STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

ROY COOPER
GOVERNOR

JAMES H. TROGDON, III
SECRETARY

January 29, 2020

Asheville Regulatory Field Office
US Army Corps of Engineers
151 Patton Avenue, Room 208
Asheville, North Carolina 28801-5006

ATTN: Ms. Nicholle Braspennickx, NCDOT Coordinator

Subject: *Updated information for the Application* Requesting Modification of Section 404 Individual Permit and Section 401 Water Quality Certification for the U-2579B Section of the Winston-Salem Northern Beltway, from US 158 to I-40 Business/US 421, Forsyth County, Division 9, WBS 34839.2.10

References: Section 404 Individual Permit – Action ID No. SAW-2009-03183, issued June 17, 2014 and modifications issued July 2, 2014, February 21, 2019, and Section 404 Individual Renewal/ ATF Permit Modification, October 17, 2019

Section 401 Water Quality Certification – NCDWR Project No. 2014090 issued April 11, 2014 and modifications issued July 18, 2014, December 17, 2018, and Section 401 Water Quality Certification Renewal/ATF issued October 15, 2019

Permit Application Request for Modification of Section 404 Individual Permit and Section 401 Water Quality Certification submitted on October 21, 2019

Dear Madam:

This letter and permit drawings dated January 14, 2020, are an update (shown in italics) to the previous letter and permit drawings submitted with the October 21, 2019 application for the Smith Creek relocation permit modification.

This update is required due to two minor design revisions. The landowner adjacent to the proposed relocation of Smith Creek owns several fish ponds and has utilized the Creek to fill the ponds each year. To enable the land owner the use of the Creek to fill his ponds, it is necessary to install a stream intake vault (see Permit Drawing Sheet 2 of 18) at the north end of the relocated stream (see Permit Drawing Sheet 14 of 18). This change will involve 12 linear feet of bank stabilization impacts as part of this modification at Site 28.

Mailing Address:
NC DEPARTMENT OF TRANSPORTATION
ENVIRONMENT ANALYSIS UNIT
1598 MAIL SERVICE CENTER
RALEIGH NC 27699-1598

Telephone: (919) 707-6000
Customer Service: 1-877-368-4968
Website: www.ncdot.gov

Location:
1000 BIRCH RIDGE DRIVE
RALEIGH NC 27610

Additionally, Site 28A will have an increase of Natural Stream Design (NSD) due to a better alignment for the confluence of UT Smith Creek to the mainstem. This will increase the NSD at site 28A from 344 linear feet to 384 linear feet.

Impact Changes for the Smith Creek Relocation and U*pdated Impacts from the Stream Vault:*

	Current Permanent Stream (LF)	Current Stream Bank Stabilization (LF)	Current Stream Temporary (LF)	**New Permanent Stream (LF)**	**New Stream Bank Stabilization (LF)**	**Stream Reloc. In The TDE**	**New Stream Temporary (LF)**	**New Pond De-watering (AC)**
Site 23	151	36	121	NC	**55**		**30**	
Site 28	598	194	127	***2233***	***132***	***76***	**0**	
Site 28A				**80**				
Site 28B								**1.62**
Site 28C								**6.20**

NC = No Change
Sites 28A, 28B, and 28C are new sites for this modification
The impacts for the TDE (Temporary Drainage Easement) are separated out in this application.

The total additional new permanent stream impacts requiring mitigation are as follows:
Site 28 1,711 Linear Feet of Stream Impacts
Site 28A 80 Linear Feet of Stream Impacts
Total new permanent requiring mitigation = 1,791 Linear Feet

Bank Stabilization Impact changes are as follows:
Site 23 +19 Linear Feet
Site 28 *-62 Linear Feet*
Total **reduction** in Bank Stabilization Impacts = ***43 Linear Feet***

Temporary impact changes will be as follows
Site 23 -91 Linear Feet
Site 28 -127 Linear Feet
Total **reduction** in Temporary Impacts = **218 Linear Feet**

There will be new impacts to ponds for this modification. Pond 1 and Pond 2 will be drained to accommodate the relocation of Smith Creek totaling 7.82 acre of impacts.

The total permanent stream impacts requiring mitigation remain at 1,791 linear feet.

The modification of this permit for the relocation of Smith Creek, will now bring the total stream impacts for the U-2579B Section of the W-S Beltway to:
12,492 linear feet of permanent stream impacts
1,570 linear feet of temporary impacts

NCDOT proposes the relocated Smith Creek NSD for mitigation of the impacts for this permit modification. The mitigation success of this project will be determined once the construction of the NSD and monitoring is completed and determined successful. Currently the proposed NSD is 2,127 linear feet for Smith Creek (Site 28) and *384 linear feet for UT Smith Creek (Site 28A).*

Please see the attached *revised permit drawings (Permit Drawing Sheets 1-18) for the relocation of Smith Creek and the corrected permit impact summary sheet. These permit Drawings will take the place of the previously submitted Permit Drawings in the October 2, 2019 Permit Modification. All other attachments with the October 21, 2019 application will remain the same.*

NCDOT is hereby requesting a Modification for this project. If you have any questions, please contact Carla Dagnino at cdagnino@ncdot.gov or (919) 707-6110.

Thank you!

Sincerely,

Carla Dagnino

for Philip S. Harris III, P.E., C.P.M.
Environmental Analysis Unit Head

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

ROY COOPER
GOVERNOR

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Thank you!

Sincerely,

Carla Dagnino

for Philip S. Harris III, P.E., C.P.M.
Environmental Analysis Unit Head

North Carolina Department of Transportation

Highway Stormwater Program

STORMWATER MANAGEMENT PLAN

FOR NCDOT PROJECTS

(Version 2.08; Released April 2018)

WBS Element:	34839.1.1	TIP No.:	U-2579B	County(ies):	Forsyth County	Page	1	of	2

General Project Information

WBS Element:	34839.1.1	**TIP Number:**	U-2579B	**Project Type:**	Roadway Relocation	**Date:**	1/14/2020
NCDOT Contact:	Amy Euliss			**Contractor / Designer:**	Kimley-Horn		
	Address: 375 Silas Creek Parkway Wiston-Salem NC 27127-7167			**Address:** 421 Fayetteville Street Suite #600 Raleigh, NC, 27601			
	Phone: (336) 747-7802			**Phone:** (919) 677-2178			
	Email: aeuliss@ncdot.gov			**Email:** dan.robinson@kimley-horn.com			
City/Town:	Winston-Salem			**County(ies):**	Forsyth		
River Basin(s):	Yadkin-Pee Dee			**CAMA County?**	No		
Wetlands within Project Limits?	Yes						

Project Description

Project Length (lin. miles or feet):	4.06 miles	**Surrounding Land Use:**	Rural, Farmland, Suburban Neighborhoods

	Proposed Project	**Existing Site**
Project Built-Upon Area (ac.)	N/A ac.	N/A ac.
Typical Cross Section Description:	In each direction there will be 3 12-foot lanes plus a 12-foot paved shoulder with a 22-foot grassed median.	N/A
Annual Avg Daily Traffic (veh/hr/day):	Design/Future: 79880 ADT Year: 2030	Existing: 53560 ADT Year: 2010

General Project Narrative: (Description of Minimization of Water Quality Impacts)

9/19/2013 - Orginal Submittal

Winston-Salem Borthern Bellway (Eastern Section) (Future I-74) from US 158 to I-40 Bus US421: Grassed Swales were used throughout the Project to treat the stormwater. These Grassed Swales have side slopes that are 3:1 or flatter, with many sode slopes being 6:1. have a velocity during the 2-Year Storm or less than 2 feet per second and have a minimum ditch length equivalent to 100 feet per acre of impervious area. In addition to the Grassed Swales, Preformed Scour Holes and Energy Dissipators are used at several locations.

12/13/2019 - Revised Submittal

Modifications to U-2579B were performed and submitted January 2019. These changes include:

- Stormdrain revisions
- Proposed 32' 3 @ 8' x 9' RCBC Downstream Extension (Sta. 45+65 -Y4-)
- Proposed 41' 3 @ 8' x 9' RCBC Upstream Extension (Sta. 45+65 -Y4-)
- Smith Creek Stream Relocation (Sta. 47+27 to 67+63 -Y4-)
- UT to Smith Creek Stream Relocation (Sta. 48+60 -Y4-)

A permit modification was needed for the revisions mentioned above. Included with this revised SMP are updated pipe sizes and flows of two outlets to Preformed Scour Holes (Sta. 43+00 and 46+00). All other stormwater features (swales, filter strip, energy dissipators, etc.) were not modified by these 2019 revisions and are not included with this modification. Refer to orginal stormwater management plan for other mitigation efforts.

Waterbody Information

Surface Water Body (1):	Smith Creek		**NCDWR Stream Index No.:**	12-94-12-2-1	
NCDWR Surface Water Classification for Water Body		**Primary Classification:**	Water Supply III (WS-III)		
		Supplemental Classification:	None		
Other Stream Classification:					
Impairments:	None				
Aquatic T&E Species?	No	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?**	No
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 2.08; Released April 2018)

WBS Element: **TIP No.:** U-2579B **County(ies):** Forsyth County

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?
25	Sta. 43+00 -Y4-		PSH	Class 'B'	0.2	Pipe	18	1.3	9.4	No
26	Sta. 46+00 -Y4-		PSH	Class 'B'	0.3	Pipe	18	1.6	4.1	No

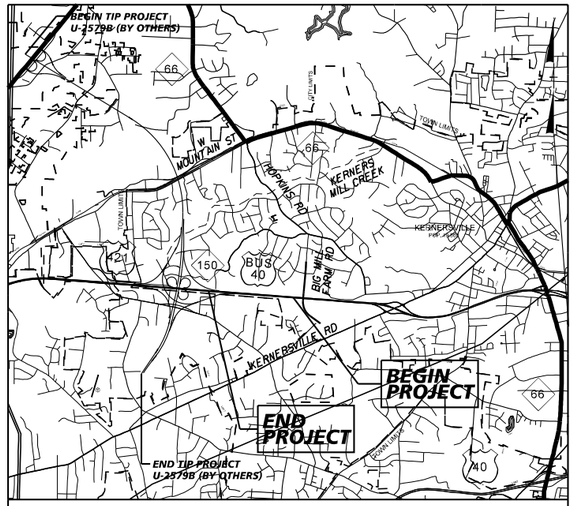
Additional Comments

* 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.

09/08/99

TIP PROJECT: U-2579BA

See Sheet 1B For Conventional Plan Sheet Symbols



VICINITY MAP

STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS

FORSYTH COUNTY

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	U-2579BA	1	

STATE PROJ. NO.	F. A. PROJ. NO.	DESCRIPTION
34839.1.10		P.E.
34839.3.11		CONST.

LOCATION: US 421/I-40 BUS/NC 150 IN KERNERSVILLE FROM THE WINSTON-SALEM NORTHERN BELTWAY (FUTURE I-74) TO WEST OF S MAIN STREET

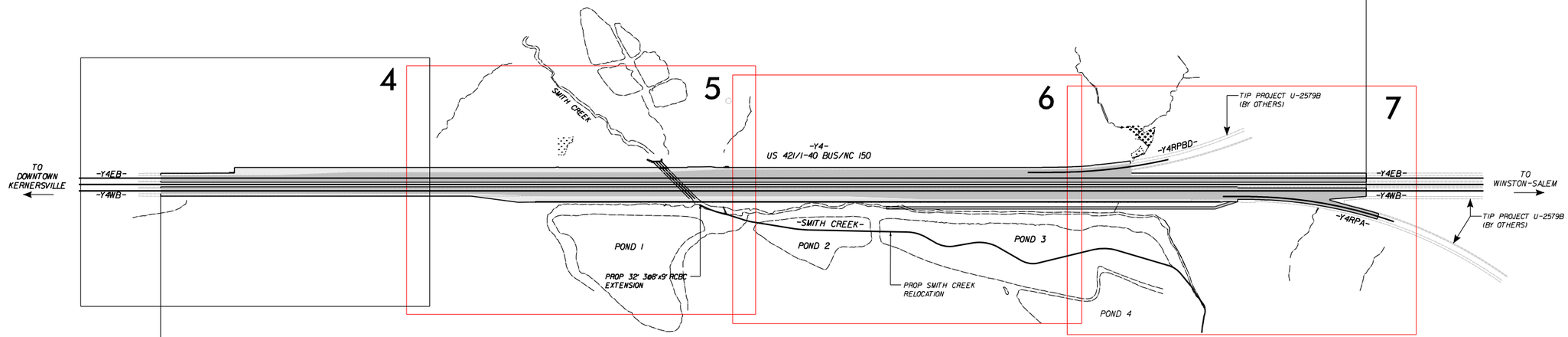
TYPE OF WORK: GRADING, DRAINAGE, PAVING, AND CULVERT

NAD 83/95

JANUARY 14, 2020
PERMIT DRAWING
SHEET 1 OF 18

PERMIT DRAWING MODIFICATION FOR U-2579B

END TIP PROJECT U-2579BA
TIE TO TIP PROJECT U-2579B (BY OTHERS)
-Y4EB- POT Sta. 75+00.00 (U-2579BA) =
-Y4EB- POT Sta. 75+00.00 (U-2579B)
-Y4WB- POT Sta. 75+00.00 (U-2579BA) =
-Y4WB- POT Sta. 75+00.00 (U-2579B)



BEGIN TIP PROJECT U-2579BA
TIE TO TIP PROJECT U-5760 (BY OTHERS)
-Y4EB- POT Sta. 23+50.00 (U-2579B) =
-Y4WB- POT Sta. 23+50.00 (U-2579B) =
-Y1- POT Sta. 56+50.00 (U-5760)

CLEARING ON THIS PROJECT SHALL BE PERFORMED TO THE LIMITS ESTABLISHED BY METHOD III
THIS PROJECT IS WITHIN THE MUNICIPAL BOUNDARIES OF THE TOWN OF KERNERSVILLE
THIS IS A CONTROLLED-ACCESS PROJECT WITH ACCESS LIMITED TO POINTS AS SHOWN ON THE PLANS

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

CONTRACT:

GRAPHIC SCALES

50 25 0 50 100
PLANS

50 25 0 50 100
PROFILE (HORIZONTAL)

5 2.5 0 5 10
PROFILE (VERTICAL)

DESIGN DATA

AADT 2020 = 57,600
AADT 2040 = 77,900
K = 9%
D = 65%
T = 7%*
V = 65 MPH
* (TTST 4% + DUAL 3%)
FUNCTIONAL CLASSIFICATION:
URBAN FREEWAY
REGIONAL TIER

PROJECT LENGTH

LENGTH ROADWAY TIP PROJECT U-2579BA = 0.975 MILES
TOTAL LENGTH TIP PROJECT U-2579BA = 0.975 MILES

PLANS PREPARED FOR THE NCDOT BY:

Kimley»Horn
© 2019
NC LICENSE #F-0102
PAYETTEVILLE STREET, SUITE 600
RALEIGH, NORTH CAROLINA 27601
PHONE: (919) 677-2000

2018 STANDARD SPECIFICATIONS

RIGHT OF WAY DATE:
N/A

LETTING DATE:
APRIL 21, 2020

DAN ROBINSON, P.E.
PROJECT ENGINEER

RHODES S. HUNT, P.E.
PROJECT DESIGN ENGINEER

JESSICA EARLEY, P.E.
PROJECT EXECUTIVE
NCDOT PRIORITY PROJECTS TEAM

HYDRAULICS ENGINEER

SIGNATURE: *P.E.*

ROADWAY DESIGN ENGINEER

SIGNATURE: *P.E.*

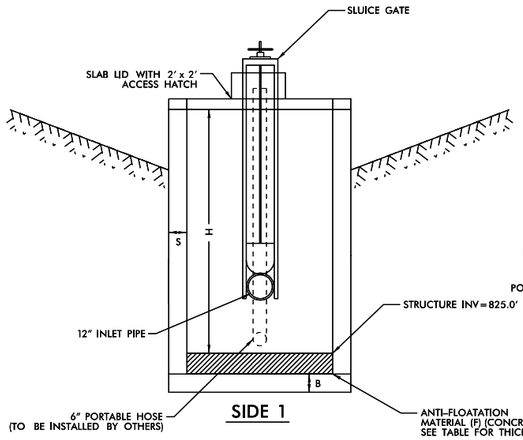
STATE OF NORTH CAROLINA • DEPARTMENT OF TRANSPORTATION •

1/14/2020

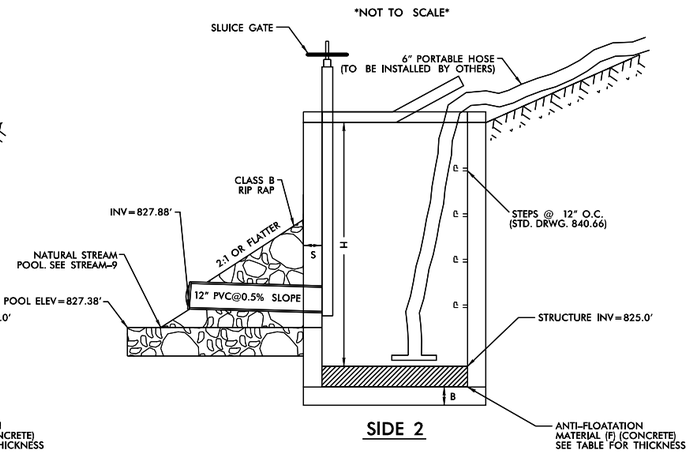
5/14/99

DETAIL
STREAM INTAKE VAULT
(SEE SPECIAL PROVISIONS)

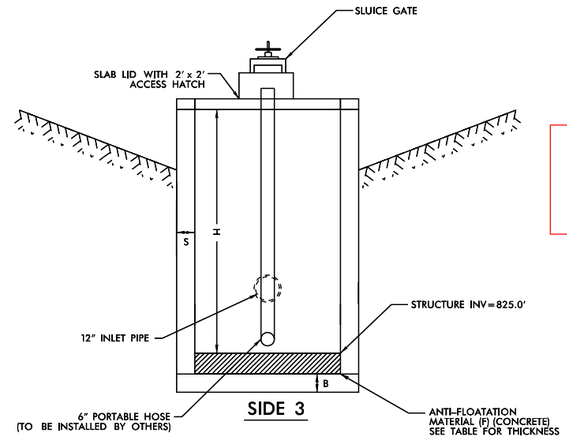
NOT TO SCALE



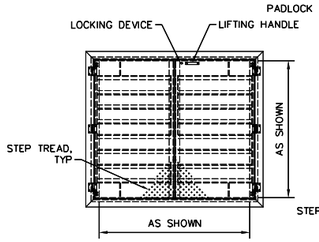
SIDE 1



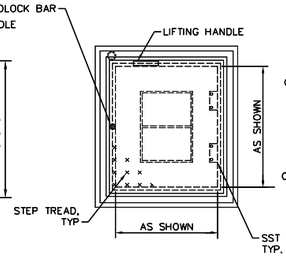
SIDE 2



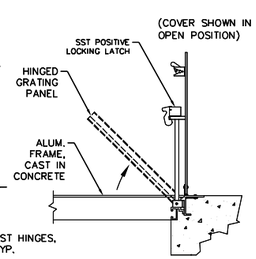
SIDE 3



DOUBLE DOOR



SINGLE DOOR

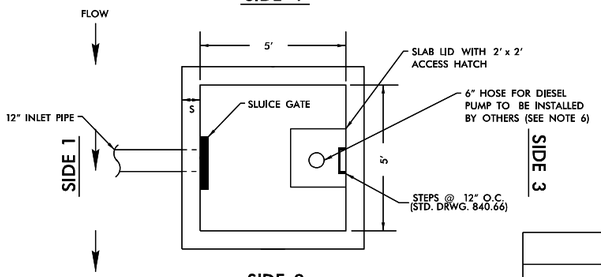


HATCH PROFILE

NOTES:
1. ALL HATCH COMPONENTS SHALL BE SST OR ALUMINUM.
2. HATCHES SHALL BE WATERPROOF AND RATED FOR 300PSF.
3. EXPOSED HARDWARE SHALL BE TAMPER-PROOF.
4. FALL PROTECTION SHALL BE IN ACCORDANCE WITH OSHA REQUIREMENTS.
5. CONTRACTOR SHALL CONFIRM THAT DIMENSIONS ARE ADEQUATE FOR INSTALLATION, REMOVAL, AND MAINTENANCE OF EQUIPMENT WITH EQUIPMENT MANUFACTURERS.

ACCESS HATCH
NOT TO SCALE

SIDE 4



SIDE 2

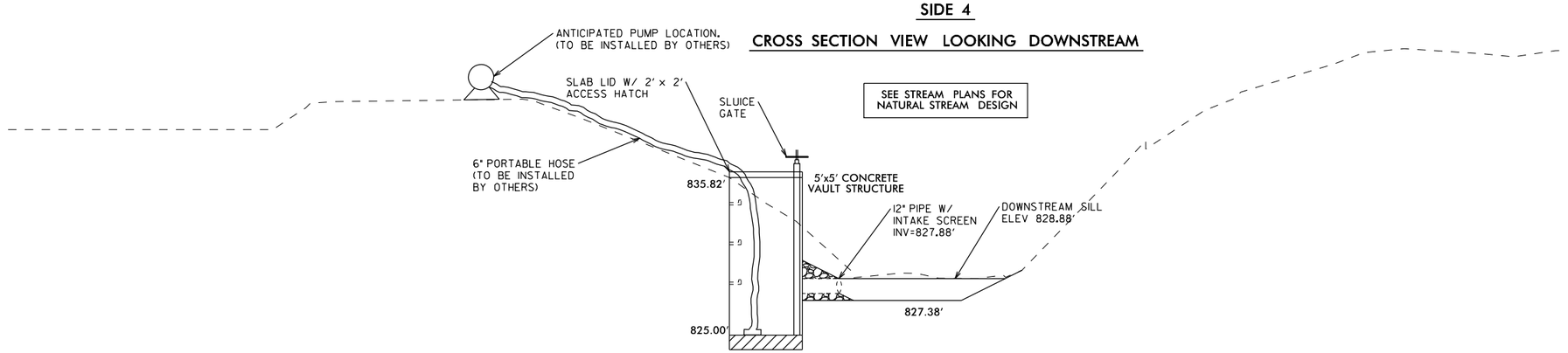
PLAN VIEW

NOTES:
1. SLUICE GATE IS FOR INTAKE VAULT AND SHOULD REMAIN CLOSED DURING NORMAL OPERATION.
2. SLUICE GATE SHALL PROVIDE WATERTIGHT SEAL. PROVIDE ADEQUATE CLEARANCE FOR INTAKE VAULT OPERATION.
3. SELECT BOX STANDARD AS REQUIRED TO ACCOMMODATE SLUICE GATE AND SLAB LID WITH ACCESS HATCH.
4. ENSURE ACCESS HATCH OPENS FREELY AND WITHOUT INTERFERENCE WITH SLUICE GATE.
5. ADJUST FOOTER DIMENSIONS AS NEEDED FOR ANTI-FLOTATION. FOOTER DIMENSIONS CAN BE 5' x 5' x 9' DEEP OR 8' x 8' x 4' DEEP. ANTI-FLOATATION MATERIAL IS REQUIRED AND SHALL BE CONCRETE.
6. NOT IN CONTRACT. SEE SPECIAL PROVISIONS.

MINIMUM DIMENSIONS FOR STREAM INTAKE VAULT							
STATION	S (INCHES) 6" MIN.	B (INCHES) 6" MIN.	BASIN BOTTOM MINIMUM ELEV.	TOP ELEVATION CONTROL STRUCTURE	INV. ELEVATION CONTROL STRUCTURE	ANTI-FLOATATION MATERIAL (F) THICKNESS FEET [5]	CTL. STR. DIMENSIONS (W x L x H)
31+69.64 –SMITH CREEK–	6	6	825.00'	835.82'	827.88'	9.0'	5' X 5' X 10.82'

SIDE 4

CROSS SECTION VIEW LOOKING DOWNSTREAM



Kimley»Horn ©2018
421 FAYETTEVILLE STREET, SUITE 600
RALEIGH, NC 27601

RIGHT-OF-WAY REV.

CONST. REV.

PROJECT REFERENCE NO.	SHEET NO.
U-2579BA	2C-2
R/W SHEET NO.	
HYDRAULIC DESIGN ENGINEER	

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

JANUARY 14, 2020
PERMIT DRAWING
SHEET 2 OF 18

1/23/2020
U-2579ba_stream_dtl.dgn

5/14/99

NOTE:
THE DETAILS BELOW REPRESENT A PRECAST CONCRETE GRAVITY WALL WITH NATURAL BOULDER APPEARANCE ALONG FACE (PER PLANS). THIS PRODUCT OR A COMPARABLE PRODUCT CAN BE UTILIZED ON THIS PROJECT. A PRODUCT SUBMITTAL AND DESIGN TO BE APPROVED BY THE ENGINEER WILL BE REQUIRED.

JANUARY 14, 2020
PERMIT DRAWING
SHEET 3 OF 18

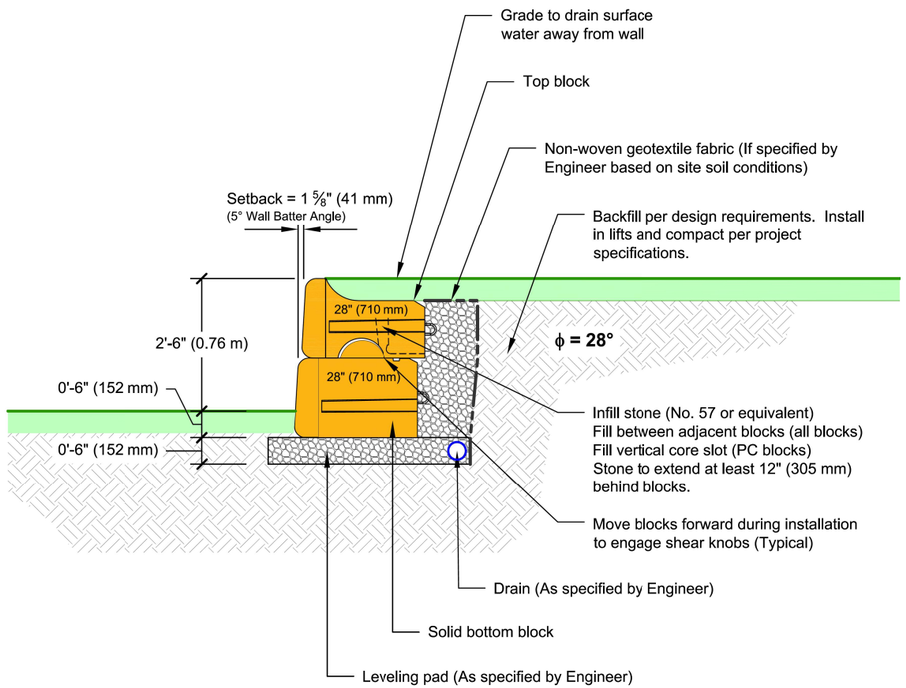
PROJECT REFERENCE NO.	SHEET NO.
U-2579BA	2C-3

$\phi = 28°$ | SILTY SAND or CLAYEY SAND

LOAD CONDITION A | NO LIVE LOAD SURCHARGE, NO BACK SLOPE, NO TOE SLOPE

2 BLO2K HIGH SECTION
(2) 28" (710 mm) Blocks

PRELIMINARY
Professional Engineering Design Required for Construction



This drawing is for reference only. Determination of the suitability and/or manner of use of any details contained in this document is the sole responsibility of the design engineer of record. Final project designs, including all construction details, shall be prepared by a licensed professional engineer using the actual conditions of the proposed site. Final wall design must address both internal and external drainage and all moces of wall stability.

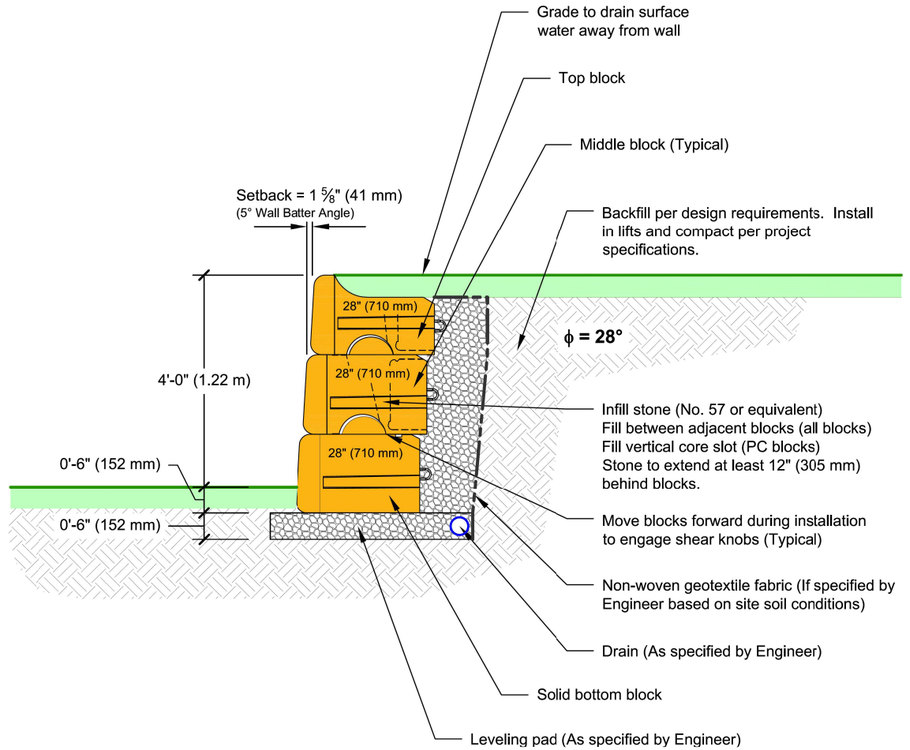
DRAWN BY:	TITLE: **Preliminary Wall Section**
APPROVED BY:	Silty Sand or Clayey Sand, $\phi = 28°$
DATE:	No Live Load Surcharge, No Back Slope, No Toe Slope
SHEET:	FILE: A_28_B_28_36_cad.dwg

$\phi = 28°$ | SILTY SAND or CLAYEY SAND

LOAD CONDITION A | NO LIVE LOAD SURCHARGE, NO BACK SLOPE, NO TOE SLOPE

3 BLOCK HIGH SECTION
(3) 28" (710 mm) Blocks

PRELIMINARY
Professional Engineering Design Required for Construction



This drawing is for reference only. Determination of the suitability and/or manner of use of any details contained in this document is the sole responsibility of the design engineer of record. Final project designs, including all construction details, shall be prepared by a licensed professional engineer using the actual conditions of the proposed site. Final wall design must address both internal and external drainage and all modes of wall stability.

DRAWN BY:	TITLE: **Preliminary Wall Section**
APPROVED BY:	Silty Sand or Clayey Sand, $\phi = 28°$
DATE:	No Live Load Surcharge, No Back Slope, No Toe Slope
SHEET:	FILE: A_30_B_28_54_cad.dwg

1/14/2020
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5/14/99

NOTE:
THE DETAILS BELOW REPRESENT A PRECAST CONCRETE GRAVITY WALL WITH NATURAL BOULDER APPEARANCE ALONG FACE (PER PLANS). THIS PRODUCT OR A COMPARABLE PRODUCT CAN BE UTILIZED ON THIS PROJECT. A PRODUCT SUBMITTAL AND DESIGN TO BE APPROVED BY THE ENGINEER WILL BE REQUIRED.

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SHEET 4 OF 18

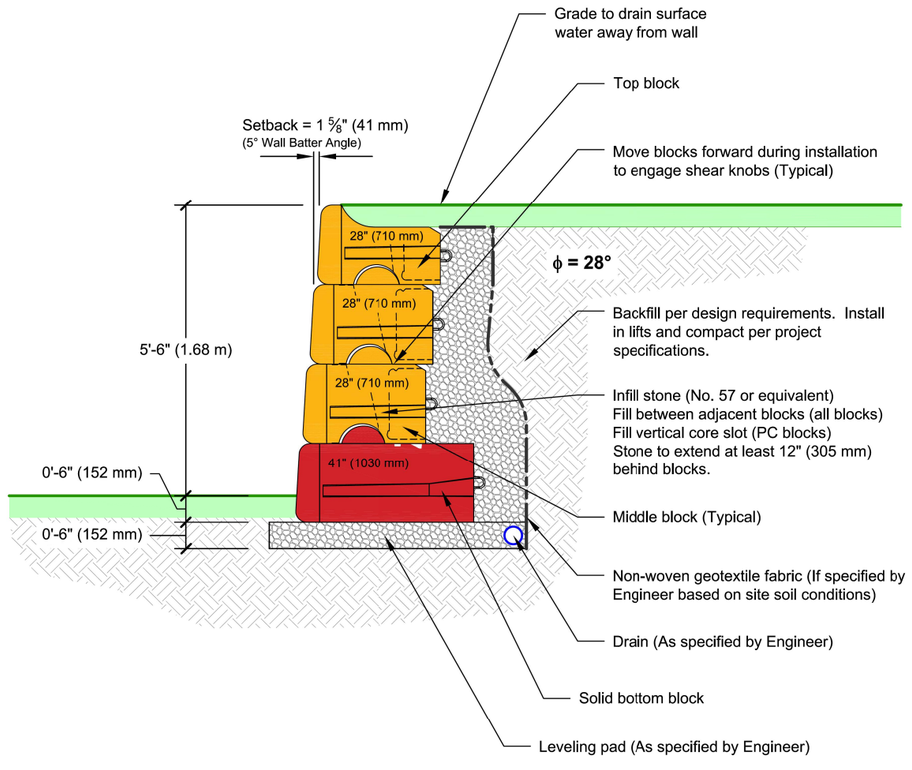
PROJECT REFERENCE NO.	SHEET NO.
U-2579BA	2C-4

$\phi = 28°$ | SILTY SAND or CLAYEY SAND

LOAD CONDITION A | NO LIVE LOAD SURCHARGE, NO BACK SLOPE, NO TOE SLOPE

4 BLOCK HIGH SECTION
(3) 28" (710 mm) Blocks
(1) 41" (1030 mm) Block

PRELIMINARY
Professional Engineering Design Required for Construction



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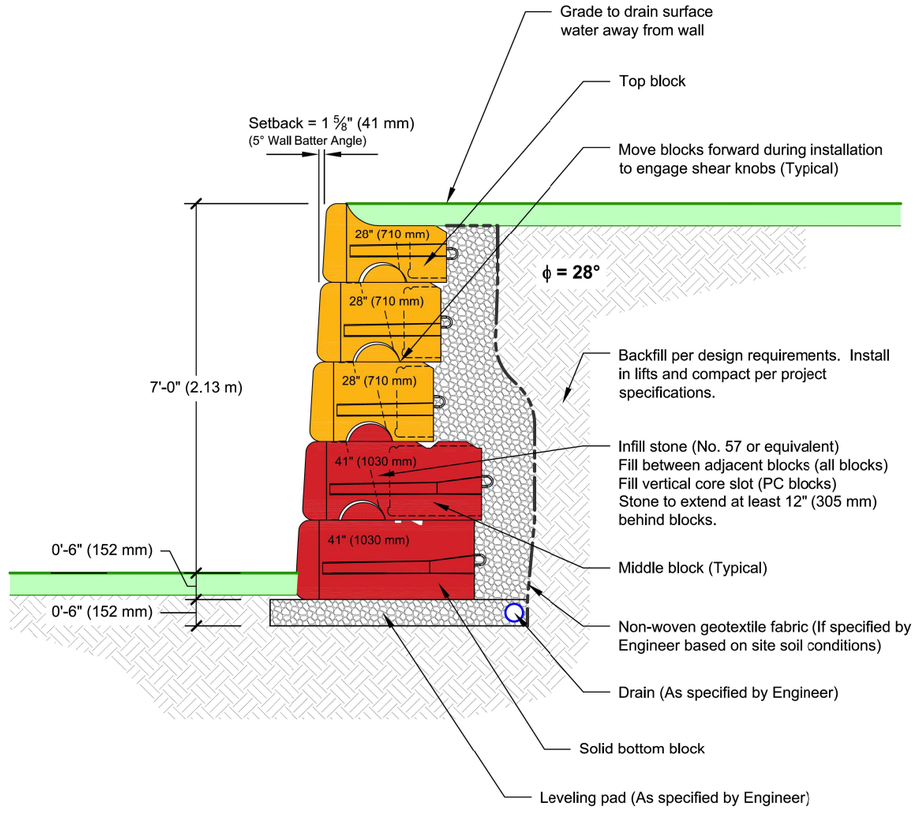
DRAWN BY:	TITLE: **Preliminary Wall Section** Silty Sand or Clayey Sand, $\phi = 28°$ No Live Load Surcharge, No Back Slope, No Toe Slope	
APPROVED BY:		
DATE:		
SHEET:	FILE: A_28_B_41_72_cad.dwg	

$\phi = 28°$ | SILTY SAND or CLAYEY SAND

LOAD CONDITION A | NO LIVE LOAD SURCHARGE, NO BACK SLOPE, NO TOE SLOPE

5 BLOCK HIGH SECTION
(3) 28" (710 mm) Blocks
(2) 41" (1030 mm) Blocks

PRELIMINARY
Professional Engineering Design Required for Construction



This drawing is for reference only. Determination of the suitability and/or manner of use of any details contained in this document is the sole responsibility of the design engineer of record. Final project designs, including all construction details, shall be prepared by a licensed professional engineer using the actual conditions of the proposed site. Final wall design must address both internal and external drainage and all modes of wall stability.

DRAWN BY:	TITLE: **Preliminary Wall Section** Silty Sand or Clayey Sand, $\phi = 28°$ No Live Load Surcharge, No Back Slope, No Toe Slope	
APPROVED BY:		
DATE:		
SHEET:	FILE: A_28_B_41_90_cad.dwg	

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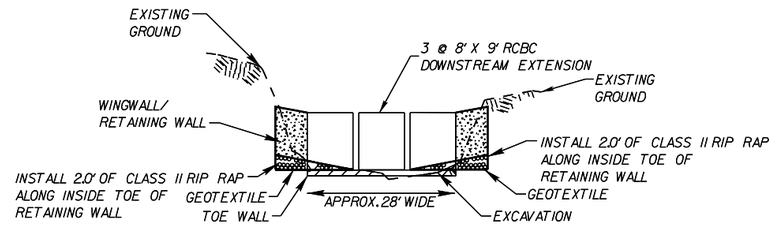
8/17/99

REVISIONS

DETAIL 1
OUTLET CHANNEL IMPROVEMENTS



STA. 46+50 –Y4– (RT)

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SHEET 5 OF 18

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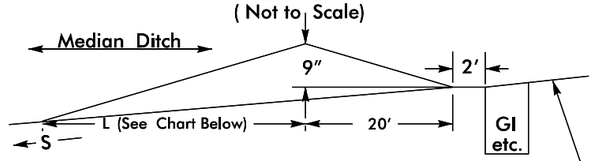
DETAIL 2
FALSE SUMP
(Not to Scale)

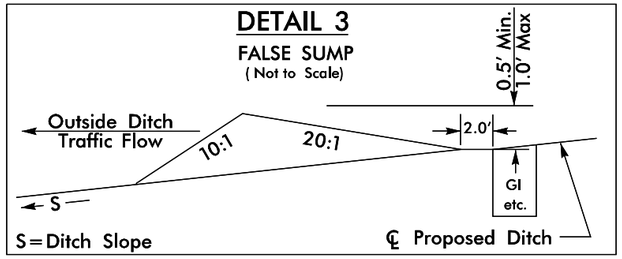


S = Ditch Slope ℄ Proposed Ditch

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. 29+21 –Y4– (CL), STA. 33+50 –Y4– (CL)
STA. 36+49 –Y4– (CL), STA. 39+49 –Y4– (CL)
STA. 43+14 –Y4– (CL), STA. 46+63 –Y4– (CL)
STA. 50+14 –Y4– (CL), STA. 52+64 –Y4– (CL)
STA. 56+37 –Y4– (CL), STA. 57+43 –Y4– (CL)
STA. 60+79 –Y4– (CL), STA. 63+21 –Y4– (CL)
STA. 67+22 –Y4– (CL), STA. 71+21 –Y4– (CL)

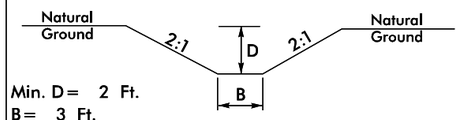
DETAIL 3
FALSE SUMP
(Not to Scale)



S = Ditch Slope ℄ Proposed Ditch

STA. 29+02 –Y4– (RT)
STA. 32+14 –Y4– (RT)
STA. 33+68 –Y4– (RT)
STA. 38+89 –Y4– (RT)
STA. 40+39 –Y4– (RT)

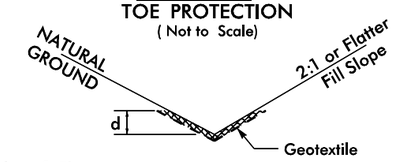
DETAIL 4
STANDARD BASE DITCH
(Not to Scale)



Min. D = 2 Ft.
B = 3 Ft.

FROM STA. 32+25 TO 32+70 –Y4– (RT)

DETAIL 5
TOE PROTECTION
(Not to Scale)

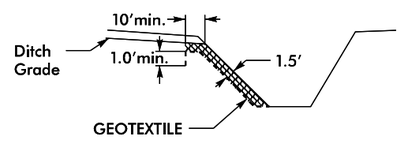


d = 1 Ft.

Type of Liner = Class 'B' Rip–Rap

FROM STA. 40+30 TO 46+30 –Y4– (RT)

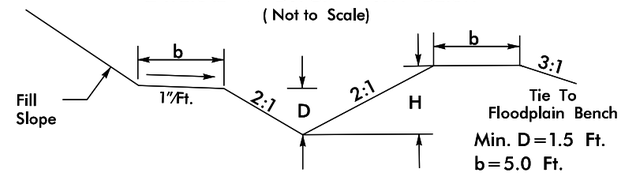
DETAIL 6
RIP RAP AT EMBANKMENT
(Not to Scale)



Type of Liner = Class II Rip–Rap

STA. 57+27 –Y4– (RT)
STA. 64+65 –Y4– (RT)

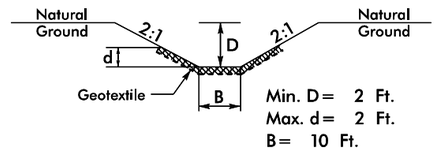
DETAIL 7
LATERAL 'V' DITCH WITH BERM
(Not to Scale)



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

FROM STA 57+50 TO 64+00 –Y4– (RT)

DETAIL 8
STANDARD BASE DITCH
(Not to Scale)

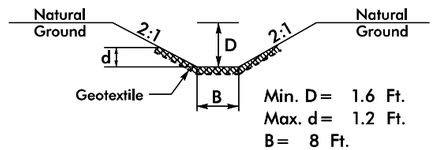


Min. D = 2 Ft.
Max. d = 2 Ft.
B = 10 Ft.

Type of Liner = CLASS 'I' Rip–Rap

FROM STA. 64+00 TO STA. 64+65 –Y4– (RT)

DETAIL 9
STANDARD BASE DITCH
(Not to Scale)



Min. D = 1.6 Ft.
Max. d = 1.2 Ft.
B = 8 Ft.

Type of Liner = CLASS 'I' Rip–Rap

FROM STA. 56+00 TO STA. 57+27 –Y4– (RT)

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R/W SHEET NO.	
HYDRAULIC DESIGN ENGINEER	

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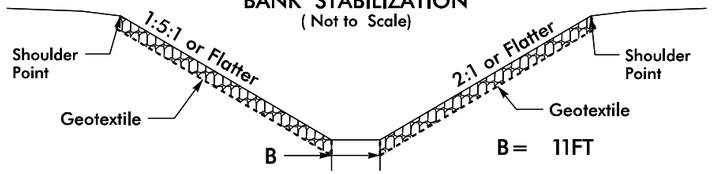
DETAIL
BANK STABILIZATION
(Not to Scale)

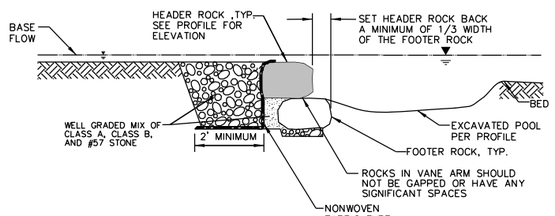
STREAMBANK SLOPES TO BE GRADED PER STREAM TYPICAL SECTIONS



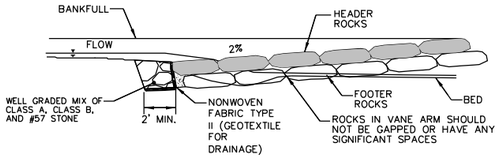
B = 11FT

Type of Liner = Class I Rip-Rap

FROM 30+15 STA. TO 32+73 STA. –SMITH CREEK– (LT)
FROM 31+60 STA. TO 32+73 STA. –SMITH CREEK– (RT)

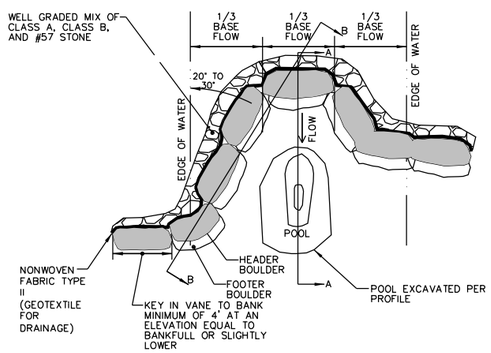


SECTION A-A



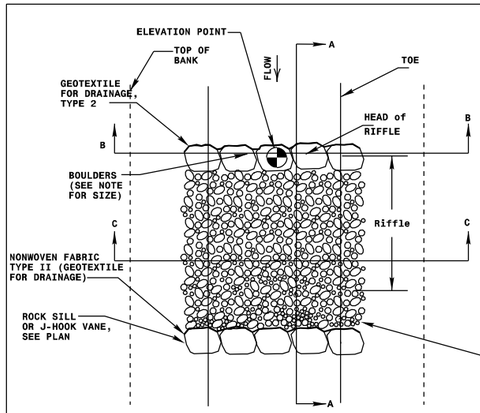
SECTION B-B

NOTES:
1. DEEPEST PART OF POOL TO BE IN LINE WITH WHERE VANE ARM TIES INTO THE BANK.
2. POOL DEPTH SHOULD BE ACCORDING PROFILE AND TYPICAL SECTIONS.
3. BOULDERS SHALL HAVE A MEAN DIAMETER OF 30"

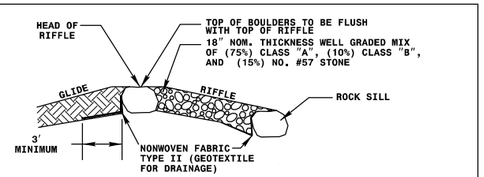


PLAN VIEW

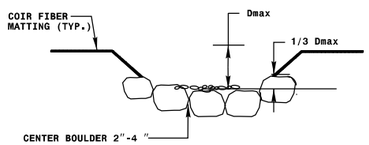
J-HOOK VANE DETAIL
NOT TO SCALE



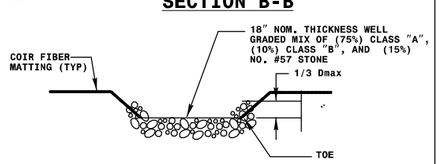
PLAN VIEW



SECTION A-A



SECTION B-B

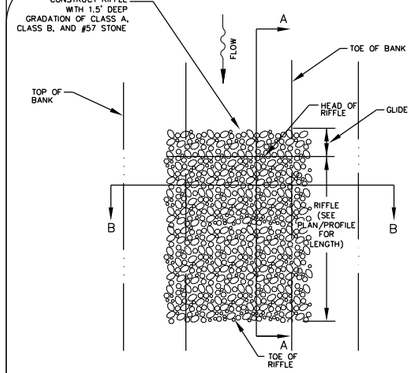


SECTION C-C

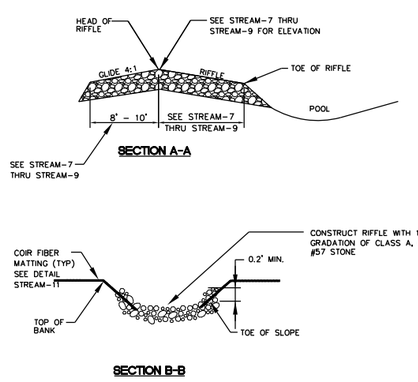
NOTE:
1. BOULDERS SHOULD BE NATIVE STONES OR SHOT ROCK, ANGULAR AND OBLONG, WITH A MEAN DIAMETER OF 30"

REACH	
Wbkf (ft)	28.8
Dmax (ft)	2.3

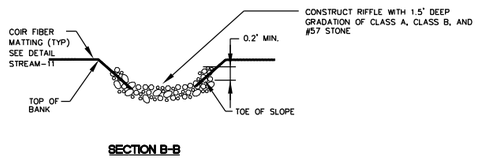
ROCK SILL DETAIL
NOT TO SCALE



PLAN VIEW



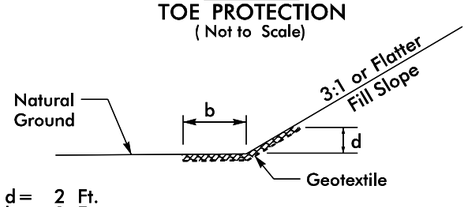
SECTION A-A



SECTION B-B

CONSTRUCTED RIFFLE
NOT TO SCALE

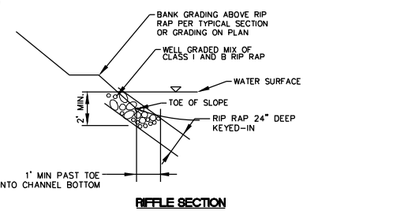
DETAIL
TOE PROTECTION
(Not to Scale)



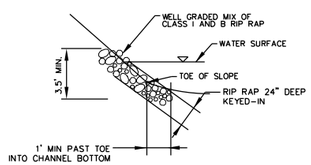
d = 2 Ft.
b = 2 Ft.

Type of Liner = Class I Rip-Rap

FROM 23+50 STA. TO 31+60 STA.
–SMITH CREEK–



RIFFLE SECTION



POOL SECTION

ROCK TOE PROTECTION
NOT TO SCALE

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SHEET 7 OF 18

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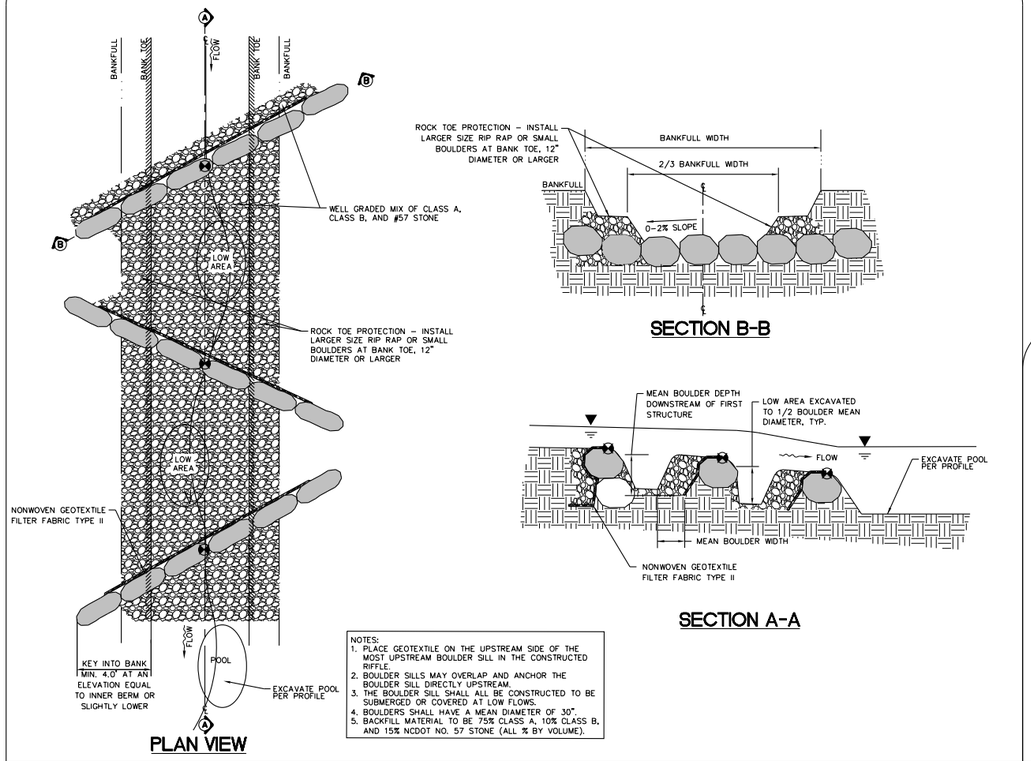


PLAN VIEW

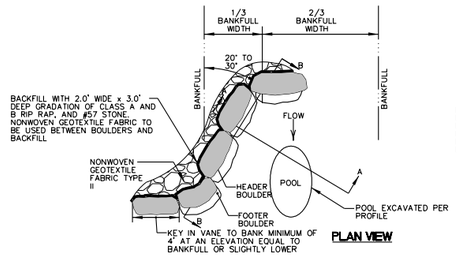
SECTION B-B

SECTION A-A

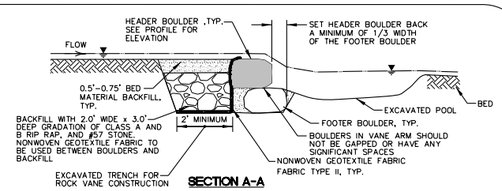
NOTES:
1. PLACE GEOTEXTILE ON THE UPSTREAM SIDE OF THE MOST UPSTREAM BOULDER SILL IN THE CONSTRUCTED RIFFLE.
2. BOULDER SILLS MAY OVERLAP AND ANCHOR THE BOULDER SILL DIRECTLY UPSTREAM.
3. THE BOULDER SILL SHALL ALL BE CONSTRUCTED TO BE SUBMERGED OR COVERED AT LOW FLOWS.
4. BOULDERS SHALL HAVE A MEAN DIAMETER OF 30".
5. BACKFILL MATERIAL TO BE 75% CLASS A, 10% CLASS B, AND 15% NCDOT NO. 57 STONE (ALL % BY VOLUME).

BOULDER ROCK AND ROLL RIFFLE

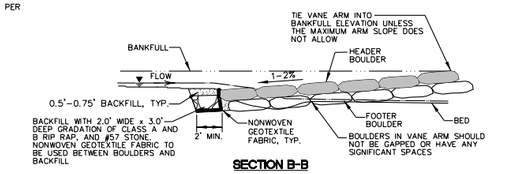
NOT TO SCALE



PLAN VIEW



SECTION A-A

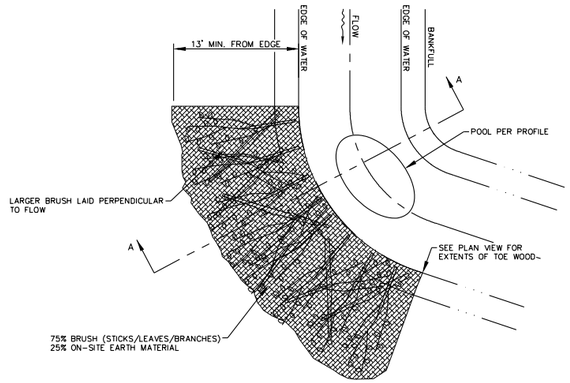


SECTION B-B

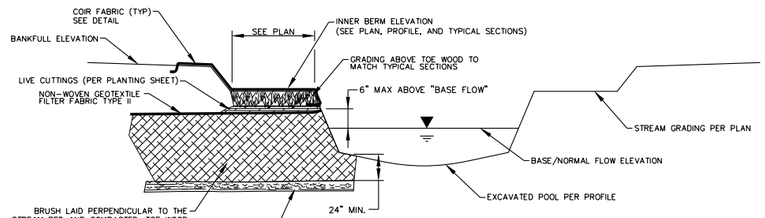
NOTES:
1. DEEPEST PART OF POOL TO BE IN LINE WITH WHERE VANE ARM TIES INTO BANKFULL.
2. DO NOT EXCAVATE POOL TOO CLOSE (1-2')TO FOOTER ROCK.
3. CLASS "A" STONE CAN BE USED TO REDUCE VOIDS BETWEEN HEADERS AND FOOTERS. BOULDERS SHOULD NOT HAVE GAPS.
4. COMPACT BANKFULL TO EXTENT POSSIBLE OR AT THE DIRECTION OF THE ENGINEER.
5. POOL DEPTH SHOULD BE ACCORDING TO PROFILE.
6. BOULDERS SHALL HAVE A MEAN DIAMETER OF 30".

ROCK VANE DETAIL

NOT TO SCALE



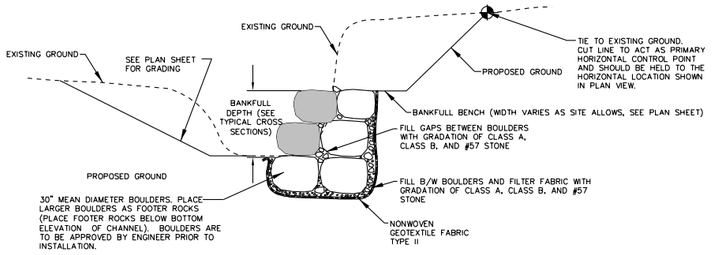
PLAN VIEW



NOTE:
1. BRUSH SHALL BE A VARIETY OF DIAMETERS AND SHALL BE LAID GENERALLY PERPENDICULAR TO FLOW AND COMPACTED BY DIRT.
2. FIRST LAYER OF BRUSH SHALL BE A BED OF 3" LIMBS/BRUSH SET 18" MIN. BELOW THE BED.
3. LAYERS ABOVE FIRST LAYER SHALL BE 75% BRUSH OF A VARIETY OF SIZES WITH 25% ON SITE MATERIAL FILLING VOIDS.
4. BRUSH BROUGHT UP IN LIFTS.
5. GRADING ABOVE THE TOE WOOD PER THE TYPICAL SECTION AND/OR GRADING PLAN.

TOE WOOD PROTECTION

NOT TO SCALE



BOULDER TOE PROTECTION

NOT TO SCALE

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R/W SHEET NO.	

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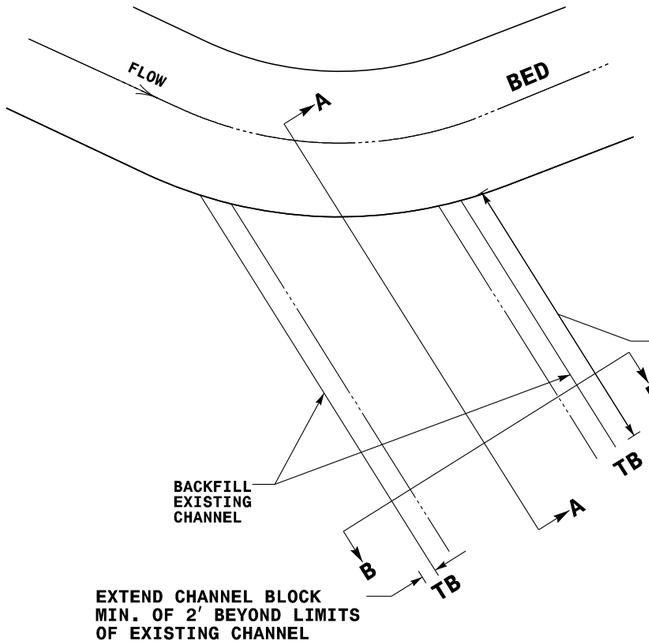
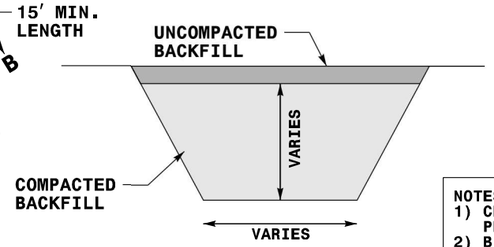
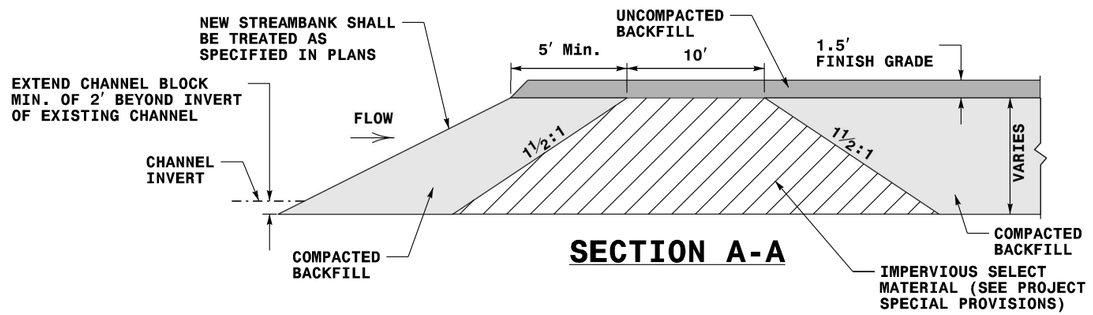
SHEET 8 OF 18



PLAN VIEW



SECTION B-B

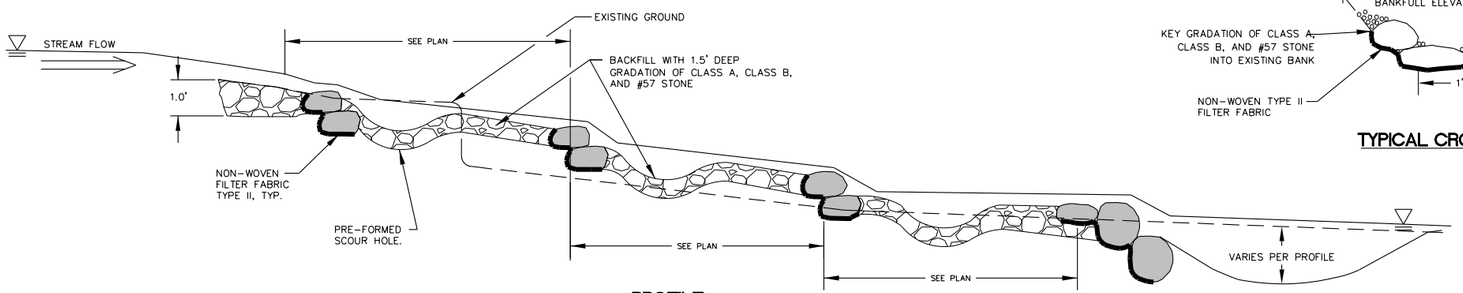


SECTION A-A

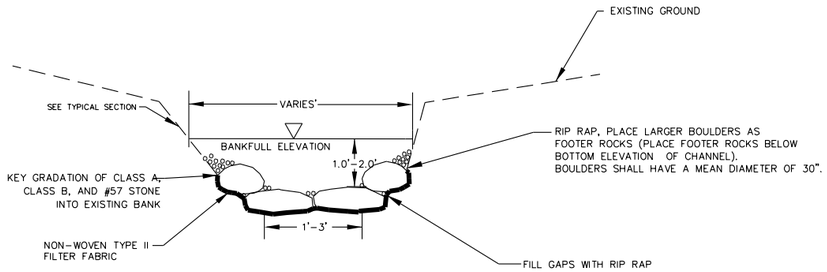
STREAM PLUG

NOT TO SCALE

NOTES:
1) CHANNEL BLOCK SHALL BE INSTALLED IN ACCORDANCE WITH THE PROJECT SPECIFICATIONS.
2) BLOCK SHOULD BE INSTALLED AT THE INTERFACE BETWEEN EXISTING CHANNEL AND PROPOSED CHANNEL.
3) BOTTOM OF BLOCK SHOULD BE A MINIMUM OF 2' BELOW THE INVERT OF THE EXISTING CHANNEL.
4) BLOCK SHOULD EXTEND A MINIMUM OF 2' 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.



PROFILE



TYPICAL CROSS SECTION

ROCK STEP POOL

NOT TO SCALE

1/14/2020
U-2579BA_stream_dtl.dgn

PROJECT REFERENCE NO.	SHEET NO.
34833933 (EWSB4 (U-2579BA))	2G-1

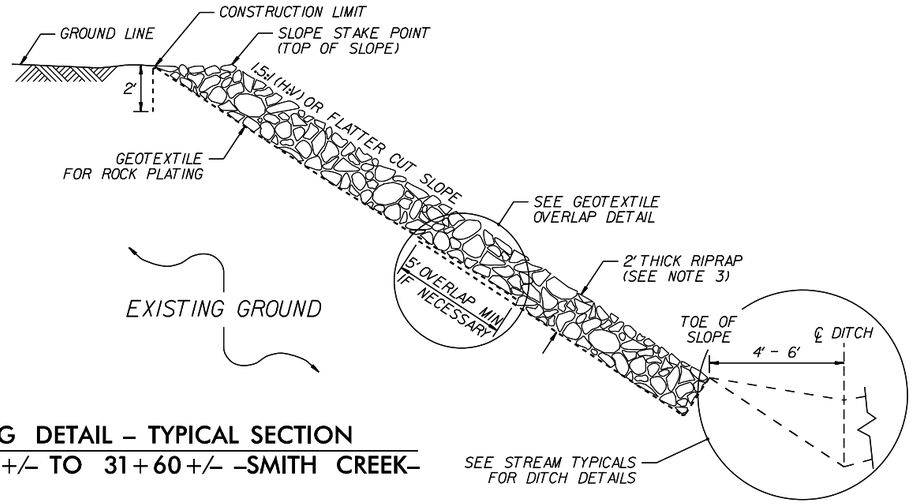
GEOTECHNICAL ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 028893 ENGINEER MICHAEL H. STEPHENS

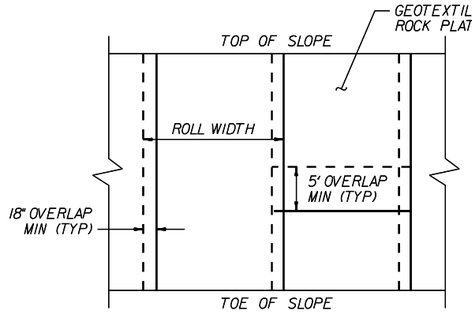
SIGNATURE DATE | SIGNATURE DATE

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

JANUARY 14, 2020
PERMIT DRAWING
SHEET 9 OF 18



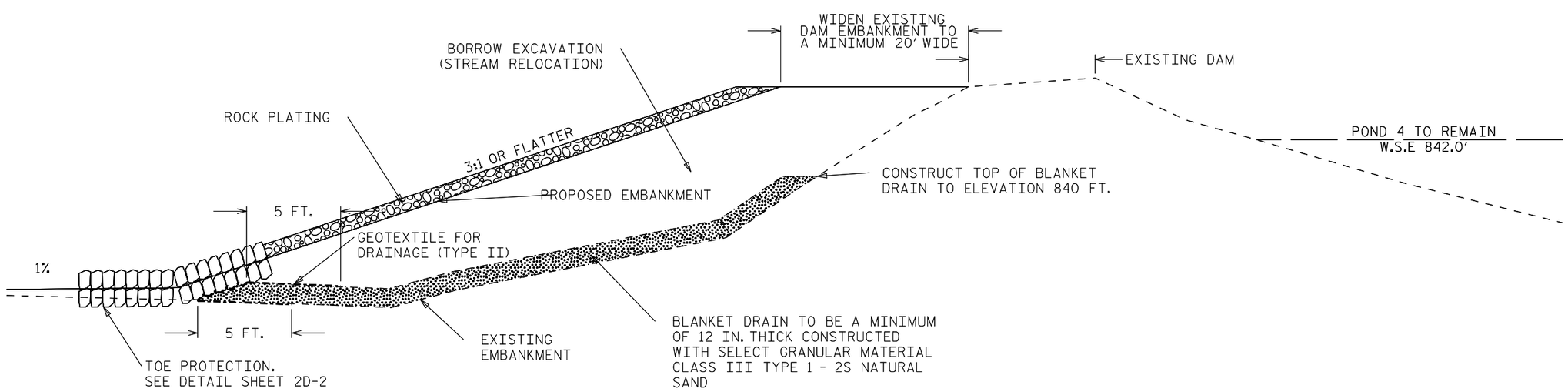
ROCK PLATING DETAIL – TYPICAL SECTION
FROM STA. 23+50+/– TO 31+60+/– –SMITH CREEK–



GEOTEXTILE OVERLAP DETAIL
(PLAN VIEW)

NOTES:

1. SEE STREAM PLANS FOR ROCK PLATING LOCATIONS.
2. FOR STANDARD ROCK PLATING, SEE SECTION 275.01 OF THE STANDARD SPECIFICATIONS.
3. USE CLASS 2 RIPRAP.



DAM EMBANKMENT WIDENING DETAIL
FROM STA. 23+50+/- TO 31+60+/- -SMITH CREEK-

ESTIMATED QUANTITES

PAY ITEM	PAY UNIT
SELECT GRANULAR MATERIAL, CLASS III	1,350 CY
BORROW EXCAVATION (STREAM RELOCATION)	2,750 CY
GEOTEXTILE FOR DRAINAGE (TYPE II)	1,050 SY
ROCK PLATING	3,750 SY

NOTES:
1) FOR DAM EMBANKMENT WIDENING, SEE DAM EMBANKMENT WIDENING PROVISION.

PREPARED BY: MHS	DATE: 10/17/19
REVIEWED BY: ENW	DATE: 10/17/19

STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS

GEOTECHNICAL ENGINEERING UNIT

DAM EMBANKMENT WIDENING DETAIL

REVISIONS

NO.	BY	DATE	NO.	BY	DATE
1			3		
2			4		

PERMIT DRAWING MODIFICATION LEGEND

- TS TS — DENOTES TEMPORARY IMPACTS IN SURFACE WATER
- S S — DENOTES IMPACTS IN SURFACE WATER (CULVERT IMPACTS)
- S S — DENOTES IMPACTS IN SURFACE WATER (STREAMBANK STABILIZATION)
- S S — DENOTES IMPACTS IN SURFACE WATER (FILL IN STREAM)
- P P — DENOTES IMPACTS IN SURFACE WATER (POND)

JANUARY 14, 2020
PERMIT DRAWING SHEET 10 OF 18

PERMIT DRAWING MODIFICATION FOR SITE 23 AND 28

PREVIOUS U-2579B SHEET 25/26

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421 FAYETTEVILLE STREET, SUITE 600
RALEIGH, NC 27601

RIGHT-OF-WAY REV.

CONST. REV.

PROJECT REFERENCE NO.	SHEET NO.
U-2579BA	5
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	PAVEMENT DESIGN ENGINEER

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

8/17/99

REVISIONS

MATCHLINE –Y4 STA. 34+50 SHEET 4

MATCHLINE –Y4– STA. 48+50 SHEET 6

NAD 83/95

SITE 22

SITE 23

SITE 23A

SITE 23 (PERMIT MOD)

SITE 23A

SITE 23B

SITE 23 (PERMIT MOD)

SITE 28 (PERMIT MOD)

SITE 28A (PERMIT MOD)

FORSYTH COUNTY
TOWN OF KERNERSVILLE

POND
W.E. 8597
FISH HATCHERY

CONVERT OTCB TO 2GI
RETAIN
N 85° 33' 45.8" W
REMOVE
2GI FS
15" RCP-IV
REMOVE EX DI
PLUG, FILL, AND ABANDON
15" CMP W/ 2 ELBOWS
2GI
COLLAR
REMOVE FES
JB W/MH COVER
18" 42" RCP-IV
60° CHL
48" RCP-IV
30" RCP-IV
FS
2GI-A
42" RCP-IV
BEGIN SBG –Y4WB– STA 39+50 RT
TOE PROTECTION W/ CLASS B RIPRAP EST 130 TONS EST 265 SY GFD SEE DETAIL 5/SHEET 2D-1
PROPOSED 32' 3@8'x9' RCBC DOWNSTREAM EXTENSION SEE CULVERT PLANS C01-1 THRU C01-10
RETAIN EXISTING SS MH AND USE CAUTION WHEN INSTALLING CHANNEL IMPROVEMENTS
OUTLET CHANNEL IMPROVEMENTS CLASS II RIP RAP EST 150 TONS EST 170 SY GFD SEE DETAIL/SHEET 2D-1
OUTLET CHANNEL IMPROVEMENTS CLASS II RIP RAP EST 170 TONS EST 200 SY GFD SEE DETAIL 4/SHEET 2D-1
TDE ACQUIRED WITH TIP PROJECT U-2579B
R/W ACQUIRED WITH TIP PROJECT U-2579B
REMOVE EXIST STONE WALL
RIP RAP
SCOUR HOLE
RETAIN
42" RCP
15" RCP
12" RCP
36" CONC
443

PAVED SHOULDER

NOTE :
FOR - Y4EB - PROFILE SEE SHEET 8
FOR - Y4WB - PROFILE SEE SHEET 10
FOR CULVERT PLANS SEE C01-1 THRU C01-10

8/17/99

REVISIONS

PERMIT DRAWING MODIFICATION LEGEND

- TS TS — DENOTES TEMPORARY IMPACTS IN SURFACE WATER
- S S — DENOTES IMPACTS IN SURFACE WATER (CULVERT IMPACTS)
- S S — DENOTES IMPACTS IN SURFACE WATER (STREAMBANK STABILIZATION)
- S S — DENOTES IMPACTS IN SURFACE WATER (FILL IN STREAM)
- P P — DENOTES IMPACTS IN SURFACE WATER (POND)

JANUARY 14, 2020
PERMIT DRAWING
SHEET 11 OF 18

PERMIT DRAWING MODIFICATION FOR SITE 23 AND 28

PREVIOUS U-2579B SHEET 25/26

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RALEIGH, NC 27601

RIGHT-OF-WAY REV.

CONST. REV.

PROJECT REFERENCE NO.	SHEET NO.
U-2579BA	5
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	PAVEMENT DESIGN ENGINEER

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

MATCHLINE -Y4 STA. 34+50 SHEET 4

MATCHLINE -Y4- STA. 48+50 SHEET 6

SITE 23 (PERMIT MOD)

SITE 23A

SITE 22

SITE 23

SITE 23B

SITE 28

SITE 28A (PERMIT MOD)

FORSYTH COUNTY
TOWN OF KERNERSVILLE

N 85° 33' 45.8" W

CONVERT OTCB TO 2GI

RETAIN

REMOVE

REMOVE FES

COLLAR

JB W/MH COVER

PLUG, FILL, AND ABANDON

15" CMP W/ 2 ELBOWS

2GI

2OI-A

18" 42° RCP-IV

42" RCP-IV

30" RCP-IV

48" RCP-IV

60" CMP

15" RCP-IV

FS

BEGIN SBG -Y4WB- STA. 39+50 RT

TOE PROTECTION W/ CLASS B RIPRAP EST 130 TONS EST 265 SY GFD SEE DETAIL 5/SHEET 2D-1

RETAIN EXISTING SS MH AND USE CAUTION WHEN INSTALLING CHANNEL IMPROVEMENTS

PROPOSED 32' 3@8'x9' RCBC DOWNSTREAM EXTENSION SEE CULVERT PLANS C01-1 THRU C01-10

OUTLET CHANNEL IMPROVEMENTS CLASS II RIP RAP EST 150 TONS EST 170 SY GFD SEE DETAIL/SHEET 2D-1

TDE ACQUIRED WITH TIP PROJECT U-2579B

R/W ACQUIRED WITH TIP PROJECT U-2579B

OUTLET CHANNEL IMPROVEMENTS CLASS II RIP RAP EST 170 TONS EST 200 SY GFD SEE DETAIL 1/SHEET 2D-1

SCOUR HOLE

RIP RAP

REMOVE EX DI

REMOVE EXIST STONE WALL

POND W.E. 859.7 FISH HATCHERY

ANTIS CREEK

PAVED SHOULDER

NOTE :
FOR - Y4EB - PROFILE SEE SHEET 8
FOR - Y4WB - PROFILE SEE SHEET 10
FOR CULVERT PLANS SEE C01-1 THRU C01-10

8/17/99

REVISIONS

PERMIT DRAWING MODIFICATION LEGEND

DENOTES IMPACTS IN SURFACE WATER (FILL IN STREAM)

DENOTES IMPACTS IN SURFACE WATER (POND)

JANUARY 14, 2020
PERMIT DRAWING
SHEET 12 OF 18

PERMIT DRAWING MODIFICATION FOR SITE 28

PREVIOUS U-2579B SHEET 26/27

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RALEIGH, NC 27601

PROJECT REFERENCE NO.	SHEET NO.
U-2579BA	6
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	PAVEMENT DESIGN ENGINEER

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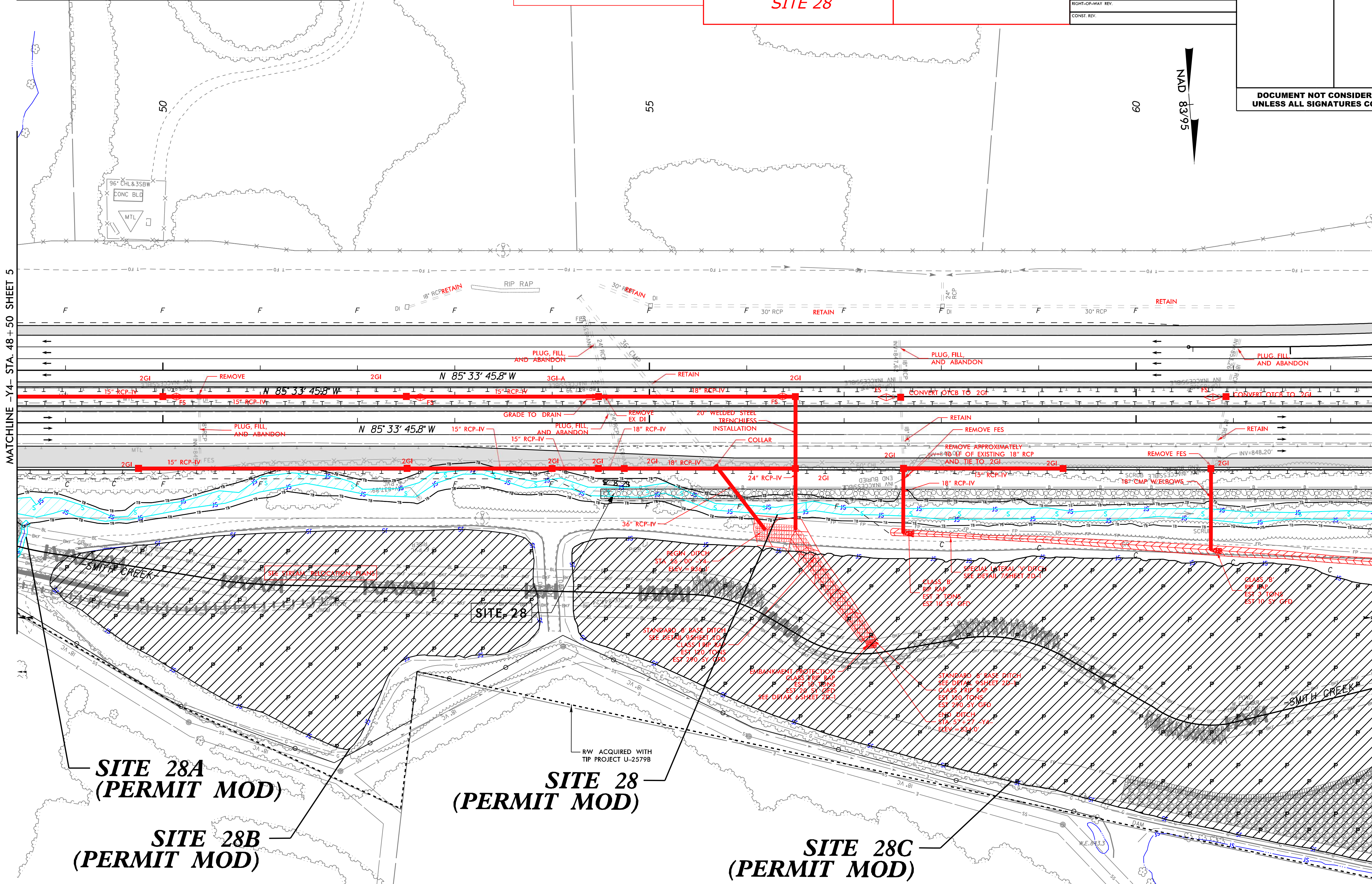

NAD 83/95
50
55
60
MATCHLINE -Y4- STA. 48+50 SHEET 5
MATCHLINE -Y4- STA. 62+50 SHEET 7
N 85° 33' 45.8" W
PLUG, FILL, AND ABANDON
REMOVE
RETAIN
CONVERT OTCB TO 2GI
GRADE TO DRAIN
REMOVE EX DI
20" WELDED STEEL TRENCHLESS INSTALLATION
COLLAR
REMOVE FES
REMOVE APPROXIMATELY 10 LF OF EXISTING 18" RCP AND TIE TO 2GI
18" CMP W/ELBOWS
SPECIAL LATERAL 'V' DITCH SEE DETAIL 7 SHEET 2D-1
CLASS 'B' RIP RAP EST 3 TONS EST 10 SY GFD
BEGIN DITCH STA 56+00 -Y4- ELEV=836.0'
STANDARD 6' BASE DITCH SEE DETAIL 9 SHEET 2D-1 CLASS I RIP RAP EST 120 TONS EST 290 SY GFD
EMBANKMENT PROTECTION CLASS I RIP RAP EST 10 TONS EST 20 SY GFD SEE DETAIL 6 SHEET 2D-1
END DITCH STA 57+27 -Y4- ELEV=834.0'
SEE STREAM RELOCATION PLANS
SMITH CREEK
SITE 28
R/W ACQUIRED WITH TIP PROJECT U-2579B
SITE 28A (PERMIT MOD)
SITE 28B (PERMIT MOD)
SITE 28 (PERMIT MOD)
SITE 28C (PERMIT MOD)

PAVED SHOULDER

NOTE :
FOR -Y4EB- PROFILE SEE SHEET 9
FOR -Y4WB- PROFILE SEE SHEET 11
FOR -Y4RPBD- PROFILE SEE SHEET 12

8/17/99

REVISIONS

PERMIT DRAWING MODIFICATION LEGEND

DENOTES IMPACTS IN SURFACE WATER (FILL IN STREAM)

DENOTES IMPACTS IN SURFACE WATER (POND)

JANUARY 14, 2020
PERMIT DRAWING
SHEET 13 OF 18

PERMIT DRAWING MODIFICATION FOR SITE 28

PREVIOUS U-2579B SHEET 26/27

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RALEIGH, NC 27601

RIGHT-OF-WAY REV.

CONST. REV.

PROJECT REFERENCE NO.	SHEET NO.
U-2579BA	6
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	PAVEMENT DESIGN ENGINEER

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

NAD 83/95

MATCHLINE -Y4- STA. 48+50 SHEET 5

MATCHLINE -Y4- STA. 62+50 SHEET 7

SITE 28

SITE 28A (PERMIT MOD)

SITE 28B (PERMIT MOD)

SITE 28 (PERMIT MOD)

SITE 28C (PERMIT MOD)

SMITH CREEK

R/W ACQUIRED WITH TIP PROJECT U-2579B

PAVED SHOULDER

NOTE :
FOR -Y4EB- PROFILE SEE SHEET 9
FOR -Y4WB- PROFILE SEE SHEET 11
FOR -Y4RPBD- PROFILE SEE SHEET 12

5/14/99

PERMIT DRAWING MODIFICATION LEGEND

- DENOTES IMPACTS IN SURFACE WATER (FILL IN STREAM)
- DENOTES IMPACTS IN SURFACE WATER (POND)
- DENOTES IMPACTS IN SURFACE WATER (STREAMBANK STABILIZATION)

JANUARY 14, 2020
PERMIT DRAWING
SHEET 14 OF 18

PERMIT DRAWING MODIFICATION FOR SITE 28

PREVIOUS U-2579B SHEET 27

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RALEIGH, NC 27601

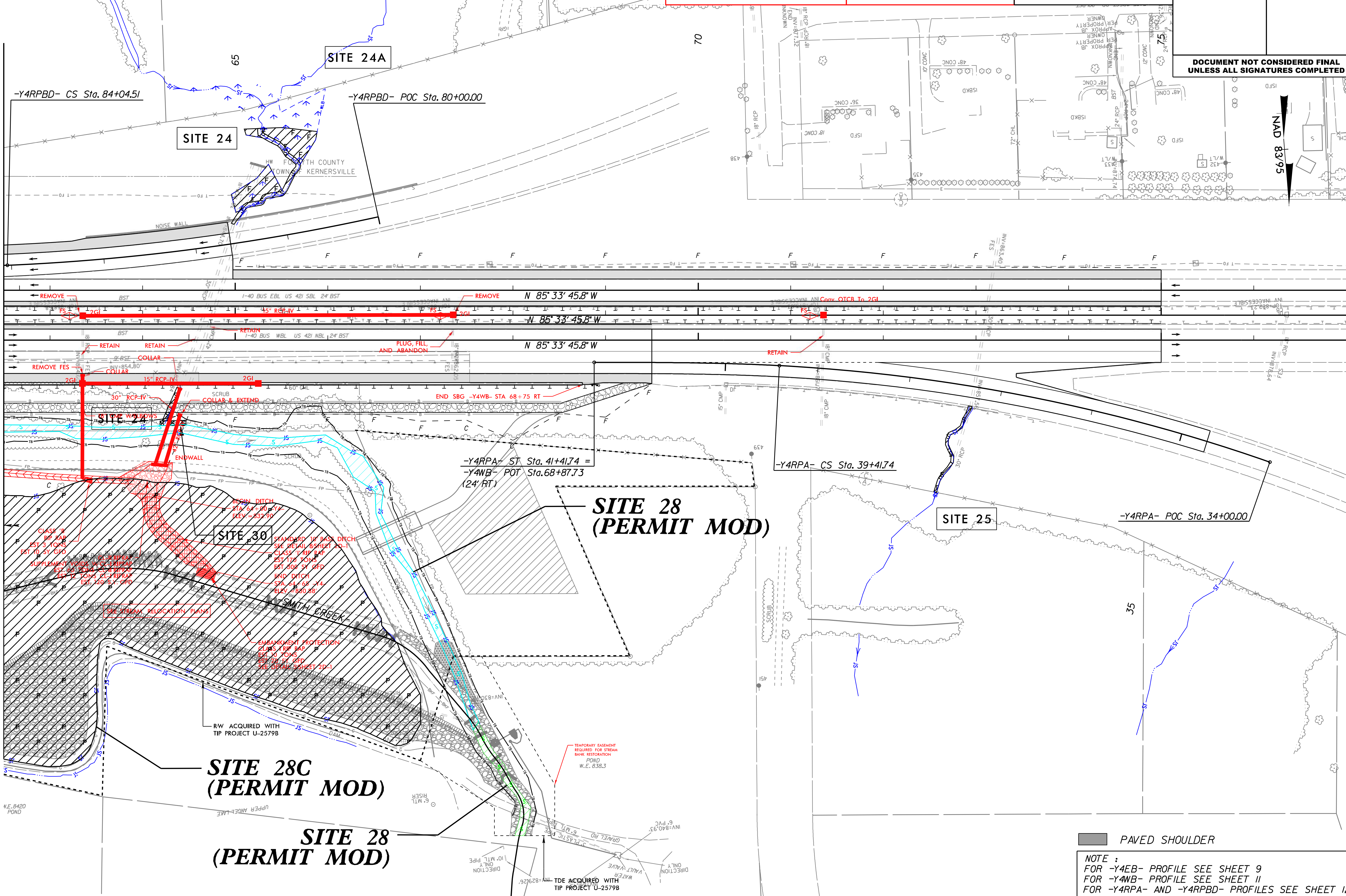
PROJECT REFERENCE NO.	SHEET NO.
U-2579BA	7
ROADWAY DESIGN ENGINEER	PAVEMENT DESIGN ENGINEER

RIGHT-OF-WAY REV.
CONST. REV.

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

REVISIONS

MATCHLINE -Y4- STA. 62+50 SHEET 6



SITE 24A
SITE 24
-Y4RPBD- CS Sta. 84+04.51
-Y4RPBD- POC Sta. 80+00.00
FORSYTH COUNTY
TOWN OF KERNERSVILLE
NOISE WALL
N 85° 33' 45.8" W
REMOVE
RETAIN
REMOVE FES
COLLAR
PLUG, FILL, AND ABANDON
15" RCP-IV
30" RCP-IV
COLLAR & EXTEND
ENDWALL
END SBG -Y4WB- STA 68+75 RT
SITE 30
-Y4RPA- ST Sta. 41+41.74 =
-Y4WB- POT Sta. 68+87.73
(24' RT)
SITE 28
(PERMIT MOD)
-Y4RPA- CS Sta. 39+41.74
SITE 25
-Y4RPA- POC Sta. 34+00.00
SMITH CREEK
SEE STREAM RELOCATION PLANS
RW ACQUIRED WITH TIP PROJECT U-2579B
SITE 28C
(PERMIT MOD)
SITE 28
(PERMIT MOD)
TDE ACQUIRED WITH TIP PROJECT U-2579B
TEMPORARY EASEMENT REQUIRED FOR STREAM BANK RESTORATION
NAD 83/95

PAVED SHOULDER

NOTE :
FOR -Y4EB- PROFILE SEE SHEET 9
FOR -Y4WB- PROFILE SEE SHEET 11
FOR -Y4RPA- AND -Y4RPBD- PROFILES SEE SHEET 12

PERMIT DRAWING MODIFICATION LEGEND

(cyan hatch)	DENOTES IMPACTS IN SURFACE WATER (FILL IN STREAM)
(black hatch)	DENOTES IMPACTS IN SURFACE WATER (POND)
(green hatch)	DENOTES IMPACTS IN SURFACE WATER (STREAMBANK STABILIZATION)

JANUARY 14, 2020
PERMIT DRAWING
SHEET 15 OF 18

PERMIT DRAWING MODIFICATION FOR SITE 28

PREVIOUS U-2579B SHEET 27

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RALEIGH, NC 27601

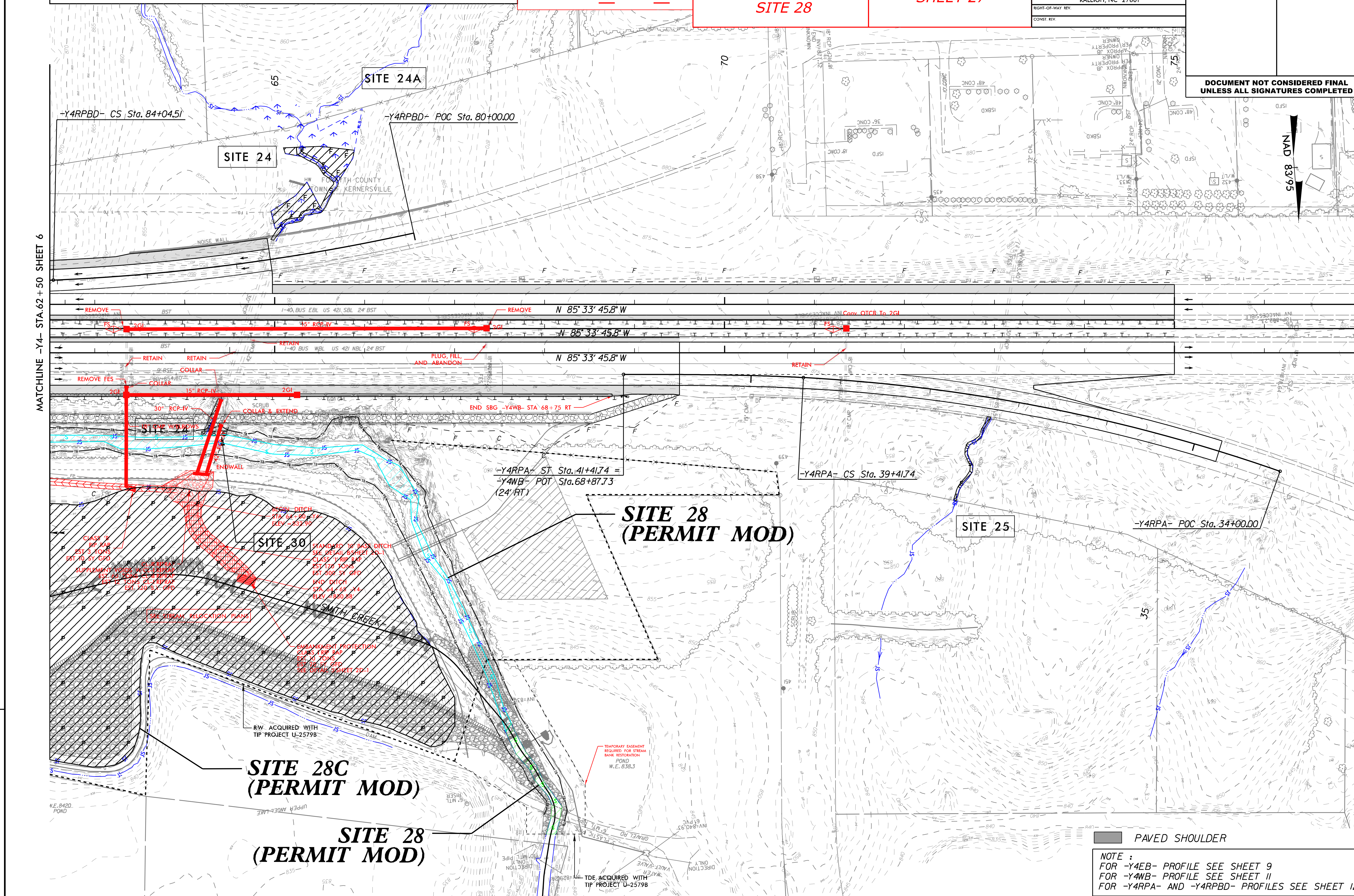
RIGHT-OF-WAY REV.
CONST. REV.

PROJECT REFERENCE NO.	SHEET NO.
U-2579BA	7
ROADWAY DESIGN ENGINEER	PAVEMENT DESIGN ENGINEER

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

REVISIONS

5/14/99



PAVED SHOULDER

NOTE :
FOR -Y4EB- PROFILE SEE SHEET 9
FOR -Y4WB- PROFILE SEE SHEET 11
FOR -Y4RPA- AND -Y4RPBD- PROFILES SEE SHEET 12

WETLAND PERMIT IMPACT SUMMARY

Site No.	Station (From/To)	Structure Size / Type	WETLAND IMPACTS: Permanent Fill In Wetlands (ac)	Temp Fill In Wetlands (ac)	Excavation in Wetlands (ac)	Mechanized Clearing in Wetlands (ac)	Hand Clearing in wetlands (ac)	SURFACE WATER IMPACTS: Permanent SW impacts (ac)	Temporary SW impacts (ac)	Existing Channel Impacts Permanent (ft)	Existing Channel Impacts Temp. (ft)	Natural Stream Design (ft)
1	28+00 -Y-	ROAD FILL	0.03		<0.01	0.02		0.02		142		
2	16+00 -Y1 RPD-	ROAD FILL - INTERMITTENT						0.01		109		
		ROAD FILL - PERENNIAL						0.02		208		
		STREAMBANK STABILIZATION						<0.01	<0.01	10	37	
3	21+56-25+22 -Y1-	2 @ 7' x 6' RCBC						0.06	<0.01	438	33	
3A	17+36-21+53 -Y1-	DETOUR - ROAD FILL							0.08		545	
3B	20+55-21+32 -Y1-	DETOUR - ROAD FILL							0.03		194	
4	501+51-503+21 -L-	ROAD FILL						0.03	<0.01	493	18	
		STREAMBANK STABILIZATION						<0.01	<0.01	9	31	
5	503+85-507+80 -L-	ROAD FILL						0.05	<0.01	740	22	
5A	507+39-509+64 -L-	ROAD FILL						0.01		306		
6	523+00 -L-	ROAD FILL	0.03			<0.01		0.02	<0.01	312	42	
7	527+00 -L-	ROAD FILL	0.52			0.01						
		ROAD FILL - POND						0.59				
8	559-75 -L-	2 @ 10' x 6' RCBC						0.06	<0.01	442	53	
		STREAMBANK STABILIZATION						<0.01	<0.01	58	44	
9	560+75 -L-	ROAD FILL	0.03			0.01						
10	560+50-568+74 -L-	ROAD FILL	0.01					0.07	<0.01	783	22	
10A	566+84-572+75 -L-	ROAD FILL						0.05		684		
11	615+00 -L-	3 @ 10' x 9' RCBC						0.43	0.02	808	57	
11A	19+76-21+44 -Y4RPBD-	CHANNEL CHANGE						0.08	0.01	223	41	
12	15+84-18+86 -Y4RPBD-	CHANNEL CHANGE						0.01	0.02	88	205	
TOTALS:			0.62	0.00	< 0.01	0.05		1.53	0.19	5,853	1,344	

NC DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS

U-2579 B Forsyth County
Winston Salem Northern Beltway
(Eastern Section) (Future I-74)

SHEET 62 of 64

JANUARY 14, 2020
PERMIT DRAWING
SHEET 16 OF 18

WETLAND PERMIT IMPACT 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)	Temporary SW impacts (ac)	Existing Channel Impacts Permanent (ft)	Existing Channel Impacts Temp. (ft)	Natural Stream Design (ft)
13	20+00-21+40 -Y4RPBD-	ROAD FILL	0.33									
14	629+95-635+90 -L-	ROAD FILL	0.04					0.05		688		
15	636+32-641+55 -L-	ROAD FILL	0.18					0.04		332		
		ROAD FILL-POND						2.38				
15A	644+00-645+00 -L-	ROAD FILL						<0.01		108		
16	643+56-644+61 -L-	ROAD FILL						<0.01		104		
		ROAD FILL-POND						0.16				
17	663+65-667+00 -L-	ROAD FILL	0.09			<0.01		0.06		928		
18	667+15 -L-	3 @ 12' x 10' RCBC						0.06	0.02	377	67	
		STREAMBANK STABILIZATION						0.02	0.01	80	59	
19	668+50 -L-	ROAD FILL	0.47			0.01						
20	687+80-691+59 -L-	ROAD FILL						0.03		163		
		ROAD FILL-POND						0.85				450
21	22+50 -Y1-	ROAD FILL	0.02									
22	40+50 -Y4-	OUTLET PAD	0.01									
~~23~~	~~45+65 -Y4-~~	~~CULVERT EXTENSION~~						~~0.06~~	~~0.01~~	~~100~~	~~32~~	
		~~STREAMBANK STABILIZATION~~						~~0.02~~	~~0.06~~	~~54~~	~~89~~	
23A	44+95-45+18 -Y4-	ROAD FILL						<0.01		57		
23B	45+07-46+34 -Y4-	ROAD FILL						0.01		135		
24	80+73-81+57 -Y4RPBD-	ROAD FILL						0.02		202		
24A	80+50-81+51 -Y4RPBD-	ROAD FILL	0.06									
25	37+31 -Y4RPA-	30" RCP						<0.01		73		
		STREAMBANK STABILIZATION						<0.01	<0.01	21	16	
TOTALS:			1.20			0.02		3.67	0.03	3,268	142	450

11/19/2018 Revisions shown in red text.

NC DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS

U-2579 B Forsyth County
Winston Salem Northern Beltway
(Eastern Section) (Future I-74)

SHEET 63 of 64

JANUARY 14, 2020
PERMIT DRAWING
SHEET 17 OF 18

WETLAND AND SURACE WATER IMPACTS SUMMARY

Site No.	Station (From/To)	Structure Size / Type	WETLAND IMPACTS: Permanent Fill In Wetlands (ac)	Temp. Fill In Wetlands (ac)	Excavation in Wetlands (ac)	Mechanized Clearing in Wetlands (ac)	Hand Clearing in Wetlands (ac)	SURFACE WATER IMPACTS: Permanent SW impacts (ac)	Temp. SW impacts (ac)	Existing Channel Impacts Permanent (ft)	Existing Channel Impacts Temp. (ft)	Natural Stream Design (ft)
26	29+16-31+12 -4RPC-	ROAD FILL-POND						0.38				
27A	104+63 - 107+53-Y4-	ROAD FILL						0.02		205		
27B	107+60 -Y4-	42" WELDED STEEL	0.05					0.01	< 0.01	130	14	
27C	107+58 - 108+44 -Y4-	30" RCP						< 0.01		116		
~~28~~	~~50+50 -56+00 -Y4- Rt~~	~~STREAMBANK STABILIZATION~~						~~0.02~~	~~0.15~~	~~365~~	~~188~~	
29	145+62 -Y4-	ROAD FILL				< 0.01						
30	64+34 -Y4-	STREAMBANK STABILIZATION						< 0.01		28		
31	557+28 -L-	STREAMBANK STABILIZATION						< 0.01		21		
		2018 Permit Modifications										
23	**44+10 to 47+96 -Y4-**	**3 @ 8' x 9' RCBC EXTENSION**						**0.06**		**151**		
		STREAMBANK STABILIZATION						**0.02**	**0.01**	**55**	**30**	
28	**47+96 to 56+84 -Y4-**	**2 @ 10' x 10' RCBC and 1 @ 10' x 8' RCBC**						**0.50**		**2233**		**2085**
		SMITH CREEK RELOCATION IN TDE (SEE PERMIT SHEET 7)						**0.01**		**76**		**42**
		STREAMBANK STABILIZATION IN TDE (SEE PERMIT SHEET 7)						**0.03**		**132**		
28A	**48+16 to 48+65 -Y4-**	**UT TO SMITH CREEK RELOCATION**						**0.01**		**80**		**384**
28B	**48+84 to 53+86 -Y4-**	**DRAIN POND**						**1.62**				
28C	**54+20 to 67+00 -Y4-**	**DRAIN POND**						**6.20**				
		09/18/2019 Permit Modifications										
8A		**STREAM RELOCATION**								**144**	**40**	
SUBTOTALS, THIS PAGE:			0.05			< 0.01		**8.87**	**0.01**	**3371**	**84**	**2511**
SUBTOTALS, PAGE 1			0.62		< 0.01	0.05		**1.53**	**0.19**	**5853**	**1344**	
SUBTOTALS, PAGE 2			1.20			0.02		**3.67**	**0.03**	**3268**	**142**	450
TOTALS:			1.87		< 0.01	0.08		**14.07**	**0.23**	**12492**	**1570**	**2961**

11/19/2018 Revisions shown in red text.

10/1/2019 Revisions shown in green text.

12/13/2019 Revisions shown in orange text.

09/18/2019 Revisions shown in blue text.

Revised 2018 Feb

NC DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS

U-2579 B Forsyth County
Winston Salem Northern Beltway
(Eastern Section) (Future I-74)

SHEET 64 OF 64

JANUARY 14, 2020
PERMIT DRAWING
SHEET 18 OF 18

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

ROY COOPER
GOVERNOR

JAMES H. TROGDON, III
SECRETARY

October 21, 2019

Asheville Regulatory Field Office
US Army Corps of Engineers
151 Patton Avenue, Room 208
Asheville, North Carolina 28801-5006

ATTN: Ms. Nicholle Braspennickx, NCDOT Coordinator

Subject: Request for Modification of Section 404 Individual Permit and Section 401 Water Quality Certification for the U-2579B Section of the Winston-Salem Northern Beltway, from US 158 to I-40 Business/US 421, Forsyth County, Division 9, WBS 34839.2.10

References: Section 404 Individual Permit – Action ID No. SAW-2009-03183, issued June 17, 2014 and modifications issued July 2, 2014, February 21, 2019, and Section 404 Individual Renewal/ ATF Permit Modification, October 17, 2019
Section 401 Water Quality Certification – NCDWR Project No. 2014090 issued April 11, 2014 and modifications issued July 18, 2014, December 17, 2018, and Section 401 Water Quality Certification Renewal/ATF issued October 15, 2019

Dear Madam:

The North Carolina Department of Transportation (NCDOT) requests a Permit Modification for the Winston -Salem Northern Beltway Eastern Section from US 158 to I-40, B Section of the U-2579 TIP. This project is currently under construction.

This modification request will include revised impacts to Smith Creek (Sites 28 and 23), new impacts to UT Smith Creek (site 28A), and new impacts to two ponds (sites 28B and 28C). Smith Creek is a parallel stream along this section of the Beltway. Due to multiple large storm events, the original proposed roadway has been destabilized, undermining the fill slopes. To correct this situation, NCDOT had determined that the only option for Smith Creek is to relocate away from the road fill. A culvert option was investigated but the length of the culvert will complicate maintenance and inspections (located under a travel lane), have drainage complications, is cost prohibitive, and overall determined to be structurally unsound.

Mailing Address:
NC DEPARTMENT OF TRANSPORTATION
ENVIRONMENT ANALYSIS UNIT
1598 MAIL SERVICE CENTER
RALEIGH NC 27699-1598

Telephone: (919) 707-6000
Customer Service: 1-877-368-4968
Website: www.ncdot.gov

Location:
1000 BIRCH RIDGE DRIVE
RALEIGH NC 27610

Impact changes for the Smith Creek Relocation:

	Current Permanent Stream (LF)	Current Stream Bank Stabilization (LF)	Current Stream Temporary (LF)	**New Permanent Stream (LF)**	**New Stream Bank Stabilization (LF)**	**New Stream Temporary (LF)**	**New Pond De-watering (AC)**
Site 23	151	36	121	NC	**55**	**30**	
Site 28	598	194	127	**2309**	**120**	**0**	
Site 28A				**80**			
Site 28B							**1.62**
Site 28C							**6.20**

NC = No Change
Sites 28A, 28B, and 28C are new sites for this modification

The total additional new permanent stream impacts requiring mitigation are as follows:
Site 28 1,711 Linear Feet of Stream Impacts
Site 28A 80 Linear Feet of Stream Impacts
Total new permanent requiring mitigation = 1,791 Linear Feet

Bank Stabilization Impact changes are as follows:
Site 23 +19 Linear Feet
Site 28 -74 Linear Feet
Total **reduction** in Bank Stabilization Impacts = **55 Linear Feet**

Temporary impact changes will be as follows:
Site 23 -91 Linear Feet
Site 28 -127 Linear Feet
Total **reduction** in Temporary Impacts = **218 Linear Feet**

There will be new impacts to ponds for this modification. Pond 1 and Pond 2 will be drained to accommodate the relocation of Smith Creek totaling 7.82 acre of impacts.

The total new permanent stream impacts for this modification are 1,736 Linear feet (1,791 LF – 55 LF).

The modification of this permit for the relocation of Smith Creek, will now bring the total stream impacts for the U-2579B Section of the W-S Beltway to:
12,480 linear feet of permanent stream impacts
1,570 linear feet of temporary impacts

The mitigation for new impacts will be determined when the final plans for the relocated stream are complete. This plan will be submitted to the USACE and NCDWR for determination of credits applicable for the Natural Stream Design (NSD) plans for this stream. Currently the proposed NSD is 2,127 linear feet for Smith Creek (Site 28) and 344 linear feet for UT Smith Creek (Site 28A). Once the credit for NSD has been determined, NCDOT will contact DMS for the balance.

Please see the attached revised permit drawings for the relocation of Smith Creek and the corrected permit impact summary sheet. NCDOT is hereby requesting a Modification for this project. If you have any questions, please contact Carla Dagnino at cdagnino@ncdot.gov or (919) 707-6110.

Thank you!

Sincerely,

Carla Dagnino

for Philip S. Harris III, P.E., C.P.M.
Environmental Analysis Unit Head

Smith Creek Stream Relocation Plan: U2579B

Site Summary

Smith Creek runs parallel to existing west bound Business 40 just east of the interchange with the Winston Salem Northern Beltway in Forsyth County. There are two active fish hatchery ponds on the north side of Smith Creek. Construction of the deceleration lane from Business 40 onto the Winston Salem Northern Beltway resulted in a need to widen the highway toward Smith Creek. In the 2014 permit application, the plans called for armoring Smith Creek with a series of retaining walls and rip rap bank stabilization. Following the initial survey work in 2008, high stormwater flows have accelerated erosion along Smith Creek between Business 40 and the two fish hatchery ponds. The stream bank erosion was further accelerated when the area received several large rain events in 2018. As a result, Smith Creek has migrated closer to existing Business 40, making it impossible to construct the series of retaining walls and rip rap bank stabilization without jeopardizing the fish hatchery ponds. NCDOT has explored a culvert running the distance of Smith Creek. However due to cost, constructability and long-term maintenance concerns, NCDOT has opted to drain the two fish hatchery ponds and relocate Smith Creek and an Unnamed Tributary to Smith Creek into new channels. The relocated channels have been designed using natural channel techniques, maximizing floodplain width for long term stability. A riparian buffer will be planted utilizing native riparian vegetation, including herbaceous plants, shrubs and trees. A monitoring plan for the stream relocation and vegetation success is detailed below (see sections titled "Stream Assessment Success Criteria" and "Vegetation Success"). The area will be held under NCDOT Right of Way and a Control of Access fence will be erected around the site.

Water Access for Existing Fish Hatchery

The two fish hatchery ponds that will be drained for the stream relocation are part of a larger fish hatchery operation. Currently, the property owner utilizes an existing dam in Smith Creek, just downstream of the existing culvert under Business 40, to keep his ponds at full capacity for aquaculture operations. There is currently an 8-inch pipe that runs from the dam to fill the series of three ponds. Two of the three ponds will be removed to relocate the stream. Since the NCDOT project will remove the inline dam and impact the 8-inch pipe, we needed to provide the property owner a means to access water to fill his remaining pond that is equivalent to his existing operation. NCDOT has reviewed a couple of different methods to maintain water access. One method included an installation of a stream bypass structure which sends water into a pipe that runs the length of the stream relocation. This method was determined infeasible due to maintenance concerns associated with the long flat slope of the proposed pipe. Instead, NCDOT has decided to install an instream vault downstream of the project area where the property owner can place a pump as needed to fill the ponds.

NCDOT has investigated the amount of water that is currently being taken from Smith Creek to determine if the property owner's existing methods are in compliance with North Carolina General Statute §143-215.22H(b1). This statute requires 'any person who with draws or transfers 1,000,000 gallons per day' to register and report their withdrawal with the North Carolina Department of Environmental Quality (NCDEQ). If the property owner took two weeks to fill the ponds utilizing the 8" pipe he currently has, then he would remove 230,037 gallons per day. In conversations with the property owner, he fills the pond over a five-week period. The property owner is not currently registered, nor is does NCDOT believe he is required to be registered with the NCDEQ. Since NCDOT's project is going to decrease the amount of water the property owner needs by decreasing the number of ponds, the amount of water being removed from Smith Creek will decrease, and not change his need to register with NCDEQ. If his operations change in the future, it will be the property owner's responsibility to coordinate with NCDEQ.

Stream Assessment Success Criteria

The stream relocation site shall be monitored for five years or until success criteria are satisfied. Monitoring protocols shall follow the Monitoring Level I outlined in the Stream Mitigation Guidelines, April 2003. NCDOT will evaluate the success of the stream relocation project based on guidance provided by the Stream Mitigation Guidelines 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 2,471 linear feet of channel (2,127' for Smith Creek and 344' for the unnamed tributary. 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 pay mitigation fees 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 and restoration wetlands. 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 ft^2. 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.

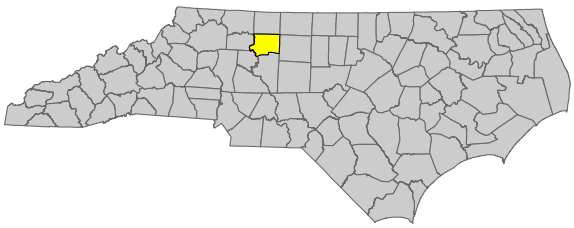
Appropriate measures will be taken to control nuisance vegetation during the monitoring period if it affects the success of the planted vegetation.

Functional Assessment: Pre and Post construction

A NCSAM form was completed for Smith Creek and the UT to Smith Creek. The forms have been attached to this Stream Relocation plan and are labeled Appendix 1. Smith Creek was divided into 3 sections, labeled SA-1, SA-2 and SA-3. SA-1 and 3 received an overall score of low, while SA-2 received a score of medium. The UT-1 to Smith Creek was assessed in its entirety within the project footprint and received an overall score of low.

A NCSAM form will be completed after the monitoring period in order to compare the potential functional uplift to pre-project conditions. It was decided with input from NCDOT, USACE, NCDWR, and NCWRC that the form will not be used to determine success of the site, but rather it will be used for comparison of pre and post project functions.

APPENDIX ONE: NCSAM Forms for Smith Creek and UT1 to Smith Creek



PREPARED BY:

RK&K

NORTH CAROLINA
DEPARTMENT Of TRANSPORTATION
ENVIRONMENTAL ANALYSIS UNIT

STIP PROJECT: U-2579B

NCSAM FORSYTH COUNTY

FIGURE 1: NCSAM MAP

SA-1

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): U-2579B (SA-1)
2. Date of evaluation: 11/07/2019
3. Applicant/owner name: NCDOT
4. Assessor name/organization: H. Bain, M. Martin / RK&K
5. County: Forsyth
6. Nearest named water body on USGS 7.5-minute quad: Smith Creek
7. River basin: Yadkin-PeeDee
8. Site coordinates (decimal degrees, at lower end of assessment reach): 36.112393, -80.115401

STREAM INFORMATION: (depth and width can be approximations)

9. Site number (show on attached map): SA-1
10. Length of assessment reach evaluated (feet): 150
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 1.0-3.0 ☐Unable to assess channel depth.
12. Channel width at top of bank (feet): 20-30
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 LB	Vegetated RB	Wooded LB	Wooded 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 LB	Abuts RB	< 30 feet LB	< 30 feet RB	30-50 feet LB	30-50 feet 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:
Reach is from Culvert to lowhead dam

Draft NC SAM Stream Rating Sheet
Accompanies User Manual Version 2.1

Stream Site Name	U-2579B (SA-1)	Date of Assessment	11/07/2019
Stream Category	Pb3	Assessor Name/Organization	H. Bain, M. Martin / RK&K

Notes of Field Assessment Form (Y/N)	YES
Presence of regulatory considerations (Y/N)	YES
Additional stream information/supplementary measurements included (Y/N)	YES
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	**MEDIUM**	
(4) Wooded Riparian Buffer	**LOW**	
(4) Microtopography	NA	
(3) Stream Stability	**LOW**	
(4) Channel Stability	**HIGH**	
(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	**MEDIUM**	
(2) Baseflow	**HIGH**	
(2) Streamside Area Vegetation	**MEDIUM**	
(3) Upland Pollutant Filtration	**MEDIUM**	
(3) Thermoregulation	**MEDIUM**	
(2) Indicators of Stressors	**NO**	
(2) Aquatic Life Tolerance	**MEDIUM**	
(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	**LOW**	
(2) Stream-side Habitat	**LOW**	
(3) Stream-side Habitat	**LOW**	
(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	**LOW**	

SA-2

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): U-2579B (SA-2)
2. Date of evaluation: 11/07/2019
3. Applicant/owner name: NCDOT
4. Assessor name/organization: H. Bain, M. Martin / RK&K
5. County: Forsyth
6. Nearest named water body on USGS 7.5-minute quad: Smith Creek
7. River basin: Yadkin-PeeDee
8. Site coordinates (decimal degrees, at lower end of assessment reach): 36.112396, -80.116455

STREAM INFORMATION: (depth and width can be approximations)

9. Site number (show on attached map): SA-2
10. Length of assessment reach evaluated (feet): 350
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 0.5-2.0 ☐Unable to assess channel depth.
12. Channel width at top of bank (feet): 3-15
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:
Reach is from lowhead dam to substrate change.

Draft NC SAM Stream Rating Sheet
Accompanies User Manual Version 2.1

Stream Site Name	U-2579B (SA-2)	Date of Assessment	11/07/2019
Stream Category	Pb3	Assessor Name/Organization	H. Bain, M. Martin / RK&K

Notes of Field Assessment Form (Y/N)	YES
Presence of regulatory considerations (Y/N)	YES
Additional stream information/supplementary measurements included (Y/N)	YES
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	**LOW**	
(4) Floodplain Access	**MEDIUM**	
(4) Wooded Riparian Buffer	**LOW**	
(4) Microtopography	NA	
(3) Stream Stability	**HIGH**	
(4) Channel Stability	**HIGH**	
(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	**MEDIUM**	
(3) Upland Pollutant Filtration	**MEDIUM**	
(3) Thermoregulation	**MEDIUM**	
(2) Indicators of Stressors	**NO**	
(2) Aquatic Life Tolerance	**HIGH**	
(2) Intertidal Zone Filtration	NA	
(1) Habitat	**MEDIUM**	
(2) In-stream Habitat	**HIGH**	
(3) Baseflow	**HIGH**	
(3) Substrate	**HIGH**	
(3) Stream Stability	**HIGH**	
(3) In-stream Habitat	**HIGH**	
(2) Stream-side Habitat	**LOW**	
(3) Stream-side Habitat	**LOW**	
(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**	

SA-3

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): U-2579B (SA-3)
2. Date of evaluation: 11/07/2019
3. Applicant/owner name: NCDOT
4. Assessor name/organization: H. Bain, M. Martin / RK&K
5. County: Forsyth
6. Nearest named water body on USGS 7.5-minute quad: Smith Creek
7. River basin: Yadkin-PeeDee
8. Site coordinates (decimal degrees, at lower end of assessment reach): 36.113886, -80.122150

STREAM INFORMATION: (depth and width can be approximations)

9. Site number (show on attached map): SA-3
10. Length of assessment reach evaluated (feet): 1000
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 1.0-3.0 ☐Unable to assess channel depth.
12. Channel width at top of bank (feet): 6.0-12.0
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:
Reach is from substrate change to end of study area.

Draft NC SAM Stream Rating Sheet
Accompanies User Manual Version 2.1

Stream Site Name	U-2579B (SA-3)	Date of Assessment	11/07/2019
Stream Category	Pa3	Assessor Name/Organization	H. Bain, M. Martin / RK&K

Notes of Field Assessment Form (Y/N)	YES
Presence of regulatory considerations (Y/N)	YES
Additional stream information/supplementary measurements included (Y/N)	YES
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	**MEDIUM**	
(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	**HIGH**	
(2) Baseflow	**HIGH**	
(2) Streamside Area Vegetation	**MEDIUM**	
(3) Upland Pollutant Filtration	**MEDIUM**	
(3) Thermoregulation	**MEDIUM**	
(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	**LOW**	
(3) Stream-side Habitat	**LOW**	
(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	**LOW**	

UT-1

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): U-2579B (UT-1)
2. Date of evaluation: 11/07/2019
3. Applicant/owner name: NCDOT
4. Assessor name/organization: H. Bain, M. Martin / RK&K
5. County: Forsyth
6. Nearest named water body on USGS 7.5-minute quad: Smith Creek
7. River basin: Yadkin-PeeDee
8. Site coordinates (decimal degrees, at lower end of assessment reach): 36.112630, -81.115104

STREAM INFORMATION: (depth and width can be approximations)

9. Site number (show on attached map): UT-1
10. Length of assessment reach evaluated (feet): 200
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 1.0-1.5 ☐Unable to assess channel depth.
12. Channel width at top of bank (feet): 1.0-3.0
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 LB	Vegetated RB	Wooded LB	Wooded 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 LB	Abuts RB	< 30 feet LB	< 30 feet RB	30-50 feet LB	30-50 feet 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:
Small Stream bounded by lawn with few trees presnt, large macroinvertebrate assemblage, habitat in stream appears diverse.

Draft NC SAM Stream Rating Sheet
Accompanies User Manual Version 2.1

Stream Site Name	U-2579B (UT-1)	Date of Assessment	11/07/2019
Stream Category	Pb2	Assessor Name/Organization	H. Bain, M. Martin / RK&K

Notes of Field Assessment Form (Y/N)	YES
Presence of regulatory considerations (Y/N)	YES
Additional stream information/supplementary measurements included (Y/N)	YES
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	**HIGH**	
(4) Wooded Riparian Buffer	**LOW**	
(4) Microtopography	NA	
(3) Stream Stability	**MEDIUM**	
(4) Channel Stability	**HIGH**	
(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	**HIGH**	
(2) Baseflow	**HIGH**	
(2) Streamside Area Vegetation	**LOW**	
(3) Upland Pollutant Filtration	**LOW**	
(3) Thermoregulation	**MEDIUM**	
(2) Indicators of Stressors	**NO**	
(2) Aquatic Life Tolerance	**HIGH**	
(2) Intertidal Zone Filtration	NA	
(1) Habitat	**LOW**	
(2) In-stream Habitat	**MEDIUM**	
(3) Baseflow	**HIGH**	
(3) Substrate	**MEDIUM**	
(3) Stream Stability	**HIGH**	
(3) In-stream Habitat	**MEDIUM**	
(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**	

North Carolina Department of Transportation

Highway Stormwater Program

STORMWATER MANAGEMENT PLAN

FOR NCDOT PROJECTS

(Version 2.08; Released April 2018)

WBS Element: 34839.1.1 **TIP No.:** U-2579B **County(ies):** Forsyth County

General Project Information

WBS Element:	34839.1.1	**TIP Number:**	U-2579B	**Project Type:**	Roadway Relocation	**Date:**	10/1/2019
NCDOT Contact:	Amy Euliss			**Contractor / Designer:**	Kimley-Horn		
	Address: 375 Silas Creek Parkway Wiston-Salem NC 27127-7167			**Address:** 421 Fayetteville Street Suite #600 Raleigh, NC, 27601			
	Phone: (336) 747-7802			**Phone:** (919) 677-2178			
	Email: aeuliss@ncdot.gov			**Email:** dan.robinson@kimley-horn.com			
City/Town:	Winston-Salem			**County(ies):**	Forsyth		
River Basin(s):	Yadkin-Pee Dee			**CAMA County?**	No		
Wetlands within Project Limits?	Yes						

Project Description

Project Length (lin. miles or feet):	4.06 miles	**Surrounding Land Use:**	Rural, Farmland, Suburban Neighborhoods

	Proposed Project	**Existing Site**
Project Built-Upon Area (ac.)	N/A ac.	N/A ac.
Typical Cross Section Description:	In each direction there will be 3 12-foot lanes plus a 12-foot paved shoulder with a 22-foot grassed median.	N/A
Annual Avg Daily Traffic (veh/hr/day):	Design/Future: 79880 ADT Year: 2030	Existing: 53560 ADT Year: 2010

General Project Narrative: (Description of Minimization of Water Quality Impacts)

9/19/2013 - Orginal Submittal

Winston-Salem Borthern Bellway (Eastern Section) (Future I-74) from US 158 to I-40 Bus US421: Grassed Swales were used throughout the Project to treat the stormwater. These Grassed Swales have side slopes that are 3:1 or flatter, with many sode slopes being 6:1. have a velocity during the 2-Year Storm or less than 2 feet per second and have a minimum ditch length equivalent to 100 feet per acre of impervious area. In addition to the Grassed Swales, Preformed Scour Holes and Energy Dissipators are used at several locations.

10/1/2019 - Revised Submittal

Modifications to U-2579B were performed and submitted January 2019. These changes include:

- Stormdrain revisions
- Proposed 32' 3 @ 8' x 9' RCBC Downstream Extension (Sta. 45+65 -Y4-)
- Proposed 41' 3 @ 8' x 9' RCBC Upstream Extension (Sta. 45+65 -Y4-)
- Smith Creek Stream Relocation (Sta. 47+27 to 67+63 -Y4-)
- UT to Smith Creek Stream Relocation (Sta. 48+60 -Y4-)

A permit modification was needed for the revisions mentioned above. Included with this revised SMP are updated pipe sizes and flows of two outlets to Preformed Scour Holes (Sta. 43+00 and 46+00). All other stormwater features (swales, filter strip, energy dissipators, etc.) were not modified by these 2019 revisions and are not included with this modification. Refer to orginal stormwater management plan for other mitigation efforts.

Waterbody Information

Surface Water Body (1):	Smith Creek		**NCDWR Stream Index No.:**	12-94-12-2-1	
NCDWR Surface Water Classification for Water Body		**Primary Classification:**	Water Supply III (WS-III)		
		Supplemental Classification:	None		
Other Stream Classification:					
Impairments:	None				
Aquatic T&E Species?	No	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?**	No
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 2.08; Released April 2018)

WBS Element: **TIP No.:** U-2579B **County(ies):** Forsyth County

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?
25	Sta. 43+00 -Y4-		PSH	Class 'B'	0.2	Pipe	18	1.3	9.4	No
26	Sta. 46+00 -Y4-		PSH	Class 'B'	0.3	Pipe	18	1.6	4.1	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.

PROJECT REFERENCE NO.	SHEET NO.
U-2579B	25
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

OCTOBER 1, 2019
PERMIT DRAWING
SHEET 1 OF 10

8/17/99

REVISIONS

DENOTES FILL IN WETLAND

SITE 22

MATCHLINE –Y4 STA. 30+50 SHEET 24

MATCHLINE –Y4– STA. 43+65 SHEET 26

119 ARNOLD G. KING, HELEN H. PRINCE, DB 2250 PG 829

120 HAROLD DAVID HOPKINS, DB 3113 PG 1518

215 TOWN OF KERNERSVILLE, DB 2065 PG 1771

FORSYTH COUNTY / TOWN OF KERNERSVILLE

TAIL DITCH SEE DETAIL#9 EST. DDE 17CY CLASS 'I' RIP RAP EST 20 TONS EST 39 SY GEO

24" RCP-III

JB w/MH

2GI FS 15" COLLAR

24"

REMOVE FES

RETAIN AND EXTEND

TRENCHLESS INSTALLATION 36" WELDED STEEL

RETAIN

CONVERT OTCB TO 2GI

RETAIN AND EXTEND

COLLAR

REMOVE FES

DITCH BLOCK MIN. HEIGHT 1.0'

2GI FS 15" 24" F HW

JB w/MH

36"

TDE

CLASS 'B' RIP RAP EST 1 TONS EST 5 SY GEO

15" W/2 ELBOWS

BEGIN SBG –Y4EB– STA 40+50 LT

18" W/2 ELBOWS

PSH SEE DETAIL, SHEET 2D-1

2GI

REMOVE

18" RCP-IV

FILL W/FLOWABLE MATERIAL

15" CMP W/2 ELBOWS

2GI-A FS

42" RCP-IV

30" RCP-IV

48" RCP-IV

JB W/MH COVER

BEGIN SBG –Y4WB– STA 39+50 RT

TOE PROTECTION W/ CLASS B RIPRAP EST 130 TONS EST 265 SY GEO SEE DETAIL#27

N 85° 33' 45.8" W

EXISTING R/W

R/W MON

WHITE WALNUT, LLC DB 3078 PG 0373

WHITE WALNUT, LLC DB 3054 PG 1059

WHITE WALNUT, LLC DB 3054 PG 1059

WHITE WALNUT, LLC DB 2858 PG 0267 PB 42 PG 137

DENNIS H. PAYNE, JR. DAWN A. PAYNE DB 2797 PG 2978

DON ALLEN HARRIS LEXA LEIGH HARRIS DB 3084 PG 4432

PAGE AND ASSOCIATES, INC. DB 2704 PG 784

THEODORE R. MEAD AMY J. MEAD DB 1862 PG 3875 PB 34 PG 103

DAVID D. WEAVER DB 2480 PG 28 PB 34 PG 103

TIMOTHY A. KUBIAK SUSAN E. KUBIAK DB 1813 PG 130 PB 34 PG 103

THOMAS W. PRINCE ARNOLD G. KING DB 2056 PG 1310

50' RURAL RD. CROSS EASEMENT

20' STORM SEWER EASEMENT PB 18 PG 134

30' R/W PER PB 44 PG 4, PB 44 PG 134

84' WD. R/W PER PB 44 PG 5, PB 44 PG 134

POND W.E. 8597 FISH HATCHERY

DETAIL #9
STANDARD BASE DITCH
(Not to Scale)

Natural Ground 2H D 2H Natural Ground B

Min. D= 2 Ft.
B= 3 Ft.

FROM STA. 35+02 TO 35+27 –Y4– LT

DETAIL #27
TOE PROTECTION
(Not to Scale)

NATURAL GROUND d 2.5H OR FLATTER Fill Slope Geotextile

d= 1Ft.

Type of Liner= Class 'B' Rip-Rap

FROM STA. 40+30 TO 46+30 –Y4– RT

DETAIL
FALSE SUMP
(Not to Scale)

Median Ditch 9" 2' L (See Chart Below) 20' CL etc. S=Ditch Slope ℄ Proposed Ditch

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. 36+49 –Y4–
STA. 39+48 –Y4–
STA. 43+13 –Y4–

DETAIL
FALSE SUMP
(Not to Scale)

Outside Ditch Traffic Flow 10:1 10:1 2' 0.5' Min. 1.0' Max. CL etc. S=Ditch Slope ℄ Proposed Ditch

STA. 39+15 –Y4– LT

DETAIL
FALSE SUMP
(Not to Scale)

Outside Ditch Traffic Flow 10:1 20:1 2.0' 0.5' Min. 1.0' Max. CL etc. S=Ditch Slope ℄ Proposed Ditch

STA. 38+89 –Y4– RT
STA. 40+39 –Y4– RT

PAVED SHOULDER

NOTE :
FOR – Y4EB – PROFILE SEE SHEET 50
FOR – Y4WB – PROFILE SEE SHEET 55

PROJECT REFERENCE NO.	SHEET NO.
U-2579B	25
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

OCTOBER 1, 2019
PERMIT DRAWING
SHEET 2 OF 10

8/17/99

REVISIONS

MATCHLINE -Y4 STA. 30+50 SHEET 24

MATCHLINE -Y4- STA. 43+65 SHEET 26

DENOTES FILL IN WETLAND

BEGIN U-2579B MODIFICATIONS
-Y4- POT Sta.35+50.00

FUTURE U-5760 IMPROVEMENTS (BY OTHERS)

119 ARNOLD G. KING
HELEN H. PRINCE
DB 2250 PG 829

120 HAROLD DAVID HOPKINS
DB 3113 PG 1518

SITE 22

TAIL DITCH
SEE DETAIL#9
EST. DDE 17CY
CLASS 'I'
RIP RAP
EST 20 TONS
EST 39 SY GEO

TDE

24" RCP-III

JB W/MH

COLLAR

REMOVE FES

RETAIN AND EXTEND

TRENCHLESS INSTALLATION
36" WELDED STEEL

RETAIN

CONVERT OTCB TO 2GI

DITCH BLOCK
MIN. HEIGHT 1.0'

15" W/2 ELBOWS

CLASS 'B' RIP RAP
EST 1 TONS
EST 5 SY GEO

FORSYTH COUNTY
TOWN OF KERNERSVILLE

BEGIN SBG
-Y4EB- STA 40+50 LT

18" W/2 ELBOWS

PSH
SEE DETAIL
SHEET 2D-1

22' PS

21'-8" PS

N 85° 33' 45.8" W

GREU MED TL-3

5' PS

42" RCP-IV

30" RCP-IV

48" RCP-IV

FILL W/FLOWABLE MATERIAL

15" CMP W/2 ELBOWS

JB W/MH COVER

BEGIN SBG
-Y4WB- STA 39+50 RT

TOE PROTECTION W/
CLASS B RIPRAP
EST 130 TONS
EST 265 SY GEO
SEE DETAIL#27

215 TOWN OF KERNERSVILLE
DB 2065 PG 1171

FUTURE U-5760 IMPROVEMENTS (BY OTHERS)

WHITE WALNUT, LLC
DB 3078 PG 0373

WHITE WALNUT, LLC
DB 3054 PG 1059

DENNIS H. PAYNE, JR.
DAWN A. PAYNE
DB 2797 PG 2978

DON ALLEN HARRIS
LEWA LEIGH HARRIS
DB 3084 PG 4432

THEODORE R. MEAD
AMY J. MEAD
DB 1862 PG 3875
PB 34 PG 103

PAGE AND ASSOCIATES, INC.
DB 2704 PG 784

DAVID D. WEAVER
DB 2480 PG 28
PB 34 PG 103

TIMOTHY A. KUBIAK
SUSAN E. KUBIAK
DB 1813 PG 130
PB 34 PG 103

THOMAS W. PRINCE
ARNOLD G. KING
DB 2056 PG 1310

WHITE WALNUT, LLC
DB 2858 PG 0267
PB 42 PG 137

POND
W.E. 8597
FISH HATCHERY

DETAIL #9
STANDARD BASE DITCH
(Not to Scale)

Min. D= 2 Ft.
B= 3 Ft.

FROM STA. 35+02 TO 35+27 -Y4- LT

DETAIL #27
TOE PROTECTION
(Not to Scale)

Type of Liner= Class 'B' Rip-Rap

FROM STA. 40+30 TO 46+30 -Y4- RT

DETAIL
FALSE SUMP
(Not to Scale)

Ditch Grade	%	Ditch Grade	%
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. 36+49 -Y4-
STA. 39+48 -Y4-
STA. 43+13 -Y4-

STA 39+15 -Y4- LT

STA 38+89 -Y4WB- RT
STA 40+39 -Y4WB- RT

PAVED SHOULDER

NOTE :
FOR - Y4EB - PROFILE SEE SHEET 50
FOR - Y4WB - PROFILE SEE SHEET 55

8/17/99

REVISIONS

PROJECT REFERENCE NO.	SHEET NO.
U-2579B	26
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

PERMIT DRAWING MODIFICATION LEGEND

- TS FS — DENOTES TEMPORARY IMPACTS IN SURFACE WATER
- S S — DENOTES IMPACTS IN SURFACE WATER (CULVERT IMPACTS)
- S S — DENOTES IMPACTS IN SURFACE WATER (STREAMBANK STABILIZATION)
- S S — DENOTES IMPACTS IN SURFACE WATER (FILL IN STREAM)
- P P — DENOTES IMPACTS IN SURFACE WATER (POND)

SITE 23 (PERMIT MOD)

SITE 23A

SITE 23B

SITE 28A (PERMIT MOD)

SITE 28 (PERMIT MOD)

SITE 28C (PERMIT MOD)

SITE 28B (PERMIT MOD)

PERMIT DRAWING MODIFICATION FOR SITE 23 AND 28

OCTOBER 1, 2019
PERMIT DRAWING SHEET 3 OF 10

MATCHLINE –Y4– STA. 43+65 SHEET 25

MATCHLINE –Y4– STA. 57+25 SHEET 27

DETAIL #16
EARTH BERM
(Not to Scale)
STA. 47+93 –Y4– LT

DETAIL #17
STANDARD 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. 44+68 TO 47+55 –Y4– LT

DETAIL #3
LATERAL BASE DITCH
(Not to Scale)
Min. D= 2 Ft.
B= 2 Ft.
b= 5 Ft.
FROM STA 53+85 TO 54+25 –Y4– LT
FROM STA 54+25 TO 54+50 –Y4– LT

DETAIL
FALSE SUMP
(Not to Scale)
S=Ditch Slope
Proposed Ditch

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. 46+63 –Y4–, STA. 50+14 –Y4–
STA. 52+63 –Y4–, STA. 56+37 –Y4–
STA. 57+43 –Y4–, STA. 60+79 –Y4–
STA. 63+91 –Y4–, STA. 67+22 –Y4–

DETAIL #6
TOE PROTECTION
(Not to Scale)
d= 2 Ft.
Type of Liner= Class 'B' Rip-Rap
FROM STA. 53+05 TO 53+85 –Y4– LT

DETAIL 18
RIP RAP AT EMBANKMENT
(Not to Scale)
Type of Liner= Class II Rip-Rap
STA. 56+50 –Y4– (RT)

DETAIL #7
STANDARD 'V' DITCH
(Not to Scale)
Min. D= 2 Ft.
FROM STA. 45+14 TO STA. 45+38 –Y4– LT

DETAIL
FALSE SUMP
(Not to Scale)
S=Ditch Slope
Proposed Ditch
STA. 52+65 –Y4– LT

DETAIL 27-3
STANDARD BASE DITCH
(Not to Scale)
Min. D= 1.5 Ft.
Max. d= 1.5 Ft.
B= 5 Ft.
Type of Liner= CLASS 'I' Rip-Rap
FROM STA. 56+00 TO STA. 57+27

PAVED SHOULDER

NOTE :
FOR –Y4EB– PROFILE SEE SHEET 50-51
FOR –Y4WB– PROFILE SEE SHEET 55-56

8/17/99

REVISIONS

PROJECT REFERENCE NO.	SHEET NO.
U-2579B	26
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

PERMIT DRAWING MODIFICATION FOR SITE 23 AND 28

OCTOBER 1, 2019
PERMIT DRAWING SHEET 4 OF 10

PERMIT DRAWING MODIFICATION LEGEND

- TS FS — DENOTES TEMPORARY IMPACTS IN SURFACE WATER
- S S — DENOTES IMPACTS IN SURFACE WATER (CULVERT IMPACTS)
- S S — DENOTES IMPACTS IN SURFACE WATER (STREAMBANK STABILIZATION)
- S S — DENOTES IMPACTS IN SURFACE WATER (FILL IN STREAM)
- P P — DENOTES IMPACTS IN SURFACE WATER (POND)

SITE 23 (PERMIT MOD)

SITE 23A

END U-2579B MODIFICATIONS
-Y4EB- POT Sta. 47+54.00 (36' LT)

INLET CHANNEL IMPROVEMENTS
CLASS II RIP RAP
EST. 90 TONS
EST. 60 SY GEO
SEE DETAIL SHEET 2D-7

RETAIN EXISTING SS MH AND USE CAUTION WHEN INSTALLING CHANNEL IMPROVEMENTS

PROPOSED 42" 3@8'x9' RCBC
UPSTREAM EXTENSION
SEE CULVERT PLANS C01-1 THRU C01-10

INLET CHANNEL IMPROVEMENTS
CLASS II RIP RAP
EST. 53 TONS
EST. 55 SY GEO
SEE DETAIL SHEET 2D-7

STANDARD 'V'
SEE DETAIL #7
EST. DDE 5CY

STANDARD BASE DITCH
SEE DETAIL#17
EST. DDE 233CY
CLASS 'I' RIP RAP
EST. 206 TONS
535 SY GEO

RETAIN

END SBG
-Y4EB- STA 46+00 LT

EARTH BERM
SEE DETAIL#16

2GI
15" RCP-IV
10' PS
5' PS
REMOVE 5' PS
FILL W/FLOWABLE MATERIAL
21'-8" PS
48" RCP-IV
15" CMP W/2 ELBOWS
JS W/MB COVER
PROPOSED 32' 3@8'x9' RCBC DOWNSTREAM EXTENSION
SEE CULVERT PLANS C01-1 THRU C01-10
BEGIN RETAINING WALL -Y4WB- STA 46+69.29 RT
SEE SHEET RTW-1 FOR WALL DETAILS
RETAIN EXISTING SS MH AND USE CAUTION WHEN INSTALLING CHANNEL IMPROVEMENTS
OUTLET CHANNEL IMPROVEMENTS
CLASS II RIP RAP
EST. 115 TONS
EST. 120 SY GEO
SEE DETAIL 2 SHEET 2D-7
TOE PROTECTION W/ CLASS B RIPRAP
EST 130 TONS
EST 265 SY GEO
SEE DETAIL#27

MATCHLINE -Y4- STA. 43+65 SHEET 25

MATCHLINE -Y4- STA. 57+25 SHEET 27

HAROLD DAVID HOPKINS
DB 3113 PG 1518

HAROLD DAVID HOPKINS, JR.
DB 3119 PG 1159

HAROLD D. CRANFILL
PATTIE CRANFILL
DB 1404 PG 661

JERRY M. PEGRAM
NANCY B. PEGRAM
DB 1864 PG 2389
DB 1950 PG 327

WHITE WALNUT, LLC
DB 2858 PG 0267
PB 42 PG 137

DONALD LEE ANGEL SR.
DB 5188 PG 81

SITE 23A
(SCALE: 1"=50')

DETAIL #16
EARTH BERM
(Not To Scale)
STA. 47+93 -Y4- LT

DETAIL #17
STANDARD BASE DITCH
(Not To Scale)
When B/s < 6:0
Type of Liner: Class 'I' Rip-Rap
FROM STA. 44+68 TO 47+85 -Y4- LT

DETAIL #3
LATERAL BASE DITCH
(Not To Scale)
Min. D= 2 Ft.
B= 2 Ft.
d= 5 Ft.
FROM STA. 53+85 TO 54+25 -Y4- LT
FROM STA. 54+25 TO 54+50 -Y4- LT

TOE PROTECTION W/ CLASS 'B' RIPRAP
EST. 14 TONS
EST 30 SY GEO
SEE DETAIL#6

CLASS 'B' RIP RAP
EST 2 TONS
EST. 7 SY GEO

LATERAL 2 BASE DITCH
SEE DETAIL#3

CLASS 'B' RIP RAP
EST 8 TONS
EST. 21 SY GEO

SAG
-Y4- STA. 54+47.45

2.73%
1.83%

ORIGINAL U-2579B IMPROVEMENTS

60' CHL
I-40 BUS WBL US 421 SBL 26' BST
N 85° 33' 45.8" W
PLUG
GRADE TO DRAIN
REMOVE EX DI
RETAIN
20' WELDED STEEL TRENCHLESS INSTALLATION
COLLAR
24" RCP-IV
18" RCP-IV
36" RCP-IV
15" RCP-IV
FILL W/FLOWABLE MATERIAL
STONE RET WALL
10' ACCESS ROAD
BEGIN DITCH -Y4EV- STA 544.3
BEGIN 10' ACCESS ROAD (CL ARC) -Y4WB- STA 544+50.00 (68' RT)
STANDARD 'I' BASE DITCH
SEE DETAIL#27-3
CLASS 'I' RIP RAP
EST. 72 TONS
EST 140 SY GEO
20' UTILITY SEWER EASEMENT PB 42 PG 137
SANITARY SEWER EASEMENT

DETAIL
FALSE SUMP
(Not to Scale)
S=Ditch Slope
℄ Proposed Ditch

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. 46+63 -Y4-, STA. 50+14 -Y4-
STA. 52+63 -Y4-, STA. 56+37 -Y4-
STA. 57+43 -Y4-, STA. 60+79 -Y4-
STA. 63+91 -Y4-, STA. 67+22 -Y4-

DETAIL #6
TOE PROTECTION
(Not to Scale)
Natural Ground
2:1 OR FLATTER
Fill Slope
Geotextile
d= 2 Ft.
Type of Liner= Class 'B' Rip-Rap
FROM STA. 53+05 TO 53+85 -Y4- LT

DETAIL 18
RIP RAP AT EMBANKMENT
(Not to Scale)
10' min
1.0' min
Ditch Grade
1.5'
GEOTEXTILE
Type of Liner= Class II Rip-Rap
STA. 56+50 -Y4- (RT)

DETAIL #7
STANDARD 'V' DITCH
(Not To Scale)
Natural Ground
Min. D= 2 Ft.
FROM STA. 45+14 TO STA. 45+38 -Y4- LT

DETAIL
FALSE SUMP
(Not to Scale)
Outside Ditch Wattle/Row
S=Ditch Slope
℄ Proposed Ditch
STA. 52+65 -Y4- LT

DETAIL 27-3
STANDARD BASE DITCH
(Not to Scale)
Natural Ground
Geotextile
When B/s < 6:0
Min. D= 1.5 Ft.
Max. d= 1.5 Ft.
B= 5 Ft.
Type of Liner= CLASS 'I' Rip-Rap
FROM STA. 56+00 TO STA. 57+27

SITE 23B

SITE 23 (PERMIT MOD)

SITE 28A (PERMIT MOD)

SITE 28 (PERMIT MOD)

SITE 28C (PERMIT MOD)

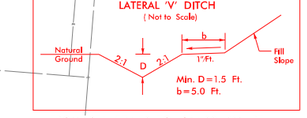
SITE 28B (PERMIT MOD)

PAVED SHOULDER

NOTE :
FOR -Y4EB- PROFILE SEE SHEET 50-51
FOR -Y4WB- PROFILE SEE SHEET 55-56

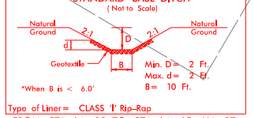
8/17/99

DETAIL 27–1
LATERAL 'V' DITCH
(Not to Scale)



FROM STA 57+50 TO 64+00 –Y4– RT

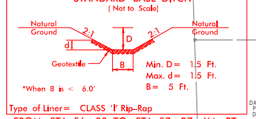
DETAIL 27–2
STANDARD BASE DITCH
(Not to Scale)



Type of Liner = CLASS 'I' Rip-Rap

FROM STA. 64+00 TO STA. 64+65 –Y4– RT

DETAIL 27–3
STANDARD BASE DITCH
(Not to Scale)



Type of Liner = CLASS 'I' Rip-Rap

FROM STA. 56+00 TO STA. 57+27 –Y4– RT

TS TS DENOTES TEMPORARY IMPACTS IN SURFACE WATER

F F DENOTES FILL IN WETLAND

S S DENOTES IMPACTS IN SURFACE WATER

SITE 28 (PERMIT MOD)

SITE 28C (PERMIT MOD)

SITE 28 (PERMIT MOD)

SITE 24A

SITE 24

SITE 30

SITE 25

MATCHLINE –Y4– STA.57+25 SHEET 26

MATCHLINE –Y4– STA.82+26 SHEET 16

MATCHLINE –Y4RPBD– STA.63+00 SHEET 16

MATCHLINE –Y4RPA– STA.26+93 SHEET 16

PERMIT DRAWING MODIFICATION LEGEND

- TS TS — DENOTES TEMPORARY IMPACTS IN SURFACE WATER
- S S — DENOTES IMPACTS IN SURFACE WATER (CULVERT IMPACTS)
- S S — DENOTES IMPACTS IN SURFACE WATER (STREAMBANK STABILIZATION)
- S S — DENOTES IMPACTS IN SURFACE WATER (FILL IN STREAM)
- P P — DENOTES IMPACTS IN SURFACE WATER (POND)

PROJECT REFERENCE NO.	SHEET NO.
U–2579B	27
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

50' 25' 0 50' 100'

–Y4RPBD

PIs Sta 33+05.42	PI Sta 61+52.40	PIs Sta 64+51.51
θs = 5° 17' 10.4"	Δ = 128° 59' 24.8" (LT)	θs = 5° 17' 10.4"
Ls = 240.00'	D = 4° 18' 28.8"	Ls = 240.00'
LT = 160.01'	L = 2,986.50'	LT = 160.01'
ST = 80.06'	T = 2,767.05'	ST = 80.06'
	R = 1,330.00'	
	SE = 0.06	

–Y4RPBD

PIs Sta 75+65.20	PI Sta 80+01.76	PIs Sta 84+71.19
θs = 2° 27' 32.8"	Δ = 19° 03' 00.0" (RT)	θs = 2° 27' 32.6"
Ls = 200.00'	D = 2° 27' 32.6"	Ls = 200.00'
LT = 133.35'	L = 772.66'	LT = 133.35'
ST = 66.68'	T = 389.59'	ST = 66.68'
	R = 2,330.00'	
	SE = 0.05	

–Y4RPA

PIs Sta 11+33.35	PI Sta 28+47.56	PIs Sta 40+08.43
θs = 2° 59' 59.2"	Δ = 82° 14' 46.6" (LT)	θs = 2° 59' 59.2"
Ls = 200.00'	D = 2° 59' 59.2"	Ls = 200.00'
LT = 133.35'	L = 274.74'	LT = 133.35'
ST = 66.68'	T = 166.56'	ST = 66.68'
	R = 1,900.00'	
	SE = 0.06	

–Y5DET

PI Sta 11+39.44
Δ = 14° 34' 40.5" (RT)
D = 5° 15' 23.4"
L = 277.37'
T = 139.44'
R = 1,090.00'

OCTOBER 1, 2019
PERMIT DRAWING
SHEET 5 OF 10

PERMIT DRAWING MODIFICATION FOR SITE 23 AND 28

PAVED SHOULDER

PAVEMENT TO BE OBLITERATED

NOTE :
FOR –Y4EB– PROFILE, SEE SHEET 51-52
FOR –Y4WB– PROFILE, SEE SHEET 56-57
FOR –Y4RPA– PROFILE, SEE SHEET 70
FOR –Y4RPBD– PROFILE, SEE SHEET 75-77
FOR –Y4RPD– PROFILE, SEE SHEET 81
FOR –Y5– PROFILE, SEE SHEET 82
FOR –Y5DET– SEE SHEET 28-1

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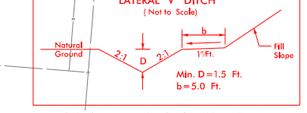
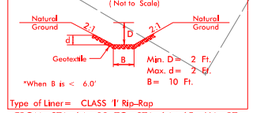
8/17/99

DETAIL 27–1
LATERAL 'V' DITCH
(Not to Scale)



FROM STA 57+50 TO 64+00 –Y4– RT

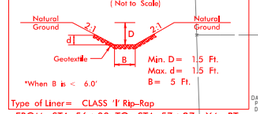
DETAIL 27–2
STANDARD BASE DITCH
(Not to Scale)



Type of Liner = CLASS 'I' Rip-Rap

FROM STA. 64+00 TO STA. 64+65 –Y4– RT

DETAIL 27–3
STANDARD BASE DITCH
(Not to Scale)



Type of Liner = CLASS 'I' Rip-Rap

FROM STA. 56+00 TO STA. 57+27 –Y4– RT

TS TS DENOTES TEMPORARY IMPACTS IN SURFACE WATER

F F DENOTES FILL IN WETLAND

S S DENOTES IMPACTS IN SURFACE WATER

SITE 28 (PERMIT MOD)

SITE 28C (PERMIT MOD)

SITE 28 (PERMIT MOD)

SITE 2AA

SITE 24

SITE 25

SITE 30

-Y4RPBD- CS Sta.841045.91

-Y4RPBD- ST Sta.861045.91

-Y4EB- POT Sta.60+53.98 (24' LT)

-Y4RPA- ST Sta.414474

-Y4WB- POT Sta.68+87.75 (24' RT)

END U-2579B MODIFICATIONS
-Y4WB- POT Sta.69+50.00 (36.9' RT)
-Y4RPA- POS Sta.40+73.41 (12' LT)

MATCHLINE -Y4- STA.57+25 SHEET 26

MATCHLINE -Y4- STA.82+26 SHEET 16

MATCHLINE -Y4RPA- STA.26+93 SHEET 16

MATCHLINE -Y4- STA.63+00 SHEET 16

PERMIT DRAWING MODIFICATION LEGEND

- TS TS — DENOTES TEMPORARY IMPACTS IN SURFACE WATER
- S S — DENOTES IMPACTS IN SURFACE WATER (CULVERT IMPACTS)
- S S — DENOTES IMPACTS IN SURFACE WATER (STREAMBANK STABILIZATION)
- S S — DENOTES IMPACTS IN SURFACE WATER (FILL IN STREAM)
- P P — DENOTES IMPACTS IN SURFACE WATER (POND)

PROJECT REFERENCE NO.	SHEET NO.
U–2579B	27
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

50' 25' 0 50' 100'

Y4RPBD
Pis Sta 33+05.42
Θs = 5° 17' 10.4"
Ls = 240.00'
LT = 160.01'
ST = 80.06'

Pi Sta 61+52.40
Δ = 128° 59' 24.8" (LT)
D = 4° 18' 28.8"
L = 2,986.10'
T = 2,767.05'
R = 1,330.00'
SE = 0.06

Pis Sta 64+51.51
Θs = 5° 17' 10.4"
Ls = 240.00'
LT = 160.01'
ST = 80.06'

Y4RPBD
Pis Sta 75+65.20
Θs = 2° 27' 32.6"
Ls = 200.00'
LT = 133.35'
ST = 66.68'

Pi Sta 80+01.76
Δ = 19° 03' 00.0" (RT)
D = 2° 27' 32.6"
L = 772.66'
T = 389.59'
R = 2,330.00'
SE = 0.05

Pis Sta 84+71.19
Θs = 2° 27' 32.6"
Ls = 200.00'
LT = 133.35'
ST = 66.68'

Y4RPA
Pis Sta 11+33.35
Θs = 2° 59' 59.2"
Ls = 200.00'
LT = 133.35'
ST = 66.68'

Pi Sta 28+67.56
Δ = 82° 14' 46.6" (LT)
D = 2° 59' 59.2"
L = 274.74'
T = 166'.56'
R = 1,900.00'
SE = 0.06

Pis Sta 40+08.43
Θs = 2° 59' 59.2"
Ls = 200.00'
LT = 133.35'
ST = 66.68'

Y5DET
Pi Sta 11+39.44
Δ = 14° 34' 40.5" (RT)
D = 5° 15' 23.4"
L = 277.37'
T = 139.44'
R = 1,090.00'

OCTOBER 1, 2019
PERMIT DRAWING
SHEET 6 OF 10

PERMIT DRAWING MODIFICATION FOR SITE 23 AND 28

PAVED SHOULDER

PAVEMENT TO BE OBLITERATED

NOTE :
FOR -Y4EB- PROFILE, SEE SHEET 51-52
FOR -Y4WB- PROFILE, SEE SHEET 56-57
FOR -Y4RPA- PROFILE, SEE SHEET 70
FOR -Y4RPBD- PROFILE, SEE SHEET 75-77
FOR -Y4RPD- PROFILE, SEE SHEET 81
FOR -Y5- PROFILE, SEE SHEET 82
FOR -Y5DET- SEE SHEET 28-7

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8/17/99

REVISIONS

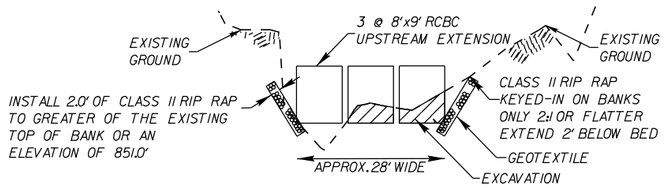
PROJECT REFERENCE NO.	SHEET NO.
U-2579B	2D-7

HYDRAULICS ENGINEER

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

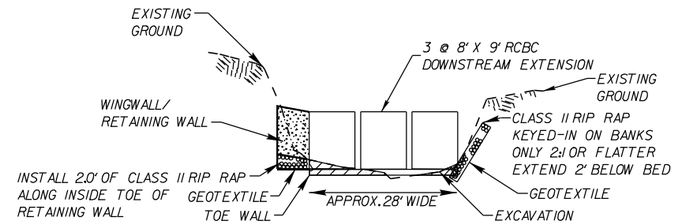
OCTOBER 1, 2019
PERMIT DRAWING
SHEET 7 OF 10

DETAIL #1
INLET CHANNEL IMPROVEMENTS



STA. 44+70 –Y4– LT

DETAIL #2
OUTLET CHANNEL IMPROVEMENTS



STA. 46+50 –Y4– RT

WETLAND PERMIT IMPACT 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)	Temporary SW impacts (ac)	Existing Channel Impacts Permanent (ft)	Existing Channel Impacts Temp. (ft)	Natural Stream Design (ft)
1	28+00 -Y-	ROAD FILL	0.03		<0.01	0.02		0.02		142		
2	16+00 -Y1 RPD-	ROAD FILL - INTERMITTENT						0.01		109		
		ROAD FILL - PERENNIAL						0.02		208		
		STREAMBANK STABILIZATION						<0.01	<0.01	10	37	
3	21+56-25+22 -Y1-	2 @ 7' x 6' RCBC						0.06	<0.01	438	33	
3A	17+36-21+53 -Y1-	DETOUR - ROAD FILL							0.08		545	
3B	20+55-21+32 -Y1-	DETOUR - ROAD FILL							0.03		194	
4	501+51-503+21 -L-	ROAD FILL						0.03	<0.01	493	18	
		STREAMBANK STABILIZATION						<0.01	<0.01	9	31	
5	503+85-507+80 -L-	ROAD FILL						0.05	<0.01	740	22	
5A	507+39-509+64 -L-	ROAD FILL						0.01		306		
6	523+00 -L-	ROAD FILL	0.03			<0.01		0.02	<0.01	312	42	
7	527+00 -L-	ROAD FILL	0.52			0.01						
		ROAD FILL - POND						0.59				
8	559-75 -L-	2 @ 10' x 6' RCBC						0.06	<0.01	442	53	
		STREAMBANK STABILIZATION						<0.01	<0.01	58	44	
9	560+75 -L-	ROAD FILL	0.03			0.01						
10	560+50-568+74 -L-	ROAD FILL	0.01					0.07	<0.01	783	22	
10A	566+84-572+75 -L-	ROAD FILL						0.05		684		
11	615+00 -L-	3 @ 10' x 9' RCBC						0.43	0.02	808	57	
11A	19+76-21+44 -Y4RPBD-	CHANNEL CHANGE						0.08	0.01	223	41	
12	15+84-18+86 -Y4RPBD-	CHANNEL CHANGE						0.01	0.02	88	205	
TOTALS:			0.62	0.00	< 0.01	0.05		1.53	0.19	5,853	1,344	

NC DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS

U-2579 B Forsyth County
Winston Salem Northern Beltway
(Eastern Section) (Future I-74)

SHEET 62 of 64

OCTOBER 1, 2019
PERMIT DRAWING
SHEET 8 OF 10

WETLAND PERMIT IMPACT 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)	Temporary SW impacts (ac)	Existing Channel Impacts Permanent (ft)	Existing Channel Impacts Temp. (ft)	Natural Stream Design (ft)
13	20+00-21+40 -Y4RPBD-	ROAD FILL	0.33									
14	629+95-635+90 -L-	ROAD FILL	0.04					0.05		688		
15	636+32-641+55 -L-	ROAD FILL	0.18					0.04		332		
		ROAD FILL-POND						2.38				
15A	644+00-645+00 -L-	ROAD FILL						<0.01		108		
16	643+56-644+61 -L-	ROAD FILL						<0.01		104		
		ROAD FILL-POND						0.16				
17	663+65-667+00 -L-	ROAD FILL	0.09			<0.01		0.06		928		
18	667+15 -L-	3 @ 12' x 10' RCBC						0.06	0.02	377	67	
		STREAMBANK STABILIZATION						0.02	0.01	80	59	
19	668+50 -L-	ROAD FILL	0.47			0.01						
20	687+80-691+59 -L-	ROAD FILL						0.03		163		
		ROAD FILL-POND						0.85				450
21	22+50 -Y1-	ROAD FILL	0.02									
22	40+50 -Y4-	OUTLET PAD	0.01									
~~23~~	~~45+65 -Y4-~~	~~CULVERT EXTENSION~~						~~0.06~~	~~0.01~~	~~100~~	~~32~~	
		~~STREAMBANK STABILIZATION~~						~~0.02~~	~~0.06~~	~~54~~	~~89~~	
23A	44+95-45+18 -Y4-	ROAD FILL						<0.01		57		
23B	45+07-46+34 -Y4-	ROAD FILL						0.01		135		
24	80+73-81+57 -Y4RPBD-	ROAD FILL						0.02		202		
24A	80+50-81+51 -Y4RPBD-	ROAD FILL	0.06									
25	37+31 -Y4RPA-	30" RCP						<0.01		73		
		STREAMBANK STABILIZATION						<0.01	<0.01	21	16	
TOTALS:			1.20			0.02		3.67	0.03	3,268	142	450

11/19/2018 Revisions shown in red text.

NC DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS

U-2579 B Forsyth County
Winston Salem Northern Beltway
(Eastern Section) (Future I-74)

SHEET 63 of 64

OCTOBER 1, 2019
PERMIT DRAWING
SHEET 9 OF 10

WETLAND PERMIT IMPACT SUMMARY

Site No.	Station (From/To)	Structure Size / Type	WETLAND IMPACTS: Permanent Fill In Wetlands (ac)	Temp Fill In Wetlands (ac)	Excavation in Wetlands (ac)	Mechanized Clearing in Wetlands (ac)	Hand Clearing in wetlands (ac)	SURFACE WATER IMPACTS: Permanent SW impacts (ac)	Temporary SW impacts (ac)	Existing Channel Impacts Permanent (ft)	Existing Channel Impacts Temp. (ft)	Natural Stream Design (ft)
26	29+16-31+12 -Y4RPC-	ROAD FILL-POND						0.38				
27A	104+63 - 107+53 -Y4-	ROAD FILL						0.02		205		
27B	107+60 -Y4-	42" WELDED STEEL	0.05					0.01	<0.01	130	14	
27C	107+58 - 108+44 -Y4-	30" RCP						<0.01		116		
~~28~~	~~50+50 - 56+00 -Y4- Rt~~	~~STREAMBANK STABILIZATION~~						~~0.02~~	~~0.15~~	~~365~~	~~188~~	
29	145+62 -Y4-	ROAD FILL				<0.01						
30	64+34 -Y4-	STREAMBANK STABILIZATION						<0.01		28		
31	557+28 -L-	STREAMBANK STABILIZATION						<0.01		21		
	2018 Permit Modifications											
23	44+10 to 47+96 -Y4-	**3 @ 8' x 9' RCBC Extension**						**0.06**		**151**		
		STREAMBANK STABILIZATION						**0.02**	**0.01**	**55**	**30**	
28	47+96 to 56+85 -Y4-	**2 @ 10' x 10' RCBC and 1 @ 10' x 8' RCBC**						**0.51**		**2309**	~~127~~	**2127**
		STREAMBANK STABILIZATION						**0.02**		**120**		
28A	**48+16 to 48+65 Y4**	**UT to Smith Creek Relocation**						**0.01**		**80**		**344**
28B	**48+84 to 53+86 Y4**	**UT to Smith Creek Relocation**						**1.62**				
28C	**54+20 to 67+00 Y4**	**Drain Pond**						**6.20**				
	2019 Permit Modifications											
8A		**STREAM RELOCATION**								**144**	**40**	
SUBTOTALS, THIS PAGE:			0.05			<0.01		**8.86**	**0.01**	**3,359**	**84**	**2471**
SUBTOTALS, PAGE 1			0.62		<0.01	0.05		**1.53**	**0.19**	**5,853**	**1,344**	
SUBTOTALS, PAGE 2			1.20			0.02		**3.67**	**0.03**	**3,268**	**142**	450
TOTALS:			1.87		<0.01	0.08		**14.06**	**0.23**	**12,480**	**1,570**	**2,921**

11/19/2018 Revisions shown in red text.

10/10/2019 Revisions shown in green text.

9/18/2019 Revisions shown in blue text

NC DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS

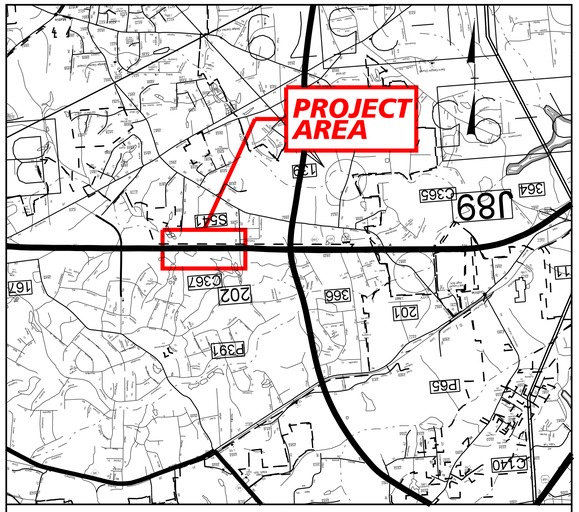
U-2579 B Forsyth County
Winston Salem Northern Beltway
(Eastern Section) (Future I-74)

09/08/99

TIP PROJECT: U-2579B

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	U-2579B	1	

STATE PROJ. NO.	F. A. PROJ. NO.	DESCRIPTION



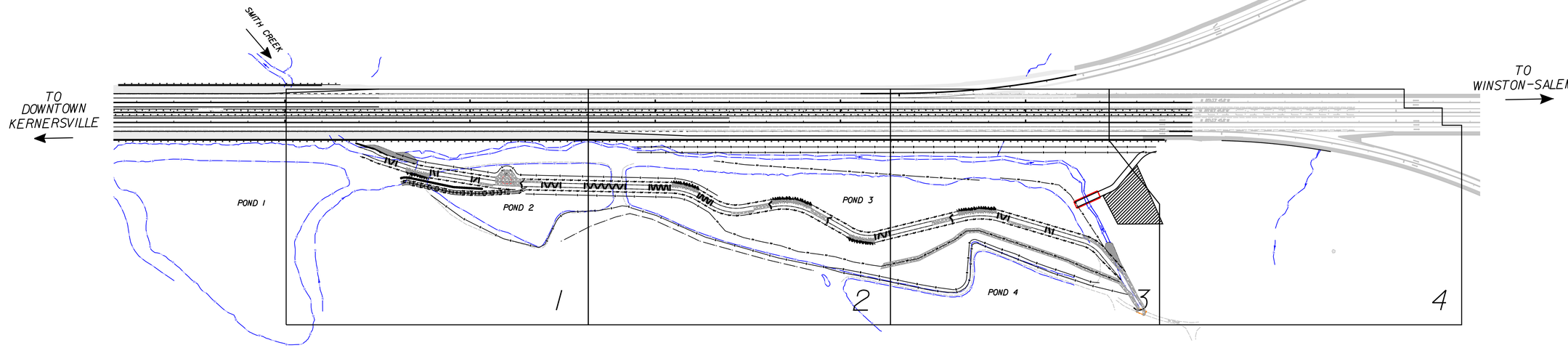
STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS

FORSYTH COUNTY

U-2579B STREAM RELOCATION AND DRAINAGE IMPROVEMENTS

60% PLANS
OCTOBER 4, 2019

NC GRID
NAD 8395



INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

GRAPHIC SCALES

PLANS: 30 15 0 30 60

PROFILE (HORIZONTAL): 50 25 0 50 100

PROFILE (VERTICAL): 5 2.5 0 5 10

10/4/2019

DESIGN DATA

PROJECT LENGTH

PLANS PREPARED FOR THE NCDOT BY:

Kimley»Horn ©2018

NC LICENSE #P-0102
FAYETTEVILLE STREET, SUITE 600
RALEIGH, NORTH CAROLINA 27601
PHONE: (919) 677-2000

2018 STANDARD SPECIFICATIONS

RIGHT OF WAY DATE:

LETTING DATE:

PROJECT ENGINEER

PROJECT DESIGN ENGINEER

PROJECT TEAM LEADER NCDOT DIVISION 9

HYDRAULICS ENGINEER

P.E.

SIGNATURE:

ROADWAY DESIGN ENGINEER

P.E.

SIGNATURE:

STATE OF NORTH CAROLINA • DEPARTMENT OF TRANSPORTATION •

5/14/99

LEGEND	
——·——·——	CHANNEL TOE
——BKF——	BANKFULL
—— FP ——	FLOODPLAIN BENCH
——G——	GRADING LIMITS
——B——	TOP OF BERM

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RALEIGH, NC 27601

RIGHT-OF-WAY REV.

CONST. REV.

PROJECT REFERENCE NO.	SHEET NO.
U-2579B	TYP-1
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

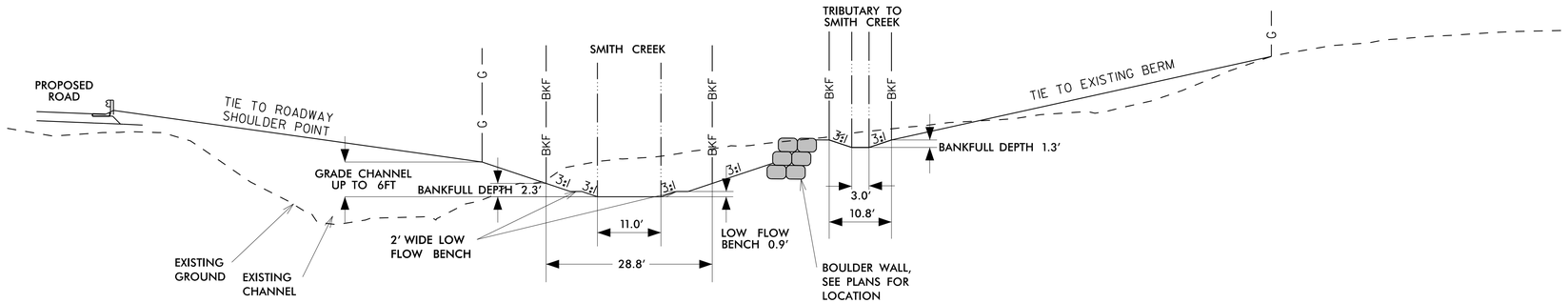
TYPICAL SECTION NO. 1

DRAWING NOT TO SCALE

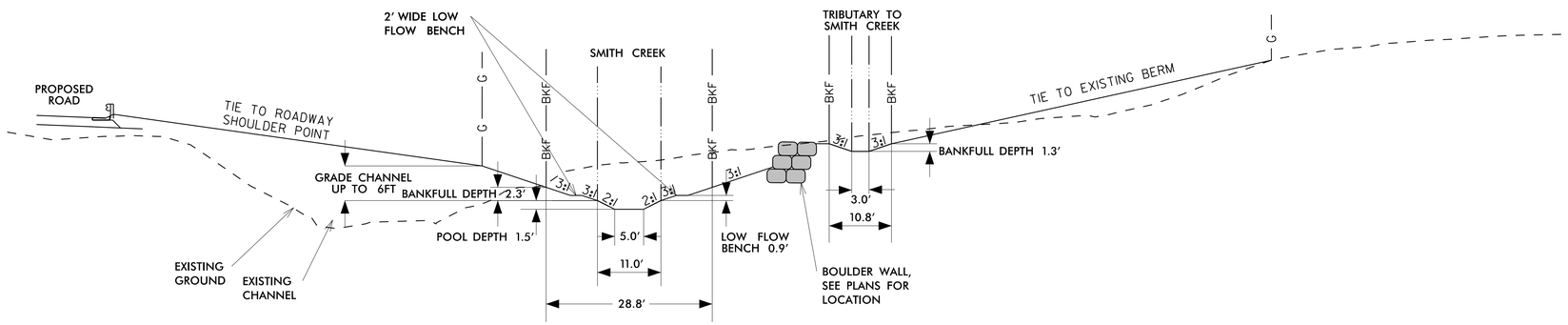
STA 10+00 TO 14+55

SEE PROFILE FOR RIFFLE AND POOL LOCATIONS

RIFFLE



POOL



5/14/99

LEGEND	
——·——·——	CHANNEL TOE
——BKF——	BANKFULL
—— FP ——	FLOODPLAIN BENCH
——G——	GRADING LIMITS
——B——	TOP OF BERM

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RIGHT-OF-WAY REV.

CONST. REV.

PROJECT REFERENCE NO.	SHEET NO.
U-2579B	TYP-2
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

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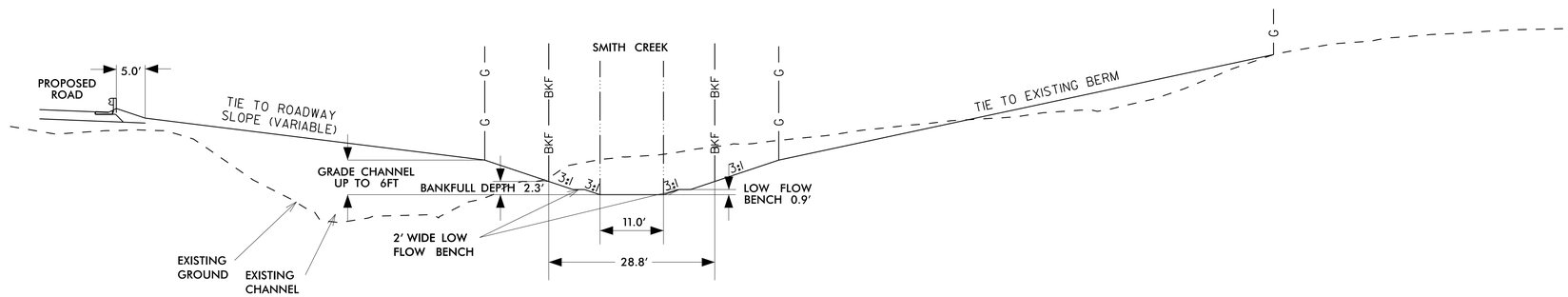
TYPICAL SECTION NO. 2

DRAWING NOT TO SCALE

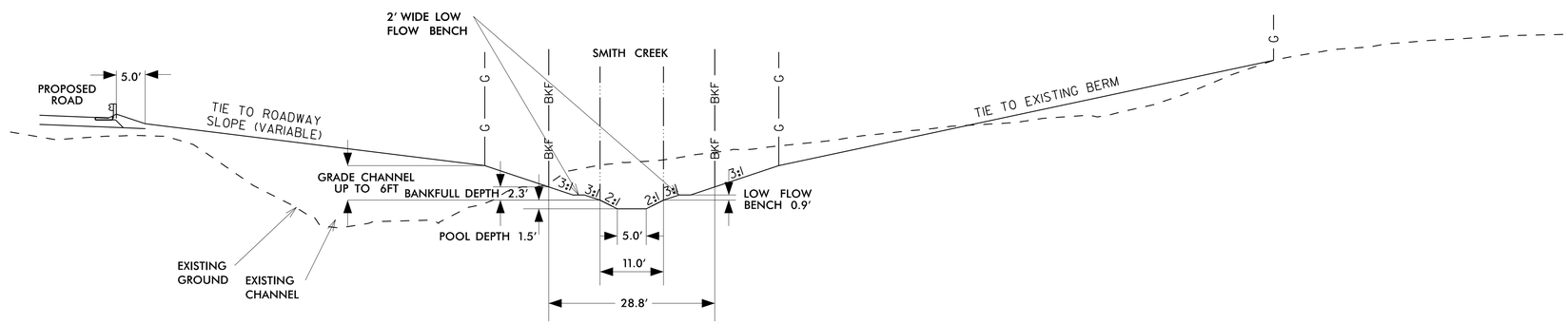
STA 14+00 TO 18+52

SEE PROFILE FOR RIFFLE AND POOL LOCATIONS

RIFFLE



POOL



5/14/99

LEGEND	
——·——·——	CHANNEL TOE
——BKF——	BANKFULL
—— FP ——	FLOODPLAIN BENCH
——G——	GRADING LIMITS
——B——	TOP OF BERM

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RIGHT-OF-WAY REV.
CONST. REV.

PROJECT REFERENCE NO.	SHEET NO.
U-2579B	TYP-3
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

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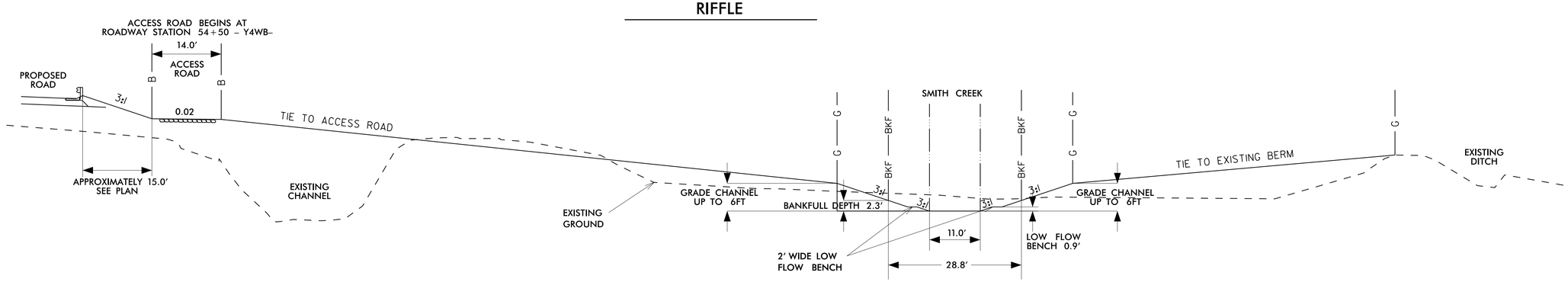
TYPICAL SECTION NO. 3

DRAWING NOT TO SCALE

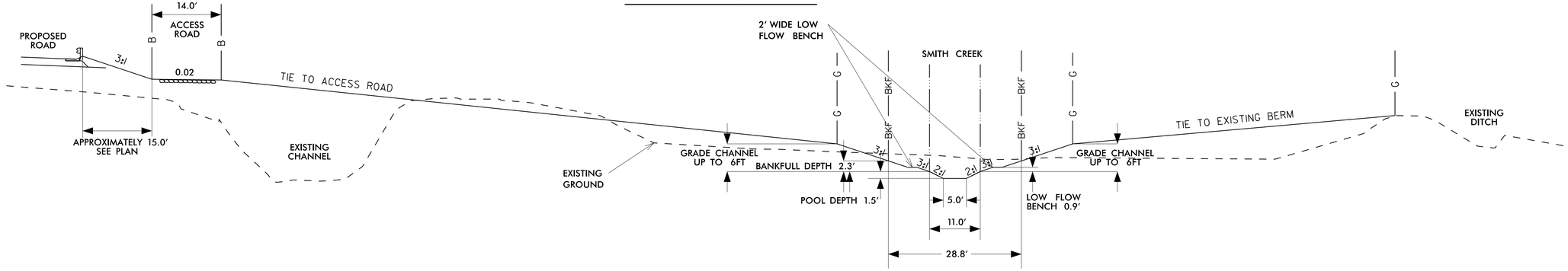
STA 18+52 TO 19+55

SEE PROFILE FOR RIFFLE AND POOL LOCATIONS

RIFFLE



POOL



5/14/99

LEGEND	
——·——·——	CHANNEL TOE
——BKF——	BANKFULL
—— FP ——	FLOODPLAIN BENCH
——G——	GRADING LIMITS
——B——	TOP OF BERM

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RIGHT-OF-WAY REV.

CONST. REV.

PROJECT REFERENCE NO.	SHEET NO.
U-2579B	TYP-4
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

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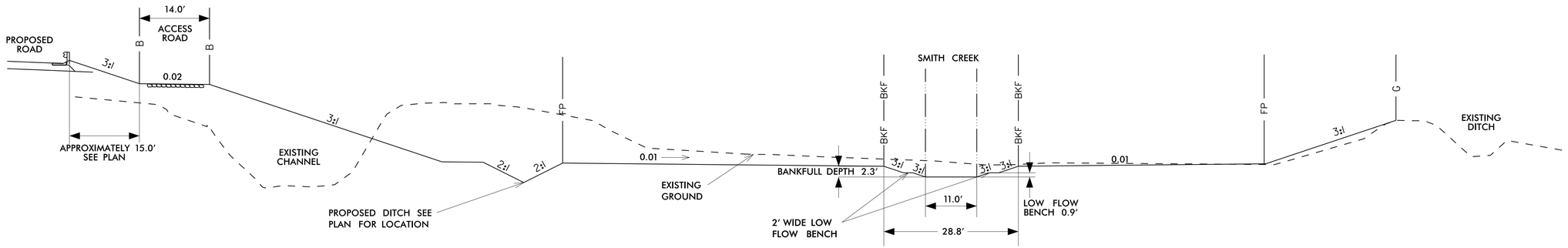
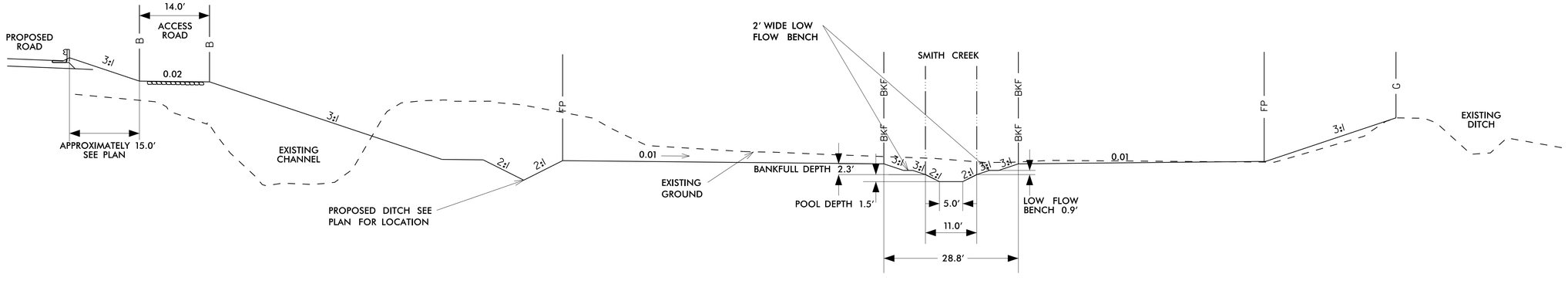
TYPICAL SECTION NO. 4

DRAWING NOT TO SCALE

STA 19+55 TO 23+40

SEE PROFILE FOR RIFFLE AND POOL LOCATIONS





5/14/99

LEGEND	
—·—·—	CHANNEL TOE
—BKF—	BANKFULL
— FP —	FLOODPLAIN BENCH
—G—	GRADING LIMITS
—B—	TOP OF BERM

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RIGHT-OF-WAY REV.

CONST. REV.

PROJECT REFERENCE NO.	SHEET NO.
U-2579B	TYP-25
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

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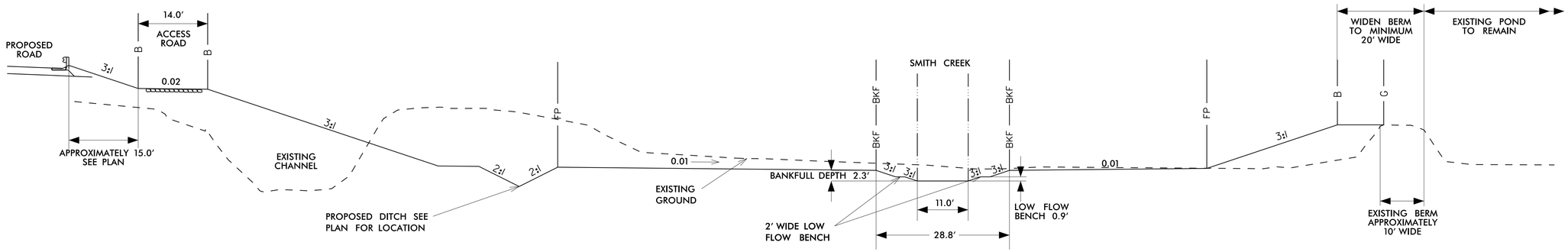
TYPICAL SECTION NO. 5

DRAWING NOT TO SCALE

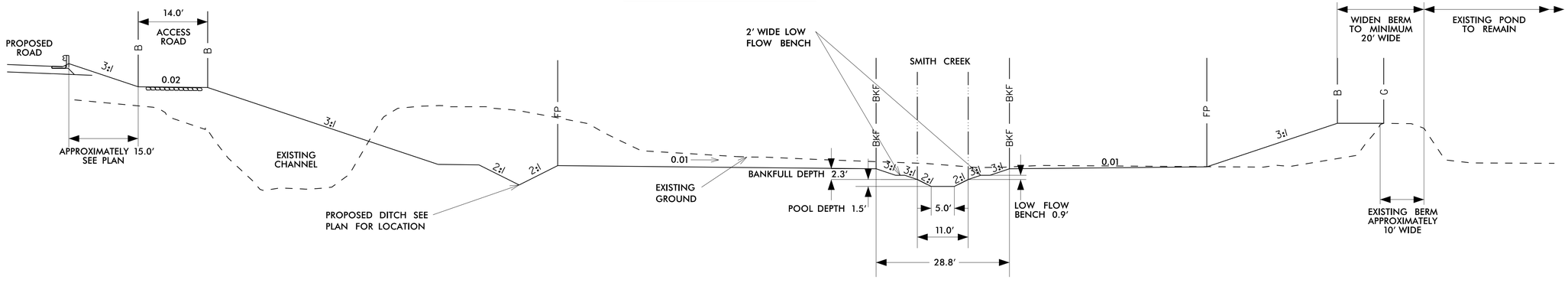
STA 23+44 TO 31+43

SEE PROFILE FOR RIFFLE AND POOL LOCATIONS

RIFFLE



POOL



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RIGHT-OF-WAY REV.

CONST. REV.

PROJECT REFERENCE NO.	SHEET NO.
U-2579B	2D-1
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	PAVEMENT DESIGN ENGINEER

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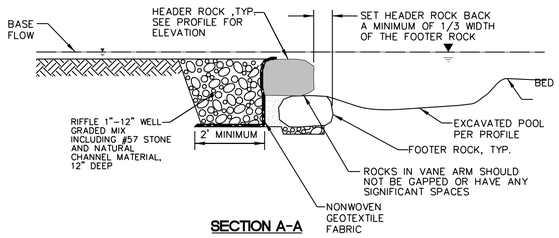
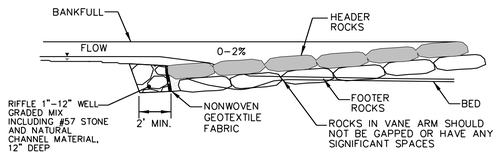
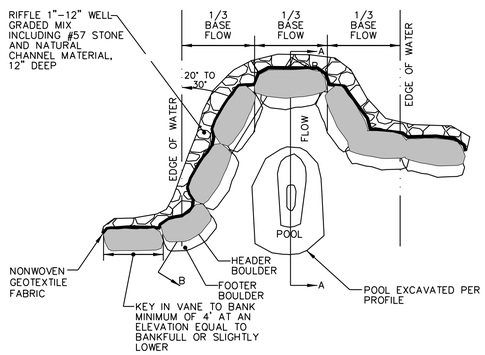


SECTION A-A



SECTION B-B

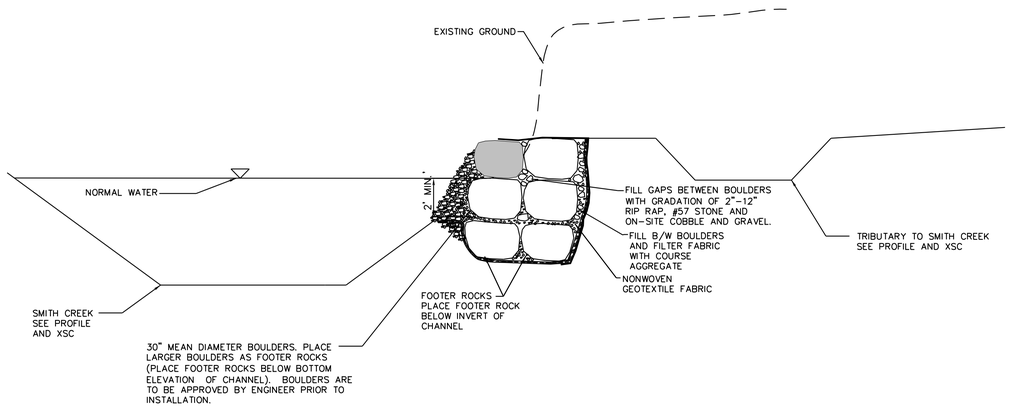
NOTES:
1. DEEPEST PART OF POOL TO BE IN LINE WITH WHERE VANE ARM TIES INTO THE BANK.
2. POOL DEPTH SHOULD BE ACCORDING PROFILE.
3. BOULDERS SHALL HAVE A MEAN DIAMETER OF 30"



PLAN VIEW

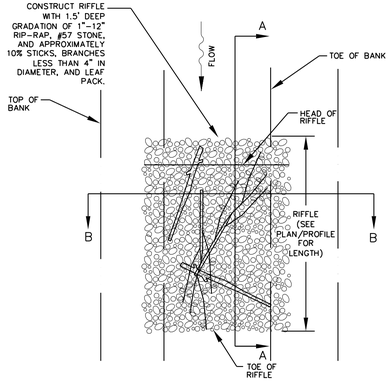
J-HOOK VANE DETAIL

NOT TO SCALE

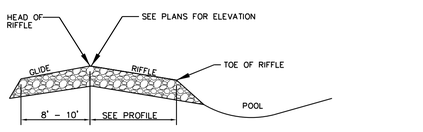


BOULDER WALL PROTECTION

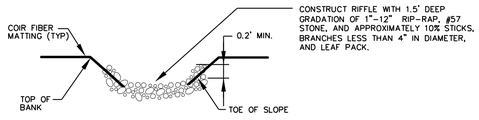
NOT TO SCALE



PLAN VIEW



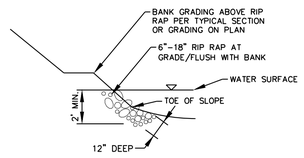
SECTION A-A



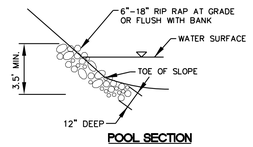
SECTION B-B

CONSTRUCTED RIFFLE

NOT TO SCALE



RIFFLE SECTION



POOL SECTION

ROCK TOE PROTECTION

NOT TO SCALE

10/4/2019
U-2579B_stream_dtl.dgn

5/14/99

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RIGHT-OF-WAY REV.

CONST. REV.

PROJECT REFERENCE NO.	SHEET NO.
U-2579B	2D-2
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	PAVEMENT DESIGN ENGINEER

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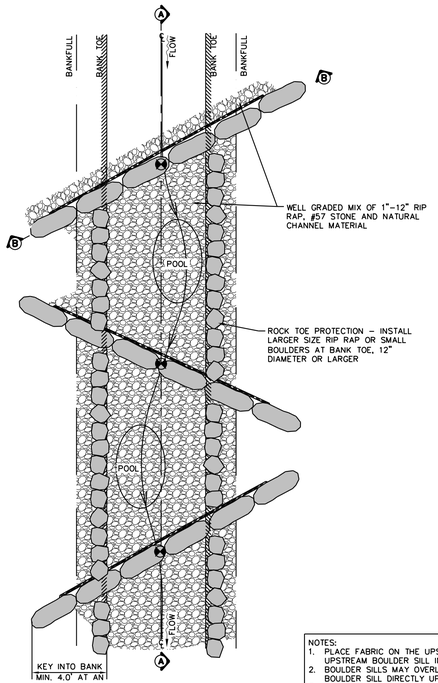
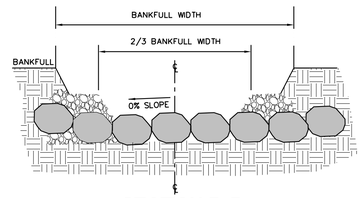
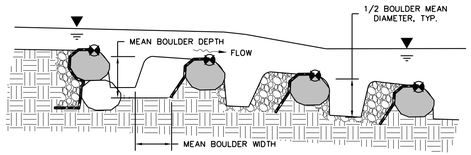


PLAN VIEW



SECTION B-B

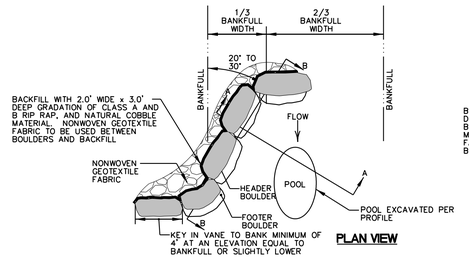


SECTION A-A

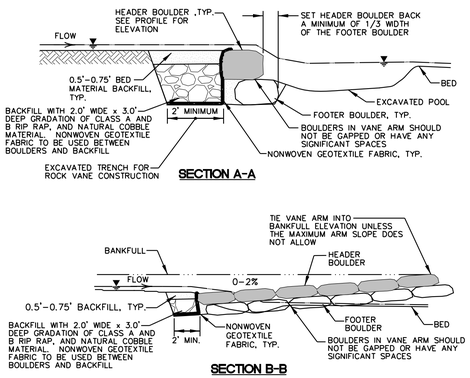
NOTES:
1. PLACE FABRIC ON THE UPSTREAM SIDE OF THE MOST UPSTREAM BOULDER SILL IN THE CONSTRUCTED RIFFLE.
2. BOULDER SILLS MAY OVERLAP AND ANCHOR THE BOULDER SILL DIRECTLY UPSTREAM.
3. THE BOULDER SILL SHALL ALL BE CONSTRUCTED TO BE SUBMERGED OR COVERED AT LOW FLOWS.
4. BOULDERS HALL HAVE A MEAN DIAMETER OF 30".
5. BACKFILL MATERIAL TO BE 70% 2"-12" RIP RAP, 10% NATURAL CHANNEL MATERIAL, 10% NCDOT NO. 57 STONE, AND 10% HARDWOOD MULCH (ALL % BY VOLUME).

BOULDER ROCK AND ROLL RIFFLE

NOT TO SCALE



PLAN VIEW



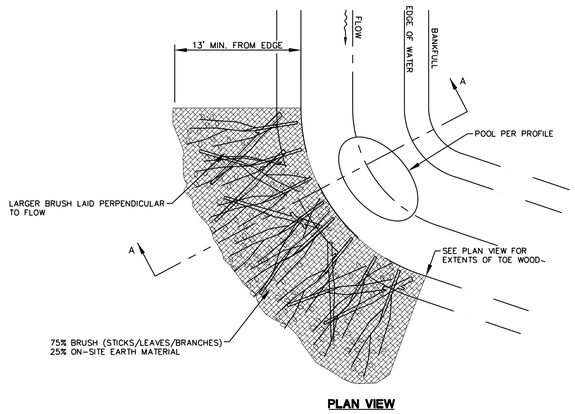
SECTION A-A

SECTION B-B

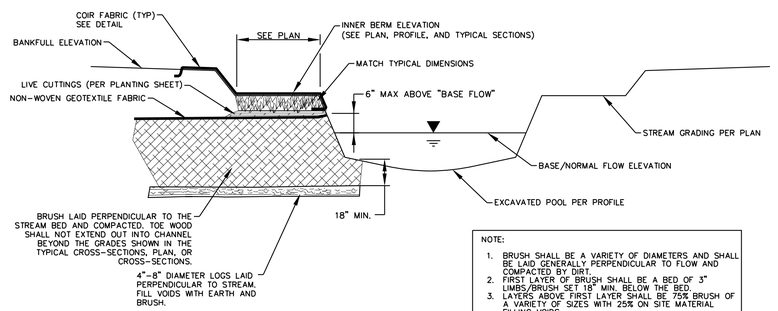
NOTES:
1. DEEPEST PART OF POOL TO BE IN LINE WITH WHERE VANE ARM TIES INTO BANKFULL.
2. DO NOT EXCAVATE POOL TOO CLOSE TO FOOTER ROCK.
3. CLASS "A" STONE CAN BE USED TO REDUCE VOIDS BETWEEN HEADERS AND FOOTERS. BOULDERS SHOULD NOT HAVE GAPS.
4. COMPACT BANKFULL TO EXTENT POSSIBLE OR AT THE DIRECTION OF THE ENGINEER.
5. POOL DEPTH SHOULD BE ACCORDING TO PROFILE.
6. BOULDERS SHALL HAVE A MEAN DIAMETER OF 30".

ROCK VANE DETAIL

NOT TO SCALE



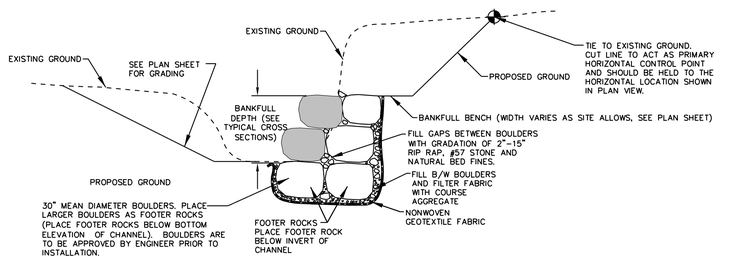
PLAN VIEW



NOTE:
1. BRUSH SHALL BE A VARIETY OF DIAMETERS AND SHALL BE LAID GENERALLY PERPENDICULAR TO FLOW AND COMPACTED BY DIRT.
2. FIRST LAYER OF BRUSH SHALL BE A BED OF 3" LIMBS/BRUSH SET 18" MIN. BELOW THE BED.
3. LAYERS ABOVE FIRST LAYER SHALL BE 75% BRUSH OF A VARIETY OF SIZES WITH 25% ON SITE MATERIAL FILLING VOIDS.
4. BRUSH BROUGHT UP IN LIFTS.
5. GRADING ABOVE THE TOE WOOD PER THE TYPICAL SECTION AND/OR GRADING PLAN.

TOE WOOD PROTECTION

NOT TO SCALE



BOULDER TOE PROTECTION

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PROJECT REFERENCE NO.	SHEET NO.
U-2579B	2D-3
R/W SHEET NO.	
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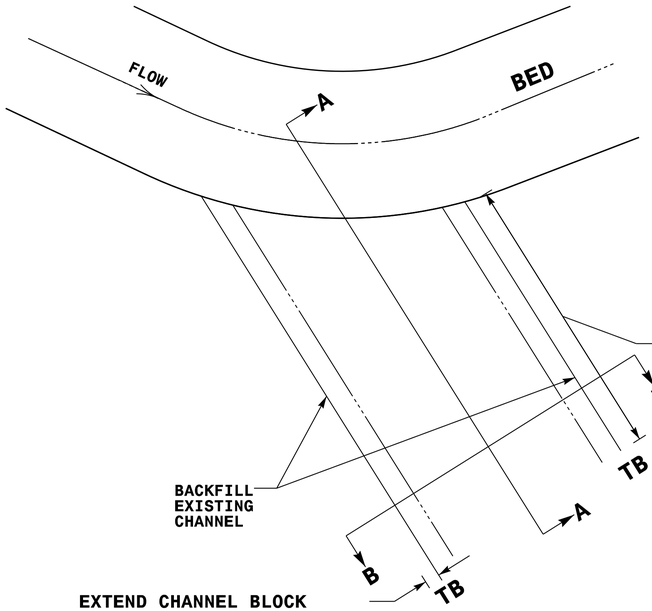
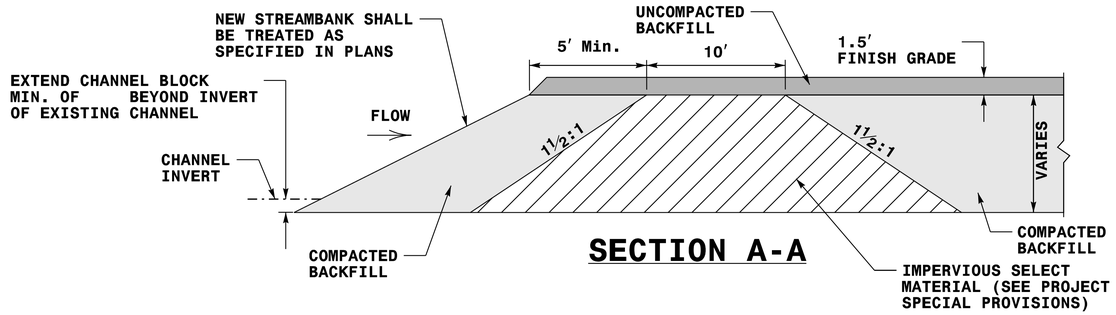
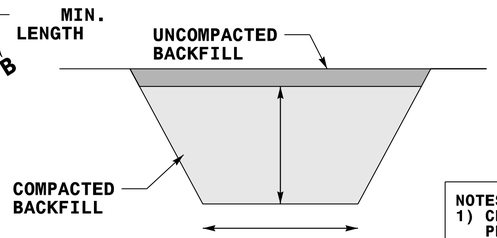


PLAN VIEW



SECTION A-A

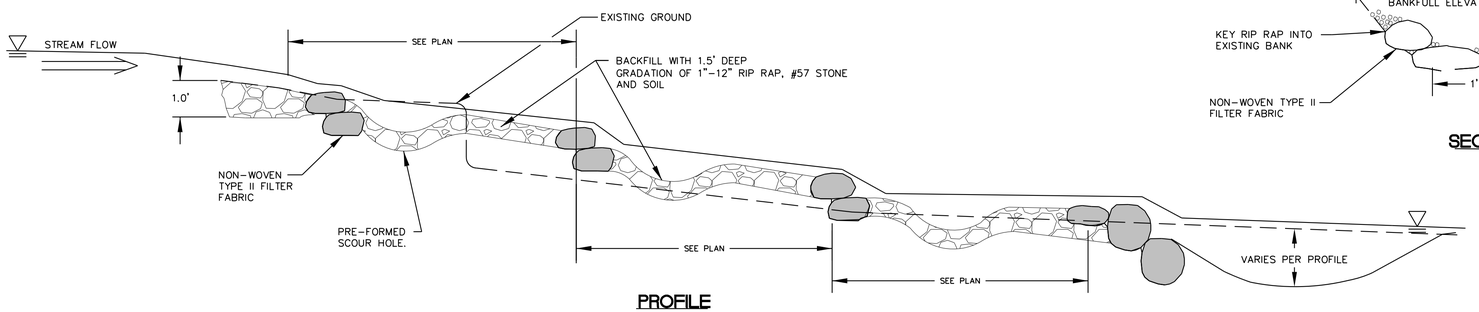


SECTION B-B

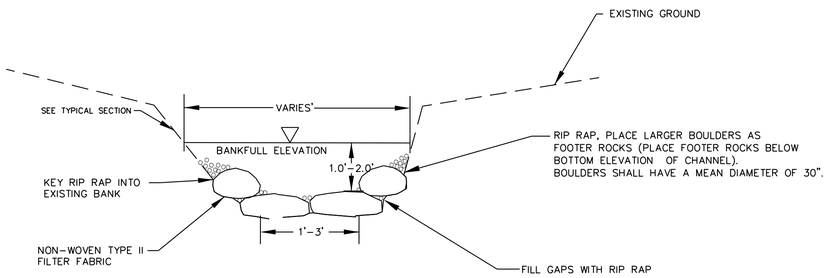
STREAM PLUG

NOT TO SCALE

NOTES:
1) CHANNEL BLOCK SHALL BE INSTALLED IN ACCORDANCE WITH THE PROJECT SPECIFICATIONS.
2) BLOCK SHOULD BE INSTALLED AT THE INTERFACE BETWEEN EXISTING CHANNEL AND PROPOSED CHANNEL.
3) BOTTOM OF BLOCK SHOULD BE A MINIMUM OF 2' BELOW THE INVERT OF THE EXISTING CHANNEL.
4) BLOCK SHOULD EXTEND A MINIMUM OF 2' 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.



PROFILE



SECTION

ROCK STEP POOL

NOT TO SCALE

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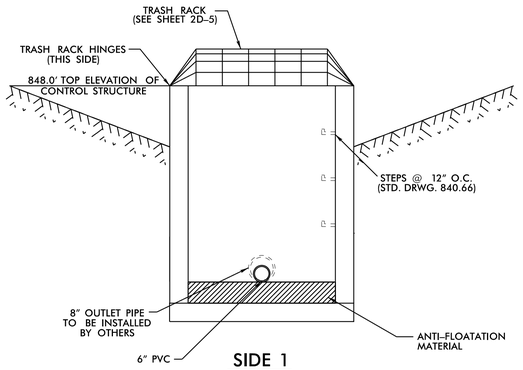
DETAIL

STREAM BYPASS STRUCTURE

NOT TO SCALE



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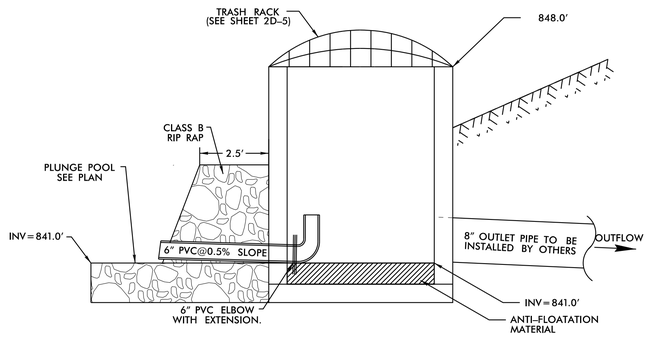

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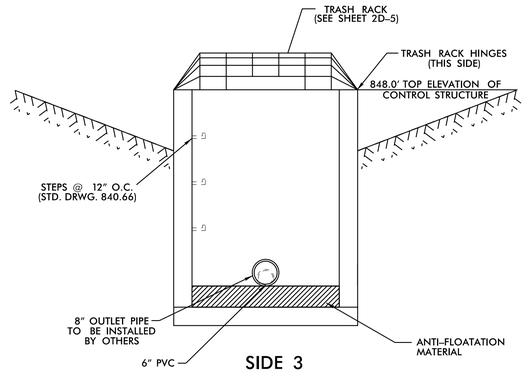

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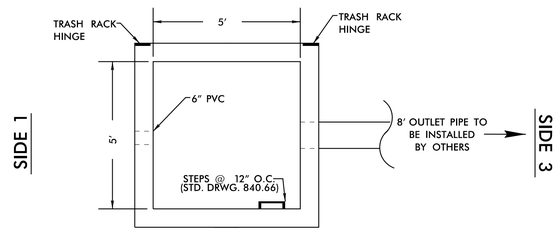

SIDE 2

PLAN VIEW

TRASH RACK NOT SHOWN FOR CLARITY

NOTES:
1. ADJUST FOOTER DIMENSIONS AS NEEDED FOR ANTI-FLOTATION. ANTI-FLOATATION MATERIAL IS REQUIRED AND SHALL BE CONCRETE.

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PROJECT REFERENCE NO.	SHEET NO.
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R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	PAVEMENT DESIGN ENGINEER

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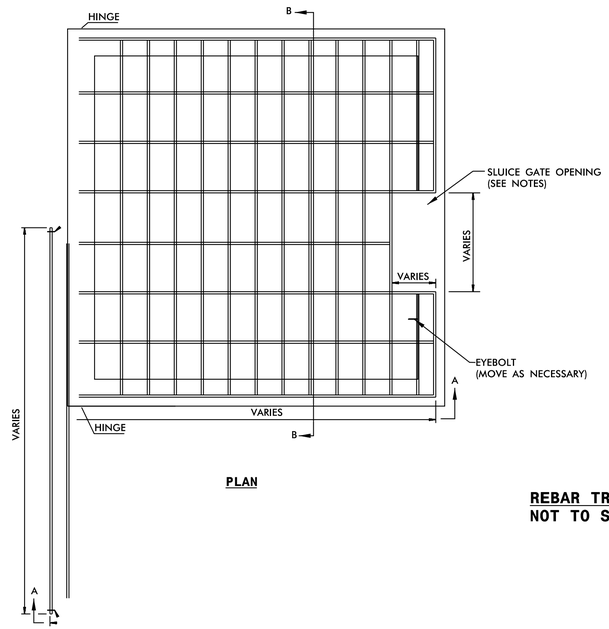
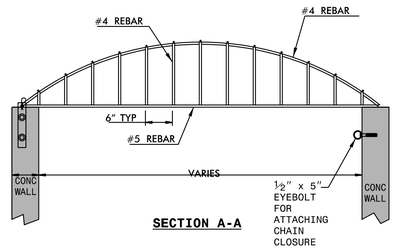
DETAIL

TRASH RACK DETAILS

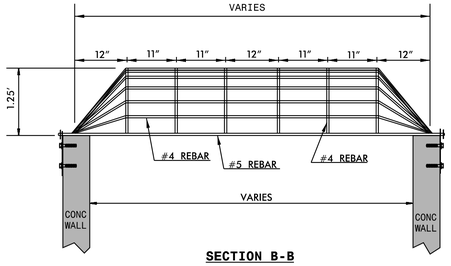
NOT TO SCALE



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.

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RIGHT-OF-WAY REV.

CONST. REV.

PROJECT REFERENCE NO.	SHEET NO.
U-2579B	STREAM-1
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

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REVISIONS

5/14/99

10/4/2019

Sta.10+00 Sta.12+00 Sta.14+00 Sta.16+00 Sta.60+00 Sta.62+00

2GI REMOVE FS 15" RCP-IV 18" RCP-IV

FILL W/FLOWABLE MATERIAL

15" W2 ELBOWS 30" JB W/MH COVER

PROPOSED 32" 3@8'x9' RCBC DOWNSTREAM EXTENSION SEE CULVERT PLANS C01-1 THRU C01-10

BEGIN RETAINING WALL -Y4WB- STA 46+69.29 RT SEE SHEET RTW-1 FOR WALL DETAILS

POND 1 TO REMAIN

RETAIN EXISTING SS MH AND USE CAUTION WHEN INSTALLING CHANNEL IMPROVEMENTS

OUTLET CHANNEL IMPROVEMENTS CLASS II RIP RAP EST 115 TONS EST 120 SY GEO SEE DETAIL 2/SHEET 2D-7

REMOVE EXISTING STONE WALL

JURISDICTIONAL TRIBUTARY TO SMITH CREEK

STONE RET WALL

STATION 11+92.53

BOULDER WALL

RELOCATE JURISDICTIONAL TRIBUTARY TO SMITH CREEK

14' ACCESS ROAD (10' GRAVEL), 2' GRASSED SHOULDERS

FILL EXISTING SMITH CREEK

STATION 14+01.05

5'x5' CONCRETE BOX STRUCTURE SEE SHEET 2D-4

841.0'

POND 2 TO BE DRAINED

127Z RONALD LEE ANGEL SR.

Sta.14+55.44 Sta.63+59.43

EXISTING DITCH TO BE RETAINED

MATCHLINE SEE STREAM SHEET-2

20' STORM SEWER EASEMENT PB 42 PG 137

55" PLASTIC

ISFD

36" CONC

WHITE WALNUT, LLC
DB 2858 PG 267
PB 42 PG 137

CROSS SECTIONS (SEE SHEET XSC-1)

NOTE:
BOULDERS, LOGS, OR CHANNEL MATERIAL FOUND ONSITE MAY BE USED FOR PROPOSED STRUCTURES IF MATERIAL MEETS SPECIAL PROVISIONS AND DETAILS.

LEGEND

CHANNEL TOE	STREAM PLUG
BKF BANKFULL	
FP FLOODPLAIN BENCH	ROCK TOE
G GRADING LIMITS	ROCK VANE
B TOP OF BERM	
BOULDER TOE	CONSTRUCTED RIFFLE WITH J-HOOK
BOULDER WALL	STEP POOL
PROPOSED CHANNEL	
TOE WOOD	BOULDER ROCK AND ROLL RIFFLE

30 15 0 30 60
PLANS

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PROJECT REFERENCE NO.	SHEET NO.
U-2579B	STREAM-2
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

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REVISIONS

MATCHLINE SEE STREAM SHEET-1

MATCHLINE SEE STREAM SHEET-3

PLUG
RETAIN
3GI-A
2GI
18" RCP-IV
GRADE TO DRAIN
REMOVE EX DI
15" RCP-IV
36" RCP-IV
36" WELDED STEEL
20" WELDED STEEL TRENCHLESS INSTALLATION
COLLAR
24"
REMOVE
Conv. OTCB To 2GI
RETAIN AND EXTEND
REMOVE FES
REMOVE APPROXIMATELY 10 LF OF EXISTING 18" RCP AND TIE TO 2GI
18" CMP W/ELBOWS
14' ACCESS ROAD (10' GRAVEL), 2' GRASSED SHOULDERS
POND 2 TO BE DRAINED
POND 3 TO BE DRAINED
CLASS 'B' RIP RAP EST 3 TONS EST 10 SY GEO
FILL EXISTING SMITH CREEK
STANDARD BASE DITCH SEE DRAINAGE PLANS
SPECIAL LATERAL 'V' DITCH SEE DRAINAGE PLANS
EXISTING SEWER MANHOLE TO REMAIN
EXISTING DITCH TO BE RETAINED
POND 4 TO REMAIN
20' SANITARY SEWER EASEMENT
Sta.18+00
Sta.20+00
Sta.22+00
Sta.24+00

LEGEND

- CHANNEL TOE
- BANKFULL
- FLOODPLAIN BENCH
- GRADING LIMITS
- TOP OF BERM
- BOULDER TOE
- BOULDER WALL
- PROPOSED CHANNEL
- TOE WOOD
- STREAM PLUG
- ROCK TOE
- ROCK VANE
- CONSTRUCTED RIFFLE WITH J-HOOK
- STEP POOL
- BOULDER ROCK AND ROLL RIFFLE

CROSS SECTIONS (SEE SHEET XSC-1)

NOTE:
BOULDERS, LOGS, OR CHANNEL MATERIAL FOUND ONSITE MAY BE USED FOR PROPOSED STRUCTURES IF MATERIAL MEETS SPECIAL PROVISIONS AND DETAILS.

30 15 0 30 60
PLANS

REVISIONS

MATCHLINE SEE STREAM SHEET–2

MATCHLINE SEE STREAM SHEET–4

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PROJECT REFERENCE NO.	SHEET NO.
U-2579B	STREAM-3
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

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LEGEND

- CHANNEL TOE
- BKF — BANKFULL
- FP — FLOODPLAIN BENCH
- G — GRADING LIMITS
- B — TOP OF BERM
- BOULDER TOE
- BOULDER WALL
- PROPOSED CHANNEL
- TOE WOOD
- STREAM PLUG
- ROCK TOE
- ROCK VANE
- CONSTRUCTED RIFFLE WITH J-HOOK
- STEP POOL
- BOULDER ROCK AND ROLL RIFFLE

CROSS SECTIONS (SEE SHEET XSC–1)

REMOVE
To 2GI
FS
18" RCP–IV
RCP–IV
14' ACCESS ROAD (10' GRAVEL), 2' GRASSED SHOULDERS
RETAIN AND EXTEND
REMOVE FES
COLLAR
2GI
18" CMP W/ELBOWS
30" RCP–III
ENDWALL
STATION 26+00
FILL EXISTING SMITH CREEK
CLASS 'B' RIP RAP EST 3 TONS EST 10 SY GEO
POND 3 TO BE DRAINED
STANDARD BASE DITCH SEE DRAINAGE PLANS
TEMPORARY CONSTRUCTION ACCESS SEE PROFILE SHEET PFL–2
TRENCHLESS INSTALLATION 42" WELDED STEEL
PLUG
BEGIN W.W. FENCE
14' ACCESS ROAD (10' GRAVEL), 2' GRASSED SHOULDERS
JEFFREY WAYNE MASTEN 126Z
TEMPORARY STREAM CROSSING FOR CONSTRUCTION ACCESS
STAGING AREA
EXISTING POND TO REMAIN
POND W.E. 838.3
127Z
RONALD LEE ANGEL SR. DB 1985 PG 81
POND 4 TO REMAIN
WIDEN BERM TO MINIMUM 20' AT TOP AND GRADE TO FLOODPLAIN BENCH AT 3:1
CONTRACTOR TO MINIMIZE IMPACTS TO TREES ON EXISTING BANK
Sta.26+00
Sta.28+00
Sta.30+00
190.00'
N 85°40'37" W
472.19'
S 78°47'03" E
UPPER ANGEL LAKE
W.E. 8420

NOTE:
BOULDERS, LOGS, OR CHANNEL MATERIAL FOUND ONSITE MAY BE USED FOR PROPOSED STRUCTURES IF MATERIAL MEETS SPECIAL PROVISIONS AND DETAILS.

30 15 0 30 60
PLANS

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PROJECT REFERENCE NO.	SHEET NO.
U-2579B	STREAM-4
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

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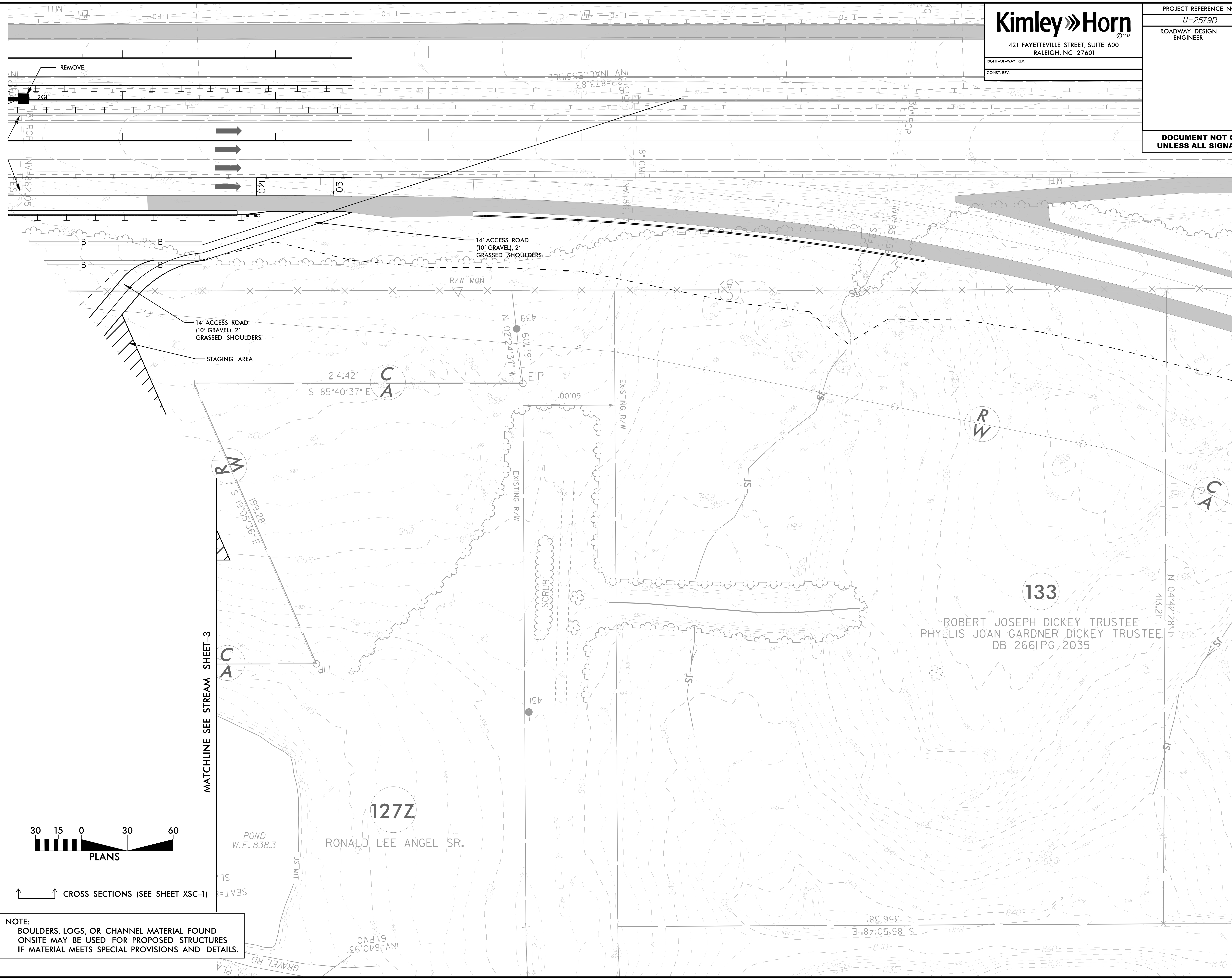

30 15 0 30 60
PLANS

CROSS SECTIONS (SEE SHEET XSC-1)

NOTE:
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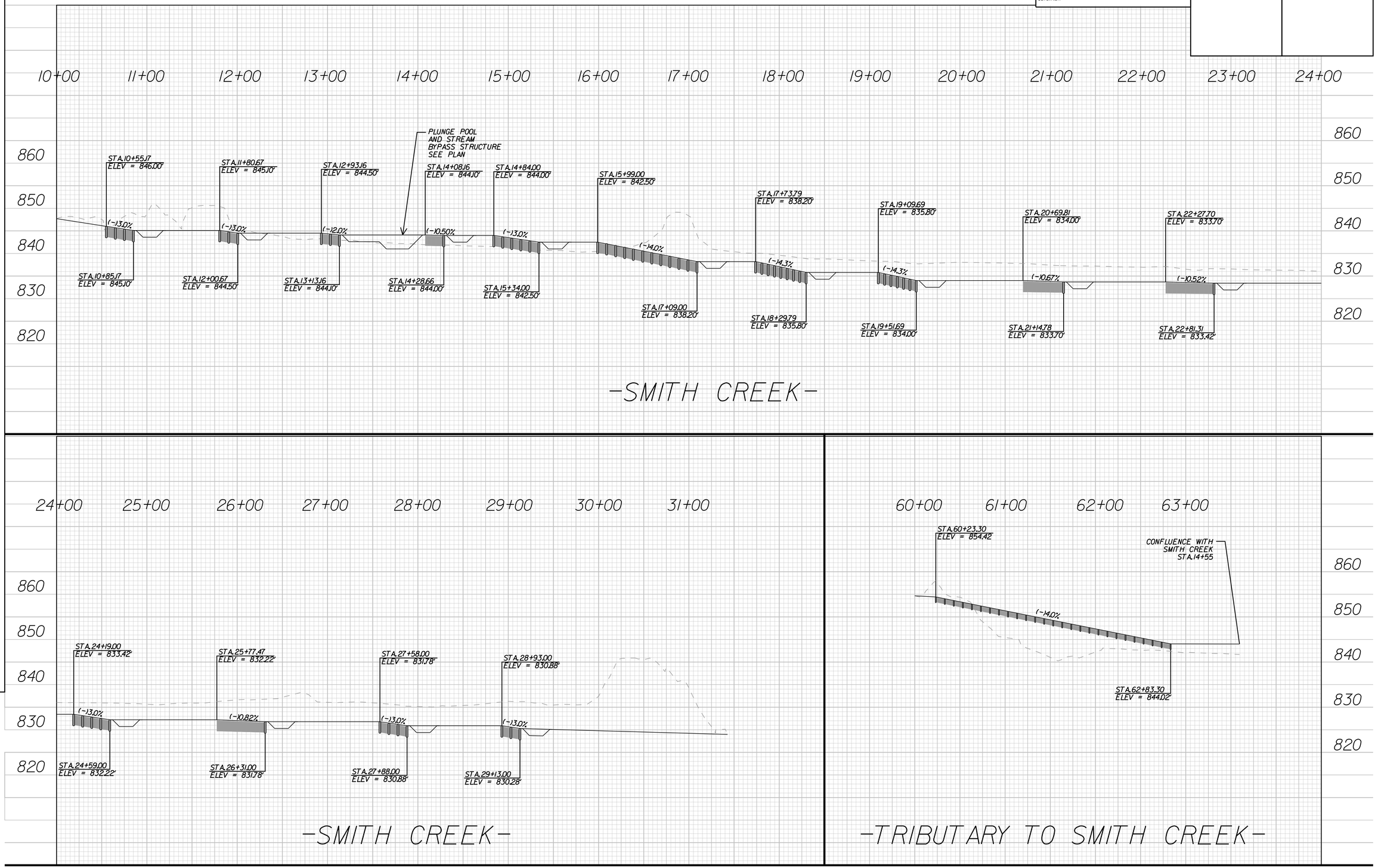
U-2579B	PFL-1
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

REVISIONS



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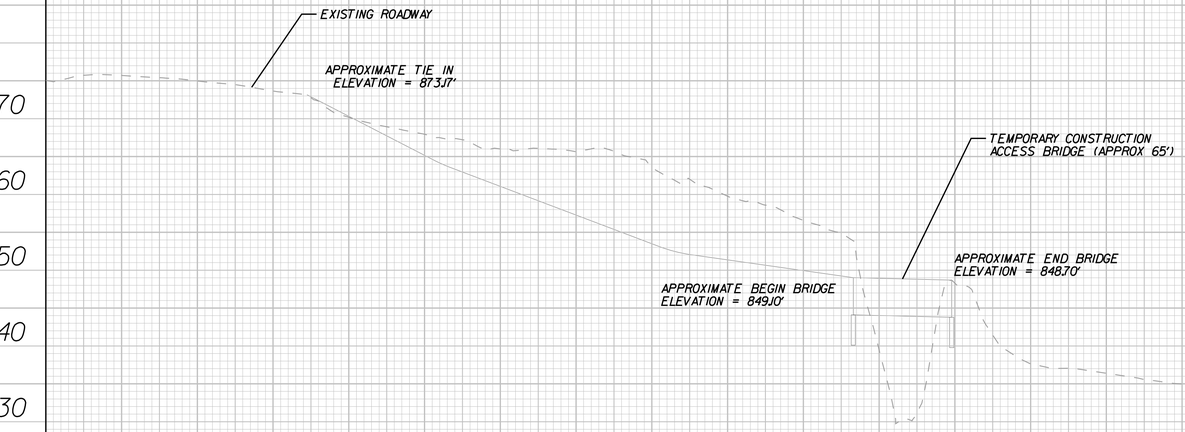
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

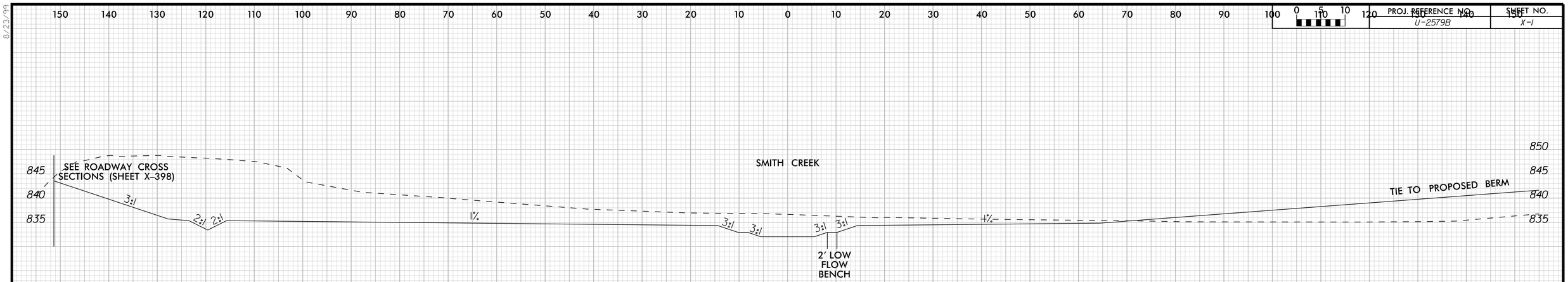
REVISIONS



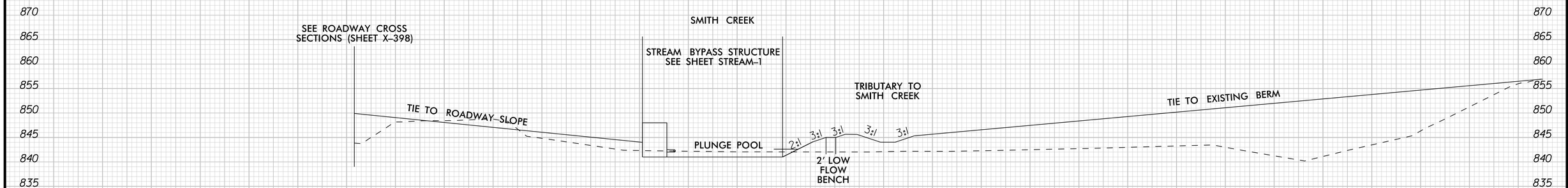
-TEMPORARY CONSTRUCTION ACCESS-

8/23/99

PROJ. REFERENCE NO.	SHEET NO.
U-2579B	X-1



26+00



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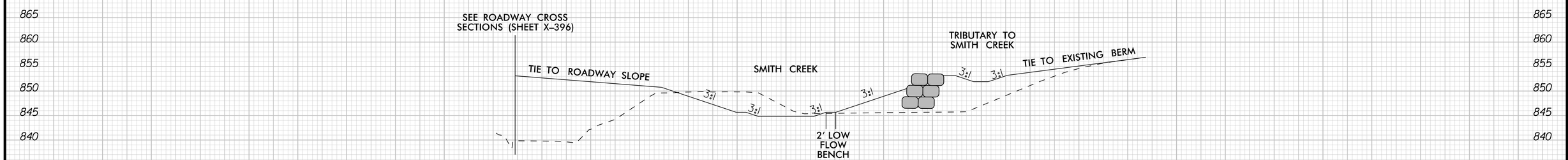


11+92.53

-SMITH CREEK-

10/4/2006

PROJECT REFERENCE NO.	SHEET NO.
U-2579B	RF-1
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

PLANTING ZONE DESCRIPTIONS AND NOTES

ZONE 1 - LIVE STAKE PLANTINGS

LOCATION DESCRIPTION;

LOWER GRADED BANKS LOCATED BETWEEN NORMAL WATER ELEVATION AND BANKFULL ELEVATION.

APPLICATION;

1. AMEND SOIL AS DESCRIBED IN SPECIAL CONDITIONS. SOIL AMENDMENT SHALL BE SUITABLE FOR STREAM BANK APPLICATION, SO THAT AMENDMENTS ARE RESISTANT TO FREQUENT WATER INUNDATION.
2. APPLY TEMPORARY SEED AND PERMANENT SEED MIXTURES PER TABLE 2 THIS SHEET AND THE SPECIAL PROVISIONS.
3. APPLY WHEAT STRAW MULCH PER GENERAL NOTES THIS SHEET AND THE SPECIAL PROVISIONS.
4. INSTALL COIR FIBER MATTING PER THE COIR FIBER MATTING DETAIL ON ALL NEWLY GRADED STREAM BANK SLOPES.
5. INSTALL LIVE STAKE PLANTINGS IN ACCORDANCE WITH TABLE 1, LIVE STAKE DETAIL THIS SHEET, AND THE SPECIAL PROVISIONS.

ZONE 2 - RIPARIAN PLANTINGS

LOCATION DESCRIPTION;

AREAS ABOVE BANKFULL.

APPLICATION;

1. AMEND SOIL AS DESCRIBED IN SPECIAL CONDITIONS. SOIL AMENDMENT SHALL BE SUITABLE FOR STREAM BANK APPLICATION, SO THAT AMENDMENTS ARE RESISTANT TO FREQUENT WATER INUNDATION.
2. APPLY TEMPORARY SEED AND PERMANENT SEED MIXTURES PER TABLE 2 THIS SHEET AND THE SPECIAL PROVISIONS.
3. APPLY WHEAT STRAW MULCH PER GENERAL NOTES THIS SHEET AND THE SPECIAL PROVISIONS.
4. INSTALL COIR FIBER MATTING ON ALL NEWLY GRADED OR DISTURBED SLOPES STEEPER THAN 1%.
5. INSTALL BARE ROOT PLANTINGS IN ACCORDANCE WITH TABLE 1, BARE ROOT DETAIL THIS SHEET, AND THE SPECIAL PROVISIONS.

TABLE 1: TREES AND SHRUBS PLANTING TABLE [4]

SCIENTIFIC NAME	COMMOM NAME	TYPE [1]	MIN/MAX COMPOSITION OF EACH ZONE	PLANT SPACING	
				FEET ON CENTER [2]	NUMBER PER 1 ACRE [3]
ZONE 1					
Salix nigra	Black Willow	LS	20/50	2-3	10890
Sambucus canadensis	Elderberry	LS	20/50		
Cornus amomum	Silky Dogwood	LS	20/50		
ZONE 2					
Betula nigra	River Birch	B	10/30	6-10	680
Cornus amomum	Silky Dogwood	B	10/30		
Platanus occidentalis	Sycamore	B	10/30		
Liriodendron tulipifera	Yellow poplar	B	10/30		
Quercus lyrata	Overcup Oak	B	10/30		
Quercus phellos	Willow Oak	B	10/30		
Quercus michauxii	Swamp Chestnut Oak	B	10/30		

1. LS = LIVE STAKE, B = BARE ROOT SEEDLING
2. AVERAGE FEET ON CENTER SPACING
3. AVERAGE NUMBER PER 1 ACRE OF PLANTING ZONE
4. PLANT SPECIES TO BE PLANTED BASED ON AVAILABILITY

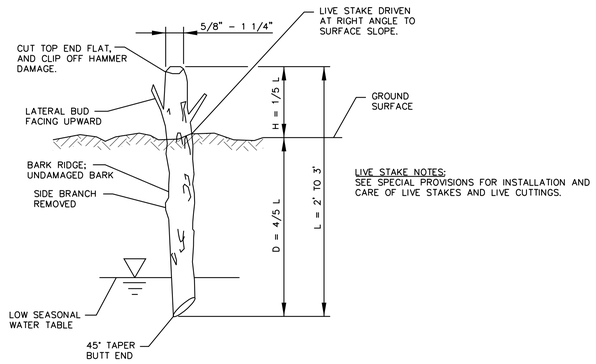
GENERAL NOTES

TEMPORARY PLANTING AND PERMANENT SEEDING SHALL OCCUR IMMEDIATLEY AFTER CONSTRUCTION TO STABILIZE AREAS OF BARE SOIL. PERMANENT PLANTINGS SHALL BE COMPLETED BETWEEN NOVEMBER 15 AND MARCH 1. HOWEVER, PLANTING MAY OCCUR OUTSIDE THIS WINDOW AS APPROVED BY DESIGN ENGINEER.

*SEE NCDOT SPECIAL PROVISION FOR STABILIZATION REQUIREMENTS FOR TEMPORARY SEED MIX, FERTILIZER APPLICATION RATES, AND OTHER PLANTING DETAILS.

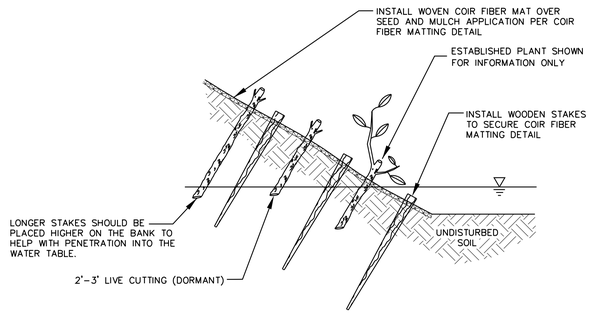
TABLE 2: PERMANENT SEED MIXTURE [1]

COMMON NAME	LBS/ACRE
AUGUST 1 - JUNE 1	
Creeping Red Fescue	18
Big Bluestem	8
Indiangrass	6
Switchgrass	4
Rye Grain	35
*Fertilizer	500
Limestone	4000
MAY 1 - SEPTEMBER 1	
Creeping Red Fescue	18
Big Bluestem	8
Indiangrass	6
Switchgrass	4
German or Browntop Millet	25
*Fertilizer	500
Limestone	4000



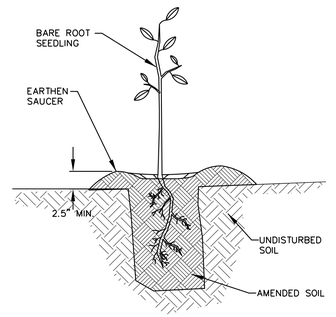
LIVE STAKE NOTES;
SEE SPECIAL PROVISIONS FOR INSTALLATION AND CARE OF LIVE STAKES AND LIVE CUTTINGS.

LIVE STAKE DETAIL
NOT TO SCALE



LIVE STAKE INSTALLATION
NOT TO SCALE

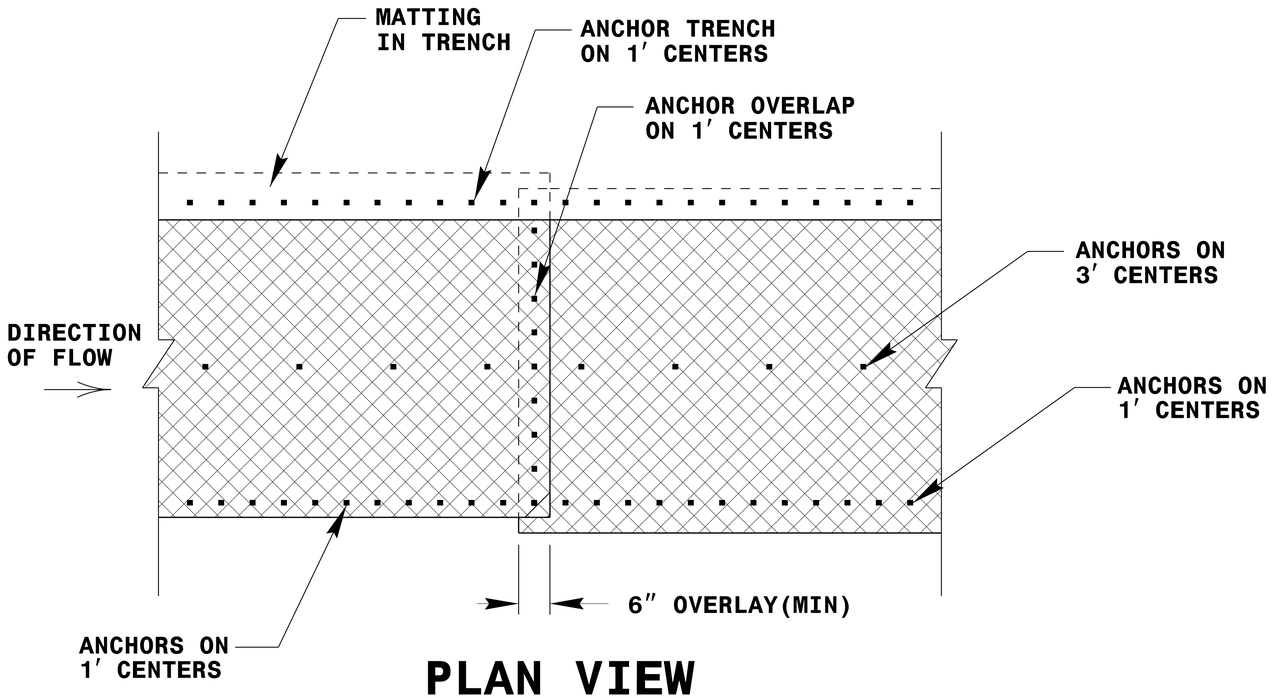
BARE ROOT NOTES;
SEE SPECIAL PROVISIONS FOR INSTALLATION AND CARE OF BARE ROOT PLANTINGS.



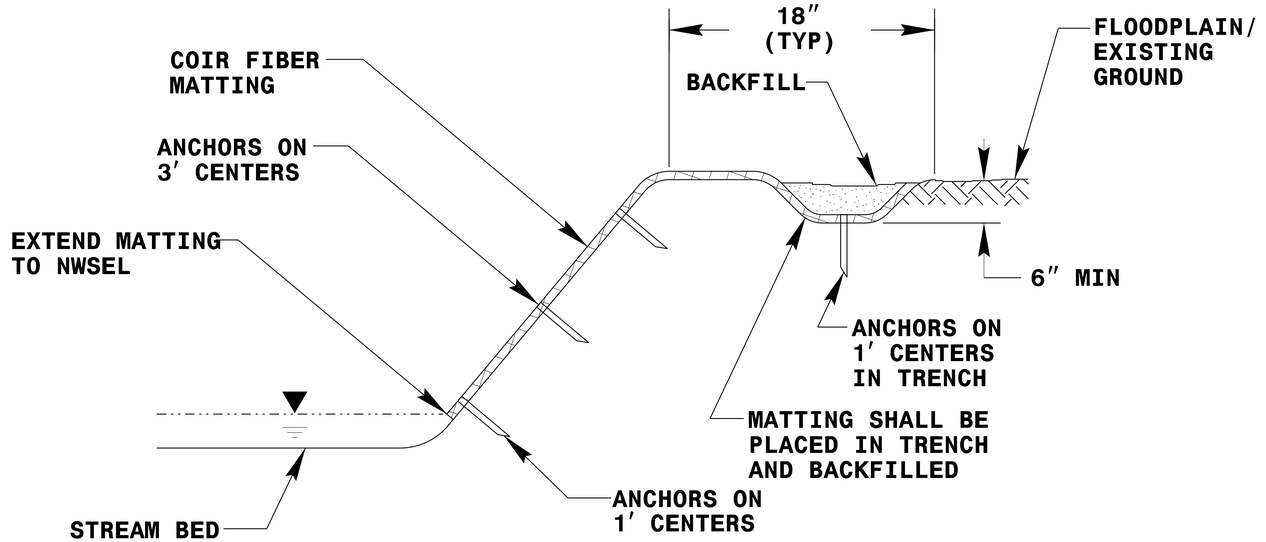
BARE ROOT PLANTING
NOT TO SCALE

STREAMBANK REFORESTATION
DETAIL SHEET 1 OF 2

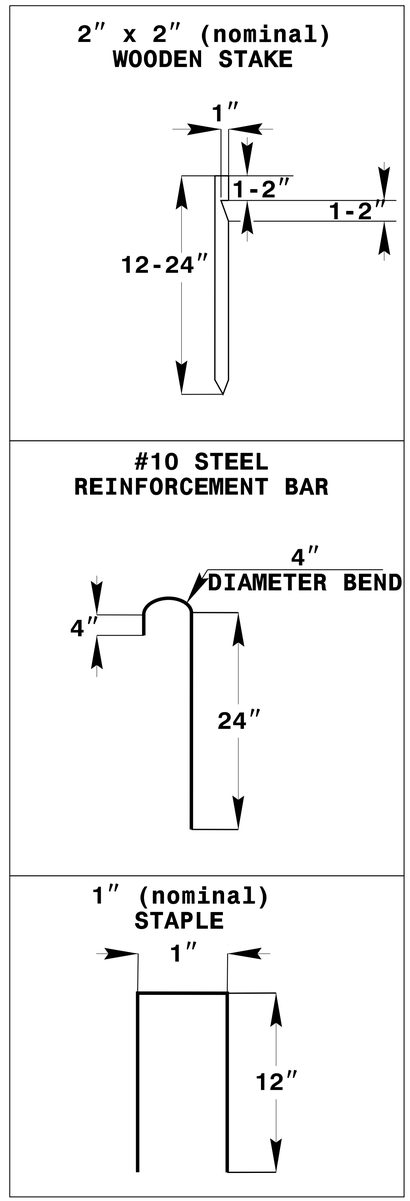
PROJECT REFERENCE NO.	SHEET NO.
U-2579B	RF-2
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER



PLAN VIEW



TYPICAL CROSS SECTION



ANCHOR OPTIONS

COIR FIBER MATTING DETAIL

NOT TO SCALE

STREAMBANK REFORESTATION
DETAIL SHEET 2 OF 2
N.C.D.O.T. - ROADSIDE ENVIRONMENTAL UNIT

Kimley»Horn
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421 FAYETTEVILLE STREET, SUITE 600
RALEIGH, NC 27601

RIGHT-OF-WAY REV.

CONST. REV.

PROJECT REFERENCE NO.	SHEET NO.
U-2579B	PLANTING-1
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

5/14/99

REVISIONS

Sta.10+00

Sta.12+00

Sta.14+00

NO LIVE STAKES OR BARE ROOTS TO BE PLANTED IN FOOTPRINT SHOWN

TDE

TDE

RW

NO LIVE STAKES OR BARE ROOTS TO BE PLANTED NEAR WALL IN FOOTPRINT SHOWN

Sta.60+00

Sta.62+00

CA

127Z

RONALD LEE ANGEL SR.

Sta.14+55.44

Sta.63+59.43

RW

Sta.16+00

MATCHLINE SEE PLANTING-2

ISFD

36" CONC

WHITE WALNUT, LLC
DB 2858 PG 267
PB 42 PG 137

20' STORM SEWER EASEMENT PB 42 PG 137

55' PLASTIC

PLANTING LEGEND

ZONE 1: LIVE STAKE PLANTINGS

ZONE 2: RIPARIAN PLANTINGS

SEE RF-1 AND RF-2 FOR DETAILS

30 15 0 30 60

PLANS

10/28/2019

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RALEIGH, NC 27601

RIGHT-OF-WAY REV.

CONST. REV.

PROJECT REFERENCE NO.	SHEET NO.
U-2579B	PLANTING-2
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

REVISIONS

MATCHLINE SEE STREAM PLANTING-1

MATCHLINE SEE PLANTING-3

REMOVE

Sta.18+00

Sta.20+00

Sta.22+00

Sta.24+00

NO LIVE STAKES OR BARE ROOTS TO BE PLANTED ON DAM BERM

20' SANITARY SEWER EASEMENT

WHITE WALNUT, LLC
DB 2858 PG 0267

PLANTING LEGEND

ZONE 1: LIVE STAKE PLANTINGS

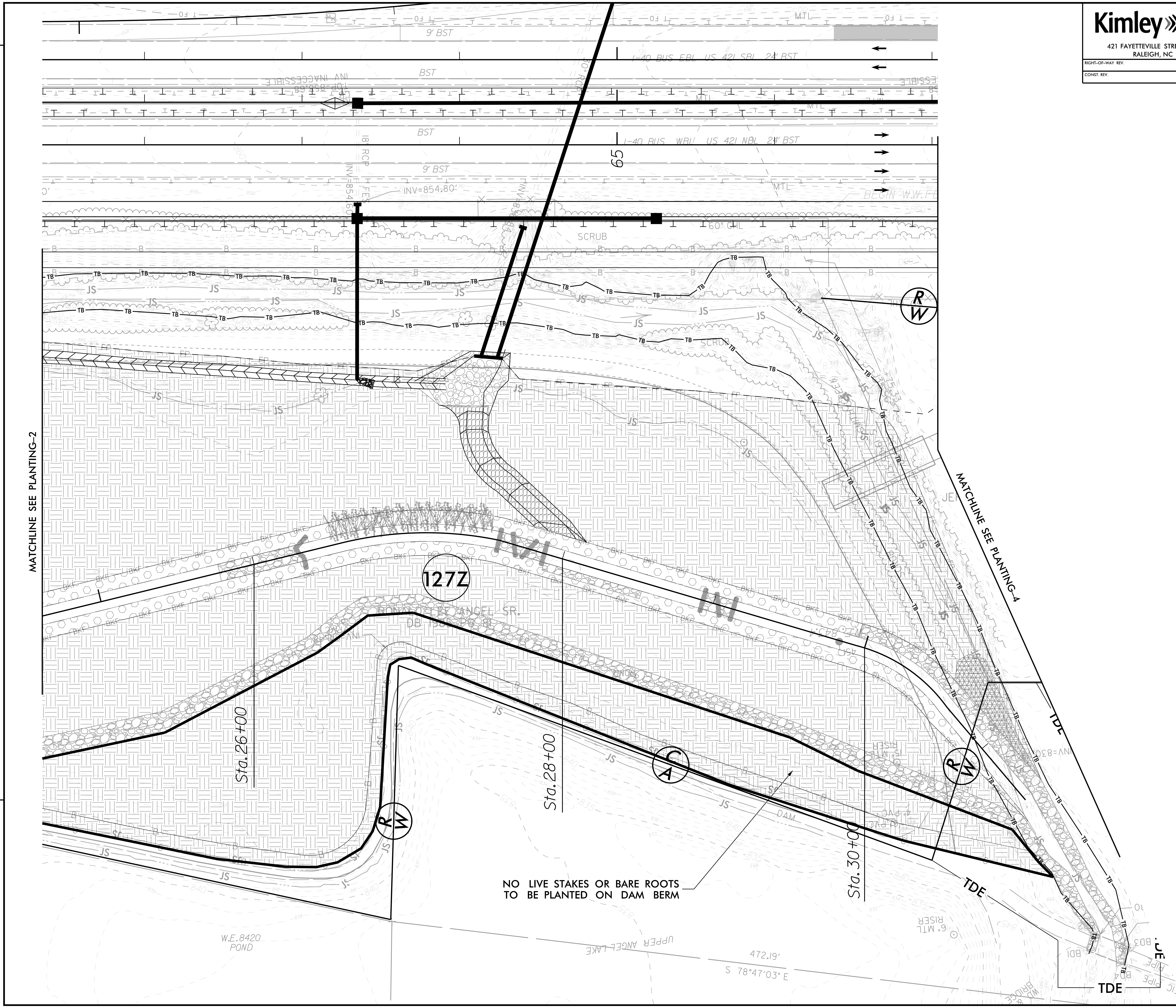
ZONE 2: RIPARIAN PLANTINGS

SEE RF-1 AND RF-2 FOR DETAILS

30 15 0 30 60

PLANS

REVISIONS



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RALEIGH, NC 27601

RIGHT-OF-WAY REV.
CONST. REV.

PROJECT REFERENCE NO.	SHEET NO.
U-2579B	PLANTING-3
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

PLANTING LEGEND

ZONE 1: LIVE STAKE PLANTINGS

ZONE 2: RIPARIAN PLANTINGS

SEE RF-1 AND RF-2 FOR DETAILS

30 15 0 30 60

PLANS

PROJECT REFERENCE NO.	SHEET NO.
U-2579B	PLANTING-4
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

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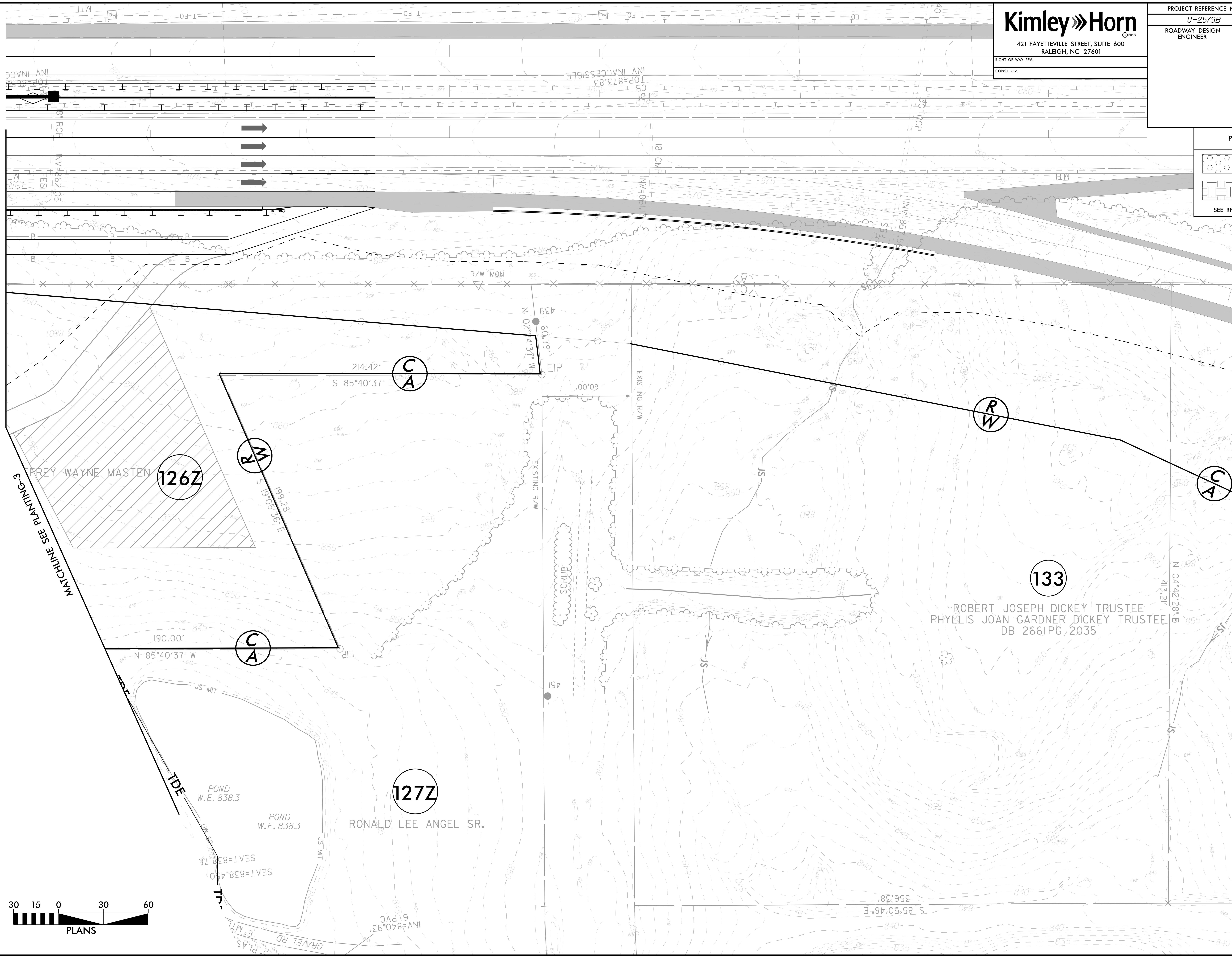
RALEIGH, NC 27601

RIGHT-OF-WAY REV.
CONST. REV.

REVISIONS

PLANTING LEGEND

ZONE 1: LIVE STAKE PLANTINGS
ZONE 2: RIPARIAN PLANTINGS
SEE RF-1 AND RF-2 FOR DETAILS



30 15 0 30 60
PLANS