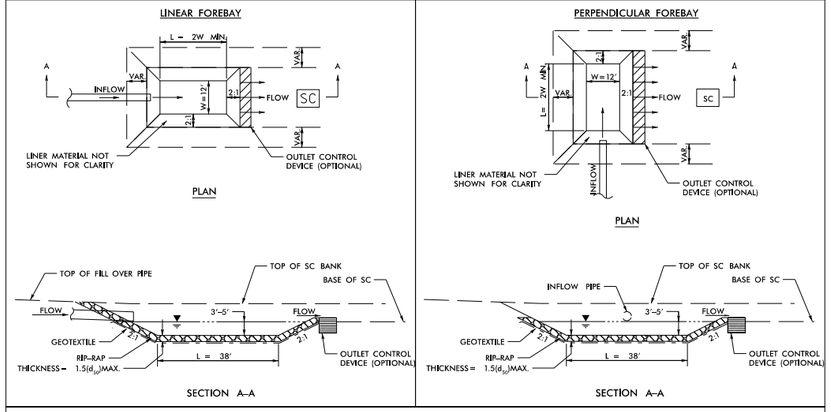


NOTES:
1) LINER MATERIAL TO BE SPECIFIED BY ENGINEER.
2) CIRCULAR FOREBAYS TO BE USED ONLY WITH PIPE INLETS, UNLESS OTHERWISE DIRECTED BY ENGINEER.
3) MODIFICATIONS MAY BE NEEDED, AS APPROVED BY ENGINEER.

Type of Liner = Class 'I' Rip–Rap

STA. 642+95 –L– LT
STA. 667+62 –L– LT

DETAIL #52
RECTANGULAR FOREBAYS WITH PIPE

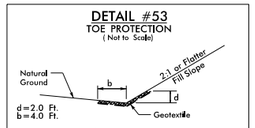


NOTES:
1) LINER MATERIAL TO BE SPECIFIED BY ENGINEER.
2) CIRCULAR FOREBAYS TO BE USED ONLY WITH PIPE INLETS, UNLESS OTHERWISE DIRECTED BY ENGINEER.
3) MODIFICATIONS MAY BE NEEDED, AS APPROVED BY ENGINEER.

Type of Liner = Class 'I' Rip–Rap

STA. 782+40 –L– RT
STA. 813+00 –L– LT

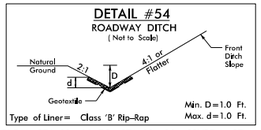
DETAIL #53
TOE PROTECTION
(Not to Scale)



Type of Liner = Class 'B' Rip–Rap

FROM STA. 24+50 TO STA. 28+00 –RAMP_A– RT

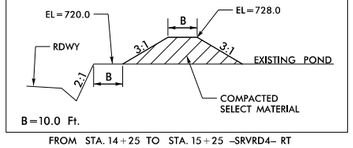
DETAIL #54
ROADWAY DITCH
(Not to Scale)



Type of Liner = Class 'B' Rip–Rap

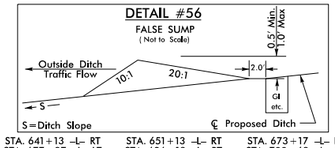
FROM STA. 10+00 TO STA. 12+00 –SRVRD4– RT
FROM STA. 10+00 TO STA. 12+40 –SRVRD4– LT
FROM STA. 10+25 TO STA. 10+95 –SRVRD5– LT

DETAIL #55
FILL IN POND
(Not to Scale)



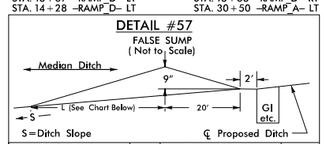
FROM STA. 14+25 TO STA. 15+25 –SRVRD4– RT

DETAIL #56
FALSE SUMP
(Not to Scale)



STA. 641+13 –L– RT
STA. 677+37 –L– RT
STA. 705+13 –L– RT
STA. 744+88 –L– LT
STA. 821+33 –L– RT
STA. 839+13 –L– RT
STA. 651+13 –L– RT
STA. 696+13 –L– RT
STA. 709+63 –L– RT
STA. 749+88 –L– LT
STA. 828+13 –L– RT
STA. 23+74 –Y1– RT
STA. 673+17 –L– LT
STA. 700+63 –L– RT
STA. 739+13 –L– RT
STA. 798+38 –L– LT
STA. 832+13 –L– RT
STA. 24+88 –Y3–LT
STA. 20+14 –SRVRD_1– LT
STA. 25+17 –RAMP_D– LT
STA. 21+87 –RAMP_D– LT
STA. 18+37 –RAMP_D– LT
STA. 14+28 –RAMP_D– LT
STA. 11+88 –SRVRD_4– RT
STA. 25+17 –RAMP_D– RT
STA. 21+88 –RAMP_D– RT
STA. 18+38 –RAMP_D– RT
STA. 30+50 –RAMP_A– LT

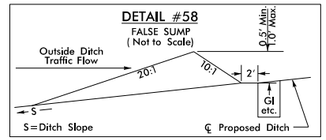
DETAIL #57
FALSE SUMP
(Not to Scale)



Ditch Grade	L	Ditch Grade	L
0.0% To 2.0%	20'	Over 4.0% To 6.0%	40'
Over 2.0% To 4.0%	30'	Over 6.0%	50'

STA. 637+63 –L– MED
STA. 647+18 –L– MED
STA. 660+37 –L– MED
STA. 677+37 –L– MED
STA. 696+13 –L– MED
STA. 709+63 –L– MED
STA. 722+63 –L– MED
STA. 734+63 –L– MED
STA. 745+38 –L– MED
STA. 764+58 –L– MED
STA. 777+63 –L– MED
STA. 792+98 –L– MED
STA. 801+88 –L– MED
STA. 810+88 –L– MED
STA. 821+33 –L– MED
STA. 641+13 –L– MED
STA. 650+88 –L– MED
STA. 668+43 –L– MED
STA. 681+87 –L– MED
STA. 700+63 –L– MED
STA. 713+13 –L– MED
STA. 726+63 –L– MED
STA. 739+13 –L– MED
STA. 749+88 –L– MED
STA. 768+63 –L– MED
STA. 782+63 –L– MED
STA. 796+93 –L– MED
STA. 804+48 –L– MED
STA. 812+88 –L– MED
STA. 828+13 –L– MED
STA. 643+08 –L– MED
STA. 655+88 –L– MED
STA. 673+17 –L– MED
STA. 688+08 –L– MED
STA. 705+13 –L– MED
STA. 718+63 –L– MED
STA. 730+63 –L– MED
STA. 741+88 –L– MED
STA. 761+13 –L– MED
STA. 772+63 –L– MED
STA. 787+63 –L– MED
STA. 798+38 –L– MED
STA. 805+38 –L– MED
STA. 817+38 –L– MED
STA. 832+13 –L– MED
STA. 835+13 –L– MED
STA. 839+13 –L– MED

DETAIL #58
FALSE SUMP
(Not to Scale)



STA. 637+00 –L– RT
STA. 696+13 –L– LT
STA. 709+63 –L– LT
STA. 745+38 –L– RT
STA. 768+63 –L– LT
STA. 801+88 –L– RT
STA. 828+13 –L– LT
STA. 660+37 –L– RT
STA. 700+63 –L– LT
STA. 713+13 –L– RT
STA. 749+88 –L– RT
STA. 772+63 –L– LT
STA. 805+38 –L– RT
STA. 835+13 –L– LT
STA. 667+13 –L– LT
STA. 705+13 –L– RT
STA. 730+00 –L– RT
STA. 762+63 –L– LT
STA. 798+38 –L– RT
STA. 808+93 –L– LT
STA. 839+13 –L– LT
STA. 25+13 –Y3– RT
STA. 19+82 –SRVRD_1– RT
STA. 11+88 –SRVRD_4– LT
STA. 16+63 –RAMPC– LT
STA. 20+36 –RAMPC– RT
STA. 17+38 –RAMP_A– LT
STA. 10+79 –SRVRD_5A– RT
STA. 16+61 –RAMPC– RT
STA. 18+36 –RAMPC– RT
STA. 22+20 –RAMPC– RT

$$$$SYSTIME$$$$
$$$$USERNAME$$$$

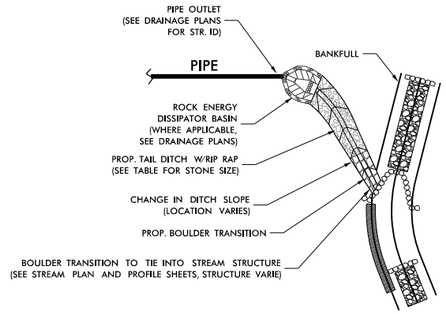
5/14/99

PERMIT DRAWING
SHEET 8 OF 50

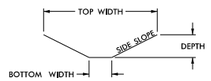
PROJECT REFERENCE NO.	SHEET NO.
R-2707D	2D-7
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

DETAIL #60

STORMWATER TIE IN TO STREAM STRUCTURE



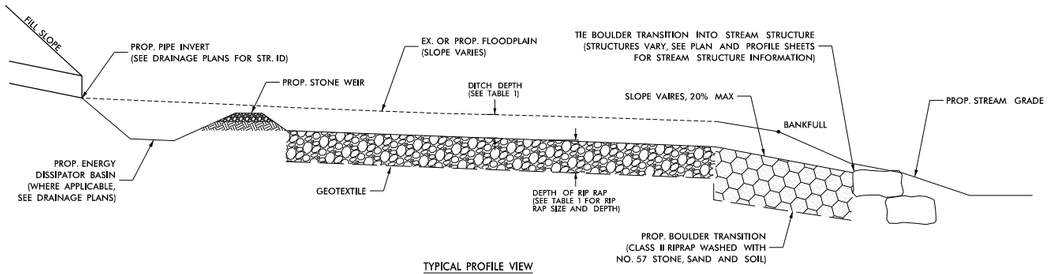
TYPICAL PLAN VIEW
N.T.S.



TYPICAL STORMWATER DITCH CROSS SECTION
N.T.S

Table 1: Stormwater Ditch Cross Section Data

Structure ID	Bottom Width	Side Slopes	Top Width	Depth	Riprap Size	Depth of Riprap	Average Slope of Ditch in Floodplain (ft/ft)
1009	2'	2:1	6'	1'	Class 'B'	16"	0.044
1012	3'	2:1	13'	2.5'	Class 'I'	20"	0.038
1112	3'	2:1	11'	2'	Class 'I'	20"	0.029
1106	2'	2:1	6'	1'	Class 'I'	20"	0.043
1109	2'	2:1	6'	1'	Class 'B'	16"	0.033
1209	2'	2:1	6'	1'	Class 'B'	16"	0.06 – 0.09



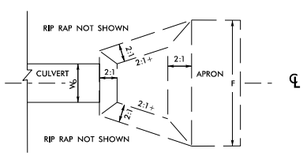
TYPICAL PROFILE VIEW
N.T.S.

DETAIL #59

RIP-RAPPED ENERGY DISSIPATOR BASIN (OUTLET TO TAIL DITCH)

DIM. (ft)	RIP RAP BASIN # 2	3	4	5	
A	2.0'	2.0'	2.0'	2.0'	
B	1.5'	1.5'	1.5'	1.5'	
C	1.5'	1.5'	1.5'	1.5'	
D	1.0'	1.0'	1.0'	1.0'	
E	4.0'	4.0'	4.0'	4.0'	
F	12.0'	12.0'	12.0'	12.0'	
G	10.0'	10.0'	10.0'	10.0'	

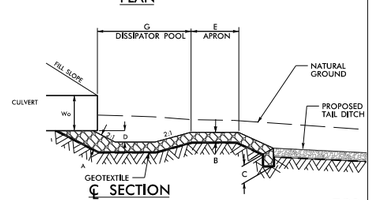
ALL DIMENSIONS APPROXIMATE



PLAN

BASIN #	LOCATION (AT OUTLET)
2	722+50 –L– LT
3	730+50 –L– LT
4	734+50 –L– LT
5	741+08 –L– LT

BASIN(S) #2–5
CLASS 'I' RIP RAP
EST. 30 TONS
EST. 50 SY GF
EST. 20 CY DDE

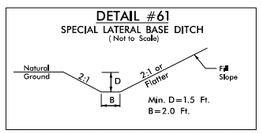


℄ SECTION

7/08

DETAIL #61

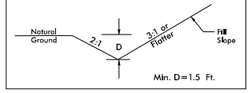
SPECIAL LATERAL BASE DITCH
(Not to Scale)



FROM STA. 29+65 TO STA. 31+00 –Y2– RT

DETAIL #62

SPECIAL LATERAL 'V' DITCH
(Not to Scale)



FROM STA. 31+00 TO STA. 32+00 –Y2– RT

$$$$$$SYSTIME$$$$$$
$$$$$$USERNAME$$$$$$
$$$$$$FILENAME$$$$$$

8/17/99

PERMIT DRAWING
SHEET 9 OF 50

PROJECT REFERENCE NO.	SHEET NO.
R-2707D	5
RW SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

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S S DENOTES IMPACTS IN SURFACE WATER

TS TS DENOTES TEMPORARY IMPACTS IN SURFACE WATER

50′ 25′ 0 50′ 100′
SCALE: 1″ = 100′

NAD 83

WADE HOMESLEY

LELIA AND HENRY YARBOROUGH

WALKER CASSIDY

S3°44′22″W 1155.00

645 650 655

SITE 1

SITE 15

TEMPORARY CONSTRUCTION EASEMENT REQUIRED FOR EROSION CONTROL DEVICE

STD. 5′ BASE CHANNEL W/EMBEDDED CL 'II' RIP RAP
EST. 62 TONS
LENGTH = 25′
SLOPE = 2.0%
SEE DETAIL #27

TOE PROTECTION
CL 'B' RIP RAP
EST. 189 TONS
EST. 508 SY GF
SEE DETAIL #6

FILL EXISTING CHANNEL WITH SUITABLE MATERIAL
EST 20 CY

PIPE
Q(10yr) = 75 cfs
S = 5.8%
V(10yr) = 23.3 fps

DO NOT BURY INVERT

STD. 4′ BASE CHANNEL W/EBMEDDED CL 'II' RIP RAP
EST. 106 TONS
LENGTH = 45′
SLOPE = 8.0%
SEE DETAIL #26

HAZARDOUS SPILL BASIN
40′ X 27′ BASE W/2:1 SIDES
MIN. CAPACITY = 213 CY
TOTAL CAPACITY @ ELEV. 848.0
W/1.0′ FREEBOARD = 214 CY

DO NOT BURY INVERT

JB w/MH (Drop Box)

48″ RCP–III

N16°15′38″W 541.20

LAT. 2′ BASE DITCH W/CL 'I' RIP RAP
EST. 312 TONS
EST. 551 SY GF
SEE DETAIL #5

CL 'I' RIP RAP
EST. 11 TONS
EST. 22 SY GF

30″ RCP–III

HW W/ SLUICE GATE

18″ RCP–III

JB w/MH (Drop Box)

18″ CMP

45° RCP–IV

36″ RCP–IV

15″ RCP–IV

FS, SEE DETAIL #57

FS, SEE DETAIL #56

2GI

18″ RCP–IV

18″ RCP–IV

15″ RCP–IV

18″ W/ELBOW

HW

PDE

SHOULDER BERM GUTTER FROM STA. 642+50 TO STA. 647+10 –L– RT

LAT. 4′ BASE CHANNEL W/EMBEDDED CL 'II' RIP RAP
EST. 188 TONS
SEE DETAIL #28

DO NOT BURY INVERT

LAT. 2′ BASE DITCH W/CL 'I' RIP RAP
EST. 327 SY GF
SEE DETAIL #5

HAZARDOUS SPILL BASIN
45′ X 15′ BASE W/2:1 SIDES
MIN. CAPACITY = 121 CY
TOTAL CAPACITY @ ELEV. 860.0
W/1.0′ FREEBOARD = 122 CY

HW W/ SLUICE GATE

CL 'B' RIP RAP
EST. — TONS
EST. — SY GF

SPECIAL DITCH GRADE SEE PROFILE

UTILIZE EXISTING SWALE AS HAZARDOUS SPILL BASIN
MIN. CAPACITY = 351 CY
CAPACITY @ ELEV. 854.0 = 487 CY

CL 'B' RIP RAP
EST. 1 TON
EST. 5 SY GF

HW W/ SLUICE GATE

CL 'B' RIP RAP
EST. 2 TONS
EST. 7 SY GF

DO NOT BURY INVERT

SHOULDER BERM GUTTER FROM STA. 654+45 TO STA. 660+00 –L– RT

S8°01′37″E 270.49

S10°18′0″ 60.0

REBAR

SPEC. LAT. 3′ BASE DITCH W/CL 'B' RIP RAP
EST. 77 TONS
EST. 200 SY GF
SEE DETAIL #8

SPEC. LAT. 3′ BASE DITCH
SEE DETAIL #7

–L– STA. 643+00

–L– STA. 656+50

MATCH SHEET NO. 4

MATCH SHEET NO. 6

MATCH SHEET NO. 5A

REFERENCE:
FOR –L– PROFILE, SEE SHEET NO.27

$$$$$$$SYSTIME$$$$$
$$$$$$$SYSTIMEFENAME$$$$$
$$$$$$$SYSTIMEFENAMEDGN$$$$$

8/17/99

PERMIT DRAWING
SHEET 10 OF 50

PROJECT REFERENCE NO.	SHEET NO.
R-2707D	5
RW SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
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S S DENOTES IMPACTS IN SURFACE WATER

TS TS DENOTES TEMPORARY IMPACTS IN SURFACE WATER

50' 25' 0 50' 100'
SCALE: 1" = 100'

NAD 83

WADE HOMESLEY

LELIA AND HENRY YARBOROUGH

WALKER CASSIDY

TEMPORARY CONSTRUCTION EASEMENT REQUIRED FOR EROSION CONTROL DEVICE

STD. 5' BASE CHANNEL W/EMBEDDED CL 'II' RIP RAP
EST. 62 TONS
LENGTH = 25'
SLOPE = 2.0%
SEE DETAIL #27

TOE PROTECTION
CL 'B' RIP RAP
EST. 189 TONS
EST. 508 SY GF
SEE DETAIL #4

SITE 1

TILL EXISTING CHANNEL WITH SUITABLE MATERIAL
EST. 20 CY

PIPE
Q(10yr) = 75 cfs
S = 5.8%
V(10yr) = 23.3 fps

DO NOT BURY INVERT

SITE 15

STD. 4' BASE CHANNEL W/EMBEDDED CL 'II' RIP RAP
EST. 106 TONS
LENGTH = 45'
SLOPE = 8.0%
SEE DETAIL #26

HAZARDOUS SPILL BASIN
40' X 27' BASE W/2:1 SIDES
MIN. CAPACITY = 213 CY
TOTAL CAPACITY @ ELEV. 848.0
W/1.0' FREEBOARD = 214 CY

DO NOT BURY INVERT

LAT. 3' BASE DITCH W/CL 'I' RIP RAP
EST. 312 TONS
EST. 551 SY GF
SEE DETAIL #5

CL 'I' RIP RAP
EST. 16 TONS
EST. 22 SY GF

30" RCP-III

JB w/MH (Drop Box)

48" RCP-III

HW w/ SLUICE GATE

18" RCP-III

JB w/MH (Drop Box)

36" RCP-IV

18" CMP

FS, SEE DETAIL #57

2GI

15" RCP-IV

18" RCP-IV

FS, SEE DETAIL #56

HW w/ SLUICE GATE

CL 'B' RIP RAP
EST. 2 TONS
EST. 9 SY GF

DO NOT BURY INVERT

SPECIAL DITCH GRADE SEE PROFILE

CL 'B' RIP RAP
EST. 1 TON
EST. 5 SY GF

UTILIZE EXISTING SWALE AS HAZARDOUS SPILL BASIN
MIN. CAPACITY = 251 CY
CAPACITY @ ELEV. 854.0 = 487 CY

SHOULDER BERM GUTTER FROM STA. 654+45 TO STA. 660+00 -L- RT

SPEC. LAT. 3' BASE DITCH W/CL 'B' RIP RAP
EST. 77 TONS
EST. 200 SY GF
SEE DETAIL #8

SPEC. LAT. 3' BASE DITCH
SEE DETAIL #7

HW

PDE

F

C

SHOULDER BERM GUTTER FROM STA. 642+50 TO STA. 647+10 -L- RT

LAT. 4' BASE CHANNEL W/EMBEDDED CL 'II' RIP RAP
EST. 188 TONS
SEE DETAIL #28

DO NOT BURY INVERT

LAT. 2' BASE DITCH W/CL 'I' RIP RAP
EST. 188 TONS
EST. 327 SY GF
SEE DETAIL #5

HW w/ SLUICE GATE

CL 'B' RIP RAP
EST. — TONS
EST. — SY GF

HAZARDOUS SPILL BASIN
45' X 15' BASE W/2:1 SIDES
MIN. CAPACITY = 121 CY
TOTAL CAPACITY @ ELEV. 860.0
W/1.0' FREEBOARD = 122 CY

18" W/ELBOWS

15" RCP-IV

18" RCP-IV

MATCH SHEET NO. 4 STA. 643+00 -L-

MATCH SHEET NO. 6 STA. 656+50 -L-

MATCH SHEET NO. 5A

REFERENCE:
FOR -L- PROFILE, SEE SHEET NO.27

$$$$$$SYSTIME$$$$$$
$$$$$$DGN$$$$$$$$$$$$$$$$$$$$
$$$$$$USERNAME$$$$

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PERMIT DRAWING
SHEET 11 OF 50

NAD 83

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PROJECT REFERENCE NO.	SHEET NO.
R-2707D	6
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

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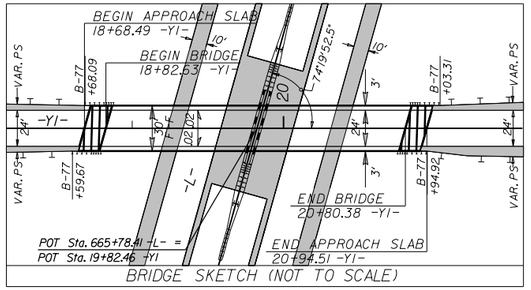

50' 25' 0 50' 100'
SCALE: 1"=100'

MATCH SHEET NO. 5
STA. 656+50 -L-

MATCH SHEET NO. 20
STA. 14+00 -SRVRD_1-

MATCH SHEET NO. 20
STA. 16+75 -Y1-

MATCH SHEET NO. 7
STA. 18+71.37 -SRVRD_1-

MATCH SHEET NO. 7
STA. 670+00 -L-

MATCH SHEET NO. 21
STA. 24+00 -Y1-

WALKER CASSIDY

LELIA AND HENRY YARBOROUGH

BURNS & SPANGLER, INC.

MICHAEL ROBERT PRICE

MACHINE BUILDERS AND DESIGN

JACQUELINE HARRISON

JAY AND SHERI BONAKDAR

NATURE'S CALLING, LLC

LAT. 2' BASE DITCH W/CL 'I' RIP RAP SEE DETAIL #5

SPEC. LAT. 2' BASE DITCH SEE DETAIL #9

SPEC. LAT. 3' BASE DITCH SEE DETAIL #7

LAT. 'V' DITCH W/CL 'B' RIP RAP EST. 69 TONS EST. 195 SY GF SEE DETAIL #42

SPEC. LAT. 'V' DITCH SEE DETAIL #2

SHOULDER BERM GUTTER FROM STA. 654+50 TO STA. 660+00 -L- RT

SHOULDER BERM GUTTER FROM STA. 18+50 TO BEGIN APPROACH SLAB -Y1- LT & RT

SHOULDER BERM GUTTER FROM END APPROACH SLAB TO STA. 21+15 -Y1- LT & RT

SHOULDER BERM GUTTER FROM STA. 666+00 TO STA. 671+50 -L- RT

BERM 'V' DITCH SEE DETAIL #3

LAT. 'V' DITCH SEE DETAIL #13

DRY DETENTION BASIN W/3:1 SIDES TOTAL CAPACITY @ ELEV. 871.0 W/1.0FT FREEBOARD=835 CY CIRCULAR FOREBAY W/CL 'I' RIP RAP EST. __ TONS EST. __ SY GF SEE DETAIL #51

DRY DETENTION/HAZARDOUS SPILL BASIN DRAWDOWN STRUCTURE W/ACCESS BERM SEE DETAIL #31 & #33

TEMPORARY CONSTRUCTION EASEMENT REQUIRED FOR EROSION CONTROL DEVICE

STD. 4' BASE CHANNEL W/EMBEDDED CL 'II' RIP RAP EST. 66 TONS, EST. 81 SY GF LENGTH=20' SLOPE=2.0% SEE DETAIL #26

PIPE Q(10yr)=80 cfs S=0.7% V(10yr)=10.9 fps

WATER LINE DIRECTIONAL BORE

DO NOT BURY INVERT 54" RCP-III

JB w/HT (Drop Box)

SITE 16

CL 'B' RIP RAP EST. 1 TON EST. 5 SY GF

SPEC. DITCH GRADE SEE PROFILE

FS, SEE DETAIL #58

FS TO EL. 897.0 SEE DETAIL #56

REMOVE

24" RCP-III

48" RCP

18" RCP-III

15" RCP-III

18" RCP-IV

18" RCP

2GI

2GI-A

TB 2GI

TB 2GI 15" W/ELBOWS

GRADE TO DRAIN

3" PVC TO BE ABANDONED

LAT. 2' BASE DITCH W/CL 'B' RIP RAP EST. 76 TONS EST. 205 SY GF SEE DETAIL #15

BERM 2' BASE DITCH W/CL 'B' RIP RAP EST. 84 TONS EST. 228 SY GF SEE DETAIL #11

STD. 3' BASE CHANNEL W/EMBEDDED CL 'II' RIP RAP EST. 101 TONS EST. 132 SY GF LENGTH=45' SLOPE=6.0% SEE DETAIL #25

S 4° 24' 33.4" W

S 78° 44' 26.0" W

S 39° 39' 44.2" W

N 7° 59' 28" W 397.22

S 85° 50' 33" E 476.98

N 7° 40' 05" W 217.57

S 7° 09' 23" E 26.09

421.93

197.77

PUE

DENOTES IMPACTS IN SURFACE WATER

DENOTES TEMPORARY IMPACTS IN SURFACE WATER

REFERENCES:
FOR –L– PROFILE, SEE SHEET NO. 28
FOR –Y1– PROFILE, SEE SHEET NO. 44
FOR –SRVRD_1– PROFILE, SEE SHEET NO. 50
FOR –DET_2– PROFILE, SEE SHEET NO. 2B–2

$$$$$$SYSTIME$$$$$$
$$$$$$SYSNAME$$$$$$DGN$$$$$$$$$$$$$$$$$$$$

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PERMIT DRAWING
SHEET 12 OF 50

NAD 83

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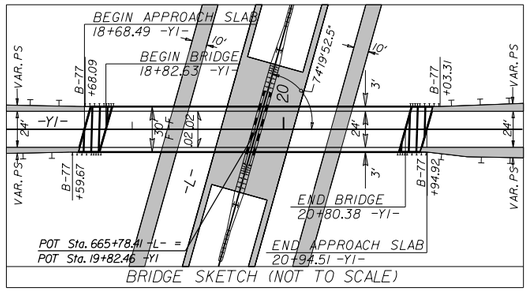
PROJECT REFERENCE NO.	SHEET NO.
R-2707D	6
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED



SCALE: 1" = 100'

MATCH SHEET NO. 20
STA. 14+00 -SRVRD_1-

MATCH SHEET NO. 20
STA. 16+75 -Y1-

MATCH SHEET NO. 5
STA. 656+50 -L-

MATCH SHEET NO. 7
STA. 18+71.37 -SRVRD_1-

MATCH SHEET NO. 7
STA. 670+00 -L-

MATCH SHEET NO. 21
STA. 24+00 -Y1-

S 39° 59' 44.2" W

S 78° 44' 26.0" W

S 4° 24' 33.4" W

N 39° 59' 28.6" E

N 40° 05' 08.9" E

WALKER CASSIDY

MICHAEL ROBERT PRICE

LELIA AND HENRY YARBOROUGH

BURNS & SPANGLER, INC.

MACHINE BUILDERS AND DESIGN

JACQUELINE HARRISON

JAY AND SHERI BONAKDAR

NATURE'S CALLING, LLC

TEMPORARY CONSTRUCTION EASEMENT REQUIRED FOR EROSION CONTROL DEVICE

WATER LINE DIRECTIONAL BORE

SITE 16

LAT. 2' BASE DITCH W/CL 'I' RIP RAP SEE DETAIL #5

SPEC. LAT. 2' BASE DITCH SEE DETAIL #9

SPEC. LAT. 3' BASE DITCH SEE DETAIL #7

LAT. 'V' DITCH W/CL 'B' RIP RAP EST. 69 TONS EST. 195 SY GF SEE DETAIL #42

SPEC. LAT. 'V' DITCH SEE DETAIL #2

DRY DETENTION BASIN W/3:1 SIDES TOTAL CAPACITY @ ELEV. 871.0 W/1.0FT FREEBOARD=835 CY CIRCULAR FOREBAY W/CL 'I' RIP RAP EST. __ TONS EST. __ SY GF SEE DETAIL #51

DRY DETENTION/HAZARDOUS SPILL BASIN DRAWDOWN STRUCTURE W/ACCESS BERM SEE DETAIL #31 & #33

STD. 'I' BASE CHANNEL W/EMBEDDED CL 'II' RIP RAP EST. 66 TONS, EST. 81 SY GF LENGTH = 20' SLOPE = 2.0% SEE DETAIL #26

PIPE Q(10yr) = 80 cfs S = 0.7% V(10yr) = 10.9 fps

DO NOT BURY INVERT 54" RCP III

18" RCP III

24" RCP III

SHOULDER BERM GUTTER FROM STA. 18+50 TO BEGIN APPROACH SLAB -Y1- LT & RT

SHOULDER BERM GUTTER FROM STA. 654+50 TO STA. 660+00 -L- RT

SHOULDER BERM GUTTER FROM END APPROACH SLAB TO STA. 21+15 -Y1- LT & RT

SHOULDER BERM GUTTER FROM STA. 666+00 TO STA. 671+50 -L- RT

TB 2GI 15" W/ELBOWS

TB 2GI

2GI

FS SEE DETAIL #57

FS SEE DETAIL #58

FS TO EL. 892.0 SEE DETAIL #56

SPEC. DITCH GRADE SEE PROFILE

REGRADE TO DRAIN

CL 'B' RIP RAP EST. 1 TON EST. 5 SY GF

BERM 'V' DITCH SEE DETAIL #3

LAT. 'V' DITCH SEE DETAIL #13

3' PVC TO BE ABANDONED

LAT. 2' BASE DITCH W/CL 'B' RIP RAP EST. 176 TONS EST. 205 SY GF SEE DETAIL #12

BERM 3' BASE DITCH W/CL 'B' RIP RAP EST. 84 TONS EST. 228 SY GF SEE DETAIL #11

STD. 3' BASE CHANNEL W/EMBEDDED CL 'II' RIP RAP EST. 101 TONS EST. 132 SY GF LENGTH = 45' SLOPE = 6.0% SEE DETAIL #25

S S — DENOTES IMPACTS IN SURFACE WATER

TS TS — DENOTES TEMPORARY IMPACTS IN SURFACE WATER

REFERENCES:
FOR –L– PROFILE, SEE SHEET NO. 28
FOR –Y1– PROFILE, SEE SHEET NO. 44
FOR –SRVRD_1– PROFILE, SEE SHEET NO. 50
FOR –DET_2– PROFILE, SEE SHEET NO. 2B–2

$$$$$$$SYSTIME$$$$$
$$$$$$$USERNAME$$$$
$$$$$$$DGN$$$$$$$$$$$$$$$$$$$$

8/17/99

PERMIT DRAWING
SHEET 13 OF 50

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PROJECT REFERENCE NO.	SHEET NO.
R-2707D	7
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

50′ 25′ 0 50′ 100′
SCALE: 1″=100′

NAD 83

MATCH SHEET NO. 7A

MATCH SHEET NO. 6 STA. 18+71.37 –SRVRD_1–

MATCH SHEET NO. 6 STA. 670+00 –L–

MATCH SHEET NO. 8 STA. 683+50 –L–

SHELBY ETJ LIMITS

NATURE'S CALLING, LLC

TEMPORARY CONSTRUCTION EASEMENT REQUIRED FOR EROSION CONTROL DEVICE

JUNKYARD

RONALD KEITH CHURCH

SOIL

675

680

SPEC. LAT. 'V' DITCH W/CL 'B' RIP RAP EST. 146 TONS EST. 436 SY GF SEE DETAIL #40

LAT. 'V' DITCH W/CL 'B' RIP RAP EST. 77 TONS EST. 231 SY GF SEE DETAIL #42

ISBLK BUS

ISFD

72" CMP

15" RCP

PROP O/H POW LINES

PUE

TIE TO EXISTING 8" WATER LINE

RONALD KEITH CHURCH DB 1670 PG 1593

RONALD KEITH CHURCH DB 1670 PG 1591

RONALD KEITH CHURCH DB 1388 PG 450

JOSEPH DALE SPANGLER

RONNIE E. JONES

FEDA A ALRABIE

JAY AND SHERI BONAKDAR

CLEVELAND VOCATIONAL INDUSTRIES

MTL BUS

CONC

BST

EOP

EIP

S 4° 24' 33.4" W

S 88°06'19" E 250.03

S 02°06'18" W 219.53

S 02°06'15" W 187.43

S 85°54'28" E 229.00

S 50°27'28" E 188.39

N 0°28'28" W 187.95

S 86°28'28" E 75.21

S 84°28'28" E 20.43

S 1°30'17" E 187.96

S 2°23'33" W 328.97

S 86°37'41" E 18.55

S 86°14'52" E 250.00

N 87°18'53" W 986.72

S 24°21'57" W 194.27

N 9°50'34" E 186.29

330.51

FS, SEE DETAIL #56

FS, SEE DETAIL #58

FS, SEE DETAIL #57

15" W/ELBOWS

18" W/ELBOW

BDO

18" RCP-III

18" RCP-IV

15" RCP-III

2GI

SHOULDER BERM GUTTER FROM STA. 668+50 TO STA. 672+00 –L– LT

SHOULDER BERM GUTTER FROM STA. 668+00 TO STA. 671+50 –L– RT

SHOULDER BERM GUTTER FROM STA. 681+00 TO STA. 688+00 –L– LT

SHOULDER BERM GUTTER FROM STA. 681+95 TO STA. 688+70 –L– RT

SPEC. LAT. 'V' DITCH SEE DETAIL #44

LAT. 'V' DITCH SEE DETAIL #13

BERM 'V' DITCH SEE DETAIL #3

END EXPRESSWAY GUTTER 30.00

BEGIN EXPRESSWAY GUTTER +25.00

STD. 4' BASE CHANNEL W/EMBEDDED CL 'II' RIP RAP EST. 66 TONS LENGTH=20' SLOPE=2.5% SEE DETAIL #26

PIPE Q(10yr)=65 cfs S=2.9% V(10yr)=22.7 fps DO NOT BURY INVERT

SITE 2

CL 'B' RIP RAP EST. 3 TONS EST. 11 SY GF

24" W/ELBOWS

HAZARDOUS SPILL BASIN 60' X 14' BASE W/2:1 & 4:1 SIDES MIN. CAPACITY=147 CY TOTAL CAPACITY @ ELEV. 881.0 W/1.0' FREEBOARD=151 CY

HW W/ SLUICE GATE

TOE PROTECTION CL 'B' RIP RAP EST. 149 TONS EST. 400 SY GF SEE DETAIL #6

S S — DENOTES IMPACTS IN SURFACE WATER

TS TS — DENOTES TEMPORARY IMPACTS IN SURFACE WATER

REFERENCES:
FOR –L– PROFILE, SEE SHEET NO. 28
FOR –SRVRD_1– PROFILE, SEE SHEET NO. 50

$$$$SYSTIME$$$$
$$$$ICONS$$$$
$$$$FILENAME$$$$

8/17/99

PERMIT DRAWING
SHEET 14 OF 50

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PROJECT REFERENCE NO.	SHEET NO.
R-2707D	7
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

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50′ 25′ 0 50′ 100′
SCALE: 1″=100′

NAD 83

MATCH SHEET NO. 7A

MATCH SHEET NO. 6 STA. 18+71.37 –SRVRD_1–

MATCH SHEET NO. 6 STA. 670+00 –L–

MATCH SHEET NO. 8 STA. 683+50 –L–

SHELBY ETJ LIMITS

JUNKYARD

NATURE'S CALLING, LLC

RONALD KEITH CHURCH

TEMPORARY CONSTRUCTION EASEMENT REQUIRED FOR EROSION CONTROL DEVICE

SPEC. LAT. 'V' DITCH W/CL 'B' RIP RAP
EST. 146 TONS
EST. 436 SY GF
SEE DETAIL #40

LAT. 'V' DITCH W/CL 'B' RIP RAP
EST. 77 TONS
EST. 238 SY GF
SEE DETAIL #42

TIE TO EXISTING 8" WATER LINE

RONALD KEITH CHURCH
DB 1670 PG 1593

STD. 4' BASE CHANNEL W/EMBEDDED CL II RIP RAP
EST. 66 TONS
LENGTH = 280'
SLOPE = 2.5%
SEE DETAIL #26

PIPE
Q(10yr) = 65 cfs
S = 2.9%
V(10yr) = 22.7 fps
DO NOT BURY INVERT

SHOULDER BERM GUTTER FROM STA. 681+00 TO STA. 688+00 – L– LT.

SITE 2

FS, SEE DETAIL #56

19° W/ELBOWS

2GI

S 4° 24' 33.4" W

SHOULDER BERM GUTTER FROM STA. 668+50 TO STA. 672+00 –L– LT.

SPEC. LAT. 'V' DITCH SEE DETAIL #44

FS, SEE DETAIL #57

18" RCP-III

18" W/ELBOW

BDO

END EXPRESSWAY GUTTER +30.00

BEGIN EXPRESSWAY GUTTER +25.00

BERM 'V' DITCH SEE DETAIL #3

LAT. 'V' DITCH SEE DETAIL #13

SHOULDER BERM GUTTER FROM STA. 668+00 TO STA. 671+50 –L– RT.

TIE TO EXISTING 8" WATER LINE

JOSEPH DALE SPANGLER

RONNIE E. JONES

FEDA A ALRABIE

JAY AND SHERI BONAKDAR

CLEVELAND VOCATIONAL INDUSTRIES

CL 'B' RIP RAP
EST. 3 TONS
EST. 11 SY GF

HAZARDOUS SPILL BASIN
60'X 14' BASE W/2:1 & 4:1 SIDES
MIN. CAPACITY = 147 CY
TOTAL CAPACITY @ ELEV. 881.0
W/1.0' FREEBOARD = 181 CY

HW/ W/ SLUICE GATE

TOE PROTECTION
CL 'B' RIP RAP
EST. 149 TONS
EST. 400 SY GF
SEE DETAIL #6

S — S — DENOTES IMPACTS IN SURFACE WATER

TS — TS — DENOTES TEMPORARY IMPACTS IN SURFACE WATER

REFERENCES:
FOR –L– PROFILE, SEE SHEET NO. 28
FOR –SRVRD_1– PROFILE, SEE SHEET NO. 50

$$$$SYSTIME$$$$
$$$$LOGIN$$$$
$$$$USERNAME$$$$

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$$$$$$$SYSTIME$$$$$$$
$$$$$$$DGN$$$$$$$

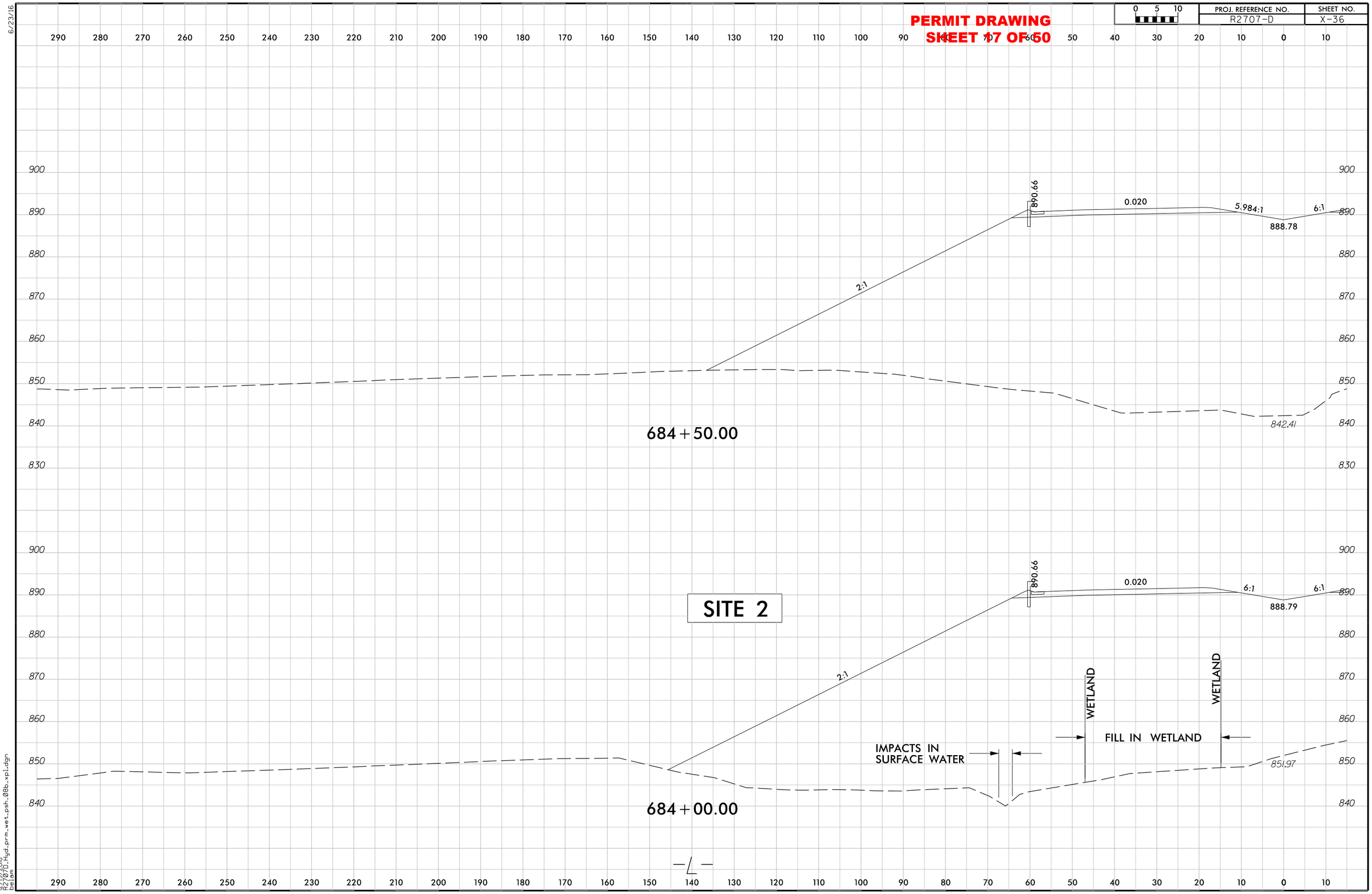
8/17/99

$$$$$$SYSTIME$$$$$$
$$$$$$USERNAME$$$$$$DGN$$$$$$

6/23/16

PERMIT DRAWING
SHEET 17 OF 50

0 5 10	PROJ. REFERENCE NO.	SHEET NO.
	R2707-D	X-36



12/19/2018
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SHEET 18 OF 50

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PROJECT REFERENCE NO.	SHEET NO.
R-2707D	10
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

50' 25' 0 50' 100'
SCALE: 1"=100'

NAD 83

MATCH SHEET NO. 9 STA. 710+50 –L–

MATCH SHEET NO. 11 STA. 724+00 –L–

CLARENCE L. JOHNSON
DONALD CAMP & WF.
NANETTE CAMP
HEIRS OF TONEY GUEST
HENRY B. EDWARDS, JR.
ABIGAIL BROOKS
THARON K. ALEXANDER & WF.
LINDA C. ALEXANDER
ANDREW USSERY & WF.
SANDRA USSERY
MICHAEL J. & CONNIE H. NORMAN
JAMES WHITE JR.
OVID ALTON WHITE
JAMES W. WHITE JR. AND MARSHA H. WHITE
JAY J. TEDDY
MARCINA
MICHAEL J. & CONNIE H. NORMAN
BILLY H. ROBERTS & WF.
MARY M. ROBERTS
NORTH CAROLINA STATE HIGHWAY AND PUBLIC WORKS COMMISSION

SITE 4B
SITE 4A
SITE 3

LAT. 4' BASE DITCH W/CL 'I' RIP RAP
EST. 132 TONS
EST. 227 SY GF
SEE DETAIL #1

LAT. 6' BASE DITCH W/CL 'II' RIP RAP
EST. 1024 TONS
EST. 1303 SY GF
SEE DETAIL #16

OUTLET 7' BASE CHANNEL W/EMBEDDED CL 'II' RIP RAP
LENGTH=70'
EST. 253 TONS
SEE DETAIL #50
CULVERT
Q(10yr)=220 cfs
S=4.3%
V(10yr)=18.7 fps

STD. 3' BASE DITCH W/CL 'A' RIP RAP
EST. 50 TONS
EST. 133 SY GF
DEPTH=2.5', SLOPE VARIES
SEE DETAIL #60

2' BASE DITCH W/CL 'B' RIP RAP
SLOPE=5.0%
EST. 28 TONS
EST. 76 SY GF
SEE DETAIL #47

ENERGY DISSIPATOR BASIN(2)
SEE DETAIL #59

42" RCP-IV
JB w/MH
(Drop Box)
PIPE
Q(10yr)=46 cfs
S=0.7%
V(10yr)=9.4 fps

30" RCP-III
FS, SEE DETAIL #58
FS, SEE DETAIL #57
2GI-A
2GI
15" W/ ELBOWS
1' SILL
1@7'X7' RCBC W/ SILLS AND BAFFLES
SEE DETAIL #35

CL 'B' RIP RAP
EST. 2 TONS
EST. 7 SY GF

CL 'II' RIP RAP
BANK STABILIZATION
EST 100 TONS
SEE DETAIL #30

LAT. 2' BASE DITCH W/CL 'B' RIP RAP
EST. 126 TONS
EST. 342 SY GF
SEE DETAIL #12

BERM 2' BASE DITCH W/CL 'B' RIP RAP
EST. 28 TONS
EST. 76 SY GF
SEE DETAIL #11

TOE PROTECTION
CL 'B' RIP RAP
EST. 282 TONS
EST. 756 SY GF
SEE DETAIL #6

DO NOT BURY INVERT

PROP U/G POW CONDUIT
PDE
EXISTING R/W
PROP. R/W
REM
SHOULDER LIMITS
WITH CREEK
SOIL
HTR
BARN
MTL GATE

DENOTES IMPACTS IN SURFACE WATER
DENOTES TEMPORARY IMPACTS IN SURFACE WATER

REFERENCE:
FOR –L– PROFILE, SEE SHEET NO. 30

$$$$$$SYSTIME$$$$$
$$$$$$LOGIN$$$$$$$$$$$$$$$$$$$$
$$$$$$FILENAME$$$

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PERMIT DRAWING
SHEET 19 OF 50

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PROJECT REFERENCE NO.	SHEET NO.
R-2707D	10
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

50' 25' 0 50' 100'
SCALE: 1"=100'

NAD 83

MATCH SHEET NO. 9 STA. 710+50 –L–

MATCH SHEET NO. 11 STA. 724+00 –L–

CLARENCE L. JOHNSON
DONALD CAMP & WF. NANETTE CAMP
HEIRS OF TONEY GUEST
HENRY B. EDWARDS, JR.
ABIGAIL BROOKS
MICHAEL J. & CONNIE H. NORMAN
ANDREW USSERY & WF. SANDRA USSERY
THARON K. ALEXANDER & WF. LINDA C. ALEXANDER
JAMES WHITE JR.
OVID ALTON WHITE
MARCINZ
JAMES W. WHITE JR. AND MARSHA H. WHITE
JAY J. TEDDY
BILLY H. ROBERTS & WF. MARY M. ROBERTS
NORTH CAROLINA STATE HIGHWAY AND PUBLIC WORKS COMMISSION

SITE 4B
SITE 4A
SITE 3

LAT. 6' BASE DITCH W/CL 'I' RIP RAP EST. 132 TONS EST. 227 SY GF SEE DETAIL #1

LAT. 6' BASE DITCH W/CL 'II' RIP RAP EST. 1024 TONS EST. 1303 SY GF SEE DETAIL #16

OUTLET 7' BASE CHANNEL W/EMBEDDED CL II RIP RAP LENGTH = 70' EST. 253 TONS SEE DETAIL #50

CULVERT Q(10yr) = 220 cfs S = 4.3% V(10yr) = 18.7 fps

STD. 3' BASE DITCH W/CL 'I' RIP RAP EST. 80 TONS EST. 133 SY GF DEPTH = 2.5' SLOPE VARIES SEE DETAIL #50

STD. 3' BASE DITCH W/CL 'I' RIP RAP SLOPE = 5.0% ± EST. 28 TONS EST. 76 SY GF SEE DETAIL #47

ENERGY DISSIPATOR BASIN(2) SEE DETAIL #59

42" RCP-IV W/MITER (Drop Box)

INLET Q(10yr) = 46 cfs S = 0.5% V(10yr) = 9.4 fps

PDE
PROP U/G POW CONDUIT
REM
15" W/ ELBOWS
1' SILL
2GI-A
FS, SEE DETAIL #58
30" RCP-III
FES, SEE DETAIL #57
2GI
1@7'X7' RCBC W/ SILLS AND BAFFLES SEE DETAIL #35
CL 'B' RIP RAP EST. 2 TONS EST. 7 SY GF
CL 'II' RIP RAP BANK STABILIZATION EST. 100 TONS SEE DETAIL #30
LAT. 2' BASE DITCH W/CL 'B' RIP RAP EST. 126 TONS EST. 342 SY GF SEE DETAIL #12
BERM 2' BASE DITCH W/CL 'B' RIP RAP EST. 28 TONS EST. 76 SY GF SEE DETAIL #11
TOE PROTECTION CL 'B' RIP RAP EST. 282 TONS EST. 756 SY GF SEE DETAIL #8
DO NOT BURY INVERT
MAIL GATE

S S DENOTES IMPACTS IN SURFACE WATER

TS TS DENOTES TEMPORARY IMPACTS IN SURFACE WATER

REFERENCE:
FOR –L– PROFILE, SEE SHEET NO. 30

$$$$$$$SYSTIME$$$$$$$
$$$$$$$DGN$$$$$$$$$$$$$$$$$$$$$
$$$$$$$USERNAME$$$$

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SHEET 20 OF 50

PROJECT REFERENCE NO.	SHEET NO.
R-2707D	10B
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
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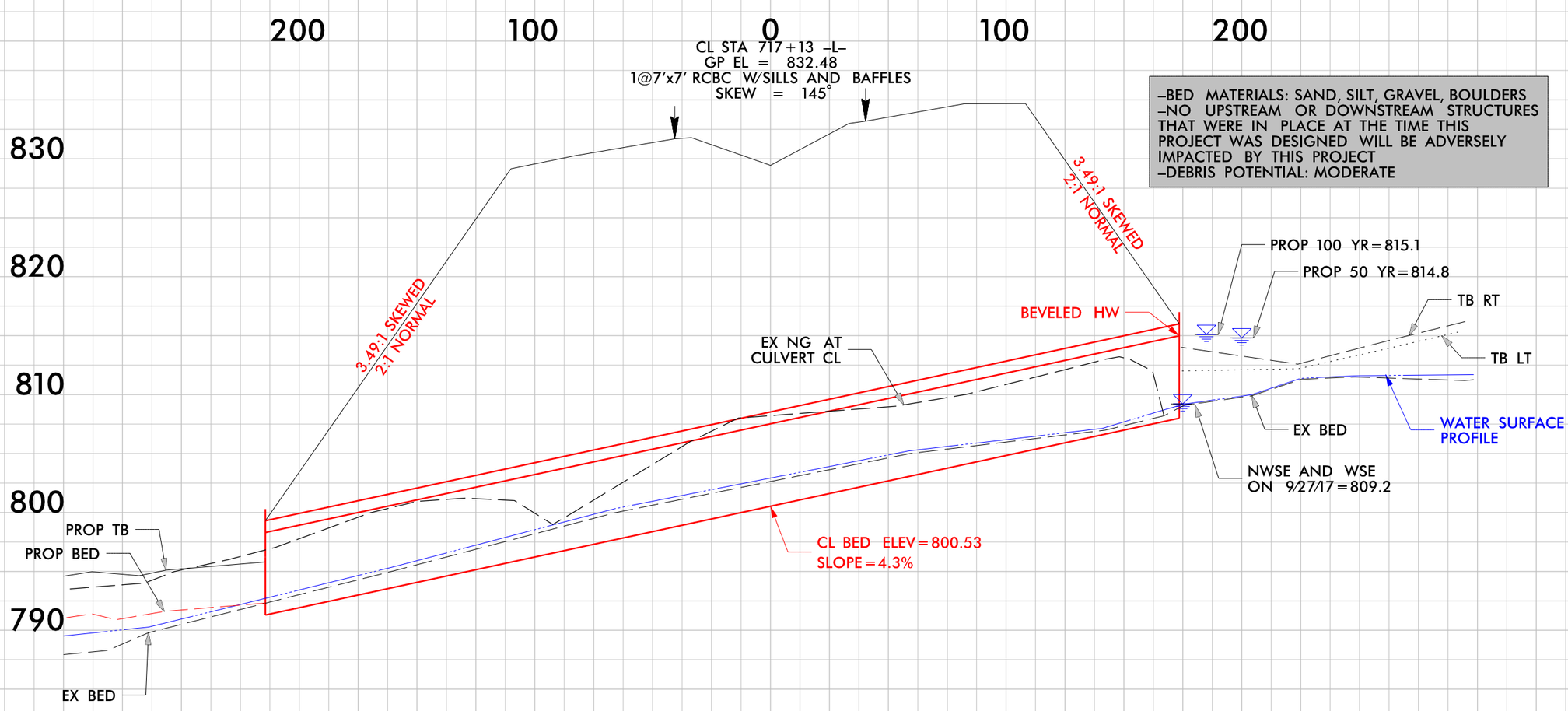

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SHEET 21 OF 50

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PROJECT REFERENCE NO.	SHEET NO.
R-2707D	11
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

NAD 83

50' 25' 0 50' 100'
SCALE: 1"=100'

MATCH SHEET NO. 10 STA. 724+00 –L–

MATCH SHEET NO. 12 STA. 737+50 –L–

SITE 4A

SITE 5B

SITE 5A

SITE 6A

ENERGY DISSIPATOR BASIN(1)
SEE DETAIL #34

STD. 3' BASE DITCH
W/CL 'I' RIP RAP
EST. 80 TONS
EST. 133 SY GF
DEPTH=2.0', SLOPE VARIES
SEE DETAIL #60

STD. 2' BASE DITCH
W/CL 'I' RIP RAP
DEPTH=1.0', SLOPE VARIES
SEE DETAIL #60

ENERGY DISSIPATOR BASIN(3)
SEE DETAIL #59

STD. 2' BASE DITCH
W/CL 'I' RIP RAP
DEPTH=1.0', SLOPE VARIES
SEE DETAIL #60

ENERGY DISSIPATOR BASIN(4)
SEE DETAIL #59

JB w/MH (Drop Box)

PIPE
Q(10yr)=50 cfs
S=0.7%
V(10yr)=9.6 fps

42" RCP-IV

15" RCP-III

FS, SEE DETAIL #57

FS TO EL. 806.6
SEE DETAIL #58

TOE PROTECTION
CL 'B' RIP RAP
SEE DETAIL #6

SPEC. LAT. 2' BASE DITCH
SEE DETAIL #9

SPEC. LAT. 2' BASE DITCH
W/CL 'B' RIP RAP
EST. 75 TONS
EST. 203 SY GF
SEE DETAIL #18

BERM 2' BASE DITCH
W/CL 'B' RIP RAP
EST. 140 TONS
EST. 380 SY GF
SEE DETAIL #11

BERM 'V' DITCH
W/CL 'B' RIP RAP
EST. 115 TONS
EST. 324 SY GF
SEE DETAIL #17

BERM 2' BASE DITCH
W/CL 'B' RIP RAP
EST. 280 TONS
EST. 759 SY GF
SEE DETAIL #11

MAGGIE LUCILLE BROWN
DIVERSE SERVICES U.S.A., INC.
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OVID ALTON WHITE
VINONA MUHAMMAD
JAMES W. WHITE JR. AND MARSHA H. WHITE
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JOHNNY BROOKS
MOAYYAD AL-NASRA
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NORTH CAROLINA STATE HIGHWAY AND PUBLIC WORKS COMMISSION
CLEVELAND COUNTY BOARD OF EDUCATION

SHELBY ETJ LIMITS

S S DENOTES IMPACTS IN SURFACE WATER

TS TS DENOTES TEMPORARY IMPACTS IN SURFACE WATER

REFERENCE:
FOR –L– PROFILE, SEE SHEET NO. 30

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PROJECT REFERENCE NO.	SHEET NO.
R-2707D	11
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

NAD 83

50' 25' 0 50' 100'
SCALE: 1"=100'

MATCH SHEET NO. 10 STA. 724+00 –L–

MATCH SHEET NO. 12 STA. 737+50 –L–

SITE 4A

SITE 5A

SITE 5B

SITE 6A

ENERGY DISSIPATOR BASIN(1)
SEE DETAIL #34

STD. 3' BASE DITCH
W/CL 'I' RIP RAP
EST. 80 TONS
EST. 133 SY GF
DEPTH=2.0', SLOPE VARIES
SEE DETAIL #60

STD. 2' BASE DITCH
W/CL 'I' RIP RAP
DEPTH=1.0', SLOPE VARIES
SEE DETAIL #60

ENERGY DISSIPATOR BASIN(3)
SEE DETAIL #59

JB w/MH
(Drop Box)

PIPE
Q(10yr)=50 cfs
S=0.7%
V(10yr)=9.6 fps

ENERGY DISSIPATOR
BASIN(4)
SEE DETAIL #59

FS, SEE
DETAIL #57

FS, SEE
DETAIL #67

FS, SEE
DETAIL #57

FS TO
EL. 806.6
SEE DETAIL #58

TOE PROTECTION
CL 'B' RIP RAP
SEE DETAIL #6

SPEC. LAT. 2' BASE DITCH
SEE DETAIL #9

SPEC. LAT. 2' BASE DITCH
W/CL 'B' RIP RAP
EST. 75 TONS
EST. 203 SY GF
SEE DETAIL #18

BERM 2' BASE DITCH
W/CL 'B' RIP RAP
EST. 140 TONS
EST. 380 SY GF
SEE DETAIL #11

BERM 'V' DITCH
W/CL 'B' RIP RAP
EST. 115 TONS
EST. 324 SY GF
SEE DETAIL #17

BERM 2' BASE DITCH
W/CL 'B' RIP RAP
EST. 280 TONS
EST. 759 SY GF
SEE DETAIL #11

MAGGIE LUCILLE BROWN

DIVERSE SERVICES U.S.A., INC.

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NORTH CAROLINA STATE HIGHWAY AND
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S S DENOTES IMPACTS IN SURFACE WATER

TS TS DENOTES TEMPORARY IMPACTS IN SURFACE WATER

REFERENCE:
FOR –L– PROFILE, SEE SHEET NO. 30

$$$$$$$SYSTIME$$$$$$$

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SHEET 23 OF 50

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PROJECT REFERENCE NO.	SHEET NO.
R-2707D	12
RW SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

50' 25' 0 50' 100'
SCALE: 1"=100'

NAD 83

S S DENOTES IMPACTS IN SURFACE WATER

TS TS DENOTES TEMPORARY IMPACTS IN SURFACE WATER

CLEVELAND COUNTY

SITE 6A

SITE 6B

SITE 6C

CS Sta. 743+49.23 -L-

ST Sta. 745+49.23 -L-

PHILLIP R. RUCKER & CAROLYN W. RUCKER

BOBBY D. FORTENBERRY & WF. EDNA C. FORTENBERRY

SHELBY ETJ LIMITS

S 39° 31' 48.6" E

S44°10'24"E 750.00' CURVE

N39°32'47"E 635.00' CURVE

STD. 2' BASE DITCH W/CL 'B' RIP RAP DEPTH=1.0', SLOPE VARIES SEE DETAIL #60

CULVERT Q(10yr)=620 cfs S=0.5% V(10yr)=10.8 fps

LAT. 3' BASE DITCH W/CL 'I' RIP RAP EST. 111 TONS EST. 194 SY GF SEE DETAIL #4

CL 'II' RIP RAP BANK STABILIZATION W/FLOODPLAIN BENCH EST. 110 TONS SEE DETAIL #37

ENERGY DISSIPATOR BASIN(5) SEE DETAIL #59

15" RCP-IV

18" RCP-IV

15" RCP-III

18" RCP-III

24" RCP-III

30" RCP-III

36" RCP-III

2' SILL

1' SILL

2@8'X8' RCBC W/SILLS SEE DETAIL #36

TOE PROTECTION CL 'B' RIP RAP EST. 81 TONS EST. 216 SY GF SEE DETAIL #6

SPECIAL DITCH GRADE SEE PROFILE

FS, SEE DETAIL #56

FS, SEE DETAIL #57

FS, SEE DETAIL #58

2GI

2GI-A

BERM 2' BASE DITCH W/CL 'B' RIP RAP SEE DETAIL #11

LAT. 3' BASE DITCH W/CL 'I' RIP RAP EST. 185 TONS EST. 323 SY GF SEE DETAIL #4

LAT. 4' BASE DITCH W/CL 'I' RIP RAP EST. 348 TONS EST. 600 SY GF SEE DETAIL #1

CL 'II' RIP RAP BANK STABILIZATION W/FLOODPLAIN BENCH EST. 110 TONS SEE DETAIL #37

TOE PROTECTION CL 'B' RIP RAP EST. 81 TONS EST. 216 SY GF SEE DETAIL #6

DAYLIGHT TO EXISTING DITCH

BERM 'V' DITCH W/CL 'B' RIP RAP EST. 152 TONS EST. 428 SY GF SEE DETAIL #17

MATCH SHEET NO. 11 STA. 737+50 -L-

MATCH SHEET NO. 13 STA. 751+00 -L-

MATCH SHEET NO. 12A

REFERENCE:
FOR -L- PROFILE, SEE SHEET NO. 31

$$$$$$$USERNAME$$$$$DGN$$$$$$$

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PERMIT DRAWING
SHEET 24 OF 50

S S DENOTES IMPACTS IN SURFACE WATER

TS TS DENOTES TEMPORARY IMPACTS IN SURFACE WATER

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PROJECT REFERENCE NO.	SHEET NO.
R-2707D	12
RW SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

50′ 25′ 0 50′ 100′
SCALE: 1″=100′

NAD 83

CLEVELAND COUNTY

SITE 6A

SITE 6B

SITE 6C

CS Sta. 743+49.23 -L-

ST Sta. 745+49.23 -L-

PHILLIP R. RUCKER & CAROLYN W. RUCKER

BOBBY D. FORTENBERRY & WF, EDNA C. FORTENBERRY

BOBBY D. FORTENBERRY & WF, EDNA C. FORTENBERRY

S 39° 31′ 48.6″ E

STD. 2′ BASE DITCH W/CL 'B' RIP RAP DEPTH=1.0′, SLOPE VARIES SEE DETAIL #60

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CL 'II' RIP RAP BANK STABILIZATION W/FLOODPLAIN BENCH EST. 110 TONS SEE DETAIL #37

ENERGY DISSIPATOR BASIN(S) SEE DETAIL #59

15" RCP-IV

2′ SILL

8′X8′ RCBC W/SILLS SEE DETAIL #36

TOE PROTECTION CL 'B' RIP RAP EST. 81 TONS EST. 276 SY GF SEE DETAIL #6

7′ SILL

36" RCP-III

30" RCP-III

24" RCP-III

15" RCP-III

18" RCP-III

FS, SEE DETAIL #56

FS, SEE DETAIL #57

FS, SEE DETAIL #58

2GI

2GI-A

SPECIAL DITCH GRADE SEE PROFILE

BERM '2' BASE DITCH W/CL 'B' RIP RAP SEE DETAIL #11

LAT. 3′ BASE DITCH W/CL 'I' RIP RAP EST. 185 TONS EST. 323 SY GF SEE DETAIL #4

LAT. 4′ BASE DITCH W/CL 'I' RIP RAP EST. 348 TONS EST. 600 SY GF SEE DETAIL #1

CL 'II' RIP RAP BANK STABILIZATION W/FLOODPLAIN BENCH EST. 110 TONS SEE DETAIL #37

TOE PROTECTION CL 'B' RIP RAP EST. 81 TONS EST. 276 SY GF SEE DETAIL #6

DAYLIGHT TO EXISTING DITCH

BERM 'V' DITCH W/CL 'B' RIP RAP EST. 152 TONS EST. 428 SY GF SEE DETAIL #17

SHEET NO. 11 STA. 737+50 -L-

MATCH SHEET NO. 13 STA. 751+00 -L-

MATCH SHEET NO. 12A

REFERENCE:
FOR –L– PROFILE, SEE SHEET NO. 31

$$$$$$$SYSTIME$$$$$$
$$$$$$$USERNAME$$$$$$
$$$$$$$DGN$$$$$$$$$$$$$$$$$$$$

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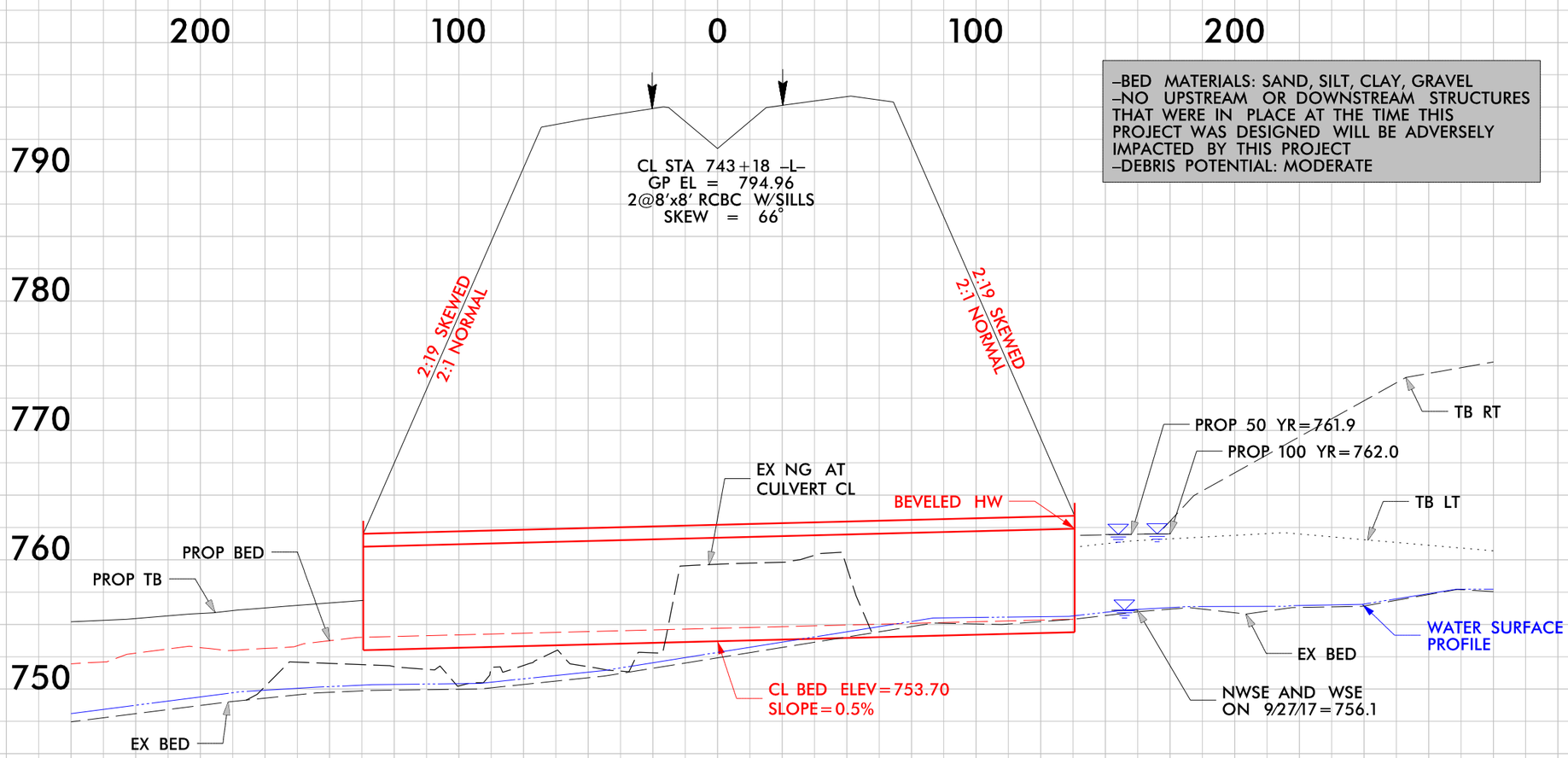
PERMIT DRAWING
SHEET 25 OF 50

PROJECT REFERENCE NO.	SHEET NO.
R-2707D	12B
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED



–BED MATERIALS: SAND, SILT, CLAY, GRAVEL
–NO UPSTREAM OR DOWNSTREAM STRUCTURES THAT WERE IN PLACE AT THE TIME THIS PROJECT WAS DESIGNED WILL BE ADVERSELY IMPACTED BY THIS PROJECT
–DEBRIS POTENTIAL: MODERATE

12/19/2018
R2707D_hyd_prm_wet_psh_12b.dgn
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8/17/99

PERMIT DRAWING
SHEET 26 OF 50

NAD 83

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Fax. (919) 851-7024
www.stantec.com
License No. F-0672

PROJECT REFERENCE NO.	SHEET NO.
R-2707D	13
RW SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

50' 25' 0 50' 100'
SCALE: 1" = 100'

MATCH SHEET NO. 24 STA. 19+00 -Y3-
MATCH SHEET NO. 24 STA. 7+39.96 -PVTENT1-

MATCH SHEET NO. 12 STA. 751+00 -L-

MATCH SHEET NO. 24

MATCH SHEET NO. 14 STA. 765+00 -L-

MATCH SHEET NO. 25 STA. 27+50 -Y3-

LARRY E. WILEY & WF. KAREN P. WILEY

TEMPORARY CONSTRUCTION EASEMENT REQUIRED FOR EROSION CONTROL DEVICE

SHELBY ETJ LIMITS

BILLY S. HOWELL (& WF. WILHELMINA J. HOWELL

BOBBY D. FORTENBERRY & WF. EDNA C. FORTENBERRY

BENJAMIN ERNEST DAVIES
VICTORIA RANDALL DAVIES

PRESERVATION AREA

SITE 7

LLOYD D. CALDWELL & WIFE, JERRALENE CALDWELL

JEFFREY L. KALE & WF. JULIE C. KALE

EARL J. LAIL & WF. BARBARA G. LAIL

ALTON RANDALL

S 46° 25' 00.9" E

S 39° 31' 48.6" E

S 41° 27' 16.6" W

S 53°08'25" E 662.08'

S 40°23'32"E 17.65' RW-REBAR

S 40°20'34"E 88.82' REBAR-REBAR

S 40°22'36"E 130.24' REBAR-REBAR

S 40°22'34"E 301.13' COR-COR

REBAR 288.16' REBAR-COR

BEGIN EXPRESSWAY GUTTER +75.00

END EXPRESSWAY GUTTER +06.00

REMOVE

GRADE TO DRAIN

RELOCATE WATER METER

WATER SERVICE LINE

+50 -PVTENT2- 26.36' 60'

+70 -PVTENT2- 60'

CL 'B' RIP RAP EST. 2 TONS EST. 7 SY GF

SHOULDER BERM GUTTER FROM STA. 21+45 TO BEGIN APPROACH SLAB -Y3- RT

STD. 3' BASE CHANNEL W/EMBEDDED CL 'II' RIP RAP EST. 45 TONS LENGTH=20' SLOPE=2.0% SEE DETAIL #25

PIPE Q(10yr)=70 cfs S=1.0% V(10yr)=12.1 fps

15" W/ELBOWS JB w/MH

DO NOT BURY INVERT

FS, SEE DETAIL #58

SHOULDER BERM GUTTER FROM STA. 763+50 TO STA. 765+55 -L- LT

FS, SEE DETAIL #57

15" RCP-III

15" RCP-IV

18" RCP-IV SEE DETAIL #5

FS, SEE DETAIL #56

CL 'B' RIP RAP EST. 2 TONS EST. 7 SY GF

CL 'II' RIP RAP BANK STABILIZATION SEE DETAIL #29 EST. 35 TONS

SHOULDER BERM GUTTER FROM STA. 762+50 TO STA. 764+50 -L- RT

BERM 'Y' DITCH SEE DETAIL #3

DENOTES IMPACTS IN SURFACE WATER

DENOTES TEMPORARY IMPACTS IN SURFACE WATER

DENOTES FILL IN WETLAND

DENOTES MECHANIZED CLEARING

BRIDGE SKETCH (NOT TO SCALE)

BEGIN APPROACH SLAB 22+15.01 -Y3-
BEGIN BRIDGE 22+28.97 -Y3-
END BRIDGE 24+47.80 -Y3-
END APPROACH SLAB 24+61.75 -Y3-
POT Sta. 756+67.45 -L-=
POC Sta. 23+21.80 -Y3-

REFERENCE:
FOR -L- PROFILE, SEE SHEET NO. 32
FOR -Y3- PROFILE, SEE SHEET NO. 46
FOR -PVTENT1- & -PVTENT2- PROFILES, SEE SHEET NO. 53

$$$$$$$$SYSTIME$$$$$$
$$$$$$$$

8/17/99

PERMIT DRAWING
SHEET 27 OF 50

NAD 83

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PROJECT REFERENCE NO.	SHEET NO.
R-2707D	13
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

50' 25' 0 50' 100'
SCALE: 1" = 100'

MATCH SHEET NO. 12 STA. 751+00 -L-

MATCH SHEET NO. 24 STA. 19+00 -Y3-
MATCH SHEET NO. 24 STA. 7+39.96 -PVTENT1-

MATCH SHEET NO. 24

MATCH SHEET NO. 25 STA. 27+50 -Y3-

MATCH SHEET NO. 14 STA. 765+00 -L-

LARRY E. WILEY & WF. KAREN P. WILEY

BILLY S. HOWELL & WF. WILHELMINA J. HOWELL

BOBBY D. FORTENBERRY & WF. EDNA C. FORTENBERRY

LLOYD D. CALDWELL & WIFE, JERRALENE CALDWELL

BENJAMIN ERNEST DAVIES II VICTORIA RANDALL DAVIES

S. ALTON RANDALL

JEFFREY L. KALE & WF. JULIE C. KALE

EARL J. LAIL & WF. BARBARA G. LAIL

TEMPORARY CONSTRUCTION EASEMENT REQUIRED FOR EROSION CONTROL DEVICE

S 46° 25' 00.9" E

S 39° 31' 48.6" E

S 41° 12' 16.6" W

PRESERVATION AREA

SITE 7

STD. 3' BASE CHANNEL W/EMBEDDED CL 'III' RIP RAP EST. 45 TONS LENGTH=30' SLOPE=2.0% SEE DETAIL #25

PIPE Q(10yr)=70 cfs S=1.0% V(10yr)=12.1 fps

CL 'B' RIP RAP EST. 2 TONS EST. 7 SY GF

CL 'B' RIP RAP EST. 1 TON EST. 5 SY GF

CL 'II' RIP RAP BANK STABILIZATION SEE DETAIL #29 EST. 35 TONS

SHOULDER BERM GUTTER FROM STA. 21+45 TO BEGIN APPROACH SLAB -Y3- RT

SHOULDER BERM GUTTER FROM STA. 763+50 TO STA. 765+55 -L- LT

SHOULDER BERM GUTTER FROM STA. 762+50 TO STA. 764+50 -L- RT

BEGIN EXPRESSWAY GUTTER +75.00

END EXPRESSWAY GUTTER +06.00

REMOVE

RELOCATE WATER METER

WATER SERVICE LINE

DO NOT BURY INVERT

FS, SEE DETAIL #58

FS, SEE DETAIL #57

FS, SEE DETAIL #56

BERM 'Y' DITCH SEE DETAIL 'Y3'

DENOTES IMPACTS IN SURFACE WATER

DENOTES TEMPORARY IMPACTS IN SURFACE WATER

DENOTES FILL IN WETLAND

DENOTES MECHANIZED CLEARING

REFERENCE:
FOR -L- PROFILE, SEE SHEET NO. 32
FOR -Y3- PROFILE, SEE SHEET NO. 46
FOR -PVTENT1- & -PVTENT2- PROFILES, SEE SHEET NO. 53

BEGIN APPROACH SLAB 22+15.01 -Y3-
BEGIN BRIDGE 22+28.97 -Y3-
END BRIDGE 24+47.80 -Y3-
END APPROACH SLAB 24+61.75 -Y3-
POT Sta. 756+67.45 -L-=
POC Sta. 23+21.80 -Y3-

BRIDGE SKETCH (NOT TO SCALE)

$$$$$$$$$$YSTIME$$$$$$
$$$$$$$$$$DGN$$$$$$$$$$$$$$$$$$$$$$
$$$$$$$$$$USERNAME$$$$

6/23/16

PERMIT DRAWING
SHEET 28 OF 50

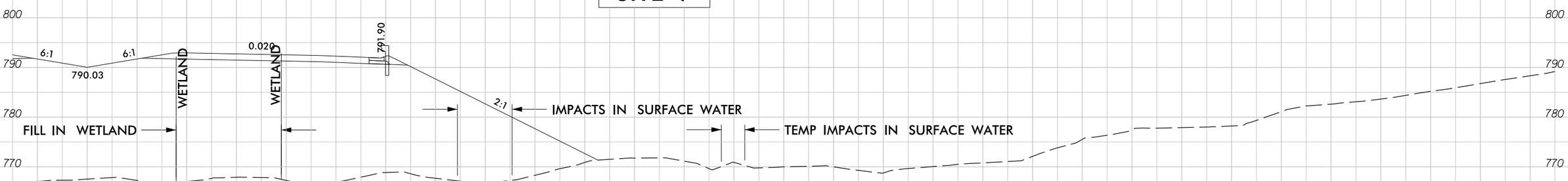
0 5 10	PROJ. REFERENCE NO.	SHEET NO.
	R2707-D	X-282

765+00.00

764+50.00

SITE 7

764+00.00



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PERMIT DRAWING
SHEET 29 OF 50

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PROJECT REFERENCE NO.	SHEET NO.
R-2707D	14
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

NAD 83

50′ 25′ 0 50′ 100′
SCALE: 1″=100′

MATCH SHEET NO. 24

MATCH SHEET NO. 13 STA. 765+00 –L–

MATCH SHEET NO. 15 STA. 779+00 –L–

BENJAMIN ERNEST DAVIES
VICTORIA RANDALL DAVIES

DEAN V. GARDNER

CHARLES ALTON RANDALL

CHARLES E. AND TAMMY M. HARBISON

HOWARD L. WEBBER & WF. FRANCES R. WEBBER

WILLIAM G. RUCKER
JAMES WEBB RUCKER

SITE 8

SHOULDER BERM GUTTER FROM STA. 763+00 TO STA. 765+55 –L– LT

SPECIAL DITCH GRADE SEE PROFILE

SHOULDER BERM GUTTER FROM STA. 773+00 TO STA. 798+00 –L– RT

TEMPORARY CONSTRUCTION EASEMENT REQUIRED FOR EROSION CONTROL DEVICE

STD. 4′ BASE CHANNEL W/EMBEDDED CL 'II' RIP RAP EST. 99 TONS LENGTH=30′ SLOPE=3.0% SEE DETAIL #26

PIPE Q(10yr)=100 cfs S=5.3% V(10yr)=24.2 fps

TOE PROTECTION CL 'B' RIP RAP EST. 149 TONS EST. 400 SY GF SEE DETAIL #6

DO NOT BURY INVERT

TOE PROTECTION CL 'B' RIP RAP EST. 65 TONS EST. 173 SY GF SEE DETAIL #6

CL 'II' RIP RAP BANK STABILIZATION SEE DETAIL #29 EST. 35 TONS

LAT. 3′ BASE DITCH W/CL 'I' RIP RAP EST. 278 TONS EST. 485 SY GF SEE DETAIL #4

36" W/ELBOWS

DO NOT BURY INVERT

JB w/MH

54" RCP-III

S 39° 31′ 48.6" E

S 36°19′39" E 310.78′

S S	DENOTES IMPACTS IN SURFACE WATER
TS TS	DENOTES TEMPORARY IMPACTS IN SURFACE WATER
F F	DENOTES FILL IN WETLAND

REFERENCE:
FOR –L– PROFILE, SEE SHEET NO. 33

$$$$USERNAME$$$$ $$$$SYSTIME$$$$

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PERMIT DRAWING
SHEET 30 OF 50

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PROJECT REFERENCE NO.	SHEET NO.
R-2707D	14
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

NAD 83

50′ 25′ 0 50′ 100′
SCALE: 1″=100′

MATCH SHEET NO. 24

MATCH SHEET NO. 13 STA. 765+00 –L–

MATCH SHEET NO. 15 STA. 779+00 –L–

BENJAMIN ERNEST DAVIES
VICTORIA RANDALL DAVIES

DEAN V. GARDNER

CHARLES ALTON RANDALL

CHARLES E. AND TAMMY M. HARBISON

HOWARD L. WEBBER & WF. FRANCES R. WEBBER

WILLIAM C. RUCKER
JAMES WEBB RUCKER

SITE 8

SHOULDER BERM GUTTER FROM STA 763+00 TO STA 765+55 –L– LT

SHOULDER BERM GUTTER FROM STA 773+00 TO STA 798+00 –L– RT

SPECIAL DITCH GRADE SEE PROFILE

TEMPORARY CONSTRUCTION EASEMENT REQUIRED FOR EROSION CONTROL DEVICE

STD. 4' BASE CHANNEL W/EMBEDDED CL 'B' RIP RAP EST. 99 TONS LENGTH=30' SLOPE=3.0% SEE DETAIL #2a

PIPE Q(10yr)=100 cfs S=5.3% V(10yr)=24.2 fps

TOE PROTECTION CL 'B' RIP RAP EST. 149 TONS EST. 400 SY GF SEE DETAIL #6

TOE PROTECTION CL 'B' RIP RAP EST. 65 TONS EST. 173 SY GF SEE DETAIL #6

CL 'B' RIP RAP BANK STABILIZATION SEE DETAIL #2a EST. 35 TONS

LAT. 3' BASE DITCH W/CL 'I' RIP RAP EST. 278 TONS EST. 485 SY GF SEE DETAIL #4

DO NOT BURY INVERT

36" W/ELBOWS

54" RCP-III

JB w/MH

30" RCP-III

24" RCP-III

18" RCP-IV

15" RCP-IV

FS, SEE DETAIL #57

FS, SEE DETAIL #58

2GI

2GI-A

S 39° 31' 48.6" E

S S	DENOTES IMPACTS IN SURFACE WATER
TS TS	DENOTES TEMPORARY IMPACTS IN SURFACE WATER
F F	DENOTES FILL IN WETLAND

REFERENCE:
FOR –L– PROFILE, SEE SHEET NO. 33

CSXTWF$$$

8/17/99

PERMIT DRAWING
SHEET 31 OF 50

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PROJECT REFERENCE NO.	SHEET NO.
R-2707D	16
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

50′ 25′ 0 50′ 100′
SCALE: 1″=100′

MATCH SHEET NO. 15 STA. 793+00 –L–

MATCH SHEET NO. 17 STA. 10+50–SRVRD_5A–

MATCH SHEET NO. 17 STA. 807+00 –L–

TEMPORARY CONSTRUCTION EASEMENT REQUIRED FOR EROSION CONTROL DEVICE

795

800

805

JOSEPH NEWTON CRAVER II & ADELAIDE AUSTELL CRAVER

SITE 9

SITE 10

CL 'II' RIP RAP BANK STABILIZATION W/FLOODPLAIN BENCH EST. 110 TONS SEE DETAIL #39

CULVERT Q(10yr)=390 cfs S=1.15% V(10yr)=9.2 fps

SHOULDER BERM GUTTER FROM STA. 797+00 TO STA. 799+00 –L– LT

1@12'X7' RCBC W/SILLS AND BAFFLES SEE DETAIL #38

2' SILL

1' SILL

FS, SEE DETAIL #56

FS, SEE DETAIL #57

FS, SEE DETAIL #58

S 23° 50' 54.0" E

24" RCP–III

30" RCP–III

18" RCP–III

15" RCP–III

12" RCP–III

2GI

2GI–A

SHOULDER BERM GUTTER FROM STA. 773+00 TO STA. 798+00 –L– RT

CL 'I' RIP RAP EST. 7 TONS EST. 15 SY GF

LAT. 3' BASE DITCH SEE DETAIL #20

LAT. 3' BASE DITCH W/CL 'I' RIP RAP EST. 173 TONS EST. 302 SY GF SEE DETAIL #4

TOE PROTECTION CL 'B' RIP RAP EST. 77 TONS EST. 206 SY GF SEE DETAIL #6

CL 'II' RIP RAP BANK STABILIZATION W/FLOODPLAIN BENCH EST. 110 TONS SEE DETAIL #39

Sta 804+55 –L– LT Q(10yr)=13.9 cfs V(10yr)=2.0 fps d=1.3 ft s=0.7% n=0.055 Liner=Class 'I' Rip Rap

PIPE Q(10yr)=13.9 cfs S=1.0% V(10yr)=7.1 fps

STD. 3' BASE DITCH W/CL 'I' RIP RAP EST. 24 TONS, EST. 40 SY GF LENGTH=15 FT, SLOPE=0.7% SEE DETAIL #22

DO NOT BURY INVERT 24" RCP–III

SHOULDER BERM GUTTER FROM STA. 804+50 TO STA. 805+50 –L– LT

JB w/MH

24" W/ ELBOW

BDO

BERM 'V' DITCH W/CL 'B' RIP RAP EST. 92 TONS EST. 259 SY GF SEE DETAIL #17

N 67°32'59" E 528.00' REBAR-C

NCDOT 10

S S	DENOTES IMPACTS IN SURFACE WATER
TS TS	DENOTES TEMPORARY IMPACTS IN SURFACE WATER
F F	DENOTES FILL IN WETLAND
E E	DENOTES EXCAVATION IN WETLAND
	DENOTES MECHANIZED CLEARING

REFERENCE:
FOR –L– PROFILE, SEE SHEET NO. 34
FOR –SRVRD_5A– PROFILE, SEE SHEET NO. 52

$$$$SYSTIME$$$$
$$$$USERNAME$$$$

8/17/99

PERMIT DRAWING
SHEET 32 OF 50

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50′ 25′ 0 50′ 100′
SCALE: 1″=100′

PROJECT REFERENCE NO.	SHEET NO.
R-2707D	16
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

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MATCH SHEET NO. 15 STA. 793+00 –L–

MATCH SHEET NO. 17 STA. 807+00 –L–

MATCH SHEET NO. 17 STA. 10+50–SRVRD_5A–

TEMPORARY CONSTRUCTION EASEMENT REQUIRED FOR EROSION CONTROL DEVICE

CL 'II' RIP RAP BANK STABILIZATION W/FLOODPLAIN BENCH EST. 110 TONS SEE DETAIL #39

CULVERT Q(10yr)=390 cfs S=1.15% V(10yr)=9.2 fps

SITE 9

SITE 10

SHOULDER BERM GUTTER FROM STA. 797+00 TO STA. 799+00 –L– LT

1@12'X7' RCBC W/SILLS AND BAFFLES SEE DETAIL #38

2' SILL

1' SILL

STD. 3' BASE DITCH W/CL 1' RIP RAP EST. 24 TONS, EST. 40 SY GF LENGTH=15 FT, SLOPE=0.7% SEE DETAIL #22

DO NOT BURY INVERT 24" RCP–III

SHOULDER BERM GUTTER FROM STA. 804+50 TO STA. 805+50 –L– LT

Sta 804+55 –L– LT Q(10yr)=13.9 cfs V(10yr)=2.0 fps d=1.5 ft s=0.7% n=0.055 Lngth=Class 'I' Rip Rap

PIPE Q(10yr)=13.9 cfs S=1.0% V(10yr)=7.1 fps

JOSEPH NEWTON CRAVER II & ADELAIDE AUSTELL CRAVER

S 23° 50' 54.0" E

FS, SEE DETAIL #57

FS, SEE DETAIL #58

SHOULDER BERM GUTTER FROM STA. 773+00 TO STA. 798+00 –L– RT

TOE PROTECTION CL B RIP RAP EST. 27 TONS EST. 206 SY GF SEE DETAIL #6

CL 'II' RIP RAP BANK STABILIZATION W/FLOODPLAIN BENCH EST. 310 TONS SEE DETAIL #39

CL 'I' RIP RAP EST. 7 TONS EST. 15 SY GF

LAT. 3' BASE DITCH SEE DETAIL #20

LAT. 3' BASE DITCH W/CL 'I' RIP RAP EST. 173 TONS EST. 302 SY GF SEE DETAIL #4

BERM 5' DITCH W/CL 'B' RIP RAP EST. 92 TONS EST. 259 SY GF SEE DETAIL #17

S S	DENOTES IMPACTS IN SURFACE WATER
TS TS	DENOTES TEMPORARY IMPACTS IN SURFACE WATER
F F	DENOTES FILL IN WETLAND
E E	DENOTES EXCAVATION IN WETLAND
	DENOTES MECHANIZED CLEARING

REFERENCE:
FOR –L– PROFILE, SEE SHEET NO. 34
FOR –SRVRD_5A– PROFILE, SEE SHEET NO. 52

$$$$SYSTIME$$$$
$$$$USERNAME$$$$

6/23/16

PERMIT DRAWING
SHEET 33 OF 50

0 5 10	PROJ. REFERENCE NO.	SHEET NO.
	R2707-D	X-141

290 280 270 260 250 240 230 220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 10

760 750 740 730 720 710

805+50.00

729.59
0.020
2:1
6:1
6:1
727.72
726.18

WETLAND
WETLAND
729.12
0.020
FILL IN WETLAND
2:1
6:1
6:1
727.25
720.48

805+00.00

770 760 750 740 730 720 710

SITE 10

WETLAND
WETLAND
WETLAND
WETLAND
WETLAND
WETLAND
728.65
0.020
FILL IN WETLAND
2:1
6:1
732.20
6:1
726.78

804+50.00

290 280 270 260 250 240 230 220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 10

12/19/2018
R2707D_hyd_prm_wet_psh_16b_xpl.dgn
beiam

5/14/99

PERMIT DRAWING
SHEET 34 OF 50

PROJECT REFERENCE NO.	SHEET NO.
R-2707D	16C
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

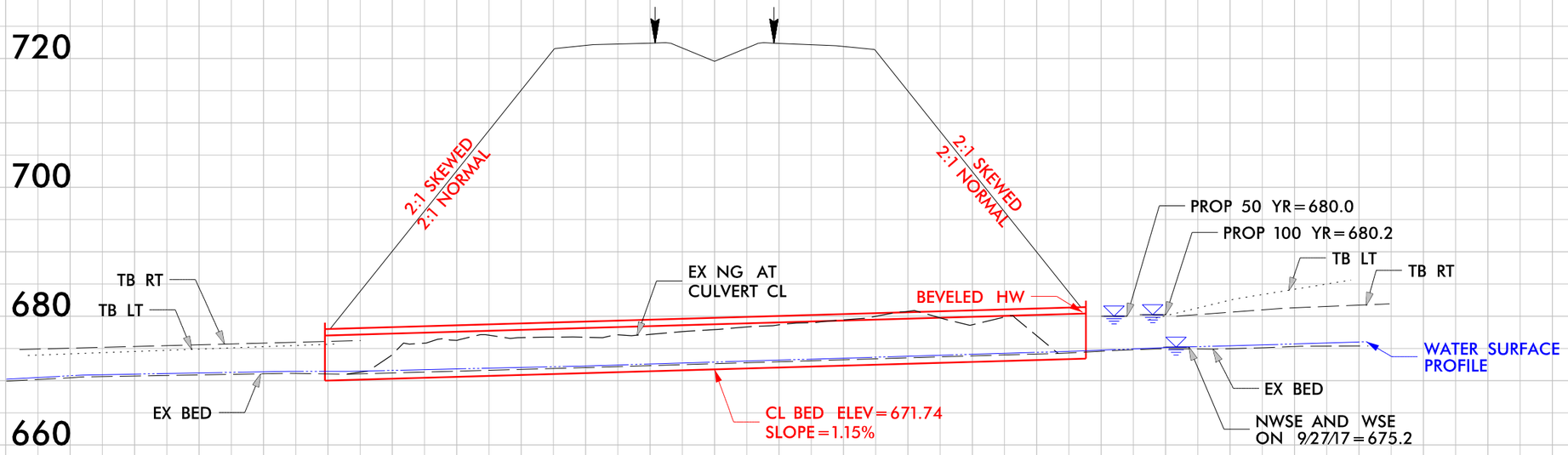
INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

200 100 0 100 200

CL STA 796+86 –L–
GP EL = 722.43
1@12'x7' RCBC W/SILLS AND BAFFLES
SKEW = 87°

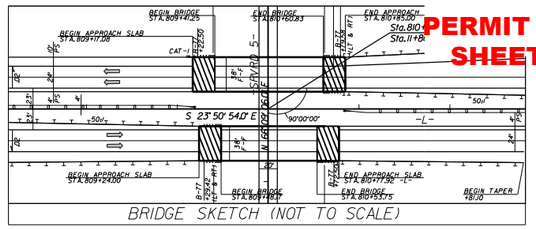
–BED MATERIALS: SAND, SILT, GRAVEL, BOULDERS
–NO UPSTREAM OR DOWNSTREAM STRUCTURES THAT WERE IN PLACE AT THE TIME THIS PROJECT WAS DESIGNED WILL BE ADVERSELY IMPACTED BY THIS PROJECT
–DEBRIS POTENTIAL: MODERATE



12/19/2018
R2707D_hyd_prm_wet_psh_16c.dgn
BeLom

8/17/99

PERMIT DRAWING
SHEET 35 OF 50



BRIDGE SKETCH (NOT TO SCALE)

MATCH SHEET NO. 17A

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PROJECT REFERENCE NO.	SHEET NO.
R-2707D	17
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

50' 25' 0 50' 100'
SCALE: 1" = 100'

NAD 83

MATCH SHEET NO. 16 STA. 10+50 -SRVRD_5A-

MATCH SHEET NO. 16 STA. 807+00 -L-

MATCH SHEET NO. 17A STA. 16+50 -SRVRD_5-

MATCH SHEET NO. 18 STA. 820+50 -L-

MATCH SHEET NO. 18 STA. 15+88.00 -RAMPC-

MATCH SHEET NO. 18 STA. 21+00.00 -SRVRD_4-

SPECIAL DITCH GRADE SEE PROFILE

F. DON MELTON & WF. VICKY C. MELTON

NCDOT

CL 'B' RIP RAP EST. 3 TONS EST. 10 SY GF

FS TO EL 716.7 SEE DETAIL #58

STD. 2' BASE DITCH W/CL 'B' RIP RAP SLOPE=10% EST. 34 TONS EST. 92 SY GF SEE DETAIL #47

S 15° 14' 49.2" E

BERM 'V' DITCH SEE DETAIL #3 DRY DETENTION BASIN 100' X 150' BASE W/3:1 SIDES TOTAL CAPACITY @ ELEV. 720.0 W/1.0FT FREEBOARD=3,829 CY

RECTANGULAR FOREBAY W/CL 'I' RIP RAP EST. 100 TONS EST. 180 SY GF SEE DETAIL #52

DRY DETENTION BASIN DRAWDOWN STRUCTURE W/ACCESS BERM SEE DETAIL #32 & #34

EMERGENCY SPILLWAY WIDTH=20' AT EL=720.0 W/CL 'B' RIP RAP EST. 60 TONS EST. 120 SY GF

PIPE Q(10yr)=160 cfs S=3.3% V(10yr)=22.9 fps

DO NOT BURY INVERT

DRAIN POND

STD. 5' BASE CHANNEL W/EMBEDDED CL 'II' RIP RAP EST. 1018 TONS LENGTH=300' SLOPE=3.0% SEE DETAIL #27

BETTY J. MAYES

JAMES C. HEAFNER

SITE 11A

CL 'B' RIP RAP EST. 2 TONS EST. 7 SY GF

SPECIAL DITCH GRADE SEE PROFILE

FS, SEE DETAIL #57

SHOULDER BERM GUTTER FROM STA. 808+75 TO BEGIN APPROACH SLAB -L- LT

SHOULDER BERM GUTTER FROM END APPROACH SLAB TO STA. 818+00 -L- LT

SHOULDER BERM GUTTER FROM STA. 809+00 TO BEGIN APPROACH SLAB -L- RT

SHOULDER BERM GUTTER FROM END APPROACH SLAB TO STA. 816+00 -L- RT

S 23° 50' 54.0" E

S 19° 45' 49.5" E

LINE ROADWAY DITCH W/CL 'B' RIP RAP EST. 250 TONS EST. 742 SY GF SEE DETAIL #54

GRADE TO DRAIN

GRADE TO EL. 710.0

FS, SEE DETAIL #58

SPECIAL DITCH GRADE SEE PROFILE

MIN. DEPTH 2GI-A

S 23°50'29" E

S 23° 50' 540" E

FS, SEE DETAIL #58

18" W/ELBOWS

BDO

BERM 'V' DITCH W/CL 'B' RIP RAP EST. 33 TONS EST. 91 SY GF SEE DETAIL #17

FILL IN POND W/ COMPACTED SELECT MATERIAL 10' BERM W/3:1 SIDES SEE DETAIL #55

DO NOT BURY INVERT

TOE PROTECTION CL 'B' RIP RAP EST. 55 TONS EST. 342 SY GF SEE DETAIL #6

OH UTILITY NO IN-WATER WORK

CL 'II' RIP RAP BANK STABILIZATION SEE DETAIL #29 EST. 35 TONS

SPEC. LAT. 'V' DITCH W/CL 'B' RIP RAP EST. 83 TONS EST. 248 SY GF SEE DETAIL #40

SPEC. LAT. 'V' DITCH SEE DETAIL #2

SPEC. DITCH GRADE SEE PROFILE

STD. 2' BASE DITCH W/CL 'B' RIP RAP EST. 96 TONS EST. 258 SY GF SEE DETAIL #47

SPEC. LAT. 2' BASE DITCH W/CL 'B' RIP RAP EST. 168 TONS EST. 432 SY GF SEE DETAIL #18

J. HAROLD PARKER & WF. HELEN PARKER

BRUCE VON PRESTON & BRENDA KAY PRESTON

CAROLYN HAMRICK

NATANAEL CARMONA

MARC S DRILLINGS & REBECCA J DRILLINGS

DONALD REAL ESTATE INVESTORS LLC

JOSEPH NEWTON CRAVER III & ANGELAINE AUSTELL CRAVER

P P DENOTES IMPACTS IN SURFACE WATER (POND)

S S DENOTES IMPACTS IN SURFACE WATER

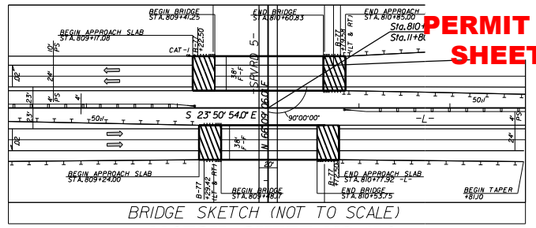
TS TS DENOTES TEMPORARY IMPACTS IN SURFACE WATER

F F DENOTES FILL IN WETLAND

REFERENCE:
FOR -L- PROFILE, SEE SHEET NO. 35
FOR -SRVRD_4- PROFILE, SEE SHEET. NO. 51
FOR -SRVRD_5- PROFILE, SEE SHEET. NO. 52
FOR -SRVRD_5A- PROFILE, SEE SHEET. NO.52
FOR -RAMPC- PROFILE, SEE SHEET NO. 42

8/17/99

PERMIT DRAWING
SHEET 36 OF 50



BRIDGE SKETCH (NOT TO SCALE)

MATCH SHEET NO. 17A

Stantec
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Raleigh, NC 27606
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Fax. (919) 851-7024
www.stantec.com
License No. F-0672

PROJECT REFERENCE NO.	SHEET NO.
R-2707D	17
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

50' 25' 0 50' 100'
SCALE: 1" = 100'

NAD 83

MATCH SHEET NO. 16 STA. 10+50 -SRVRD_5A-

MATCH SHEET NO. 16 STA. 807+00 -L-

MATCH SHEET NO. 17A STA. 16+50 -SRVRD_5-

MATCH SHEET NO. 18 STA. 820+50 -L-

MATCH SHEET NO. 18 -RAMPC-

MATCH SHEET NO. 18 STA. 15+88.00 -RAMPC-

MATCH SHEET NO. 18 STA. 21+00.00 -SRVRD_4-

SITE 11A

F. DON MELTON & WF. VICKY C. MELTON

NCDOT

DRY DETENTION BASIN DRAWDOWN STRUCTURE W/ ACCESS BERM SEE DETAIL #32 & #34

DRAIN POND

STD. 5' BASE CHANNEL W/EMBEDDED CL 'II' RIP RAP EST. 1018 TONS LENGTH = 300' SLOPE = 3.0% SEE DETAIL #27

SPECIAL DITCH GRADE SEE PROFILE

CL 'B' RIP RAP EST. 3 TONS EST. 10 SY GF

FS TO EL 716.7 SEE DETAIL #58

STD. 2' BASE DITCH W/CL 'B' RIP RAP SLOPE = 10% EST. 3 TONS EST. 92 SY GF SEE DETAIL #47

BERM 'V' DITCH SEE DETAIL #3 DRY DETENTION BASIN 100' X 150' BASE W/3:1 SIDES TOTAL CAPACITY @ ELEV. 720.0 W/1.0FT FREEBOARD = 3,829 CY

RECTANGULAR FOREBAY W/CL 'I' RIP RAP EST. 100 TONS EST. 180 SY GF SEE DETAIL #52

EMERGENCY SPILLWAY WIDTH = 20' AT EL = 720.0 W/CL 'B' RIP RAP EST. 60 TONS EST. 120 SY GF

PIPE Q(10yr) = 160 cfs S = 3.3% V(10yr) = 22.9 fps

DO NOT BURY INVERT

CL 'B' RIP RAP EST. 2 TONS EST. 7 SY GF

SHOULDER BERM GUTTER FROM STA. 808+75.00 TO BEGIN APPROACH SLAB -L- LT

SHOULDER BERM GUTTER FROM STA. 809+00.00 TO BEGIN APPROACH SLAB -L- RT

SHOULDER BERM GUTTER FROM END APPROACH SLAB TO STA. 816+00 -L- RT

SHOULDER BERM GUTTER FROM END APPROACH SLAB TO STA. 818+00 -L- LT

S 23° 50' 54.0" E

S 19° 45' 49.5" E

S 30° 48' 34" E

S 23° 50' 29" E

N 66° 09' 06.0" E

S 15° 14' 49.2" E

S 21° 30' 02.1" W

LINE ROADWAY DITCH W/CL 'B' RIP RAP EST. 250 TONS EST. 742 SY GF SEE DETAIL #54

BERM 'V' DITCH W/CL 'B' RIP RAP EST. 33 TONS EST. 91 SY GF SEE DETAIL #17

FILL IN POND W/ COMPACTED SELECT MATERIAL 10' BERM W/3:1 SIDES SEE DETAIL #55

GRADE TO DRAIN

GRADE TO EL. 710.0

MIN. DEPTH 2GI-A

SPECIAL DITCH GRADE SEE PROFILE

TOE PROTECTION CL 'B' RIP RAP EST. 135 TONS EST. 302 SY GF SEE DETAIL #6

CL 'B' RIP RAP BANK STABILIZATION SEE DETAIL #29 EST. 35 TONS

OH UTILITY
NO IN-WATER WORK

SPEC. LAT. 'V' DITCH W/CL 'B' RIP RAP EST. 83 TONS EST. 248 SY GF SEE DETAIL #40

SPEC. LAT. 'V' DITCH SEE DETAIL #2

SPEC. DITCH GRADE SEE PROFILE

STD. 2' BASE DITCH W/CL 'B' RIP RAP EST. 96 TONS EST. 298 SY GF SEE DETAIL #47

SPEC. LAT. 2' BASE DITCH W/CL 'B' RIP RAP EST. 168 TONS EST. 448 SY GF SEE DETAIL #18

SHOULDER BERM GUTTER FROM END APPROACH SLAB TO STA. 818+00 -L- LT

REMOVE

RETAIN

FS, SEE DETAIL #57

FS, SEE DETAIL #58

15" RCP-IV

18" RCP-III

24" RCP-III

30" RCP-III

36" RCP-III

15" W/ELBOWS

18" W/ELBOWS

30" W/ELBOWS

36" W/ELBOWS

2GI

2GI-A

2GI-D

BDO

DITCH

P P — DENOTES IMPACTS IN SURFACE WATER (POND)

S S — DENOTES IMPACTS IN SURFACE WATER

TS TS — DENOTES TEMPORARY IMPACTS IN SURFACE WATER

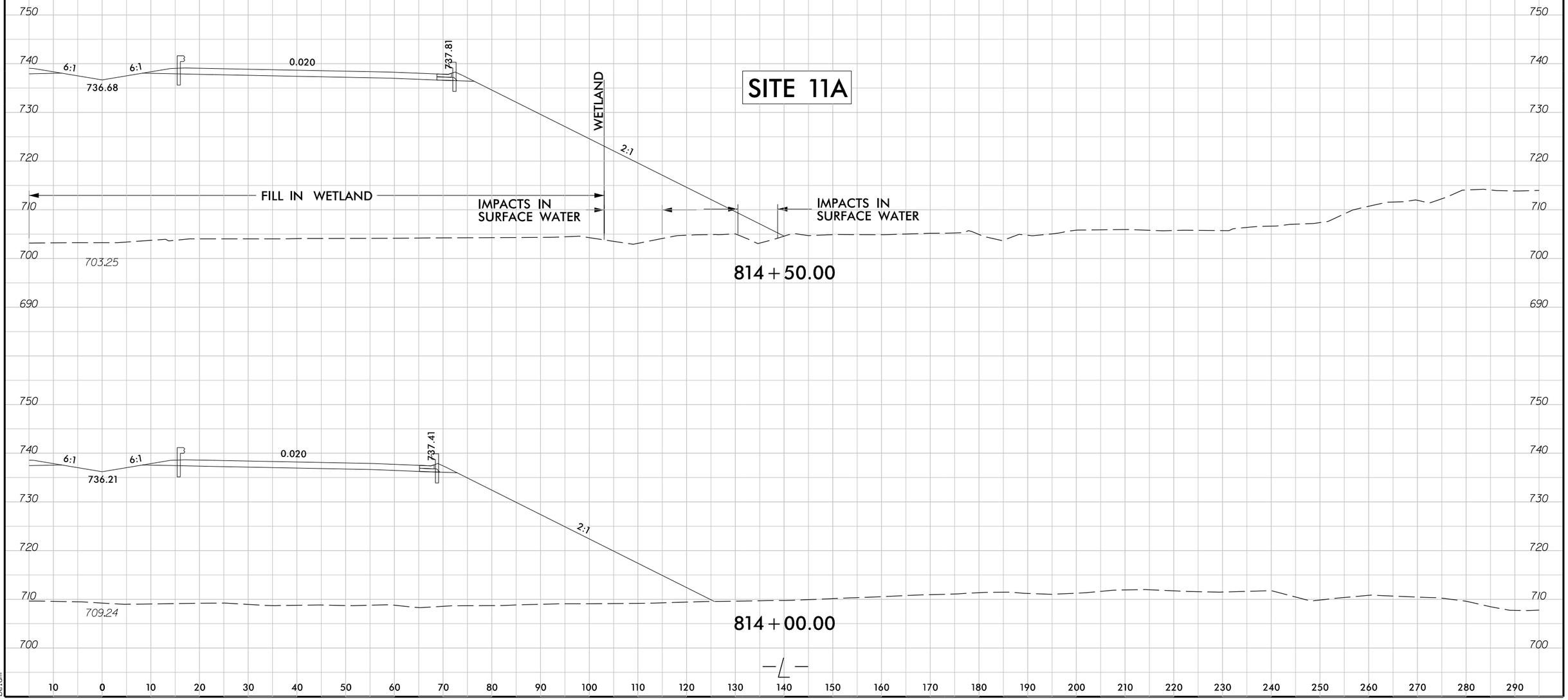
F F — DENOTES FILL IN WETLAND

REFERENCE:
FOR -L- PROFILE, SEE SHEET NO. 35
FOR -SRVRD_4- PROFILE, SEE SHEET. NO. 51
FOR -SRVRD_5- PROFILE, SEE SHEET. NO. 52
FOR -SRVRD_5A- PROFILE, SEE SHEET. NO.52
FOR -RAMPC- PROFILE, SEE SHEET NO. 42

$$$$SYSTIME$$$$
$$$$USERNAME$$$$

0 5 10	PROJ. REFERENCE NO.	SHEET NO.
	R2707-D	X-327

SITE 11A



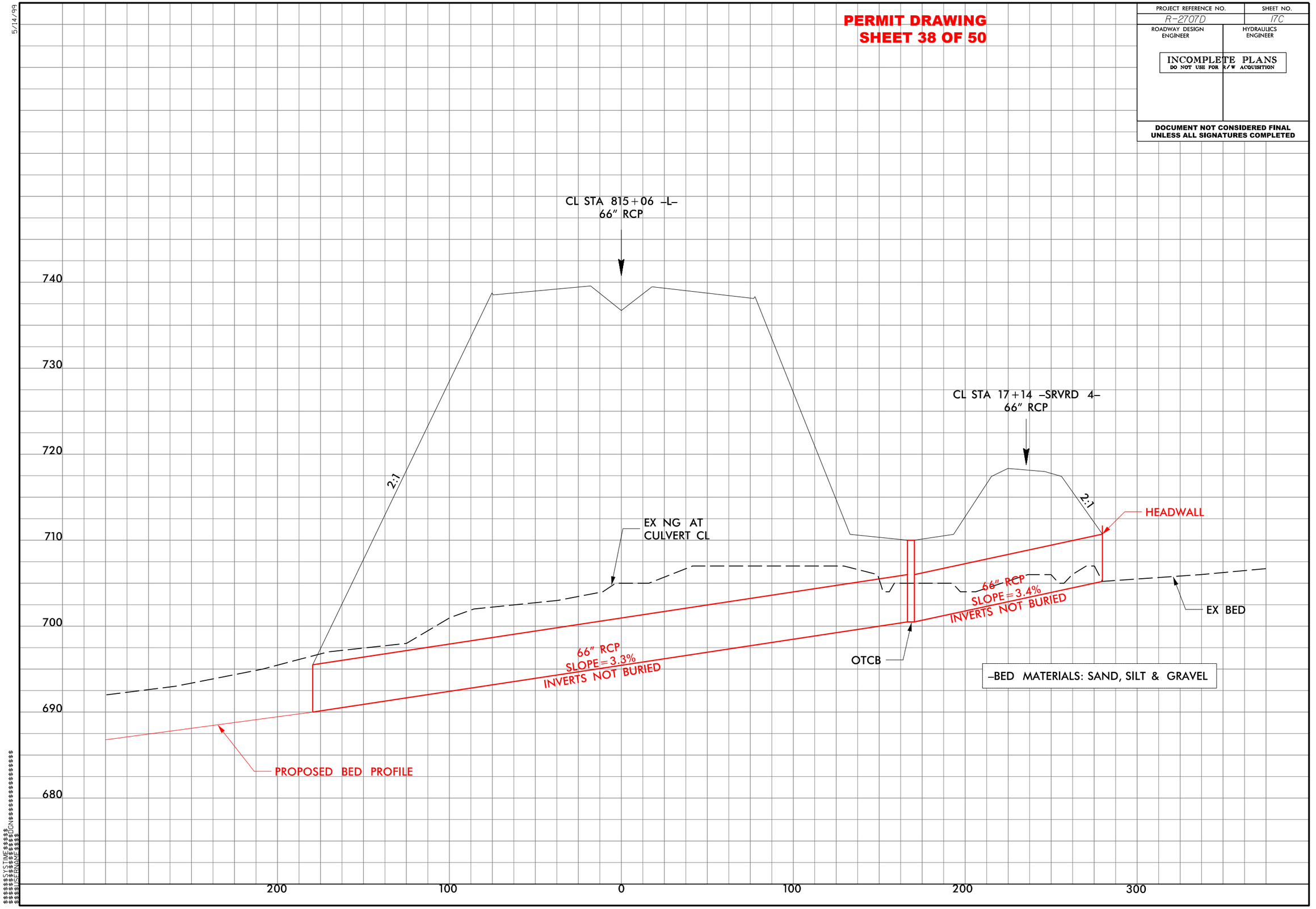
5/14/99

PERMIT DRAWING
SHEET 38 OF 50

PROJECT REFERENCE NO.	SHEET NO.
R-2707D	17C
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED



$$$$$$SYSTIME$$$$$$
$$$$$$DESIGN$$$$$$$$$$$$$$$$$$$$
$$$$$$USERNAME$$$$

8/17/99

PERMIT DRAWING
SHEET 39 OF 50

P P — DENOTES IMPACTS IN SURFACE WATER (POND)

S S — DENOTES IMPACTS IN SURFACE WATER

TS TS — DENOTES TEMPORARY IMPACTS IN SURFACE WATER

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License No. F-0672

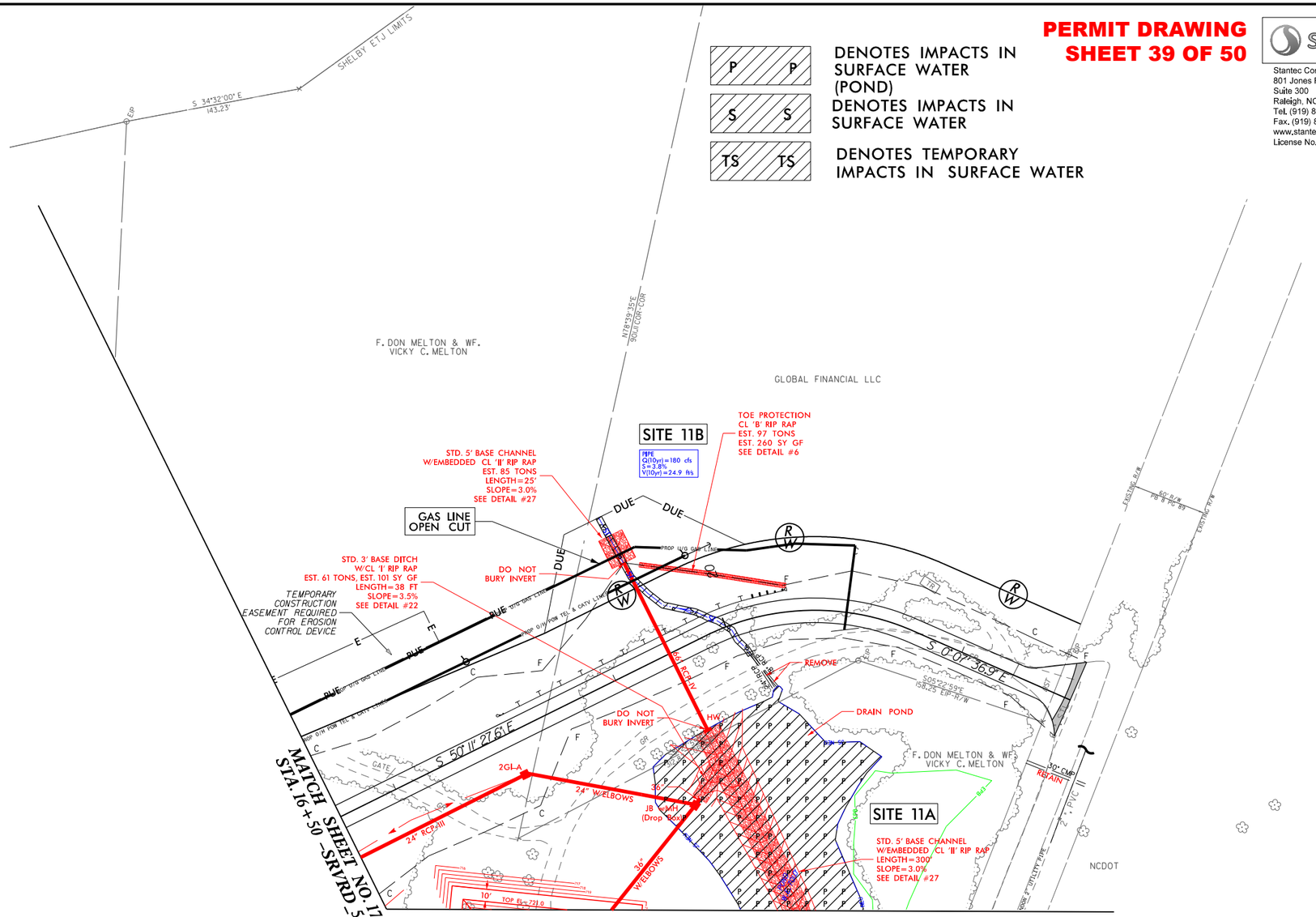
PROJECT REFERENCE NO.	SHEET NO.
R-2707D	17A
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

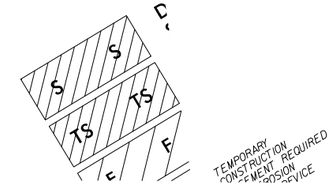
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

50′ 25′ 0 50′ 100′
SCALE: 1″=100′

NAD 83



MATCH SHEET NO. 17



REFERENCE:
FOR –SRVRD_5– PROFILE, SEE SHEET NO. 52

$$$$$$$SYSTIME$$$$$
$$$$$$$USERNAME$$$$$DGN$$$$$$$$$$$$$$$$$

8/17/99

PERMIT DRAWING
SHEET 40 OF 50

P P — DENOTES IMPACTS IN SURFACE WATER (POND)

S S — DENOTES IMPACTS IN SURFACE WATER

TS TS — DENOTES TEMPORARY IMPACTS IN SURFACE WATER

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PROJECT REFERENCE NO.	SHEET NO.
R-2707D	17A
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

50′ 25′ 0 50′ 100′
SCALE: 1″=100′

NAD 83

F. DON MELTON & WF
VICKY C. MELTON

GLOBAL FINANCIAL LLC

SITE 11B

PIPE
Q(10yr)=180 cfs
S=3.8%
V(10yr)=24.9 fps

STD. 5' BASE CHANNEL W/EMBEDDED CL 'I' RIP RAP
EST. 85 TONS
LENGTH=25'
SLOPE=3.0%
SEE DETAIL #27

TOE PROTECTION
CL 'B' RIP RAP
EST. 97 TONS
EST. 260 SY GF
SEE DETAIL #6

GAS LINE OPEN CUT

STD. 3' BASE DITCH W/CL 'I' RIP RAP
EST. 61 TONS, EST. 101 SY GF
LENGTH=38 FT
SLOPE=3.5%
SEE DETAIL #22

DO NOT BURY INVERT

TEMPORARY CONSTRUCTION EASEMENT REQUIRED FOR EROSION CONTROL DEVICE

S 01° 36.9' E

REMOVE

DRAIN POND

DO NOT BURY INVERT

HW

S 50° 11' 27.6" E

24" RCP

2 GI-A

24" W/ELBOWS

JB (Drop Box)

48" W/ELBOWS

10' TOP W. 72"ø

F. DON MELTON & WF
VICKY C. MELTON

30" CMP

RETAIN

SITE 11A

STD. 5' BASE CHANNEL W/EMBEDDED CL 'II' RIP RAP
LENGTH=300'
SLOPE=3.0%
SEE DETAIL #27

NCDOT

TEMPORARY CONSTRUCTION EASEMENT REQUIRED FOR EROSION CONTROL DEVICE

MATCH SHEET NO. 17
STA. 16+50 –SRVRD_5–

MATCH SHEET NO. 17

REFERENCE:
FOR –SRVRD_5– PROFILE, SEE SHEET NO. 52

$$$$$$$SYSTIME$$$$$
$$$$$$$$$$$$$$$$$$$DGN$$$$$$$$$$$$$$$$$$$
$$$$$$$USERNAME$$$$$

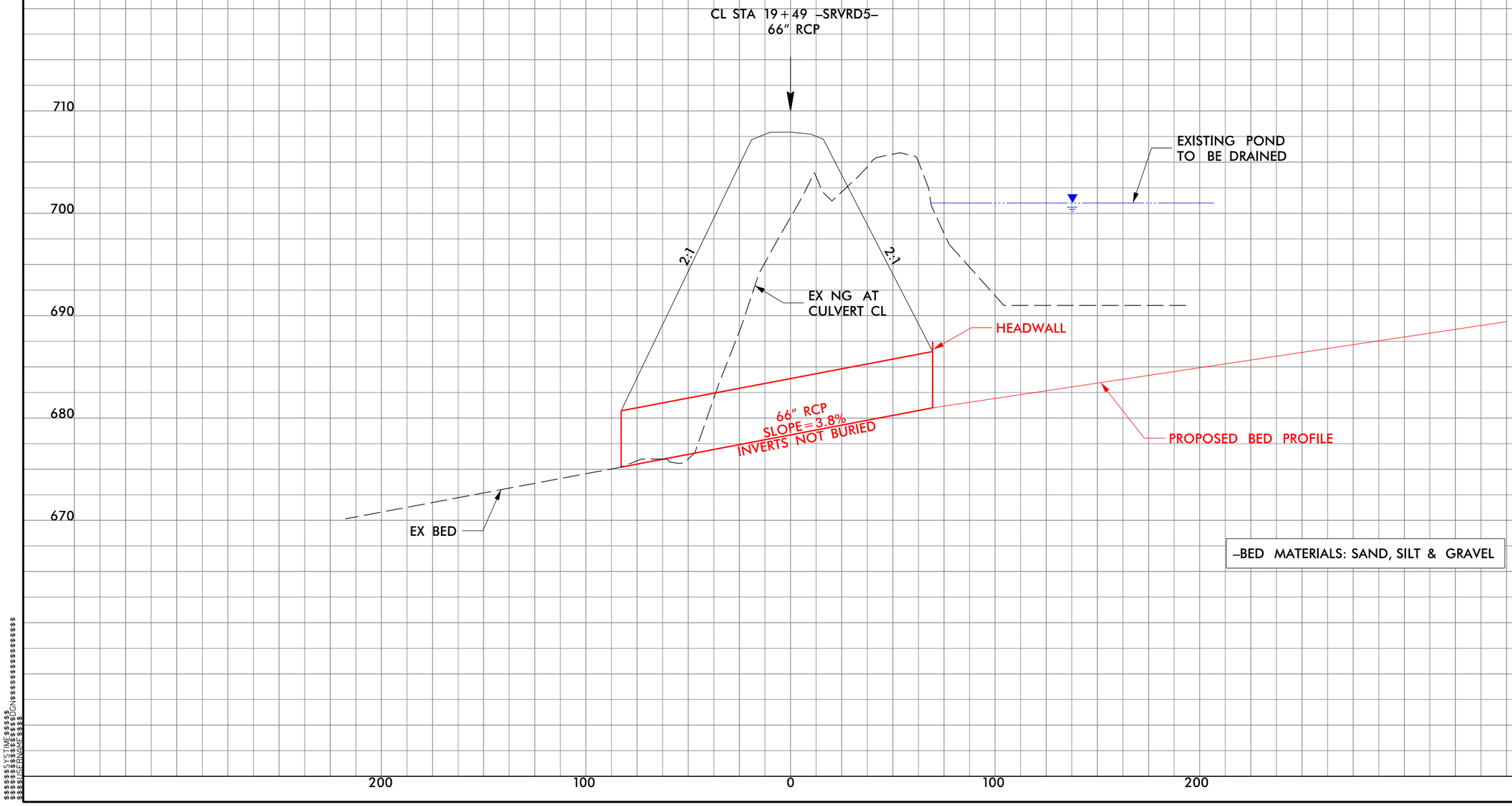
5/14/99

PERMIT DRAWING
SHEET 41 OF 50

PROJECT REFERENCE NO.	SHEET NO.
R-2707D	17DB
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

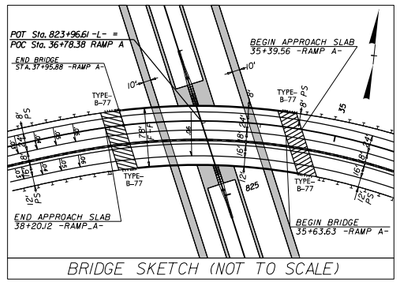
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED



$$$$$$SYSTIME$$$$$$
$$$$$$SYSNAME$$$$$$
$$$$$$USERNAME$$$$$$
$$$$$$DESIGN$$$$$$$$$$$$$$$$$$$$

PERMIT DRAWING
SHEET 42 OF 50

REVISIONS
3 / 11 / 19-R/W REVISION NO.1 – ASSIGN PARCEL NO.182 TO INTEN LLC PROPERTY BASED ON UPDATED PROPERTY LINES.ASSIGN PARCEL NO.681 TO REMAINING PROPERTY OF FRED LEWIS & TERESA LEWIS.



BRIDGE SKETCH (NOT TO SCALE)

DENOTES IMPACTS IN SURFACE WATER
DENOTES TEMPORARY IMPACTS IN SURFACE WATER
DENOTES FILL IN WETLAND
DENOTES MECHANIZED CLEARING

PSH 18B

NAD 83

SCALE: 1" = 200'

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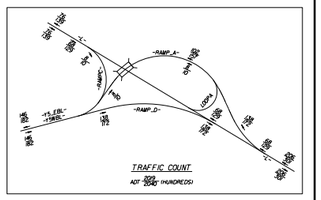
License No. F-0672

PROJECT REFERENCE NO.	SHEET NO.
R-2970	18
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED



TRAFFIC COUNT
ADT 2040 (HUNDREDS)

MATCH SEE THIS SHEET

INSET A

MATCH SHEET NO. 17 STA. 15+88.00 –SRVRD_4–

MATCH SHEET NO. 17 STA. 21+00.00 –SRVRD_4–

MATCH SHEET NO. 17, STA. 820+50 –L–

MATCH SHEET NO. 29 STA. 32+00.00 –RAMP D–
MATCH SHEET NO. 26 STA. 48+24.94 –RAMP_2–

MATCH SHEET NO. 19 STA. 15+80 –RAMP_A–

MATCH SHEET NO. 19 STA. 18+33.33 –SRVRD_2–

MATCH SHEET NO. 19 STA. 61+00 –L–

MATCH SEE THIS SHEET FOR INSET A

SITE 12A

SITE 12B

J.D. JOHNSON

JEAN LINEBERGER

J.A. RUE JRJAN

FORMERLY PARCEL 072

CAROL TH HAMRICK

FRED LEWIS & TERESA LEWIS

INTEN LLC

BARBARA MAE BALKER

FORMERLY PARCEL 069

RANDOLPH NELSON BIGGS

STEVEN L. STRICKLAND & WF. MARCELLE D. STRICKLAND

KEVIN MORROW & PATRICIA B. ROSE

JANET HOWELL

JOHN W. BEHELER & WF. FRANCES M. BEHELER

JOHN LEMUEL RACHELS & WF. BETTINA B. RACHELS

BRENDA HUGHES

GATHER MASK

GARVIS LEE STRICKLAND & WF. REBA B. STRICKLAND

HECTOR GARCIA & WF. ANGELICA GARCIA

THE CAROLINA CONFERENCE ASSOCIATION OF SEVENTH DAY ADVENTIST, INC. DB 1863 PG 1269

REFERENCE:
FOR –L– PROFILE, SEE SHEET NO. 36 & 37
FOR –RAMP A– PROFILE, SEE SHEET NO. 38, 39 & 40
FOR –LOOPA– PROFILE, SEE SHEET NO. 41 & 42
FOR –RAMPC– PROFILE, SEE SHEET NO. 42
FOR –RAMP D– PROFILE, SEE SHEET NO. 43
FOR –Y4– PROFILE, SEE SHEET NO. 47
FOR –SRVRD_3– PROFILE, SEE SHEET NO. 51
FOR –PVTENT_4– PROFILE, SEE SHEET NO. 54
FOR SHEAR POINT LAYOUT, SEE SHEET NO. 2F

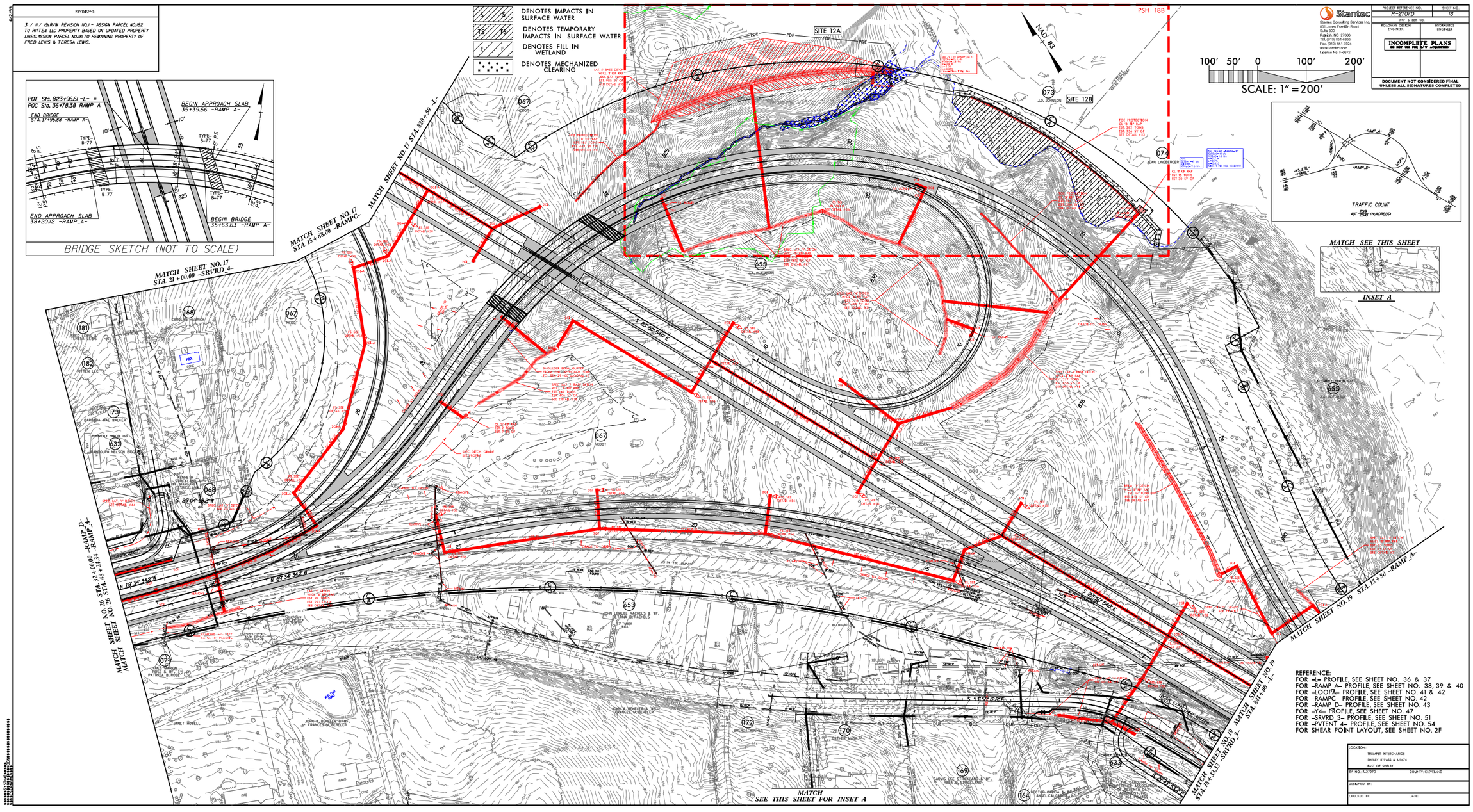
LOCATION: TRUMPET INTERCHANGE SHELBY BYPASS & US-74 EAST OF SHELBY	
TIP NO. R-2707D	COUNTY: CLEVELAND
DESIGNED BY:	
CHECKED BY:	DATE:

PERMIT DRAWING
SHEET 43 OF 50

REVISIONS
3 / 11 / 19-R/W REVISION NO.1 - ASSIGN PARCEL NO.182 TO WITTEN LLC PROPERTY BASED ON UPDATED PROPERTY LINES.ASSIGN PARCEL NO.181 TO REMAINING PROPERTY OF FRED LEWIS & TERESA LEWIS.

DENOTES IMPACTS IN SURFACE WATER
DENOTES TEMPORARY IMPACTS IN SURFACE WATER
DENOTES FILL IN WETLAND
DENOTES MECHANIZED CLEARING

BRIDGE SKETCH (NOT TO SCALE)



REFERENCE:
FOR -L- PROFILE, SEE SHEET NO. 36 & 37
FOR -RAMP A- PROFILE, SEE SHEET NO. 38, 39 & 40
FOR -LOOPA- PROFILE, SEE SHEET NO. 41 & 42
FOR -RAMPC- PROFILE, SEE SHEET NO. 42
FOR -RAMP D- PROFILE, SEE SHEET NO. 43
FOR -Y4- PROFILE, SEE SHEET NO. 47
FOR -SRVRD_3- PROFILE, SEE SHEET NO. 51
FOR -PVTENT_4- PROFILE, SEE SHEET NO. 54
FOR SHEAR POINT LAYOUT, SEE SHEET NO. 2F

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License No. F-0672

PROJECT REFERENCE NO.	SHEET NO.
R-2970	18
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

LOCATION: TRUMPET INTERCHANGE SHELBY BYPASS & US-74 EAST OF SHELBY	
TIP NO. R-2970	COUNTY: CLEVELAND
DESIGNED BY:	
CHECKED BY:	DATE:

8/17/99

PERMIT DRAWING
SHEET 44 OF 50

40′ 20′ 0 40′ 80′
SCALE: 1″ = 80′

PROJECT REFERENCE NO.	SHEET NO.
R-2707D	18B
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

F F — DENOTES FILL IN WETLAND

DENOTES MECHANIZED CLEARING

S S — DENOTES IMPACTS IN SURFACE WATER

TS TS — DENOTES TEMPORARY IMPACTS IN SURFACE WATER

J.D. JOHNSON

SITE 12A

SITE 12B

073
J.D. JOHNSON

655
J.A. INJEJIKIAN

07
JEAN LINE

N27°39'56"E
118.60 EIP-COR

S05°48'25"W
709.50 COR-COR

N75°48'25"E
827.38 COR-CREEK

S20°41'35"E
74.30 COR-COR

S39°11'35"E
297.00 COR-COR

PDE

SF

EPB

RW

CA

15" RCP-III

15" RCP-IV

2GI

CB

15" W/ELBOWS

36" CSP

36" JB w/MH (Drop Box)

Sta 29+50 -RAMP_A- RT
Q(10yr)=15.6 cfs
V(10yr)=2.8 ft/s
d=0.8 ft
s=2.0%
n=0.055
Liner=Class 'I' Rip Rap

SPRING

SPRING BOX

FS TO EL. 724.0
SEE DETAIL #56

SC Sta.20+10.19 -ILOOPA-

CS Sta.18+60.19 -ILOOPA-

POT Sta.823+96.61 -L- =
POC Sta.36+78.37 -RAMP_A-
FORMERLY PARCEL 072

SPEC. LAT. 'V' DITCH
W/CL 'B' RIP RAP
EST. 420 TONS
EST. 1175 SY GF
SEE DETAIL #21

TOE PROTECTION
CL 'B' RIP RAP
EST. 282 TONS
EST. 756 SY GF
SEE DETAIL #53

TOE PROTECTION
CL 'B' RIP RAP
EST. 143 TONS
EST. 386 SY GF
SEE DETAIL #16

825
830
30
20
25

7/10/2019
R2707D_Hyd_prm_wet_psh_18b.dgn
bstorm

6/23/16

PERMIT DRAWING
SHEET 45 OF 50

0 5 10

PROJ. REFERENCE NO.	SHEET NO.
R2707-D	X-374

150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150

750 740 730 720 710 700 690 680 670 660

0.060 0.060 0.060

4:1

2:1

722.30

700.31

2:1

SITE 12

WETLAND WETLAND

FILL IN WETLAND

FILL IN WETLAND

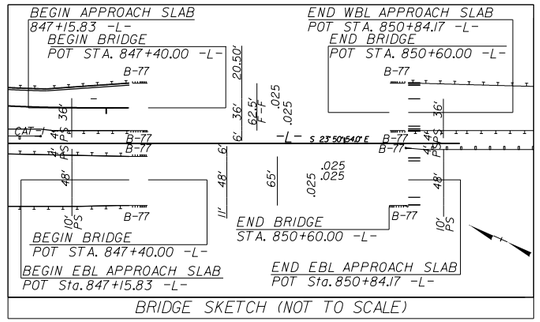
IMPACTS IN SURFACE WATER

30+50.00

-RAMP_A-

12/19/2018
R2707D_hyd_prm_wet_psh_18c_xpl.dgn
belam

8/17/99



BRIDGE SKETCH (NOT TO SCALE)

S S DENOTES IMPACTS IN SURFACE WATER

TS TS DENOTES TEMPORARY IMPACTS IN SURFACE WATER

PERMIT DRAWING
SHEET 46 OF 50

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Tel. (919) 851-6866
Fax. (919) 851-7024
www.stantec.com
License No. F-0672

PROJECT REFERENCE NO.	SHEET NO.
R-2707D	19
RW SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

50' 25' 0 50' 100'
SCALE: 1"=100'

NAD 83

MATCH SHEET NO. 18 STA. 15+80 -RAMP_A-

MATCH SHEET NO. 18 STA. 841+00 -L-

MATCH SHEET NO. 18 STA. 18+33.33 -SRVRD_3-

SITE 13

SITE 14A

SITE 14B

SITE 14C

OH UTILITY NO IN-WATER WORK

GAS LINE DIRECTIONAL BORE

J.A. INJEJIKIAN

WESTLEY M. LAIL

HAL STAN QUEEN DB 03E PG 622 DB 7-P PG 414 DB 1192 PG 816

ASPHALT PAVING OF SHELBY, INC.

THE CAROLINA CONFERENCE ASSOCIATION OF SEVENTH DAY ADVENTIST, INC.

JOHN L. AND BETTINA B. RACHELS

BUFFALO CREEK

PROPERTY LINE - CENTERLINE BUFFALO CREEK N 73°58'35"E 1025.78'

SHELBY E.J.U. LIMITS

TOE PROTECTION CL 'B' RIP RAP EST. 157 TONS EST. 422 SY GF SEE DETAIL #6

SHOULDER BERM GUTTER FROM STA. 9+71 TO STA. 15+00 -RAMP_A- RT

PIPE Q(10yr) = 115.6 cfs S = 0.3% V(10yr) = 9.7 fps

24" RCP-III

JB w/MH (Drop Box)

DO NOT BURY INVERT 54" RCP-III

JB w/SLAB LID

SPEC. DITCH C&GRAP II SEE PROFILE

30" RCP-III

FS, SEE DETAIL #57

REMOVE

18" RCP

FLOWABLE FILL

2'x4' CONC HW

15" RCP-IV

2GI

2GI-A

STD. 5' BASE CHANNEL W/EMBEDDED CL 'I' RIP RAP EST. 1951 TONS LENGTH = 575' SLOPE = 2.8% SEE DETAIL #27

FILL EXISTING CHANNEL WITH SUITABLE MATERIAL EST. 350 CY

CL 'I' RIP RAP TO EL. 625.5

DECK DRAIN DISSIPATOR PAD SEE DETAIL #49

TEMP. WORK PAD

CL 'II' RIP RAP BANK STABILIZATION TO EL 655.5 SEE STRUCTURE PLANS

EXISTING BRIDGE EXCAVATION (SEE STRUCTURE PLANS, TYP.)

STD. 3' BASE DITCH W/CL 'I' RIP RAP EST. 127 TONS EST. 212 SY GF SEE DETAIL #22

CL 'II' RIP RAP AT EMBANKMENT EST. 35 TONS EST. 65 SY GF SEE DETAIL #24

STD. 3' BASE DITCH W/CL 'I' RIP RAP EST. 207 TONS EST. 346 SY GF SEE DETAIL #22

BERM 'V' DITCH W/CL 'B' RIP RAP EST. 115 TONS EST. 324 SY GF SEE DETAIL #17

SPEC. DIT 'V' DITCH SEE DETAIL #2

REMOVE CONC DI

REMOVE 15" RCP

15" RCP-IV

15" RCP-III

18" W/ELBOW

W/ELBOWS

BDO

S 23°50'54.0" E

S 21°43'53.4" E

S 25°42'24"E 74.75' REBAR-EIP

S 46°55'37"W 92.17'

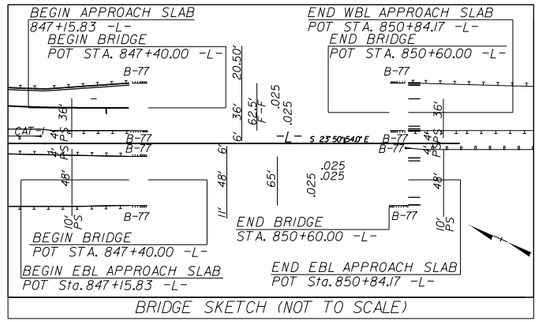
N 21°52'20" W 20.65'

REFERENCE:
FOR –L– PROFILE, SEE SHEET NO. 37
FOR –RAMP_A– PROFILE, SEE SHEET NO. 38
FOR –SRVRD_3– PROFILE, SEE SHEET NO. 51
FOR –PVTENT_4– PROFILE, SEE SHEET NO. 54

$$$$SYSTIME$$$$
$$$$USERNAME$$$$
$$$$DGN$$$$

8/17/99

$$$$$$SYSTIME$$$$$$
$$$$$$LOGNAME$$$$$$



BRIDGE SKETCH (NOT TO SCALE)

S S DENOTES IMPACTS IN SURFACE WATER

TS TS DENOTES TEMPORARY IMPACTS IN SURFACE WATER

PERMIT DRAWING
SHEET 47 OF 50

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PROJECT REFERENCE NO.	SHEET NO.
R-2707D	19
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

50' 25' 0 50' 100'
SCALE: 1"=100'
NAD 83

OH UTILITY
NO IN-WATER WORK

MATCH SHEET NO. 18 STA. 15+80 -RAMP A-

MATCH SHEET NO. 18 STA. 841+00 -L-

MATCH SHEET NO. 18 STA. 18+33.33 -SRVRD_3-

SITE 13
SITE 14A
SITE 14B
SITE 14C

TOE PROTECTION CL 'B' RIP RAP EST. 157 TONS EST. 422 SY GF SEE DETAIL #6

SHOULDER BERM GUTTER FROM STA 9+71 TO STA 15+00 -RAMP A- RT

STD. 15' BASE CHANNEL W/EMBEDDED CL 'B' RIP RAP EST. 1951 TONS LENGTH=575' SLOPE=2.8% SEE DETAIL #27

FILL EXISTING CHANNEL WITH SUITABLE MATERIAL EST 350 CY

CL 'B' RIP RAP TO EL 652.5

DECK DRAIN DISSIPATOR PAD SEE DETAIL #49

PIPE Q(10yr)=115.6 cfs S=0.3% V(10yr)=9.7 fps

DO NOT BURY INVERT 54" RCP-III

REMOVE CONC DI

REMOVE 18" RCP

REMOVE 15" RCP

TEMP. WORK PAD CONC

CL 'B' RIP RAP BANK STABILIZATION TO EL 655.5 SEE STRUCTURE PLANS

CL 'I' RIP RAP BANK STABILIZATION TO EL 655.5 SEE STRUCTURE PLANS

SPEC. 'A1' V DITCH SEE DETAIL #2

STD. 3' BASE DITCH W/CL 'I' RIP RAP EST. 127 TONS EST. 212 SY GF SEE DETAIL #22

CL 'II' RIP RAP AT EMBANKMENT EST. 35 TONS EST. 43 SY GF SEE DETAIL #24

STD. 3' BASE DITCH W/CL 'I' RIP RAP EST. 207 TONS EST. 345 SY GF SEE DETAIL #22

BERM 'V' DITCH W/CL 'B' RIP RAP EST. 115 TONS EST. 324 SY GF SEE DETAIL #17

EXISTING BRIDGE EXCAVATION (SEE STRUCTURE PLANS, TYP.)

GAS LINE DIRECTIONAL BORE

S 23° 50' 54.0" E

S 21° 43' 53.4" E

J.A. INJEJIKIAN

WESTLEY M. LAIL

HAL STAN QUEEN DB 03E PG 622 DB 7-P PG 414 DB 192 PG 816

THE CAROLINA CONFERENCE ASSOCIATION OF SEVENTH DAY ADVENTISTS, INC.

JOHN L. AND BETTINA B. RAGHES

ASPHALT PAVING OF SHELBY, INC.

BUFFALO CREEK

REFERENCE:
FOR –L– PROFILE, SEE SHEET NO. 37
FOR –RAMP_A– PROFILE, SEE SHEET NO. 38
FOR –SRVRD_3– PROFILE, SEE SHEET NO. 51
FOR –PVTENT_4– PROFILE, SEE SHEET NO. 54

5/28/99

PERMIT DRAWING
SHEET 48 OF 50

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PROJECT REFERENCE NO.	SHEET NO.
R-2707D	37
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

–L–

–L– STA 838+94.04 =
RAMP D STA 10+00.00 (59' RT)

(–)4.0000%

PI = 826+00.00
EL = 749.82'
VC = 2,100'
K = 425
DS = >70 MPH

EXISTING GROUND

EX 48" RCP

PROPOSED GRADE

PI = 845+30.00
EL = 672.62'
VC = 700'
K = 189
DS = 70 MPH

(–)4.0000%

PIPE HYDRAULIC DATA
EX 48" RCP Sta. 840+00-L-

DRAINAGE AREA	=	AC
DESIGN FREQUENCY	= 50	YRS
DESIGN DISCHARGE	=	CFS
DESIGN HW ELEVATION	= 683.7	FT
100 YEAR DISCHARGE	=	CFS
100 YEAR HW ELEVATION	= 683.70	FT
OVERTOPPING FREQUENCY	=	YRS
OVERTOPPING DISCHARGE	=	CFS
OVERTOPPING ELEVATION	=	FT

FOR –L– PLAN SEE RDY SHEET 18 & 19

–L–

BEGIN APPROACH SLAB
STA 847+15.83

END APPROACH SLAB
STA 850+84.17

END TIP PROJECT R-2707D
BEGIN TIP PROJECT R-2707E
END GRADE
–L– STA 851+00.00
ELEV = 670.91'

–L– STA 847+14.58 =
–RAMP A– STA 9+71.05 (59' LT)

PI = 845+30.00
EL = 672.62'
VC = 700'
K = 189
DS = 70 MPH

BEGIN BRIDGE
STA 847+40.00

END BRIDGE
STA 850+60.00

EXISTING BRIDGE TO BE REMOVED

PROPOSED GRADE
LOW SIDE
LOW STEEL

FUTURE GRADE

(–)0.3000%

(–) 5.4200%

(–)4.0000%

PI =846+00 RT
EL = 670.42

CL 'II' RIP RAP
1.5:1 NORMAL

PI =847+00 RT
EL = 665.00

EXISTING GROUND

TEMP. WORK PAD
TOP EL. 638.0 W/
1.5:1 SIDE SLOPES

EXCAVATE TO
APPROX. EL. 652.0
EST. 120 CY

BM#101
–L– STA.850+42.89, 7.27' RT
ELEV. 667.84'
DESCRIPTION MISSING

WSE ON 9-27-17
=635.3

BRIDGE HYDRAULIC DATA

DESIGN DISCHARGE	= 14,290	CFS
DESIGN FREQUENCY	= 50	YRS
DESIGN HW ELEVATION	= 654.4	FT
BASE DISCHARGE	= 16,860	CFS
BASE FREQUENCY	= 100	YRS
BASE HW ELEVATION	= 655.8	FT
OVERTOPPING DISCHARGE	= 55,000	CFS
OVERTOPPING FREQUENCY	= >500	YRS
OVERTOPPING ELEVATION	= 671.2	FT
	=	FT
DATE OF SURVEY	= 9-27-17	
W.S. ELEVATION AT DATE OF SURVEY	= 635.3	FT

FOR –L– PLAN SEE RDY SHEET 19

12/19/2018
R2707D_hyd_prm_wet_psh_19b.dgn
Plan

WETLAND AND SURACE WATER IMPACTS SUMMARY

			WETLAND IMPACTS					SURFACE WATER IMPACTS				
Site No.	Station (From/To)	Structure Size / Type	Permanent Fill In Wetlands (ac)	Temp. Fill In Wetlands (ac)	Excavation in Wetlands (ac)	Mechanized Clearing in Wetlands (ac)	Hand Clearing in Wetlands (ac)	Permanent SW impacts (ac)	Temp. SW impacts (ac)	Existing Channel Impacts Permanent (ft)	Existing Channel Impacts Temp. (ft)	Natural Stream Design (ft)
1	643+78 to 647+11-L-	48" RCP						0.05		572		
		INLET/OUTLET CHANNEL						< 0.01	< 0.01	47	20	
2	683+16 to 685+09-L-	42" RCP	0.05					0.04		507		
		INLET/OUTLET CHANNEL						< 0.01	< 0.01	63	20	
3	715+09 to 720+05-L-	1@7'x7' RCBC						0.09	< 0.01	633	52	
		BANK STABILIZATION						< 0.01		50		
4A	720+05 to 725+00-L-LT	CHANNEL RELOCATION						0.15	< 0.01	806	20	621
4B	720+52 to 721+60-L-LT	CHANNEL RELOCATION						< 0.01	< 0.01	109	15	199
5A	727+99 to 732+97-L-LT	CHANNEL RELOCATION						0.16	< 0.01	664	40	530
5B	730+88 to 732+24-L-LT	CHANNEL RELOCATION						0.01	< 0.01	186	15	134
6A	734+37 to 740+78-L-LT	CHANNEL RELOCATION						0.30	0.02	1178	56	878
6B	739+73 to 742+83-L-LT	CHANNEL RELOCATION						0.12		468		316
6C	742+83 to 744+14-L-	2@8'x8' RCBC						0.17	< 0.01	597	40	
		BANK STABILIZATION						0.01		50		
7	763+53 to 764+51-L-	48" RCP	0.02			< 0.01		0.02	< 0.01	268	10	
		OUTLET CHANNEL						< 0.01	< 0.01	20	10	
		BANK STABILIZATION						< 0.01		20		
8	776+56 to 778+61-L-	54" RCP	< 0.01					0.03	< 0.01	483	10	
		OUTLET CHANNEL						< 0.01	< 0.01	32	10	
		BANK STABILIZATION						< 0.01		20		
9	796+29 to 797+06-L-	1@12'x7' RCBC						0.05	0.02	323	85	
		BANK STABILIZATION						0.02		100		
SHEET 1 SUBTOTALS*:			0.07			< 0.01		1.24	0.06	7196	403	2678

*Rounded totals are sum of actual impacts

NOTES:
Site 4A: 1@7'x7' RCBC Outlet Channel Stabilization = 70ft
Site 6B: 2@8'x8' RCBC Outlet Bank Stabilization = 50ft

NC DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
8-31-22
CLEVELAND
R-2707D
34497.1.F56

Revised 2018 Feb

WETLAND AND SURACE WATER IMPACTS SUMMARY

			WETLAND IMPACTS					SURFACE WATER IMPACTS				
Site No.	Station (From/To)	Structure Size / Type	Permanent Fill In Wetlands (ac)	Temp. Fill In Wetlands (ac)	Excavation in Wetlands (ac)	Mechanized Clearing in Wetlands (ac)	Hand Clearing in Wetlands (ac)	Permanent SW impacts (ac)	Temp. SW impacts (ac)	Existing Channel Impacts Permanent (ft)	Existing Channel Impacts Temp. (ft)	Natural Stream Design (ft)
10	804+32 to 805+12-L-LT	ROADWAY FILL / 24" RCP	0.05		< 0.01	0.02						
11A	814+26 to 816+25-L-	66" RCP	0.22					0.05	< 0.01	438	29	
		POND						0.87				
		BANK STABILIZATION						< 0.01		20		
11B	19+48 to 20+13-SRVRD5-	66" RCP						0.02		134		
		OUTLET CHANNEL						< 0.01	< 0.01	25	17	
12A	29+17 to 34+77-RAMPA-	ROADWAY FILL	0.12			0.01		0.05	< 0.01	682	14	
12B	23+80 to29+35-RAMPA-RT	ROADWAY FILL	0.65			0.13						
13	841+05 to 848+66-L-LT	42" RCP						0.04		308		
		OUTLET CHANNEL						0.06		534		
14A	849+42-L-LT	BANK STABILIZATION						< 0.01		35		
14B	848+50 to 850+05-L-	BANK STABILIZATION						0.03		250		
		TEMP. WORKPAD							0.03			
14C	849+06-L-RT	BANK STABILIZATION						< 0.01		15		
15	652+82 to 652+98-L-LT	OUTLET CHANNEL							< 0.01		15	
16	669+32 to 670+07-L-	48" RCP						0.03		367		
		INLET/OUTLET CHANNEL						< 0.01	< 0.01	58	15	
SHEET 1 SUBTOTALS*:			0.07			< 0.01		1.24	0.06	7196	403	2678
SHEET 2 SUBTOTALS*:			1.04		< 0.01	0.16		1.15	0.04	2866	90	
GRAND TOTALS*:			1.11		< 0.01	0.17		2.40	0.10	10062	493	2678

*Rounded totals are sum of actual impacts

NOTES:

NC DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
8-31-22
CLEVELAND
R-2707D
34497.1.F56

North Carolina Department of Transportation

Highway Stormwater Program

STORMWATER MANAGEMENT PLAN

FOR NCDOT PROJECTS

(Version 2.07; Released October 2016)

WBS Element: 34497.1.F56 **TIP No.:** R-2707E **County(ies):** Cleveland

General Project Information

WBS Element:	34497.1.F56	**TIP Number:**	R-2707E	**Project Type:**	New Location	**Date:**	2/20/2018
NCDOT Contact:	Paul Atkinson, PE			**Contractor / Designer:**	Brian Elam, PE		
Address:	NCDOT Hydraulics Unit 1590 Mail Service Raleigh, NC 27699-1590			**Address:**	Sungate Design Group, PA 905 Jones Franklin Road Raleigh, NC 27606		
Phone:	919-707-6707			**Phone:**	919-859-2243 ext. 207		
Email:	patkinson@ncdot.gov			**Email:**	belam@sungatedesign.com		
City/Town:	Shelby			**County(ies):**	Cleveland		
River Basin(s):	Broad			**CAMA County?**	No		
Wetlands within Project Limits?	Yes						

Project Description

Project Length (lin. miles or feet):	2.63	**Surrounding Land Use:**	Urban, Residential, Light Industrial		
	Proposed Project			**Existing Site**	
Project Built-Upon Area (ac.)	43.0	ac.		25.0	ac.
Typical Cross Section Description:	-L-: 34' grassed ditch median with 6:1 side slopes. 2 paved lanes (total 24' wide) with 12' outside shoulder (15' with guardrail, 10' paved) and 6' inside shoulder (4' paved) in each direction. Varying fill and cut slopes (see project XSC's for detailed information).			Existing US 74 (-L-): 2 paved lanes (total 24') with 15' grassed median, 10' outside and 6' insides shoulders	
Annual Avg Daily Traffic (veh/hr/day):	Design/Future: 59,200	Year: 2040		Existing: 41,600	Year: 2019
General Project Narrative: (Description of Minimization of Water Quality Impacts)	The R-2707E project involves constructing the section of proposed US 74 (Shelby bypass) from west of SR 2238 (Long Branch Road) to west of SR 1001. There are no major structures involved with the construction of R-2707E. Dry detention basins are utilized at locations throughout the project to attenuate increased peak flows and provide water quality treatment. 2:1 and 1.5:1 slopes will be used in areas to reduce impacts to surrounding wetlands and jurisdictional streams. Existing drainage patterns have been maintained to the extent practicable.				

Waterbody Information

Surface Water Body (1):	Buffalo Creek		**NCDWR Stream Index No.:**	9-53-(5)		
NCDWR Surface Water Classification for Water Body		**Primary Classification:**	Class C			
		Supplemental Classification:	None			
Other Stream Classification:	None					
Impairments:	None					
Aquatic T&E Species?		Comments:				
NRTR Stream ID:				**Buffer Rules in Effect:**	N/A	
Project Includes Bridge Spanning Water Body?	No	**Deck Drains Discharge Over Buffer?**	N/A	**Dissipator Pads Provided in Buffer?**	N/A	
Deck Drains Discharge Over Water Body?	No	(If yes, provide justification in the General Project Narrative)		(If yes, describe in the General Project Narrative; if no, justify in the General Project Narrative)		
(If yes, provide justification in the General Project Narrative)						

North Carolina Department of Transportation

Highway Stormwater Program

STORMWATER MANAGEMENT PLAN

FOR NCDOT PROJECTS

(Version 2.07; Released October 2016)

WBS Element:	34497.1.F56	TIP No.:	R-2707E	County(ies):	Cleveland	Page	2	of	3

Additional Waterbody Information

Surface Water Body (2):	Potts Creek		**NCDWR Stream Index No.:**	9-53-6-3		
NCDWR Surface Water Classification for Water Body		**Primary Classification:**	Class C			
		Supplemental Classification:	None			
Other Stream Classification:	None					
Impairments:	None					
Aquatic T&E Species?		Comments:				
NRTR Stream ID:				**Buffer Rules in Effect:**	N/A	
Project Includes Bridge Spanning Water Body?	No	**Deck Drains Discharge Over Buffer?**	No	**Dissipator Pads Provided in Buffer?**	N/A	
Deck Drains Discharge Over Water Body?	No	(If yes, provide justification in the General Project Narrative)		(If yes, describe in the General Project Narrative; if no, justify in the General Project Narrative)		
(If yes, provide justification in the General Project Narrative)						

North Carolina Department of Transportation

Highway Stormwater Program

STORMWATER MANAGEMENT PLAN

FOR NCDOT PROJECTS

(Version 2.07; Released October 2016)

WBS Element: 34497.1.F56 **TIP No.:** R-2707E **County(ies):** Cleveland

Other Best Management Practices

Sheet No.	Station & Coordinates (Road and Non Road Projects)	Surface Water Body	BMP Type	Drainage Area (ac)	New Built-Upon Area (ac)	Volume Treated (ac-ft)	Precipitation Depth Treated over NBUA (in)	BMP Associated w/ Buffer Rules?
6	19+22 -Y42RPB- LT 35.250899 / -81.448850	(2)Potts Creek	Dry Detention Basin	7.5	1.0	0.58	7.32	No
6	20+25 -Y42RPC- RT 35.249476 / -81.449411	(1)Buffalo Creek	Dry Detention Basin	2.7	0.4	0.23	7.26	No
6	896+75 -L- RT 35.248487 / -81.446191	(1)Buffalo Creek	Dry Detention Basin	5.0	1.8	0.46	3.23	No

Additional Comments

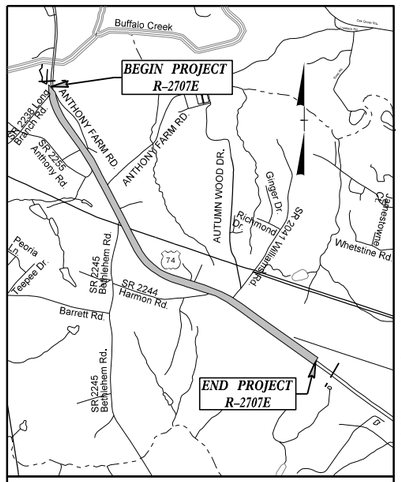
PERMIT DRAWING SHEET 1 OF 22

TIP PROJECT: R-2707E

CONTRACT:

75% APPROVED PLANS

See Sheet 1A For Index of Sheets
See Sheet 1B For Conventional Symbols



VICINITY MAP NTS

STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS

CLEVELAND COUNTY

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	R-2707E	1	

STATE PROJ. NO.	F. A. PROJ. NO.	DESCRIPTION
34497.1.F56	N/A	P.E.
34497.1.F56	N/A	R/W
34497.1.F56	N/A	UTIL.

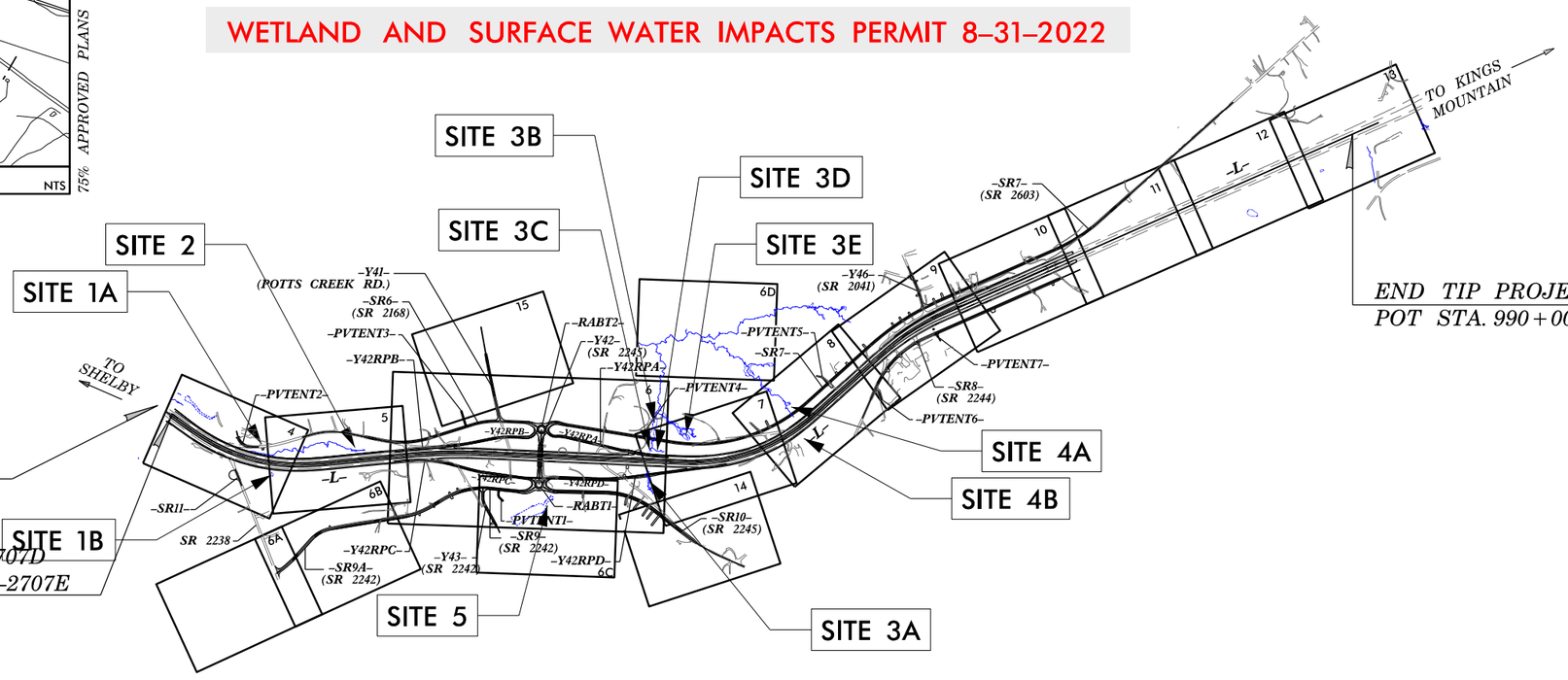
PART 2

NAD 83 / 95

LOCATION: US 74 FROM EXISTING US 74 WEST OF SR 2238 (LONG BRANCH RD) TO WEST OF SR 1001 (STONEY POINT RD)

TYPE OF WORK: GRADING, DRAINAGE, PAVING, STRUCTURE, & SIGNING

WETLAND AND SURFACE WATER IMPACTS PERMIT 8-31-2022



THIS PROJECT IS NOT WITHIN ANY CITY LIMITS

THIS IS A CONTROLLED ACCESS PROJECT WITH ACCESS BEING LIMITED TO INTERCHANGES

CLEARING FOR THIS PROJECT SHALL BE PERFORMED TO THE LIMITS ESTABLISHED BY METHOD III.

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

GRAPHIC SCALES

50 25 0 50 100
PLANS

50 25 0 50 100
PROFILE (HORIZONTAL)

50 25 0 50 100
PROFILE (VERTICAL)

DESIGN DATA

ADT 2019 = 41,600
ADT 2040 = 59,200
K = 11 %
D = 55 %
T = 15 % *
V = 70 MPH

* TTST =10% DUAL 5%

FUNC CLASS = FREEWAY

PROJECT LENGTH

LENGTH OF ROADWAY TIP PROJECT R-2707E = *2.63 MI.*

TOTAL LENGTH OF TIP PROJECT R-2707E = *2.63 MI.*

PREPARED IN THE OFFICE OF:

Stantec
Stantec Consulting Services Inc, Tel, (919) 851-6866
801 Jones Franklin Road Fax, (919) 851-7024
Suite 300 www.stantec.com
Raleigh, NC 27606 License No. F-0672

SUNGATE DESIGN GROUP, P.A.
905 JONES FRANKLIN ROAD
RALEIGH, NORTH CAROLINA 27606
TEL (919) 859-2243
ENG FIRM LICENSE NO. C-990

FOR THE NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

2018 STANDARD SPECIFICATIONS

RIGHT OF WAY DATE: 01 /10 /2019

LETTING DATE: 07 /18 /2023

JOSEPH T. KELVINGTON, P.E.
PROJECT ENGINEER

MICHAEL LINDGREN, P.E.
PROJECT DESIGN ENGINEER

THAD DUNCAN, P.E.
NCDOT DIVISON 12

HYDRAULICS ENGINEER

P.E.
SIGNATURE:

ROADWAY DESIGN ENGINEER

P.E.
SIGNATURE:

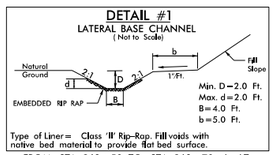
STATE OF NORTH CAROLINA • DEPARTMENT OF TRANSPORTATION •

5/14/99

PERMIT DRAWING SHEET 2 OF 22

PROJECT REFERENCE NO.	SHEET NO.
R-2707E	2D-1
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

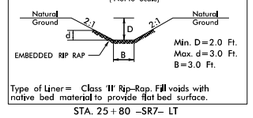
DETAIL #1
LATERAL BASE CHANNEL
(Not to Scale)



Type of Liner= Class 'II' Rip-Rap. Fill voids with native bed material to provide flat bed surface.

FROM STA. 862+50 TO STA. 863+70 -L- LT
FROM STA. 871+15 TO STA. 874+00 -L- LT

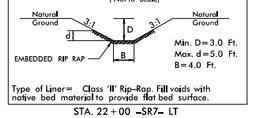
DETAIL #2
STANDARD BASE CHANNEL
(Not to Scale)



Type of Liner= Class 'II' Rip-Rap. Fill voids with native bed material to provide flat bed surface.

STA. 25+80 -SR7- LT

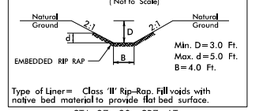
DETAIL #3
STANDARD BASE CHANNEL
(Not to Scale)



Type of Liner= Class 'II' Rip-Rap. Fill voids with native bed material to provide flat bed surface.

STA. 22+00 -SR7- LT

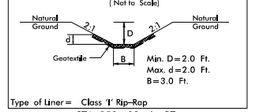
DETAIL #4
STANDARD BASE CHANNEL
(Not to Scale)



Type of Liner= Class 'II' Rip-Rap. Fill voids with native bed material to provide flat bed surface.

STA. 37+90 -SR7- LT

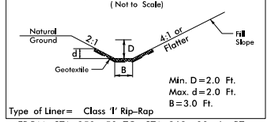
DETAIL #5
STANDARD BASE DITCH
(Not to Scale)



Type of Liner= Class 'I' Rip-Rap

STA. 850+00 -L- RT
STA. 859+50 -L- RT

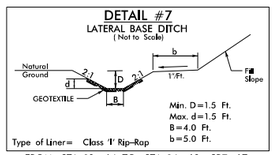
DETAIL #6
SPECIAL LATERAL BASE DITCH
(Not to Scale)



Type of Liner= Class 'I' Rip-Rap

FROM STA. 859+50 TO STA. 868+00 -L- RT
FROM STA. 815+00 TO STA. 817+00 -L- LT
FROM STA. 26+00 TO STA. 31+80 -SR7- RT

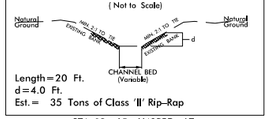
DETAIL #7
LATERAL BASE DITCH
(Not to Scale)



Type of Liner= Class 'I' Rip-Rap

FROM STA. 12+64 TO STA. 14+63 -SR7- LT

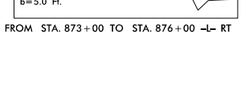
DETAIL #8
PIPE OUTLET CHANNEL
(Not to Scale)



Length=20 Ft.
d=4.0 Ft.
Est.= 35 Tons of Class 'II' Rip-Rap

STA. 18+65 -Y42RPD- LT
STA. 921+00 -L- RT

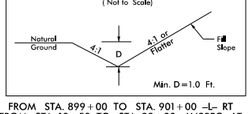
DETAIL #9
SPECIAL LATERAL BASE DITCH
(Not to Scale)



Type of Liner= Class 'B' Rip-Rap

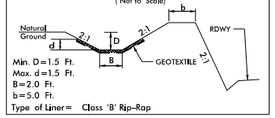
FROM STA. 876+00 TO STA. 879+00 -L- RT

DETAIL #10
SPECIAL LATERAL 'V' DITCH
(Not to Scale)



FROM STA. 899+00 TO STA. 901+00 -L- RT
FROM STA. 18+50 TO STA. 23+00 -Y42RPC- LT

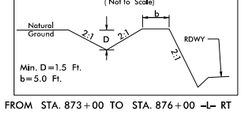
DETAIL #11
BERM BASE DITCH
(Not to Scale)



Type of Liner= Class 'B' Rip-Rap

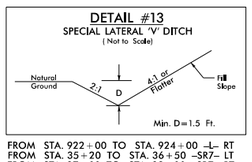
FROM STA. 868+00 TO STA. 873+00 -L- RT

DETAIL #12
BERM 'V' DITCH
(Not to Scale)



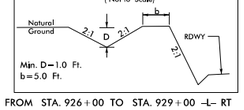
FROM STA. 873+00 TO STA. 876+00 -L- RT

DETAIL #13
SPECIAL LATERAL 'V' DITCH
(Not to Scale)



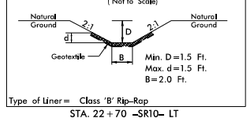
FROM STA. 922+00 TO STA. 924+00 -L- RT
FROM STA. 35+20 TO STA. 36+50 -SR7- LT
FROM STA. 37+00 TO STA. 39+00 -SR7- RT
FROM STA. 41+75 TO STA. 42+90 -SR7- RT
FROM STA. 43+60 TO STA. 44+50 -SR7- RT
FROM STA. 19+50 TO STA. 21+00 -Y42RPD- LT

DETAIL #14
BERM 'V' DITCH
(Not to Scale)



FROM STA. 926+00 TO STA. 929+00 -L- RT

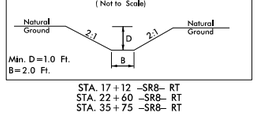
DETAIL #15
LATERAL 'V' DITCH
(Not to Scale)



Type of Liner= Class 'B' Rip-Rap

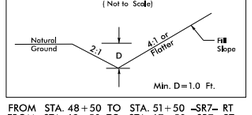
FROM STA. 36+50 TO STA. 37+00 -SR7- LT

DETAIL #16
STANDARD BASE DITCH
(Not to Scale)



STA. 17+12 -SR8- RT
STA. 22+60 -SR8- RT
STA. 35+75 -SR8- RT

DETAIL #17
SPECIAL LATERAL 'V' DITCH
(Not to Scale)



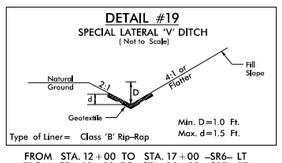
FROM STA. 48+50 TO STA. 51+50 -SR7- RT
FROM STA. 63+50 TO STA. 67+50 -SR7- RT
FROM STA. 75+75 TO STA. 80+00 -SR7- RT
FROM STA. 21+80 TO STA. 22+60 -SR8- LT
FROM STA. 34+00 TO STA. 35+75 -SR8- RT
FROM STA. 10+50 TO STA. 14+00 -SR9- LT
FROM STA. 19+50 TO STA. 22+00 -SR9A- RT
FROM STA. 16+90 TO STA. 19+00 -SR10- LT
FROM STA. 13+13 TO STA. 13+50 -Y46- LT

DETAIL #18
STANDARD BASE DITCH
(Not to Scale)

Type of Liner= Class 'B' Rip-Rap

STA. 22+70 -SR10- LT

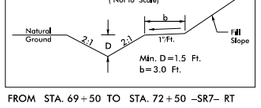
DETAIL #19
SPECIAL LATERAL 'V' DITCH
(Not to Scale)



Type of Liner= Class 'B' Rip-Rap

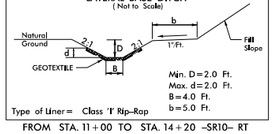
FROM STA. 12+00 TO STA. 17+00 -SR6- LT
FROM STA. 19+50 TO STA. 25+00 -SR7- RT
FROM STA. 43+35 TO STA. 44+25 -SR7- LT
FROM STA. 22+70 TO STA. 24+50 -SR10- LT
FROM STA. 22+80 TO STA. 28+50 -SR10- RT
FROM STA. 14+30 TO STA. 15+90 -Y42RPA- RT
FROM STA. 16+30 TO STA. 18+00 -Y42RPD- LT
FROM STA. 11+50 TO STA. 12+50 -PVTENT_2- RT

DETAIL #20
LATERAL 'V' DITCH
(Not to Scale)



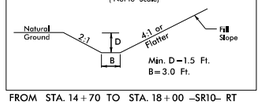
FROM STA. 69+50 TO STA. 72+50 -SR7- RT

DETAIL #21
BERM 'V' DITCH
(Not to Scale)



FROM STA. 914+50 TO STA. 917+50 -L- RT
FROM STA. 30+25 TO STA. 33+25 -SR7- LT

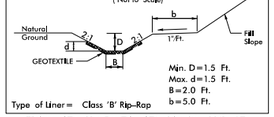
DETAIL #22
SPECIAL LATERAL BASE DITCH
(Not to Scale)



Min. D=1.5 Ft.
B=3.0 Ft.

FROM STA. 14+70 TO STA. 18+00 -SR10- RT

DETAIL #23
LATERAL BASE DITCH
(Not to Scale)



Type of Liner= Class 'B' Rip-Rap

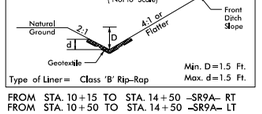
FROM STA. 11+50 TO STA. 16+90 -Y41- LT

DETAIL #24
LATERAL BASE DITCH
(Not to Scale)

Type of Liner= Class 'I' Rip-Rap

FROM STA. 11+00 TO STA. 14+20 -SR10- RT

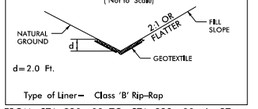
DETAIL #25
SPECIAL CUT DITCH
(Not to Scale)



Type of Liner= Class 'B' Rip-Rap

FROM STA. 10+15 TO STA. 14+50 -SR9A- RT
FROM STA. 10+50 TO STA. 14+50 -SR9A- LT

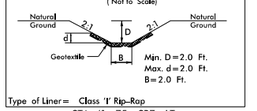
DETAIL #26
TOE PROTECTION
(Not to Scale)



Type of Liner= Class 'B' Rip-Rap

FROM STA. 920+00 TO STA. 922+00 -L- RT
FROM STA. 21+45 TO STA. 21+95 -SR7- LT
FROM STA. 37+00 TO STA. 37+88 -SR7- LT
FROM STA. 18+15 TO STA. 19+25 -Y42RPD- LT

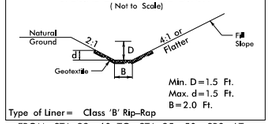
DETAIL #27
STANDARD BASE DITCH
(Not to Scale)



Type of Liner= Class 'I' Rip-Rap

STA. 41+75 -SR7- LT

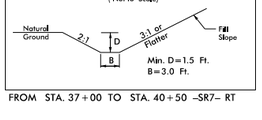
DETAIL #28
SPECIAL LATERAL BASE DITCH
(Not to Scale)



Type of Liner= Class 'B' Rip-Rap

FROM STA. 22+60 TO STA. 25+50 -SR8- LT
FROM STA. 12+90 TO STA. 14+30 -Y42RPA- RT

DETAIL #29
SPECIAL LATERAL BASE DITCH
(Not to Scale)



FROM STA. 37+00 TO STA. 40+50 -SR7- RT

$$$

5/14/99

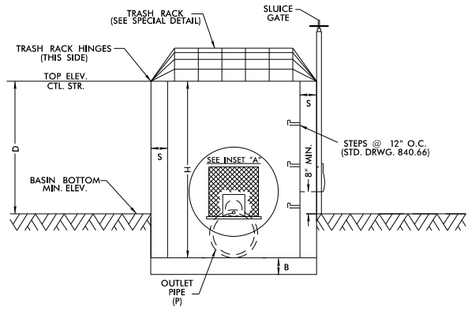
PERMIT DRAWING SHEET 3 OF 22

PROJECT REFERENCE NO.	SHEET NO.
R-2707E	2D-2
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

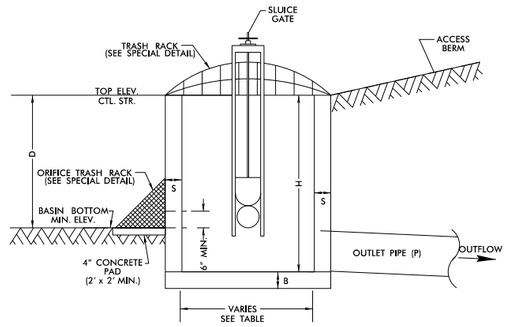
DETAIL #30

DRY DETENTION BASIN DRAWDOWN STRUCTURE

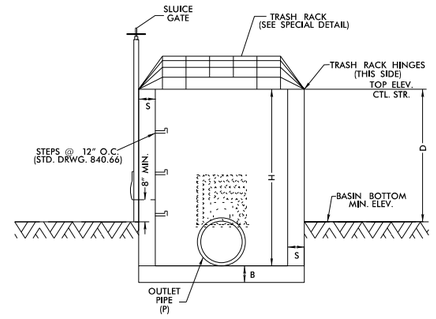
NOT TO SCALE



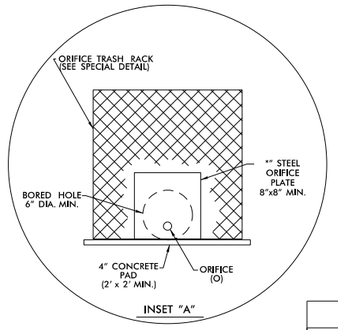
SIDE 1



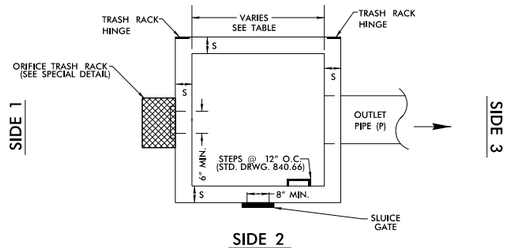
SIDE 2



SIDE 3



INSET "A"



SIDE 2

PLAN VIEW

TRASH RACK NOT SHOWN FOR CLARITY

NOTES:
1. TOP ELEVATION OF CONTROL STRUCTURE (WEIR ELEVATION) SHOULD BE SET AT THE WQv ELEVATION.
2. 15" MINIMUM DIAMETER FOR OUTLET PIPE.
3. 2" MINIMUM DIAMETER ORIFICE. IF ORIFICE IS GREATER THAN 6", A STEEL PLATE IS NOT REQUIRED.
4. NO BEDDING MATERIAL TO BE USED. THEREFORE, DO NOT FOLLOW STANDARD DRAWINGS FOR METHOD OF PIPE INSTALLATION FOR OUTLET PIPE THROUGH EMBANKMENT.
5. SLUICE GATE IS FOR MAINTENANCE AND SHOULD REMAIN CLOSED DURING NORMAL OPERATION. A GATE VALVE MAY BE USED IN LIEU OF THE 8" SLUICE GATE.
6. SLUICE GATE SHALL PROVIDE WATERTIGHT SEAL. PROVIDE ADEQUATE CLEARANCE FOR GATE OPERATION AND FOR PROPER SEATING OF GATE OVER PIPE.
7. SELECT BOX STANDARD AS REQUIRED TO ACCOMMODATE SLUICE GATE AND ORIFICE TRASH RACK WIDTH.
8. ENSURE TRASH RACK OPENS FREELY AND WITHOUT INTERFERENCE WITH SLUICE GATE.
9. ADJUST FOOTER DIMENSIONS AS NEEDED FOR ANTI-FLOTATION.
10. PAYMENT OF TRASH RACKS ARE INCIDENTAL TO BASIN DRAWDOWN STRUCTURE.

MINIMUM DIMENSIONS FOR DRY DETENTION BASIN DRAWDOWN STRUCTURE

STATION	STRUCTURE NUMBER	S (INCHES) 6" MIN.	B (INCHES) 6" MIN.	BASIN BOTTOM MINIMUM ELEV.	TOP ELEVATION CONTROL STRUCTURE	MAX. STORAGE DEPTH(D) FEET	INV. ELEV. CTL. STR.	CTL. STR. DIMENSIONS (W x L x H)	ORIFICE DIAMETER (O) INCHES	ORIFICE INV. ELEV.	OUTLET PIPE DIAMETER(P) INCHES
896+75 –L– RT	0630	6"	18"	772.0	775.0	3.0'	770.0	5.0' X 5.0' X 5.0'	2.0"	772.0	24"
19+22 –Y42RPB– LT	0619	6"	18"	764.0	768.0	4.0'	762.0	5.0' X 5.0' X 6.0'	2.0"	724.0	24"
20+25 –Y42RPC– RT	0635	6"	18"	773.0	775.0	2.0'	770.0	5.0' X 5.0' X 5.0'	2.0"	773.0	24"

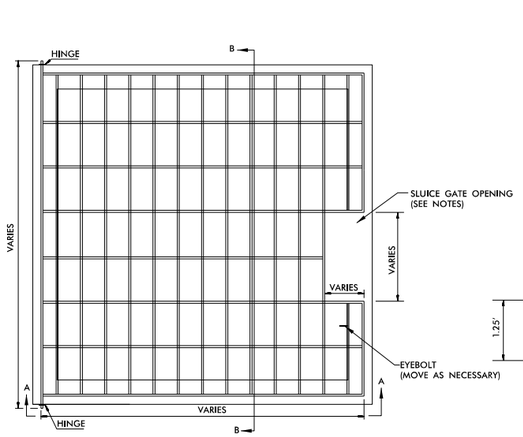
$$$$SYSTIME$$$$
$$$$SYSNAME$$$$
$$$$USERNAME$$$$
$$$$DGN$$$$

5/14/99

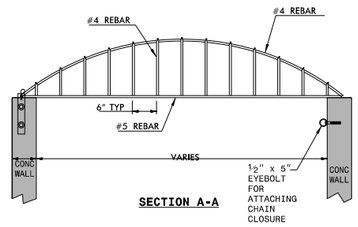
PERMIT DRAWING SHEET 4 OF 22

PROJECT REFERENCE NO.	SHEET NO.
R-2707E	2D-3
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

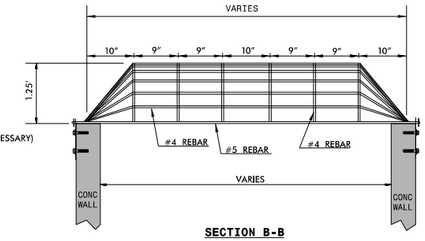
DETAIL #31
REMOVABLE ORIFICE TRASH RACK
NOT TO SCALE



PLAN



SECTION A-A

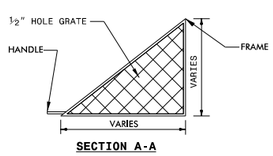


SECTION B-B

REBAR TRASH RACK
NOT TO SCALE

RISER TRASH RACK NOTES:
1. ALL JOINTS SHALL BE FULLY WELDED AROUND JOINT WITH A MINIMUM OF A 1/4" BEAD.
2. IF BOLTS ARE ANCHORED IN CONCRETE, FOLLOW STD. DWG. 862.03 AND 862.04 FOR ANCHORING PROCEDURE.
3. EYEBOLT FOR CHAIN CLOSURE SHALL BE INSTALLED BY THE SAME METHOD AS THE HINGE PLATE BOLTS.
4. RACK AND HARDWARE SHALL BE ALUMINUM OR REBAR AND GALVANIZED IN ACCORDANCE WITH ASTM A-153.
5. PROVIDE OPENING IN TRASH RACK TO ACCOMODATE SLUICE GATE ON THE OUTLET PIPE. ENSURE TRASH RACK OPENS FREELY AND WITHOUT INTERFERENCE WITH SLUICE GATES.

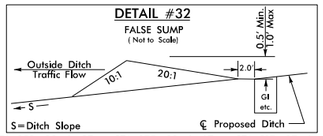
PLAN



SECTION A-A

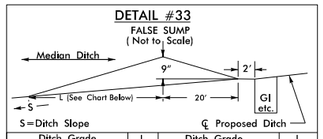
ORIFICE TRASH RACK NOTES:
1. ALL JOINTS SHALL BE FULLY WELDED AROUND JOINT WITH A MINIMUM OF A "" BEAD.
2. IF BOLTS ARE ANCHORED IN CONCRETE, FOLLOW STD. DWG. 862.03 AND 862.04 FOR ANCHORING PROCEDURE.
3. REMOVEABLE ORIFICE TRASH RACK SHALL BE ATTACHED TO CONCRETE BOX BY HINGE OR SLIDE RAIL SYSTEM.
4. RACK AND HARDWARE SHALL BE ALUMINUM OR GALVANIZED IN ACCORDANCE WITH ASTM A-153.

DETAIL #32
FALSE SUMP
(Not to Scale)



STA. 859+30 –L– RT
STA. 940+88 –L– LT
STA. 968+69 –L– RT
STA. 12+75 –SR7– RT
STA. 875+88 –L– LT
STA. 960+29 –L– RT
STA. 973+25 –L– RT
STA. 26+87 –SR7– LT
STA. 19+37 –Y42RPD– LT
STA. 917+37 –L– LT
STA. 964+24 –L– RT
STA. 983+33 –L– RT
STA. 14+24 –Y46– LT

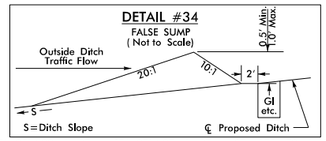
DETAIL #33
FALSE SUMP
(Not to Scale)



Ditch Grade	L	Ditch Grade	L
0.0% To 2.0%	20'	Over 4.0% To 6.0%	40'
Over 2.0% To 4.0%	30'	Over 6.0%	50'

STA. 855+87 –L– MED
STA. 866+06 –L– MED
STA. 881+36 –L– MED
STA. 910+37 –L– MED
STA. 920+22 –L– MED
STA. 929+88 –L– MED
STA. 942+70 –L– MED
STA. 964+53 –L– MED
STA. 978+08 –L– MED
STA. 858+87 –L– MED
STA. 871+26 –L– MED
STA. 901+99 –L– MED
STA. 913+86 –L– MED
STA. 923+44 –L– MED
STA. 934+01 –L– MED
STA. 953+52 –L– MED
STA. 969+07 –L– MED
STA. 983+08 –L– MED
STA. 862+47 –L– MED
STA. 875+88 –L– MED
STA. 905+87 –L– MED
STA. 917+37 –L– MED
STA. 926+46 –L– MED
STA. 938+84 –L– MED
STA. 960+56 –L– MED
STA. 973+06 –L– MED
STA. 985+25 –L– MED

DETAIL #34
FALSE SUMP
(Not to Scale)



STA. 851+88 –L– RT
STA. 885+37 –L– LT
STA. 930+18 –L– RT
STA. 968+92 –L– LT
STA. 27+82 –SR6– RT
STA. 56+50 –SR7– RT
STA. 13+33 –Y42RPC– RT
STA. 871+27 –L– RT
STA. 917+39 –L– RT
STA. 960+20 –L– LT
STA. 972+75 –L– LT
STA. 985+53 –L– LT
STA. 25+72 –SR7– RT
STA. 79+18 –SR7– RT
STA. 14+77 –Y42RPC– RT
STA. 11+96 –Y42RPD– LT
STA. 875+79 –L– RT
STA. 926+43 –L– RT
STA. 964+24 –L– LT
STA. 982+75 –L– LT
STA. 37+13 –SR7– LT
STA. 14+13 –SR10– LT

$$$$$$SYSTIME$$$$$$
$$$$$$SESSION$$$$$$$$$$$$$$$$$$$$$$
$$$$$$FRAME$$$$$$

PERMIT DRAWING SHEET 5 OF 22

8/17/99

REVISIONS

E E DENOTES EXCAVATION IN WETLAND

DENOTES MECHANIZED CLEARING

S S DENOTES IMPACTS IN SURFACE WATER

TS TS DENOTES TEMPORARY IMPACTS IN SURFACE WATER

Stantec

Stantec Consulting Services Inc.
801 Jones Franklin Road
Suite 300
Raleigh, NC 27606
Tel. (919) 851-6866
Fax. (919) 851-7024
www.stantec.com
License No. F-0672

PROJECT REFERENCE NO.	SHEET NO.
R-2707E	4
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

50' 25' 0 50' 100'
SCALE: 1" = 100'
NAD 83

MATCH -L- STA 850+15.00 SEE INSET THIS SHEET

MATCHLINE -L- STA 894+00.00 SEE SHEET 5

SITE 1A

SITE 1B

BEGIN CONSTRUCTION R-2707E
POT STA 849+12.00 -L-

MATCH -L- STA 850+15.00 SEE THIS SHEET

FORMERLY PARCEL 078 635 WESTLEY M. LAIL

FORMERLY PARCEL 077 634 HAL STAN QUEEN

175 ASPHALT PAVING OF SHELBY, INC.

079 RONNIE BRADY CHEEK CATHY CORNWELL CHEEK

080 JERRY LEE ALLEN

SHOULDER BERM GUTTER FROM END APPROACH SLAB TO STA. 851+15 -L- MED LT

SHOULDER BERM GUTTER FROM END APPROACH SLAB TO STA. 851+30 -L- RT

SHOULDER BERM GUTTER FROM STA. 861+95 TO STA. 875+50 -L- LT

SPEC. LAT. 'V' DITCH W/CL 'B' RIP RAP EST. 115 TONS EST. 181 SY GF SEE DETAIL #19

LAT. 4' BASE CHANNEL W/EMBEDDED CL 'II' RIP RAP EST. 226 TONS SEE DETAIL #1

STD. 3' BASE DITCH W/CL 'I' RIP RAP EST. 148 TONS EST. 259 SY GF SEE DETAIL #5

SPEC. LAT. 3' BASE DITCH W/CL 'I' RIP RAP EST. 1390 TONS EST. 2437 SY GF SEE DETAIL #6

STD. 3' BASE CHANNEL W/CL 'I' RIP RAP EST. 432 TONS EST. 753 SY GF SLOPE=4.8% SEE DETAIL #5

STD. 3' BASE DITCH W/CL 'I' RIP RAP EST. — TONS EST. — SY GF SEE DETAIL #5

RETAIN

REMOVE

REMOVE EXTG. 1@6'X4' RCBC

DO NOT BURY INVERT

FS TO N 678.5 SEE DETAIL #32

FS, SEE DETAIL #34

FS, SEE DETAIL #33

APPROX. LOCATION OF SEPTIC SYSTEM

APPROX. LOCATION AS PER PLANS FOR EROSION CONTROL FOR BUFFALO VALLEY MINE

REFERENCES:
FOR -L- PROFILE, SEE SHEET NO. 16
FOR -SR11- PROFILE, SEE SHEET NO. 41
FOR -PVTENT2- PROFILE, SEE SHEET NO. 42

$CSTLINE $CSTSCALE $CSTSHEET $CSTSHEETNAME $CSTUSERNAME

PERMIT DRAWING SHEET 6 OF 22

8/17/99

REVISIONS

E E — DENOTES EXCAVATION IN WETLAND

DENOTES MECHANIZED CLEARING

S S — DENOTES IMPACTS IN SURFACE WATER

TS TS — DENOTES TEMPORARY IMPACTS IN SURFACE WATER

Stantec

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www.stantec.com
License No. F-0672

PROJECT REFERENCE NO.	SHEET NO.
R-2707E	4

R/W SHEET NO.

ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

50' 25' 0 50' 100'
SCALE: 1" = 100'
NAD 83

MATCH -L- STA 850+15.00 SEE INSET THIS SHEET

MATCH -L- STA 850+15.00 SEE THIS SHEET

MATCHLINE -L- STA 849+00.00 SEE SHEET 5

SITE 1A

SITE 1B

BEGIN CONSTRUCTION R-2707E
POT STA 849+12.00 -L-

SHOULDER BERM GUTTER FROM END APPROACH SLAB TO STA. 851+15.95 MED LT

SHOULDER BERM GUTTER FROM END APPROACH SLAB TO STA. 851+15 -L- MED RT

SHOULDER BERM GUTTER FROM END APPROACH SLAB TO STA. 851+38 -L- RT

LAT. 4' BASE CHANNEL W/EMBEDDED CL. II RIP RAP EST. 226 TONS SEE DETAIL #1

SPEC. LAT. 'V' DITCH W/CL 'B' RIP RAP EST. 115 TONS EST. 181 SY GF SEE DETAIL #19

STD. 3' BASE DITCH W/CL 'I' RIP RAP EST. 148 TONS EST. 259 SY GF SEE DETAIL #5

STD. 3' BASE DITCH W/CL 'I' RIP RAP EST. — TONS EST. — SY GF SEE DETAIL #5

STD. 3' BASE CHANNEL W/CL 'I' RIP RAP EST. 432 TONS EST. 753 SY GF SLOPE=4.8% SEE DETAIL #5

SPEC. LAT. 3' BASE DITCH W/CL 'I' RIP RAP EST. 1390 TONS EST. 2437 SY GF SEE DETAIL #6

FS TO EL 678.5 SEE DETAIL #32

FS, SEE DETAIL #34

FS SEE DETAIL #33

DS, SEE DETAIL #33

RETAIN

REMOVE

REMOVE EXTG. 1@6'X4' RCBC

DO NOT BURY INVERT

FLOWABLE FILL

APPROX. LOCATION OF SEPTIC SYSTEM

APPROX. LOCATION AS PER PLANS FOR EROSION CONTROL FOR BUFFALO VALLEY MINE

FORMERLY PARCEL 078
635
WESTLEY M. LAIL

FORMERLY PARCEL 077
634
HAL STAN QUEEN

175
ASPHALT PAVING OF SHELBY, INC.

079
RONNIE BRADY CHEEK
CATHY CORNWELL CHEEK

080
JERRY LEE ALLEN

R/W PURCHASED UNDER TIP R-2707D

R/W PURCHASED UNDER TIP R-2707D FORMERLY PARCEL 077

DB 15-S PG 117
DB NNN PG 32 A
DB FFF PG 543
DB YY PG 357

DB 536 PG 622
DB 2715 PG 84
DB 1990 PG 816

US 74 EAST DIXON BLVD
EBL 24' ASPH
WBL 24' ASPH
DIXON BLVD
LONG BRANCH RD
SR 2288

REFERENCES:
FOR -L- PROFILE, SEE SHEET NO. 16
FOR -SR11- PROFILE, SEE SHEET NO. 41
FOR -PVTENT2- PROFILE, SEE SHEET NO. 42

$$$$ SYSTIME $$$$
$$$$ DGN $$$$
$$$$ USERNAME $$$$

6/23/16

PERMIT DRAWING SHEET 7 OF 22

0 5 10

PROJ. REFERENCE NO.	SHEET NO.
R-2707E	X-105

10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240 250 260 270 280 290

720 710 700 690 680 670 660

6.990:1 6:1 0.080 4.03:1 2:1

685.51
686.90

681.80

864+00.00

720 710 700 690 680 670 660

6.907:1 6:1 0.080 4.30:1 2:1

683.47
684.73

678.70

WETLAND

WETLAND

EXCAVATION

MECHANIZED CLEARING

SITE 1B

863+50.00

10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240 250 260 270 280 290

12/19/2018
R2707E_hyd_prm_wet_psh_04b_xpl.dgn
bellam

8/17/99

PERMIT DRAWING SHEET 8 OF 22

Stantec

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www.stantec.com
License No. F-0672

PROJECT REFERENCE NO.	SHEET NO.
R-2707E	5

R/W SHEET NO.

ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

50' 25' 0 50' 100'
SCALE: 1"=100'

MATCHLINE –L– STA 864+00.00 SEE SHEET 4

MATCHLINE –L– STA 877+00.00 SEE SHEET 6

MATCHLINE –SR6– STA. 15+55.00 SEE SHEET 6

AT&SF RAILROAD ABANDONED

NAD 83

WESTLEY M. LAIL

WILLIE A. HOWARD

CONCRETE SUPPLY CO. LLC

DAVID WAYNE ALLEN

JERRY LEE ALLEN

ROBERT L. TRICE & WF. LISA V. TRICE

SR 2168 ANTHONY FARM RD 26' BST

US 74 EAST DIXON BLVD WBL 29' ASPH

US 74 EAST DIXON BLVD EBL 30' ASPH

SITE 2

S 76°13'52.0" E

S 65°38'47.4" E

S 48°41'28.8" E

PROP O/H POW TEL & CATV LINES

EXISTING R/W

SPEC. LAT. 'V' DITCH W/CL 'B' RIP RAP
EST. 323 TONS
EST. 904 SY GF
SEE DETAIL #19

LAT. 4' BASE CHANNEL W/EMBEDDED CL II RIP RAP
EST. 536 TONS
SEE DETAIL #1

Q(10yr) = 45.9 cfs
S = 6.0%
V(10yr) = 5.9 fps

CL 'B' RIP RAP
EST. 2 TONS
EST. 7 SY GF

SHOULDER BERM GUTTER FROM STA. 861+95 TO STA. 875+50 –L– LT

GRADE TO DRAIN

REMOVE

FS, SEE DETAIL #32

FS, SEE DETAIL #33

FS, SEE DETAIL #34

FS TO EL 743.0

BERM 'V' DITCH SEE DETAIL #12

SPEC. LAT. 3' BASE DITCH W/CL 'B' RIP RAP
SEE DETAIL #6

BERM 2' BASE DITCH W/CL 'B' RIP RAP
EST. 280 TONS
EST. 759 SY GF
SEE DETAIL #11

SPEC. LAT. 3' BASE DITCH W/CL 'B' RIP RAP
EST. 239 TONS
EST. 642 SY GF
SEE DETAIL #9

F F DENOTES FILL IN WETLAND

S S DENOTES IMPACTS IN SURFACE WATER

TS TS DENOTES TEMPORARY IMPACTS IN SURFACE WATER

REFERENCES:
FOR –L– PROFILE, SEE SHEET NO. 17
FOR –SR6– PROFILE, SEE SHEET NO. 34
FOR –Y42RPB– PROFILE, SEE SHEET NO. 28
FOR –Y42RPC– PROFILE, SEE SHEET NO. 29

$$SYSTIME$$ $$SYSTIME$$
$$USERNAME$$ $$USERNAME$$
$$COMMENT$$ $$COMMENT$$

8/17/99

PERMIT DRAWING SHEET 9 OF 22

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PROJECT REFERENCE NO.	SHEET NO.
R-2707E	5
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

50' 25' 0 50' 100'
SCALE: 1"=100'

NAD 83

MATCHLINE –L– STA 864+00.00 SEE SHEET 4

MATCHLINE –SR6– STA. 15+55.00 SEE SHEET 6

MATCHLINE –L– STA 877+00.00 SEE SHEET 6

SITE 2

WESTLEY M. LAIL

WILLIE A. HOWARD

CONCRETE SUPPLY CO. LLC

DAVID WAYNE ALLEN

JERRY LEE ALLEN

ROBERT L. TRICE & WF. LISA V. TRICE

ANTHONY FARM RD SR 2268

US 74 EAST DIXON BLVD WBL 29' ASPH

US 74 EAST DIXON BLVD EBL 30' ASPH

S 76°13'52.0" E

S 48°41'28.8" E

S 65°38'47.4" E

N 53°26'40.38" E 245.86' R/W COR 245.86' NAIL COR

N 50°40'38" E 1320.00'

N 73°22'23" W 126.76'

N 53°26'40" E 10.47' EIP

PROP O/H POW TEL & CATV LINES

PROP U/G POW TEL & CATV LINES

EXISTING R/W

PROP R/W

TEMP CONST EASEMENT

PUE

LAT. 1' BASE CHANNEL W/EMBEDDED CL II RIP RAP EST. 536 TONS SEE DETAIL #1

Q(10yr) = 45.9 cfs
S = 6.0%
V(10yr) = 5.9 fps

SHOULDER BERM GUTTER FROM STA. 861+95 TO STA. 875+50 –L– LT

REMOVE

GRADE TO DRAIN

SPEC. LAT. 'V' DITCH W/CL 'B' RIP RAP EST. 323 TONS EST. 904 SY GF SEE DETAIL #19

FLOWABLE FILL

FS, SEE DETAIL #32

FS, SEE DETAIL #33

FS, SEE DETAIL #34

FS, SEE DETAIL #24

FS TO EL 743.0

FS TO EL 743.0 SEE DETAIL #34

BERM 'V' DITCH SEE DETAIL #12

SPEC. LAT. 3' BASE DITCH W/CL 'I' RIP RAP SEE DETAIL #6

BERM 2' BASE DITCH W/CL 'B' RIP RAP EST. 280 TONS EST. 759 SY GF SEE DETAIL #11

SPEC. LAT. 3' BASE DITCH W/CL 'B' RIP RAP EST. 239 TONS EST. 642 SY GF SEE DETAIL #9

CL 'B' RIP RAP EST. 3 TONS EST. 7 SY GF

15" W ELBOW W/ RIP RAP

15" RCP III

18" RCP

18" CMP

24" CONC

42" RCP IV

2GI

2GI-A

DI

CB

JB

HW

BUS

HTR

F F DENOTES FILL IN WETLAND

S S DENOTES IMPACTS IN SURFACE WATER

TS TS DENOTES TEMPORARY IMPACTS IN SURFACE WATER

REFERENCES:
FOR –L– PROFILE, SEE SHEET NO. 17
FOR –SR6– PROFILE, SEE SHEET NO. 34
FOR –Y42RPB– PROFILE, SEE SHEET NO. 28
FOR –Y42RPC– PROFILE, SEE SHEET NO. 29

$$$$SYSTIME$$$$
$$$$USERNAME$$$$

6/23/16

PERMIT DRAWING SHEET 10 OF 22

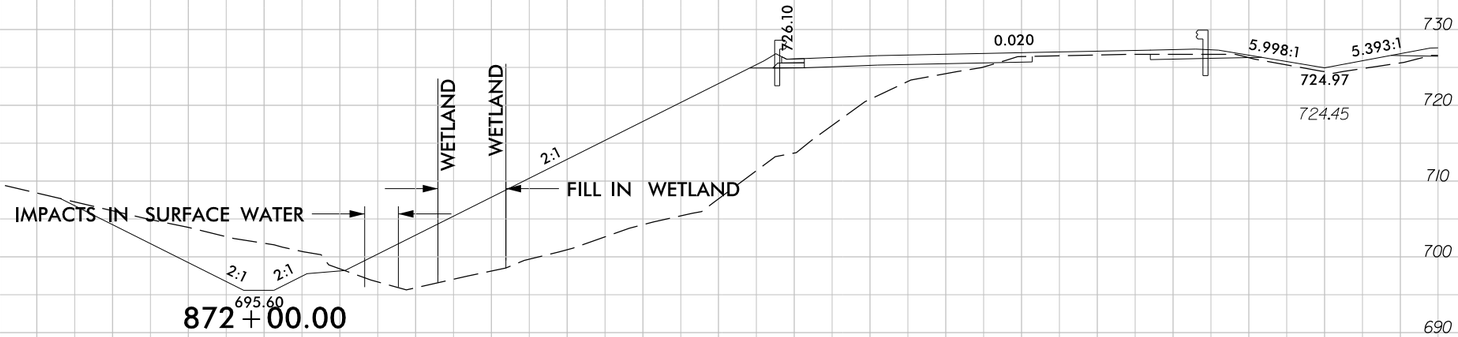
0 5 10

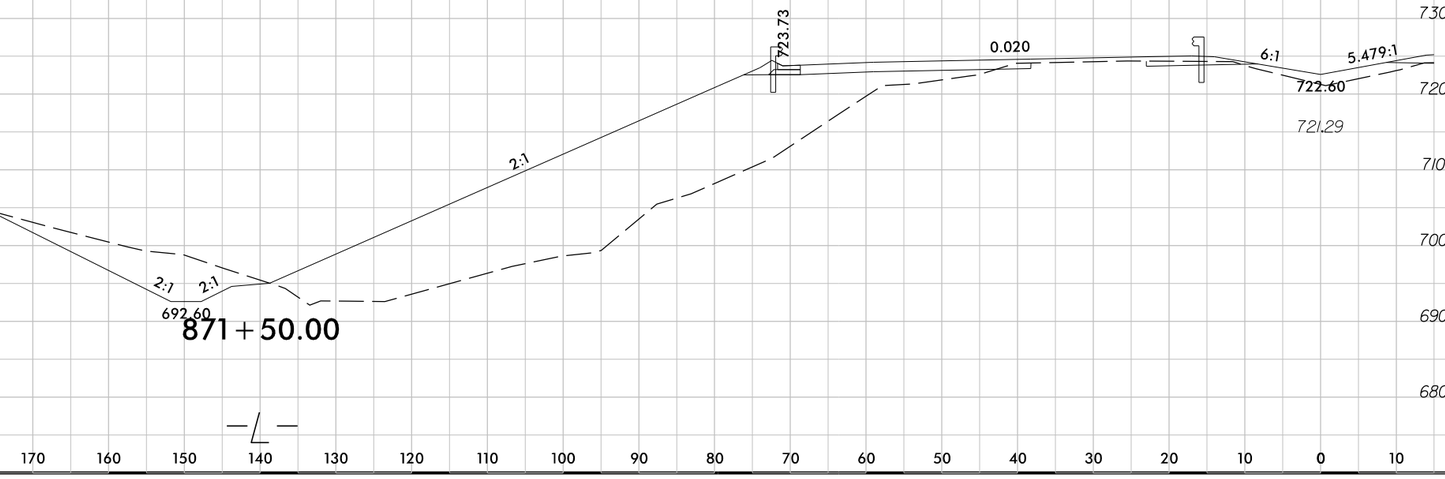
PROJ. REFERENCE NO.	SHEET NO.
R-2707E	X-18

290 280 270 260 250 240 230 220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 10

760 750 740 730 720 710 700 690

SITE 2





760 750 740 730 720 710 700 690 680

290 280 270 260 250 240 230 220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 10

12/19/2018
R2707E_hyd_prm_wet_psh_05b_xpl.dgn
bellam

PERMIT DRAWING SHEET 11 OF 22

REVISIONS

5/22/19 R/W REVISION NO.2 - UPDATED SURVEY FILE FOR PARCEL 085 TO SHOW A SINGLE PARCEL BY REMOVING THE SMALLER PARCEL WITHIN THE LARGER PROPERTY BOUNDARY, ADJUSTED PUE ON PARCEL 059,ADD TCE FOR PARCEL 640.

BRIDGE SKETCH NTS

TRAFFIC COUNT ADT 2020 (HUNDREDS)

F F	DENOTES FILL IN WETLAND
E E	DENOTES EXCAVATION IN WETLAND
	DENOTES MECHANIZED CLEARING
S S	DENOTES IMPACTS IN SURFACE WATER
TS TS	DENOTES TEMPORARY IMPACTS IN SURFACE WATER
P P	DENOTES IMPACTS IN SURFACE WATER (POND)

SCALE: 1" = 200'

SUNGATE DESIGN GROUP, P.A.
900 JONES FRANKLIN ROAD
RALEIGH, NORTH CAROLINA 27606
TEL: (919) 859-2243
ENG FIRM LICENSE NO.: C-490

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Fax. (919) 851-7024
www.stantec.com
License No. F-0572

PROJECT REFERENCE NO.	SHEET NO.
R-2707E	6
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

SEE PSH 06D

SEE PSH 06C

SEE PSH 06B

SITE 3B

SITE 3C

SITE 3A

SITE 5

MATCHLINE -SR6- STA 15+55.00 SEE SHEET 5

MATCHLINE -L- STA 877+00.00 SEE SHEET 5

MATCHLINE -SR8A- STA 27+00.00 SEE SHEET 6B

MATCHLINE -Y4- STA 15+50.00 SEE SHEET 15

MATCHLINE SEE SHEET 6C

MATCHLINE -SR7- STA 22+55.00 SEE SHEET 7

MATCHLINE -L- STA 905+60.00 SEE SHEET 7

MATCHLINE -Y42RPD- STA 1+80.00 SEE SHEET 7

MATCHLINE -SR10- STA 21+00.00 SEE SHEET 14

PLUG EXISTING 4" WATER LINE

PLUG EXISTING 8" WATER LINE

OH UTILITY NO RW-WATER WORK

LOCATION:	US 74 (SHELBY BYPASS) FROM EXISTING US 74 WEST OF SR 2238 (LONG BRANCH ROAD) TO WEST OF SR 1001
TIP NO.: R-2707E	COUNTY: CLEVELAND
DESIGNED BY: RES	
CHECKED BY: DLW	DATE:

PERMIT DRAWING SHEET 12 OF 22

REVISIONS

5/22/19 R/W REVISION NO.2 - UPDATED SURVEY FILE FOR PARCEL 085 TO SHOW A SINGLE PARCEL BY REMOVING THE SMALLER PARCEL WITHIN THE LARGER PROPERTY BOUNDARY, ADJUSTED PUE ON PARCEL 059,ADD TCE FOR PARCEL 640.

BRIDGE SKETCH NTS

TRAFFIC COUNT ADT 5500 2040 (HUNDREDS)

F DENOTES FILL IN WETLAND
E DENOTES EXCAVATION IN WETLAND
DENOTES MECHANIZED CLEARING
S DENOTES IMPACTS IN SURFACE WATER
TS DENOTES TEMPORARY IMPACTS IN SURFACE WATER
P DENOTES IMPACTS IN SURFACE WATER (POND)

SCALE: 1" = 200'

SUNGATE DESIGN GROUP, P.A.
905 JONES FRANKLIN ROAD
RALEIGH, NORTH CAROLINA 27606
TEL (919) 859-0115
ENG. FIRM LICENSE NO. C-690

Stantec
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801 Jones Franklin Road
Suite 300
Raleigh, NC 27606
Tel. (919) 851-6666
Fax. (919) 851-7024
www.stantec.com
License No. F-0572

PROJECT REFERENCE NO.	SHEET NO.
R-2707E	6
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

SEE PSH 06D
SEE PSH 06C
SEE PSH 06B

SITE 3B
SITE 3C
SITE 3B
SITE 3A
SITE 5
SITE 4

MATCHLINE -SR6- STA 15+55.00 SEE SHEET 5
MATCHLINE -L- STA 877+00.00 SEE SHEET 5
MATCHLINE -SR04- STA 27+00.00 SEE SHEET 6B
MATCHLINE -L- STA 22+55.00 SEE SHEET 7
MATCHLINE -L- STA 905+00.00 SEE SHEET 7
MATCHLINE -SR10- STA 23+00.00 SEE SHEET 14
MATCHLINE -L- STA 15+50.00 SEE SHEET 15
MATCHLINE SEE SHEET 6C

PLUG EXISTING 4" WATER LINE
PLUG EXISTING 2" WATER LINE

LOCATION: US 74 (SHELBY BYPASS) FROM EXISTING US 74 WEST OF SR 2238 (LONG BRANCH ROAD) TO WEST OF SR 1001

TIP NO.: R-2707E	COUNTY: CLEVELAND
DESIGNED BY: RES	
CHECKED BY: DLW	DATE:

8/17/99

PERMIT DRAWING SHEET 13 OF 22

PROJECT REFERENCE NO.	SHEET NO.
R-2707E	6B
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

25' 12.5' 0 25' 50'

SCALE: 1" = 50'

JACK RAY HARMON

DI — 15" RCP-IV — CB — 15" RCP-IV — DI

CB — 15" RCP-IV

397.00' IRON-COR
S54°57'28"E

S25°38'32"W
16.48' IRON-AXLE

AXLE

MTL GATE

2SFD

CHANNEL
Q(10yr) = 22.5 cfs
S = 9.5%
V(10yr) = 5.6 ft/s

POND
WATER EL=748.5'

TDE

137.00'
S88°53'33"E

MONTE & AMANDA DEATON

SITE 5

LAT. ft. BASE DITCH
W/CL "I" RIP RAP
EST. 420 TONS
EST. 724 SY GF
SEE DETAIL #4

PROP U/G TEL CONDUIT

68' TRANSMISSION / POWER COMP.

PROP U/G WATER LINE

PROP O/H POW TEL & CATV LINES

P — DENOTES IMPACTS IN SURFACE WATER (POND)

S — DENOTES IMPACTS IN SURFACE WATER

TS — DENOTES TEMPORARY IMPACTS IN SURFACE WATER

$$$$USERNAME$$$$
$$$$SYSTIME$$$$

PERMIT DRAWING SHEET 14 OF 22

PROJECT REFERENCE NO.	SHEET NO.
R-2707E	6C
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

25' 12.5' 0 25' 50'
SCALE: 1" = 50'

REVISIONS 8/17/99

MATCHLINE -L- STA 905+00.00 SEE SHEET 7

MATCHLINE -Y42RPD- STA 17+80.00 SEE SHEET 7

PLUG EXISTING 6" WATER LINE

SITE 3A

2GI
15" RCP-III
FS, SEE DETAIL #33
15"
REMOVE
PROP U/G TEL CONDUIT
REMOVE
TRENCHLESS INSTALLATION 48" WELDED STE
FLOWABLE FILL
3GI
JB w/SLAB LID
18" RCP-III
48" RCP-IV
FS, SEE DETAIL #32
2GI
18" W/ELBOWS
JB w/MH
48" RCP-III
HW
DO NOT BURY INVERT
TOE PROTECTION CL 'B' RIP RAP EST. 89 TONS EST. 238 SY GF SEE DETAIL #26
CL 'II' RIP RAP BANK STABILIZATION SEE DETAIL #8 EST. __ TONS
REMOVE
SPEC. LAT. 'V' DITCH SEE DETAIL #22
SPEC. LAT. 'V' DITCH SEE DETAIL #17
REM
REM
REM
ABANDON 6" W UTIL
PROP O/H POW TEL & CATV LINES
PROP O/H POW TEL & CATV LINES
PROP O/H POW TEL & CATV LINES
PROP O/H POW LINES
PROP U/G TEL CONDUIT
PROP U/G TEL CONDUIT
WIRE LOW POINT 846.2'
WIRE LOW POINT 846.2'
CM
REMOVE
BETHLEHEM RD
N 67° 31' 06.3" W
REBAR
0.11'
HW
EPB
+19 -SR10- 116'
+23 -SR10- 106'
+04 -SR10- 108'
+35 -Y42RPD- 139'
+25 -Y42RPD- 125'
ALCONON CLUB OF SHELBY, INC.
383.25' R/W-R/W S17°47'21"W 382.90' REBAR-REBAR
337.10' R/W-REBAR-REBAR S82°12'24"W 338.92' REBAR-REBAR
STD. 2' BASE DITCH W/CL 'B' RIP RAP EST. 23 TONS EST. 61 SY GF SLOPE=1.0% SEE DETAIL #18
REMOVE
ISBKD
ISFD
EXISTING R/W
SOLID IRON
SOLID IRON
WL
WL
WL
WL
LF
PUE
PUE
PUE
PUE
PUE
15"
N40°59'52"E
S5°51'22"E
COR-R/W
COR-IRON
15" CONC
12" CONC
48" CMP
MTL
MTL
MTL
AATUR
BST
GR
WD
DK
CONC
SBW
20
20
20
20
15
15
15

8/17/99

PERMIT DRAWING SHEET 15 OF 22

PROJECT REFERENCE NO.	SHEET NO.
R-2707E	6D
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

25' 12.5' 0 25' 50'
SCALE: 1" = 50'

CHARLES E. DOVER

GLENN ALTON DOVER

345.72'
S58°58'59"E

OH UTILITY
NO IN-WATER WORK

STD. 4' BASE CHANNEL
W/EMBEDDED CL 'II' RIP RAP
EST. 644 TONS
LENGTH = 145'
SLOPE = 0.7%
SEE DETAIL #3

CHANNEL
Q(10yr) = 75 cfs
S = 2.0%
V(10yr) = 3.9 ft/s

PUE
DUE
PROP O/H POW TEL & CATV LINES
SOIL
JS
SR

SITE 3B

DO NOT
BURY INVERT

PIPE
Q(10yr) = 75 cfs
S = 4.5%
V(10yr) = 21.2 ft/s

CL 'B' RIP RAP
EST. 2 TONS
EST. 7 SY GF

48" RCP-III
JB w/MH

S 50° 45' 21.6" E

SPEC. LAT. 'V' DITCH
W/CL 'B' RIP RAP
EST. 355 TONS
EST. 994 SY GF
SEE DETAIL #19

REM

438.79' R/W-COR
N32°33'13"E

24" RCP-III

PROP U/G TEL CONDUIT

SPEC. LAT. 2' BASE DITCH
W/CL 'B' RIP RAP
EST. 105 TONS
EST. 284 SY GF
SEE DETAIL #28

18"
W/ELBOWS

SHOULDER BERM GUTTER
FROM STA. 14+50 -Y42RPA- RT
TO STA. 910+60 -L- LT

SITE 3C

SITE 3D

48" RCP-III

905

MATCHLINE -SR7-
STA 22+55.00
SEE SHEET 7

2GI

18" RCP-III

COLLAR

SITE 3B

F F	DENOTES FILL IN WETLAND
	DENOTES MECHANIZED CLEARING
E E	DENOTES EXCAVATION IN WETLAND
S S	DENOTES IMPACTS IN SURFACE WATER
TS TS	DENOTES TEMPORARY IMPACTS IN SURFACE WATER

$$$$USERNAME$$$$ $$$$SYSTIME$$$$

6/23/16

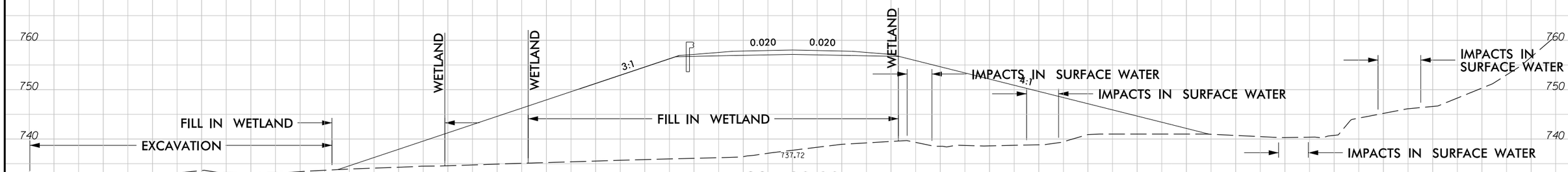
PERMIT DRAWING SHEET 16 OF 22

0 5 10	PROJ. REFERENCE NO.	SHEET NO.
	R-2707E	X-285

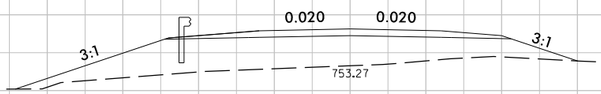
150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150

790 780 770 760 750 740 730

SITE 3B



22 + 00.00



21 + 50.00

-SR7-

12/19/2018
R2707E_hyd_prm_wet_psh_06f_xpl.dgn
bejam

PERMIT DRAWING SHEET 17 OF 22

8/17/99

REVISIONS

MATCHLINE –SR7– STA 22+55.00 SEE SHEET 6

MATCHLINE –L– STA 905+00.00 SEE SHEET 6

MATCHLINE –Y42RPD– STA 17+80.00 SEE SHEET 6

MATCHLINE –SR10– STA 23+00.00 SEE SHEET 14

MATCHLINE SEE SHEET 14

MATCHLINE –SR7– STA 34+52.00 SEE SHEET 8

MATCHLINE –L– STA 918+00.00 SEE SHEET 8

SITE 3E

SITE 3D

OH UTILITY
HAND CLEARING IN WETLAND
NO IN-WATER WORK

CHARLES E. DOVER

JO ANN HARMON

KENNETH B. RANDALL

PAMELA R. BIVINS

NCDOT

NETH & NELL RANDALL

CASSANDRA EVERHART

US 74 EAST DIXON BLVD WBL 24' BST

US 74 EAST DIXON BLVD EBL 24' BST

S 50° 45' 21.6" E

S 57° 28' 24.4" E

N 67° 31' 06.3" W

S74°41'28"E 264.00'

S74°41'28"E 135.59' R/W-COR

S74°41'28"E 100.00'

N43°53'25"E 63.66' R/W-COR

N43°53'25"E 226.28' R/W-COR

S25°25'50"W 226.98' R/W-COR

S85°51'49"E 518.42' COR-COR

STD. 3' BASE CHANNEL W/EMBEDDED CL 'II' RIP RAP
EST. 45 TONS
LENGTH = 20'
SLOPE = 2.0%
SEE DETAIL #2

CHANNEL
Q(10yr) = 60 cfs
S = 2.0%
V(10yr) = 4.1 fps

PIPE
Q(10yr) = 60 cfs
S = 0.7%
V(10yr) = 10.1 fps

DO NOT BURY INVERT

CL 'B' RIP RAP
EST. 2 TONS
EST. 7 SY GF

SPEC. LAT. 'V' DITCH
W/CL 'B' RIP RAP
SEE DETAIL #19

42" RCP-IV
JB w/MH
(Drop Box)

FILL EXISTING CHANNEL
WITH SUITABLE MATERIAL
EST 200 CY

15" RCP-III

2GI

FS, SEE DETAIL #33

FS TO EL 864.5
SEE DETAIL #34

REMOVE

SHOULDER BERM GUTTER
FROM STA. 903+50 TO
STA. 910+60 –L– LT

TB JB w/MH

30" RCP-III

COLLAR

GRADE TO DRAIN

SPEC. LAT. 3' BASE DITCH
W/CL 'I' RIP RAP
EST. 949 TONS
EST. 1663 SY GF
SEE DETAIL #6

RETAIN

Conv. 2GI To JB w/MH

FLOWABLE FILL

REMOVE HW

FS TO EL 805.3
SEE DETAIL #34

SPECIAL DITCH GRADE
SEE PROFILE

BERM 'V' DITCH
W/CL 'B' RIP RAP
EST. 138 TONS
EST. 389 SY GF
SEE DETAIL #21

FS TO EL 822.5
SEE DETAIL #34

SPEC. DITCH GRADE
SEE PROFILE

PROP O/H POW TEL & CATV LINES

F F	DENOTES FILL IN WETLAND
E E	DENOTES EXCAVATION IN WETLAND
HC HC	DENOTES HAND CLEARING
	DENOTES MECHANIZED CLEARING
S S	DENOTES IMPACTS IN SURFACE WATER
TS TS	DENOTES TEMPORARY IMPACTS IN SURFACE WATER

REFERENCES:
FOR –L– PROFILE, SEE SHEET NO. 20
FOR –SR7– PROFILE, SEE SHEET NO. 35
FOR –Y42RPA– PROFILE, SEE SHEET NO. 27
FOR –Y42RPD– PROFILE, SEE SHEET NO. 30

Stantec
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Raleigh, NC 27606
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www.stantec.com
License No. F-0672

NAD 83/95

PROJECT REFERENCE NO.	SHEET NO.
R-2707E	7
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

50' 25' 0 50' 100'
SCALE: 1"=100'

$$$$USERNAME$$$$ $$$$SYSTIME$$$$

PERMIT DRAWING SHEET 18 OF 22

8/17/99

REVISIONS

$$$$SYSTIME$$$$
$$$$USERNAME$$$$

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PROJECT REFERENCE NO.	SHEET NO.
R-2707E	7
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

NAD 83/95

50' 25' 0 50' 100'
SCALE: 1"=100'

MATCHLINE –SR7– STA 22+55.00 SEE SHEET 6

MATCHLINE –L– STA 905+00.00 SEE SHEET 6

MATCHLINE –Y42RPD– STA 17+80.00 SEE SHEET 6

MATCHLINE –SR10– STA 23+00.00 SEE SHEET 14

MATCHLINE SEE SHEET 14

MATCHLINE –SR7– STA 34+52.00 SEE SHEET 8

MATCHLINE –L– STA 918+00.00 SEE SHEET 8

SITE 3E

SITE 3D

OH UTILITY
HAND CLEARING IN WETLAND
NO IN-WATER WORK

STD. 3' BASE CHANNEL W/EMBEDDED CL II RIP RAP EST. 45 TONS LENGTH=20' SLOPE=2.0% SEE DETAIL #2

CHANNEL Q(10yr)=60 cfs S=2.0% V(10yr)=4.1 ft/s

PIPE Q(10yr)=60 cfs S=0.7% V(10yr)=10.1 ft/s

DO NOT BURY INVERT

42" RCP-IV JB w/MH (Drop Box)

CL B RIP RAP EST. 2 TONS EST. 7 SY GF

SPEC. LAT. 'V' DITCH W/CL 'B' RIP RAP SEE DETAIL #19

FILL EXISTING CHANNEL WITH SUITABLE MATERIAL EST. 200 CY

15" RCP-III

2GI

FS, SEE DETAIL #33

FS TO EL 794.5 SEE DETAIL #34

REMOVE

SHOULDER BERM GUTTER FROM STA 903+50 TO STA 910+60 – LT

TB JB w/MH

30" RCP-III

COLLAR

GRADE TO DRAIN

RETAIN

Conv. 2GI TO JB w/MH

FS TO EL 805.3 SEE DETAIL #34

SPECIAL DITCH: GRADE SEE PROFILE

SPEC. LAT. 'V' DITCH W/CL 'B' RIP RAP EST. 110 TONS EST. 308 SY GF SEE DETAIL #19

SPEC. LAT. 'A' BASE DITCH W/CL 'I' RIP RAP EST. 949 TONS EST. 1663 SY GF SEE DETAIL #6

BERM 'V' DITCH W/CL 'B' RIP RAP EST. 138 TONS EST. 389 SY GF SEE DETAIL #21

REMOVE HW

FLOWABLE FILL

SPEC. DITCH GRADE SEE PROFILE

BERM 'V' DITCH W/CL 'B' RIP RAP EST. 138 TONS EST. 389 SY GF SEE DETAIL #21

FS TO EL 822.5 SEE DETAIL #34

KENNETH B. RANDALL

PAMELA R. IRVING

CHARLES E. DOVER

JO ANN HARMON

NCDOT

KENNETH & NELL RANDALL

CASSANDRA EVERHART

US 74 EAST DIXON BLVD WBL 24 BST

US 74 EAST DIXON BLVD EBL 24 BST

F F	DENOTES FILL IN WETLAND
E E	DENOTES EXCAVATION IN WETLAND
HC HC	DENOTES HAND CLEARING
	DENOTES MECHANIZED CLEARING
S S	DENOTES IMPACTS IN SURFACE WATER
TS TS	DENOTES TEMPORARY IMPACTS IN SURFACE WATER

REFERENCES:
FOR –L– PROFILE, SEE SHEET NO. 20
FOR –SR7– PROFILE, SEE SHEET NO. 35
FOR –Y42RPA– PROFILE, SEE SHEET NO. 27
FOR –Y42RPD– PROFILE, SEE SHEET NO. 30

PERMIT DRAWING SHEET 19 OF 22

8/17/99

REVISIONS

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PROJECT REFERENCE NO.	SHEET NO.
R-2707E	8
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

NAD 83/95

50' 25' 0 50' 100'
SCALE: 1"=100'

KENNETH B. RANDALL

JACK WILLIAMS

JOHN M. OVERMAN

OH UTILITY
NO IN-WATER WORK

SITE 4A

SITE 4B

MATCHLINE -SR7-
STA 34+52.00
SEE SHEET 7

MATCHLINE -L-
STA 918+00.00
SEE SHEET 7

MATCHLINE -L-
STA 931+00.00
SEE SHEET 9

MATCHLINE -SR7-
STA 47+00.00
SEE SHEET 9

MATCHLINE -SR8-
STA 13+00.00
SEE SHEET 9

LAT. 'V' DITCH W/CL 'B' RIP RAP EST. 23 TONS EST. 65 SY GF SEE DETAIL #15

SPEC. LAT. 'V' DITCH SEE DETAIL #13

TOE PROTECTION CL 'B' RIP RAP EST. 71 TONS EST. 191 SY GF SEE DETAIL #26

STD. 4' BASE CHANNEL W/EMBEDDED CL 'II' RIP RAP EST. 66 TONS LENGTH=20' SLOPE=2.5% SEE DETAIL #3

CHANNEL Q(10yr)=65 cfs S=2.5% V(10yr)=4.4 ft/s

PIPE Q(10yr)=65 cfs S=0.5% V(10yr)=9.1 ft/s

DO NOT BURY INVERT

STD. 2' BASE CHANNEL W/CL 'I' RIP RAP EST. 70 TONS LENGTH=60' SLOPE=6% SEE DETAIL #27

CL B RIP RAP EST. 3 TONS EST. 10 SY GF

SPEC. LAT. 'V' DITCH W/CL 'B' RIP RAP EST. 59 TONS EST. 163 SY GF SEE DETAIL #19

CL B RIP RAP EST. 2 TONS EST. 7 SY GF

SPEC. LAT. 3' BASE DITCH SEE DETAIL #29

SHOULDER BERM GUTTER FROM STA. 920+55 TO STA. 927+00 -L- LT

SPEC. DITCH GRADE SEE PROFILE

TOE PROTECTION CL 'B' RIP RAP EST. 161 TONS EST. 432 SY GF SEE DETAIL #26

CL 'II' RIP RAP BANK STABILIZATION SEE DETAIL #8 EST. 35 TONS

TRENCH/CLASS INSTALLATION 48" WELDED STEEL FLEXIBLE PIPE

BERM 'V' DITCH SEE DETAIL #14

PROPOSED 250 LF 6" WATER LINE

PROPOSED - 1 6" GATE VALVE

TIE TO EXISTING 6" WATER LINE

N 78° 04' 21.4" E

N 53° 56' 40.0" E

DENOTES EXCAVATION IN WETLAND

DENOTES MECHANIZED CLEARING

DENOTES IMPACTS IN SURFACE WATER

DENOTES TEMPORARY IMPACTS IN SURFACE WATER

CASSANDRA EVERHART

WILLIAM PRESTON HARMON, JR.

JAMES RALPH LEDBETTER & LORA M. LEDBETTER

CHRISTOPHER HOGSTON, ET UX

CHARLES CARRIGAN

BETTY CARRIGAN

REFERENCES:
FOR -L- PROFILE, SEE SHEET NO. 21
FOR -SR7- PROFILE, SEE SHEET NO. 35 & 36
FOR -SR8- PROFILE, SEE SHEET NO. 38
FOR -PVTENT5- PROFILE, SEE SHEET NO. 44
FOR -PVTENT6- PROFILE, SEE SHEET NO. 44

$$$$SYSTIME$$$$
$$$$USERNAME$$$$

PERMIT DRAWING SHEET 20 OF 22

8/17/99

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PROJECT REFERENCE NO.	SHEET NO.
R-2707E	8
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

NAD 83/95

50' 25' 0 50' 100'
SCALE: 1"=100'

KENNETH B. RANDALL

JACK WILLIAMS

JOHN M. OVERMAN

JAMES RALPH LEDBETTER & LORA M. LEDBETTER

CASSANDRA EVERHART

WILLIAM PRESTON HARMON, JR.

BETTY CARRIGAN

CHARLES CARRIGAN

CHRISTOPHER HOGSTON, ET UX

OH UTILITY
NO IN-WATER WORK

SITE 4A

SITE 4B

MATCHLINE –SR7–
STA 34+52.00
SEE SHEET 7

MATCHLINE –L–
STA 918+00.00
SEE SHEET 7

MATCHLINE –L–
STA 931+00.00
SEE SHEET 9

MATCHLINE –SR7–
STA 47+00.00
SEE SHEET 9

MATCHLINE –SR8–
STA 13+00.00
SEE SHEET 9

LAT. 'V' DITCH
W/CL 'B' RIP RAP
EST. 23 TONS
EST. 65 SY GF
SEE DETAIL #15

SPEC. LAT. 'V' DITCH
SEE DETAIL #13

TOE PROTECTION
CL 'B' RIP RAP
EST. 71 TONS
EST. 191 SY GF
SEE DETAIL #26

STD. 4' BASE CHANNEL
W/EMBEDDED CL 'II' RIP RAP
EST. 66 TONS
LENGTH=20'
SLOPE=2.5%
SEE DETAIL #3

CHANNEL
Q(10yr)=65 cfs
S=2.5%
V(10yr)=4.4 fps

PIPE
Q(10yr)=65 cfs
S=0.5%
V(10yr)=9.1 fps

DO NOT BURY INVERT

18" RCP-III

18" W/ELBOWS

2GI

FS, SEE DETAIL #34

JB w/MH
Drop Box

CL B RIP RAP
EST. 2 TONS
EST. 7 SY GF

SPEC. LAT. 3' BASE DITCH
SEE DETAIL #29

15" RCP-III

15" W/ELBOWS

COLLAR

18" RCP-IV

FLOATABLE FILL

REMOVE

RETAIN

ADJUST 2GI

FS, SEE DETAIL #33

18" RCP-III COLLAR & EXTEND

SHOULDER BERM GUTTER
FROM STA. 920+55 TO
STA. 922+00 -L- LT

STD. 2' BASE CHANNEL
W/CL 'I' RIP RAP
EST. 70 TONS
LENGTH=60'
SLOPE=6%
SEE DETAIL #27

CL B RIP RAP
EST. 3 TONS
EST. 10 SY GF

SPEC. LAT. 'V' DITCH
W/CL 'B' RIP RAP
EST. 59 TONS
EST. 163 SY GF
SEE DETAIL #19

2GI-D

18" RCP-III COLLAR AND EXTEND

FS, SEE DETAIL 34

BDO

BERM 'V' DITCH
SEE DETAIL #14

SPEC. DITCH GRADE
SEE PROFILE

48" RCP-III

DO NOT BURY INVERT

TOE PROTECTION
CL 'B' RIP RAP
EST. 161 TONS
EST. 432 SY GF
SEE DETAIL #26

CL 'II' RIP RAP
BANK STABILIZATION
SEE DETAIL #8
EST. 35 TONS

PROPOSED 250 LF
6" WATER LINE

PROPOSED - 1
6" GATE VALVE

TIE TO EXISTING
6" WATER LINE

N 78° 04' 21.4" E

N 53° 56' 40.0" E
SR 2544 (OLD HARMON RD)

DENOTES EXCAVATION IN WETLAND

DENOTES MECHANIZED CLEARING

DENOTES IMPACTS IN SURFACE WATER

DENOTES TEMPORARY IMPACTS IN SURFACE WATER

REFERENCES:
FOR –L– PROFILE, SEE SHEET NO. 21
FOR –SR7– PROFILE, SEE SHEET NO. 35 & 36
FOR –SR8– PROFILE, SEE SHEET NO. 38
FOR –PVTENT5– PROFILE, SEE SHEET NO. 44
FOR –PVTENT6– PROFILE, SEE SHEET NO. 44

$$$$USERNAME$$$$ $$$$DGN$$$$ $$$$SYSTIME$$$$

6/23/16

PERMIT DRAWING SHEET 21 OF 22

0 5 10	PROJ. REFERENCE NO.	SHEET NO.
	R-2707E	X-299

150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150

840 830 820 810 800 790 780 770

0.050 0.050

1.50:1

4:1

815.80

SHEAR LINE
SEE "L" - XS

803.66

38+50.00

SITE 4A

WETLAND

EXCAVATION

814.30

SHEAR LINE
SEE "L" - XS

788.02

38+00.00

-SR7-

12/19/2018
R2707E_hyd_prm_wet_psh_08b_xpl.dgn
belson

WETLAND AND SURACE WATER IMPACTS SUMMARY

			WETLAND IMPACTS					SURFACE WATER IMPACTS				
Site No.	Station (From/To)	Structure Size / Type	Permanent Fill In Wetlands (ac)	Temp. Fill In Wetlands (ac)	Excavation in Wetlands (ac)	Mechanized Clearing in Wetlands (ac)	Hand Clearing in Wetlands (ac)	Permanent SW impacts (ac)	Temp. SW impacts (ac)	Existing Channel Impacts Permanent (ft)	Existing Channel Impacts Temp. (ft)	Natural Stream Design (ft)
1A	860+55 to 863+90-L-LT	54" RCP						0.03	< 0.01	336	28	
1B	863+28 to 863+51-L-RT	LATERAL DITCH			0.02							
2	871+05 to 873+50-L-LT	ROADWAY FILL	< 0.01					0.02	< 0.01	253	10	
3A	18+36 to 18+98-Y42RPD-	48" RCP	0.02					0.01	< 0.01	193	14	
		BANK STABILIZATION						< 0.01		20		
3B	21+58 to 23+47-SR7-	48" RCP	0.08					0.01		191		
		OUTLET CHANNEL			0.12			< 0.01	< 0.01	7	19	
3C	21+82 to 22+00-SR7-RT	ROADWAY FILL						< 0.01		43		
3D	22+00 to 22+12-SR7-RT	ROADWAY FILL						0.01		159		
3E	25+39 to 26+00-SR7-LT	42" RCP	0.01					< 0.01		9		
		OUTLET CHANNEL			< 0.01	0.02		< 0.01	< 0.01	24	10	
		OH UTILITY					0.03					
4A	37+54 to 38+18-SR7-	48" RCP						0.01		192		
		OUTLET CHANNEL			< 0.01	0.01		< 0.01	< 0.01	21	11	
4B	921+00 to 921+15-L-LT	48" RCP						< 0.01		16		
5	10+86 to 11+33-SR10-RT	ROADWAY FILL (POND)						0.06	0.87			
SHEET TOTALS*:			0.13		0.14	0.03	0.03	0.18	0.88	1464	92	0

*Rounded totals are sum of actual impacts

NOTES:
Site 1B: Total Take Wetland
Site 3B: Total Take Wetland
Site 5: JS Non-Mitigable Pond.

NC DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
8-31-22
CLEVELAND
R-2707E
34497.1.F56
SHEET 22 OF 22

Revised 2018 Feb

RELOCATION PLAN
R2707D CLEVELAND COUNTY
SEPTEMBER 20, 2022

The Shelby Bypass (R2707) individual 404/401 permit was issued in 2012. One of the project commitments is to use bioengineering techniques to relocate the tributary of Buffalo Creek between SR 2063 (Kemper Road) and the Light Oak community. The result would be meandering stream with riffles and pools and banks stabilized with native vegetation and root wads instead of rip-rap as appropriate.

The tributary to Buffalo Creek flows parallel to the proposed D section of the Bypass (R2707D) and construction will result in impacts to various sections of the tributary. Site visits were conducted with regulatory agencies in 2018 to determine if the identified tributary was suitable for relocation using bioengineering techniques. Areas were identified for relocation if they would be buried by the road fill. Adjacent areas were identified as well as connections to tributaries in order to create a more stable system. Relocating the tributaries in place of burying them or creating rip-rap lined channels minimizes the impacts from the proposed roadway. In addition, the relocation will result in functional uplift to a degraded system. The tributary is identified as stream 7-1 in the permit document and impact figures. The connecting tributaries are mapped as 7-3, 7-4, and 7-5. The below table summarizes the stream and connecting tributary impacts as presented in the permit application and impact drawings:

Surface Water Impact Summary							
Impact Site No.	Station (From/To)	Structure Size/Type	Permanent SW Impacts (ac)	Temp. SW Impacts (ac)	Existing Channel Impacts Permanent (ft)	Existing Channel Impacts Temp. (ft)	Natural Stream Design(ft)
4A	720+05 TO 725+00-L-LT	CHANNEL	0.15	< 0.01	806	20	621
4B	720+52 TO 721+60-L-LT	CHANNEL	< 0.01	< 0.01	109	15	199
5A	727+99 TO 732+97-L-LT	CHANNEL	0.16	< 0.01	664	40	530
5B	730+88 TO 732+24-L-LT	CHANNEL	0.01	< 0.01	186	15	134
6A	734+37 TO 740+78-L-LT	CHANNEL	0.30	0.02	1,178	56	878
6B	739+73 TO 742+83-L-LT	CHANNEL	0.12		468		316

This mitigation plan includes information on the existing and proposed conditions as well as monitoring standards.

1.0 BASELINE INFORMATION

The R2707D Channel Relocation is located east of Shelby in Light Oak, Cleveland County. The channel relocation initiates north of Kemper Road and continues downstream past Kellom Dr.

Watershed Designations	
River Basin	Broad River
DWR Sub-basin	03-08-05
Watershed	Beason Creek – Buffalo Creek
Hydrologic Unit Code	030501050804
NCDWR Classification	C
EPA 303(d) List	Not Listed
Physiographic Region	Piedmont
EPA Level IV Ecoregion	Southern Outer Piedmont

Site Watershed Characteristics				
Site Watershed size	1.14 sq mi (730 acres)			
Historic Land Use	An historic aerial from 1947 shows the watershed is mostly agricultural land with some wooded areas along streams and the county fairgrounds. By 1993 the fairgrounds have expanded, parking lots and a bus depot off of Kemper Road were built, and residential development has occurred in the Oak Grove neighborhood and along roadways in the headwaters.			
Site Watershed Land Use	Forested	24.5%	Residential	23.1%
	Open Space/Grass	22.1%	Impervious	15.2%
	Agriculture	15.2%		
Zoning/Future Land Use	Impervious surfaces will increase to 19% with construction of the bypass. In addition, 11% of undeveloped portions of the watershed are zoned for future commercial development. However, a quarter of this will be protected in NCDOT ROW purchased for the stream relocation and protection of the dwarf flowered heartleaf. The remainder of the undeveloped portions of the watershed are zoned for low density residential development.			

Stream Existing Conditions

Historically managed to support generations of silviculture and agriculture, the existing streams are now flanked on each side of the valley by residential/light industrial development. Throughout this land use

history, the streams themselves have experienced a range of human modifications including damming, ditching, channelizing, and/or armoring.

The following table provides a summary of existing conditions (length, characteristics and classification) for each reach: 7-1, 7-3, 7-4, 7-5.

Reach Classification									
Surface Waters ID	Impact ID	Cross Reference: *"Plan for Channel Relocation"* Drawings	Length (ft)	Reach Properties (average)					**Rosgen Classification**
				Width To Depth Ratio	Entrenchment Ratio	Sinuosity	Slope (%)	Substrate	
7-1	4A	Site 1 / Reach 1A	806	9.90	1.38	1.86	1.26	Gravel	B4c
	5A	Site 2 / Reach 1B	664	11.08	1.47	1.26	1.10	Gravel	B4c
	6A	Site 3 / Reach 2A Site 3 / Reach 2C	1178	32.34 37.56	2.66 3.06	1.18 1.49	3.30 0.53	Cobble/Bedrock Gravel	B3/1 C4
7-3	4B	Site 1 / Reach 1A	109	13.00	2.5	1.02	2.6	Cobble/Gravel	Bc3/4
7-4	5B	Site 2 / Reach 1B	186	15.04	2.27	1.02	1.69	Gravel	B4
7-5	6B	Site 3 / Reach 2B	468	32.34	2.66	1.66	0.65	Gravel	C4

NOTE: In general, the data presented above serves as "representative", meaning that some variations/departures within reaches may exist. Data were analyzed by reach and then adapted to impact sites

Beginning in the upper reaches of the project (upstream including stream 7-1, Impact 4A; reference Figure 1), the channel is steeper, interacting with bedrock to behave as a gravel/bedrock step-pool system (classification: Rosgen B). These upper reaches, though somewhat armored by bedrock, have still degraded as observed in the channel downcutting, lateral instability, fair bedform, and fair riparian zone (vegetative width and composition). Further downstream (middle portion of Reach 7-1, Impact 5A), the valley broadens and where there is potential to transition (through a bedrock armored section, Impact 5A) to a sinuous riffle-pool sand bed complex (Classification: Rosgen C), the disturbed existing channels become further incised and resemble confined F-channels, characterized by poor horizontal stability, disconnection with active floodplain, poor bedform (indistinguishable facets), and poor riparian zone. Approaching the downstream extents of the stream project (lower Reach 7-1, Impact 6A), further valley widening and sediment contribution from tributaries and surrounding land results in aggradation and sediment imbalance. Throughout Stream 7-1, the channel predominantly classes out as a Bc/C type channel attempting to establish a stable form (downstream of Reach 7-5).

Detailed field data was collected at seven locations along Reaches 7-1 and 7-5 (reference "Plan for Channel Relocation") within the project area and compiled/evaluated to develop this summary of existing stream conditions. At each location, the thalweg profile and multiple cross sections were surveyed by engineers with a total station. The reach locations were predominantly where the proposed relocated stream will tie-in to the existing channel. Profile and cross section data were used to classify the Rosgen stream type and for consideration of hydraulic geometry in support of overall functional assessment.

The geomorphic data, in addition to visual investigation (Pfankuch Stability, consistently "Fair"), was used to determine the Bank Erosion Hazard Index (BEHI, mostly "High" to "High-Moderate") and Near-Bank Stress (NBS, also mostly "High" to "High-Moderate") for both stream banks along the impact sites. A summary of BEHI/NBS approximation and weighted average is provided in the below table:

BEHI/NBS Summary														
Impact Site No.	% Very Low		% Low		Moderate		High		Very High		Extreme		Weighted Average	
	BEHI	NBS	BEHI	NBS	BEHI	NBS	BEHI	NBS	BEHI	NBS	BEHI	NBS	BEHI	NBS
4A	5	10	20	30	40	35	15	10	15	10	5		M-H	M-H
4B	5	5	30	25	50	65	10	5	5				M	M-H
5A	10	40	40	50	45	10	5						M-L	L
5B	30	55	60	40	10	5							L	L
6A			5	15	15	15	60	40	15	25	5	5	H-VH	H-VH
6B			5	15	15	15	65	50	10	15	5	5	H-VH	H-VH

These metrics can be used to predict the magnitude of erosion from the banks at the current condition via the Bank Assessment for Non-point Source Consequences of Sediment (BANCS) method. In this case, the BEHI and NBS data collected were used to qualitatively assess the stability of the banks. Additionally, the North Carolina Stream Assessment Method (NC SAM) was used to determine the level of function of the streams at the impact sites. Cumulatively, this data was used to evaluate the function, form, and stability of the existing channel that will be relocated.

2.0 MITIGATION WORK PLAN

The goal of the project is to minimize impacts to the Buffalo Creek tributary and provide functional uplift by relocating the channel using bioengineering techniques and natural channel design methods. The stream design allowed for lower gradient culverts located at the upstream and downstream ends of the relocation area.

The existing, manipulated stream struggles to convey the hydrologic and sediment loading regimes of a modified (developed) watershed, resulting in a dysfunctional, degraded stream. With or without the proposed roadway project, this existing stream will persist in disequilibrium util it receives active management imposing a balance between form and process.

The proposed improvements aim to pair proposed channel form and hydraulic geometry (reference "Plan for Channel Relocation" for geomorphic table) with the current/future hydrologic and sediment loading regimes resulting in an appropriate natural form that corresponds to modified watershed processes. A Proposed channel hydraulics build upon existing function, reducing or eliminating issues associated with lateral bank stability, bedform diversity, access to active floodplain and riparian zone functions. By crafting channels in select locations and leaving other portions undisturbed, this plan proposes to improve stream and floodplain functionality throughout the project length. In addition to detailed grading (channel-floodplain geometry), this plan proposes in-stream bedform treatments (Vanes, J-Hook, Riffles) and bank bioengineering treatments (wood toe, live staking) that both promote vertical/horizontal stability, while also contributing to bedform diversity and associated aquatic habitat.

Thirdly, this plan proposes a robust reforestation plan that provides for stable establishment of buffer/bank vegetation following construction. Reforestation plans are included in the "Plan for Channel Relocation" on sheets RF-1 to RF-4.

4.0 SUCCESS CRITERIA

The stream relocation site shall be monitored for five years or until success criteria are satisfied. NCDOT will evaluate the success of the stream relocation project based on guidance provided by the April 2003 Stream Mitigation Guidelines, Monitoring Level I protocol disseminated by the United States Army Corps of Engineers-Wilmington District. The survey of channel dimension will consist of permanent cross sections placed at six (6) cross sections (three riffles and three pools). Annual photographs showing both banks and upstream and downstream views will be taken from permanent, mapped photo points. The survey of the longitudinal profile will cover a cumulative total of approximately 2,678 linear feet of channel (2,029' of 7-1, 199'et of 7-3, 134' of 7-4 and 316'of 7-5). The entire restored length of stream will be investigated for channel stability and in-stream structure functionality. Any evidence of channel instability will be identified, mapped and photographed. Pebble counts shall not be conducted. In the event that success criteria are not being met, remedial measures will be coordinated with resource agencies. The monitoring shall be conducted annually for a minimum of five (5) years after final planting. The monitoring results shall be submitted to resource agencies in a final report within sixty (60) days after completing monitoring. After 5 years, the NCDOT shall contact resource agencies to schedule a site visit to "close out" the mitigation site if the site has met success criteria. If success is not met, NCDOT will make necessary adjustments to the site or provide alternative mitigation credits to cover the impacts.

Vegetation Success

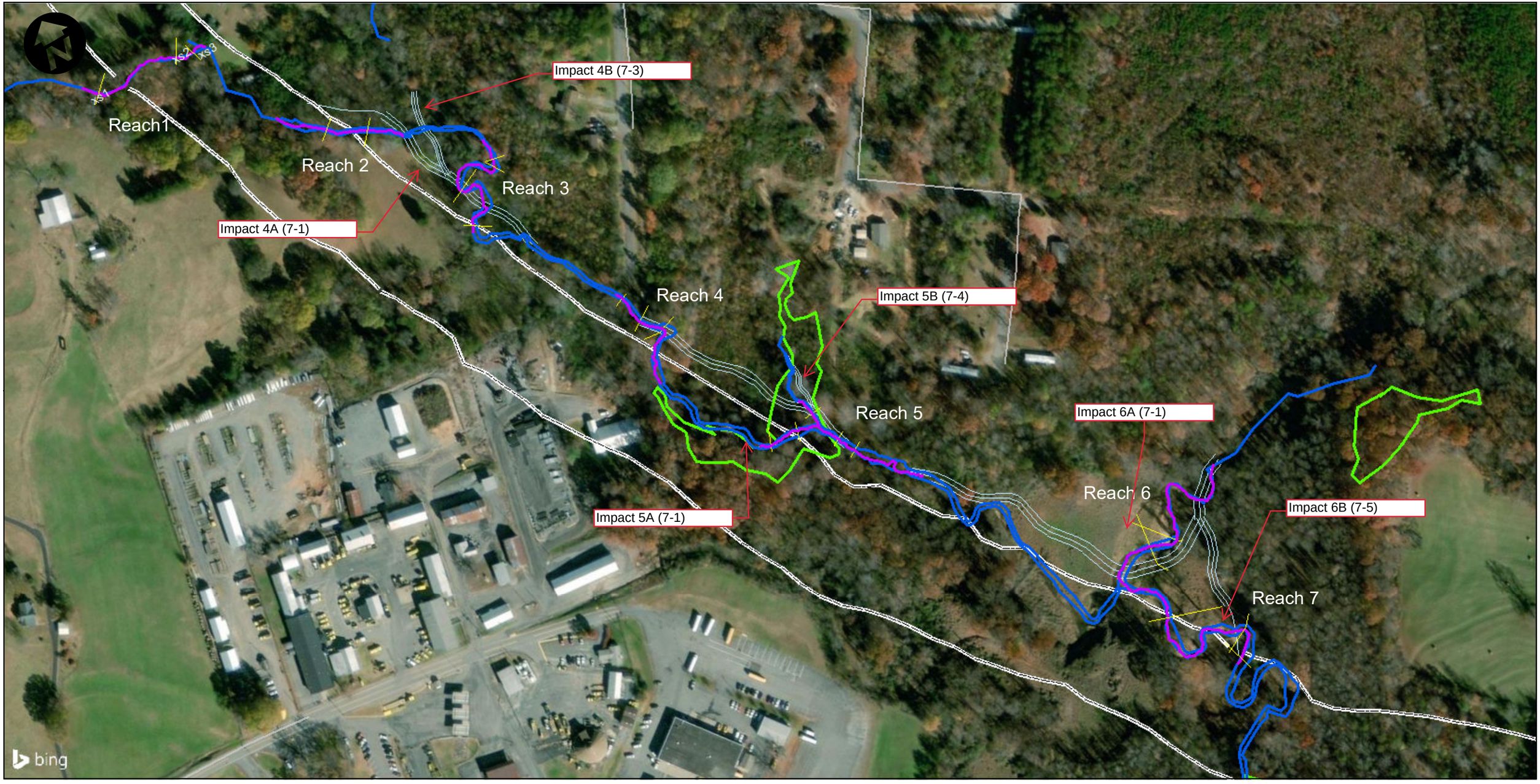
The success of vegetation and plantings will be measured through stem counts. Permanent quadrants will be used to sample the riparian buffer. Survival of the live stakes will be determined by visual observation throughout the five-year monitoring period. Bare root vegetation will be evaluated using three (3) staked survival plots. Plots will be 50ft. by 50ft. If site conditions prevent a 50ft. by 50ft. plot, then the plot will have varying dimensions to encompass an area of 2,500 ft2. All flagged stems will be counted in those plots. Success will be defined as 320 stems per acre after three years and 260 stems per acre after five years. All vegetation monitoring will be conducted during the growing season. Appropriate measures will be taken to control nuisance vegetation during the monitoring period if it affects the success of the planted vegetation.

Functional Assessment: Pre and Post construction

NCSAM forms were completed for seven locations along the proposed stream relocation. The main channel was split into 4 reaches. The forms have been attached to this Stream Relocation plan and are labeled Appendix 1. See table below for scores by relocation area. A NCSAM form will be completed after the monitoring period in order to compare the potential functional uplift to pre-project conditions.

SAM Scores		
Stream	Impact Site	SAM Score
7-1 (upstream 1)	4A	Low
7-1 (upstream 2)	4A	Medium
7-3	4B	Medium
7-1 (middle)	5A	High*
7-4	5B	High*
7-1 (lower above confluence with 7-5))	6A	Low
7-1 (lower below confluence with 7-5)	6A	Low
7-5	6B	Low

*These reaches scored high due to the wooded riparian buffers and streamside vegetation. Both reaches have considerable bank instability.



0 200 400 Feet

Disclaimer: Stantec assumes no responsibility for data supplied in electronic format. The recipient accepts full responsibility for verifying the accuracy and completeness of the data. The recipient releases Stantec, its officers, employees, consultants and agents, from any and all claims arising in any way from the content or provision of the data.

Stantec

Project Location
Cleveland County

Client/Project
NCDOT Division 12
STIP Project R-2707D/E
2017 Merger Team Update

Figure No.
2B

Title
Stream Relocation

NC SAM FIELD ASSESSMENT RESULTS
Accompanies User Manual Version 2.1

USACE AID #: NCDWR #:

INSTRUCTIONS: Attach a sketch of the assessment area and photographs. Attach a copy of the USGS 7.5-minute topographic quadrangle, and circle the location of the stream reach under evaluation. If multiple stream reaches will be evaluated on the same property, identify and number all reaches on the attached map, and include a separate form for each reach. See the NC SAM User Manual for detailed descriptions and explanations of requested information. Record in the "Notes/Sketch" section if supplementary measurements were performed. See the NC SAM User Manual for examples of additional measurements that may be relevant.

NOTE EVIDENCE OF STRESSORS AFFECTING THE ASSESSMENT AREA (do not need to be within the assessment area).

PROJECT/SITE INFORMATION:

1. Project name (if any): R2707D
2. Date of evaluation: 11/10/2017
3. Applicant/owner name: NCDOT
4. Assessor name/organization: Melissa Ruiz, Alex Baldwin, Stnatec
5. County: Cleveland
6. Nearest named water body on USGS 7.5-minute quad: Buffalo Creek
7. River basin: Broad
8. Site coordinates (decimal degrees, at lower end of assessment reach): 35.286554, -81.480992

STREAM INFORMATION: (depth and width can be approximations)

9. Site number (show on attached map): 7-1 (Impact Site 4A US)
10. Length of assessment reach evaluated (feet): 100
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 4 ☐Unable to assess channel depth.
12. Channel width at top of bank (feet): 8
13. Is assessment reach a swamp steam? ☐Yes ☐No
14. Feature type: ☒Perennial flow ☐Intermittent flow ☐Tidal Marsh Stream

STREAM CATEGORY INFORMATION:

15. NC SAM Zone: ☐ Mountains (M) ☒ Piedmont (P) ☐ Inner Coastal Plain (I) ☐ Outer Coastal Plain (O)
16. Estimated geomorphic valley shape (**skip for Tidal Marsh Stream**):
☒A (more sinuous stream, flatter valley slope)
☐B (less sinuous stream, steeper valley slope)
17. Watershed size: **(skip for Tidal Marsh Stream**) ☐Size 1 (< 0.1 mi^2) ☒Size 2 (0.1 to < 0.5 mi^2) ☐Size 3 (0.5 to < 5 mi^2) ☐Size 4 (≥ 5 mi^2)

ADDITIONAL INFORMATION:

18. Were regulatory considerations evaluated? ☒Yes ☐No If Yes, check all that apply to the assessment area.
☐Section 10 water ☐Classified Trout Waters ☐Water Supply Watershed (☐I ☐II ☐III ☐IV ☐V)
☐Essential Fish Habitat ☐Primary Nursery Area ☐ High Quality Waters/Outstanding Resource Waters
☐Publicly owned property ☐NCDWR Riparian buffer rule in effect ☐Nutrient Sensitive Waters
☐Anadromous fish ☐303(d) List ☐CAMA Area of Environmental Concern (AEC)
☐Documented presence of a federal and/or state listed protected species within the assessment area.
List species:
☐Designated Critical Habitat (list species)
19. Are additional stream information/supplementary measurements included in "Notes/Sketch" section or attached? ☐Yes ☒No

1. Channel Water – assessment reach metric (skip for Size 1 streams and Tidal Marsh Streams)

☒A Water throughout assessment reach.
☐B No flow, water in pools only.
☐C No water in assessment reach.

2. Evidence of Flow Restriction – assessment reach metric

☐A At least 10% of assessment reach in-stream habitat or riffle-pool sequence is severely affected by a flow restriction or fill to the point of obstructing flow or a channel choked with aquatic macrophytes or ponded water or impoundment on flood or ebb within the assessment reach (examples: undersized or perched culverts, causeways that constrict the channel, tidal gates, debris jams, beaver dams).
☒B Not A

3. Feature Pattern – assessment reach metric

☐A A majority of the assessment reach has altered pattern (examples: straightening, modification above or below culvert).
☒B Not A

4. Feature Longitudinal Profile – assessment reach metric

☒A Majority of assessment reach has a substantially altered stream profile (examples: channel down-cutting, existing damming, over widening, active aggradation, dredging, and excavation where appropriate channel profile has not reformed from any of these disturbances).
☐B Not A

5. Signs of Active Instability – assessment reach metric

Consider only current instability, not past events from which the stream has currently recovered. Examples of instability include active bank failure, active channel down-cutting (head-cut), active widening, and artificial hardening (such as concrete, gabion, rip-rap).

☐A < 10% of channel unstable
☒B 10 to 25% of channel unstable
☐C > 25% of channel unstable

6. Streamside Area Interaction – streamside area metric
Consider for the Left Bank (LB) and the Right Bank (RB).

LB	RB	
☐A	☐A	Little or no evidence of conditions that adversely affect reference interaction
☒B	☒B	Moderate evidence of conditions (examples: berms, levees, down-cutting, aggradation, dredging) that adversely affect reference interaction (examples: limited streamside area access, disruption of flood flows through streamside area, leaky or intermittent bulkheads, causeways with floodplain constriction, minor ditching [including mosquito ditching])
☐C	☐C	Extensive evidence of conditions that adversely affect reference interaction (little to no floodplain/intertidal zone access [examples: causeways with floodplain and channel constriction, bulkheads, retaining walls, fill, stream incision, disruption of flood flows through streamside area] or too much floodplain/intertidal zone access [examples: impoundments, intensive mosquito ditching]) or floodplain/intertidal zone unnaturally absent or assessment reach is a man-made feature on an interstream divide

7. Water Quality Stressors – assessment reach/intertidal zone metric
Check all that apply.

- ☐A Discolored water in stream or intertidal zone (milky white, blue, unnatural water discoloration, oil sheen, stream foam)
- ☐B Excessive sedimentation (burying of stream features or intertidal zone)
- ☐C Noticeable evidence of pollutant discharges entering the assessment reach and causing a water quality problem
- ☐D Odor (not including natural sulfide odors)
- ☐E Current published or collected data indicating degraded water quality in the assessment reach. Cite source in "Notes/Sketch" section.
- ☐F Livestock with access to stream or intertidal zone
- ☐G Excessive algae in stream or intertidal zone
- ☐H Degraded marsh vegetation in the intertidal zone (removal, burning, regular mowing, destruction, etc)
- ☐I Other: _____ (explain in "Notes/Sketch" section)
- ☒J Little to no stressors

8. Recent Weather – watershed metric (skip for Tidal Marsh Streams)
For Size 1 or 2 streams, D1 drought or higher is considered a drought; for Size 3 or 4 streams, D2 drought or higher is considered a drought.

- ☐A Drought conditions and no rainfall or rainfall not exceeding 1 inch within the last 48 hours
- ☐B Drought conditions and rainfall exceeding 1 inch within the last 48 hours
- ☒C No drought conditions

9. Large or Dangerous Stream – assessment reach metric
☐Yes ☒No Is stream is too large or dangerous to assess? If Yes, skip to Metric 13 (Streamside Area Ground Surface Condition).

10. Natural In-stream Habitat Types – assessment reach metric
10a. ☐Yes ☐No Degraded in-stream habitat over majority of the assessment reach (examples of stressors include excessive sedimentation, mining, excavation, in-stream hardening [for example, rip-rap], recent dredging, and snagging) **(evaluate for Size 4 Coastal Plain streams only, then skip to Metric 12)**

10b. **Check all that occur** (occurs if > 5% coverage of assessment reach) **(skip for Size 4 Coastal Plain streams)**

- ☐A Multiple aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
- ☒B Multiple sticks and/or leaf packs and/or emergent vegetation
- ☒C Multiple snags and logs (including lap trees)
- ☐D 5% undercut banks and/or root mats and/or roots in banks extend to the normal wetted perimeter
- ☐E Little or no habitat

Check for Tidal Marsh Streams Only

- ☐F 5% oysters or other natural hard bottoms
- ☐G Submerged aquatic vegetation
- ☐H Low-tide refugia (pools)
- ☐I Sand bottom
- ☐J 5% vertical bank along the marsh
- ☐K Little or no habitat

**************************************REMAINING QUESTIONS ARE NOT APPLICABLE FOR TIDAL MARSH STREAMS*********************************

11. Bedform and Substrate – assessment reach metric (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)

11a. ☐Yes ☒No Is assessment reach in a natural sand-bed stream? **(skip for Coastal Plain streams)**

11b. Bedform evaluated. **Check the appropriate box(es).**

- ☒A Riffle-run section **(evaluate 11c)**
- ☒B Pool-glide section **(evaluate 11d)**
- ☐C Natural bedform absent **(skip to Metric 12, Aquatic Life)**

11c. In riffle sections, check all that occur below the normal wetted perimeter of the assessment reach – whether or not submerged. **Check at least one box in each row (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)**. Not Present (NP) = absent, Rare (R) = present but ≤ 10%, Common (C) = > 10-40%, Abundant (A) = > 40-70%, Predominant (P) = > 70%. Cumulative percentages should not exceed 100% for each assessment reach.

NP	R	C	A	P	
☒	☐	☐	☐	☐	Bedrock/saprolite
☒	☐	☐	☐	☐	Boulder (256 – 4096 mm)
☐	☐	☐	☒	☐	Cobble (64 – 256 mm)
☐	☐	☒	☐	☐	Gravel (2 – 64 mm)
☐	☐	☐	☒	☐	Sand (.062 – 2 mm)
☒	☐	☐	☐	☐	Silt/clay (< 0.062 mm)
☐	☒	☐	☐	☐	Detritus
☒	☐	☐	☐	☐	Artificial (rip-rap, concrete, etc.)

11d. ☒Yes ☐No Are pools filled with sediment? (**skip for Size 4 Coastal Plain streams and Tidal Marsh Streams**)

12. Aquatic Life – assessment reach metric (skip for Tidal Marsh Streams)

12a. ☒Yes ☐No Was an in-stream aquatic life assessment performed as described in the User Manual?
If No, select one of the following reasons and skip to Metric 13. ☐No Water ☒Other: _____

12b. ☒Yes ☐No Are aquatic organisms present in the assessment reach (look in riffles, pools, then snags)? If Yes, check all that apply. If No, skip to Metric 13.

1	>1	Numbers over columns refer to "individuals" for Size 1 and 2 streams and "taxa" for Size 3 and 4 streams.
☐	☐	Adult frogs
☐	☐	Aquatic reptiles
☐	☐	Aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
☒	☐	Beetles
☐	☐	Caddisfly larvae (T)
☐	☐	Asian clam (*Corbicula*)
☐	☐	Crustacean (isopod/amphipod/crayfish/shrimp)
☐	☐	Damselfly and dragonfly larvae
☐	☐	Dipterans
☐	☒	Mayfly larvae (E)
☐	☐	Megaloptera (alderfly, fishfly, dobsonfly larvae)
☐	☐	Midges/mosquito larvae
☐	☐	Mosquito fish (*Gambusia*) or mud minnows (*Umbra pygmaea*)
☐	☐	Mussels/Clams (not *Corbicula*)
☒	☐	Other fish
☐	☐	Salamanders/tadpoles
☐	☐	Snails
☐	☐	Stonefly larvae (P)
☐	☐	Tipulid larvae
☐	☐	Worms/leeches

13. Streamside Area Ground Surface Condition – streamside area metric (skip for Tidal Marsh Streams and B valley types)
Consider for the Left Bank (LB) and the Right Bank (RB). Consider storage capacity with regard to both overbank flow and upland runoff.

LB	RB	
☐A	☐A	Little or no alteration to water storage capacity over a majority of the streamside area
☒B	☐B	Moderate alteration to water storage capacity over a majority of the streamside area
☐C	☒C	Severe alteration to water storage capacity over a majority of the streamside area (examples: ditches, fill, soil compaction, livestock disturbance, buildings, man-made levees, drainage pipes)

14. Streamside Area Water Storage – streamside area metric (skip for Size 1 streams, Tidal Marsh Streams, and B valley types)
Consider for the Left Bank (LB) and the Right Bank (RB) of the streamside area.

LB	RB	
☐A	☐A	Majority of streamside area with depressions able to pond water ≥ 6 inches deep
☐B	☐B	Majority of streamside area with depressions able to pond water 3 to 6 inches deep
☒C	☒C	Majority of streamside area with depressions able to pond water < 3 inches deep

15. Wetland Presence – streamside area metric (skip for Tidal Marsh Streams)
Consider for the Left Bank (LB) and the Right Bank (RB). Do not consider wetlands outside of the streamside area or within the normal wetted perimeter of assessment reach.

LB	RB	
☐Y	☐Y	Are wetlands present in the streamside area?
☒N	☒N	

16. Baseflow Contributors – assessment reach metric (skip for Size 4 streams and Tidal Marsh Streams)
Check all contributors within the assessment reach or within view of <u>and</u> draining to the assessment reach.

- ☐A Streams and/or springs (jurisdictional discharges)
- ☐B Ponds (include wet detention basins; do not include sediment basins or dry detention basins)
- ☐C Obstruction passing flow during low-flow periods within the assessment area (beaver dam, leaky dam, bottom-release dam, weir)
- ☐D Evidence of bank seepage or sweating (iron in water indicates seepage)
- ☒E Stream bed or bank soil reduced (dig through deposited sediment if present)
- ☐F None of the above

17. Baseflow Detractors – assessment area metric (skip for Tidal Marsh Streams)
Check all that apply.

- ☐A Evidence of substantial water withdrawals from the assessment reach (includes areas excavated for pump installation)
- ☐B Obstruction not passing flow during low-flow periods affecting the assessment reach (ex: watertight dam, sediment deposit)
- ☐C Urban stream (≥ 24% impervious surface for watershed)
- ☐D Evidence that the streamside area has been modified resulting in accelerated drainage into the assessment reach
- ☐E Assessment reach relocated to valley edge
- ☒F None of the above

18. Shading – assessment reach metric (skip for Tidal Marsh Streams)
Consider aspect. Consider "leaf-on" condition.

- ☒A Stream shading is appropriate for stream category (may include gaps associated with natural processes)
- ☐B Degraded (example: scattered trees)
- ☐C Stream shading is gone or largely absent

19. Buffer Width – streamside area metric (skip for Tidal Marsh Streams)

Consider "vegetated buffer" and "wooded buffer" separately for left bank (LB) and right bank (RB) starting at the top of bank out to the first break.

Vegetated		Wooded		
LB	RB	LB	RB	
☒A	☒A	☒A	☐A	≥ 100 feet wide or extends to the edge of the watershed
☐B	☐B	☐B	☐B	From 50 to < 100 feet wide
☐C	☐C	☐C	☐C	From 30 to < 50 feet wide
☐D	☐D	☐D	☐D	From 10 to < 30 feet wide
☐E	☐E	☐E	☒E	< 10 feet wide or no trees

20. Buffer Structure – streamside area metric (skip for Tidal Marsh Streams)

Consider for left bank (LB) and right bank (RB) for Metric 19 ("Vegetated" Buffer Width).

LB	RB	
☐A	☐A	Mature forest
☒B	☐B	Non-mature woody vegetation or modified vegetation structure
☐C	☒C	Herbaceous vegetation with or without a strip of trees < 10 feet wide
☐D	☐D	Maintained shrubs
☐E	☐E	Little or no vegetation

21. Buffer Stressors – streamside area metric (skip for Tidal Marsh Streams)

Check all appropriate boxes for left bank (LB) and right bank (RB). Indicate if listed stressor abuts stream (Abuts), does not abut but is within 30 feet of stream (< 30 feet), or is between 30 to 50 feet of stream (30-50 feet).

If none of the following stressors occurs on either bank, check here and skip to Metric 22: ☐

Abuts		< 30 feet		30-50 feet		
LB	RB	LB	RB	LB	RB	
☐A	☐A	☐A	☐A	☐A	☐A	Row crops
☐B	☐B	☐B	☐B	☐B	☐B	Maintained turf
☐C	☒C	☐C	☐C	☐C	☐C	Pasture (no livestock)/commercial horticulture
☐D	☐D	☐D	☐D	☐D	☐D	Pasture (active livestock use)

22. Stem Density – streamside area metric (skip for Tidal Marsh Streams)

Consider for left bank (LB) and right bank (RB) for Metric 19 ("Wooded" Buffer Width).

LB	RB	
☒A	☐A	Medium to high stem density
☐B	☒B	Low stem density
☐C	☐C	No wooded riparian buffer or predominantly herbaceous species or bare ground

23. Continuity of Vegetated Buffer – streamside area metric (skip for Tidal Marsh Streams)

Consider whether vegetated buffer is continuous along stream (parallel). Breaks are areas lacking vegetation > 10 feet wide.

LB	RB	
☒A	☒A	The total length of buffer breaks is < 25 percent.
☐B	☐B	The total length of buffer breaks is between 25 and 50 percent.
☐C	☐C	The total length of buffer breaks is > 50 percent.

24. Vegetative Composition – streamside area metric (skip for Tidal Marsh Streams)

Evaluate the dominant vegetation within 100 feet of each bank or to the edge of the watershed (whichever comes first) as it contributes to assessment reach habitat.

LB	RB	
☐A	☐A	Vegetation is close to undisturbed in species present and their proportions. Lower strata composed of native species, with non-native invasive species absent or sparse.
☒B	☐B	Vegetation indicates disturbance in terms of species diversity or proportions, but is still largely composed of native species. This may include communities of weedy native species that develop after clear-cutting or clearing or communities with non-native invasive species present, but not dominant, over a large portion of the expected strata or communities missing understory but retaining canopy trees.
☐C	☒C	Vegetation is severely disturbed in terms of species diversity or proportions. Mature canopy is absent or communities with non-native invasive species dominant over a large portion of expected strata or communities composed of planted stands of non-characteristic species or communities inappropriately composed of a single species or no vegetation.

25. Conductivity – assessment reach metric (skip for all Coastal Plain streams)

25a. ☐Yes ☒No Was conductivity measurement recorded?
If No, select one of the following reasons. ☒No Water ☐Other: _____

25b. Check the box corresponding to the conductivity measurement (units of microsiemens per centimeter).
☐A < 46 ☐B 46 to < 67 ☐C 67 to < 79 ☐D 79 to < 230 ☐E ≥ 230

Notes/Sketch:

Draft NC SAM Stream Rating Sheet
Accompanies User Manual Version 2.1

Stream Site Name	R27207D 7-1 (Impact Site 4A US)	Date of Assessment	11/10/2017
Stream Category	Pa2	Assessor Name/Organization	Melissa Ruiz, Alex Baldwin, Stnatec

Notes of Field Assessment Form (Y/N)	NO
Presence of regulatory considerations (Y/N)	NO
Additional stream information/supplementary measurements included (Y/N)	NO
NC SAM feature type (perennial, intermittent, Tidal Marsh Stream)	Intermittent

Function Class Rating Summary	USACE/ All Streams	NCDWR Intermittent
(1) Hydrology	**LOW**	
(2) Baseflow	**HIGH**	
(2) Flood Flow	**LOW**	
(3) Streamside Area Attenuation	**MEDIUM**	
(4) Floodplain Access	**MEDIUM**	
(4) Wooded Riparian Buffer	**MEDIUM**	
(4) Microtopography	**LOW**	
(3) Stream Stability	**LOW**	
(4) Channel Stability	**MEDIUM**	
(4) Sediment Transport	**LOW**	
(4) Stream Geomorphology	**MEDIUM**	
(2) Stream/Intertidal Zone Interaction	NA	
(2) Longitudinal Tidal Flow	NA	
(2) Tidal Marsh Stream Stability	NA	
(3) Tidal Marsh Channel Stability	NA	
(3) Tidal Marsh Stream Geomorphology	NA	
(1) Water Quality	**HIGH**	
(2) Baseflow	**HIGH**	
(2) Streamside Area Vegetation	**MEDIUM**	
(3) Upland Pollutant Filtration	**LOW**	
(3) Thermoregulation	**HIGH**	
(2) Indicators of Stressors	**NO**	
(2) Aquatic Life Tolerance	**HIGH**	
(2) Intertidal Zone Filtration	NA	
(1) Habitat	**LOW**	
(2) In-stream Habitat	**LOW**	
(3) Baseflow	**HIGH**	
(3) Substrate	**LOW**	
(3) Stream Stability	**MEDIUM**	
(3) In-stream Habitat	**MEDIUM**	
(2) Stream-side Habitat	**HIGH**	
(3) Stream-side Habitat	**MEDIUM**	
(3) Thermoregulation	**HIGH**	
(2) Tidal Marsh In-stream Habitat	NA	
(3) Flow Restriction	NA	
(3) Tidal Marsh Stream Stability	NA	
(4) Tidal Marsh Channel Stability	NA	
(4) Tidal Marsh Stream Geomorphology	NA	
(3) Tidal Marsh In-stream Habitat	NA	
(2) Intertidal Zone	NA	
Overall	**LOW**	

NC SAM FIELD ASSESSMENT RESULTS
Accompanies User Manual Version 2.1

USACE AID #: NCDWR #:

INSTRUCTIONS: Attach a sketch of the assessment area and photographs. Attach a copy of the USGS 7.5-minute topographic quadrangle, and circle the location of the stream reach under evaluation. If multiple stream reaches will be evaluated on the same property, identify and number all reaches on the attached map, and include a separate form for each reach. See the NC SAM User Manual for detailed descriptions and explanations of requested information. Record in the "Notes/Sketch" section if supplementary measurements were performed. See the NC SAM User Manual for examples of additional measurements that may be relevant.

NOTE EVIDENCE OF STRESSORS AFFECTING THE ASSESSMENT AREA (do not need to be within the assessment area).

PROJECT/SITE INFORMATION:

1. Project name (if any): R2707D
2. Date of evaluation: 11/10/2017
3. Applicant/owner name: NCDOT
4. Assessor name/organization: Melissa Ruiz, Alex Baldwin, Stnatec
5. County: Cleveland
6. Nearest named water body on USGS 7.5-minute quad: Kings Mountain Reservoir
7. River basin: Broad
8. Site coordinates (decimal degrees, at lower end of assessment reach): 35.285453, -81.480133

STREAM INFORMATION: (depth and width can be approximations)

9. Site number (show on attached map): 7-1 (Impact Site4A DS)
10. Length of assessment reach evaluated (feet): 100
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 4 ☐Unable to assess channel depth.
12. Channel width at top of bank (feet): 8
13. Is assessment reach a swamp steam? ☐Yes ☐No
14. Feature type: ☒Perennial flow ☐Intermittent flow ☐Tidal Marsh Stream

STREAM CATEGORY INFORMATION:

15. NC SAM Zone: ☐ Mountains (M) ☒ Piedmont (P) ☐ Inner Coastal Plain (I) ☐ Outer Coastal Plain (O)
16. Estimated geomorphic valley shape (**skip for Tidal Marsh Stream**):
☒A (more sinuous stream, flatter valley slope)
☐B (less sinuous stream, steeper valley slope)
17. Watershed size: **(skip for Tidal Marsh Stream**) ☐Size 1 (< 0.1 mi^2) ☒Size 2 (0.1 to < 0.5 mi^2) ☐Size 3 (0.5 to < 5 mi^2) ☐Size 4 (≥ 5 mi^2)

ADDITIONAL INFORMATION:

18. Were regulatory considerations evaluated? ☒Yes ☐No If Yes, check all that apply to the assessment area.
☐Section 10 water ☐Classified Trout Waters ☐Water Supply Watershed (☐I ☐II ☐III ☐IV ☐V)
☐Essential Fish Habitat ☐Primary Nursery Area ☐ High Quality Waters/Outstanding Resource Waters
☐Publicly owned property ☐NCDWR Riparian buffer rule in effect ☐Nutrient Sensitive Waters
☐Anadromous fish ☐303(d) List ☐CAMA Area of Environmental Concern (AEC)
☐Documented presence of a federal and/or state listed protected species within the assessment area.
List species:
☐Designated Critical Habitat (list species)
19. Are additional stream information/supplementary measurements included in "Notes/Sketch" section or attached? ☐Yes ☒No

1. Channel Water – assessment reach metric (skip for Size 1 streams and Tidal Marsh Streams)

☒A Water throughout assessment reach.
☐B No flow, water in pools only.
☐C No water in assessment reach.

2. Evidence of Flow Restriction – assessment reach metric

☐A At least 10% of assessment reach in-stream habitat or riffle-pool sequence is severely affected by a flow restriction or fill to the point of obstructing flow or a channel choked with aquatic macrophytes or ponded water or impoundment on flood or ebb within the assessment reach (examples: undersized or perched culverts, causeways that constrict the channel, tidal gates, debris jams, beaver dams).
☒B Not A

3. Feature Pattern – assessment reach metric

☐A A majority of the assessment reach has altered pattern (examples: straightening, modification above or below culvert).
☒B Not A

4. Feature Longitudinal Profile – assessment reach metric

☒A Majority of assessment reach has a substantially altered stream profile (examples: channel down-cutting, existing damming, over widening, active aggradation, dredging, and excavation where appropriate channel profile has not reformed from any of these disturbances).
☐B Not A

5. Signs of Active Instability – assessment reach metric

Consider only current instability, not past events from which the stream has currently recovered. Examples of instability include active bank failure, active channel down-cutting (head-cut), active widening, and artificial hardening (such as concrete, gabion, rip-rap).

☐A < 10% of channel unstable
☐B 10 to 25% of channel unstable
☒C > 25% of channel unstable

6. Streamside Area Interaction – streamside area metric
Consider for the Left Bank (LB) and the Right Bank (RB).

LB	RB	
☐A	☐A	Little or no evidence of conditions that adversely affect reference interaction
☒B	☒B	Moderate evidence of conditions (examples: berms, levees, down-cutting, aggradation, dredging) that adversely affect reference interaction (examples: limited streamside area access, disruption of flood flows through streamside area, leaky or intermittent bulkheads, causeways with floodplain constriction, minor ditching [including mosquito ditching])
☐C	☐C	Extensive evidence of conditions that adversely affect reference interaction (little to no floodplain/intertidal zone access [examples: causeways with floodplain and channel constriction, bulkheads, retaining walls, fill, stream incision, disruption of flood flows through streamside area] or too much floodplain/intertidal zone access [examples: impoundments, intensive mosquito ditching]) or floodplain/intertidal zone unnaturally absent or assessment reach is a man-made feature on an interstream divide

7. Water Quality Stressors – assessment reach/intertidal zone metric
Check all that apply.

- ☐A Discolored water in stream or intertidal zone (milky white, blue, unnatural water discoloration, oil sheen, stream foam)
- ☒B Excessive sedimentation (burying of stream features or intertidal zone)
- ☐C Noticeable evidence of pollutant discharges entering the assessment reach and causing a water quality problem
- ☐D Odor (not including natural sulfide odors)
- ☐E Current published or collected data indicating degraded water quality in the assessment reach. Cite source in "Notes/Sketch" section.
- ☐F Livestock with access to stream or intertidal zone
- ☐G Excessive algae in stream or intertidal zone
- ☐H Degraded marsh vegetation in the intertidal zone (removal, burning, regular mowing, destruction, etc)
- ☐I Other: _____ (explain in "Notes/Sketch" section)
- ☐J Little to no stressors

8. Recent Weather – watershed metric (skip for Tidal Marsh Streams)
For Size 1 or 2 streams, D1 drought or higher is considered a drought; for Size 3 or 4 streams, D2 drought or higher is considered a drought.

- ☐A Drought conditions and no rainfall or rainfall not exceeding 1 inch within the last 48 hours
- ☐B Drought conditions and rainfall exceeding 1 inch within the last 48 hours
- ☒C No drought conditions

9. Large or Dangerous Stream – assessment reach metric
☐Yes ☐No Is stream is too large or dangerous to assess? If Yes, skip to Metric 13 (Streamside Area Ground Surface Condition).

10. Natural In-stream Habitat Types – assessment reach metric
10a. ☐Yes ☒No Degraded in-stream habitat over majority of the assessment reach (examples of stressors include excessive sedimentation, mining, excavation, in-stream hardening [for example, rip-rap], recent dredging, and snagging) **(evaluate for Size 4 Coastal Plain streams only, then skip to Metric 12)**

10b. **Check all that occur** (occurs if > 5% coverage of assessment reach) **(skip for Size 4 Coastal Plain streams)**

- ☐A Multiple aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
- ☒B Multiple sticks and/or leaf packs and/or emergent vegetation
- ☒C Multiple snags and logs (including lap trees)
- ☐D 5% undercut banks and/or root mats and/or roots in banks extend to the normal wetted perimeter
- ☐E Little or no habitat

Check for Tidal Marsh Streams Only

- ☐F 5% oysters or other natural hard bottoms
- ☐G Submerged aquatic vegetation
- ☐H Low-tide refugia (pools)
- ☐I Sand bottom
- ☐J 5% vertical bank along the marsh
- ☐K Little or no habitat

**************************************REMAINING QUESTIONS ARE NOT APPLICABLE FOR TIDAL MARSH STREAMS*********************************

11. Bedform and Substrate – assessment reach metric (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)

11a. ☐Yes ☒No Is assessment reach in a natural sand-bed stream? **(skip for Coastal Plain streams)**

11b. Bedform evaluated. **Check the appropriate box(es).**

- ☒A Riffle-run section **(evaluate 11c)**
- ☒B Pool-glide section **(evaluate 11d)**
- ☐C Natural bedform absent **(skip to Metric 12, Aquatic Life)**

11c. In riffle sections, check all that occur below the normal wetted perimeter of the assessment reach – whether or not submerged. **Check at least one box in each row (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)**. Not Present (NP) = absent, Rare (R) = present but ≤ 10%, Common (C) = > 10-40%, Abundant (A) = > 40-70%, Predominant (P) = > 70%. Cumulative percentages should not exceed 100% for each assessment reach.

NP	R	C	A	P	
☒	☐	☐	☐	☐	Bedrock/saprolite
☒	☐	☐	☐	☐	Boulder (256 – 4096 mm)
☐	☐	☐	☒	☐	Cobble (64 – 256 mm)
☐	☐	☒	☐	☐	Gravel (2 – 64 mm)
☐	☐	☐	☒	☐	Sand (.062 – 2 mm)
☒	☐	☐	☐	☐	Silt/clay (< 0.062 mm)
☒	☐	☐	☐	☐	Detritus
☒	☐	☐	☐	☐	Artificial (rip-rap, concrete, etc.)

11d. ☐Yes ☒No Are pools filled with sediment? (**skip for Size 4 Coastal Plain streams and Tidal Marsh Streams**)

12. Aquatic Life – assessment reach metric (skip for Tidal Marsh Streams)

12a. ☒Yes ☐No Was an in-stream aquatic life assessment performed as described in the User Manual?
If No, select one of the following reasons and skip to Metric 13. ☐No Water ☒Other: _____

12b. ☒Yes ☐No Are aquatic organisms present in the assessment reach (look in riffles, pools, then snags)? If Yes, check all that apply. If No, skip to Metric 13.

1	>1	Numbers over columns refer to "individuals" for Size 1 and 2 streams and "taxa" for Size 3 and 4 streams.
☐	☐	Adult frogs
☐	☐	Aquatic reptiles
☐	☐	Aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
☒	☐	Beetles
☐	☒	Caddisfly larvae (T)
☐	☐	Asian clam (*Corbicula*)
☐	☐	Crustacean (isopod/amphipod/crayfish/shrimp)
☐	☐	Damselfly and dragonfly larvae
☐	☐	Dipterans
☐	☒	Mayfly larvae (E)
☐	☐	Megaloptera (alderfly, fishfly, dobsonfly larvae)
☐	☐	Midges/mosquito larvae
☐	☐	Mosquito fish (*Gambusia*) or mud minnows (*Umbra pygmaea*)
☐	☐	Mussels/Clams (not *Corbicula*)
☒	☐	Other fish
☒	☐	Salamanders/tadpoles
☐	☐	Snails
☒	☐	Stonefly larvae (P)
☐	☐	Tipulid larvae
☐	☐	Worms/leeches

13. Streamside Area Ground Surface Condition – streamside area metric (skip for Tidal Marsh Streams and B valley types)
Consider for the Left Bank (LB) and the Right Bank (RB). Consider storage capacity with regard to both overbank flow and upland runoff.

LB	RB	
☐A	☒A	Little or no alteration to water storage capacity over a majority of the streamside area
☒B	☐B	Moderate alteration to water storage capacity over a majority of the streamside area
☐C	☐C	Severe alteration to water storage capacity over a majority of the streamside area (examples: ditches, fill, soil compaction, livestock disturbance, buildings, man-made levees, drainage pipes)

14. Streamside Area Water Storage – streamside area metric (skip for Size 1 streams, Tidal Marsh Streams, and B valley types)
Consider for the Left Bank (LB) and the Right Bank (RB) of the streamside area.

LB	RB	
☐A	☐A	Majority of streamside area with depressions able to pond water ≥ 6 inches deep
☐B	☐B	Majority of streamside area with depressions able to pond water 3 to 6 inches deep
☒C	☒C	Majority of streamside area with depressions able to pond water < 3 inches deep

15. Wetland Presence – streamside area metric (skip for Tidal Marsh Streams)
Consider for the Left Bank (LB) and the Right Bank (RB). Do not consider wetlands outside of the streamside area or within the normal wetted perimeter of assessment reach.

LB	RB	
☐Y	☐Y	Are wetlands present in the streamside area?
☒N	☒N	

16. Baseflow Contributors – assessment reach metric (skip for Size 4 streams and Tidal Marsh Streams)
Check all contributors within the assessment reach or within view of <u>and</u> draining to the assessment reach.

- ☐A Streams and/or springs (jurisdictional discharges)
- ☐B Ponds (include wet detention basins; do not include sediment basins or dry detention basins)
- ☐C Obstruction passing flow during low-flow periods within the assessment area (beaver dam, leaky dam, bottom-release dam, weir)
- ☐D Evidence of bank seepage or sweating (iron in water indicates seepage)
- ☒E Stream bed or bank soil reduced (dig through deposited sediment if present)
- ☐F None of the above

17. Baseflow Detractors – assessment area metric (skip for Tidal Marsh Streams)
Check all that apply.

- ☐A Evidence of substantial water withdrawals from the assessment reach (includes areas excavated for pump installation)
- ☐B Obstruction not passing flow during low-flow periods affecting the assessment reach (ex: watertight dam, sediment deposit)
- ☐C Urban stream (≥ 24% impervious surface for watershed)
- ☐D Evidence that the streamside area has been modified resulting in accelerated drainage into the assessment reach
- ☐E Assessment reach relocated to valley edge
- ☒F None of the above

18. Shading – assessment reach metric (skip for Tidal Marsh Streams)
Consider aspect. Consider "leaf-on" condition.

- ☐A Stream shading is appropriate for stream category (may include gaps associated with natural processes)
- ☒B Degraded (example: scattered trees)
- ☐C Stream shading is gone or largely absent

19. Buffer Width – streamside area metric (skip for Tidal Marsh Streams)

Consider "vegetated buffer" and "wooded buffer" separately for left bank (LB) and right bank (RB) starting at the top of bank out to the first break.

Vegetated		Wooded		
LB	RB	LB	RB	
☒A	☒A	☒A	☐A	≥ 100 feet wide or extends to the edge of the watershed
☐B	☐B	☐B	☐B	From 50 to < 100 feet wide
☐C	☐C	☐C	☐C	From 30 to < 50 feet wide
☐D	☐D	☐D	☐D	From 10 to < 30 feet wide
☐E	☐E	☐E	☒E	< 10 feet wide or no trees

20. Buffer Structure – streamside area metric (skip for Tidal Marsh Streams)

Consider for left bank (LB) and right bank (RB) for Metric 19 ("Vegetated" Buffer Width).

LB	RB	
☐A	☐A	Mature forest
☒B	☐B	Non-mature woody vegetation or modified vegetation structure
☐C	☒C	Herbaceous vegetation with or without a strip of trees < 10 feet wide
☐D	☐D	Maintained shrubs
☐E	☐E	Little or no vegetation

21. Buffer Stressors – streamside area metric (skip for Tidal Marsh Streams)

Check all appropriate boxes for left bank (LB) and right bank (RB). Indicate if listed stressor abuts stream (Abuts), does not abut but is within 30 feet of stream (< 30 feet), or is between 30 to 50 feet of stream (30-50 feet).

If none of the following stressors occurs on either bank, check here and skip to Metric 22: ☐

Abuts		< 30 feet		30-50 feet		
LB	RB	LB	RB	LB	RB	
☐A	☐A	☐A	☐A	☐A	☐A	Row crops
☐B	☐B	☐B	☐B	☐B	☐B	Maintained turf
☐C	☒C	☐C	☐C	☐C	☐C	Pasture (no livestock)/commercial horticulture
☐D	☐D	☐D	☐D	☐D	☐D	Pasture (active livestock use)

22. Stem Density – streamside area metric (skip for Tidal Marsh Streams)

Consider for left bank (LB) and right bank (RB) for Metric 19 ("Wooded" Buffer Width).

LB	RB	
☒A	☐A	Medium to high stem density
☐B	☐B	Low stem density
☐C	☒C	No wooded riparian buffer or predominantly herbaceous species or bare ground

23. Continuity of Vegetated Buffer – streamside area metric (skip for Tidal Marsh Streams)

Consider whether vegetated buffer is continuous along stream (parallel). Breaks are areas lacking vegetation > 10 feet wide.

LB	RB	
☒A	☒A	The total length of buffer breaks is < 25 percent.
☐B	☐B	The total length of buffer breaks is between 25 and 50 percent.
☐C	☐C	The total length of buffer breaks is > 50 percent.

24. Vegetative Composition – streamside area metric (skip for Tidal Marsh Streams)

Evaluate the dominant vegetation within 100 feet of each bank or to the edge of the watershed (whichever comes first) as it contributes to assessment reach habitat.

LB	RB	
☐A	☐A	Vegetation is close to undisturbed in species present and their proportions. Lower strata composed of native species, with non-native invasive species absent or sparse.
☒B	☐B	Vegetation indicates disturbance in terms of species diversity or proportions, but is still largely composed of native species. This may include communities of weedy native species that develop after clear-cutting or clearing or communities with non-native invasive species present, but not dominant, over a large portion of the expected strata or communities missing understory but retaining canopy trees.
☐C	☒C	Vegetation is severely disturbed in terms of species diversity or proportions. Mature canopy is absent or communities with non-native invasive species dominant over a large portion of expected strata or communities composed of planted stands of non-characteristic species or communities inappropriately composed of a single species or no vegetation.

25. Conductivity – assessment reach metric (skip for all Coastal Plain streams)

25a. ☐Yes ☒No Was conductivity measurement recorded?
If No, select one of the following reasons. ☒No Water ☐Other: _____

25b. Check the box corresponding to the conductivity measurement (units of microsiemens per centimeter).
☐A < 46 ☐B 46 to < 67 ☐C 67 to < 79 ☐D 79 to < 230 ☐E ≥ 230

Notes/Sketch:

Draft NC SAM Stream Rating Sheet
Accompanies User Manual Version 2.1

Stream Site Name	R2707D 7-1 (Impact Site4A DS)	Date of Assessment	11/10/2017
Stream Category	Pa2	Assessor Name/Organization	Melissa Ruiz, Alex Baldwin, Stantec

Notes of Field Assessment Form (Y/N)	NO
Presence of regulatory considerations (Y/N)	NO
Additional stream information/supplementary measurements included (Y/N)	NO
NC SAM feature type (perennial, intermittent, Tidal Marsh Stream)	Perennial

Function Class Rating Summary	USACE/ All Streams	NCDWR Intermittent
(1) Hydrology	**LOW**	
(2) Baseflow	**HIGH**	
(2) Flood Flow	**LOW**	
(3) Streamside Area Attenuation	**MEDIUM**	
(4) Floodplain Access	**MEDIUM**	
(4) Wooded Riparian Buffer	**MEDIUM**	
(4) Microtopography	**LOW**	
(3) Stream Stability	**LOW**	
(4) Channel Stability	**LOW**	
(4) Sediment Transport	**MEDIUM**	
(4) Stream Geomorphology	**MEDIUM**	
(2) Stream/Intertidal Zone Interaction	NA	
(2) Longitudinal Tidal Flow	NA	
(2) Tidal Marsh Stream Stability	NA	
(3) Tidal Marsh Channel Stability	NA	
(3) Tidal Marsh Stream Geomorphology	NA	
(1) Water Quality	**MEDIUM**	
(2) Baseflow	**HIGH**	
(2) Streamside Area Vegetation	**LOW**	
(3) Upland Pollutant Filtration	**LOW**	
(3) Thermoregulation	**MEDIUM**	
(2) Indicators of Stressors	**YES**	
(2) Aquatic Life Tolerance	**HIGH**	
(2) Intertidal Zone Filtration	NA	
(1) Habitat	**MEDIUM**	
(2) In-stream Habitat	**MEDIUM**	
(3) Baseflow	**HIGH**	
(3) Substrate	**MEDIUM**	
(3) Stream Stability	**LOW**	
(3) In-stream Habitat	**MEDIUM**	
(2) Stream-side Habitat	**MEDIUM**	
(3) Stream-side Habitat	**MEDIUM**	
(3) Thermoregulation	**MEDIUM**	
(2) Tidal Marsh In-stream Habitat	NA	
(3) Flow Restriction	NA	
(3) Tidal Marsh Stream Stability	NA	
(4) Tidal Marsh Channel Stability	NA	
(4) Tidal Marsh Stream Geomorphology	NA	
(3) Tidal Marsh In-stream Habitat	NA	
(2) Intertidal Zone	NA	
Overall	**MEDIUM**	

NC SAM FIELD ASSESSMENT RESULTS
Accompanies User Manual Version 2.1

USACE AID #: NCDWR #:

INSTRUCTIONS: Attach a sketch of the assessment area and photographs. Attach a copy of the USGS 7.5-minute topographic quadrangle, and circle the location of the stream reach under evaluation. If multiple stream reaches will be evaluated on the same property, identify and number all reaches on the attached map, and include a separate form for each reach. See the NC SAM User Manual for detailed descriptions and explanations of requested information. Record in the "Notes/Sketch" section if supplementary measurements were performed. See the NC SAM User Manual for examples of additional measurements that may be relevant.

NOTE EVIDENCE OF STRESSORS AFFECTING THE ASSESSMENT AREA (do not need to be within the assessment area).

PROJECT/SITE INFORMATION:

1. Project name (if any): R2707D
2. Date of evaluation: 3/4/2019
3. Applicant/owner name: NCDOT
4. Assessor name/organization: Melissa Ruiz/Stantec
5. County: Cleveland
6. Nearest named water body on USGS 7.5-minute quad: Buffalo Creek
7. River basin: Broad
8. Site coordinates (decimal degrees, at lower end of assessment reach): 35.286208, -81.480007

STREAM INFORMATION: (depth and width can be approximations)

9. Site number (show on attached map): 7-3 (Impact Site 4B)
10. Length of assessment reach evaluated (feet): 100
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 4 ☐Unable to assess channel depth.
12. Channel width at top of bank (feet): 8
13. Is assessment reach a swamp steam? ☐Yes ☐No
14. Feature type: ☐Perennial flow ☒Intermittent flow ☐Tidal Marsh Stream

STREAM CATEGORY INFORMATION:

15. NC SAM Zone: ☐ Mountains (M) ☒ Piedmont (P) ☐ Inner Coastal Plain (I) ☐ Outer Coastal Plain (O)
16. Estimated geomorphic valley shape (**skip for Tidal Marsh Stream**):
☒A (more sinuous stream, flatter valley slope)
☐B (less sinuous stream, steeper valley slope)
17. Watershed size: **(skip for Tidal Marsh Stream**) ☒Size 1 (< 0.1 mi^2) ☐Size 2 (0.1 to < 0.5 mi^2) ☐Size 3 (0.5 to < 5 mi^2) ☐Size 4 (≥ 5 mi^2)

ADDITIONAL INFORMATION:

18. Were regulatory considerations evaluated? ☐Yes ☐No If Yes, check all that apply to the assessment area.
☐Section 10 water ☐Classified Trout Waters ☐Water Supply Watershed (☐I ☐II ☐III ☐IV ☐V)
☐Essential Fish Habitat ☐Primary Nursery Area ☐ High Quality Waters/Outstanding Resource Waters
☐Publicly owned property ☐NCDWR Riparian buffer rule in effect ☐Nutrient Sensitive Waters
☐Anadromous fish ☐303(d) List ☐CAMA Area of Environmental Concern (AEC)
☐Documented presence of a federal and/or state listed protected species within the assessment area.
List species:
☐Designated Critical Habitat (list species)
19. Are additional stream information/supplementary measurements included in "Notes/Sketch" section or attached? ☐Yes ☒No

1. Channel Water – assessment reach metric (skip for Size 1 streams and Tidal Marsh Streams)

☒A Water throughout assessment reach.
☐B No flow, water in pools only.
☐C No water in assessment reach.

2. Evidence of Flow Restriction – assessment reach metric

☐A At least 10% of assessment reach in-stream habitat or riffle-pool sequence is severely affected by a flow restriction or fill to the point of obstructing flow or a channel choked with aquatic macrophytes or ponded water or impoundment on flood or ebb within the assessment reach (examples: undersized or perched culverts, causeways that constrict the channel, tidal gates, debris jams, beaver dams).
☒B Not A

3. Feature Pattern – assessment reach metric

☐A A majority of the assessment reach has altered pattern (examples: straightening, modification above or below culvert).
☒B Not A

4. Feature Longitudinal Profile – assessment reach metric

☒A Majority of assessment reach has a substantially altered stream profile (examples: channel down-cutting, existing damming, over widening, active aggradation, dredging, and excavation where appropriate channel profile has not reformed from any of these disturbances).
☐B Not A

5. Signs of Active Instability – assessment reach metric

Consider only current instability, not past events from which the stream has currently recovered. Examples of instability include active bank failure, active channel down-cutting (head-cut), active widening, and artificial hardening (such as concrete, gabion, rip-rap).

☐A < 10% of channel unstable
☐B 10 to 25% of channel unstable
☒C > 25% of channel unstable

6. Streamside Area Interaction – streamside area metric
Consider for the Left Bank (LB) and the Right Bank (RB).

LB	RB	
☐A	☐A	Little or no evidence of conditions that adversely affect reference interaction
☒B	☒B	Moderate evidence of conditions (examples: berms, levees, down-cutting, aggradation, dredging) that adversely affect reference interaction (examples: limited streamside area access, disruption of flood flows through streamside area, leaky or intermittent bulkheads, causeways with floodplain constriction, minor ditching [including mosquito ditching])
☐C	☐C	Extensive evidence of conditions that adversely affect reference interaction (little to no floodplain/intertidal zone access [examples: causeways with floodplain and channel constriction, bulkheads, retaining walls, fill, stream incision, disruption of flood flows through streamside area] or too much floodplain/intertidal zone access [examples: impoundments, intensive mosquito ditching]) or floodplain/intertidal zone unnaturally absent or assessment reach is a man-made feature on an interstream divide

7. Water Quality Stressors – assessment reach/intertidal zone metric
Check all that apply.

- ☐A Discolored water in stream or intertidal zone (milky white, blue, unnatural water discoloration, oil sheen, stream foam)
- ☐B Excessive sedimentation (burying of stream features or intertidal zone)
- ☐C Noticeable evidence of pollutant discharges entering the assessment reach and causing a water quality problem
- ☐D Odor (not including natural sulfide odors)
- ☐E Current published or collected data indicating degraded water quality in the assessment reach. Cite source in "Notes/Sketch" section.
- ☐F Livestock with access to stream or intertidal zone
- ☐G Excessive algae in stream or intertidal zone
- ☐H Degraded marsh vegetation in the intertidal zone (removal, burning, regular mowing, destruction, etc)
- ☒I Other: _____ (explain in "Notes/Sketch" section)
- ☐J Little to no stressors

8. Recent Weather – watershed metric (skip for Tidal Marsh Streams)
For Size 1 or 2 streams, D1 drought or higher is considered a drought; for Size 3 or 4 streams, D2 drought or higher is considered a drought.

- ☐A Drought conditions and no rainfall or rainfall not exceeding 1 inch within the last 48 hours
- ☐B Drought conditions and rainfall exceeding 1 inch within the last 48 hours
- ☒C No drought conditions

9. Large or Dangerous Stream – assessment reach metric
☐Yes ☒No Is stream is too large or dangerous to assess? If Yes, skip to Metric 13 (Streamside Area Ground Surface Condition).

10. Natural In-stream Habitat Types – assessment reach metric
10a. ☐Yes ☐No Degraded in-stream habitat over majority of the assessment reach (examples of stressors include excessive sedimentation, mining, excavation, in-stream hardening [for example, rip-rap], recent dredging, and snagging) **(evaluate for Size 4 Coastal Plain streams only, then skip to Metric 12)**

10b. **Check all that occur** (occurs if > 5% coverage of assessment reach) **(skip for Size 4 Coastal Plain streams)**

- ☐A Multiple aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
- ☐B Multiple sticks and/or leaf packs and/or emergent vegetation
- ☐C Multiple snags and logs (including lap trees)
- ☒D 5% undercut banks and/or root mats and/or roots in banks extend to the normal wetted perimeter
- ☐E Little or no habitat

Check for Tidal Marsh Streams Only

- ☐F 5% oysters or other natural hard bottoms
- ☐G Submerged aquatic vegetation
- ☐H Low-tide refugia (pools)
- ☐I Sand bottom
- ☐J 5% vertical bank along the marsh
- ☐K Little or no habitat

**************************************REMAINING QUESTIONS ARE NOT APPLICABLE FOR TIDAL MARSH STREAMS*********************************

11. Bedform and Substrate – assessment reach metric (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)

11a. ☐Yes ☐No Is assessment reach in a natural sand-bed stream? **(skip for Coastal Plain streams)**

11b. Bedform evaluated. **Check the appropriate box(es).**

- ☒A Riffle-run section **(evaluate 11c)**
- ☒B Pool-glide section **(evaluate 11d)**
- ☐C Natural bedform absent **(skip to Metric 12, Aquatic Life)**

11c. In riffle sections, check all that occur below the normal wetted perimeter of the assessment reach – whether or not submerged. **Check at least one box in each row (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)**. Not Present (NP) = absent, Rare (R) = present but ≤ 10%, Common (C) = > 10-40%, Abundant (A) = > 40-70%, Predominant (P) = > 70%. Cumulative percentages should not exceed 100% for each assessment reach.

NP	R	C	A	P	
☒	☐	☐	☐	☐	Bedrock/saprolite
☒	☐	☐	☐	☐	Boulder (256 – 4096 mm)
☐	☐	☒	☐	☐	Cobble (64 – 256 mm)
☐	☐	☐	☒	☐	Gravel (2 – 64 mm)
☐	☐	☐	☒	☐	Sand (.062 – 2 mm)
☐	☒	☐	☐	☐	Silt/clay (< 0.062 mm)
☒	☐	☐	☐	☐	Detritus
☒	☐	☐	☐	☐	Artificial (rip-rap, concrete, etc.)

11d. ☐Yes ☒No Are pools filled with sediment? (**skip for Size 4 Coastal Plain streams and Tidal Marsh Streams**)

12. Aquatic Life – assessment reach metric (skip for Tidal Marsh Streams)

12a. ☒Yes ☐No Was an in-stream aquatic life assessment performed as described in the User Manual?
If No, select one of the following reasons and skip to Metric 13. ☐No Water ☐Other: _____

12b. ☒Yes ☐No Are aquatic organisms present in the assessment reach (look in riffles, pools, then snags)? If Yes, check all that apply. If No, skip to Metric 13.

1	>1	Numbers over columns refer to "individuals" for Size 1 and 2 streams and "taxa" for Size 3 and 4 streams.
☐	☐	Adult frogs
☐	☐	Aquatic reptiles
☐	☐	Aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
☐	☐	Beetles
☐	☒	Caddisfly larvae (T)
☐	☐	Asian clam (*Corbicula*)
☐	☐	Crustacean (isopod/amphipod/crayfish/shrimp)
☐	☐	Damselfly and dragonfly larvae
☐	☐	Dipterans
☒	☐	Mayfly larvae (E)
☐	☐	Megaloptera (alderfly, fishfly, dobsonfly larvae)
☐	☐	Midges/mosquito larvae
☐	☐	Mosquito fish (*Gambusia*) or mud minnows (*Umbra pygmaea*)
☐	☐	Mussels/Clams (not *Corbicula*)
☐	☐	Other fish
☐	☐	Salamanders/tadpoles
☐	☐	Snails
☐	☐	Stonefly larvae (P)
☐	☐	Tipulid larvae
☐	☐	Worms/leeches

13. Streamside Area Ground Surface Condition – streamside area metric (skip for Tidal Marsh Streams and B valley types)
Consider for the Left Bank (LB) and the Right Bank (RB). Consider storage capacity with regard to both overbank flow and upland runoff.

LB	RB	
☒A	☒A	Little or no alteration to water storage capacity over a majority of the streamside area
☐B	☐B	Moderate alteration to water storage capacity over a majority of the streamside area
☐C	☐C	Severe alteration to water storage capacity over a majority of the streamside area (examples: ditches, fill, soil compaction, livestock disturbance, buildings, man-made levees, drainage pipes)

14. Streamside Area Water Storage – streamside area metric (skip for Size 1 streams, Tidal Marsh Streams, and B valley types)
Consider for the Left Bank (LB) and the Right Bank (RB) of the streamside area.

LB	RB	
☐A	☐A	Majority of streamside area with depressions able to pond water ≥ 6 inches deep
☐B	☐B	Majority of streamside area with depressions able to pond water 3 to 6 inches deep
☒C	☒C	Majority of streamside area with depressions able to pond water < 3 inches deep

15. Wetland Presence – streamside area metric (skip for Tidal Marsh Streams)
Consider for the Left Bank (LB) and the Right Bank (RB). Do not consider wetlands outside of the streamside area or within the normal wetted perimeter of assessment reach.

LB	RB	
☐Y	☐Y	Are wetlands present in the streamside area?
☒N	☒N	

16. Baseflow Contributors – assessment reach metric (skip for Size 4 streams and Tidal Marsh Streams)
Check all contributors within the assessment reach or within view of <u>and</u> draining to the assessment reach.

- ☐A Streams and/or springs (jurisdictional discharges)
- ☐B Ponds (include wet detention basins; do not include sediment basins or dry detention basins)
- ☐C Obstruction passing flow during low-flow periods within the assessment area (beaver dam, leaky dam, bottom-release dam, weir)
- ☐D Evidence of bank seepage or sweating (iron in water indicates seepage)
- ☒E Stream bed or bank soil reduced (dig through deposited sediment if present)
- ☐F None of the above

17. Baseflow Detractors – assessment area metric (skip for Tidal Marsh Streams)
Check all that apply.

- ☐A Evidence of substantial water withdrawals from the assessment reach (includes areas excavated for pump installation)
- ☐B Obstruction not passing flow during low-flow periods affecting the assessment reach (ex: watertight dam, sediment deposit)
- ☐C Urban stream (≥ 24% impervious surface for watershed)
- ☐D Evidence that the streamside area has been modified resulting in accelerated drainage into the assessment reach
- ☐E Assessment reach relocated to valley edge
- ☒F None of the above

18. Shading – assessment reach metric (skip for Tidal Marsh Streams)
Consider aspect. Consider "leaf-on" condition.

- ☒A Stream shading is appropriate for stream category (may include gaps associated with natural processes)
- ☐B Degraded (example: scattered trees)
- ☐C Stream shading is gone or largely absent

19. Buffer Width – streamside area metric (skip for Tidal Marsh Streams)

Consider "vegetated buffer" and "wooded buffer" separately for left bank (LB) and right bank (RB) starting at the top of bank out to the first break.

Vegetated		Wooded		
LB	RB	LB	RB	
☒A	☒A	☒A	☒A	≥ 100 feet wide or extends to the edge of the watershed
☐B	☐B	☐B	☐B	From 50 to < 100 feet wide
☐C	☐C	☐C	☐C	From 30 to < 50 feet wide
☐D	☐D	☐D	☐D	From 10 to < 30 feet wide
☐E	☐E	☐E	☐E	< 10 feet wide or no trees

20. Buffer Structure – streamside area metric (skip for Tidal Marsh Streams)

Consider for left bank (LB) and right bank (RB) for Metric 19 ("Vegetated" Buffer Width).

LB	RB	
☐A	☐A	Mature forest
☒B	☒B	Non-mature woody vegetation or modified vegetation structure
☐C	☐C	Herbaceous vegetation with or without a strip of trees < 10 feet wide
☐D	☐D	Maintained shrubs
☐E	☐E	Little or no vegetation

21. Buffer Stressors – streamside area metric (skip for Tidal Marsh Streams)

Check all appropriate boxes for left bank (LB) and right bank (RB). Indicate if listed stressor abuts stream (Abuts), does not abut but is within 30 feet of stream (< 30 feet), or is between 30 to 50 feet of stream (30-50 feet).

If none of the following stressors occurs on either bank, check here and skip to Metric 22: ☒

Abuts		< 30 feet		30-50 feet		
LB	RB	LB	RB	LB	RB	
☐A	☐A	☐A	☐A	☐A	☐A	Row crops
☐B	☐B	☐B	☐B	☐B	☐B	Maintained turf
☐C	☐C	☐C	☐C	☐C	☐C	Pasture (no livestock)/commercial horticulture
☐D	☐D	☐D	☐D	☐D	☐D	Pasture (active livestock use)

22. Stem Density – streamside area metric (skip for Tidal Marsh Streams)

Consider for left bank (LB) and right bank (RB) for Metric 19 ("Wooded" Buffer Width).

LB	RB	
☒A	☒A	Medium to high stem density
☐B	☐B	Low stem density
☐C	☐C	No wooded riparian buffer or predominantly herbaceous species or bare ground

23. Continuity of Vegetated Buffer – streamside area metric (skip for Tidal Marsh Streams)

Consider whether vegetated buffer is continuous along stream (parallel). Breaks are areas lacking vegetation > 10 feet wide.

LB	RB	
☒A	☒A	The total length of buffer breaks is < 25 percent.
☐B	☐B	The total length of buffer breaks is between 25 and 50 percent.
☐C	☐C	The total length of buffer breaks is > 50 percent.

24. Vegetative Composition – streamside area metric (skip for Tidal Marsh Streams)

Evaluate the dominant vegetation within 100 feet of each bank or to the edge of the watershed (whichever comes first) as it contributes to assessment reach habitat.

LB	RB	
☐A	☐A	Vegetation is close to undisturbed in species present and their proportions. Lower strata composed of native species, with non-native invasive species absent or sparse.
☒B	☒B	Vegetation indicates disturbance in terms of species diversity or proportions, but is still largely composed of native species. This may include communities of weedy native species that develop after clear-cutting or clearing or communities with non-native invasive species present, but not dominant, over a large portion of the expected strata or communities missing understory but retaining canopy trees.
☐C	☐C	Vegetation is severely disturbed in terms of species diversity or proportions. Mature canopy is absent or communities with non-native invasive species dominant over a large portion of expected strata or communities composed of planted stands of non-characteristic species or communities inappropriately composed of a single species or no vegetation.

25. Conductivity – assessment reach metric (skip for all Coastal Plain streams)

25a. ☐Yes ☒No Was conductivity measurement recorded?
If No, select one of the following reasons. ☐No Water ☐Other: _____

25b. Check the box corresponding to the conductivity measurement (units of microsiemens per centimeter).
☐A < 46 ☐B 46 to < 67 ☐C 67 to < 79 ☐D 79 to < 230 ☐E ≥ 230

Notes/Sketch:

Draft NC SAM Stream Rating Sheet
Accompanies User Manual Version 2.1

Stream Site Name	R2707D 7-3 (Impact Site 4B)	Date of Assessment	3/4/2019
Stream Category	Pa1	Assessor Name/Organization	Melissa Ruiz/Stantec

Notes of Field Assessment Form (Y/N)	NO
Presence of regulatory considerations (Y/N)	NO
Additional stream information/supplementary measurements included (Y/N)	NO
NC SAM feature type (perennial, intermittent, Tidal Marsh Stream)	Intermittent

Function Class Rating Summary	USACE/ All Streams	NCDWR Intermittent
(1) Hydrology	**MEDIUM**	**MEDIUM**
(2) Baseflow	**HIGH**	**HIGH**
(2) Flood Flow	**MEDIUM**	**MEDIUM**
(3) Streamside Area Attenuation	**HIGH**	**HIGH**
(4) Floodplain Access	**MEDIUM**	**MEDIUM**
(4) Wooded Riparian Buffer	**HIGH**	**HIGH**
(4) Microtopography	**HIGH**	**HIGH**
(3) Stream Stability	**LOW**	**LOW**
(4) Channel Stability	**LOW**	**LOW**
(4) Sediment Transport	**MEDIUM**	**MEDIUM**
(4) Stream Geomorphology	**MEDIUM**	**MEDIUM**
(2) Stream/Intertidal Zone Interaction	NA	NA
(2) Longitudinal Tidal Flow	NA	NA
(2) Tidal Marsh Stream Stability	NA	NA
(3) Tidal Marsh Channel Stability	NA	NA
(3) Tidal Marsh Stream Geomorphology	NA	NA
(1) Water Quality	**MEDIUM**	**MEDIUM**
(2) Baseflow	**HIGH**	**HIGH**
(2) Streamside Area Vegetation	**HIGH**	**HIGH**
(3) Upland Pollutant Filtration	**HIGH**	**HIGH**
(3) Thermoregulation	**HIGH**	**HIGH**
(2) Indicators of Stressors	**YES**	**YES**
(2) Aquatic Life Tolerance	**HIGH**	**NA**
(2) Intertidal Zone Filtration	NA	NA
(1) Habitat	**LOW**	**HIGH**
(2) In-stream Habitat	**LOW**	**MEDIUM**
(3) Baseflow	**HIGH**	**HIGH**
(3) Substrate	**MEDIUM**	**MEDIUM**
(3) Stream Stability	**LOW**	**LOW**
(3) In-stream Habitat	**LOW**	**HIGH**
(2) Stream-side Habitat	**HIGH**	**HIGH**
(3) Stream-side Habitat	**HIGH**	**HIGH**
(3) Thermoregulation	**HIGH**	**HIGH**
(2) Tidal Marsh In-stream Habitat	NA	NA
(3) Flow Restriction	NA	NA
(3) Tidal Marsh Stream Stability	NA	NA
(4) Tidal Marsh Channel Stability	NA	NA
(4) Tidal Marsh Stream Geomorphology	NA	NA
(3) Tidal Marsh In-stream Habitat	NA	NA
(2) Intertidal Zone	NA	NA
Overall	**MEDIUM**	**MEDIUM**

NC SAM FIELD ASSESSMENT RESULTS
Accompanies User Manual Version 2.1

USACE AID #: NCDWR #:

INSTRUCTIONS: Attach a sketch of the assessment area and photographs. Attach a copy of the USGS 7.5-minute topographic quadrangle, and circle the location of the stream reach under evaluation. If multiple stream reaches will be evaluated on the same property, identify and number all reaches on the attached map, and include a separate form for each reach. See the NC SAM User Manual for detailed descriptions and explanations of requested information. Record in the "Notes/Sketch" section if supplementary measurements were performed. See the NC SAM User Manual for examples of additional measurements that may be relevant.

NOTE EVIDENCE OF STRESSORS AFFECTING THE ASSESSMENT AREA (do not need to be within the assessment area).

PROJECT/SITE INFORMATION:

1. Project name (if any): R2707D
2. Date of evaluation: 11/10/2017
3. Applicant/owner name: NCDOT
4. Assessor name/organization: Melissa Ruiz, Alex Baldwin, Stantec
5. County: Cleveland
6. Nearest named water body on USGS 7.5-minute quad: Kings Mountain Reservoir
7. River basin: Broad
8. Site coordinates (decimal degrees, at lower end of assessment reach): 35.284027, -81.47944

STREAM INFORMATION: (depth and width can be approximations)

9. Site number (show on attached map): 7-1 (Impact Site 5A)
10. Length of assessment reach evaluated (feet): 100
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 4 ☐Unable to assess channel depth.
12. Channel width at top of bank (feet): 8
13. Is assessment reach a swamp steam? ☐Yes ☐No
14. Feature type: ☒Perennial flow ☐Intermittent flow ☐Tidal Marsh Stream

STREAM CATEGORY INFORMATION:

15. NC SAM Zone: ☐ Mountains (M) ☒ Piedmont (P) ☐ Inner Coastal Plain (I) ☐ Outer Coastal Plain (O)
16. Estimated geomorphic valley shape (**skip for Tidal Marsh Stream**):
☒A (more sinuous stream, flatter valley slope)
☐B (less sinuous stream, steeper valley slope)
17. Watershed size: **(skip for Tidal Marsh Stream**) ☐Size 1 (< 0.1 mi^2) ☒Size 2 (0.1 to < 0.5 mi^2) ☐Size 3 (0.5 to < 5 mi^2) ☐Size 4 (≥ 5 mi^2)

ADDITIONAL INFORMATION:

18. Were regulatory considerations evaluated? ☒Yes ☐No If Yes, check all that apply to the assessment area.
☐Section 10 water ☐Classified Trout Waters ☐Water Supply Watershed (☐I ☐II ☐III ☐IV ☐V)
☐Essential Fish Habitat ☐Primary Nursery Area ☐ High Quality Waters/Outstanding Resource Waters
☐Publicly owned property ☐NCDWR Riparian buffer rule in effect ☐Nutrient Sensitive Waters
☐Anadromous fish ☐303(d) List ☐CAMA Area of Environmental Concern (AEC)
☐Documented presence of a federal and/or state listed protected species within the assessment area.
List species:
☐Designated Critical Habitat (list species)
19. Are additional stream information/supplementary measurements included in "Notes/Sketch" section or attached? ☐Yes ☐No

1. Channel Water – assessment reach metric (skip for Size 1 streams and Tidal Marsh Streams)
☒A Water throughout assessment reach.
☐B No flow, water in pools only.
☐C No water in assessment reach.

2. Evidence of Flow Restriction – assessment reach metric
☐A At least 10% of assessment reach in-stream habitat or riffle-pool sequence is severely affected by a flow restriction or fill to the point of obstructing flow or a channel choked with aquatic macrophytes or ponded water or impoundment on flood or ebb within the assessment reach (examples: undersized or perched culverts, causeways that constrict the channel, tidal gates, debris jams, beaver dams).
☒B Not A

3. Feature Pattern – assessment reach metric
☐A A majority of the assessment reach has altered pattern (examples: straightening, modification above or below culvert).
☒B Not A

4. Feature Longitudinal Profile – assessment reach metric
☒A Majority of assessment reach has a substantially altered stream profile (examples: channel down-cutting, existing damming, over widening, active aggradation, dredging, and excavation where appropriate channel profile has not reformed from any of these disturbances).
☐B Not A

5. Signs of Active Instability – assessment reach metric
Consider only current instability, not past events from which the stream has currently recovered. Examples of instability include active bank failure, active channel down-cutting (head-cut), active widening, and artificial hardening (such as concrete, gabion, rip-rap).
☐A < 10% of channel unstable
☐B 10 to 25% of channel unstable
☒C > 25% of channel unstable

6. Streamside Area Interaction – streamside area metric
Consider for the Left Bank (LB) and the Right Bank (RB).

LB	RB	
☐A	☐A	Little or no evidence of conditions that adversely affect reference interaction
☒B	☒B	Moderate evidence of conditions (examples: berms, levees, down-cutting, aggradation, dredging) that adversely affect reference interaction (examples: limited streamside area access, disruption of flood flows through streamside area, leaky or intermittent bulkheads, causeways with floodplain constriction, minor ditching [including mosquito ditching])
☐C	☐C	Extensive evidence of conditions that adversely affect reference interaction (little to no floodplain/intertidal zone access [examples: causeways with floodplain and channel constriction, bulkheads, retaining walls, fill, stream incision, disruption of flood flows through streamside area] or too much floodplain/intertidal zone access [examples: impoundments, intensive mosquito ditching]) or floodplain/intertidal zone unnaturally absent or assessment reach is a man-made feature on an interstream divide

7. Water Quality Stressors – assessment reach/intertidal zone metric
Check all that apply.

- ☐A Discolored water in stream or intertidal zone (milky white, blue, unnatural water discoloration, oil sheen, stream foam)
- ☐B Excessive sedimentation (burying of stream features or intertidal zone)
- ☐C Noticeable evidence of pollutant discharges entering the assessment reach and causing a water quality problem
- ☐D Odor (not including natural sulfide odors)
- ☐E Current published or collected data indicating degraded water quality in the assessment reach. Cite source in "Notes/Sketch" section.
- ☐F Livestock with access to stream or intertidal zone
- ☐G Excessive algae in stream or intertidal zone
- ☐H Degraded marsh vegetation in the intertidal zone (removal, burning, regular mowing, destruction, etc)
- ☐I Other: _____ (explain in "Notes/Sketch" section)
- ☒J Little to no stressors

8. Recent Weather – watershed metric (skip for Tidal Marsh Streams)
For Size 1 or 2 streams, D1 drought or higher is considered a drought; for Size 3 or 4 streams, D2 drought or higher is considered a drought.

- ☐A Drought conditions and no rainfall or rainfall not exceeding 1 inch within the last 48 hours
- ☐B Drought conditions and rainfall exceeding 1 inch within the last 48 hours
- ☒C No drought conditions

9. Large or Dangerous Stream – assessment reach metric
☐Yes ☒No Is stream is too large or dangerous to assess? If Yes, skip to Metric 13 (Streamside Area Ground Surface Condition).

10. Natural In-stream Habitat Types – assessment reach metric
10a. ☐Yes ☒No Degraded in-stream habitat over majority of the assessment reach (examples of stressors include excessive sedimentation, mining, excavation, in-stream hardening [for example, rip-rap], recent dredging, and snagging) **(evaluate for Size 4 Coastal Plain streams only, then skip to Metric 12)**

10b. **Check all that occur** (occurs if > 5% coverage of assessment reach) **(skip for Size 4 Coastal Plain streams)**

- ☐A Multiple aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
- ☐B Multiple sticks and/or leaf packs and/or emergent vegetation
- ☒C Multiple snags and logs (including lap trees)
- ☐D 5% undercut banks and/or root mats and/or roots in banks extend to the normal wetted perimeter
- ☐E Little or no habitat

Check for Tidal Marsh Streams Only

- ☐F 5% oysters or other natural hard bottoms
- ☐G Submerged aquatic vegetation
- ☐H Low-tide refugia (pools)
- ☐I Sand bottom
- ☐J 5% vertical bank along the marsh
- ☐K Little or no habitat

**************************************REMAINING QUESTIONS ARE NOT APPLICABLE FOR TIDAL MARSH STREAMS*********************************

11. Bedform and Substrate – assessment reach metric (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)

11a. ☐Yes ☒No Is assessment reach in a natural sand-bed stream? **(skip for Coastal Plain streams)**

11b. Bedform evaluated. **Check the appropriate box(es).**

- ☒A Riffle-run section **(evaluate 11c)**
- ☒B Pool-glide section **(evaluate 11d)**
- ☐C Natural bedform absent **(skip to Metric 12, Aquatic Life)**

11c. In riffle sections, check all that occur below the normal wetted perimeter of the assessment reach – whether or not submerged. **Check at least one box in each row (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)**. Not Present (NP) = absent, Rare (R) = present but ≤ 10%, Common (C) = > 10-40%, Abundant (A) = > 40-70%, Predominant (P) = > 70%. Cumulative percentages should not exceed 100% for each assessment reach.

NP	R	C	A	P	
☐	☒	☐	☐	☐	Bedrock/saprolite
☐	☐	☒	☐	☐	Boulder (256 – 4096 mm)
☐	☐	☐	☒	☐	Cobble (64 – 256 mm)
☐	☐	☒	☐	☐	Gravel (2 – 64 mm)
☐	☐	☒	☐	☐	Sand (.062 – 2 mm)
☒	☐	☐	☐	☐	Silt/clay (< 0.062 mm)
☒	☐	☐	☐	☐	Detritus
☒	☐	☐	☐	☐	Artificial (rip-rap, concrete, etc.)

11d. ☐Yes ☒No Are pools filled with sediment? (**skip for Size 4 Coastal Plain streams and Tidal Marsh Streams**)

12. Aquatic Life – assessment reach metric (skip for Tidal Marsh Streams)

12a. ☒Yes ☐No Was an in-stream aquatic life assessment performed as described in the User Manual?
If No, select one of the following reasons and skip to Metric 13. ☐No Water ☒Other: _____

12b. ☒Yes ☐No Are aquatic organisms present in the assessment reach (look in riffles, pools, then snags)? If Yes, check all that apply. If No, skip to Metric 13.

1	>1	Numbers over columns refer to "individuals" for Size 1 and 2 streams and "taxa" for Size 3 and 4 streams.
☐	☐	Adult frogs
☐	☐	Aquatic reptiles
☐	☐	Aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
☐	☐	Beetles
☒	☐	Caddisfly larvae (T)
☐	☐	Asian clam (*Corbicula*)
☐	☐	Crustacean (isopod/amphipod/crayfish/shrimp)
☐	☐	Damselfly and dragonfly larvae
☐	☐	Dipterans
☒	☐	Mayfly larvae (E)
☐	☐	Megaloptera (alderfly, fishfly, dobsonfly larvae)
☐	☐	Midges/mosquito larvae
☐	☐	Mosquito fish (*Gambusia*) or mud minnows (*Umbra pygmaea*)
☐	☐	Mussels/Clams (not *Corbicula*)
☒	☐	Other fish
☒	☐	Salamanders/tadpoles
☐	☐	Snails
☒	☐	Stonefly larvae (P)
☐	☐	Tipulid larvae
☐	☐	Worms/leeches

13. Streamside Area Ground Surface Condition – streamside area metric (skip for Tidal Marsh Streams and B valley types)
Consider for the Left Bank (LB) and the Right Bank (RB). Consider storage capacity with regard to both overbank flow and upland runoff.

LB	RB	
☐A	☐A	Little or no alteration to water storage capacity over a majority of the streamside area
☒B	☐B	Moderate alteration to water storage capacity over a majority of the streamside area
☐C	☒C	Severe alteration to water storage capacity over a majority of the streamside area (examples: ditches, fill, soil compaction, livestock disturbance, buildings, man-made levees, drainage pipes)

14. Streamside Area Water Storage – streamside area metric (skip for Size 1 streams, Tidal Marsh Streams, and B valley types)
Consider for the Left Bank (LB) and the Right Bank (RB) of the streamside area.

LB	RB	
☐A	☐A	Majority of streamside area with depressions able to pond water ≥ 6 inches deep
☐B	☐B	Majority of streamside area with depressions able to pond water 3 to 6 inches deep
☒C	☒C	Majority of streamside area with depressions able to pond water < 3 inches deep

15. Wetland Presence – streamside area metric (skip for Tidal Marsh Streams)
Consider for the Left Bank (LB) and the Right Bank (RB). Do not consider wetlands outside of the streamside area or within the normal wetted perimeter of assessment reach.

LB	RB	
☐Y	☐Y	Are wetlands present in the streamside area?
☒N	☒N	

16. Baseflow Contributors – assessment reach metric (skip for Size 4 streams and Tidal Marsh Streams)
Check all contributors within the assessment reach or within view of <u>and</u> draining to the assessment reach.

- ☐A Streams and/or springs (jurisdictional discharges)
- ☐B Ponds (include wet detention basins; do not include sediment basins or dry detention basins)
- ☐C Obstruction passing flow during low-flow periods within the assessment area (beaver dam, leaky dam, bottom-release dam, weir)
- ☐D Evidence of bank seepage or sweating (iron in water indicates seepage)
- ☒E Stream bed or bank soil reduced (dig through deposited sediment if present)
- ☐F None of the above

17. Baseflow Detractors – assessment area metric (skip for Tidal Marsh Streams)
Check all that apply.

- ☐A Evidence of substantial water withdrawals from the assessment reach (includes areas excavated for pump installation)
- ☐B Obstruction not passing flow during low-flow periods affecting the assessment reach (ex: watertight dam, sediment deposit)
- ☐C Urban stream (≥ 24% impervious surface for watershed)
- ☒D Evidence that the streamside area has been modified resulting in accelerated drainage into the assessment reach
- ☐E Assessment reach relocated to valley edge
- ☐F None of the above

18. Shading – assessment reach metric (skip for Tidal Marsh Streams)
Consider aspect. Consider "leaf-on" condition.

- ☒A Stream shading is appropriate for stream category (may include gaps associated with natural processes)
- ☐B Degraded (example: scattered trees)
- ☐C Stream shading is gone or largely absent

19. Buffer Width – streamside area metric (skip for Tidal Marsh Streams)
Consider "vegetated buffer" and "wooded buffer" separately for left bank (LB) and right bank (RB) starting at the top of bank out to the first break.

Vegetated		Wooded		
LB	RB	LB	RB	
☒A	☐A	☒A	☐A	≥ 100 feet wide or extends to the edge of the watershed
☐B	☒B	☐B	☒B	From 50 to < 100 feet wide
☐C	☐C	☐C	☐C	From 30 to < 50 feet wide
☐D	☐D	☐D	☐D	From 10 to < 30 feet wide
☐E	☐E	☐E	☐E	< 10 feet wide or no trees

20. Buffer Structure – streamside area metric (skip for Tidal Marsh Streams)
Consider for left bank (LB) and right bank (RB) for Metric 19 ("Vegetated" Buffer Width).

LB	RB	
☐A	☐A	Mature forest
☒B	☒B	Non-mature woody vegetation or modified vegetation structure
☐C	☐C	Herbaceous vegetation with or without a strip of trees < 10 feet wide
☐D	☐D	Maintained shrubs
☐E	☐E	Little or no vegetation

21. Buffer Stressors – streamside area metric (skip for Tidal Marsh Streams)
Check all appropriate boxes for left bank (LB) and right bank (RB). Indicate if listed stressor abuts stream (Abuts), does not abut but is within 30 feet of stream (< 30 feet), or is between 30 to 50 feet of stream (30-50 feet).
If none of the following stressors occurs on either bank, check here and skip to Metric 22: ☒

Abuts		< 30 feet		30-50 feet		
LB	RB	LB	RB	LB	RB	
☐A	☐A	☐A	☐A	☐A	☐A	Row crops
☐B	☐B	☐B	☐B	☐B	☐B	Maintained turf
☐C	☐C	☐C	☐C	☐C	☐C	Pasture (no livestock)/commercial horticulture
☐D	☐D	☐D	☐D	☐D	☐D	Pasture (active livestock use)

22. Stem Density – streamside area metric (skip for Tidal Marsh Streams)
Consider for left bank (LB) and right bank (RB) for Metric 19 ("Wooded" Buffer Width).

LB	RB	
☒A	☒A	Medium to high stem density
☐B	☐B	Low stem density
☐C	☐C	No wooded riparian buffer or predominantly herbaceous species or bare ground

23. Continuity of Vegetated Buffer – streamside area metric (skip for Tidal Marsh Streams)
Consider whether vegetated buffer is continuous along stream (parallel). Breaks are areas lacking vegetation > 10 feet wide.

LB	RB	
☒A	☒A	The total length of buffer breaks is < 25 percent.
☐B	☐B	The total length of buffer breaks is between 25 and 50 percent.
☐C	☐C	The total length of buffer breaks is > 50 percent.

24. Vegetative Composition – streamside area metric (skip for Tidal Marsh Streams)
Evaluate the dominant vegetation within 100 feet of each bank or to the edge of the watershed (whichever comes first) as it contributes to assessment reach habitat.

LB	RB	
☐A	☐A	Vegetation is close to undisturbed in species present and their proportions. Lower strata composed of native species, with non-native invasive species absent or sparse.
☒B	☒B	Vegetation indicates disturbance in terms of species diversity or proportions, but is still largely composed of native species. This may include communities of weedy native species that develop after clear-cutting or clearing or communities with non-native invasive species present, but not dominant, over a large portion of the expected strata or communities missing understory but retaining canopy trees.
☐C	☐C	Vegetation is severely disturbed in terms of species diversity or proportions. Mature canopy is absent or communities with non-native invasive species dominant over a large portion of expected strata or communities composed of planted stands of non-characteristic species or communities inappropriately composed of a single species or no vegetation.

25. Conductivity – assessment reach metric (skip for all Coastal Plain streams)
25a. ☐Yes ☒No Was conductivity measurement recorded?
If No, select one of the following reasons. ☒No Water ☐Other: _____

25b. Check the box corresponding to the conductivity measurement (units of microsiemens per centimeter).
☐A < 46 ☐B 46 to < 67 ☐C 67 to < 79 ☐D 79 to < 230 ☐E ≥ 230

Notes/Sketch:

Draft NC SAM Stream Rating Sheet
Accompanies User Manual Version 2.1

Stream Site Name	R2707D 7-1 (Impact Site 5A)	Date of Assessment	11/10/2017
Stream Category	Pa2	Assessor Name/Organization	Melissa Ruiz, Alex Baldwin, Stantec

Notes of Field Assessment Form (Y/N)	NO
Presence of regulatory considerations (Y/N)	NO
Additional stream information/supplementary measurements included (Y/N)	
NC SAM feature type (perennial, intermittent, Tidal Marsh Stream)	Perennial

Function Class Rating Summary	USACE/ All Streams	NCDWR Intermittent
(1) Hydrology	**MEDIUM**	
(2) Baseflow	**HIGH**	
(2) Flood Flow	**MEDIUM**	
(3) Streamside Area Attenuation	**MEDIUM**	
(4) Floodplain Access	**MEDIUM**	
(4) Wooded Riparian Buffer	**HIGH**	
(4) Microtopography	**LOW**	
(3) Stream Stability	**MEDIUM**	
(4) Channel Stability	**LOW**	
(4) Sediment Transport	**HIGH**	
(4) Stream Geomorphology	**MEDIUM**	
(2) Stream/Intertidal Zone Interaction	NA	
(2) Longitudinal Tidal Flow	NA	
(2) Tidal Marsh Stream Stability	NA	
(3) Tidal Marsh Channel Stability	NA	
(3) Tidal Marsh Stream Geomorphology	NA	
(1) Water Quality	**HIGH**	
(2) Baseflow	**HIGH**	
(2) Streamside Area Vegetation	**HIGH**	
(3) Upland Pollutant Filtration	**HIGH**	
(3) Thermoregulation	**HIGH**	
(2) Indicators of Stressors	**NO**	
(2) Aquatic Life Tolerance	**HIGH**	
(2) Intertidal Zone Filtration	NA	
(1) Habitat	**HIGH**	
(2) In-stream Habitat	**HIGH**	
(3) Baseflow	**HIGH**	
(3) Substrate	**HIGH**	
(3) Stream Stability	**LOW**	
(3) In-stream Habitat	**HIGH**	
(2) Stream-side Habitat	**HIGH**	
(3) Stream-side Habitat	**HIGH**	
(3) Thermoregulation	**HIGH**	
(2) Tidal Marsh In-stream Habitat	NA	
(3) Flow Restriction	NA	
(3) Tidal Marsh Stream Stability	NA	
(4) Tidal Marsh Channel Stability	NA	
(4) Tidal Marsh Stream Geomorphology	NA	
(3) Tidal Marsh In-stream Habitat	NA	
(2) Intertidal Zone	NA	
Overall	**HIGH**	

NC SAM FIELD ASSESSMENT RESULTS
Accompanies User Manual Version 2.1

USACE AID #: NCDWR #:

INSTRUCTIONS: Attach a sketch of the assessment area and photographs. Attach a copy of the USGS 7.5-minute topographic quadrangle, and circle the location of the stream reach under evaluation. If multiple stream reaches will be evaluated on the same property, identify and number all reaches on the attached map, and include a separate form for each reach. See the NC SAM User Manual for detailed descriptions and explanations of requested information. Record in the "Notes/Sketch" section if supplementary measurements were performed. See the NC SAM User Manual for examples of additional measurements that may be relevant.

NOTE EVIDENCE OF STRESSORS AFFECTING THE ASSESSMENT AREA (do not need to be within the assessment area).

PROJECT/SITE INFORMATION:

1. Project name (if any): R2707D
2. Date of evaluation: 3/4/2019
3. Applicant/owner name: NCDOT
4. Assessor name/organization: Melissa Ruiz/Stantec
5. County: Cleveland
6. Nearest named water body on USGS 7.5-minute quad: Buffalo Creek
7. River basin: Broad
8. Site coordinates (decimal degrees, at lower end of assessment reach): 35.28539, -81.478568

STREAM INFORMATION: (depth and width can be approximations)

9. Site number (show on attached map): 7-4 (Impact Site 5B)
10. Length of assessment reach evaluated (feet): 100
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 4 ☐Unable to assess channel depth.
12. Channel width at top of bank (feet): 8
13. Is assessment reach a swamp steam? ☐Yes ☐No
14. Feature type: ☐Perennial flow ☒Intermittent flow ☐Tidal Marsh Stream

STREAM CATEGORY INFORMATION:

15. NC SAM Zone: ☐ Mountains (M) ☒ Piedmont (P) ☐ Inner Coastal Plain (I) ☐ Outer Coastal Plain (O)
16. Estimated geomorphic valley shape (**skip for Tidal Marsh Stream**):
☒A (more sinuous stream, flatter valley slope)
☐B (less sinuous stream, steeper valley slope)
17. Watershed size: **(skip for Tidal Marsh Stream**) ☒Size 1 (< 0.1 mi^2) ☐Size 2 (0.1 to < 0.5 mi^2) ☐Size 3 (0.5 to < 5 mi^2) ☐Size 4 (≥ 5 mi^2)

ADDITIONAL INFORMATION:

18. Were regulatory considerations evaluated? ☒Yes ☐No If Yes, check all that apply to the assessment area.
☐Section 10 water ☐Classified Trout Waters ☐Water Supply Watershed (☐I ☐II ☐III ☐IV ☐V)
☐Essential Fish Habitat ☐Primary Nursery Area ☐ High Quality Waters/Outstanding Resource Waters
☐Publicly owned property ☐NCDWR Riparian buffer rule in effect ☐Nutrient Sensitive Waters
☐Anadromous fish ☐303(d) List ☐CAMA Area of Environmental Concern (AEC)
☐Documented presence of a federal and/or state listed protected species within the assessment area.
List species:
☐Designated Critical Habitat (list species)
19. Are additional stream information/supplementary measurements included in "Notes/Sketch" section or attached? ☐Yes ☒No

1. Channel Water – assessment reach metric (skip for Size 1 streams and Tidal Marsh Streams)
☒A Water throughout assessment reach.
☐B No flow, water in pools only.
☐C No water in assessment reach.

2. Evidence of Flow Restriction – assessment reach metric
☐A At least 10% of assessment reach in-stream habitat or riffle-pool sequence is severely affected by a flow restriction or fill to the point of obstructing flow or a channel choked with aquatic macrophytes or ponded water or impoundment on flood or ebb within the assessment reach (examples: undersized or perched culverts, causeways that constrict the channel, tidal gates, debris jams, beaver dams).
☒B Not A

3. Feature Pattern – assessment reach metric
☐A A majority of the assessment reach has altered pattern (examples: straightening, modification above or below culvert).
☒B Not A

4. Feature Longitudinal Profile – assessment reach metric
☒A Majority of assessment reach has a substantially altered stream profile (examples: channel down-cutting, existing damming, over widening, active aggradation, dredging, and excavation where appropriate channel profile has not reformed from any of these disturbances).
☐B Not A

5. Signs of Active Instability – assessment reach metric
Consider only current instability, not past events from which the stream has currently recovered. Examples of instability include active bank failure, active channel down-cutting (head-cut), active widening, and artificial hardening (such as concrete, gabion, rip-rap).
☐A < 10% of channel unstable
☒B 10 to 25% of channel unstable
☐C > 25% of channel unstable

6. Streamside Area Interaction – streamside area metric
Consider for the Left Bank (LB) and the Right Bank (RB).

LB	RB	
☐A	☐A	Little or no evidence of conditions that adversely affect reference interaction
☒B	☒B	Moderate evidence of conditions (examples: berms, levees, down-cutting, aggradation, dredging) that adversely affect reference interaction (examples: limited streamside area access, disruption of flood flows through streamside area, leaky or intermittent bulkheads, causeways with floodplain constriction, minor ditching [including mosquito ditching])
☐C	☐C	Extensive evidence of conditions that adversely affect reference interaction (little to no floodplain/intertidal zone access [examples: causeways with floodplain and channel constriction, bulkheads, retaining walls, fill, stream incision, disruption of flood flows through streamside area] or too much floodplain/intertidal zone access [examples: impoundments, intensive mosquito ditching]) or floodplain/intertidal zone unnaturally absent or assessment reach is a man-made feature on an interstream divide

7. Water Quality Stressors – assessment reach/intertidal zone metric
Check all that apply.

- ☐A Discolored water in stream or intertidal zone (milky white, blue, unnatural water discoloration, oil sheen, stream foam)
- ☒B Excessive sedimentation (burying of stream features or intertidal zone)
- ☐C Noticeable evidence of pollutant discharges entering the assessment reach and causing a water quality problem
- ☐D Odor (not including natural sulfide odors)
- ☐E Current published or collected data indicating degraded water quality in the assessment reach. Cite source in "Notes/Sketch" section.
- ☐F Livestock with access to stream or intertidal zone
- ☐G Excessive algae in stream or intertidal zone
- ☐H Degraded marsh vegetation in the intertidal zone (removal, burning, regular mowing, destruction, etc)
- ☐I Other: _____ (explain in "Notes/Sketch" section)
- ☐J Little to no stressors

8. Recent Weather – watershed metric (skip for Tidal Marsh Streams)
For Size 1 or 2 streams, D1 drought or higher is considered a drought; for Size 3 or 4 streams, D2 drought or higher is considered a drought.

- ☐A Drought conditions and no rainfall or rainfall not exceeding 1 inch within the last 48 hours
- ☐B Drought conditions and rainfall exceeding 1 inch within the last 48 hours
- ☒C No drought conditions

9. Large or Dangerous Stream – assessment reach metric
☐Yes ☒No Is stream is too large or dangerous to assess? If Yes, skip to Metric 13 (Streamside Area Ground Surface Condition).

10. Natural In-stream Habitat Types – assessment reach metric
10a. ☐Yes ☐No Degraded in-stream habitat over majority of the assessment reach (examples of stressors include excessive sedimentation, mining, excavation, in-stream hardening [for example, rip-rap], recent dredging, and snagging) **(evaluate for Size 4 Coastal Plain streams only, then skip to Metric 12)**

10b. **Check all that occur** (occurs if > 5% coverage of assessment reach) **(skip for Size 4 Coastal Plain streams)**

- ☐A Multiple aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
- ☒B Multiple sticks and/or leaf packs and/or emergent vegetation
- ☐C Multiple snags and logs (including lap trees)
- ☐D 5% undercut banks and/or root mats and/or roots in banks extend to the normal wetted perimeter
- ☐E Little or no habitat

Check for Tidal Marsh Streams Only

- ☐F 5% oysters or other natural hard bottoms
- ☐G Submerged aquatic vegetation
- ☐H Low-tide refugia (pools)
- ☐I Sand bottom
- ☐J 5% vertical bank along the marsh
- ☐K Little or no habitat

**************************************REMAINING QUESTIONS ARE NOT APPLICABLE FOR TIDAL MARSH STREAMS*********************************

11. Bedform and Substrate – assessment reach metric (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)

11a. ☐Yes ☒No Is assessment reach in a natural sand-bed stream? **(skip for Coastal Plain streams)**

11b. Bedform evaluated. **Check the appropriate box(es).**

- ☒A Riffle-run section **(evaluate 11c)**
- ☒B Pool-glide section **(evaluate 11d)**
- ☐C Natural bedform absent **(skip to Metric 12, Aquatic Life)**

11c. In riffle sections, check all that occur below the normal wetted perimeter of the assessment reach – whether or not submerged. **Check at least one box in each row (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)**. Not Present (NP) = absent, Rare (R) = present but ≤ 10%, Common (C) = > 10-40%, Abundant (A) = > 40-70%, Predominant (P) = > 70%. Cumulative percentages should not exceed 100% for each assessment reach.

NP	R	C	A	P	
☒	☐	☐	☐	☐	Bedrock/saprolite
☒	☐	☐	☐	☐	Boulder (256 – 4096 mm)
☐	☐	☒	☐	☐	Cobble (64 – 256 mm)
☐	☐	☐	☒	☐	Gravel (2 – 64 mm)
☐	☐	☐	☒	☐	Sand (.062 – 2 mm)
☒	☐	☐	☐	☐	Silt/clay (< 0.062 mm)
☒	☐	☐	☐	☐	Detritus
☒	☐	☐	☐	☐	Artificial (rip-rap, concrete, etc.)

11d. ☐Yes ☒No Are pools filled with sediment? (**skip for Size 4 Coastal Plain streams and Tidal Marsh Streams**)

12. Aquatic Life – assessment reach metric (skip for Tidal Marsh Streams)

12a. ☒Yes ☐No Was an in-stream aquatic life assessment performed as described in the User Manual?
If No, select one of the following reasons and skip to Metric 13. ☐No Water ☐Other: _____

12b. ☒Yes ☐No Are aquatic organisms present in the assessment reach (look in riffles, pools, then snags)? If Yes, check all that apply. If No, skip to Metric 13.

1	>1	Numbers over columns refer to "individuals" for Size 1 and 2 streams and "taxa" for Size 3 and 4 streams.
☐	☐	Adult frogs
☐	☐	Aquatic reptiles
☐	☐	Aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
☐	☐	Beetles
☐	☐	Caddisfly larvae (T)
☐	☐	Asian clam (*Corbicula*)
☐	☐	Crustacean (isopod/amphipod/crayfish/shrimp)
☐	☐	Damselfly and dragonfly larvae
☐	☐	Dipterans
☐	☐	Mayfly larvae (E)
☐	☐	Megaloptera (alderfly, fishfly, dobsonfly larvae)
☐	☐	Midges/mosquito larvae
☐	☐	Mosquito fish (*Gambusia*) or mud minnows (*Umbra pygmaea*)
☐	☐	Mussels/Clams (not *Corbicula*)
☐	☐	Other fish
☐	☐	Salamanders/tadpoles
☐	☐	Snails
☒	☐	Stonefly larvae (P)
☐	☐	Tipulid larvae
☐	☐	Worms/leeches

13. Streamside Area Ground Surface Condition – streamside area metric (skip for Tidal Marsh Streams and B valley types)
Consider for the Left Bank (LB) and the Right Bank (RB). Consider storage capacity with regard to both overbank flow and upland runoff.

LB	RB	
☐A	☐A	Little or no alteration to water storage capacity over a majority of the streamside area
☒B	☒B	Moderate alteration to water storage capacity over a majority of the streamside area
☐C	☐C	Severe alteration to water storage capacity over a majority of the streamside area (examples: ditches, fill, soil compaction, livestock disturbance, buildings, man-made levees, drainage pipes)

14. Streamside Area Water Storage – streamside area metric (skip for Size 1 streams, Tidal Marsh Streams, and B valley types)
Consider for the Left Bank (LB) and the Right Bank (RB) of the streamside area.

LB	RB	
☐A	☐A	Majority of streamside area with depressions able to pond water ≥ 6 inches deep
☐B	☐B	Majority of streamside area with depressions able to pond water 3 to 6 inches deep
☒C	☒C	Majority of streamside area with depressions able to pond water < 3 inches deep

15. Wetland Presence – streamside area metric (skip for Tidal Marsh Streams)
Consider for the Left Bank (LB) and the Right Bank (RB). Do not consider wetlands outside of the streamside area or within the normal wetted perimeter of assessment reach.

LB	RB	
☐Y	☐Y	Are wetlands present in the streamside area?
☒N	☒N	

16. Baseflow Contributors – assessment reach metric (skip for Size 4 streams and Tidal Marsh Streams)
Check all contributors within the assessment reach or within view of <u>and</u> draining to the assessment reach.

- ☐A Streams and/or springs (jurisdictional discharges)
- ☐B Ponds (include wet detention basins; do not include sediment basins or dry detention basins)
- ☐C Obstruction passing flow during low-flow periods within the assessment area (beaver dam, leaky dam, bottom-release dam, weir)
- ☐D Evidence of bank seepage or sweating (iron in water indicates seepage)
- ☒E Stream bed or bank soil reduced (dig through deposited sediment if present)
- ☐F None of the above

17. Baseflow Detractors – assessment area metric (skip for Tidal Marsh Streams)
Check all that apply.

- ☐A Evidence of substantial water withdrawals from the assessment reach (includes areas excavated for pump installation)
- ☐B Obstruction not passing flow during low-flow periods affecting the assessment reach (ex: watertight dam, sediment deposit)
- ☐C Urban stream (≥ 24% impervious surface for watershed)
- ☐D Evidence that the streamside area has been modified resulting in accelerated drainage into the assessment reach
- ☐E Assessment reach relocated to valley edge
- ☒F None of the above

18. Shading – assessment reach metric (skip for Tidal Marsh Streams)
Consider aspect. Consider "leaf-on" condition.

- ☒A Stream shading is appropriate for stream category (may include gaps associated with natural processes)
- ☐B Degraded (example: scattered trees)
- ☐C Stream shading is gone or largely absent

19. Buffer Width – streamside area metric (skip for Tidal Marsh Streams)

Consider "vegetated buffer" and "wooded buffer" separately for left bank (LB) and right bank (RB) starting at the top of bank out to the first break.

Vegetated		Wooded		
LB	RB	LB	RB	
☒A	☒A	☒A	☒A	≥ 100 feet wide or extends to the edge of the watershed
☐B	☐B	☐B	☐B	From 50 to < 100 feet wide
☐C	☐C	☐C	☐C	From 30 to < 50 feet wide
☐D	☐D	☐D	☐D	From 10 to < 30 feet wide
☐E	☐E	☐E	☐E	< 10 feet wide or no trees

20. Buffer Structure – streamside area metric (skip for Tidal Marsh Streams)

Consider for left bank (LB) and right bank (RB) for Metric 19 ("Vegetated" Buffer Width).

LB	RB	
☐A	☐A	Mature forest
☒B	☒B	Non-mature woody vegetation or modified vegetation structure
☐C	☐C	Herbaceous vegetation with or without a strip of trees < 10 feet wide
☐D	☐D	Maintained shrubs
☐E	☐E	Little or no vegetation

21. Buffer Stressors – streamside area metric (skip for Tidal Marsh Streams)

Check all appropriate boxes for left bank (LB) and right bank (RB). Indicate if listed stressor abuts stream (Abuts), does not abut but is within 30 feet of stream (< 30 feet), or is between 30 to 50 feet of stream (30-50 feet).

If none of the following stressors occurs on either bank, check here and skip to Metric 22: ☒

Abuts		< 30 feet		30-50 feet		
LB	RB	LB	RB	LB	RB	
☐A	☐A	☐A	☐A	☐A	☐A	Row crops
☐B	☐B	☐B	☐B	☐B	☐B	Maintained turf
☐C	☐C	☐C	☐C	☐C	☐C	Pasture (no livestock)/commercial horticulture
☐D	☐D	☐D	☐D	☐D	☐D	Pasture (active livestock use)

22. Stem Density – streamside area metric (skip for Tidal Marsh Streams)

Consider for left bank (LB) and right bank (RB) for Metric 19 ("Wooded" Buffer Width).

LB	RB	
☒A	☒A	Medium to high stem density
☐B	☐B	Low stem density
☐C	☐C	No wooded riparian buffer or predominantly herbaceous species or bare ground

23. Continuity of Vegetated Buffer – streamside area metric (skip for Tidal Marsh Streams)

Consider whether vegetated buffer is continuous along stream (parallel). Breaks are areas lacking vegetation > 10 feet wide.

LB	RB	
☒A	☒A	The total length of buffer breaks is < 25 percent.
☐B	☐B	The total length of buffer breaks is between 25 and 50 percent.
☐C	☐C	The total length of buffer breaks is > 50 percent.

24. Vegetative Composition – streamside area metric (skip for Tidal Marsh Streams)

Evaluate the dominant vegetation within 100 feet of each bank or to the edge of the watershed (whichever comes first) as it contributes to assessment reach habitat.

LB	RB	
☐A	☐A	Vegetation is close to undisturbed in species present and their proportions. Lower strata composed of native species, with non-native invasive species absent or sparse.
☒B	☒B	Vegetation indicates disturbance in terms of species diversity or proportions, but is still largely composed of native species. This may include communities of weedy native species that develop after clear-cutting or clearing or communities with non-native invasive species present, but not dominant, over a large portion of the expected strata or communities missing understory but retaining canopy trees.
☐C	☐C	Vegetation is severely disturbed in terms of species diversity or proportions. Mature canopy is absent or communities with non-native invasive species dominant over a large portion of expected strata or communities composed of planted stands of non-characteristic species or communities inappropriately composed of a single species or no vegetation.

25. Conductivity – assessment reach metric (skip for all Coastal Plain streams)

25a. ☐Yes ☒No Was conductivity measurement recorded?
If No, select one of the following reasons. ☐No Water ☐Other: _____

25b. Check the box corresponding to the conductivity measurement (units of microsiemens per centimeter).
☐A < 46 ☐B 46 to < 67 ☐C 67 to < 79 ☐D 79 to < 230 ☐E ≥ 230

Notes/Sketch:

Draft NC SAM Stream Rating Sheet
Accompanies User Manual Version 2.1

Stream Site Name	R2707D 7-4 (Impact Site 5B)	Date of Assessment	3/4/2019
Stream Category	Pa1	Assessor Name/Organization	Melissa Ruiz/Stantec

Notes of Field Assessment Form (Y/N)	NO
Presence of regulatory considerations (Y/N)	NO
Additional stream information/supplementary measurements included (Y/N)	NO
NC SAM feature type (perennial, intermittent, Tidal Marsh Stream)	Intermittent

Function Class Rating Summary	USACE/ All Streams	NCDWR Intermittent
(1) Hydrology	**HIGH**	**HIGH**
(2) Baseflow	**HIGH**	**HIGH**
(2) Flood Flow	**HIGH**	**HIGH**
(3) Streamside Area Attenuation	**HIGH**	**HIGH**
(4) Floodplain Access	**MEDIUM**	**MEDIUM**
(4) Wooded Riparian Buffer	**HIGH**	**HIGH**
(4) Microtopography	**MEDIUM**	**MEDIUM**
(3) Stream Stability	**MEDIUM**	**MEDIUM**
(4) Channel Stability	**MEDIUM**	**MEDIUM**
(4) Sediment Transport	**MEDIUM**	**MEDIUM**
(4) Stream Geomorphology	**MEDIUM**	**MEDIUM**
(2) Stream/Intertidal Zone Interaction	NA	NA
(2) Longitudinal Tidal Flow	NA	NA
(2) Tidal Marsh Stream Stability	NA	NA
(3) Tidal Marsh Channel Stability	NA	NA
(3) Tidal Marsh Stream Geomorphology	NA	NA
(1) Water Quality	**HIGH**	**HIGH**
(2) Baseflow	**HIGH**	**HIGH**
(2) Streamside Area Vegetation	**HIGH**	**HIGH**
(3) Upland Pollutant Filtration	**HIGH**	**HIGH**
(3) Thermoregulation	**HIGH**	**HIGH**
(2) Indicators of Stressors	**NO**	**NO**
(2) Aquatic Life Tolerance	**MEDIUM**	**NA**
(2) Intertidal Zone Filtration	NA	NA
(1) Habitat	**LOW**	**HIGH**
(2) In-stream Habitat	**LOW**	**HIGH**
(3) Baseflow	**HIGH**	**HIGH**
(3) Substrate	**MEDIUM**	**MEDIUM**
(3) Stream Stability	**MEDIUM**	**MEDIUM**
(3) In-stream Habitat	**LOW**	**HIGH**
(2) Stream-side Habitat	**HIGH**	**HIGH**
(3) Stream-side Habitat	**HIGH**	**HIGH**
(3) Thermoregulation	**HIGH**	**HIGH**
(2) Tidal Marsh In-stream Habitat	NA	NA
(3) Flow Restriction	NA	NA
(3) Tidal Marsh Stream Stability	NA	NA
(4) Tidal Marsh Channel Stability	NA	NA
(4) Tidal Marsh Stream Geomorphology	NA	NA
(3) Tidal Marsh In-stream Habitat	NA	NA
(2) Intertidal Zone	NA	NA
Overall	**HIGH**	**HIGH**

NC SAM FIELD ASSESSMENT RESULTS
Accompanies User Manual Version 2.1

USACE AID #: NCDWR #:

INSTRUCTIONS: Attach a sketch of the assessment area and photographs. Attach a copy of the USGS 7.5-minute topographic quadrangle, and circle the location of the stream reach under evaluation. If multiple stream reaches will be evaluated on the same property, identify and number all reaches on the attached map, and include a separate form for each reach. See the NC SAM User Manual for detailed descriptions and explanations of requested information. Record in the "Notes/Sketch" section if supplementary measurements were performed. See the NC SAM User Manual for examples of additional measurements that may be relevant.

NOTE EVIDENCE OF STRESSORS AFFECTING THE ASSESSMENT AREA (do not need to be within the assessment area).

PROJECT/SITE INFORMATION:

1. Project name (if any): R2707D
2. Date of evaluation: 11/10/2017
3. Applicant/owner name: NCDOT
4. Assessor name/organization: Melissa Ruiz, Alex Baldwin, Stantec
5. County: Cleveland
6. Nearest named water body on USGS 7.5-minute quad: Kings Mountain Reservoir
7. River basin: Broad
8. Site coordinates (decimal degrees, at lower end of assessment reach): 35.281757, -81.477606

STREAM INFORMATION: (depth and width can be approximations)

9. Site number (show on attached map): 7-1 (Impact Site 6A US)
10. Length of assessment reach evaluated (feet): 100
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 4 ☐Unable to assess channel depth.
12. Channel width at top of bank (feet): 8
13. Is assessment reach a swamp steam? ☐Yes ☐No
14. Feature type: ☒Perennial flow ☐Intermittent flow ☐Tidal Marsh Stream

STREAM CATEGORY INFORMATION:

15. NC SAM Zone: ☐ Mountains (M) ☒ Piedmont (P) ☐ Inner Coastal Plain (I) ☐ Outer Coastal Plain (O)
16. Estimated geomorphic valley shape (**skip for Tidal Marsh Stream**):
☒A (more sinuous stream, flatter valley slope)
☐B (less sinuous stream, steeper valley slope)
17. Watershed size: **(skip for Tidal Marsh Stream**) ☐Size 1 (< 0.1 mi^2) ☐Size 2 (0.1 to < 0.5 mi^2) ☒Size 3 (0.5 to < 5 mi^2) ☐Size 4 (≥ 5 mi^2)

ADDITIONAL INFORMATION:

18. Were regulatory considerations evaluated? ☒Yes ☐No If Yes, check all that apply to the assessment area.
☐Section 10 water ☐Classified Trout Waters ☐Water Supply Watershed (☐I ☐II ☐III ☐IV ☐V)
☐Essential Fish Habitat ☐Primary Nursery Area ☐ High Quality Waters/Outstanding Resource Waters
☐Publicly owned property ☐NCDWR Riparian buffer rule in effect ☐Nutrient Sensitive Waters
☐Anadromous fish ☐303(d) List ☐CAMA Area of Environmental Concern (AEC)
☐Documented presence of a federal and/or state listed protected species within the assessment area.
List species:
☐Designated Critical Habitat (list species)
19. Are additional stream information/supplementary measurements included in "Notes/Sketch" section or attached? ☐Yes ☐No

1. Channel Water – assessment reach metric (skip for Size 1 streams and Tidal Marsh Streams)
☒A Water throughout assessment reach.
☐B No flow, water in pools only.
☐C No water in assessment reach.

2. Evidence of Flow Restriction – assessment reach metric
☐A At least 10% of assessment reach in-stream habitat or riffle-pool sequence is severely affected by a flow restriction or fill to the point of obstructing flow or a channel choked with aquatic macrophytes or ponded water or impoundment on flood or ebb within the assessment reach (examples: undersized or perched culverts, causeways that constrict the channel, tidal gates, debris jams, beaver dams).
☒B Not A

3. Feature Pattern – assessment reach metric
☒A A majority of the assessment reach has altered pattern (examples: straightening, modification above or below culvert).
☐B Not A

4. Feature Longitudinal Profile – assessment reach metric
☒A Majority of assessment reach has a substantially altered stream profile (examples: channel down-cutting, existing damming, over widening, active aggradation, dredging, and excavation where appropriate channel profile has not reformed from any of these disturbances).
☐B Not A

5. Signs of Active Instability – assessment reach metric
Consider only current instability, not past events from which the stream has currently recovered. Examples of instability include active bank failure, active channel down-cutting (head-cut), active widening, and artificial hardening (such as concrete, gabion, rip-rap).
☐A < 10% of channel unstable
☐B 10 to 25% of channel unstable
☒C > 25% of channel unstable

6. Streamside Area Interaction – streamside area metric
Consider for the Left Bank (LB) and the Right Bank (RB).

LB	RB	
☐A	☐A	Little or no evidence of conditions that adversely affect reference interaction
☐B	☐B	Moderate evidence of conditions (examples: berms, levees, down-cutting, aggradation, dredging) that adversely affect reference interaction (examples: limited streamside area access, disruption of flood flows through streamside area, leaky or intermittent bulkheads, causeways with floodplain constriction, minor ditching [including mosquito ditching])
☒C	☒C	Extensive evidence of conditions that adversely affect reference interaction (little to no floodplain/intertidal zone access [examples: causeways with floodplain and channel constriction, bulkheads, retaining walls, fill, stream incision, disruption of flood flows through streamside area] or too much floodplain/intertidal zone access [examples: impoundments, intensive mosquito ditching]) or floodplain/intertidal zone unnaturally absent or assessment reach is a man-made feature on an interstream divide

7. Water Quality Stressors – assessment reach/intertidal zone metric
Check all that apply.

- ☐A Discolored water in stream or intertidal zone (milky white, blue, unnatural water discoloration, oil sheen, stream foam)
- ☒B Excessive sedimentation (burying of stream features or intertidal zone)
- ☐C Noticeable evidence of pollutant discharges entering the assessment reach and causing a water quality problem
- ☐D Odor (not including natural sulfide odors)
- ☐E Current published or collected data indicating degraded water quality in the assessment reach. Cite source in "Notes/Sketch" section.
- ☐F Livestock with access to stream or intertidal zone
- ☐G Excessive algae in stream or intertidal zone
- ☐H Degraded marsh vegetation in the intertidal zone (removal, burning, regular mowing, destruction, etc)
- ☐I Other: _____ (explain in "Notes/Sketch" section)
- ☐J Little to no stressors

8. Recent Weather – watershed metric (skip for Tidal Marsh Streams)
For Size 1 or 2 streams, D1 drought or higher is considered a drought; for Size 3 or 4 streams, D2 drought or higher is considered a drought.

- ☐A Drought conditions and no rainfall or rainfall not exceeding 1 inch within the last 48 hours
- ☐B Drought conditions and rainfall exceeding 1 inch within the last 48 hours
- ☒C No drought conditions

9. Large or Dangerous Stream – assessment reach metric
☐Yes ☒No Is stream is too large or dangerous to assess? If Yes, skip to Metric 13 (Streamside Area Ground Surface Condition).

10. Natural In-stream Habitat Types – assessment reach metric
10a. ☒Yes ☐No Degraded in-stream habitat over majority of the assessment reach (examples of stressors include excessive sedimentation, mining, excavation, in-stream hardening [for example, rip-rap], recent dredging, and snagging) **(evaluate for Size 4 Coastal Plain streams only, then skip to Metric 12)**

10b. **Check all that occur** (occurs if > 5% coverage of assessment reach) **(skip for Size 4 Coastal Plain streams)**

- ☐A Multiple aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
- ☐B Multiple sticks and/or leaf packs and/or emergent vegetation
- ☐C Multiple snags and logs (including lap trees)
- ☐D 5% undercut banks and/or root mats and/or roots in banks extend to the normal wetted perimeter
- ☒E Little or no habitat

Check for Tidal Marsh Streams Only

- ☐F 5% oysters or other natural hard bottoms
- ☐G Submerged aquatic vegetation
- ☐H Low-tide refugia (pools)
- ☐I Sand bottom
- ☐J 5% vertical bank along the marsh
- ☐K Little or no habitat

*****

12. Aquatic Life – assessment reach metric (skip for Tidal Marsh Streams)

12a. ☒Yes ☐No Was an in-stream aquatic life assessment performed as described in the User Manual?
If No, select one of the following reasons and skip to Metric 13. ☐No Water ☒Other: _____

12b. ☒Yes ☐No Are aquatic organisms present in the assessment reach (look in riffles, pools, then snags)? If Yes, check all that apply. If No, skip to Metric 13.

1	>1	Numbers over columns refer to "individuals" for Size 1 and 2 streams and "taxa" for Size 3 and 4 streams.
☐	☐	Adult frogs
☐	☐	Aquatic reptiles
☐	☐	Aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
☐	☐	Beetles
☐	☐	Caddisfly larvae (T)
☐	☐	Asian clam (*Corbicula*)
☐	☐	Crustacean (isopod/amphipod/crayfish/shrimp)
☐	☐	Damselfly and dragonfly larvae
☐	☐	Dipterans
☐	☐	Mayfly larvae (E)
☐	☐	Megaloptera (alderfly, fishfly, dobsonfly larvae)
☐	☐	Midges/mosquito larvae
☐	☐	Mosquito fish (*Gambusia*) or mud minnows (*Umbra pygmaea*)
☐	☐	Mussels/Clams (not *Corbicula*)
☐	☒	Other fish
☐	☐	Salamanders/tadpoles
☐	☐	Snails
☐	☒	Stonefly larvae (P)
☐	☐	Tipulid larvae
☒	☐	Worms/leeches

13. Streamside Area Ground Surface Condition – streamside area metric (skip for Tidal Marsh Streams and B valley types)
Consider for the Left Bank (LB) and the Right Bank (RB). Consider storage capacity with regard to both overbank flow and upland runoff.

LB	RB	
☐A	☐A	Little or no alteration to water storage capacity over a majority of the streamside area
☐B	☐B	Moderate alteration to water storage capacity over a majority of the streamside area
☒C	☒C	Severe alteration to water storage capacity over a majority of the streamside area (examples: ditches, fill, soil compaction, livestock disturbance, buildings, man-made levees, drainage pipes)

14. Streamside Area Water Storage – streamside area metric (skip for Size 1 streams, Tidal Marsh Streams, and B valley types)
Consider for the Left Bank (LB) and the Right Bank (RB) of the streamside area.

LB	RB	
☐A	☐A	Majority of streamside area with depressions able to pond water ≥ 6 inches deep
☐B	☐B	Majority of streamside area with depressions able to pond water 3 to 6 inches deep
☒C	☒C	Majority of streamside area with depressions able to pond water < 3 inches deep

15. Wetland Presence – streamside area metric (skip for Tidal Marsh Streams)
Consider for the Left Bank (LB) and the Right Bank (RB). Do not consider wetlands outside of the streamside area or within the normal wetted perimeter of assessment reach.

LB	RB	
☐Y	☐Y	Are wetlands present in the streamside area?
☒N	☒N	

16. Baseflow Contributors – assessment reach metric (skip for Size 4 streams and Tidal Marsh Streams)
Check all contributors within the assessment reach or within view of <u>and</u> draining to the assessment reach.

- ☐A Streams and/or springs (jurisdictional discharges)
- ☐B Ponds (include wet detention basins; do not include sediment basins or dry detention basins)
- ☐C Obstruction passing flow during low-flow periods within the assessment area (beaver dam, leaky dam, bottom-release dam, weir)
- ☐D Evidence of bank seepage or sweating (iron in water indicates seepage)
- ☒E Stream bed or bank soil reduced (dig through deposited sediment if present)
- ☐F None of the above

17. Baseflow Detractors – assessment area metric (skip for Tidal Marsh Streams)
Check all that apply.

- ☐A Evidence of substantial water withdrawals from the assessment reach (includes areas excavated for pump installation)
- ☐B Obstruction not passing flow during low-flow periods affecting the assessment reach (ex: watertight dam, sediment deposit)
- ☐C Urban stream (≥ 24% impervious surface for watershed)
- ☒D Evidence that the streamside area has been modified resulting in accelerated drainage into the assessment reach
- ☐E Assessment reach relocated to valley edge
- ☐F None of the above

18. Shading – assessment reach metric (skip for Tidal Marsh Streams)
Consider aspect. Consider "leaf-on" condition.

- ☐A Stream shading is appropriate for stream category (may include gaps associated with natural processes)
- ☐B Degraded (example: scattered trees)
- ☒C Stream shading is gone or largely absent

19. Buffer Width – streamside area metric (skip for Tidal Marsh Streams)
Consider "vegetated buffer" and "wooded buffer" separately for left bank (LB) and right bank (RB) starting at the top of bank out to the first break.

Vegetated		Wooded		
LB	RB	LB	RB	
☒A	☒A	☐A	☐A	≥ 100 feet wide or extends to the edge of the watershed
☐B	☐B	☐B	☐B	From 50 to < 100 feet wide
☐C	☐C	☐C	☐C	From 30 to < 50 feet wide
☐D	☐D	☐D	☐D	From 10 to < 30 feet wide
☐E	☐E	☒E	☒E	< 10 feet wide or no trees

20. Buffer Structure – streamside area metric (skip for Tidal Marsh Streams)
Consider for left bank (LB) and right bank (RB) for Metric 19 ("Vegetated" Buffer Width).

LB	RB	
☐A	☐A	Mature forest
☐B	☐B	Non-mature woody vegetation or modified vegetation structure
☒C	☒C	Herbaceous vegetation with or without a strip of trees < 10 feet wide
☐D	☐D	Maintained shrubs
☐E	☐E	Little or no vegetation

21. Buffer Stressors – streamside area metric (skip for Tidal Marsh Streams)
Check all appropriate boxes for left bank (LB) and right bank (RB). Indicate if listed stressor abuts stream (Abuts), does not abut but is within 30 feet of stream (< 30 feet), or is between 30 to 50 feet of stream (30-50 feet).
If none of the following stressors occurs on either bank, check here and skip to Metric 22: ☐

Abuts		< 30 feet		30-50 feet		
LB	RB	LB	RB	LB	RB	
☐A	☐A	☐A	☐A	☐A	☐A	Row crops
☐B	☐B	☐B	☐B	☐B	☐B	Maintained turf
☒C	☒C	☐C	☐C	☐C	☐C	Pasture (no livestock)/commercial horticulture
☐D	☐D	☐D	☐D	☐D	☐D	Pasture (active livestock use)

22. Stem Density – streamside area metric (skip for Tidal Marsh Streams)
Consider for left bank (LB) and right bank (RB) for Metric 19 ("Wooded" Buffer Width).

LB	RB	
☐A	☐A	Medium to high stem density
☐B	☐B	Low stem density
☒C	☒C	No wooded riparian buffer or predominantly herbaceous species or bare ground

23. Continuity of Vegetated Buffer – streamside area metric (skip for Tidal Marsh Streams)
Consider whether vegetated buffer is continuous along stream (parallel). Breaks are areas lacking vegetation > 10 feet wide.

LB	RB	
☒A	☒A	The total length of buffer breaks is < 25 percent.
☐B	☐B	The total length of buffer breaks is between 25 and 50 percent.
☐C	☐C	The total length of buffer breaks is > 50 percent.

24. Vegetative Composition – streamside area metric (skip for Tidal Marsh Streams)
Evaluate the dominant vegetation within 100 feet of each bank or to the edge of the watershed (whichever comes first) as it contributes to assessment reach habitat.

LB	RB	
☐A	☐A	Vegetation is close to undisturbed in species present and their proportions. Lower strata composed of native species, with non-native invasive species absent or sparse.
☐B	☐B	Vegetation indicates disturbance in terms of species diversity or proportions, but is still largely composed of native species. This may include communities of weedy native species that develop after clear-cutting or clearing or communities with non-native invasive species present, but not dominant, over a large portion of the expected strata or communities missing understory but retaining canopy trees.
☒C	☒C	Vegetation is severely disturbed in terms of species diversity or proportions. Mature canopy is absent or communities with non-native invasive species dominant over a large portion of expected strata or communities composed of planted stands of non-characteristic species or communities inappropriately composed of a single species or no vegetation.

25. Conductivity – assessment reach metric (skip for all Coastal Plain streams)
25a. ☐Yes ☒No Was conductivity measurement recorded?
If No, select one of the following reasons. ☒No Water ☐Other: _____

25b. Check the box corresponding to the conductivity measurement (units of microsiemens per centimeter).
☐A < 46 ☐B 46 to < 67 ☐C 67 to < 79 ☐D 79 to < 230 ☐E ≥ 230

Notes/Sketch:
Trash in stream

Draft NC SAM Stream Rating Sheet
Accompanies User Manual Version 2.1

Stream Site Name	R2707D 7-1 (Impact Site 6A US)	Date of Assessment	11/10/2017
Stream Category	Pa3	Assessor Name/Organization	Melissa Ruiz, Alex Baldwin, Stantec

Notes of Field Assessment Form (Y/N)	YES
Presence of regulatory considerations (Y/N)	NO
Additional stream information/supplementary measurements included (Y/N)	
NC SAM feature type (perennial, intermittent, Tidal Marsh Stream)	Perennial

Function Class Rating Summary	USACE/ All Streams	NCDWR Intermittent
(1) Hydrology	**LOW**	
(2) Baseflow	**HIGH**	
(2) Flood Flow	**LOW**	
(3) Streamside Area Attenuation	**LOW**	
(4) Floodplain Access	**LOW**	
(4) Wooded Riparian Buffer	**LOW**	
(4) Microtopography	**LOW**	
(3) Stream Stability	**LOW**	
(4) Channel Stability	**LOW**	
(4) Sediment Transport	**LOW**	
(4) Stream Geomorphology	**LOW**	
(2) Stream/Intertidal Zone Interaction	NA	
(2) Longitudinal Tidal Flow	NA	
(2) Tidal Marsh Stream Stability	NA	
(3) Tidal Marsh Channel Stability	NA	
(3) Tidal Marsh Stream Geomorphology	NA	
(1) Water Quality	**LOW**	
(2) Baseflow	**HIGH**	
(2) Streamside Area Vegetation	**LOW**	
(3) Upland Pollutant Filtration	**LOW**	
(3) Thermoregulation	**LOW**	
(2) Indicators of Stressors	**YES**	
(2) Aquatic Life Tolerance	**HIGH**	
(2) Intertidal Zone Filtration	NA	
(1) Habitat	**LOW**	
(2) In-stream Habitat	**LOW**	
(3) Baseflow	**HIGH**	
(3) Substrate	**LOW**	
(3) Stream Stability	**LOW**	
(3) In-stream Habitat	**LOW**	
(2) Stream-side Habitat	**LOW**	
(3) Stream-side Habitat	**LOW**	
(3) Thermoregulation	**LOW**	
(2) Tidal Marsh In-stream Habitat	NA	
(3) Flow Restriction	NA	
(3) Tidal Marsh Stream Stability	NA	
(4) Tidal Marsh Channel Stability	NA	
(4) Tidal Marsh Stream Geomorphology	NA	
(3) Tidal Marsh In-stream Habitat	NA	
(2) Intertidal Zone	NA	
Overall	**LOW**	

NC SAM FIELD ASSESSMENT RESULTS
Accompanies User Manual Version 2.1

USACE AID #: NCDWR #:

INSTRUCTIONS: Attach a sketch of the assessment area and photographs. Attach a copy of the USGS 7.5-minute topographic quadrangle, and circle the location of the stream reach under evaluation. If multiple stream reaches will be evaluated on the same property, identify and number all reaches on the attached map, and include a separate form for each reach. See the NC SAM User Manual for detailed descriptions and explanations of requested information. Record in the "Notes/Sketch" section if supplementary measurements were performed. See the NC SAM User Manual for examples of additional measurements that may be relevant.

NOTE EVIDENCE OF STRESSORS AFFECTING THE ASSESSMENT AREA (do not need to be within the assessment area).

PROJECT/SITE INFORMATION:

1. Project name (if any): R2707D
2. Date of evaluation: 11/10/2017
3. Applicant/owner name: NCDOT
4. Assessor name/organization: Melissa Ruiz, Alex Baldwin, Stantec
5. County: Cleveland
6. Nearest named water body on USGS 7.5-minute quad: Kings Mountain Reservoir
7. River basin: Broad
8. Site coordinates (decimal degrees, at lower end of assessment reach): 35.281812, -81.477274

STREAM INFORMATION: (depth and width can be approximations)

9. Site number (show on attached map): 7-1 (Impact Site 6A DS)
10. Length of assessment reach evaluated (feet): 100
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 4 ☐Unable to assess channel depth.
12. Channel width at top of bank (feet): 8
13. Is assessment reach a swamp steam? ☐Yes ☐No
14. Feature type: ☒Perennial flow ☐Intermittent flow ☐Tidal Marsh Stream

STREAM CATEGORY INFORMATION:

15. NC SAM Zone: ☐ Mountains (M) ☒ Piedmont (P) ☐ Inner Coastal Plain (I) ☐ Outer Coastal Plain (O)
16. Estimated geomorphic valley shape (**skip for Tidal Marsh Stream**):
☒A (more sinuous stream, flatter valley slope)
☐B (less sinuous stream, steeper valley slope)
17. Watershed size: (**skip for Tidal Marsh Stream**) ☐Size 1 (< 0.1 mi²) ☐Size 2 (0.1 to < 0.5 mi²) ☒Size 3 (0.5 to < 5 mi²) ☐Size 4 (≥ 5 mi²)

ADDITIONAL INFORMATION:

18. Were regulatory considerations evaluated? ☒Yes ☐No If Yes, check all that apply to the assessment area.
☐Section 10 water ☐Classified Trout Waters ☐Water Supply Watershed (☐I ☐II ☐III ☐IV ☐V)
☐Essential Fish Habitat ☐Primary Nursery Area ☐ High Quality Waters/Outstanding Resource Waters
☐Publicly owned property ☐NCDWR Riparian buffer rule in effect ☐Nutrient Sensitive Waters
☐Anadromous fish ☐303(d) List ☐CAMA Area of Environmental Concern (AEC)
☐Documented presence of a federal and/or state listed protected species within the assessment area.
List species:
☐Designated Critical Habitat (list species)
19. Are additional stream information/supplementary measurements included in "Notes/Sketch" section or attached? ☐Yes ☐No

1. Channel Water – assessment reach metric (skip for Size 1 streams and Tidal Marsh Streams)
☒A Water throughout assessment reach.
☐B No flow, water in pools only.
☐C No water in assessment reach.

2. Evidence of Flow Restriction – assessment reach metric
☐A At least 10% of assessment reach in-stream habitat or riffle-pool sequence is severely affected by a flow restriction or fill to the point of obstructing flow or a channel choked with aquatic macrophytes or ponded water or impoundment on flood or ebb within the assessment reach (examples: undersized or perched culverts, causeways that constrict the channel, tidal gates, debris jams, beaver dams).
☒B Not A

3. Feature Pattern – assessment reach metric
☒A A majority of the assessment reach has altered pattern (examples: straightening, modification above or below culvert).
☐B Not A

4. Feature Longitudinal Profile – assessment reach metric
☒A Majority of assessment reach has a substantially altered stream profile (examples: channel down-cutting, existing damming, over widening, active aggradation, dredging, and excavation where appropriate channel profile has not reformed from any of these disturbances).
☐B Not A

5. Signs of Active Instability – assessment reach metric
Consider only current instability, not past events from which the stream has currently recovered. Examples of instability include active bank failure, active channel down-cutting (head-cut), active widening, and artificial hardening (such as concrete, gabion, rip-rap).
☐A < 10% of channel unstable
☐B 10 to 25% of channel unstable
☒C > 25% of channel unstable

6. Streamside Area Interaction – streamside area metric
Consider for the Left Bank (LB) and the Right Bank (RB).

LB	RB	
☐A	☐A	Little or no evidence of conditions that adversely affect reference interaction
☐B	☐B	Moderate evidence of conditions (examples: berms, levees, down-cutting, aggradation, dredging) that adversely affect reference interaction (examples: limited streamside area access, disruption of flood flows through streamside area, leaky or intermittent bulkheads, causeways with floodplain constriction, minor ditching [including mosquito ditching])
☒C	☒C	Extensive evidence of conditions that adversely affect reference interaction (little to no floodplain/intertidal zone access [examples: causeways with floodplain and channel constriction, bulkheads, retaining walls, fill, stream incision, disruption of flood flows through streamside area] or too much floodplain/intertidal zone access [examples: impoundments, intensive mosquito ditching]) or floodplain/intertidal zone unnaturally absent or assessment reach is a man-made feature on an interstream divide

7. Water Quality Stressors – assessment reach/intertidal zone metric
Check all that apply.

- ☐A Discolored water in stream or intertidal zone (milky white, blue, unnatural water discoloration, oil sheen, stream foam)
- ☒B Excessive sedimentation (burying of stream features or intertidal zone)
- ☐C Noticeable evidence of pollutant discharges entering the assessment reach and causing a water quality problem
- ☐D Odor (not including natural sulfide odors)
- ☐E Current published or collected data indicating degraded water quality in the assessment reach. Cite source in "Notes/Sketch" section.
- ☐F Livestock with access to stream or intertidal zone
- ☐G Excessive algae in stream or intertidal zone
- ☐H Degraded marsh vegetation in the intertidal zone (removal, burning, regular mowing, destruction, etc)
- ☐I Other: _____ (explain in "Notes/Sketch" section)
- ☐J Little to no stressors

8. Recent Weather – watershed metric (skip for Tidal Marsh Streams)
For Size 1 or 2 streams, D1 drought or higher is considered a drought; for Size 3 or 4 streams, D2 drought or higher is considered a drought.

- ☐A Drought conditions and no rainfall or rainfall not exceeding 1 inch within the last 48 hours
- ☐B Drought conditions and rainfall exceeding 1 inch within the last 48 hours
- ☒C No drought conditions

9. Large or Dangerous Stream – assessment reach metric
☐Yes ☒No Is stream is too large or dangerous to assess? If Yes, skip to Metric 13 (Streamside Area Ground Surface Condition).

10. Natural In-stream Habitat Types – assessment reach metric
10a. ☒Yes ☐No Degraded in-stream habitat over majority of the assessment reach (examples of stressors include excessive sedimentation, mining, excavation, in-stream hardening [for example, rip-rap], recent dredging, and snagging) **(evaluate for Size 4 Coastal Plain streams only, then skip to Metric 12)**

10b. **Check all that occur** (occurs if > 5% coverage of assessment reach) **(skip for Size 4 Coastal Plain streams)**

- ☐A Multiple aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
- ☐B Multiple sticks and/or leaf packs and/or emergent vegetation
- ☐C Multiple snags and logs (including lap trees)
- ☐D 5% undercut banks and/or root mats and/or roots in banks extend to the normal wetted perimeter
- ☒E Little or no habitat

Check for Tidal Marsh Streams Only

- ☐F 5% oysters or other natural hard bottoms
- ☐G Submerged aquatic vegetation
- ☐H Low-tide refugia (pools)
- ☐I Sand bottom
- ☐J 5% vertical bank along the marsh
- ☐K Little or no habitat

**************************************REMAINING QUESTIONS ARE NOT APPLICABLE FOR TIDAL MARSH STREAMS*********************************

11. Bedform and Substrate – assessment reach metric (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)

11a. ☐Yes ☒No Is assessment reach in a natural sand-bed stream? **(skip for Coastal Plain streams)**

11b. Bedform evaluated. **Check the appropriate box(es).**

- ☒A Riffle-run section **(evaluate 11c)**
- ☒B Pool-glide section **(evaluate 11d)**
- ☐C Natural bedform absent **(skip to Metric 12, Aquatic Life)**

11c. In riffle sections, check all that occur below the normal wetted perimeter of the assessment reach – whether or not submerged. **Check at least one box in each row (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)**. Not Present (NP) = absent, Rare (R) = present but ≤ 10%, Common (C) = > 10-40%, Abundant (A) = > 40-70%, Predominant (P) = > 70%. Cumulative percentages should not exceed 100% for each assessment reach.

NP	R	C	A	P	
☒	☐	☐	☐	☐	Bedrock/saprolite
☒	☐	☐	☐	☐	Boulder (256 – 4096 mm)
☐	☐	☒	☐	☐	Cobble (64 – 256 mm)
☐	☐	☒	☐	☐	Gravel (2 – 64 mm)
☐	☐	☐	☐	☒	Sand (.062 – 2 mm)
☒	☐	☐	☐	☐	Silt/clay (< 0.062 mm)
☒	☐	☐	☐	☐	Detritus
☒	☐	☐	☐	☐	Artificial (rip-rap, concrete, etc.)

11d. ☐Yes ☒No Are pools filled with sediment? (**skip for Size 4 Coastal Plain streams and Tidal Marsh Streams**)

12. Aquatic Life – assessment reach metric (skip for Tidal Marsh Streams)

12a. ☒Yes ☐No Was an in-stream aquatic life assessment performed as described in the User Manual?
If No, select one of the following reasons and skip to Metric 13. ☐No Water ☒Other: _____

12b. ☒Yes ☐No Are aquatic organisms present in the assessment reach (look in riffles, pools, then snags)? If Yes, check all that apply. If No, skip to Metric 13.

1	>1	Numbers over columns refer to "individuals" for Size 1 and 2 streams and "taxa" for Size 3 and 4 streams.
☐	☐	Adult frogs
☐	☐	Aquatic reptiles
☐	☐	Aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
☐	☐	Beetles
☐	☐	Caddisfly larvae (T)
☐	☐	Asian clam (*Corbicula*)
☐	☐	Crustacean (isopod/amphipod/crayfish/shrimp)
☐	☐	Damselfly and dragonfly larvae
☐	☐	Dipterans
☐	☐	Mayfly larvae (E)
☐	☐	Megaloptera (alderfly, fishfly, dobsonfly larvae)
☐	☐	Midges/mosquito larvae
☐	☐	Mosquito fish (*Gambusia*) or mud minnows (*Umbra pygmaea*)
☐	☐	Mussels/Clams (not *Corbicula*)
☐	☒	Other fish
☐	☐	Salamanders/tadpoles
☐	☐	Snails
☐	☒	Stonefly larvae (P)
☐	☐	Tipulid larvae
☒	☐	Worms/leeches

13. Streamside Area Ground Surface Condition – streamside area metric (skip for Tidal Marsh Streams and B valley types)
Consider for the Left Bank (LB) and the Right Bank (RB). Consider storage capacity with regard to both overbank flow and upland runoff.

LB	RB	
☐A	☐A	Little or no alteration to water storage capacity over a majority of the streamside area
☐B	☐B	Moderate alteration to water storage capacity over a majority of the streamside area
☒C	☒C	Severe alteration to water storage capacity over a majority of the streamside area (examples: ditches, fill, soil compaction, livestock disturbance, buildings, man-made levees, drainage pipes)

14. Streamside Area Water Storage – streamside area metric (skip for Size 1 streams, Tidal Marsh Streams, and B valley types)
Consider for the Left Bank (LB) and the Right Bank (RB) of the streamside area.

LB	RB	
☐A	☐A	Majority of streamside area with depressions able to pond water ≥ 6 inches deep
☐B	☐B	Majority of streamside area with depressions able to pond water 3 to 6 inches deep
☒C	☒C	Majority of streamside area with depressions able to pond water < 3 inches deep

15. Wetland Presence – streamside area metric (skip for Tidal Marsh Streams)
Consider for the Left Bank (LB) and the Right Bank (RB). Do not consider wetlands outside of the streamside area or within the normal wetted perimeter of assessment reach.

LB	RB	
☐Y	☐Y	Are wetlands present in the streamside area?
☒N	☒N	

16. Baseflow Contributors – assessment reach metric (skip for Size 4 streams and Tidal Marsh Streams)
Check all contributors within the assessment reach or within view of <u>and</u> draining to the assessment reach.

- ☐A Streams and/or springs (jurisdictional discharges)
- ☐B Ponds (include wet detention basins; do not include sediment basins or dry detention basins)
- ☐C Obstruction passing flow during low-flow periods within the assessment area (beaver dam, leaky dam, bottom-release dam, weir)
- ☐D Evidence of bank seepage or sweating (iron in water indicates seepage)
- ☒E Stream bed or bank soil reduced (dig through deposited sediment if present)
- ☐F None of the above

17. Baseflow Detractors – assessment area metric (skip for Tidal Marsh Streams)
Check all that apply.

- ☐A Evidence of substantial water withdrawals from the assessment reach (includes areas excavated for pump installation)
- ☐B Obstruction not passing flow during low-flow periods affecting the assessment reach (ex: watertight dam, sediment deposit)
- ☐C Urban stream (≥ 24% impervious surface for watershed)
- ☒D Evidence that the streamside area has been modified resulting in accelerated drainage into the assessment reach
- ☐E Assessment reach relocated to valley edge
- ☐F None of the above

18. Shading – assessment reach metric (skip for Tidal Marsh Streams)
Consider aspect. Consider "leaf-on" condition.

- ☐A Stream shading is appropriate for stream category (may include gaps associated with natural processes)
- ☐B Degraded (example: scattered trees)
- ☒C Stream shading is gone or largely absent

19. Buffer Width – streamside area metric (skip for Tidal Marsh Streams)
Consider "vegetated buffer" and "wooded buffer" separately for left bank (LB) and right bank (RB) starting at the top of bank out to the first break.

Vegetated		Wooded		
LB	RB	LB	RB	
☒A	☒A	☐A	☐A	≥ 100 feet wide or extends to the edge of the watershed
☐B	☐B	☐B	☐B	From 50 to < 100 feet wide
☐C	☐C	☐C	☐C	From 30 to < 50 feet wide
☐D	☐D	☐D	☐D	From 10 to < 30 feet wide
☐E	☐E	☒E	☒E	< 10 feet wide or no trees

20. Buffer Structure – streamside area metric (skip for Tidal Marsh Streams)
Consider for left bank (LB) and right bank (RB) for Metric 19 ("Vegetated" Buffer Width).

LB	RB	
☐A	☐A	Mature forest
☐B	☐B	Non-mature woody vegetation or modified vegetation structure
☒C	☒C	Herbaceous vegetation with or without a strip of trees < 10 feet wide
☐D	☐D	Maintained shrubs
☐E	☐E	Little or no vegetation

21. Buffer Stressors – streamside area metric (skip for Tidal Marsh Streams)
Check all appropriate boxes for left bank (LB) and right bank (RB). Indicate if listed stressor abuts stream (Abuts), does not abut but is within 30 feet of stream (< 30 feet), or is between 30 to 50 feet of stream (30-50 feet).
If none of the following stressors occurs on either bank, check here and skip to Metric 22: ☐

Abuts		< 30 feet		30-50 feet		
LB	RB	LB	RB	LB	RB	
☐A	☐A	☐A	☐A	☐A	☐A	Row crops
☐B	☐B	☐B	☐B	☐B	☐B	Maintained turf
☒C	☒C	☐C	☐C	☐C	☐C	Pasture (no livestock)/commercial horticulture
☐D	☐D	☐D	☐D	☐D	☐D	Pasture (active livestock use)

22. Stem Density – streamside area metric (skip for Tidal Marsh Streams)
Consider for left bank (LB) and right bank (RB) for Metric 19 ("Wooded" Buffer Width).

LB	RB	
☐A	☐A	Medium to high stem density
☐B	☐B	Low stem density
☒C	☒C	No wooded riparian buffer or predominantly herbaceous species or bare ground

23. Continuity of Vegetated Buffer – streamside area metric (skip for Tidal Marsh Streams)
Consider whether vegetated buffer is continuous along stream (parallel). Breaks are areas lacking vegetation > 10 feet wide.

LB	RB	
☒A	☒A	The total length of buffer breaks is < 25 percent.
☐B	☐B	The total length of buffer breaks is between 25 and 50 percent.
☐C	☐C	The total length of buffer breaks is > 50 percent.

24. Vegetative Composition – streamside area metric (skip for Tidal Marsh Streams)
Evaluate the dominant vegetation within 100 feet of each bank or to the edge of the watershed (whichever comes first) as it contributes to assessment reach habitat.

LB	RB	
☐A	☐A	Vegetation is close to undisturbed in species present and their proportions. Lower strata composed of native species, with non-native invasive species absent or sparse.
☐B	☐B	Vegetation indicates disturbance in terms of species diversity or proportions, but is still largely composed of native species. This may include communities of weedy native species that develop after clear-cutting or clearing or communities with non-native invasive species present, but not dominant, over a large portion of the expected strata or communities missing understory but retaining canopy trees.
☒C	☒C	Vegetation is severely disturbed in terms of species diversity or proportions. Mature canopy is absent or communities with non-native invasive species dominant over a large portion of expected strata or communities composed of planted stands of non-characteristic species or communities inappropriately composed of a single species or no vegetation.

25. Conductivity – assessment reach metric (skip for all Coastal Plain streams)
25a. ☐Yes ☒No Was conductivity measurement recorded?
If No, select one of the following reasons. ☒No Water ☐Other: _____

25b. Check the box corresponding to the conductivity measurement (units of microsiemens per centimeter).
☐A < 46 ☐B 46 to < 67 ☐C 67 to < 79 ☐D 79 to < 230 ☐E ≥ 230

Notes/Sketch:
Trash in stream

Draft NC SAM Stream Rating Sheet
Accompanies User Manual Version 2.1

Stream Site Name	R2707D 7-1 (Impact Site 6A DS)	Date of Assessment	11/10/2017
Stream Category	Pa3	Assessor Name/Organization	Melissa Ruiz, Alex Baldwin, Stantec

Notes of Field Assessment Form (Y/N)	YES
Presence of regulatory considerations (Y/N)	NO
Additional stream information/supplementary measurements included (Y/N)	
NC SAM feature type (perennial, intermittent, Tidal Marsh Stream)	Perennial

Function Class Rating Summary	USACE/ All Streams	NCDWR Intermittent
(1) Hydrology	**LOW**	
(2) Baseflow	**HIGH**	
(2) Flood Flow	**LOW**	
(3) Streamside Area Attenuation	**LOW**	
(4) Floodplain Access	**LOW**	
(4) Wooded Riparian Buffer	**LOW**	
(4) Microtopography	**LOW**	
(3) Stream Stability	**LOW**	
(4) Channel Stability	**LOW**	
(4) Sediment Transport	**LOW**	
(4) Stream Geomorphology	**LOW**	
(2) Stream/Intertidal Zone Interaction	NA	
(2) Longitudinal Tidal Flow	NA	
(2) Tidal Marsh Stream Stability	NA	
(3) Tidal Marsh Channel Stability	NA	
(3) Tidal Marsh Stream Geomorphology	NA	
(1) Water Quality	**LOW**	
(2) Baseflow	**HIGH**	
(2) Streamside Area Vegetation	**LOW**	
(3) Upland Pollutant Filtration	**LOW**	
(3) Thermoregulation	**LOW**	
(2) Indicators of Stressors	**YES**	
(2) Aquatic Life Tolerance	**HIGH**	
(2) Intertidal Zone Filtration	NA	
(1) Habitat	**LOW**	
(2) In-stream Habitat	**LOW**	
(3) Baseflow	**HIGH**	
(3) Substrate	**LOW**	
(3) Stream Stability	**LOW**	
(3) In-stream Habitat	**LOW**	
(2) Stream-side Habitat	**LOW**	
(3) Stream-side Habitat	**LOW**	
(3) Thermoregulation	**LOW**	
(2) Tidal Marsh In-stream Habitat	NA	
(3) Flow Restriction	NA	
(3) Tidal Marsh Stream Stability	NA	
(4) Tidal Marsh Channel Stability	NA	
(4) Tidal Marsh Stream Geomorphology	NA	
(3) Tidal Marsh In-stream Habitat	NA	
(2) Intertidal Zone	NA	
Overall	**LOW**	

NC SAM FIELD ASSESSMENT RESULTS
Accompanies User Manual Version 2.1

USACE AID #: NCDWR #:

INSTRUCTIONS: Attach a sketch of the assessment area and photographs. Attach a copy of the USGS 7.5-minute topographic quadrangle, and circle the location of the stream reach under evaluation. If multiple stream reaches will be evaluated on the same property, identify and number all reaches on the attached map, and include a separate form for each reach. See the NC SAM User Manual for detailed descriptions and explanations of requested information. Record in the "Notes/Sketch" section if supplementary measurements were performed. See the NC SAM User Manual for examples of additional measurements that may be relevant.

NOTE EVIDENCE OF STRESSORS AFFECTING THE ASSESSMENT AREA (do not need to be within the assessment area).

PROJECT/SITE INFORMATION:

1. Project name (if any): R2707D
2. Date of evaluation: 11/10/2017
3. Applicant/owner name: NCDOT
4. Assessor name/organization: Melissa Ruiz, Alex Baldwin, Stantec
5. County: Cleveland
6. Nearest named water body on USGS 7.5-minute quad: Kings Mountain Reservoir
7. River basin: Broad
8. Site coordinates (decimal degrees, at lower end of assessment reach): 35.2818434, -81.477095

STREAM INFORMATION: (depth and width can be approximations)

9. Site number (show on attached map): 7-5 (Impact Site 6B)
10. Length of assessment reach evaluated (feet): 100
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 4 ☐Unable to assess channel depth.
12. Channel width at top of bank (feet): 8
13. Is assessment reach a swamp steam? ☐Yes ☐No
14. Feature type: ☒Perennial flow ☐Intermittent flow ☐Tidal Marsh Stream

STREAM CATEGORY INFORMATION:

15. NC SAM Zone: ☐ Mountains (M) ☒ Piedmont (P) ☐ Inner Coastal Plain (I) ☐ Outer Coastal Plain (O)
16. Estimated geomorphic valley shape (**skip for Tidal Marsh Stream**):
☒A (more sinuous stream, flatter valley slope)
☐B (less sinuous stream, steeper valley slope)
17. Watershed size: (**skip for Tidal Marsh Stream**) ☐Size 1 (< 0.1 mi^2) ☐Size 2 (0.1 to < 0.5 mi^2) ☒Size 3 (0.5 to < 5 mi^2) ☐Size 4 (≥ 5 mi^2)

ADDITIONAL INFORMATION:

18. Were regulatory considerations evaluated? ☒Yes ☐No If Yes, check all that apply to the assessment area.
☐Section 10 water ☐Classified Trout Waters ☐Water Supply Watershed (☐I ☐II ☐III ☐IV ☐V)
☐Essential Fish Habitat ☐Primary Nursery Area ☐ High Quality Waters/Outstanding Resource Waters
☐Publicly owned property ☐NCDWR Riparian buffer rule in effect ☐Nutrient Sensitive Waters
☐Anadromous fish ☐303(d) List ☐CAMA Area of Environmental Concern (AEC)
☐Documented presence of a federal and/or state listed protected species within the assessment area.
List species:
☐Designated Critical Habitat (list species)
19. Are additional stream information/supplementary measurements included in "Notes/Sketch" section or attached? ☐Yes ☐No

1. Channel Water – assessment reach metric (skip for Size 1 streams and Tidal Marsh Streams)
☒A Water throughout assessment reach.
☐B No flow, water in pools only.
☐C No water in assessment reach.

2. Evidence of Flow Restriction – assessment reach metric
☐A At least 10% of assessment reach in-stream habitat or riffle-pool sequence is severely affected by a flow restriction or fill to the point of obstructing flow or a channel choked with aquatic macrophytes or ponded water or impoundment on flood or ebb within the assessment reach (examples: undersized or perched culverts, causeways that constrict the channel, tidal gates, debris jams, beaver dams).
☒B Not A

3. Feature Pattern – assessment reach metric
☒A A majority of the assessment reach has altered pattern (examples: straightening, modification above or below culvert).
☐B Not A

4. Feature Longitudinal Profile – assessment reach metric
☒A Majority of assessment reach has a substantially altered stream profile (examples: channel down-cutting, existing damming, over widening, active aggradation, dredging, and excavation where appropriate channel profile has not reformed from any of these disturbances).
☐B Not A

5. Signs of Active Instability – assessment reach metric
Consider only current instability, not past events from which the stream has currently recovered. Examples of instability include active bank failure, active channel down-cutting (head-cut), active widening, and artificial hardening (such as concrete, gabion, rip-rap).
☐A < 10% of channel unstable
☐B 10 to 25% of channel unstable
☒C > 25% of channel unstable

6. Streamside Area Interaction – streamside area metric
Consider for the Left Bank (LB) and the Right Bank (RB).

LB	RB	
☐A	☐A	Little or no evidence of conditions that adversely affect reference interaction
☐B	☐B	Moderate evidence of conditions (examples: berms, levees, down-cutting, aggradation, dredging) that adversely affect reference interaction (examples: limited streamside area access, disruption of flood flows through streamside area, leaky or intermittent bulkheads, causeways with floodplain constriction, minor ditching [including mosquito ditching])
☒C	☒C	Extensive evidence of conditions that adversely affect reference interaction (little to no floodplain/intertidal zone access [examples: causeways with floodplain and channel constriction, bulkheads, retaining walls, fill, stream incision, disruption of flood flows through streamside area] or too much floodplain/intertidal zone access [examples: impoundments, intensive mosquito ditching]) or floodplain/intertidal zone unnaturally absent or assessment reach is a man-made feature on an interstream divide

7. Water Quality Stressors – assessment reach/intertidal zone metric
Check all that apply.

- ☐A Discolored water in stream or intertidal zone (milky white, blue, unnatural water discoloration, oil sheen, stream foam)
- ☒B Excessive sedimentation (burying of stream features or intertidal zone)
- ☐C Noticeable evidence of pollutant discharges entering the assessment reach and causing a water quality problem
- ☐D Odor (not including natural sulfide odors)
- ☐E Current published or collected data indicating degraded water quality in the assessment reach. Cite source in "Notes/Sketch" section.
- ☐F Livestock with access to stream or intertidal zone
- ☐G Excessive algae in stream or intertidal zone
- ☐H Degraded marsh vegetation in the intertidal zone (removal, burning, regular mowing, destruction, etc)
- ☐I Other: _____ (explain in "Notes/Sketch" section)
- ☐J Little to no stressors

8. Recent Weather – watershed metric (skip for Tidal Marsh Streams)
For Size 1 or 2 streams, D1 drought or higher is considered a drought; for Size 3 or 4 streams, D2 drought or higher is considered a drought.

- ☐A Drought conditions and no rainfall or rainfall not exceeding 1 inch within the last 48 hours
- ☐B Drought conditions and rainfall exceeding 1 inch within the last 48 hours
- ☒C No drought conditions

9. Large or Dangerous Stream – assessment reach metric
☐Yes ☒No Is stream is too large or dangerous to assess? If Yes, skip to Metric 13 (Streamside Area Ground Surface Condition).

10. Natural In-stream Habitat Types – assessment reach metric
10a. ☒Yes ☐No Degraded in-stream habitat over majority of the assessment reach (examples of stressors include excessive sedimentation, mining, excavation, in-stream hardening [for example, rip-rap], recent dredging, and snagging) **(evaluate for Size 4 Coastal Plain streams only, then skip to Metric 12)**

10b. **Check all that occur** (occurs if > 5% coverage of assessment reach) **(skip for Size 4 Coastal Plain streams)**

- ☐A Multiple aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
- ☐B Multiple sticks and/or leaf packs and/or emergent vegetation
- ☐C Multiple snags and logs (including lap trees)
- ☐D 5% undercut banks and/or root mats and/or roots in banks extend to the normal wetted perimeter
- ☒E Little or no habitat

Check for Tidal Marsh Streams Only

- ☐F 5% oysters or other natural hard bottoms
- ☐G Submerged aquatic vegetation
- ☐H Low-tide refugia (pools)
- ☐I Sand bottom
- ☐J 5% vertical bank along the marsh
- ☐K Little or no habitat

************************************REMAINING QUESTIONS ARE NOT APPLICABLE FOR TIDAL MARSH STREAMS*****************************

11. Bedform and Substrate – assessment reach metric (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)

11a. ☐Yes ☒No Is assessment reach in a natural sand-bed stream? **(skip for Coastal Plain streams)**

11b. Bedform evaluated. **Check the appropriate box(es).**

- ☒A Riffle-run section **(evaluate 11c)**
- ☒B Pool-glide section **(evaluate 11d)**
- ☐C Natural bedform absent **(skip to Metric 12, Aquatic Life)**

11c. In riffle sections, check all that occur below the normal wetted perimeter of the assessment reach – whether or not submerged. **Check at least one box in each row (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)**. Not Present (NP) = absent, Rare (R) = present but ≤ 10%, Common (C) = > 10-40%, Abundant (A) = > 40-70%, Predominant (P) = > 70%. Cumulative percentages should not exceed 100% for each assessment reach.

NP	R	C	A	P	
☒	☐	☐	☐	☐	Bedrock/saprolite
☒	☐	☐	☐	☐	Boulder (256 – 4096 mm)
☐	☐	☒	☐	☐	Cobble (64 – 256 mm)
☐	☐	☒	☐	☐	Gravel (2 – 64 mm)
☐	☐	☐	☐	☒	Sand (.062 – 2 mm)
☒	☐	☐	☐	☐	Silt/clay (< 0.062 mm)
☒	☐	☐	☐	☐	Detritus
☒	☐	☐	☐	☐	Artificial (rip-rap, concrete, etc.)

11d. ☐Yes ☒No Are pools filled with sediment? (**skip for Size 4 Coastal Plain streams and Tidal Marsh Streams**)

12. Aquatic Life – assessment reach metric (skip for Tidal Marsh Streams)

12a. ☒Yes ☐No Was an in-stream aquatic life assessment performed as described in the User Manual?
If No, select one of the following reasons and skip to Metric 13. ☐No Water ☒Other: _____

12b. ☒Yes ☐No Are aquatic organisms present in the assessment reach (look in riffles, pools, then snags)? If Yes, check all that apply. If No, skip to Metric 13.

1	>1	Numbers over columns refer to "individuals" for Size 1 and 2 streams and "taxa" for Size 3 and 4 streams.
☐	☐	Adult frogs
☐	☐	Aquatic reptiles
☐	☐	Aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
☐	☐	Beetles
☐	☐	Caddisfly larvae (T)
☐	☐	Asian clam (*Corbicula*)
☐	☐	Crustacean (isopod/amphipod/crayfish/shrimp)
☐	☐	Damselfly and dragonfly larvae
☐	☐	Dipterans
☐	☐	Mayfly larvae (E)
☐	☐	Megaloptera (alderfly, fishfly, dobsonfly larvae)
☐	☐	Midges/mosquito larvae
☐	☐	Mosquito fish (*Gambusia*) or mud minnows (*Umbra pygmaea*)
☐	☐	Mussels/Clams (not *Corbicula*)
☐	☒	Other fish
☐	☐	Salamanders/tadpoles
☐	☐	Snails
☐	☒	Stonefly larvae (P)
☐	☐	Tipulid larvae
☒	☐	Worms/leeches

13. Streamside Area Ground Surface Condition – streamside area metric (skip for Tidal Marsh Streams and B valley types)
Consider for the Left Bank (LB) and the Right Bank (RB). Consider storage capacity with regard to both overbank flow and upland runoff.

LB	RB	
☐A	☐A	Little or no alteration to water storage capacity over a majority of the streamside area
☐B	☐B	Moderate alteration to water storage capacity over a majority of the streamside area
☒C	☒C	Severe alteration to water storage capacity over a majority of the streamside area (examples: ditches, fill, soil compaction, livestock disturbance, buildings, man-made levees, drainage pipes)

14. Streamside Area Water Storage – streamside area metric (skip for Size 1 streams, Tidal Marsh Streams, and B valley types)
Consider for the Left Bank (LB) and the Right Bank (RB) of the streamside area.

LB	RB	
☐A	☐A	Majority of streamside area with depressions able to pond water ≥ 6 inches deep
☐B	☐B	Majority of streamside area with depressions able to pond water 3 to 6 inches deep
☒C	☒C	Majority of streamside area with depressions able to pond water < 3 inches deep

15. Wetland Presence – streamside area metric (skip for Tidal Marsh Streams)
Consider for the Left Bank (LB) and the Right Bank (RB). Do not consider wetlands outside of the streamside area or within the normal wetted perimeter of assessment reach.

LB	RB	
☐Y	☐Y	Are wetlands present in the streamside area?
☒N	☒N	

16. Baseflow Contributors – assessment reach metric (skip for Size 4 streams and Tidal Marsh Streams)
Check all contributors within the assessment reach or within view of <u>and</u> draining to the assessment reach.

- ☐A Streams and/or springs (jurisdictional discharges)
- ☐B Ponds (include wet detention basins; do not include sediment basins or dry detention basins)
- ☐C Obstruction passing flow during low-flow periods within the assessment area (beaver dam, leaky dam, bottom-release dam, weir)
- ☐D Evidence of bank seepage or sweating (iron in water indicates seepage)
- ☒E Stream bed or bank soil reduced (dig through deposited sediment if present)
- ☐F None of the above

17. Baseflow Detractors – assessment area metric (skip for Tidal Marsh Streams)
Check all that apply.

- ☐A Evidence of substantial water withdrawals from the assessment reach (includes areas excavated for pump installation)
- ☐B Obstruction not passing flow during low-flow periods affecting the assessment reach (ex: watertight dam, sediment deposit)
- ☐C Urban stream (≥ 24% impervious surface for watershed)
- ☒D Evidence that the streamside area has been modified resulting in accelerated drainage into the assessment reach
- ☐E Assessment reach relocated to valley edge
- ☐F None of the above

18. Shading – assessment reach metric (skip for Tidal Marsh Streams)
Consider aspect. Consider "leaf-on" condition.

- ☐A Stream shading is appropriate for stream category (may include gaps associated with natural processes)
- ☐B Degraded (example: scattered trees)
- ☒C Stream shading is gone or largely absent

19. Buffer Width – streamside area metric (skip for Tidal Marsh Streams)
Consider "vegetated buffer" and "wooded buffer" separately for left bank (LB) and right bank (RB) starting at the top of bank out to the first break.

Vegetated		Wooded		
LB	RB	LB	RB	
☒A	☒A	☐A	☐A	≥ 100 feet wide or extends to the edge of the watershed
☐B	☐B	☐B	☐B	From 50 to < 100 feet wide
☐C	☐C	☐C	☐C	From 30 to < 50 feet wide
☐D	☐D	☐D	☐D	From 10 to < 30 feet wide
☐E	☐E	☒E	☒E	< 10 feet wide or no trees

20. Buffer Structure – streamside area metric (skip for Tidal Marsh Streams)
Consider for left bank (LB) and right bank (RB) for Metric 19 ("Vegetated" Buffer Width).

LB	RB	
☐A	☐A	Mature forest
☐B	☐B	Non-mature woody vegetation or modified vegetation structure
☒C	☒C	Herbaceous vegetation with or without a strip of trees < 10 feet wide
☐D	☐D	Maintained shrubs
☐E	☐E	Little or no vegetation

21. Buffer Stressors – streamside area metric (skip for Tidal Marsh Streams)
Check all appropriate boxes for left bank (LB) and right bank (RB). Indicate if listed stressor abuts stream (Abuts), does not abut but is within 30 feet of stream (< 30 feet), or is between 30 to 50 feet of stream (30-50 feet).
If none of the following stressors occurs on either bank, check here and skip to Metric 22: ☐

Abuts		< 30 feet		30-50 feet		
LB	RB	LB	RB	LB	RB	
☐A	☐A	☐A	☐A	☐A	☐A	Row crops
☐B	☐B	☐B	☐B	☐B	☐B	Maintained turf
☒C	☒C	☐C	☐C	☐C	☐C	Pasture (no livestock)/commercial horticulture
☐D	☐D	☐D	☐D	☐D	☐D	Pasture (active livestock use)

22. Stem Density – streamside area metric (skip for Tidal Marsh Streams)
Consider for left bank (LB) and right bank (RB) for Metric 19 ("Wooded" Buffer Width).

LB	RB	
☐A	☐A	Medium to high stem density
☐B	☐B	Low stem density
☒C	☒C	No wooded riparian buffer or predominantly herbaceous species or bare ground

23. Continuity of Vegetated Buffer – streamside area metric (skip for Tidal Marsh Streams)
Consider whether vegetated buffer is continuous along stream (parallel). Breaks are areas lacking vegetation > 10 feet wide.

LB	RB	
☒A	☒A	The total length of buffer breaks is < 25 percent.
☐B	☐B	The total length of buffer breaks is between 25 and 50 percent.
☐C	☐C	The total length of buffer breaks is > 50 percent.

24. Vegetative Composition – streamside area metric (skip for Tidal Marsh Streams)
Evaluate the dominant vegetation within 100 feet of each bank or to the edge of the watershed (whichever comes first) as it contributes to assessment reach habitat.

LB	RB	
☐A	☐A	Vegetation is close to undisturbed in species present and their proportions. Lower strata composed of native species, with non-native invasive species absent or sparse.
☐B	☐B	Vegetation indicates disturbance in terms of species diversity or proportions, but is still largely composed of native species. This may include communities of weedy native species that develop after clear-cutting or clearing or communities with non-native invasive species present, but not dominant, over a large portion of the expected strata or communities missing understory but retaining canopy trees.
☒C	☒C	Vegetation is severely disturbed in terms of species diversity or proportions. Mature canopy is absent or communities with non-native invasive species dominant over a large portion of expected strata or communities composed of planted stands of non-characteristic species or communities inappropriately composed of a single species or no vegetation.

25. Conductivity – assessment reach metric (skip for all Coastal Plain streams)
25a. ☐Yes ☒No Was conductivity measurement recorded?
If No, select one of the following reasons. ☒No Water ☐Other: _____

25b. Check the box corresponding to the conductivity measurement (units of microsiemens per centimeter).
☐A < 46 ☐B 46 to < 67 ☐C 67 to < 79 ☐D 79 to < 230 ☐E ≥ 230

Notes/Sketch:
Trash in stream

Draft NC SAM Stream Rating Sheet
Accompanies User Manual Version 2.1

Stream Site Name	R2707D 7-5 (Impact Site 6B)	Date of Assessment	11/10/2017
Stream Category	Pa3	Assessor Name/Organization	Melissa Ruiz, Alex Baldwin, Stantec

Notes of Field Assessment Form (Y/N)	YES
Presence of regulatory considerations (Y/N)	NO
Additional stream information/supplementary measurements included (Y/N)	
NC SAM feature type (perennial, intermittent, Tidal Marsh Stream)	Perennial

Function Class Rating Summary	USACE/ All Streams	NCDWR Intermittent
(1) Hydrology	**LOW**	
(2) Baseflow	**HIGH**	
(2) Flood Flow	**LOW**	
(3) Streamside Area Attenuation	**LOW**	
(4) Floodplain Access	**LOW**	
(4) Wooded Riparian Buffer	**LOW**	
(4) Microtopography	**LOW**	
(3) Stream Stability	**LOW**	
(4) Channel Stability	**LOW**	
(4) Sediment Transport	**LOW**	
(4) Stream Geomorphology	**LOW**	
(2) Stream/Intertidal Zone Interaction	NA	
(2) Longitudinal Tidal Flow	NA	
(2) Tidal Marsh Stream Stability	NA	
(3) Tidal Marsh Channel Stability	NA	
(3) Tidal Marsh Stream Geomorphology	NA	
(1) Water Quality	**LOW**	
(2) Baseflow	**HIGH**	
(2) Streamside Area Vegetation	**LOW**	
(3) Upland Pollutant Filtration	**LOW**	
(3) Thermoregulation	**LOW**	
(2) Indicators of Stressors	**YES**	
(2) Aquatic Life Tolerance	**HIGH**	
(2) Intertidal Zone Filtration	NA	
(1) Habitat	**LOW**	
(2) In-stream Habitat	**LOW**	
(3) Baseflow	**HIGH**	
(3) Substrate	**LOW**	
(3) Stream Stability	**LOW**	
(3) In-stream Habitat	**LOW**	
(2) Stream-side Habitat	**LOW**	
(3) Stream-side Habitat	**LOW**	
(3) Thermoregulation	**LOW**	
(2) Tidal Marsh In-stream Habitat	NA	
(3) Flow Restriction	NA	
(3) Tidal Marsh Stream Stability	NA	
(4) Tidal Marsh Channel Stability	NA	
(4) Tidal Marsh Stream Geomorphology	NA	
(3) Tidal Marsh In-stream Habitat	NA	
(2) Intertidal Zone	NA	
Overall	**LOW**	

09/08/99

TIP PROJECT: R-2707D

CONTRACT:

STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS

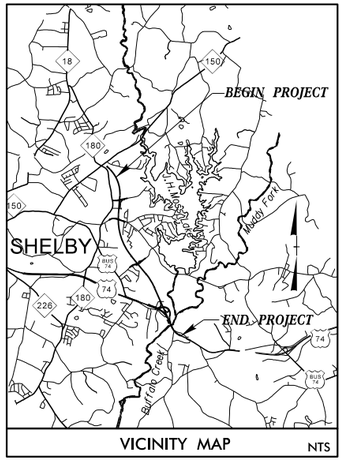
STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	R-2707D	OSM-1	

STATE PROJ. NO.	F. A. PROJ. NO.	DESCRIPTION
34497.1.F56	N/A	P.E.
34497.1.F56	N/A	R/W & UTIL

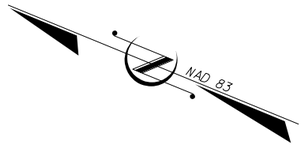
PLAN FOR CHANNEL RELOCATION
CLEVELAND COUNTY

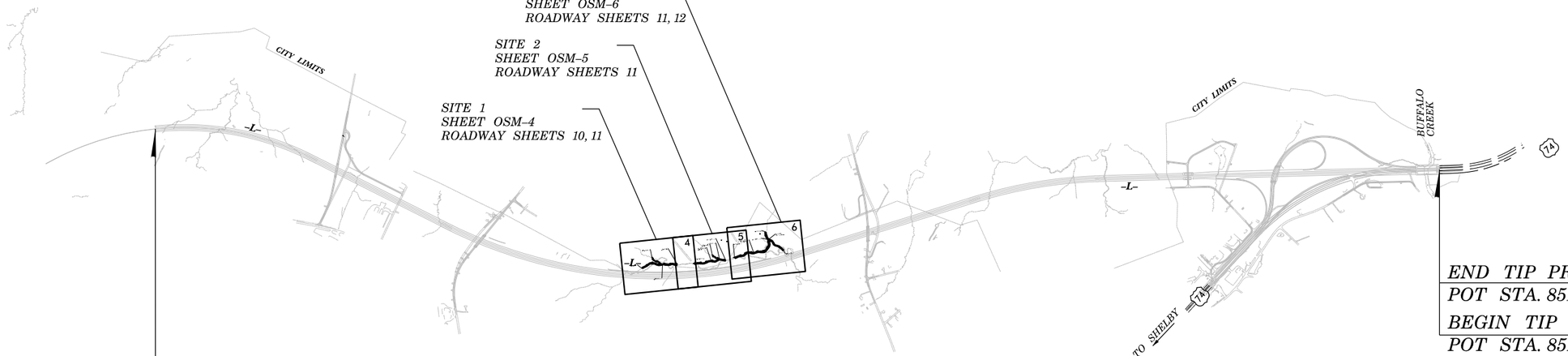
LOCATION: US 74, SHELBY BYPASS FROM EAST OF NC 150 TO EXISTING US 74, WEST OF SR 2238 (LONG BRANCH ROAD)

TYPE OF WORK: STREAM RELOCATION



VICINITY MAP NTS





END TIP PROJECT R-2707C
POC STA. 635+00.00 -L-

BEGIN TIP PROJECT R-2707D
POC STA. 635+00.00 -L-

END TIP PROJECT R-2707D
POT STA. 851+00.00 -L-

BEGIN TIP PROJECT R-2707E
POT STA. 851+00.00 -L-

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION

GRAPHIC SCALES

40 20 0 40 80
PLANS

40 20 0 40 80
PROFILE (HORIZONTAL)

4 2 0 4 8
PROFILE (VERTICAL)

DESIGN DATA

PROJECT LENGTH

MITIGATION SITE	MITIGATION TYPE	LENGTH
SITE 1	RELOCATION	812LF
SITE 2	RELOCATION	664LF
SITE 3	RELOCATION	1195LF

Stantec

PREPARED IN THE OFFICE OF:
STANTEC CONSULTING
801 Jones Franklin Road |Suite 300| Raleigh, NC 27606
Tel. (919) 851-6866 | Fax. (919) 851-7024 | www.stantec.com
License No. F-0672

FOR THE NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

2018 STANDARD SPECIFICATIONS

RIGHT OF WAY DATE:
JULY 2018

LETTING DATE:
AUGUST 2019

PROJECT ENGINEER

PROJECT DESIGN ENGINEER
THAD DUNCAN, P.E.
NCDOT DIVISON 12

DESIGN ENGINEER

SIGNATURE: *P.E.*

STATE OF NORTH CAROLINA • DEPARTMENT OF TRANSPORTATION •

8/24/2018
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lstarnes

8/17/99

REVISIONS

GENERAL NOTES

ALL WORK SHALL BE PERFORMED IN ACCORDANCE WITH THE FOLLOWING STANDARDS:

A) NORTH CAROLINA DEPARTMENT OF TRANSPORTATION "STANDARD SPECIFICATIONS FOR ROADS AND STRUCTURES, DATED JANUARY 2018, AND ANY SUPPLEMENTS THERETO ISSUED PRIOR TO THE DATE OF RECEIPT OF BIDS.

B) NORTH CAROLINA DEPARTMENT OF TRANSPORTATION "ROADWAY STANDARD DRAWINGS, ENGLISH" DATED JANUARY 2018, AND ANY SUPPLEMENTS ISSUED THERETO PRIOR TO THE DATE OF RECEIPT OF BIDS.

ALL RIGHT OF WAY CORNER MARKERS OR FENCING SHALL BE PLACED BY OTHERS AS NECESSARY.

THE CONTRACTOR IS RESPONSIBLE FOR AVOIDING ANY DISTURBANCE OR DAMAGE TO EXISTING UTILITIES AND SHALL BE RESPONSIBLE FOR IMMEDIATELY REPAIRING ANY DAMAGES AT A COST INCIDENT TO THIS CONTRACT.

ABANDONED SECTIONS OF THE EXISTING CHANNEL SHALL BE FILLED TO THE MAXIMUM EXTENT FEASIBLE WITH MATERIAL EXCAVATED ON-SITE. THIS EXCAVATED MATERIAL SHALL BE STOCKPILED ADJACENT TO THE REACHES OF CHANNEL OR DITCHES TO BE BACKFILLED.

THE PROPOSED STREAM RELOCATION SHALL BE CONSTRUCTED IN ACCORDANCE TO THE PROPOSED TYPICAL SECTIONS AND PROFILES, IN CONFORMANCE WITH THE PLANS.

SUBSURFACE PLANS: NO SUBSURFACE PLANS ARE AVAILABLE ON THE PROJECT. THE CONTRACTOR SHOULD MAKE HIS OWN INVESTIGATION AS TO THE SUBSURFACE CONDITIONS.

ROADWAY STANDARD DRAWINGS

(REV. JANUARY 2018)

THE FOLLOWING ROADWAY STANDARDS AS APPEAR IN "ROADWAY STANDARD DRAWINGS" - ROADWAY DESIGN UNIT - N.C. DEPARTMENT OF TRANSPORTATION - RALEIGH, N.C., DATED JANUARY 2018 AND THE LATEST REVISION THERETO ARE APPLICABLE TO THIS PROJECT AND BY REFERENCE HEREBY ARE CONSIDERED A PART OF THESE PLANS:

CONSTRUCTION SEQUENCING

THIS STREAM RELOCATION PROJECT CONSISTS OF TWO REACHES (1 & 2) INCLUSIVE OF MULTIPLE DESIGNED SUB REACHES(1A,1B,1ATRIB,1BTRIB,2A,2B,2C). ONCE WORK BEGINS ON A STREAM REACH, THE CONTRACTOR MUST COMPLETE THAT REACH BEFORE MOVING WORK CREWS AND EQUIPMENT TO A DIFFERENT REACH, UNLESS APPROVED TO DO SO BY THE ENGINEER.

PERFORM STAKEOUT SURVEY FOR THE PROPOSED STREAM CHANNEL, CONSTRUCTION EASEMENT LIMITS, AND GRADE STAKES. THE ENGINEER MUST INSPECT AND APPROVE ALL STAKEOUT WORK BEFORE CONSTRUCTION MAY BEGIN.

MOBILIZE EQUIPMENT AND MATERIALS TO THE SITE.

INSTALL CONSTRUCTION ENTRANCE PER EROSION CONTROL PLAN.(REFER TO ROADWAY CONSTRUCTION DRAWINGS)

ESTABLISH STAGING AREAS AND MARK CONSTRUCTION EQUIPMENT ACCESS LOCATIONS WITH VISIBLE MARKERS. CONSTRUCTION EQUIPMENT SHALL BE CONTAINED WITHIN THE LIMITS OF CONSTRUCTION AS DEPICTED IN THE PLANS OR SPECIFIED BY THE ENGINEER.

INSTALL TEMPORARY EROSION CONTROL MEASURES.

BEGIN FLOODPLAIN GRADING, INCLUDING EXCAVATION OF BANKFULL BENCHES AT LOCATIONS DEPICTED IN THE PLANS AND AS DIRECTED BY THE ENGINEER. STOCKPILE MATERIALS ONLY WITHIN APPROVED LIMITS OF DISTURBANCE AS DESIGNATED ON THE EROSION CONTROL PLANS(REFER TO ROADWAY CONSTRUCTION DRAWINGS). KEEP TOPSOIL SEPARATE FROM OTHER STOCKPILE MATERIAL FOR LATER USE IN FLOODPLAIN. FINISH GRADING AND REVEGETATION PREPARATION.

TOPSOIL SHALL BE EXCAVATED AND STOCKPILED SEPARATELY FROM THE WASTE MATERIAL SO THAT IT CAN BE PLACED BACK ON THE FLOODPLAIN ONCE GRADING IS COMPLETE. NO DIRECT PAYMENT WILL BE MADE FOR THIS EXCAVATION. OVER-EXCAVATE FLOODPLAIN AND FLOODPLAIN SLOPES TO A DEPTH OF 6" BELOW FINAL GRADE AND PLACE 6" OF TOPSOIL TO FILL TO FINAL GRADE. OVER-EXCAVATION SHOULD BEGIN 3' FROM TOP OF BANK AND EXTEND TO EXCAVATION LIMITS. SEE TYPICAL SECTIONS FOR DETAIL.
INSTALL IMPERVIOUS DIKES AND PUMP AROUND SYSTEM TO PUMP STREAM DISCHARGE AROUND THE IMMEDIATE WORK AREA AS NECESSARY.

CONSTRUCTION SHALL PROCEED IN SUCCESSIVE REACHES WITH THE UPSTREAM REACH BEING COMPLETED PRIOR TO INITIATING CONSTRUCTION OF THE ADJACENT DOWNSTREAM REACH. EACH REACH SHALL BE LIMITED IN LENGTH TO WORK THAT CAN BE COMPLETED BEFORE ALLOWING WATER TO FLOW THROUGH THAT REACH. COMPLETION OF A REACH SHALL CONSIST OF CHANNEL CONSTRUCTION, FLOODPLAIN GRADING, IN-STREAM STRUCTURE INSTALLATION, BED MATERIAL INSTALLATION, AND EROSION CONTROL MEASURES. CONSTRUCTION SHALL BE DONE IN THE DRY, WITH THE CHANNEL FLOW PUMPED AROUND THE DEWATERED REACH UNDER CONSTRUCTION AS NECESSARY.

AT THE END OF EACH DAY'S CONSTRUCTION WORK, THE CONTRACTOR SHALL SEED ALL DISTURBED AREAS AND COVER THE STREAM BANKS AND BANKFULL BENCHES WITH COIR FIBER MATTING TO THE EXTENT AS SHOWN ON PLANS. IN ADDITION, THE CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTAINING ALL TEMPORARY EROSION CONTROL MEASURES ON A DAILY BASIS THROUGHOUT THE CONSTRUCTION PROCESS.

ONCE NEW CHANNEL CONSTRUCTION IS COMPLETE, THE CONTRACTOR SHALL INSTALL STREAM PLUGS TO DIRECT STREAM FLOW INTO THE NEW CHANNEL. THE CONTRACTOR SHALL THEN FILL IN THE ABANDONED SECTIONS OF THE EXISTING CHANNEL TO THE EXTENT FEASIBLE AND AS DIRECTED BY THE ENGINEER. CONTRACTOR WILL ENSURE THAT EITHER:1) VEGETATION HAS BEEN ESTABLISHED ALONG THE BANKS OF THE NEW STREAM CHANNEL OR 2)BANKS HAVE BEEN FULLY MATTED,STEAKED AND PLANTED PER VEGETATION PLAN.
FOR NEW STREAM CHANNEL REACHES WHERE THIS IS NOT POSSIBLE, THE CONTRACTOR SHOULD GET APPROVAL FROM THE ENGINEER BEFORE DIRECTING FLOW INTO THE NEW STREAM CHANNEL.

AFTER ALL IN-STREAM WORK IS COMPLETED, THE CONTRACTOR SHALL REMOVE TEMPORARY EROSION CONTROL MEASURES AND TEMPORARY STREAM ACCESS PER EROSION CONTROL PLAN (REFER TO ROADWAY CONSTRUCTION DRAWINGS). SCARIFY ANY COMPACTED AREAS AS DIRECTED BY THE ENGINEER. ALL PORTIONS OF THE SITE SHALL BE STABILIZED WITH TEMPORARY EROSION CONTROL MEASURES.

8/24/2018
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lstarnes

R-2707D
ON-SITE MITIGATION
CLEVELAND COUNTY

Stantec
Stantec Consulting Services Inc.
801 Jones Franklin Road
Suite 300
Raleigh, NC 27606
Tel. (919) 851-6866
Fax. (919) 851-7024
www.stantec.com
License No. F-0672

PROJECT REFERENCE NO.	SHEET NO.
R2707D	OSM-1A

PROJECT ENGINEER

APPROVED BY:

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

DATE:

INDEX OF SHEETS

OSM-1	TITLE SHEET
OSM-1A	INDEX OF SHEETS, CONSTRUCTION SEQUENCING, GENERAL NOTES
OSM-1B	CONVENTIONAL PLAN SHEET SYMBOLS
OSM-2 - OSM-2A	CHANNEL TYPICAL DETAIL
OSM-2B	DETAILS -COIR FIBER MATTING -ROCK CROSS VANE
OSM-2C	-CONSTRUCTED RIFFLE -WOOD TOE PROTECTION -ROCK ENERGY DISSIPATOR BASIN
OSM-2D	-STREAM PLUG -ROCK J-HOOK VANE -LOG VANE WITH ROCK J-HOOK
OSM-2E - OSM-2F	-MORPHOLOGICAL TABLES
OSM-3	SUMMARY OF QUANTITIES EARTHWORK SUMMARY
OSM-4 - OSM-6	PLAN SHEETS
OSM-7 - OSM-10	PROFILE SHEETS
OSM-11 - OSM-31	CROSS SECTIONS
RF-1	PLANTING DETAILS
RF-2 - RF-4	PLANTING PLAN SHEETS

STREAM SYMBOLS

PLAN VIEW SYMBOLS

LOG VANE WITH ROCK J-HOOK

ROCK ENERGY DISSIPATOR BASIN

WOOD TOE

CONSTRUCTED RIFFLE

STREAM PLUG

BACKFILL EXISTING CHANNEL

ROCK J-HOOK VANE

ROCK CROSS VANE

FP——FP FLOODPLAIN LINE

PROFILE SYMBOLS

EXISTING GROUND ELEVATION

PROPOSED GROUND ELEVATION

PROPOSED BANKFULL

LOG VANE WITH ROCK J-HOOK

CONSTRUCTED RIFFLE

ROCK CROSS VANE

ROCK J-HOOK VANE

PLANTING SYMBOLS

TYPE I

TYPE II

PROJECT REFERENCE NO.	SHEET NO.
U-2525B	OSM-1B

Note: Not to Scale

S.U.E. = Subsurface Utility Engineering

STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS

CONVENTIONAL PLAN SHEET SYMBOLS

BOUNDARIES AND PROPERTY:

- State Line
- County Line
- Township Line
- City Line
- Reservation Line
- Property Line
- Existing Iron Pin — EIP
- Property Corner
- Property Monument — ECM
- 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

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

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 — G
- 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
- 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.

R2707D
CHANNEL RELOCATION
CLEVELAND COUNTY

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License No. F-0672

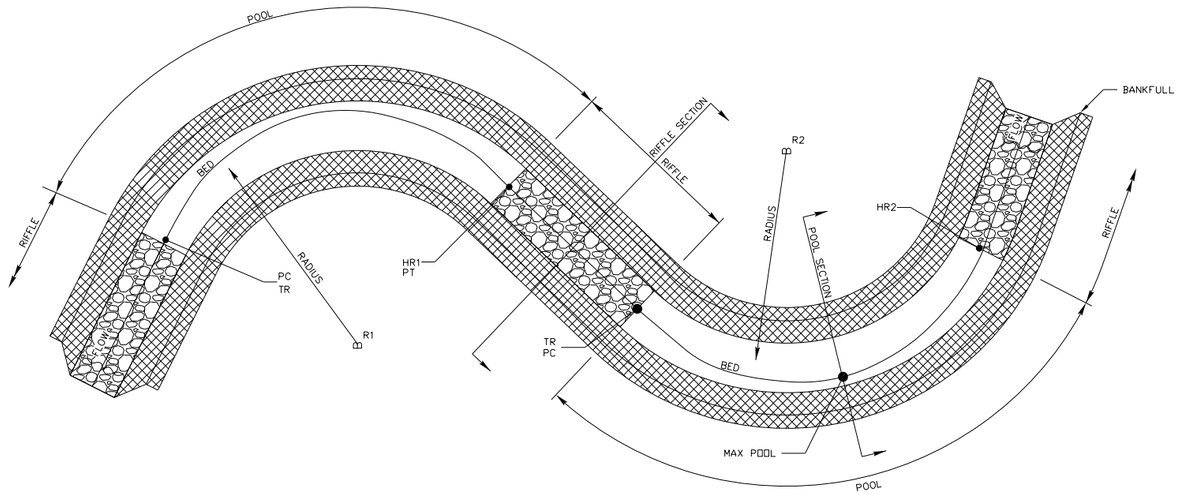
PROJECT REFERENCE NO.	SHEET NO.
R2707D	OSM-2

PROJECT ENGINEER

APPROVED BY:

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

DATE:

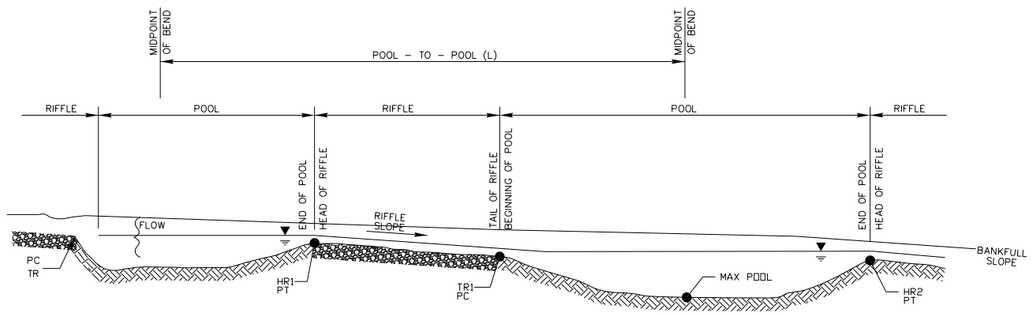


TYPICAL PLAN

NOTE:
1. TYPICAL PLAN NOT REFLECTIVE OF ACTUAL DESIGN.
2. REFER TO PLAN SHEETS FOR SPECIFIC PROPOSED TREATMENTS, GEOMETRY DATA, AND HORIZONTAL PLACEMENT.
3. REFER TO PROFILE SHEETS FOR VERTICAL PLACEMENT.

NOTE:
PC: POINT OF CURVATURE
TR: TAIL OF RIFFLE
PT: POINT OF TANGENCY
HR: HEAD OF RIFFLE

REFER TO CHANNEL TYPICAL DETAIL SECTIONS FOR ADDITIONAL INFORMATION



TYPICAL PROFILE

CHANNEL TYPICAL DETAIL-PLAN & PROFILE

NOT TO SCALE

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CLEVELAND COUNTY

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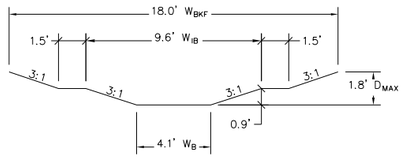
PROJECT REFERENCE NO.	SHEET NO.
R2707D	OSM-2A

PROJECT ENGINEER

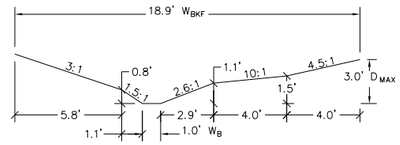
APPROVED BY:

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

DATE:

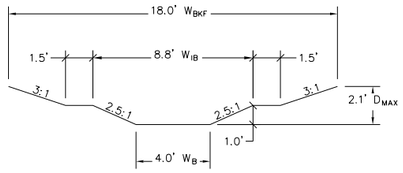


TYPICAL RIFFLE



TYPICAL POOL

REACH 1A: STA 10+00 – 16+21.34



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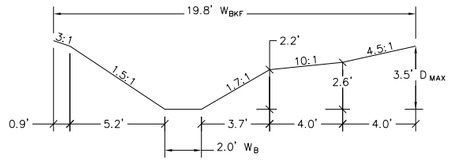
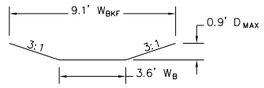


TYPICAL POOL

REACH 1B UPPER: STA 30+00 – 32+83.34



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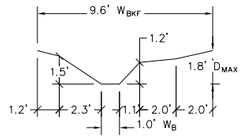
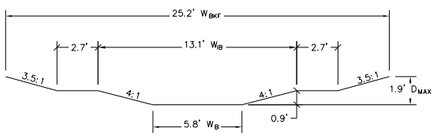


TYPICAL POOL

REACH 1B TRIBUTARY: STA 40+00 – 41+33.89



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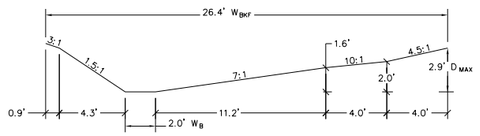
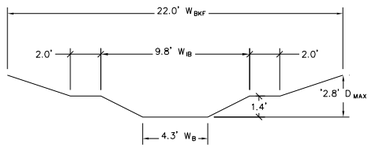


TYPICAL POOL

REACH 2A LOWER: STA 53+38.09 – 57+41.00



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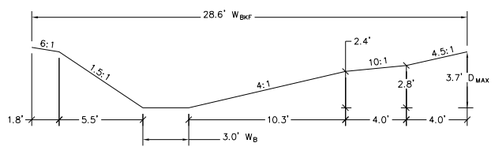
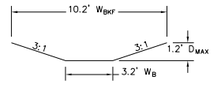
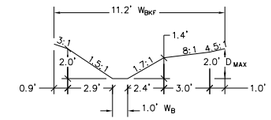


TYPICAL POOL

REACH 2C: STA 63+23.20 – 64+60.02

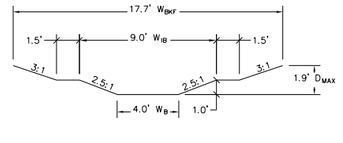


TYPICAL RIFFLE

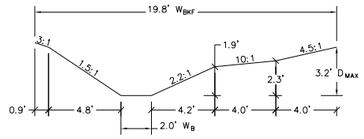


TYPICAL POOL

REACH 1A TRIBUTARY: STA 20+00 – 21+98.90

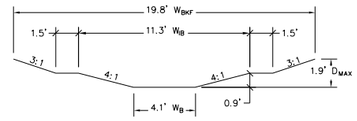


TYPICAL RIFFLE

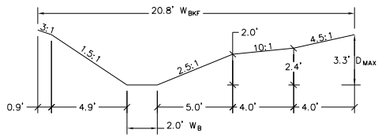


TYPICAL POOL

REACH 1B LOWER: STA 32+83.34 – 35+30.28

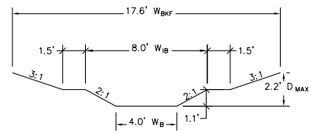


TYPICAL RIFFLE

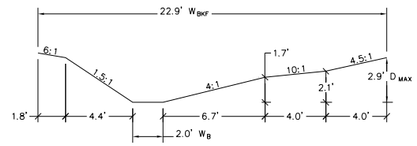


TYPICAL POOL

REACH 2A UPPER: STA 50+00 – 53+38.09



TYPICAL RIFFLE



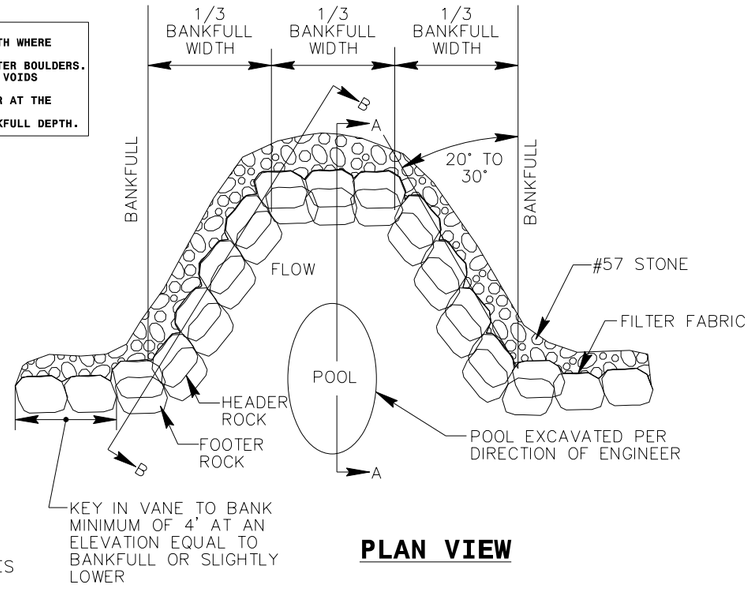
TYPICAL POOL

REACH 2B: STA 60+00 – 63+23.20

CHANNEL TYPICAL DETAIL SECTIONS

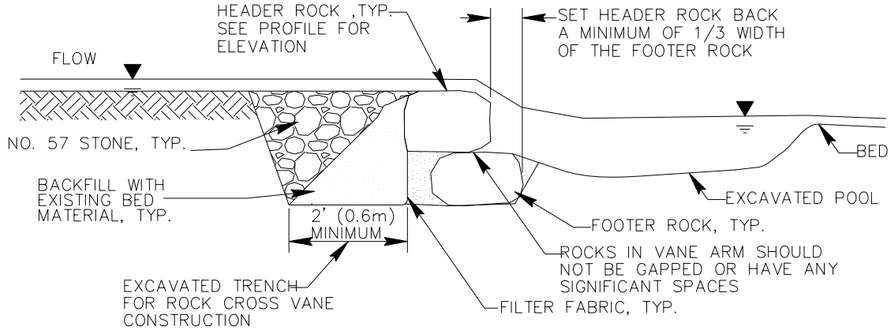
NOT TO SCALE

NOTES:
1. DEEPEST PART OF POOL TO BE IN LINE WITH WHERE VANE ARM TIES INTO BANKFULL.
2. DO NOT EXCAVATE POOL TOO CLOSE TO FOOTER BOULDERS.
3. CLASS "A" STONE CAN BE USED TO REDUCE VOIDS BETWEEN HEADERS AND FOOTERS.
4. COMPACT BACKFILL TO EXTENT POSSIBLE OR AT THE DIRECTION OF THE ENGINEER.
5. POOL DEPTH SHOULD BE 2 TO 3 TIMES BANKFULL DEPTH.

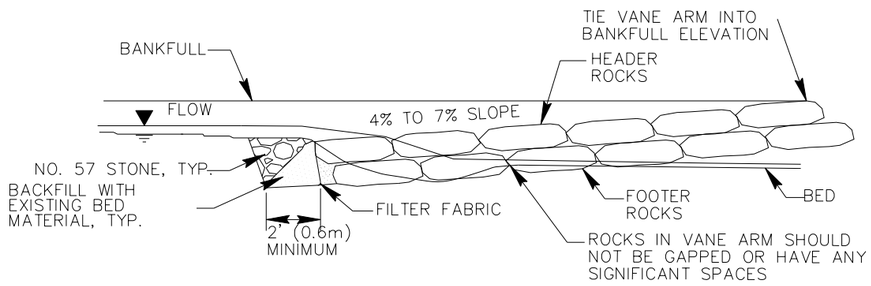


NOTE: REFER TO CONSTRUCTED RIFFLE DETAIL FOR BOULDER SIZES

PLAN VIEW



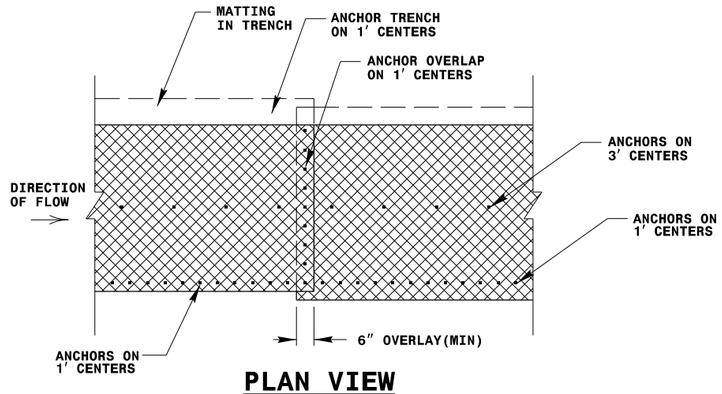
SECTION A-A



SECTION B-B

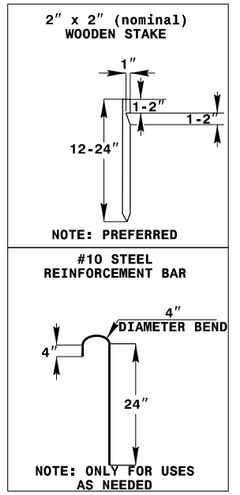
ROCK CROSS VANE DETAIL (MODIFIED)

NOT TO SCALE

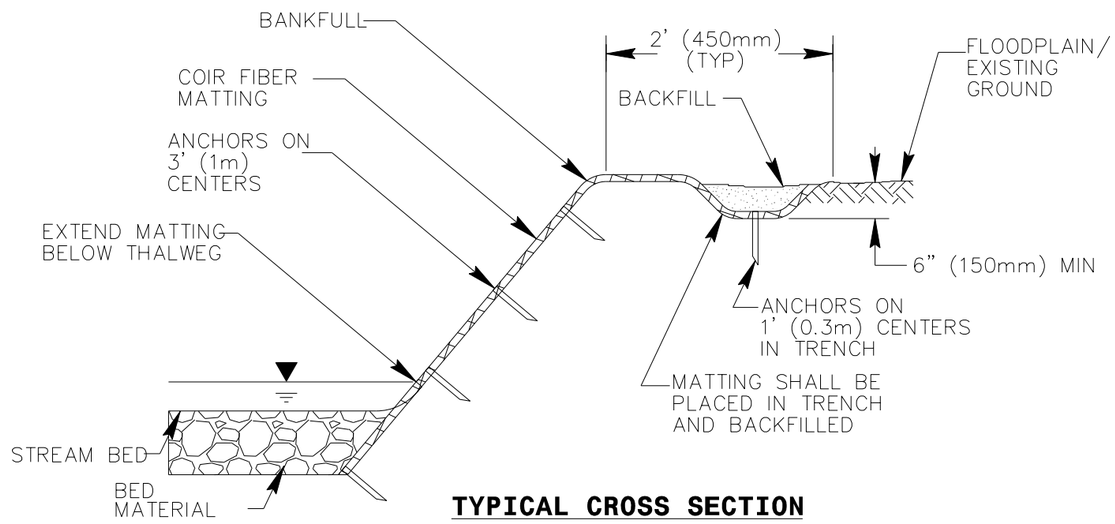


PLAN VIEW

NOTES:
1. IN AREAS TO BE MATTED, ALL SEEDING, SOIL AMENDMENTS, AND SOIL PREPARATION MUST BE COMPLETED IN ACCORDANCE WITH THE PROJECT SPECIFICATIONS PRIOR TO PLACEMENT OF COIR FIBER MATTING.
2. REBAR OR STAPLES MAY BE USED IN PLACE OF WOODEN STAKES AS DIRECTED BY THE ENGINEER.



ANCHOR OPTIONS



TYPICAL CROSS SECTION

COIR FIBER MATTING DETAIL (MODIFIED)

NOT TO SCALE

NOTE: REFER TO CONSTRUCTED RIFFLE DETAIL FOR BOULDER SIZES

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PROJECT REFERENCE NO.	SHEET NO.
R2707D	OSM-2B

PROJECT ENGINEER

APPROVED BY:

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

DATE:

R2707D CHANNEL RELOCATION CLEVELAND COUNTY

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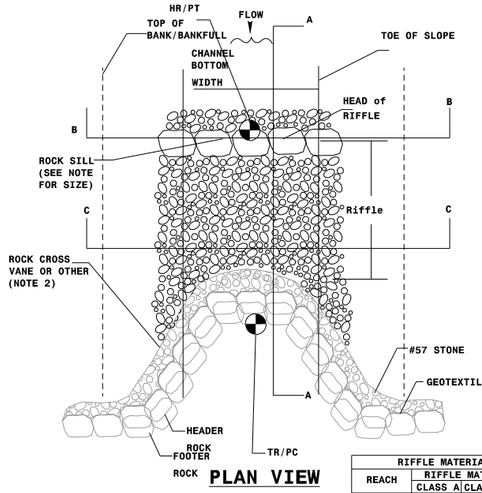
PROJECT REFERENCE NO.	SHEET NO.
R2707D	OSM-2C

PROJECT ENGINEER

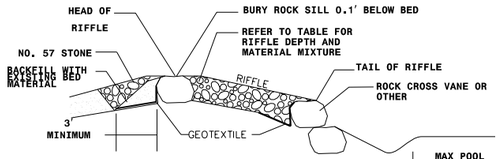
APPROVED BY:

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

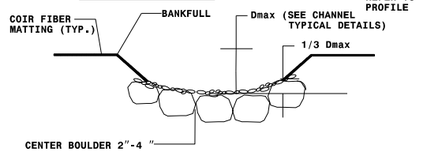
DATE:



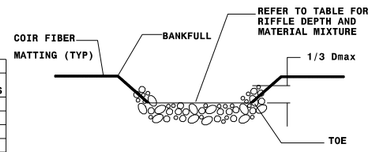
PLAN VIEW



SECTION A-A



SECTION B-B



SECTION C-C

BOULDER SIZE DATA CHART			
REACH	BOULDER DIMENSIONS HEIGHT	WIDTH	LENGTH
1A	2'	3'	4'
1A TRIB	1'	2'	3'
1B-UPPER	1'	2'	3'
1B-LOWER	2'	3'	4'
1B TRIB	1'	2'	3'
2A-UPPER	2'	3'	4'
2A-LOWER	1'	2'	3'
2B	2'	3'	4'
2C	2'	3'	4'

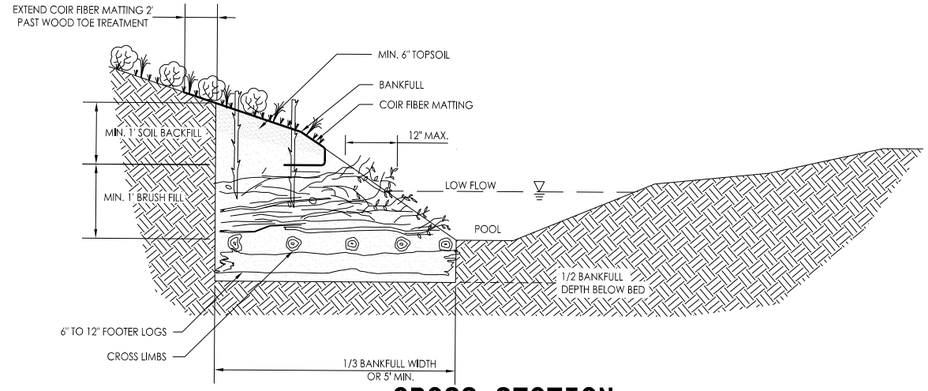
NOTE: THESE DIMENSIONS SPECIFY THE MINIMUM BOULDER SIZE

RIFFLE MATERIAL SIZE DATA CHART				
REACH	RIFFLE MATERIAL MIXTURE CLASS A	CLASS 1	CLASS 2	NOMINAL THICKNESS
1A	10	45	45	3'
1A TRIB	10	90	-	2'
1B-UPPER	10	90	-	2'
1B-LOWER	10	45	45	3'
1B TRIB	10	90	-	2'
2A-UPPER	10	45	45	3'
2A-LOWER	10	90	-	2'
2B	10	45	45	3'
2C	10	45	45	3'

NOTE:
1. BOULDER ROCK SILL SHOULD BE NATIVE STONES OR SHOT ROCK, ANGULAR AND OBLONG, WITH AN AXIS APPROXIMATELY 4'Lx3'Wx2'D
2. REFER TO PLAN SHEET AND PROFILE FOR SPECIFIC STRUCTURE AND CORRESPONDING DETAIL.

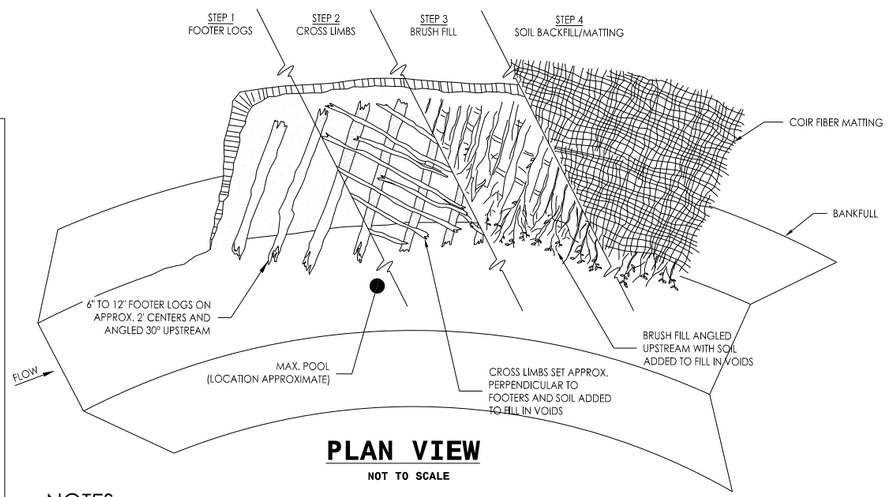
CONSTRUCTED RIFFLE DETAIL (MODIFIED)

NOT TO SCALE



CROSS SECTION

NOT TO SCALE



PLAN VIEW

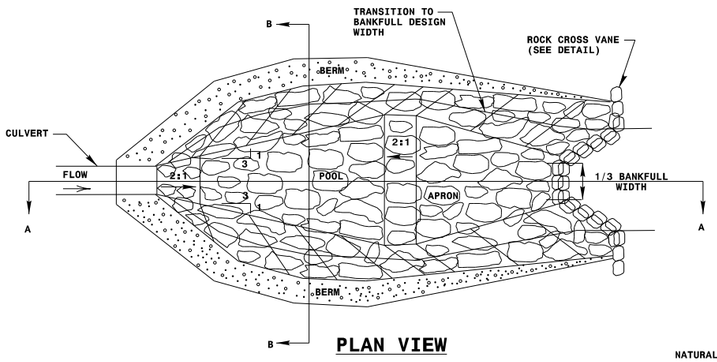
NOT TO SCALE

NOTES:

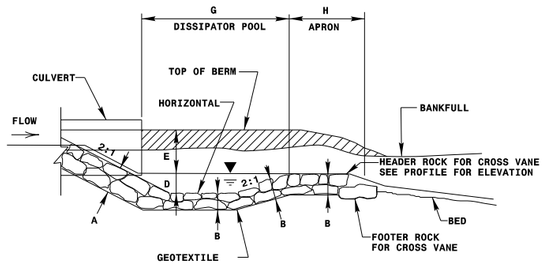
1. MIX LAYERS OF SOIL WITH COARSE WOODY DEBRIS. (30% TO BE FROM LIVE MATERIAL OF NON-INVASIVE SPECIES). THIS SHALL EXTEND TO A DEPTH OF 1/2 BANKFULL, BELOW THE BOTTOM OF THE BED.
2. WRAP SOIL BACKFILL/TOPSOIL WITH COIR FIBER MATTING AND PLANT WITH LIVE STAKES PER THE PLANTING PLAN.
3. WOODY DEBRIS SHALL NOT EXTEND INTO THE PROPOSED CHANNEL MORE THAN 12" MAXIMUM.
4. NO WOOD MATERIALS SHALL BE DEAD OR ROTTING.
5. ALL MATERIALS ARE TO BE APPROVED BY ENGINEER OR ENGINEER'S ONSITE CONSTRUCTION MANAGER.
6. EXTEND WOOD TOE TREATMENT DOWNSTREAM BEYOND HEAD OF RIFFLE PER PLAN.

WOOD TOE PROTECTION

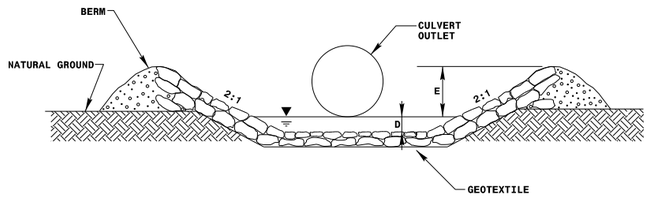
NOT TO SCALE



PLAN VIEW



SECTION A-A



SECTION B-B

ROCK ENERGY DISSIPATOR BASIN DETAIL

NOT TO SCALE

R2707D
CHANNEL RELOCATION
CLEVELAND COUNTY

Stantec
Stantec Consulting Services Inc.
801 Jones Franklin Road
Suite 300
Raleigh, NC 27606
Tel. (919) 851-6866
Fax. (919) 851-7024
www.stantec.com
License No. F-0672

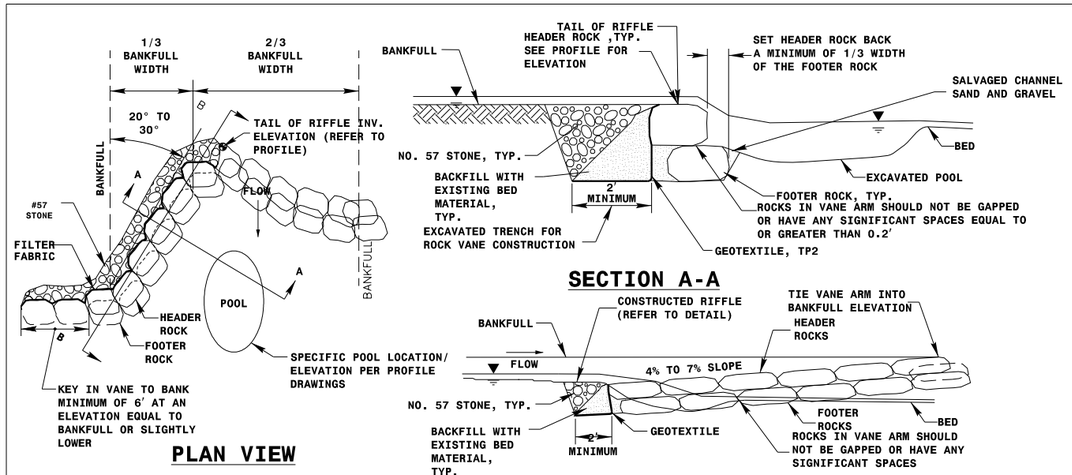
PROJECT REFERENCE NO.	SHEET NO.
R2707D	OSM-2D

PROJECT ENGINEER

APPROVED BY:

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

DATE:



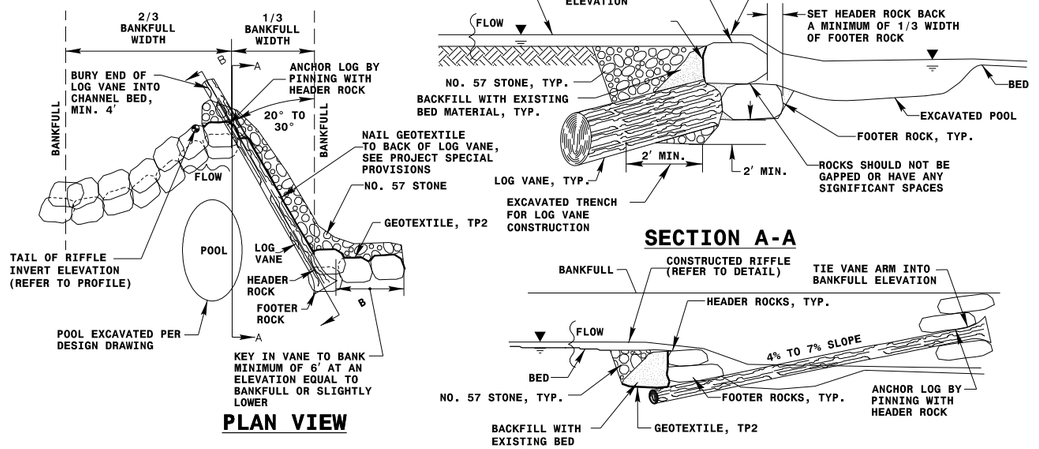
NOTES:
1. DEEPEST PART OF POOL (MAX POOL).
2. DO NOT EXCAVATE POOL TOO CLOSE TO FOOTER BOULDERS.
3. CLASS "A" STONE CAN BE USED TO REDUCE VOIDS BETWEEN HEADERS AND FOOTERS.
4. COMPACT BACKFILL TO EXTENT POSSIBLE OR AT THE DIRECTION OF THE ENGINEER.
5. POOL DEPTH SHOULD BE 2 TO 3 TIMES BANKFULL DEPTH.

NOTE: NUMBER OF STONES VARY DEPENDING ON ⅓ BANFULL WIDTH

REFER TO CONSTRUCTED RIFFLE DETAIL FOR BOULDER SIZES

ROCK J-HOOK VANE DETAIL (MODIFIED)

NOT TO SCALE



#57 STONE	
1.5"	100
1"	85-100
0.5"	25-60
#4	0.10
#8	0.5

REFER TO CONSTRUCTED RIFFLE DETAIL FOR BOULDER SIZES

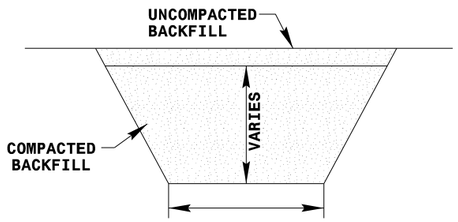
NOTES:
1. DEEPEST PART OF POOL (MAX POOL).
2. DO NOT EXCAVATE POOL TOO CLOSE TO FOOTER BOULDERS.
3. CLASS "A" STONE CAN BE USED TO REDUCE VOIDS BETWEEN HEADERS AND FOOTERS.
4. COMPACT BACKFILL TO EXTENT POSSIBLE OR AT THE DIRECTION OF THE ENGINEER.
5. POOL DEPTH SHOULD BE 2 TO 3 TIMES BANKFULL DEPTH.

NOTE: NUMBER OF STONES VARY DEPENDING ON ⅓ BANFULL WIDTH

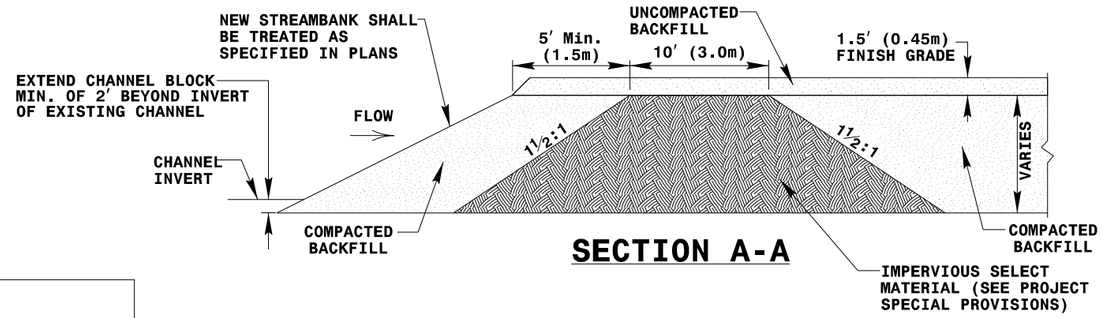
LOG VANE WITH ROCK J-HOOK DETAIL (MODIFIED)

NOT TO SCALE

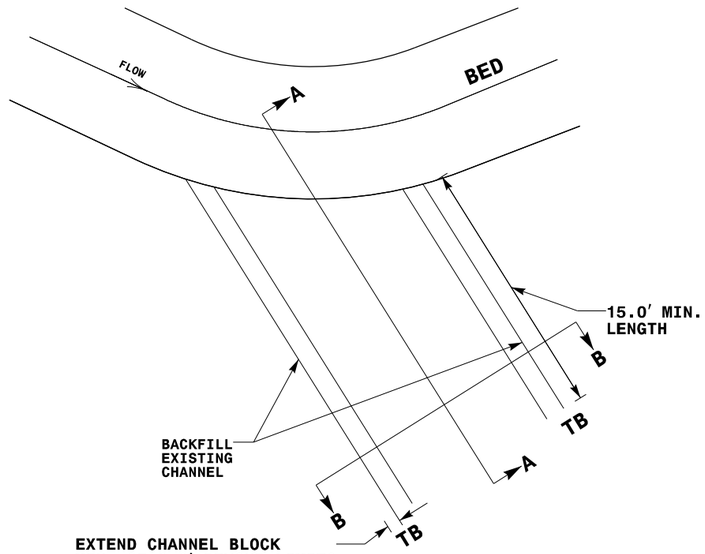
NOTES:
1) STREAM PLUG SHALL BE INSTALLED IN ACCORDANCE WITH THE PROJECT SPECIFICATIONS AND AS SHOWN ON PLANS.
3) BOTTOM OF BLOCK SHOULD BE A MINIMUM OF 2.0' BELOW THE INVERT OF THE EXISTING CHANNEL.
4) BLOCK SHOULD EXTEND A MINIMUM OF 2.0' BEYOND THE LIMITS OF THE EXISTING STREAM CHANNEL.
5) INSTALL EROSION CONTROL MATTING AND SEED IN ACCORDANCE WITH THE PROJECT SPECIFICATIONS IMMEDIATELY AFTER GRADING.
6) COMPACT BACKFILL TO EXTENT POSSIBLE OR AT THE DIRECTION OF THE ENGINEER.



SECTION B-B



SECTION A-A



PLAN VIEW

STREAM PLUG

NOT TO SCALE

R2707D
CHANNEL RELOCATION
CLEVELAND COUNTY

Stantec
Stantec Consulting Services Inc.
801 Jones Franklin Road
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www.stantec.com
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PROJECT REFERENCE NO.	SHEET NO.
R2707D	OSM-2E

PROJECT ENGINEER

APPROVED BY:

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

DATE:

VARIABLES		Reference Reach	Reference Reach	Reference Reach	Existing Reach 1A	Design Reach 1A	Design Reach 1A Tributary	Existing Reach 1B	Design Reach 1B Upper	Design Reach 1B Lower	Design Reach 1B Tributary
STATION		-	-	-	-	-	-	-	-	-	-
1.	Stream Type	C4	B 4/1c	B 4	B 4c	B4/1	B/Bc	B 4c	Bc	Bc	B
	(Rosgen)										
2.	Drainage Area	0.21	0.19	0.81	0.42	0.42	0.09	0.46	0.53	0.53	0.05
	[mi2]										
	Riffle Dimensions										
3.	Bankfull Width	**Mean:** 7.55	**Mean:** 7.37	**Mean:** 13.14	**Mean:** 12.31	**Mean:** 17.98	**Mean:** 10.20	**Mean:** 15.67	**Mean:** 18.00	**Mean:** 17.73	**Mean:** 9.13
	(Wbkf) [ft]	Range: 7.03 8.06	Range: 6.58 8.16	Range: 12.12 14.16	Range: 10.57 14.04	Range:	Range:	Range: 15.4 15.94	Range:	Range:	Range:
4.	Mean Riffle Depth	**Mean:** 0.90	**Mean:** 1.04	**Mean:** 0.86	**Mean:** 1.31	**Mean:** 1.20	**Mean:** 0.78	**Mean:** 1.49	**Mean:** 1.20	**Mean:** 1.27	**Mean:** 0.61
	(dbkf) [ft]	Range: 0.82 0.97	Range: 0.94 1.13	Range: 0.82 0.89	Range: 1.09 1.53	Range:	Range:	Range: 1.15 1.82	Range:	Range:	Range:
5.	Maximum Riffle Depth	**Mean:** 1.29	**Mean:** 1.53	**Mean:** 1.22	**Mean:** 1.7	**Mean:** 1.80	**Mean:** 1.20	**Mean:** 2.20	**Mean:** 2.10	**Mean:** 1.90	**Mean:** 0.91
	(dmax) [ft]	Range: 1.19 1.39	Range: 1.38 1.67	Range: 1.16 1.27	Range: 1.44 1.96	Range:	Range:	Range: 1.77 2.62	Range:	Range:	Range:
6.	Width of Flood-Prone Area	**Mean:** 31	**Mean:** 20	**Mean:** 21	**Mean:** 17	**Mean:**	**Mean:**	**Mean:** 23	**Mean:**	**Mean:**	**Mean:**
	(Wfpa) [ft]	Range: 27 34	Range: 19 22	Range: 18 25	Range: 14 20	Range:	Range:	Range: 22 24	Range:	Range:	Range:
7.	Riffle Inner Berm Width	**Mean:** -	**Mean:** -	**Mean:** -	**Mean:** -	**Mean:** 9.60	**Mean:** -	**Mean:** -	**Mean:** 8.8	**Mean:** 9.0	**Mean:** -
	(Wib) [ft]	Range: - -	Range: - -	Range: - -	Range: - -	Range:	Range: - -	Range: - -	Range:	Range:	Range: - -
8.	Riffle Inner Berm Depth	**Mean:** -	**Mean:** -	**Mean:** -	**Mean:** -	**Mean:** 0.90	**Mean:** -	**Mean:** -	**Mean:** 1.0	**Mean:** 1.0	**Mean:** -
	(dib) [ft]	Range: - -	Range: - -	Range: - -	Range: - -	Range:	Range: - -	Range: - -	Range:	Range:	Range: - -
9.	Riffle Inner Berm Area	**Mean:** -	**Mean:** -	**Mean:** -	**Mean:** -	**Mean:** 6.14	**Mean:** -	**Mean:** -	**Mean:** 6.7	**Mean:** 6.2	**Mean:** -
	(Aib) [ft2]	Range: - -	Range: - -	Range: - -	Range: - -	Range:	Range: - -	Range: - -	Range:	Range:	Range: - -
10.	Riffle Cross-Sectional Area	**Mean:** 6.78	**Mean:** 7.55	**Mean:** 11.25	**Mean:** 15.77	**Mean:** 21.56	**Mean:** 8.00	**Mean:** 23.33	**Mean:** 24.96	**Mean:** 22.47	**Mean:** 5.56
	(Abkf) [ft2]	Range: 5.76 7.80	Range: 7.42 7.68	Range: 10.85 11.65	Range: 15.37 16.16	Range:	Range:	Range: 17.66 28.99	Range:	Range:	Range:
11.	Riffle Width/Depth Ratio	**Mean:** 8.44	**Mean:** 7.25	**Mean:** 15.44	**Mean:** 9.90	**Mean:** 15.00	**Mean:** 15.00	**Mean:** 11.08	**Mean:** 13.00	**Mean:** 14.00	**Mean:** 15.00
	(Wbkf/dbkf)	Range: 8.31 8.57	Range: 5.82 8.68	Range: 13.62 17.27	Range: 6.91 12.88	Range:	Range:	Range: 8.76 13.39	Range:	Range:	Range:
12.	Max Riffle Depth to Mean Riffle Depth	**Mean:** 1.44	**Mean:** 1.47	**Mean:** 1.43	**Mean:** 1.30	**Mean:** 1.50	**Mean:** 1.50	**Mean:** 1.49	**Mean:** 1.50	**Mean:** 1.50	**Mean:** 1.50
	(dmax/dbkf)	Range: 1.43 1.45	Range: 1.47 1.48	Range: 1.30 1.55	Range: 1.28 1.32	Range:	Range:	Range: 1.44 1.54	Range:	Range:	Range:
13.	Entrenchment Ratio	**Mean:** 4.03	**Mean:** 2.83	**Mean:** 1.62	**Mean:** 1.38	**Mean:** 1.60	**Mean:** 1.60	**Mean:** 1.47	**Mean:** 2.50	**Mean:** 1.90	**Mean:** 1.60
	(Wfpa/Wbkf)	Range: 3.85 4.21	Range: 2.29 3.36	Range: 1.47 1.77	Range: 1.37 1.40	Range:	Range:	Range: 1.42 1.51	Range:	Range:	Range:
14.	Bankfull Mean Velocity	**Mean:**	**Mean:**	**Mean:**	**Mean:** 4.4	**Mean:** 4.9	**Mean:** 4.0	**Mean:** 4.9	**Mean:** 4.8	**Mean:** 4.9	**Mean:** 3.5
	(Vbkf) [ft/s]	Range:	Range:	Range:	Range:	Range: 4.7 5.1	Range: 3.8 4.2	Range: 4.6 5.2	Range: 4.6 4.9	Range: 4.7 5.1	Range: 3.3 3.7
15.	Bankfull discharge	**Mean:**	**Mean:**	**Mean:**	**Mean:** 67.1	**Mean:** 97.0	**Mean:** 29.2	**Mean:** 125.7	**Mean:** 105.8	**Mean:** 98.2	**Mean:** 17.4
	(Qbkf) [ft3/s]	Range:	Range:	Range:	Range:	Range: 92.0 102.0	Range: 27.7 30.6	Range: 118.6 132.7	Range: 102.2 109.3	Range: 93.8 102.5	Range: 16.5 18.3
	Pool Dimensions										
16.	Pool Width	**Mean:** 9.72	**Mean:** 10.6	**Mean:** 10.37	**Mean:** 18.36	**Mean:** 18.88	**Mean:** 11.22	**Mean:** 27.75	**Mean:** 19.82	**Mean:** 19.82	**Mean:** 9.59
	(Wbkfp) [ft]	Range: 8.87 10.57	Range: 10.55 10.65	Range: 9.27 11.46	Range: 18.14 18.57	Range:	Range:	Range:	Range:	Range:	Range:
17.	Mean Pool Depth	**Mean:** 1.25	**Mean:** 1.43	**Mean:** 1.22	**Mean:** 1.71	**Mean:** 1.68	**Mean:** 1.18	**Mean:** 2.64	**Mean:** 2.08	**Mean:** 2.08	**Mean:** 0.85
	(dbkfp)	Range: 0.84 1.65	Range: 1.4 1.45	Range: 0.85 1.58	Range: 1.45 1.96	Range:	Range:	Range:	Range:	Range:	Range:
18.	Pool Cross-Sectional Area	**Mean:** 11.75	**Mean:** 15.07	**Mean:** 13.02	**Mean:** 31.26	**Mean:** 34.50	**Mean:** 34.50	**Mean:** 73.33	**Mean:** 49.93	**Mean:** 49.93	**Mean:** 8.90
	(Abkfp) [ft2]	Range: 8.9 14.6	Range: 14.73 15.41	Range: 7.87 18.16	Range: 26.92 35.59	Range:	Range:	Range:	Range:	Range:	Range:
19.	Maximum Pool Depth	**Mean:** 1.93	**Mean:** 2.17	**Mean:** 1.68	**Mean:** 3.3	**Mean:** 3.00	**Mean:** 2.00	**Mean:** 4.54	**Mean:** 3.46	**Mean:** 3.17	**Mean:** 1.83
	(dmaxp)	Range: 1.59 2.26	Range: 1.99 2.35	Range: 1.33 2.02	Range: 3.17 3.43	Range:	Range:	Range:	Range:	Range:	Range:
20.	Pool Width to Riffle Width	**Mean:** 1.29	**Mean:** 1.44	**Mean:** 0.79	**Mean:** 1.49	**Mean:** 1.05	**Mean:** 1.05	**Mean:** 1.77	**Mean:** 1.10	**Mean:** 1.10	**Mean:** 1.05
	(Wbkfp/Wbkf)	Range: 1.17 1.40	Range: 1.43 1.45	Range: 0.71 0.87	Range: 1.47 1.51	Range:	Range:	Range:	Range:	Range:	Range:
21.	Mean Pool Depth to Mean Riffle Depth	**Mean:** 1.39	**Mean:** 1.38	**Mean:** 1.42	**Mean:** 1.31	**Mean:** 1.40	**Mean:** 1.40	**Mean:** 1.77	**Mean:** 1.50	**Mean:** 1.50	**Mean:** 1.40
	(dbkfp/dbkf)	Range: 0.93 1.83	Range: 1.35 1.39	Range: 0.99 1.84	Range: 1.11 1.50	Range:	Range:	Range:	Range:	Range:	Range:
22.	Pool Area to Riffle Area	**Mean:** 1.73	**Mean:** 2.00	**Mean:** 1.16	**Mean:** 1.98	**Mean:** 1.60	**Mean:** 1.60	**Mean:** 3.14	**Mean:** 2.00	**Mean:** 2.00	**Mean:** 1.60
	(Abkfp/Abkf)	Range: 1.31 2.15	Range: 1.95 2.04	Range: 0.70 1.61	Range: 1.71 2.26	Range:	Range:	Range:	Range:	Range:	Range:
23.	Max Pool Depth to Mean Riffle Depth	**Mean:** 2.14	**Mean:** 2.09	**Mean:** 1.95	**Mean:** 2.52	**Mean:** 2.50	**Mean:** 2.50	**Mean:** 3.05	**Mean:** 2.50	**Mean:** 2.50	**Mean:** 3.00
	(dbkfp/dbkf)	Range: 1.77 2.51	Range: 1.91 2.26	Range: 1.55 2.35	Range: 2.42 2.62	Range:	Range:	Range:	Range:	Range:	Range:
	Channel Pattern										
24.	Stream Meander Length	**Mean:** 87.0	**Mean:** 87.0	**Mean:** 136.3	**Mean:**	**Mean:** 147.3	**Mean:** 89.3	**Mean:**	**Mean:** 197.9	**Mean:** 166.4	**Mean:** 42.7
	(Lm)	Range: 57.0 117.0	Range: 57.0 117.0	Range: 69.2 197.7	Range:	Range: 140.4 156.0	Range: 88.0 90.5	Range:	Range: 196.9 199.0	Range: 161.1 171.7	Range: 41.1 44.4
25.	Stream Meander Length Ratio	**Mean:** 11.5	**Mean:** 11.8	**Mean:** 10.4	**Mean:**	**Mean:** 8.2	**Mean:** 8.8	**Mean:**	**Mean:** 19.4	**Mean:** 9.4	**Mean:** 4.7
	(Lm/Wbkf)	Range: 7.5 15.5	Range: 7.7 15.9	Range: 5.3 15.0	Range:	Range: 7.8 8.7	Range: 8.6 8.9	Range:	Range: 19.3 19.5	Range: 9.1 9.7	Range: 4.5 4.9
26.	Radius of Curvature	**Mean:** 12.9	**Mean:** 61.7	**Mean:** 85.0	**Mean:**	**Mean:** 87.2	**Mean:** 53.5	**Mean:**	**Mean:** 95.3	**Mean:** 80.3	**Mean:** 27.3
	(Rc)	Range: 7.6 17.3	Range: 45.0 80.0	Range: 41.0 132.0	Range:	Range: 35.0 215.0	Range: 40.0 72.0	Range:	Range: 76.0 110.0	Range: 55.0 123.0	Range: 18.0 57.0
27.	Radius of Curvature to Riffle Width	**Mean:** 1.7	**Mean:** 8.4	**Mean:** 6.5	**Mean:**	**Mean:** 4.8	**Mean:** 5.2	**Mean:**	**Mean:** 9.3	**Mean:** 4.5	**Mean:** 3.0
	(Rc/Wbkf)	Range: 1.0 2.3	Range: 6.1 10.9	Range: 3.1 10.0	Range:	Range: 1.9 119.5	Range: 3.9 7.1	Range:	Range: 7.5 10.8	Range: 3.1 6.9	Range: 2.0 6.2
28.	Belt Width	**Mean:** 40.7	**Mean:** -	**Mean:** 22.3	**Mean:**	**Mean:** 31.4	**Mean:** 21.2	**Mean:**	**Mean:** 36.4	**Mean:** 38.4	**Mean:** 15.9
	(Wblt)	Range: 31.8 49.6	Range: - -	Range: 19.8 28.7	Range:	Range: 25.1 37.5	Range: 19.8 22.7	Range:	Range: 37.0 41.3	Range: 37.0 41.3	Range: 13.9 17.2
29.	Meander Width Ratio	**Mean:** 5.4	**Mean:** -	**Mean:** 1.7	**Mean:**	**Mean:** 1.7	**Mean:** 2.1	**Mean:**	**Mean:** 3.6	**Mean:** 2.2	**Mean:** 1.7
	(Wblt/Wbkf)	Range: 4.2 6.6	Range: - -	Range: 1.5 2.2	Range:	Range: 1.4 3.9	Range: 1.9 2.2	Range:	Range: 3.6 4.0	Range: 2.1 2.3	Range: 1.5 1.9
30.	Riffle Length	**Mean:** 12.1	**Mean:** 13.0	**Mean:** 10.8	**Mean:**	**Mean:** 43.5	**Mean:** 24.4	**Mean:**	**Mean:** 47.3	**Mean:** 40.9	**Mean:** 11.1
	(Lr)	Range: 7.0 17.2	Range: 9.1 17.0	Range: 9.0 12.9	Range:	Range: 39.3 46.4	Range: 21.6 26.5	Range:	Range: 41.7 50.8	Range: 39.3 44.1	Range: 10.1 12.4
31.	Riffle Length to Riffle Width	**Mean:** 1.6	**Mean:** 1.6	**Mean:** 0.8	**Mean:**	**Mean:** 2.4	**Mean:** 2.4	**Mean:**	**Mean:** 4.6	**Mean:** 2.3	**Mean:** 1.2
	(Lr/Wbkf)	Range: 0.9 2.3	Range: 0.9 2.3	Range: 0.7 1.0	Range:	Range: 2.2 7.6	Range: 2.1 2.6	Range:	Range: 4.1 5.0	Range: 2.2 2.5	Range: 1.1 1.4
32.	Individual Pool Length	**Mean:** 19.6	**Mean:** 18.6	**Mean:** 13.6	**Mean:**	**Mean:** 30.4	**Mean:** 19.2	**Mean:**	**Mean:** 47.2	**Mean:** 48.2	**Mean:** 11.0
	(Lp)	Range: 10.1 33.1	Range: 6.8 32.4	Range: 6.9 29.3	Range:	Range: 23.8 40.5	Range: 17.6 20.4	Range:	Range: 29.9 56.3	Range: 39.9 56.3	Range: 10.0 13.8
33.	Individual Pool Length to Riffle Width	**Mean:** 2.6	**Mean:** 2.5	**Mean:** 1.0	**Mean:**	**Mean:** 1.7	**Mean:** 1.9	**Mean:**	**Mean:** 4.6	**Mean:** 2.7	**Mean:** 1.2
	(Lp/Wbkf)	Range: 1.3 4.4	Range: 0.9 4.4	Range: 0.5 2.2	Range:	Range: 1.3 2.7	Range: 1.7 2.0	Range:	Range: 2.9 5.5	Range: 2.2 3.2	Range: 1.1 1.5
34.	Pool to Pool Spacing	**Mean:** 51.6	**Mean:** 31.1	**Mean:** 26.8	**Mean:**	**Mean:** 73.6	**Mean:** 44.7	**Mean:**	**Mean:** 99.5	**Mean:** 84.3	**Mean:** 21.6
	(Ps)	Range: 30.5 69.3	Range: 25.2 36.4	Range: 20.7 34.4	Range:	Range: 69.3 79.0	Range: 43.6 46.1	Range:	Range: 93.9 105.2	Range: 80.0 91.7	Range: 20.1 22.6
35.	Pool to Pool Spacing to Riffle Width	**Mean:** 6.8	**Mean:** 4.2	**Mean:** 2.0	**Mean:**	**Mean:** 4.1	**Mean:** 4.4	**Mean:**	**Mean:** 9.8	**Mean:** 4.8	**Mean:** 2.4
	(Ps/Wbkf)	Range: 4.0 9.2	Range: 3.4 4.9	Range: 1.6 2.6	Range:	Range: 3.9 49.4	Range: 4.3 4.5	Range:	Range: 9.2 10.3	Range: 4.5 5.2	Range: 2.2 2.5
	Channel Profile										
36.	Valley Slope	**Mean:** 0.022	**Mean:** 0.020	**Mean:** 0.04	**Mean:** 0.0234	**Mean:** 0.027	**Mean:** 0.027	**Mean:** 0.014	**Mean:** 0.011	**Mean:** 0.023	**Mean:** 0.032
	(Svalley) [ft/ft]	Range:	Range:	Range:	Range:	Range:	Range:	Range:	Range:	Range:	Range:
37.	Average Water Surface Slope	**Mean:** 0.016	**Mean:** 0.018	**Mean:** 0.022	**Mean:** 0.0126	**Mean:** 0.026	**Mean:** 0.026	**Mean:** 0.011	**Mean:** 0.011	**Mean:** 0.022	**Mean:** 0.031
	(S)	Range:	Range:	Range:	Range:	Range:	Range:	Range:	Range:	Range:	Range:
38.	Sinuosity (k)	**Mean:** 1.36	**Mean:** 1.10	**Mean:** 1.12	**Mean:** 1.86	**Mean:** 1.04	**Mean:** 1.02	**Mean:** 1.26	**Mean:** 1.03	**Mean:** 1.03	**Mean:** 1.03
	(Svalley/S)	Range:	Range:	Range:	Range:	Range:	Range:	Range:	Range:	Range:	Range:

R2707D
CHANNEL RELOCATION
CLEVELAND COUNTY

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PROJECT REFERENCE NO.	SHEET NO.
R2707D	OSM-2F

PROJECT ENGINEER

APPROVED BY:

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

DATE:

	VARIABLES	Reference Reach	Reference Reach	Reference Reach	Existing Reach 2A	Design Reach 2A Upper	Design Reach 2A Lower	Existing Reach 2B	Design Reach 2B	Existing Reach 2C	Design Reach 2C
	STATION	-	-	-	-	-	-	-	-	-	-
1.	Stream Type	C4	B 4/1c	B 4	B 3/1	B3/1	B3/1c	C 4	C4	C 4	C
	(Rosgen)										
2.	Drainage Area	0.21	0.19	0.81	0.55	0.57	0.57	0.56	0.56	1.14	1.14
	[mi2]										
	Riffle Dimensions										
3.	Bankfull Width	Mean: 7.55	Mean: 7.37	Mean: 13.14	Mean: 19.81	Mean: 19.80	Mean: 25.19	Mean: 26.58	Mean: 17.61	Mean: 35.68	Mean: 22.03
	(Wbkf) [ft]	Range: 7.03 8.06	Range: 6.58 8.16	Range: 12.12 14.16	Range: 17.99 21.63	Range:	Range:	Range: 16.07 37.08	Range:	Range:	Range:
4.	Mean Riffle Depth	Mean: 0.90	Mean: 1.04	Mean: 0.86	Mean: 1.14	Mean: 1.32	Mean: 1.15	Mean: 1.00	Mean: 1.47	Mean: 0.95	Mean: 1.84
	(dbkf) [ft]	Range: 0.82 0.97	Range: 0.94 1.13	Range: 0.82 0.89	Range: 0.71 1.29	Range:	Range:	Range: 0.71 1.29	Range:	Range:	Range:
5.	Maximum Riffle Depth	Mean: 1.29	Mean: 1.53	Mean: 1.22	Mean: 1.76	Mean: 1.85	Mean: 1.85	Mean: 1.76	Mean: 2.20	Mean: 2.05	Mean: 2.75
	(dmax) [ft]	Range: 1.19 1.39	Range: 1.38 1.67	Range: 1.16 1.27	Range: 1.21 2.31	Range:	Range:	Range: 1.21 2.31	Range:	Range:	Range:
6.	Width of Flood-Prone Area	Mean: 31	Mean: 20	Mean: 21	Mean: 55	Mean:	Mean:	Mean:	Mean:	Mean: 109	Mean:
	(Wfpa) [ft]	Range: 27 34	Range: 19 22	Range: 18 25	Range: 45 66	Range:	Range:	Range:	Range:	Range:	Range:
7.	Riffle Inner Berm Width	Mean: -	Mean: -	Mean: -	Mean: -	Mean: 11.3	Mean: 13.1	Mean: -	Mean: 8.0	Mean: -	Mean: 9.8
	(Wib) [ft]	Range: - -	Range: - -	Range: - -	Range: - -	Range:	Range:	Range: - -	Range:	Range: - -	Range:
8.	Riffle Inner Berm Depth	Mean: -	Mean: -	Mean: -	Mean: -	Mean: 0.9	Mean: 0.9	Mean: -	Mean: 1.1	Mean: -	Mean: 1.4
	(dib) [ft]	Range: - -	Range: - -	Range: - -	Range: - -	Range:	Range:	Range: - -	Range:	Range: - -	Range:
9.	Riffle Inner Berm Area	Mean: -	Mean: -	Mean: -	Mean: -	Mean: 7.1	Mean: 8.7	Mean: -	Mean: 6.6	Mean: -	Mean: 9.7
	(Aib) [ft2]	Range: - -	Range: - -	Range: - -	Range: - -	Range:	Range:	Range: - -	Range:	Range: - -	Range:
10.	Riffle Cross-Sectional Area	Mean: 6.78	Mean: 7.55	Mean: 11.25	Mean: 23.46	Mean: 26.13	Mean: 26.13	Mean: 23.46	Mean: 25.84	Mean: 33.82	Mean: 40.43
	(Abkf) [ft2]	Range: 5.76 7.80	Range: 7.42 7.68	Range: 10.85 11.65	Range: 20.72 26.19	Range:	Range:	Range: 20.72 26.19	Range:	Range:	Range:
11.	Riffle Width/Depth Ratio	Mean: 8.44	Mean: 7.25	Mean: 15.44	Mean: 32.34	Mean: 15.00	Mean: 15.00	Mean: 32.34	Mean: 12.00	Mean: 37.56	Mean: 12.00
	(Wbkf/dbkf)	Range: 8.31 8.57	Range: 5.82 8.68	Range: 13.62 17.27	Range: 12.46 52.23	Range:	Range:	Range: 12.46 52.23	Range:	Range:	Range:
12.	Max Riffle Depth to Mean Riffle Depth	Mean: 1.44	Mean: 1.47	Mean: 1.43	Mean: 1.75	Mean: 1.40	Mean: 1.40	Mean: 1.75	Mean: 1.50	Mean: 2.16	Mean: 1.50
	(dmax/dbkf)	Range: 1.43 1.45	Range: 1.47 1.48	Range: 1.30 1.55	Range: 1.70 1.79	Range:	Range:	Range: 1.70 1.79	Range:	Range:	Range:
13.	Entrenchment Ratio	Mean: 4.03	Mean: 2.83	Mean: 1.62	Mean: 2.66	Mean: 1.60	Mean: 1.60	Mean: 2.66	Mean: 4.00	Mean: 3.06	Mean: 4.00
	(Wfpa/Wbkf)	Range: 3.85 4.21	Range: 2.29 3.36	Range: 1.47 1.77	Range: 1.21 4.11	Range:	Range:	Range: 1.21 4.11	Range:	Range:	Range:
14.	Bankfull Mean Velocity	Mean:	Mean:	Mean:	Mean: 4.6	Mean: 5.0	Mean: 3.5	Mean: 4.3	Mean: 5.2	Mean: 2.9	Mean: 4.6
	(Vbkf) [ft/s]	Range:	Range:	Range:	Range:	Range: 4.8 5.2	Range: 3.4 3.7	Range: 4.19 4.44	Range: 5.0 5.5	Range: 2.54 3.19	Range: 3.4 5.8
15.	Bankfull discharge	Mean:	Mean:	Mean:	Mean: 97.4	Mean: 112.9	Mean: 102.3	Mean: 89.4	Mean: 117.6	Mean: 96.9	Mean: 161.9
	(Qbkf) [ft3/s]	Range:	Range:	Range:	Range:	Range: 108.1 117.6	Range: 98.6 106.1	Range: 86.87 91.95	Range: 111.9 123.3	Range: 86.03 107.75	Range: 119.4 204.5
	Pool Dimensions										
16.	Pool Width	Mean: 9.72	Mean: 10.6	Mean: 10.37	Mean: 16.67	Mean: 20.79	Mean: 26.45	Mean: 40.97	Mean: 22.89	Mean: 58.72	Mean: 28.63
	(Wbkfp) [ft]	Range: 8.87 10.57	Range: 10.55 10.65	Range: 9.27 11.46	Range: 14.93 18.4	Range:	Range:	Range:	Range:	Range:	Range:
17.	Mean Pool Depth	Mean: 1.25	Mean: 1.43	Mean: 1.22	Mean: 1.79	Mean: 1.85	Mean: 1.61	Mean: 1.03	Mean: 2.20	Mean: 1.03	Mean: 2.20
	(dbkfp)	Range: 0.84 1.65	Range: 1.4 1.45	Range: 0.85 1.58	Range: 1.05 2.53	Range:	Range:	Range:	Range:	Range:	Range:
18.	Pool Cross-Sectional Area	Mean: 11.75	Mean: 15.07	Mean: 13.02	Mean: 28.62	Mean: 41.81	Mean: 46.18	Mean: 42.14	Mean: 46.52	Mean: 60.37	Mean: 72.77
	(Abkfp) [ft2]	Range: 8.9 14.6	Range: 14.73 15.41	Range: 7.87 18.16	Range: 19.4 37.84	Range:	Range:	Range:	Range:	Range:	Range:
19.	Maximum Pool Depth	Mean: 1.93	Mean: 2.17	Mean: 1.68	Mean: 2.73	Mean: 3.30	Mean: 2.88	Mean: 3.27	Mean: 2.94	Mean: 2.77	Mean: 3.67
	(dmaxp)	Range: 1.59 2.26	Range: 1.99 2.35	Range: 1.33 2.02	Range: 1.8 3.65	Range:	Range:	Range:	Range:	Range:	Range:
20.	Pool Width to Riffle Width	Mean: 1.29	Mean: 1.44	Mean: 0.79	Mean: 0.84	Mean: 1.05	Mean: 1.05	Mean: 1.54	Mean: 1.30	Mean: 1.65	Mean: 1.30
	(Wbkfp/Wbkf)	Range: 1.17 1.40	Range: 1.43 1.45	Range: 0.71 0.87	Range: 0.75 0.93	Range:	Range:	Range:	Range:	Range:	Range:
21.	Mean Pool Depth to Mean Riffle Depth	Mean: 1.39	Mean: 1.38	Mean: 1.42	Mean: 1.57	Mean: 1.40	Mean: 1.40	Mean: 1.03	Mean: 1.50	Mean: 1.08	Mean: 1.50
	(dbkfp/dbkf)	Range: 0.93 1.83	Range: 1.35 1.39	Range: 0.99 1.84	Range: 0.92 2.22	Range:	Range:	Range:	Range:	Range:	Range:
22.	Pool Area to Riffle Area	Mean: 1.73	Mean: 2.00	Mean: 1.16	Mean: 1.27	Mean: 1.60	Mean: 1.60	Mean: 1.80	Mean: 1.80	Mean: 1.79	Mean: 1.80
	(Abkfp/Abkf)	Range: 1.31 2.15	Range: 1.95 2.04	Range: 0.70 1.61	Range: 0.86 1.68	Range:	Range:	Range:	Range:	Range:	Range:
23.	Max Pool Depth to Mean Riffle Depth	Mean: 2.14	Mean: 2.09	Mean: 1.95	Mean: 2.39	Mean: 2.50	Mean: 2.50	Mean: 3.27	Mean: 2.00	Mean: 2.92	Mean: 2.00
	(dbkfp/dbkf)	Range: 1.77 2.51	Range: 1.91 2.26	Range: 1.55 2.35	Range: 1.58 3.20	Range:	Range:	Range:	Range:	Range:	Range:
	Channel Pattern										
24.	Stream Meander Length	Mean: 87.0	Mean: 87.0	Mean: 136.3	Mean:	Mean: 173.2	Mean: 212.8	Mean:	Mean: 183.3	Mean:	Mean: 183.3
	(Lm)	Range: 57.0 117.0	Range: 57.0 117.0	Range: 69.2 197.7	Range:	Range: 168.0 175.8	Range: 193.5 232.2	Range:	Range:	Range:	Range:
25.	Stream Meander Length Ratio	Mean: 11.5	Mean: 11.8	Mean: 10.4	Mean:	Mean: 8.7	Mean: 8.4	Mean:	Mean: 10.4	Mean:	Mean: 8.3
	(Lm/Wbkf)	Range: 7.5 15.5	Range: 7.7 15.9	Range: 5.3 15.0	Range:	Range: 8.5 8.9	Range: 7.7 9.2	Range:	Range:	Range:	Range:
26.	Radius of Curvature	Mean: 12.9	Mean: 61.7	Mean: 85.0	Mean:	Mean: 55.5	Mean: 82.7	Mean:	Mean: 116.8	Mean:	Mean: 72.5
	(Rc)	Range: 7.6 17.3	Range: 45.0 80.0	Range: 41.0 132.0	Range:	Range: 32.0 80.0	Range: 68.0 95.0	Range:	Range: 45.0 296.0	Range:	Range: 50.0 95.0
27.	Radius of Curvature to Riffle Width	Mean: 1.7	Mean: 8.4	Mean: 6.5	Mean:	Mean: 2.8	Mean: 3.3	Mean:	Mean: 6.6	Mean:	Mean: 3.3
	(Rc/Wbkf)	Range: 1.0 2.3	Range: 6.1 10.9	Range: 3.1 10.0	Range:	Range: 1.6 4.0	Range: 2.7 3.8	Range:	Range: 2.6 16.8	Range:	Range: 2.3 4.3
28.	Belt Width	Mean: 40.7	Mean: -	Mean: 22.3	Mean:	Mean: 40.0	Mean: 59.3	Mean:	Mean: 36.9	Mean:	Mean: 45.5
	(Wblt)	Range: 31.8 49.6	Range: - -	Range: 19.8 28.7	Range:	Range: 29.6 52.7	Range: 32.2 86.5	Range:	Range: 33.9 40.9	Range:	Range:
29.	Meander Width Ratio	Mean: 5.4	Mean: -	Mean: 1.7	Mean:	Mean: 2.0	Mean: 2.4	Mean:	Mean: 2.1	Mean:	Mean: 2.1
	(Wblt/Wbkf)	Range: 4.2 6.6	Range: - -	Range: 1.5 2.2	Range:	Range: 1.5 2.7	Range:	Range:	Range: 1.9 2.3	Range:	Range: 0.0 0.0
30.	Riffle Length	Mean: 12.1	Mean: 13.0	Mean: 10.8	Mean:	Mean: 56.3	Mean: 59.0	Mean:	Mean: 44.2	Mean:	Mean: 50.3
	(Lr)	Range: 7.0 17.2	Range: 9.1 17.0	Range: 9.0 12.9	Range:	Range: 52.3 59.3	Range: 57.0 63.0	Range:	Range: 40.8 46.8	Range:	Range: 39.8 60.9
31.	Riffle Length to Riffle Width	Mean: 1.6	Mean: 1.6	Mean: 0.8	Mean:	Mean: 2.8	Mean: 2.3	Mean:	Mean: 2.5	Mean:	Mean: 2.3
	(Lr/Wbkf)	Range: 0.9 2.3	Range: 0.9 2.3	Range: 0.7 1.0	Range:	Range: 2.6 3.0	Range: 2.3 2.5	Range:	Range: 2.3 2.7	Range:	Range: 1.8 2.8
32.	Individual Pool Length	Mean: 19.6	Mean: 18.6	Mean: 13.6	Mean:	Mean: 28.5	Mean: 55.7	Mean:	Mean: 36.6	Mean:	Mean: 36.0
	(Lp)	Range: 10.1 33.1	Range: 6.8 32.4	Range: 6.9 29.3	Range:	Range: 26.2 30.0	Range: 31.6 69.4	Range:	Range: 34.6 40.8	Range:	Range: 32.2 39.8
33.	Individual Pool Length to Riffle Width	Mean: 2.6	Mean: 2.5	Mean: 1.0	Mean:	Mean: 1.4	Mean: 2.2	Mean:	Mean: 2.1	Mean:	Mean: 1.6
	(Lp/Wbkf)	Range: 1.3 4.4	Range: 0.9 4.4	Range: 0.5 2.2	Range:	Range: 1.3 1.5	Range: 1.3 2.8	Range:	Range: 2.0 2.3	Range:	Range: 1.5 1.8
34.	Pool to Pool Spacing	Mean: 51.6	Mean: 31.1	Mean: 26.8	Mean:	Mean: 86.0	Mean: 106.6	Mean:	Mean: 80.9	Mean:	Mean: 97.4
	(Ps)	Range: 30.5 69.3	Range: 25.2 36.4	Range: 20.7 34.4	Range:	Range: 80.5 88.2	Range: 87.6 126.4	Range:	Range: 76.2 85.9	Range:	Range:
35.	Pool to Pool Spacing to Riffle Width	Mean: 6.8	Mean: 4.2	Mean: 2.0	Mean:	Mean: 4.3	Mean: 4.2	Mean:	Mean: 4.6	Mean:	Mean: 4.4
	(Ps/Wbkf)	Range: 4.0 9.2	Range: 3.4 4.9	Range: 1.6 2.6	Range:	Range: 4.1 4.5	Range: 3.5 5.0	Range:	Range: 4.3 4.9	Range:	Range:
	Channel Profile										
36.	Valley Slope	Mean: 0.022	Mean: 0.020	Mean: 0.04	Mean: 0.039	Mean: 0.020	Mean: 0.010	Mean: 0.011	Mean: 0.024	Mean: 0.008	Mean: 0.024
	(Svalley) [ft/ft]	Range:	Range:	Range:	Range:	Range:	Range:	Range:	Range:	Range:	Range:
37.	Average Water Surface Slope	Mean: 0.016	Mean: 0.018	Mean: 0.022	Mean: 0.033	Mean: 0.019	Mean: 0.009	Mean: 0.0065	Mean: 0.023	Mean: 0.0053	Mean: 0.023
	(S)	Range:	Range:	Range:	Range:	Range:	Range:	Range:	Range:	Range:	Range:
38.	Sinuosity (k)	Mean: 1.36	Mean: 1.10	Mean: 1.12	Mean: 1.18	Mean: 1.04	Mean: 1.07	Mean: 1.66	Mean: 1.04	Mean: 1.49	Mean: 1.04
	(Svalley/S)	Range:	Range:	Range:	Range:	Range:	Range:	Range:	Range:	Range:	Range:

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PROJECT REFERENCE NO.	SHEET NO.
R2707D	OSM-3

PROJECT ENGINEER

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INCOMPLETE PLANS
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DATE:

SUMMARY OF QUANTITIES

SECTION	QUANTITIY	UNIT	ITEM DESCRIPTION
225	1	LS	UNCLASSIFIED EXCAVATION (CUT)
SP, 226	1	LS	GRADING FOR STREAM RELOCATION
230	1	LS	BORROW EXCAVATION (FILL)
876	957	SY	GEOTEXTILE
876, 1042	213	TON	PLAIN RIP RAP, CLASS A
876, 1042	1,490	TON	PLAIN RIP RAP, CLASS 1
876, 1042	729	TON	PLAIN RIP RAP, CLASS 2
876, 1042	10	TON	PLAIN RIP RAP, CLASS B
1005	576	TON	#57 STONE
1060, 14	7241	SY	COIR FIBER MATTING
1060	4.8	AC	STREAMBANK REFORESTATION
SP	20	EA	LOGS
SP	629	LF	WOOD TOE
SP	719	TON	BOULDER
SP	1488	CY	IMPERVIOUS SELECT MATERIAL

SUMMARY OF APPROXIMATE EARTHWORK FOR STREAM RELOCATION

LOCATION	RELOCATION UNCLASSIFIED EXCAV. (CU.YD.)	RELOCATION EMBANKMENT	RELOCATION BORROW (CU.YD.)	RELOCATION WASTE (CU.YD.)
1A COMBINED	2339	1928		411
1B COMBINED	2253	864		1389
2ABC COMBINED	7272	11266	3994	

APPROXIMATE QUANTITIES ONLY, RELOCATION UNCLASSIFIED EXCAVATION, RELOCATION BORROW EXCAVATION, RELOCATION FINE GRADING AND RELOCATION CLEARING AND GRUBBING WILL BE PAID FOR AT THE CONTRACT LUMP SUM PRICE FOR "GRADING FOR RELOCATION".

SITE 1

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PROJECT REFERENCE NO.	SHEET NO.
R2707D	OSM-4

PROJECT ENGINEER

APPROVED BY:

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DATE:

REVISIONS 8/17/99

REACH 1A					
DESCRIPTION	STATION	NORTHING	EASTING	ELEVATION	RADIUS
BEGIN ENERGEY DISSIPATOR BASIN	10+08.52	568478.30	1259775.33	792.30	
CENTER OF RADIUS (1)		568466.05	1259792.10		216
HEAD RIFFLE	10+46.17	568454.97	1259804.83	792.30	
TAIL RIFFLE	10+84.20	568428.90	1259832.51	791.06	
CENTER OF RADIUS (2)		568420.98	1259842.03		100
HEAD RIFFLE	11+08.98	568414.31	1259852.46	790.63	
TAIL RIFFLE	11+52.27	568393.26	1259890.30	789.09	
CENTER OF RADIUS (3)		568385.63	1259899.71		35
HEAD RIFFLE	11+76.63	568375.24	1259905.95	788.82	
TAIL RIFFLE	12+19.78	568334.97	1259921.44	787.33	
CENTER OF RADIUS (4)		568321.50	1259925.22		75
HEAD RIFFLE	12+47.80	568307.56	1259926.44	786.93	
TAIL RIFFLE	12+94.18	568261.19	1259926.13	785.29	
CENTER OF RADIUS (5)		568244.81	1259928.52		55
HEAD RIFFLE	13+27.40	568229.89	1259935.66	784.86	
TAIL RIFFLE	13+72.91	568192.26	1259961.26	783.57	
CENTER OF RADIUS (6)		568177.48	1259969.41		90
HEAD RIFFLE	14+06.70	568161.44	1259974.65	782.80	
TAIL RIFFLE	14+49.24	568119.95	1259984.01	781.36	
CENTER OF RADIUS (7)		568105.88	1259988.85		68
HEAD RIFFLE	14+79.05	568093.21	1259996.63	780.93	
TAIL RIFFLE	15+19.52	568061.25	1260021.45	779.35	
CENTER OF RADIUS (8)		568047.18	1260029.67		62
HEAD RIFFLE	15+52.19	568031.46	1260033.93	779.03	
TAIL RIFFLE	15+97.51	567986.54	1260039.95	777.57	
CENTER OF RADIUS (8)		567974.89	1260042.36		84.5
END POOL	16+21.34	567963.67	1260046.39	777.23	

REACH 1A TRIBUTARY					
DESCRIPTION	STATION	NORTHING	EASTING	ELEVATION	RADIUS
HEAD RIFFLE	20+00.00	568385.25	1259986.00	788.85	
TAIL RIFFLE	20+23.74	568363.77	1259975.88	788.08	
CENTER OF RADIUS (1)		568354.40	1259972.24		72
HEAD RIFFLE	20+43.87	568344.60	1259969.94	787.71	
TAIL RIFFLE	20+68.56	568320.23	1259965.99	786.95	
CENTER OF RADIUS (2)		568311.47	1259965.39		48
HEAD RIFFLE	20+86.15	568302.74	1259966.39	786.61	
TAIL RIFFLE	21+11.61	568277.82	1259971.60	785.79	
CENTER OF RADIUS (3)		568267.69	1259972.39		40
HEAD RIFFLE	21+31.99	568257.69	1259970.61	785.42	
TAIL RIFFLE	21+58.47	568232.42	1259962.70	784.61	
CENTER OF RADIUS (4)		568223.23	1259960.68		54
HEAD RIFFLE	21+77.31	568213.83	1259960.28	784.24	
TAIL RIFFLE	21+98.90	568192.26	1259961.26	783.56	

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BEGIN RELOCATION
–1A– STA 10+08.52

BEGIN RELOCATION
–1A TRIB– STA 20+00.00

END RELOCATION
–1A– STA 16+21.35

END RELOCATION
–1A TRIB– STA 21+98.90

PROPOSED STORMWATER CONNECTION
SEE ROADWAY DRAINAGE PLANS

BACKFILL, TYP.

STREAM
PLUG, TYP.

PROP. ROCK ENERGY DISSIPATOR

CENTER OF RADIUS (R1)
CENTER OF RADIUS (R2)
CENTER OF RADIUS (R3)
CENTER OF RADIUS (R4)
CENTER OF RADIUS (R5)
CENTER OF RADIUS (R6)
CENTER OF RADIUS (R7)
CENTER OF RADIUS (R8)
CENTER OF RADIUS (R9)
CENTER OF RADIUS (R10)
CENTER OF RADIUS (R11)
CENTER OF RADIUS (R12)
CENTER OF RADIUS (R13)

HEAD OF CONSTRUCTED RIFFLE
TAIL OF CONSTRUCTED RIFFLE
LOG VANE WITH ROCK J-HOOK (LV1)
LOG VANE WITH ROCK J-HOOK (LV2)
LOG VANE WITH ROCK J-HOOK (LV3)
LOG VANE WITH ROCK J-HOOK (LV4)
LOG VANE WITH ROCK J-HOOK (LV5)
LOG VANE WITH ROCK J-HOOK (LV6)
ROCK CROSS VANE (RCV1)
ROCK CROSS VANE (RCV2)
ROCK CROSS VANE (RCV3)

11+00
12+00
13+00
14+00
15+00
16+00

JAMES WHITE DB 1582 PG 109
OVID ALTON WHITE DB 1446 PG 1127
MARCINA WHITE HARRIS DB 1446 PG 1129
JAY J. TEDDY DB 1613 PG 2442 PB 21PG 19
JAMES W. WHITE JR. AND MARSHA H. WHITE DB 1582 PG 109
SILINDA WATTS DB 1263 PG 2225 DB 1257 PG 785 PB 8 PG 85
DB 1260 PG 1000 PB 8 PG 85
BILLY H. ROBERTS & WF. MARY M. ROBERTS DB 176 PG 642
SHELBY ETJ LIMIT

8/24/2008
C:\Users\lstarnes\Documents\pw-working\d0118711\R2707D_NEU_OSM-04_PSH.dgn
lstarnes

8/17/99

REVISIONS

REACH 1B						REACH 1B TRIBUTARY					
DESCRIPTION	STATION	NORTHING	EASTING	ELEVATION	RADIUS	DESCRIPTION	STATION	NORTHING	EASTING	ELEVATION	RADIUS
HEAD RIFFLE	30+73.11	567654.00	1260203.79	772.53		HEAD RIFFLE	40+00.00	567490.68	1260395.05	772.13	
TAIL RIFFLE	31+22.37	567605.44	1260218.73	771.85		TAIL RIFFLE	40+10.78	567479.98	1260393.73	771.74	
CENTER OF RADIUS (1)		567579.88	1260230.35		110	CENTER OF RADIUS (1)		567474.02	1260393.51		35
HEAD RIFFLE	31+78.67	567558.09	1260248.05	771.37		HEAD RIFFLE	40+22.71	567468.12	1260394.31	771.44	
TAIL RIFFLE	32+27.99	567524.10	1260283.79	770.71		TAIL RIFFLE	40+38.36	567452.84	1260397.70	770.83	
CENTER OF RADIUS (2)		567502.51	1260300.96		100	CENTER OF RADIUS (2)		567447.15	1260397.93		16
HEAD RIFFLE	32+83.34	567477.05	1260311.58	770.22		HEAD RIFFLE	40+49.81	567441.74	1260396.15	770.62	
TAIL RIFFLE	33+27.42	567434.43	1260322.78	768.97		TAIL RIFFLE	40+64.56	567428.77	1260389.13	770.08	
CENTER OF RADIUS (3)		567416.26	1260330.79		63	CENTER OF RADIUS (3)		567422.84	1260387.21		17
HEAD RIFFLE	33+67.28	567401.49	1260344.05	768.40		HEAD RIFFLE	40+77.09	567416.62	1260387.57	769.78	
TAIL RIFFLE	34+06.68	567376.69	1260374.65	767.27		TAIL RIFFLE	40+93.84	567400.35	1260391.56	769.12	
CENTER OF RADIUS (4)		567360.95	1260387.94		55	CENTER OF RADIUS (4)		567394.49	1260392.31		26
HEAD RIFFLE	34+48.10	567341.44	1260394.51	766.65		HEAD RIFFLE	41+05.69	567388.61	1260391.72	768.91	
TAIL RIFFLE	34+87.41	567302.50	1260399.86	765.55		TAIL RIFFLE	41+21.72	567372.95	1260388.30	768.26	
CENTER OF RADIUS (5)		567281.96	1260404.50		123	CENTER OF RADIUS (5)		567366.98	1260387.51		36
END OF POOL	35+30.28	567261.88	1260412.90	764.87		END OF POOL	41+33.89	567360.84	1260387.74	768.05	

NAD 83

END RELOCATION
–1B LOWER– STA 35+29.57

END RELOCATION
–1B TRIB– STA 41+33.78

BEGIN RELOCATION
–1B TRIB– STA 40+00.00

END RELOCATION
–1B UPPER– STA 32+83.34
BEGIN RELOCATION
–1B LOWER–

BEGIN RELOCATION
–1B UPPER– STA 30+00.00

PRESERVATION AREA

BM #32
BY27- STA 5+84
31' LEFT
ELEV.= 800.60'

BY27-418

BY27-419

BL-159
BY27

BL-160

30+00 31+00 32+00 33+00 35+00

BACKFILL, TYP.

HEAD OF CONSTRUCTED RIFFLE

CENTER OF RADIUS (R15)
CENTER OF RADIUS (R14)
CENTER OF RADIUS (R16)
CENTER OF RADIUS (R17)
CENTER OF RADIUS (R18)
CENTER OF RADIUS (R19)
CENTER OF RADIUS (R20)
CENTER OF RADIUS (R21)
CENTER OF RADIUS (R22)
CENTER OF RADIUS (R23)
CENTER OF RADIUS (R24)

ROCK CROSS VANE (RCV6)
ROCK CROSS VANE (RCV7)
ROCK CROSS VANE (RCV8)
ROCK CROSS VANE (RCV9)
ROCK CROSS VANE (RCV4)
ROCK CROSS VANE (RCV5)

LOG VANE WITH ROCK J-HOOK (LV11)
LOG VANE WITH ROCK J-HOOK (LV10)
LOG VANE WITH ROCK J-HOOK (LV12)

JB with Box (Drop)

STREAM PLUG, TYP.

PROPOSED STORMWATER CONNECTION
SEE ROADWAY DRAINAGE PLANS

PROPOSED STORMWATER CONNECTION
SEE ROADWAY DRAINAGE PLANS

FS TO EL. 806.6

SHELBY ETJ LIMITS

SITE 2

Stantec

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License No. F-0672

PROJECT REFERENCE NO.	SHEET NO.
R2707D	OSM-5

PROJECT ENGINEER

APPROVED BY:

INCOMPLETE PLANS
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DATE:

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SITE 3

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PROJECT REFERENCE NO.	SHEET NO.
R2707D	OSM-6

PROJECT ENGINEER

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DATE:

REVISIONS

8/17/99

2B-C

DESCRIPTION	STATION	NORTHING	EASTING	ELEVATION	RADIUS
BEGIN ENERGY DISSIPATOR BASIN	60+06.29	566451.80	1260915.84	754.00	
CENTER OF RADIUS (1)		566470.05	1260924.82		290
HEAD RIFFLE	60+46.94	566488.85	1260932.49	754.00	
TAIL RIFFLE	60+88.35	566527.71	1260946.78	752.79	
CENTER OF RADIUS (2)		566543.47	1260950.57		70
HEAD RIFFLE	61+20.83	566559.67	1260950.64	752.24	
TAIL RIFFLE	61+64.72	566603.29	1260945.74	750.94	
CENTER OF RADIUS (3)		566620.40	1260947.12		45
HEAD RIFFLE	61+99.28	566635.76	1260954.81	750.37	
TAIL RIFFLE	62+40.11	566668.12	1260979.72	749.15	
CENTER OF RADIUS (4)		566684.00	1260988.28		56
HEAD RIFFLE	62+76.36	566701.78	1260991.34	748.55	
TAIL RIFFLE	63+23.20	566748.62	1260991.76	747.24	
CENTER OF RADIUS (5)		566768.05	1260999.41		95
HEAD RIFFLE	63+64.61	566785.00	1261010.83	746.51	
TAIL RIFFLE	64+24.63	566823.78	1261056.65	744.84	
CENTER OF RADIUS (6)		566832.74	1261071.60		54
END OF POOL	64+60.02	566836.50	1261089.00	744.31	

END RELOCATION
–2C– STA 64+59.64

BACKFILL, TYP.

END RELOCATION
–2A UPPER– STA 53+38.09
BEGIN RELOCATION
–2A LOWER–

END RELOCATION
–2A LOWER– STA 57+41.00

END RELOCATION
–2B– STA 63+23.20

BEGIN RELOCATION –2C–

BEGIN RELOCATION
–2A UPPER– STA 50+00.00

BACKFILL, TYP.

NAD 83

50+00
51+00
52+00
53+00
54+00
55+00
56+00
57+00
64+00

STREAM
PLUG, TYP.

BEGIN RELOCATION
–2B– STA 60+06.29

PROPOSED
STORMWATER
CONNECTION
SEE ROADWAY
DRAINAGE
PLANS

PROPOSED STORMWATER CONNECTION
SEE ROADWAY DRAINAGE PLANS

REACH 2A

DESCRIPTION	STATION	NORTHING	EASTING	ELEVATION	RADIUS
HEAD RIFFLE	50+00.00	567142.49	1260502.76	758.42	
TAIL RIFFLE	50+54.18	567105.93	1260542.74	757.15	
CENTER OF RADIUS (1)		567096.33	1260551.65		80
HEAD RIFFLE	50+80.39	567085.41	1260558.87	756.92	
TAIL RIFFLE	51+32.73	567039.53	1260584.07	755.67	
CENTER OF RADIUS (2)		567027.60	1260593.08		52
HEAD RIFFLE	51+62.75	567018.72	1260605.11	755.39	
TAIL RIFFLE	52+21.00	566991.24	1260656.47	754.06	
CENTER OF RADIUS (3)		566981.94	1260667.19		32
HEAD RIFFLE	52+49.61	566968.92	1260672.83	753.78	
TAIL RIFFLE	53+08.88	566910.66	1260683.75	752.46	
CENTER OF RADIUS (4)		566896.80	1260688.21		58
HEAD RIFFLE	53+38.09	566884.48	1260695.99	752.13	
TAIL RIFFLE	53+95.33	566840.30	1260732.37	750.86	
CENTER OF RADIUS (5)		566827.34	1260741.35		95
HEAD RIFFLE	54+26.90	566813.07	1260748.06	750.48	
TAIL RIFFLE	54+83.89	566759.66	1260767.96	749.76	
CENTER OF RADIUS (6)		566732.65	1260786.43		68
HEAD RIFFLE	55+49.99	566717.38	1260815.37	749.37	
TAIL RIFFLE	56+08.67	566703.31	1260872.34	748.59	
CENTER OF RADIUS (7)		566701.99	1260906.75		85
HEAD RIFFLE	56+78.02	566714.44	1260938.85	748.21	
TAIL RIFFLE	57+41.00	566748.62	1260991.76	747.27	

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SITE 1 PROFILES

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PROJECT REFERENCE NO.	SHEET NO.
R2707D	OSM-7

PROJECT ENGINEER

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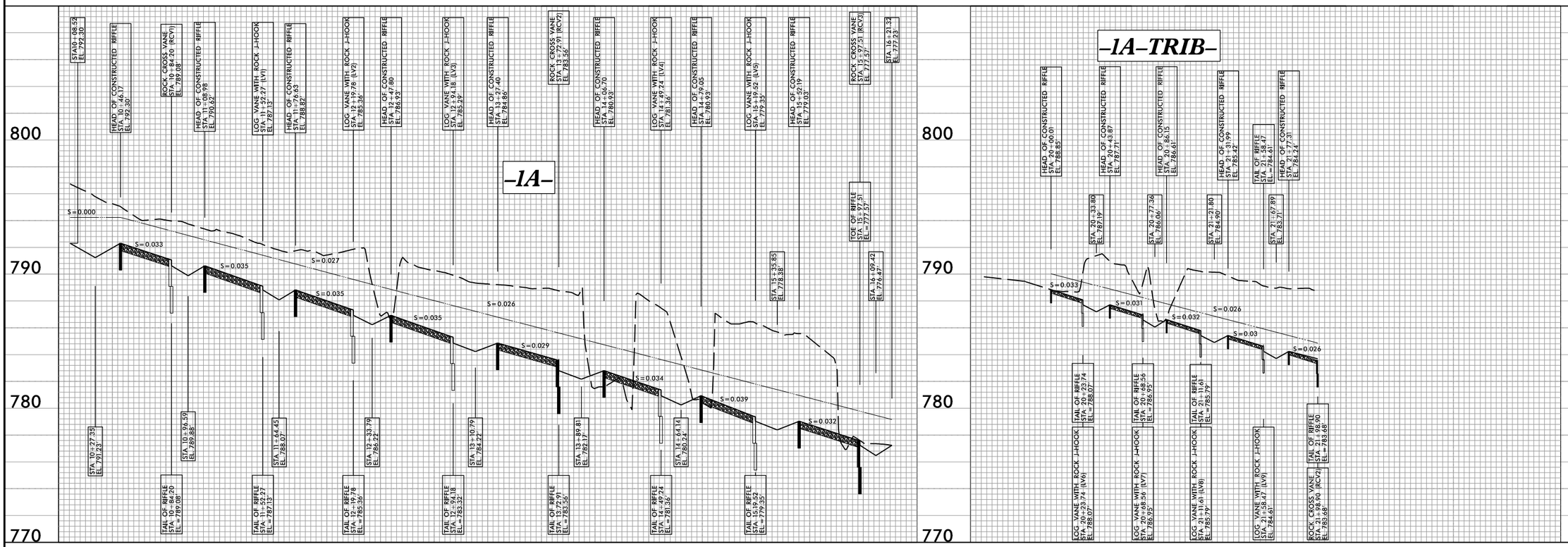

LEGEND

EXISTING GROUND ELEVATION

PROPOSED GROUND ELEVATION

PROPOSED BANKFULL

ROCK J-HOOK VANE

ROCK CROSS VANE

CONSTRUCTED RIFFLE

LOG VANE WITH ROCK J-HOOK

SITE 2 PROFILES

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PROJECT REFERENCE NO.	SHEET NO.
R2707D	OSM-8

PROJECT ENGINEER

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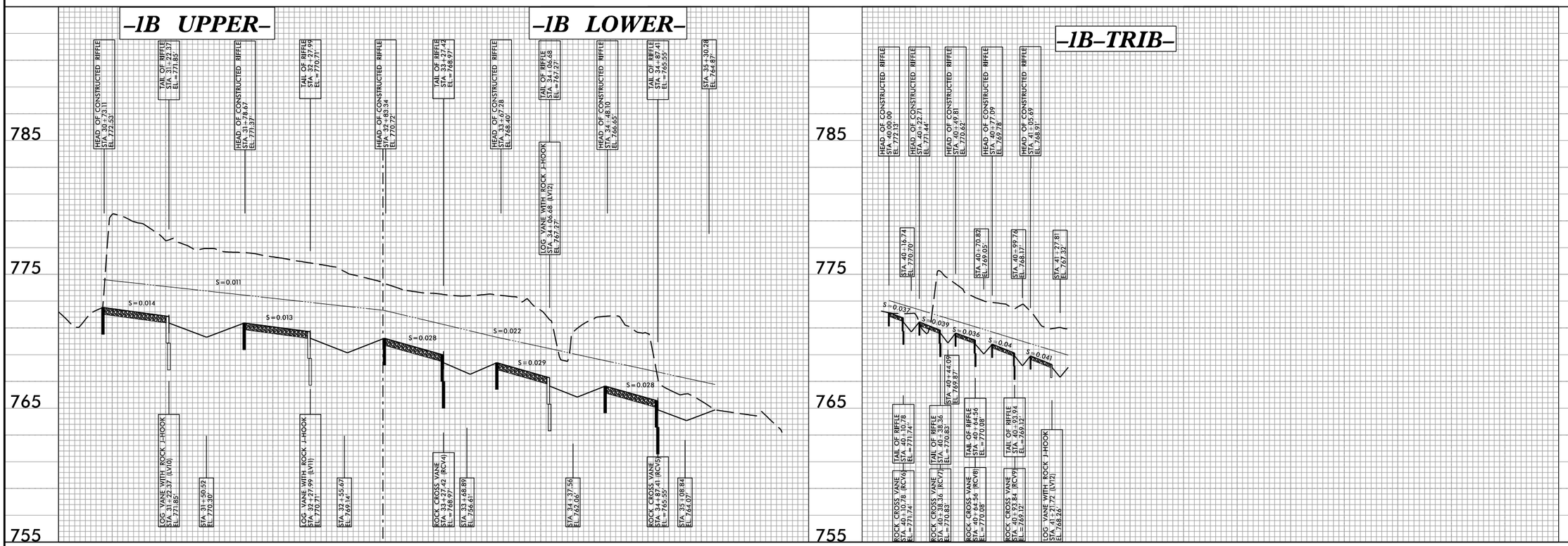
DATE:



LEGEND

EXISTING GROUND ELEVATION

PROPOSED GROUND ELEVATION

PROPOSED BANKFULL

ROCK J-HOOK VANE

ROCK CROSS VANE

CONSTRUCTED RIFFLE

LOG VANE WITH ROCK J-HOOK

SITE 3 PROFILE

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PROJECT REFERENCE NO.	SHEET NO.
R2707D	OSM-9

PROJECT ENGINEER

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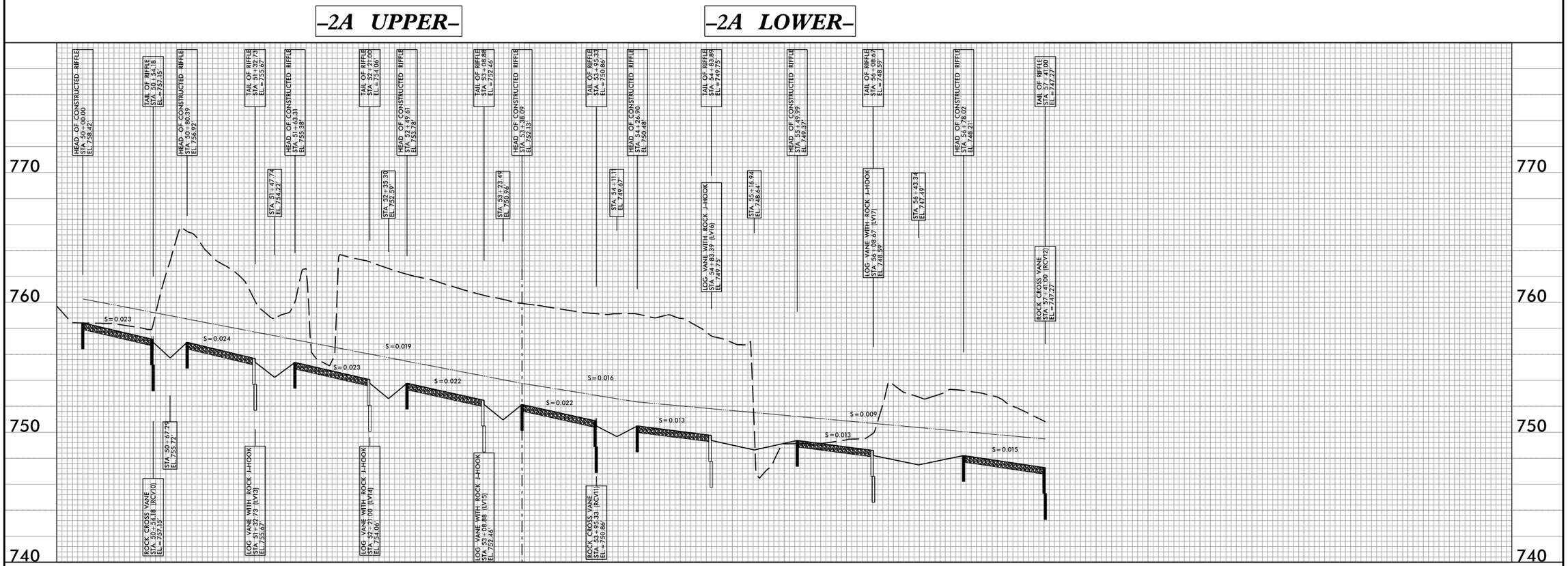
DATE:



LEGEND

EXISTING GROUND ELEVATION

PROPOSED GROUND ELEVATION

PROPOSED BANKFULL

ROCK J-HOOK VANE

ROCK CROSS VANE

CONSTRUCTED RIFFLE

LOG VANE WITH ROCK J-HOOK

SITE 3
PROFILES

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PROJECT REFERENCE NO.	SHEET NO.
R2707D	OSM-10

PROJECT ENGINEER

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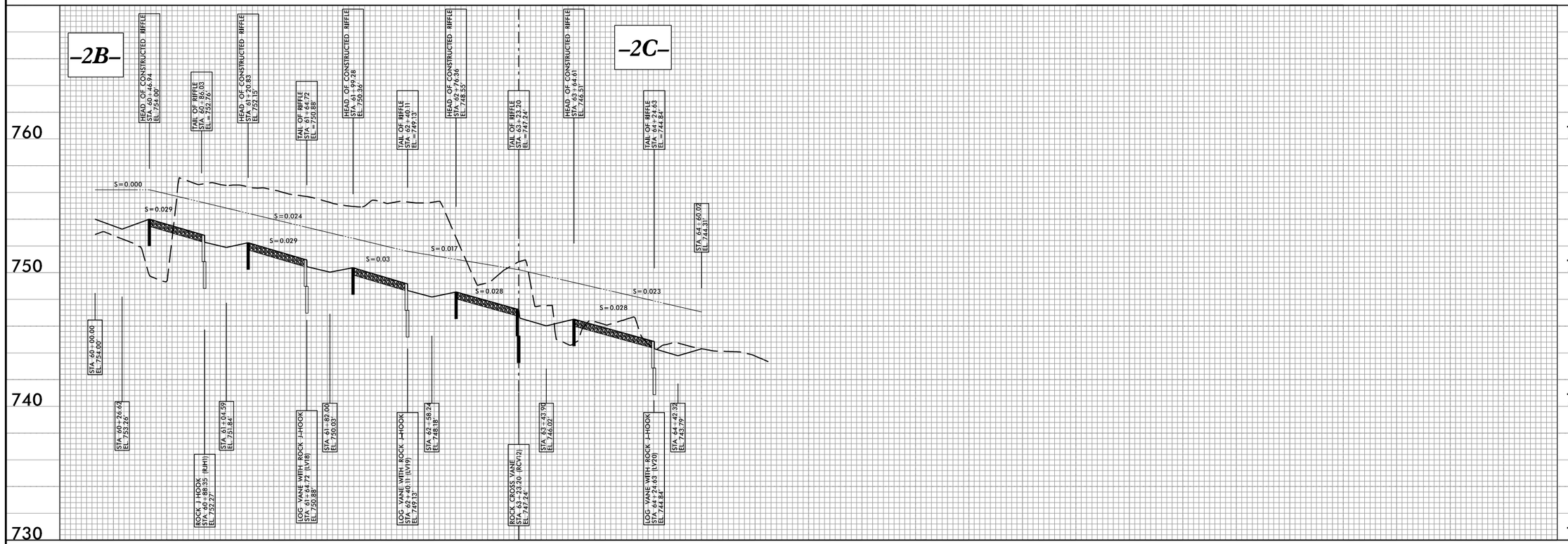
DATE:



LEGEND

EXISTING GROUND ELEVATION

PROPOSED GROUND ELEVATION

PROPOSED BANKFULL

ROCK J-HOOK VANE

ROCK CROSS VANE

CONSTRUCTED RIFFLE

LOG VANE WITH ROCK J-HOOK

6/23/16

0 5 10	PROJ. REFERENCE NO.	SHEET NO.
	R-2707D	OSM-11

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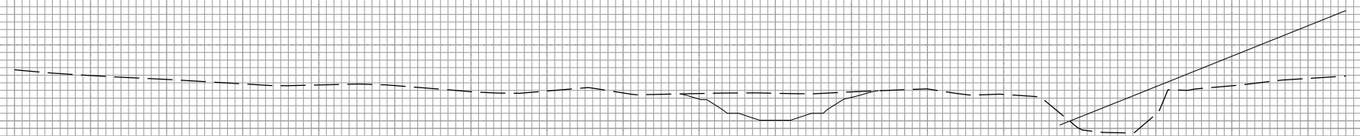

11+00

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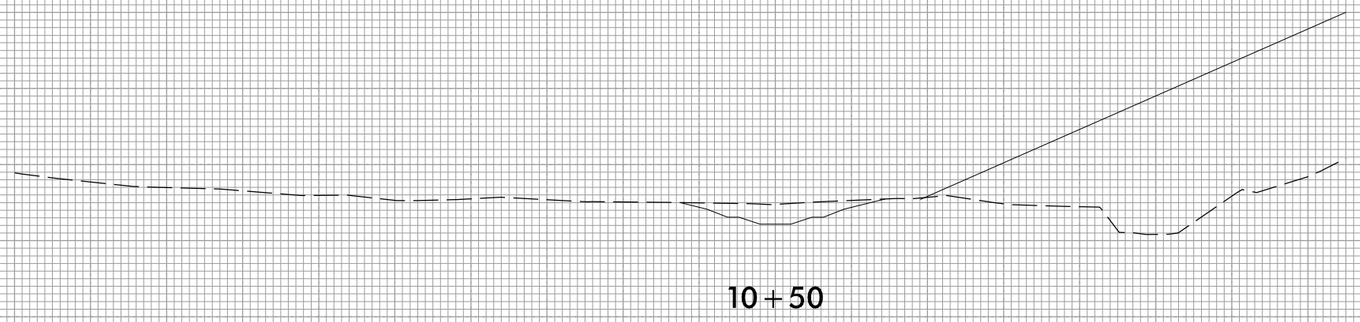

10+50

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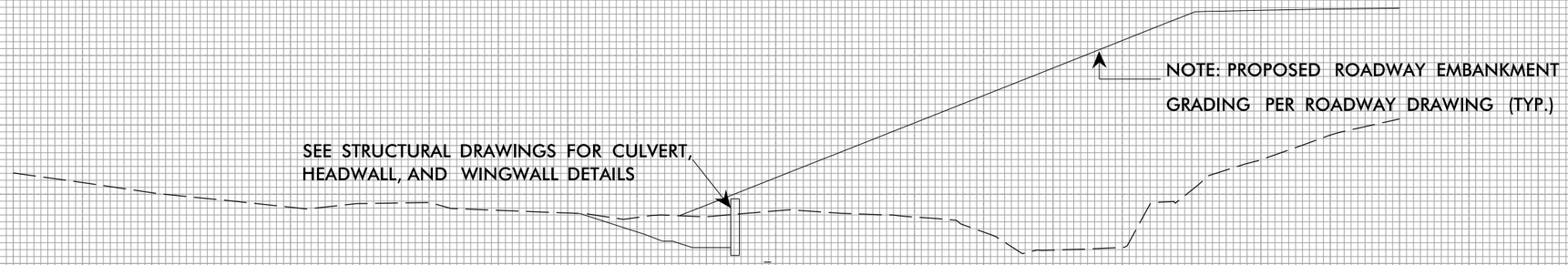

10+08.52

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	R-2707D	OSM-12

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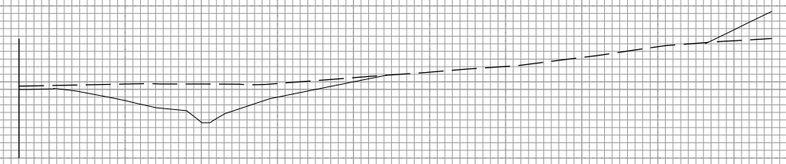
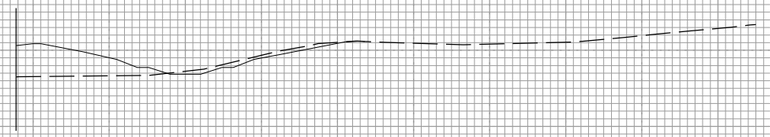
REFER TO 1A TRIB CROSS SECTIONS FOR CONT.



13+00

800 790 780 770

REFER TO 1A TRIB CROSS SECTIONS FOR CONT.



12+50

810 800 790 780

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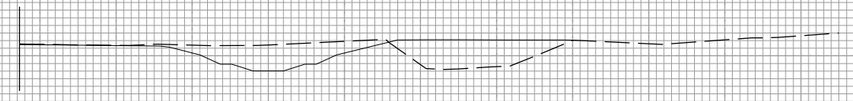

12+00

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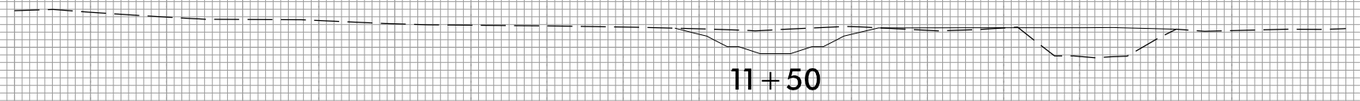

11+50

-1A-

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6/23/16

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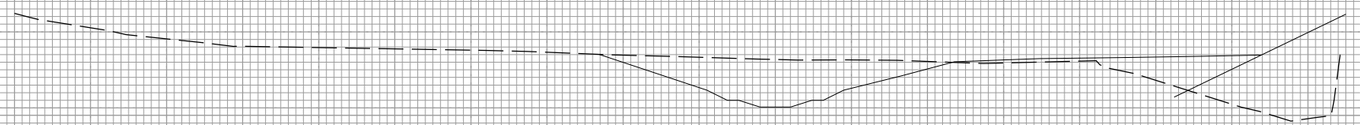

15+00

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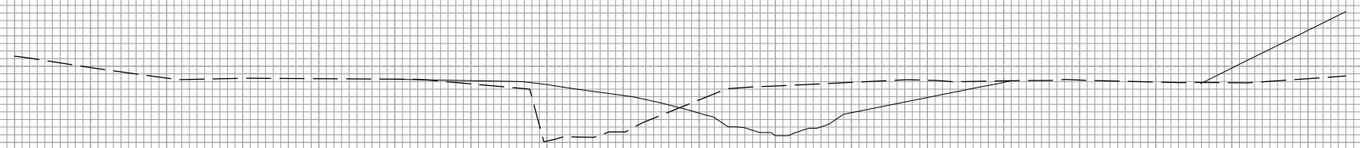

14+50

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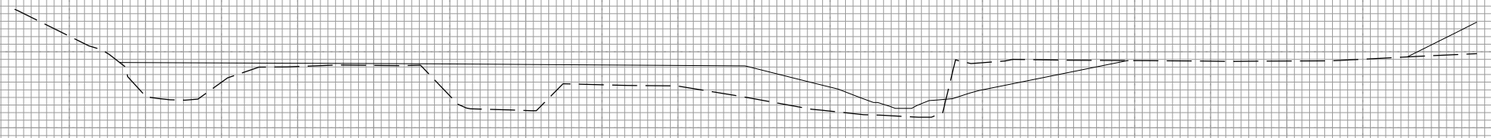

14+00

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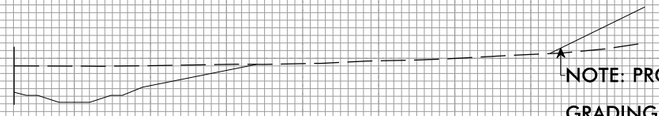

NOTE: PROPOSED ROADWAY EMBANKMENT GRADING PER ROADWAY DRAWING (TYP.)

13+50

800 790 780 770

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-1A-

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6/23/16

0 5 10	PROJ. REFERENCE NO.	SHEET NO.
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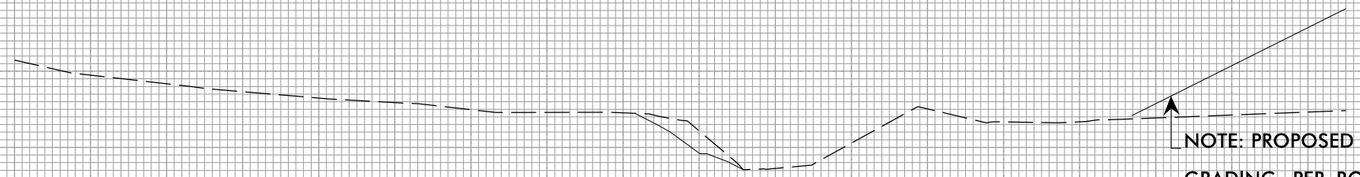
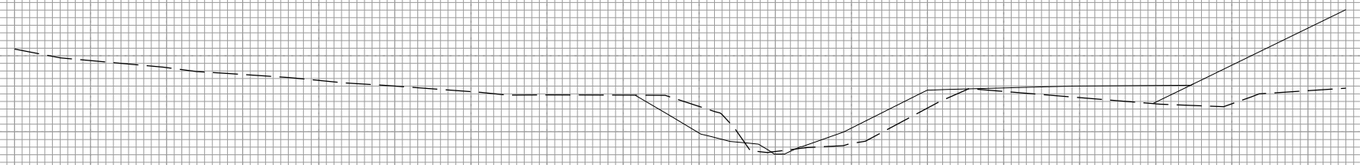


NOTE: PROPOSED ROADWAY EMBANKMENT GRADING PER ROADWAY DRAWING (TYP.)

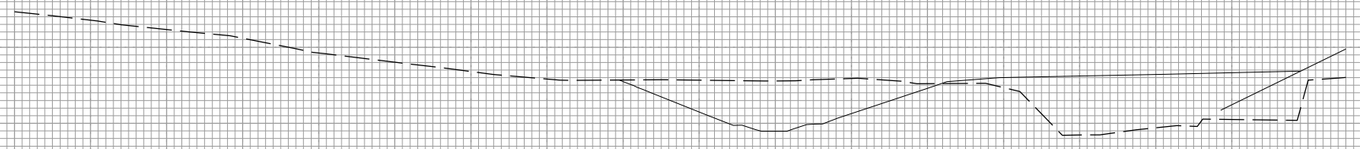
16+21.34

800 790 780 770



16+00

800 790 780 770



15+50

-/A-

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6/23/16

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	R-2707D	OSM-15

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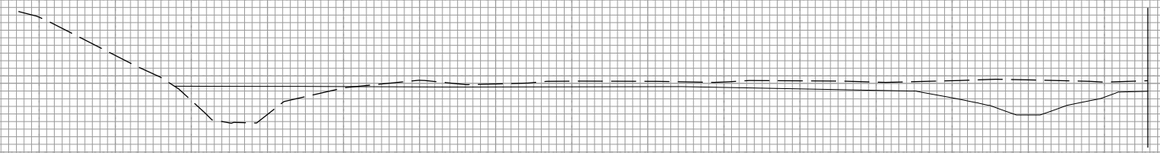
810
800
790
780



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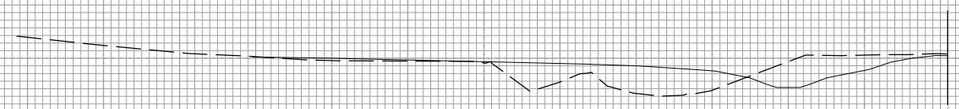
21+50

800
790
780

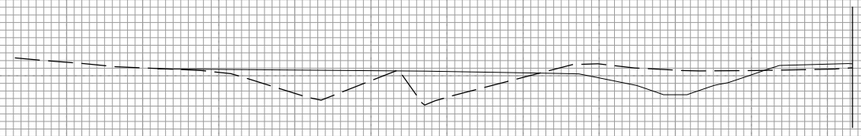


REFER TO 1A CROSS SECTIONS FOR CONT.

21+00

770

800
790
780

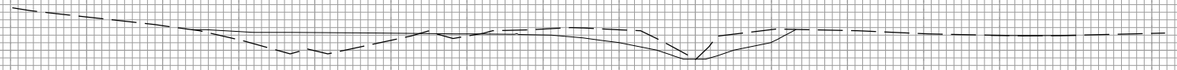


REFER TO 1A CROSS SECTIONS FOR CONT.

20+50

770

810
800
790
780



20+00

770

-1A TRIB-

150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150

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c:\users\lstarnes\documents\pw_working\d0118711\R2707D_NEU_OSM-12XSEC.dgn
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6/23/16

0 5 10	PROJ. REFERENCE NO.	SHEET NO.
	R-2707D	OSM-16

150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150

8/24/2018
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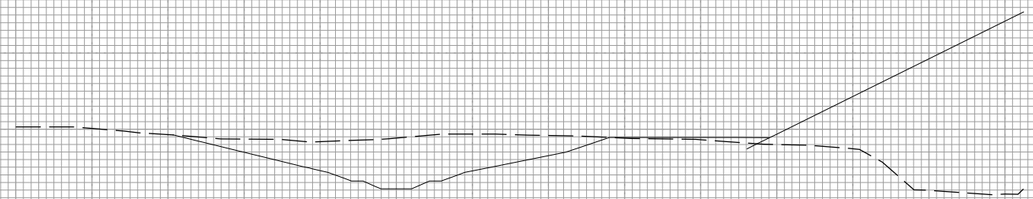
lstarnes

6/23/16

0 5 10	PROJ. REFERENCE NO.	SHEET NO.
	R-2707D	OSM-17

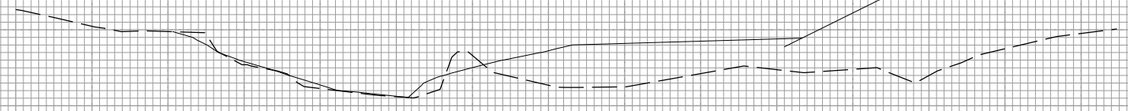
150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150

800 790 780 770 760



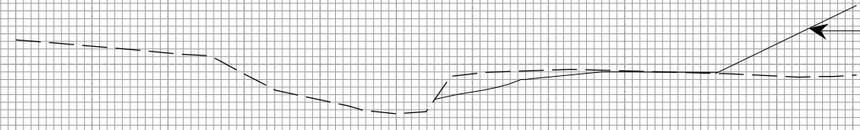
31+00

800 790 780 770 760



30+50

800 790 780 770 760



NOTE: PROPOSED ROADWAY EMBANKMENT GRADING PER ROADWAY DRAWING (TYP.)

30+00

-IB UPPER-

150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150

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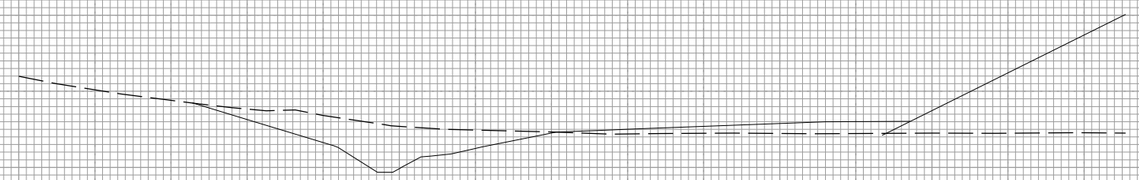
6/23/16

0 5 10	PROJ. REFERENCE NO.	SHEET NO.
	R-2707D	OSM-18

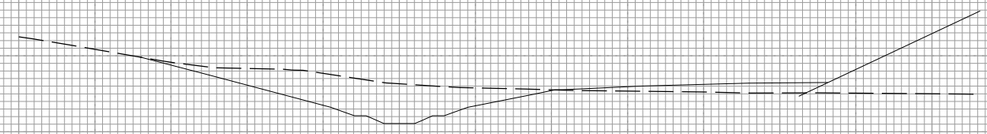
150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150

800
790
780
770
760



32+50

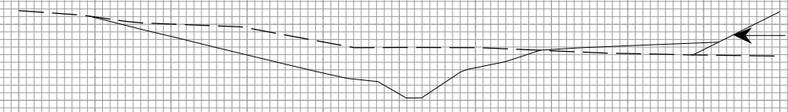
790
780
770
760



32+00

790
780
770
760

REFER TO 1B TRIB CROSS SECTIONS FOR CONT.



NOTE: PROPOSED ROADWAY EMBANKMENT GRADING PER ROADWAY DRAWING (TYP.)

31+50

-1B UPPER-

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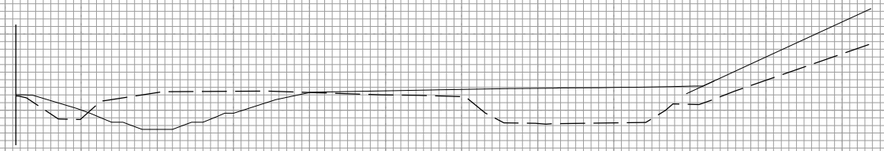
0 5 10	PROJ. REFERENCE NO.	SHEET NO.
	R-2707D	OSM-19

150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150

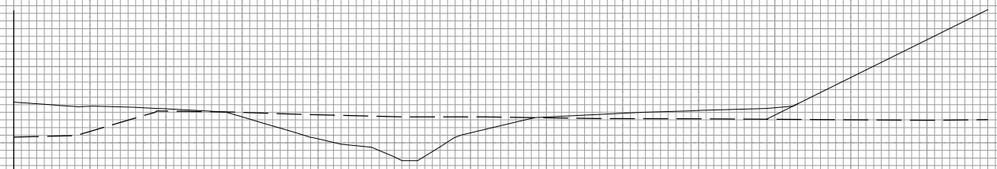
790
780
770
760
750

REFER TO 1B TRIB CROSS SECTIONS FOR CONT.



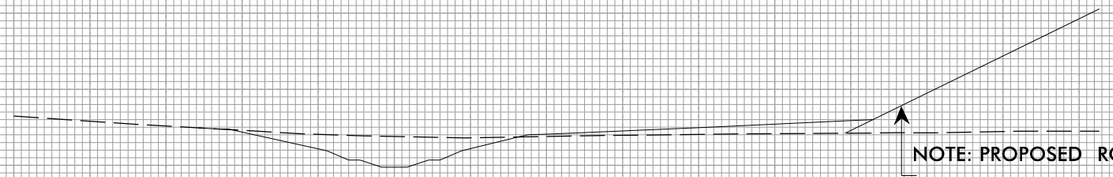
34+00

790
780
770
760



33+50

800
790
780
770
760



NOTE: PROPOSED ROADWAY EMBANKMENT GRADING PER ROADWAY DRAWING (TYP.)

33+00

-1B LOWER-

150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150

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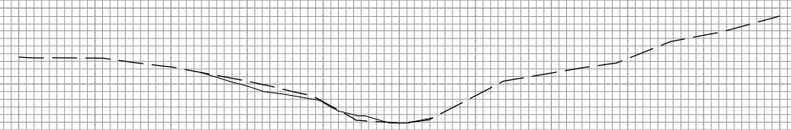
lstarnes

6/23/16

0 5 10	PROJ. REFERENCE NO.	SHEET NO.
	R-2707D	OSM-20

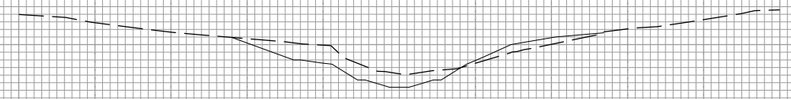
150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150

790
780
770
760
750



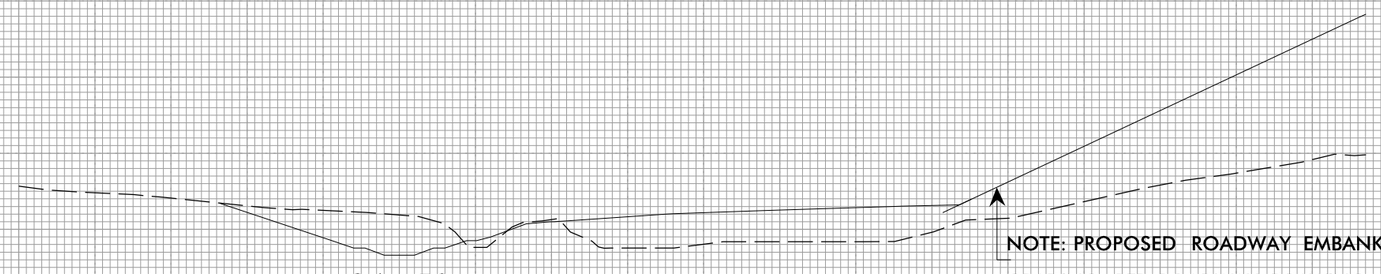
35+30.28

790
780
770
760
750



35+00

800
790
780
770
760



34+50

NOTE: PROPOSED ROADWAY EMBANKMENT GRADING PER ROADWAY DRAWING (TYP.)

-IB LOWER-

150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150

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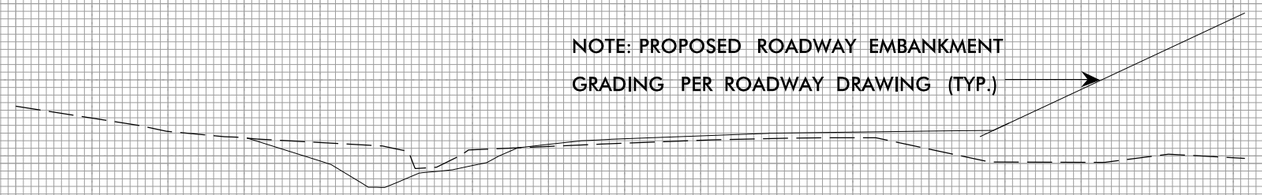
lstarnes

6/23/16

0 5 10	PROJ. REFERENCE NO.	SHEET NO.
	R-2707D	OSM-21

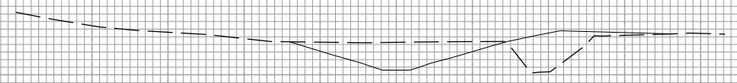
150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150

790 780 770 760

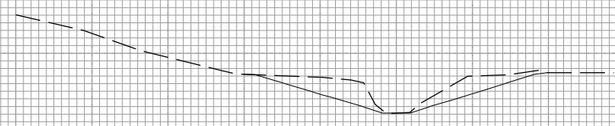


41+33.89

41+00



40+50



40+00

-1B TRIB-

8/24/2018
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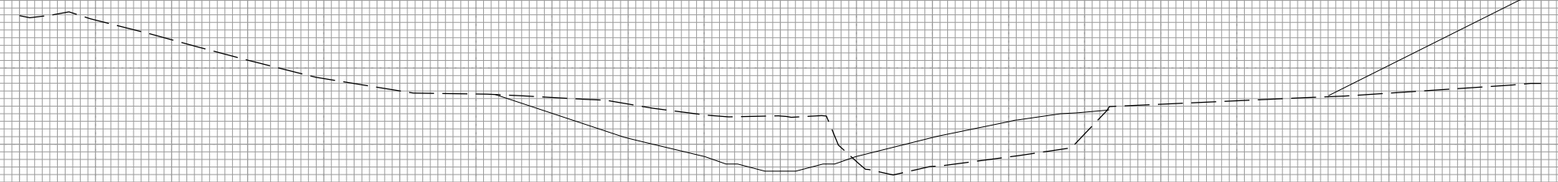
lstarnes

6/23/16

0 5 10	PROJ. REFERENCE NO.	SHEET NO.
	R-2707D	OSM-22

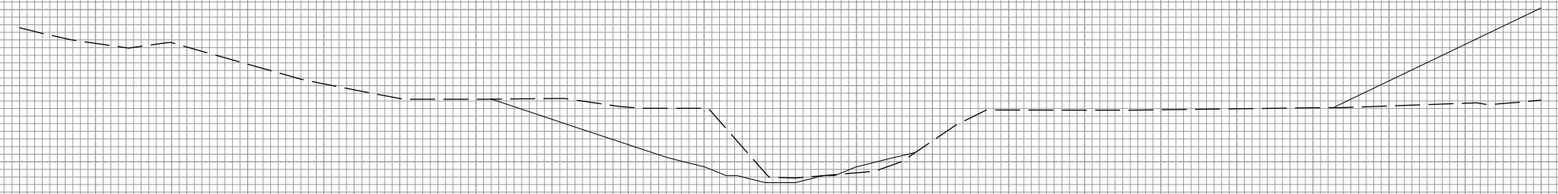
150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150

790 780 770 760 750



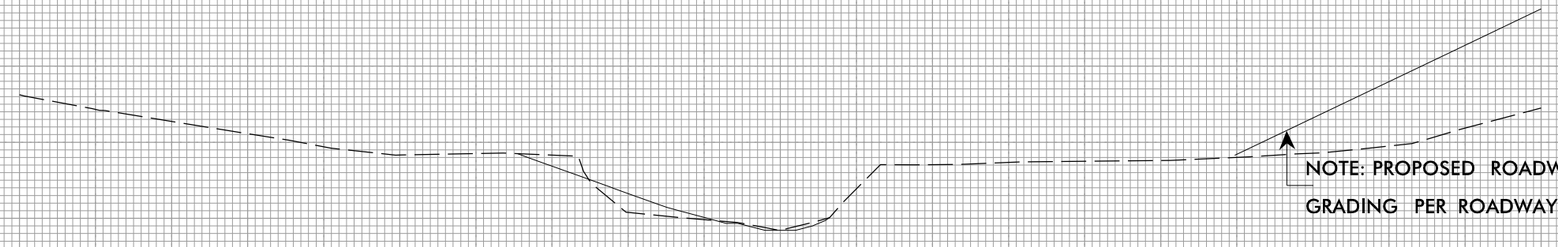
51+00

790 780 770 760 750



50+50

790 780 770 760 750



NOTE: PROPOSED ROADWAY EMBANKMENT GRADING PER ROADWAY DRAWING (TYP.)

50+00

-2A UPPER-

150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150

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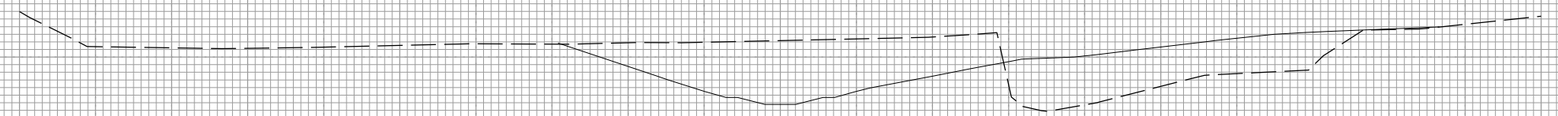
lstarnes

6/23/16

0 5 10	PROJ. REFERENCE NO.	SHEET NO.
	R-2707D	OSM-23

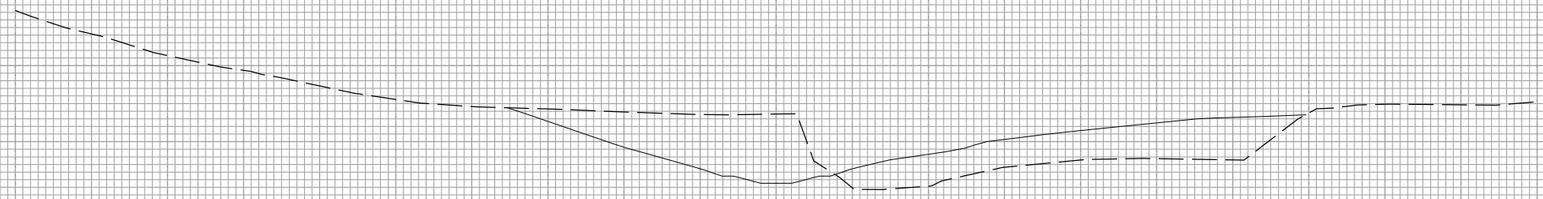
150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150

780 770 760 750 740



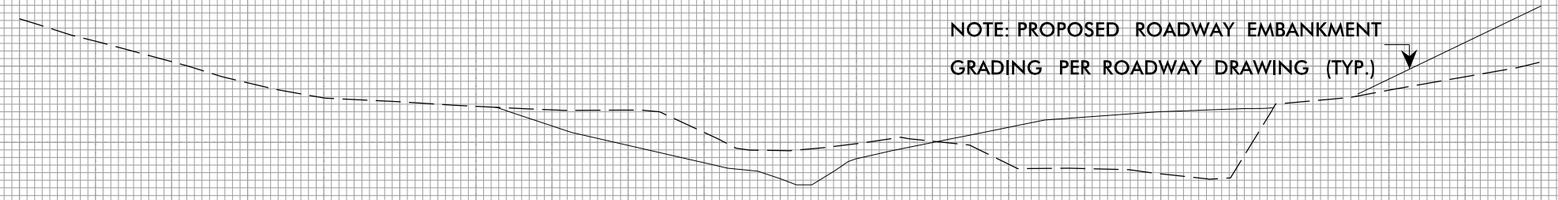
52 + 50

780 770 760 750 740



52 + 00

780 770 760 750 740



51 + 50

780 770 760 750 740

-2A UPPER-

150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150

8/24/2018
c:\users\lstarnes\documents\pw_working\d0118711\R2707D_NEU_OSM-12XSEC.dgn
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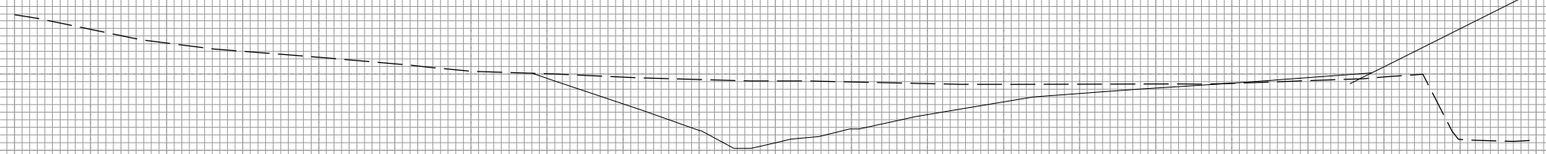
6/23/16

0 5 10	PROJ. REFERENCE NO.	SHEET NO.
	R-2707D	OSM-24

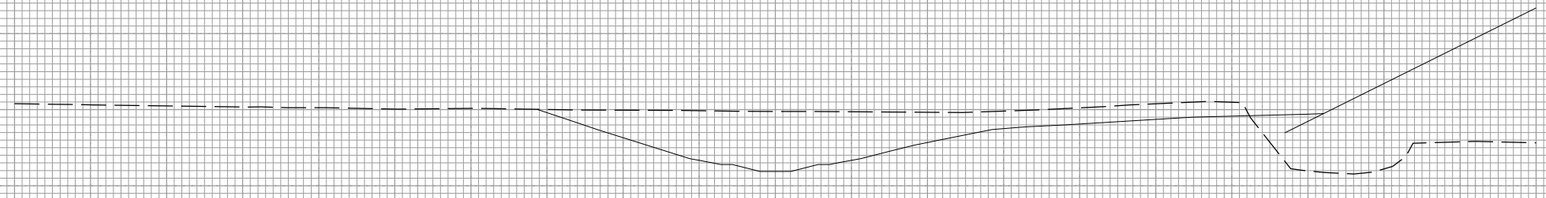
150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150

780 770 760 750 740



54+00

780 770 760 750 740

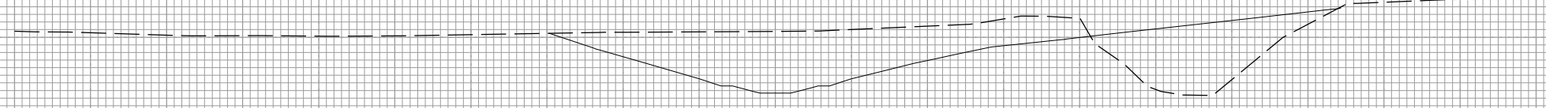


53+50

780 770 760 750 740

-2A LOWER-

NOTE: PROPOSED ROADWAY EMBANKMENT GRADING PER ROADWAY DRAWING (TYP.)



53+00

780 770 760 750 740

-2A UPPER-

150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150

8/24/2018
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lstarnes

6/23/16

0 5 10	PROJ. REFERENCE NO.	SHEET NO.
	R-2707D	OSM-25

150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150

780 770 760 750 740

55+50

790 780 770 760 750 740

55+00

780 770 760 750 740

54+50

NOTE: PROPOSED ROADWAY EMBANKMENT GRADING PER ROADWAY DRAWING (TYP.)

-2A LOWER-

8/24/2018
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lstarnes

6/23/16

0 5 10	PROJ. REFERENCE NO.	SHEET NO.
	R-2707D	OSM-26

150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150

770 760 750 740 730

REFER TO 2B CROSS SECTIONS FOT CONT.

57+00

770 760 750 740 730

REFER TO 2B CROSS SECTIONS FOR CONT.

56+50

770 760 750 740 730

REFER TO 2B CROSS SECTIONS FOR CONT.

56+00

-2A LOWER-

150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150

8/24/2018
c:\users\lstarnes\documents\pw_working\d0118711\R2707D_NEU_OSM-12XSEC.dgn
lstarnes

6/23/16

0 5 10	PROJ. REFERENCE NO.	SHEET NO.
	R-2707D	OSM-27

150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150

8/24/2018
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lstarnes

6/23/16

0 5 10	PROJ. REFERENCE NO.	SHEET NO.
	R-2707D	OSM-12

150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150

780 770 760 750 740

61+00

790 780 770 760 750 740

60+50

770 760 750 740 730 720

NOTE: PROPOSED ROADWAY EMBANKMENT GRADING PER ROADWAY DRAWING (TYP.)

SEE STRUCTURAL DRAWINGS FOR CULVERT, HEADWALL, AND WINGWALL DETAILS

60+06.29

-2B-

150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150

8/24/2018
c:\users\lstarnes\documents\pw_working\d0118711\R2707D_NEU_OSM-12XSEC.dgn
lstarnes

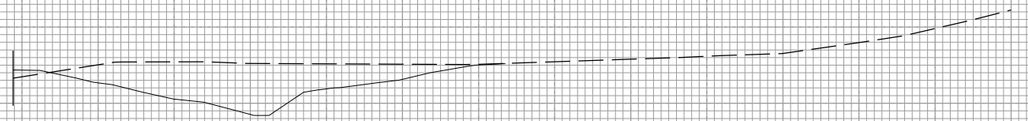
6/23/16

0 5 10	PROJ. REFERENCE NO.	SHEET NO.
	R-2707D	OSM-29

150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150

770
760
750
740
730

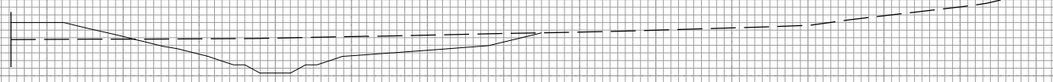
REFER TO 2A CROSS
SECTIONS FOR CONT.



62 + 50

770
760
750
740

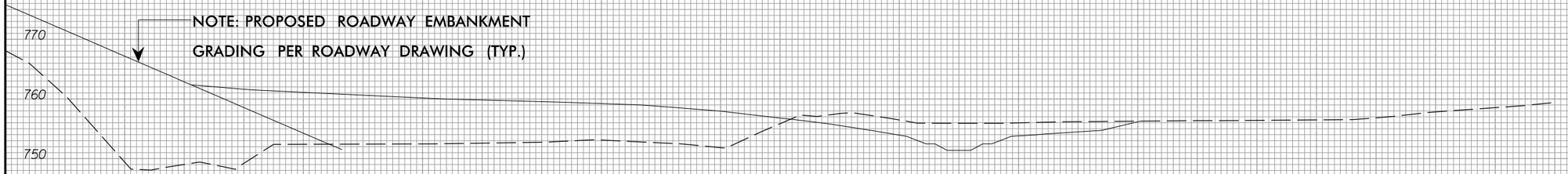
REFER TO 2A CROSS
SECTIONS FOR CONT.



62 + 00

780
770
760
750
740

NOTE: PROPOSED ROADWAY EMBANKMENT
GRADING PER ROADWAY DRAWING (TYP.)



61 + 50

150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150

-2B-

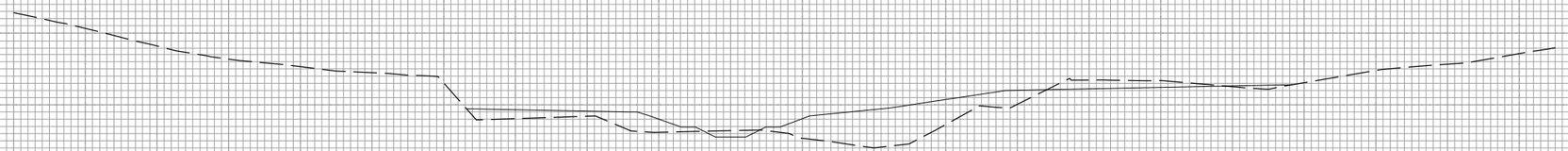
8/24/2018
c:\users\lstarnes\documents\pw_working\d0118711\R2707D_NEU_OSM-12XSEC.dgn
lstarnes

6/23/16

0 5 10	PROJ. REFERENCE NO.	SHEET NO.
	R-2707D	OSM-30

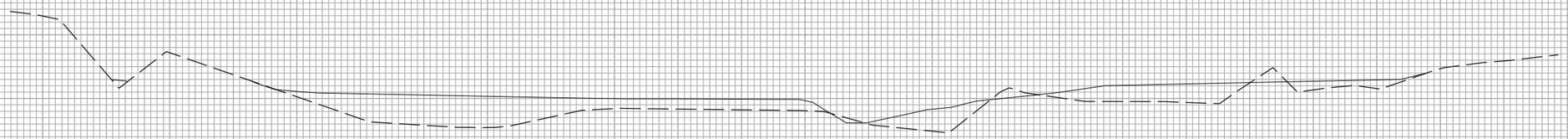
150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150

770 760 750 740 730



64+00

770 760 750 740 730

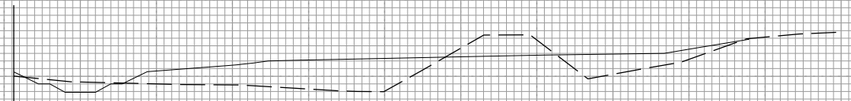


63+50

-2C-

770 760 750 740 730

REFER TO 2A CROSS SECTIONS FOR CONT.



63+00

-2B-

150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150

8/24/2018
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lstarnes

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0 5 10	PROJ. REFERENCE NO.	SHEET NO.
	R-2707D	OSM-12

150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150

770 760 750 740 730

64+60.02

770 760 750 740 730

64+50

770 760 750 740 730

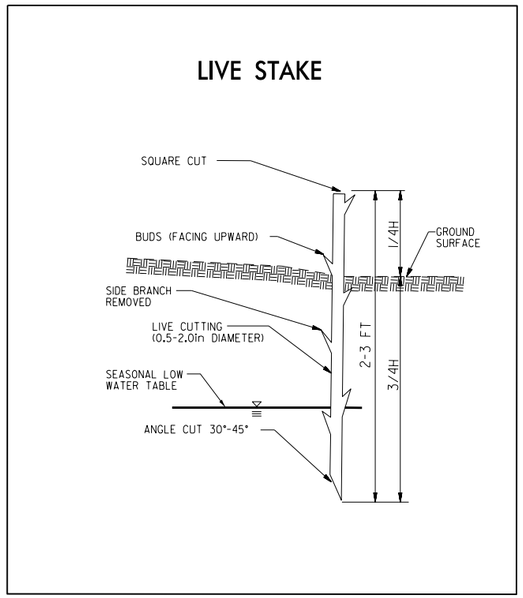
150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150

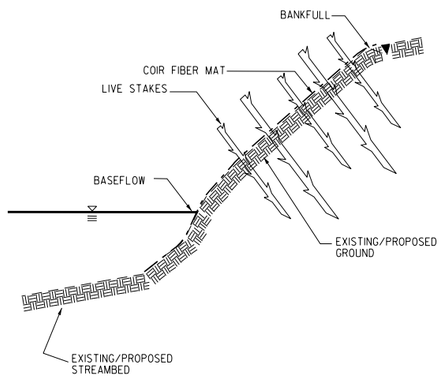
-2C-

8/24/2018
c:\users\lstarnes\documents\pw_working\d0118711\R2707D_NEU_OSM-12XSEC.dgn
lstarnes

PLANTING DETAILS

LIVE STAKES PLANTING DETAIL

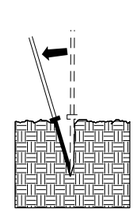




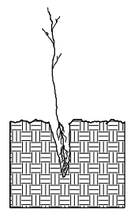
BANK STABILIZATION WITH LIVE STAKES

NOTE:
LIVE STAKES SHALL BE DRIVEN UNTIL APPROXIMATELY 3/4 OF THE LIVE STAKE LENGTH IS WITHIN THE GROUND.

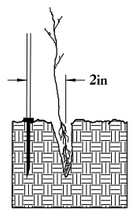
BAREROOT PLANTING DETAIL
DIBBLE PLANTING METHOD
USING THE KBC PLANTING BAR



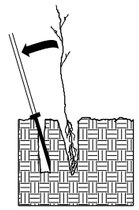
1. Insert planting bar as shown and pull handle toward planter.



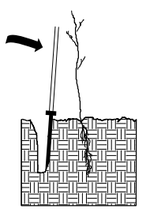
2. Remove planting bar and place seedling at correct depth.



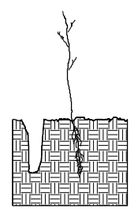
3. Insert planting bar 2in toward planter from from seedling.



4. Pull handle of bar toward planter, firming soil at bottom.



5. Push handle forward firming soil at top.



6. Leave compaction hole open. Water thoroughly.

PLANTING NOTES:

PLANTING BAG
During planting, seedlings shall be kept in a moist canvas bag or similar container to prevent the root systems from drying.

KBC PLANTING BAR
Planting bar shall have a blade with a triangular cross section, and shall be 12in long, 4in wide and 1in thick at center.

ROOT PRUNING
All seedlings shall be root pruned, if necessary, so that no roots extend more than 10in below the root collar.

Stantec
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Tel. (919) 851-6866
Fax. (919) 851-7024
www.stantec.com
License No. F-0672

PROJECT REFERENCE NO.	SHEET NO.
R2707D	RF-1

PROJECT ENGINEER

APPROVED BY:

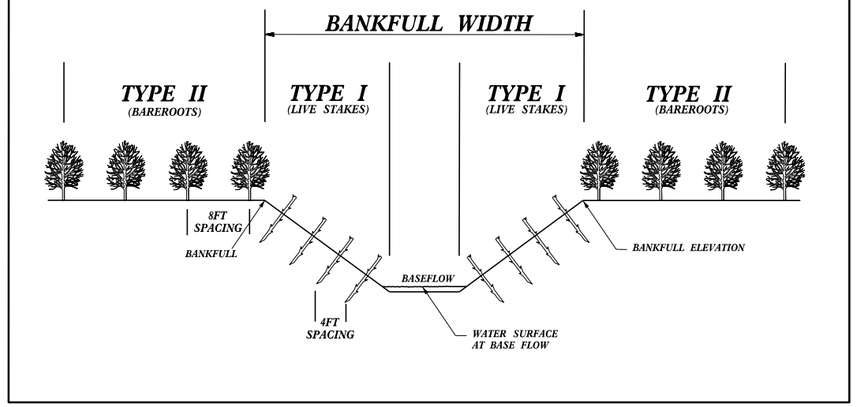
DATE:

☐ *TYPE 1 STREAM REFORESTATION SHALL INCLUDE PLANTING LIVE STAKES ALONG THE STREAMBANK FOR BASE FLOW TO BANKFULL ELEVATION AND BE PLANTED 3FT TO 5FT ON CENTER, RANDOM SPACING, AVERAGING 4FT ON CENTER, APPROXIMATELY 2,723 PLANTS PER ACRE.*

☐ *TYPE 2 STREAM REFORESTATION SHALL INCLUDE PLANTING BAREROOTS IN THE RIPARIAN ZONE ABOVE BANKFULL ELEVATION AND BE PLANTED 6FT TO 10FT ON CENTER, RANDOM SPACING, AVERAGING 8FT ON CENTER, APPROXIMATELY 680 PLANTS PER ACRE.*

☐ *NOTE: TYPE 1 AND TYPE 2 STREAMBANK REFORESTATION SHALL BE PAID FOR AS "STREAMBANK REFORESTATION"*

STREAMBANK REFORESTATION TYPICAL



STREAMBANK REFORESTATION

MIXTURE, TYPE, SIZE, AND FURNISH SHALL CONFORM TO THE FOLLOWING:

TYPE 1				
50%	*CEPHALANTHUS OCCIDENTALIS*	*BUTTONBUSH*	*2FT to 3FT*	*LIVE STAKES*
50%	*CORNUS AMOMUM*	*SILKY DOGWOOD*	*2FT to 3FT*	*LIVE STAKES*
TYPE 2				
20%	*LIRIODENDRON TULIPIFERA*	*TULIP POPLAR*	*12in – 18in*	*BAREROOTS*
20%	*PLATANUS OCCIDENTALIS*	*SYCAMORE*	*12in – 18in*	*BAREROOTS*
20%	*FRAXINUS PENNSYLVANICA*	*GREEN ASH*	*12in – 18in*	*BAREROOTS*
20%	*QUERCUS PHELLOS*	*WILLOW OAK*	*12in – 18in*	*BAREROOTS*
20%	*BETULA NIGRA*	*RIVER BIRCH*	*12in – 18in*	*BAREROOTS*

☐ *SEE STREAM REFORESTATION PLAN SHEETS FOR AREAS TO BE PLANTED*

SITE I STREAM REFORESTATION

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PROJECT REFERENCE NO.	SHEET NO.
R2707D	RF-2

PROJECT ENGINEER

APPROVED BY:

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

DATE:

NAD 83

BEGIN RELOCATION
–1A TRIB– STA 20+00.00

END RELOCATION
–1A– STA 16+21.35

TYPE I

TYPE II

BEGIN RELOCATION
–1A– STA 10+08.52

END RELOCATION
–1A TRIB– STA 21+98.90

10+00

11+00

12+00

13+00

14+00

15+00

16+00

1@7'X7' RCBC W/ SILLS AND BAFFLES SEE DETAIL #35

REVISIONS

8/17/99

8/24/2018
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lstarnes

SITE 2
STREAM
REFORESTATION

Stantec
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PROJECT REFERENCE NO.	SHEET NO.
R2707D	RF-3

PROJECT ENGINEER

APPROVED BY:

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

DATE:

NAD 83

END RELOCATION
–1B LOWER– STA 35+29.57

END RELOCATION
–1B TRIB– STA 41+33.78

BEGIN RELOCATION
–1B TRIB– STA 40+00.00

END RELOCATION
–1B UPPER– STA 32+83.34
BEGIN RELOCATION
–1B LOWER–

BEGIN RELOCATION
–1B UPPER– STA 30+00.00

TYPE I

TYPE II

30+00
32+00
33+00
34+00
35+00

PRESERVATION AREA

ERNEST L. AND SHIRLEY A. PROCTOR
DB 1345 PG 1266
PB 8 PG 85

MAGGIE LUCILLE BROWN
DB 18T PG 529
PB 8 PG 85

DIVERSE SERVICES U.S.A., INC.
DB 1250 PG 1388
DB 1260 PG 1000
PB 8 PG 85

SILINDA WATTS
DB 1263 PG 2225
DB 1257 PG 785
PB 8 PG 85

VINONA MUHAMMAD
DB 1257 PG 783
PB 8 PG 85

JAMES W. WHITE JR. AND MARSHA H. WHITE
DB 1582 PG 109

JOE L. MORRIS & WF. CHRISTINE B. MORRIS
DB 1082 PG 2420
PB 8 PG 85

JOHNNY BROOKS
DB 1591 PG 293
PB 8 PG 85

KEITH KEVIN CLARK & MARTHA ROWE CL
DB 1196 PG 600
PB 8 PG 85

SHELBY ETJ LIMITS

REVISIONS

8/17/99

8/24/2018
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SITE 3 STREAM REFORESTATION

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PROJECT REFERENCE NO.	SHEET NO.
R2707D	RF-4

PROJECT ENGINEER

APPROVED BY:

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

DATE:

REVISIONS
8/17/99

NAD 83

END RELOCATION
–2C– STA 64+59.64

END RELOCATION
–2B– STA 63+23.20

BEGIN RELOCATION –2C–

TYPE II

END RELOCATION
–2A UPPER– STA 53+38.09
BEGIN RELOCATION
–2A LOWER–

END RELOCATION
–2A LOWER– STA 57+41.00

BEGIN RELOCATION
–2A UPPER– STA 50+00.00

TYPE I

BEGIN RELOCATION
–2B– STA 60+06.29

ANNIE P. TAYLOR
DB 1429 PG 1423
PB 8 PG 85

JOE L. MORRIS & WF
CHRISTINE B. MORRIS
DB 1132 PG 952
PB 8 PG 85

SR 2145 KELLOW DR

FORMERLY PARCEL 046
654
CLEVELAND COUNTY
DB 1107 PG 1795
DB 982 PG 481
DB 982 PG 483
DB K PG 282

SHELBY ETJ LIMITS

CS Sta. 743+49.23 -L-

ST Sta. 745+49.23 -L-

BM #33
-BL- STA 709+29
3' LEFT
ELEV.= 784.14'

STA 741+07.40

50+00
51+00
52+00
53+00
54+00
55+00
56+00

8/24/2018
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