Site # 011-01-eab2f
NC Hwy 9
over Broad River
Buncombe County

09/08/99

SHEET: RD1

PROJECT: BUNCOMBE 011-01-EAB2F

PROJECT LENGTH

LENGTH ROADWAY PROJECT BUNCOMBE 011-01-EAB2F = 0.021 MILES
LENGTH STRUCTURE PROJECT BUNCOMBE 011-01-EAB2F = 0.016 MILES
TOTAL LENGTH PROJECT BUNCOMBE 011-01-EAB2F = 0.037 MILES

PRB CONTACT: WRENN BARRETT, PE
PROJECT MANAGER

100% PLAN SET

NORTH CAROLINA

NCEM PRIVATE ROADS AND BRIDGES

BUNCOMBE COUNTY

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

HYDRAULICS ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 054713 ENGINEER HE YANG

Signed by: He Yang 5/7/2026 P.E.

ROADWAY DESIGN ENGINEER

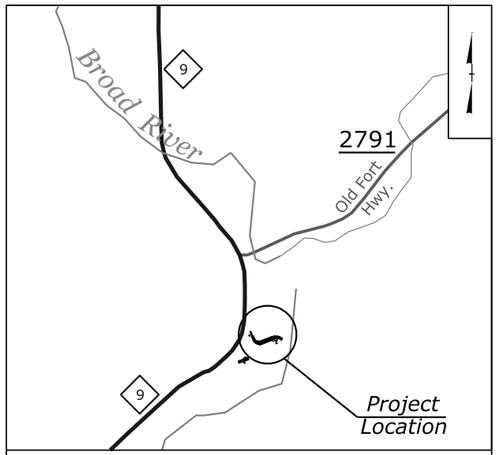
NORTH CAROLINA PROFESSIONAL SEAL 053483 ENGINEER SPENCER W. MERRITT

Signed by: 5/7/2026 P.E.

PREPARED IN THE OFFICE OF:
SUMMIT DESIGN AND ENGINEERING SERVICES FIRM NO. C-5176
1000 Social St., Suite 800
Raleigh, NC 27609
Voice: (919) 732-3883
Fax: (919) 732-6776
www.summitde.com

SPENCER MERRITT, PE
PROJECT ENGINEER

JOSHUA JERNIGAN, PE
PROJECT DESIGN ENGINEER



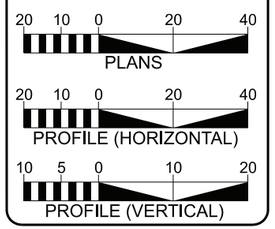
VICINITY MAP (NTS)

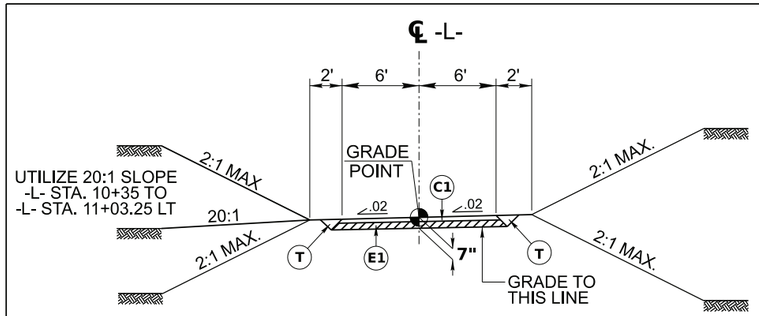
PAVEMENT SCHEDULE (FINAL PAVEMENT DESIGN)	
C1	PROP. APPROX. 3" ASPHALT CONCRETE SURFACE COURSE, TYPE S9.5B, AT AN AVERAGE RATE OF 165 LBS. PER SQ. YD. IN EACH OF TWO LAYERS.
C2	PROP. VAR. DEPTH ASPHALT CONCRETE SURFACE COURSE, TYPE S9.5B, AT AN AVERAGE RATE OF 110 LBS. PER SQ. YD. PER 1" DEPTH TO BE PLACED IN LAYERS NOT TO EXCEED 1½" IN DEPTH.
E1	PROP. APPROX. 4" ASPHALT CONCRETE BASE COURSE, TYPE B25.0C, AT AN AVERAGE RATE OF 456 LBS. PER SQ. YD.
T	EARTH MATERIAL

INDEX OF SHEETS

RD1 - TYPICALS, VICINITY MAP, GEN. NOTES
RD2 - CONVENTIONAL SYMBOLS
RD2A - ROADWAY DETAIL
RD2B - DRAINAGE SUMMARY SHEET
RD3 - PROJECT PLAN AND PROFILE
EC1 THRU EC4 - EROSION CONTROL PLAN
RF1 - REFORESTATION DETAIL
X1 THRU X5 - CROSS SECTIONS
S1 THRU S15 - STRUCTURE PLANS
SN - STANDARD NOTES
MR - BRIDGE MAINTENANCE RECCOMENDATIONS

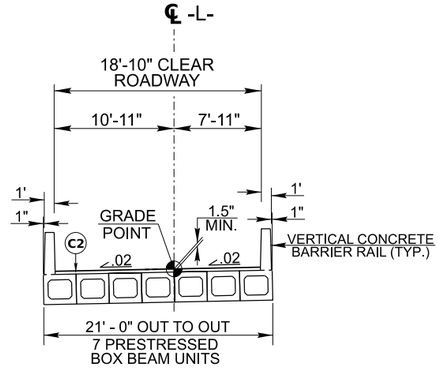
GRAPHIC SCALES





TYPICAL SECTION NO. 1

-L- STA. 10+35.00 TO -L- STA. 11+03.25 (BEGIN BRIDGE)
-L- STA. 11+90.13 (END BRIDGE) TO -L- STA. 12+40.00



BRIDGE TYPICAL

-L- STA. 11+03.25 TO -L- STA. 11+90.13

TYPICAL SECTIONS

THE PROPOSED HYDRAULIC CONVEYANCE PROVIDES EQUAL OR GREATER HYDRAULIC CONVEYANCE THAN THE DESTROYED CROSSING.(SEE APROX. HYDRAULIC CONVEYANCE TABLE ON SHEET RD-3)

ACTUAL EXISTING HYDRAULIC CONVEYANCE MAY DIFFER FROM WHAT IS SHOWN DUE TO POST HELENE DAMAGE TO THE EXISTING STRUCTURE.

2024 ROADWAY ENGLISH STANDARD DRAWINGS

The following Roadway Standards as appear in "Roadway Standard Drawings" Contracts Standards and Development Unit - N. C. Department of Transportation - Raleigh, N. C., Dated January 16, 2024 are applicable to this project and by reference hereby are considered a part of these plans:

STD.NO.	TITLE
DIVISION 2 - EARTHWORK	
200.03	Method of Clearing - Method III
225.02	Guide for Grading Subgrade - Secondary and Local
225.04	Method of Obtaining Superelevation - Two Lane Pavement
300.01	Method of Pipe Installation
840.22	Frames and Wide Slot Sag Grates
840.35	Traffic Bearing Grated Drop Inlet
1101.01	Stationary Work Zone Signs
1145.01	Barricades

GENERAL NOTES: 2024 SPECIFICATIONS
EFFECTIVE: 01-16-2024
REVISED:

GRADE LINE:
GRADING AND SURFACING:

THE GRADE LINES SHOWN DENOTE THE FINISHED ELEVATION OF THE PROPOSED SURFACING AT GRADE POINTS SHOWN ON THE TYPICAL SECTIONS. GRADE LINES MAY BE ADJUSTED AT THEIR BEGINNING AND ENDING AND AT STRUCTURES AS DIRECTED BY THE ENGINEER IN ORDER TO SECURE A PROPER TIE-IN.

CLEARING:

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

SUPERELEVATION:

ALL CURVES ON THIS PROJECT SHALL BE SUPERELEVATED IN ACCORDANCE WITH STD. NO. 225.04 USING THE RATE OF SUPERELEVATION AND RUNOFF SHOWN ON THE PLANS. SUPERELEVATION IS TO BE REVOLVED ABOUT THE GRADE POINTS SHOWN ON THE TYPICAL SECTIONS.

SHOULDER CONSTRUCTION:

ASPHALT, EARTH, AND CONCRETE SHOULDER CONSTRUCTION ON THE HIGH SIDE OF SUPERELEVATED CURVES SHALL BE IN ACCORDANCE WITH STD. NO. 560.01

END BENTS:

THE ENGINEER SHALL CHECK THE STRUCTURE END BENT PLANS, DETAILS, AND CROSS-SECTION PRIOR TO SETTING OF THE SLOPE STAKES FOR THE EMBANKMENT OR EXCAVATION APPORACHING A BRIDGE.

UTILITIES:

UTILITY OWNERS ON THIS PROJECT ARE BLUE RIDGE EMC, BLUE RIDGE TRANSMISSION, SKYLINE, AND SPECTRUM.

ANY RELOCATION OF EXISTING UTILITIES WILL BE ACCOMPLISHED BY OTHERS.

TRAFFIC PATTERN ALTERATIONS:

NOTIFY THE ENGINEER THIRTY (30) CALENDAR DAYS PRIOR TO ANY TRAFFIC PATTERN ALTERATION.

TRAFFIC CONTROL DEVICES:
PLACE TYPE III BARRICADES, WITH "ROAD CLOSED" SIGN R11-2 ATTACHED, OF SUFFICIENT LENGTH TO CLOSE ENTIRE ROADWAY.

DRAWN BY: J. JERNIGAN 10-2025
CHECKED BY: S. MERRITT 10-2025

05/20/24

STATE OF NORTH CAROLINA, DIVISION OF HIGHWAYS

CONVENTIONAL PLAN SHEET SYMBOLS

011-01-EAB2F | RD 002

Note: Not to Scale

BOUNDARIES AND PROPERTY:

- State Line
- County Line
- Township Line
- City Line
- Reservation Line
- Property Line
- Existing Iron Pin (EIP)
- Computed Property Corner
- Existing Concrete Monument (ECM)
- Parcel / Sequence Number
- Existing Fence Line
- Proposed Woven Wire Fence
- Proposed Chain Link Fence
- Proposed Barbed Wire Fence
- Existing Wetland Boundary
- Proposed Wetland Boundary
- Existing Endangered Animal Boundary
- Existing Endangered Plant Boundary
- Existing Historic Property Boundary
- Known Contamination Area: Soil
- Potential Contamination Area: Soil
- Known Contamination Area: Water
- Potential Contamination Area: Water
- Contaminated Site: Known or Potential

BUILDINGS AND OTHER CULTURE:

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

HYDROLOGY:

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

RAILROADS:

- Standard Gauge
- RR Signal Milepost
- Switch
- RR Abandoned
- RR Dismantled

RIGHT OF WAY & PROJECT CONTROL:

- Primary Horiz Control Point
- Primary Horiz and Vert Control Point
- Secondary Horiz and Vert Control Point
- Vertical Benchmark
- Existing Right of Way Monument
- Proposed Right of Way Monument (Rebar and Cap)
- Proposed Right of Way Monument (Concrete)
- Existing Permanent Easement Monument
- Proposed Permanent Easement Monument (Rebar and Cap)
- Existing C/A Monument
- Proposed C/A Monument (Rebar and Cap)
- Proposed C/A Monument (Concrete)
- Existing Right of Way Line
- Proposed Right of Way Line
- Existing Control of Access Line
- Proposed Control of Access Line
- Proposed ROW and CA Line
- Existing Easement Line
- Proposed Temporary Construction Easement
- Proposed Temporary Drainage Easement
- Proposed Permanent Drainage Easement
- Proposed Permanent Drainage/Utility Easement
- Proposed Permanent Utility Easement
- Proposed Temporary Utility Easement
- Proposed Aerial Utility Easement

ROADS AND RELATED FEATURES:

- Existing Edge of Pavement
- Existing Curb
- Proposed Slope Stakes Cut
- Proposed Slope Stakes Fill
- Proposed Curb Ramp
- Existing Metal Guardrail
- Proposed Guardrail
- Existing Cable Guiderail
- Proposed Cable Guiderail
- Equality Symbol
- Pavement Removal

VEGETATION:

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

EXISTING STRUCTURES:

MAJOR:

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

MINOR:

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

UTILITIES:

** SUE - Subsurface Utility Engineering*
LOS - Level of Service - A,B,C or D (Accuracy)

POWER:

- Existing Power Pole
- Proposed Power Pole
- Existing Joint Use Pole
- Proposed Joint Use Pole
- Power Manhole
- Power Line Tower
- Power Transformer
- U/G Power Cable Hand Hole
- H-Frame Pole
- U/G Power Line Test Hole (SUE - LOS A)*
- U/G Power Line (SUE - LOS B)*
- U/G Power Line (SUE - LOS C)*
- U/G Power Line (SUE - LOS D)*

TELEPHONE:

- Existing Telephone Pole
- Proposed Telephone Pole
- Telephone Manhole
- Telephone Pedestal
- Telephone Cell Tower
- U/G Telephone Cable Hand Hole
- U/G Telephone Test Hole (SUE - LOS A)*
- U/G Telephone Cable (SUE - LOS B)*
- U/G Telephone Cable (SUE - LOS C)*
- U/G Telephone Cable (SUE - LOS D)*
- U/G Telephone Conduit (SUE - LOS B)*
- U/G Telephone Conduit (SUE - LOS C)*
- U/G Telephone Conduit (SUE - LOS D)*
- U/G Fiber Optics Cable (SUE - LOS B)*
- U/G Fiber Optics Cable (SUE - LOS C)*
- U/G Fiber Optics Cable (SUE - LOS D)*

WATER:

- Water Manhole
- Water Meter
- Water Valve
- Water Hydrant
- U/G Water Line Test Hole (SUE - LOS A)*
- U/G Water Line (SUE - LOS B)*
- U/G Water Line (SUE - LOS C)*
- U/G Water Line (SUE - LOS D)*
- Above Ground Water Line

TV:

- TV Pedestal
- TV Tower
- U/G TV Cable Hand Hole
- U/G TV Test Hole (SUE - LOS A)*
- U/G TV Cable (SUE - LOS B)*
- U/G TV Cable (SUE - LOS C)*
- U/G TV Cable (SUE - LOS D)*
- U/G Fiber Optic Cable (SUE - LOS B)*
- U/G Fiber Optic Cable (SUE - LOS C)*
- U/G Fiber Optic Cable (SUE - LOS D)*

GAS:

- Gas Valve
- Gas Meter
- U/G Gas Line Test Hole (SUE - LOS A)*
- U/G Gas Line (SUE - LOS B)*
- U/G Gas Line (SUE - LOS C)*
- U/G Gas Line (SUE - LOS D)*
- Above Ground Gas Line

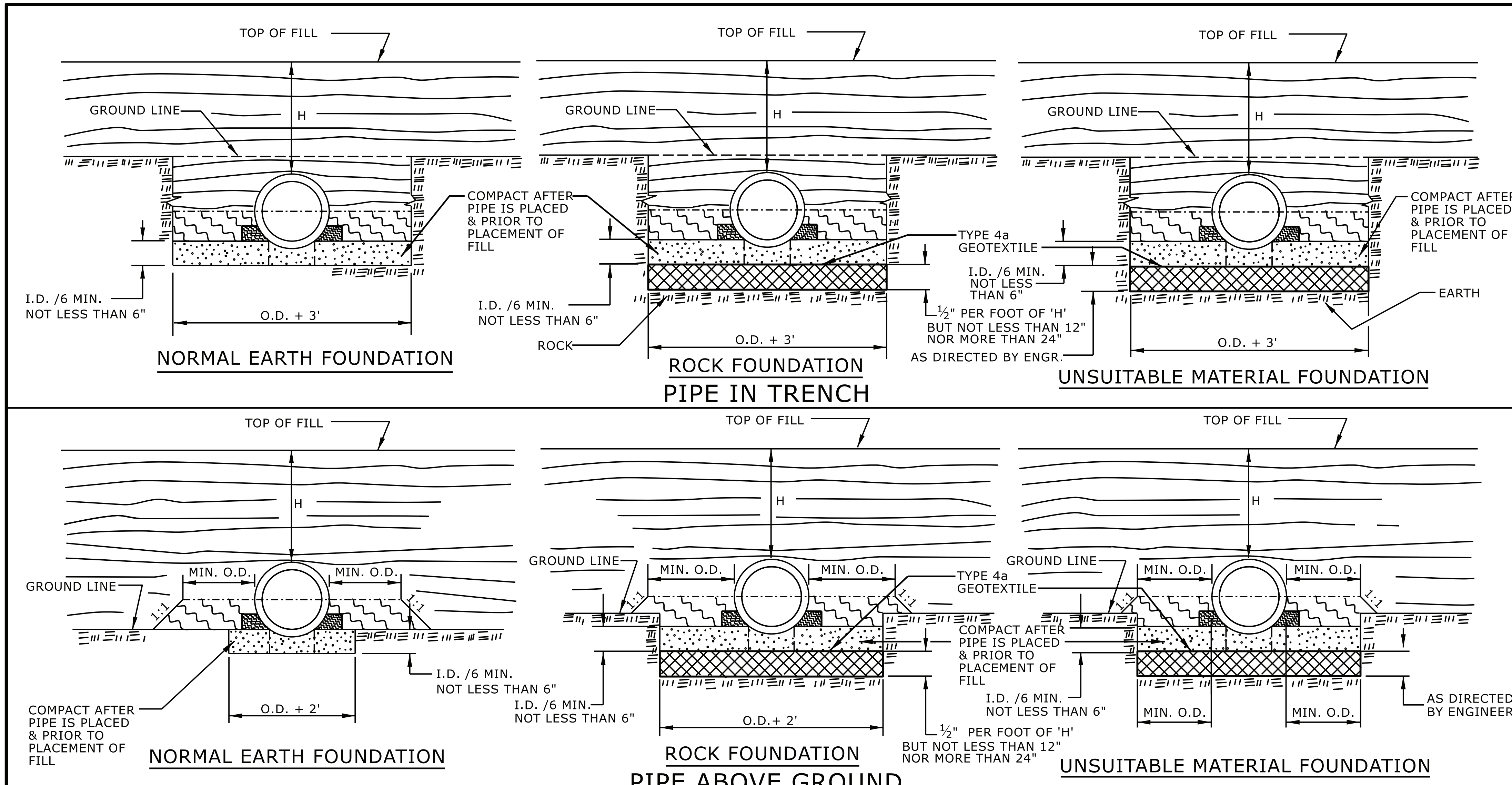
SANITARY SEWER:

- Sanitary Sewer Manhole
- Sanitary Sewer Cleanout
- U/G Sanitary Sewer Line
- Above Ground Sanitary Sewer
- SS Force Main Line Test Hole (SUE - LOS A)*
- SS Force Main Line (SUE - LOS B)*
- SS Force Main Line (SUE - LOS C)*
- SS Force Main Line (SUE - LOS D)*

MISCELLANEOUS:

- Utility Pole
- Utility Pole with Base
- Utility Located Object
- Utility Traffic Signal Box
- Utility Unknown U/G Line (SUE - LOS B)*
- U/G Tank; Water, Gas, Oil
- Underground Storage Tank, Approx. Loc.
- A/G Tank; Water, Gas, Oil
- Geoenvironmental Boring
- Abandoned According to Utility Records — AATUR
- End of Information — E.O.I.

PROJECT REFERENCE NO.	SHEET NO.
011-01-EAB2F	RD-002A



GENERAL NOTES:

I.D. = THE MAXIMUM HORIZONTAL INSIDE DIAMETER DIMENSION.

O.D. = THE MAXIMUM HORIZONTAL OUTSIDE DIAMETER DIMENSION.

H = THE FILL HEIGHT MEASURED VERTICALLY AT ANY POINT ALONG THE PIPE FROM THE TOP OF THE PIPE TO THE TOP OF THE EMBANKMENT AT THAT POINT.

APPROVED SUITABLE LOCAL MATERIAL.

TAKE CARE TO FULLY COMPACT HAUNCH ZONE OF PIPE BACKFILL.

LOOSELY PLACED SELECT MATERIAL CLASS III OR CLASS II, TYPE 1 FOR PIPE BEDDING. LEAVE SECTION DIRECTLY BENEATH PIPE UNCOMPACTED AS PIPE SEATING AND BACKFILL WILL ACCOMPLISH COMPACTION.

DO NOT OPERATE HEAVY EQUIPMENT OVER ANY PIPE CULVERT UNTIL THE PIPE CULVERT HAS BEEN PROPERLY BACKFILLED AND COVERED WITH AT LEAST 3 FEET OF APPROVED MATERIAL.

REFER TO NCDOT PIPE MATERIAL SELECTION GUIDE AND STANDARD SPECIFICATIONS FOR ALLOWABLE PIPE FILL HEIGHTS AND PIPE SPECIFICATIONS.

SPRINGLINE OF PIPE

SELECT BACKFILL MATERIAL CLASS III OR CLASS II, BELOW SPRINGLINE.

UNDISTURBED EARTH MATERIAL

SELECT MATERIAL CLASS V OR VI FOR FOUNDATION CONDITIONING. ENCAPSULATE WITH TYPE IV GEOTEXTILE AS DIRECTED BY THE ENGINEER.

STATE OF NORTH CAROLINA
DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS
RALEIGH, N.C.

ROADWAY DETAIL DRAWING FOR
METHOD OF PIPE INSTALLATION
RIGID PIPE

SHEET 2 OF 2

300.01

5/7/2026

NORTH CAROLINA PROFESSIONAL SEAL 033144 ENGINEER NICOLE M. HACKLER

Signed by: Nicole M. Hackler

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

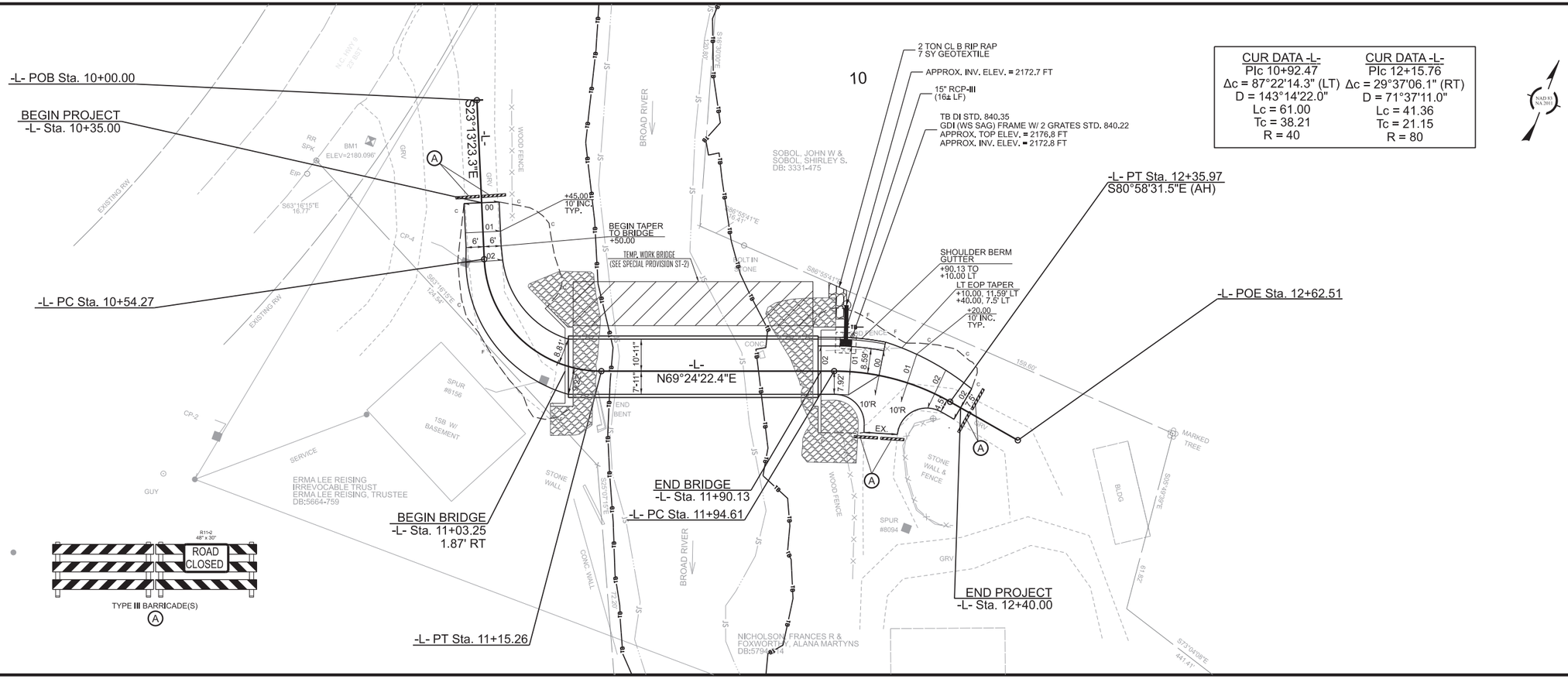
CONTRACTS STANDARDS AND DEVELOPMENT UNIT
Office 919-707-6950 FAX 919-250-4119

SEE TITLE BLOCK

ORIGINAL BY: S.CALHOUN DATE: 7-25-2024
MODIFIED BY: DATE:
CHECKED BY: DATE:
FILE SPEC.:

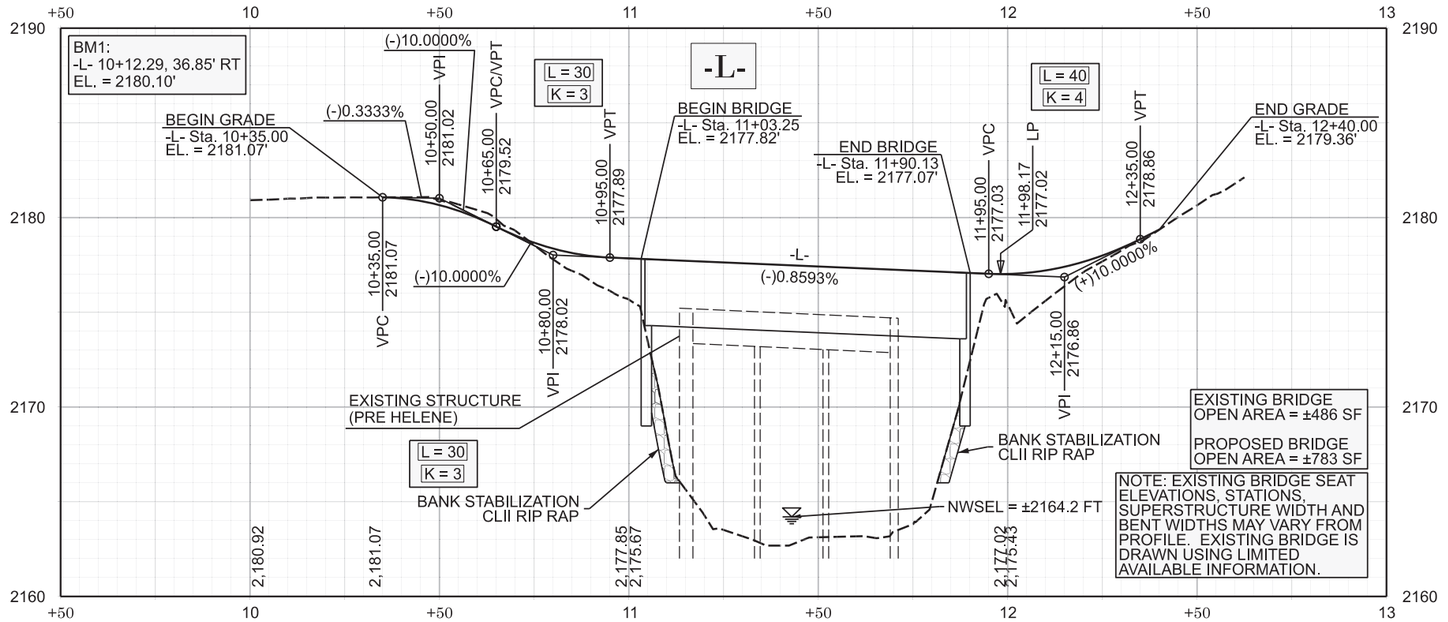
11/14/23

APPROXIMATE HYDRAULIC CONVEYANCE (SF)	
PRE-HELENE (EXISTING)	±486
PROPOSED	±783



CUR DATA -L-	CUR DATA -L-
PIc 10+92.47	PIc 12+15.76
Δc = 87°22'14.3" (LT)	Δc = 29°37'06.1" (RT)
D = 143°14'22.0"	D = 71°37'11.0"
Lc = 61.00	Lc = 41.36
Tc = 38.21	Tc = 21.15
R = 40	R = 80

NAD 83 NA 2011



011-01-EAB2F

RD	003

NORTH CAROLINA
BUNCOMBE COUNTY

ROADWAY DESIGN ENGINEER
5/7/2026
NORTH CAROLINA PROFESSIONAL SEAL 053483 ENGINEER SPENCER MERRITT
Signed by:
2/20/2026 | 8:20 AM EST
CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

HYDRAULIC DESIGN ENGINEER
5/7/2026
NORTH CAROLINA PROFESSIONAL SEAL 054713 ENGINEER HE YANG
Signed by:
2/19/2026 | 7:44 PM EST
CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

PLANS PREPARED BY:
SUMMIT DESIGN AND ENGINEERING SERVICES
NC FIRM LICENSE No: C-5176
1000 Social Street, Suite 800
Raleigh, NC 27609
(919) 732-3883
(919) 732-6676 (FAX)

PROJECT: BUNCOMBE 011-01-EAB2F

STATE OF NORTH CAROLINA
EMERGENCY MANAGEMENT

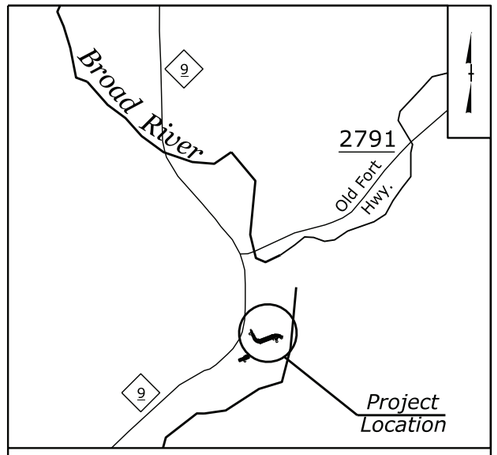
PLAN FOR PROPOSED
HIGHWAY EROSION CONTROL

BUNCOMBE COUNTY

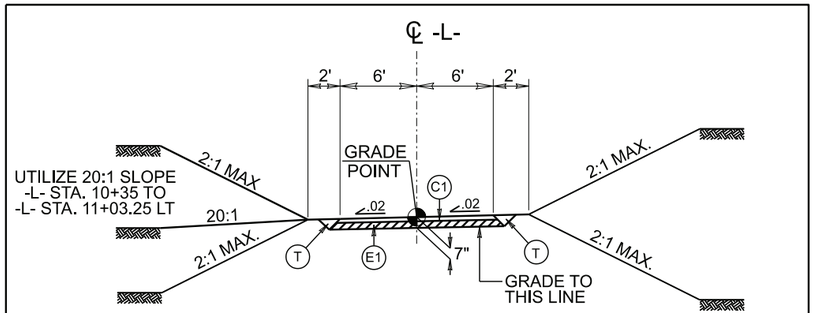
STATE	NCEM PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	BUNCOMBE 011-01-EAB2F	EC-1	

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

SUMMIT DESIGN AND ENGINEERING SERVICES

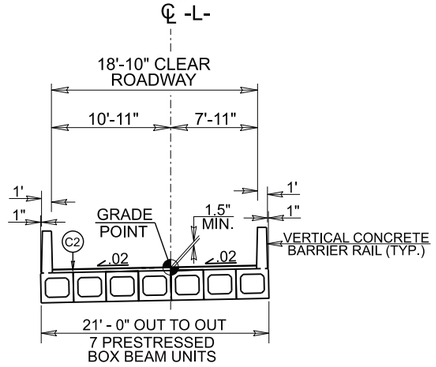


VICINITY MAP (NTS)



TYPICAL SECTION NO. 1

-L- STA. 10+35.00 TO -L- STA. 11+03.25 (BEGIN BRIDGE)
-L- STA. 11+90.13 (END BRIDGE) TO -L- STA. 12+40.00



BRIDGE TYPICAL

-L- STA. 11+03.25 TO -L- STA. 11+90.13

TYPICAL SECTIONS

PAVEMENT SCHEDULE (FINAL PAVEMENT DESIGN)	
C1	PROP. APPROX. 3" ASPHALT CONCRETE SURFACE COURSE, TYPE S9.5B, AT AN AVERAGE RATE OF 165 LBS. PER SQ. YD. IN EACH OF TWO LAYERS.
C2	PROP. VAR. DEPTH ASPHALT CONCRETE SURFACE COURSE, TYPE S9.5B, AT AN AVERAGE RATE OF 110 LBS. PER SQ. YD. PER 1" DEPTH TO BE PLACED IN LAYERS NOT TO EXCEED 1½" IN DEPTH.
E1	PROP. APPROX. 4" ASPHALT CONCRETE BASE COURSE, TYPE B25.0C, AT AN AVERAGE RATE OF 456 LBS. PER SQ. YD.
T	EARTH MATERIAL

THIS IS NOT A CONTROLLED ACCESS PROJECT.
CLEARING AND GRUBBING ON THIS PROJECT SHALL BE PERFORMED TO THE LIMITS ESTABLISHED BY METHOD III.

The signatures affixed below certify that this sheet has been reviewed and approved solely per the certifications signed on the cover sheet of these construction plans.

Public Works - Transportation	Water Resources - Stormwater
Building Inspections	Planning
Water Resources - Utility Engineering	Planning - Transportation
Electric	Fire
Water Resources - Soil & Erosion Control	Parks, Recreation & Cultural Resources

THIS PROJECT CONTAINS EROSION CONTROL PLANS FOR CLEARING AND GRUBBING PHASE OF CONSTRUCTION.

GRAPHIC SCALE

50 25 0 50 100

PLANS

THESE EROSION AND SEDIMENT CONTROL PLANS COMPLY WITH THE REGULATIONS SET FORTH BY THE NCG-010000 GENERAL STORMWATER CONSTRUCTION PERMIT ISSUED BY THE NORTH CAROLINA DEPARTMENT OF ENVIRONMENTAL QUALITY DIVISION OF ENERGY, MINERAL, AND LAND RESOURCES.

EROSION CONTROL ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 054713 ENGINEER HE YANG

Signed by: He Yang D6739823A7F4406...

5/7/2026 *P.E.*

Prepared in the Office of:
Summit Design And Engineering Sevices
1000 Social St., Suite 800
Raleigh, NC 27609
Voice: (919) 732-3883
Fax: (919) 732-6676
www.summitde.com

Designed by:

HE YANG *4408*
NAME LEVEL III CERTIFICATION NO.

Roadway Standard Drawings

The "Roadway Standard Drawings"- Roadway Design Unit - N. C. Department of Transportation - Raleigh, N. C., dated January 2024 and the latest revision thereto are applicable to this project and by reference hereby are considered a part of these plans.

5/26/20

NCEM PRIVATE ROADS AND BRIDGES
STATE OF NORTH CAROLINA

The signatures affixed below certify that this sheet has been reviewed and approved solely per the certifications signed on the cover sheet of these construction plans.

Public Works - Transportation	Water Resources - Stormwater
Building Inspections	Planning
Water Resources - Utility Engineering	Planning - Transportation
Electric	Fire
Water Resources - Soil & Erosion Control	Parks, Recreation & Cultural Resources

011-01-EAB2F
EC-2

NORTH CAROLINA
BUNCOMBE COUNTY

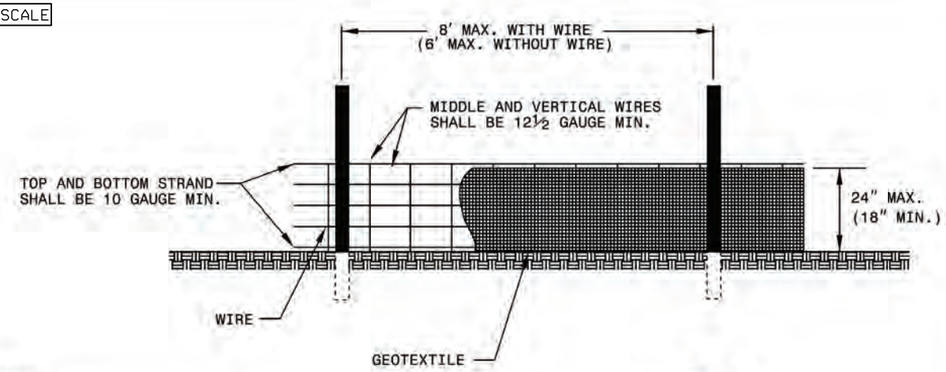
PLANS PREPARED BY:
SUMMIT DESIGN AND ENGINEERING SERVICES
NC FIRM LICENSE No: C-5176
1000 Social Street, Suite 800
Raleigh, NC 27609
(919) 732-3883
(919) 732-6676 (FAX)

EROSION & SEDIMENT CONTROL LEGEND

Std. #	Description	Symbol
1605.01	Temporary Silt Fence	
1606.01	Special Sediment Control Fence	
1622.01	Temporary Berms and Slope Drains	
1630.02	Silt Basin Type B	
1630.03	Temporary Silt Ditch	TSD
1630.04	Stilling Basin	
1630.05	Temporary Diversion	TD
1630.06	Special Stilling Basin	
1630.07	Skimmer Basin	
1630.08	Tiered Skimmer Basin	
1630.09	Earthen Dam with Skimmer	
	Infiltration Basin	
	Rock Inlet Sediment Trap:	
1632.01	Type A	A
1632.02	Type B	B
1632.03	Type C	C

Std. #	Description	Symbol
1633.01	Temporary Rock Silt Check Type A	
1633.02	Temporary Rock Silt Check Type B	
1633.03	Temporary Rock Silt Check Type A with Excelsior Matting and Flocculant	
1634.01	Temporary Rock Sediment Dam Type A	
1634.02	Temporary Rock Sediment Dam Type B	
1635.01	Rock Pipe Inlet Sediment Trap Type A	A
1635.02	Rock Pipe Inlet Sediment Trap Type B	B
1636.01	Excelsior Wattle Check	
1636.01	Excelsior Wattle Check with Flocculant	
1636.01	Coir Fiber Wattle Check	
1636.01	Coir Fiber Wattle Check with Flocculant	
1636.02	Silt Fence Excelsior Wattle Break	EW
	Silt Fence Coir Fiber Wattle Break	CFW
1636.03	Excelsior Wattle Barrier	EW—EW—EW
1636.03	Coir Fiber Wattle Barrier	CFW—CFW—CFW

NOT TO SCALE



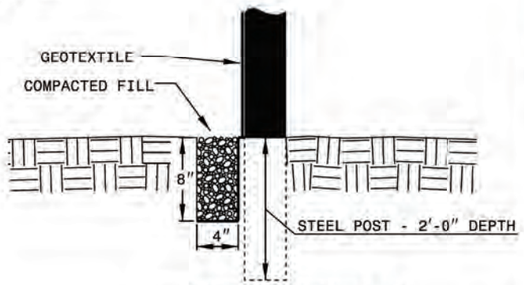
NOTES

USE GEOTEXTILE A MINIMUM OF 36" IN WIDTH AND FASTEN ADEQUATELY TO THE POSTS AND WIRE AS DIRECTED.

USE WIRE A MINIMUM OF 32" IN WIDTH AND WITH A MINIMUM OF 5 LINE WIRES WITH 12" VERTICAL SPACING.

PROVIDE 5'-0" STEEL POST OF THE SELF-FASTENER ANGLE STEEL TYPE.

FOR MECHANICAL SLICING METHOD INSTALLATION, GEOTEXTILE SHALL BE A MAXIMUM OF 18" ABOVE GROUND SURFACE.



EXTENSION OF GEOTEXTILE AND WIRE INTO TRENCH

STATE OF NORTH CAROLINA
DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS
RALEIGH, N.C.

1-24

ROADWAY STANDARD DRAWING FOR
TEMPORARY SILT FENCE

SHEET 1 OF 1
1605.01

NOT TO SCALE

NOTES

USE NO. 5 OR NO. 57 STONE FOR SEDIMENT CONTROL STONE.

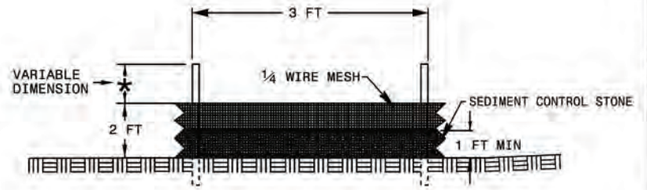
USE HARDWARE CLOTH 24 GAUGE WIRE MESH WITH ¼ INCH MESH OPENINGS.

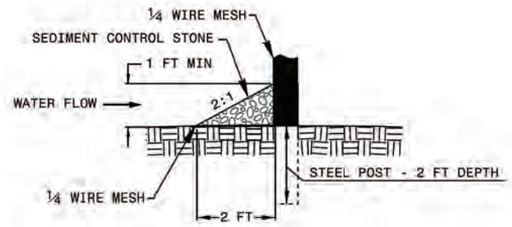
INSTALL 5 FT. SELF FASTENER ANGLE STEEL POST 2 FT. DEEP MINIMUM.

ATTACH HARDWARE CLOTH TO POSTS WITH WIRE STAPLE OR OTHER ACCEPTABLE METHODS.

SPACE POSTS A MAXIMUM OF 3 FT.

FOR INSTALLATION BETWEEN SECTIONS OF SILT FENCE, EXTEND SEDIMENT CONTROL STONE A MINIMUM OF 12" ON EACH SIDE OF SPECIAL SEDIMENT CONTROL FENCE SECTION.





The signatures affixed below certify that this sheet has been reviewed and approved solely per the certifications signed on the cover sheet of these construction plans.

Public Works - Transportation	Water Resources - Stormwater
Building Inspections	Planning
Water Resources - Utility Engineering	Planning - Transportation
Electric	Fire
Water Resources - Soil & Erosion Control	Parks, Recreation & Cultural Resources

STATE OF NORTH CAROLINA
DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS
RALEIGH, N.C.

1-24

ROADWAY STANDARD DRAWING FOR
SPECIAL SEDIMENT CONTROL FENCE

SHEET 1 OF 1
1606.01

011-01-EAB2F
EC-2A

NORTH CAROLINA
BUNCOMBE COUNTY

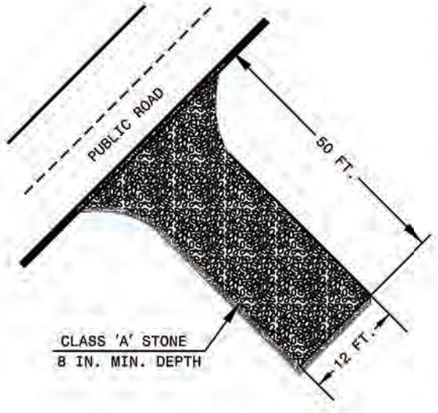
EROSION CONTROL ENGINEER
5/7/2026

NORTH CAROLINA PROFESSIONAL SEAL 054713 ENGINEER HE YANG

Signed by: He Yang
D6739823A7F4406... CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

PLANS PREPARED BY:
SUMMIT DESIGN AND ENGINEERING SERVICES
NC FIRM LICENSE No: C-5176
1000 Social Street, Suite 800
Raleigh, NC 27609
(919) 732-3883
(919) 732-6676 (FAX)

NOT TO SCALE



NOTES

1. PROVIDE TURNING RADIUS SUFFICIENT TO ACCOMMODATE LARGE TRUCKS.
2. LOCATE ENTRANCES TO PROVIDE FOR UTILIZATION BY ALL CONSTRUCTION VEHICLES.
3. MUST BE MAINTAINED IN A CONDITION WHICH WILL PREVENT TRACKING OR DIRECT FLOW OF MUD ONTO STREETS. PERIODIC TOPDRESSING WITH STONE WILL BE NECESSARY.
4. ANY MATERIAL TRACKED ONTO THE ROADWAY MUST BE CLEANED UP IMMEDIATELY.
5. LOCATE GRAVEL CONSTRUCTION ENTRANCE AT ALL POINTS OF INGRESS AND EGRESS UNTIL SITE IS STABILIZED. PROVIDE FREQUENT CHECKS OF THE DEVICE AND TIMELY MAINTENANCE.
6. NUMBER AND LOCATION OF CONSTRUCTION ENTRANCES TO BE DETERMINED BY THE ENGINEER.
7. USE CLASS 'A' STONE OR OTHER COARSE AGGREGATE APPROVED BY THE ENGINEER.
8. INSTALL CONSTRUCTION ENTRANCES IN A WAY TO PREVENT VEHICLES FROM BYPASSING CONSTRUCTION ENTRANCE LEAVING PROJECT SITE.

NOTE: PLACE GEOTEXTILE FOR DRAINAGE BENEATH STONE

STATE OF NORTH CAROLINA
DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS
RALEIGH, N.C.

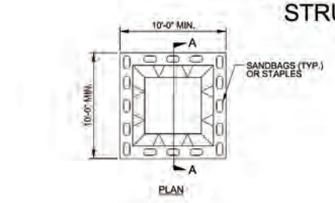
1-24

ROADWAY STANDARD DRAWING FOR
GRAVEL CONSTRUCTION ENTRANCE

SHEET 1 OF 1
1607.01

NOT TO SCALE

ONSITE CONCRETE WASHOUT STRUCTURE WITH LINER



BELOW GRADE WASHOUT STRUCTURE
NOT TO SCALE

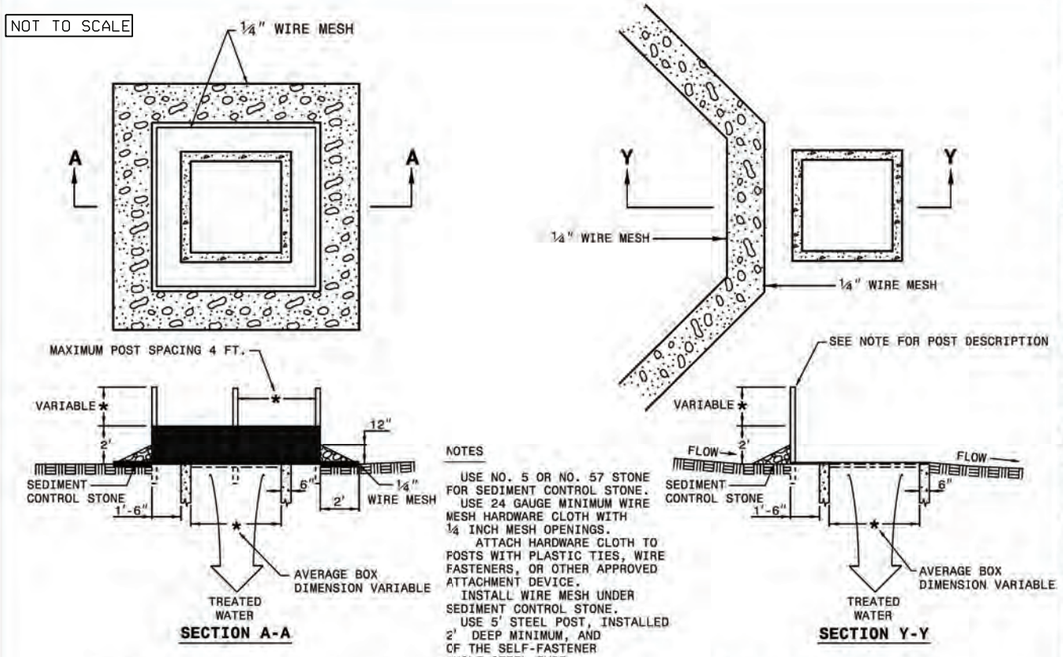
NOTES:
1. ACTUAL LOCATION DETERMINED IN FIELD
2. THE CONCRETE WASHOUT STRUCTURES SHALL BE MAINTAINED WHEN THE LIQUID AND/OR SOLID REACHES 75% OF THE STRUCTURES CAPACITY TO PROVIDE ADEQUATE HOLDING CAPACITY WITH A MINIMUM 12 INCHES OF FREEBOARD.
3.CONCRETE WASHOUT STRUCTURE NEEDS TO BE CLEARY MARKED WITH SIGNAGE NOTING DEVICE.

ABOVE GRADE WASHOUT STRUCTURE
NOT TO SCALE

NOTES:
1. ACTUAL LOCATION DETERMINED IN FIELD
2. THE CONCRETE WASHOUT STRUCTURES SHALL BE MAINTAINED WHEN THE LIQUID AND/OR SOLID REACHES 75% OF THE STRUCTURES CAPACITY TO PROVIDE ADEQUATE HOLDING CAPACITY WITH A MINIMUM 12 INCHES OF FREEBOARD.
3.CONCRETE WASHOUT STRUCTURE NEEDS TO BE CLEARY MARKED WITH SIGNAGE NOTING DEVICE.

EROSION CONTROL DETAIL	CONCRETE WASHOUT STRUCTURE	STD. NO. N/A
EFFECTIVE: N/A		SHEET 1 OF 1

NOT TO SCALE



NOTES

USE NO. 5 OR NO. 57 STONE FOR SEDIMENT CONTROL STONE.

USE 24 GAUGE MINIMUM WIRE MESH HARDWARE CLOTH WITH ¼ INCH MESH OPENINGS.

ATTACH HARDWARE CLOTH TO POSTS WITH PLASTIC TIES, WIRE FASTENERS, OR OTHER APPROVED ATTACHMENT DEVICE.

INSTALL WIRE MESH UNDER SEDIMENT CONTROL STONE.

USE 5' STEEL POST, INSTALLED 2' DEEP MINIMUM, AND OF THE SELF-FASTENER ANGLE STEEL TYPE.

SPACE POST A MAXIMUM OF 4'.

STATE OF NORTH CAROLINA
DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS
RALEIGH, N.C.

1-24

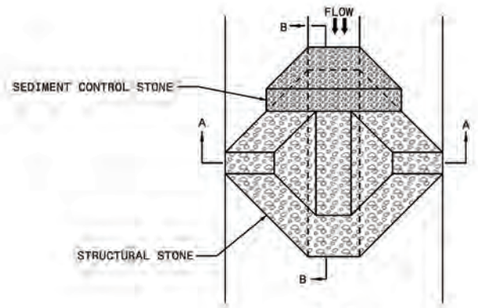
ROADWAY STANDARD DRAWING FOR

ROCK INLET SEDIMENT TRAP TYPE C

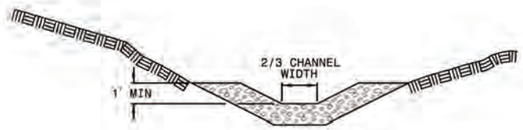
SHEET 1 OF 1

1632.03

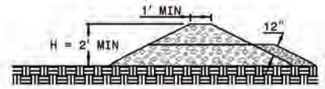
NOT TO SCALE



PLAN



SECTION A-A



SECTION B-B

NOTES

USE CLASS B EROSION CONTROL STONE FOR STRUCTURAL STONE.

USE NO. 5 OR NO. 57 STONE FOR SEDIMENT CONTROL STONE.

The signatures affixed below certify that this sheet has been reviewed and approved solely per the certifications signed on the cover sheet of these construction plans.

Public Works - Transportation	Water Resources - Stormwater
Building Inspections	Planning
Water Resources - Utility Engineering	Planning - Transportation
Electric	Fire
Water Resources - Soil & Erosion Control	Parks, Recreation & Cultural Resources

STATE OF NORTH CAROLINA
DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS
RALEIGH, N.C.

1-24

ROADWAY STANDARD DRAWING FOR

TEMPORARY ROCK SILT CHECK TYPE A

SHEET 1 OF 1

1633.01

011-01-EAB2F

EC-2B

NORTH CAROLINA
BUNCOMBE COUNTY

EROSION CONTROL ENGINEER

5/7/2026

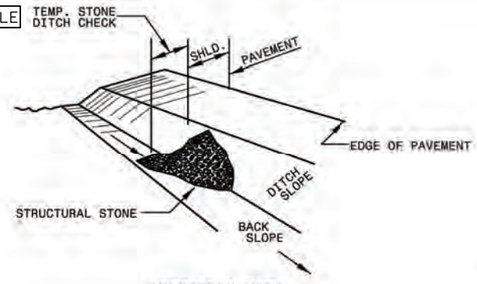
Signed by: He Yang
D6739823A7F4406...

CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

PLANS PREPARED BY:

SUMMIT DESIGN AND ENGINEERING SERVICES
NC FIRM LICENSE No: C-5176
1000 Social Street, Suite 800
Raleigh, NC 27609
(919) 732-3883
(919) 732-6676 (FAX)

NOT TO SCALE

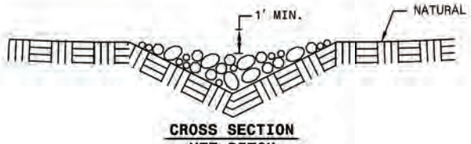


ISOMETRIC VIEW

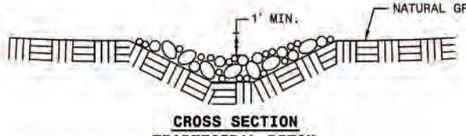
NOTES

USE CLASS B EROSION CONTROL STONE FOR STRUCTURAL STONE.

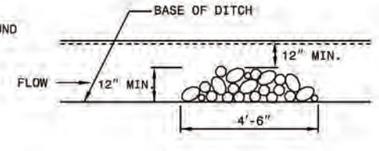
THE ENGINEER MAY DIRECT THE OPTION OF CLASS A STONE FOR SITES HAVING LESS THAN ONE (1) ACRE DRAINAGE AREA AND A DITCH GRADE LESS THAN 3%.



CROSS SECTION
VEE DITCH



CROSS SECTION
TRAPEZOIDAL DITCH



ELEVATION VIEW

STATE OF NORTH CAROLINA
DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS
RALEIGH, N.C.

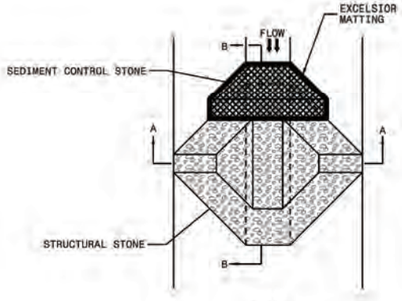
1-24

ROADWAY STANDARD DRAWING FOR

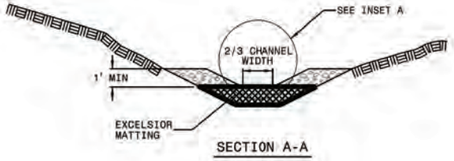
TEMPORARY ROCK SILT CHECK TYPE B

SHEET 1 OF 1

1633.02



PLAN



SECTION A-A

NOTES:

USE CLASS B EROSION CONTROL STONE FOR STRUCTURAL STONE,

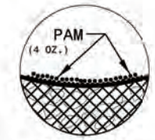
USE NO. 5 OR NO. 57 STONE FOR SEDIMENT CONTROL STONE,

DO NOT APPLY FLOCCULANT TO A TEMPORARY ROCK SILT CHECK THAT SERVES AS A STORMWATER DISCHARGE OUTFALL.

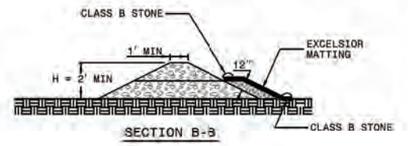
USE EXCELSIOR FOR MATTING MATERIAL AND ANCHOR MATTING SECTION AT TOP AND BOTTOM WITH CLASS B STONE.

PRIOR TO FLOCCULANT APPLICATION, OBTAIN A SOIL SAMPLE FROM PROJECT LOCATION, AND FROM OFFSITE MATERIAL, AND ANALYZE FOR APPROPRIATE FLOCCULANT TO BE APPLIED TO EACH ROCK SILT CHECK.

INITIALLY APPLY 4 OUNCES OF FLOCCULANT TO TOP OF MATTING SECTION AND AFTER EVERY RAINFALL EVENT THAT EQUALS OR EXCEEDS 0.50 INCHES.



INSET A



SECTION B-B

STATE OF NORTH CAROLINA
DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS
RALEIGH, N.C.

1-24

ROADWAY STANDARD DRAWING FOR

TEMPORARY ROCK SILT CHECK TYPE A WITH EXCELSIOR MATTING AND FLOCCULANT

SHEET 1 OF 1

1633.03

GROUND STABILIZATION AND MATERIALS HANDLING PRACTICES FOR COMPLIANCE WITH THE NCG01 CONSTRUCTION GENERAL PERMIT

Implementing the details and specifications on this plan sheet will result in the construction activity being considered compliant with the Ground Stabilization and Materials Handling sections of the NCG01 Construction General Permit (Sections E and F, respectively). The permittee shall comply with the Erosion and Sediment Control plan approved by the delegated authority having jurisdiction. All details and specifications shown on this sheet may not apply depending on site conditions and the delegated authority having jurisdiction.

SECTION E: GROUND STABILIZATION

Required Ground Stabilization Timeframes

Site Area Description	Stabilize within this many calendar days after ceasing land disturbance	Timeframe variations
(a) Perimeter dikes, swales, ditches, and perimeter slopes	7	None
(b) High Quality Water (HQW) Zones	7	None
(c) Slopes steeper than 3:1	7	If slopes are 10' or less in length and are not steeper than 2:1, 14 days are allowed
(d) Slopes 3:1 to 4:1	14	-7 days for slopes greater than 50' in length and with slopes steeper than 4:1 -7 days for perimeter dikes, swales, ditches, perimeter slopes and HQW Zones -10 days for Falls Lake Watershed
(e) Areas with slopes flatter than 4:1	14	-7 days for perimeter dikes, swales, ditches, perimeter slopes and HQW Zones -10 days for Falls Lake Watershed unless there is zero slope

Note: After the permanent cessation of construction activities, any areas with temporary ground stabilization shall be converted to permanent ground stabilization as soon as practicable but in no case longer than 90 calendar days after the last land disturbing activity. Temporary ground stabilization shall be maintained in a manner to render the surface stable against accelerated erosion until permanent ground stabilization is achieved.

GROUND STABILIZATION SPECIFICATION

Stabilize the ground sufficiently so that rain will not dislodge the soil. Use one of the techniques in the table below:

Temporary Stabilization	Permanent Stabilization
• Temporary grass seed covered with straw or other mulches and tackifiers • Hydroseeding • Rolled erosion control products with or without temporary grass seed • Appropriately applied straw or other mulch • Plastic sheeting	• Permanent grass seed covered with straw or other mulches and tackifiers • Geotextile fabrics such as permanent soil reinforcement matting • Hydroseeding • Shrubs or other permanent plantings covered with mulch • Uniform and evenly distributed ground cover sufficient to restrain erosion • Structural methods such as concrete, asphalt or retaining walls • Rolled erosion control products with grass seed

POLYACRYLAMIDES (PAMS) AND FLOCCULANTS

1. Select flocculants that are appropriate for the soils being exposed during construction, selecting from the *NC DWR List of Approved PAMS/Flocculants*.
2. Apply flocculants at or before the inlets to Erosion and Sediment Control Measures.
3. Apply flocculants at the concentrations specified in the *NC DWR List of Approved PAMS/Flocculants* and in accordance with the manufacturer's instructions.
4. Provide ponding area for containment of treated Stormwater before discharging offsite.
5. Store flocculants in leak-proof containers that are kept under storm-resistant cover or surrounded by secondary containment structures.

EQUIPMENT AND VEHICLE MAINTENANCE

1. Maintain vehicles and equipment to prevent discharge of fluids.
2. Provide drip pans under any stored equipment.
3. Identify leaks and repair as soon as feasible, or remove leaking equipment from the project.
4. Collect all spent fluids, store in separate containers and properly dispose as hazardous waste (recycle when possible).
5. Remove leaking vehicles and construction equipment from service until the problem has been corrected.
6. Bring used fuels, lubricants, coolants, hydraulic fluids and other petroleum products to a recycling or disposal center that handles these materials.

LITTER, BUILDING MATERIAL AND LAND CLEARING WASTE

1. Never bury or burn waste. Place litter and debris in approved waste containers.
2. Provide a sufficient number and size of waste containers (e.g dumpster, trash receptacle) on site to contain construction and domestic wastes.
3. Locate waste containers at least 50 feet away from storm drain inlets and surface waters unless no other alternatives are reasonably available.
4. Locate waste containers on areas that do not receive substantial amounts of runoff from upland areas and does not drain directly to a storm drain, stream or wetland.
5. Cover waste containers at the end of each workday and before storm events or provide secondary containment. Repair or replace damaged waste containers.
6. Anchor all lightweight items in waste containers during times of high winds.
7. Empty waste containers as needed to prevent overflow. Clean up immediately if containers overflow.
8. Dispose waste off-site at an approved disposal facility.
9. On business days, clean up and dispose of waste in designated waste containers.

PAINT AND OTHER LIQUID WASTE

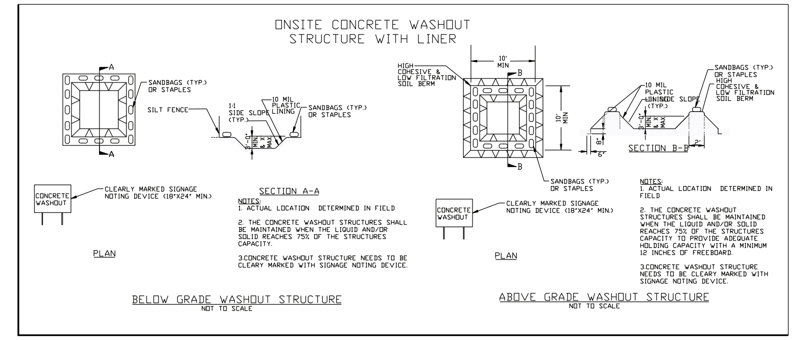
1. Do not dump paint and other liquid waste into storm drains, streams or wetlands.
2. Locate paint washouts at least 50 feet away from storm drain inlets and surface waters unless no other alternatives are reasonably available.
3. Contain liquid wastes in a controlled area.
4. Containment must be labeled, sized and placed appropriately for the needs of site.
5. Prevent the discharge of soaps, solvents, detergents and other liquid wastes from construction sites.

PORTABLE TOILETS

1. Install portable toilets on level ground, at least 50 feet away from storm drains, streams or wetlands unless there is no alternative reasonably available. If 50 foot offset is not attainable, provide relocation of portable toilet behind silt fence or place on a gravel pad and surround with sand bags.
2. Provide staking or anchoring of portable toilets during periods of high winds or in high foot traffic areas.
3. Monitor portable toilets for leaking and properly dispose of any leaked material. Utilize a licensed sanitary waste hauler to remove leaking portable toilets and replace with properly operating unit.

EARTHEN STOCKPILE MANAGEMENT

1. Show stockpile locations on plans. Locate earthen-material stockpile areas at least 50 feet away from storm drain inlets, sediment basins, perimeter sediment controls and surface waters unless it can be shown no other alternatives are reasonably available.
2. Protect stockpile with silt fence installed along toe of slope with a minimum offset of five feet from the toe of stockpile.
3. Provide stable stone access point when feasible.
4. Stabilize stockpile within the timeframes provided on this sheet and in accordance with the approved plan and any additional requirements. Soil stabilization is defined as vegetative, physical or chemical coverage techniques that will restrain accelerated erosion on disturbed soils for temporary or permanent control needs.



CONCRETE WASHOUTS

1. Do not discharge concrete or cement slurry from the site.
2. Dispose of, or recycle settled, hardened concrete residue in accordance with local and state solid waste regulations and at an approved facility.
3. Manage washout from mortar mixers in accordance with the above item and in addition place the mixer and associated materials on impervious barrier and within lot perimeter silt fence.
4. Install temporary concrete washouts per local requirements, where applicable. If an alternate method or product is to be used, contact your approval authority for review and approval. If local standard details are not available, use one of the two types of temporary concrete washouts provided on this detail.
5. Do not use concrete washouts for dewatering or storing defective curb or sidewalk sections. Stormwater accumulated within the washout may not be pumped into or discharged to the storm drain system or receiving surface waters. Liquid waste must be pumped out and removed from project.
6. Locate washouts at least 50 feet from storm drain inlets and surface waters unless it can be shown that no other alternatives are reasonably available. At a minimum, install protection of storm drain inlet(s) closest to the washout which could receive spills or overflow.
7. Locate washouts in an easily accessible area, on level ground and install a stone entrance pad in front of the washout. Additional controls may be required by the approving authority.
8. Install at least one sign directing concrete trucks to the washout within the project limits. Post signage on the washout itself to identify this location.
9. Remove leavings from the washout when at approximately 75% capacity to limit overflow events. Replace the tarp, sand bags or other temporary structural components when no longer functional. When utilizing alternative or proprietary products, follow manufacturer's instructions.
10. At the completion of the concrete work, remove remaining leavings and dispose of in an approved disposal facility. Fill pit, if applicable, and stabilize any disturbance caused by removal of washout.

HERBICIDES, PESTICIDES AND RODENTICIDES

1. Store and apply herbicides, pesticides and rodenticides in accordance with label restrictions.
2. Store herbicides, pesticides and rodenticides in their original containers with the label, which lists directions for use, ingredients and first aid steps in case of accidental poisoning.
3. Do not store herbicides, pesticides and rodenticides in areas where flooding is possible or where they may spill or leak into wells, stormwater drains, ground water or surface water. If a spill occurs, clean area immediately.
4. Do not stockpile these materials onsite.

HAZARDOUS AND TOXIC WASTE

1. Create designated hazardous waste collection areas on-site.
2. Place hazardous waste containers under cover or in secondary containment.
3. Do not store hazardous chemicals, drums or bagged materials directly on the ground.

NCG01 GROUND STABILIZATION AND MATERIALS HANDLING

EFFECTIVE: 04/01/19

The signatures affixed below certify that this sheet has been reviewed and approved solely per the certifications signed on the cover sheet of these construction plans.

Public Works - Transportation	Water Resources - Stormwater
Building Inspections	Planning
Water Resources - Utility Engineering	Planning - Transportation
Electric	Fire
Water Resources - Soil & Erosion Control	Parks, Recreation & Cultural Resources

NOT TO SCALE

011-01-EAB2F

EC-2C

NORTH CAROLINA
BUNCOMBE COUNTY

EROSION CONTROL ENGINEER

5/7/2026

NORTH CAROLINA PROFESSIONAL SEAL 054713 ENGINEER HE YANG

Signed by: He Yang
D6739823A7F4406...

CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

PLANS PREPARED BY:

SUMMIT DESIGN AND ENGINEERING SERVICES

NC FIRM LICENSE No: C-5176
1000 Social Street, Suite 800
Raleigh, NC 27609
(919) 732-3883
(919) 732-6676 (FAX)

PART III
SELF-INSPECTION, RECORDKEEPING AND REPORTING

SECTION A: SELF-INSPECTION

Self-inspections are required during normal business hours in accordance with the table below. When adverse weather or site conditions would cause the safety of the inspection personnel to be in jeopardy, the inspection may be delayed until the next business day on which it is safe to perform the inspection. In addition, when a storm event of equal to or greater than 1.0 inch occurs outside of normal business hours, the self-inspection shall be performed upon the commencement of the next business day. Any time when inspections were delayed shall be noted in the Inspection Record.

Inspect	Frequency (during normal business hours)	Inspection records must include:
(1) Rain gauge maintained in good working order	Daily	Daily rainfall amounts. If no daily rain gauge observations are made during weekend or holiday periods, and no individual-day rainfall information is available, record the cumulative rain measurement for those un-attended days (and this will determine if a site inspection is needed). Days on which no rainfall occurred shall be recorded as "zero." The permittee may use another rain-monitoring device approved by the Division.
(2) E&SC Measures	At least once per 7 calendar days and within 24 hours of a rain event ≥ 1.0 inch in 24 hours	1. Identification of the measures inspected, 2. Date and time of the inspection, 3. Name of the person performing the inspection, 4. Indication of whether the measures were operating properly, 5. Description of maintenance needs for the measure, 6. Description, evidence, and date of corrective actions taken.
(3) Stormwater discharge outfalls (SDOs)	At least once per 7 calendar days and within 24 hours of a rain event ≥ 1.0 inch in 24 hours	1. Identification of the discharge outfalls inspected, 2. Date and time of the inspection, 3. Name of the person performing the inspection, 4. Evidence of indicators of stormwater pollution such as oil sheen, floating or suspended solids or discoloration, 5. Indication of visible sediment leaving the site, 6. Description, evidence, and date of corrective actions taken.
(4) Perimeter of site	At least once per 7 calendar days and within 24 hours of a rain event > 1.0 inch in 24 hours	If visible sedimentation is found outside site limits, then a record of the following shall be made: 1. Actions taken to clean up or stabilize the sediment that has left the site limits, 2. Description, evidence, and date of corrective actions taken, and 3. An explanation as to the actions taken to control future releases.
(5) Streams or wetlands onsite or offsite (where accessible)	At least once per 7 calendar days and within 24 hours of a rain event ≥ 1.0 inch in 24 hours	If the stream or wetland has increased visible sedimentation or a stream has visible increased turbidity from the construction activity, then a record of the following shall be made: 1. Description, evidence and date of corrective actions taken, and 2. Records of the required reports to the appropriate Division Regional Office per Part III, Section C, Item (2)(a) of this permit.
(6) Ground stabilization measures	After each phase of grading	1. The phase of grading (installation of perimeter E&SC measures, clearing and grubbing, installation of storm drainage facilities, completion of all land-disturbing activity, construction or redevelopment, permanent ground cover). 2. Documentation that the required ground stabilization measures have been provided within the required timeframe or an assurance that they will be provided as soon as possible.

NOTE: The rain inspection resets the required 7 calendar day inspection requirement.

PART III
SELF-INSPECTION, RECORDKEEPING AND REPORTING

SECTION B: RECORDKEEPING

1. E&SC Plan Documentation

The approved E&SC plan as well as any approved deviation shall be kept on the site. The approved E&SC plan must be kept up-to-date throughout the coverage under this permit. The following items pertaining to the E&SC plan shall be kept on site and available for inspection at all times during normal business hours.

Item to Document	Documentation Requirements
(a) Each E&SC measure has been installed and does not significantly deviate from the locations, dimensions and relative elevations shown on the approved E&SC plan.	Initial and date each E&SC measure on a copy of the approved E&SC plan or complete, date and sign an inspection report that lists each E&SC measure shown on the approved E&SC plan. This documentation is required upon the initial installation of the E&SC measures or if the E&SC measures are modified after initial installation.
(b) A phase of grading has been completed.	Initial and date a copy of the approved E&SC plan or complete, date and sign an inspection report to indicate completion of the construction phase.
(c) Ground cover is located and installed in accordance with the approved E&SC plan.	Initial and date a copy of the approved E&SC plan or complete, date and sign an inspection report to indicate compliance with approved ground cover specifications.
(d) The maintenance and repair requirements for all E&SC measures have been performed.	Complete, date and sign an inspection report.
(e) Corrective actions have been taken to E&SC measures.	Initial and date a copy of the approved E&SC plan or complete, date and sign an inspection report to indicate the completion of the corrective action.

2. Additional Documentation to be Kept on Site

In addition to the E&SC plan documents above, the following items shall be kept on the site and available for inspectors at all times during normal business hours, unless the Division provides a site-specific exemption based on unique site conditions that make this requirement not practical:

(a) This General Permit as well as the Certificate of Coverage, after it is received.

(b) Records of inspections made during the previous twelve months. The permittee shall record the required observations on the Inspection Record Form provided by the Division or a similar inspection form that includes all the required elements. Use of electronically-available records in lieu of the required paper copies will be allowed if shown to provide equal access and utility as the hard-copy records.

3. Documentation to be Retained for Three Years

All data used to complete the e-NOI and all inspection records shall be maintained for a period of three years after project completion and made available upon request. [40 CFR 122.41]

PART III
SELF-INSPECTION, RECORDKEEPING AND REPORTING

SECTION C: REPORTING

1. Occurrences that Must be Reported

Permittees shall report the following occurrences:

(a) Visible sediment deposition in a stream or wetland.

(b) Oil spills if:
- They are 25 gallons or more,
- They are less than 25 gallons but cannot be cleaned up within 24 hours,
- They cause sheen on surface waters (regardless of volume), or
- They are within 100 feet of surface waters (regardless of volume).

(c) Releases of hazardous substances in excess of reportable quantities under Section 311 of the Clean Water Act (Ref: 40 CFR 110.3 and 40 CFR 117.3) or Section 102 of CERCLA (Ref: 40 CFR 302.4) or G.S. 143-215.85.

(d) Anticipated bypasses and unanticipated bypasses.

(e) Noncompliance with the conditions of this permit that may endanger health or the environment.

2. Reporting Timeframes and Other Requirements

After a permittee becomes aware of an occurrence that must be reported, he shall contact the appropriate Division regional office within the timeframes and in accordance with the other requirements listed below. Occurrences outside normal business hours may also be reported to the Department's Environmental Emergency Center personnel at (800) 858-0368.

Occurrence	Reporting Timeframes (After Discovery) and Other Requirements
(a) Visible sediment deposition in a stream or wetland	• ***Within 24 hours***, an oral or electronic notification. • ***Within 7 calendar days***, a report that contains a description of the sediment and actions taken to address the cause of the deposition. Division staff may waive the requirement for a written report on a case-by-case basis. • If the stream is named on the NC 303(d) list as impaired for sediment-related causes, the permittee may be required to perform additional monitoring, inspections or apply more stringent practices if staff determine that additional requirements are needed to assure compliance with the federal or state impaired-waters conditions.
(b) Oil spills and release of hazardous substances per Item 1(b)-(c) above	• ***Within 24 hours***, an oral or electronic notification. The notification shall include information about the date, time, nature, volume and location of the spill or release.
(c) Anticipated bypasses [40 CFR 122.41(m)(3)]	• ***A report at least ten days before the date of the bypass, if possible***. The report shall include an evaluation of the anticipated quality and effect of the bypass.
(d) Unanticipated bypasses [40 CFR 122.41(m)(3)]	• ***Within 24 hours***, an oral or electronic notification. • ***Within 7 calendar days,*** a report that includes an evaluation of the quality and effect of the bypass.
(e) Noncompliance with the conditions of this permit that may endanger health or the environment[40 CFR 122.41(l)(7)]	• ***Within 24 hours***, an oral or electronic notification. • ***Within 7 calendar days***, a report that contains a description of the noncompliance, and its causes; the period of noncompliance, including exact cates and times, and if the noncompliance has not been corrected, the anticipated time noncompliance is expected to continue; and steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance. [40 CFR 122.41(l)(6). • Division staff may waive the requirement for a written report on a case-by-case basis.

PART II, SECTION G, ITEM (4)
DRAW DOWN OF SEDIMENT BASINS FOR MAINTENANCE OR CLOSE OUT

Sediment basins and traps that receive runoff from drainage areas of one acre or more shall use outlet structures that withdraw water from the surface when these devices need to be drawn down for maintenance or close out unless this is infeasible. The circumstances in which it is not feasible to withdraw water from the surface shall be rare (for example, times with extended cold weather). Non-surface withdrawals from sediment basins shall be allowed only when all of the following criteria have been met:

(a) The E&SC plan authority has been provided with documentation of the non-surface withdrawal and the specific time periods or conditions in which it will occur. The non-surface withdrawal shall not commence until the E&SC plan authority has approved these items,

(b) The non-surface withdrawal has been reported as an anticipated bypass in accordance with Part III, Section C, Item (2)(c) and (d) of this permit,

(c) Dewatering discharges are treated with controls to minimize discharges of pollutants from stormwater that is removed from the sediment basin. Examples of appropriate controls include properly sited, designed and maintained dewatering tanks, weir tanks, and filtration systems,

(d) Vegetated, upland areas of the sites or a properly designed stone pad is used to the extent feasible at the outlet of the dewatering treatment devices described in Item (c) above,

(e) Velocity dissipation devices such as check dams, sediment traps, and riprap are provided at the discharge points of all dewatering devices, and

(f) Sediment removed from the dewatering treatment devices described in Item (c) above is disposed of in a manner that does not cause deposition of sediment into waters of the United States.

NCG01 SELF-INSPECTION, RECORDKEEPING AND REPORTING

EFFECTIVE: 04/01/19

011-01-EAB2F
EC-2D
NORTH CAROLINA
BUNCOMBE COUNTY

EROSION CONTROL ENGINEER
5/7/2026
NORTH CAROLINA PROFESSIONAL SEAL 054713 ENGINEER HE YANG
Signed by: He Yang
D6736823A7F4406...
CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

PLANS PREPARED BY:
SUMMIT DESIGN AND ENGINEERING SERVICES
NC FIRM LICENSE No: C-5176
1000 Social Street, Suite 800
Raleigh, NC 27609
(919) 732-3883
(919) 732-6676 (FAX)

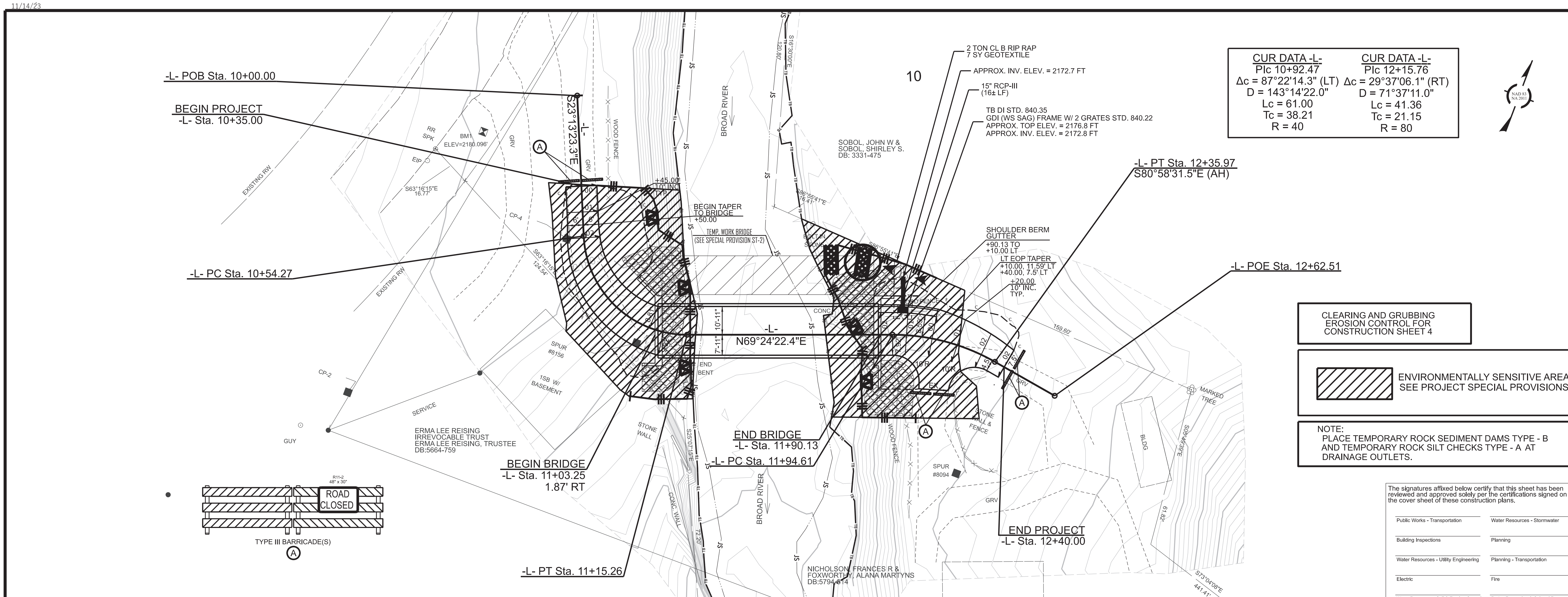
The signatures affixed below certify that this sheet has been reviewed and approved solely per the certifications signed on the cover sheet of these construction plans.

Public Works - Transportation	Water Resources - Stormwater
Building Inspections	Planning
Water Resources - Utility Engineering	Planning - Transportation
Electric	Fire
Water Resources - Soil & Erosion Control	Parks, Recreation & Cultural Resources

NOT TO SCALE

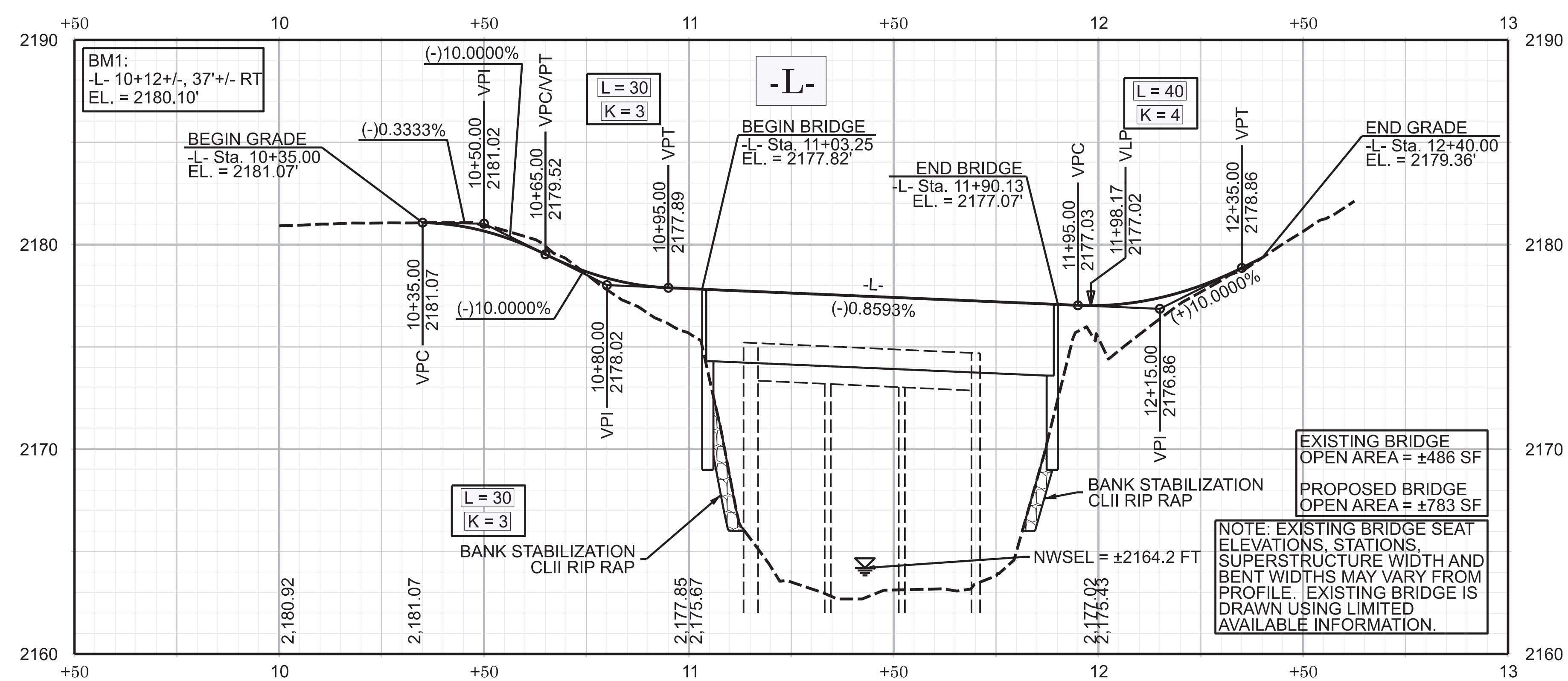
Docusign Envelope ID: 6DFFE66F-9F49-49B8-BF23-C53D9D6DBFD2

11/14/23



The signatures affixed below certify that this sheet has been reviewed and approved solely per the certifications signed on the cover sheet of these construction plans.

Public Works - Transportation	Water Resources - Stormwater
Building Inspections	Planning
Water Resources - Utility Engineering	Planning - Transportation
Electric	Fire
Water Resources - Soil & Erosion Control	Parks, Recreation & Cultural Resources



011-01-EAB2F

EC-003 CONST. 003

NORTH CAROLINA BUNCOMBE COUNTY

HYDRAULIC DESIGN ENGINEER

5/7/2026

NORTH CAROLINA PROFESSIONAL SEAL 054713 ENGINEER YANG

Signed by: He Yang

D6739823A7F4406

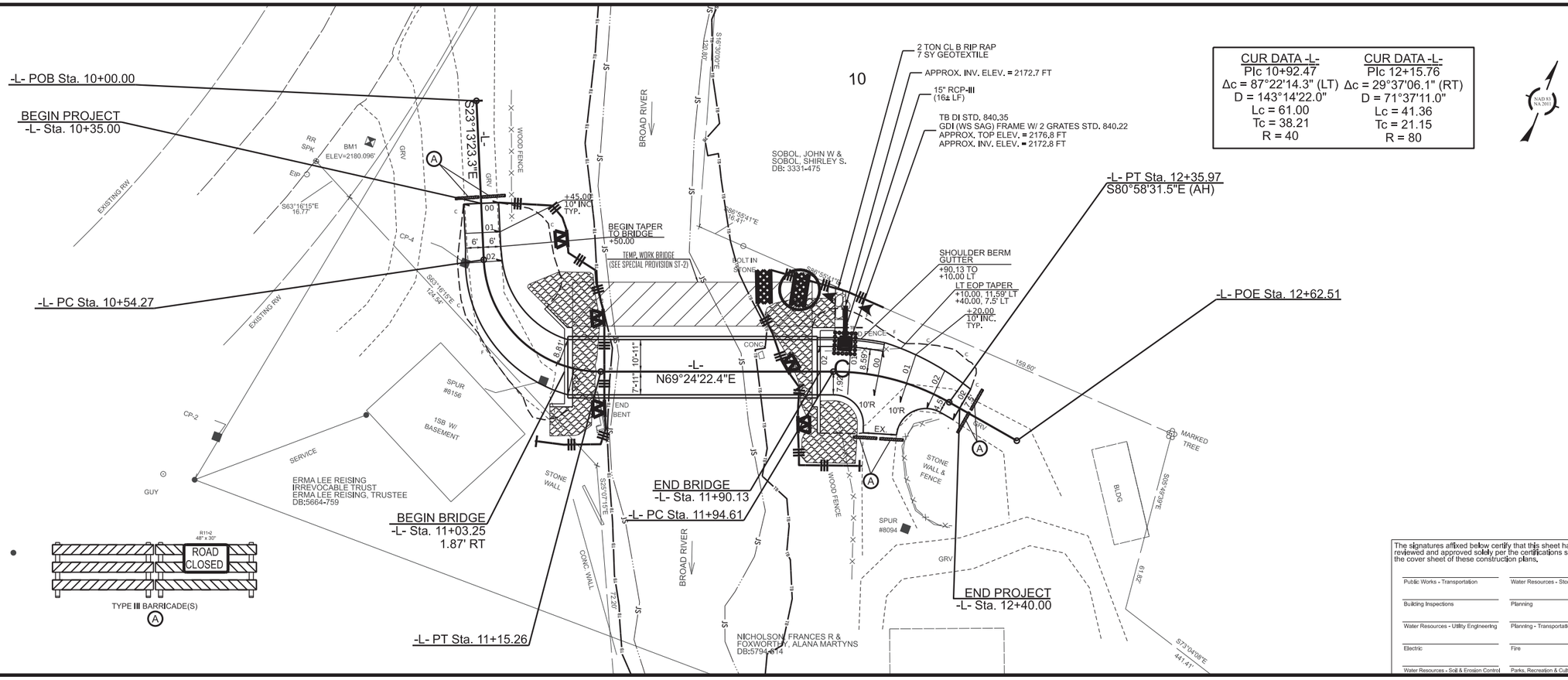
CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

PLANS PREPARED BY:

SUMMIT DESIGN AND ENGINEERING SERVICES

NC FIRM LICENSE No: C-5176
1000 Social Street, Suite 800
Raleigh, NC 27609
(919) 732-3883
(919) 732-6676 (FAX)

SCE/he.yang - 2/19/2026



11/14/23

CUR DATA -L-	CUR DATA -L-
PIc 10+92.47	PIc 12+15.76
Δc = 87°22'14.3" (LT)	Δc = 29°37'06.1" (RT)
D = 143°14'22.0"	D = 71°37'11.0"
Lc = 61.00	Lc = 41.36
Tc = 38.21	Tc = 21.15
R = 40	R = 80

The signatures affixed below certify that this sheet has been reviewed and approved solely per the certifications signed on the cover sheet of these construction plans.

Public Works - Transportation	Water Resources - Stormwater
Building Inspections	Planning
Water Resources - Utility Engineering	Planning - Transportation
Electric	Fire
Water Resources - Soil & Erosion Control	Parks, Recreation & Cultural Resources

EXISTING BRIDGE
OPEN AREA = ±486 SF

PROPOSED BRIDGE
OPEN AREA = ±783 SF

NOTE: EXISTING BRIDGE SEAT ELEVATIONS, STATIONS, SUPERSTRUCTURE WIDTH AND BENT WIDTHS MAY VARY FROM PROFILE. EXISTING BRIDGE IS DRAWN USING LIMITED AVAILABLE INFORMATION.

011-01-EAB2F

EC-004 | CONST. 003

NORTH CAROLINA
BUNCOMBE COUNTY

HYDRAULIC DESIGN ENGINEER

5/7/2026

SEAL
054713
HE YANG

Signed by:
He Yang
D6739823A7F4406...

...CONSIDERED FINAL
UNLESS ALL SIGNATURES COMPLETED

PLANS PREPARED BY:

SUMMIT
DESIGN AND ENGINEERING SERVICES

NC FIRM LICENSE No: C-5176
1000 Social Street, Suite 800
Raleigh, NC 27609
(919) 732-3883
(919) 732-6676 (FAX)

SCE/he.yang - 2/19/2026

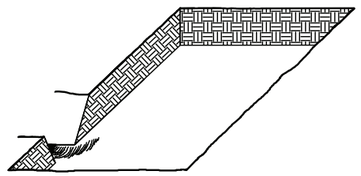
STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	011-01-EAB2F	RF-1	
STATE PROJ. NO.	F. A. PROJ. NO.	DESCRIPTION	

PLANTING DETAILS

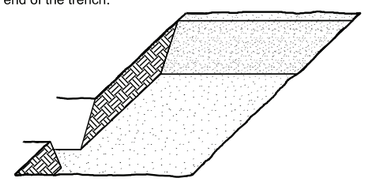
SEEDLING / LINER BAREROOT PLANTING DETAIL

HEALING IN

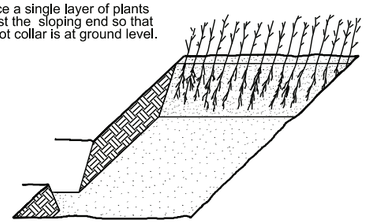
1. Locate a healing-in site in a shady, well protected area.
2. Excavate a flat bottom trench 12 inches deep and provide drainage.



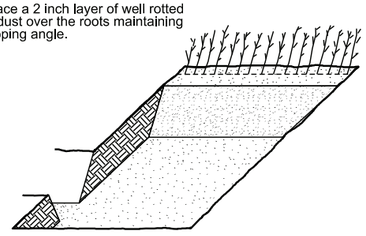
3. Backfill the trench with 2 inches well rotted sawdust. Place a 2 inch layer of well rotted sawdust at a sloping angle at one end of the trench.



4. Place a single layer of plants against the sloping end so that the root collar is at ground level.

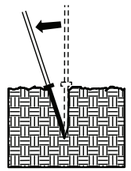


5. Place a 2 inch layer of well rotted sawdust over the roots maintaining a sloping angle.

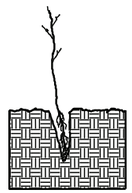


6. Repeat layers of plants and sawdust as necessary and water thoroughly.

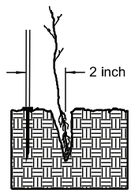
DIBBLE PLANTING METHOD
USING THE KBC PLANTING BAR



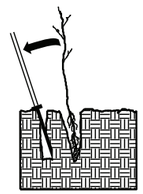
1. Insert planting bar as shown and pull handle toward planter.



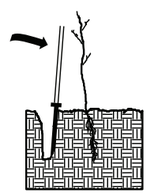
2. Remove planting bar and place seedling at correct depth.



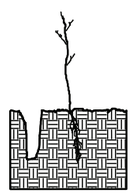
3. Insert planting bar 2 inches toward planter from seedling.



4. Pull handle of bar toward planter, firming soil at bottom.



5. Push handle forward firming soil at top.



6. Leave compaction hole open. Water thoroughly.

PLANTING NOTES:

PLANTING BAG
During planting, seedlings shall be kept in a moist canvas bag or similar container to prevent the root systems from drying.

KBC PLANTING BAR
Planting bar shall have a blade with a triangular cross section, and shall be 12 inches long, 4 inches wide and 1 inch thick at center.

ROOT PRUNING
All seedlings shall be root pruned, if necessary, so that no roots extend more than 10 inches below the root collar.

REFORESTATION

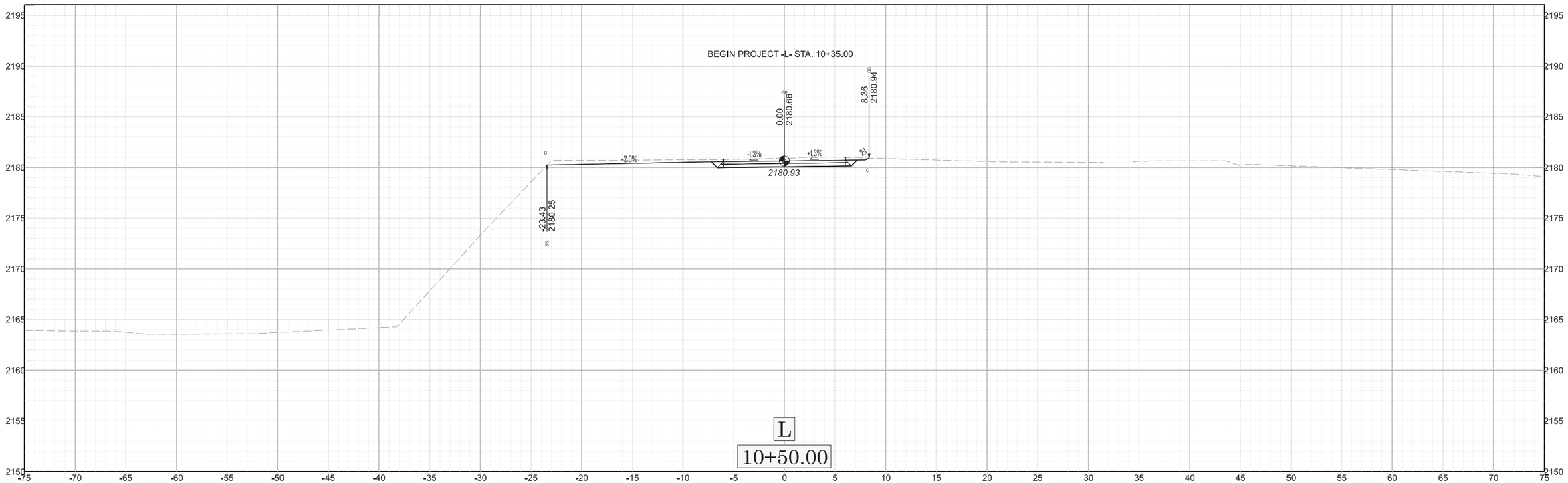
☐ TREE REFORESTATION SHALL BE PLANTED 6 FT. TO 10 FT. ON CENTER, RANDOM SPACING, AVERAGING 8 FT. ON CENTER, APPROXIMATELY 680 PLANTS PER ACRE.

REFORESTATION

MIXTURE, TYPE, SIZE, AND FURNISH SHALL CONFORM TO THE FOLLOWING:

34% LIRIODENDRON TULIPIFERA	TULIP POPLAR	12 in - 18 in BR
33% PLATANUS OCCIDENTALIS	AMERICAN SYCAMORE	12 in - 18 in BR
33% BETULA NIGRA	RIVER BIRCH	12 in - 18 in BR

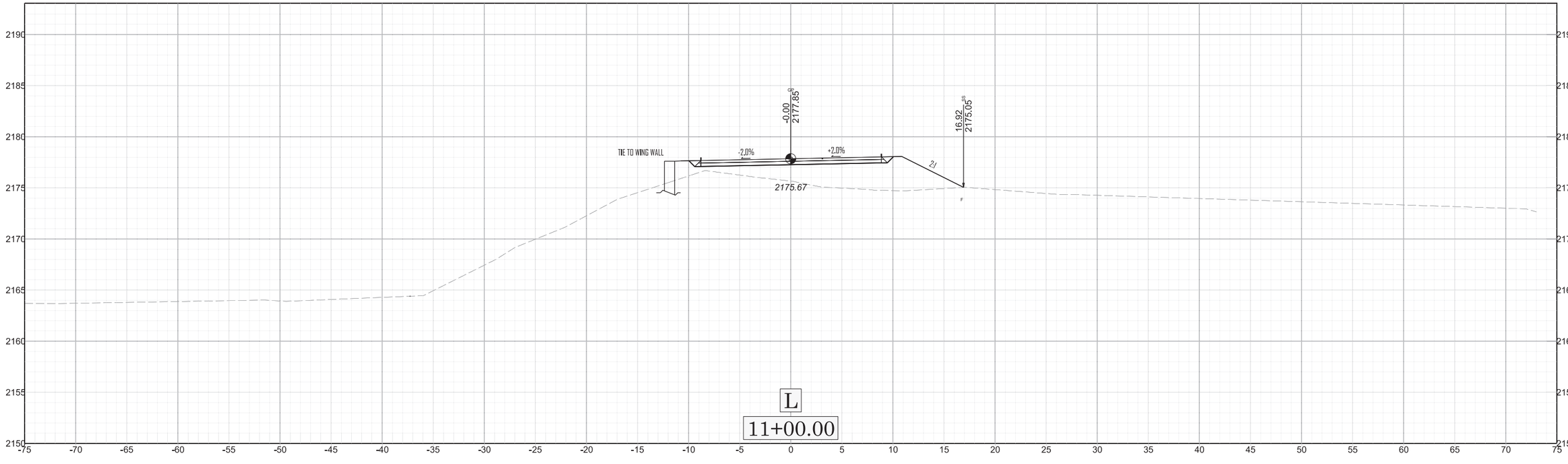
REFORESTATION DETAIL SHEET

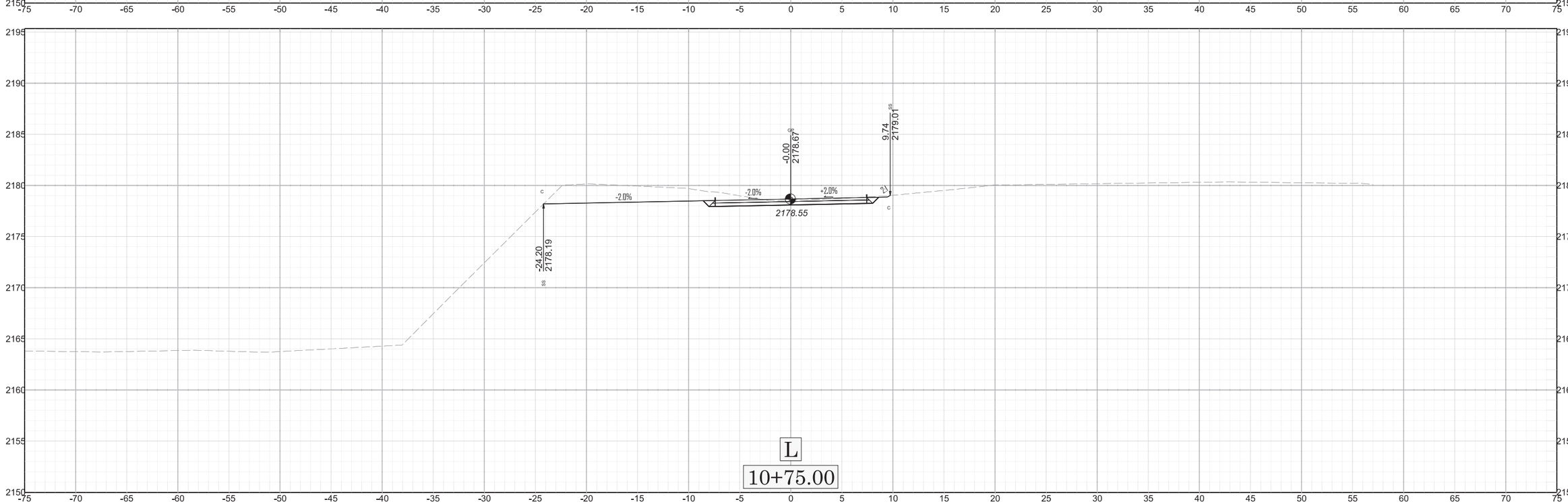


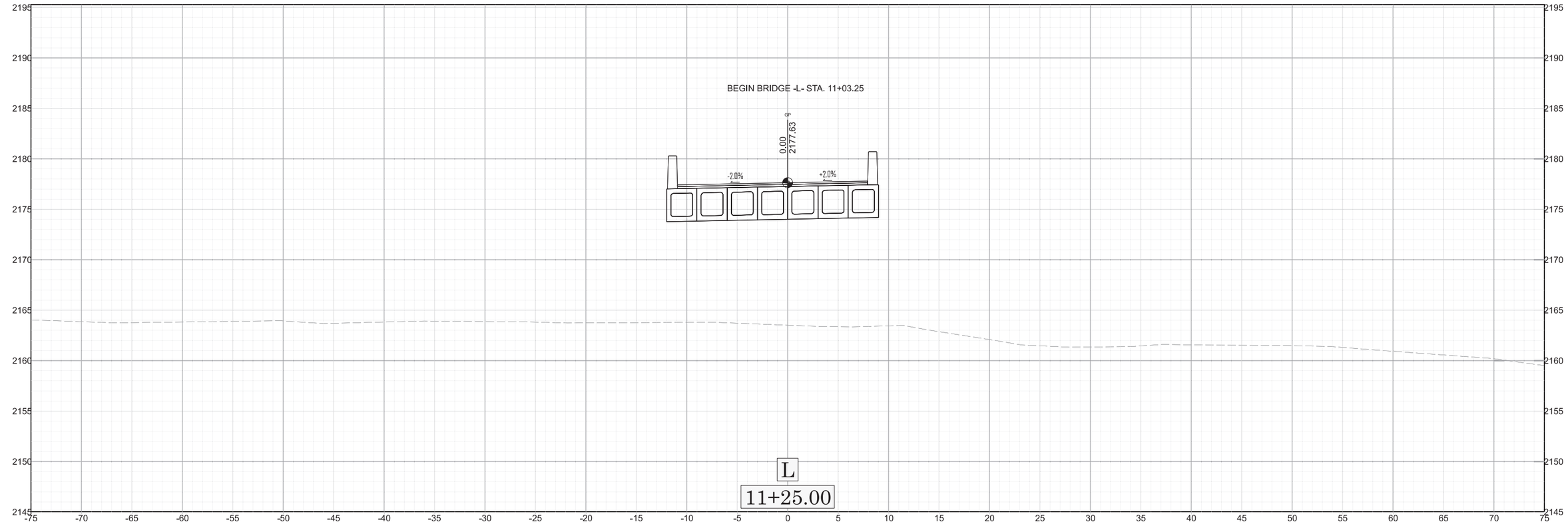
0 5 10

X 001

ON1-01-EAB2F


TIE TO WING WALL
-2.0%
+2.0%
2:1
-0.00
2177.85
16.92
2175.05
2175.67
L
11+00.00


-2.0%
-2.0%
+2.0%
2:1
-0.00
2178.67
9.74
2179.01
2178.55
-24.20
2178.19
L
10+75.00

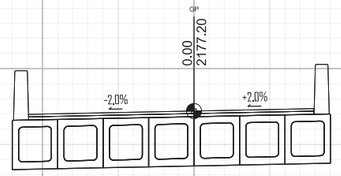


0 5 10

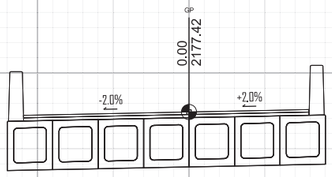
X 003

01-01-EAB2F

END BRIDGE -L- STA. 11+90.13



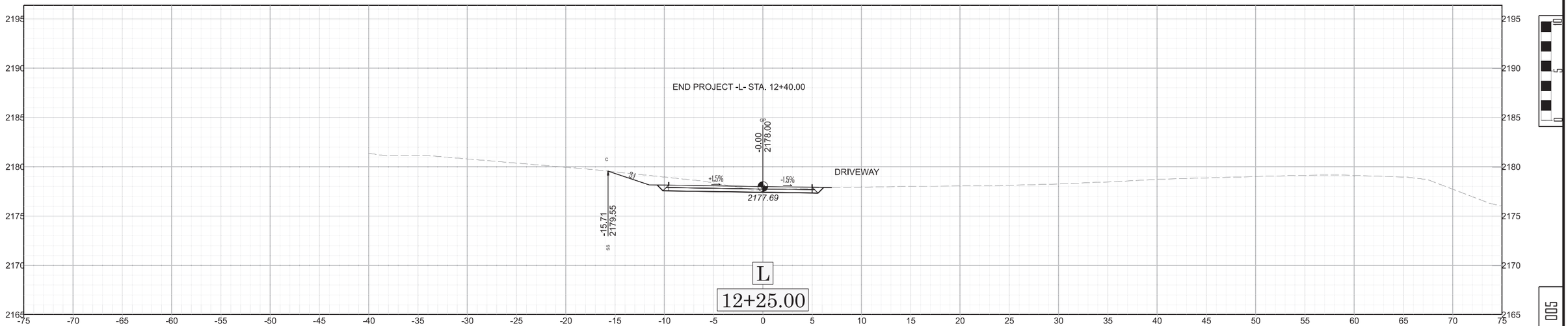
L
11+75.00

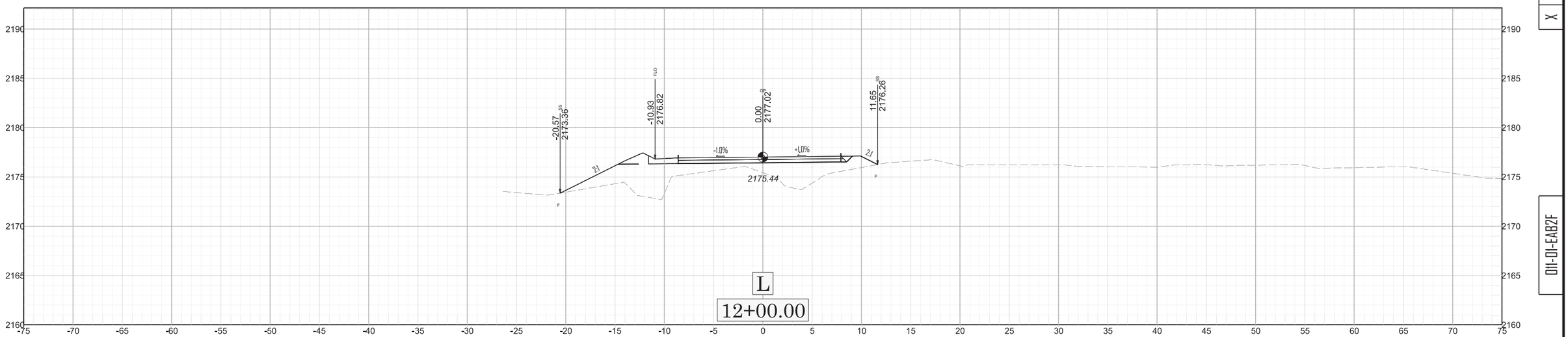


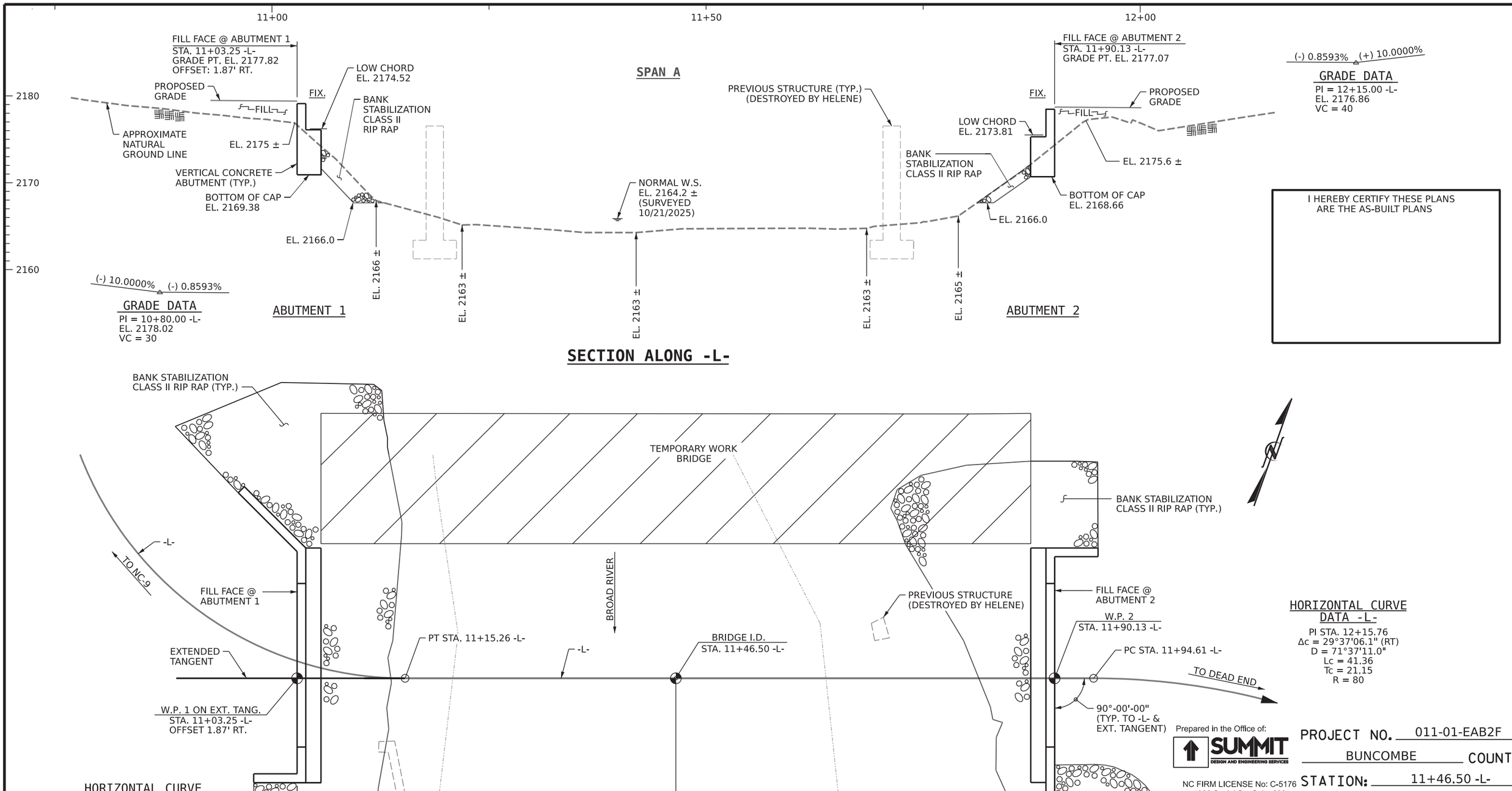
L
11+50.00

X 004

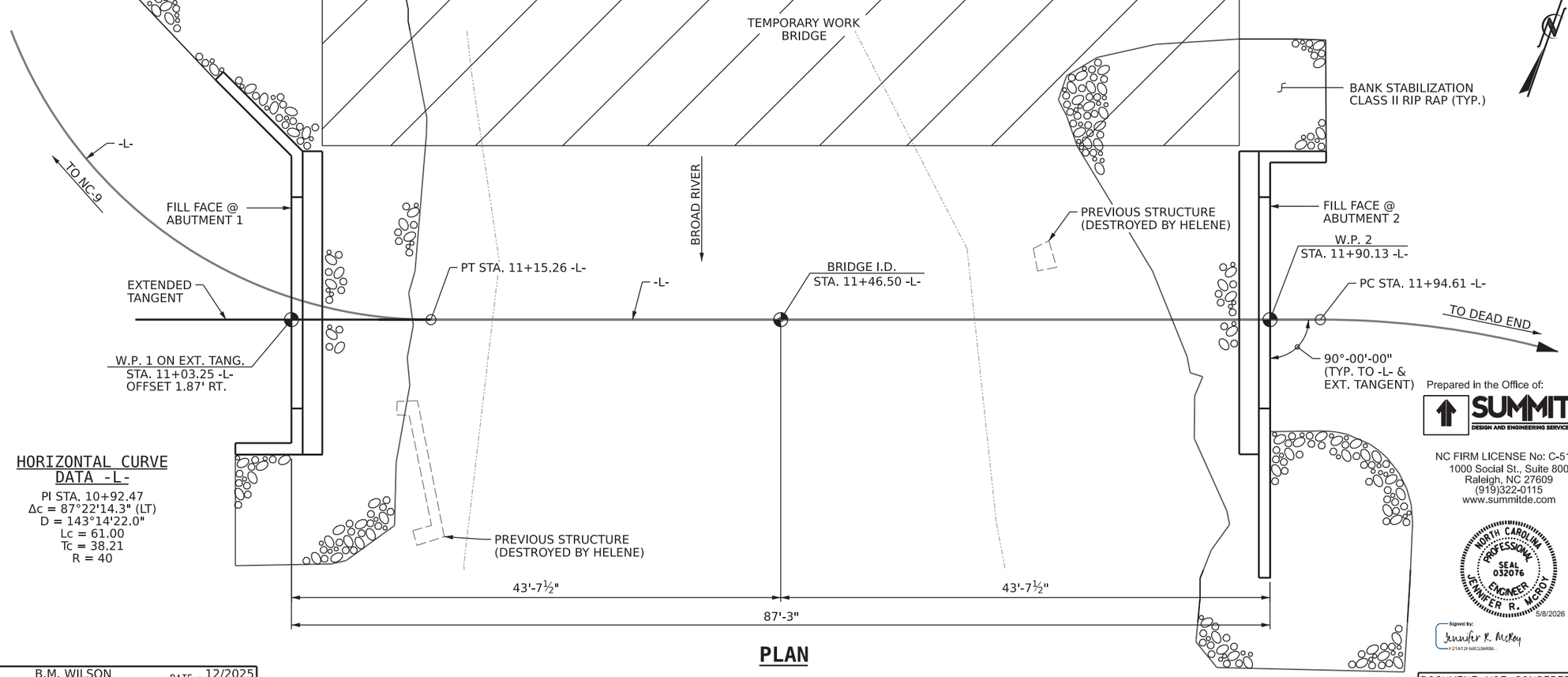
011-01-EAB2F


END PROJECT -L- STA. 12+40.00
-0.00
2178.00
G
DRIVEWAY
+1.5%
-1.5%
2177.69
-15.71
2179.55
SS
2:1
L
12+25.00


-20.57
2173.36
SS
-10.93
2176.82
FLO
0.00
2177.02
G
11.65
2176.26
SS
-1.0%
+1.0%
2:1
2175.44
F
L
12+00.00



SECTION ALONG -L-



PLAN

HORIZONTAL CURVE DATA -L-
PI STA. 10+92.47
Δc = 87°22'14.3" (LT)
D = 143°14'22.0"
Lc = 61.00
Tc = 38.21
R = 40

HORIZONTAL CURVE DATA -L-
PI STA. 12+15.76
Δc = 29°37'06.1" (RT)
D = 71°37'11.0"
Lc = 41.36
Tc = 21.15
R = 80

I HEREBY CERTIFY THESE PLANS ARE THE AS-BUILT PLANS

DRAWN BY : B.M. WILSON DATE : 12/2025
CHECKED BY : J.R. MCROY DATE : 12/2025
DESIGN ENGINEER OF RECORD: J.R. MCROY DATE : 12/2025

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

Prepared in the Office of:
SUMMIT DESIGN AND ENGINEERING SERVICES
NC FIRM LICENSE No: C-5176
1000 Social St., Suite 800
Raleigh, NC 27609
(919)322-0115
www.summitde.com

NORTH CAROLINA PROFESSIONAL SEAL 032076 ENGINEER JENNIFER R. MCROY
5/8/2026
Signed by: Jennifer R. McRoy

PROJECT NO. 011-01-EAB2F
BUNCOMBE COUNTY
STATION: 11+46.50 -L-
SHEET 1 OF 3

GENERAL DRAWING

FOR BRIDGE OVER BROAD RIVER ON PRIVATE ROAD BETWEEN NC-9 AND DEAD END

90° SKEW

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	S-1
1			3			TOTAL SHEETS
2			4			15

SUMMARY OF SPREAD FOOTING INFORMATION

(Blank entries indicate item is not applicable to structure)

End Bent / Bent No, Footing(s) #(-#) (e.g., "Bent 1, Footing 1-2")	Factored Bearing Resistance KSF	Footing Dimensions (Length x Width) FT x FT	Required Bearing Resistance KSF	Scour Critical Elevation FT	Minimum Bottom of Footing (Footing No Higher Than) Elevation FT
End Bent No. 1	6.5	27 x 2.75	5.5		2169.38
End Bent No. 1	6.5	27 x 2.75	5.5		2168.66

FOUNDATION NOTES ON PLANS:

1. For foundation excavation, see Section 410 of the Standard Specifications.
2. For bridge abutments, see Section 420 of the Standard Specifications.
3. Bridge abutments must be keyed into weathered rock or crystalline rock a minimum of 4 inches to resist sliding.
4. Minimum bottom of footing elevations at End Bent 1 with rock keyway shall be 2169.38 ft.
5. Minimum bottom of footing elevations at End Bent 2 with rock keyway shall be 2168.66 ft.

NOTES:

1. The Micropile and Spread Footing Foundation Tables are based on the bridge substructure design and foundation recommendations sealed by a North Carolina Professional Engineer (Robert D. Botzenmayer, #044443) on 11-20-2025.

PROJECT NO. 011-01-EAB2F

BUNCOMBE COUNTY

STATION: 11+46.50 -L-

NORTH CAROLINA PROFESSIONAL SEAL 032076 ENGINEER JENNIFER R. MCROY

5/8/2026

Signed by: Jennifer R. McRoy

SIGNATURE DATE

MICROPILE AND SPREAD FOOTING FOUNDATION TABLES

DRAWN BY: B. M. WILSON DATE: 12/2025

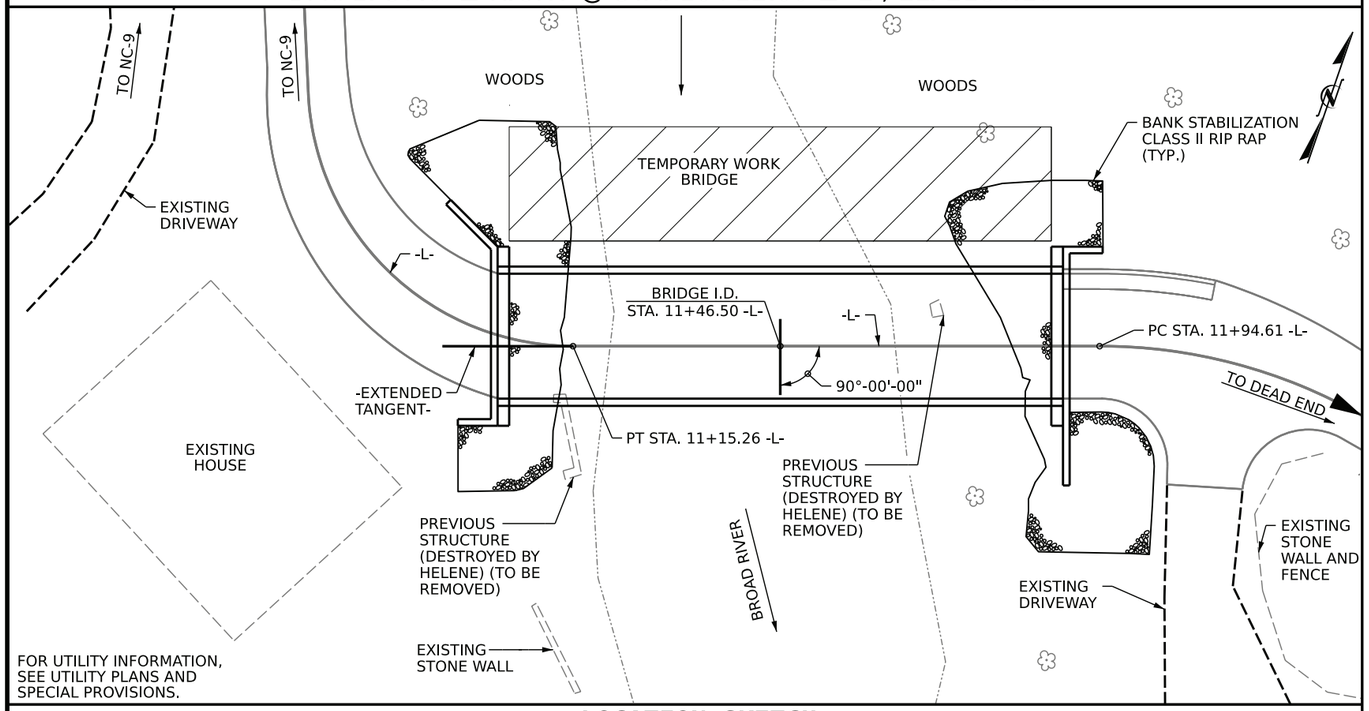
CHECKED BY: J. R. MCROY DATE: 12/2025

DESIGN ENGINEER OF RECORD: J. R. MCROY DATE: 12/2025

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

REVISIONS							SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:		S-2
1			3				TOTAL SHEETS
2			4				15

BM#1: 37.0' ± RIGHT @ STA. 10+12.00 ± -L-, EL. 2180.10



LOCATION SKETCH

NOTES

ASSUMED LIVE LOAD = HL-93 OR ALTERNATE LOADING.

THIS BRIDGE HAS BEEN DESIGNED IN ACCORDANCE WITH THE REQUIREMENTS OF THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS.

THIS BRIDGE IS LOCATED IN SEISMIC ZONE 1.

FOR OTHER DESIGN DATA AND GENERAL NOTES, SEE SHEET SN.

FOR BRIDGE MAINTENANCE RECOMMENDATIONS, SEE SHEET MN.

FOR SUBMITTAL OF WORKING DRAWINGS, SEE SPECIAL PROVISIONS.

FOR FALSEWORK AND FORMWORK, SEE SPECIAL PROVISIONS.

FOR CRANE SAFETY, SEE SPECIAL PROVISIONS.

FOR GROUT FOR STRUCTURES, SEE SPECIAL PROVISIONS.

FOR EROSION CONTROL MEASURES, SEE EROSION CONTROL PLANS.

FOR ASBESTOS ASSESSMENT, SEE SPECIAL PROVISIONS.

THE SUBSTRUCTURE OF THE EXISTING BRIDGE INDICATED ON THE PLANS IS FROM THE BEST INFORMATION AVAILABLE. THE INFORMATION IS SHOWN FOR THE CONVENIENCE OF THE CONTRACTOR. THE CONTRACTOR SHALL HAVE NO CLAIM WHATSOEVER FOR ANY DELAYS OR ADDITIONAL COST INCURRED BASED ON DIFFERENCES BETWEEN THE EXISTING BRIDGE SUBSTRUCTURE SHOWN ON THE PLANS AND THE ACTUAL CONDITIONS AT THE PROJECT SITE.

THE EXISTING STRUCTURE REMAINING AT THE PROJECT SITE SHALL BE REMOVED.

REMOVAL OF THE EXISTING BRIDGE SHALL BE PERFORMED IN A MANNER THAT PREVENTS DEBRIS FROM FALLING INTO THE WATER. THE CONTRACTOR SHALL SUBMIT DEMOLITION PLANS FOR REVIEW AND REMOVE THE BRIDGE IN ACCORDANCE WITH ARTICLE 402-2 OF THE STANDARDS SPECIFICATIONS.

A HYDRAULIC MODEL WAS NOT DEVELOPED FOR THIS BRIDGE SITE. HYDRAULIC DATA IS NOT PROVIDED OTHER THAN WHAT IS SHOWN IN THE ELEVATION VIEW, GENERAL DRAWING SHEET 1 OF 3. A FUTURE HYDRAULIC MODEL WILL BE DEVELOPED BY FEMA TO INCORPORATE THE PROPOSED STRUCTURE AND ANY CHANGES TO THE FLOODPLAIN AND FLOODWAY.

TOTAL BILL OF MATERIAL

	REMOVAL OF EXISTING STRUCTURE @ STA. 11+46.50 -L-	ASBESTOS ASSESSMENT	CLASS A CONCRETE	REINFORCING STEEL	VERTICAL CONCRETE BARRIER RAIL	RIP RAP CLASS II (2'-0" THICK)	GEOTEXTILE FOR DRAINAGE	ELASTOMERIC BEARINGS	3'-0" X 2'-9" PRESTRESSED CONC. BOX BEAMS	
	LUMP SUM	LUMP SUM	CU. YDS.	LBS.	LIN. FT.	TONS	SQ. YDS.	LUMP SUM	NO.	LIN. FT.
SUPERSTRUCTURE	LUMP SUM	LUMP SUM			170			LUMP SUM	7	595
ABUTMENT 1			22.4	3,363		112	125			
ABUTMENT 2			22.6	3,657		126	144			
TOTAL	LUMP SUM	LUMP SUM	45.0	7,020	170	238	269	LUMP SUM	7	595

DRAWN BY : B.M. WILSON DATE : 12/2025
CHECKED BY : J.R. MCROY DATE : 12/2025
DESIGN ENGINEER OF RECORD: J.R. MCROY DATE : 12/2025

Prepared in the Office of:
SUMMIT DESIGN AND ENGINEERING SERVICES

NC FIRM LICENSE No: C-5176
1000 Social St., Suite 800
Raleigh, NC 27609
(919)322-0115
www.summitde.com

NORTH CAROLINA PROFESSIONAL SEAL 032076 ENGINEER JENNIFER R. MCROY
5/8/2026
Signed by: Jennifer R. McRoy

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

PROJECT NO. 011-01-EAB2F
BUNCOMBE COUNTY
STATION: 11+46.50 -L-
SHEET 3 OF 3

GENERAL DRAWING

FOR BRIDGE OVER BROAD RIVER ON PRIVATE ROAD BETWEEN NC-9 AND DEAD END

90° SKEW

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	S-3
1			3			TOTAL SHEETS
2			4			15

LOAD AND RESISTANCE FACTOR RATING (LRFR) SUMMARY FOR PRESTRESSED CONCRETE GIRDERS

LOAD TYPE		VEHICLE	WEIGHT (W) (TONS)	CONTROLLING LOAD RATING (#)	MINIMUM RATING FACTORS (RF)	TONS = W x RF	STRENGTH I LIMIT STATE											SERVICE III LIMIT STATE							COMMENT NUMBER
								MOMENT					SHEAR						MOMENT						
							LIVE-LOAD FACTORS (γLL)	DISTRIBUTION FACTORS (DF)	RATING FACTOR	SPAN	GIRDER LOCATION	DISTANCE FROM LEFT END OF SPAN (ft)	DISTRIBUTION FACTORS (DF)	RATING FACTOR	SPAN	GIRDER LOCATION	DISTANCE FROM LEFT END OF SPAN (ft)	LIVE-LOAD FACTORS (γLL)	DISTRIBUTION FACTORS (DF)	RATING FACTOR	SPAN	GIRDER LOCATION	DISTANCE FROM LEFT END OF SPAN (ft)	
DESIGN LOAD		HL-93 (INVENTORY)	N/A	1	1.109	--	1.75	0.272	1.47	90'	EL	44.250	0.493	1.26	90'	EL	4.425	0.80	0.272	1.11	90'	EL	44.250	
		HL-93 (OPERATING)	N/A		1.633	--	1.35	0.272	1.90	90'	EL	44.250	0.493	1.63	90'	EL	4.425	N/A	--	--	--	--	--	
		HS-20 (INVENTORY)	36.000	2	1.507	54.255	1.75	0.272	1.99	90'	EL	44.250	0.493	1.65	90'	EL	4.425	0.80	0.272	1.51	90'	EL	44.250	
		HS-20 (OPERATING)	36.000		2.140	77.039	1.35	0.272	2.59	90'	EL	44.250	0.493	2.14	90'	EL	4.425	N/A	--	--	--	--	--	
LEGAL LOAD	SINGLE VEHICLE (SV)	SNSH	13.500		3.519	47.501	1.4	0.272	5.82	90'	EL	44.250	0.493	5.05	90'	EL	4.425	0.80	0.272	3.52	90'	EL	44.250	
		SNGARBS2	20.000		2.572	51.43	1.4	0.272	4.25	90'	EL	44.250	0.493	3.55	90'	EL	4.425	0.80	0.272	2.57	90'	EL	44.250	
		SNAGRIS2	22.000		2.415	53.122	1.4	0.272	4.00	90'	EL	44.250	0.493	3.27	90'	EL	4.425	0.80	0.272	2.41	90'	EL	44.250	
		SNCOTTS3	27.250		1.749	47.674	1.4	0.272	2.89	90'	EL	44.250	0.493	2.52	90'	EL	4.425	0.80	0.272	1.75	90'	EL	44.250	
		SNAGGRS4	34.925		1.443	50.381	1.4	0.272	2.39	90'	EL	44.250	0.493	2.06	90'	EL	4.425	0.80	0.272	1.44	90'	EL	44.250	
		SNS5A	35.550		1.412	50.195	1.4	0.272	2.34	90'	EL	44.250	0.493	2.07	90'	EL	4.425	0.80	0.272	1.41	90'	EL	44.250	
		SNS6A	39.950		1.287	51.435	1.4	0.272	2.13	90'	EL	44.250	0.493	1.88	90'	EL	4.425	0.80	0.272	1.29	90'	EL	44.250	
		SNS7B	42.000		1.226	51.483	1.4	0.272	2.03	90'	EL	44.250	0.493	1.83	90'	EL	4.425	0.80	0.272	1.23	90'	EL	44.250	
	TRUCK TRACTOR SEMI-TRAILER (TTST)	TNAGRIT3	33.000		1.568	51.733	1.4	0.272	2.59	90'	EL	44.250	0.493	2.24	90'	EL	4.425	0.80	0.272	1.57	90'	EL	44.250	
		TNT4A	33.075		1.572	52.007	1.4	0.272	2.60	90'	EL	44.250	0.493	2.20	90'	EL	4.425	0.80	0.272	1.57	90'	EL	44.250	
		TNT6A	41.600		1.278	53.170	1.4	0.272	2.11	90'	EL	44.250	0.493	1.92	90'	EL	4.425	0.80	0.272	1.28	90'	EL	44.250	
		TNT7A	42.000		1.281	53.782	1.4	0.272	2.12	90'	EL	44.250	0.493	1.89	90'	EL	4.425	0.80	0.272	1.28	90'	EL	44.250	
		TNT7B	42.000		1.315	55.229	1.4	0.272	2.18	90'	EL	44.250	0.493	1.79	90'	EL	4.425	0.80	0.272	1.31	90'	EL	44.250	
		TNAGRIT4	43.000		1.258	54.101	1.4	0.272	2.08	90'	EL	44.250	0.493	1.74	90'	EL	4.425	0.80	0.272	1.26	90'	EL	44.250	
		TNAGT5A	45.000		1.190	53.537	1.4	0.272	1.97	90'	EL	44.250	0.493	1.71	90'	EL	4.425	0.80	0.272	1.19	90'	EL	44.250	
		TNAGT5B	45.000	3	1.178	53.027	1.4	0.272	1.95	90'	EL	44.250	0.493	1.66	90'	EL	4.425	0.80	0.272	1.18	90'	EL	44.250	
EMERGENCY VEHICLE (EV)		EV2	28.750		2.296	66.005	1.3	0.272	3.25	90'	EL	44.250	0.493	2.49	90'	EL	4.425	0.80	0.272	2.30	90'	EL	44.250	
		EV3	43.000	4	1.510	64.924	1.3	0.272	2.14	90'	EL	44.250	0.493	1.67	90'	EL	4.425	0.80	0.272	1.51	90'	EL	44.250	

LOAD FACTORS:

DESIGN LOAD RATING FACTORS	LIMIT STATE	γDC	γDW
	STRENGTH I	1.25	1.50
	SERVICE III	1.00	1.00

NOTES:

MINIMUM RATING FACTORS ARE BASED ON THE STRENGTH I AND SERVICE III LIMIT STATES.

ALLOWABLE STRESSES FOR SERVICE III LIMIT STATE ARE AS REQUIRED FOR DESIGN.

COMMENTS:

1.

2.

3.

4.

(#) CONTROLLING LOAD RATING

(1) DESIGN LOAD RATING (HL-93)

(2) DESIGN LOAD RATING (HS-20)

(3) LEGAL LOAD RATING * *

(4) EMERGENCY VEHICLE LOAD RATING **

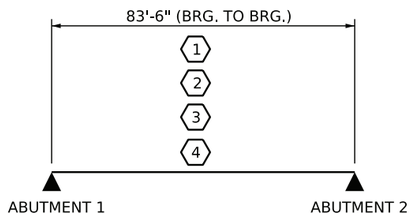
* * SEE CHART FOR VEHICLE TYPE

GIRDER LOCATION

I - INTERIOR BOX BEAM UNIT

EL - EXTERIOR LEFT BOX BEAM UNIT

ER - EXTERIOR RIGHT BOX BEAM UNIT



LRFR SUMMARY

FOR SPAN A

ASSEMBLED BY : B.M. WILSON DATE :12/2025
CHECKED BY : J.R. MCROY DATE :12/2025
DESIGN ENGINEER OF RECORD: J.R. MCROY DATE :12/2025

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

Prepared in the Office of:
SUMMIT DESIGN AND ENGINEERING SERVICES
NC FIRM LICENSE No: C-5176
1000 Social St., Suite 800
Raleigh, NC 27609
Ph: (919) 322-0115
www.summitde.com

NORTH CAROLINA PROFESSIONAL SEAL 032076 ENGINEER JENNIFER R. MCROY

5/8/2026

Signed by: Jennifer R. McRoy

PROJECT NO. 011-01-EAB2F

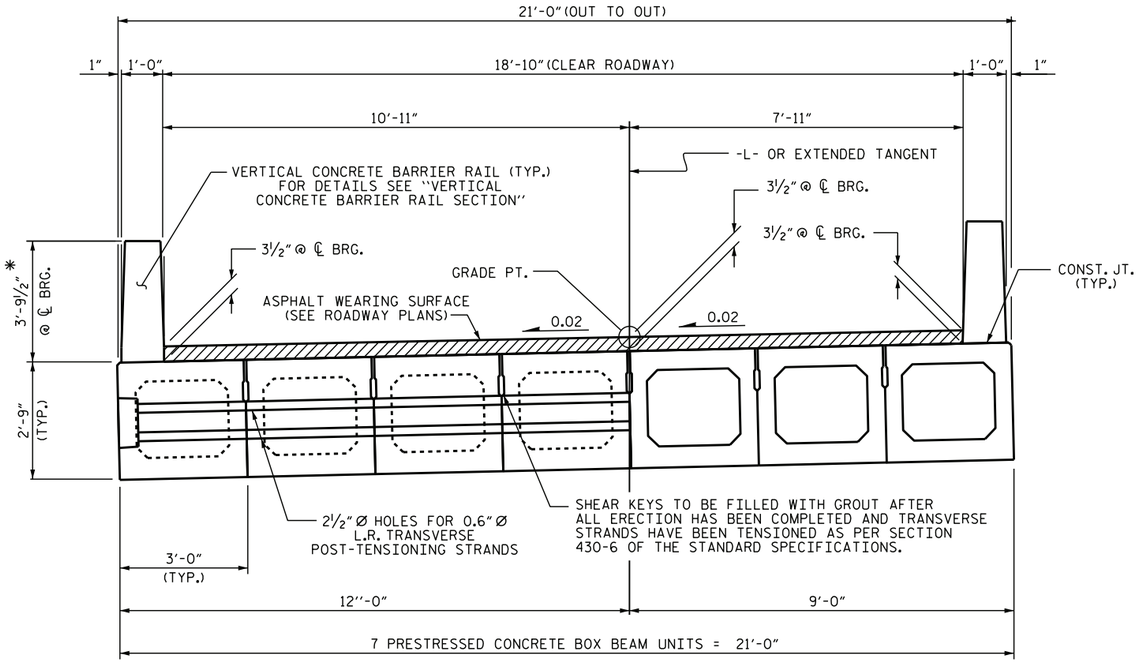
BUNCOMBE COUNTY

STATION: 11+46.50 -L-

LRFR SUMMARY FOR 85' BOX BEAM UNIT 90° SKEW

(NON-INTERSTATE TRAFFIC)

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	S-4
1			3			TOTAL SHEETS
2			4			15

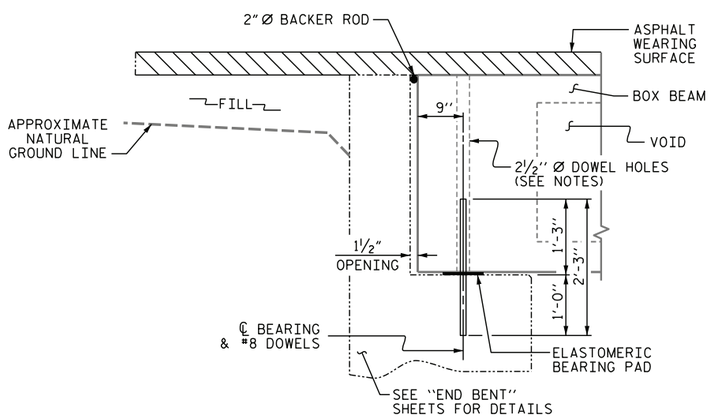


SECTION
AT INTERMEDIATE DIAPHRAGMS

SECTION
THROUGH VOIDS

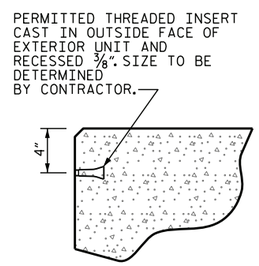
TYPICAL SECTION

* THE MAXIMUM BARRIER RAIL HEIGHT AND ASPHALT THICKNESS IS SHOWN. THE HEIGHT OF THE BARRIER RAIL AND ASPHALT THICKNESS VARIES WHILE THE TOP OF THE BARRIER RAIL FOLLOWS THE PROFILE OF THE GUTTERLINE. FOR RAIL HEIGHT DETAILS AND ASPHALT THICKNESS, SEE THE "VERTICAL CONCRETE BARRIER RAIL SECTION" DETAIL.



SECTION AT ABUTMENT

(ABUTMENT #1 SHOWN, ABUTMENT #2 SIMILAR)



THREADED INSERT DETAIL

NOTES

ALL PRESTRESSING STRANDS SHALL BE 7-WIRE LOW RELAXATION GRADE 270 STRANDS AND SHALL CONFORM TO AASHTO M203 EXCEPT FOR SAMPLING REQUIREMENTS WHICH SHALL BE IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS.

ALL REINFORCING STEEL CAST WITH THE BOX BEAM SECTIONS SHALL BE GRADE 60 AND SHALL BE INCLUDED IN THE UNIT PRICE BID FOR PRESTRESSED CONCRETE BOX BEAMS.

FLAME CUTTING OF THE TRANSVERSE POST-TENSIONING STRAND IS NOT ALLOWED.

RECESSES FOR TRANSVERSE STRANDS SHALL BE GROUTED AFTER THE TENSIONING OF THE STRANDS.

THE 2½" Ø DOWEL HOLES AT FIXED ENDS OF BOX BEAM SECTIONS SHALL BE FILLED WITH NON-SHRINK GROUT.

THE BACKER RODS SHALL CONFORM TO THE REQUIREMENTS OF TYPE M BOND BREAKER. SEE SECTION 1028 OF THE STANDARD SPECIFICATIONS.

THE TRANSFER OF LOAD FROM THE ANCHORAGES TO THE BOX BEAM UNIT SHALL BE DONE WHEN THE CONCRETE HAS REACHED A COMPRESSIVE STRENGTH OF NOT LESS THAN 6000 PSI.

ALL REINFORCING STEEL IN VERTICAL CONCRETE BARRIER RAILS SHALL BE EPOXY COATED.

PRESTRESSING STRANDS SHALL BE CUT FLUSH WITH THE BOX BEAM UNIT ENDS.

APPLY EPOXY PROTECTIVE COATING TO BOX BEAM UNIT ENDS.

VERTICAL GROOVED CONTRACTION JOINTS, ½" IN DEPTH, SHALL BE TOOLED IN ALL EXPOSED FACES OF THE BARRIER RAIL AND IN ACCORDANCE WITH ARTICLE 825-10(B) OF THE STANDARD SPECIFICATIONS. A VERTICAL CONTRACTION JOINT SHALL BE LOCATED AT EACH THIRD POINT BETWEEN BARRIER RAIL EXPANSION JOINTS. ONLY ONE CONTRACTION JOINT IS REQUIRED AT MIDPOINT OF BARRIER RAIL SEGMENTS LESS THAN 20 FEET IN LENGTH AND NO CONTRACTION JOINTS ARE REQUIRED FOR THOSE SEGMENTS LESS THAN 10 FEET IN LENGTH.

THE LOCATION OF THE VOID DRAINS MAY BE SHIFTED SLIGHTLY WHERE NECESSARY TO CLEAR PRESTRESSING STRANDS OR TRANSVERSE REINFORCING STEEL.

FOR GROUT FOR STRUCTURES, SEE SPECIAL PROVISIONS.

THE PERMITTED THREADED INSERTS ARE DETAILED AS AN OPTION FOR THE CONTRACTOR TO ATTACH FALSEWORK AND FORMWORK DURING CONSTRUCTION.

THE PERMITTED THREADED INSERTS IN THE EXTERIOR UNITS SHALL BE SIZED BY THE CONTRACTOR, SPACED AT 4'-0" CENTERS AND GALVANIZED IN ACCORDANCE WITH SECTION 1076 OF THE STANDARD SPECIFICATIONS. STAINLESS STEEL THREADED INSERTS MAY BE USED AS AN ALTERNATE.

THE PERMITTED THREADED INSERTS SHALL BE GROUTED BY THE CONTRACTOR IMMEDIATELY FOLLOWING REMOVAL OF THE FALSEWORK.

THE COST OF THE PERMITTED THREADED INSERTS SHALL BE INCLUDED IN THE PRICE BID FOR THE PRECAST UNITS.

ASSEMBLED BY : K. D. LAYNE DATE : 12/2025
CHECKED BY : J. R. MCROY DATE : 12/2025
DESIGN ENGINEER OF RECORD: J. R. MCROY DATE : 12/2025

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

Prepared in the Office of:
SUMMIT DESIGN AND ENGINEERING SERVICES
NC FIRM LICENSE No: C-5176
1000 Social St., Suite 800
Raleigh, NC 27609
Ph: (919) 322-0115
www.summitde.com

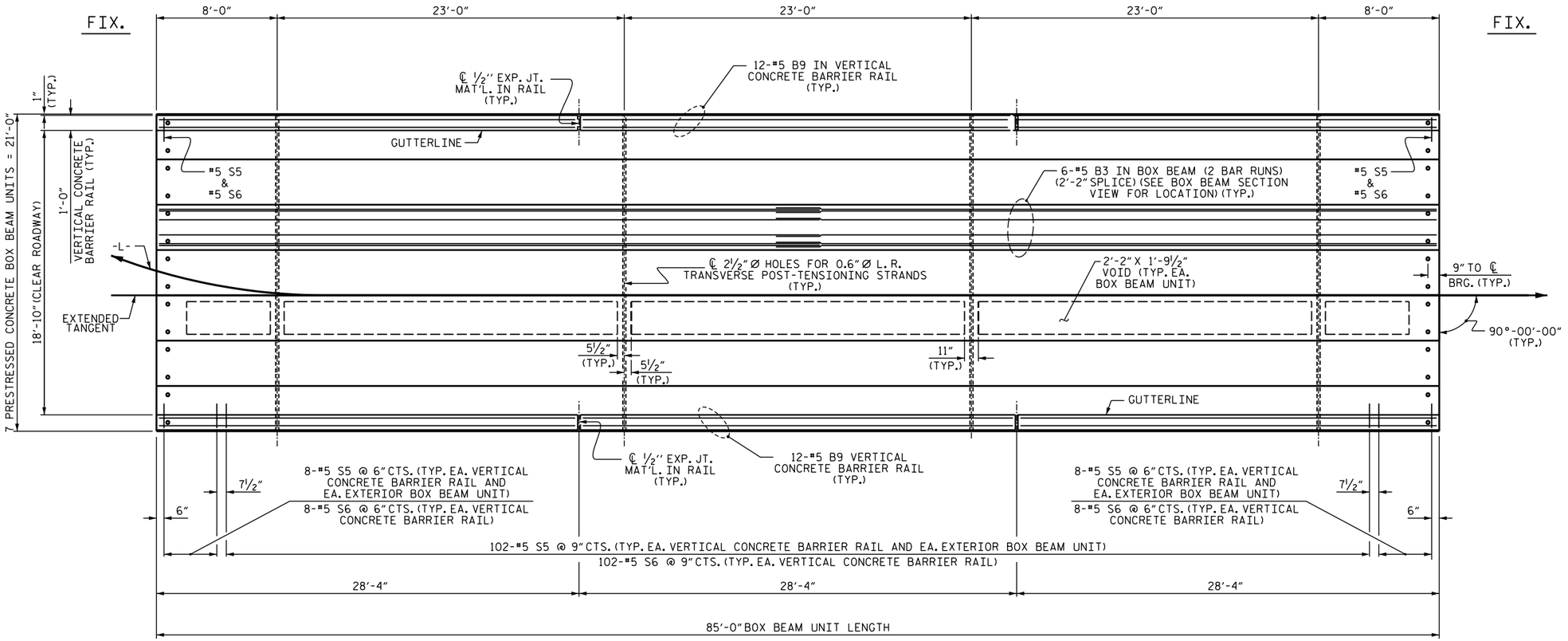
NORTH CAROLINA PROFESSIONAL SEAL 032076 ENGINEER JENNIFER R. MCROY
5/8/2026
Signed by: Jennifer R. McRoy

PROJECT NO. 011-01-EAB2F
BUNCOMBE COUNTY
STATION: 11+46.50 -L-

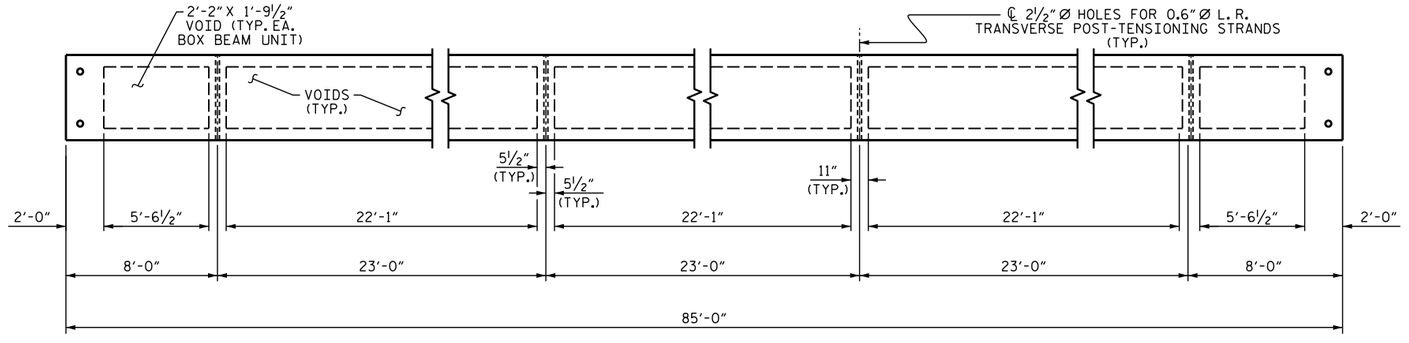
SHEET 1 OF 5

3'-0" X 2'-9" PRESTRESSED CONCRETE BOX BEAM UNIT

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	S-5
1			3			TOTAL SHEETS
2			4			15



PLAN OF UNIT



DIAPHRAGM AND VOID LAYOUT

ASSEMBLED BY : K. D. LAYNE DATE : 12/2025
CHECKED BY : J. R. MCROY DATE : 12/2025
DESIGN ENGINEER OF RECORD: J. R. MCROY DATE : 12/2025

Prepared in the Office of:
SUMMIT DESIGN AND ENGINEERING SERVICES
NC FIRM LICENSE No: C-5176
1000 Social St., Suite 800
Raleigh, NC 27609
Ph: (919) 322-0115
www.summitde.com

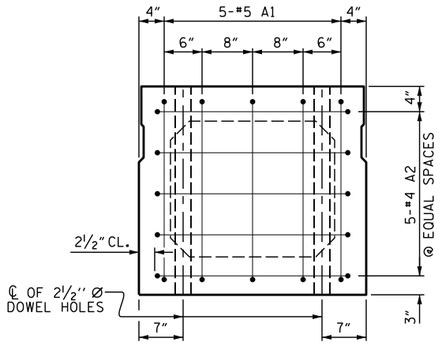
NORTH CAROLINA PROFESSIONAL SEAL 032076 ENGINEER JENNIFER R. MCROY
5/8/2026
Signed by: Jennifer R. McRoy

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

PROJECT NO. 011-01-EAB2F
BUNCOMBE COUNTY
STATION: 11+46.50 -L-
SHEET 2 OF 5

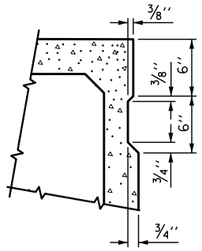
PLAN OF 85' UNIT 18'-10" CLEAR ROADWAY 90° SKEW

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	S-6
1			3			TOTAL SHEETS
2			4			15



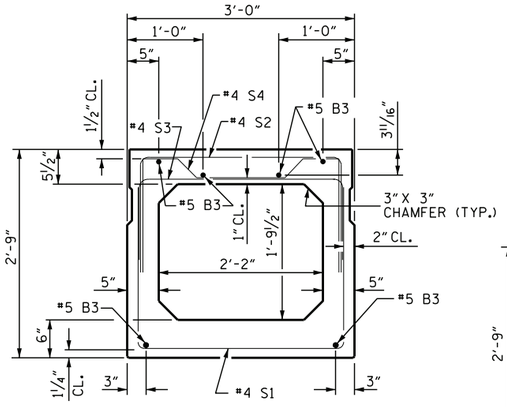
END ELEVATION

SHOWING PLACEMENT OF #5 & #4 "A" BARS AND LOCATION OF DOWEL HOLES. (INTERIOR BOX BEAM SECTION SHOWN-EXTERIOR SECTION SIMILAR EXCEPT SHEAR KEY LOCATION. STRAND LAYOUT NOT SHOWN.)



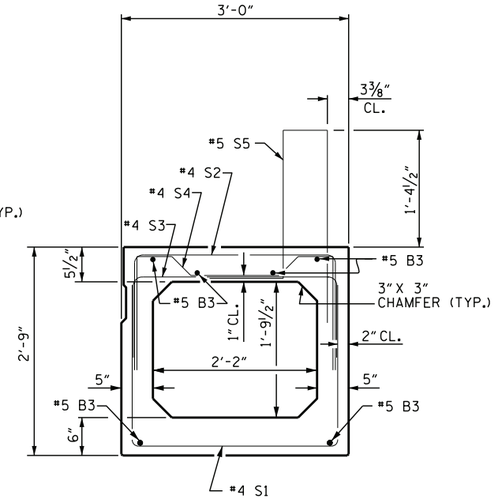
SHEAR KEY DETAIL

NOTE: OMIT SHEAR KEY ON OUTSIDE FACE OF EXTERIOR BOX BEAMS.



INTERIOR BOX BEAM SECTION

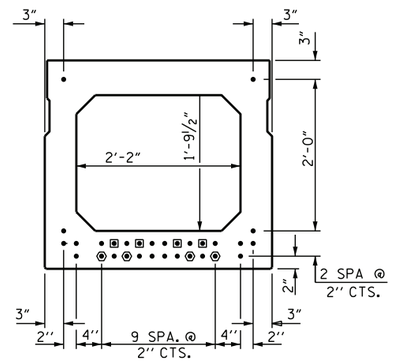
(STRAND LAYOUT NOT SHOWN)



EXTERIOR BOX BEAM SECTION

(STRAND LAYOUT NOT SHOWN)

0.6" Ø LOW RELAXATION STRAND LAYOUT



TYPICAL STRAND LOCATION

(30 STRANDS REQUIRED)

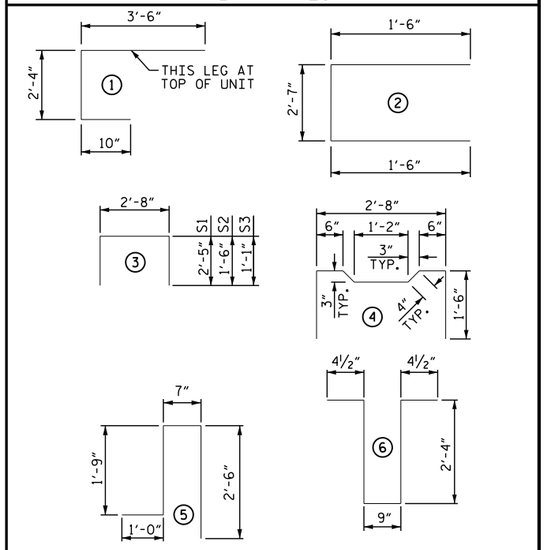
DEBONDING LEGEND

- ● FULLY BONDED STRANDS
- ◉ STRANDS DEBONDED FOR 4'-0" FROM END OF GIRDER
- ⬢ STRANDS DEBONDED FOR 12'-0" FROM END OF GIRDER

BOND SHALL BE BROKEN ON STRANDS AS SHOWN FOR THE SPECIFIED LENGTH FROM EACH END OF THE BOX BEAM. SEE STANDARD SPECIFICATIONS ARTICLE 1078-7.

GRADE 270 STRANDS	
	0.6" Ø L.R.
AREA (SQUARE INCHES)	0.217
ULTIMATE STRENGTH (LBS. PER STRAND)	58,600
APPLIED PRESTRESS (LBS. PER STRAND)	43,950

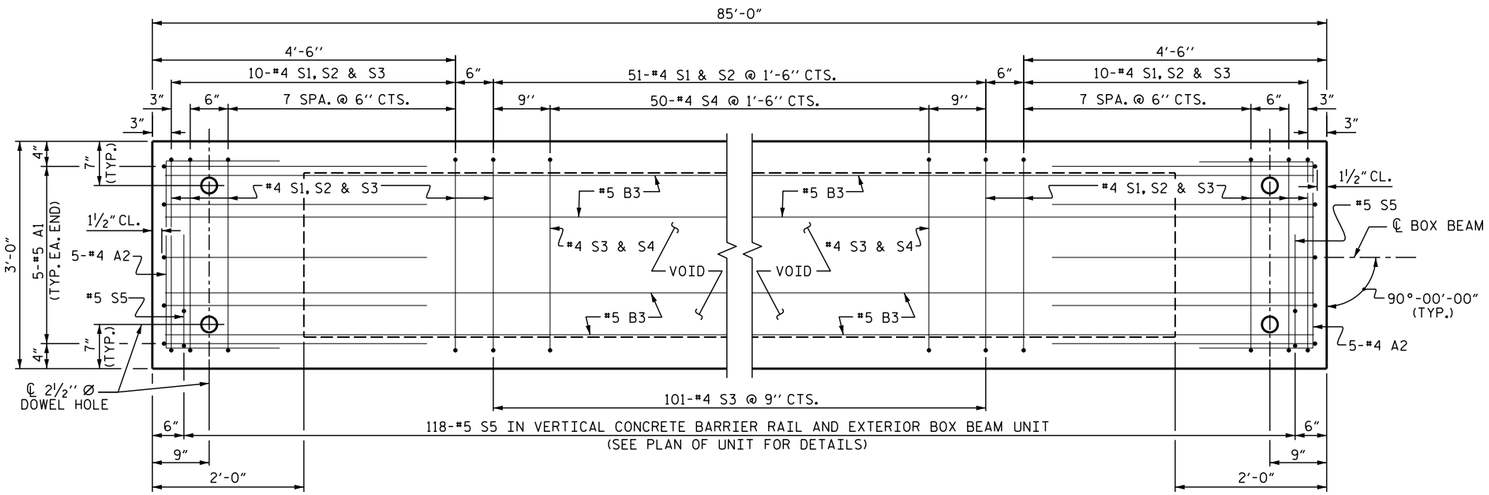
BAR TYPES



ALL BAR DIMENSIONS ARE OUT TO OUT

BILL OF MATERIAL FOR ONE BOX BEAM SECTION

				EXTERIOR UNIT		INTERIOR UNIT	
BAR	NUMBER	SIZE	TYPE	LENGTH	WEIGHT	LENGTH	WEIGHT
A1	10	#5	1	6'-8"	70	6'-8"	70
A2	34	#4	2	5'-7"	127	5'-7"	127
B3	12	#5	STR	43'-5"	543	43'-5"	543
K1	12	#4	6	6'-2"	49	6'-2"	49
K2	8	#4	STR	2'-7"	14	2'-7"	14
S1	71	#4	3	7'-6"	356	7'-6"	356
S2	71	#4	3	5'-8"	269	5'-8"	269
S3	121	#4	3	4'-10"	391	4'-10"	391
S4	50	#4	4	5'-10"	195	5'-10"	195
✱ S5	118	#5	5	5'-10"	718	--	--
REINFORCING STEEL				2014	LBS.	2014	LBS.
✱ EPOXY COATED REINF. STEEL				718	LBS.		
8000 P.S.I. CONCRETE				15.1	CU. YDS.	15.0	CU. YDS.
0.6" Ø L.R. STRANDS				No. 30		No. 30	



PLAN OF BOX BEAM

EXTERIOR UNIT SHOWN, INTERIOR UNIT SIMILAR EXCEPT OMIT #5 S5 BARS.
FOR LOCATION OF DIAPHRAGMS, SEE "PLAN OF UNIT".
FOR THREADED INSERTS, SEE "THREADED INSERT DETAIL".
FOR REINFORCING STEEL IN DIAPHRAGMS, SEE "DOUBLE DIAPHRAGM DETAILS".

ASSEMBLED BY : K.D. LAYNE DATE : 12/2025
CHECKED BY : J.R. MCROY DATE : 12/2025
DESIGN ENGINEER OF RECORD: J.R. MCROY DATE : 12/2025

Prepared in the Office of:
SUMMIT DESIGN AND ENGINEERING SERVICES
NC FIRM LICENSE No: C-5176
1000 Social St., Suite 800
Raleigh, NC 27609
Ph: (919) 322-0115
www.summitde.com

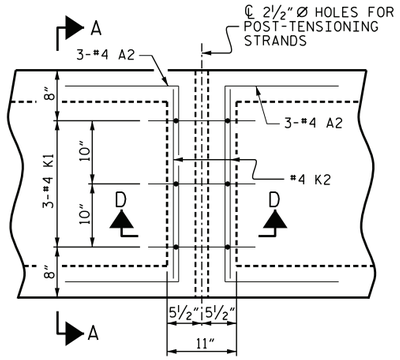
NORTH CAROLINA PROFESSIONAL SEAL 032076 ENGINEER JENNIFER R. MCROY
5/8/2026
Signed by: Jennifer R. McRoy

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

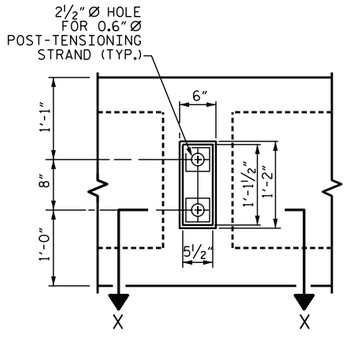
PROJECT NO. 011-01-EAB2F
BUNCOMBE COUNTY
STATION: 11+46.50 -L-
SHEET 3 OF 5

3'-0" X 2'-9" PRESTRESSED CONCRETE BOX BEAM UNIT

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	S-7
1			3			TOTAL SHEETS
2			4			15

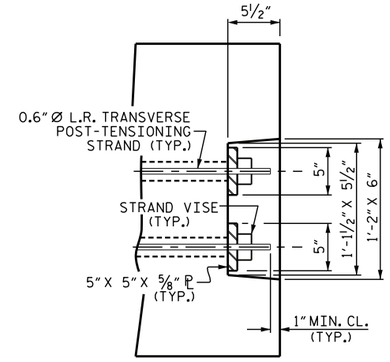


PLAN

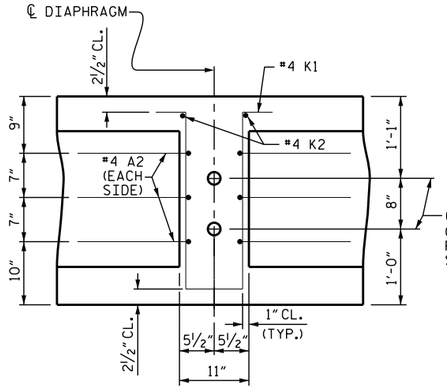


VIEW Y-Y

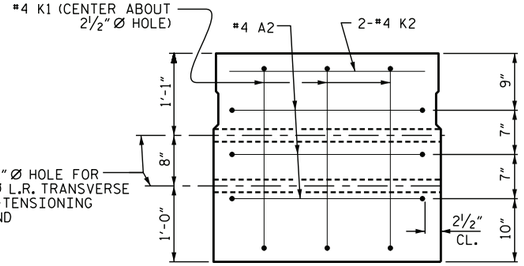
SHOWING ELEVATION VIEW OF GROUTED RECESS



DETAIL "C"

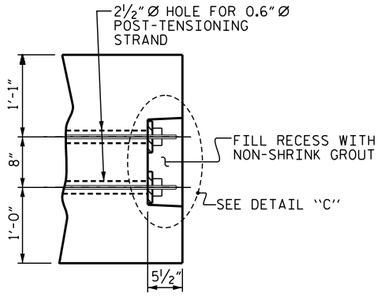


SECTION D-D

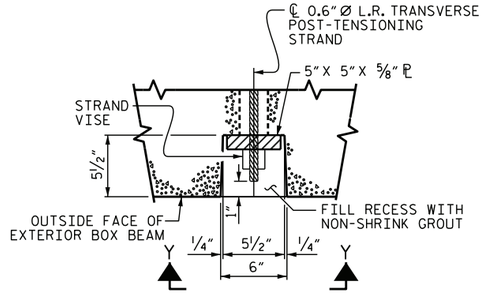


SECTION A-A

VOIDS NOT SHOWN



PART SECTION AT RECESS

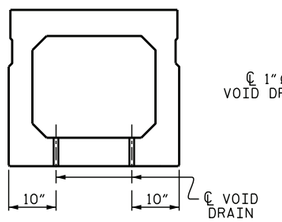


SECTION X-X

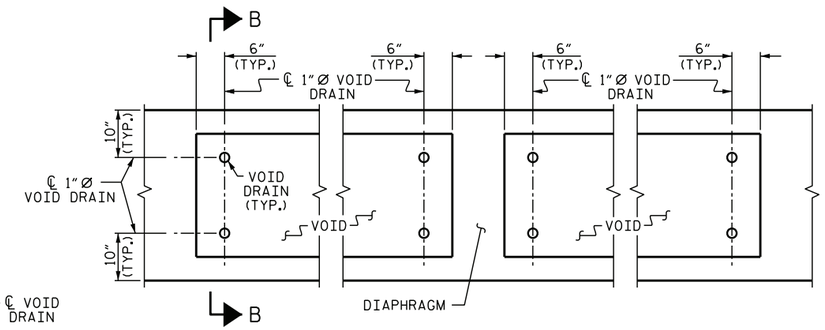
SHOWING PLAN VIEW OF GROUTED RECESS

DOUBLE DIAPHRAGM DETAILS

#4 "S" BARS NOT SHOWN. #4 "S" BARS MAY BE SHIFTED SLIGHTLY TO CLEAR 2½" Ø HOLE.



SECTION B-B



PART PLAN

VOID DRAIN DETAILS

(DIMENSIONS SHOWN ARE TYPICAL FOR EACH VOID)

GROUTED RECESS DETAIL AT END OF POST-TENSIONED STRANDS OF EXTERIOR BOX BEAM

DEAD LOAD DEFLECTION AND CAMBER	
	3'-0" x 2'-9"
85' BOX BEAM UNIT	0.6" Ø L.R. STRAND
CAMBER (SLAB ALONE IN PLACE)	2⅜" ↑
DEFLECTION DUE TO SUPERIMPOSED DEAD LOAD**	⅞" ↓
FINAL CAMBER	1½" ↑

** INCLUDES FUTURE WEARING SURFACE

Prepared in the Office of:
SUMMIT DESIGN AND ENGINEERING SERVICES
NC FIRM LICENSE No: C-5176
1000 Social St., Suite 800
Raleigh, NC 27609
Ph: (919) 322-0115
www.summitde.com

NORTH CAROLINA PROFESSIONAL SEAL 032076 ENGINEER JENNIFER R. MCROY

5/8/2026

Signed by: Jennifer R. McRoy

PROJECT NO. 011-01-EAB2F

BUNCOMBE COUNTY

STATION: 11+46.50 -L-

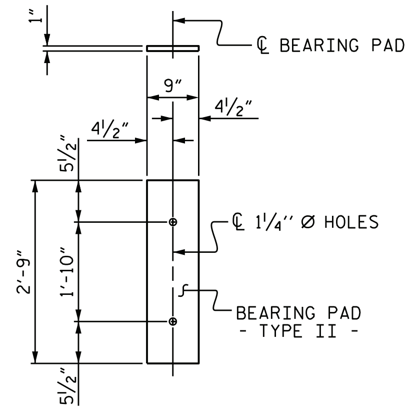
SHEET 4 OF 5

3'-0" X 2'-9" PRESTRESSED CONCRETE BOX BEAM UNIT

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	S-8
1			3			TOTAL SHEETS
2			4			15

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

ASSEMBLED BY : K. D. LAYNE DATE : 12/2025
CHECKED BY : J. R. MCROY DATE : 12/2025
DESIGN ENGINEER OF RECORD: J. R. MCROY DATE : 12/2025

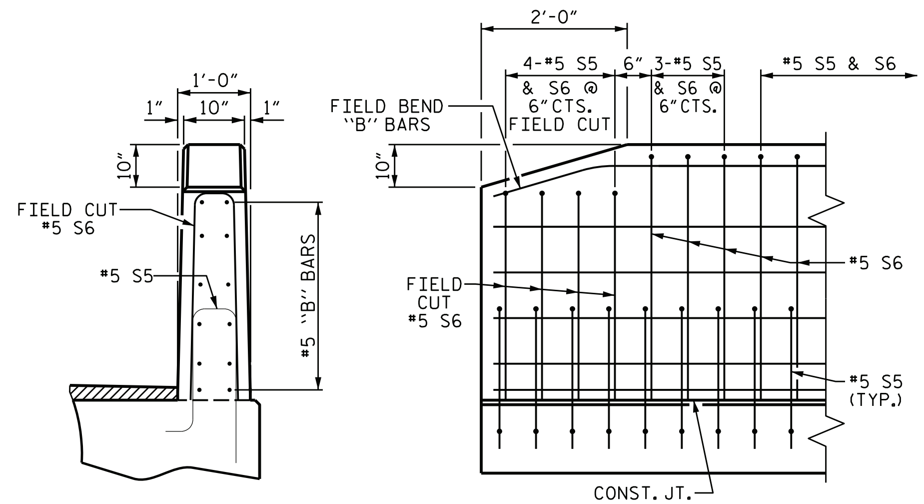


FIXED END

(TYPE II - 14 REQ'D)

ELASTOMERIC BEARING DETAILS

ELASTOMER IN ALL BEARINGS SHALL BE 60 DUROMETER HARDNESS.

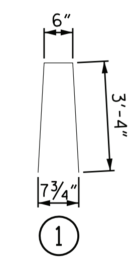


END VIEW

SIDE VIEW

END OF RAIL DETAILS

BILL OF MATERIAL FOR VERTICAL CONCRETE BARRIER RAIL					
BAR	BARS PER PAIR OF EXTERIOR UNITS	SIZE	TYPE	LENGTH	WEIGHT
	85' UNIT				
✻ B9	72	#5	STR	27'-11"	2096
✻ S6	236	#5	1	7'-2"	1764
✻ EPOXY COATED REINFORCING STEEL		LBS.			3860
CLASS AA CONCRETE		CU.YDS.			22.0
TOTAL VERTICAL CONCRETE BARRIER RAIL		LN. FT.			170.0

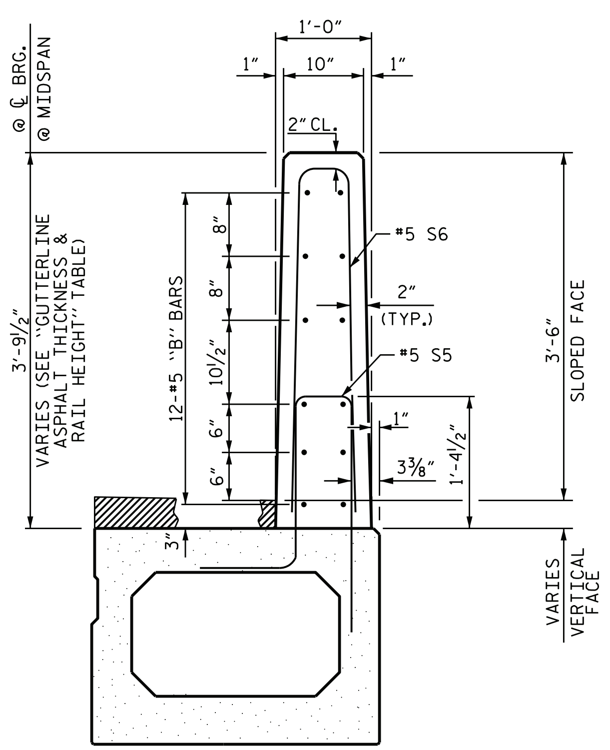


BAR TYPE

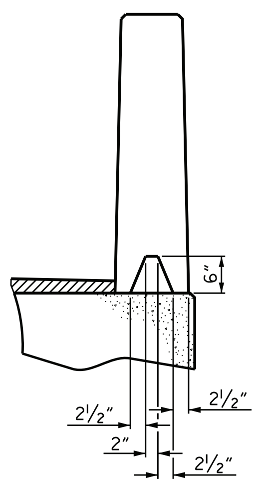
BAR DIMENSIONS ARE OUT TO OUT

BOX BEAM UNITS REQUIRED			
	NUMBER	LENGTH	TOTAL LENGTH
EXTERIOR B.B.	2	85'-0"	170'-0"
INTERIOR B.B.	5	85'-0"	425'-0"
TOTAL	7	———	595'-0"

GUTTERLINE ASPHALT THICKNESS & RAIL HEIGHT		
	ASPHALT OVERLAY THICKNESS @ MID-SPAN	RAIL HEIGHT @ MID-SPAN
85' UNITS	2"	3'-8"

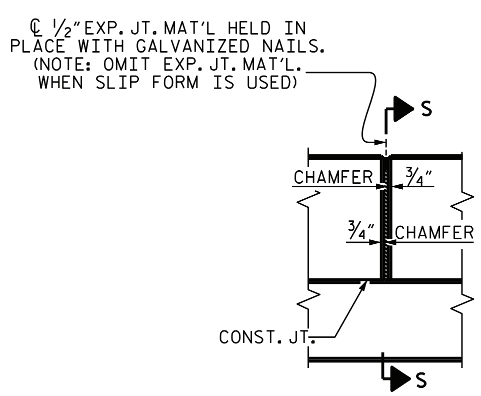


SECTION THRU RAIL



SECTION S-S

AT DAM IN OPEN JOINT
(THIS IS TO BE USED ONLY
WHEN SLIP FORM IS USED)



ELEVATION AT EXPANSION JOINTS

VERTICAL CONCRETE BARRIER RAIL DETAILS

Prepared in the Office of:

SUMMIT DESIGN AND ENGINEERING SERVICES

NC FIRM LICENSE No: C-5176
1000 Social St., Suite 800
Raleigh, NC 27609
Ph: (919) 322-0115
www.summitde.com

NORTH CAROLINA PROFESSIONAL SEAL 032076 ENGINEER JENNIFER R. MCROY

5/8/2026

Signed by: Jennifer R. McRoy

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

PROJECT NO. 011-01-EAB2F

BUNCOMBE COUNTY

STATION: 11+46.50 -L-

SHEET 5 OF 5

3'-0" X 2'-9"
PRESTRESSED CONCRETE
BOX BEAM UNIT

REVISIONS							
NO.	BY:	DATE:	NO.	BY:	DATE:	SHEET NO.	S-9
1			3			TOTAL SHEETS	15
2			4				

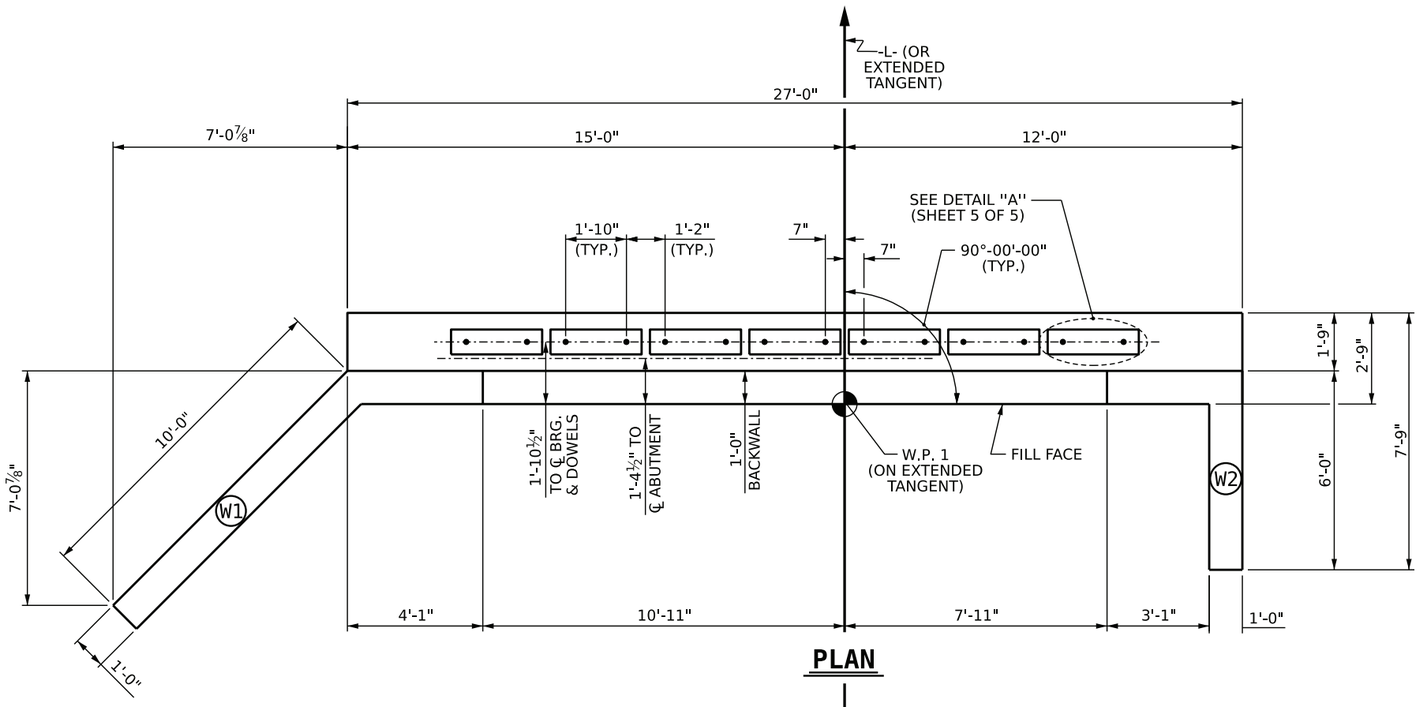
ASSEMBLED BY : K. D. LAYNE DATE : 12/2025
CHECKED BY : J. R. MCROY DATE : 12/2025
DESIGN ENGINEER OF RECORD: J. R. MCROY DATE : 12/2025

NOTES

STIRRUPS IN CAP MAY BE SHIFTED AS NECESSARY TO CLEAR DOWELS.

FOR SECTION A-A, SEE SHEET 5 OF 5.

FOR SECTION C-C AND WING DETAILS, SEE SHEET 3 OF 5.



ELEVATION

Prepared in the Office of:
SUMMIT DESIGN AND ENGINEERING SERVICES
NC FIRM LICENSE No: C-5176
1000 Social St., Suite 800
Raleigh, NC 27609
(919)322-0115
www.summitde.com

NORTH CAROLINA PROFESSIONAL SEAL 032076 ENGINEER JENNIFER R. MCROY
5/8/2026
Signed by: Jennifer R. McRoy

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

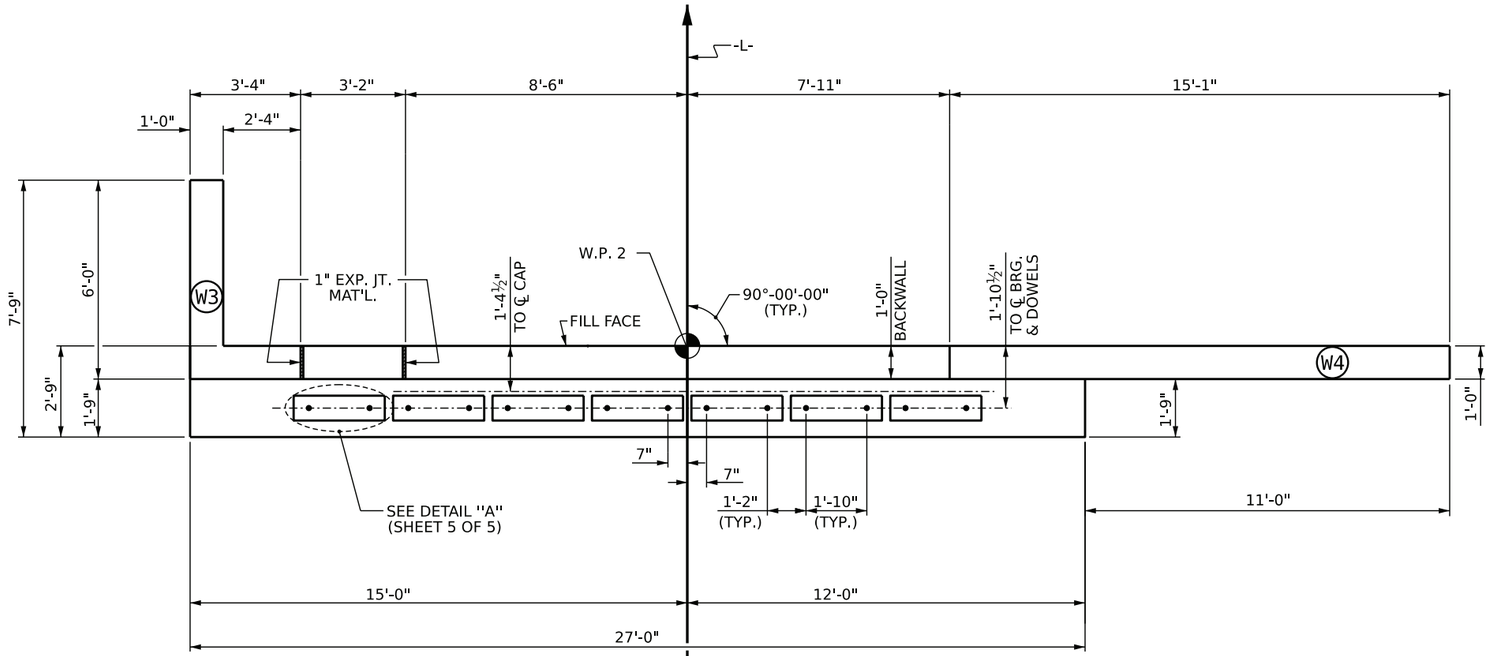
PROJECT NO. 011-01-EAB2F
BUNCOMBE COUNTY
STATION: 11+46.50 -L-
SHEET 1 OF 5

SUBSTRUCTURE

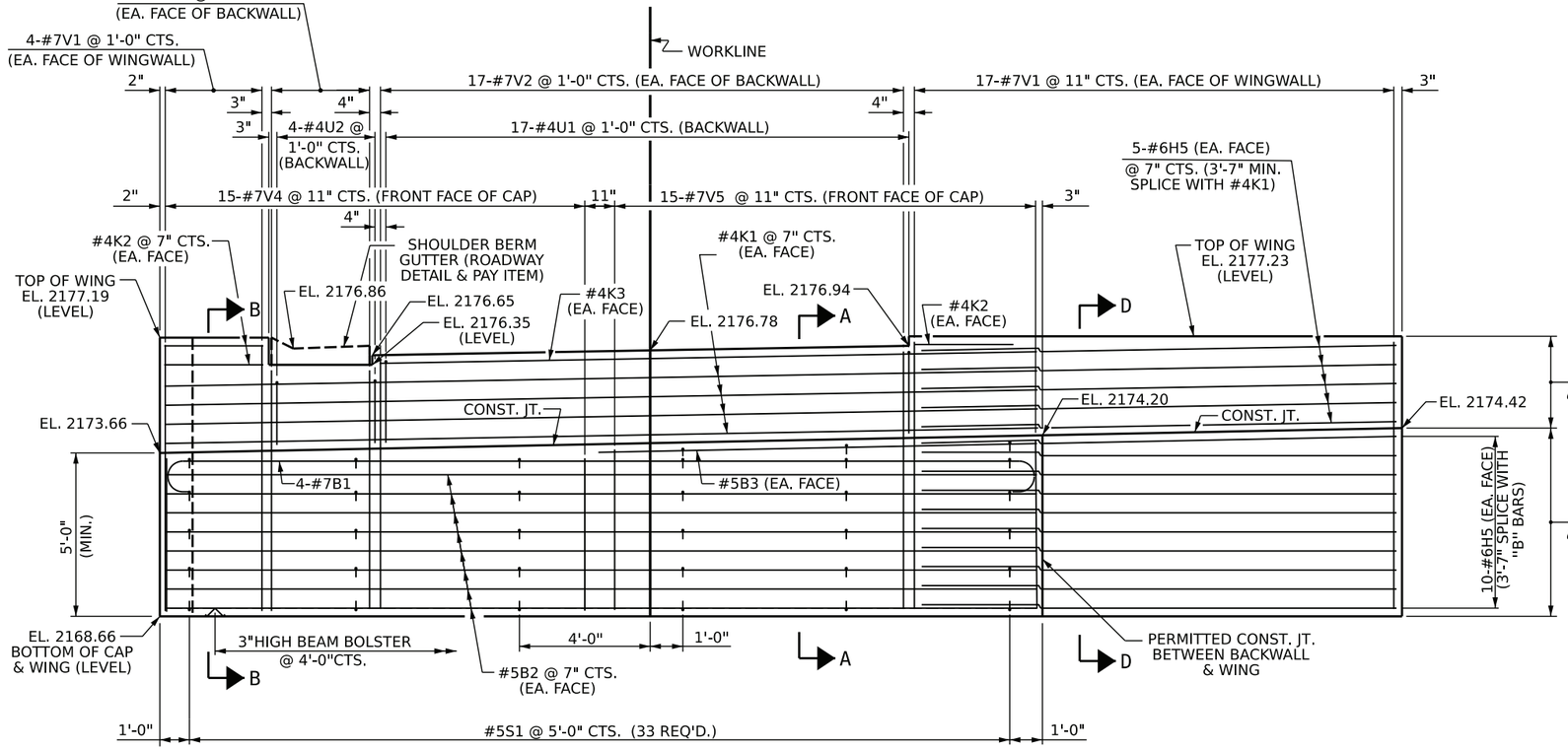
ABUTMENT 1

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	S-10
1			3			TOTAL SHEETS
2			4			15

DRAWN BY : M.K. BEARD DATE : 12/2025
CHECKED BY : J.R. MCROY DATE : 12/2025
DESIGN ENGINEER OF RECORD: J.R. MCROY DATE : 12/2025



PLAN



ELEVATION

NOTES

STIRRUPS IN CAP MAY BE SHIFTED AS NECESSARY TO CLEAR DOWELS.

FOR SECTIONS A-A & B-B, SEE SHEET 5 OF 5.

FOR SECTION D-D AND WING DETAILS, SEE SHEET 4 OF 5.

DRAWN BY : M.K. BEARD DATE : 12/2025
CHECKED BY : J.R. MCROY DATE : 12/2025
DESIGN ENGINEER OF RECORD: J.R. MCROY DATE : 12/2025

Prepared in the Office of:
SUMMIT DESIGN AND ENGINEERING SERVICES
NC FIRM LICENSE No: C-5176
1000 Social St., Suite 800
Raleigh, NC 27609
(919)322-0115
www.summitde.com

NORTH CAROLINA PROFESSIONAL SEAL 032076 ENGINEER JENNIFER R. MCROY
5/8/2026
Signed by: Jennifer R. McRoy

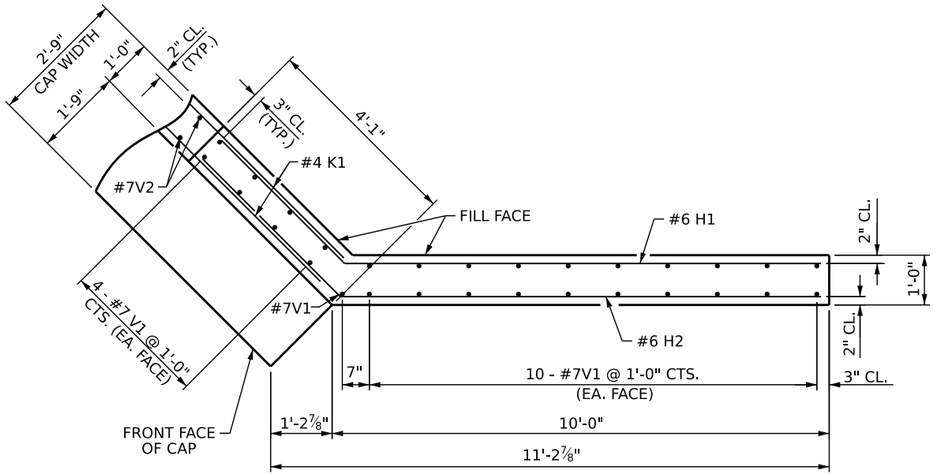
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

PROJECT NO. 011-01-EAB2F
BUNCOMBE COUNTY
STATION: 11+46.50 -L-
SHEET 2 OF 5

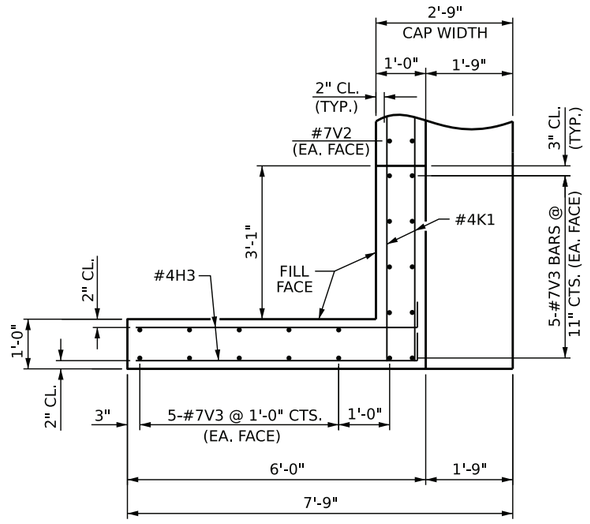
SUBSTRUCTURE

ABUTMENT 2

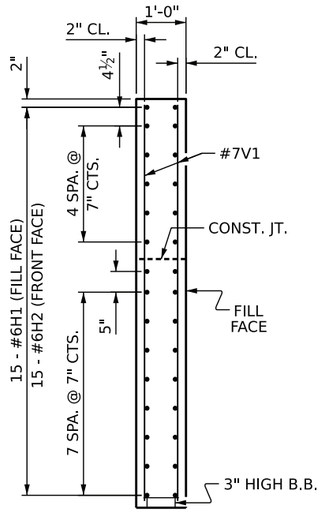
REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	S-11
1			3			TOTAL SHEETS
2			4			15



W1 PLAN OF WING



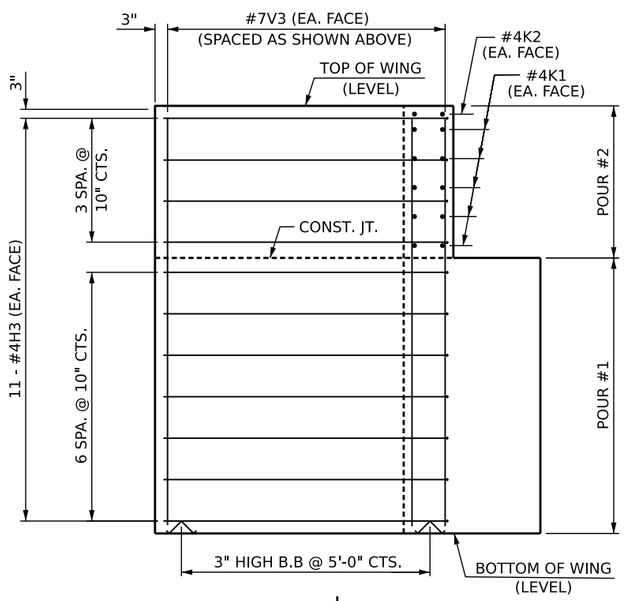
W2 PLAN OF WING



W1 SECTION C-C

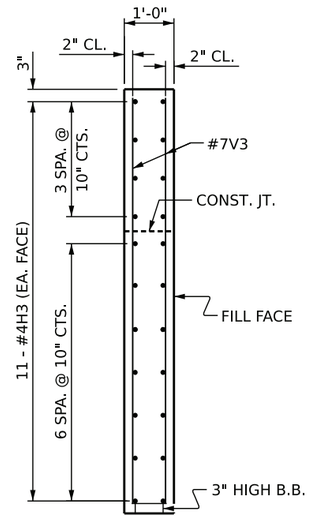
(SEE SHEET 1 OF 5 FOR ELEVATION OF WING)

X



X

W2 ELEVATION



SECTION X-X

DRAWN BY : M.K. BEARD DATE : 12/2025
CHECKED BY : J.R. MCROY DATE : 12/2025
DESIGN ENGINEER OF RECORD: J.R. MCROY DATE : 12/2025

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

Prepared in the Office of:
SUMMIT DESIGN AND ENGINEERING SERVICES
NC FIRM LICENSE No: C-5176
1000 Social St., Suite 800
Raleigh, NC 27609
(919)322-0115
www.summitde.com

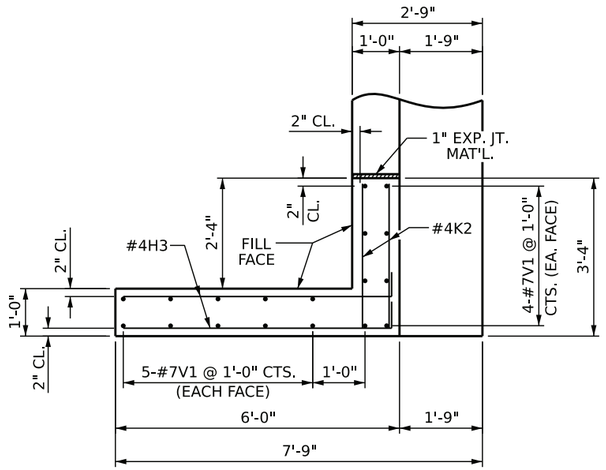
NORTH CAROLINA PROFESSIONAL SEAL 032076 ENGINEER JENNIFER R. MCROY
5/8/2026
Signed by: Jennifer R. McRoy

PROJECT NO. 011-01-EAB2F
BUNCOMBE COUNTY
STATION: 11+46.50 -L-
SHEET 3 OF 5

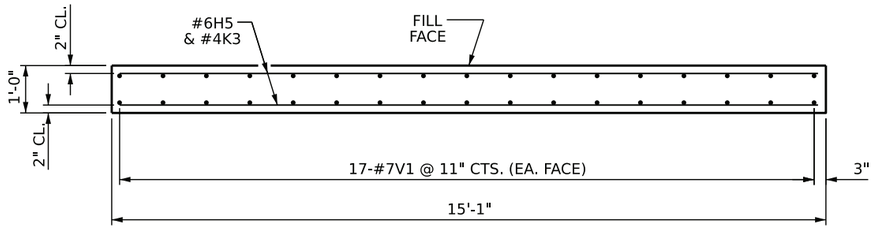
SUBSTRUCTURE

ABUTMENT 1
WING DETAILS

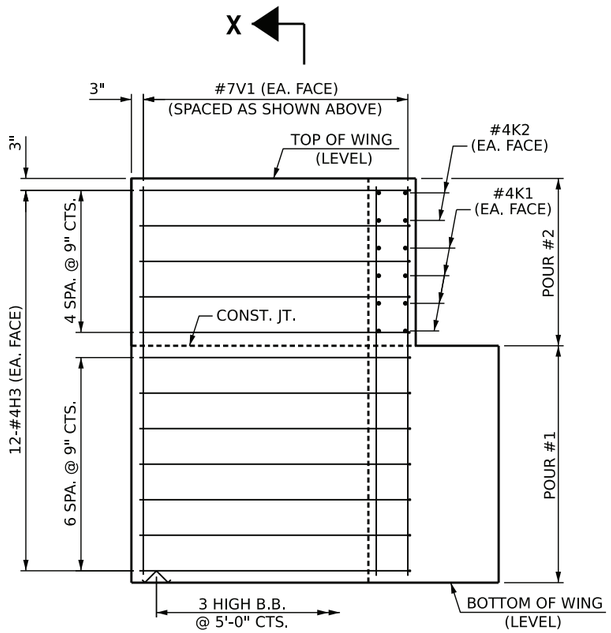
REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	S-12
1			3			TOTAL SHEETS
2			4			15



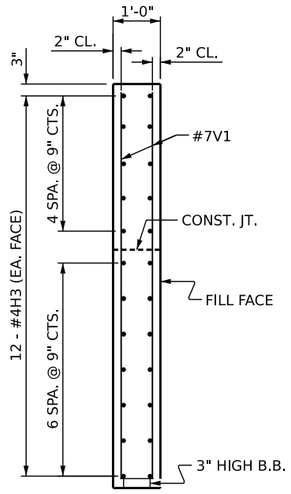
W3 PLAN OF WING



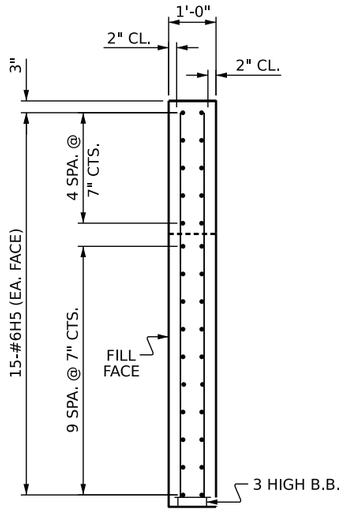
W4 PLAN OF WING



W3 ELEVATION



SECTION X-X



W4 SECTION D-D

(SEE SHEET 2 OF 5 FOR ELEVATION OF WING)

Prepared in the Office of:
SUMMIT DESIGN AND ENGINEERING SERVICES
NC FIRM LICENSE No: C-5176
1000 Social St., Suite 800
Raleigh, NC 27609
(919)322-0115
www.summitde.com

NORTH CAROLINA PROFESSIONAL SEAL 032076 ENGINEER JENNIFER R. MCROY 5/8/2026
Signed by: Jennifer R. McRoy

PROJECT NO. 011-01-EAB2F
BUNCOMBE COUNTY
STATION: 11+46.50 -L-
SHEET 4 OF 5

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

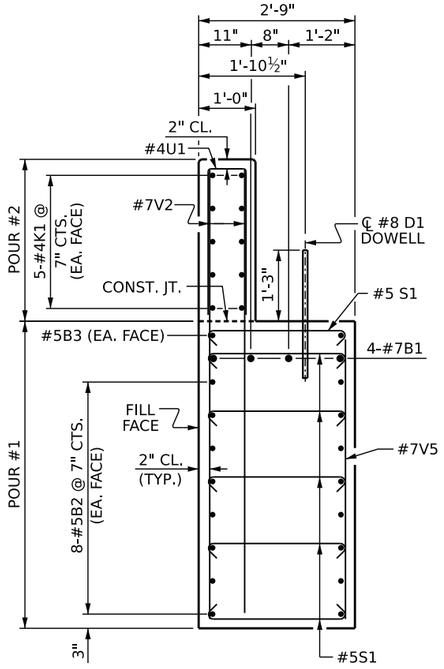
SUBSTRUCTURE

ABUTMENT 2 WING DETAILS

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	S-13
1			3			TOTAL SHEETS
2			4			15

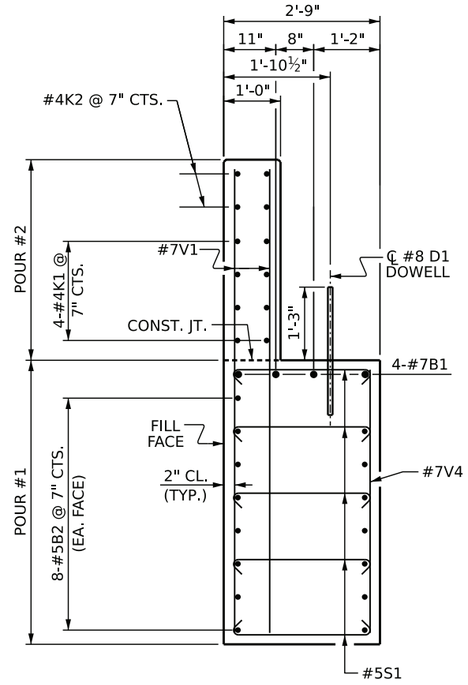
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

DRAWN BY : M.K. BEARD DATE : 12/2025
CHECKED BY : J.R. MCROY DATE : 12/2025
DESIGN ENGINEER OF RECORD: J.R. MCROY DATE : 12/2025



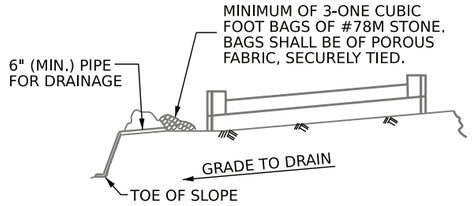
SECTION A-A

(ABUTMENT 1 & 2)



SECTION B-B

(ABUTMENT 2)

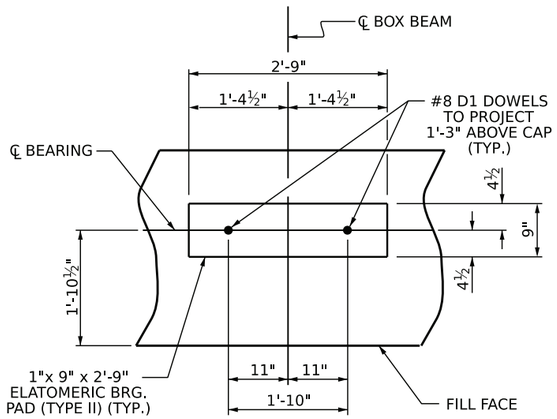


BAGGED STONE AND PIPE SHALL BE PLACED IMMEDIATELY AFTER COMPLETION OF ABUTMENT EXCAVATION. PIPE MAY BE EITHER CONCRETE, CORRUGATED STEEL, CORRUGATED ALUMINUM ALLOY OR CORRUGATED PLASTIC. PERFORATED PIPE WILL NOT BE ALLOWED.

BAGGED STONE SHALL REMAIN IN PLACE UNTIL THE ENGINEER DIRECTS THAT IT BE REMOVED. THE CONTRACTOR SHALL REMOVE AND DISPOSE OF SILT ACCUMULATIONS AT BAGGED STONE WHEN SO DIRECTED BY THE ENGINEER. BAGS SHALL BE REMOVED AND REPLACED WHENEVER THE ENGINEER DETERMINES THAT THEY HAVE DETERIORATED AND LOST THEIR EFFECTIVENESS.

NO SEPARATE PAYMENT WILL BE MADE FOR THIS WORK AND THE ENTIRE COST OF THIS WORK SHALL BE INCLUDED IN THE UNIT CONTRACT PRICE BID FOR THE SEVERAL PAY ITEMS.

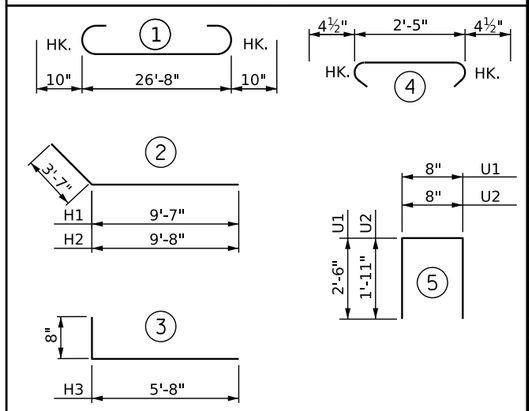
TEMPORARY DRAINAGE AT ABUTMENT



DETAIL "A"

(ABUTMENT NO. 1 SHOWN, ABUTMENT NO. 2 SIMILAR BY ROTATION)

BAR TYPES



ALL BAR DIMENSIONS ARE OUT TO OUT.

BILL OF MATERIAL — ABUTMENT 1

BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
B1	4	#7	1	28'-4"	232
B2	16	#5	STR	26'-8"	445
B3	2	#5	STR	13'-5"	28
D1	14	#8	STR	2'-3"	84
H1	15	#6	2	13'-2"	297
H2	15	#6	2	13'-3"	299
H3	22	#4	3	6'-4"	93
K1	10	#4	STR	26'-8"	178
K2	2	#4	STR	3'-9"	5
S1	33	#5	4	3'-2"	109
U1	19	#4	5	5'-8"	72
V1	19	#7	STR	7'-10"	304
V2	38	#7	STR	7'-7"	589
V3	20	#7	STR	8'-2"	334
V4	15	#7	STR	4'-8"	143
V5	15	#7	STR	4'-11"	151

REINFORCING STEEL (ABUTMENT 1) 3,363 LBS.

CLASS A CONCRETE BREAKDOWN (FOR ABUTMENT 1)

POUR #1	CAP, LOWER PART OF WINGS	17.5 C.Y.
POUR #2	BACKWALL & UPPER PART OF WINGS	4.9 C.Y.
TOTAL CLASS A CONCRETE		22.4 C.Y.

BILL OF MATERIAL — ABUTMENT 2

BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
B1	4	#7	1	28'-4"	232
B2	16	#5	STR	26'-8"	445
B3	2	#5	STR	13'-5"	28
D1	14	#8	STR	2'-3"	84
H3	24	#4	3	6'-4"	102
H5	30	#6	STR	14'-5"	650
K1	8	#4	STR	26'-8"	143
K2	6	#4	STR	3'-0"	12
K3	2	#4	STR	20'-2"	27
S1	33	#5	4	3'-2"	109
U1	17	#4	5	5'-8"	64
U2	4	#4	5	4'-6"	12
V1	52	#7	STR	8'-2"	868
V2	34	#7	STR	7'-7"	527
V3	4	#7	STR	7'-4"	60
V4	15	#7	STR	4'-8"	143
V5	15	#7	STR	4'-11"	151

REINFORCING STEEL (ABUTMENT 2) 3,657 LBS.

CLASS A CONCRETE BREAKDOWN (FOR ABUTMENT 2)

POUR #1	CAP, LOWER PART OF WINGS	17.7 C.Y.
POUR #2	BACKWALL & UPPER PART OF WINGS	4.9 C.Y.
TOTAL CLASS A CONCRETE		22.6 C.Y.

Prepared in the Office of:
SUMMIT DESIGN AND ENGINEERING SERVICES
NC FIRM LICENSE No: C-5176
1000 Social St., Suite 800
Raleigh, NC 27609
(919)322-0115
www.summitde.com

NORTH CAROLINA PROFESSIONAL SEAL 032076 ENGINEER JENNIFER R. MCROY 5/8/2026

Signed by: Jennifer R. McRoy

PROJECT NO. 011-01-EAB2F

BUNCOMBE COUNTY

STATION: 11+46.50 -L-

SHEET 5 OF 5

SUBSTRUCTURE

ABUTMENT 1 & 2 DETAILS

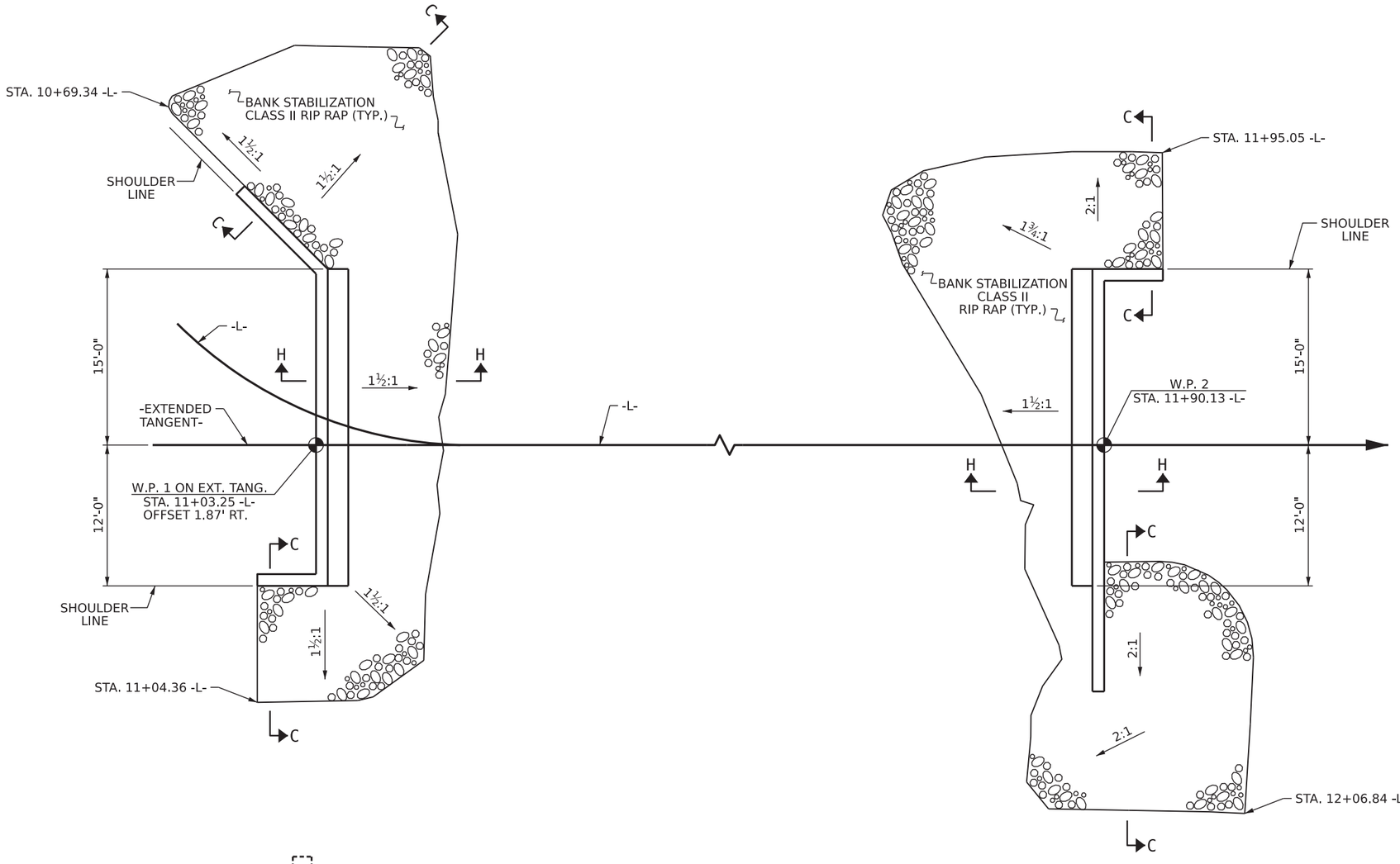
DRAWN BY : B.M.WILSON DATE : 12/2025
CHECKED BY : J.R. MCROY DATE : 12/2025
DESIGN ENGINEER OF RECORD: J.R. MCROY DATE : 12/2025

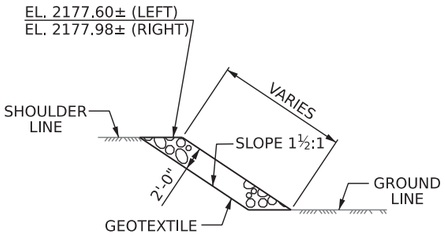
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	S-14
1			3			TOTAL SHEETS
2			4			15

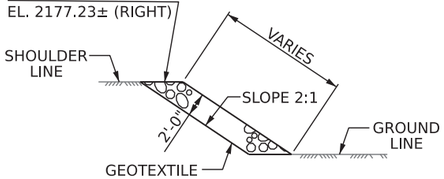
ESTIMATED QUANTITIES

BRIDGE @ STA. 11+46.50 -L-	RIP RAP CLASS II (2'-0" THICK)	GEOTEXTILE FOR DRAINAGE
BANK STABILIZATION	TONS	SQUARE YARDS
ABUTMENT 1	112	125
ABUTMENT 2	126	144

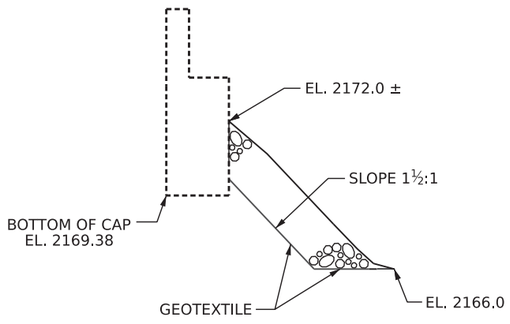




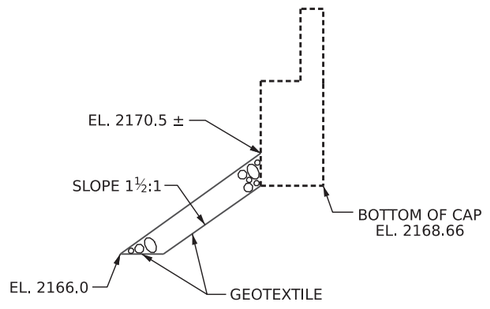
SECTION C-C
ABUTMENT 1



SECTION C-C
ABUTMENT 2



SECTION H-H
ABUTMENT 1



SECTION H-H
ABUTMENT 2

DRAWN BY : B.M WILSON DATE : 12/2025
CHECKED BY : J.R. MCROY DATE : 12/2025
DESIGN ENGINEER OF RECORD: J.R. MCROY DATE : 12/2025

Prepared in the Office of:
SUMMIT DESIGN AND ENGINEERING SERVICES
NC FIRM LICENSE No: C-5176
1000 Social Dr., Suite 800
Raleigh, NC 27609
(919)322-0115
www.summitde.com

NORTH CAROLINA PROFESSIONAL SEAL 032076 ENGINEER JENNIFER R. MCROY
5/8/2026
Signed by: Jennifer R. McRoy

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

PROJECT NO. 011-01-EAB2F
BUNCOMBE COUNTY
STATION: 11+46.50 -L-

RIP RAP DETAILS

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	S-15
1			3			TOTAL SHEETS
2			4			15

STANDARD NOTES

DESIGN DATA:

SPECIFICATIONS	AASHTO (CURRENT)
LIVE LOAD	SEE PLANS
IMPACT ALLOWANCE	SEE AASHTO
STRESS IN EXTREME FIBER OF STRUCTURAL STEEL - AASHTO M270 GRADE 36	20,000 LBS. PER SQ. IN.
- AASHTO M270 GRADE 50W	27,000 LBS. PER SQ. IN.
- AASHTO M270 GRADE 50	27,000 LBS. PER SQ. IN.
REINFORCING STEEL IN TENSION - GRADE 60	24,000 LBS. PER SQ. IN.
CONCRETE IN COMPRESSION	1,200 LBS. PER SQ. IN.
CONCRETE IN SHEAR	SEE AASHTO
STRUCTURAL TIMBER - TREATED OR UNTREATED EXTREME FIBER STRESS	1,800 LBS. PER SQ. IN.
COMPRESSION PERPENDICULAR TO GRAIN OF TIMBER	375 LBS. PER SQ. IN.
EQUIVALENT FLUID PRESSURE OF EARTH	30 LBS. PER CU. FT. (MINIMUM)

MATERIAL AND WORKMANSHIP:

EXCEPT AS MAY OTHERWISE BE SPECIFIED ON PLANS OR IN THE SPECIAL PROVISIONS, ALL MATERIAL AND WORKMANSHIP SHALL BE IN ACCORDANCE WITH THE 2024 "STANDARD SPECIFICATIONS FOR ROADS AND STRUCTURES" OF THE N. C. DEPARTMENT OF TRANSPORTATION.

STEEL SHEET PILING FOR PERMANENT OR TEMPORARY APPLICATIONS SHALL BE HOT ROLLED.

CONCRETE:

UNLESS OTHERWISE REQUIRED ON PLANS, CLASS A CONCRETE SHALL BE USED FOR ALL PORTIONS OF ALL STRUCTURES WITH THE EXCEPTION THAT: CLASS AA CONCRETE SHALL BE USED IN BRIDGE SUPERSTRUCTURES, ABUTMENT BACKWALLS, AND APPROACH SLABS; AND CLASS B CONCRETE SHALL BE USED FOR SLOPE PROTECTION AND RIP RAP.

CONCRETE CHAMFERS:

UNLESS OTHERWISE NOTED ON THE PLANS, ALL EXPOSED CORNERS ON STRUCTURES SHALL BE CHAMFERED $\frac{3}{4}$" WITH THE FOLLOWING EXCEPTIONS: TOP CORNERS OF CURBS MAY BE ROUNDED TO $1\frac{1}{2}$" RADIUS WHICH IS BUILT INTO CURB FORMS; CORNERS OF TRANSVERSE FLOOR EXPANSION JOINTS SHALL BE ROUNDED WITH A $\frac{1}{4}$" FINISHING TOOL UNLESS OTHERWISE REQUIRED ON PLANS; AND CORNERS OF EXPANSION JOINTS IN THE ROADWAY FACES AND TOPS OF CURBS AND SIDEWALKS SHALL BE ROUNDED TO A $\frac{1}{4}$" RADIUS WITH A FINISHING STONE OR TOOL UNLESS OTHERWISE REQUIRED ON PLANS.

DOWELS:

DOWELS WHEN INDICATED ON PLANS AS FOR CULVERT EXTENSIONS, SHALL BE EMBEDDED AT LEAST 12" INTO THE OLD CONCRETE AND GROUTED INTO PLACE WITH 1:2 CEMENT MORTAR.

ALLOWANCE FOR DEAD LOAD DEFLECTION, SETTLEMENT, ETC. IN CASTING SUPERSTRUCTURES:

BRIDGES SHALL BE BUILT ON THE GRADE OR VERTICAL CURVE SHOWN ON PLANS. SLABS, CURBS AND PARAPETS SHALL CONFORM TO THE GRADE OR CURVE.

ALL DIMENSIONS WHICH ARE GIVEN IN SECTION AND ARE AFFECTED BY DEAD LOAD DEFLECTIONS ARE DIMENSIONS AT CENTER LINE OF BEARING UNLESS OTHERWISE NOTED ON PLANS. IN SETTING FORMS FOR STEEL BEAM BRIDGES AND PRESTRESSED CONCRETE GIRDER BRIDGES, ADJUSTMENTS SHALL BE MADE DUE TO THE DEAD LOAD DEFLECTIONS FOR THE ELEVATIONS SHOWN. WHERE BLOCKS ARE SHOWN OVER BEAMS FOR BUILDING UP TO THE SLAB, THE VERTICAL DIMENSIONS OF THE BLOCKS SHALL BE ADJUSTED BETWEEN BEARINGS TO COMPENSATE FOR DEAD LOAD DEFLECTIONS, VERTICAL CURVE ORDINATE, AND ACTUAL BEAM CAMBER. WHERE BOTTOM OF SLAB IS IN LINE WITH BOTTOM OF TOP FLANGES, DEPTH OF SLAB BETWEEN BEARINGS SHALL BE ADJUSTED TO COMPENSATE FOR DEAD LOAD DEFLECTION, VERTICAL CURVE ORDINATE, AND ACTUAL BEAM CAMBER.

IN SETTING FALSEWORK AND FORMS FOR REINFORCED CONCRETE SPANS, AN ALLOWANCE SHALL BE MADE FOR DEAD LOAD DEFLECTIONS, SETTLEMENT OF FALSEWORK, AND PERMANENT CAMBER WHICH SHALL BE PROVIDED FOR IN ADDITION TO THE ELEVATIONS SHOWN. AFTER REMOVAL OF THE FALSEWORK, THE FINISHED STRUCTURES SHALL CONFORM TO THE PROFILE AND ELEVATIONS SHOWN ON THE PLANS AND CONSTRUCTION ELEVATIONS FURNISHED BY THE ENGINEER.

DETAILED DRAWINGS FOR FALSEWORK OR FORMS FOR BRIDGE SUPERSTRUCTURE AND ANY STRUCTURE OR PARTS OF A STRUCTURE AS NOTED ON THE PLANS SHALL BE SUBMITTED TO THE ENGINEER FOR APPROVAL BEFORE CONSTRUCTION OF THE FALSEWORK OR FORMS IS STARTED.

REINFORCING STEEL:

ALL REINFORCING STEEL SHALL BE DEFORMED. DIMENSIONS RELATIVE TO PLACEMENT OF REINFORCING ARE TO CENTERS OF BARS UNLESS OTHERWISE INDICATED IN THE PLANS. DIMENSIONS ON BAR DETAILS ARE TO CENTERS OF BARS OR ARE OUT TO OUT AS INDICATED ON PLANS.

WIRE BAR SUPPORTS SHALL BE PROVIDED FOR REINFORCING STEEL WHERE INDICATED ON THE PLANS. WHEN BAR SUPPORT PIECES ARE PLACED IN CONTINUOUS LINES, THEY SHALL BE SO PLACED THAT THE ENDS OF THE SUPPORTING WIRES SHALL BE LAPPED TO LOCK LEGS ON ADJOINING PIECES.

STRUCTURAL STEEL:

AT THE CONTRACTOR'S OPTION, HE MAY SUBSTITUTE $\frac{7}{8}$" ∅ SHEAR STUDS FOR THE $\frac{3}{4}$" ∅ STUDS SPECIFIED ON THE PLANS. THIS SUBSTITUTION SHALL BE MADE AT THE RATE OF 3 - $\frac{7}{8}$" ∅ STUDS FOR 4 - $\frac{3}{4}$" ∅ STUDS, AND STUD SPACING CHANGES SHALL BE MADE AS NECESSARY TO PROVIDE THE SAME EQUIVALENT NUMBER OF $\frac{7}{8}$" ∅ STUDS ALONG THE BEAM AS SHOWN FOR $\frac{3}{4}$" ∅ STUDS BASED ON THE RATIO OF 3 - $\frac{7}{8}$"∅ STUDS FOR 4 - $\frac{3}{4}$" ∅ STUDS. STUDS OF THE LENGTH SPECIFIED ON THE PLANS MUST BE PROVIDED. THE MAXIMUM SPACING SHALL BE 2'-0".

EXCEPT AT THE INTERIOR SUPPORTS OF CONTINUOUS BEAMS WHERE THE COVER PLATE IS IN CONTACT WITH BEARING PLATE, THE CONTRACTOR MAY, AT HIS OPTION, SUBSTITUTE FOR THE COVER PLATES DESIGNATED ON THE PLANS COVER PLATES OF THE EQUIVALENT AREA PROVIDED THESE PLATES ARE AT LEAST $\frac{5}{16}$" IN THICKNESS AND DO NOT EXCEED A WIDTH EQUAL TO THE FLANGE WIDTH LESS 2" OR A THICKNESS EQUAL TO 2 TIMES THE FLANGE THICKNESS. THE SIZE OF FILLET WELDS SHALL CONFORM TO THE REQUIREMENTS OF THE CURRENT ANSI/AASHTO/AWS "BRIDGE WELDING CODE". ELECTROSLAG WELDING WILL NOT BE PERMITTED.

WITH THE SOLE EXCEPTION OF EDGES AT SURFACES WHICH BEAR ON OTHER SURFACES, ALL SHARP EDGES AND ENDS OF SHAPES AND PLATES SHALL BE SLIGHTLY ROUNDED BY SUITABLE MEANS TO A RADIUS OF APPROXIMATELY $\frac{1}{16}$" OR EQUIVALENT FLAT SURFACE AT A SUITABLE ANGLE PRIOR TO PAINTING, GALVANIZING, OR METALLIZING.

HANDRAILS AND POSTS:

METAL STANDARDS AND FACES OF THE CONCRETE END POSTS FOR THE METAL RAIL SHALL BE SET NORMAL TO THE GRADE OF THE CURB, UNLESS OTHERWISE SHOWN ON PLANS. THE METAL RAIL AND TOPS OF CONCRETE POSTS USED WITH THE ALUMINUM RAIL SHALL BE BUILT PARALLEL TO THE GRADE OF THE CURB.

METAL HANDRAILS SHALL BE IN ACCORDANCE WITH THE PLANS. RAILS SHALL BE AS MANUFACTURED FOR BRIDGE RAILING. CASTINGS SHALL BE OF A UNIFORM APPEARANCE. FINS AND OTHER DEFORMATIONS RESULTING FROM CASTING OR OTHERWISE SHALL BE REMOVED IN A MANNER SO THAT A UNIFORM COLORING OF THE COMPLETED CASTING SHALL BE OBTAINED. CASTINGS WITH DISCOLORATIONS OR OF NON-UNIFORM COLORING WILL NOT BE ACCEPTED. CERTIFIED MILL REPORTS ARE REQUIRED FOR METAL RAILS AND POSTS.

SPECIAL NOTES:

GENERALLY, IN CASE OF DISCREPANCY, THIS STANDARD SHEET OF NOTES SHALL GOVERN OVER THE SPECIFICATIONS, BUT THE REMAINDER OF THE PLANS SHALL GOVERN OVER NOTES HEREON, AND SPECIAL PROVISIONS SHALL GOVERN OVER ALL. SEE SPECIFICATIONS ARTICLE 105-4.

BRIDGE MAINTENANCE RECOMMENDATIONS

011-01-EAB2F BUNCOMBE COUNTY (PRIVATE DRIVEWAY) BRIDGE

A. BRIDGE APPROACH

1. CHECK SIGNS ON BOTH ENDS OF BRIDGE
   - i. WARNING AND INFORMATION SIGNS.
   - ii. BRIDGE END MARKERS.
2. CLEAR WEEDS, BRUSH AND OVERHANGING LIMBS
   - i. ENSURE CLEAR VISIBILITY OF BRIDGE AND SIGNS.
   - ii. CLEAN AREA AROUND BRIDGE.
   - iii. REMOVE ALL DEBRIS FROM SITE.
3. EROSION OF BRIDGE APPROACH
   - i. FILL ANY ERODED AREAS AT GUTTER LINE ON SHOULDER.
   - ii. AT GUTTER LINE, BUILD (IF NEEDED) A PAVED CHANNEL TO CARRY WATER TO SIDE DITCH AT NON-EROSIVE VELOCITY.
   - iii. CHECK SHOULDERS FOR SIGNS OF EROSION AND FILL AND TAMP EROSION CHANNELS.

B. APPROACH ROAD TRAFFIC LANES

1. FILL ALL RUTS AND HOLES.
2. CHECK TRANSITION FROM ROAD TO BRIDGE AND ENSURE A SMOOTH TRANSITION.
3. BUILD A SHORT BITUMINOUS RAMP TO PROVIDE A SMOOTH TRANSITION, IF NEEDED.

C. SIDE DITCHES AND STREAM CHANNEL

1. CLEAR SIDE DITCHES OF ALL BRUSH, WEEDS AND DEBRIS.
2. CLEAR DEBRIS AND OBSTRUCTIONS FROM STREAM CHANNEL THROUGH FULL WIDTH OF R.O.W.
3. ELIMINATE ALL BRUSH GROWING UNDER THE BRIDGE.

D. BRIDGE SUPERSTRUCTURE (DECK, RAILS, BOX BEAMS AND BEARINGS)

1. DECK MAINTENACE
   - i. DECK MAINTENANCE SHOULD BE PERFORMED ON AN ANNUAL BASIS.
   - ii. CLEAN ALL DIRT, GRAVEL, TRASH AND DEBRIS FROM DECK.
   - iii. CLEAR ALL GUTTERS AND DRAINAGE OUTLETS (IF PRESENT).
   - iv. REMOVE ANY OBSTRUCTIONS CAUSING PONDING OF WATER.
   - v. DIRECT DECK DRAINS (IF PRESENT) AWAY FROM ALL STRUCTURAL COMPONENTS.
   - vi. CHECK ASPHALT WEARING SURFACE FOR ANY CRACKS OR POTHOLES. SEAL CRACKS AND FILL POTHOLES, AS NEEDED.
2. BOX BEAM UNITS
   - i. INSPECT BOX BEAMS FOR EXPOSED REINFORCING STEEL OR PRESTRESSED OR POST-TENSIONED STRANDS. REPAIR CONCRETE TO PROTECT STEEL.
3. VERTICAL CONCRETE BARRIER RAIL AND SHOULDER BERM GUTTER
   - i. CHECK VERTICAL CONCRETE BARRIER RAIL FOR SPALLING AND CRACKING. REPAIR CONCRETE TO PROTECT STEEL.
   - ii. CLEAR DEBRIS FROM GUTTER AT LEFT SIDE OF ABUTMENT 2 AND CLEAN ANY DEBRIS FROM GRATED DRAIN.

E. BRIDGE SUBSTRUCTURE (ABUTMENTS)

1. ABUTMENTS
   - i. INSPECT FOR CRACKING OF ABUTMENT CAP OR WING WALLS. REPAIR CONCRETE TO PROTECT STEEL.
   - ii. ASSESS SIGNIFICANT MOVEMENT OF ANY PART OF THE ABUTMENT.
   - iii. NOTE OUT-OF-PLUMB COMPONENTS AND REPORT ANY SERIOUS DETERIORATION OF THE ABUTMENT. CONSULT A PROFESSIONAL ENGINEER, AS NEEDED.
   - iv. NOTE ANY EROSION OF THE STREAM THAT MAY UNDERMINE THE ABUTMENT AND ELIMINATE THE CAUSE OF THE EROSION, IF POSSIBLE.
   - v. FILL AND TAMP ANY RODENT HOLES ALONG THE BASE OF THE ABUTMENT AND WING WALLS.

SUMMIT
DESIGN AND ENGINEERING SERVICES

Summary of Soil Test Borings

SUMMIT
DESIGN AND ENGINEERING SERVICES

320 Executive Court, Hillsborough, NC 27278
Phone // 919.732.3883 Web // www.summitde.com

October 31, 2025

Reference Number: 011-01-EAB2F
County: BUNCOMBE
Description: Replace Bridge on private drive over Broad River
SUBJECT: Geotechnical Screening Report - Structure Subsurface Inventory

Project Description

The proposed 0.037-mile-long project is located approximately 6 miles north of Bat Cave in Buncombe County, North Carolina. The project consists of the replacement of the destroyed single lane bridge on a private drive over the Broad River. In general, the proposed earthwork is minor throughout the project corridor, with slight change in grade of the roadway/bridge approaches. The proposed new bridge will be approximately 87 feet long and will be located close to where the prior bridge was located.

The geotechnical investigation for this project was conducted during the middle of October of 2025. One (1) boring was advanced using 3.25-inch hollow stem auger drilling methods and NQ wireline coring methods to a depth of 20.4 feet below ground surface. The boring was advanced using a CME-550X ATV drill rig equipped with an automatic hammer. Standard Penetration Tests (SPT) were performed at 5.0-foot intervals to provide subsurface information for bridge foundation design/construction. This boring was drilled at the proposed western end bent of the new bridge to depths that meet the requirements for driven pile foundations. The boring was advanced with NQ-sized rock coring methods after shallow SPT refusal on Crystalline Rock. Borings were filled in after completion of drilling. The eastern end bent of the proposed structure was investigated using rod sounding methods. One (1) rod sounding was performed for the inaccessible eastern end bent and advanced to a depth of 1.7 feet. Representative soil samples were collected for visual classification in the field. Final bore logs and core logs with core photographs are included with this report.

All borings were advanced by a North Carolina Licensed Driller (Certified Well Contractors - CWC). All borings were logged by a North Carolina Licensed Geologist (LG/PG), Geologist in Training (GIT), Engineer Intern (EI), or other professional geotechnical field staff deemed qualified by NCDOT. All investigations and reporting were performed in accordance with the NCDOT Geotechnical Engineering Unit's 2021 "Geotechnical Investigation and Recommendations Manual."

Physiography, Geography, and Geology

The project area is situated within the Blue Ridge Physiographic Province, a mountainous region characterized by steep ridges and valleys that intersect at all angles with elevation differences of a several hundred feet between peaks and valleys. Within the project corridor, the topography is best described as moderately rolling with well-developed drainages. A relative topographic low of approximately 2161 feet above sea level occurs within the channel of Broad River in the middle of the project area. From this area, the project ascends on either side of the Broad River to a relative topographic high of approximately 2181 feet above sea level on the west side of the project, and approximately 2179 feet above sea level at the west end of the project corridor.

The project area lies within the Santee River Basin. Surface drainage within the project corridor follows the existing topography, flowing into Broad River, which in turn meanders to the south and east and eventually flows into Lake Lure in Chimney Rock, North Carolina.

The project area is located within the Chauga Belt. A geological belt is a typically fault-bounded fragment of Earth's crust that shares a common geologic history distinguishing it from surrounding belts or areas. The Chauga Belt is characterized by mostly Cambrian aged, highly metamorphosed, and deformed rocks including gneisses, schists, phyllites, amphibolites, and carbonates, which have been strongly folded, faulted and thrust-faulted during various orogenies. According to the Geologic Map of North Carolina, the project site is underlain by a rock unit that has been mapped by the North Carolina Geological Survey (NCGS) as "Henderson Gneiss; (Map Symbol: Chg)."

Soil Properties

Soils encountered during this geotechnical investigation have been divided into two categories based on origin, including Artificial Fill and Residual soils.

Artificial fill soil is present along the project corridor, underlying and adjacent to the existing private road. Where encountered, these soils consist of granular soils characterized as gray and brown, dry, medium dense silty sand, (A-2-4), with some gravel.

Residual soils were encountered underlying the Artificial Fill or from the ground surface. The Residual soils consisted of granular soils characterized as brown and orange, dry to moist, medium dense silty sand (A-2-4) with trace rock fragments. Residual soils at the project site are derived from the in-situ weathering of the underlying bedrock materials. Consistency or denseness typically increases with depth, as well as the amount of relic rock fragments present within the soil profile, until Weathered Rock and/or Crystalline Rock materials are encountered.

Rock Properties

Weathered Rock and Crystalline Rock consisting of gneiss was encountered within the subsurface beneath the Residual soils at depths ranging from ±1 to ±4 feet below existing ground surface in all the borings performed for the proposed bridge replacement at the project site. Crystalline Rock: Gneiss was cored at End Bent 1 of the proposed bridge to confirm the presence of continuous bedrock and is characterized as gray and white, moderately weathered to fresh, very closely to widely fractured, hard gneiss. Trace iron staining was observed on some fracture surfaces of the recovered core to a depth of 6.7 feet. A rod sounding was performed on the eastern end bent of the bridge that was inaccessible to the drill rig and encountered Weathered Rock at a depth of 1.5 feet and encountered Crystalline Rock and a depth of 1.7. Significant outcropping was observed in the river bed underlying the proposed replacement bridge alignment.

Groundwater Properties

The geotechnical investigation was conducted during a period of average rainfall. Due to the introduction of water into the subsurface during coring activities, accurate groundwater measurements were not obtainable. It may be interpreted that groundwater can be at or near the surface level elevation of the Broad River.

SUMMIT
DESIGN AND ENGINEERING SERVICES

320 Executive Court, Hillsborough, NC 27278
Phone // 919.732.3883 Web // www.summitde.com

Areas of Special Geotechnical Interest

Shallow Weathered Rock and Crystalline Rock was encountered in the boring and rod sounding performed at the end bent locations. Weathered Rock was encountered at depths between 1.5 and 3.5 feet and Crystalline Rock was encountered at depths between 1.7 and 4.0 feet below the existing ground surface at the end bent locations. Shallow Weathered Rock and Crystalline Rock may prevent driven piles from achieving the required embedment for bearing or stability. Therefore, shallow foundations may need to be considered during foundation design for the end bents of this bridge.

Respectfully Submitted,

Aaron. B. Gross, PG
Senior Geologist
Summit Design and Engineering Services, Inc.
NC License # 2620

PROJECT REFERENCE NO.	SHEET NO.
011-01-EAB2F	3

SITE PLAN

0 40 80

FEET

CUR DATA -L-	CUR DATA -L-
PIc 10+92.47	PIc 12+15.76
Δc = 87°22'14.3" (LT)	Δc = 29°37'06.1" (RT)
D = 143°14'22.0"	D = 71°37'11.0"
Lc = 61.00	Lc = 41.36
Tc = 38.21	Tc = 21.15
R = 40	R = 80

N.C. GRID NAD 83 NA 2011

N.C. HWY 9
23' BST

BM1
ELEV=2180.096'

-L- START Sta. 10+00.00

BEGIN PROJECT
-L- Sta. 10+35.00

EXISTING RW

GRV

S23°13'23.3"E
-L- GRV

S63°16'15"E
16.77'

CP-4

S62°16'55"E
124.54'

-L- PC Sta. 10+54.27

EXISTING RW

EB1-B

SPUR
#8156

CP-2

SERVICE

BEGIN BRIDGE
-L- Sta. 11+03.25
1.87' RT

S89°45'00"E
60.25'

JS

S16°30'00"E
120.80'

BROAD RIVER

10

S86°55'41"E
16.41'

S86°55'41"E

-L- PC Sta. 11+94.61

-L- PT Sta. 12+35.97
S80°58'31.5"E (AH)

END PROJECT
-L- Sta. 12+50.00

-L- END Sta. 12+62.51

159.60'

CONC.

-L-
N69°24'22.4"E

END
BENT

EB2-A BR

GRV

END BRIDGE
-L- Sta. 11+90.13

S25°07'15"E
72.20'

-L- PT Sta. 11+15.26

CP-1

S23°41'08"E
41.08'

S05°59.0
98.05'

BROAD RIVER

SPUR
#8094

GRV

END GRADE
-L- Sta. 12+40.00

S05°49'39"E
91.82'

S73°04'08"E
441.41'

PROJECT REFERENCE NO.	SHEET NO.
Ø11-Ø1-EAB2F	4

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION

SOIL IS CONSIDERED UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER AND YIELD LESS THAN 100 BLOWS PER FOOT ACCORDING TO THE STANDARD PENETRATION TEST (AASHTO T 206, ASTM D1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY INCLUDE THE FOLLOWING: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. FOR EXAMPLE,
VERY STIFF, GRAY, SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6

SOIL LEGEND AND AASHTO CLASSIFICATION

GENERAL CLASS.	GRANULAR MATERIALS (≤ 35% PASSING #200)							SILT-CLAY MATERIALS (> 35% PASSING #200)				ORGANIC MATERIALS		
GROUP CLASS.	A-1		A-3	A-2				A-4	A-5	A-6	A-7	A-1, A-2 A-3	A-4, A-5 A-6, A-7	
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5, A-7-6			
SYMBOL														
% PASSING #10 #40 #200	50 MX 30 MX 15 MX		50 MX 25 MX	51 MN 10 MX	35 MX	35 MX	35 MX	35 MX	36 MN	36 MN	36 MN	36 MN	GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT
MATERIAL PASSING #40 LL PI	— 6 MX			— NP	40 MX 10 MX	41 MN 10 MX	40 MX 11 MN	41 MN 11 MN	40 MX 10 MX	41 MN 10 MX	40 MX 11 MN	41 MN 11 MN	SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER		HIGHLY ORGANIC SOILS
GROUP INDEX	0			0	0		4 MX		8 MX	12 MX	16 MX	NO MX			
USUAL TYPES OF MAJOR MATERIALS	STONE FRAGS. GRAVEL, AND SAND		FINE SAND	SILTY OR CLAYEY GRAVEL AND SAND					SILTY SOILS		CLAYEY SOILS				
GEN. RATING AS SUBGRADE	EXCELLENT TO GOOD								FAIR TO POOR				FAIR TO POOR	POOR	UNSUITABLE

PI OF A-7-5 SUBGROUP IS ≤ LL - 30 ; PI OF A-7-6 SUBGROUP IS > LL - 30

CONSISTENCY OR DENSENESS

PRIMARY SOIL TYPE	COMPACTNESS OR CONSISTENCY	RANGE OF STANDARD PENETRATION RESISTENCE (N-VALUE)	RANGE OF UNCONFINED COMPRESSIVE STRENGTH ($TONS/FT^2$)
GENERALLY GRANULAR MATERIAL (NON-COHESIVE)	VERY LOOSE LOOSE MEDIUM DENSE DENSE VERY DENSE	< 4 4 TO 10 10 TO 30 30 TO 50 > 50	N/A
GENERALLY SILT-CLAY MATERIAL (COHESIVE)	VERY SOFT SOFT MEDIUM STIFF STIFF VERY STIFF HARD	< 2 2 TO 4 4 TO 8 8 TO 15 15 TO 30 > 30	< 0.25 0.25 TO 0.5 0.5 TO 1.0 1 TO 2 2 TO 4 > 4

TEXTURE OR GRAIN SIZE

U.S. STD. SIEVE SIZE	4	10	40	60	200	270
OPENING (MM)	4.76	2.00	0.42	0.25	0.075	0.053

BOULDER (BLDR.)	COBBLE (COB.)	GRAVEL (GR.)	COARSE SAND (CSE. SD.)	FINE SAND (F SD.)	SILT (SL.)	CLAY (CL.)

GRAIN SIZE	MM	305	75	2.0	0.25	0.05	0.005
	IN.	12	3				

SOIL MOISTURE - CORRELATION OF TERMS

SOIL MOISTURE SCALE (ATTERBERG LIMITS)	FIELD MOISTURE DESCRIPTION	GUIDE FOR FIELD MOISTURE DESCRIPTION
	- SATURATED - (SAT.)	USUALLY LIQUID; VERY WET, USUALLY FROM BELOW THE GROUND WATER TABLE
LL — LIQUID LIMIT		
PLASTIC RANGE (PI)	- WET - (W)	SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE
PL — PLASTIC LIMIT		
OM — OPTIMUM MOISTURE SL — SHRINKAGE LIMIT	- MOIST - (M)	SOLID; AT OR NEAR OPTIMUM MOISTURE
	- DRY - (D)	REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE

PLASTICITY

	PLASTICITY INDEX (PI)	DRY STRENGTH
NON PLASTIC	0-5	VERY LOW
SLIGHTLY PLASTIC	6-15	SLIGHT
MODERATELY PLASTIC	16-25	MEDIUM
HIGHLY PLASTIC	26 OR MORE	HIGH

COLOR

DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-GRAY). MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE.

GRADATION

WELL GRADED - INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COARSE.
UNIFORMLY GRADED - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE.
GAP-GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLE SIZES OF TWO OR MORE SIZES.

ANGULARITY OF GRAINS

THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS IS DESIGNATED BY THE TERMS: ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.

MINERALOGICAL COMPOSITION

MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHEN THEY ARE CONSIDERED OF SIGNIFICANCE.

COMPRESSIBILITY

SLIGHTLY COMPRESSIBLE	LL < 31
MODERATELY COMPRESSIBLE	LL = 31 - 50
HIGHLY COMPRESSIBLE	LL > 50

PERCENTAGE OF MATERIAL

ORGANIC MATERIAL	GRANULAR SOILS	SILT - CLAY SOILS	OTHER MATERIAL	
TRACE OF ORGANIC MATTER	2 - 3%	3 - 5%	TRACE	1 - 10%
LITTLE ORGANIC MATTER	3 - 5%	5 - 12%	LITTLE	10 - 20%
MODERATELY ORGANIC	5 - 10%	12 - 20%	SOME	20 - 35%
HIGHLY ORGANIC	> 10%	> 20%	HIGHLY	35% AND ABOVE

GROUND WATER

- WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING
- STATIC WATER LEVEL AFTER 24 HOURS
- PW — PERCHED WATER, SATURATED ZONE, OR WATER BEARING STRATA
- SPRING OR SEEP

MISCELLANEOUS SYMBOLS

- ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION
- SOIL SYMBOL
- ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT
- INFERRED SOIL BOUNDARY
- INFERRED ROCK LINE
- ALLUVIAL SOIL BOUNDARY
- 25/025 — DIP & DIP DIRECTION OF ROCK STRUCTURES
- SPT, DPT, DMT, VST, PMT — TEST BORING
- AUGER BORING
- CORE BORING
- MW — MONITORING WELL
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- CONE PENETROMETER TEST
- SOUNDING ROD
- TEST BORING WITH CORE
- SPT N-VALUE

RECOMMENDATION SYMBOLS

- UNDERCUT
- SHALLOW UNDERCUT
- UNCLASSIFIED EXCAVATION - UNSUITABLE WASTE
- UNCLASSIFIED EXCAVATION - ACCEPTABLE DEGRADABLE ROCK
- UNCLASSIFIED EXCAVATION - ACCEPTABLE, BUT NOT TO BE USED IN THE TOP 3 FEET OF EMBANKMENT OR BACKFILL

ABBREVIATIONS

AR - AUGER REFUSAL
BT - BORING TERMINATED
CL. - CLAY
CPT - CONE PENETRATION TEST
CSE. - COARSE
DMT - DILATOMETER TEST
DPT - DYNAMIC PENETRATION TEST
e - VOID RATIO
F - FINE
FOSS. - FOSSILIFEROUS
FRAC. - FRACTURED, FRACTURES
FRAGS. - FRAGMENTS
HI. - HIGHLY
MED. - MEDIUM
MICA. - MICACEOUS
MOD. - MODERATELY
NP - NON PLASTIC
ORG. - ORGANIC
PMT - PRESSUREMETER TEST
SAP. - SAPROLITIC
SD. - SAND, SANDY
SL. - SILT, SILTY
SLI. - SLIGHTLY
TCR - TRICONE REFUSAL
w - MOISTURE CONTENT
V - VERY
VST - VANE SHEAR TEST
WEA. - WEATHERED
γ - UNIT WEIGHT
γ_d - DRY UNIT WEIGHT

SAMPLE ABBREVIATIONS

S - BULK
SS - SPLIT SPOON
ST - SHELBY TUBE
RS - ROCK
RT - RECOMPACTED TRIAXIAL
CBR - CALIFORNIA BEARING RATIO

EQUIPMENT USED ON SUBJECT PROJECT

DRILL UNITS:
- [ ] CME-45C
- [ ] CME-55
- [X] CME-550
- [ ] VANE SHEAR TEST
- [ ] PORTABLE HOIST
- [ ] _____
- [ ] _____

ADVANCING TOOLS:
- [ ] CLAY BITS
- [ ] 6" CONTINUOUS FLIGHT AUGER
- [X] 8" HOLLOW AUGERS
- [ ] HARD FACED FINGER BITS
- [ ] TUNG.-CARBIDE INSERTS
- [ ] CASING [ ] W/ ADVANCER
- [ ] TRICONE _____" STEEL TEETH
- [ ] TRICONE _____" TUNG.-CARB.
- [X] CORE BIT
- [ ] _____

HAMMER TYPE:
- [X] AUTOMATIC [ ] MANUAL

CORE SIZE:
- [ ] -B _____ [ ] -H _____
- [X] -N Q2

HAND TOOLS:
- [ ] POST HOLE DIGGER
- [ ] HAND AUGER
- [X] SOUNDING ROD
- [ ] VANE SHEAR TEST
- [ ] _____

ROCK DESCRIPTION

HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT REFUSAL IF TESTED. AN INFERRED ROCK LINE INDICATES THE LEVEL AT WHICH NON-COASTAL PLAIN MATERIAL WOULD YIELD SPT REFUSAL. SPT REFUSAL IS PENETRATION BY A SPLIT SPOON SAMPLER EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS IN NON-COASTAL PLAIN MATERIAL, THE TRANSITION BETWEEN SOIL AND ROCK IS OFTEN REPRESENTED BY A ZONE OF WEATHERED ROCK.
ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLLOWS:

WEATHERED ROCK (WR)	NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES > 100 BLOWS PER FOOT IF TESTED.
CRYSTALLINE ROCK (CR)	FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC.
NON-CRYSTALLINE ROCK (NCR)	FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SEDIMENTARY ROCK THAT WOULD YEILD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC.
COASTAL PLAIN SEDIMENTARY ROCK (CP)	COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.

WEATHERING

FRESH	ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE.
VERY SLIGHT (V SLI.)	ROCK GENERALLY FRESH, JOINTS STAINED, SOME JOINTS MAY SHOW THIN CLAY COATINGS IF OPEN, CRYSTALS ON A BROKEN SPECIMEN FACE SHINE BRIGHTLY. ROCK RINGS UNDER HAMMER BLOWS IF OF A CRYSTALLINE NATURE.
SLIGHT (SLI.)	ROCK GENERALLY FRESH, JOINTS STAINED AND DISCOLORATION EXTENDS INTO ROCK UP TO 1 INCH. OPEN JOINTS MAY CONTAIN CLAY. IN GRANITOID ROCKS SOME OCCASIONAL FELDSPAR CRYSTALS ARE DULL AND DISCOLORED. CRYSTALLINE ROCKS RING UNDER HAMMER BLOWS.
MODERATE (MOD.)	SIGNIFICANT PORTIONS OF ROCK SHOW DISCOLORATION AND WEATHERING EFFECTS. IN GRANITOID ROCKS, MOST FELDSPARS ARE DULL AND DISCOLORED, SOME SHOW CLAY. ROCK HAS DULL SOUND UNDER HAMMER BLOWS AND SHOWS SIGNIFICANT LOSS OF STRENGTH AS COMPARED WITH FRESH ROCK.
MODERATELY SEVERE (MOD. SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. IN GRANITOID ROCKS, ALL FELDSPARS DULL AND DISCOLORED AND A MAJORITY SHOW KAOLINIZATION. ROCK SHOWS SEVERE LOSS OF STRENGTH AND CAN BE EXCAVATED WITH A GEOLOGIST'S PICK. ROCK GIVES "CLUNK" SOUND WHEN STRUCK. *IF TESTED, WOULD YIELD SPT REFUSAL*
SEVERE (SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC CLEAR AND EVIDENT BUT REDUCED IN STRENGTH TO STRONG SOIL. IN GRANITOID ROCKS ALL FELDSPARS ARE KAOLINIZED TO SOME EXTENT. SOME FRAGMENTS OF STRONG ROCK USUALLY REMAIN. *IF TESTED, WOULD YIELD SPT N VALUES > 100 BPF*
VERY SEVERE (V SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE THAT ONLY MINOR VESTIGES OF ORIGINAL ROCK FABRIC REMAIN. *IF TESTED, WOULD YIELD SPT N VALUES < 100 BPF*
COMPLETE	ROCK REDUCED TO SOIL. ROCK FABRIC NOT DISCERNIBLE, OR DISCERNIBLE ONLY IN SMALL AND SCATTERED CONCENTRATIONS. QUARTZ MAY BE PRESENT AS DIKES OR STRINGERS. SAPROLITE IS ALSO AN EXAMPLE.

ROCK HARDNESS

VERY HARD	CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK.
HARD	CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN.
MODERATELY HARD	CAN BE SCRATCHED BY KNIFE OR PICK. GOUGES OR GROOVES TO 0.25 INCHES DEEP CAN BE EXCAVATED BY HARD BLOW OF A GEOLOGIST'S PICK. HAND SPECIMENS CAN BE DETACHED BY MODERATE BLOWS.
MEDIUM HARD	CAN BE GROOVED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PEICES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.
SOFT	CAN BE GROVED OR GOUGED READILY BY KNIFE OR PICK. CAN BE EXCAVATED IN FRAGMENTS FROM CHIPS TO SEVERAL INCHES IN SIZE BY MODERATE BLOWS OF A PICK POINT. SMALL, THIN PIECES CAN BE BROKEN BY FINGER PRESSURE.
VERY SOFT	CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGERNAIL.

FRACTURE SPACING

TERM	SPACING
VERY WIDE	MORE THAN 10 FEET
WIDE	3 TO 10 FEET
MODERATELY CLOSE	1 TO 3 FEET
CLOSE	0.16 TO 1 FOOT
VERY CLOSE	LESS THAN 0.16 FEET

BEDDING

TERM	THICKNESS
VERY THICKLY BEDDED	4 FEET
THICKLY BEDDED	1.5 - 4 FEET
THINLY BEDDED	0.16 - 1.5 FEET
VERY THINLY BEDDED	0.03 - 0.16 FEET
THICKLY LAMINATED	0.008 - 0.03 FEET
THINLY LAMINATED	< 0.008 FEET

INDURATION

FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC.

FRIABLE	RUBBING WITH FINGER FREES NUMEROUS GRAINS; GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE.
MODERATELY INDURATED	GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER.
INDURATED	GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE; DIFFICULT TO BREAK WITH HAMMER.
EXTREMELY INDURATED	SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; SAMPLE BREAKS ACROSS GRAINS.

TERMS AND DEFINITIONS

ALLUVIUM (ALLUV.) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER.

AQUIFER - A WATER BEARING FORMATION OR STRATA.

ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.

ARGILLACEOUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, SUCH AS SHALE, SLATE, ETC.

ARTESIAN - GROUND WATER THAT IS UNDER SUFFICIENT PRESSURE TO RISE ABOVE THE LEVEL AT WHICH IT IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE GROUND SURFACE.

CALCAREOUS (CALC.) - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE.

COLLUVIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE.

CORE RECOVERY (REC.) - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED BY TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.

DIKE - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK.

DIP - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL.

DIP DIRECTION (DIP AZIMUTH) - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH.

FAULT - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE.

FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES.

FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM PARENT MATERIAL.

FLOOD PLAIN (FP) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM.

FORMATION (FM.) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD.

JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED.

LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT.

LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS.

MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE.

PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM.

RESIDUAL (RES.) SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK.

ROCK QUALITY DESIGNATION (RQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.

SAPROLITE (SAP.) - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK.

SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS.

SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE.

STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS (N OR BPF) OF A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS.

STRATA CORE RECOVERY (SREC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE.

STRATA ROCK QUALITY DESIGNATION (SRQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.

TOPSOIL (TS.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.

BENCH MARK: SEE NOTES

ELEVATION: N/A FEET

NOTES:

FIAD = FILLED IMMEDIATELY AFTER DRILLING

LOCATIONS AND ELEVATIONS DETERMINED WITH SURVEY GRADE GPS - EMLID REACH RS3 RECEIVER PERFORMING GNSS RTK VRS SURVEYS REFERENCED TO THE NC CORS RTN

DATE: 8-15-14

PROJECT REFERENCE NO.	SHEET NO.
011-01-EAB2F	4A

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SUPPLEMENTAL LEGEND, GEOLOGICAL STRENGTH INDEX (GSI) TABLES FROM AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS

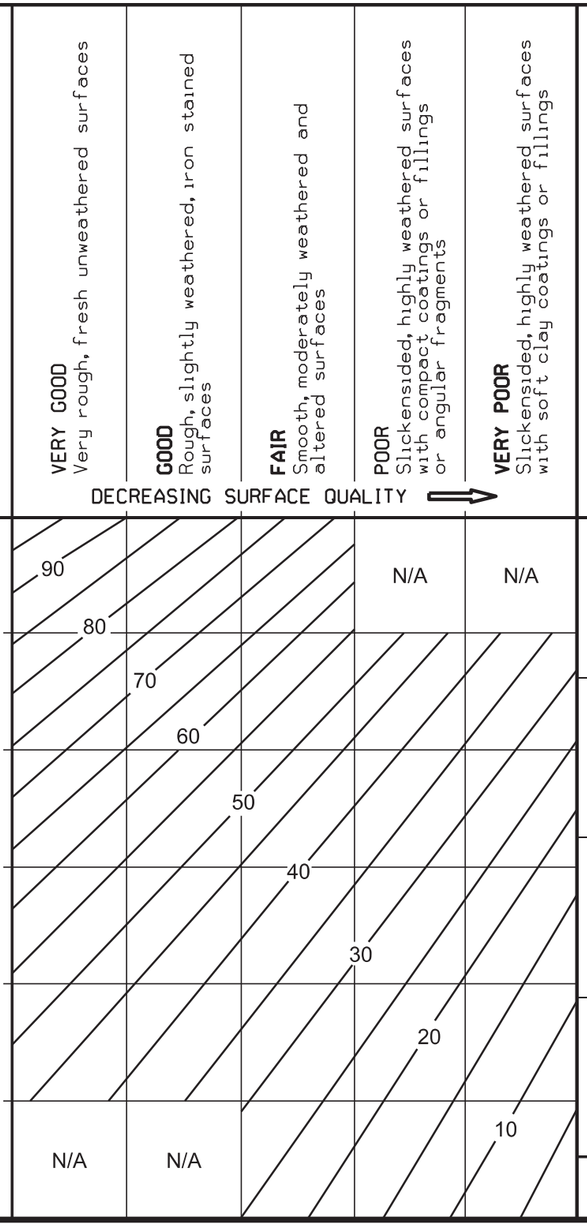
AASHTO LRFD Figure 10.4.6.4-1 — Determination of GSI for Jointed Rock Mass (Marinos and Hoek, 2000)

GEOLOGICAL STRENGTH INDEX (GSI) FOR JOINTED ROCKS (Hoek and Marinos, 2000)

From the lithology, structure and surface conditions of the discontinuities, estimate the average value of GSI. Do not try to be too precise. Quoting a range from 33 to 37 is more realistic than stating that GSI = 35. Note that the table does not apply to structurally controlled failures. Where weak planar structural planes are present in an unfavorable orientation with respect to the excavation face, these will dominate the rock mass behaviour. The shear strength of surfaces in rocks that are prone to deterioration as a result of changes in moisture content will be reduced if water is present. When working with rocks in the fair to very poor categories, a shift to the right may be made for wet conditions. Water pressure is dealt with by effective stress analysis.

STRUCTURE

- INTACT OR MASSIVE - intact rock specimens or massive in situ rock with few widely spaced discontinuities
- BLOCKY - well interlocked undisturbed rock mass consisting of cubical blocks formed by three intersecting discontinuity sets
- VERY BLOCKY - interlocked, partially disturbed mass with multi-faceted angular blocks formed by 4 or more joint sets
- BLOCKY/DISTURBED/SEAMY - folded with angular blocks formed by many intersecting discontinuity sets. Persistence of bedding planes or schistosity
- DISINTEGRATED - poorly interlocked, heavily broken rock mass with mixture of angular and rounded rock pieces
- LAMINATED/SHEARED - Lack of blockiness due to close spacing of weak schistosity or shear planes

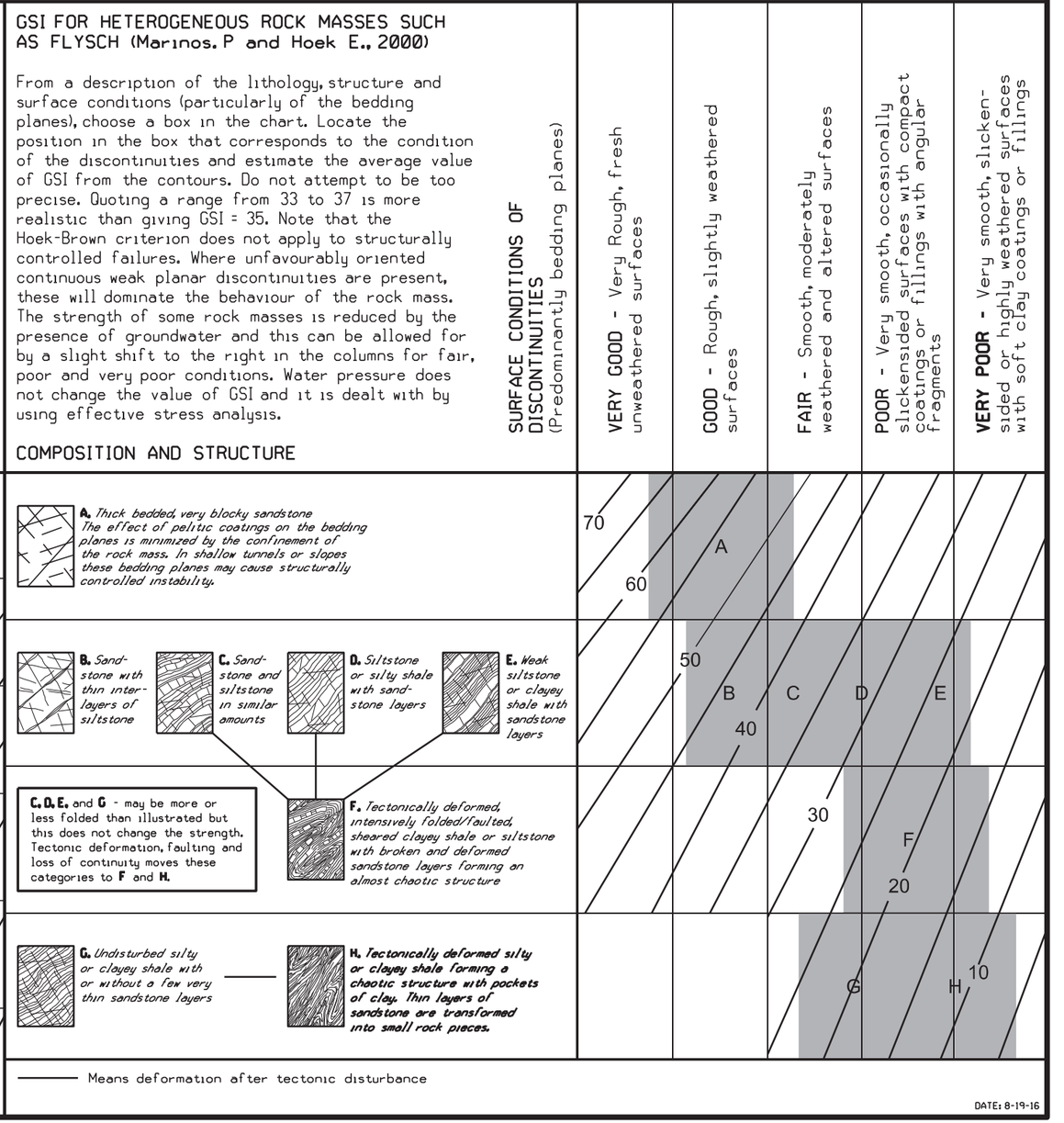


AASHTO LRFD Figure 10.4.6.4-2 — Determination of GSI for Tectonically Deformed Heterogeneous Rock Masses (Marinos and Hoek, 2000)

GSI FOR HETEROGENEOUS ROCK MASSES SUCH AS FLYSCH (Marinos. P and Hoek E., 2000)

From a description of the lithology, structure and surface conditions (particularly of the bedding planes), choose a box in the chart. Locate the position in the box that corresponds to the condition of the discontinuities and estimate the average value of GSI from the contours. Do not attempt to be too precise. Quoting a range from 33 to 37 is more realistic than giving GSI = 35. Note that the Hoek-Brown criterion does not apply to structurally controlled failures. Where unfavourably oriented continuous weak planar discontinuities are present, these will dominate the behaviour of the rock mass. The strength of some rock masses is reduced by the presence of groundwater and this can be allowed for by a slight shift to the right in the columns for fair, poor and very poor conditions. Water pressure does not change the value of GSI and it is dealt with by using effective stress analysis.

COMPOSITION AND STRUCTURE



——— Means deformation after tectonic disturbance

DATE: 8-19-16

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 011-01-EAB2F	**TIP** N/A	**COUNTY** BUNCOMBE	**GEOLOGIST** K. Haven	
SITE DESCRIPTION BUNCOMBE COUNTY - Replace Bridge on private drive over Broad River				**GROUND WTR (ft)**
BORING NO. EB1-B	**STATION** 10+94	**OFFSET** 14 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 2,175.6 ft	**TOTAL DEPTH** 20.4 ft	**NORTHING** 660,676	**EASTING** 1,033,517	**24 HR.** N/A
DRILL RIG/HAMMER EFF./DATE SUM2603 CME-550X 86% 11/14/2023		**DRILL METHOD** SPT Core Boring	**HAMMER TYPE** Automatic	
DRILLER M. G. Moseley	**START DATE** 10/20/25	**COMP. DATE** 10/21/25	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
2180											
2175	2,175.6	0.0	10	11	14	25	D			2,175.6 GROUND SURFACE	0.0
										2,174.6 **ARTIFICIAL FILL** Gray and brown, dry, medium dense Silty SAND (A-2-4) with some gravel	1.0
	2,172.1	3.5	100/0.3			100/0.3				2,172.1 **RESIDUAL** Brown and orange, medium dense Silty SAND (A-2-4)	3.5
2170	2,171.6	4.0	60/0.0			60/0.0 BOF=1769.38'				2,171.6 **WEATHERED ROCK** GNEISS	4.0
2165										**CRYSTALLINE ROCK** Gray and white, moderately weathered to fresh, hard, very closeley to widely fractured GNEISS (SREC: 99% / SRQD: 57% / GSI = 50-60) -iron staining on fracture surfaces from 4.0 - 6.7 feet -highly fractured zone with 45 degree fractures oriented in the same direction at 4.0 - 10.4 feet	
2160										2,155.2 Boring Terminated at Elevation 2,155.2 ft in Crystalline Rock: GNEISS	20.4

GEOTECHNICAL BORING REPORT
BORE LOG

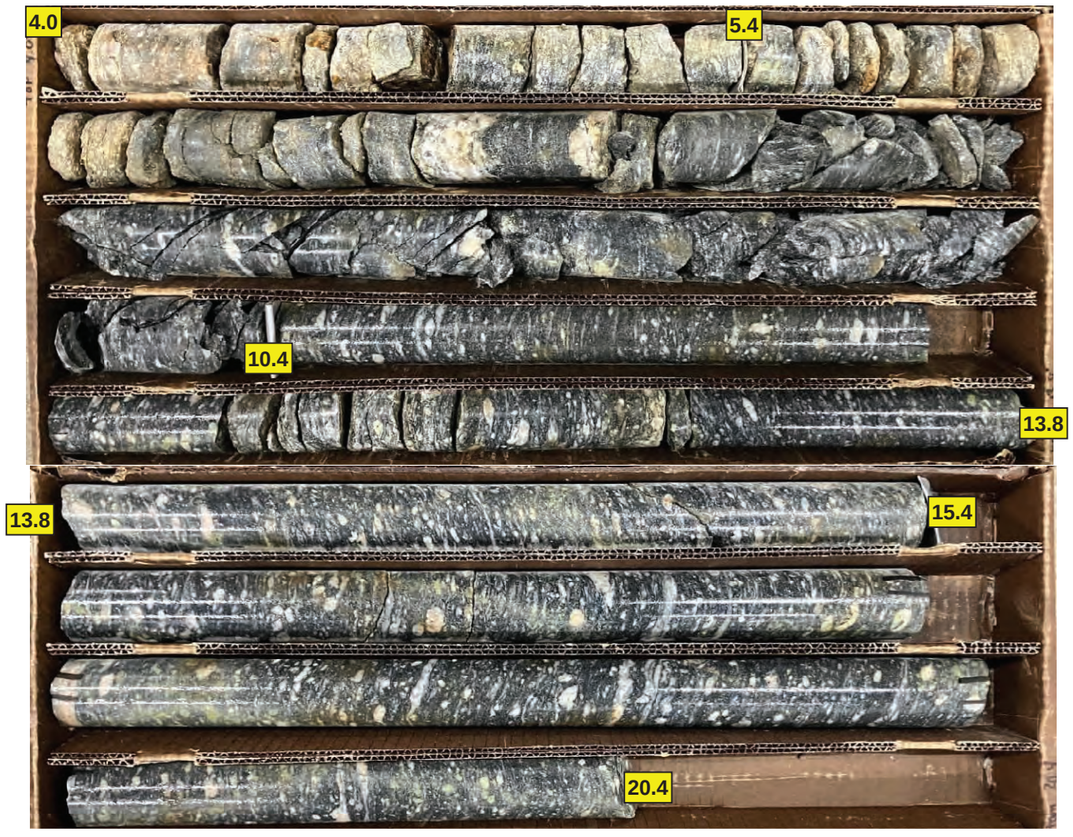
WBS 011-01-EAB2F	**TIP** N/A	**COUNTY** BUNCOMBE	**GEOLOGIST** K. Haven	
SITE DESCRIPTION BUNCOMBE COUNTY - Replace Bridge on private drive over Broad River				**GROUND WTR (ft)**
BORING NO. EB1-B	**STATION** 10+94	**OFFSET** 14 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 2,175.6 ft	**TOTAL DEPTH** 20.4 ft	**NORTHING** 660,676	**EASTING** 1,033,517	**24 HR.** N/A
DRILL RIG/HAMMER EFF./DATE SUM2603 CME-550X 86% 11/14/2023		**DRILL METHOD** SPT Core Boring	**HAMMER TYPE** Automatic	
DRILLER M. G. Moseley	**START DATE** 10/20/25	**COMP. DATE** 10/21/25	**SURFACE WATER DEPTH** N/A	
CORE SIZE NQ2	**TOTAL RUN** 16.4 ft			

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS ELEV. (ft)	DEPTH (ft)
2171.6											Begin Coring @ 4.0 ft	
2170	2,171.6 2,170.2	4.0 5.4	1.4	0:36/0.4 2:28	(1.4) 100%	(0.0) 0%		(16.2) 99%	(9.4) 57%		2,171.6 **CRYSTALLINE ROCK** Gray and white, moderately weathered to fresh, hard, very closeley to widely fractured GNEISS GSI = 50-60 -iron staining on fracture surfaces from 4.0 - 6.7 feet -highly fractured zone with 45 degree fractures oriented in the same direction at 4.0 - 10.4 feet	4.0
			5.0	1:39 2:07 2:24 2:45 2:50	(5.0) 100%	(0.4) 8%						
2165	2,165.2	10.4	5.0	3:02 3:11 2:14 3:14 3:22	(5.0) 100%	(4.5) 90%						
2160	2,160.2	15.4	5.0	2:36 2:32 2:16 2:35 2:28	(4.8) 96%	(4.5) 90%						
	2,155.2	20.4									2,155.2 Boring Terminated at Elevation 2,155.2 ft in Crystalline Rock: GNEISS	20.4

CORE PHOTOGRAPHS

EB1-B

BOXES 1 and 2 of 2: 4.0 - 20.4 FEET



GEOTECHNICAL BORING REPORT
BORE LOG

WBS 011-01-EAB2F	**TIP** N/A	**COUNTY** BUNCOMBE	**GEOLOGIST** K. Haven	
SITE DESCRIPTION BUNCOMBE COUNTY - Replace Bridge on private drive over Broad River				**GROUND WTR (ft)**
BORING NO. EB2-A BR	**STATION** 11+99	**OFFSET** 4 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 2,175.5 ft	**TOTAL DEPTH** 1.7 ft	**NORTHING** 660,725	**EASTING** 1,033,615	**24 HR.** N/A
DRILL RIG/HAMMER EFF./DATE N/A		**DRILL METHOD** Rod Sounding		**HAMMER TYPE** Manual
DRILLER M. G. Moseley	**START DATE** 10/21/25	**COMP. DATE** 10/21/25	**SURFACE WATER DEPTH** N/A	

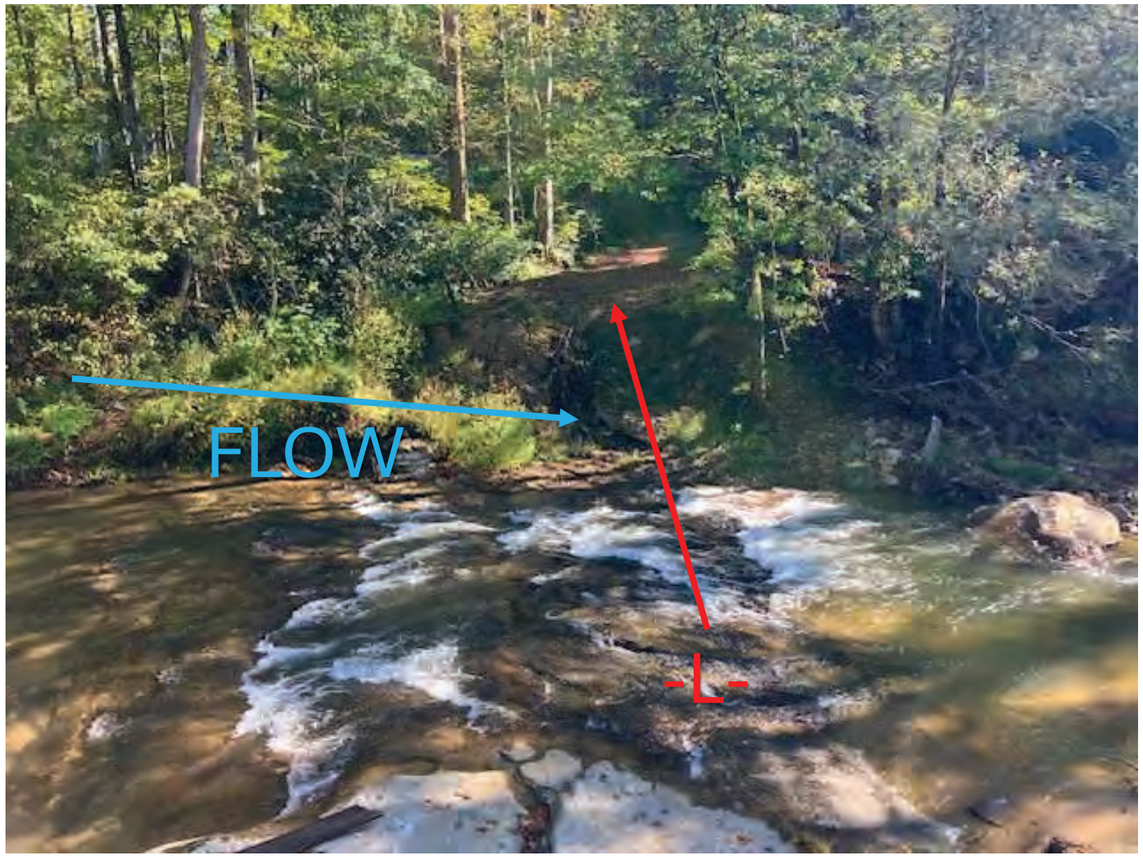
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
2180											
2175	2,175.5	0.0	NA	6	5	11		M		2,175.5 GROUND SURFACE	0.0
	2,174.5	1.0	NA	4	100/0.2	100/0.2				2,174.0 **RESIDUAL** Brown and orange, moist, medium dense Silty SAND (A-2-4) with trace rock fragments	1.5
										2,173.8 **WEATHERED ROCK** GNEISS	1.7
						BOF=1768.66'				Boring Terminated at Elevation 2,173.8 ft on Crystalline Rock: GNEISS	

SUMMIT
DESIGN AND ENGINEERING SERVICES

320 Executive Court, Hillsborough, NC 27278
Phone // 919.732.3883 Web // www.summitde.com

SITE PHOTOGRAPHS

REPLACE BRIDGE ON PRIVATE DRIVE OVER BROAD RIVER, BUNCOMBE COUNTY, NC



VIEW TO EAST FROM END BENT 1 TOWARDS END BENT 2

VIEW TO WEST FROM END BENT 2 TOWARDS END BENT 1