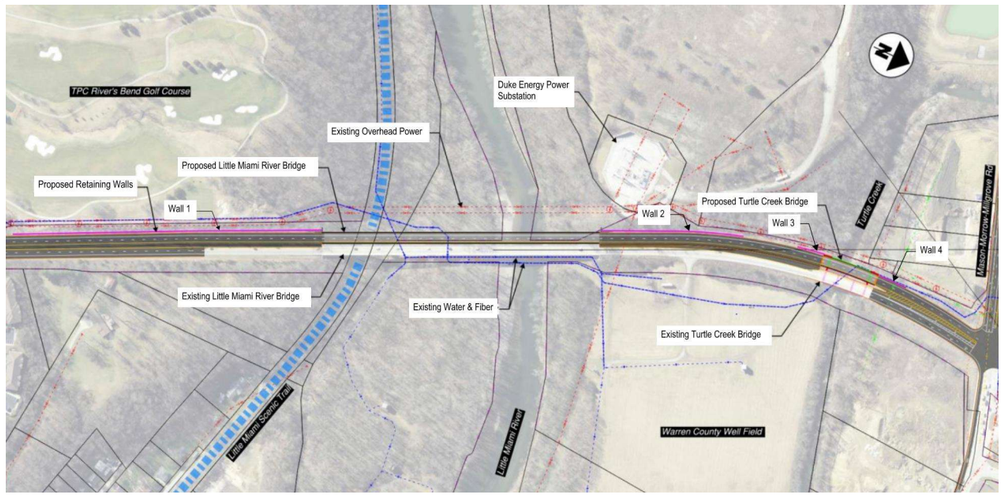
Retaining Wall 3 & 4 Justification Study

Introduction

The Warren County TID and Ohio Department of Transportation (ODOT) are looking to implement corridor improvements along SR 48 over the Little Miami River and Turtle Creek in Warren County, Ohio. These improvements are intended to address existing safety and congestion issues by widening the roadway from two lanes to four lanes and constructing two new parallel bridges west of the existing structures over the Little Miami River and Turtle Creek. The preferred alignment alternative, identified through the feasibility and structure type studies performed by Michael Baker International (Michael Baker) as the prime consultant and Burgess and Niple (B&N) as the subconsultant, requires significant roadway widening in an area with steep side slopes, limited right-of-way, environmental constraints associated with the Turtle Creek corridor, and proximity to utilities- both underground and overhead. As a result, retaining walls are a critical component of the project to accommodate the proposed roadway geometry while minimizing right-of-way acquisition, avoiding utility relocations where feasible, and reducing environmental impacts. The retaining walls will be used to support roadway embankments and bridge approach grading along the west side of SR 48 and are essential to achieving the project goals of constructability, maintaining traffic, and reducing impacts to surrounding properties and utilities.

Project Location



[Proposed Project State Route 48 over Little Miami River & Turtle Creek]

Retaining Wall 3 & 4 Justification

Retaining walls 3 & 4 are proposed along the west side of State Route 48, north and south of Turtle Creek. The location of these walls presents several design constraints related to limited available right-of-way and the presence of the Duke Energy overhead power lines. While the new parallel bridge west of the existing SR 48 bridge can be constructed largely within the existing right-of-way, minor additional acquisition is required. On the north side of Turtle Creek, behind the BP gas station, there is a pump station situated close to the right-of-way that will require relocation if we do not build Wall 4.

For both Wall 3 and 4, both cast-in-place cantilever walls and MSE walls were considered due to their relatively low design height and being fill walls. Ultimately, a mechanically stabilized earth (MSE) wall is considered the most feasible solution because the soil can support a fill-based system that stays within the available right-of-way while remaining more cost-efficient than cast in place wall.

MSE walls can be constructed efficiently in tight right-of-way areas because they require relatively small excavation limits and use a straightforward bottom-up construction approach. They rely on standard earthwork practices and do not require specialized labor, which helps streamline the process and reduce costs. Overall, their simplicity and minimal footprint make them a highly cost-effective option for constrained sites.

Retaining walls 3 & 4 will be a 143’-3” & 150’-6” long wall placed behind a moment slab barrier for its full length. The proposed height of the walls ranges from 11’ to 16’ with an area of 4500 SF. The area of select granular backfill will extend underneath the proposed SR 48 Southbound alignment, which will have no right-of-way impacts to the project.

A mechanically stabilized earth wall has relatively low environmental impact because its small excavation limits ground disturbance. Its bottom-up construction approach also reduces the need for large concrete pours, which helps minimize noise, emissions, and on-site waste. The primary drawback is the substantial amount of imported fill required, which carries its own off-site environmental footprint.

MSE walls are prone to settlement issues and as such were evaluated during this study. The total estimated settlement ranges from 0.5 inch to 1 inch in its final condition. It is expected that 90% consolidation will be achieved between 20 and 40 days of construction. Global stability of the wall was also considered. The results of that analysis recommend strap lengths into the reinforced backfill zone extending to 70% of the total MSE height. The analysis assumed Select Granular Backfill per SS840.03.E behind the MSE panel facing.

Cost Analysis

Estimated construction costs for the proposed wall were developed using ODOT's Summary of Contracts and historical bid data from similar projects to establish unit costs for the major wall work items.

There is no anticipated right-of-way acquisition cost for Wall 3 or 4.

Not including inflation or contingencies, the approximate cost associated with MSE wall construction is $175/SF, where Wall 3 is $357,175 and Wall 4 is $428,925.

For the wall estimate with the contingency and inflation included, please see project cost estimate.

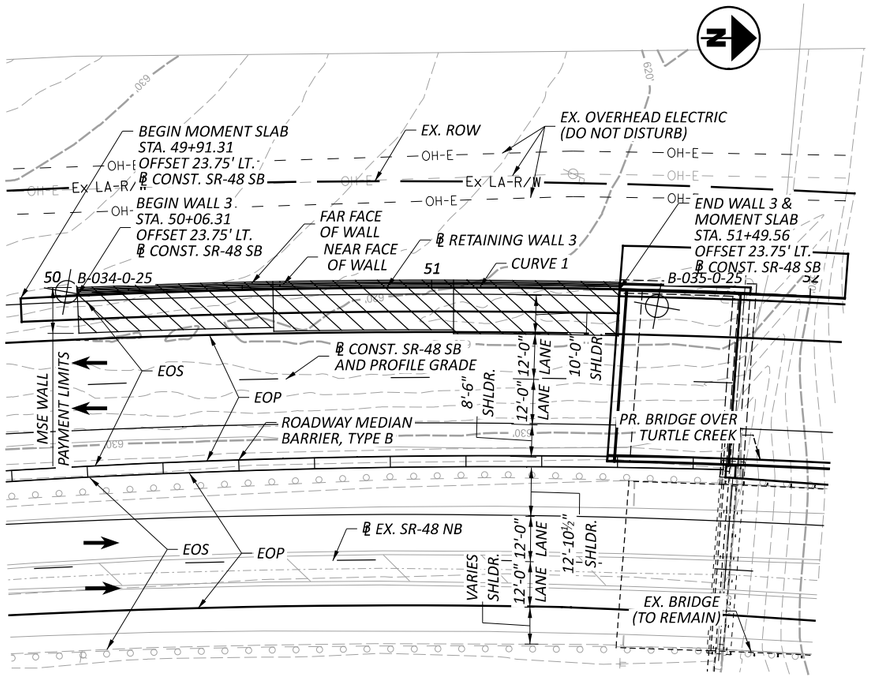
Appendices Index

Appendix A: Plan, Cross Section, and Typical Sections ..... (pg. 3)

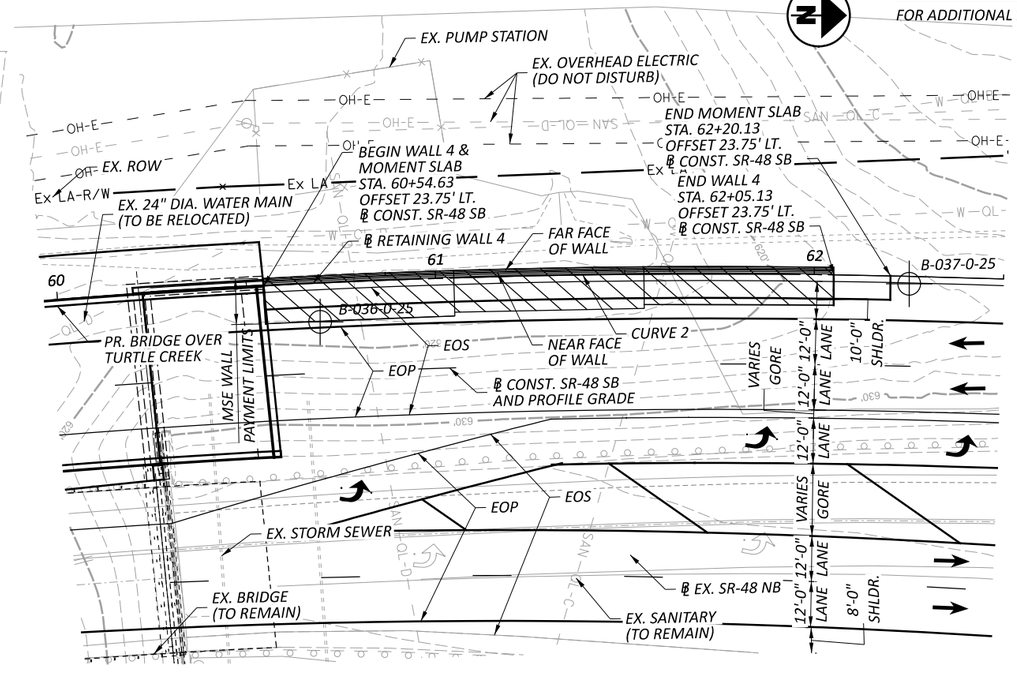
Appendix A: Plan, Cross Section, and Typical Sections

BENCHMARK DATA					
BM #1 STA.	,	ELEV.	,	OFFSET	,
BM #2 STA.	,	ELEV.	,	OFFSET	,
BM #3 STA.	,	ELEV.	,	OFFSET	,
BM #4 STA.	,	ELEV.	,	OFFSET	,

FOR ADDITIONAL BENCHMARK INFORMATION. SEE ROADWAY PLAN SHEET



WALL 3 PLAN



WALL 4 PLAN

NOTES

EARTHWORK LIMITS SHOWN ARE APPROXIMATE. ACTUAL SLOPES SHALL CONFORM TO PLAN CROSS SECTIONS.

WALL ALIGNMENTS ARE DEFINED ALONG NEAR FACE AND ℄ RETAINING WALL 3 & 4.

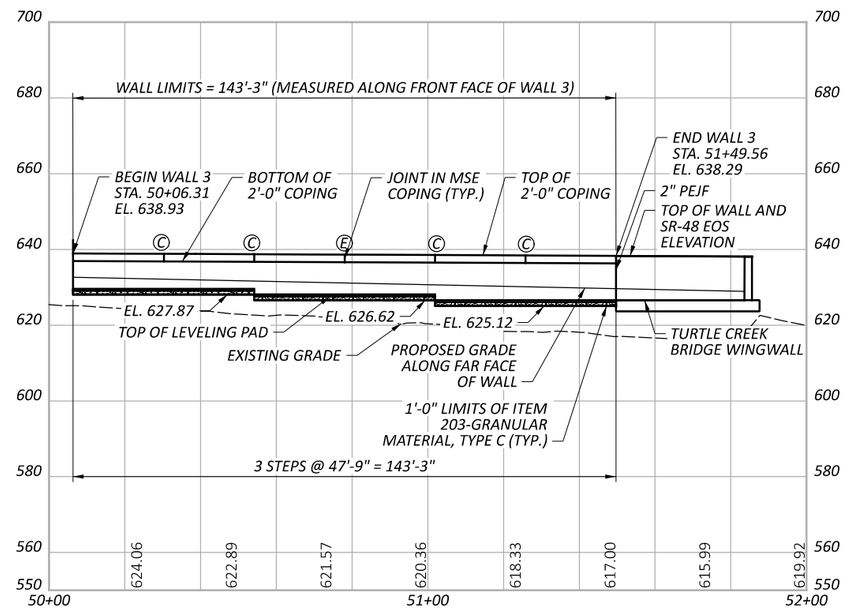
NOTE TO REVIEWER: FINAL GRADING MODELS HAVE NOT BEEN DEVELOPED. BOTTOM OF MSE WALLS ARE ESTIMATED FOR NOW AND WILL BE FINALIZED AT THE NEXT STAGE.

LEGEND

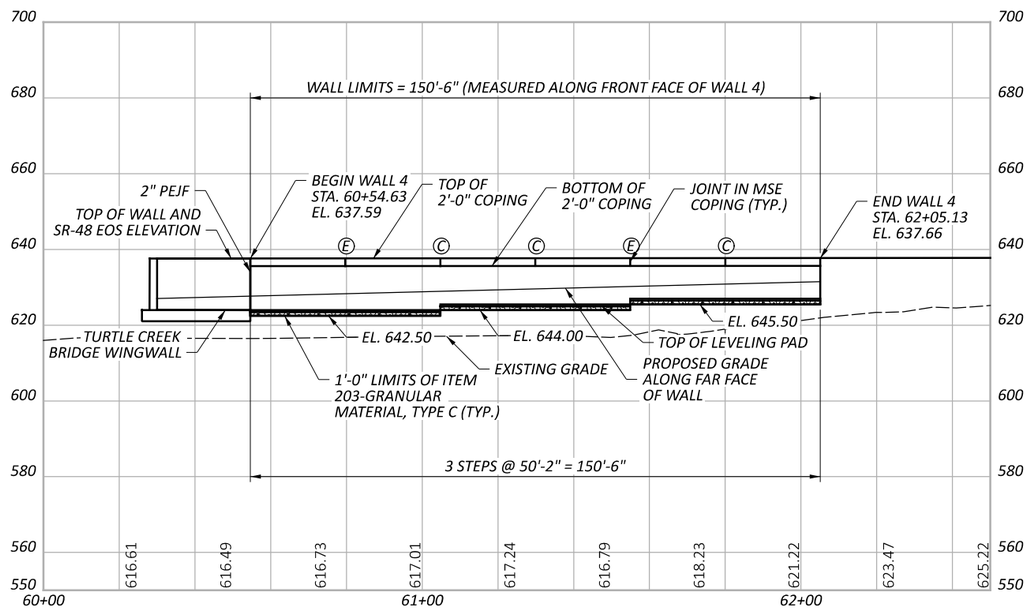
- BORING LOCATION
- Ⓒ CONTRACTION JOINT
- Ⓔ EXPANSION JOINT
- EOP = EDGE OF PAVEMENT
- EOS = EDGE OF SHOULDER

℄ CONST. WALL 3 CURVE 1 DATA

P.I. = STA. 51+00.07
Δ = 5°10'19" RT
Dc = 2°35'09"
R = 2215.49'
T = 100.07'
L = 200.00'
E = 2.26'



DEVELOPED ELEVATION ALONG ℄ CONST. WALL 3



DEVELOPED ELEVATION ALONG ℄ CONST. WALL 4

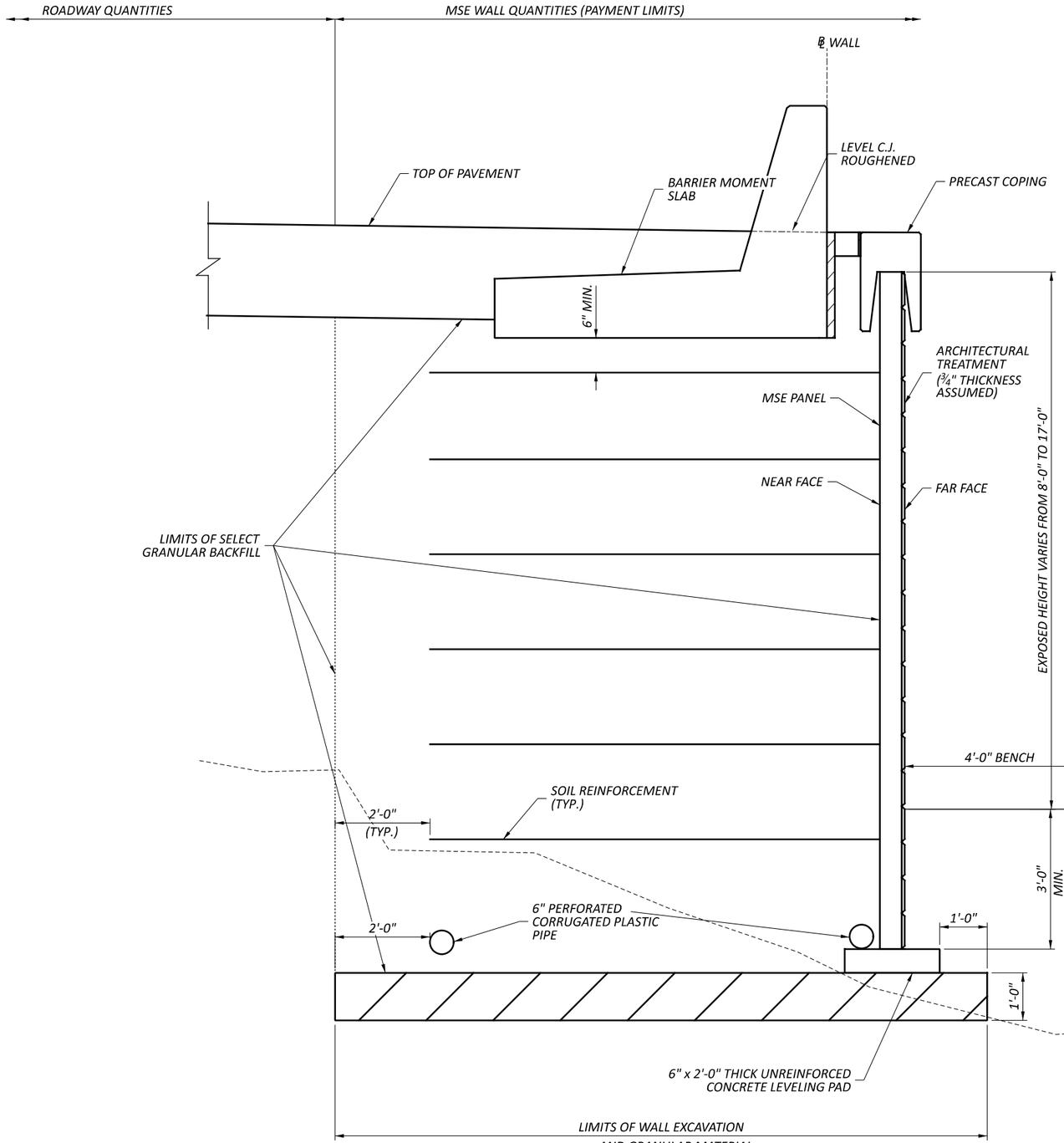
℄ CONST. WALL 4 CURVE 2 DATA

P.I. = STA. 61+25.13
Δ = 6°27'54" RT
Dc = 2°35'09"
R = 2215.49'
T = 125.13'
L = 250.00'
E = 3.53'

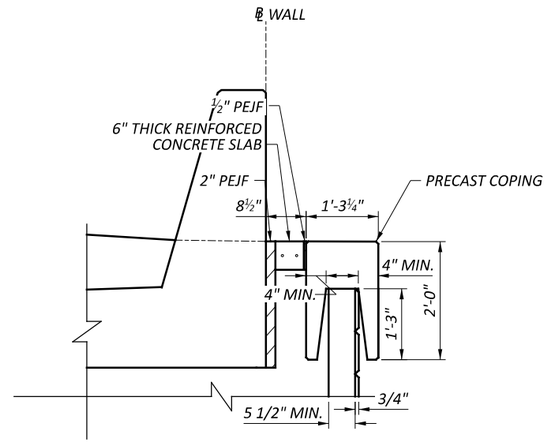
WAR-SR48-7.50

WALL PLAN AND PROFILE
WALL 3 & 4
ALONG WEST SIDE OF SR-48

SFN	N/A
DESIGN AGENCY	Michael Baker INTERNATIONAL
DESIGNER	BDC
CHECKER	SRW
REVIEWER	CWL 04/17/26
PROJECT ID	117567
SUBSET	1
TOTAL	2
SHEET	P.1
TOTAL	P.6



MSE WALL TYPICAL SECTION



PRECAST COPING DETAIL

WAR-SR48-7.50

WALL SECTION AND DETAILS
WALL 3 & 4
ALONG WEST SIDE OF SR-48

SFN
N/A

DESIGN AGENCY
Michael Baker INTERNATIONAL

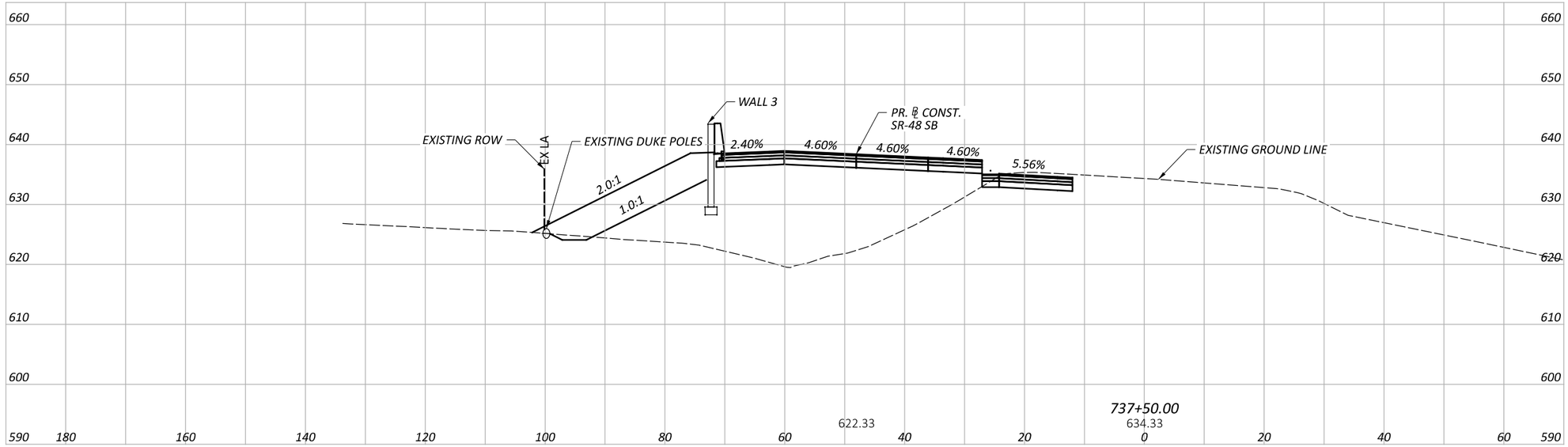
DESIGNER	CHECKER
BDC	SRW

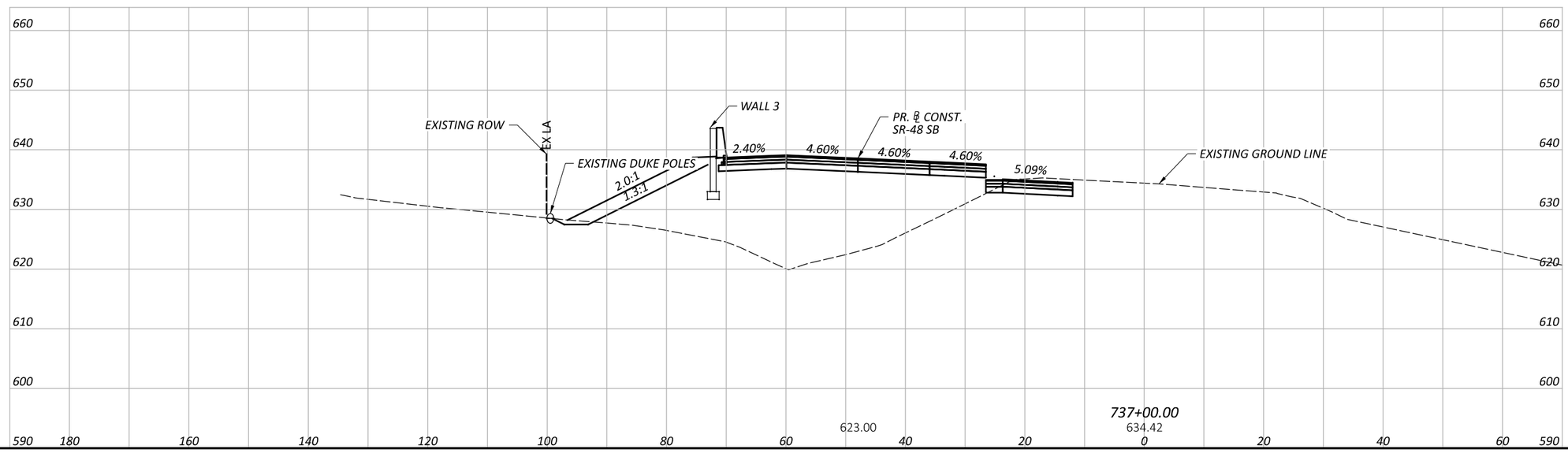
REVIEWER
CWL 04/17/26

PROJECT ID
117567

SUBSET	TOTAL
2	2

SHEET	TOTAL
P.2	P.6





CROSS SECTIONS 1 OF 2
WALL 3

WAR-SR48-7.50

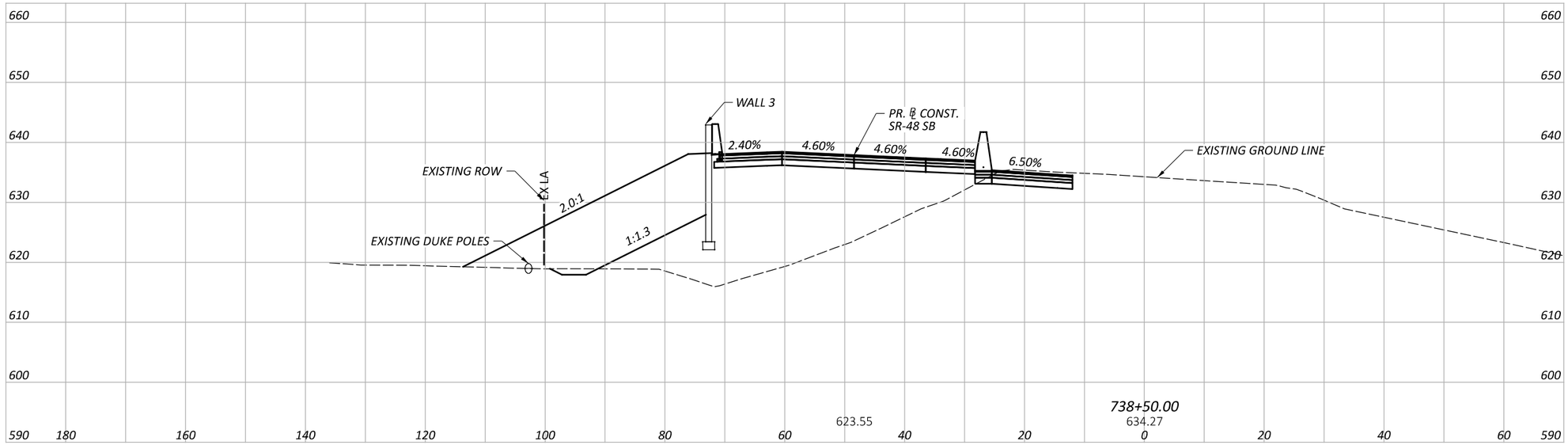
DESIGN AGENCY
Michael Baker INTERNATIONAL

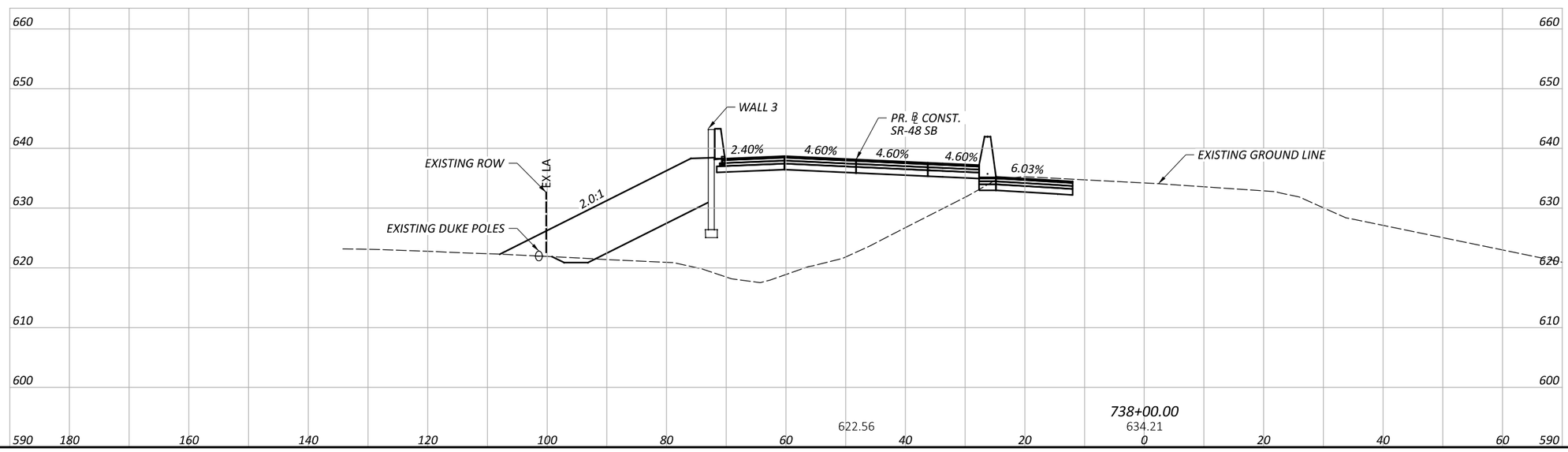
DESIGNER
BDC

REVIEWER
CWL 04/17/26

PROJECT ID
117567

SHEET P.3 | TOTAL 6





CROSS SECTIONS 2 OF 2
WALL 3

WAR-SR48-7.50

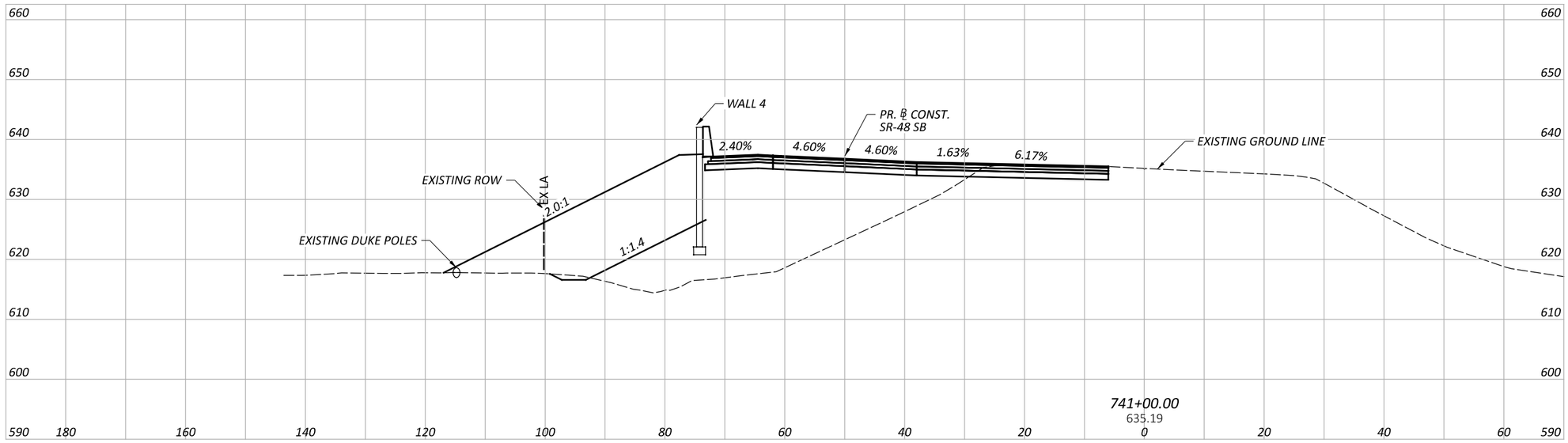
DESIGN AGENCY
Michael Baker INTERNATIONAL

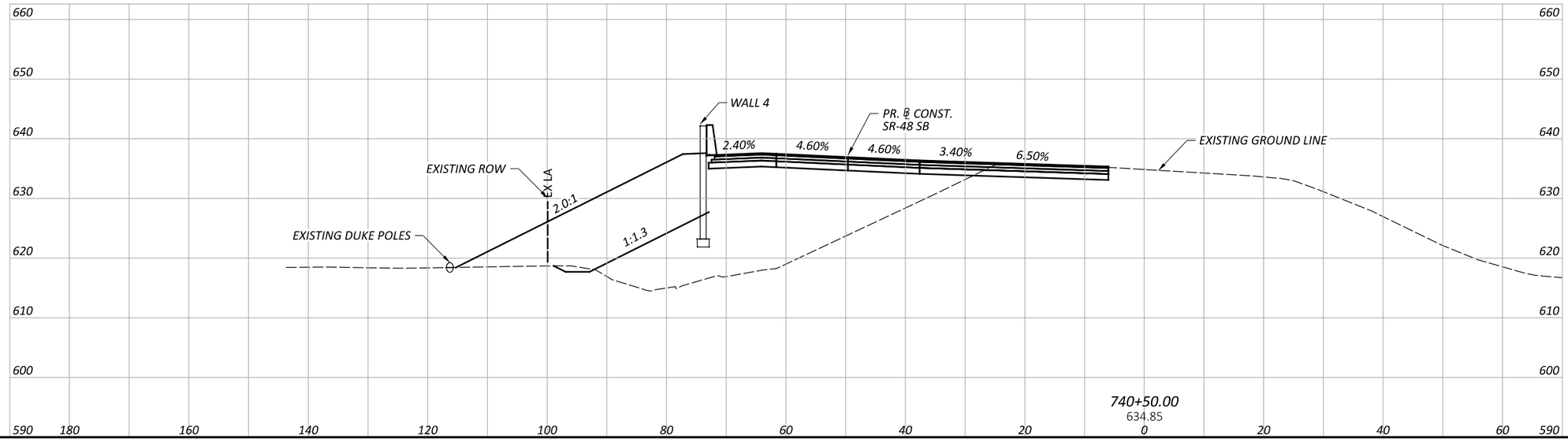
DESIGNER
BDC

REVIEWER
CWL 04/17/26

PROJECT ID
117567

SHEET P.4 | TOTAL 6





CROSS SECTIONS 1 OF 2
WALL 4

WAR-SR48-7.50

DESIGN AGENCY
Michael Baker INTERNATIONAL

DESIGNER
BDC

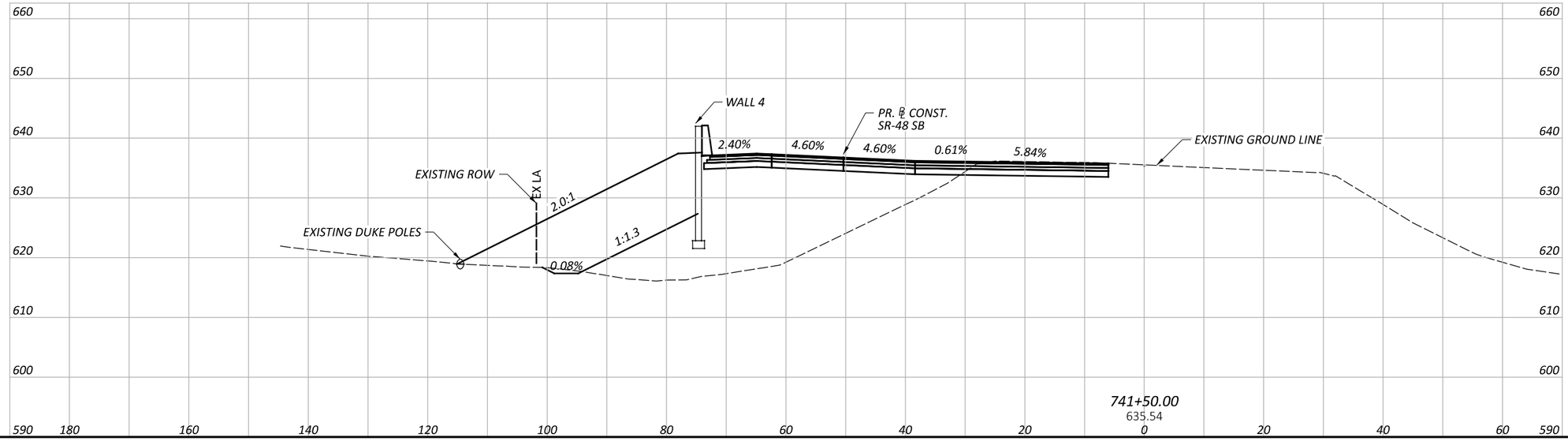
REVIEWER
CWL 04/17/26

PROJECT ID
117567

SHEET P.5 | TOTAL 6

WAR-SR48-7.50

CROSS SECTIONS 2 OF 2
WALL 4



DESIGN AGENCY
Michael Baker INTERNATIONAL

DESIGNER
BDC

REVIEWER
CWL 04/17/26

PROJECT ID
117567

SHEET P.6 | TOTAL 6