Preliminary Structural Geotechnical Report

Proposed Retaining Wall #9A – Ramp C
Structure No. 099-W128
IDOT PTB 198-003
FAI-80 (I-80) over Des Plaines River

Will County, Illinois

Prepared for

Illinois Department of Transportation
Contract Number: D-91-204-19

Project Design Engineer Team
WSP USA

Geotechnical Consultant

GSG CONSULTANTS, INC.
Engineers. Scientists. Construction Managers
735 Remington Road, Schaumburg IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

May 3, 2024

GSG CONSULTANTS, INC.

735 Remington Road
Schaumburg, IL 60173
Tel: 630.994.2600
www.gsg-consultants.com

May 3, 2024

Mr. David Skaleski, P.E.
Project Manager
WSP USA
30 N. LaSalle Street, Suite 4200
Chicago, Illinois 60602

Structural Geotechnical Report - Preliminary
Proposed Retaining Wall #9A – Ramp C
FAI-80 over Des Plaines River Bridge
Will County, IL
PTB 198-003

Dear Mr. Skaleski:

Attached is a copy of the Preliminary Structural Geotechnical Report for the above referenced project. The report provides a description of the site investigation, site conditions, and foundation and construction recommendations. The site investigation for the proposed retaining wall and embankment included advancing four (4) soil borings to depths between 20 and 38.5 feet and one (1) bedrock core. Additional soil borings are proposed along the proposed wall alignment once access to those locations is available.

Should you have any questions or require additional information, please call us at 630-994-2600.

Sincerely,

Daniel DiMaggio

Daniel DiMaggio, E.I.T.
Project Engineer

Ala E Sassila, Ph.D., P.E.
Principal

TABLE OF CONTENTS

Preliminary Structural Geotechnical Report
IDOT PTB 198-003
FAI-80 (I-80) over Des Plaines River
Proposed Retaining Wall #9A along Ramp C
Structure No. 099-W128
Will County, Illinois

1.0 INTRODUCTION

GSG Consultants, Inc. (GSG) completed a preliminary geotechnical investigation for the proposed Retaining Wall #9A and associated embankment along Ramp C as part of the FAI-80 over Des Plaines project in the City of Joliet in Will County, Illinois. The purpose of the investigation was to explore the subsurface conditions, to determine engineering properties of the subsurface soil, and develop design and construction recommendations for the proposed construction. **Exhibit 1** shows the general project location.

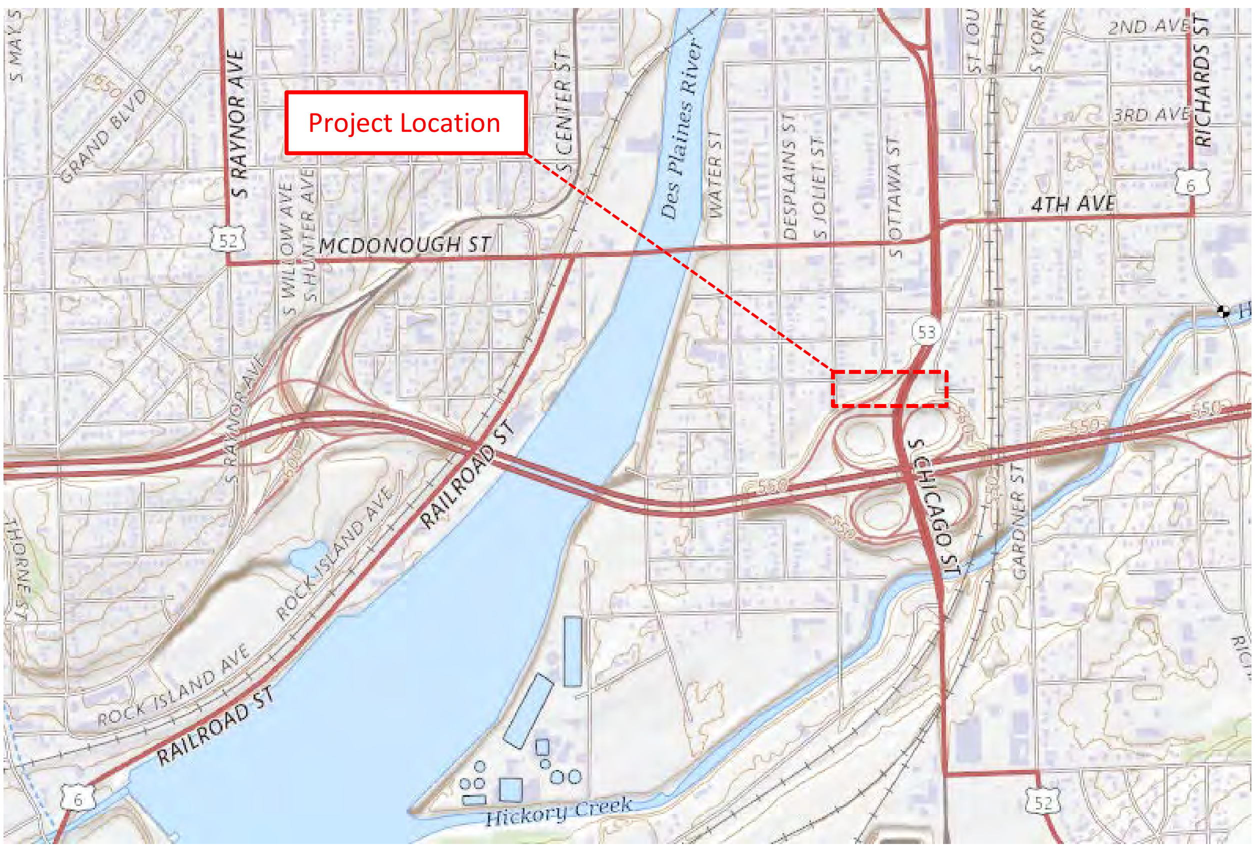


Exhibit 1 – Project Location Map
(Source: USGS Topographic Maps, usgs.gov)

1.1 Existing Site Conditions Information

The proposed improvements at this location will shift the existing Ramp C alignment to the west by approximately 40 to 50 feet requiring the proposed retaining wall to separate the roadway from the adjacent residential area. According to the proposed Phase 1 plan drawings provided and the preliminary GPE, the proposed retaining wall will primarily be a “fill” section for construction of the new Ramp C. The area where the proposed wall will be constructed is partially outside of the existing IDOT Right-of-Way, between the I-80/Chicago Street interchange and the neighboring residential area to the north and west. **Exhibits 2a thru 2c** show the existing conditions where the proposed retaining wall and embankment will be constructed for the new ramp.

Exhibit 2a – Existing WB I-80 Exit Ramp to Chicago Street, Looking North

Exhibit 2b – Existing South Joliet Street, Looking South

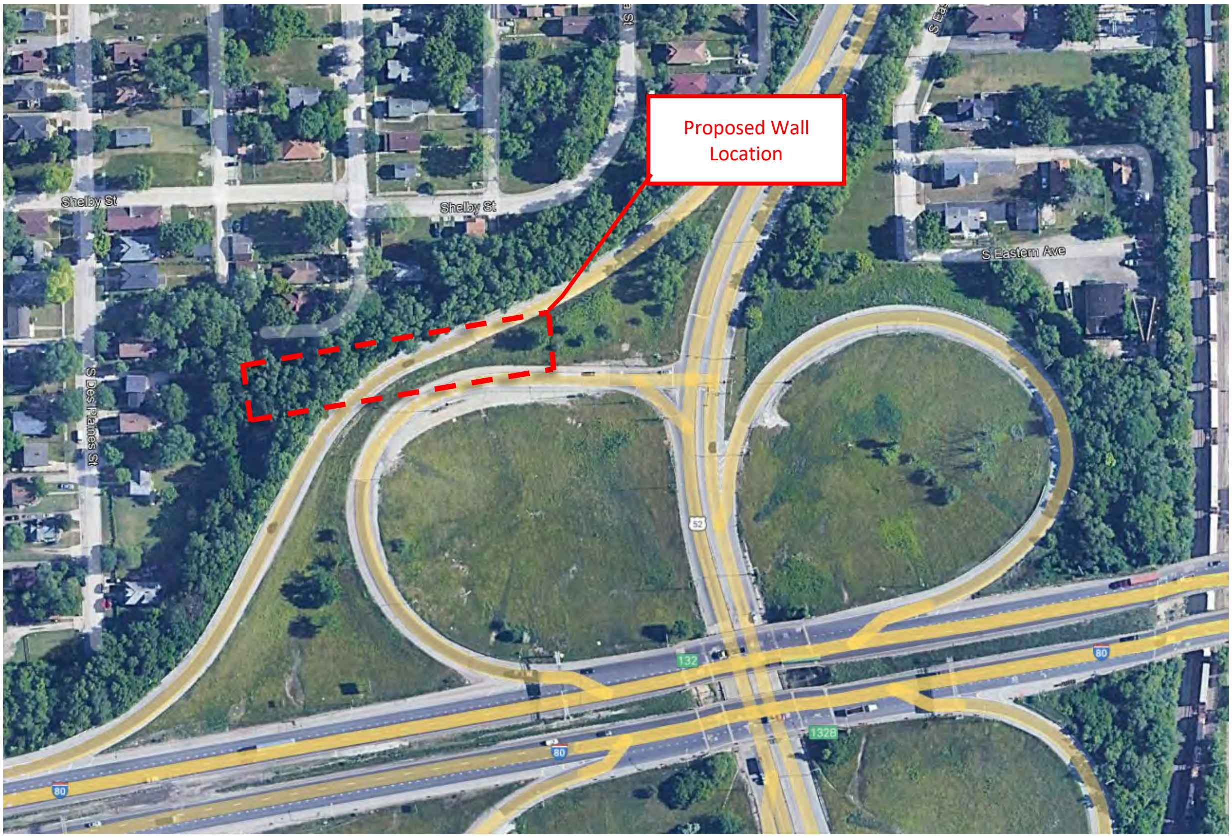


Exhibit 2b – Proposed Project Area, Aerial

1.2 Proposed Structure Information

Based on preliminary Phase I design information and the preliminary GPE plan (**Appendix A**), the proposed wall will be in a predominantly "fill" section along the newly constructed Ramp C embankment, with a maximum exposed wall height of up to approximately 23.5 feet, and maximum retained height of 27 feet. The wall will be at least 34 feet from the Ramp C center line. A new embankment will be constructed along Ramp C between Sta. 6+50 and Sta. 10+50. It is anticipated that the new embankment will have a maximum height of 28.5 feet. A 3H:1V slope will be constructed at the top of the wall towards the new pavement; a noise wall will be constructed at the top of the slope. The proposed retaining wall will be approximately 369 feet in length along Ramp C between Sta. 7+07.00 and Sta. 10+13.59. It is anticipated that the proposed structure will be a mechanically stabilized earth (MSE) wall. Recommendations for the proposed noise wall will be provided in a separate report.

A retaining wall is proposed for this location as shown on the General Plan & Elevation dated 12/13/22 (**Appendix A)**. **Table 1** presents a summary of the proposed structure.

Table 1 – Proposed Structure Summary

Wall Name	Wall Stations*	Approximate Length (ft)	Maximum Anticipated Exposed Wall Height (ft)
Retaining Wall #9A	7+07.00 to 10+13.74	369.1	23.5

* Based on proposed Ramp C Stationing

2.0 SITE SUBSURFACE CONDITIONS

This section describes the subsurface exploration program and laboratory testing program completed as part of this project. The proposed locations and depths of the soil borings were selected in accordance with IDOT requirements and reviewed with WSP based on the Phase 1 plans. Additional borings are proposed along the final wall alignment and will be completed once the area is accessible. The borings were completed in the field based on field conditions and accessibility.

2.1 Subsurface Exploration and Laboratory Testing

The preliminary site subsurface exploration for the proposed retaining wall structure was conducted between May 18 and September 15, 2022. The investigation included advancing four (4) borings in the vicinity of the proposed retaining wall to depths of 20 to 38.5 feet. Borings RWB-97 and RWB-98 were completed for the proposed retaining wall and borings SSB-51 and SSB-52, were completed for the proposed new roadway embankment behind the retaining wall. The locations of these soil borings were reviewed by WSP and adjusted in the field as necessary based on utilities and access. Elevations and as-drilled locations for the borings were gathered by GSG's field crew using GPS surveying equipment. The approximate as-drilled locations of the soil borings are shown on the Soil Boring Location Plan & Subsurface Profiles **(Appendix B)**. **Table 2** presents a summary of the borings used for the proposed retaining wall analyses.

Table 2 – Summary of Subsurface Exploration Borings[1]

Boring ID	Station **	Offset (ft)	Northing	Easting	Depth (ft)	Surface Elevation (ft)
RWB-97	7+62.53	13.11 RT	1765266.678	1052725.147	38.5*	543.52
RWB-98	7+13.28	0.19 LT	1765278.557	1052774.656	28.5	542.24
SSB-51	6+99.34	1.54 RT	1765280.001	1052788.631	20.0	546.11
SSB-52	7+97.04	1.02 RT	1765281.520	1052690.945	20.0	543.99

* Depth includes Bedrock Core (10 feet)

** Based on proposed Ramp C Stationing

[1] Additional borings are proposed along the proposed alignment of the retaining wall,

Copies of the Soil Boring Logs are provided in **Appendix C**.

The soil borings were drilled using a truck-mounted B-57 Mobile (hammer efficiency 89%) drill rig, a truck-mounted D-50 Diedrich (hammer efficiency 96%) drill rig, and an all-terrain Geoprobe 7822DT (hammer efficiency 102%) drill rig, each equipped with 3¼-inch I.D. hollow stem augers and an automatic hammer. Soil sampling was performed according to AASHTO T 206, "Penetration Test and Split Barrel Sampling of Soils." Soil samples were obtained at 2.5-foot intervals to the planned boring termination depths or auger refusal on bedrock. Water level measurements were made in each boring when evidence of free groundwater was detected on the drill rods or in the samples. The boreholes were also checked for free water immediately after auger removal, and before filling the open boreholes with soil cuttings.

GSG's field representative inspected, visually classified and logged the soil samples during the subsurface exploration activities. Representative soil samples were collected from each sample interval and were placed in jars and returned to the laboratory for further testing and evaluation.

2.2 Laboratory Testing Program

All samples were inspected in the laboratory to verify the field classifications. A laboratory testing program was undertaken to characterize and determine engineering properties of the subsurface soils encountered in the area.

The following laboratory tests were performed on representative soil and rock samples:

- Moisture content ASTM D2216 / AASHTO T-265
- Unconfined Compression Strength on Rock ASTM D2938

The laboratory tests were performed in accordance with test procedures outlined in the most current IDOT Geotechnical Manual, and per ASTM and AASHTO requirements. Based on the laboratory test results, the soils encountered were classified according to the AASHTO and the Illinois Division of Highways (IDH) classification systems. The results of the laboratory testing program are included in the Laboratory Test Results **(Appendix D)** and are also shown along with the field test results in the Soil Boring Logs **(Appendix C)**.

2.3 Subsurface Soil Conditions

This section provides a brief description of the soils encountered in the borings performed in the vicinity of the proposed retaining wall and embankment. Variations in the general subsurface soil profile were noted during the drilling activities. Detailed descriptions of the subsurface soils are provided in the soil boring logs and are shown graphically in the Boring Location Plan & Subsurface Profiles. The soil boring logs provide specific conditions encountered at each boring location and include soil descriptions, stratifications, penetration resistance, elevations, location of the samples, and laboratory test data. Unless otherwise noted, soil descriptions indicated on boring logs are visual identifications. The stratifications shown on the boring logs represent the conditions only at the actual boring locations and represent the approximate boundary between subsurface materials; however, the actual transition may be gradual.

The surface elevations of the borings ranged between 542.2 and 546.1 feet. Most of the borings initially noted 2 to 3 inches of topsoil; boring SSB-52 was completed on the shoulder of the existing ramp and noted 4 inches of asphalt. Beneath the surface materials, the borings encountered brown and gray silty clay fill materials to depths of 12.5 to 20 feet below the ground surface. Boring SSB-51 also encountered gray and black sand with gravel fill and cobbles to the boring termination depth of 20 feet below the ground surface; boring SSB-52 encountered brown gravel with sand fill to the boring termination depth of 20 feet. Brick fragments were noted within the granular fill in boring SSB-51 at a depth of 16 feet below grade.

Beneath the fill materials, borings RWB-97 and RWB-98 encountered native brown sand with gravel to the boring termination depths. Borings RWB-97 and RWB-98 encountered practical auger refusal or split-spoon refusal on apparent bedrock at depths of 28.5 feet (elevations 515.0 and 513.7 feet). Cobbles were noted in borings RWB-97 and RWB-98 at various depths.

The silty clay fill soils have unconfined compressive strength values ranging from of 0.5 to 5.4 tons per square foot (tsf), with an average value of 2.2 tsf. The native sand with gravel had SPT blow count (N) values ranging from 6 to 50 blows per foot (bpf), with an average of 32 bpf.

2.4 Subsurface Bedrock Conditions

A 10-foot bedrock core was collected at 1 boring location, RWB-97. The extracted bedrock core was visually inspected, classified and the Rock Quality Designation (RQD) was determined according to ASTM D 6032, “Standard Test Method for Determining Rock Quality Designation (RQD) of Rock Core” and as per the IDOT geotechnical manual by totaling all sections with a length in excess of four inches (4”) and dividing it by the total length of the core run. The RQD is given a classification based upon the numeric value as indicated in **Table 3**. A photograph of the rock core is included with the respective soil boring log in **Appendix C**.

Table 3 - Rock Quality Designation

Rock Quality Designation	Descriptions
< 25%	Very Poor
25 – 50%	Poor
51 – 75%	Fair
76 – 90%	Good
91 – 100%	Excellent

Table 4 provides a summary of the RQD values and unconfined compressive strength values of the rock core extracted during the site investigation.

Table 4 – Rock Core Summary and Classification

Boring Number	Core Run	Core Depth (feet)	Type of Rock	RQD (%)	RQD Classification	Depth (ft)/ Unconfined Compression Strength (psi)
RWB-97	1	28.5-38.5	Limestone	55.1	Fair	34.5 / 12,232

The soil boring logs provide bedrock conditions encountered at the location of RWB-97. The bedrock core consisted of limestone that was moderately weathered and moderately fractured. The RQD value was 55.1 percent: Fair as shown in **Table 4**.

2.5 Groundwater Conditions

Water levels were checked in each boring to determine the general groundwater conditions present at the site and were measured while drilling and after each boring was completed. Groundwater was not encountered during or immediately after drilling at any of the borings. None of the borings were left open after leaving the site due to safety concerns.

Based on lack of observed water, it is anticipated that the long-term groundwater level may be at an approximate elevation of 515.0 to 513.7 feet or deeper, within the bedrock. Perched water may also be present within the fill observed in the borings. Water level readings were made in the boreholes at times and under conditions shown on the boring logs and stated in the text of this report. However, it should be noted that fluctuations in groundwater level may occur due to variations in the rainfall, other climatic conditions, or other factors not evident at the time measurements were made and reported herein.

3.0 PRELIMINARY GEOTECHNICAL ANALYSES

This section provides GSG's geotechnical analysis for the design of the proposed retaining wall and embankment based on the results of the field exploration, laboratory testing, and geotechnical analysis. Subsurface conditions between borings may vary from those encountered at the boring locations. If structure locations, loadings, or elevations are changed, we request that GSG be contacted so that we may re-evaluate our recommendations.

3.1 Preliminary Embankment Settlement

It is anticipated that up to 28.5 feet of new fill behind the wall may be required to construct the new retaining wall embankment and Ramp C alignment.

The new embankment behind the proposed wall was evaluated with respect to settlement. Based on the proposed new fill of up to 28.5 feet, analyses were performed at several locations along the wall to evaluate the anticipated amount of total settlement that may be expected. The maximum estimated settlement within the native granular soils was calculated as shown in **Table 5.**

Table 5 – Anticipated Embankment Settlement

Structure Name	Structure Stations *	Embankment Height (ft)	Anticipated Settlement (inches)	Differential Settlement (in)
New Embankment	Sta. 9+50	28.5	0.033	<0.5
New Embankment	Sta. 10+50	28.0	0.031	<0.5

* Based on proposed Ramp C Stationing

3.2 Seismic Parameters

The seismic hazard for the site was analyzed per the IDOT Geotechnical Manual, IDOT Bridge Design Manual, and AASHTO LRFD Bridge Design Specifications. The Seismic Soil Site Class was determined per the requirements of All Geotechnical Manual Users (AGMU) Memo 9.1, Design Guide for Seismic Site Class Determination, and the "Seismic Site Class Determination" Excel spreadsheet provided by IDOT. A global Site Class Definition was determined for this project, and was found to be Soil Site Class C. The Seismic Performance Zone (SPZ) was determined using Figure 2.3.10-2 in the IDOT Bridge Manual and was found to be Seismic Performance Zone 1.

The AASHTO Seismic Design Parameters program was used to determine the peak ground acceleration coefficient (PGA), and the short (S_{DS}) and long (S_{D1}) period design spectral acceleration coefficients for the proposed structure. For this section of the project, the S_{DS} and the S_{D1} were determined using 2020 AASHTO Guide Specifications as shown in **Table 6**. Given the site location and materials encountered, the potential for liquefaction is minimal.

Table 6 – Seismic Parameters

Building Code Reference	PGA	S_{DS}	S_{D1}
2020 AASHTO Guide for LRFD Seismic Bridge Design	0.047g	0.136g	0.084g

4.0 PRELIMINARY GEOTECHNICAL WALL DESIGN RECOMMENDATIONS

This section provides retaining wall design parameters including preliminary recommendations on foundation type, bearing capacity, settlement, and lateral earth pressures. The foundations for the proposed retaining wall must provide sufficient support to resist the dead and live loads, as well as seismic loading.

4.1 Retaining Wall Type Recommendations

It is anticipated that the proposed retaining wall will be constructed predominantly within a fill section. There are various types of retaining walls that could be utilized for retaining earthen pressures in fill areas. This section discusses several earth retaining structures that could be used for the proposed project. Based on the proposed grading, the proposed wall will be in a fill area, adjacent to the proposed roadway. Several typical wall types are described in the section below.

4.1.1 CIP Concrete Cantilever Walls

CIP concrete cantilever retaining walls are typically used in fill areas. They are constructed with a footing that extends laterally both in front of and behind the wall. They can be designed to resist horizontal loading with or without tie-backs by changing the geometry of the foundation. This type of wall typically requires that the area behind the wall be excavated to facilitate construction or are constructed where new fill embankments are necessary.

The advantages of a CIP wall include that it is a conventional system with well-established design procedures and performance characteristics; it is durable; and it has the ability to easily be formed, textured, or colored to meet aesthetic requirements. Disadvantages include a relatively long construction period due to undercutting, excavation, form work, steel placement, and curing of the concrete. This wall system is also sensitive to total and differential settlements.

4.1.2 Mechanically Stabilized Earth Walls

A Mechanically Stabilized Earth (MSE) wall is typically associated with fill wall construction and consists of facing such as segmental precast units, dry block concrete or CIP concrete facing units connected to horizontal steel strips, bars or geosynthetic to create a reinforced soil mass. The reinforcement is typically placed in horizontal layers between successive layers of granular backfill. A free draining backfill is required to provide adequate performance of the wall. MSE walls can be used in cut situations as well. The additional cost of the excavations for an MSE wall is usually offset by the savings in construction costs and schedule as compared to a CIP wall on spread footings. Advantages of the MSE wall include a relatively rapid construction schedule that does not require specialized labor or equipment, provided excavation for the reinforcement is not extensive. This type of retaining wall can accommodate relatively large total and differential settlements without distress, and the reinforcement materials are light and easy to handle. Facing panels can be designed for various architectural finishes.

The design of MSE walls for internal stability is the Contractor's responsibility and will need to be designed by a licensed Structural Engineer in the State of Illinois. The length of the reinforced soil mass from the outside face should be a minimum of 8 feet, but not less than 70% of the wall height. The length should be determined to satisfy eccentricity and sliding criteria and provide adequate length to prevent structural failure with respect to pullout and rupture of reinforcement. The MSE wall could be designed using a unit weight of 120 pcf and a friction angle of 30 degrees for the reinforced backfill soil.

4.1.3 Prefabricated Modular Gravity Walls

This type of wall typically consists of interlocking soil or rock-filled concrete, steel, or wire modules or bins (such as gabions). The combined weight of the wall materials resists the lateral loads from the soil embankment being retained. This type of wall may be used where conventional reinforced concrete walls are also being considered but are typically selected when the overall wall height will be less than 25 feet.

The advantage of this type of wall is that less select fill is required for the backfill behind the wall and the construction is relatively more economical compared to other wall types; however, this type of wall may require additional soil excavation for placement of the modules. The additional cost of the excavations could be offset by the savings in construction costs and schedule as compared to other walls.

4.1.4 Recommended Wall Type

GSG understands that a MSE Wall will be selected for the design of the retaining wall the project. The retaining wall is considered a "fill" wall. GSG evaluated the global and external stability and settlement to determine the suitability of the retaining wall for this project. The wall section should be analyzed to determine adequate factors of safety relative to overturning failure. The contractor is responsible for providing a detailed internal stability design for the wall. The final wall design should be submitted to the structural design team for review prior to commencing construction of the wall.

4.2 Retaining Wall Design Recommendations

The engineering analyses performed for evaluation of the retaining wall options followed the current AASHTO Load and Resistance Factor Design (LRFD) Methodology as required by IDOT. LRFD methodology incorporates the use of load factors and resistance factors to account for uncertainty in applied loads and load resistance of structure elements separately. The AASHTO LRFD Bridge Design Specifications outline load factors and combinations for various strength, extreme event, service, and fatigue limit states. Section 11, which outlines geotechnical criteria for retaining walls, of the AASHTO Specifications requires the evaluation of bearing resistance failure, lateral sliding, and overturning at the strength limit state and excessive vertical displacement, excessive lateral displacement, and overall stability at the service limit state. The selected wall should be also evaluated with respect to the collision load. **Table 7** outlines the load factors used in evaluation of the retaining wall in accordance with AASHTO Specification Tables 3.4.1-1 and 3.4.1-2.

Table 7 - LRFD Load Factors for Retaining Wall Analyses

	Type of Load	Sliding and Eccentricity Strength	Bearing Resistance Strength I	Sliding and Eccentricity Extreme II	Bearing Resistance Extreme II	Settlement Service I
Load Factors for Vertical Loads	Dead Load of Structural Components (DC)	0.90	1.25	1.00	1.00	1.00
	Vertical Earth Pressure Load (EV)	1.00	1.35	1.00	1.00	1.00
	Earth Surcharge Load (ES)		1.50			
	Live Load Surcharge (LS)		1.75		0.50	1.00
Load Factors for Horizontal Loads	Horizontal Earth Pressure Load (EH)	1.50		1.00	1.00	1.00
	Active		1.50			
	At-Rest		1.35			
	AEP for anchored walls		1.35			
	Earth Surcharge (ES)	1.50	1.50			
	Live Load Surcharge (LS)	1.75	1.75	0.50	0.50	1.00
Load Factor for Vehicular Collision				1.00	1.00	

4.2.1 Lateral Earth Pressures and Loading

The wall should be designed to withstand earth and live lateral earth pressures. The lateral earth pressures on retaining walls depend on the type of wall (i.e. restrained or unrestrained), the type of backfill and the method of placement against the wall, and the magnitude of surcharge weight on the ground surface adjacent to the wall. The active earth pressure coefficient (Ka), and the passive earth pressure coefficient (Kp) were determined in accordance with AASHTO Section 3.11.5.3 and 3.11.5.4. Soil parameters for the site are included in **Appendix F**.

Traffic and other surcharge loads should be included in the retaining wall design as applicable. A live load surcharge shall be applied where vehicular load is expected to act on the surface of the backfill within a distance equal to one-half the wall height behind the back face of the wall in accordance with AASHTO 3.11.6.4. The live load surcharge may be estimated as a uniform horizontal earth pressure due to an equivalent height (Heq) of soil. **Table 8** provides the equivalent heights of soils for vehicular loadings on retaining walls.

Table 8 - Equivalent Height of Soil for Vehicular Loading on Retaining Walls Parallel to Traffic

Retaining Wall Height (ft)	H_{eq} Distance from Wall Back face to Edge of Traffic	
	0 feet	1.0 feet or Further
5	5.0 feet	2.0 feet
10	3.5 feet	2.0 feet
≥20	2.0 feet	2.0 feet

Reference: AASHTO LRFD Table 3.11.6.4-2

The retaining wall design should include a drainage system to allow movement of any water behind the wall, and not allowing hydrostatic (seepage) pressures to develop in the active soil wedge behind the wall. The backfill should be placed in accordance with the IDOT SSRBC.

Heavy compaction equipment should not be allowed closer than three (3) feet to the retaining wall to prevent inducing high lateral earth pressures and causing wall yielding and/or other damage. The passive lateral earth pressure coefficient (Kp) from the upper 3.5 feet of level backfill at the toe of the wall should be neglected, unless the soil is confined or protected by a concrete slab or well drained pavement. The passive lateral earth pressure coefficient from the upper 3.5 feet of soil for a descending slope at the wall toe should also be neglected, regardless of any surface protection.

4.2.2 Bearing Resistance – MSE Wall

It is anticipated that the retaining wall will bear on new engineered fill or native sand with gravel soils. Bearing resistance for the retaining wall shall be evaluated at the strength limit state using load factors (see **Table 7**), and factored bearing resistances. The bearing resistance factor, ϕ_b, for a MSE wall is 0.65 per AASHTO Table 11.5.7-1. The bearing resistance shall be checked for the extreme limit state with a resistance factor of 1.0. **Table 9** presents the proposed bearing elevation and recommended bearing resistances of suitable materials to support the wall system.

Table 9 – Recommended Bearing Resistance (MSE Wall)

Stations	Elevation (feet)	Nominal Resistance (ksf)	Factored Bearing Resistance (ksf)	Bearing Resistance for 1-inch Settlement Service Limit (ksf)	Bearing Resistance for 2-inch Settlement Service Limit (ksf)	Anticipated Bearing Soil
7+07 to 8+15	532.5	11.3	7.3	3.3	7.3	Existing Silty Clay Fill
8+15 to 10+13.59	521.5	29.3	19.0	19.0	N/A	Native Sand and Gravel

The minimum depth of the wall should be 3.5 feet below the final exterior grade to alleviate the effects of frost. The subgrade soils encountered at the bearing elevations should be cleared of any unsuitable material, such as topsoil. Based on the results of the subsurface exploration we anticipate the wall would be supported upon the soil types noted in **Table 9.**

4.2.3 Subgrade Undercut Areas

Based on the soil conditions along the wall alignment, little to no undercuts are anticipated. Undercut areas (if needed) should be replaced with granular structural fill in accordance with IDOT standard construction requirements. The lateral limit of the structural fill should extend a minimum of 1 foot beyond the edge of the footing, then an additional 1 foot laterally for every 2 feet of structural fill depth as depicted in **Exhibit 3**. The granular structural fill should be placed and compacted to a minimum of 95% of the maximum dry density, as determined by AASHTO T-180: Standard Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures (ASTM D1557) in accordance with IDOT standard construction requirements.

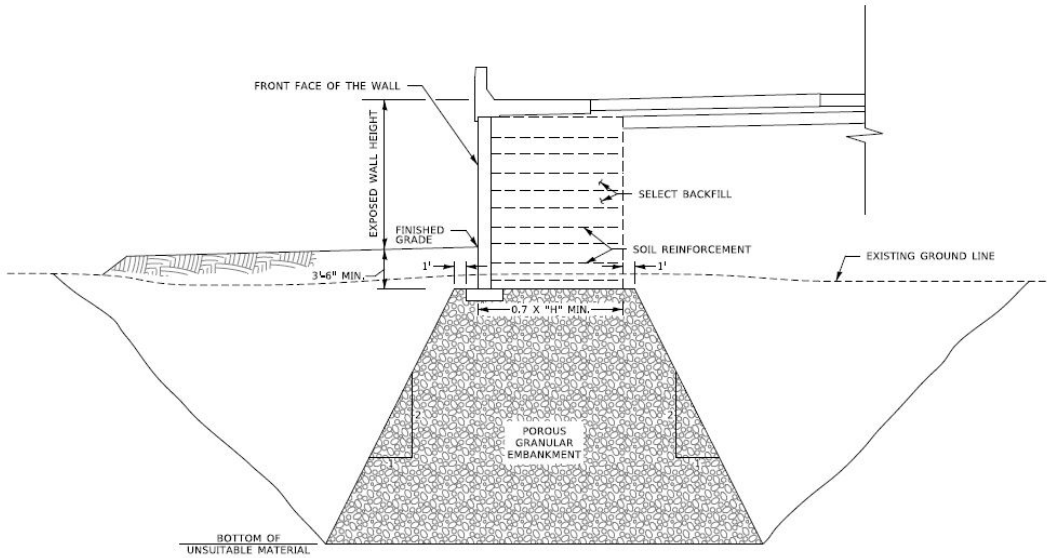


Exhibit 3 - Structural Fill Placement below MSE Wall

4.3 Sliding and Overturning Stability

The wall base width should be sufficient to resist sliding. The frictional resistance shall include the friction between granular backfill for the wall and supportive granular soils, and the friction between the wall foundation and bearing soils.

The factored resistance against sliding should be calculated using equation 10.6.3.4-1 in the AASHTO LRFD manual. A sliding resistance factor, ϕ, of 1.0 (Table 11.5.7-1) shall be applied to the nominal sliding resistance of soil beneath the wall footing. Assuming a layer of compacted granular material under the footing, the sliding resistance may be taken as one-half the normal stress on the interface between the footing and soil. The footing must be wide enough to resist overturning forces. The location of the resultant of the forces shall be within the middle two-thirds of the base width.

4.4 Wall Settlement

Settlement of the proposed wall and embankment system depends on the foundation size and bearing resistance, as well as the strength and compressibility characteristics of the underlying bearing soil. Assuming the foundation subgrade has been prepared as recommended above and the service bearing resistances as noted in **Table 9** are used, settlement of the retaining wall will be on the order of 1 inch. Differential settlement between two points of 100 feet apart along the length of the wall will be ½ inch or less.

4.5 Global Slope Stability

Based on the preliminary information provided by WSP, the retaining wall should be designed for external stability of the wall system. The parameters in **Table 10** were used to evaluate the proposed MSE preliminary wall types in order to reach a minimum Factor of Safety of 1.5.

Table 10 – MSE Wall Description
*Based on preliminary drawings provided

Description	Value at Station		
	7+50	**9+00**	**10+00**
Maximum total retained height of retaining wall (H), feet	11.5	27.0	8.0
Minimum length of reinforcement 0.7XH or 8.0 feet*	8.0	19.0	8.0
Unit weight of the retained soil (embankment), pcf	125		
Unit weight of the reinforced soil mass, pcf	120		
Assumed bearing elevation, feet	532.5	521.5	521.5

*Actual minimum length may be greater than 0.7H depending on structural analysis

The actual wall width, and total height of the wall should be based on structural analysis performed by a Licensed Structural Engineer in the State of Illinois.

Slide2 is a comprehensive slope stability analysis software used to evaluate the proposed wall for the project based on the limit equilibrium method. The proposed wall was analyzed based on the preliminary grading and the soils encountered while drilling. Circular failure analyses were evaluated using the simplified Bishops analyses methods for the proposed wall geometries. Based on the proposed geometry and the soil borings, global stability analyses were performed.

4.5.1 Global Slope Stability Results

Circular failure analyses were evaluated for both a short term (undrained) and long term (drained) condition based on the proposed geometries (**Table 10**) for the proposed MSE retaining wall scenarios. The analyses were performed at Stations 7+50, 9+00 and 10+00. The results of the analyses are shown in **Table 11**.

Table 11 – Retaining Wall Global Slope Stability Analyses Results

Analysis Exhibit	Location	Wall Type	Analysis Type	Factor of Safety	Minimum Factor of Safety
Exhibit 1	Station 7+50	MSE Wall	Circular – Short Term	3.4	1.5
Exhibit 2			Circular – Long Term	1.7	1.5
Exhibit 3	Station 9+00		Circular – Short Term	2.8	1.5
Exhibit 4			Circular – Long Term	2.2	1.5
Exhibit 5	Station 10+00		Circular – Short Term	3.2	1.5
Exhibit 6			Circular – Long Term	2.3	1.5

Based on the analyses performed, the proposed retaining wall meets the minimum factor of safety of 1.5. Copies of the slope stability analyses are included in the Slope Stability Analysis Exhibits (**Appendix E**).

4.6 Drainage Recommendations

The wall design should include a free draining system through panel joints to prevent the buildup of hydrostatic forces behind the wall. A drainage system could also be accomplished with the installation of drainage blankets, geocomposite drainage panels, or gravel drains behind the facing of the wall with outlet pipes below the facing to collect and remove surface water away from the face of the MSE wall. If weep holes are to be used, it is recommended that a geocomposite wall drain to be placed over the interlocks and area of the weep holes. If drainage is not provided, hydrostatic pressure should be included in the wall design and the horizontal earth pressure should be determined in accordance with AASHTO article 3.11.3.

5.0 CONSTRUCTION CONSIDERATIONS

All work performed for the proposed project should conform to the requirements in the IDOT Standard Specifications for Road and Bridge Construction (SSRBC) (2022). Any deviation from the requirements in the manuals above should be approved by the design engineer.

5.1 Site Preparation

All trees, pavements, vegetation, landscaping, and surface topsoil should be cleared and removed from the vicinity of the proposed construction. Where possible, the engineer may require proof-rolling of the subgrade with a 35-ton loaded truck or other pneumatic-tired vehicle of similar size and weight. The purpose of the proof-rolling is to locate soft, weak, or excessively wet soils present at the time of construction. Proof-rolling should be performed during a time of good weather and not while the site is wet, frozen, or severely desiccated. Any unsuitable materials observed during the evaluation and proof-rolling operations should be undercut and replaced with compacted structural fill and/or stabilized in-place. The possible need for, and extent of, undercutting and/or in-place stabilization required can best be determined by the geotechnical engineer at the time of construction. Once the site has been properly prepared, at grade construction may proceed.

Foundation aggregate fill should not be placed upon wet or frozen subgrade soils. If the subgrade or structural fill becomes frozen, desiccated, wet, disturbed, softened, or loose, the affected materials should be scarified, dried and moisture conditioned, and compacted to the full depth of the affected area or the soils should be removed. Rainfall and runoff can soften soils and affect the load bearing capacity of the soils. All water entering the foundation excavation should be removed prior to placement of backfill materials above the wall bottom.

5.2 Existing Utilities

Based on the existing site conditions, utilities exist along the project corridor. Before proceeding with construction, all existing underground utility lines or structures that will interfere with construction should be completely relocated from the proposed construction areas. Where possible, existing utility lines that are to be abandoned in place should be removed and/or plugged with cement grout. All excavations resulting from underground utilities removal activities should be cleaned of loose and disturbed materials, including all previously placed backfill, and backfilled with suitable fill materials in accordance with the requirements of this section. During the clearing and stripping operations, positive surface drainage should be maintained to prevent the accumulation of water.

5.3 Site Excavation

Site excavations are expected to encounter various types of soils as described in the Subsurface Exploration section of this report. The contractor will be responsible to provide a safe excavation during the construction activities of the project. All excavations should be conducted in accordance with applicable federal, state, and local safety regulations, including, but not limited to the Occupational Safety and Health Administration (OSHA) excavation safety standards. Excavation stability and soil pressures on temporary shoring are dependent on soil conditions, depth of excavations, installation procedures, and the magnitude of any surcharge loads on the ground surface adjacent to the excavation. Excavation near existing structures and underground utilities should be performed with extreme care to avoid undermining existing structures. Excavations should not extend below the level of adjacent existing foundations or utilities unless underpinning or other support is installed. It is the responsibility of the contractor for field determinations of applicable conditions and providing adequate shoring (if needed) for all excavation activities.

5.4 Borrow Material and Compaction Requirements

If borrow material is to be used for onsite construction, it should conform to Section 204 “Borrow and Furnish Excavations” of the IDOT Construction Manual (2022). The fill material should be free of organic matter and debris and should be placed and compacted in accordance with Section 205, Embankment, of the IDOT Construction Manual. Should fill be placed during cool, wet seasons, the use of granular fill may be necessary since weather conditions will make compaction of cohesive soils more difficult. If water seepage while excavating and backfilling procedures, or where wet conditions are encountered such that the water cannot be removed with conventional sump and pump procedures, GSG recommends placing open grade stone similar to IDOT CA-7 to stabilize the bottom of the excavation. The CA-7 stone should be placed to 12 inches above the water level, in 12-inch lifts, and should be compacted with the use of a heavy smooth drum roller or heavy vibratory plate compactor until stable. The remaining portion of the excavation should be backfilled using approved engineered fill.

GSG recommends that subgrade preparation, and structural fill placement and compaction be inspected by a GSG geotechnical engineer to verify the type and strength of soil materials present at the site and their conformance with the geotechnical recommendations in this report.

5.5 Groundwater Management

Based on the general lack of water levels and color change from brown to gray observed in the soil borings, it is anticipated that the long-term groundwater level may be near the bedrock interface. GSG does not anticipate that significant groundwater related issues will occur during construction activity, however perched water may be encountered within the existing fill. If rainwater run-off or groundwater is accumulated at the base of excavations, the contractor should remove accumulated water using conventional sump pit and pump procedures and maintain a dry and stable excavation. The location of the sump should be determined by the contractor based on field conditions. During earthmoving activities at the site, grading should be performed to ensure that drainage is maintained throughout the construction period. Water should not be allowed to accumulate in the foundation area either during or after construction. Undercut and excavated areas should be sloped toward one corner to facilitate removal of any collected rainwater or surface run-off. Grades should be sloped away from the excavations to minimize runoff from entering.

If water seepage occurs during excavations or where wet conditions are encountered such that the water cannot be removed with conventional sumping, we recommend placing open grade stone similar to IDOT CA-7 to stabilize the bottom of the excavation below the water table. The CA-7 stone should be placed to 12 inches above the water table, in 12-inch lifts, and should be compacted with the use of a heavy smooth drum roller or heavy vibratory plate compactor until stable. The remaining portion of the excavation beneath the footings should be backfilled using approved structural fill.

5.6 Temporary Earth Structure Lateral Earth Pressures

It is anticipated that staged construction will be utilized for construction of the new ramp and wall; therefore, a temporary soil retention system (TSRS) is anticipated to be required. The Temporary Soil Retention System shall be designed by an Illinois licensed structural engineer in accordance with the IDOT Bridge Design Manual, Section 3.13.1, Temporary Sheet Piling Design, Temporary Soil Retention Systems. The design of the Temporary Soil Retention System is the responsibility of the contractor.

The IDOT Temporary Sheet Piling Design procedures include limitations if the required embedment depths fall below soil layers with a Qu value larger than 4.5 tsf or N-values larger than 45 blows or rock, because the sheet piling may not penetrate these layers. Refer to the soil boring logs for the elevations to the hard stratum. If adequate retained heights cannot be obtained using the IDOT Temporary Sheet Piling Design Guide, then a Temporary Soil Retention System shall be designed by the Contractor. The Temporary Soil Retention Systems should include surcharge loads from the excavated materials, construction equipment and truck traffic as necessary. The retention system should extend to a sufficient depth below excavation bottom to provide the required lateral passive resistance if the active case is used for the design. Embedment depths should be determined based on the principles of force and moment equilibrium. The retention system should be designed for at-rest condition if the adjacent railroad embankment cannot withstand the anticipated horizontal and vertical movements of the construction excavation.

The retention system shall be designed by an Illinois licensed structural engineer in accordance with the IDOT Bridge Design Manual. The design of the temporary soil retention system (TSRS) is the responsibility of the contractor. The contractor should submit the TSRS plans to the structural design team for review prior to commencing construction of the TSRS.

6.0 LIMITATIONS

This report has been prepared for the exclusive use of the Illinois Department of Transportation (IDOT) and its Design Section Engineer consultant. The recommendations provided in the report are specific to the project described herein and are based on the information obtained at the soil boring locations within the proposed project area. The analyses have been performed and the recommendations provided in this report are based on subsurface conditions determined at the location of the borings. This report may not reflect all variations that may occur between boring locations or at some other time, the nature and extent of which may not become evident until during the time of construction. If variations in subsurface conditions become evident after submission of this report, it will be necessary to evaluate their nature and review the recommendations presented herein.

Appendix A

Preliminary GPE

Benchmark: Iron Rod with Cap I-80 Sta. 67+29.78, 390.65' LT
N 1,765,102.773 and E 1,052,594.602
Elev.= 546.815

Existing Structures: None.

Traffic Control: Traffic will be detoured during construction.

Salvage: None.

* Measured along F.F. of Wall

DESIGN SPECIFICATIONS

2020 AASHTO LRFD Bridge Design Specifications, 9th Edition

DESIGN STRESSES

PRECAST UNITS

f'c = 4,500 psi

FIELD UNITS

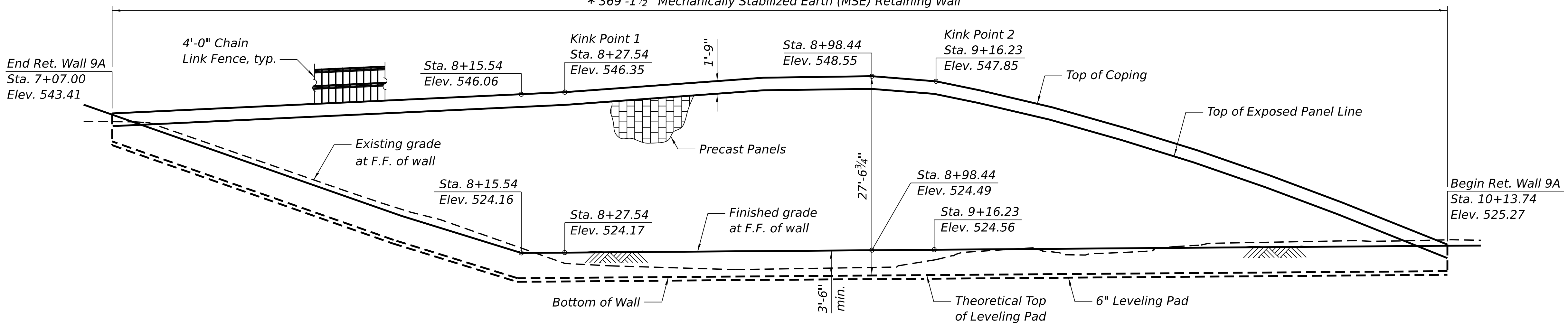
f'c = 3,500 psi
fy = 60,000 psi (Reinforcement)

HIGHWAY CLASSIFICATION

I-80	Ramp C
Functional Class: Interstate	Functional Class: Interstate
ADT: 91,100 (2017); 133,500 (2040)	ADT: 4,590 (2017); 12,500 (2040)
ADTT: 19,241 (2017); 28,169 (2040)	ADTT: 395 (2017); 1,075 (2040)
Design Speed: 70 m.p.h.	Design Speed: 35 m.p.h.
Posted Speed: 65 m.p.h.	Posted Speed: 35 m.p.h.
One-Way Traffic	One-Way Traffic
Directional Distribution: 100% EB	Directional Distribution: 100% WB

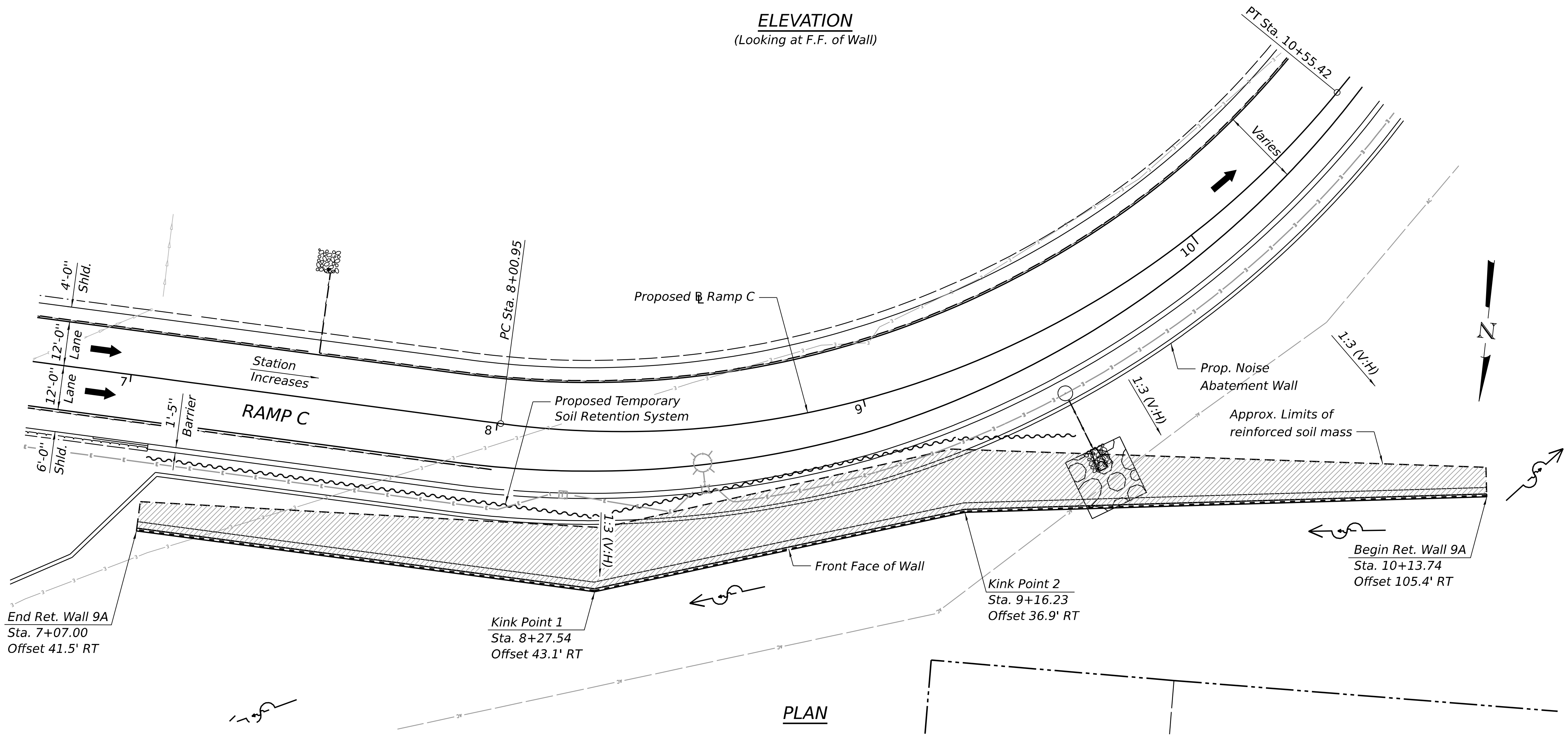
NOTES:

1. Stations and offsets are measured from the ℄ of Ramp C to the front face of precast panels.



ELEVATION

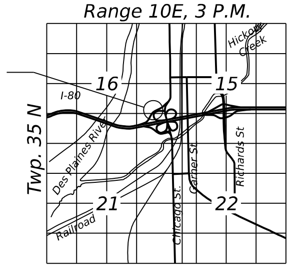
(Looking at F.F. of Wall)



PLAN

LEGEND

- Soil Borings
- Exist. Underground Electric
- Exist. Underground Storm Sewer
- Exist. ROW Access Control (To be removed)
- Prop. Underground Electric
- Prop. Storm Sewer
- Prop. Pipe Underdrain
- Prop. Temporary Soil Retention System
- Prop. ROW
- F.F. Front Face
- B.F. Back Face



LOCATION SKETCH

GENERAL PLAN AND ELEVATION
RETAINING WALL ALONG RAMP C
F.A.I. RTE. 80 - SEC 2017-057F
WILL COUNTY
STA. 7+07.00 TO STA. 10+13.74
STRUCTURE NO. 099-W128

MODEL: Default
FILE NAME: 099XXXX-62F94-sht-TSL_W9A_001.dgn

SEA
1111 BURLINGTON AVE., SUITE 111 - LISLE, IL 60532
(630) 641-9900

USER NAME = Jsandoval	DESIGNED - JS	REVISED -	
	CHECKED - RRD	REVISED -	
PLOT SCALE = 0:0.1667 ':' / in.	DRAWN - SVJ	REVISED -	
PLOT DATE = 12/13/2022	CHECKED - 10/7/2022	REVISED -	

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

GENERAL PLAN AND ELEVATION
STRUCTURE NO. 099-W128

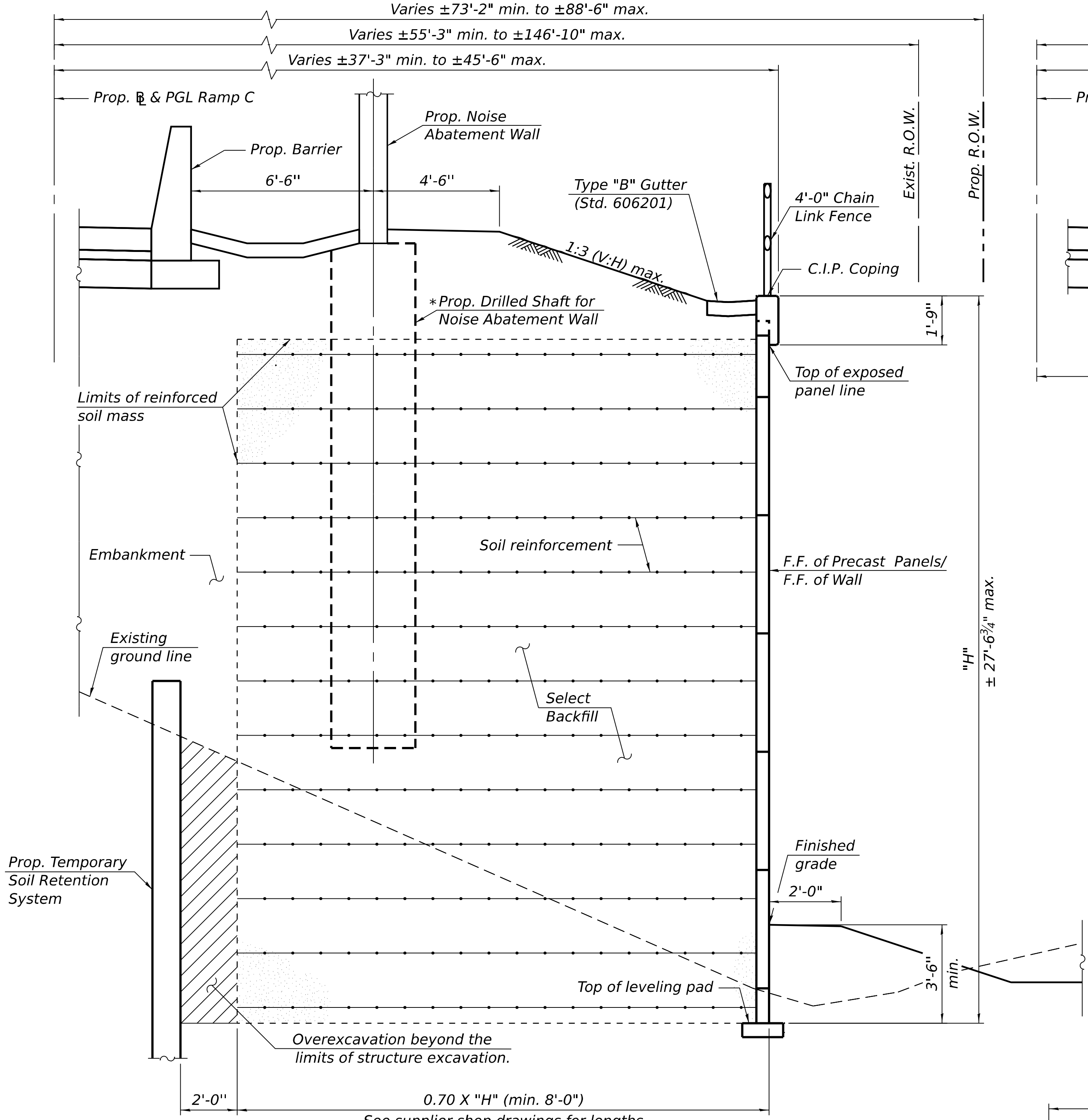
SHEET 1 OF 2 SHEETS

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
80	2017-057F	WILL	2	1

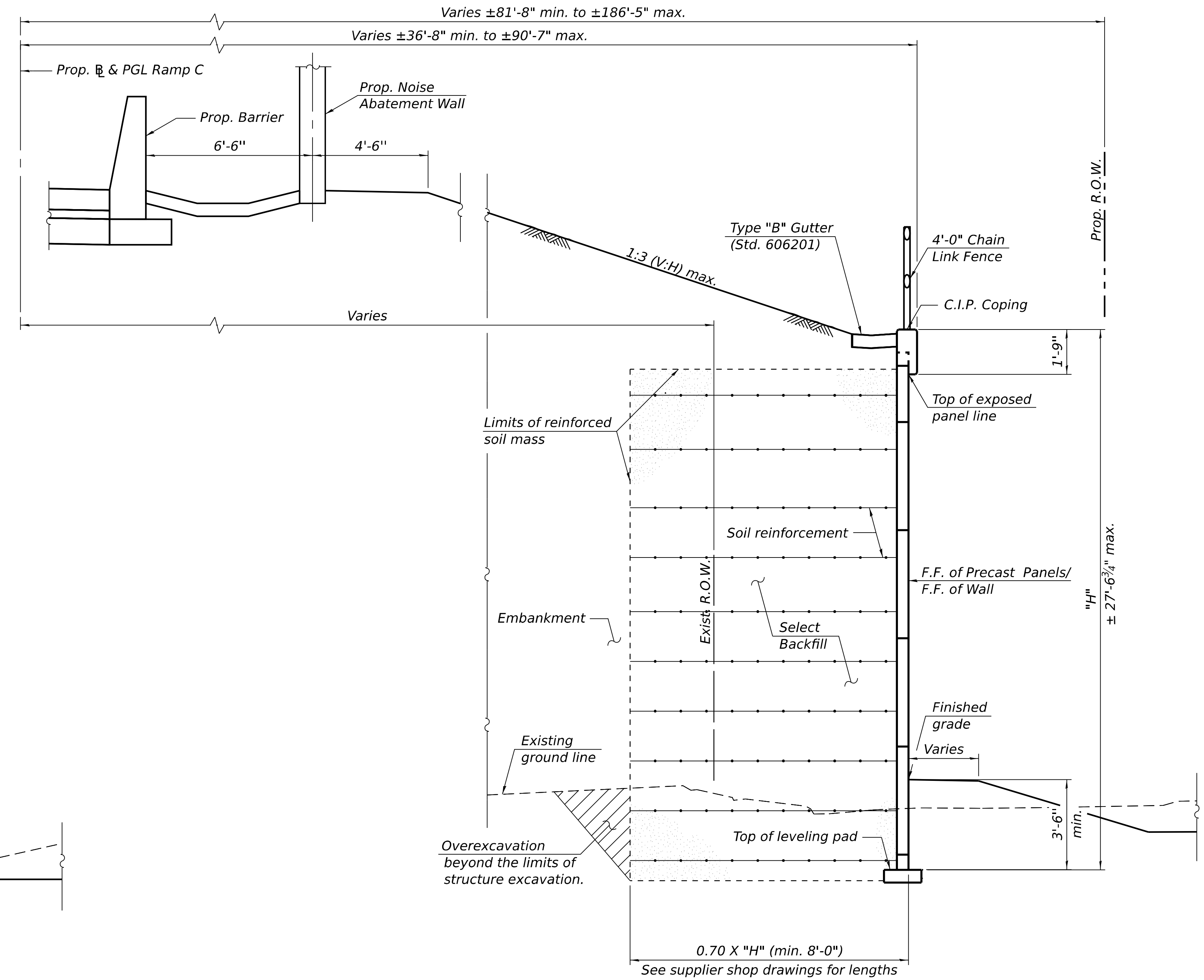
CONTRACT NO. 62F94

ILLINOIS FED. AID PROJECT

12/13/2022 3:13:11 PM



TYPICAL WALL SECTION
(Sta. 7+07.00 thru Sta. 9+16.17)
(Looking West)

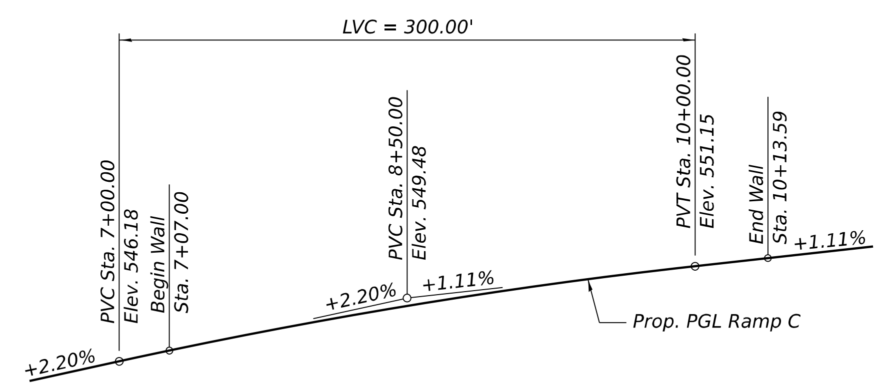


TYPICAL WALL SECTION
(Sta. 9+16.17 thru Sta. 10+13.74)
(Looking West)

* Shown for information only. Size and depth to be determined in final design.

PR RAMP C CURVE 1

P.I. Sta. = 9+40.44
Δ = 58°19'14" (LT)
D = 22°55'06"
R = 250.00'
T = 139.49'
L = 254.47'
E = 36.28'
e = 6.0%
P.C. Sta. = 8+00.95
P.T. Sta. = 10+55.42



RAMP C PROFILE GRADE
(Along Prop. ℄ Ramp C)

WALL DETAIL AND TYPICAL SECTIONS
RETAINING WALL ALONG RAMP C
F.A.I. RTE. 80 - SEC 2017-057F
WILL COUNTY
STA. 7+07.00 TO STA. 10+13.74
STRUCTURE NO. 099-W128

SEC
1111 BURLINGTON AVE., SUITE 111 - LISLE, IL 60532
(630) 641-9900

USER NAME = jsandoval	DESIGNED - JS	REVISED -	
	CHECKED - RRD	REVISED -	
PLOT SCALE = 0:1.9999 ':' / in.	DRAWN - SVJ	REVISED -	
PLOT DATE = 12/13/2022	CHECKED - 10/7/2022	REVISED -	

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

WALL DETAIL AND TYPICAL SECTION
STRUCTURE NO. 099-W128

SHEET 2 OF 2 SHEETS

F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
80	2017-057F	WILL	2	2
		CONTRACT NO. 62F94		
		ILLINOIS	FED. AID PROJECT	

MODEL: Default
FILE NAME: 099XXXX-62F94-sht-TSL_W9A_002.dgn

12/13/2022 3:13:18 PM

Appendix B

Soil Boring Location Plan and Subsurface Profile

FILE NAME = $FILEL$
PEN TABLE = $PENTBLL$
PLOT DATE = $DATE$
TIME = $TIME$
SHEET SIZE = $SHEETSIZE$
PLOT SCALE = $SCALE$
USER NAME = $USER$

GSG CONSULTANTS, INC.
735 E. REMINGTON RD, SCHAUMBURG, IL 60173
TEL: +1630.994.2600 | WWW.GSG-CONSULTANTS.COM

USER NAME	= $USER$	DESIGNED	- DD
SHEET SIZE	= $SHEETSIZE$	DRAWN	- NN
PLOT SCALE	= $SCALE$	CHECKED	- DE
PLOT DATE	= $DATE$	DATE	- 12/14/2022

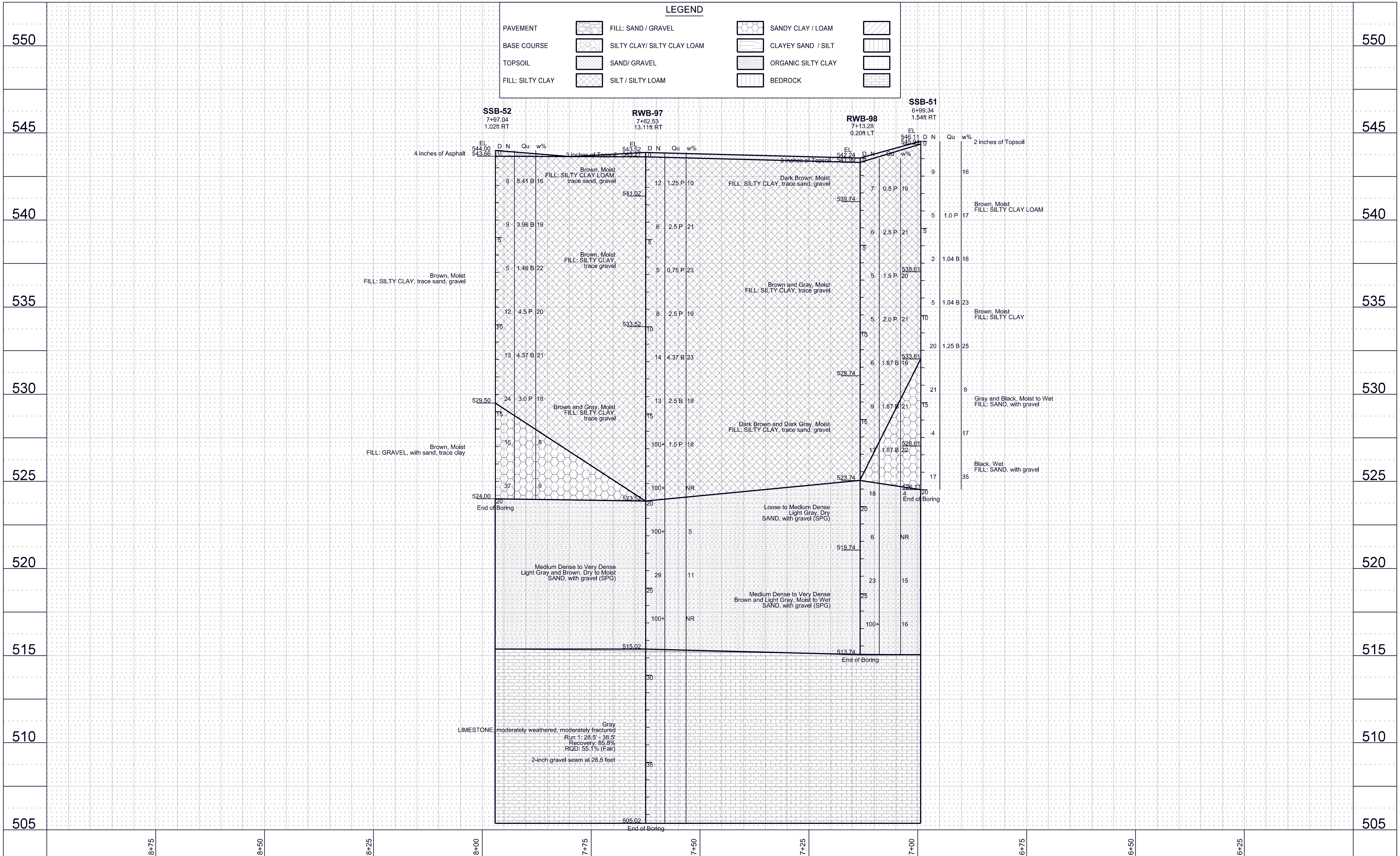
STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

RETAINING WALL NO. 9A - RAMP C
SOIL BORING LOCATION PLAN
JOLIET, ILLINOIS

SCALE: 1:50 | SHEET 1 OF 1 SHEETS | STA. | TO STA.

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
		WILL	2	1

CONTRACT NO. PTB-198-003
ILLINOIS | FED. AID PROJECT



USER NAME	= nnano	DESIGNED	- DD
SHEET SIZE	= 1.41667x0.916667 (ft.)	DRAWN	- NN
PLOT SCALE	= 1200:0.0000 ':" / ft.	CHECKED	- DE
PLOT DATE	= 12/15/2022	DATE	- 12/14/2022

GSG CONSULTANTS, INC.
735 E. REMINGTON RD, SCHAUMBURG, IL 60173
TEL: +1630.994.2600 | WWW.GSG-CONSULTANTS.COM

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

RETAINING WALL NO. 9A - RAMP C

SOIL BORING PROFILE

SCALE: AS NOTED | SHEET 1 OF 1 SHEETS | STA. 8+75 TO STA. 6+25

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
		WILL	2	2
		CONTRACT NO. PTB- 198-003		
ILLINOIS	FED. AID PROJECT			

Appendix C
Soil Boring Logs

Illinois Department of Transportation

Division of Highways
GSG

SOIL BORING LOG

Date 9/15/22

ROUTE I-80 **DESCRIPTION** Retaining Wall No. 9A - Ramp C **LOGGED BY** KA

SECTION C-91-109-22 **LOCATION** , **SEC.** 16, **TWP.** 35 N, **RNG.** 10 E,
Latitude 41.5130955, **Longitude** -88.0833101

COUNTY Will **DRILLING RIG** Diedrich D-50 **HAMMER TYPE** Auto
DRILLING METHOD HSA **HAMMER EFF (%)** 96

STRUCT. NO. 099-W128
Station

BORING NO. RWB-97
Station 7+62.5329
Offset 13.11ft RT
Ground Surface Elev. 543.52 ft

Surface Water Elev. N/A ft
Stream Bed Elev. N/A ft

Groundwater Elev.:
First Encounter Dry ft
Upon Completion N/A ft
After ___ **Hrs.** N/A ft

Description	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
3 inches of Topsoil 543.27				
Brown, Moist FILL: SILTY CLAY LOAM, trace sand, gravel		5		
		7	1.3	10
541.02		5	P	
Brown, Moist FILL: SILTY CLAY, trace gravel		3		
		3	2.5	21
	-5	3	P	
Cobbles at 6 feet		2		
		2	0.8	23
		3	P	
		2		
		3	2.5	19
533.52	-10	5	P	
Brown and Gray, Moist FILL: SILTY CLAY, trace gravel		5		
		8	4.4	23
		6	B	
		5		
		6	2.5	19
	-15	7	B	
Cobbles at 16 feet		3		
		5	1.5	18
		50/3"	P	
		50/2"		
				NR
523.52	-20			

Description	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Medium Dense to Very Dense Light Gray and Brown, Dry to Moist SAND, with gravel (SPG)		6		
		9		5
		50/2"		
Clay seam at 23.5 feet		11		
		9		11
	-25	20		
		50/1"		
				NR
515.02				
Gray LIMESTONE, moderately weathered, moderately fractured				
	-30			
Run 1: 28.5' - 38.5' Recovery: 85.8% RQD: 55.1% (Fair)				
2-inch gravel seam at 28.5 feet				
	-35			
505.02				
End of Boring				
	-40			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

Retaining Wall #9A
RWB-97
Will County, IL

Top

Depth = 28.5 ft
Elev. = 513.7 ft

Depth = 38.5 ft
Elev. = 503.7 ft

Bottom

Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Compressive Strength (psi)	Description
RWB-97	1	28.5' – 38.5'	85.8	55.1	Fair	12,232	Gray Limestone Moderately Weathered, Moderately Fractured, 2" of Black Gravel at 28.5'

Illinois Department of Transportation
Division of Highways
GSG

SOIL BORING LOG

Date 9/15/22

ROUTE I-80 **DESCRIPTION** Retaining Wall No. 9A - Ramp C **LOGGED BY** KA

SECTION C-91-109-22 **LOCATION** , **SEC.** 16, **TWP.** 35 N, **RNG.** 10 E,
Latitude 41.5131277, **Longitude** -88.0831292

COUNTY Will **DRILLING RIG** Diedrich D-50 **HAMMER TYPE** Auto
DRILLING METHOD HSA **HAMMER EFF (%)** 96

STRUCT. NO. 099-W128
Station

BORING NO. RWB-98
Station 7+13.2830
Offset 0.20ft LT
Ground Surface Elev. 542.24 ft

Surface Water Elev. N/A ft
Stream Bed Elev. N/A ft

Groundwater Elev.:
First Encounter Dry ft
Upon Completion N/A ft
After ____ **Hrs.** N/A ft

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
3 inches of Topsoil	~~541.99~~				
Dark Brown, Moist FILL: SILTY CLAY, trace sand, gravel			6 4 3	0.5 P	19
	539.74				
Brown and Gray, Moist FILL: SILTY CLAY, trace gravel		-5	3 3 3	2.5 P	21
			2 2 3	1.5 P	20
		-10	3 2 3	2.0 P	21
			3 3 3	1.9 B	16
	529.74				
Dark Brown and Dark Gray, Moist FILL: SILTY CLAY, trace sand, gravel		-15	3 5 4	1.9 B	21
Cobbles at 16 feet			3 4 9	1.9 B	22
	523.74				
Loose to Medium Dense Light Gray, Dry SAND, with gravel (SPG)		-20	28 11 7		4

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Loose to Medium Dense Light Gray, Dry SAND, with gravel (SPG) *(continued)*			5 5 1		NR
	519.74				
Medium Dense to Very Dense Brown and Light Gray, Moist to Wet SAND, with gravel (SPG)		-25	11 15 8		15
			14 14 50/3"		16
	513.74				
Auger refusal at 28.5 feet End of Boring		-30			
		-35			
		-40			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

Illinois Department of Transportation
Division of Highways
GSG

SOIL BORING LOG

Date 5/24/22

ROUTE I-80 DESCRIPTION Embankment - Ramp C (Chicago Street) LOGGED BY KA

SECTION C-91-109-22 LOCATION , SEC. 16, TWP. 35 N, RNG. 10 E,
Latitude , Longitude

COUNTY Will DRILLING RIG Geoprobe 7822DT HAMMER TYPE Auto
DRILLING METHOD HSA HAMMER EFF (%) 92

STRUCT. NO. 099-W128
Station

BORING NO. SSB-51
Station 6+99.3412
Offset 1.54ft RT
Ground Surface Elev. 546.11 ft

Surface Water Elev. N/A ft
Stream Bed Elev. N/A ft

Groundwater Elev.:
First Encounter Dry ft
Upon Completion N/A ft
After ___ Hrs. N/A ft

Description	Elev. (ft)	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
2 inches of Topsoil	545.94				
Brown, Moist FILL: SILTY CLAY LOAM			3 4 5		16
		-5	1 2 3	1.0 P	17
	538.61		1 1 1	1.0 B	16
Brown, Moist FILL: SILTY CLAY		-10	1 2 3	1.0 B	23
Cobbles at 11 feet	533.61		2 4 16	1.3 B	25
Gray and Black, Moist to Wet FILL: SAND, with gravel Cobbles at 13.5 feet		-15	13 9 12		8
Brick fragments at 16 feet	528.61		1 2 2		17
Black, Wet FILL: SAND, with gravel Cobbles at 18.5 feet	526.11	-20	4 5 12		35

End of Boring

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

Illinois Department of Transportation
Division of Highways
GSG

SOIL BORING LOG

Date 5/18/22

ROUTE I-80 **DESCRIPTION** Embankment - Ramp C (Chicago Street) **LOGGED BY** DM

SECTION C-91-109-22 **LOCATION** , **SEC.** 16, **TWP.** 35 N, **RNG.** 10 E, **Latitude** , **Longitude**

COUNTY Will **DRILLING RIG** Mobile B-57 **HAMMER TYPE** Auto
DRILLING METHOD HSA **HAMMER EFF (%)** 89

STRUCT. NO. 099-W128
Station

BORING NO. SSB-52
Station 7+97.0377
Offset 1.02ft RT
Ground Surface Elev. 544.00 ft

Surface Water Elev. N/A ft
Stream Bed Elev. N/A ft

Groundwater Elev.:
First Encounter Dry ft
Upon Completion N/A ft
After Hrs. N/A ft

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
4 inches of Asphalt	543.66				
Brown, Moist FILL: SILTY CLAY, trace sand, gravel			1		
			3	5.4	16
			5	B	
			3		
			4	4.0	19
		-5	5	B	
			1		
			2	1.5	22
			3	B	
			2		
			5	4.5	20
		-10	7	P	
			3		
			5	4.4	21
			8	B	
			3		
	529.50		9	3.0	18
Brown, Moist FILL: GRAVEL, with sand, trace clay		-15	15	P	
			8		
			8		9
			7		
			8		
			24		9
	524.00	-20	13		

End of Boring

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

BBS, form 137 (Rev. 8-99)

Appendix D
Laboratory Test Results

Compressive Strength of Rock by ASTM D7012 - Method C

GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

Project Name:	WSP 198-003 I-80	Project No:	21-2007
Boring ID:	RWB-97	Bulk/Prep	MC/CS
Sample Depth (ft):	34.5-35	Tester: SM	Tester: SM
Lithological Description:	Lime Stone	Date: 09/19/22	Date: 09/19/22
Formation Name:		Load Direction: Vertical	Angle Drilled: vertical
Appearance (e.g. cracks, shearing, spalling):	Cracks, Holes		

Bulk Density Determination

	1	2	3	Average
Height, *in.*	4.6045	4.5875	4.6030	4.5983
Diameter, *in.*	1.9755	1.9755	1.9760	1.9757

Specimen Mass, *g*	623.8	Ratio (2.0-2.5)	
Bulk Density, *pcf*	168.6		2.33

Moisture Condition - D2216

Container ID	Dots
container, *g*	226.8
container + wet rock, *g*	803.7
container + dry soil, *g*	791.6
moisture content, *w%*	2.1

Preparation Check	Yes	No	Reason/Readings If No:
Ends Flat within 0.02 mm prior to capping?	X		
Ends perpendicular to side within 0.25 degrees?	X		
Ends parallel to each other within 0.25 degrees?	X		

Axial Loading

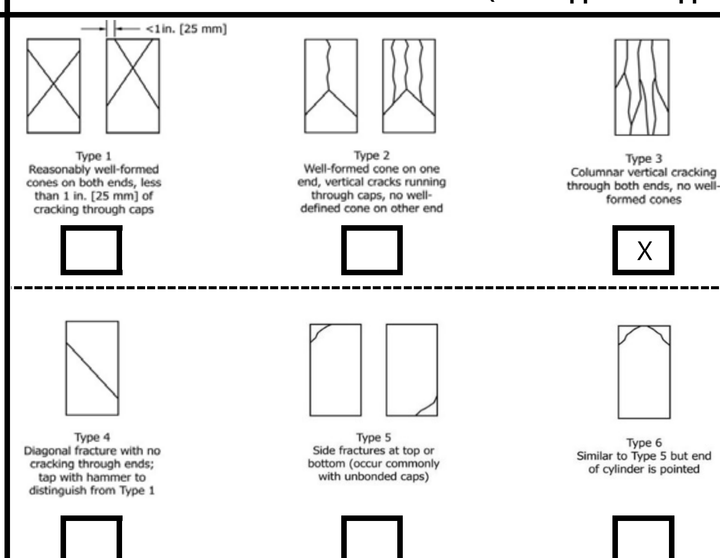
Seating Load (≤1000 psi)	1000
Rate of Loading (73-145 psi/s)	75
Time to Failure (2-15 min)	2 min 34 sec
Load @ Failure, *lbf*	37,498
Uniaxial Compressive Strength, *psi*	12,232

Remarks

Best efforts have been made for the specimen to meet the required tolerances of D4543. See IH3 Procedure for efforts made.

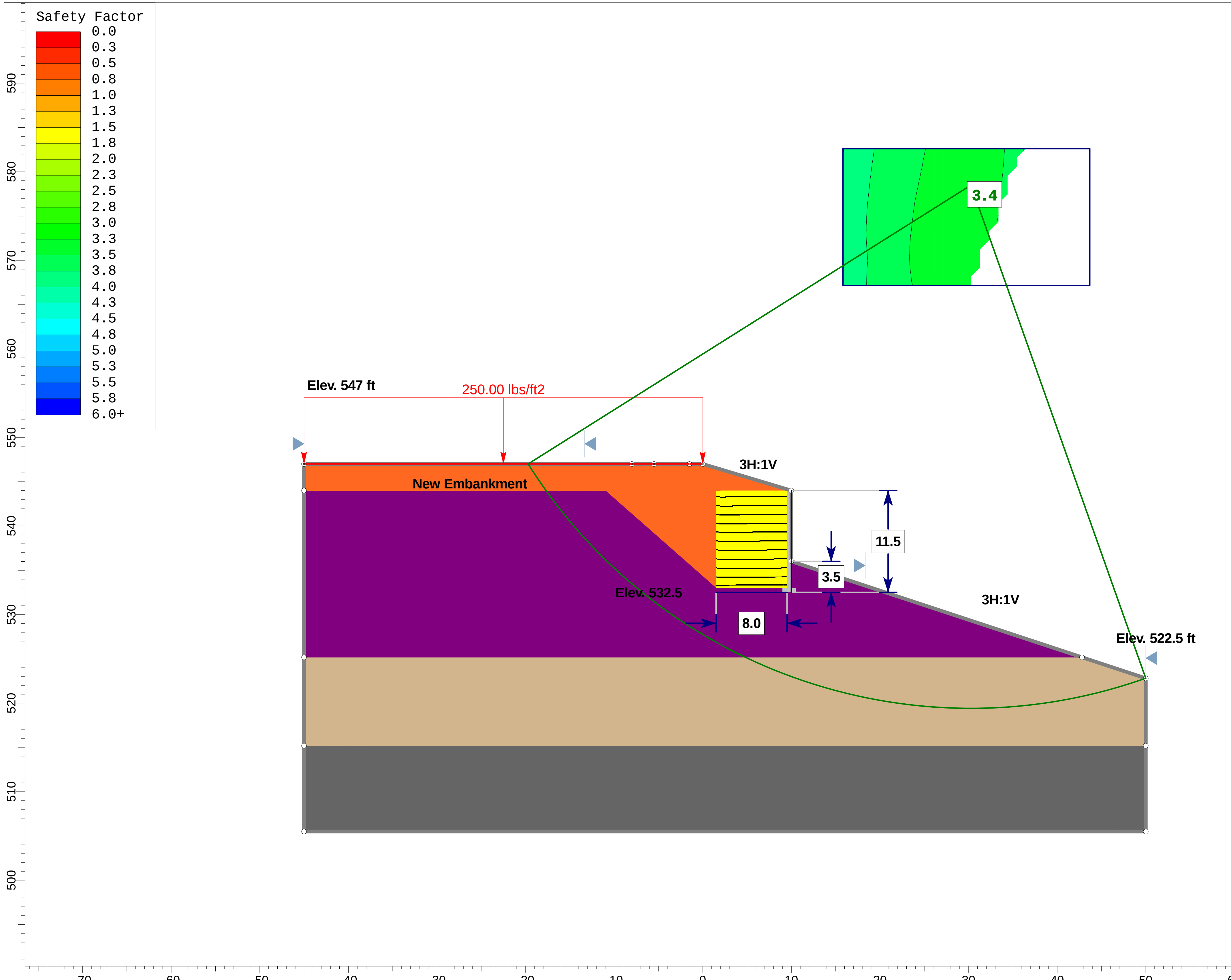
After Preparation

After Break (check applicable appearance)



Form ID	TF-RCS	Reviewed By	SL
Revision Date	10/21/2021	Review Date	09/29/22

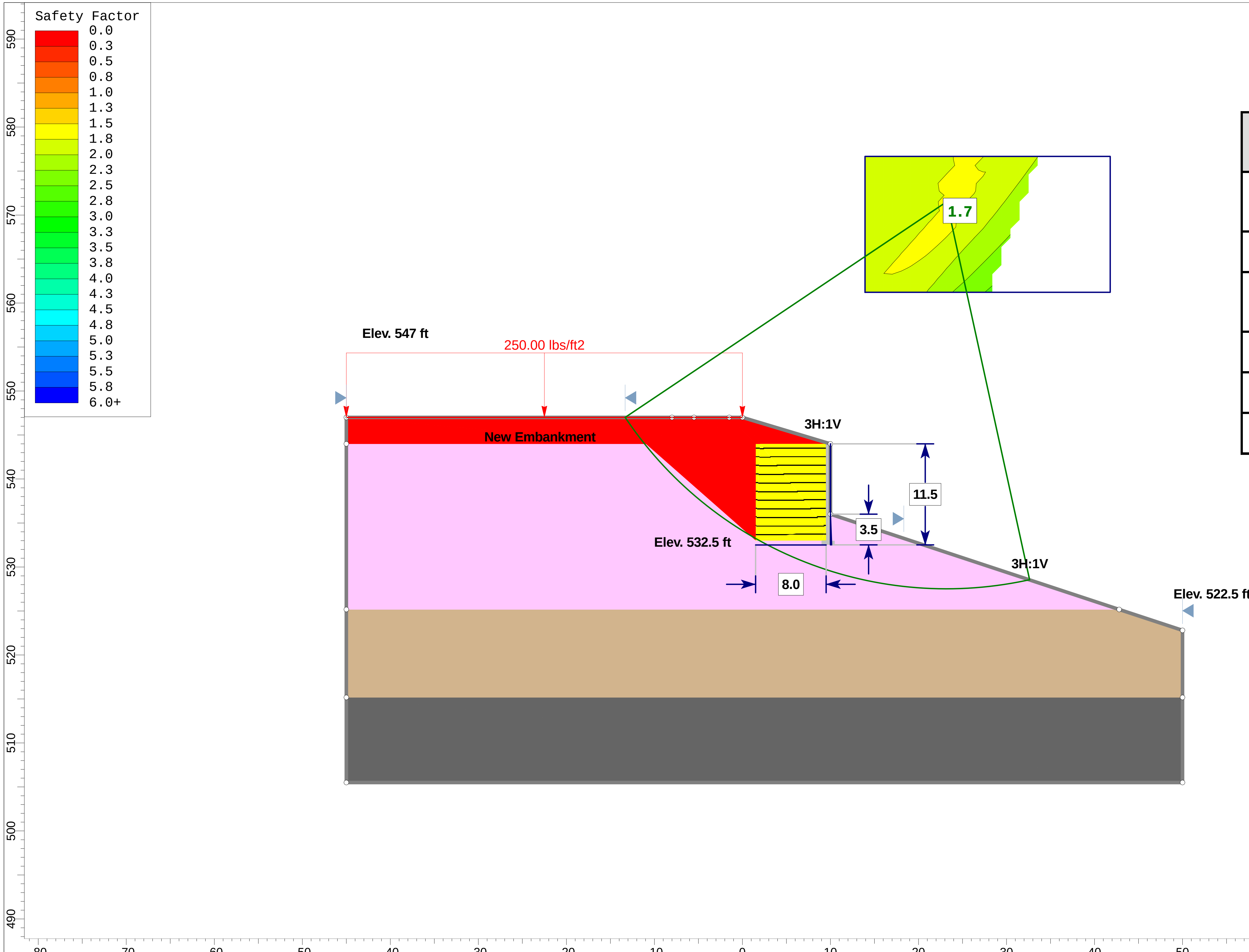
Appendix E
Slope Stability Analysis Exhibits



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
CIP Concrete Wall		150	Infinite strength		
New Clay Fill Undrained		120	Mohr-Coulomb	1000	0
Existing Silty Clay Fill Undrained		138	Mohr-Coulomb	2200	0
Brown Sand with Gravel		133	Mohr-Coulomb	0	42
Limestone		150	Mohr-Coulomb	0	45
MSE Wall		120	Infinite strength		

GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel. 630.994.2600, www.gsg-consultants.com

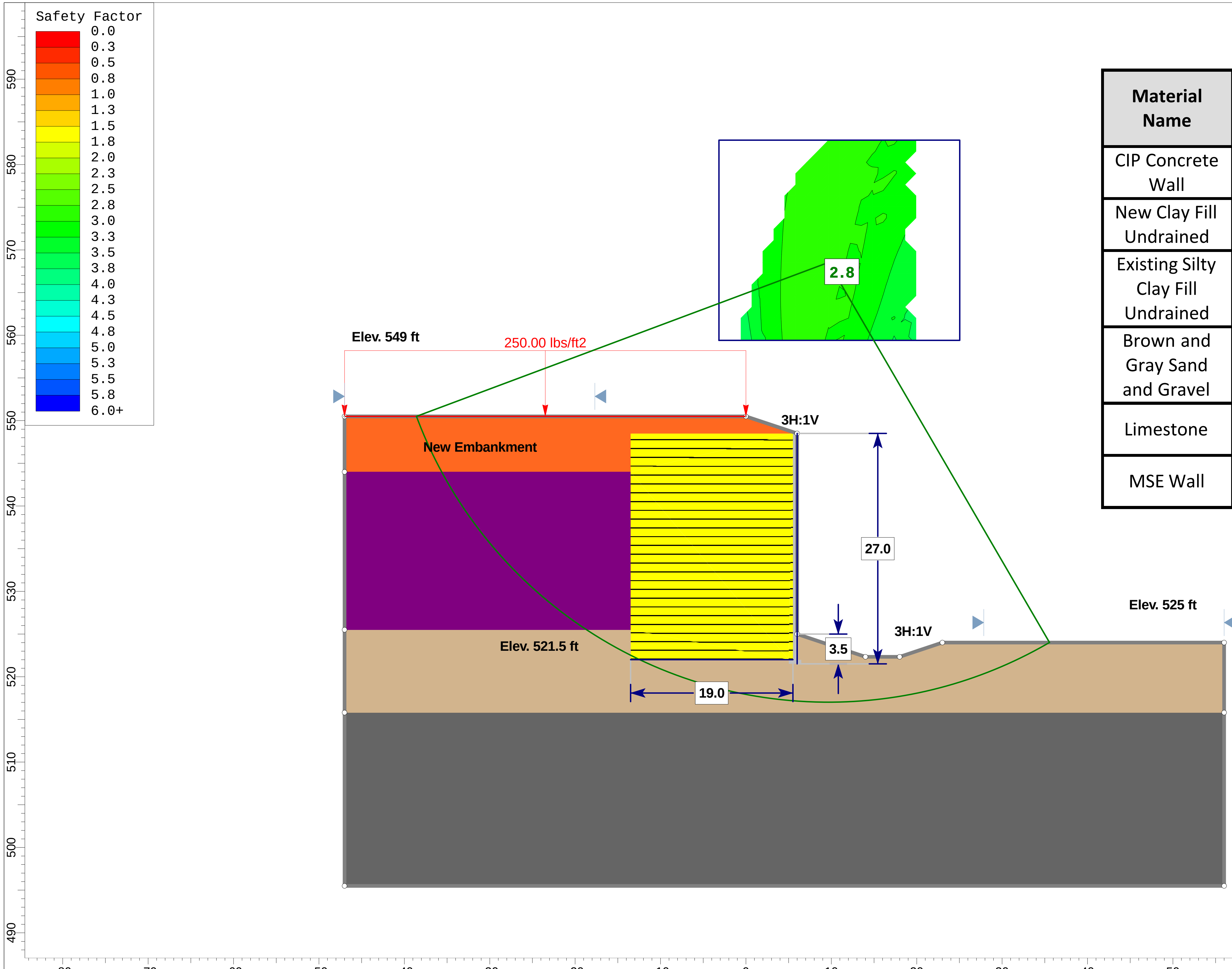
Project	I-80: IDOT PTB 198-003 - Retaining Wall #9A - MSE Wall - Station 7+50		
Analysis Description	Exhibit 1 - Circular Failure Short Term		
Drawn By	DD	Company	GSG Consultants Inc.
Date	12/16/2022	File Name	MSE Wall 7+50.slmd



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
CIP Concrete Wall		150	Infinite strength		
New Clay Fill Drained		120	Mohr-Coulomb	100	25
Existing Silty Clay Fill Drained		138	Mohr-Coulomb	220	25
Brown Sand with Gravel		133	Mohr-Coulomb	0	42
Limestone		150	Mohr-Coulomb	0	45
MSE Wall		120	Infinite strength		

GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel. 630.994.2600, www.gsg-consultants.com

Project	I-80: IDOT PTB 198-003 - Retaining Wall #9A - MSE Wall - Station 7+50
Analysis Description	Exhibit 2 - Circular Failure Long Term
Drawn By	DD
Company	GSG Consultants Inc.
Date	12/16/2022
File Name	MSE Wall 7+50.slmd

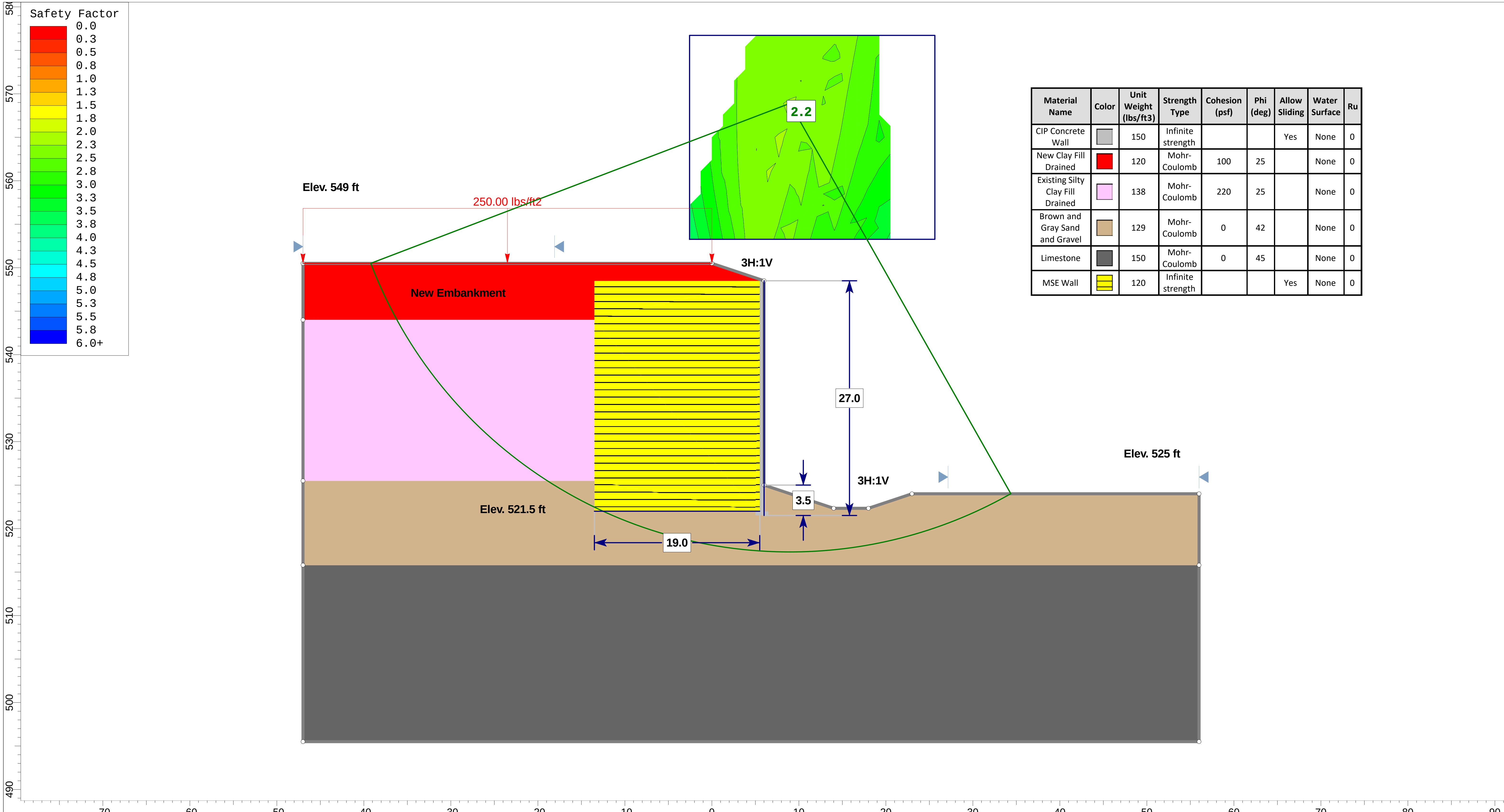


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
CIP Concrete Wall		150	Infinite strength		
New Clay Fill Undrained		120	Mohr-Coulomb	1000	0
Existing Silty Clay Fill Undrained		138	Mohr-Coulomb	2200	0
Brown and Gray Sand and Gravel		129	Mohr-Coulomb	0	42
Limestone		150	Mohr-Coulomb	0	45
MSE Wall		120	Infinite strength		

GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel. 630.994.2600, www.gsg-consultants.com

Project	I-80: IDOT PTB 198-003 - Retaining Wall #9A - MSE Wall - Station 9+00
Analysis Description	Exhibit 1 - Circular Failure Short Term

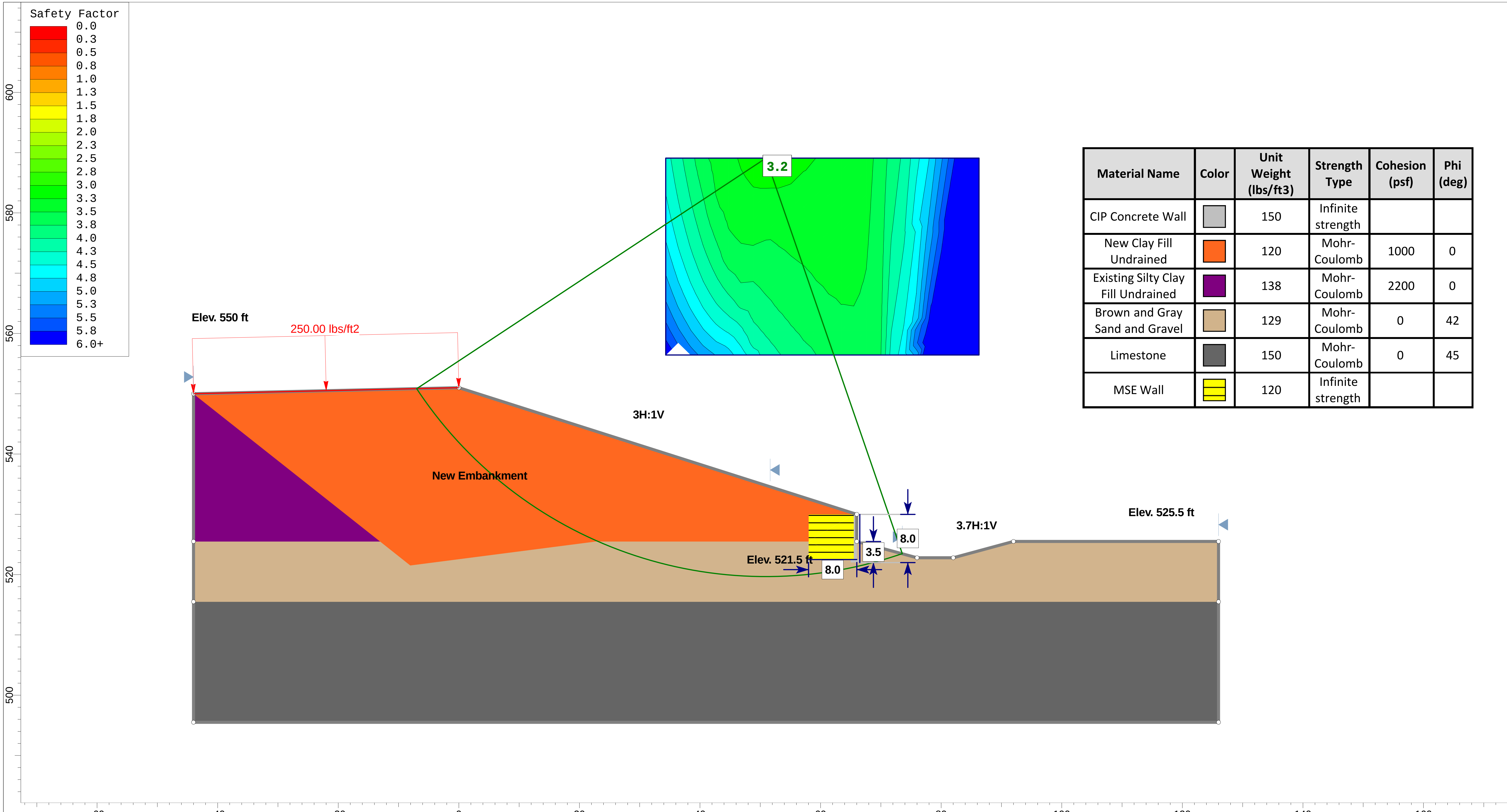
Drawn By	DD	Company	GSG Consultants Inc.
Date	12/16/2022	File Name	MSE Wall 9+00.slmd



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Allow Sliding	Water Surface	Ru
CIP Concrete Wall		150	Infinite strength			Yes	None	0
New Clay Fill Drained		120	Mohr-Coulomb	100	25		None	0
Existing Silty Clay Fill Drained		138	Mohr-Coulomb	220	25		None	0
Brown and Gray Sand and Gravel		129	Mohr-Coulomb	0	42		None	0
Limestone		150	Mohr-Coulomb	0	45		None	0
MSE Wall		120	Infinite strength			Yes	None	0

GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel. 630.994.2600, www.gsg-consultants.com

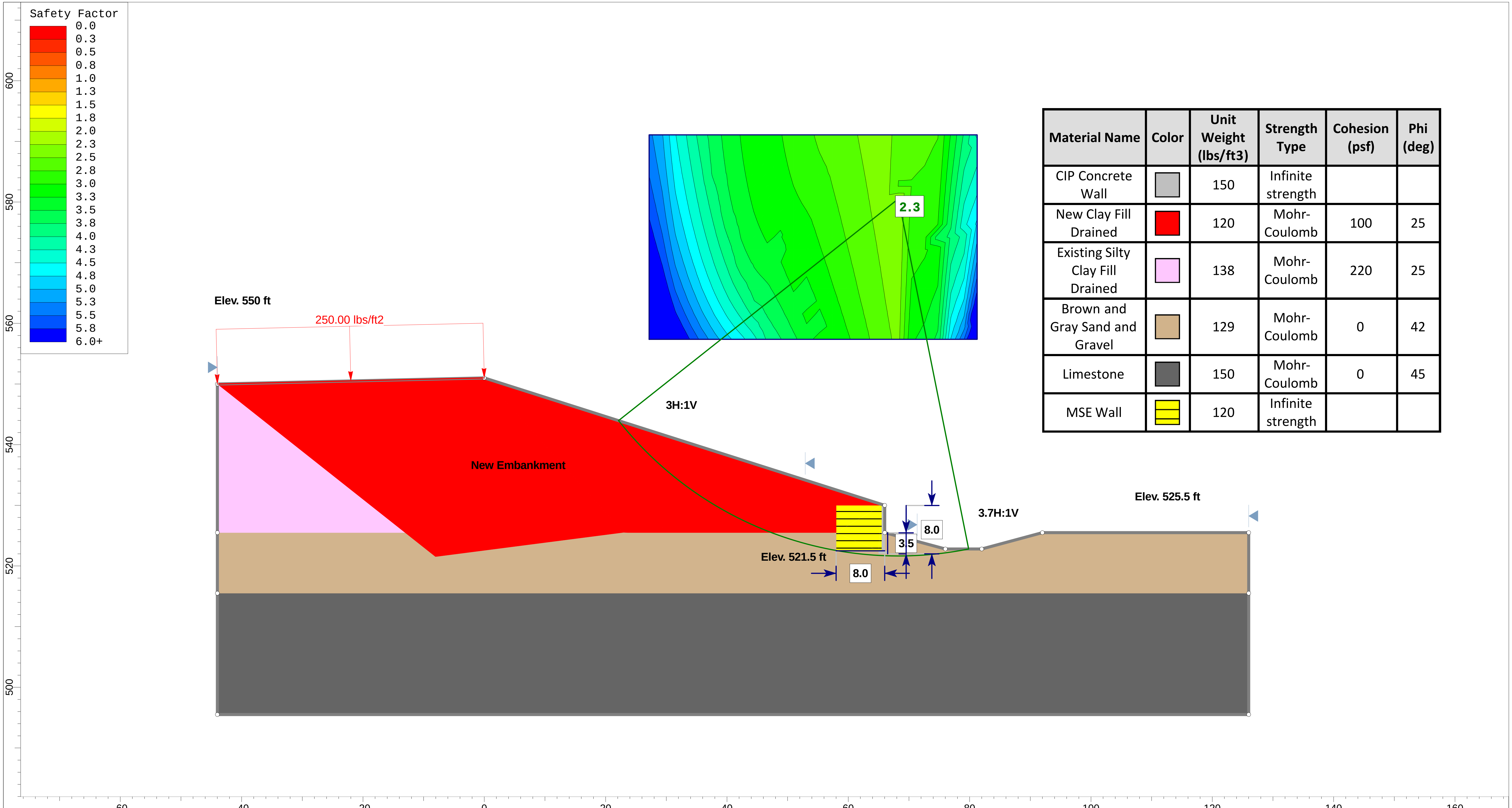
Project	I-80: IDOT PTB 198-003 - Retaining Wall #9A - MSE Wall - Station 9+00
Analysis Description	Exhibit 2 - Circular Failure Long Term
Drawn By	DD
Company	GSG Consultants Inc.
Date	12/16/2022
File Name	MSE Wall 9+00.slmd



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
CIP Concrete Wall		150	Infinite strength		
New Clay Fill Undrained		120	Mohr-Coulomb	1000	0
Existing Silty Clay Fill Undrained		138	Mohr-Coulomb	2200	0
Brown and Gray Sand and Gravel		129	Mohr-Coulomb	0	42
Limestone		150	Mohr-Coulomb	0	45
MSE Wall		120	Infinite strength		

GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel. 630.994.2600, www.gsg-consultants.com

Project	I-80: IDOT PTB 198-003 - Retaining Wall #9A - MSE Wall - Station 10+00		
Analysis Description	Exhibit 1 - Circular Failure Short term		
Drawn By	DD	*Company*	GSG Consultants Inc.
Date	12-16-2022	*File Name*	MSE Wall 10+00.slmd



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
CIP Concrete Wall		150	Infinite strength		
New Clay Fill Drained		120	Mohr-Coulomb	100	25
Existing Silty Clay Fill Drained		138	Mohr-Coulomb	220	25
Brown and Gray Sand and Gravel		129	Mohr-Coulomb	0	42
Limestone		150	Mohr-Coulomb	0	45
MSE Wall		120	Infinite strength		

GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel. 630.994.2600, www.gsg-consultants.com

Project	I-80: IDOT PTB 198-003 - Retaining Wall #9A - MSE Wall - Station 10+00
Analysis Description	Exhibit 2 - Circular Failure Long term
Drawn By	DD
Company	GSG Consultants Inc.
Date	12-16-2022
File Name	MSE Wall 10+00.slmd

APPENDIX F

SOIL DESIGN PARAMETERS

Table F1 – Retaining Wall #9A Soil Parameters

Approximate Depth Range (Elevation, feet)	Soil Description	In situ Unit Weight γ (pcf)	Undrained		Drained				
			Cohesion c (psf)	Friction Angle ϕ (Degrees)	Cohesion c (psf)	Friction Angle ϕ (Degrees)	Active Earth Pressure Coefficient (K_a)	Passive Earth Pressure Coefficient (K_p)	At-Rest Earth Pressure Coefficient (K_o)
	New Engineered Clay Fill	120	1,000	0	50	30	0.41	2.46	0.58
	New Engineered Granular Fill	120	0	30	0	30	0.33	3.00	0.50
0.0 - 18.5 (544.0 – 525.5)	FILL: Brown and Gray Silty Clay	138	2200	0	220	25	0.41	2.46	0.58
18.5 - 28.5 (525.5 - 515.5)	Loose to Very Dense Light Brown Sand, with gravel	133	0	42	0	42	0.20	5.04	0.33
28.5-38.5 (515.5 - 505.5)	Gray Limestone	150	0	45	0	45	0.17	5.83	0.29
14.5 - 20.0 (529.5 - 524.0) ***SSB-52 Only**	FILL: Brown Gravel, with sand, trace clay	131	0	41	0	41	0.21	4.81	0.34
12.5 – 20.0 (533.6 – 526.1) ***SSB-51 Only**	FILL: Black and Gray Sand, with gravel	126	0	34	0	34	0.28	3.54	0.44