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09/08/99

TIP PROJECT: R-2707D

CONTRACT: C204851

STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS

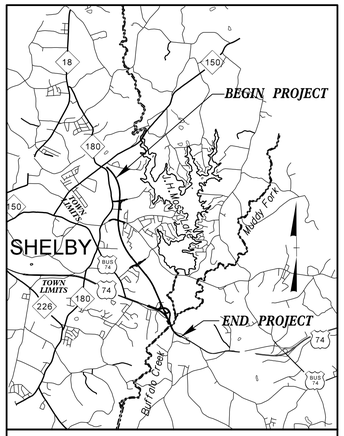
STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	R-2707D	NS-1	

STATE PROJ. NO.	F.A. PROJ. NO.	DESCRIPTION
34497.1.FS6	NHS-0074(164)	P.E.
34497.2.13	N/A	R/W & UTIL
34497.3.12	N/A	CONST.

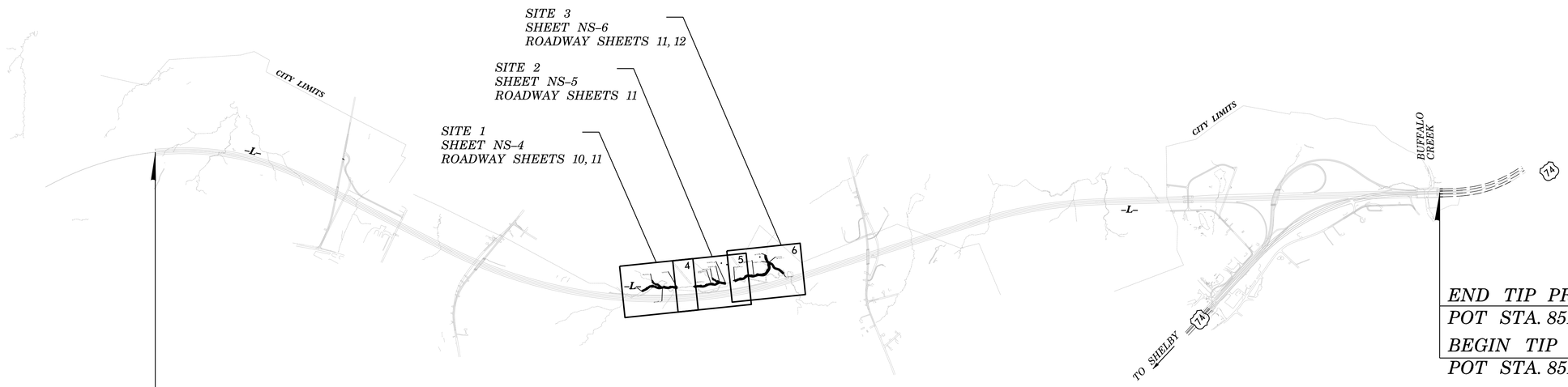
PLAN FOR CHANNEL RELOCATION
CLEVELAND COUNTY

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

TYPE OF WORK: STREAM RELOCATION



VICINITY MAP NTS



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

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

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

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

NAD 83/95

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

GRAPHIC SCALES

40 20 0 40 80
PLANS

40 20 0 40 80
PROFILE (HORIZONTAL)

4 2 0 4 8
PROFILE (VERTICAL)

PROJECT LENGTH

MITIGATION SITE	MITIGATION TYPE	LENGTH
SITE 1	RELOCATION	812LF
SITE 2	RELOCATION	664LF
SITE 3	RELOCATION	1195LF

Stantec

PREPARED IN THE OFFICE OF:
STANTEC CONSULTING
801 Jones Franklin Road | Suite 300| Raleigh, NC 27606
Tel. (919) 851-6866 | Fax. (919) 851-7024 | www.stantec.com
License No. F-0672

FOR THE NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

2018 STANDARD SPECIFICATIONS

RIGHT OF WAY DATE:
01/10/2019

LETTING DATE:
07/18/2023

JOSH GILMAN, P.E.
PROJECT DESIGN ENGINEER

THAD DUNCAN, P.E.
NCDOT DIVISON 12

DESIGN ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 030839 ENGINEER JOSHUA B. GILMAN

Docusigned by:
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4/20/2023

SIGNATURE: P.E.

STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

3/31/2023
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8/17/99

GENERAL NOTES

ALL WORK SHALL BE PERFORMED IN ACCORDANCE WITH THE FOLLOWING STANDARDS:

A) NORTH CAROLINA DEPARTMENT OF TRANSPORTATION "STANDARD SPECIFICATIONS FOR ROADS AND STRUCTURES, DATED JANUARY 2018, AND ANY SUPPLEMENTS THERETO ISSUED PRIOR TO THE DATE OF RECEIPT OF BIDS.

B) NORTH CAROLINA DEPARTMENT OF TRANSPORTATION "ROADWAY STANDARD DRAWINGS, ENGLISH" DATED JANUARY 2018, AND ANY SUPPLEMENTS ISSUED THERETO PRIOR TO THE DATE OF RECEIPT OF BIDS.

ALL RIGHT OF WAY CORNER MARKERS OR FENCING SHALL BE PLACED BY OTHERS AS NECESSARY.

THE CONTRACTOR IS RESPONSIBLE FOR AVOIDING ANY DISTURBANCE OR DAMAGE TO EXISTING UTILITIES AND SHALL BE RESPONSIBLE FOR IMMEDIATELY REPAIRING ANY DAMAGES AT A COST INCIDENT TO THIS CONTRACT.

ABANDONED SECTIONS OF THE EXISTING CHANNEL SHALL BE FILLED TO THE MAXIMUM EXTENT FEASIBLE WITH MATERIAL EXCAVATED ON-SITE. THIS EXCAVATED MATERIAL SHALL BE STOCKPILED ADJACENT TO THE REACHES OF CHANNEL OR DITCHES TO BE BACKFILLED.

THE PROPOSED STREAM RELOCATION SHALL BE CONSTRUCTED IN ACCORDANCE TO THE PROPOSED TYPICAL SECTIONS AND PROFILES, IN CONFORMANCE WITH THE PLANS.

SUBSURFACE PLANS: NO SUBSURFACE PLANS ARE AVAILABLE ON THE PROJECT. THE CONTRACTOR SHOULD MAKE HIS OWN INVESTIGATION AS TO THE SUBSURFACE CONDITIONS.

THE PRIME CONTRACTOR AND/OR SUBCONTRACTOR(S) SHALL BE PREQUALIFIED IN THE WORK CODE "1601" STREAM RESTORATION AND CONSTRUCTION, FOR WHICH THEY IDENTIFY AS WORK ITEMS IN THE PRIME CONTRACTOR'S CONSTRUCTION PROGRESS SCHEDULE THAT THEY WILL COMPLETE THEMSELVES. ANY CONTRACTOR IDENTIFIED AS WORKING OUTSIDE THEIR EXPERTISE MAY BE CONSIDERED IN DEFAULT OF THE CONTRACT. THIS WORK INCLUDES ALL FLOODPLAIN EXCAVATION, STREAM EXCAVATION, IN-STREAM STRUCTURES, STREAM FEATURES AND STABILIZATION EFFORTS (I.E. COIR FIBER MATTING, SEEDING, MULCHING, ETC.).

ROADWAY STANDARD DRAWINGS

(REV. JANUARY 2018)

THE FOLLOWING ROADWAY STANDARDS AS APPEAR IN "ROADWAY STANDARD DRAWINGS" - ROADWAY DESIGN UNIT - N.C. DEPARTMENT OF TRANSPORTATION - RALEIGH, N.C., DATED JANUARY 2018 AND THE LATEST REVISION THERETO ARE APPLICABLE TO THIS PROJECT AND BY REFERENCE HEREBY ARE CONSIDERED A PART OF THESE PLANS:

CONSTRUCTION SEQUENCING

THIS STREAM RELOCATION PROJECT CONSISTS OF TWO REACHES (1 & 2) INCLUSIVE OF MULTIPLE DESIGNED SUB REACHES(1A,1B,1ATRIB,1BTRIB,2A,2B,2C). ONCE WORK BEGINS ON A STREAM REACH, THE CONTRACTOR MUST COMPLETE THAT REACH BEFORE MOVING WORK CREWS AND EQUIPMENT TO A DIFFERENT REACH, UNLESS APPROVED TO DO SO BY THE ENGINEER.

PERFORM STAKEOUT SURVEY FOR THE PROPOSED STREAM CHANNEL, CONSTRUCTION EASEMENT LIMITS, AND GRADE STAKES. THE ENGINEER MUST INSPECT AND APPROVE ALL STAKEOUT WORK BEFORE CONSTRUCTION MAY BEGIN.

MOBILIZE EQUIPMENT AND MATERIALS TO THE SITE.

INSTALL CONSTRUCTION ENTRANCE PER EROSION CONTROL PLAN.(REFER TO ROADWAY CONSTRUCTION DRAWINGS)

ESTABLISH STAGING AREAS AND MARK CONSTRUCTION EQUIPMENT ACCESS LOCATIONS WITH VISIBLE MARKERS. CONSTRUCTION EQUIPMENT SHALL BE CONTAINED WITHIN THE LIMITS OF CONSTRUCTION AS DEPICTED IN THE PLANS OR SPECIFIED BY THE ENGINEER.

INSTALL TEMPORARY EROSION CONTROL MEASURES.

BEGIN FLOODPLAIN GRADING, INCLUDING EXCAVATION OF BANKFULL BENCHES AT LOCATIONS DEPICTED IN THE PLANS AND AS DIRECTED BY THE ENGINEER. STOCKPILE MATERIALS ONLY WITHIN APPROVED LIMITS OF DISTURBANCE AS DESIGNATED ON THE EROSION CONTROL PLANS(REFER TO ROADWAY CONSTRUCTION DRAWINGS). KEEP TOPSOIL SEPARATE FROM OTHER STOCKPILE MATERIAL FOR LATER USE IN FLOODPLAIN. FINISH GRADING AND REVEGETATION PREPARATION.

TOPSOIL SHALL BE EXCAVATED AND STOCKPILED SEPARATELY FROM THE WASTE MATERIAL SO THAT IT CAN BE PLACED BACK ON THE FLOODPLAIN ONCE GRADING IS COMPLETE. NO DIRECT PAYMENT WILL BE MADE FOR THIS EXCAVATION. OVER-EXCAVATE FLOODPLAIN AND FLOODPLAIN SLOPES TO A DEPTH OF 6" BELOW FINAL GRADE AND PLACE 6" OF TOPSOIL TO FILL TO FINAL GRADE. OVER-EXCAVATION SHOULD BEGIN 3' FROM TOP OF BANK AND EXTEND TO EXCAVATION LIMITS. SEE TYPICAL SECTIONS FOR DETAIL.
INSTALL IMPERVIOUS DIKES AND PUMP AROUND SYSTEM TO PUMP STREAM DISCHARGE AROUND THE IMMEDIATE WORK AREA AS NECESSARY.

CONSTRUCTION SHALL PROCEED IN SUCCESSIVE REACHES WITH THE UPSTREAM REACH BEING COMPLETED PRIOR TO INITIATING CONSTRUCTION OF THE ADJACENT DOWNSTREAM REACH. EACH REACH SHALL BE LIMITED IN LENGTH TO WORK THAT CAN BE COMPLETED BEFORE ALLOWING WATER TO FLOW THROUGH THAT REACH. COMPLETION OF A REACH SHALL CONSIST OF CHANNEL CONSTRUCTION, FLOODPLAIN GRADING, IN-STREAM STRUCTURE INSTALLATION, BED MATERIAL INSTALLATION, AND EROSION CONTROL MEASURES. CONSTRUCTION SHALL BE DONE IN THE DRY, WITH THE CHANNEL FLOW PUMPED AROUND THE DEWATERED REACH UNDER CONSTRUCTION AS NECESSARY.

AT THE END OF EACH DAY'S CONSTRUCTION WORK, THE CONTRACTOR SHALL SEED ALL DISTURBED AREAS AND COVER THE STREAM BANKS AND BANKFULL BENCHES WITH COIR FIBER MATTING TO THE EXTENT AS SHOWN ON PLANS. IN ADDITION, THE CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTAINING ALL TEMPORARY EROSION CONTROL MEASURES ON A DAILY BASIS THROUGHOUT THE CONSTRUCTION PROCESS.

ONCE NEW CHANNEL CONSTRUCTION IS COMPLETE, THE CONTRACTOR SHALL INSTALL STREAM PLUGS TO DIRECT STREAM FLOW INTO THE NEW CHANNEL. THE CONTRACTOR SHALL THEN FILL IN THE ABANDONED SECTIONS OF THE EXISTING CHANNEL TO THE EXTENT FEASIBLE AND AS DIRECTED BY THE ENGINEER. CONTRACTOR WILL ENSURE THAT EITHER:1) VEGETATION HAS BEEN ESTABLISHED ALONG THE BANKS OF THE NEW STREAM CHANNEL OR 2)BANKS HAVE BEEN FULLY MATTED,STEAKED AND PLANTED PER VEGETATION PLAN. FOR NEW STREAM CHANNEL REACHES WHERE THIS IS NOT POSSIBLE, THE CONTRACTOR SHOULD GET APPROVAL FROM THE ENGINEER BEFORE DIRECTING FLOW INTO THE NEW STREAM CHANNEL.

AFTER ALL IN-STREAM WORK IS COMPLETED, THE CONTRACTOR SHALL REMOVE TEMPORARY EROSION CONTROL MEASURES AND TEMPORARY STREAM ACCESS PER EROSION CONTROL PLAN (REFER TO ROADWAY CONSTRUCTION DRAWINGS). SCARIFY ANY COMPACTED AREAS AS DIRECTED BY THE ENGINEER. ALL PORTIONS OF THE SITE SHALL BE STABILIZED WITH TEMPORARY EROSION CONTROL MEASURES.

3/10/2023
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mgferguson

R-2707D
ON-SITE MITIGATION
CLEVELAND COUNTY

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PROJECT REFERENCE NO.	SHEET NO.
R-2707D	NS-1A

DESIGN ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 030839 ENGINEER JOSHUA B. GUIMAN

DocuSigned by: 9EC9E02F2B3C4C0...

4/20/2023

INDEX OF SHEETS

NS-1	TITLE SHEET
NS-1A	INDEX OF SHEETS, CONSTRUCTION SEQUENCING, GENERAL NOTES
NS-1B	CONVENTIONAL PLAN SHEET SYMBOLS
NS-2 - NS-2A	CHANNEL TYPICAL DETAIL
NS-2B	DETAILS -COIR FIBER MATTING -ROCK CROSS VANE
NS-2C	-CONSTRUCTED RIFFLE -BRUSH TOE PROTECTION
NS-2D	-STREAM PLUG -LOG VANE WITH ROCK J-HOOK
NS-2E - NS-2F	-MORPHOLOGICAL TABLES
NS-3	SUMMARY OF QUANTITIES EARTHWORK SUMMARY
NS-4 - NS-6	PLAN SHEETS
NS-7 - NS-10	PROFILE SHEETS
NS-11 - NS-31	CROSS SECTIONS
RF-1 - RF-3	PLANTING DETAILS
RF-4 - RF-6	PLANTING PLAN SHEETS

STREAM SYMBOLS

PLAN VIEW SYMBOLS

LOG VANE WITH ROCK J-HOOK

BRUSH TOE

CONSTRUCTED RIFFLE

STREAM PLUG

BACKFILL EXISTING CHANNEL

ROCK CROSS VANE

FP——FP FLOODPLAIN LINE

PROFILE SYMBOLS

EXISTING GROUND ELEVATION

PROPOSED GROUND ELEVATION

PROPOSED BANKFULL

ROCK CROSS VANE

LOG VANE WITH ROCK J-HOOK

CONSTRUCTED RIFFLE

PLANTING SYMBOLS

TYPE I -STREAMBANK REFORESTATION

TYPE II - STREAMBANK REFORESTATION

REFORESTATION

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12/2/2016

PROJECT REFERENCE NO.	SHEET NO.
R-2707D	NS-1B

STATE OF NORTH CAROLINA, DIVISION OF HIGHWAYS

CONVENTIONAL PLAN SHEET SYMBOLS

Note: Not to Scale

**S.U.E. = Subsurface Utility Engineering*

BOUNDARIES AND PROPERTY:

- State Line
- County Line
- Township Line
- City Line
- Reservation Line
- Property Line
- Existing Iron Pin — EIP
- Computed Property Corner
- Property Monument — ECM
- Parcel/Sequence Number — 123
- Existing Fence Line
- Proposed Woven Wire Fence
- Proposed Chain Link Fence
- Proposed Barbed Wire Fence
- Existing Wetland Boundary — WLB
- Proposed Wetland Boundary — WLB
- Existing Endangered Animal Boundary — EAB
- Existing Endangered Plant Boundary — EPB
- Existing Historic Property Boundary — HPB
- Known Contamination Area: Soil — S
- Potential Contamination Area: Soil — S
- Known Contamination Area: Water — W
- Potential Contamination Area: Water — W
- Contaminated Site: Known or Potential

BUILDINGS AND OTHER CULTURE:

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

HYDROLOGY:

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

RAILROADS:

- Standard Gauge — CSX TRANSPORTATION
- RR Signal Milepost — MILEPOST 35
- Switch — SWITCH
- RR Abandoned
- RR Dismantled

RIGHT OF WAY & PROJECT CONTROL:

- Secondary Horiz and Vert Control Point
- Primary Horiz Control Point
- Primary Horiz and Vert Control Point
- Exist Permanent Easment Pin and Cap
- New Permanent Easement Pin and Cap
- Vertical Benchmark
- Existing Right of Way Marker
- Existing Right of Way Line
- New Right of Way Line — RW
- New Right of Way Line with Pin and Cap — RW
- New Right of Way Line with Concrete or Granite R/W Marker — RW
- New Control of Access Line with Concrete C/A Marker — CA
- Existing Control of Access — CA
- New Control of Access — CA
- Existing Easement Line — E
- New Temporary Construction Easement — E
- New Temporary Drainage Easement — TDE
- New Permanent Drainage Easement — PDE
- New Permanent Drainage / Utility Easement — DUE
- New Permanent Utility Easement — PUE
- New Temporary Utility Easement — TUE
- New Aerial Utility Easement — AUE

ROADS AND RELATED FEATURES:

- Existing Edge of Pavement
- Existing Curb
- Proposed Slope Stakes Cut — C
- Proposed Slope Stakes Fill — F
- Proposed Curb Ramp — CR
- 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 — Vineyard

EXISTING STRUCTURES:

MAJOR:

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

MINOR:

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

UTILITIES:

POWER:

- Existing Power Pole
- Proposed Power Pole
- Existing Joint Use Pole
- Proposed Joint Use Pole
- Power Manhole — P
- Power Line Tower
- Power Transformer
- U/G Power Cable Hand Hole
- H-Frame Pole
- U/G Power Line LOS B (S.U.E.*) — P
- U/G Power Line LOS C (S.U.E.*) — P
- U/G Power Line LOS D (S.U.E.*) — P

TELEPHONE:

- Existing Telephone Pole
- Proposed Telephone Pole
- Telephone Manhole — T
- Telephone Pedestal — T
- Telephone Cell Tower
- U/G Telephone Cable Hand Hole
- U/G Telephone Cable LOS B (S.U.E.*) — T
- U/G Telephone Cable LOS C (S.U.E.*) — T
- U/G Telephone Cable LOS D (S.U.E.*) — T
- U/G Telephone Conduit LOS B (S.U.E.*) — TC
- U/G Telephone Conduit LOS C (S.U.E.*) — TC
- U/G Telephone Conduit LOS D (S.U.E.*) — TC
- U/G Fiber Optics Cable LOS B (S.U.E.*) — T FO
- U/G Fiber Optics Cable LOS C (S.U.E.*) — T FO
- U/G Fiber Optics Cable LOS D (S.U.E.*) — T FO

WATER:

- Water Manhole — W
- Water Meter
- Water Valve
- Water Hydrant
- U/G Water Line LOS B (S.U.E*) — W
- U/G Water Line LOS C (S.U.E*) — W
- U/G Water Line LOS D (S.U.E*) — W
- Above Ground Water Line — A/G Water

TV:

- TV Pedestal — C
- TV Tower
- U/G TV Cable Hand Hole — HH
- U/G TV Cable LOS B (S.U.E.*) — TV
- U/G TV Cable LOS C (S.U.E.*) — TV
- U/G TV Cable LOS D (S.U.E.*) — TV
- U/G Fiber Optic Cable LOS B (S.U.E.*) — TV FO
- U/G Fiber Optic Cable LOS C (S.U.E.*) — TV FO
- U/G Fiber Optic Cable LOS D (S.U.E.*) — TV FO

GAS:

- Gas Valve
- Gas Meter
- U/G Gas Line LOS B (S.U.E.*) — G
- U/G Gas Line LOS C (S.U.E.*) — G
- U/G Gas Line LOS D (S.U.E.*) — G
- Above Ground Gas Line — A/G Gas

SANITARY SEWER:

- Sanitary Sewer Manhole
- Sanitary Sewer Cleanout
- U/G Sanitary Sewer Line — SS
- Above Ground Sanitary Sewer — A/G Sanitary Sewer
- SS Forced Main Line LOS B (S.U.E.*) — FSS
- SS Forced Main Line LOS C (S.U.E.*) — FSS
- SS Forced Main Line LOS D (S.U.E.*) — FSS

MISCELLANEOUS:

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

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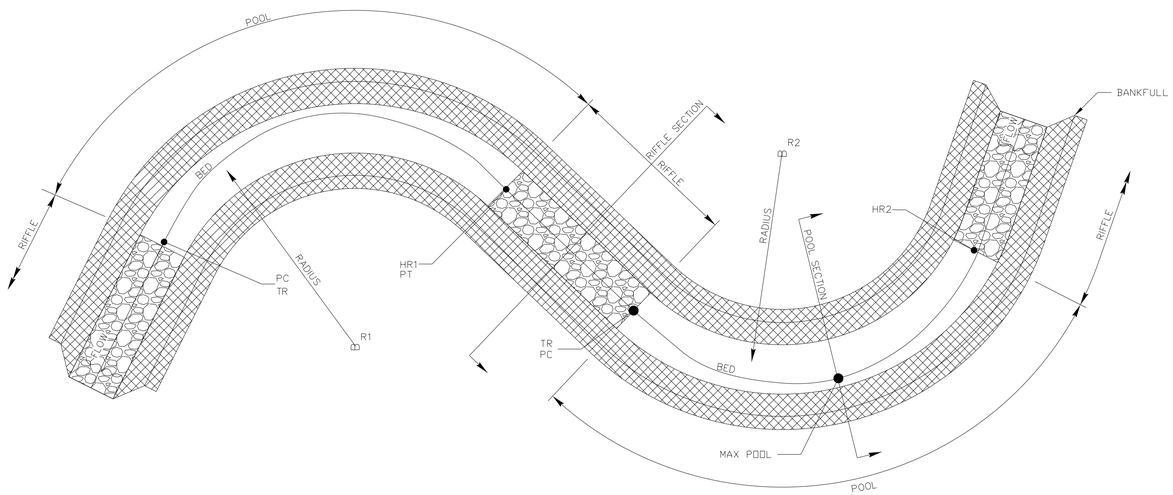
R-2707D CHANNEL RELOCATION CLEVELAND COUNTY	Stantec Stantec Consulting Services Inc. 801 Jones Franklin Road Suite 300 Raleigh, NC 27606 Tel. (919) 851-6866 Fax. (919) 851-7024 www.stantec.com License No. F-0672	PROJECT REFERENCE NO. R-2707D	SHEET NO. NS-2
			DESIGN ENGINEER NORTH CAROLINA PROFESSIONAL SEAL 030839 ENGINEER JOSHUA B. GILMAN DocuSigned by: 9EC9E02F2B7B4D8... 4/20/2023

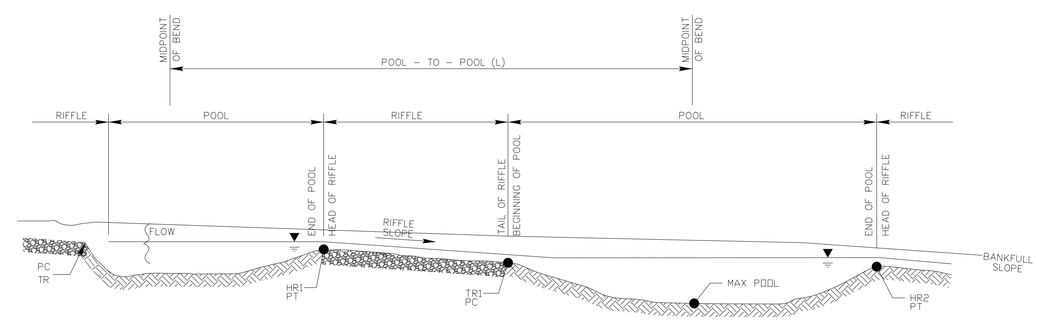


TYPICAL PLAN

NOTE:
1.TYPICAL PLAN NOT REFLECTIVE OF ACTUAL DESIGN.
2.REFER TO PLAN SHEETS FOR SPECIFIC PROPOSED TREATMENTS, GEOMETRY DATA, AND HORIZONTAL PLACEMENT.
3.REFER TO PROFILE SHEETS FOR VERTICAL PLACEMENT.

NOTE:
PC: POINT OF CURVATURE
TR: TAIL OF RIFFLE
PT: POINT OF TANGENCY
HR: HEAD OF RIFFLE

REFER TO CHANNEL TYPICAL DETAIL SECTIONS FOR ADDITIONAL INFORMATION



TYPICAL PROFILE

CHANNEL TYPICAL DETAIL-PLAN & PROFILE

NOT TO SCALE

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R-2707D
CHANNEL RELOCATION
CLEVELAND COUNTY

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PROJECT REFERENCE NO.	SHEET NO.
R-2707D	NS-2A

DESIGN ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 030839 ENGINEER JOSHUA B. GILMAN

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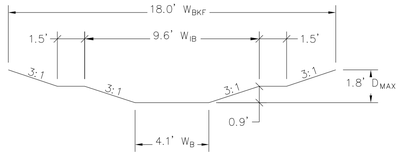

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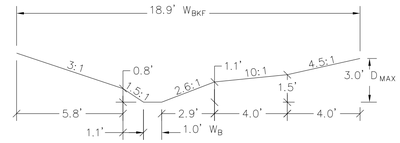
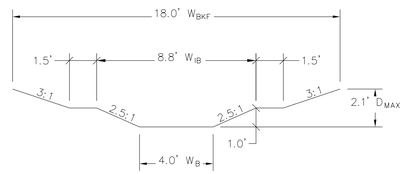


TYPICAL POOL

REACH 1A: STA 10+00 – 16+21.34



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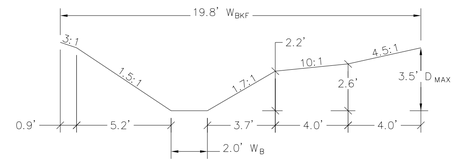
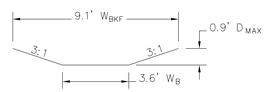


TYPICAL POOL

REACH 1B UPPER: STA 30+00 – 32+83.34



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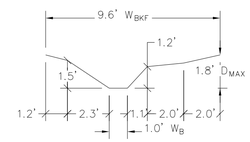
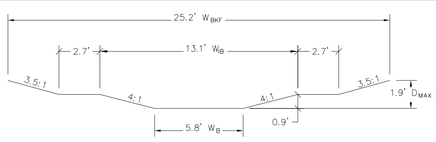


TYPICAL POOL

REACH 1B TRIBUTARY: STA 40+00 – 41+33.89



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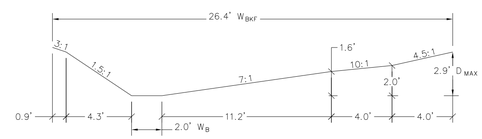
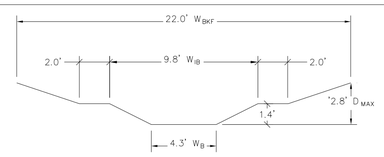
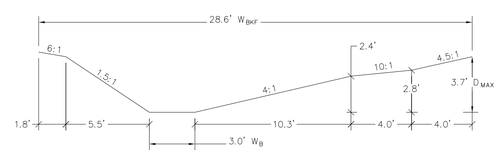


TYPICAL POOL

REACH 2A LOWER: STA 53+38.09 – 57+41.00

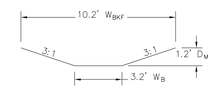


TYPICAL RIFFLE

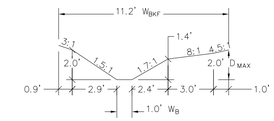


TYPICAL POOL

REACH 2C: STA 63+23.20 – 64+60.02

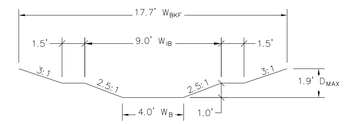


TYPICAL RIFFLE

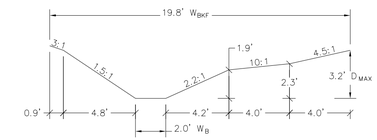


TYPICAL POOL

REACH 1A TRIBUTARY: STA 20+00 – 21+98.90

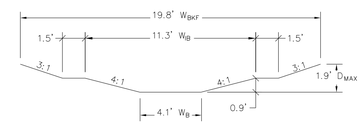


TYPICAL RIFFLE

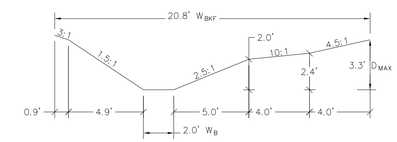


TYPICAL POOL

REACH 1B LOWER: STA 32+83.34 – 35+30.28

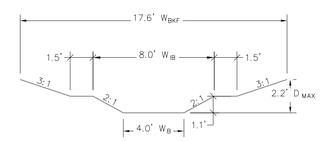


TYPICAL RIFFLE

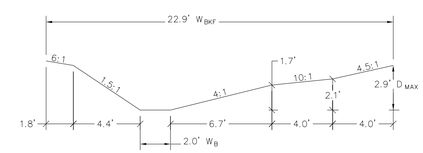


TYPICAL POOL

REACH 2A UPPER: STA 50+00 – 53+38.09



TYPICAL RIFFLE



TYPICAL POOL

REACH 2B: STA 60+00 – 63+23.20

CHANNEL TYPICAL DETAIL SECTIONS

NOT TO SCALE

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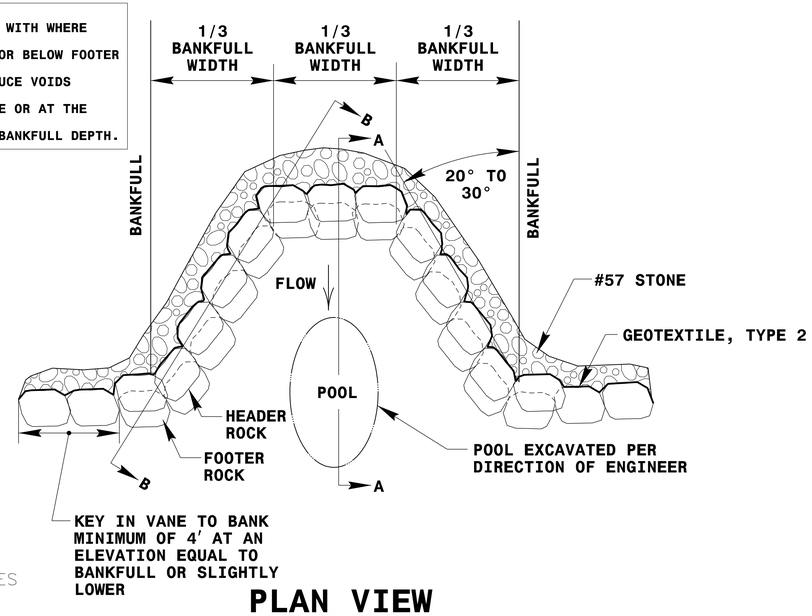
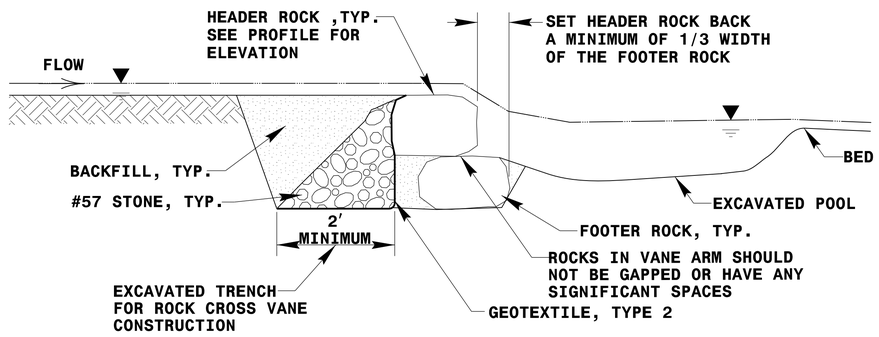
NOTES:
1. DEEPEST PART OF POOL TO BE IN LINE WITH WHERE VANE ARM TIES INTO BANKFULL.
2. DO NOT EXCAVATE POOL TOO CLOSE TO OR BELOW FOOTER BOULDERS.
3. CLASS "A" STONE CAN BE USED TO REDUCE VOIDS BETWEEN HEADERS AND FOOTERS.
4. COMPACT BACKFILL TO EXTENT POSSIBLE OR AT THE DIRECTION OF THE ENGINEER.
5.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

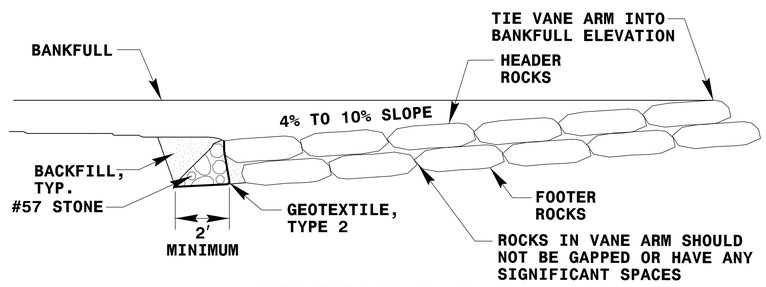


NOTE: REFER TO CONSTRUCTED RIFFLE DETAIL FOR BOULDER SIZES

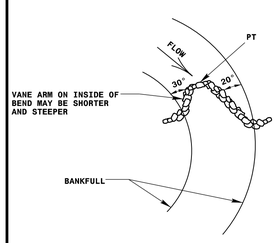
PLAN VIEW



SECTION A-A



SECTION B-B



CROSS VANE CONSTRUCTION IN MEANDER-BEND PLAN VIEW

ROCK CROSS VANE DETAIL

NOTE: REFER TO CONSTRUCTED RIFFLE DETAIL FOR BOULDER SIZES

NOT TO SCALE

R-2707D
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CLEVELAND COUNTY

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PROJECT REFERENCE NO.	SHEET NO.
R-2707D	NS-2B

DESIGN ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 030839 ENGINEER JOSHUA B. GUMAN

DocuSigned by: 9EC9E02F28784D0...

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R-2707D	NS-2C

DESIGN ENGINEER
NORTH CAROLINA PROFESSIONAL SEAL 030839 ENGINEER JOSHUA B. GILMAN
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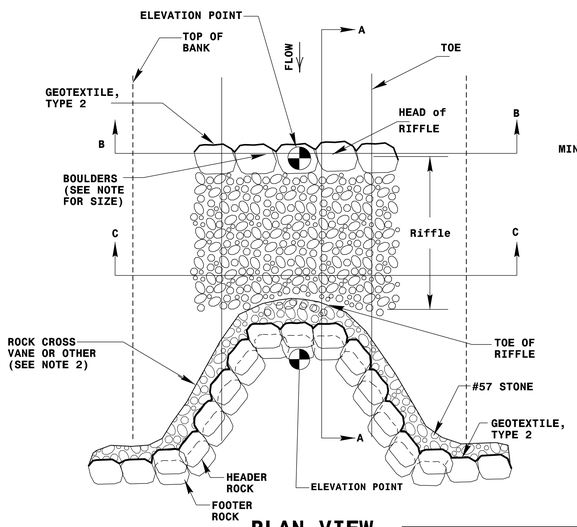
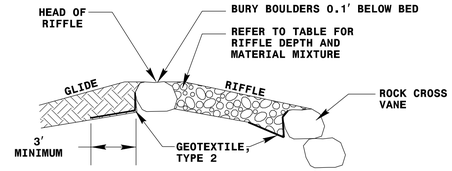
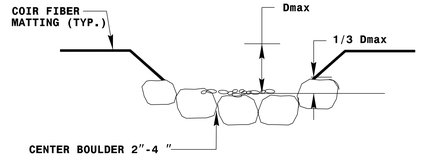


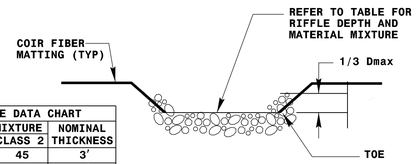
PLAN VIEW



SECTION A-A



SECTION B-B



SECTION C-C

BOULDER SIZE DATA CHART			
	BOULDER DIMENSIONS		
REACH	HEIGHT	WIDTH	LENGTH
1A	2'	3'	4'
1A TRIB	1'	2'	3'
1B-UPPER	1'	2'	3'
1B-LOWER	2'	3'	4'
1B TRIB	1'	2'	3'
2A-UPPER	2'	3'	4'
2A-LOWER	1'	2'	3'
2B	2'	3'	4'
2C	2'	3'	4'

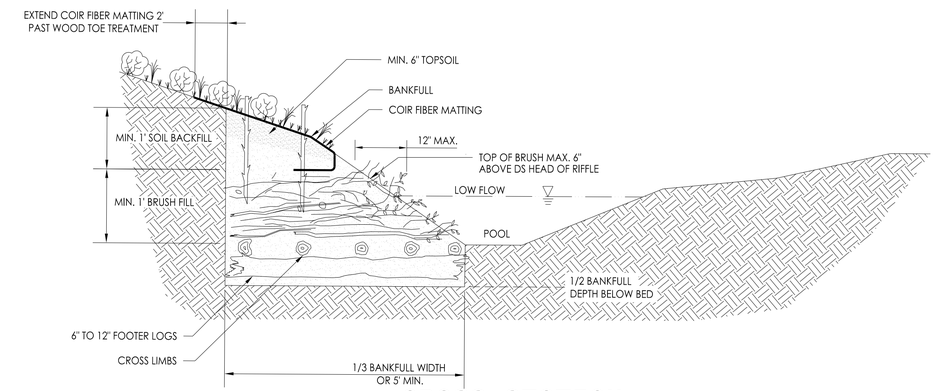
NOTE:THESE DIMENSIONS SPECIFY THE MINIMUM BOULDER SIZE

RIFFLE MATERIAL SIZE DATA CHART				
REACH	RIFFLE MATERIAL MIXTURE			NOMINAL THICKNESS
	CLASS A	CLASS 1	CLASS 2	
1A	10	45	45	3'
1A TRIB	10	90	-	2'
1B-UPPER	10	90	-	2'
1B-LOWER	10	45	45	3'
1B TRIB	10	90	-	2'
2A-UPPER	10	45	45	3'
2A-LOWER	10	90	-	2'
2B	10	45	45	3'
2C	10	45	45	3'

NOTE:
1. BOULDERS SHOULD BE NATIVE STONES OR SHOT ROCK, ANGULAR AND OBLONG, WITH DIMENSIONS AS SHOWN IN SIZE DATA CHART
2. REFER TO PLAN SHEET AND PROFILE FOR SPECIFIC STRUCTURE AND CORRESPONDING DETIAL.

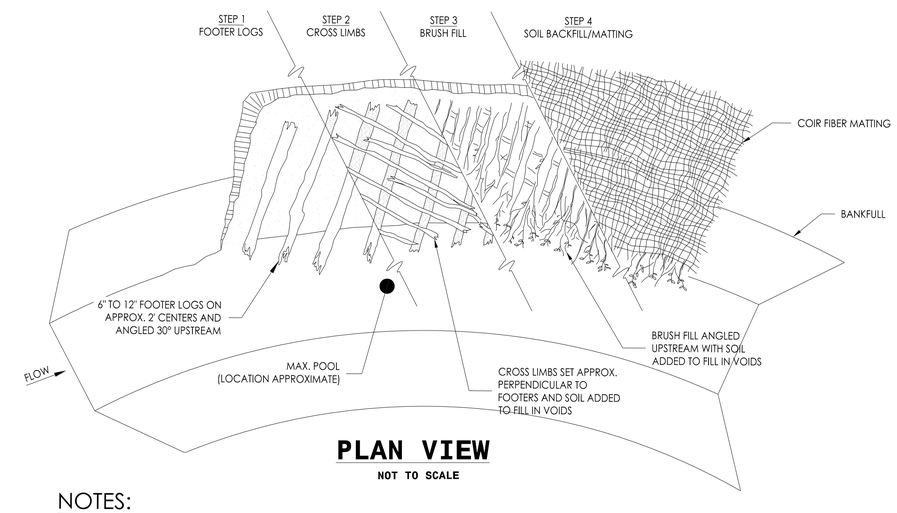
CONSTRUCTED RIFFLE DETAIL

NOT TO SCALE



CROSS SECTION

NOT TO SCALE



PLAN VIEW

NOT TO SCALE

NOTES:

1. MIX LAYERS OF SOIL WITH COARSE WOODY DEBRIS. (30% TO BE FROM LIVE MATERIAL OF NON-INVASIVE SPECIES). THIS SHALL EXTEND TO A DEPTH OF 1/2 BANKFULL, BELOW THE BOTTOM OF THE BED.
2. WRAP SOIL BACKFILL/TOPSOIL WITH COIR FIBER MATTING AND PLANT WITH LIVE STAKES PER THE PLANTING PLAN.
3. WOODY DEBRIS SHALL NOT EXTEND INTO THE PROPOSED CHANNEL MORE THAN 12" MAXIMUM.
4. NO WOOD MATERIALS SHALL BE DEAD OR ROTTING.
5. ALL MATERIALS ARE TO BE APPROVED BY ENGINEER OR ENGINEER'S ONSITE CONSTRUCTION MANAGER.
6. EXTEND BRUSH TOE TREATMENT DOWNSTREAM BEYOND HEAD OF RIFFLE PER PLAN.

BRUSH TOE MEANDER BANK PROTECTION

NOT TO SCALE

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PROJECT REFERENCE NO.	SHEET NO.
R-2707D	NS-2D

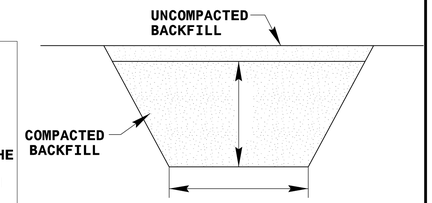
DESIGN ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 030839 ENGINEER JOSHUA B. GUMAN

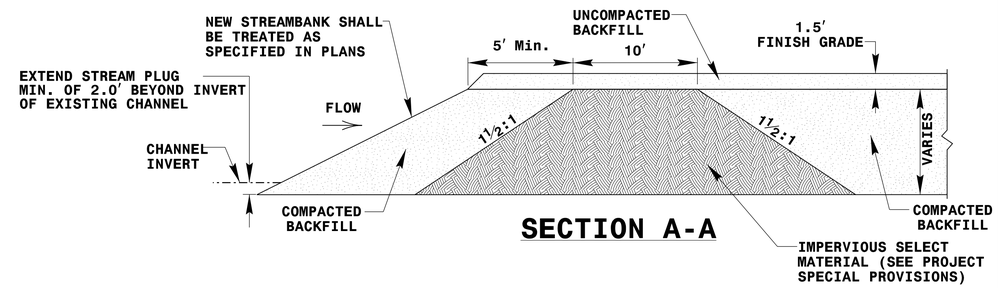
DocuSigned by: 9EC9E02F2B7E4D8...

4/20/2023

NOTES:
1. STREAM PLUG SHALL BE INSTALLED IN ACCORDANCE WITH THE PROJECT SPECIFICATIONS.
2. PLUG SHOULD BE INSTALLED AT THE INTERFACE BETWEEN EXISTING CHANNEL AND PROPOSED CHANNEL.
3. BOTTOM OF PLUG SHOULD BE A MINIMUM OF 2.0′ BELOW THE INVERT OF THE EXISTING CHANNEL.
4. PLUG SHOULD EXTEND A MINIMUM OF 2.0′ BEYOND THE LIMITS OF THE EXISTING STREAM CHANNEL.
5. INSTALL EROSION CONTROL MATTING AND SEED IN ACCORDANCE WITH THE PROJECT SPECIFICATIONS IMMEDIATELY AFTER GRADING.
6. COMPACT BACKFILL TO EXTENT POSSIBLE OR AT THE DIRECTION OF THE ENGINEER.

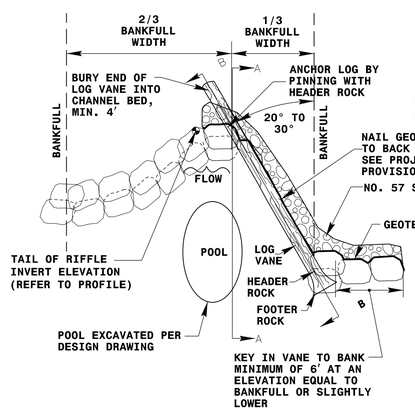


SECTION B-B

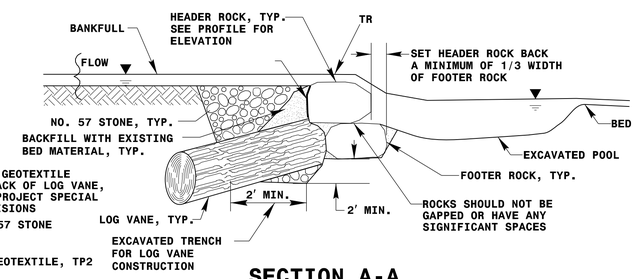


SECTION A-A

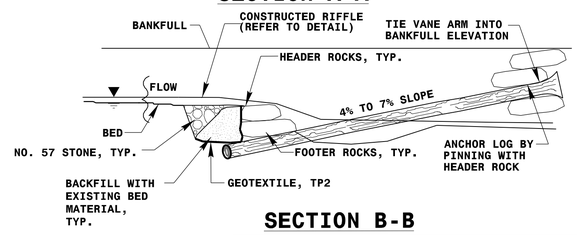
NOTE: REFER TO CONSTRUCTED RIFFLE DETAIL FOR BOULDER SIZES



PLAN VIEW



SECTION A-A



SECTION B-B

NOTES:
1. DEEPEST PART OF POOL (MAX POOL).
2. DO NOT EXCAVATE POOL TOO CLOSE TO FOOTER BOULDERS.
3. CLASS "A" STONE CAN BE USED TO REDUCE VOIDS BETWEEN HEADERS AND FOOTERS.
4. COMPACT BACKFILL TO EXTENT POSSIBLE OR AT THE DIRECTION OF THE ENGINEER.
5. POOL DEPTH SHOULD BE 2 TO 3 TIMES BANKFULL DEPTH.

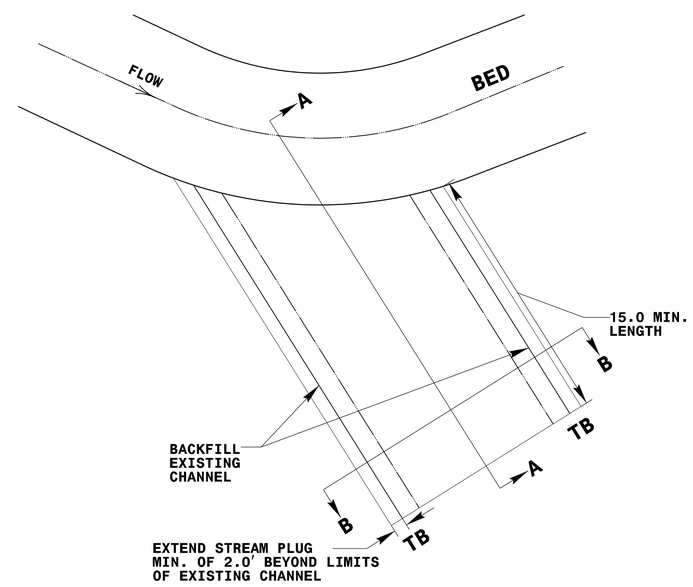
NOTE: NUMBER OF STONES VARY DEPENDING ON ⅓ BANFULL WIDTH

REFER TO CONSTRUCTED RIFFLE DETAIL FOR BOULDER SIZES

#57 STONE GRADATION	
1.5″	100
1″	85-100
0.5″	25-60
#4	0.10
#8	0.5

LOG VANE WITH ROCK J-HOOK DETAIL (MODIFIED)

NOT TO SCALE



PLAN VIEW

STREAM PLUG

NOT TO SCALE

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PROJECT REFERENCE NO.	SHEET NO.
R-2707D	NS-2E

DESIGN ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 030839 ENGINEER JOSHUA B. GUIMAN

DocuSigned by: 9EC9E02F-6C38-40E9-9B1B-206E507D8C62

4/20/2023

VARIABLES	Reference Reach	Reference Reach	Reference Reach	Existing Reach 1A	Design Reach 1A	Design Reach 1A Tributary	Existing Reach 1B	Design Reach 1B Upper	Design Reach 1B Lower	Design Reach 1B Tributary
STATION	-	-	-	-	-	-	-	-	-	-
1. Stream Type (Rosgen)	C4	B 4/1c	B 4	B 4c	B4/1	B/Bc	B 4c	Bc	Bc	B
2. Drainage Area [mi2]	0.21	0.19	0.81	0.42	0.42	0.09	0.46	0.53	0.53	0.05
Riffle Dimensions										
3. Bankfull Width	**Mean:** 7.55	**Mean:** 7.37	**Mean:** 13.14	**Mean:** 12.31	**Mean:** 17.98	**Mean:** 10.20	**Mean:** 15.67	**Mean:** 18.00	**Mean:** 17.73	**Mean:** 9.13
(Wbkf) [ft]	Range: 7.03 8.06	Range: 6.58 8.16	Range: 12.12 14.16	Range: 10.57 14.04	Range:	Range:	Range: 15.4 15.94	Range:	Range:	Range:
4. Mean Riffle Depth	**Mean:** 0.90	**Mean:** 1.04	**Mean:** 0.86	**Mean:** 1.31	**Mean:** 1.20	**Mean:** 0.78	**Mean:** 1.49	**Mean:** 1.20	**Mean:** 1.27	**Mean:** 0.61
(dbkf) [ft]	Range: 0.82 0.97	Range: 0.94 1.13	Range: 0.82 0.89	Range: 1.09 1.53	Range:	Range:	Range: 1.15 1.82	Range:	Range:	Range:
5. Maximum Riffle Depth	**Mean:** 1.29	**Mean:** 1.53	**Mean:** 1.22	**Mean:** 1.7	**Mean:** 1.80	**Mean:** 1.20	**Mean:** 2.20	**Mean:** 2.10	**Mean:** 1.90	**Mean:** 0.91
(dmax) [ft]	Range: 1.19 1.39	Range: 1.38 1.67	Range: 1.16 1.27	Range: 1.44 1.96	Range:	Range:	Range: 1.77 2.62	Range:	Range:	Range:
6. Width of Flood-Prone Area	**Mean:** 31	**Mean:** 20	**Mean:** 21	**Mean:** 17	**Mean:**	**Mean:**	**Mean:** 23	**Mean:**	**Mean:**	**Mean:**
(Wfpa) [ft]	Range: 27 34	Range: 19 22	Range: 18 25	Range: 14 20	Range:	Range:	Range: 22 24	Range:	Range:	Range:
7. Riffle Inner Berm Width	**Mean:** -	**Mean:** -	**Mean:** -	**Mean:** -	**Mean:** 9.60	**Mean:** -	**Mean:** -	**Mean:** 8.8	**Mean:** 9.0	**Mean:** -
(Wib) [ft]	Range: - -	Range: - -	Range: - -	Range: - -	Range:	Range: - -	Range: - -	Range:	Range:	Range: - -
8. Riffle Inner Berm Depth	**Mean:** -	**Mean:** -	**Mean:** -	**Mean:** -	**Mean:** 0.90	**Mean:** -	**Mean:** -	**Mean:** 1.0	**Mean:** 1.0	**Mean:** -
(dib) [ft]	Range: - -	Range: - -	Range: - -	Range: - -	Range:	Range: - -	Range: - -	Range:	Range:	Range: - -
9. Riffle Inner Berm Area	**Mean:** -	**Mean:** -	**Mean:** -	**Mean:** -	**Mean:** 6.14	**Mean:** -	**Mean:** -	**Mean:** 6.7	**Mean:** 6.2	**Mean:** -
(Aib) [ft2]	Range: - -	Range: - -	Range: - -	Range: - -	Range:	Range: - -	Range: - -	Range:	Range:	Range: - -
10. Riffle Cross-Sectional Area	**Mean:** 6.78	**Mean:** 7.55	**Mean:** 11.25	**Mean:** 15.77	**Mean:** 21.56	**Mean:** 8.00	**Mean:** 23.33	**Mean:** 24.96	**Mean:** 22.47	**Mean:** 5.56
(Abkf) [ft2]	Range: 5.76 7.80	Range: 7.42 7.68	Range: 10.85 11.65	Range: 15.37 16.16	Range:	Range:	Range: 17.66 28.99	Range:	Range:	Range:
11. Riffle Width/Depth Ratio	**Mean:** 8.44	**Mean:** 7.25	**Mean:** 15.44	**Mean:** 9.90	**Mean:** 15.00	**Mean:** 15.00	**Mean:** 11.08	**Mean:** 13.00	**Mean:** 14.00	**Mean:** 15.00
(Wbkf/dbkf)	Range: 8.31 8.57	Range: 5.82 8.68	Range: 13.62 17.27	Range: 6.91 12.88	Range:	Range:	Range: 8.76 13.39	Range:	Range:	Range:
12. Max Riffle Depth to Mean Riffle Depth	**Mean:** 1.44	**Mean:** 1.47	**Mean:** 1.43	**Mean:** 1.30	**Mean:** 1.50	**Mean:** 1.50	**Mean:** 1.49	**Mean:** 1.50	**Mean:** 1.50	**Mean:** 1.50
(dmax/dbkf)	Range: 1.43 1.45	Range: 1.47 1.48	Range: 1.30 1.55	Range: 1.28 1.32	Range:	Range:	Range: 1.44 1.54	Range:	Range:	Range:
13. Entrenchment Ratio	**Mean:** 4.03	**Mean:** 2.83	**Mean:** 1.62	**Mean:** 1.38	**Mean:** 1.60	**Mean:** 1.60	**Mean:** 1.47	**Mean:** 2.50	**Mean:** 1.90	**Mean:** 1.60
(Wfpa/Wbkf)	Range: 3.85 4.21	Range: 2.29 3.36	Range: 1.47 1.77	Range: 1.37 1.40	Range:	Range:	Range: 1.42 1.51	Range:	Range:	Range:
14. Bankfull Mean Velocity	**Mean:**	**Mean:**	**Mean:**	**Mean:** 4.4	**Mean:** 4.9	**Mean:** 4.0	**Mean:** 4.9	**Mean:** 4.8	**Mean:** 4.9	**Mean:** 3.5
(Vbkf) [ft/s]	Range:	Range:	Range:	Range:	Range: 4.7 5.1	Range: 3.8 4.2	Range: 4.6 5.2	Range: 4.6 4.9	Range: 4.7 5.1	Range: 3.3 3.7
15. Bankfull discharge	**Mean:**	**Mean:**	**Mean:**	**Mean:** 67.1	**Mean:** 97.0	**Mean:** 29.2	**Mean:** 125.7	**Mean:** 105.8	**Mean:** 98.2	**Mean:** 17.4
(Qbkf) [ft3/s]	Range:	Range:	Range:	Range:	Range: 92.0 102.0	Range: 27.7 30.6	Range: 118.6 132.7	Range: 102.2 109.3	Range: 93.8 102.5	Range: 16.5 18.3
Pool Dimensions										
16. Pool Width	**Mean:** 9.72	**Mean:** 10.6	**Mean:** 10.37	**Mean:** 18.36	**Mean:** 18.88	**Mean:** 11.22	**Mean:** 27.75	**Mean:** 19.82	**Mean:** 19.82	**Mean:** 9.59
(Wbkfp) [ft]	Range: 8.87 10.57	Range: 10.55 10.65	Range: 9.27 11.46	Range: 18.14 18.57	Range:	Range:	Range:	Range:	Range:	Range:
17. Mean Pool Depth	**Mean:** 1.25	**Mean:** 1.43	**Mean:** 1.22	**Mean:** 1.71	**Mean:** 1.68	**Mean:** 1.18	**Mean:** 2.64	**Mean:** 2.08	**Mean:** 2.08	**Mean:** 0.85
(dbkfp)	Range: 0.84 1.65	Range: 1.4 1.45	Range: 0.85 1.58	Range: 1.45 1.96	Range:	Range:	Range:	Range:	Range:	Range:
18. Pool Cross-Sectional Area	**Mean:** 11.75	**Mean:** 15.07	**Mean:** 13.02	**Mean:** 31.26	**Mean:** 34.50	**Mean:** 34.50	**Mean:** 73.33	**Mean:** 49.93	**Mean:** 49.93	**Mean:** 8.90
(Abkfp) [ft2]	Range: 8.9 14.6	Range: 14.73 15.41	Range: 7.87 18.16	Range: 26.92 35.59	Range:	Range:	Range:	Range:	Range:	Range:
19. Maximum Pool Depth	**Mean:** 1.93	**Mean:** 2.17	**Mean:** 1.68	**Mean:** 3.3	**Mean:** 3.00	**Mean:** 2.00	**Mean:** 4.54	**Mean:** 3.46	**Mean:** 3.17	**Mean:** 1.83
(dmaxp)	Range: 1.59 2.26	Range: 1.99 2.35	Range: 1.33 2.02	Range: 3.17 3.43	Range:	Range:	Range:	Range:	Range:	Range:
20. Pool Width to Riffle Width	**Mean:** 1.29	**Mean:** 1.44	**Mean:** 0.79	**Mean:** 1.49	**Mean:** 1.05	**Mean:** 1.05	**Mean:** 1.77	**Mean:** 1.10	**Mean:** 1.10	**Mean:** 1.05
(Wbkfp/Wbkf)	Range: 1.17 1.40	Range: 1.43 1.45	Range: 0.71 0.87	Range: 1.47 1.51	Range:	Range:	Range:	Range:	Range:	Range:
21. Mean Pool Depth to Mean Riffle Depth	**Mean:** 1.39	**Mean:** 1.38	**Mean:** 1.42	**Mean:** 1.31	**Mean:** 1.40	**Mean:** 1.40	**Mean:** 1.77	**Mean:** 1.50	**Mean:** 1.50	**Mean:** 1.40
(dbkfp/dbkf)	Range: 0.93 1.83	Range: 1.35 1.39	Range: 0.99 1.84	Range: 1.11 1.50	Range:	Range:	Range:	Range:	Range:	Range:
22. Pool Area to Riffle Area	**Mean:** 1.73	**Mean:** 2.00	**Mean:** 1.16	**Mean:** 1.98	**Mean:** 1.60	**Mean:** 1.60	**Mean:** 3.14	**Mean:** 2.00	**Mean:** 2.00	**Mean:** 1.60
(Abkfp/Abkf)	Range: 1.31 2.15	Range: 1.95 2.04	Range: 0.70 1.61	Range: 1.71 2.26	Range:	Range:	Range:	Range:	Range:	Range:
23. Max Pool Depth to Mean Riffle Depth	**Mean:** 2.14	**Mean:** 2.09	**Mean:** 1.95	**Mean:** 2.52	**Mean:** 2.50	**Mean:** 2.50	**Mean:** 3.05	**Mean:** 2.50	**Mean:** 2.50	**Mean:** 3.00
(dbkfp/dbkf)	Range: 1.77 2.51	Range: 1.91 2.26	Range: 1.55 2.35	Range: 2.42 2.62	Range:	Range:	Range:	Range:	Range:	Range:
Channel Pattern										
24. Stream Meander Length	**Mean:** 87.0	**Mean:** 87.0	**Mean:** 136.3	**Mean:**	**Mean:** 147.3	**Mean:** 89.3	**Mean:**	**Mean:** 197.9	**Mean:** 166.4	**Mean:** 42.7
(Lm)	Range: 57.0 117.0	Range: 57.0 117.0	Range: 69.2 197.7	Range:	Range: 140.4 156.0	Range: 88.0 90.5	Range:	Range: 196.9 199.0	Range: 161.1 171.7	Range: 41.1 44.4
25. Stream Meander Length Ratio	**Mean:** 11.5	**Mean:** 11.8	**Mean:** 10.4	**Mean:**	**Mean:** 8.2	**Mean:** 8.8	**Mean:**	**Mean:** 19.4	**Mean:** 9.4	**Mean:** 4.7
(Lm/Wbkf)	Range: 7.5 15.5	Range: 7.7 15.9	Range: 5.3 15.0	Range:	Range: 7.8 8.7	Range: 8.6 8.9	Range:	Range: 19.3 19.5	Range: 9.1 9.7	Range: 4.5 4.9
26. Radius of Curvature	**Mean:** 12.9	**Mean:** 61.7	**Mean:** 85.0	**Mean:**	**Mean:** 87.2	**Mean:** 53.5	**Mean:**	**Mean:** 95.3	**Mean:** 80.3	**Mean:** 27.3
(Rc)	Range: 7.6 17.3	Range: 45.0 80.0	Range: 41.0 132.0	Range:	Range: 35.0 215.0	Range: 40.0 72.0	Range:	Range: 76.0 110.0	Range: 55.0 123.0	Range: 18.0 57.0
27. Radius of Curvature to Riffle Width	**Mean:** 1.7	**Mean:** 8.4	**Mean:** 6.5	**Mean:**	**Mean:** 4.8	**Mean:** 5.2	**Mean:**	**Mean:** 9.3	**Mean:** 4.5	**Mean:** 3.0
(Rc/Wbkf)	Range: 1.0 2.3	Range: 6.1 10.9	Range: 3.1 10.0	Range:	Range: 1.9 119.5	Range: 3.9 7.1	Range:	Range: 7.5 10.8	Range: 3.1 6.9	Range: 2.0 6.2
28. Belt Width	**Mean:** 40.7	**Mean:** -	**Mean:** 22.3	**Mean:**	**Mean:** 31.4	**Mean:** 21.2	**Mean:**	**Mean:** 36.4	**Mean:** 38.4	**Mean:** 15.9
(Wblt)	Range: 31.8 49.6	Range: - -	Range: 19.8 28.7	Range:	Range: 25.1 37.5	Range: 19.8 22.7	Range:	Range: 37.0 41.3	Range: 37.0 41.3	Range: 13.9 17.2
29. Meander Width Ratio	**Mean:** 5.4	**Mean:** -	**Mean:** 1.7	**Mean:**	**Mean:** 1.7	**Mean:** 2.1	**Mean:**	**Mean:** 3.6	**Mean:** 2.2	**Mean:** 1.7
(Wblt/Wbkf)	Range: 4.2 6.6	Range: - -	Range: 1.5 2.2	Range:	Range: 1.4 3.9	Range: 1.9 2.2	Range:	Range: 3.6 4.0	Range: 2.1 2.3	Range: 1.5 1.9
30. Riffle Length	**Mean:** 12.1	**Mean:** 13.0	**Mean:** 10.8	**Mean:**	**Mean:** 43.5	**Mean:** 24.4	**Mean:**	**Mean:** 47.3	**Mean:** 40.9	**Mean:** 11.1
(Lr)	Range: 7.0 17.2	Range: 9.1 17.0	Range: 9.0 12.9	Range:	Range: 39.3 46.4	Range: 21.6 26.5	Range:	Range: 41.7 50.8	Range: 39.3 44.1	Range: 10.1 12.4
31. Riffle Length to Riffle Width	**Mean:** 1.6	**Mean:** 1.6	**Mean:** 0.8	**Mean:**	**Mean:** 2.4	**Mean:** 2.4	**Mean:**	**Mean:** 4.6	**Mean:** 2.3	**Mean:** 1.2
(Lr/Wbkf)	Range: 0.9 2.3	Range: 0.9 2.3	Range: 0.7 1.0	Range:	Range: 2.2 7.6	Range: 2.1 2.6	Range:	Range: 4.1 5.0	Range: 2.2 2.5	Range: 1.1 1.4
32. Individual Pool Length	**Mean:** 19.6	**Mean:** 18.6	**Mean:** 13.6	**Mean:**	**Mean:** 30.4	**Mean:** 19.2	**Mean:**	**Mean:** 47.2	**Mean:** 48.2	**Mean:** 11.0
(Lp)	Range: 10.1 33.1	Range: 6.8 32.4	Range: 6.9 29.3	Range:	Range: 23.8 40.5	Range: 17.6 20.4	Range:	Range: 29.9 56.3	Range: 39.9 56.3	Range: 10.0 13.8
33. Individual Pool Length to Riffle Width	**Mean:** 2.6	**Mean:** 2.5	**Mean:** 1.0	**Mean:**	**Mean:** 1.7	**Mean:** 1.9	**Mean:**	**Mean:** 4.6	**Mean:** 2.7	**Mean:** 1.2
(Lp/Wbkf)	Range: 1.3 4.4	Range: 0.9 4.4	Range: 0.5 2.2	Range:	Range: 1.3 2.7	Range: 1.7 2.0	Range:	Range: 2.9 5.5	Range: 2.2 3.2	Range: 1.1 1.5
34. Pool to Pool Spacing	**Mean:** 51.6	**Mean:** 31.1	**Mean:** 26.8	**Mean:**	**Mean:** 73.6	**Mean:** 44.7	**Mean:**	**Mean:** 99.5	**Mean:** 84.3	**Mean:** 21.6
(Ps)	Range: 30.5 69.3	Range: 25.2 36.4	Range: 20.7 34.4	Range:	Range: 69.3 79.0	Range: 43.6 46.1	Range:	Range: 93.9 105.2	Range: 80.0 91.7	Range: 20.1 22.6
35. Pool to Pool Spacing to Riffle Width	**Mean:** 6.8	**Mean:** 4.2	**Mean:** 2.0	**Mean:**	**Mean:** 4.1	**Mean:** 4.4	**Mean:**	**Mean:** 9.8	**Mean:** 4.8	**Mean:** 2.4
(Ps/Wbkf)	Range: 4.0 9.2	Range: 3.4 4.9	Range: 1.6 2.6	Range:	Range: 3.9 49.4	Range: 4.3 4.5	Range:	Range: 9.2 10.3	Range: 4.5 5.2	Range: 2.2 2.5
Channel Profile										
36. Valley Slope	**Mean:** 0.022	**Mean:** 0.020	**Mean:** 0.04	**Mean:** 0.0234	**Mean:** 0.027	**Mean:** 0.027	**Mean:** 0.014	**Mean:** 0.011	**Mean:** 0.023	**Mean:** 0.032
(Svalley) [ft/ft]	Range:	Range:	Range:	Range:	Range:	Range:	Range:	Range:	Range:	Range:
37. Average Water Surface Slope	**Mean:** 0.016	**Mean:** 0.018	**Mean:** 0.022	**Mean:** 0.0126	**Mean:** 0.026	**Mean:** 0.026	**Mean:** 0.011	**Mean:** 0.011	**Mean:** 0.022	**Mean:** 0.031
(S)	Range:	Range:	Range:	Range:	Range:	Range:	Range:	Range:	Range:	Range:
38. Sinuosity (k)	**Mean:** 1.36	**Mean:** 1.10	**Mean:** 1.12	**Mean:** 1.86	**Mean:** 1.04	**Mean:** 1.02	**Mean:** 1.26	**Mean:** 1.03	**Mean:** 1.03	**Mean:** 1.03
(Svalley/S)	Range:	Range:	Range:	Range:	Range:	Range:	Range:	Range:	Range:	Range:

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R-2707D CHANNEL RELOCATION CLEVELAND COUNTY

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PROJECT REFERENCE NO.	SHEET NO.
R-2707D	NS-2F

DESIGN ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 030839 ENGINEER JOSHUA B. GUIMAN

DocuSigned by: 9EC9E02F-6C38-40E9-9B1B-206E507D8C62

4/20/2023

VARIABLES	Reference Reach	Reference Reach	Reference Reach	Existing Reach 2A	Design Reach 2A Upper	Design Reach 2A Lower	Existing Reach 2B	Design Reach 2B	Existing Reach 2C	Design Reach 2C
STATION	-	-	-	-	-	-	-	-	-	-
1. Stream Type (Rosgen)	C4	B 4/1c	B 4	B 3/1	B3/1	B3/1c	C 4	C4	C 4	C
2. Drainage Area [mi2]	0.21	0.19	0.81	0.55	0.57	0.57	0.56	0.56	1.14	1.14
Riffle Dimensions										
3. Bankfull Width	Mean: 7.55	Mean: 7.37	Mean: 13.14	Mean: 19.81	Mean: 19.80	Mean: 25.19	Mean: 26.58	Mean: 17.61	Mean: 35.68	Mean: 22.03
(Wbkf) [ft]	Range: 7.03 8.06	Range: 6.58 8.16	Range: 12.12 14.16	Range: 17.99 21.63	Range:	Range:	Range: 16.07 37.08	Range:	Range:	Range:
4. Mean Riffle Depth	Mean: 0.90	Mean: 1.04	Mean: 0.86	Mean: 1.14	Mean: 1.32	Mean: 1.15	Mean: 1.00	Mean: 1.47	Mean: 0.95	Mean: 1.84
(dbkf) [ft]	Range: 0.82 0.97	Range: 0.94 1.13	Range: 0.82 0.89	Range: 0.71 1.29	Range:	Range:	Range: 0.71 1.29	Range:	Range:	Range:
5. Maximum Riffle Depth	Mean: 1.29	Mean: 1.53	Mean: 1.22	Mean: 1.76	Mean: 1.85	Mean: 1.85	Mean: 1.76	Mean: 2.20	Mean: 2.05	Mean: 2.75
(dmax) [ft]	Range: 1.19 1.39	Range: 1.38 1.67	Range: 1.16 1.27	Range: 1.21 2.31	Range:	Range:	Range: 1.21 2.31	Range:	Range:	Range:
6. Width of Flood-Prone Area	Mean: 31	Mean: 20	Mean: 21	Mean: 55	Mean:	Mean:	Mean:	Mean:	Mean: 109	Mean:
(Wfpa) [ft]	Range: 27 34	Range: 19 22	Range: 18 25	Range: 45 66	Range:	Range:	Range:	Range:	Range:	Range:
7. Riffle Inner Berm Width	Mean: -	Mean: -	Mean: -	Mean: -	Mean: 11.3	Mean: 13.1	Mean: -	Mean: 8.0	Mean: -	Mean: 9.8
(Wib) [ft]	Range: - -	Range: - -	Range: - -	Range: - -	Range:	Range:	Range: - -	Range:	Range: - -	Range:
8. Riffle Inner Berm Depth	Mean: -	Mean: -	Mean: -	Mean: -	Mean: 0.9	Mean: 0.9	Mean: -	Mean: 1.1	Mean: -	Mean: 1.4
(dib) [ft]	Range: - -	Range: - -	Range: - -	Range: - -	Range:	Range:	Range: - -	Range:	Range: - -	Range:
9. Riffle Inner Berm Area	Mean: -	Mean: -	Mean: -	Mean: -	Mean: 7.1	Mean: 8.7	Mean: -	Mean: 6.6	Mean: -	Mean: 9.7
(Aib) [ft2]	Range: - -	Range: - -	Range: - -	Range: - -	Range:	Range:	Range: - -	Range:	Range: - -	Range:
10. Riffle Cross-Sectional Area	Mean: 6.78	Mean: 7.55	Mean: 11.25	Mean: 23.46	Mean: 26.13	Mean: 26.13	Mean: 23.46	Mean: 25.84	Mean: 33.82	Mean: 40.43
(Abkf) [ft2]	Range: 5.76 7.80	Range: 7.42 7.68	Range: 10.85 11.65	Range: 20.72 26.19	Range:	Range:	Range: 20.72 26.19	Range:	Range:	Range:
11. Riffle Width/Depth Ratio	Mean: 8.44	Mean: 7.25	Mean: 15.44	Mean: 32.34	Mean: 15.00	Mean: 15.00	Mean: 32.34	Mean: 12.00	Mean: 37.56	Mean: 12.00
(Wbkf/dbkf)	Range: 8.31 8.57	Range: 5.82 8.68	Range: 13.62 17.27	Range: 12.46 52.23	Range:	Range:	Range: 12.46 52.23	Range:	Range:	Range:
12. Max Riffle Depth to Mean Riffle Depth	Mean: 1.44	Mean: 1.47	Mean: 1.43	Mean: 1.75	Mean: 1.40	Mean: 1.40	Mean: 1.75	Mean: 1.50	Mean: 2.16	Mean: 1.50
(dmax/dbkf)	Range: 1.43 1.45	Range: 1.47 1.48	Range: 1.30 1.55	Range: 1.70 1.79	Range:	Range:	Range: 1.70 1.79	Range:	Range:	Range:
13. Entrenchment Ratio	Mean: 4.03	Mean: 2.83	Mean: 1.62	Mean: 2.66	Mean: 1.60	Mean: 1.60	Mean: 2.66	Mean: 4.00	Mean: 3.06	Mean: 4.00
(Wfpa/Wbkf)	Range: 3.85 4.21	Range: 2.29 3.36	Range: 1.47 1.77	Range: 1.21 4.11	Range:	Range:	Range: 1.21 4.11	Range:	Range:	Range:
14. Bankfull Mean Velocity	Mean:	Mean:	Mean:	Mean: 4.6	Mean: 5.0	Mean: 3.5	Mean: 4.3	Mean: 5.2	Mean: 2.9	Mean: 4.6
(Vbkf) [ft/s]	Range:	Range:	Range:	Range:	Range: 4.8 5.2	Range: 3.4 3.7	Range: 4.19 4.44	Range: 5.0 5.5	Range: 2.54 3.19	Range: 3.4 5.8
15. Bankfull discharge	Mean:	Mean:	Mean:	Mean: 97.4	Mean: 112.9	Mean: 102.3	Mean: 89.4	Mean: 117.6	Mean: 96.9	Mean: 161.9
(Qbkf) [ft3/s]	Range:	Range:	Range:	Range:	Range: 108.1 117.6	Range: 98.6 106.1	Range: 86.87 91.95	Range: 111.9 123.3	Range: 86.03 107.75	Range: 119.4 204.5
Pool Dimensions										
16. Pool Width	Mean: 9.72	Mean: 10.6	Mean: 10.37	Mean: 16.67	Mean: 20.79	Mean: 26.45	Mean: 40.97	Mean: 22.89	Mean: 58.72	Mean: 28.63
(Wbkfp) [ft]	Range: 8.87 10.57	Range: 10.55 10.65	Range: 9.27 11.46	Range: 14.93 18.4	Range:	Range:	Range:	Range:	Range:	Range:
17. Mean Pool Depth	Mean: 1.25	Mean: 1.43	Mean: 1.22	Mean: 1.79	Mean: 1.85	Mean: 1.61	Mean: 1.03	Mean: 2.20	Mean: 1.03	Mean: 2.20
(dbkfp)	Range: 0.84 1.65	Range: 1.4 1.45	Range: 0.85 1.58	Range: 1.05 2.53	Range:	Range:	Range:	Range:	Range:	Range:
18. Pool Cross-Sectional Area	Mean: 11.75	Mean: 15.07	Mean: 13.02	Mean: 28.62	Mean: 41.81	Mean: 46.18	Mean: 42.14	Mean: 46.52	Mean: 60.37	Mean: 72.77
(Abkfp) [ft2]	Range: 8.9 14.6	Range: 14.73 15.41	Range: 7.87 18.16	Range: 19.4 37.84	Range:	Range:	Range:	Range:	Range:	Range:
19. Maximum Pool Depth	Mean: 1.93	Mean: 2.17	Mean: 1.68	Mean: 2.73	Mean: 3.30	Mean: 2.88	Mean: 3.27	Mean: 2.94	Mean: 2.77	Mean: 3.67
(dmaxp)	Range: 1.59 2.26	Range: 1.99 2.35	Range: 1.33 2.02	Range: 1.8 3.65	Range:	Range:	Range:	Range:	Range:	Range:
20. Pool Width to Riffle Width	Mean: 1.29	Mean: 1.44	Mean: 0.79	Mean: 0.84	Mean: 1.05	Mean: 1.05	Mean: 1.54	Mean: 1.30	Mean: 1.65	Mean: 1.30
(Wbkfp/Wbkf)	Range: 1.17 1.40	Range: 1.43 1.45	Range: 0.71 0.87	Range: 0.75 0.93	Range:	Range:	Range:	Range:	Range:	Range:
21. Mean Pool Depth to Mean Riffle Depth	Mean: 1.39	Mean: 1.38	Mean: 1.42	Mean: 1.57	Mean: 1.40	Mean: 1.40	Mean: 1.03	Mean: 1.50	Mean: 1.08	Mean: 1.50
(dbkfp/dbkf)	Range: 0.93 1.83	Range: 1.35 1.39	Range: 0.99 1.84	Range: 0.92 2.22	Range:	Range:	Range:	Range:	Range:	Range:
22. Pool Area to Riffle Area	Mean: 1.73	Mean: 2.00	Mean: 1.16	Mean: 1.27	Mean: 1.60	Mean: 1.60	Mean: 1.80	Mean: 1.80	Mean: 1.79	Mean: 1.80
(Abkfp/Abkf)	Range: 1.31 2.15	Range: 1.95 2.04	Range: 0.70 1.61	Range: 0.86 1.68	Range:	Range:	Range:	Range:	Range:	Range:
23. Max Pool Depth to Mean Riffle Depth	Mean: 2.14	Mean: 2.09	Mean: 1.95	Mean: 2.39	Mean: 2.50	Mean: 2.50	Mean: 3.27	Mean: 2.00	Mean: 2.92	Mean: 2.00
(dbkfp/dbkf)	Range: 1.77 2.51	Range: 1.91 2.26	Range: 1.55 2.35	Range: 1.58 3.20	Range:	Range:	Range:	Range:	Range:	Range:
Channel Pattern										
24. Stream Meander Length	Mean: 87.0	Mean: 87.0	Mean: 136.3	Mean:	Mean: 173.2	Mean: 212.8	Mean:	Mean: 183.3	Mean:	Mean: 183.3
(Lm)	Range: 57.0 117.0	Range: 57.0 117.0	Range: 69.2 197.7	Range:	Range: 168.0 175.8	Range: 193.5 232.2	Range:	Range:	Range:	Range:
25. Stream Meander Length Ratio	Mean: 11.5	Mean: 11.8	Mean: 10.4	Mean:	Mean: 8.7	Mean: 8.4	Mean:	Mean: 10.4	Mean:	Mean: 8.3
(Lm/Wbkf)	Range: 7.5 15.5	Range: 7.7 15.9	Range: 5.3 15.0	Range:	Range: 8.5 8.9	Range: 7.7 9.2	Range:	Range:	Range:	Range:
26. Radius of Curvature	Mean: 12.9	Mean: 61.7	Mean: 85.0	Mean:	Mean: 55.5	Mean: 82.7	Mean:	Mean: 116.8	Mean:	Mean: 72.5
(Rc)	Range: 7.6 17.3	Range: 45.0 80.0	Range: 41.0 132.0	Range:	Range: 32.0 80.0	Range: 68.0 95.0	Range:	Range: 45.0 296.0	Range:	Range: 50.0 95.0
27. Radius of Curvature to Riffle Width	Mean: 1.7	Mean: 8.4	Mean: 6.5	Mean:	Mean: 2.8	Mean: 3.3	Mean:	Mean: 6.6	Mean:	Mean: 3.3
(Rc/Wbkf)	Range: 1.0 2.3	Range: 6.1 10.9	Range: 3.1 10.0	Range:	Range: 1.6 4.0	Range: 2.7 3.8	Range:	Range: 2.6 16.8	Range:	Range: 2.3 4.3
28. Belt Width	Mean: 40.7	Mean: -	Mean: 22.3	Mean:	Mean: 40.0	Mean: 59.3	Mean:	Mean: 36.9	Mean:	Mean: 45.5
(Wblt)	Range: 31.8 49.6	Range: - -	Range: 19.8 28.7	Range:	Range: 29.6 52.7	Range: 32.2 86.5	Range:	Range: 33.9 40.9	Range:	Range:
29. Meander Width Ratio	Mean: 5.4	Mean: -	Mean: 1.7	Mean:	Mean: 2.0	Mean: 2.4	Mean:	Mean: 2.1	Mean:	Mean: 2.1
(Wblt/Wbkf)	Range: 4.2 6.6	Range: - -	Range: 1.5 2.2	Range:	Range: 1.5 2.7	Range:	Range:	Range: 1.9 2.3	Range:	Range: 0.0 0.0
30. Riffle Length	Mean: 12.1	Mean: 13.0	Mean: 10.8	Mean:	Mean: 56.3	Mean: 59.0	Mean:	Mean: 44.2	Mean:	Mean: 50.3
(Lr)	Range: 7.0 17.2	Range: 9.1 17.0	Range: 9.0 12.9	Range:	Range: 52.3 59.3	Range: 57.0 63.0	Range:	Range: 40.8 46.8	Range:	Range: 39.8 60.9
31. Riffle Length to Riffle Width	Mean: 1.6	Mean: 1.6	Mean: 0.8	Mean:	Mean: 2.8	Mean: 2.3	Mean:	Mean: 2.5	Mean:	Mean: 2.3
(Lr/Wbkf)	Range: 0.9 2.3	Range: 0.9 2.3	Range: 0.7 1.0	Range:	Range: 2.6 3.0	Range: 2.3 2.5	Range:	Range: 2.3 2.7	Range:	Range: 1.8 2.8
32. Individual Pool Length	Mean: 19.6	Mean: 18.6	Mean: 13.6	Mean:	Mean: 28.5	Mean: 55.7	Mean:	Mean: 36.6	Mean:	Mean: 36.0
(Lp)	Range: 10.1 33.1	Range: 6.8 32.4	Range: 6.9 29.3	Range:	Range: 26.2 30.0	Range: 31.6 69.4	Range:	Range: 34.6 40.8	Range:	Range: 32.2 39.8
33. Individual Pool Length to Riffle Width	Mean: 2.6	Mean: 2.5	Mean: 1.0	Mean:	Mean: 1.4	Mean: 2.2	Mean:	Mean: 2.1	Mean:	Mean: 1.6
(Lp/Wbkf)	Range: 1.3 4.4	Range: 0.9 4.4	Range: 0.5 2.2	Range:	Range: 1.3 1.5	Range: 1.3 2.8	Range:	Range: 2.0 2.3	Range:	Range: 1.5 1.8
34. Pool to Pool Spacing	Mean: 51.6	Mean: 31.1	Mean: 26.8	Mean:	Mean: 86.0	Mean: 106.6	Mean:	Mean: 80.9	Mean:	Mean: 97.4
(Ps)	Range: 30.5 69.3	Range: 25.2 36.4	Range: 20.7 34.4	Range:	Range: 80.5 88.2	Range: 87.6 126.4	Range:	Range: 76.2 85.9	Range:	Range:
35. Pool to Pool Spacing to Riffle Width	Mean: 6.8	Mean: 4.2	Mean: 2.0	Mean:	Mean: 4.3	Mean: 4.2	Mean:	Mean: 4.6	Mean:	Mean: 4.4
(Ps/Wbkf)	Range: 4.0 9.2	Range: 3.4 4.9	Range: 1.6 2.6	Range:	Range: 4.1 4.5	Range: 3.5 5.0	Range:	Range: 4.3 4.9	Range:	Range:
Channel Profile										
36. Valley Slope	Mean: 0.022	Mean: 0.020	Mean: 0.04	Mean: 0.039	Mean: 0.020	Mean: 0.010	Mean: 0.011	Mean: 0.024	Mean: 0.008	Mean: 0.024
(Svalley) [ft/ft]	Range:	Range:	Range:	Range:	Range:	Range:	Range:	Range:	Range:	Range:
37. Average Water Surface Slope	Mean: 0.016	Mean: 0.018	Mean: 0.022	Mean: 0.033	Mean: 0.019	Mean: 0.009	Mean: 0.0065	Mean: 0.023	Mean: 0.0053	Mean: 0.023
(S)	Range:	Range:	Range:	Range:	Range:	Range:	Range:	Range:	Range:	Range:
38. Sinuosity (k)	Mean: 1.36	Mean: 1.10	Mean: 1.12	Mean: 1.18	Mean: 1.04	Mean: 1.07	Mean: 1.66	Mean: 1.04	Mean: 1.49	Mean: 1.04
(Svalley/S)	Range:	Range:	Range:	Range:	Range:	Range:	Range:	Range:	Range:	Range:

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R-2707D
CHANNEL RELOCATION
CLEVELAND COUNTY

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PROJECT REFERENCE NO.	SHEET NO.
R-2707D	NS-3

DESIGN ENGINEER
NORTH CAROLINA PROFESSIONAL SEAL 030839 ENGINEER JOSHUA B. GUMAN
4/20/2023

SUMMARY OF QUANTITIES

DESCRIPTION	SECTION	QUANTITIY	UNIT	ITEM DESCRIPTION
1077000000–E	SP	570	TON	#57 STONE
3656000000–E	876	810	SY	GEOTEXTILE FOR DRAINAGE, TYPE 2
3651000000–E	SP	720	TON	BOULDERS
3628000000–E	876	1,190	TON	PLAIN RIP RAP, CLASS I
3635000000–E	876	730	TON	PLAIN RIP RAP, CLASS II
3642000000–E	876	220	TON	PLAIN RIP RAP, CLASS A
3649000000–E	876	10	TON	PLAIN RIP RAP, CLASS B
6123000000–E	SP	3.3	ACR	REFORESTATION
6070000000–N	1639	22	EA	SPECIAL STILLING BASINS
6126000000–E	SP	1.5	ACR	STREAMBANK REFORESTATION
6132000000–N	SP	21	EA	GENERIC EROSION CONTROL ITEM – LOGS
6133000000–N	SP	1	LS	GENERIC EROSION CONTROL ITEM – CONSTRUCTION SURVEYING FOR MITIGATION
6133000000–N	SP	1	LS	GENERIC EROSION CONTROL ITEM – SITE GRADING FOR MITIGATION
6133000000–N	SP	1	LS	GENERIC EROSION CONTROL ITEM – DIVERSION PUMPING FOR MITIGATION
6138000000–N	SP	1,500	CY	IMPERVIOUS SELECT MATERIAL
6147000000–E	SP	630	LF	GENERIC EROSION CONTROL ITEM – BRUSH TOE

SUMMARY OF APPROXIMATE EARTHWORK FOR STREAM RELOCATION

LOCATION	RELOCATION UNCLASSIFIED EXCAV. (CU.YD.)	RELOCATION EMBANKMENT	RELOCATION BORROW (CU.YD.)	RELOCATION WASTE (CU.YD.)
1A COMBINED	2,339	1,928		411
1B COMBINED	2,253	864		1,389
2ABC COMBINED	7,272	11,266	3,994	

APPROXIMATE QUANTITIES ONLY, RELOCATION UNCLASSIFIED EXCAVATION, RELOCATION BORROW EXCAVATION, RELOCATION FINE GRADING AND RELOCATION CLEARING AND GRUBBING WILL BE PAID FOR AT THE CONTRACT LUMP SUM PRICE FOR "GRADING FOR MITIGATION".

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SITE 1

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PROJECT REFERENCE NO.	SHEET NO.
R-2707D	NS-4

DESIGN ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 030839 ENGINEER JOSHUA B. GUMAN

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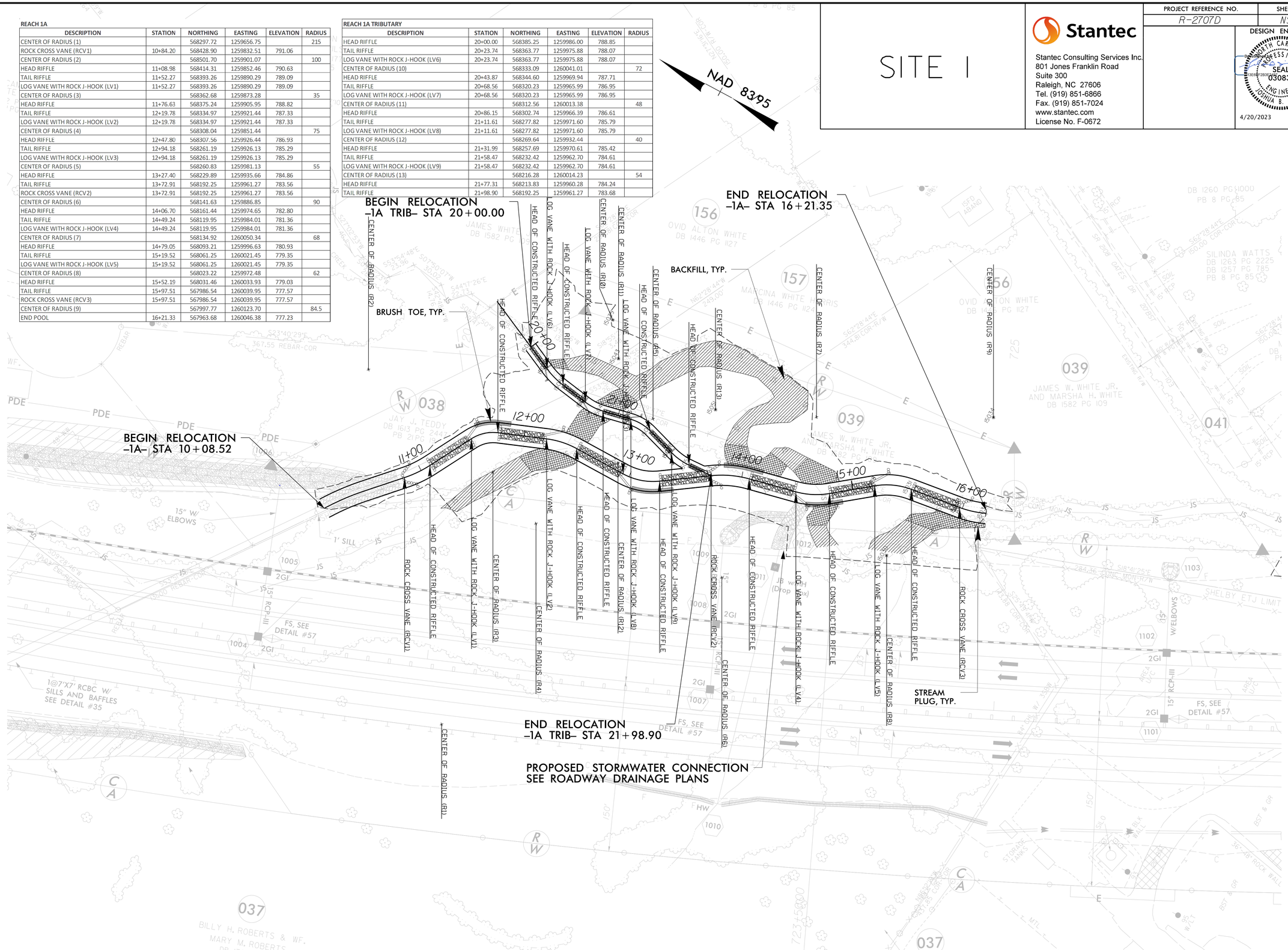
4/20/2023

REACH 1A

DESCRIPTION	STATION	NORTHING	EASTING	ELEVATION	RADIUS
CENTER OF RADIUS (1)		568297.72	1259656.75		215
ROCK CROSS VANE (RCV1)	10+84.20	568428.90	1259832.51	791.06	
CENTER OF RADIUS (2)		568501.70	1259901.07		100
HEAD RIFFLE	11+08.98	568414.31	1259852.46	790.63	
TAIL RIFFLE	11+52.27	568393.26	1259890.29	789.09	
LOG VANE WITH ROCK J-HOOK (LV1)	11+52.27	568393.26	1259890.29	789.09	
CENTER OF RADIUS (3)		568362.68	1259873.28		35
HEAD RIFFLE	11+76.63	568375.24	1259905.95	788.82	
TAIL RIFFLE	12+19.78	568334.97	1259921.44	787.33	
LOG VANE WITH ROCK J-HOOK (LV2)	12+19.78	568334.97	1259921.44	787.33	
CENTER OF RADIUS (4)		568308.04	1259851.44		75
HEAD RIFFLE	12+47.80	568307.56	1259926.44	786.93	
TAIL RIFFLE	12+94.18	568261.19	1259926.13	785.29	
LOG VANE WITH ROCK J-HOOK (LV3)	12+94.18	568261.19	1259926.13	785.29	
CENTER OF RADIUS (5)		568260.83	1259981.13		55
HEAD RIFFLE	13+27.40	568229.89	1259935.66	784.86	
TAIL RIFFLE	13+72.91	568192.25	1259961.27	783.56	
ROCK CROSS VANE (RCV2)	13+72.91	568192.25	1259961.27	783.56	
CENTER OF RADIUS (6)		568141.63	1259886.85		90
HEAD RIFFLE	14+06.70	568161.44	1259974.65	782.80	
TAIL RIFFLE	14+49.24	568119.95	1259984.01	781.36	
LOG VANE WITH ROCK J-HOOK (LV4)	14+49.24	568119.95	1259984.01	781.36	
CENTER OF RADIUS (7)		568134.92	1260050.34		68
HEAD RIFFLE	14+79.05	568093.21	1259996.63	780.93	
TAIL RIFFLE	15+19.52	568061.25	1260021.45	779.35	
LOG VANE WITH ROCK J-HOOK (LV5)	15+19.52	568061.25	1260021.45	779.35	
CENTER OF RADIUS (8)		568023.22	1259972.48		62
HEAD RIFFLE	15+52.19	568031.46	1260033.93	779.03	
TAIL RIFFLE	15+97.51	567986.54	1260039.95	777.57	
ROCK CROSS VANE (RCV3)	15+97.51	567986.54	1260039.95	777.57	
CENTER OF RADIUS (9)		567997.77	1260123.70		84.5
END POOL	16+21.33	567963.68	1260046.38	777.23	

REACH 1A TRIBUTARY

DESCRIPTION	STATION	NORTHING	EASTING	ELEVATION	RADIUS
HEAD RIFFLE	20+00.00	568385.25	1259986.00	788.85	
TAIL RIFFLE	20+23.74	568363.77	1259975.88	788.07	
LOG VANE WITH ROCK J-HOOK (LV6)	20+23.74	568363.77	1259975.88	788.07	
CENTER OF RADIUS (10)		568333.09	1260041.01		72
HEAD RIFFLE	20+43.87	568344.60	1259969.94	787.71	
TAIL RIFFLE	20+68.56	568320.23	1259965.99	786.95	
LOG VANE WITH ROCK J-HOOK (LV7)	20+68.56	568320.23	1259965.99	786.95	
CENTER OF RADIUS (11)		568312.56	1260013.38		48
HEAD RIFFLE	20+86.15	568302.74	1259966.39	786.61	
TAIL RIFFLE	21+11.61	568277.82	1259971.60	785.79	
LOG VANE WITH ROCK J-HOOK (LV8)	21+11.61	568277.82	1259971.60	785.79	
CENTER OF RADIUS (12)		568269.64	1259932.44		40
HEAD RIFFLE	21+31.99	568257.69	1259970.61	785.42	
TAIL RIFFLE	21+58.47	568232.42	1259962.70	784.61	
LOG VANE WITH ROCK J-HOOK (LV9)	21+58.47	568232.42	1259962.70	784.61	
CENTER OF RADIUS (13)		568216.28	1260014.23		54
HEAD RIFFLE	21+77.31	568213.83	1259960.28	784.24	
TAIL RIFFLE	21+98.90	568192.25	1259961.27	783.68	



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PROJECT REFERENCE NO.	SHEET NO.
R-2707D	NS-5

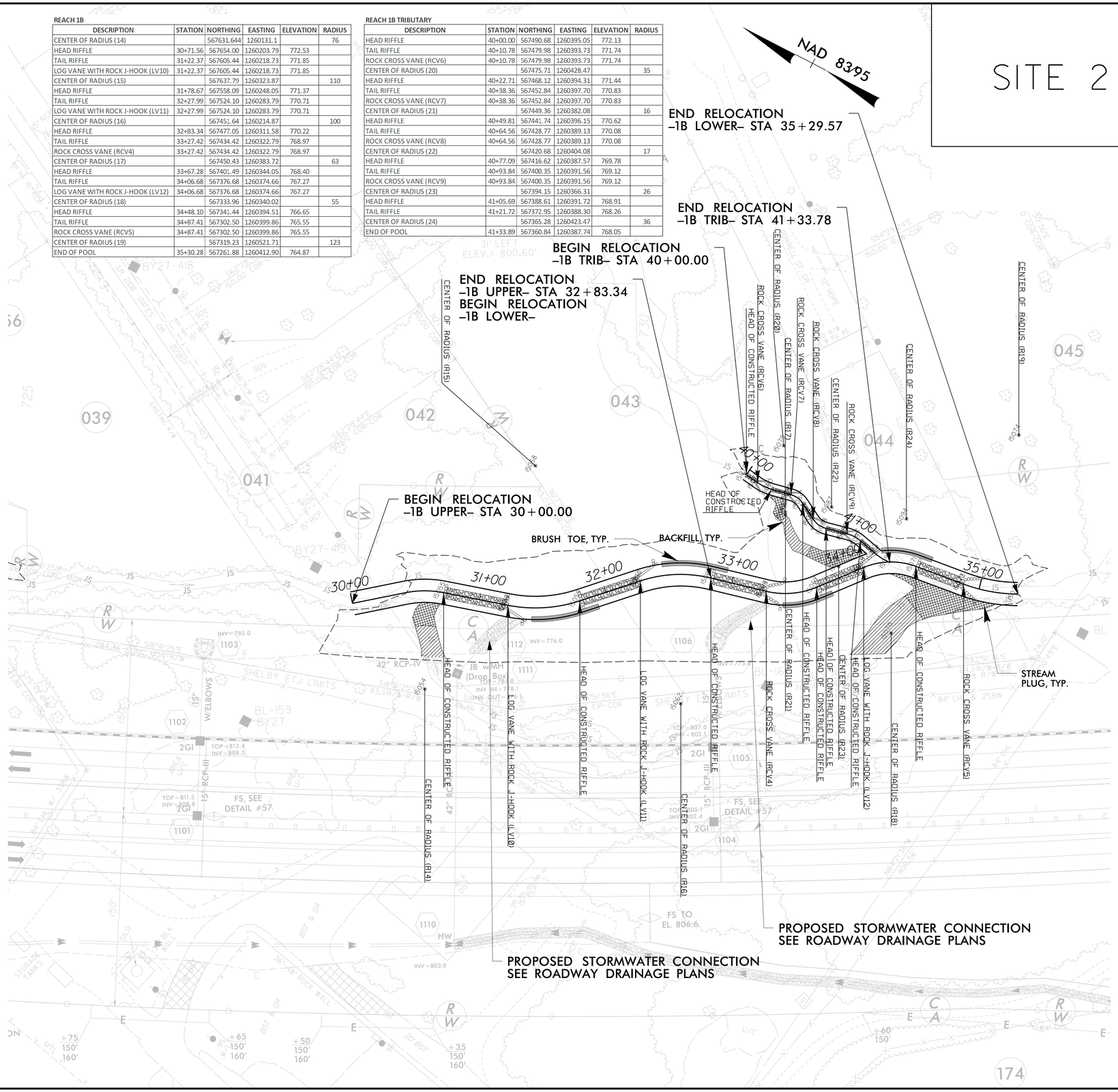
DESIGN ENGINEER
NORTH CAROLINA PROFESSIONAL SEAL 030839 ENGINEER JOSHUA B. GUIMAN
DocuSigned by: 9EC9E02F38704D8...
4/20/2023

REACH 1B

DESCRIPTION	STATION	NORTHING	EASTING	ELEVATION	RADIUS
CENTER OF RADIUS (14)		567631.644	1260131.1		76
HEAD RIFFLE	30+71.56	567654.00	1260203.79	772.53	
TAIL RIFFLE	31+22.37	567605.44	1260218.73	771.85	
LOG VANE WITH ROCK J-HOOK (LV10)	31+22.37	567605.44	1260218.73	771.85	
CENTER OF RADIUS (15)		567637.79	1260323.87		110
HEAD RIFFLE	31+78.67	567558.09	1260248.05	771.37	
TAIL RIFFLE	32+27.99	567524.10	1260283.79	770.71	
LOG VANE WITH ROCK J-HOOK (LV11)	32+27.99	567524.10	1260283.79	770.71	
CENTER OF RADIUS (16)		567451.64	1260214.87		100
HEAD RIFFLE	32+83.34	567477.05	1260311.58	770.22	
TAIL RIFFLE	33+27.42	567434.42	1260322.79	768.97	
ROCK CROSS VANE (RCV4)	33+27.42	567434.42	1260322.79	768.97	
CENTER OF RADIUS (17)		567450.43	1260383.72		63
HEAD RIFFLE	33+67.28	567401.49	1260344.05	768.40	
TAIL RIFFLE	34+06.68	567376.68	1260374.66	767.27	
LOG VANE WITH ROCK J-HOOK (LV12)	34+06.68	567376.68	1260374.66	767.27	
CENTER OF RADIUS (18)		567333.96	1260340.02		55
HEAD RIFFLE	34+48.10	567341.44	1260394.51	766.65	
TAIL RIFFLE	34+87.41	567302.50	1260399.86	765.55	
ROCK CROSS VANE (RCV5)	34+87.41	567302.50	1260399.86	765.55	
CENTER OF RADIUS (19)		567319.23	1260521.71		123
END OF POOL	35+30.28	567261.88	1260412.90	764.87	

REACH 1B TRIBUTARY

DESCRIPTION	STATION	NORTHING	EASTING	ELEVATION	RADIUS
HEAD RIFFLE	40+00.00	567490.68	1260395.05	772.13	
TAIL RIFFLE	40+10.78	567479.98	1260393.73	771.74	
ROCK CROSS VANE (RCV6)	40+10.78	567479.98	1260393.73	771.74	
CENTER OF RADIUS (20)		567475.71	1260428.47		35
HEAD RIFFLE	40+22.71	567468.12	1260394.31	771.44	
TAIL RIFFLE	40+38.36	567452.84	1260397.70	770.83	
ROCK CROSS VANE (RCV7)	40+38.36	567452.84	1260397.70	770.83	
CENTER OF RADIUS (21)		567449.36	1260382.08		16
HEAD RIFFLE	40+49.81	567441.74	1260396.15	770.62	
TAIL RIFFLE	40+64.56	567428.77	1260389.13	770.08	
ROCK CROSS VANE (RCV8)	40+64.56	567428.77	1260389.13	770.08	
CENTER OF RADIUS (22)		567420.68	1260404.08		17
HEAD RIFFLE	40+77.09	567416.62	1260387.57	769.78	
TAIL RIFFLE	40+93.84	567400.35	1260391.56	769.12	
ROCK CROSS VANE (RCV9)	40+93.84	567400.35	1260391.56	769.12	
CENTER OF RADIUS (23)		567394.15	1260366.31		26
HEAD RIFFLE	41+05.69	567388.61	1260391.72	768.91	
TAIL RIFFLE	41+21.72	567372.95	1260388.30	768.26	
CENTER OF RADIUS (24)		567365.28	1260423.47		36
END OF POOL	41+33.89	567360.84	1260387.74	768.05	



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PROJECT REFERENCE NO.	SHEET NO.
R-2707D	NS-6

DESIGN ENGINEER
NORTH CAROLINA PROFESSIONAL SEAL 030839 ENGINEER JOSHUA B. GUMAN
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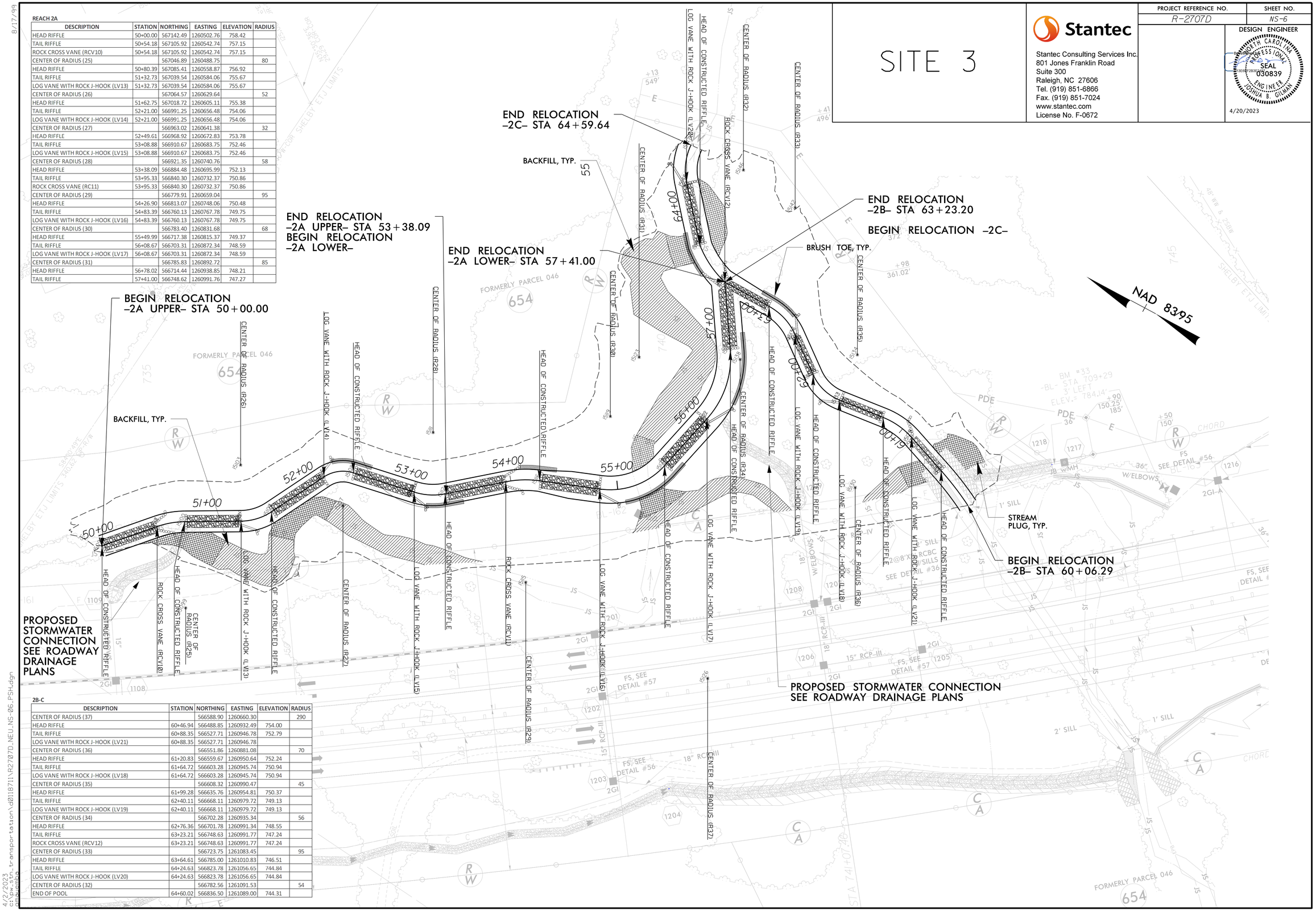
4/20/2023



REACH 2A

DESCRIPTION	STATION	NORTHING	EASTING	ELEVATION	RADIUS
HEAD RIFFLE	50+00.00	567142.49	1260502.76	758.42	
TAIL RIFFLE	50+54.18	567105.92	1260542.74	757.15	
ROCK CROSS VANE (RCV10)	50+54.18	567105.92	1260542.74	757.15	
CENTER OF RADIUS (25)		567046.89	1260488.75		80
HEAD RIFFLE	50+80.39	567085.41	1260558.87	756.92	
TAIL RIFFLE	51+32.73	567039.54	1260584.06	755.67	
LOG VANE WITH ROCK J-HOOK (LV13)	51+32.73	567039.54	1260584.06	755.67	
CENTER OF RADIUS (26)		567064.57	1260629.64		52
HEAD RIFFLE	51+62.75	567018.72	1260605.11	755.38	
TAIL RIFFLE	52+21.00	566991.25	1260656.48	754.06	
LOG VANE WITH ROCK J-HOOK (LV14)	52+21.00	566991.25	1260656.48	754.06	
CENTER OF RADIUS (27)		566963.02	1260641.38		32
HEAD RIFFLE	52+49.61	566968.92	1260672.83	753.78	
TAIL RIFFLE	53+08.88	566910.67	1260683.75	752.46	
LOG VANE WITH ROCK J-HOOK (LV15)	53+08.88	566910.67	1260683.75	752.46	
CENTER OF RADIUS (28)		566921.35	1260740.76		58
HEAD RIFFLE	53+38.09	566884.48	1260695.99	752.13	
TAIL RIFFLE	53+95.33	566840.30	1260732.37	750.86	
ROCK CROSS VANE (RC11)	53+95.33	566840.30	1260732.37	750.86	
CENTER OF RADIUS (29)		566779.91	1260659.04		95
HEAD RIFFLE	54+26.90	566813.07	1260748.06	750.48	
TAIL RIFFLE	54+83.39	566760.13	1260767.78	749.75	
LOG VANE WITH ROCK J-HOOK (LV16)	54+83.39	566760.13	1260767.78	749.75	
CENTER OF RADIUS (30)		566783.40	1260831.68		68
HEAD RIFFLE	55+49.99	566717.38	1260815.37	749.37	
TAIL RIFFLE	56+08.67	566703.31	1260872.34	748.59	
LOG VANE WITH ROCK J-HOOK (LV17)	56+08.67	566703.31	1260872.34	748.59	
CENTER OF RADIUS (31)		566785.83	1260892.72		85
HEAD RIFFLE	56+78.02	566714.44	1260938.85	748.21	
TAIL RIFFLE	57+41.00	566748.62	1260991.76	747.27	

2B-C

DESCRIPTION	STATION	NORTHING	EASTING	ELEVATION	RADIUS
CENTER OF RADIUS (37)		566588.90	1260660.30		290
HEAD RIFFLE	60+46.94	566488.85	1260932.49	754.00	
TAIL RIFFLE	60+88.35	566527.71	1260946.78	752.79	
LOG VANE WITH ROCK J-HOOK (LV21)	60+88.35	566527.71	1260946.78		
CENTER OF RADIUS (36)		566551.86	1260881.08		70
HEAD RIFFLE	61+20.83	566559.67	1260950.64	752.24	
TAIL RIFFLE	61+64.72	566603.28	1260945.74	750.94	
LOG VANE WITH ROCK J-HOOK (LV18)	61+64.72	566603.28	1260945.74	750.94	
CENTER OF RADIUS (35)		566608.32	1260990.47		45
HEAD RIFFLE	61+99.28	566635.76	1260954.81	750.37	
TAIL RIFFLE	62+40.11	566668.11	1260979.72	749.13	
LOG VANE WITH ROCK J-HOOK (LV19)	62+40.11	566668.11	1260979.72	749.13	
CENTER OF RADIUS (34)		566702.28	1260935.34		56
HEAD RIFFLE	62+76.36	566701.78	1260991.34	748.55	
TAIL RIFFLE	63+23.21	566748.63	1260991.77	747.24	
ROCK CROSS VANE (RCV12)	63+23.21	566748.63	1260991.77	747.24	
CENTER OF RADIUS (33)		566723.75	1261083.45		95
HEAD RIFFLE	63+64.61	566785.00	1261010.83	746.51	
TAIL RIFFLE	64+24.63	566823.78	1261056.65	744.84	
LOG VANE WITH ROCK J-HOOK (LV20)	64+24.63	566823.78	1261056.65	744.84	
CENTER OF RADIUS (32)		566782.56	1261091.53		54
END OF POOL	64+60.02	566836.50	1261089.00	744.31	

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SITE 1 PROFILES

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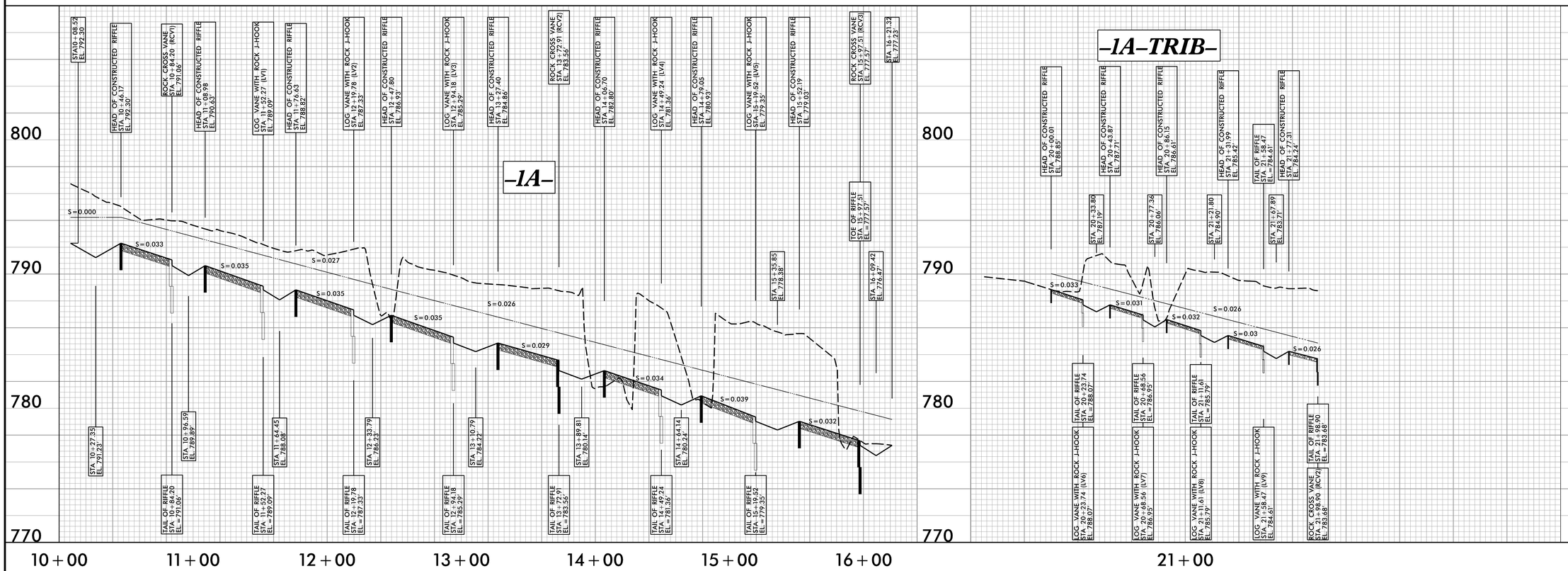
PROJECT REFERENCE NO.	SHEET NO.
R-2707D	NS-7

DESIGN ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 030839 ENGINEER JOSHUA B. GUMAN

4/20/2023



LEGEND

EXISTING GROUND ELEVATION

PROPOSED GROUND ELEVATION

PROPOSED BANKFULL

ROCK CROSS VANE

CONSTRUCTED RIFFLE

LOG VANE WITH ROCK J-HOOK

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SITE 2 PROFILES

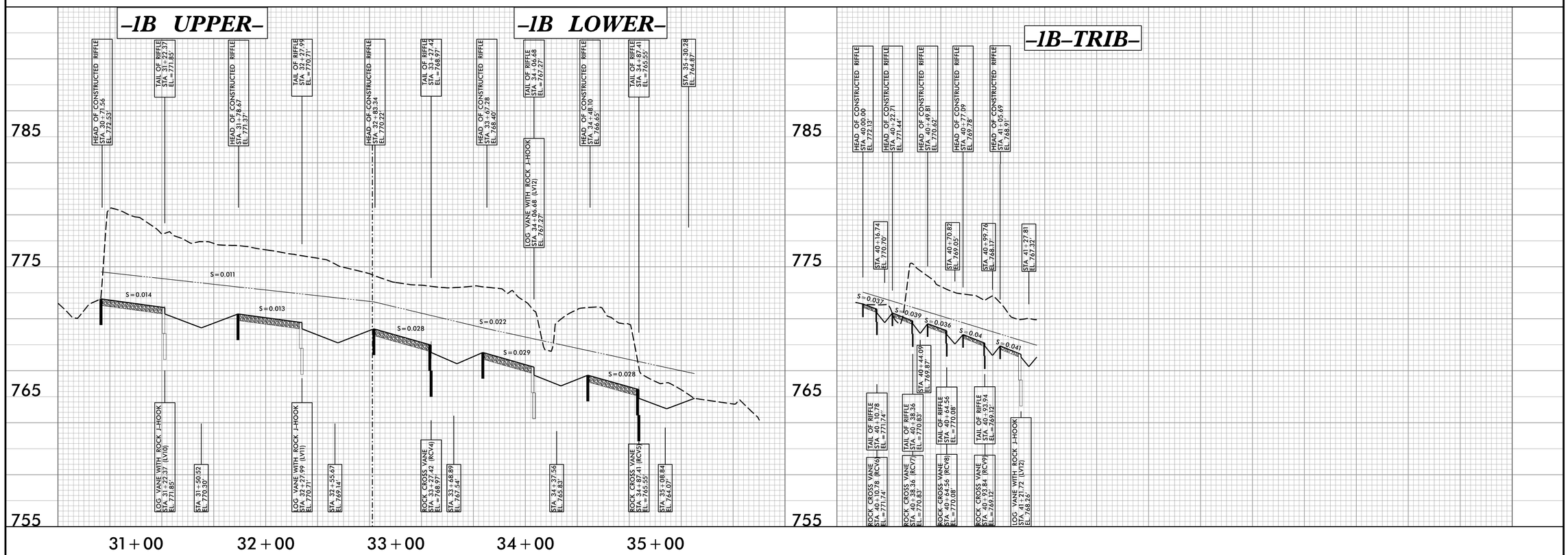
Stantec
Stantec Consulting Services Inc.
801 Jones Franklin Road
Suite 300
Raleigh, NC 27606
Tel. (919) 851-6866
Fax. (919) 851-7024
www.stantec.com
License No. F-0672

PROJECT REFERENCE NO.	SHEET NO.
R-2707D	NS-8

DESIGN ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 030839 ENGINEER JOSHUA B. GUMAN

4/20/2023



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SITE 3
PROFILE

Stantec
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801 Jones Franklin Road
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PROJECT REFERENCE NO.	SHEET NO.
R-2707D	NS-9

DESIGN ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 030839 ENGINEER JOSHUA B. GUMAN

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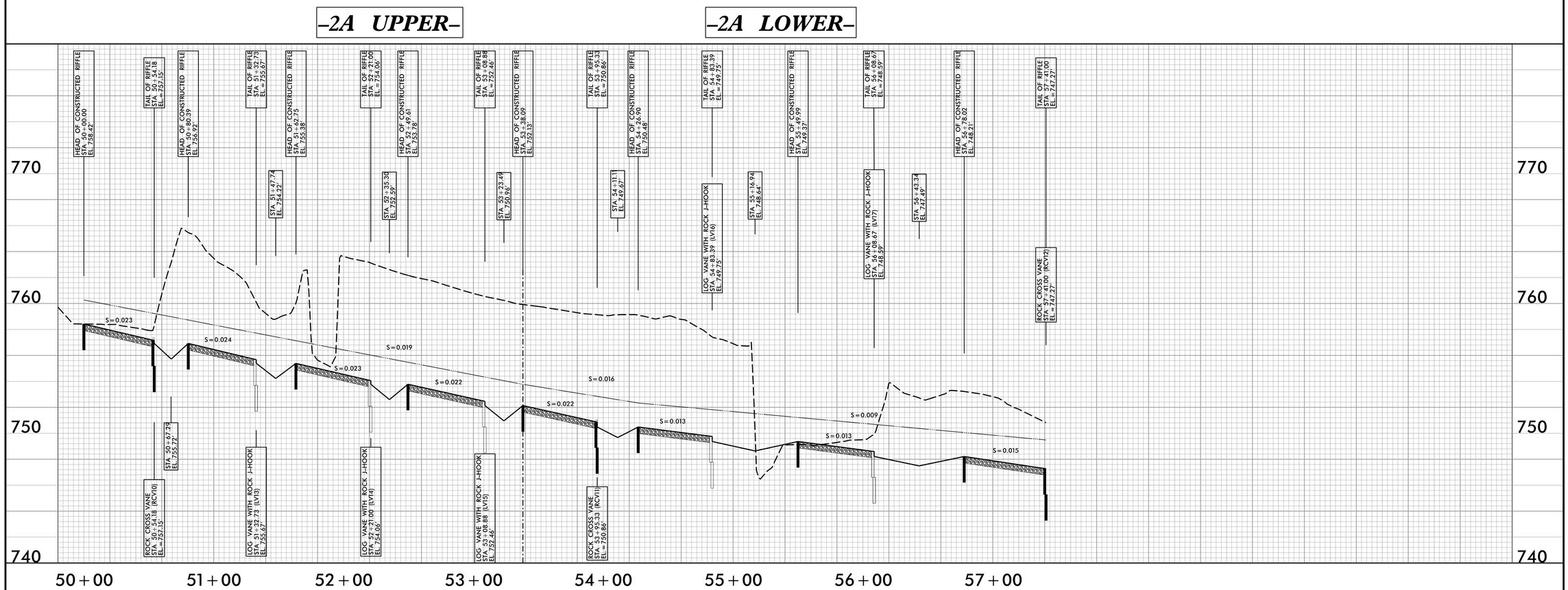

LEGEND

EXISTING GROUND ELEVATION

PROPOSED GROUND ELEVATION

PROPOSED BANKFULL

ROCK CROSS VANE

CONSTRUCTED RIFFLE

LOG VANE WITH ROCK J-HOOK

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SITE 3 PROFILES

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PROJECT REFERENCE NO.	SHEET NO.
R-2707D	NS-10

DESIGN ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 030839 ENGINEER JOSHUA B. GUMAN

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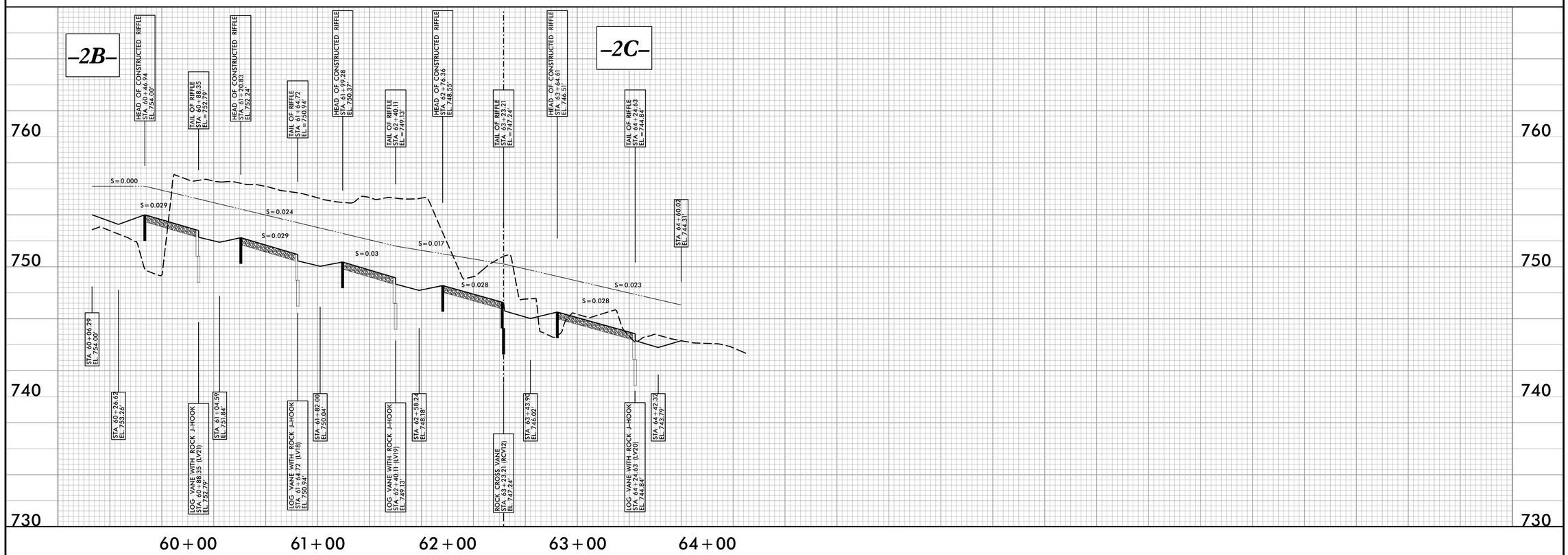

LEGEND

EXISTING GROUND ELEVATION

PROPOSED GROUND ELEVATION

PROPOSED BANKFULL

ROCK CROSS VANE

CONSTRUCTED RIFFLE

LOG VANE WITH ROCK J-HOOK

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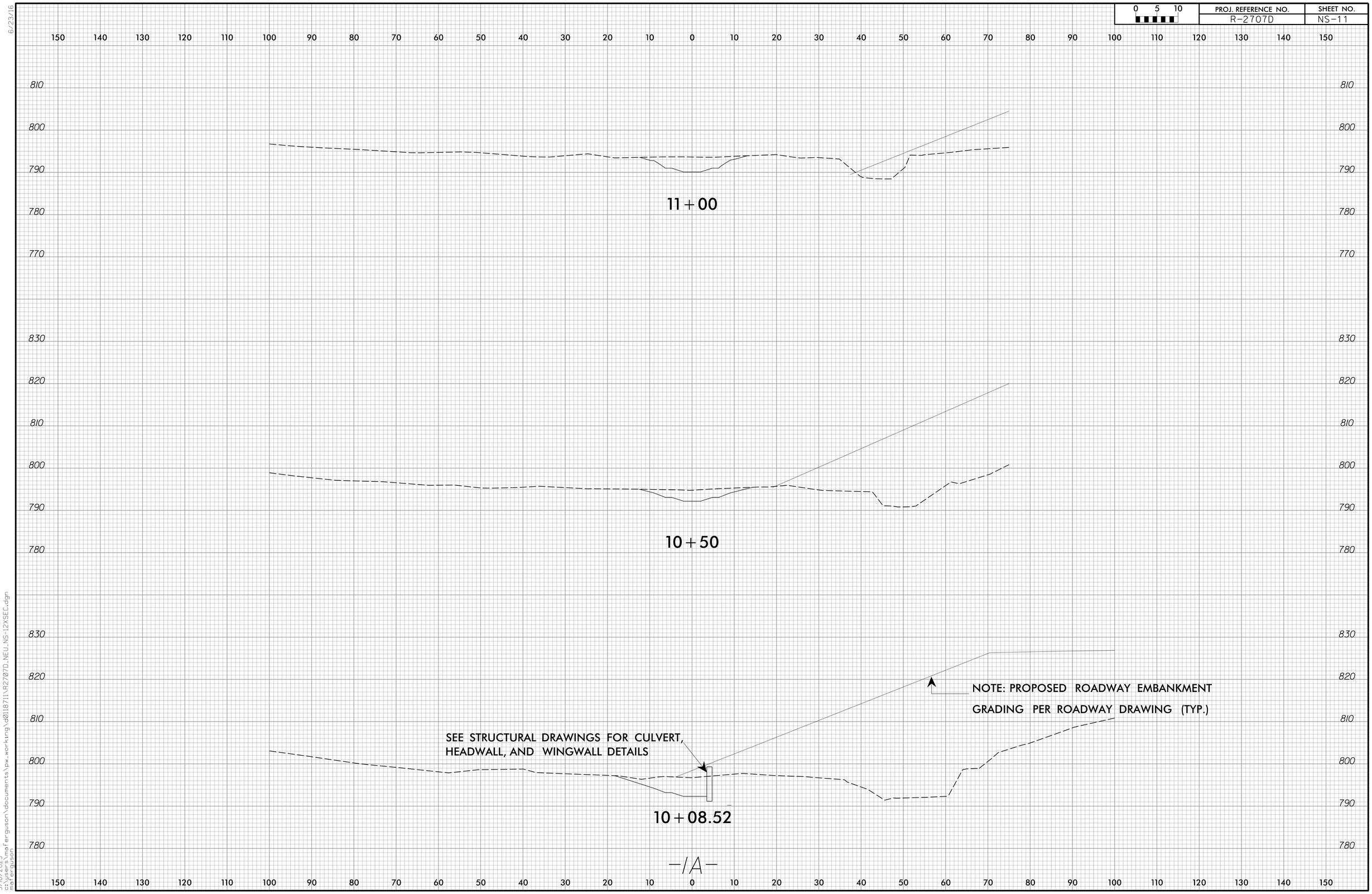

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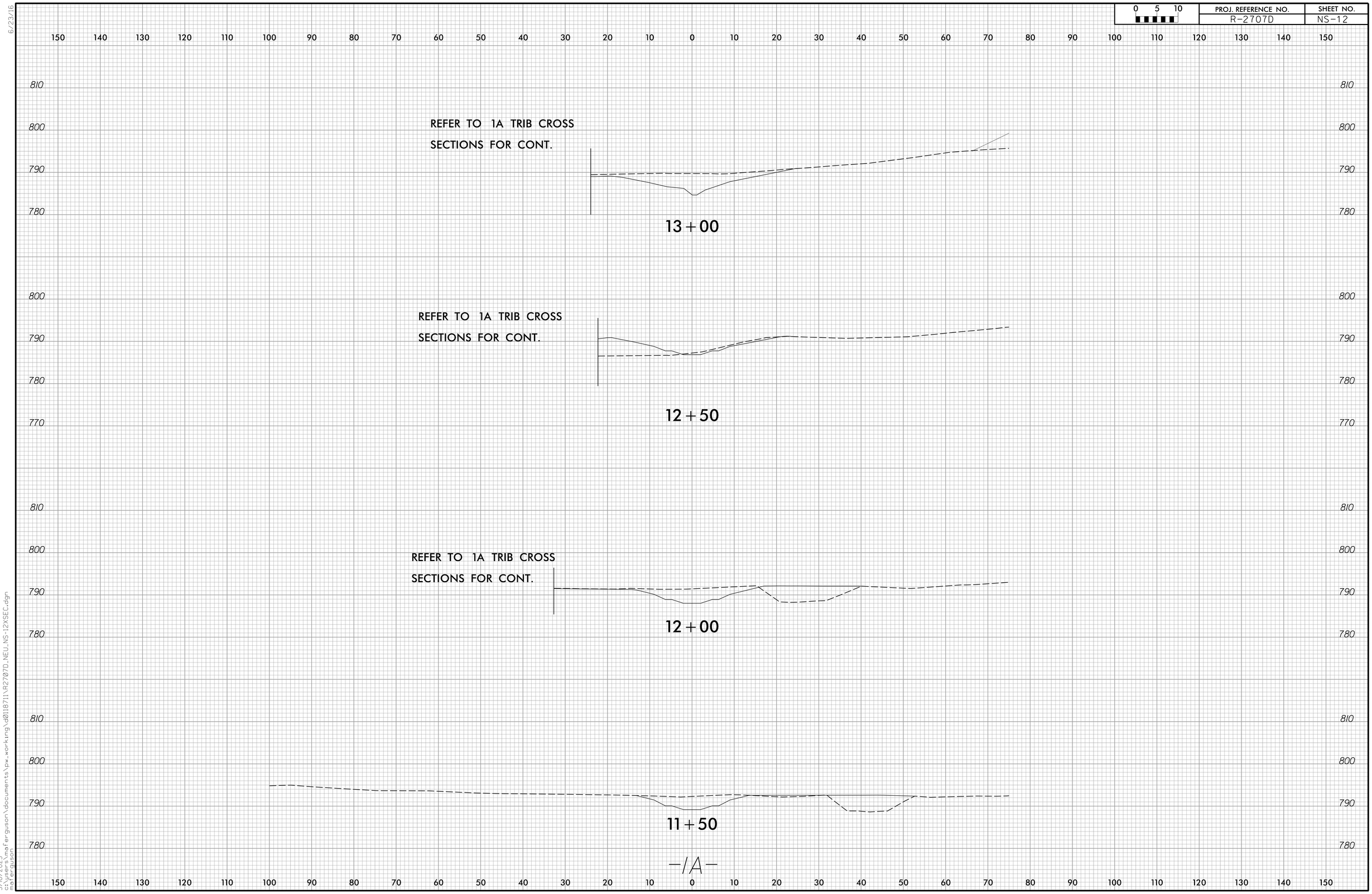

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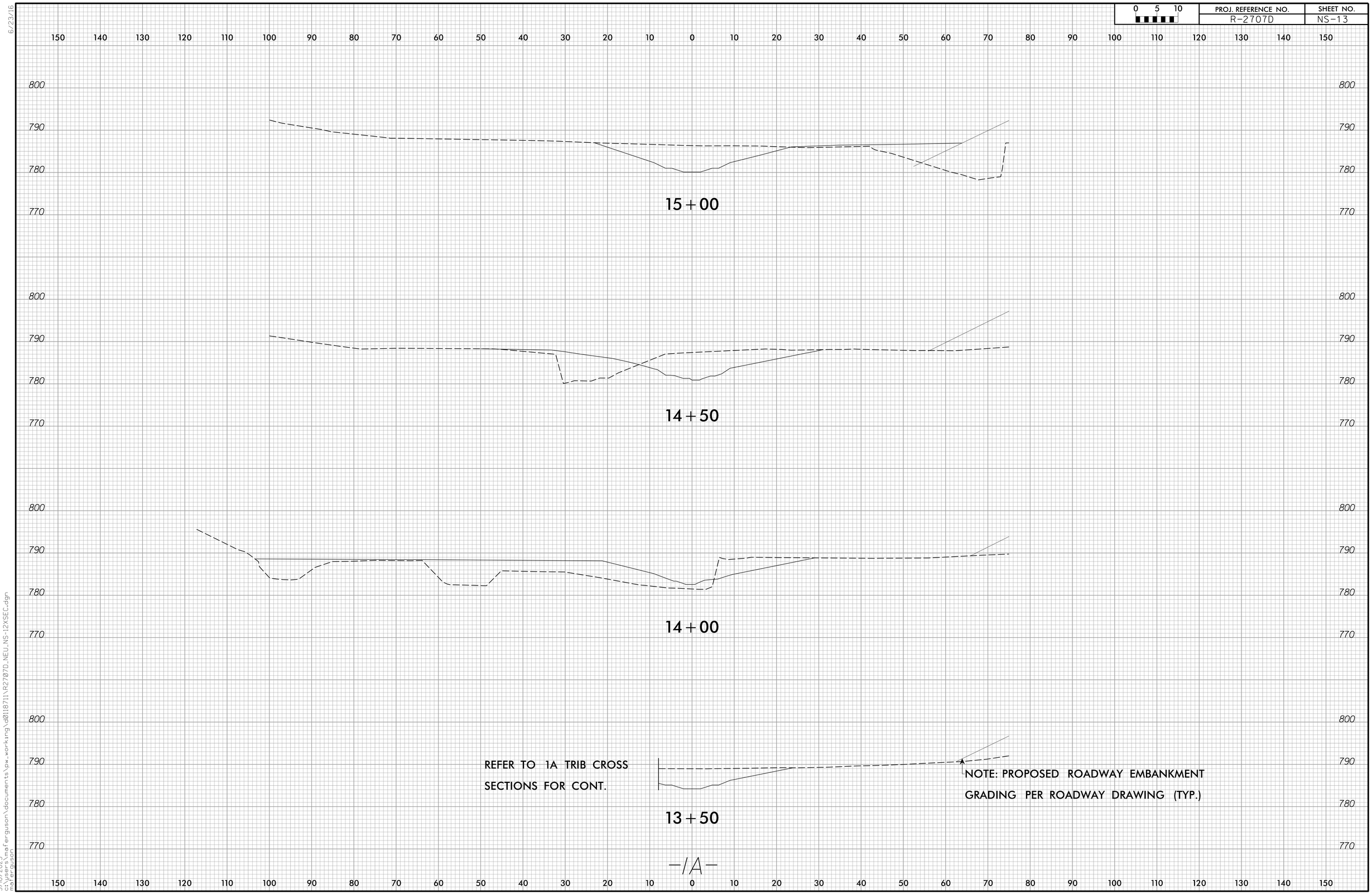

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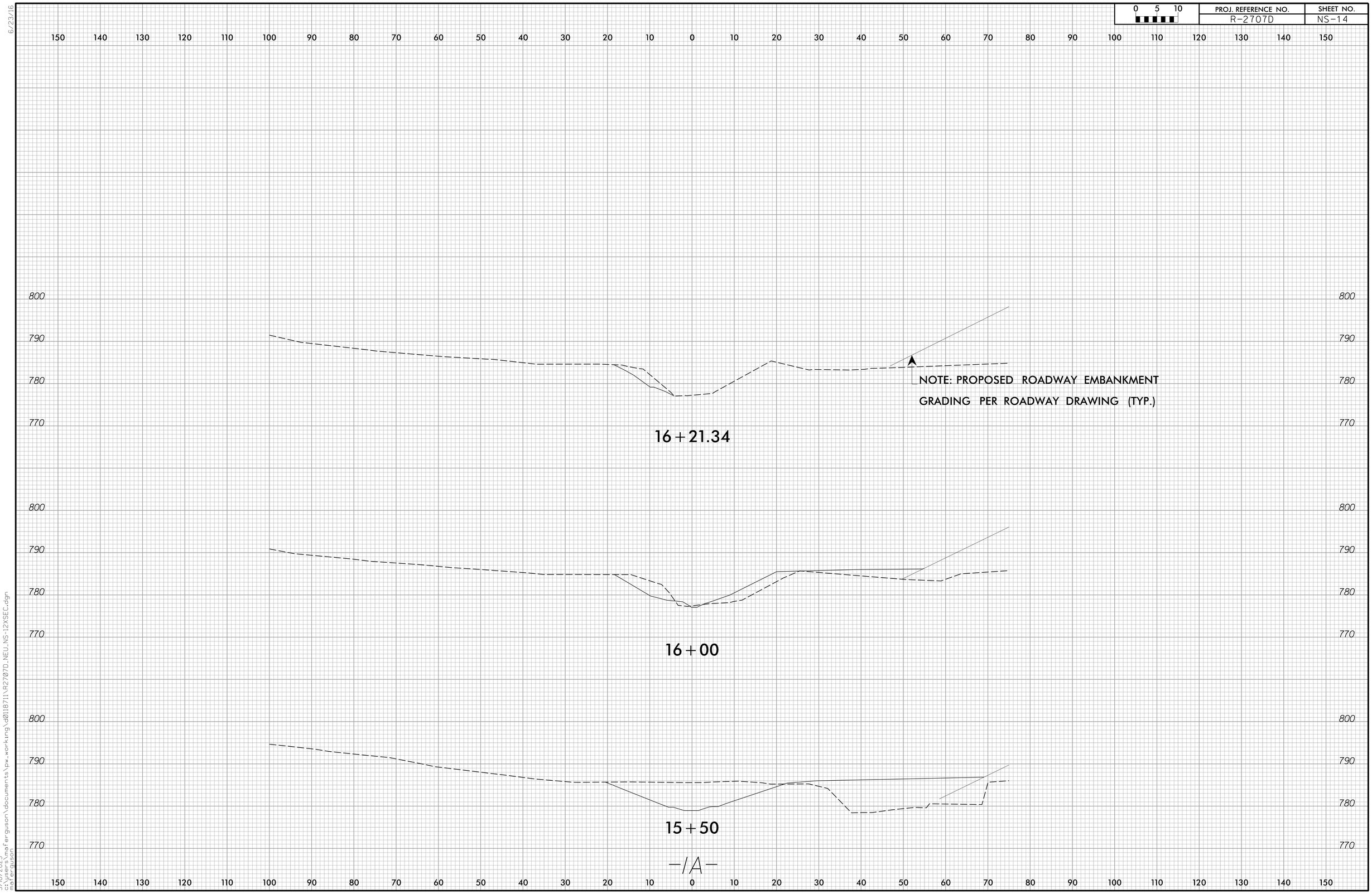

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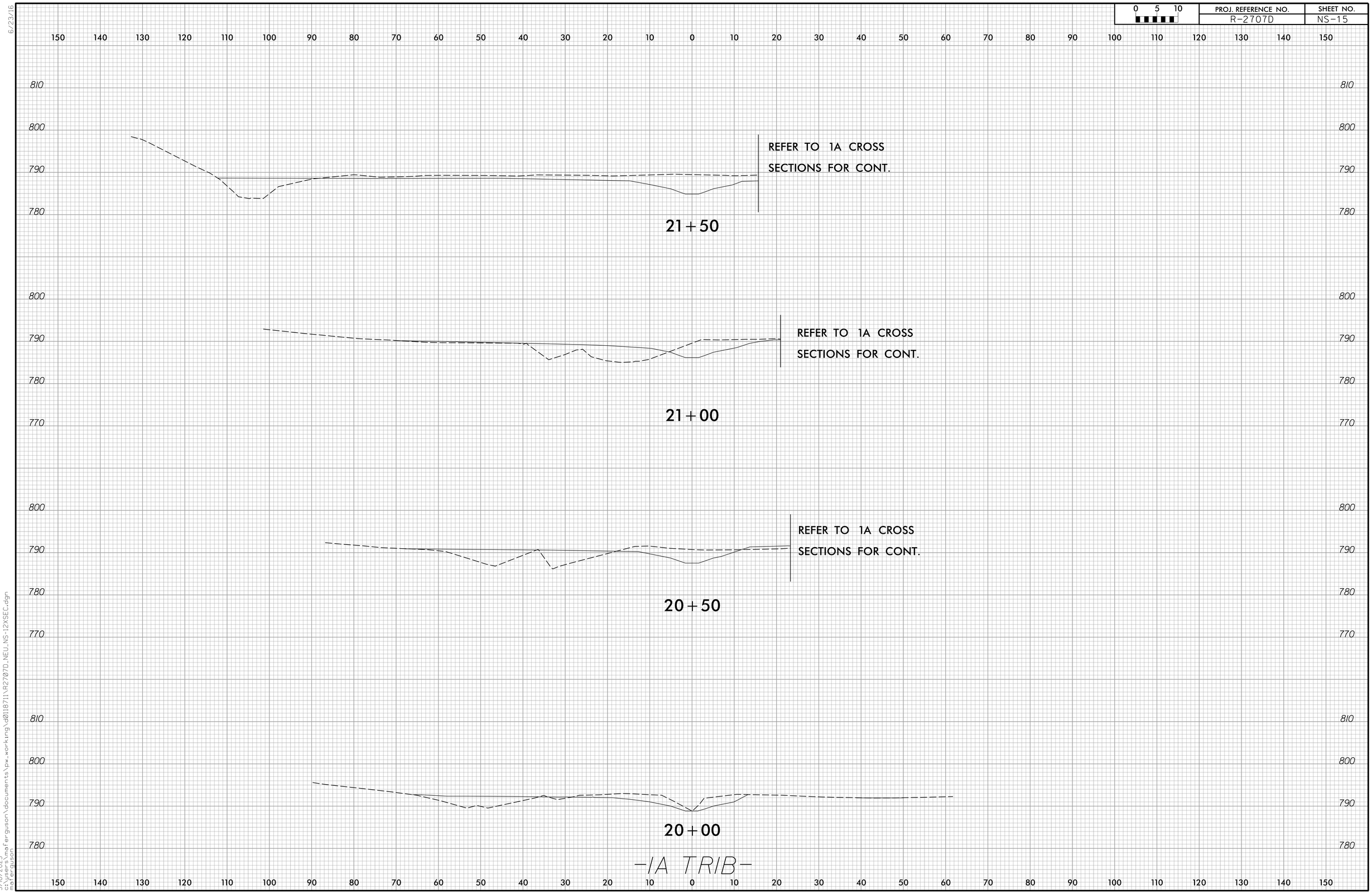

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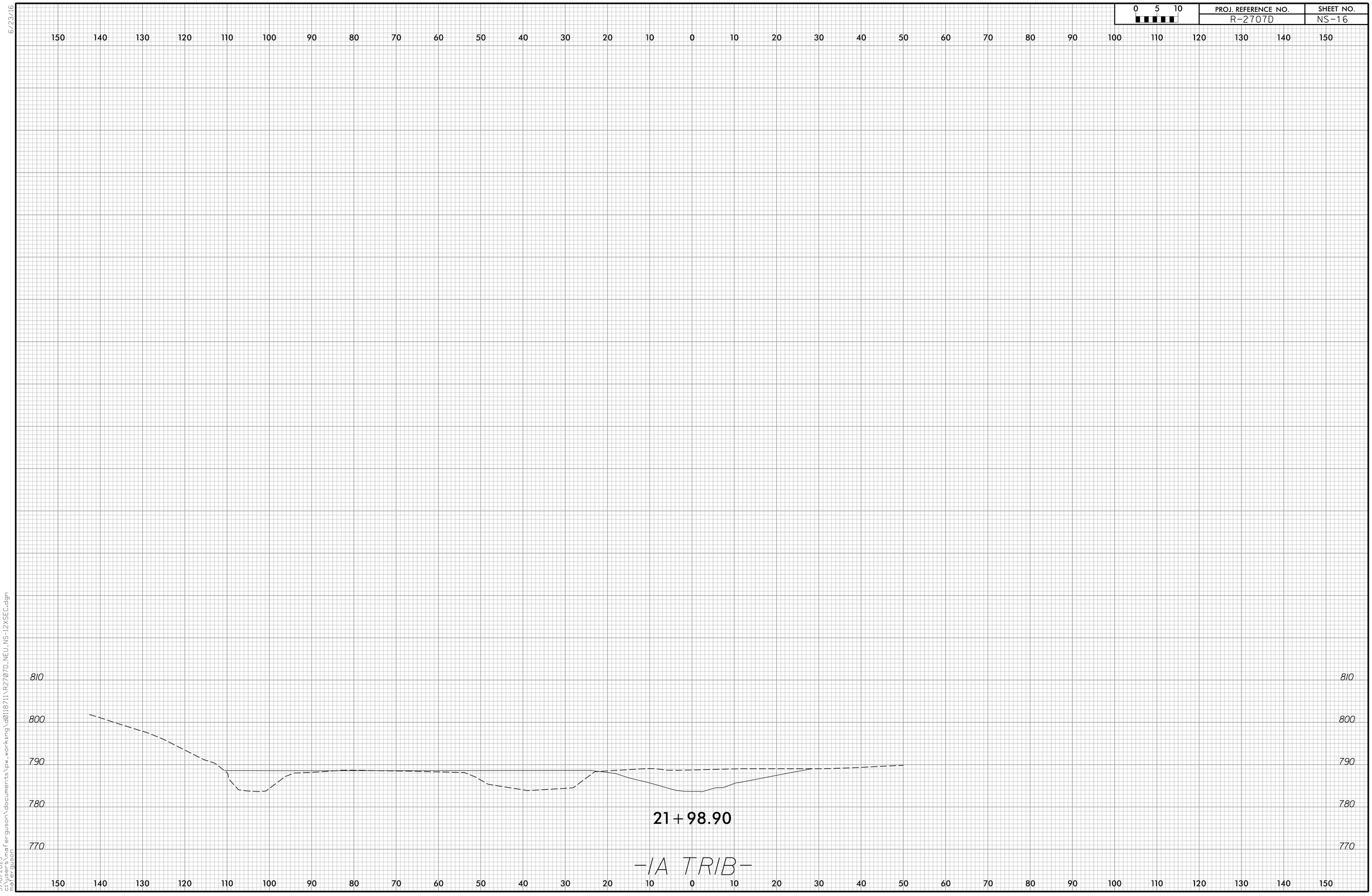

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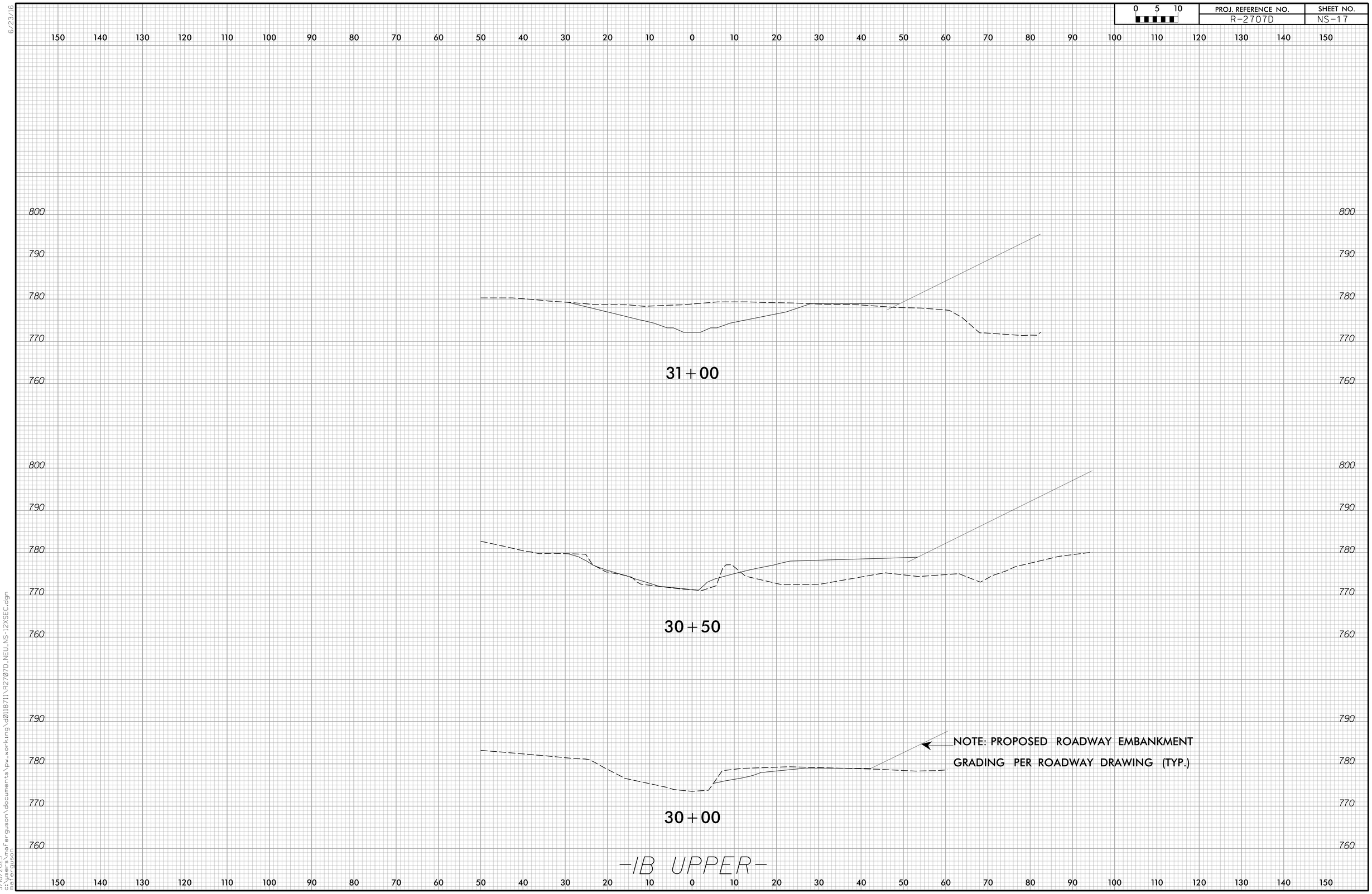

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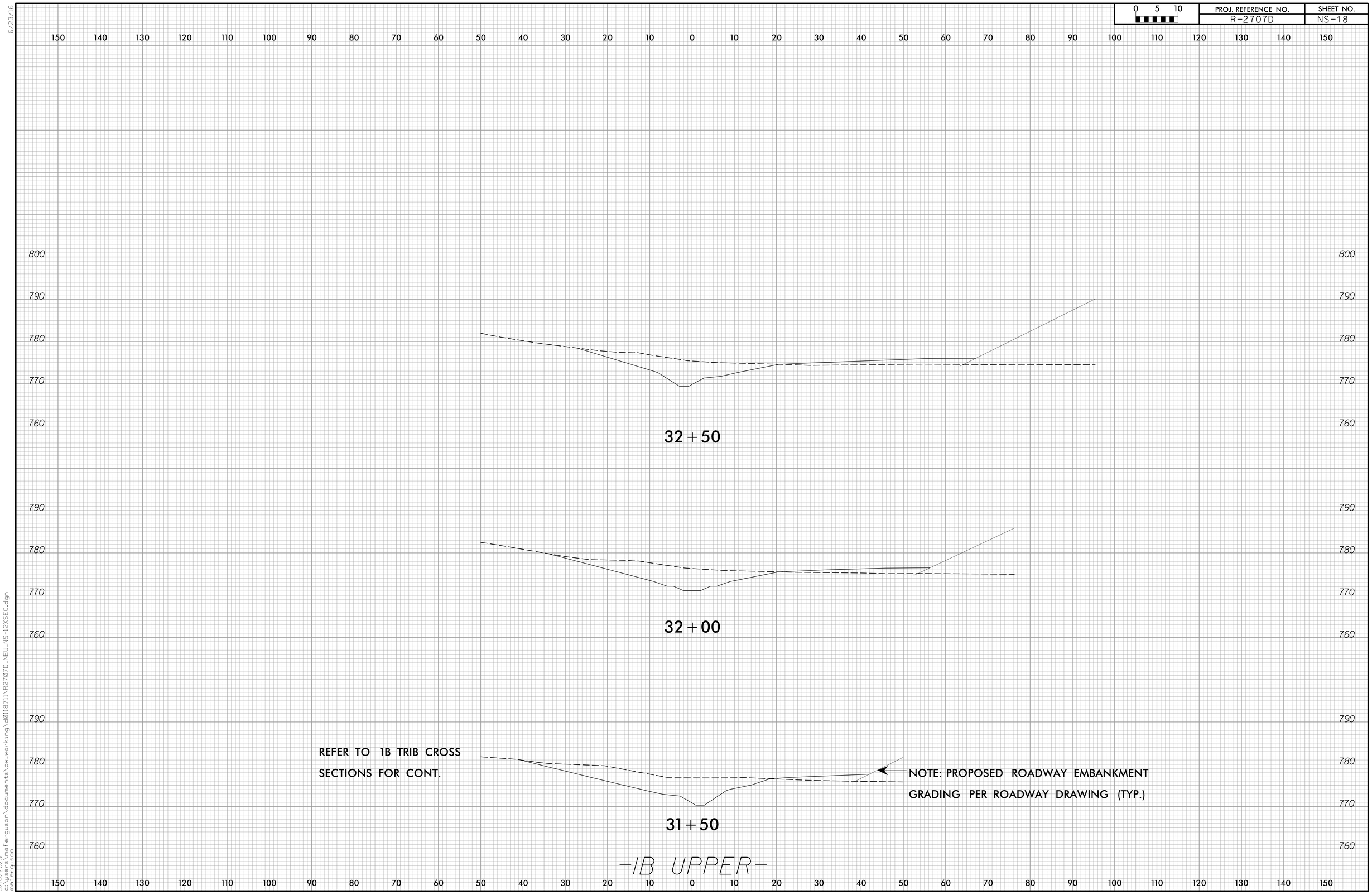

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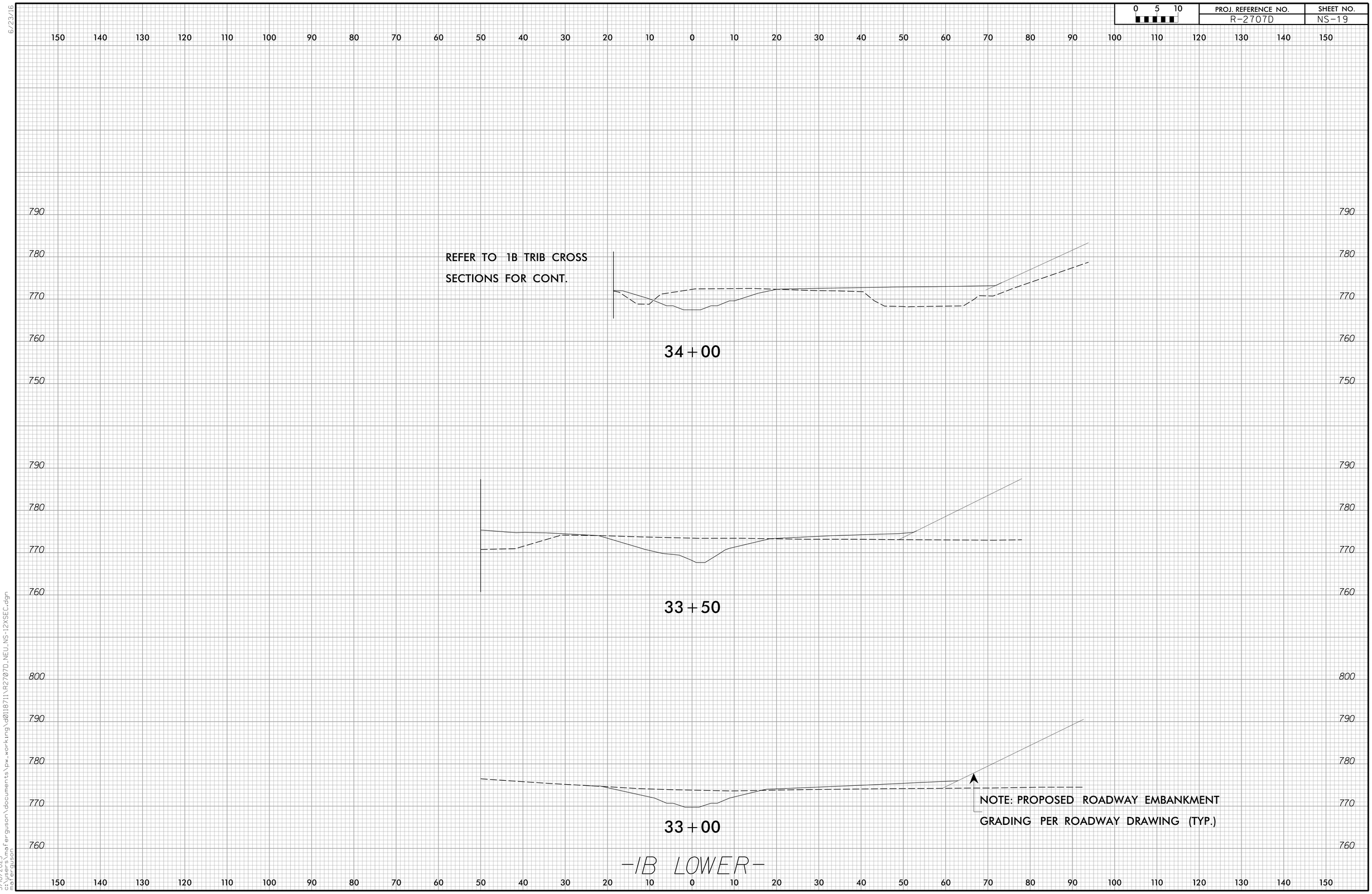

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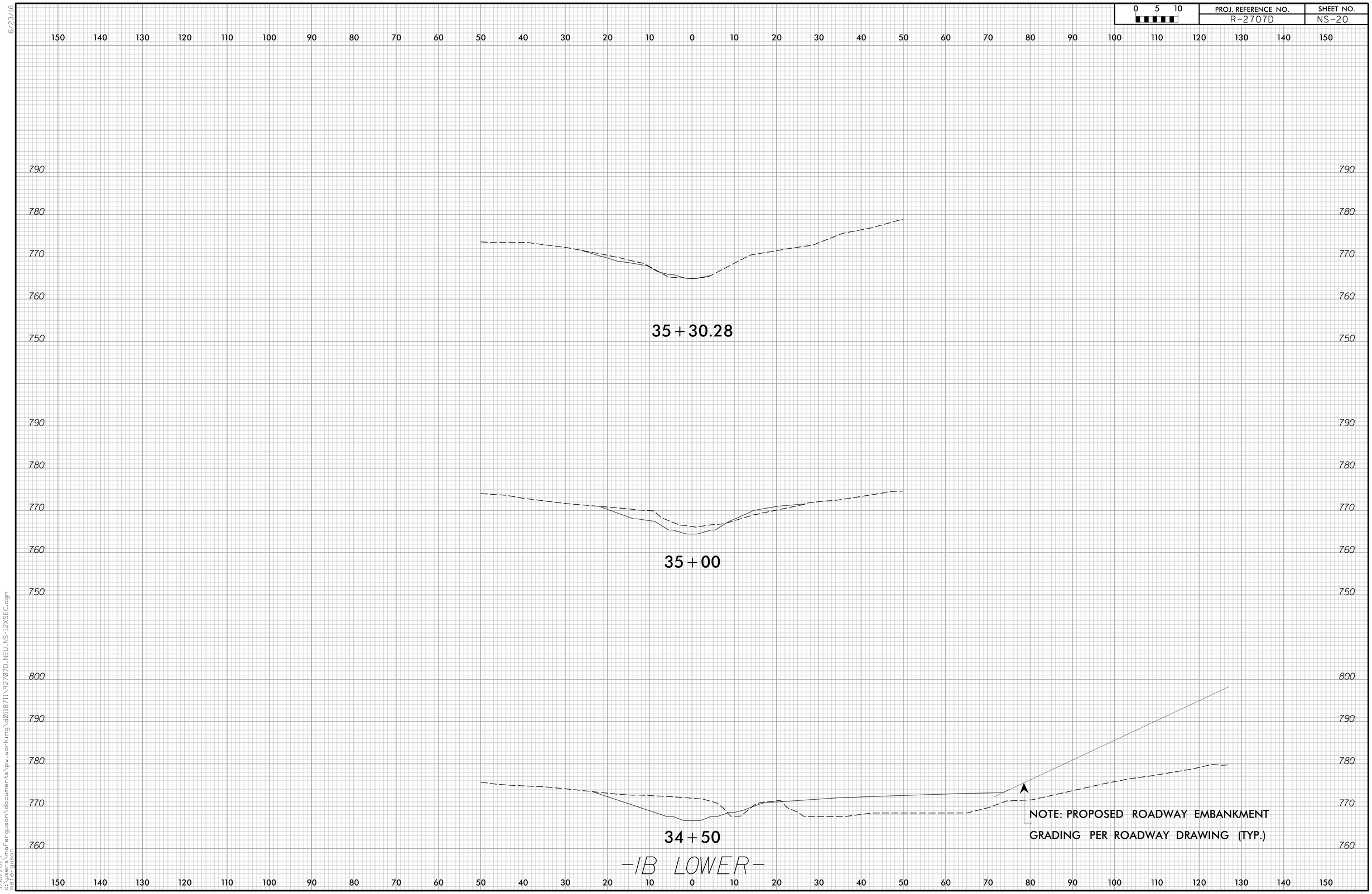

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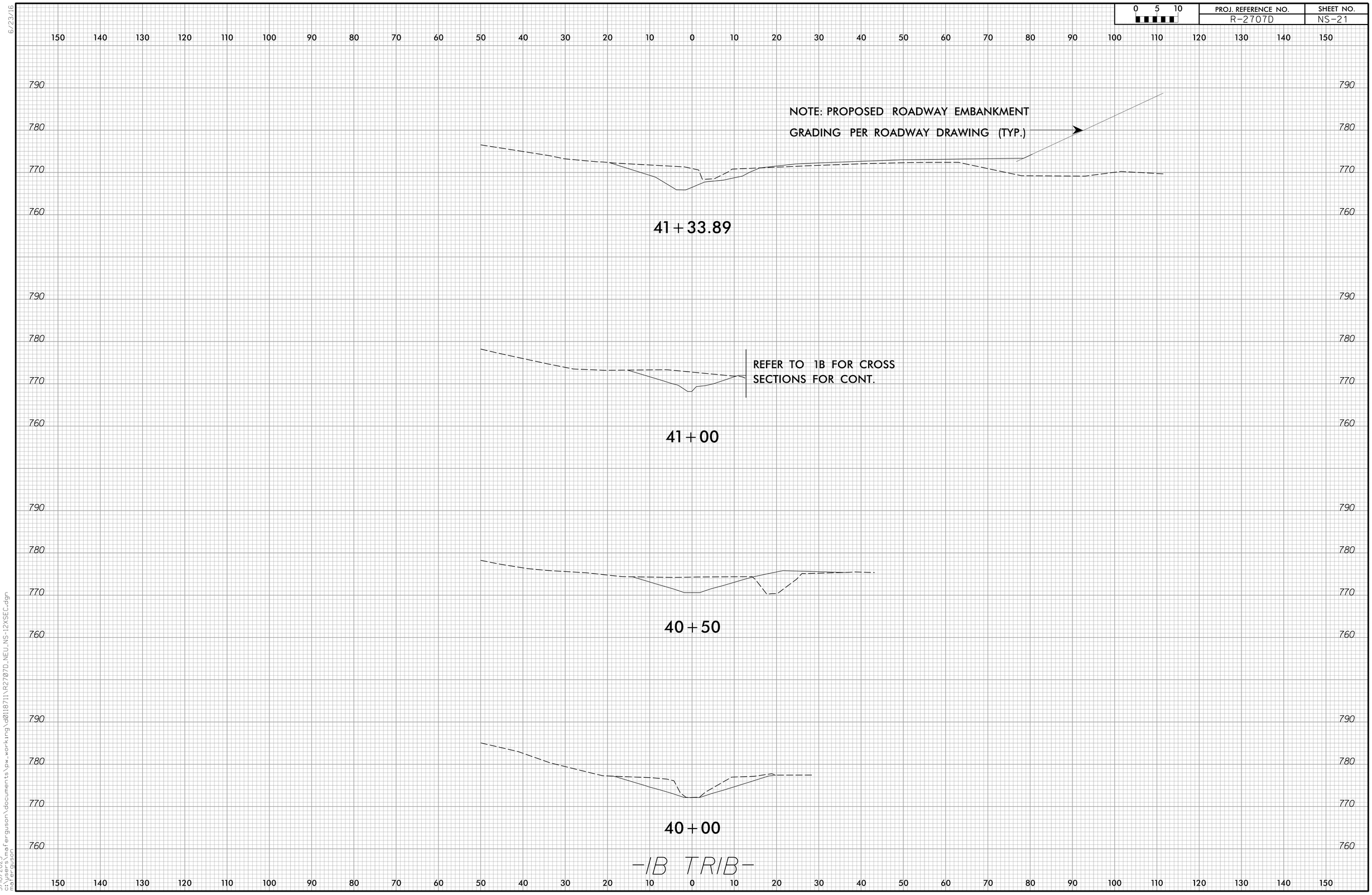

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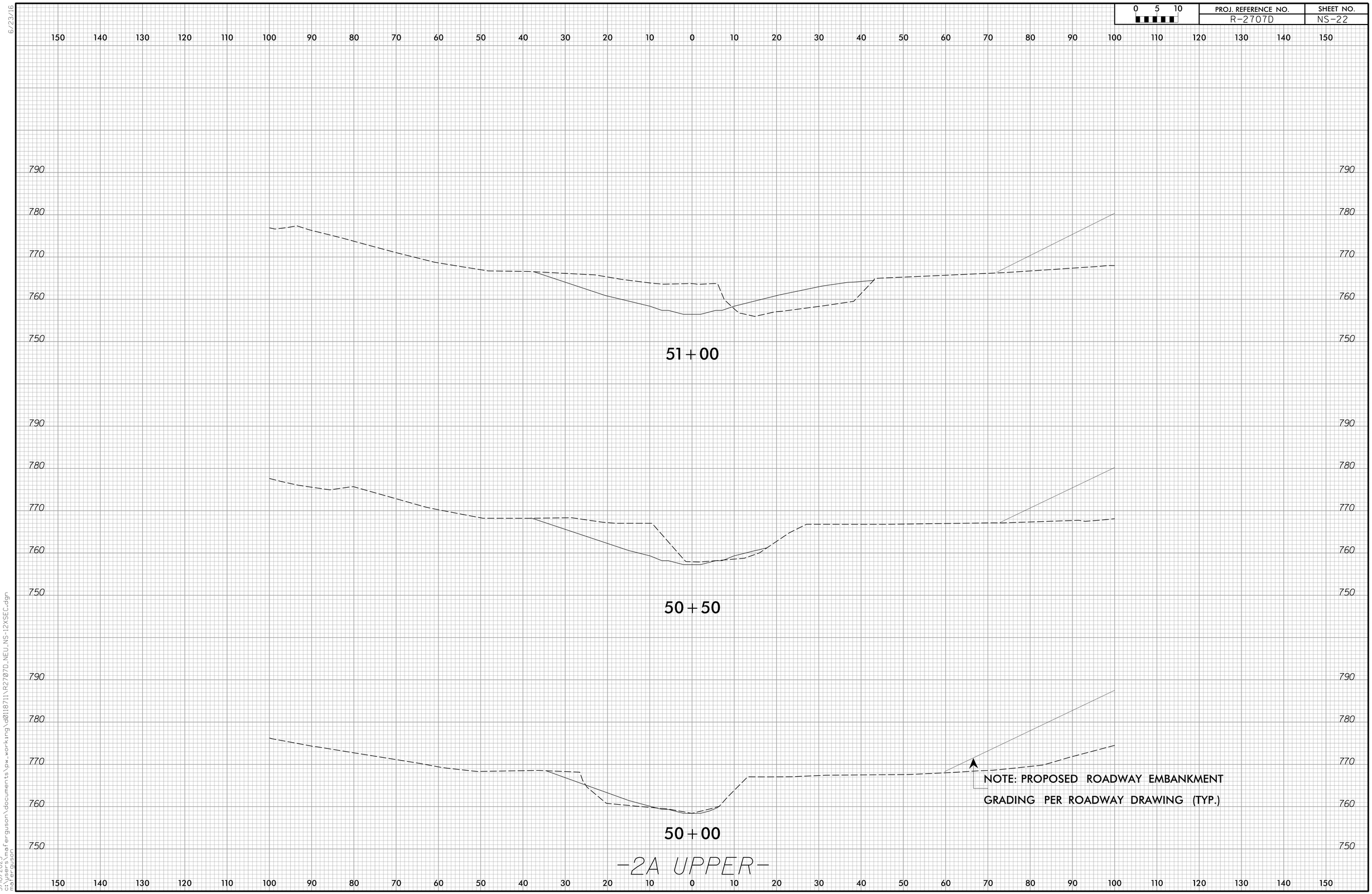

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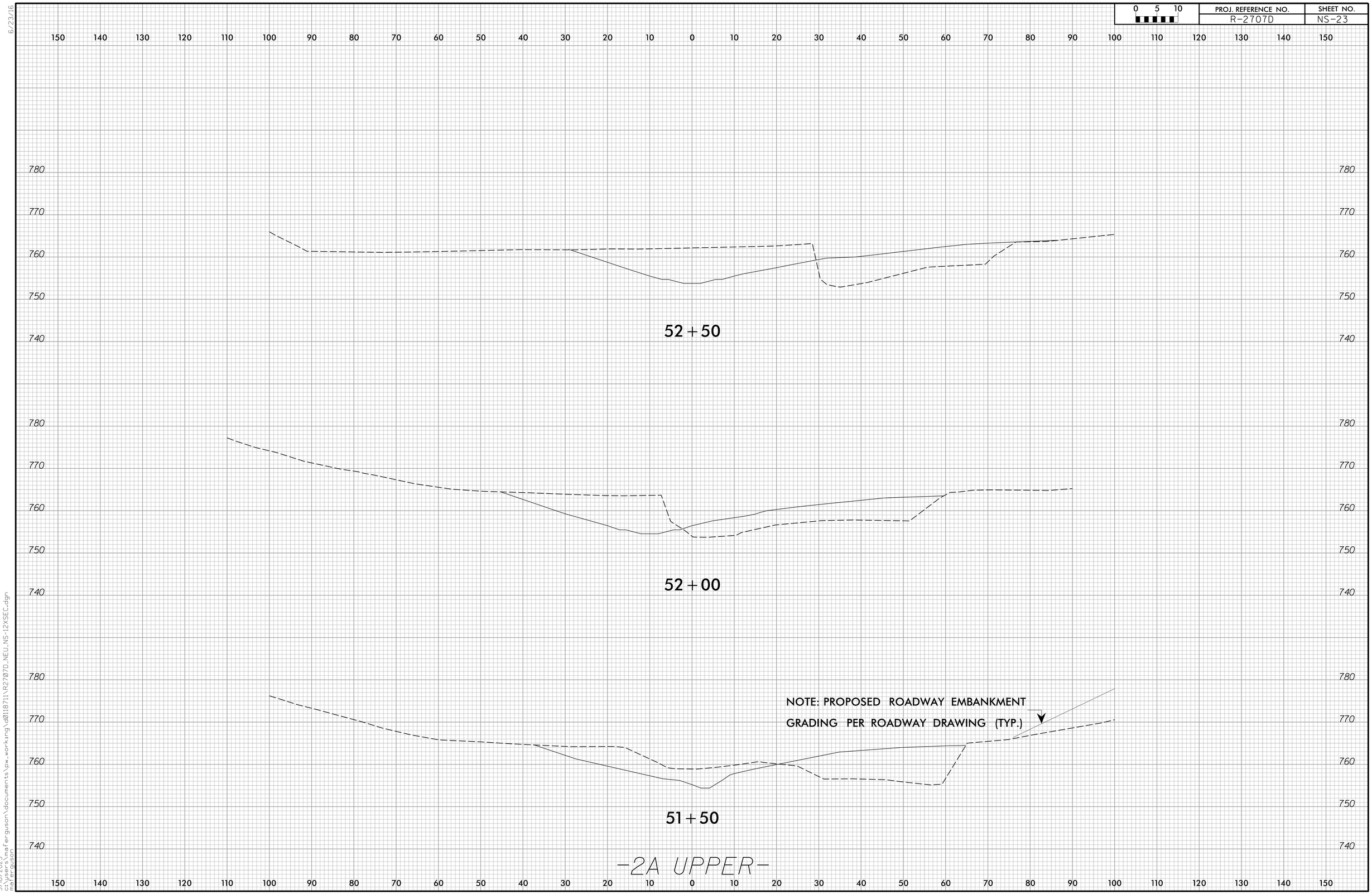

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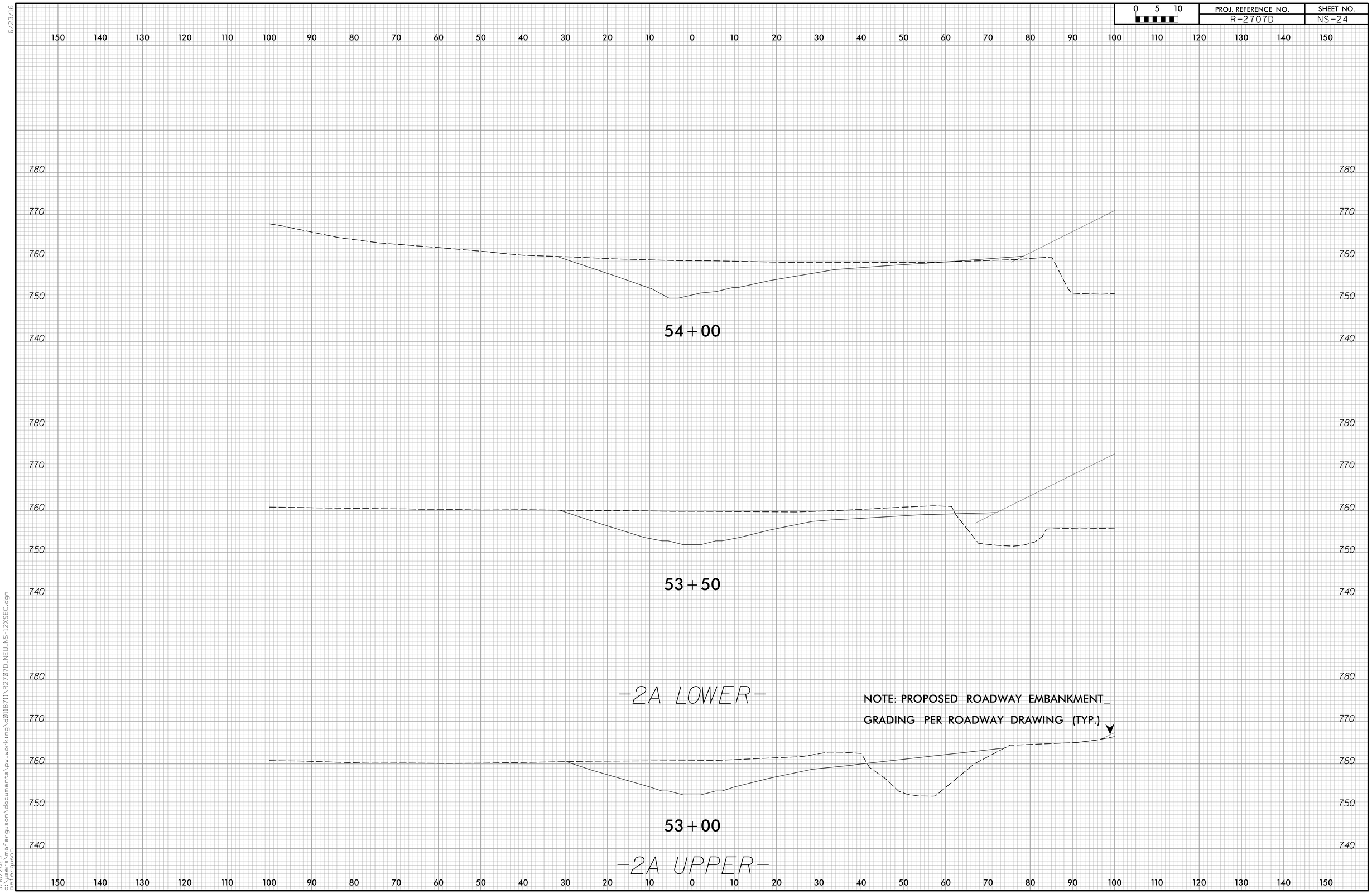

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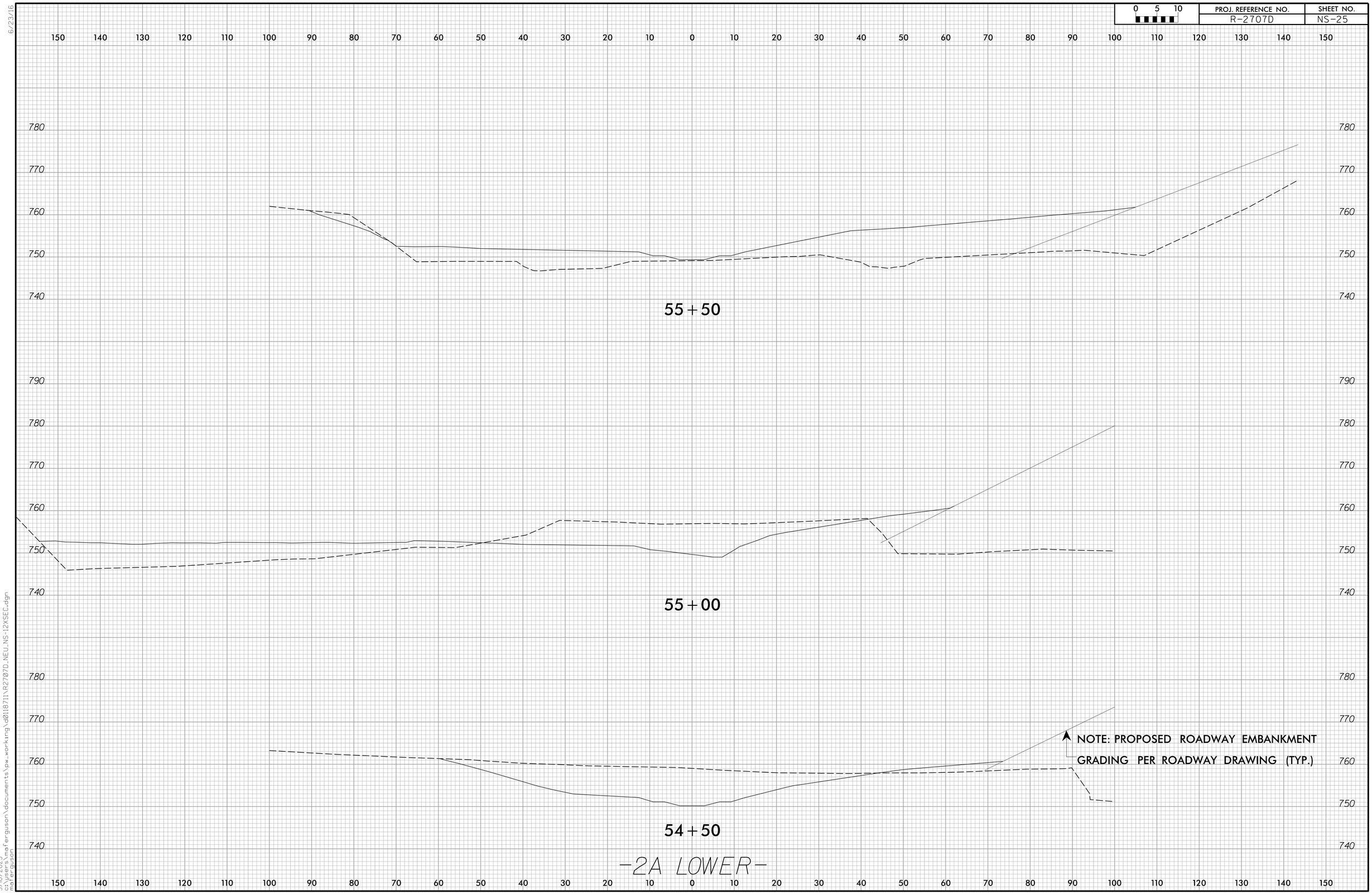

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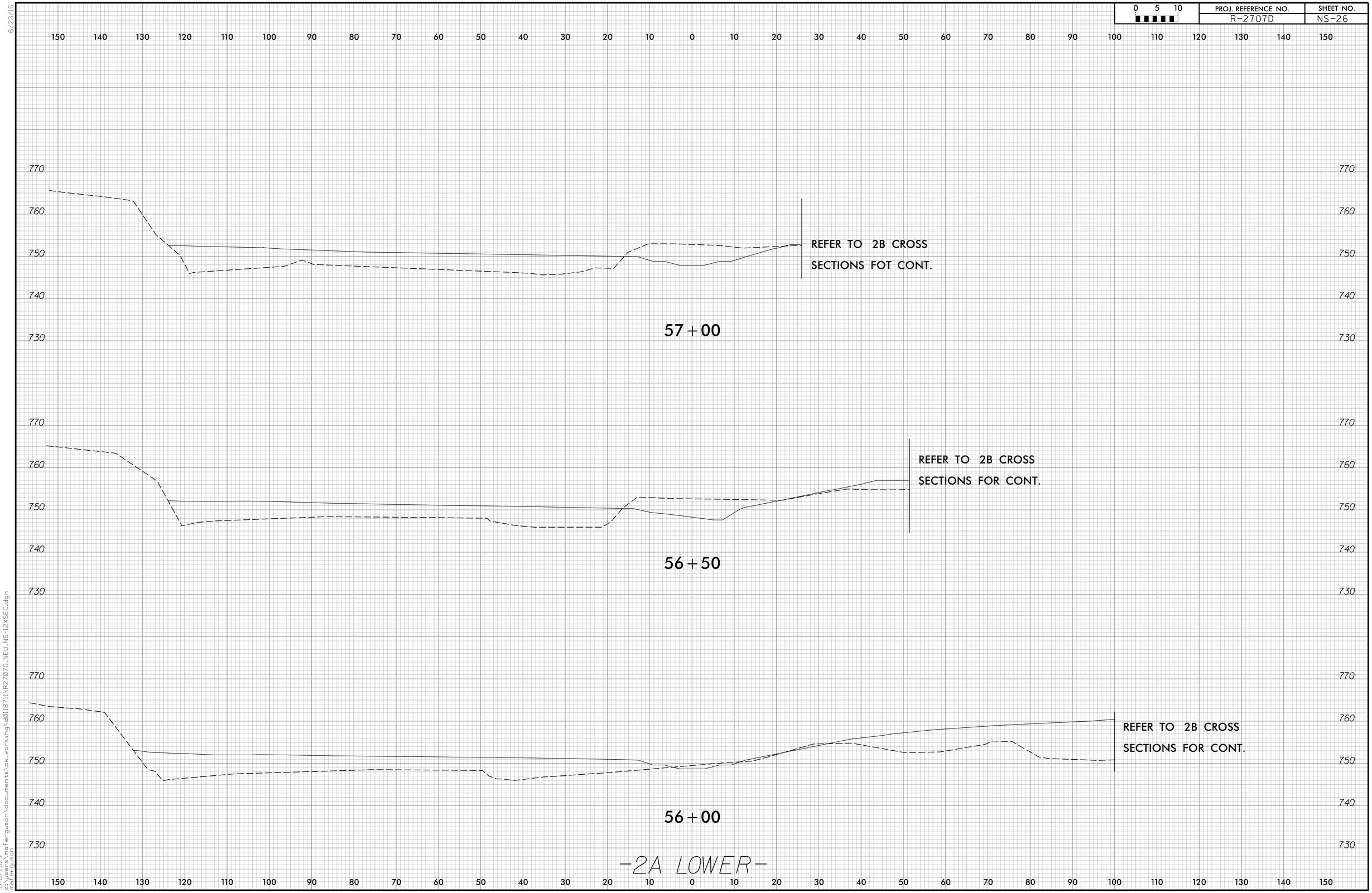

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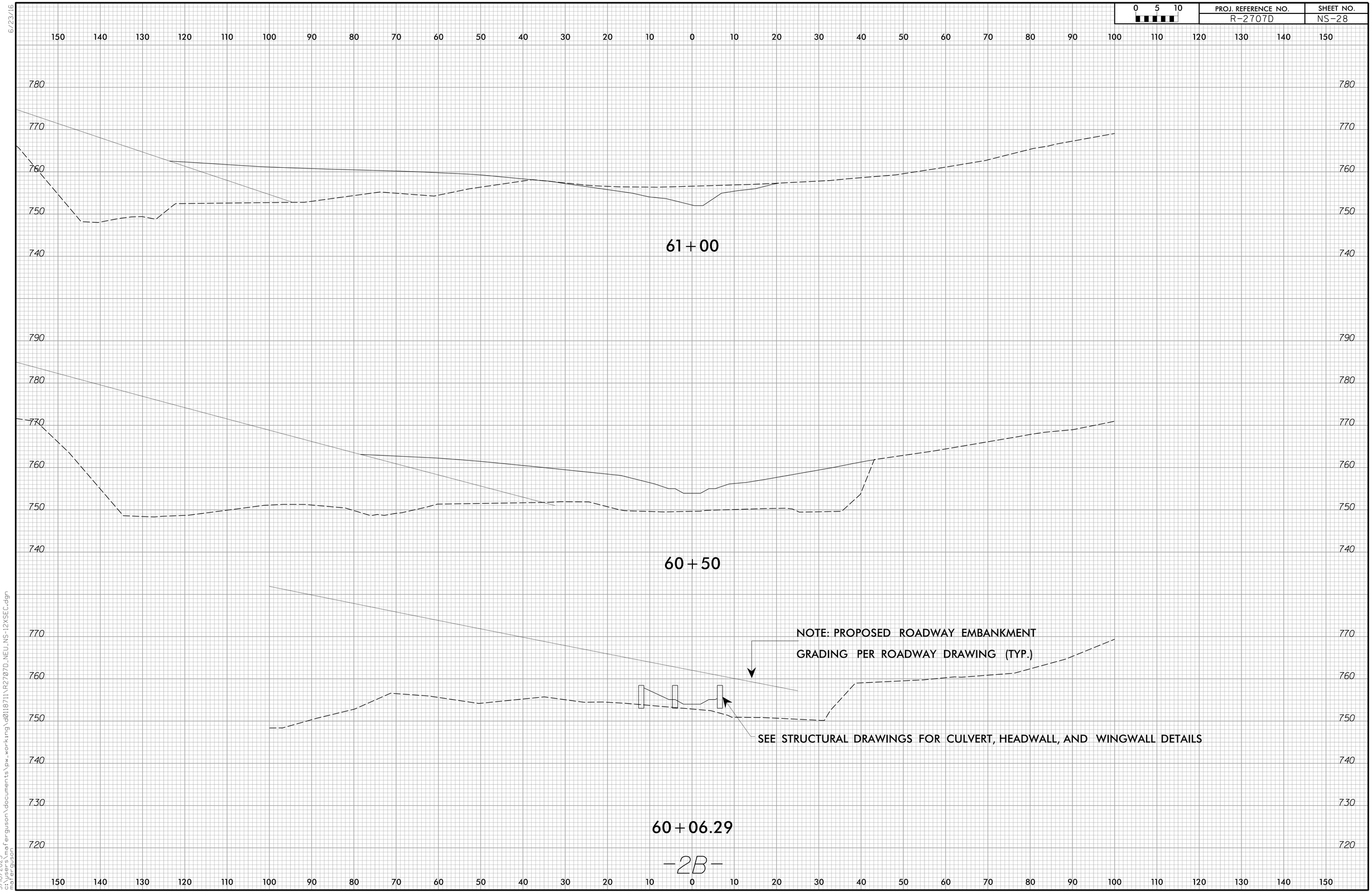

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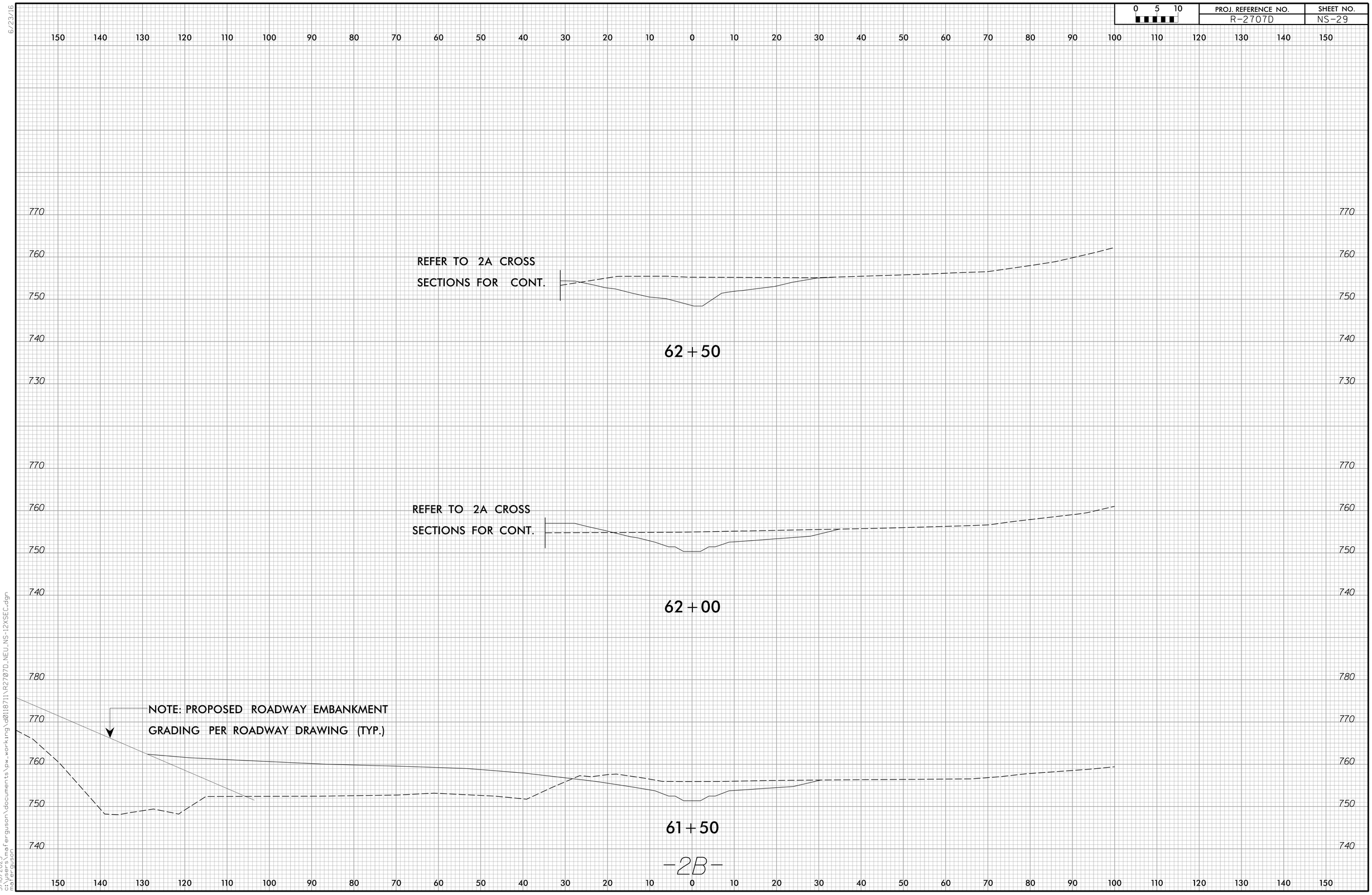

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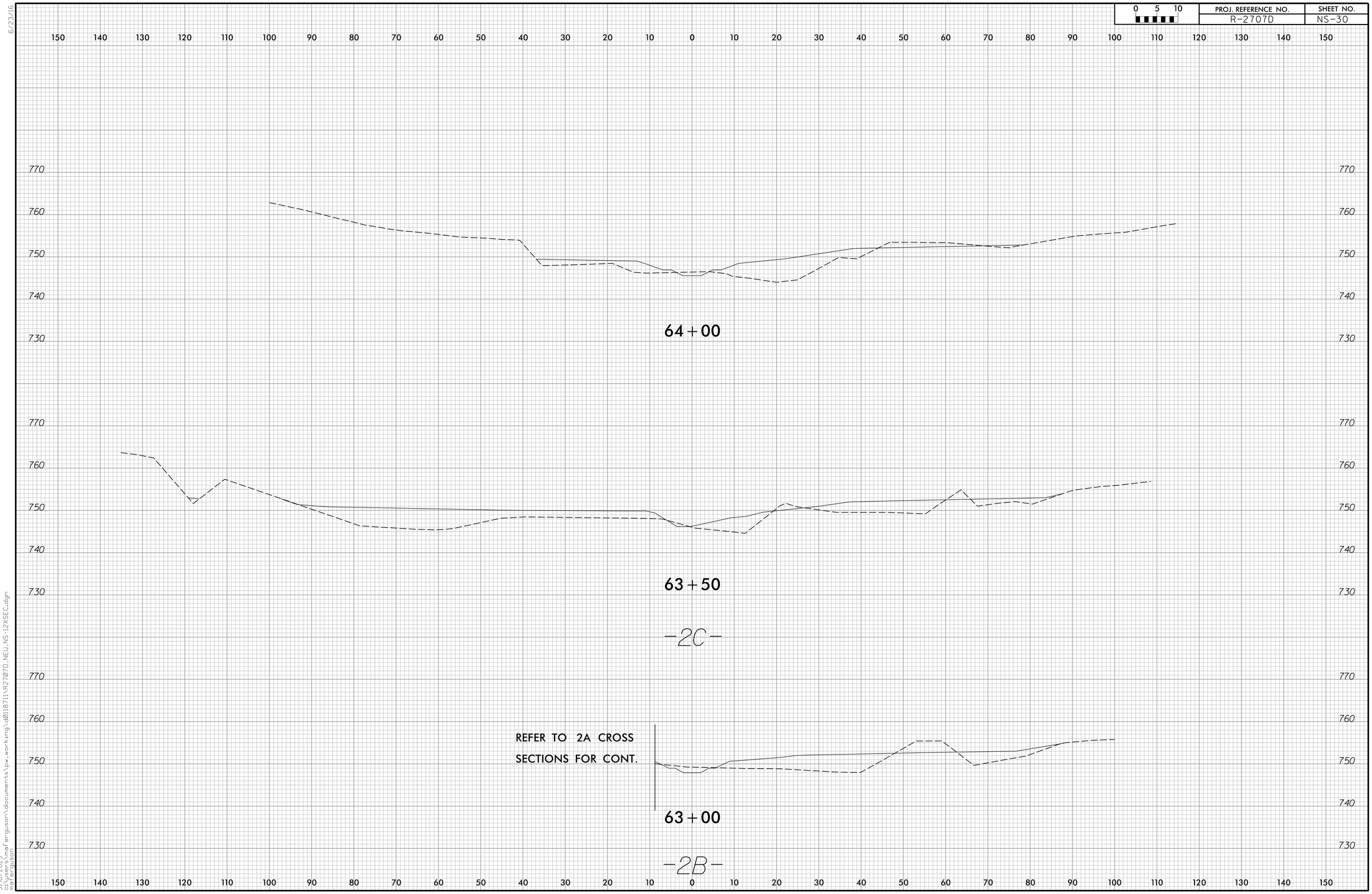

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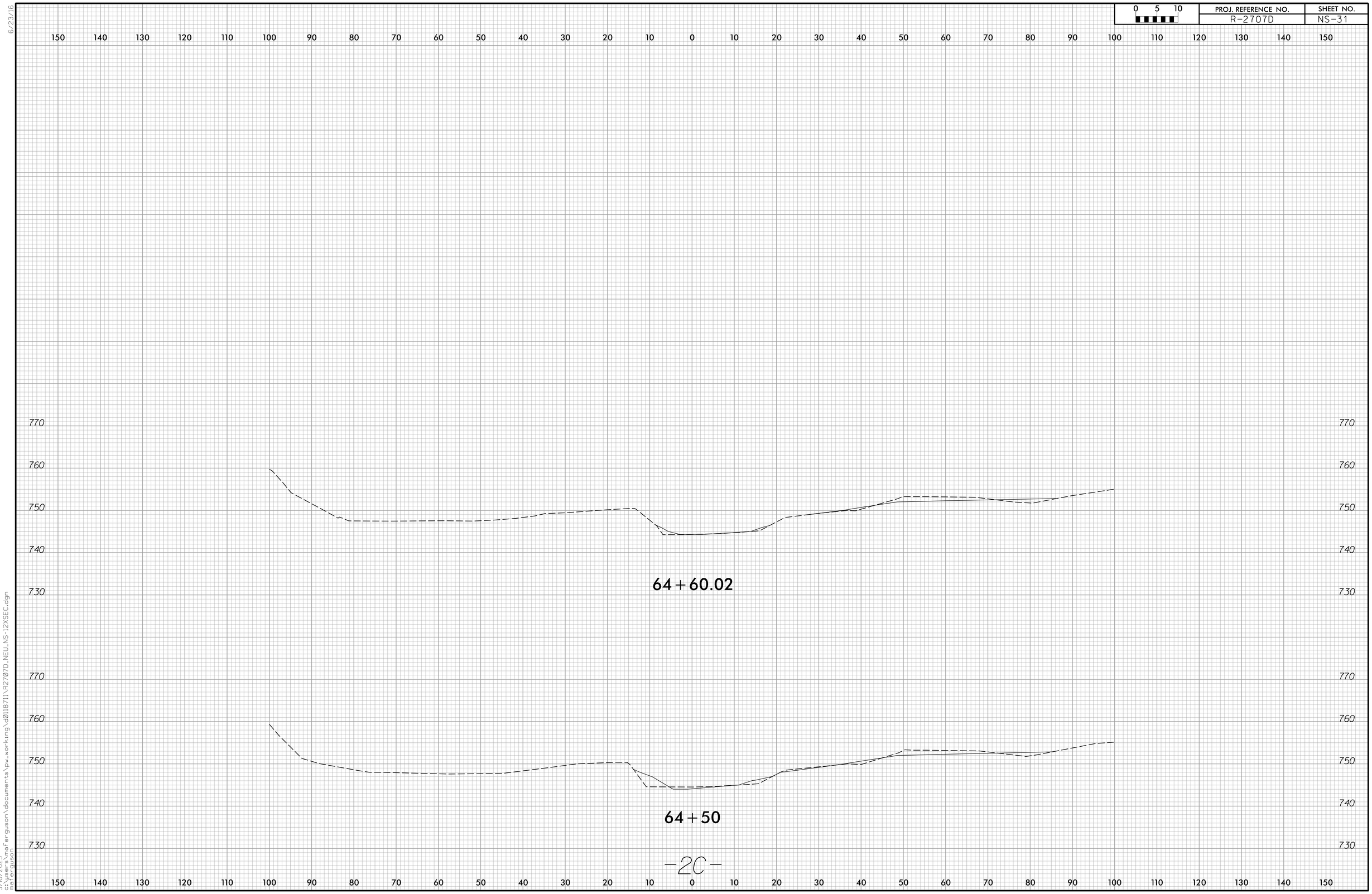

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