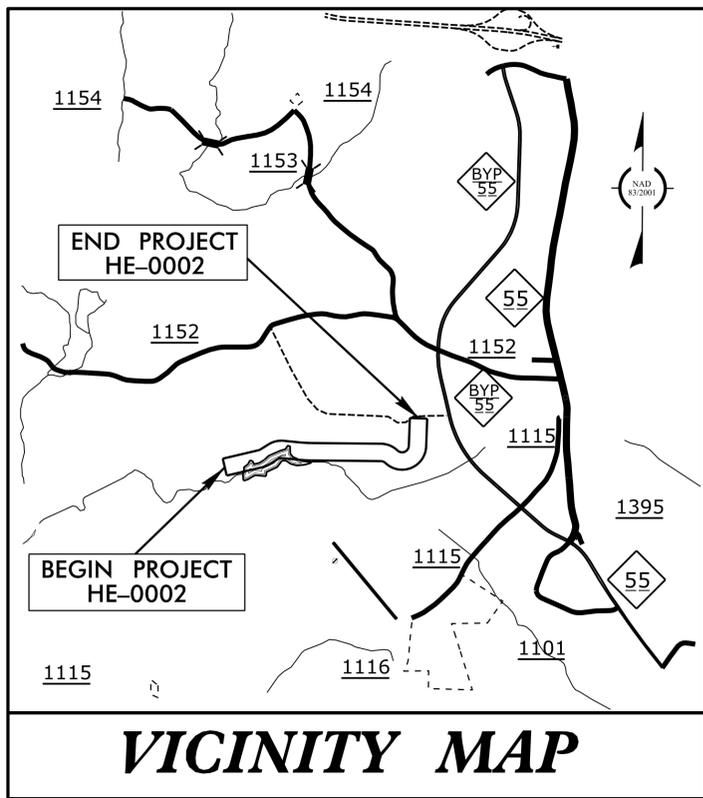


PROJECT: HE-0002

CONTRACT: C2044898

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	HE-0002		5
STATE PROJ. NO.	F. A. PROJ. NO.	DESCRIPTION	
49745.1.1	N/A	P.E.	
49745.2.1	N/A	RW	
49745.2.2	N/A	UTIL.	
49745.3.1	N/A	CONST.	



STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS

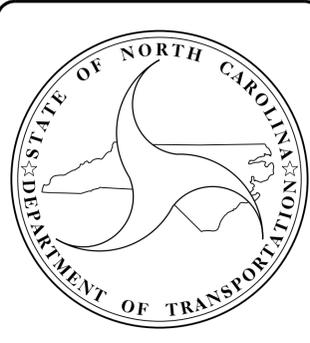
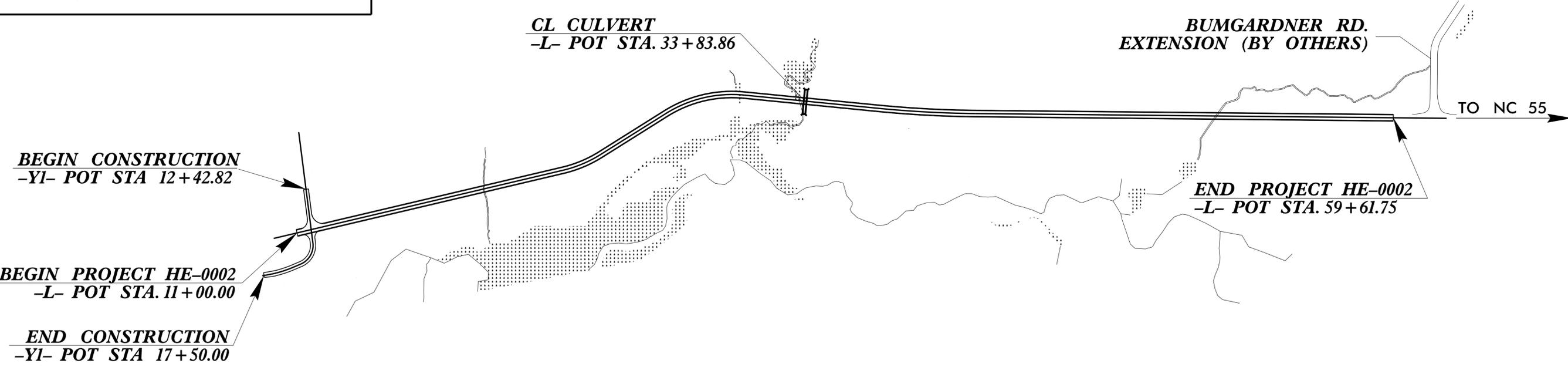
WAKE COUNTY

LOCATION: HOLLY SPRINGS BUSINESS PARK SOUTHERN ACCESS ROAD FROM FUJI DIOSYNTH BIOTECHNOLOGIES PROPERTY & SEWER PUMP STATION TO 175 FEET WEST OF THE BUMGARDNER ROAD EXTENSION INTERSECTION

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



CULVERT



DESIGN DATA

ADT 2025 =	8,000
ADT 2045 =	10,700
K =	13 %
D =	N/A %
T =	N/A %
V =	40 MPH
TTST =	N/A
DUALS =	N/A
FUNC CLASS =	
	LOCAL
	REGIONAL TIER

PROJECT LENGTH

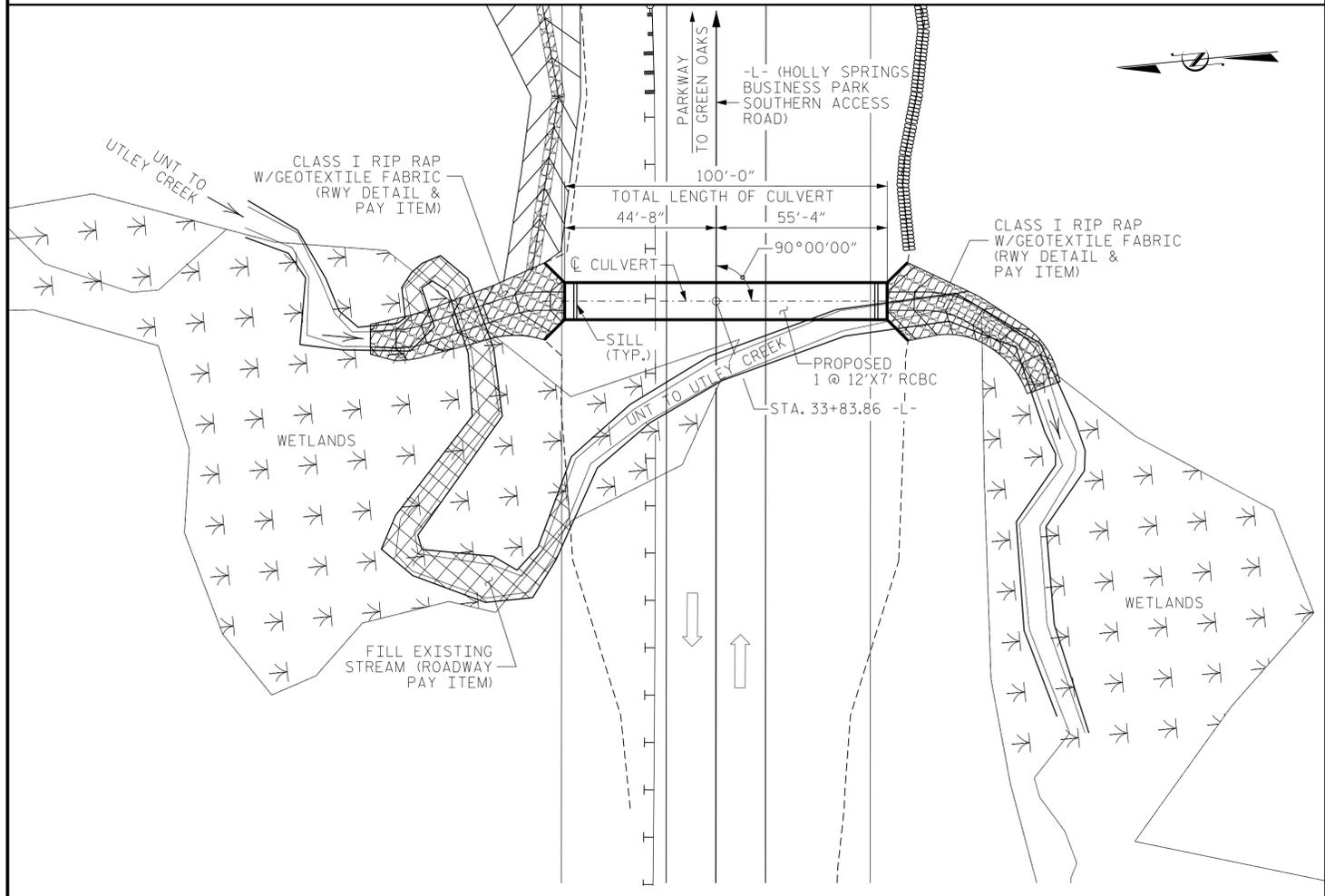
LENGTH ROADWAY PROJECT HE-0002 =	0.918 MILES
LENGTH CULVERT PROJECT HE-0002 =	0.003 MILES
TOTAL LENGTH PROJECT HE-0002 =	0.921 MILES

Prepared in the Office of:
CDM Smith
5400 Glenwood Avenue, Suite 400
Raleigh, NC 27612-3228
NC COA No. F-1255

FOR THE NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
2024 STANDARD SPECIFICATIONS

LETTING DATE : JUNE 17, 2025	DAVID Z. KEISER, P.E. <small>PROJECT ENGINEER</small>	 TING H. FANG, P.E. <small>PROJECT DESIGN ENGINEER</small> <small>Doc# 20240401</small> <small>4/3/2025</small>
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BM 2: -L- STA. 29+08.56; OFFSET 112.65' RT. EL. 277.70'



LOCATION SKETCH

ROADWAY DATA

GRADE PT. EL. @ STA. 33+83.86 -L-	= 289.17'
BED ELEV. @ STA. 33+83.86 -L-	= 269.47'
ROADWAY SLOPE (LEFT)	= 2 : 1
ROADWAY SLOPE (RIGHT)	= 2 : 1

HYDRAULIC DATA

DESIGN DISCHARGE	= 380 CFS
FREQUENCY OF DESIGN FLOOD	= 25 YRS.
DESIGN HIGH WATER ELEVATION	= 276.1'
DRAINAGE AREA	= 0.375 SQ. MI.
BASE DISCHARGE (Q100)	= 420 CFS
BASE HIGH WATER ELEVATION	= 276.4'

OVERTOPPING FLOOD DATA

OVERTOPPING DISCHARGE	= 1,138 CFS
FREQUENCY OF OVERTOPPING FLOOD	= 500+ YRS.
OVERTOPPING FLOOD ELEVATION	= 285.2' *

* AT SAG STA. 31+22.35 -L-

TOTAL STRUCTURE QUANTITIES

CLASS A CONCRETE		
BARRELS @ 1.749 CY/FT	174.9	C.Y.
WINGS	19.7	C.Y.
SILLS	1.3	C.Y.
TOTAL	195.9	C.Y.
REINFORCING STEEL		
BARRELS & SILL	16,483	LBS.
WINGS	1,151	LBS.
TOTAL	17,634	LBS.
CULVERT EXCAVATION	LUMP SUM	
FOUNDATION CONDITIONING MAT'L	122.2	TONS

NOTES

- ASSUMED LIVE LOAD ----- HL-93 OR ALTERNATE LOADING.
- FOR CULVERT DIVERSION DETAILS AND PAY ITEM, SEE EROSION CONTROL PLANS.
- FOR CONSTRUCTION SEQUENCE, EROSION CONTROL AND MEASURES, SEE EROSION CONTROL PLANS.
- DESIGN FILL----- 12.96' MAX., 10.66' MIN.
- FOR OTHER DESIGN DATA AND NOTES SEE STANDARD NOTE SHEET.
- 3" Ø WEEP HOLES INDICATED TO BE IN ACCORDANCE WITH THE SPECIFICATIONS.
- CONCRETE IN CULVERTS TO BE POURED IN THE FOLLOWING ORDER:
 1. WING FOOTINGS AND FLOOR SLAB INCLUDING 4" OF ALL VERTICAL WALLS.
 2. THE REMAINING PORTIONS OF WALLS AND SILLS WITH NATIVE MATERIAL BACKFILL.
 3. FOLLOWED BY THE WING WALLS FULL HEIGHT, ROOF SLAB, AND HEADWALLS.
- THE CONTRACTOR SHALL CHECK THE LENGTH OF CULVERT BEFORE STAKING IT OUT TO MAKE CERTAIN THAT IT WILL PROPERLY TAKE CARE OF THE FILL.
- DIMENSIONS FOR WING LAYOUT AS WELL AS ADDITIONAL REINFORCING STEEL EMBEDDED IN BARREL ARE SHOWN ON WING SHEET.
- TRANSVERSE CONSTRUCTION JOINTS SHALL BE USED IN THE BARREL, SPACED TO LIMIT THE POURS TO A MAXIMUM OF 70 FEET. LOCATION OF JOINTS SHALL BE SUBJECT TO APPROVAL OF THE ENGINEER.
- STEEL IN THE BOTTOM SLAB MAY BE SPLICED AT THE PERMITTED CONSTRUCTION JOINT AT THE CONTRACTOR'S OPTION. EXTRA WEIGHT OF STEEL DUE TO THE SPLICES SHALL BE PAID FOR BY CONTRACTOR.
- AT THE CONTRACTOR'S OPTION, HE MAY SPLICE THE VERTICAL REINFORCING STEEL IN THE INTERIOR FACE OF EXTERIOR WALL ABOVE LOWER WALL CONSTRUCTION JOINT. THE SPLICE LENGTH SHALL BE AS PROVIDED IN THE SPLICE LENGTH CHART SHOWN ON THE PLANS. EXTRA WEIGHT OF STEEL DUE TO THE SPLICES SHALL BE PAID FOR BY THE CONTRACTOR.
- A 3 FOOT STRIP OF FILTER FABRIC SHALL BE ATTACHED TO THE FILL FACE OF THE WING COVERING THE ENTIRE LENGTH OF THE EXPANSION JOINT.
- NO PRECAST REINFORCED BOX CULVERT OPTION WILL BE ALLOWED.
- 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.

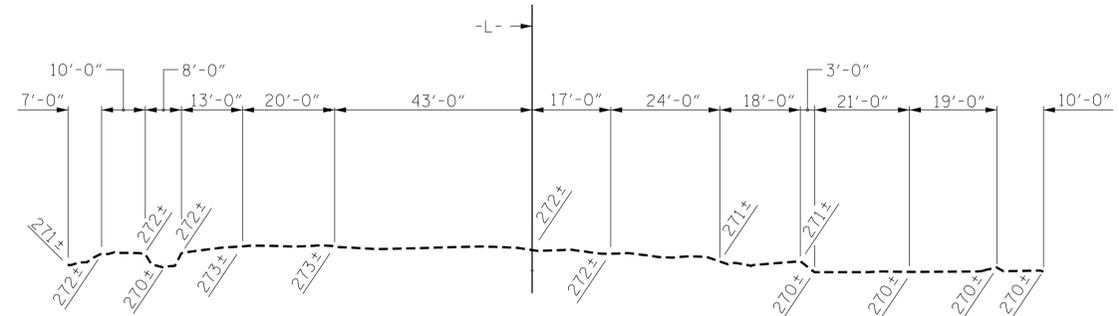
NATIVE MATERIAL SPECIFICATION FOR BACKFILLING NOTE

THE ENGINEER, IN CONSULTATION WITH DEO STAFF, SHALL REVIEW ALL MATERIAL TO BE USED AS BACKFILL PRIOR TO CONDUCTING THE BACKFILL ACTIVITY. BACKFILL SHALL CONSIST OF NATIVE MATERIAL ONLY UNLESS THE ENGINEER, IN CONSULTATION WITH DEO STAFF, DETERMINES THAT (1) THE NATIVE MATERIAL IS UNSUITABLE, OR (2) ADDITIONAL MATERIAL IS REQUIRED TO SUPPLEMENT THE NATIVE MATERIAL. THE CHOSEN BACKFILL MATERIAL SHALL NOT HAVE ADVERSE EFFECTS TO AQUATIC LIFE, AQUATIC LIFE PASSAGE, OR WATER QUALITY. NATIVE MATERIAL CONSISTS OF MATERIAL THAT IS EXCAVATED FROM THE STREAM BED OR FLOODPLAIN AT THE PROJECT SITE DURING CULVERT CONSTRUCTION.

FOUNDATION NOTES

EXCAVATE A MINIMUM 1 FT BELOW THE BOTTOM OF BOX CULVERT AND REPLACE THE EXCAVATED MATERIAL WITH FOUNDATION CONDITIONING MATERIAL IN ACCORDANCE WITH SECTION 414 OF THE STANDARD SPECIFICATIONS.

EXCAVATIONS FOR FOUNDATION CONDITIONING MATERIAL WILL EXTEND INTO WEATHERED ROCK MATERIAL THAT DETERIORATES WHEN EXPOSED TO THE ELEMENTS. PLACE FOUNDATION CONDITIONING MATERIAL AS SOON AS PRACTICAL AFTER THE EXCAVATION IS COMPLETED.



PROFILE ALONG CULVERT

PROJECT NO. HE-0002
 WAKE COUNTY
 STATION: 33+83.86 -L-

SHEET 1 OF 5

STATE OF NORTH CAROLINA
 DEPARTMENT OF TRANSPORTATION
 RALEIGH
 BARREL STANDARD
 SINGLE 12' X 7'
 CONCRETE BOX CULVERT
 90° SKEW

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

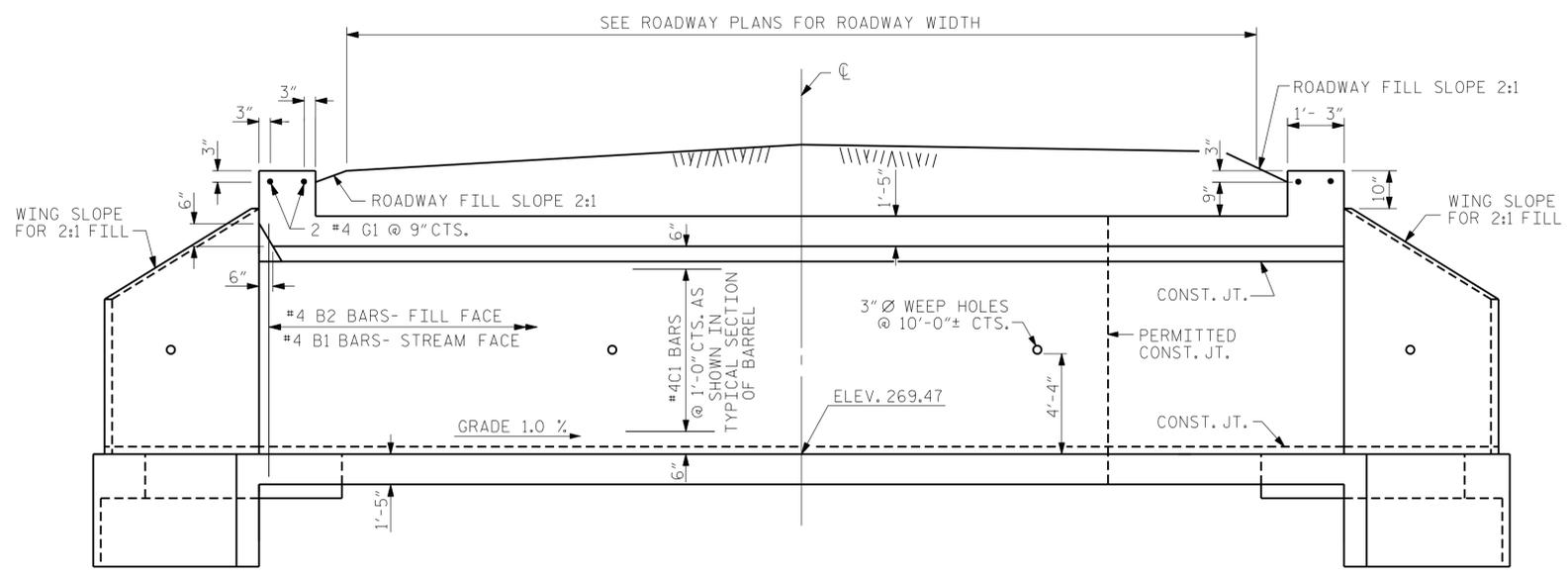
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

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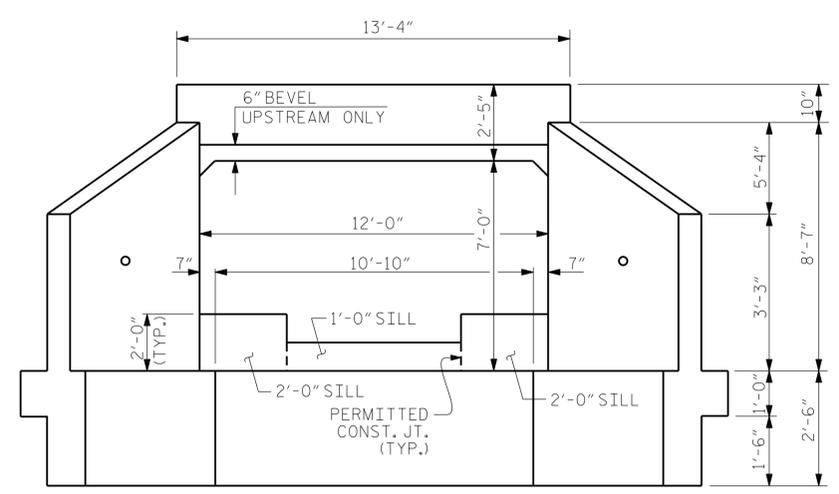
DRAWN BY: JJR DATE: 1/23
 CHECKED BY: THF DATE: 1/25
 DESIGN ENGINEER: THF DATE: 1/25

DWG. No.

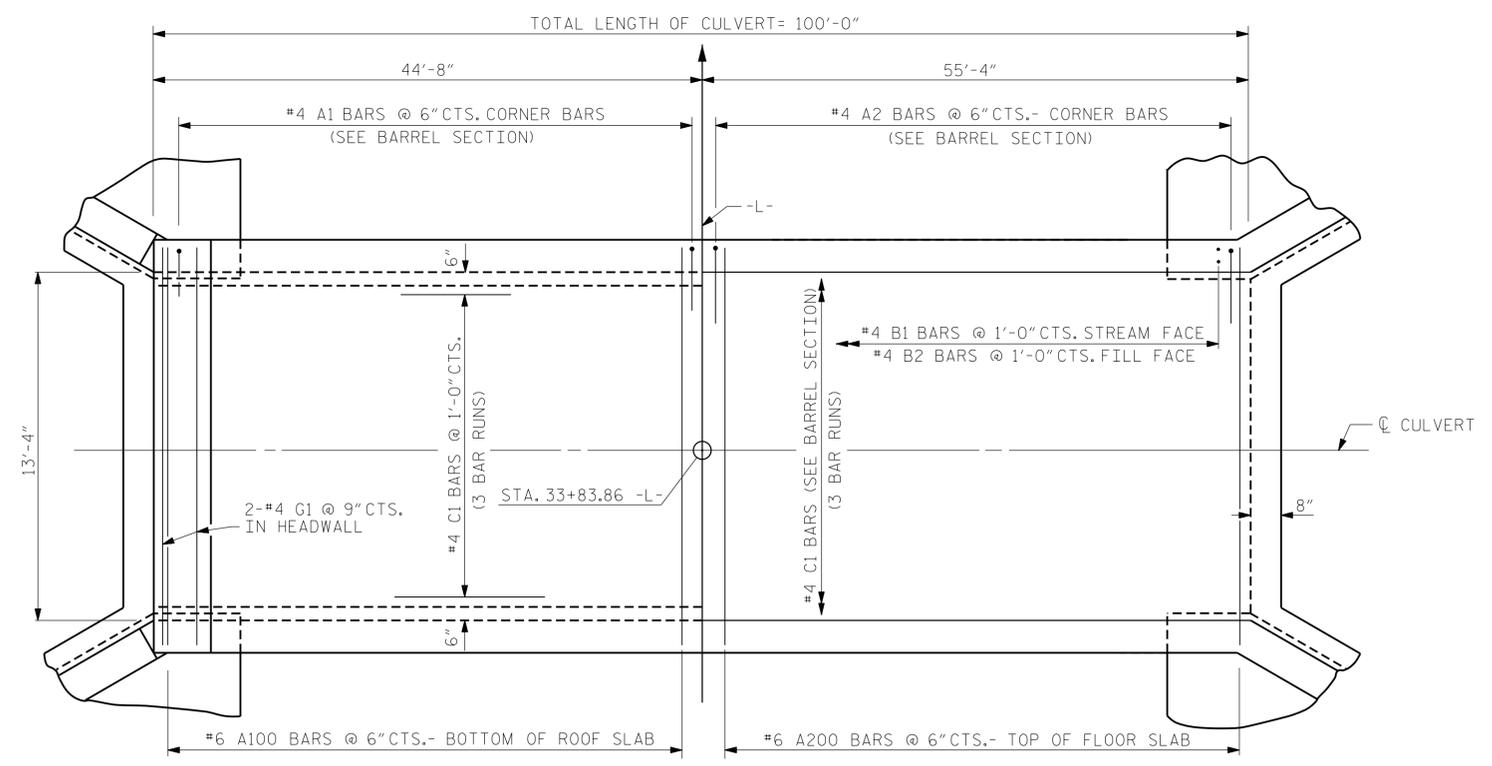




CULVERT SECTION NORMAL TO ROADWAY



END ELEVATION NORMAL TO SKEW

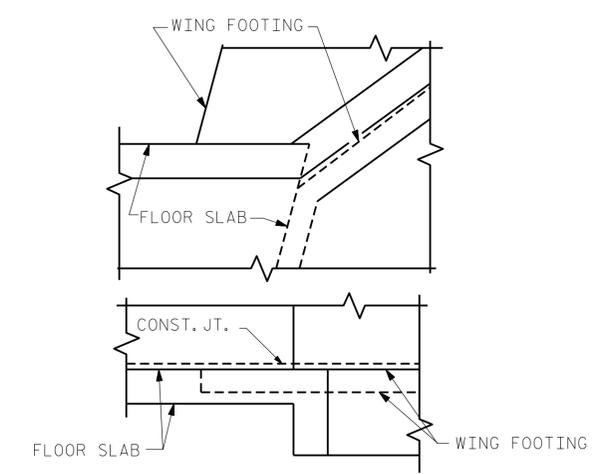


PART PLAN - ROOF SLAB

TOATL NUBER OF #4 A1 BARS = 400
TOATL NUBER OF #6 A100 BARS = 200

PART PLAN - FLOOR SLAB

TOATL NUBER OF #4 A2 BARS = 400
TOATL NUBER OF #6 A200 BARS = 200



CONNECTION OF WING FOOTING AND FLOOR SLAB WHEN SLAB IS THICKER THAN FOOTING

PROJECT NO. HE-0002
WAKE COUNTY
STATION: 33+83.86 -L-

SHEET 2 OF 5

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH
BARREL STANDARD

SINGLE 12' X 7'
CONCRETE BOX CULVERT

DOCUMENT NOT CONSIDERED
FINAL UNLESS ALL
SIGNATURES COMPLETED

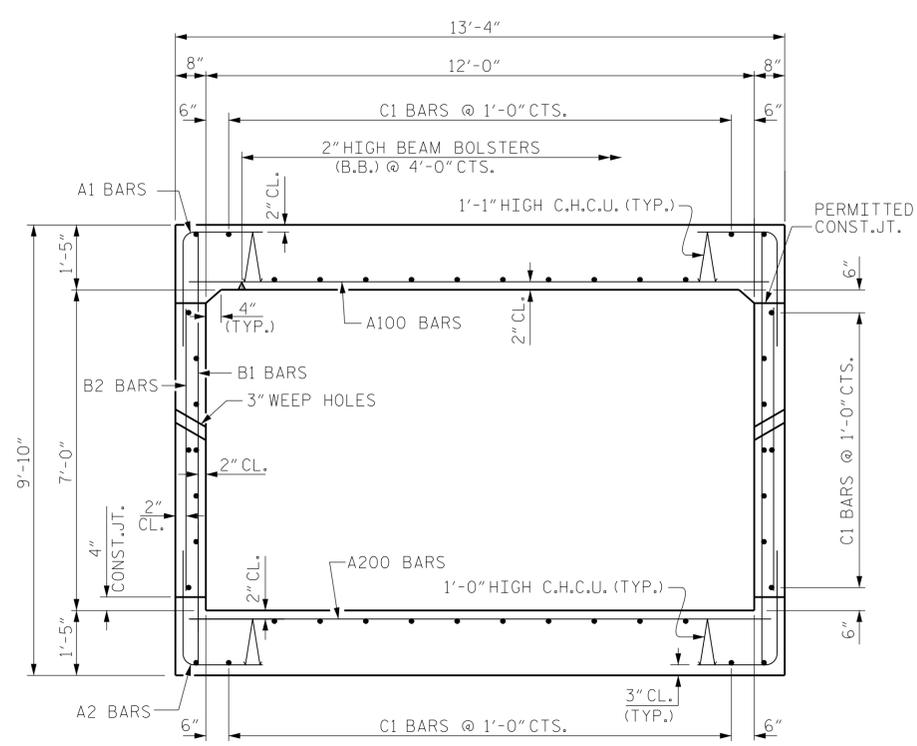
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Raleigh, NC 27612-3228
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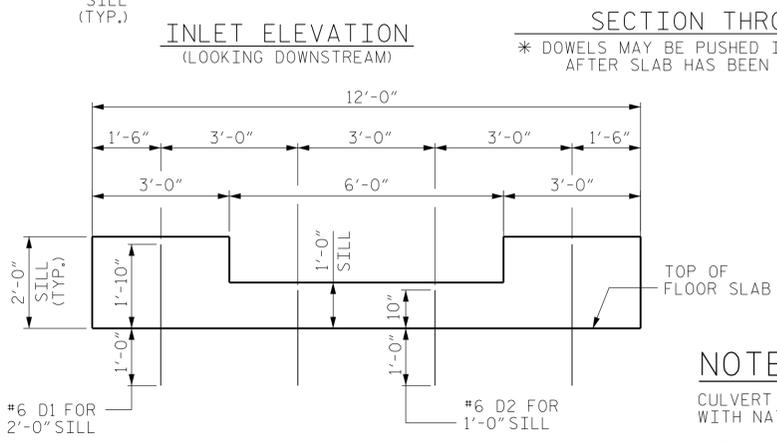
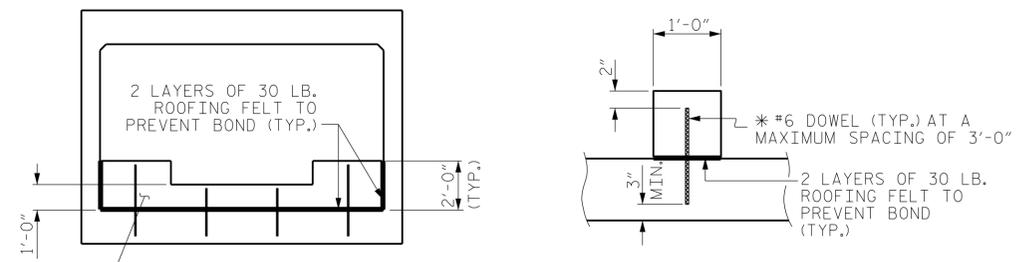
DRAWN BY: JJR DATE: 1/23
CHECKED BY: THF DATE: 1/25
DESIGN ENGINEER: THF DATE: 1/25

DWG. No.

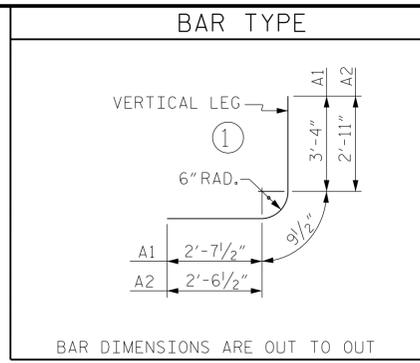
REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	
1			3			C-2
2			4			TOTAL SHEETS 5



RIGHT ANGLE SECTION OF BARREL
THERE ARE 44 "C" BARS IN SECTION OF BARREL



ELEVATION SILL DETAILS

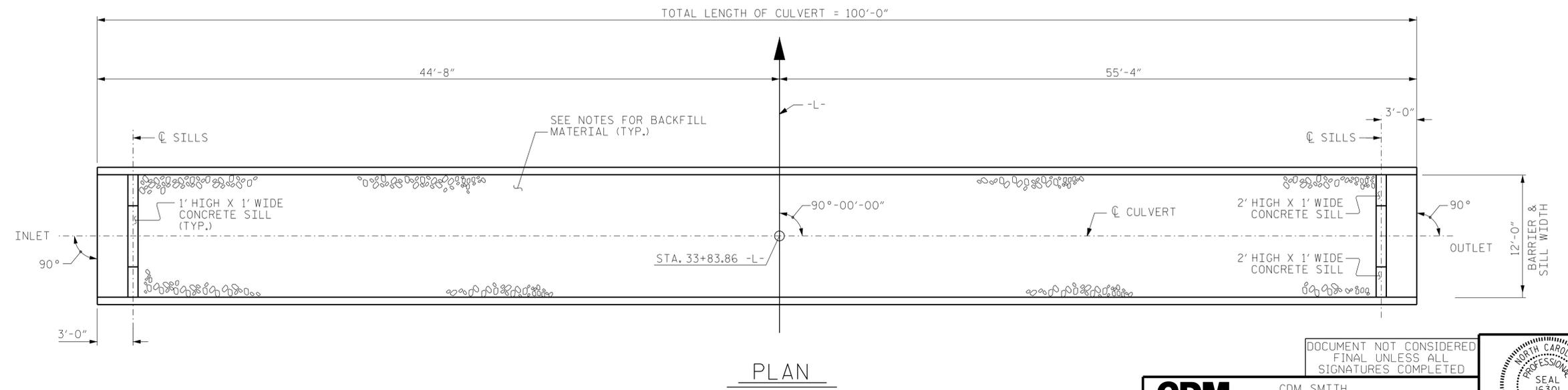


BAR	SIZE	SPLICE LENGTH
C1	#4	1'-11"

BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
A1	400	#4	1	6'-9"	1804
A2	400	#4	1	6'-3"	1670
B1	200	#4	STR	9'-4"	1247
B2	200	#4	STR	6'-4"	846
A100	200	#6	STR	13'-0"	3905
A200	200	#6	STR	13'-0"	3905
C1	132	#5	STR	34'-6"	3042
D1	4	#6	STR	2'-10"	17
D2	4	#6	STR	1'-10"	11
G1	4	#5	STR	13'-0"	35
REINFORCING STEEL				LBS.	16,483

NOTES:

- CULVERT FLOOR SLAB IS BURIED 1 FOOT BELOW EXISTING STREAM BED. BACKFILL WITH NATIVE MATERIAL TO LOW SILL HEIGHT IN THE BARREL.
- NATIVE MATERIAL BETWEEN SILLS IN THE CULVERT SHALL PROVIDE A CONTINUOUS FLOW CHANNEL.
- NATIVE MATERIAL CONSISTS OF MATERIAL THAT IS EXCAVATED FROM THE STREAM BED OR FLOODPLAIN AT THE PROJECT SITE DURING CONSTRUCTION. ONLY MATERIAL THAT IS EXCAVATED FROM THE STREAM BED MAY BE USED TO LINE CULVERT BARREL. AT THE CONTRACTOR'S OPTION, RIP RAP MAY BE USED TO SUPPLEMENT THE NATIVE MATERIAL IN THE BARREL.
- IF RIP RAP IS USED TO LINE THE FLOW CULVERT BARREL, NATIVE MATERIAL SHOULD BE PLACED ON TOP TO FILL VOIDS AND PROVIDE A FLAT SURFACE FOR ANIMAL PASSAGE.
- FOR NATIVE MATERIAL SEE "NATIVE MATERIAL SPECIFICATION FOR BACKFILING NOTE" ON SHEET C-1.
- SILLS ARE TO BE 1' AND 2' HIGH, CAST IN PLACE AND ATTACHED BY DOWELS.
- TOP OF LOW SILL SHOULD MATCH STREAM BED ELEVATION.
- THE ENTIRE COST OF WORK REQUIRED TO PLACE EXCAVATED OR SUPPLEMENTAL MATERIAL AS SHOWN ON THE PLANS SHALL BE INCLUDED IN THE LUMP SUM PRICE FOR CULVERT EXCAVATION.



PLAN

PROJECT NO. HE-0002
WAKE COUNTY
 STATION: 33+83.86 -L-
 SHEET 3 OF 5

STATE OF NORTH CAROLINA
 DEPARTMENT OF TRANSPORTATION
 RALEIGH
 BARREL STANDARD
 SINGLE 12' X 7'
 CONCRETE BOX CULVERT

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

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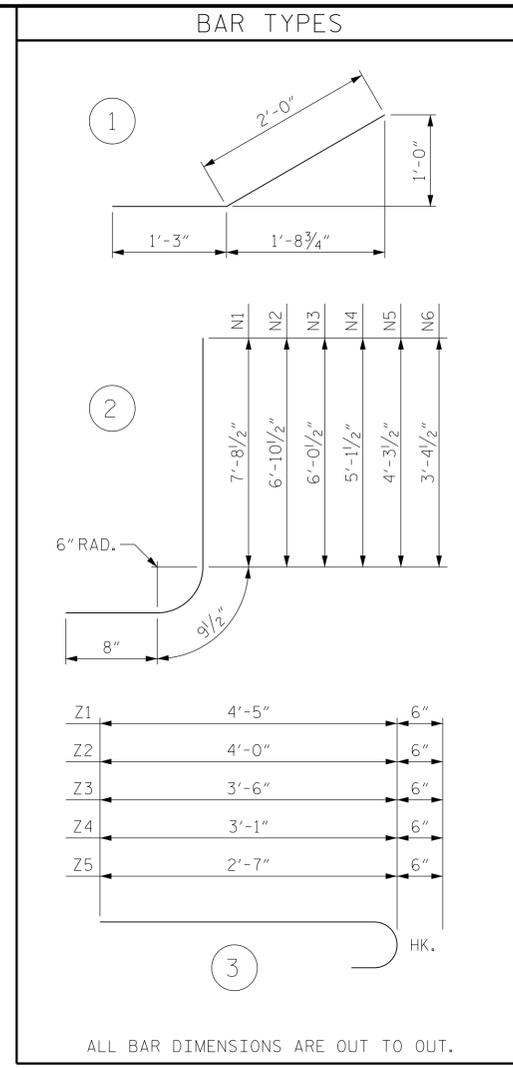
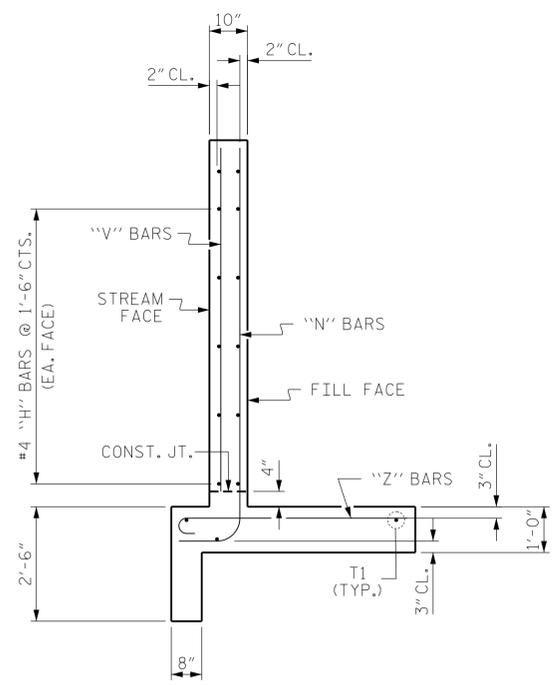
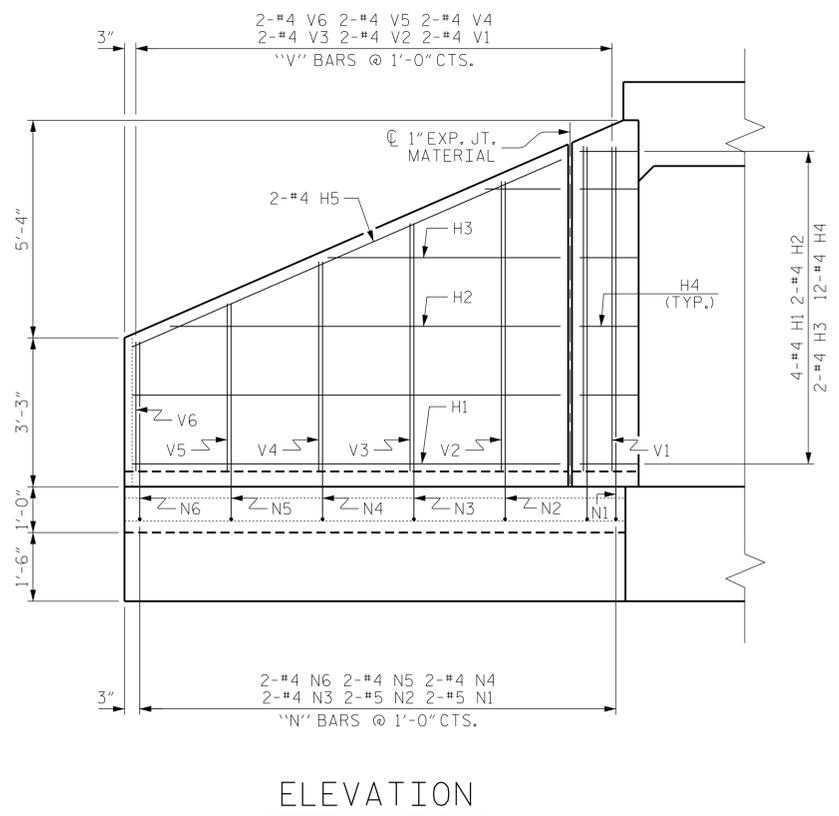
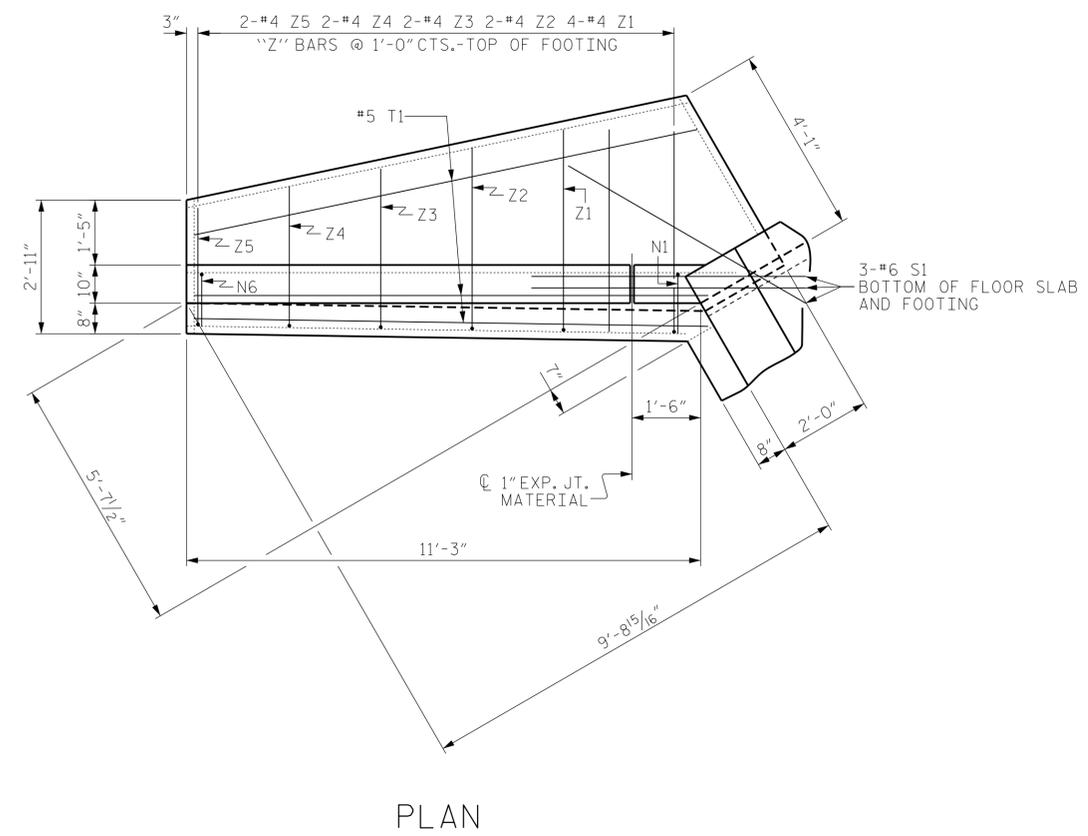
CHECKED BY: THF DATE: 1/25
 DESIGN ENGINEER: THF DATE: 1/25

DWG. No. _____



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

SHEET NO. **C-3**
 TOTAL SHEETS 5



BILL OF MATERIAL					
BAR NO.	NO.	SIZE	TYPE	LENGTH	WEIGHT
H1	16	#4	STR	9'-4"	100
H2	8	#4	STR	8'-6"	45
H3	8	#4	STR	5'-1"	27
H4	48	#4	1	3'-3"	104
H5	8	#4	STR	10'-3"	55
N1	8	#5	2	9'-2"	76
N2	8	#5	2	8'-4"	70
N3	8	#4	2	7'-6"	40
N4	8	#4	2	6'-7"	35
N5	8	#4	2	5'-9"	31
N6	8	#4	2	4'-10"	26
S1	12	#6	STR	6'-0"	108
T1	12	#5	STR	11'-3"	141
V1	8	#4	STR	7'-1"	38
V2	8	#4	STR	6'-4"	34
V3	8	#4	STR	5'-5"	29
V4	8	#4	STR	4'-7"	24
V5	8	#4	STR	3'-8"	20
V6	8	#4	STR	2'-10"	15
Z1	16	#4	3	4'-11"	53
Z2	8	#4	3	4'-6"	24
Z3	8	#4	3	4'-0"	21
Z4	8	#4	3	3'-7"	19
Z5	8	#4	3	3'-1"	16

TOTAL REINFORCING STEEL FOR 4 WINGS 1151 LBS

CLASS A CONCRETE
 4 WINGS 17.1 CY
 2 HEADWALLS 1.2 CY
 2 END CURTAIN WALLS 1.4 CY
 TOTAL 19.7 CY

PROJECT NO. HE-0002
 WAKE COUNTY
 STATION: 33+83.86 -L-

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

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 NC COA No. F-1255

CHECKED BY: THF DATE: 1/25
 DESIGN ENGINEER: THF DATE: 1/25

DWG. No.



STATE OF NORTH CAROLINA
 DEPARTMENT OF TRANSPORTATION
 RALEIGH

STANDARD WINGS
 FOR
 CONCRETE BOX CULVERT
 H = 7'-0" SLOPE = 2:1
 90° SKEW

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

SHEET NO. C-5
 TOTAL SHEETS 5

LOAD AND RESISTANCE FACTOR RATING (LRFR) SUMMARY FOR REINFORCED CONCRETE BOX CULVERTS

LEVEL	VEHICLE	WEIGHT (W) (TONS)	CONTROLLING LOAD RATING #	MINIMUM RATING FACTORS (RF)	TONS = W × RF	STRENGTH I LIMIT STATE								COMMENT NUMBER		
						LIVE-LOAD FACTORS (γ _{LL})	MOMENT				SHEAR					
							RATING FACTOR	BOX NO.	ELEMENT TYPE	DISTANCE FROM LEFT END OF ELEMENT (ft)	RATING FACTOR	BOX NO.	ELEMENT TYPE		DISTANCE FROM LEFT END OF ELEMENT (ft)	
DESIGN LOAD RATING	HL-93 (INVENTORY)	N/A	①	1.52	--	1.75	1.52	1	BOTTOM SLAB	6.00	5.13	1	EXTERIOR WALL	0.00		
	HL-93 (OPERATING)	N/A		1.97	--	1.35	1.97	1	BOTTOM SLAB	6.00	6.65	1	EXTERIOR WALL	0.00		
	HS-20 (INVENTORY)	36.000	②	2.03	73.08	1.75	2.03	1	BOTTOM SLAB	6.00	5.16	1	EXTERIOR WALL	0.00		
	HS-20 (OPERATING)	36.000		2.63	94.68	1.35	2.63	1	BOTTOM SLAB	6.00	6.69	1	EXTERIOR WALL	0.00		
LEGAL LOAD RATING	SINGLE VEHICLE (SV)	SNSH	13.500		1.76	23.76	1.40	1.76	1	BOTTOM SLAB	6.00	5.12	1	EXTERIOR WALL	0.00	
		SNGARBS2	20.000		1.67	33.40	1.40	1.67	1	BOTTOM SLAB	6.00	5.11	1	EXTERIOR WALL	0.00	
		SNAGRIS2	22.000		1.76	38.72	1.40	1.76	1	BOTTOM SLAB	6.00	5.12	1	EXTERIOR WALL	0.00	
		SNCOTTS3	27.250		1.59	43.33	1.40	1.59	1	BOTTOM SLAB	6.00	5.10	1	EXTERIOR WALL	0.00	
		SNAGGRS4	34.925		1.98	69.15	1.40	1.98	1	BOTTOM SLAB	6.00	5.13	1	EXTERIOR WALL	0.00	
		SNS5A	35.550		1.83	65.06	1.40	1.83	1	BOTTOM SLAB	6.00	5.12	1	EXTERIOR WALL	0.00	
		SNS6A	39.950		1.83	73.11	1.40	1.83	1	BOTTOM SLAB	6.00	5.12	1	EXTERIOR WALL	0.00	
		SNS7B	42.000		1.83	76.86	1.40	1.83	1	BOTTOM SLAB	6.00	5.12	1	EXTERIOR WALL	0.00	
	TRUCK TRACTOR SEMI-TRAILER (TTST)	TNAGRIT3	33.000		1.76	58.08	1.40	1.76	1	BOTTOM SLAB	6.00	5.12	1	EXTERIOR WALL	0.00	
		TNT4A	33.075		1.83	60.53	1.40	1.83	1	BOTTOM SLAB	6.00	5.12	1	EXTERIOR WALL	0.00	
		TNT6A	41.600		1.83	76.13	1.40	1.83	1	BOTTOM SLAB	6.00	5.12	1	EXTERIOR WALL	0.00	
		TNT7A	42.000		1.83	76.86	1.40	1.83	1	BOTTOM SLAB	6.00	5.12	1	EXTERIOR WALL	0.00	
		TNT7B	42.000		1.83	76.86	1.40	1.83	1	BOTTOM SLAB	6.00	5.12	1	EXTERIOR WALL	0.00	
		TNAGRIT4	43.000		1.76	75.68	1.40	1.76	1	BOTTOM SLAB	6.00	5.12	1	EXTERIOR WALL	0.00	
EMERGENCY VEHICLE (EV)	EV2	28.750	③	1.45	41.69	1.30	1.45	1	BOTTOM SLAB	6.00	5.12	1	EXTERIOR WALL	0.00		
	EV3	43.000		1.57	67.51	1.30	1.57	1	BOTTOM SLAB	6.00	5.13	1	EXTERIOR WALL	0.00		

LOAD FACTORS:

DESIGN LOAD RATING FACTORS

LOAD TYPE	MAX FACTOR	MIN FACTOR
DC	1.25	0.90
DW	1.50	0.65
EV	1.30	0.90
EH	1.35	0.90
ES	1.35	0.90
LS	1.75	--
WA	1.00	--

NOTE:

RATING FACTORS ARE BASED ON THE STRENGTH I LIMIT STATE.

COMMENTS:

- 1.
- 2.
- 3.
- 4.

CONTROLLING LOAD RATING

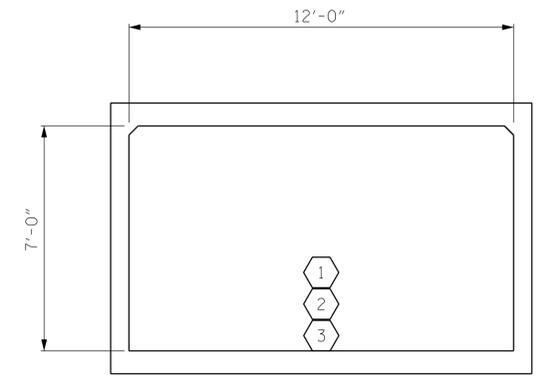
① DESIGN LOAD RATING (HL-93)

② DESIGN LOAD RATING (HS-20)

③ LEGAL LOAD RATING **

④ EMERGENCY VEHICLE LOAD RATING **

** SEE CHART FOR VEHICLE TYPE



LRFR SUMMARY
(LOOKING DOWNSTREAM)

PROJECT NO. HE-0002
WAKE COUNTY
 STATION: 33+83.86 -L-

SHEET 5 OF 5

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CDM Smith

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DRAWN BY: JJR DATE: 1/23

DWG. No.

CHECKED BY: THF DATE: 1/25

DESIGN ENGINEER: THF DATE: 1/25



STATE OF NORTH CAROLINA
 DEPARTMENT OF TRANSPORTATION
 RALEIGH

STANDARD
 LRFR SUMMARY FOR
 REINFORCED CONCRETE
 BOX CULVERTS
 (NON-INTERSTATE TRAFFIC)

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

