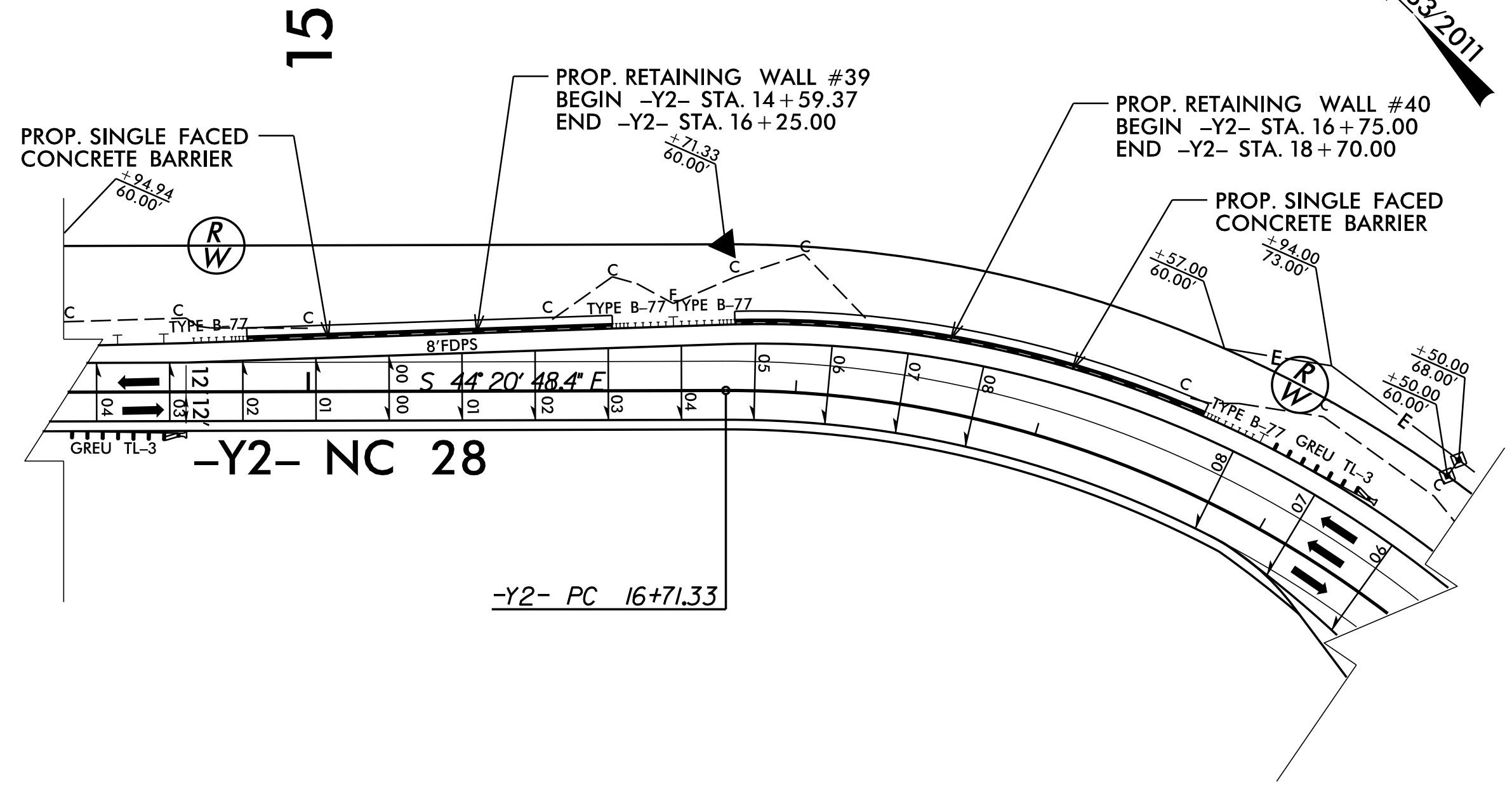
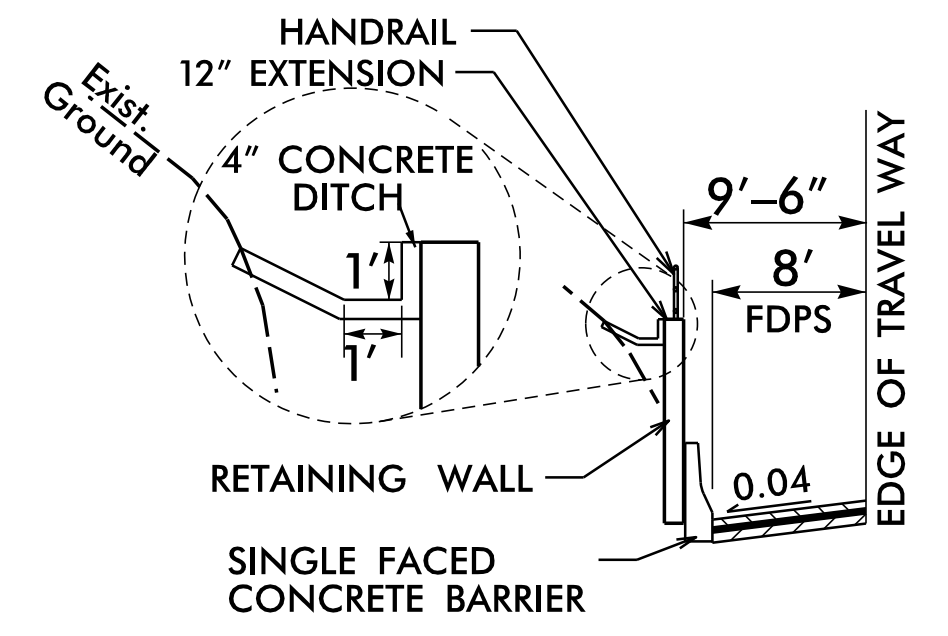


# RETAINING WALL #39 & #40:



**RETAINING WALL #39 & #40 - PLAN**  
NOT TO SCALE



**DETAIL FOR WALL #39 & #40**  
NOT TO SCALE  
-Y2- STA. 14+59.37 TO -Y2- STA. 16+25.00, LT  
-Y2- 16+75.00 TO -Y2- STA. 18+70.00, LT

ESTIMATED SOIL NAIL WALL QUANTITIES			
RETAINING WALL NO.	SOIL NAIL RETAINING WALLS (SQ. FEET)	SOIL NAIL VERIFICATION TESTS	SOIL NAIL PROOF TESTS
39	1,720 *	2	5
40	2,690 *	2	10
HORIZONTAL DRAINS (CONTINGENCY)			210 LF

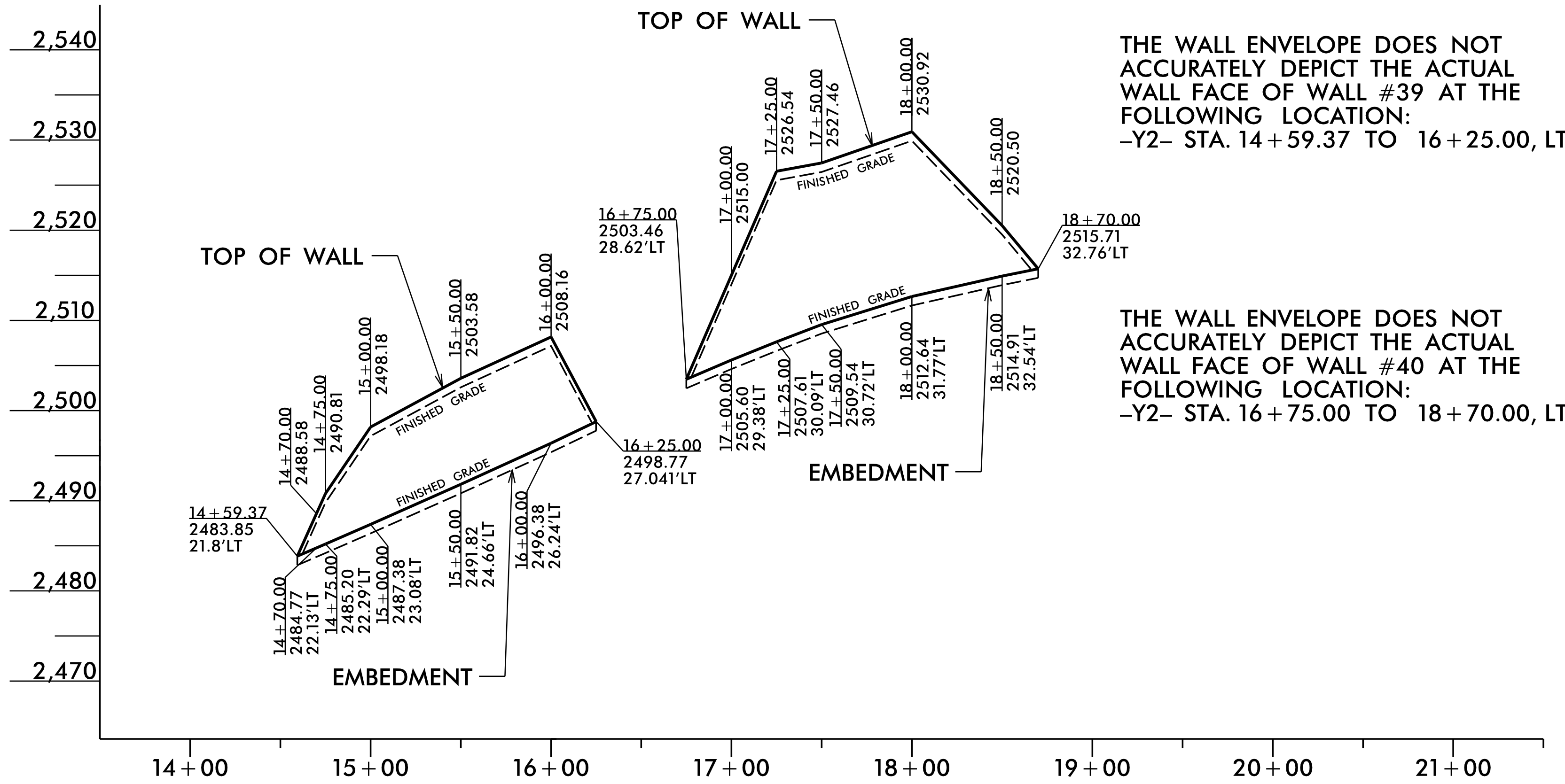
\* INCLUDES RETAINING WALL EMBEDMENT

SOIL NAIL RETAINING WALL #39						
STA. -Y2-	OFFSET FROM -Y2- (RT) FT.	ELEV. @ TOP OF WALL	BOW FINISHED GRADE	TOP OF LEVELING PAD	ESTIMATED WALL EMBEDMENT FT.	WALL DESIGN HEIGHT "H"
14+59.37	21.80	2483.85	2483.85	2482.85	1.00	1.00
14+70.00	22.13	2488.58	2484.77	2483.77	1.00	3.81
14+75.00	22.29	2490.81	2485.20	2484.20	1.00	5.61
15+00.00	23.08	2498.18	2487.38	2486.38	1.00	10.80
15+50.00	24.66	2503.58	2491.82	2490.82	1.00	11.76
16+00.00	26.24	2508.16	2496.38	2495.38	1.00	11.78
16+25.00	27.04	2498.77	2498.77	2497.77	1.00	1.00

BOW = BOTTOM OF WALL  
ALL MEASUREMENTS ARE IN FEET

SOIL NAIL RETAINING WALL #40						
STA. -Y2-	OFFSET FROM -Y2- (RT) FT.	ELEV. @ TOP OF WALL	BOW FINISHED GRADE	TOP OF LEVELING PAD	ESTIMATED WALL EMBEDMENT FT.	WALL DESIGN HEIGHT "H"
16+75.00	28.62	2503.46	2503.46	2502.46	1.00	1.00
17+00.00	29.38	2515.00	2505.60	2504.60	1.00	9.40
17+25.00	30.09	2526.54	2507.61	2506.61	1.00	18.93
17+50.00	30.72	2527.46	2509.54	2508.54	1.00	17.92
18+00.00	31.77	2530.92	2512.64	2511.64	1.00	18.28
18+50.00	32.54	2520.50	2514.91	2513.91	1.00	5.59
18+70.00	32.76	2515.71	2515.71	2514.71	1.00	1.00

BOW = BOTTOM OF WALL  
ALL MEASUREMENTS ARE IN FEET



THE WALL ENVELOPE DOES NOT ACCURATELY DEPICT THE ACTUAL WALL FACE OF WALL #39 AT THE FOLLOWING LOCATION:  
-Y2- STA. 14+59.37 TO 16+25.00, LT

THE WALL ENVELOPE DOES NOT ACCURATELY DEPICT THE ACTUAL WALL FACE OF WALL #40 AT THE FOLLOWING LOCATION:  
-Y2- STA. 16+75.00 TO 18+70.00, LT

**RETAINING WALL #39 & #40 - ENVELOPE**  
NOT TO SCALE  
(LOOKING AT FACE OF WALL)

GEOTECHNICAL ENGINEER

ENGINEER

SEAL 042642

ROBERT E. KRAL

DocuSigned by: 08/01/2022

DATE

SIGNATURE

DATE

**DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED**

PROJECT NO.: A-0009CC

GRAHAM COUNTY

RETAINING WALL #39: -Y2- 14+59, 22' LT TO 16+25, 27' LT

RETAINING WALL #40: -Y2- 16+75, 29' LT TO 18+70, 33' LT

SHEET 1 OF 3

PREPARED BY: R. KRAL DATE: 7/9/2022

REVIEWED BY: M. BREWER DATE: 7/9/2022

RETAINING WALL #39 & #40 ENVELOPE AND WALL LAYOUT PROVIDED BY TGS ENGINEERS, INC.

Prepared in the Office of:

**CGE** CAROLINAS GEOTECHNICAL GROUP

2400 CROWNPOINT EXECUTIVE DRIVE SUITE 800 CHARLOTTE, NC 28227 (980) 339-8684

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS

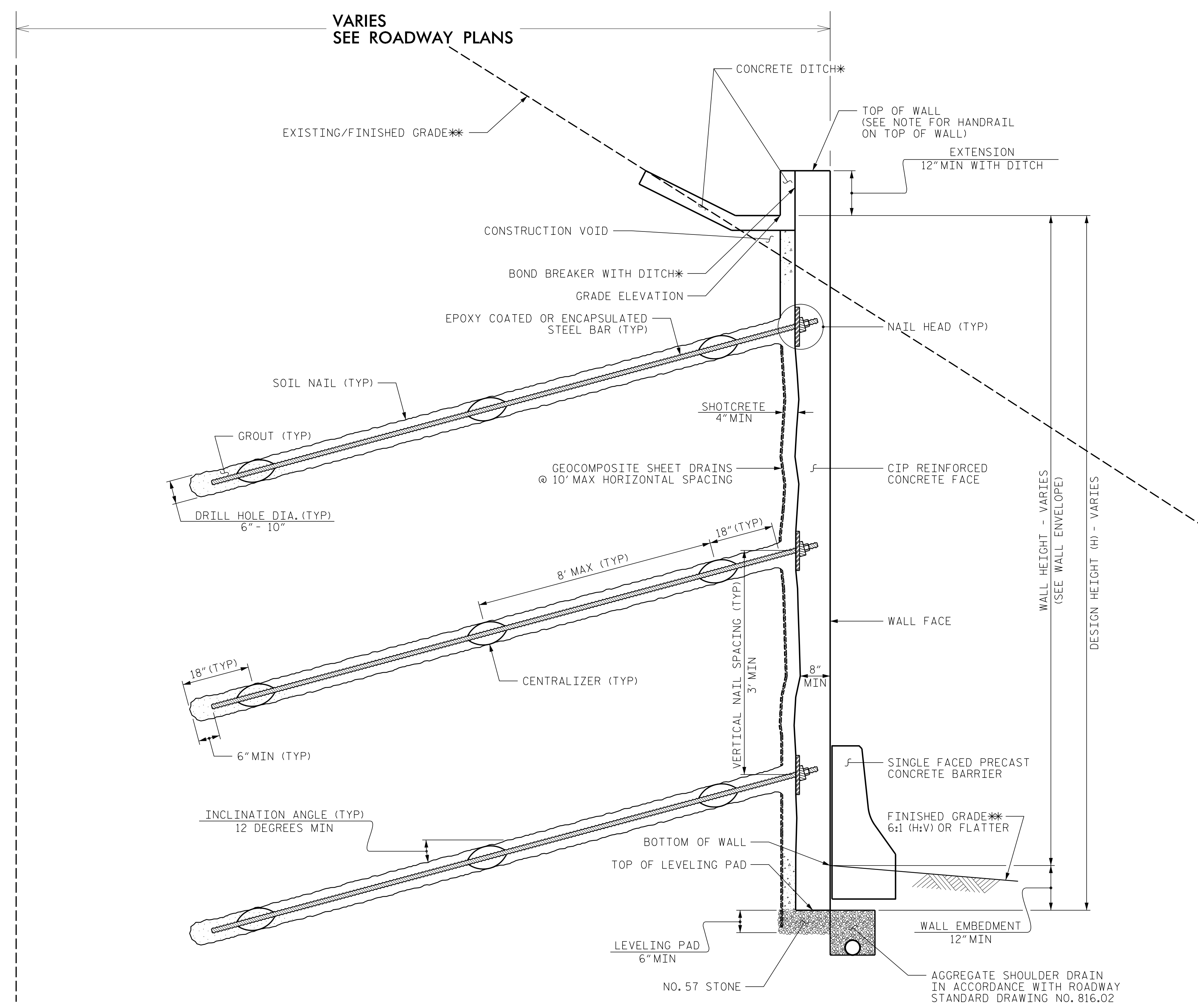
**GEOTECHNICAL ENGINEERING UNIT**

RETAINING WALL #39 & #40 SOIL NAIL RETAINING WALL

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

SHEET NO. W09\_40-1

PROPOSED RIGHT OF WAY



VARIES  
SEE ROADWAY PLANS

EXISTING/FINISHED GRADE\*\*

CONCRETE DITCH\*

TOP OF WALL  
(SEE NOTE FOR HANDRAIL  
ON TOP OF WALL)

EXTENSION  
12" MIN WITH DITCH

CONSTRUCTION VOID

BOND BREAKER WITH DITCH\*

GRADE ELEVATION

EPOXY COATED OR ENCAPSULATED  
STEEL BAR (TYP)

NAIL HEAD (TYP)

SOIL NAIL (TYP)

SHOTCRETE  
4" MIN

GROUT (TYP)

GEOCOMPOSITE SHEET DRAINS  
@ 10' MAX HORIZONTAL SPACING

CIP REINFORCED  
CONCRETE FACE

DRILL HOLE DIA. (TYP)  
6" - 10"

8' MAX (TYP)

18" (TYP)

WALL HEIGHT - VARIES  
(SEE WALL ENVELOPE)

DESIGN HEIGHT (H) - VARIES

WALL FACE

18" (TYP)

6" MIN (TYP)

CENTRALIZER (TYP)

3' MIN

8" MIN

SINGLE FACED PRECAST  
CONCRETE BARRIER

FINISHED GRADE\*\*  
6:1 (H:V) OR FLATTER

INCLINATION ANGLE (TYP)  
12 DEGREES MIN

BOTTOM OF WALL

TOP OF LEVELING PAD

LEVELING PAD  
6" MIN

WALL EMBEDMENT  
12" MIN

NO. 57 STONE

AGGREGATE SHOULDER DRAIN  
IN ACCORDANCE WITH ROADWAY  
STANDARD DRAWING NO. 816.02

**SOIL NAIL WALL - TYPICAL SECTION**

\*SEE CONCRETE DITCH BEHIND WALL DETAILS.  
\*\*SEE PLANS FOR FINISHED GRADE.

GEOTECHNICAL ENGINEER   DocuSigned by:  SIGNATURE	ENGINEER   DATE 08/01/2022 SIGNATURE DATE
<b>DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED</b>	

**NOTES:**

- FOR SOIL NAIL RETAINING WALLS, SEE SOIL NAIL RETAINING WALLS PROVISION.
- FOR SINGLE FACED PRECAST CONCRETE BARRIER, SEE ROADWAY PLANS AND SECTION 857 OF THE STANDARD SPECIFICATIONS.
- A HANDRAIL IS REQUIRED ON TOP OF RETAINING WALL #39 & #40. SEE ROADWAY PLANS FOR FENCE ATTACHMENT DETAILS.
- BEFORE BEGINNING SOIL NAIL WALL DESIGN FOR RETAINING WALL #39 & #40, SURVEY WALL LOCATION AND SUBMIT A REVISED WALL PROFILE VIEW (WALL ENVELOPE) FOR REVIEW. DO NOT START WALL DESIGN OR CONSTRUCTION UNTIL THE REVISED WALL ENVELOPE IS ACCEPTED.
- DESIGN RETAINING WALL #39 & #40 FOR THE FOLLOWING:
  - DESIGN HEIGHT (H) = WALL HEIGHT + WALL EMBEDMENT
  - DESIGN LIFE = 75 YEARS
  - MINIMUM WALL EMBEDMENT ELEVATION = VARIES (MIN. 1 FT BELOW PROPOSED FINISHED GRADE ELEVATION)
  - IN-SITU ASSUMED LOOSE TO MEDIUM DENSE RESIDUAL SOIL PARAMETERS:  
UNIT WEIGHT,  $\gamma = 120$  PCF  
FRICTION ANGLE,  $\phi = 32$  DEGREES  
COHESION,  $c = 0$  PSF
  - IN-SITU ASSUMED MEDIUM DENSE TO VERY DENSE RESIDUAL SOIL PARAMETERS:  
UNIT WEIGHT,  $\gamma = 125$  PCF  
FRICTION ANGLE,  $\phi = 36$  DEGREES  
COHESION,  $c = 0$  PSF
  - IN-SITU ASSUMED SOFT TO MEDIUM STIFF RESIDUAL SOIL PARAMETERS:  
UNIT WEIGHT,  $\gamma = 120$  PCF  
FRICTION ANGLE,  $\phi = 30$  DEGREES  
COHESION,  $c = 0$  PSF
  - IN-SITU ASSUMED MEDIUM STIFF TO VERY STIFF RESIDUAL SOIL PARAMETERS:  
UNIT WEIGHT,  $\gamma = 125$  PCF  
FRICTION ANGLE,  $\phi = 34$  DEGREES  
COHESION,  $c = 0$  PSF
  - IN-SITU ASSUMED WEATHERED ROCK PARAMETERS:  
UNIT WEIGHT,  $\gamma = 135$  PCF  
FRICTION ANGLE,  $\phi = 32$  DEGREES  
COHESION,  $c = 500$  PSF
  - IN-SITU ASSUMED CRYSTALLINE ROCK PARAMETERS:  
UNIT WEIGHT,  $\gamma = 170$  PCF  
FRICTION ANGLE,  $\phi = 34$  DEGREES  
COHESION,  $c = 1,000$  PSF
  - WHERE ROCK IS ENCOUNTERED IN THE WALL ENVELOPE, DESIGNERS SHOULD REFER TO THE FHWA PRESUMPTIVE STRENGTH PARAMETERS OR OTHER REPRESENTATIVE AND REPEATABLE VALUES AND PROVIDE SOURCE REFERENCES IN THEIR DESIGN SUBMITTAL.
- WHEN ANALYZING FOR INFINITE SLOPE CONDITIONS, DESIGNERS SHOULD ANALYZE UP TO TWO (2) TIMES THE WALL HEIGHT BEHIND THE WALL FACE FOR FAILURE PLANE SEARCHES. THIS INFORMATION SHOULD BE INCLUDED WITH THE DESIGN SUBMITTAL.
- EXISTING OR FUTURE OBSTRUCTIONS SUCH AS FOUNDATIONS, GUARDRAIL, FENCE OR HANDRAIL POSTS, PAVEMENTS, PIPES, INLETS OR UTILITIES MAY INTERFERE WITH SOIL NAILS FOR RETAINING WALL #39 & #40.
- THE PROPOSED RIGHT OF WAY (ROW) BOUNDARY VARIES FROM THE FACE OF RETAINING WALL #39 & #40. SEE THE ROADWAY PLANS FOR OFFSET DISTANCES FROM THE FACE OF RETAINING WALL #39 & #40. SOIL NAILS MAY NOT BE INSTALLED BEYOND THE PROPOSED ROW BOUNDARY. SEE "SOIL NAIL WALL - TYPICAL SECTION" DETAIL.
- IF GROUNDWATER IS ENCOUNTERED BEHIND THE FACE OF RETAINING WALL #39 & #40, HORIZONTAL DRAINS MAY BE REQUIRED AS DIRECTED BY THE ENGINEER. FOR HORIZONTAL DRAINS, SEE THE RETAINING WALL HORIZONTAL DRAIN DETAIL.
- WHERE ROCK IS PRESENT IN THE WALL ENVELOPE, CONTROLLED BLASTING IS RECOMMENDED, BUT NOT REQUIRED, TO MAINTAIN THE NEAT EXCAVATION LINE. VOIDS, RESULTING FROM BLASTING OR EXCAVATING, THAT EXTEND BEYOND THE NEAT LINES ARE TO BE FILLED WITH A COMBINATION OF SHORT SOIL NAILS, WELDED WIRE, AND SHOTCRETE, AT THE DISCRETION OF THE ENGINEER. THE COSTS ASSOCIATED WITH THIS WORK WILL BE CONSIDERED INCIDENTAL TO WALL CONSTRUCTION AND NO ADDITIONAL COMPENSATION WILL BE MADE. FOR BLASTING, SEE THE BLASTING PROVISION.
- WHERE CONSTRUCTION VOIDS EXIST ALONG THE TOP OF RETAINING WALL #39 & #40, THE CONTRACTOR SHOULD BE PREPARED TO FORM THE CANTILEVERED SECTION OF THE CIP REINFORCED CONCRETE FACE TO THE TOP OF WALL ELEVATION. THE CONSTRUCTION VOID SHOULD BE FILLED WITH CONCRETE OR SHOTCRETE PRIOR TO CONSTRUCTION OF THE CONCRETE DITCH. ADDITIONAL WALL FACE REINFORCEMENT OR SOIL NAILS MAY BE REQUIRED FOR TALLER THAN TYPICAL CANTILEVER FACE HEIGHTS.

PROJECT NO.: A-0009CC  
 GRAHAM COUNTY  
 RETAINING WALL #39: -Y2- 14+59, 22' LT TO 16+25, 27' LT  
 RETAINING WALL #40: -Y2- 16+75, 29' LT TO 18+70, 33' LT  
 SHEET 2 OF 3

PREPARED BY: R. KRAL	DATE: 7/9/2022
REVIEWED BY: M. BREWER	DATE: 7/9/2022

Prepared in the Office of:

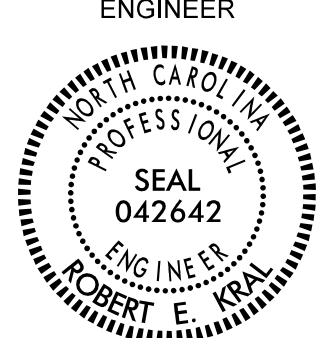
**CAROLINAS  
GEOTECHNICAL  
GROUP**  
 2400 CROWNPOINT EXECUTIVE DRIVE  
 SUITE 800  
 CHARLOTTE, NC 28227  
 (980) 339-8684

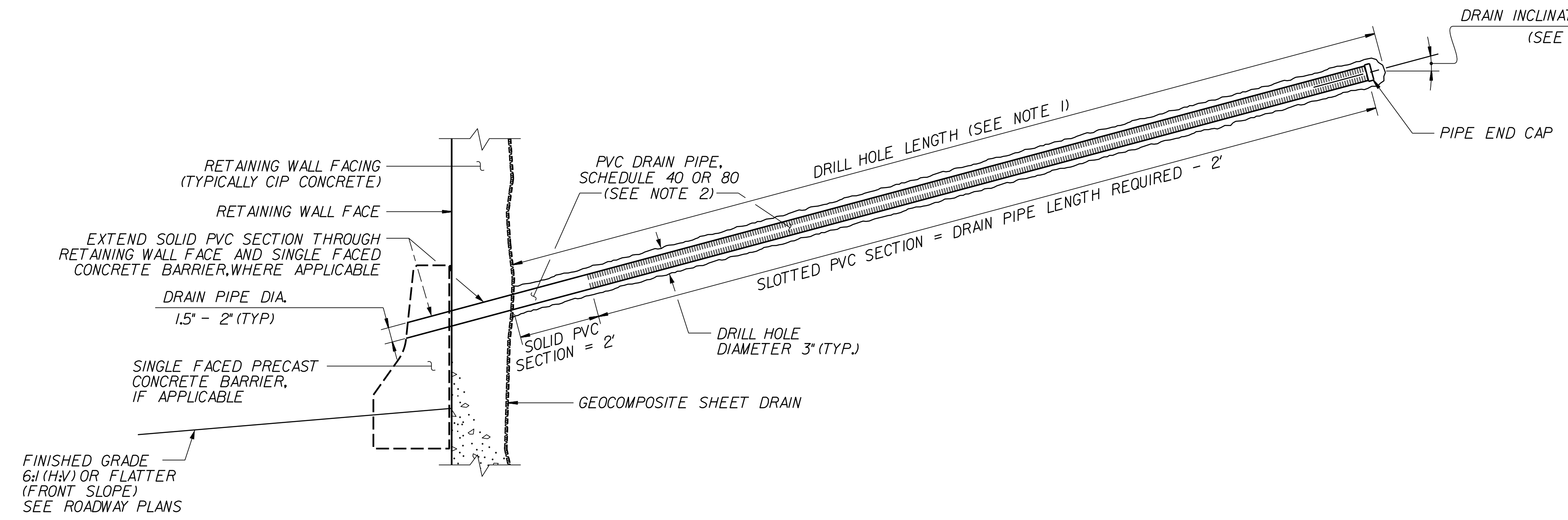
**NORTH CAROLINA  
DEPARTMENT OF TRANSPORTATION  
DIVISION OF HIGHWAYS**

**GEOTECHNICAL  
ENGINEERING UNIT**

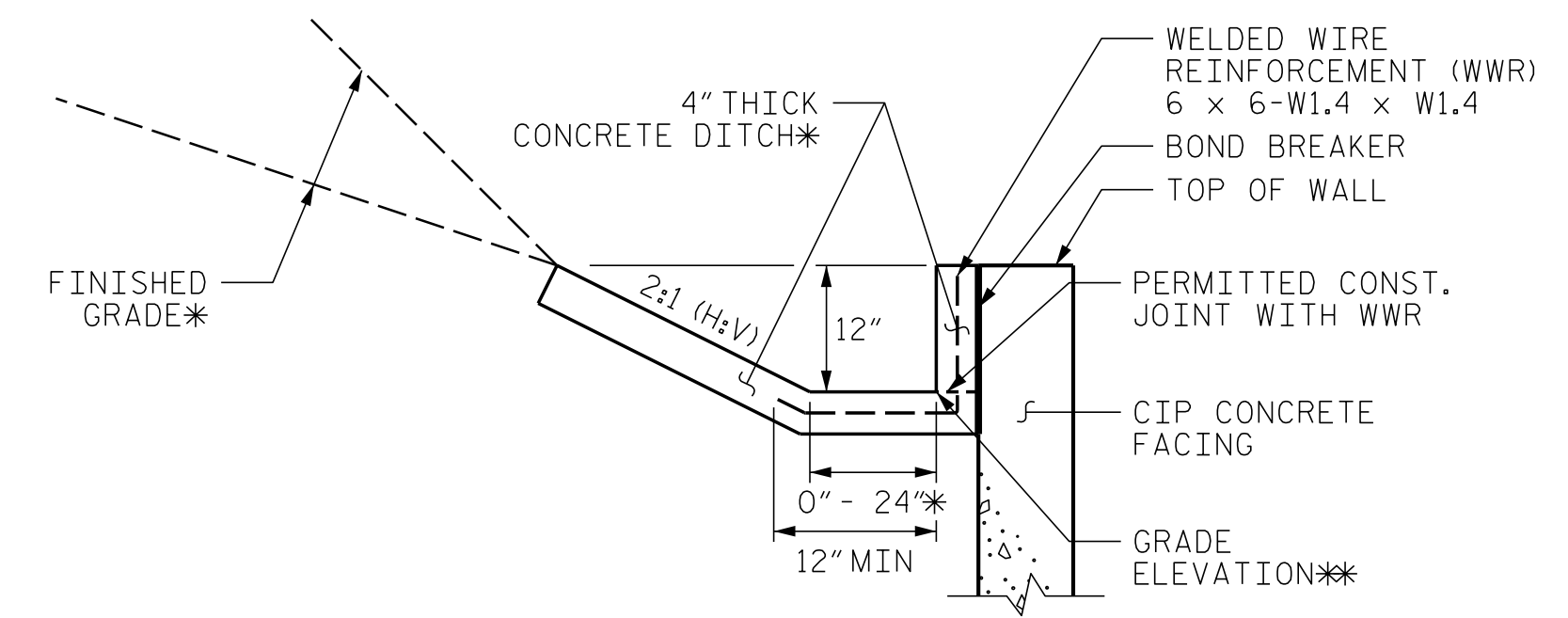
REVISIONS					
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2			4		

SHEET NO. W99\_40-2

GEOTECHNICAL ENGINEER  SEAL 042642 ROBERT E. KRAL	ENGINEER  DATE: 08/01/2022 SIGNATURE: _____ DATE: _____
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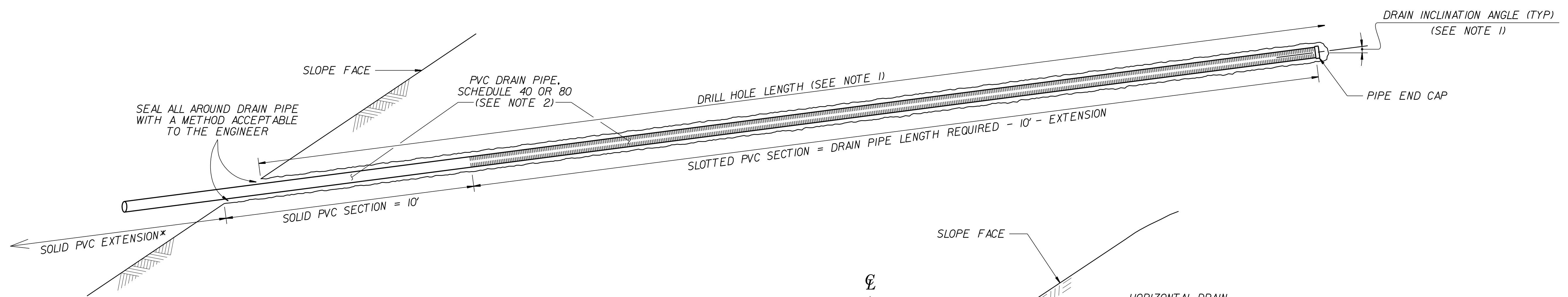


**RETAINING WALL HORIZONTAL DRAIN**



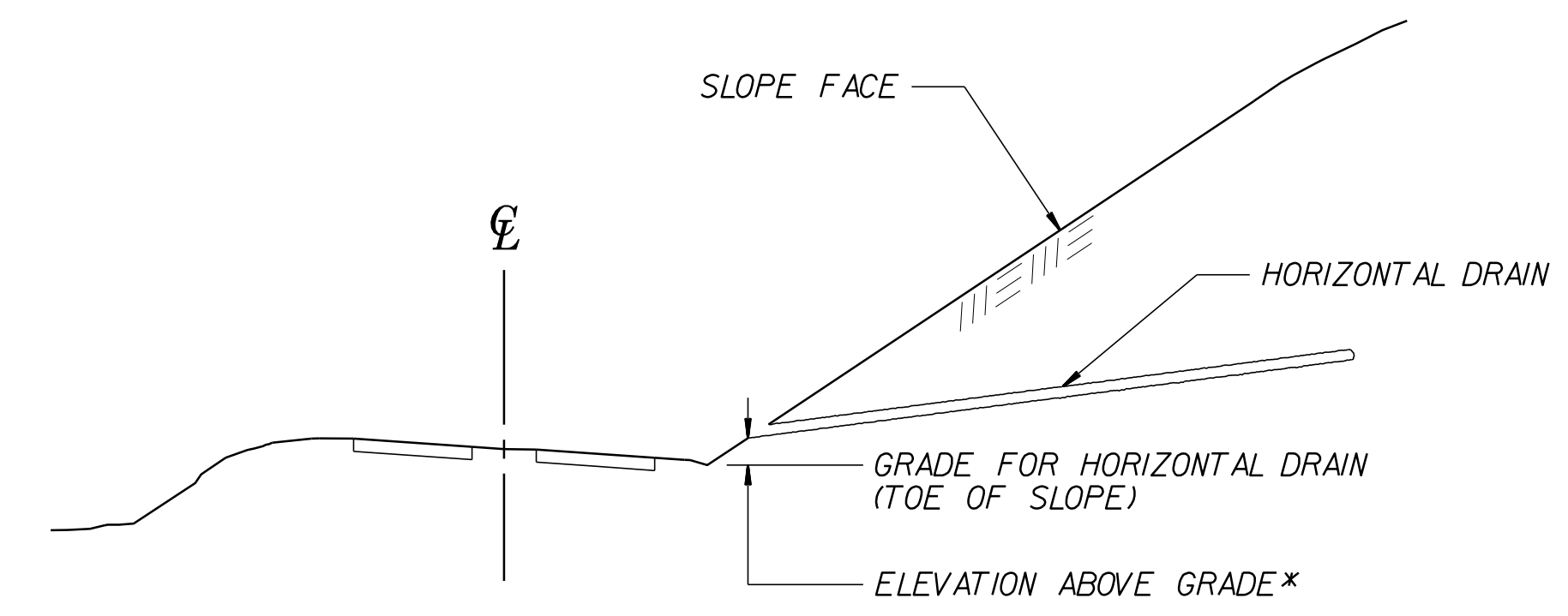
**CONCRETE DITCH BEHIND WALL WITH CONCRETE FACING**

\*SEE ROADWAY PLANS FOR CONCRETE DITCH AND FINISHED GRADE DETAILS.  
\*\*SEE WALL ENVELOPE FOR GRADE ELEVATIONS.



**SLOPE HORIZONTAL DRAIN**

\*EXTEND SOLID PVC SECTION TO CONNECT PIPE TO A DRAINAGE SYSTEM OR DISCHARGE WATER AS DIRECTED



**EXAMPLE CROSS-SECTION WITH SLOPE HORIZONTAL DRAIN**

\*SEE NOTE 1 FOR DRAIN ELEVATIONS ABOVE (OR BELOW) GRADE

**NOTES:**

1. SEE ROADWAY SUMMARY SHEETS FOR APPROXIMATE KNOWN HORIZONTAL DRAIN LOCATIONS, ELEVATIONS, INCLINATION AND LENGTHS. ADDITIONAL DRAINS MAY BE REQUIRED AS DETERMINED BY THE ENGINEER.
2. DRAIN PIPES MAY BE OMITTED FOR SOME HORIZONTAL DRAINS. SEE ROADWAY SUMMARY SHEETS FOR DRAIN PIPE REQUIREMENTS INCLUDING THOSE DRAINS WITHOUT PIPES.
3. FOR HORIZONTAL DRAINS, SEE HORIZONTAL DRAINS SPECIAL PROVISION (GT-6).

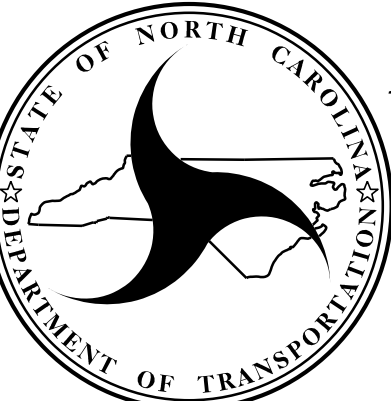
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 SHEET 3 OF 3

PREPARED BY: R. KRAL	DATE: 7/9/2022
REVIEWED BY: M. BREWER	DATE: 7/9/2022

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 SUITE 800  
 CHARLOTTE, NC 28227  
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**NORTH CAROLINA DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS**

**GEOTECHNICAL ENGINEERING UNIT**

REVISIONS						SHEET NO.
NO.	BY	DATE	NO.	BY	DATE	
1			3			W39_40-3
2			4			