

14 January 2025

Mark Hoffman
Garden Homes Management
820 Morris Turnpike
Suite 301
Short Hills, NJ 07078

**Re: Executive Summary of Global Stability Study for Eastern
Slope near Building D
West Essex – Highlands Development
West Orange, New Jersey
Langan Project No.: 101049801**

Dear Mr. Hoffman:

This letter serves as an executive summary of the enclosed report that documents the findings of a subsurface investigation and global slope stability evaluation performed by Langan Engineering and Environmental Services, LLC (Langan) for the eastern portion (the "Study Area") of the proposed West Essex Highlands development site located in West Orange, New Jersey.

EXECUTIVE SUMMARY

Langan was requested by West Essex Highlands, Inc. ("WEHI") to perform a global slope stability evaluation in response to the comments made by the public during Planning Board hearings regarding the proposed location of Building D. As depicted on the "Overall Grading Plan" (Sheet SP-11) prepared by Anderson Consulting Services, LLC, Building D is proposed to be constructed near the eastern portion of the subject property, but west of the slope which descends towards the Rosemont Terrace and Mayfair Drive developments to the east (the "Subject Slope").

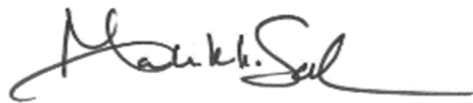
Langan's investigation summarized in the enclosed letter report evaluates the proposed construction of Building D from a geotechnical standpoint as it relates to the stability of the adjacent Subject Slope. As set forth therein, the subsurface investigation performed as part of this study consisted of soil borings and test pits that were performed in November and December 2024.

Based on our study, it is the professional opinion of the undersigned that the Subject Slope is stable under current conditions, would remain stable during the rock excavation to construct Building D foundations provided appropriate excavation and blasting

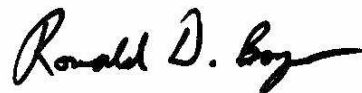
methods are utilized, and would be stable following the construction of Building D based on its anticipated structural loads and distance of Building D from the top of the slope.

It should be noted that Langan's study is based on the geotechnical subsurface data collected at accessible locations within the Study Area, the topographic survey data, currently existing site conditions and proposed building information made available to us. Any proposed changes in proposed structures (location, layout, loading, elevation) or existing slope conditions should be brought to our attention so that we can determine whether such changes affect our conclusions.

Sincerely,
**Langan Engineering and Environmental Services,
LLC**



Mark K. Seel, P.E.
Vice President



Ronald D. Boyer, P.E.
Senior Principal / Senior Vice President

Enclosure(s): Letter Report

cc: John Cote, Michael Vitello, Adam Yoda / Langan

NJ Certificate of Authorization No. 24GA27996400

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**Re: Global Stability Study for Eastern Slope near Building D
West Essex – Highlands Development
West Orange, New Jersey
Langan Project No.: 101049801**

Dear Mr. Hoffman:

This letter report documents the findings of a subsurface investigation and global slope stability evaluation performed by Langan Engineering and Environmental Services, LLC (Langan) for the eastern portion (the "Study Area") of the proposed West Essex Highlands development site located in West Orange, New Jersey.

The purpose of the study is to address perceived slope stability concerns (the "Subject Slope") raised by the public during previous Site Plan review meetings, related to the proposed construction of Building D on the West Essex Highlands Development.

This report provides an overview of the issue being investigated and statements of our opinions in that regard. Details concerning our subsurface investigation, analysis, and evaluation are provided as Attachment A in support of the statements and opinions herein.

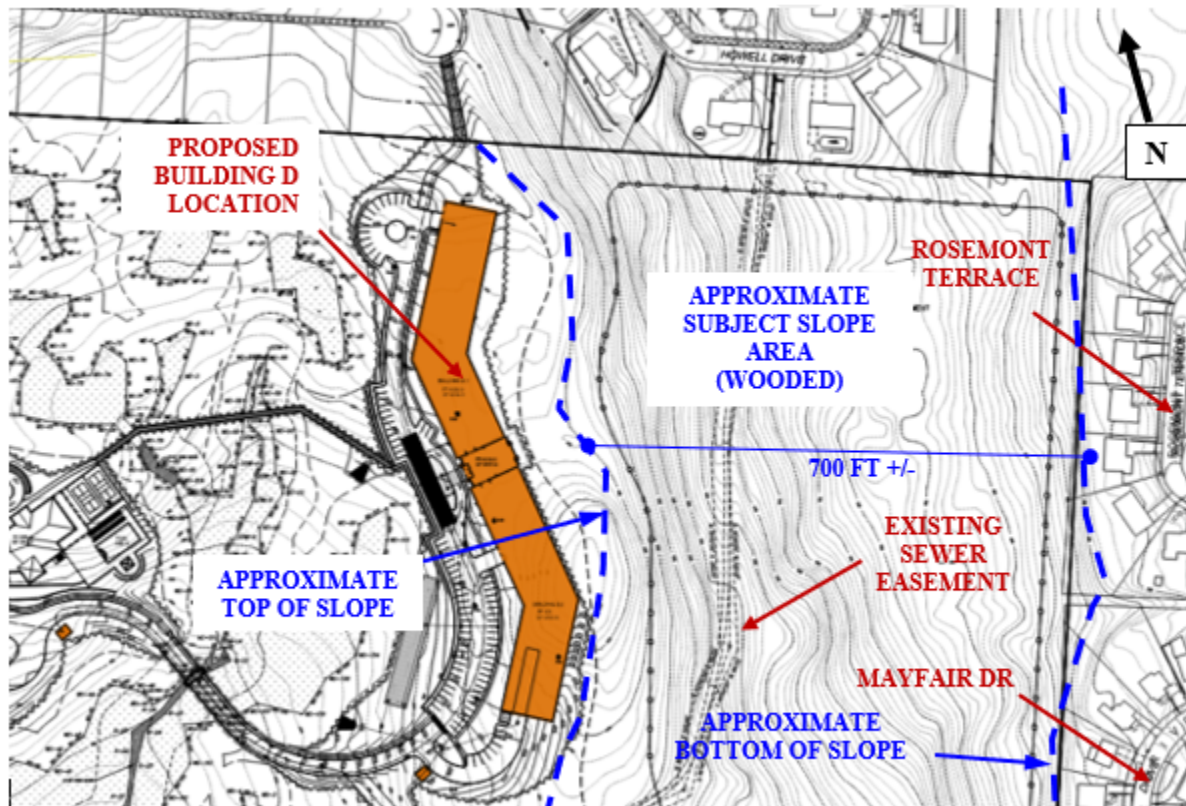
OVERVIEW DISCUSSION

The Subject Slope descends about 150 feet in elevation to the east from the east side of proposed Building D at roughly 10 degrees (or roughly 17%). The distance to the adjacent Rosemont Terrace and Mayfair Drive developments at the bottom of the slope is roughly 700 feet east of the proposed Building D. A site location map showing the approximate limits of the Study Area is provided below.

Langan investigated the subsurface conditions within Subject Slope/Study Area along two transects roughly 385 feet apart using a combination of drilled borings and test pit excavations. The locations of the transect lines and boring/test pit locations are shown on attached Figure 1. Soil and rock samples were collected and laboratory testing was performed to determine physical and strength parameters, which along with data from our logs of borings and test pits were utilized in our 2-dimensional slope stability analysis.

The generalized subsurface conditions encountered in the borings and test pits consisted of up to 2 feet of silty, sandy topsoil over relatively dense gravelly sandy soils overlying basalt bedrock at the top of the slope with similar dense sands over sedimentary bedrock at greater depths lower on the slope further to the east.

During our subsurface investigation, groundwater was observed in only one test pit (TP-1), at a depth of roughly 11 feet below existing grade, which is below the top of decomposed basalt. There was no indication of mottling of soils in the test pits that would suggest a seasonal water table.



Proposed Site Map

Geologic Hazard Review

The Subject Slope has a few scattered rock outcrops along the top and upper portions of the slope. No adverse / problematic jointing was observed. Potential for rock fall hazard is low and would be expected to ravel directly to the ground beneath the outcrops. A high-angle fault with no history of activity is mapped about 2,000 feet to the east of the site. A copy of the geologic mapping is provided on Figure 2. The seismic risk at the site is considered low based on our review of available New Jersey earthquake history in the area. Nonetheless, we included a seismic case in our slope stability analysis.

Global Stability of Slope

Our analysis included an evaluation of slope stability under both static and seismic (dynamic) design conditions. Building D is far enough from the top of the slope that there is no surcharge load that would impact the slope stability. Although no indication of a seasonal variability in groundwater elevation was observed in the test pits, we performed a sensitivity analysis to determine if changes in groundwater level would impact the stability of the subject slope.

Our base case static and seismic analyses used the base groundwater level encountered in our one test pit. The results of the static case indicate the lowest factors of safety exceed 1.5, indicating stable slopes. The potential slip plane surface that resulted in the lowest factor of safety was limited in length to roughly 100 feet and occurred near the middle of the Subject Slope as a shallow surficial slip surface (i.e., within the upper 2 feet of soil). Similarly, the results of the dynamic (seismic) case indicate the lowest factors of safety to be greater than 1.2, indicating stable slopes during a potential earthquake. Factors of safety greater than 3.29 and 2.23 were computed where software-generated potential slip planes extend from the top of the Subject Slope to the downslope neighboring properties for the static and seismic cases, respectively.

In addition to the base cases described above, we analyzed groundwater midway in the soil profile and at a depth of 2 feet below grade. Only when groundwater was modeled at a depth of 2 feet below grade did the factor of safety decrease to 1.36 under the static case. This potential slip surface is within 2 feet of ground and does not pose a hazard to the site of neighboring properties. Factors of safety greater than 3.0 were computed where software-generated potential slip planes extend from the top of the Subject Slope to the downslope neighboring properties and include unrealistically high-water levels in the soil.

Construction Related Blasting Impacts

We understand up to 25 feet of rock is expected to be excavated from one localized area at the top of the Subject Slope in order to reach design grades for Building D. It is common for rock excavation to be achieved using controlled blasting techniques, which include but are not limited to line and/or channel drilling, limiting charge per delay, use of blasting mats, and performing vibration monitoring. Such methods thereby limit the amount of energy transmitted to the surrounding rock, generally limit the nuisance impacts of construction compared to conventional earth excavating methods (i.e., less time to excavate and haul off material), and limit the potential for impacts to neighboring properties.

OPINIONS

Based on our investigation and analysis, the Subject Slope is not at risk of failure under current conditions or from proper construction of Building D. Our analyses further indicate that there would be negligible impact on the global stability of the Subject Slope even if groundwater levels were to rise. However, direct precipitation and runoff can be expected to flow over the sloping

ground surface with some lesser amount of infiltration, and the development is not expected to increase stormwater run off toward the Subject Slope.

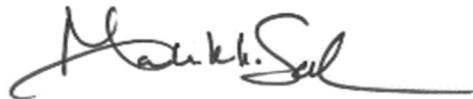
As part of the proposed development, we understand that appropriate drainage and conveyances will be provided to prevent site development stormwater from entering the Subject Slope.

LIMITATIONS

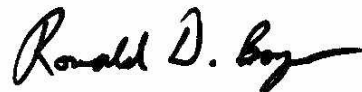
Our study is based on the geotechnical subsurface data collected at accessible locations within the Study Area, the topographic survey data, currently existing site conditions and proposed building information made available to us. Any proposed changes in proposed structures (location, layout, loading, elevation) or existing slope conditions should be brought to our attention so that we can determine whether such changes affect our conclusions.

Sincerely,

Langan Engineering and Environmental Services, LLC



Mark K. Seel, P.E.
Vice President



Ronald D. Boyer, P.E.
Senior Principal / Senior Vice President

Enclosure(s): Figure 1, Figure 2, Attachment A

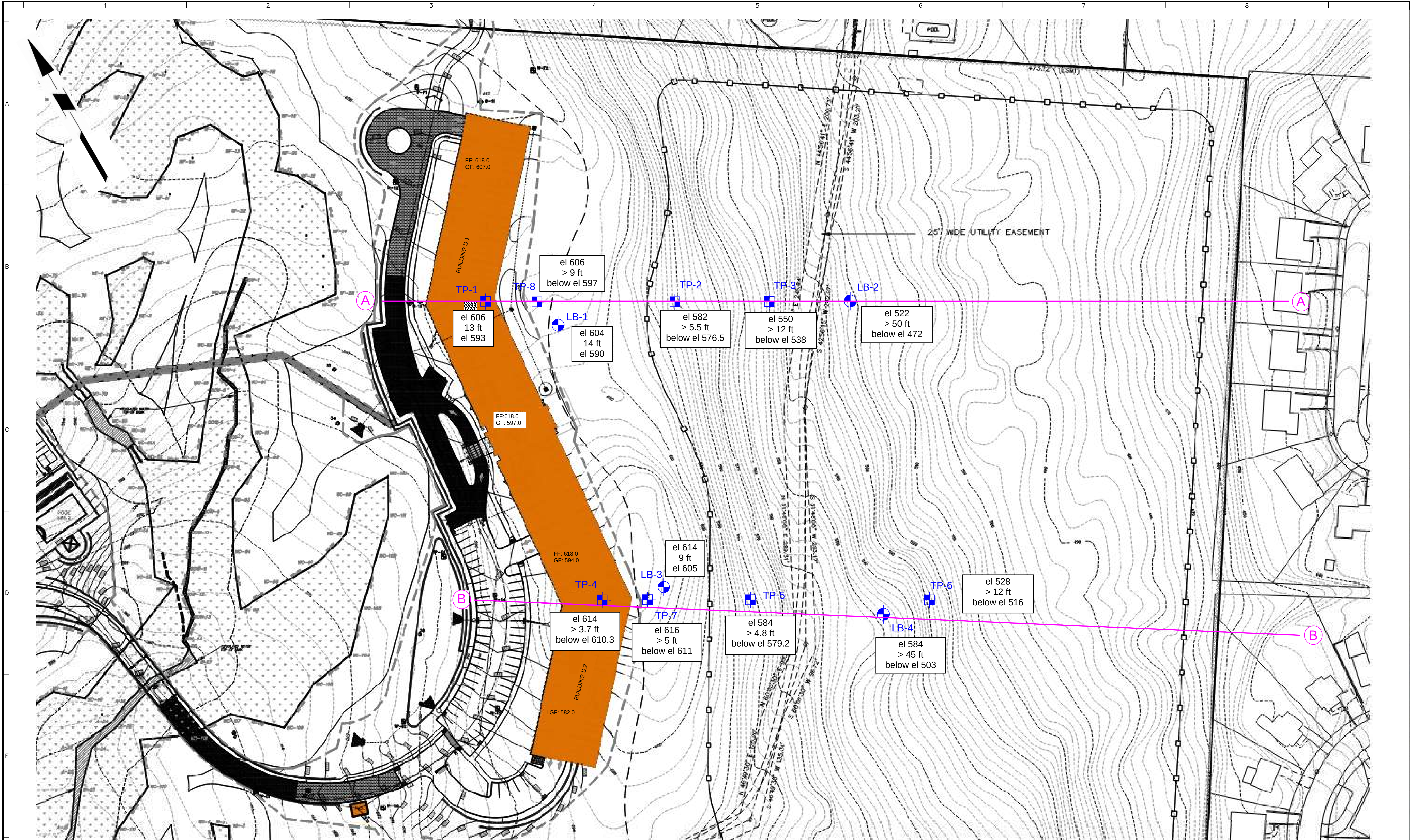
cc: John Cote, Michael Vitello, Adam Yoda / Langan

NJ Certificate of Authorization No. 24GA27996400

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FIGURES

Figure 1	Boring and Test Pit Location Plan with Building Sections A and B
Figure 2	Geological Map



NOTES:

1. BASE PLAN OBTAINED FROM PLAN TITLED "OVERALL GRADING PLAN SP-11" DATED 1 OCTOBER 2024 PREPARED BY ANDERSON CONSULTING SERVICES LLC (ACS).

el 606	APPROXIMATE SURFACE ELEVATION
13 ft	APPROXIMATE OVERBURDEN SOIL AND DECOMPOSED ROCK THICKNESS
el 593	APPROXIMATE TOP OF ROCK

LEGEND:

- LB-1
TP-1
A—A
- APPROXIMATE LOCATION OF LANGAN BORING
APPROXIMATE LOCATION OF LANGAN TEST PIT
APPROXIMATE LOCATION GLOBAL SLOPE STABILITY ANALYSIS SECTION

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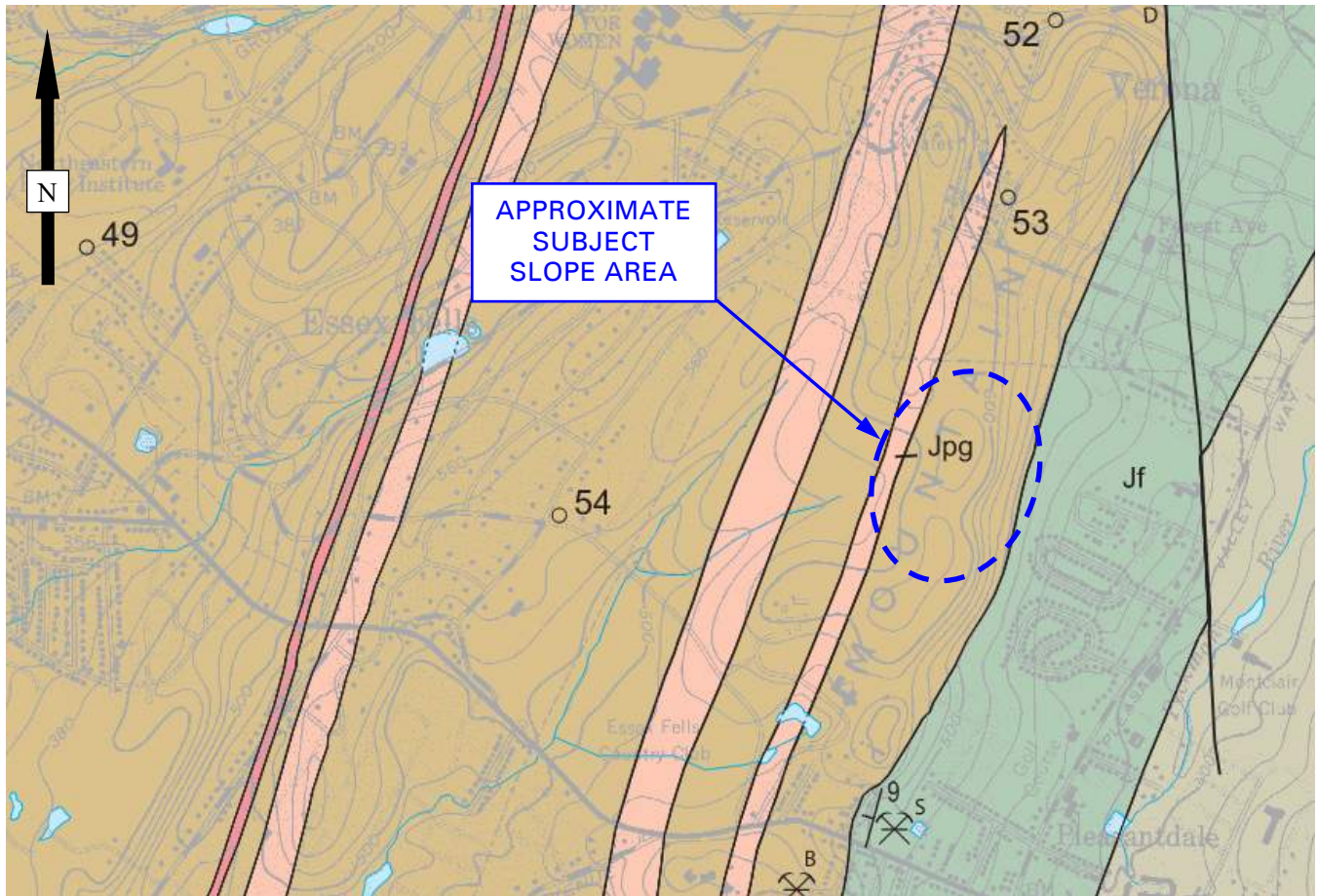
Project
**WEST ESSEX -
HIGHLANDS**
WEST ORANGE NEW JERSEY

Drawing Title
**INVESTIGATION
PLAN**

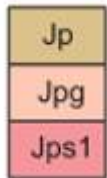
Project No.
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Date
1/14/2025
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RLB
Checked By
AY

Figure
1

SCALE: 1" = 50'



LEGEND



Preakness Basalt – Dark-greenish-gray to black, fine-grained, dense, hard basalt



Feltville Formation – Reddish-brown or light-grayish-red, fine-to-coarse-grained sandstone, siltstone, shaly siltstone and silty mudstone.

Source: Bedrock Geologic Map of The Caldwell Quadrangle, Essex and Morris Counties, New Jersey by Richard A. Volkert (2006)

LANGAN

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Langan Engineering and Environmental Services, LLC.
Langan Engineering, Environmental, Surveying and Landscape Architecture, D.P.C.
Langan International LLC
Collectively known as Langan

WEST ESSEX - HIGHLANDS

GEOLOGIC MAP

WEST ORANGE

NEW JERSEY

PROJECT NO.
101049801

SCALE
N.T.S.

DATE
1/14/2025

FIGURE
2

ATTACHMENT A

SUPPORTING GLOBAL STABILITY STUDY MEMORANDUM BY LANGAN

300 Kimball Drive Parsippany, NJ 07054 T: 973.560.4900 F: 973.560.4901

To: Mark Hoffman / Garden Homes

From: Mark K. Seel / Langan
Ronald D. Boyer / Langan

Info: Adam Yoda / Langan
John Cote / Langan
Michael Vitello / Langan



Ronald D. Boyer, P.E.
Professional Engineer
NJ Lic. No. 24GE04200300

Date: 14 January 2025

Re: **Global Slope Stability Study for Building D**
West Essex Highlands Project
West Orange, New Jersey
Langan Project No.: 101049801

This memorandum summarizes the subsurface investigation and global slope stability evaluation performed by Langan Engineering and Environmental Services, LLC (Langan) for the eastern portion of the proposed West Essex Highlands development site located in West Orange, New Jersey. The following sections provide a description of existing site conditions, proposed development, subsurface investigation and conditions, our global slope stability analysis and our evaluation regarding slope stability with respect to the associated building construction.

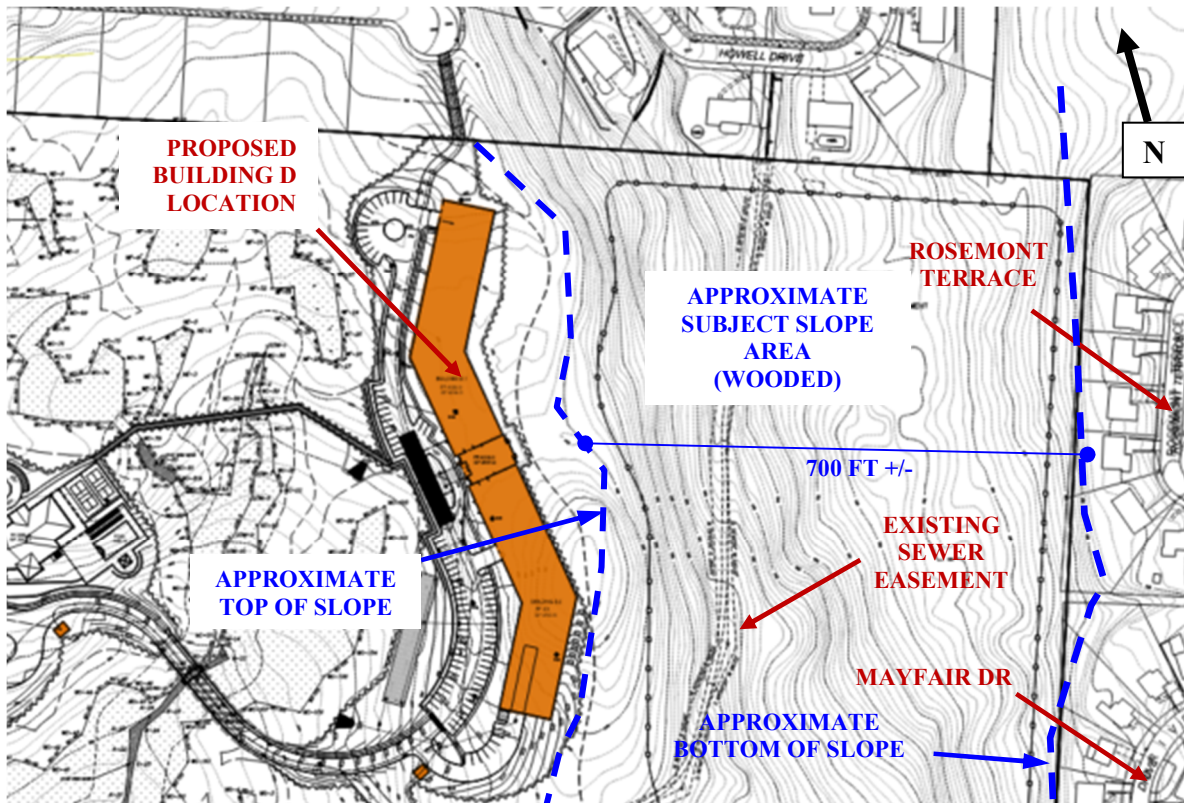
EXISTING CONDITIONS AND PROPOSED CONSTRUCTION

The subject project site is located on Lot 32, Block 179, and is bounded by Avon Drive and Howell Drive and residential properties to the north, and residential developments to the south, east and west. The study area for the global slope stability analysis is the easternmost portion of the site bounded by Rosemont Terrace and Mayfair Drive to the east. The study area is heavily wooded and surface grades slope downward from west to east. There is a 25-foot-wide utility easement that bisects the subject area running in the north-south direction.

Site surface grades generally range from approximately elevation (el) 616 to el 450. Typically, the slope in the subject area ranges from 2 Horizontal (H): 1 Vertical (V) or approximately 26 degrees from horizontal at its steepest to approximately 6H:1V or approximately 10 degrees from horizontal east of the utility easement.

The proposed residential development will consist of the construction of new 4-story structures over structured parking. Based on available site drawings prepared by Anderson Consulting Services, LLC. (ACS), the closest building to the subject slope is proposed Building D, which is to be located at the top of the slope within the study area approximately 700 ft west of the eastern property line. We understand that no site improvements are proposed in the wooded subject area located approximately 20 ft east of the proposed eastern building line of Building D.

Based on the proposed grading plans, we understand the proposed construction of Building D will not include any grade changes from the existing conditions immediately east. The lowest proposed level will range from elevation (el) 607 to el 582 which will require cuts up to about 25 ft from existing surface grade in some isolated areas. The lower structured parking level for Building D will be nested into the eastern slope with adjacent grades east of the proposed building remaining unchanged. The building will be supported on shallow foundations bearing on natural soils or rock. A site location map showing the approximate limits of the study area and proposed Building D is provided below and as Figure 1.



Proposed Site Map

REGIONAL GEOLOGY

According to the available geological maps we reviewed, the upper portion of the subject slope is underlain by the Preakness Basalt. The lower portion of the slope is mapped as the Feltville Formation, which consists of sandstone, siltstone or mudstone. A high-angle fault with no history of activity is mapped about 2,000 ft to the east of the site. An abandoned sandstone rock quarry is also identified about 1,000 ft southeast of the site. A copy of the geologic mapping is provided on Figure 2.

SUBSURFACE INVESTIGATION

A targeted subsurface investigation for the global slope stability study consisting of borings and test pits was completed between November and December 2024 under full-time supervision by

Langan. The borings and test pits were performed at accessible areas along two cross-sections running in the east-west direction through the subject area. The locations of the borings and test pits are shown on Figure 1. Logs of the borings and test pits are provided in Appendix A and Appendix B, respectively.

Borings

Four (4) borings, identified as LB-1 through LB-4, were drilled within the subject area by Craig Geotechnical Drilling Co. Inc. (Craig). The borings were performed using a track-mounted drill rig and mud-rotary drilling techniques. Borings extended approximately 19 ft to 50 ft below existing surface grades.

Borings LB-1 and LB-3 were performed at the higher portion of the slope near the proposed Building D footprint area. Borings LB-2 and LB-4 were performed east of the existing sewer easement located at the lower portion of the slope.

Soil samples were collected, and Standard Penetration Tests (SPT) were performed using a standard 2-inch outside-diameter split-spoon sampler driven by a 140-pound automatic hammer in accordance with ASTM D1586. Soil sampling and SPTs were typically performed continuously in the upper 12 ft and at 5 ft intervals thereafter. Recovered soil samples were visually examined and classified in the field in accordance with the Unified Soil Classification System (USCS). Where encountered, rock was cored for a minimum of 10 ft using an NQ-sized core barrel.

Test Pits

Eight (8) test pits were excavated by Frank Semeraro Construction using a John Deere 75G excavator. Test pits identified as TP-1 through TP-8 were performed throughout the subject area and extended approximately 3.5 ft to 13 ft below existing surface grades. Upon completion, the test pits were backfilled with excavated materials and the backfill was compacted with the excavator bucket.

Geotechnical Laboratory Testing

Soil and rock samples collected during the subsurface investigation were classified and examined in the field by a Langan geotechnical engineer. Representative rock samples were tested by a geotechnical laboratory to determine the unconfined compressive strength of the rock. The results of the laboratory tests are included in Appendix C.

SUBSURFACE CONDITIONS

The generalized subsurface conditions consisted of surficial materials (topsoil) underlain by natural sand and silt overlying a decomposed rock and rock strata. Detailed descriptions of the subsurface conditions are given below.

Surficial Materials

Surficial materials at the test locations generally consisted of topsoil. The thickness of the topsoil was observed to vary from 6 inches to 24 inches. Large boulders and cobbles as well as rock outcrops were also visible at the surface throughout the subject area.

Overburden Soils

Natural sandy and silty soils were encountered below the topsoil in all test pits and borings. The natural sand was typically described as brown to reddish brown fine to coarse silty sand or sandy silt with varying amounts of clay, gravel and roots. Boulders and cobbles were encountered in several test pits at varying depths and several large boulders were encountered in boring LB-4 starting about 16 ft below existing surface grade.

The top of the natural soils was first encountered at depths ranging from approximately 0.5 ft to 2 ft, corresponding to elevation (el) 614 to el 522. The thickness of the natural soil varied typically between 7 ft and 9 ft in the borings located at the higher portion of the slope near the proposed building D footprint.

At the lower portion of the slope, the thickness of the natural soil layer was approximately 43 ft in boring LB-2. Boring LB-4 was terminated in natural sand at approximately 45 ft below surface grade or at approximately el 503.

The recorded N-values in this stratum ranged from 21 bl/ft to split-spoon refusal values, indicative of dense to very dense materials and the presence of cobbles and boulders. The recorded N-values typically increased with depth.

Decomposed Rock

A decomposed rock stratum was encountered in all Langan borings, excluding boring LB-4. The thickness of this decomposed rock layer ranged from 2 ft to 5 ft. This decomposed rock was in the form of a mixture of brown sand with silt, clay, gravel and rock fragments. All recorded SPT N-values in this decomposed zone were split-spoon sampler refusals. It should be noted that it is difficult to differentiate between the very dense soils and the decomposed rock stratum with the limited split-spoon sample recovery.

Bedrock

Bedrock consisting of gray basalt was encountered in borings LB-1 and LB-3 below the overburden soils and decomposed rock stratum at approximately 14 ft and 9 ft below existing surface grade or at approximately el 590 and el 605, respectively. The top of rock was determined by rock coring in these borings. The recorded rock recovery (REC) values varied from 87% to 97% and the rock quality designation (RQD) values varied from 58% to 82%, indicative of fair to good quality rock. As previously stated, some basalt rock outcrops were visible typically at the upper portion of section A near the proposed Building D footprint.

Bedrock was not encountered at the termination depths of borings LB-2 and LB-4, which are located at the lower slope approximately 420 ft and 350 ft east of proposed Building D,

respectively. Boring LB-2 was terminated at about 50 ft below existing surface grade or at approximately el 472. Boring LB-4 was terminated at about 45 ft below existing surface grade or at approximately el 503.

The top of rock contours are expected to vary considerably between investigation locations. Therefore, it should be noted that the top of rock elevations given herein are approximate and the reported conditions refer to the conditions at the specific investigation locations. Variations in the top of rock elevations, rock quality and weathering should be expected across the site.

Laboratory Testing: Unconfined compressive tests were performed on 2 rock core samples taken from boring LB-3 located at the upper portion of the slope. The tests suggest that the unconfined compressive strength of the basalt rock samples varied between approximately 2,200 pounds per square inch (psi) and 3,500 psi or approximately 316,800 pounds per square foot (psf) and 504,000 psf.

Groundwater

The groundwater level could not be inferred from the moisture content of the soil samples during drilling. Water seepage at approximately 11 ft below existing surface grade in the decomposed rock layer was observed in test pit TP-1. Water seepage or indications of mottling were not observed in any other test pit. Surface water flowing over the sloping rock surface should be expected, especially during wet seasons. Groundwater levels are subjected to seasonal fluctuations.

GLOBAL SLOPE STABILITY ANALYSIS

As requested, Langan performed a global stability analysis of the subject area slope. The purpose of such a study is to evaluate if the slope is stable, with an adequate factor of safety, in the existing condition and in the proposed building loading condition.

The analysis consisted of performing two-dimensional Limit Equilibrium Method (LEM) analyses for representative slope cross-sections to evaluate the global slope stability. During our study and analyses, we performed the following key tasks:

1. We reviewed the available geotechnical subsurface information along with our targeted subsurface investigation results for the subject slope area.
2. We reviewed the soil and rock geometry in the cross-sections along with the proposed building gravity building loads. We chose two sections (section A and section B) across the proposed Building D footprint and down the subject area slope to the eastern residences for our slope stability analyses. Locations of Sections A and B are shown on Figure 1.
3. We estimated strength parameters for the soil based on visual observation and the collected N-value results obtained during sampling.

4. We estimated strength parameters for the rock based on laboratory testing results and rock recovery and rock quality designation values obtained in the rock cores.
5. We analyzed the global slope stability using LEM for the estimated proposed Building D load and we calculated factors of safety with respect to global stability for the static condition.
6. We analyzed the slope stability using the LEM for the combined service and seismic loads and we calculated factors of safety with respect to global stability for the maximum considered earthquake.

We used the computer software SLOPE/W for the LEM analyses. An overview of our analyses and a summary of our results are presented below.

Model Parameters

Model Geometry

For our two-dimensional global stability analyses, we selected two representative cross-sections (section A and section B) across the proposed Building D footprint extending to the eastern property line in the subject area. The eastern property line is approximately 900 ft east of the proposed Building D footprint. The soil and rock elevations used in the model are based upon the results of available subsurface investigation information, which was collected from the accessible explored areas of the site.

Material Properties

The generalized subsurface conditions consisted of surficial materials (topsoil) underlain by natural sand and silt over decomposed rock and rock strata. Due to steep slope geometry, no subsurface investigation was performed at the lower slope located northeast of proposed Building D.

We estimated the material parameters including friction angle (ϕ'), of the surficial fill, natural soil and decomposed rock layers based on in-situ test data. The soil parameters utilized in our analyses are presented in Table 1 provided on the following page.

Table 1: Soil Strength Properties

Soil/Rock	Unit Weight (pcf)	ϕ' (deg.)	c (psf)
Topsoil	115	30	0
Medium Dense Sand	120	32	0
Dense Sand	125	34	0
Decomposed Rock/Very Dense Granular Soil	135	38	0

The rock encountered and cored during the investigation at the upper portion of the slope was classified as basalt. Rock properties were estimated using values recommended in the SLOPE/W manual and a Geologic Strength Index (GSI) of 65, an intact rock parameter (mi) of 17, a disturbance factor (D) of 1 and an unconfined compressive strength (UCS) of 316,800 psf (lowest laboratory value) were used in the analyses.

Groundwater

For our main analysis, groundwater was assumed to be at the top of the decomposed rock / very dense granular soil layer. It should be noted that our subsurface investigation was performed during a time of drought and not during the wet season. To account for groundwater fluctuation, a parametric sensitivity analysis was also performed to evaluate the impact of higher groundwater.

Proposed Building D Loading

Proposed Building D will be 4-stories above structured parking. A total uniform service load of 1,000 psf was applied to the eastern slope to simulate the effect of the proposed building. This service load estimate was derived from live loads specified in the New Jersey UCC Building Subcode 2021 and an approximate estimation of the dead loads.

LEM Analyses and Results (Service Loads)

The LEM analyses were performed to represent the pre-construction condition and post-construction condition after the construction of the structure. We used the Morgenstern-Price LEM for our analysis, which satisfies the equilibrium of forces and moments.

To consider the effect of the proposed construction on slope stability, the critical slip surfaces for the existing and proposed gravity (static) loading conditions for Sections A and B are provided in the tables below. LEM analysis results under gravity loading (static) conditions are presented in Appendix D.

Table 2A - LEM Factors of Safety against Sliding for Service Loads – Section A

Condition	Critical Slip Surface	Critical Slip Surface That Reaches the Downslope Building
Existing	2.20	3.29
Proposed	2.20	3.29

Table 2B - LEM Factors of Safety against Sliding for Service Loads – Section B

Condition	Critical Slip Surface	Critical Slip Surface That Reaches the Downslope Building
Existing	1.67	6.46
Proposed	1.67	6.45

Seismic Slope Stability Analyses

Seismic slope stability analyses have traditionally been performed by using pseudo-static limit equilibrium analyses. These analyses consist of applying a lateral force to the slope equal to the product of a seismic coefficient (k_h) and the weight of the slope. The seismic coefficient is based on the actual anticipated level of acceleration in the failure mass and corresponds to some fraction of the anticipated peak acceleration (a_{max}). Hynes-Griffin and Franklin (1984)¹ seismic coefficient equation $k_h = 0.5a_{max}/g$ is considered appropriate to use for most slopes (Kramer, 1996)². For this site, we utilized the Hynes-Griffin and Franklin (1984) criteria that resulted in $k_h = 0.0875$.

To consider the effect of the proposed construction on slope stability, the critical slip surfaces for the existing and proposed seismic loading conditions for Sections A and B are provided in the tables below. LEM analysis results under seismic conditions are presented in Appendix E.

Table 3A: LEM Factors of Safety against Sliding for Seismic Loads – Section A

Condition	Critical Slip Surface	Critical Slip Surface That Reaches the Downslope Building
Existing	1.65	2.23
Proposed	1.65	2.23

Table 3B: LEM Factors of Safety against Sliding for Seismic Loads – Section B

Condition	Critical Slip Surface	Critical Slip Surface That Reaches the Downslope Building
Existing	1.29	4.59
Proposed	1.30	4.59

¹ Hynes-Griffin Mary E; Franklin Arley G (2007). "Rationalizing the Seismic Coefficient Method". Department of the Army.

² Steven L Kramer. "Geotechnical Earthquake Engineering" 1996.

Parametric Sensitivity Analysis due to Groundwater Level

We performed sensitivity analyses to evaluate the impact of groundwater on the slope stability for the static loading condition. We evaluated the groundwater effect with the groundwater level located immediately below the topsoil layer, at the top of the decomposed rock/very dense sand layer and at the top of the rock stratum. The estimated resulting factors of safety are provided in Table 4A.

Table 4A: LEM Factors of Safety against Sliding for Gravity Loads with Groundwater

Groundwater Level	Section A (Critical Slip Surface)	Section B (Critical Slip Surface)
Immediately Below Topsoil	1.36	1.54
Top of Decomposed Rock / Very Dense Granular Soil	2.20	1.67
Top of Rock	2.26	1.68

We also performed an infinite slope analysis for the varying groundwater level conditions as part of the sensitivity analysis. The critical slip surfaces were modeled to be at varying groundwater levels. The estimated resulting factors of safety from this analysis are provided in Table 4B.

**Table 4B: LEM Factors of Safety against Sliding for Gravity Loads with Groundwater
(Infinite Slope Analysis)**

Groundwater Level/Critical Slip Surface Location	Section A	Section B
Immediately Below Topsoil	3.44	3.09
Top of Decomposed Rock / Very Dense Granular Soil	3.94	3.87
Top of Rock	5.28	4.57

EVALUATION

We utilized the NAVFAC Design Manual 7.1 "Soil Mechanics" (NAVFAC 1986) reference in the evaluation of the factors of safety calculated in our global slope stability evaluation for the static and seismic design loading conditions. This manual indicates that a factor of safety of no less than 1.5 should be utilized for permanent or sustained (static) loading conditions of slopes. This manual indicates that a factor of safety of no less than 1.15 should be utilized for seismic loading conditions of slopes due to earthquakes.

We modeled the existing slope and the proposed building loads per the available topographic survey plan, boring and test pit data and the anticipated building and seismic loads as outlined in the "Modeling Parameters" section of this memorandum.

Geologic Hazard Review

Based on rock maps and our subsurface findings, igneous basalt rock is near the surface at the upper portion of the slope with a few visible rock outcrops. The lower portion of the slope is anticipated to consist of sedimentary rock as part of the Feltville Formation at depth greater than 50 ft from existing surface grade based on the subsurface investigation. The eastern slope does not appear to have significant amounts of exposed rock outcrops along the slope so rock fall hazard due to the toppling of exposed rock faces would be limited. Due to the relatively shallow slope and distance to adjacent properties, rock fall does not appear to be a high risk.

Based on a review of New Jersey earthquake history provided by the New Jersey Department of Environmental Protection (NJDEP), the seismic risk of the site appears to be low.

Stability for Gravity Loading Condition

Our evaluation indicates that the factor of safety values for the gravity loading (static) condition for both the existing and proposed conditions is greater than the minimum required safety factor of 1.5, indicating stable slopes. The proposed construction of Building D will have a negligible impact on the global stability of the eastern slope as shown in Tables 2A and 2B.

Stability for Seismic Loading Condition

Our evaluation indicates that the factor of safety values for the seismic loading (dynamic) condition for both the existing and proposed conditions is greater than the minimum required safety factor of 1.15, indicating stable slopes. Additionally, the proposed construction of Building D will have a negligible impact on the global stability of the eastern slope as shown in Tables 3A and 3B.

Groundwater Impacts

Our sensitivity analysis associated with groundwater level indicates the factors of safety with respect to global stability generally decrease when the water level increases. Although highly unlikely, we modeled the groundwater immediately below the topsoil layer resulting in a factor of safety of 1.36 for the critical potential failure surface. This potential slip surface is surficial and does not pose an impact on the downslope residences.

The lowest factor of safety against sliding for gravity loads at varying groundwater levels was approximately 3.09 when the groundwater was modeled to be below the topsoil layer for the infinite slope analysis. This is above the minimum required safety factor of 1.5, indicating stable slopes.

MEMO

As part of the proposed development, we understand that appropriate drainage conveyances will be provided to prevent site development stormwater from entering the eastern slope. As such, the proposed construction of Building D will not have an impact on increasing groundwater levels at the eastern slope.

LIMITATIONS

Our evaluation is based on the geotechnical subsurface data collected at the subject area (at accessible areas), the topographic survey data, currently existing site conditions and proposed building information made available to us. Any proposed changes in proposed structures (location, layout, loading, elevation) or existing slope conditions should be brought to our attention so that we can determine whether such changes affect our conclusions.

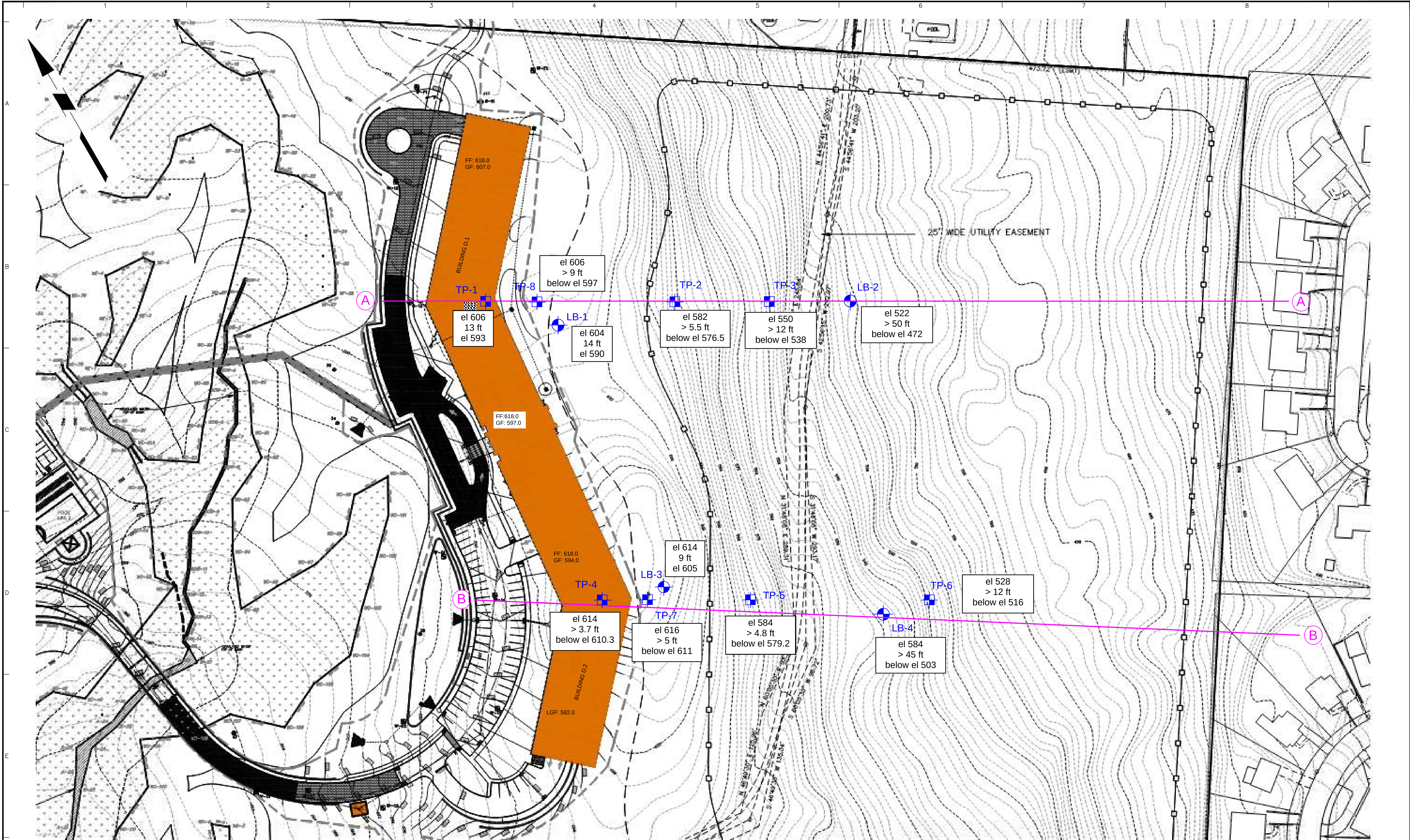
CLOSURE

This memorandum summarized our global slope stability analyses and results associated with the proposed eastern slope of the West Essex Highlands project site located in West Orange, New Jersey.

\\langan.com\data\PAR\data8\101049801\Project Data_Discipline\Geotechnical\Reports\2024 - Slope Stability Memorandum\2025-01-14- Attachment A - Slope Stability Analysis Memo.docx

FIGURES

Figure 1	Boring and Test Pit Location Plan with Building Sections A and B
Figure 2	Geological Map



NOTES:

1. BASE PLAN OBTAINED FROM PLAN TITLED "OVERALL GRADING PLAN SP-11" DATED 1 OCTOBER 2024 PREPARED BY ANDERSON CONSULTING SERVICES LLC (ACS).

el 606 13 ft el 593	APPROXIMATE SURFACE ELEVATION APPROXIMATE OVERBURDEN SOIL AND DECOMPOSED ROCK THICKNESS APPROXIMATE TOP OF ROCK
---------------------------	---

LEGEND:

- LB-1
TP-1
A—A
APPROXIMATE LOCATION OF LANGAN BORING
APPROXIMATE LOCATION OF LANGAN TEST PIT
APPROXIMATE LOCATION GLOBAL SLOPE STABILITY ANALYSIS SECTION

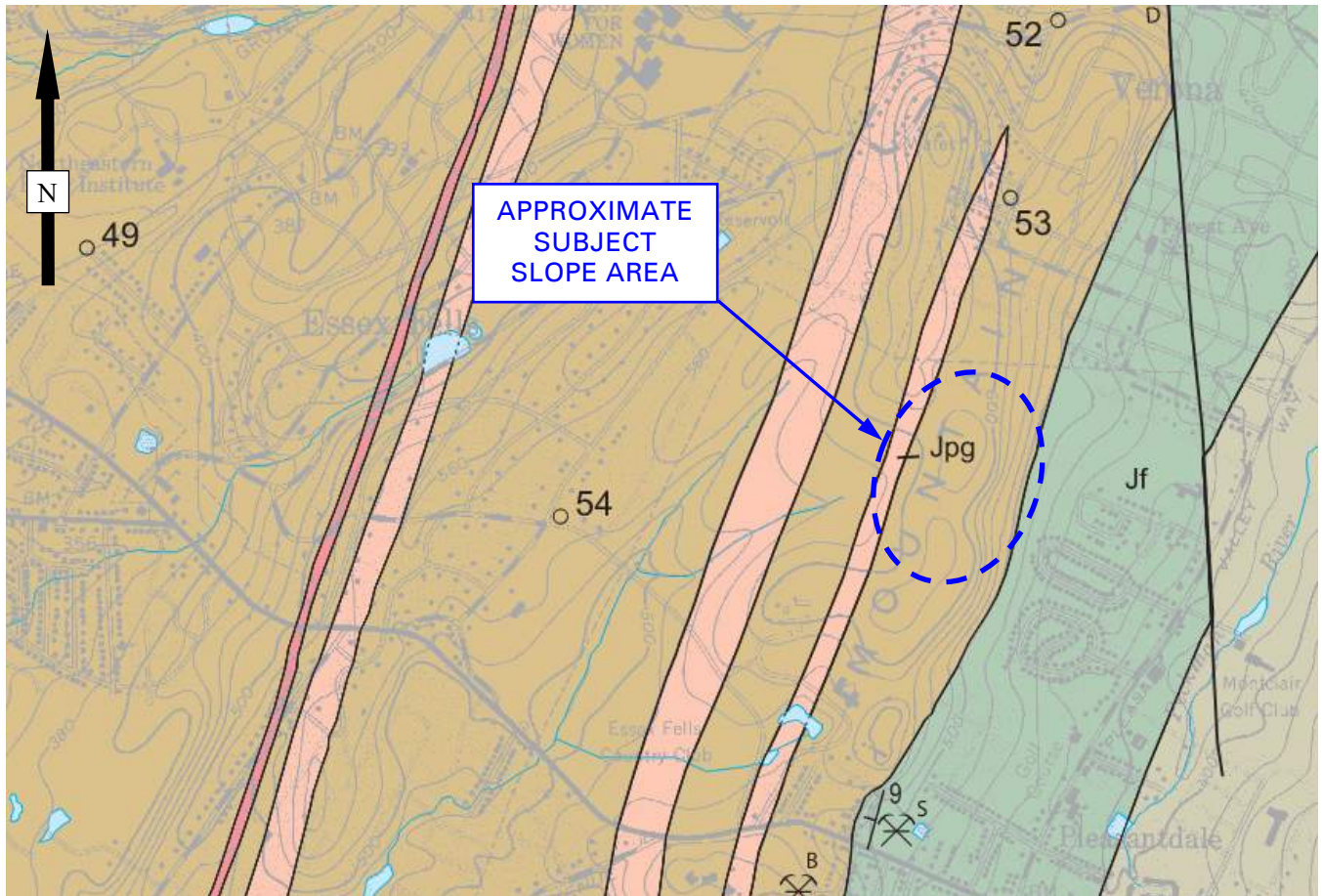
LANGAN
Langan Engineering and
Environmental Services, LLC.
300 Kimball Drive
Parsippany, NJ 07054
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NJ CERTIFICATE OF AUTHORIZATION No. 24GA27896400

Project
**WEST ESSEX -
HIGHLANDS**
WEST ORANGE NEW JERSEY

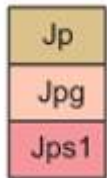
Drawing Title
**INVESTIGATION
PLAN**

Project No. 101049801	Figure 1
Date 1/14/2025	
Drawn By RLB	
Checked By AY	

SCALE: 1" = 50'



LEGEND



Preakness Basalt – Dark-greenish-gray to black, fine-grained, dense, hard basalt



Feltville Formation – Reddish-brown or light-grayish-red, fine-to-coarse-grained sandstone, siltstone, shaly siltstone and silty mudstone.

Source: Bedrock Geologic Map of The Caldwell Quadrangle, Essex and Morris Counties, New Jersey by Richard A. Volkert (2006)

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Langan Engineering, Environmental, Surveying and Landscape Architecture, D.P.C.
Langan International LLC
Collectively known as Langan

WEST ESSEX - HIGHLANDS

GEOLOGIC MAP

WEST ORANGE

NEW JERSEY

PROJECT NO.
101049801

SCALE
N.T.S.

DATE
1/14/2025

FIGURE
2

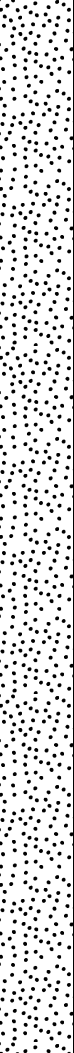
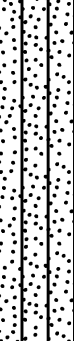
APPENDIX A

LOGS OF LANGAN BORINGS

Project West Essex Highlands				Project No. 101049801							
Location West Orange, New Jersey				Elevation and Datum Approx. el. 604.0 (NAVD 88)							
Drilling Company Craig Geotechnical Drilling Co., Inc.				Date Started 12/12/2024		Date Finished 12/12/2024					
Drilling Equipment ATV Rig				Completion Depth 24.0 ft		Rock Depth 12.0 ft					
Size and Type of Bit 3-7/8in Tricone Roller Bit				Number of Samples Disturbed 5		Undisturbed 0 Core 2					
Casing Diameter (in) 4" diameter steel			Casing Depth (ft) 9.0	Water Level (ft.) First ▽ -		Completion ▽ -	24 HR. ▽ -				
Casing Hammer Automatic		Weight (lbs) 140		Drop (in) 30		Drilling Foreman Matt Michelotti					
Sampler 2in OD Split Spoon				Field Engineer Rebecca Blocker							
Sampler Hammer Automatic		Weight (lbs) 140		Drop (in) 30							
Material Symbol	Elev. (ft)	Sample Description	Coring (min)	Depth Scale	Sample Data						Remarks (Drilling Fluid, Casing Depth, Fluid Loss, Drilling Resistance, etc.)
					Number	Type	Recov. (in)	Penetr- resist BL/6in	N-Value (Blows/ft) 10 20 30 40		
	+604.0	Brown fine to coarse SAND, some silt, trace clay, root fragments (moist) [TOPSOIL]		0							Began drilling 12/12/2024 at 8:19 AM G-1 at 0 ft
	+602.0	Brown fine to medium SAND, trace silt, some gravel (dry) [SP]		1	G-1	GRAB					
	+599.0	Reddish brown Silty SAND, trace clay, trace gravel (moist) [SM]		2				5			
	+597.0	Reddish brown Sandy SILT, some clay, some gravel (moist) [ML]		3	S-1	SS	6	45			70
	+595.0	[DECOMPOSED ROCK]		4				56			
	+590.0	Gray BASALT [BEDROCK]		5				10			
	+597.0			6	S-2	SS	6	25			40
	+595.0			7	S-3	SS	6	54			50/2"
	+595.0			8							
	+590.0			9	S-4	SS	0	50/2"			50/2"
	+590.0			10							
	+590.0			11							
	+590.0			12							Very hard drilling. Rig chatter.
	+590.0			13							
	+590.0			14							C-1 at 14 ft
	+590.0			15							
	+590.0			16							
	+590.0			17							

Project West Essex Highlands				Project No. 101049801						
Location New Jersey, West Orange				Elevation and Datum Approx. el. 604.0 (NAVD 88)						
Material Symbol	Elev. (ft)	Sample Description	Coring (min)	Depth Scale	Sample Data					Remarks (Drilling Fluid, Casing Depth, Fluid Loss, Drilling Resistance, etc.)
					Number	Type	Recov. (in)	Penetr- resist BL/6in	N-Value (Blows/ft)	
	+588.0	Gray BASALT [BEDROCK]		16	C-1	NQ	REC=58"/60"=97%	RQD=35"/60"=58%		C-2 at 19 ft
	02:35		17							
	01:38		18							
	01:21		19							
	02:05		20	C-2	NQ	REC=58"/60"=97%	RQD=49"/60"=82%			
	02:10		21							
	02:37		22							
	02:41		23							
	02:32		24							
			25							
	+580.0	End of Boring at 24.0ft.		26	Stopped drilling 12/12/2024 at 11:00 AM. Upon completion, borehole backfilled with soil cuttings and hole plug.					
			27							
			28							
			29							
			30							
			31							
			32							
			33							
			34							
			35							

Project West Essex Highlands				Project No. 101049801								
Location West Orange, New Jersey				Elevation and Datum Approx. el. 522.0 (NAVD 88)								
Drilling Company Craig Geotechnical Drilling Co., Inc.				Date Started 12/17/2024		Date Finished 12/17/2024						
Drilling Equipment ATV Rig				Completion Depth 50.1 ft		Rock Depth Not Encountered						
Size and Type of Bit 2-7/8in Tricone Roller Bit				Number of Samples Disturbed 14		Undisturbed 0	Core 0					
Casing Diameter (in) 4" diameter steel			Casing Depth (ft) 15.0	Water Level (ft.) First ▽ -		Completion ▼ -	24 HR. ▽ -					
Casing Hammer Automatic		Weight (lbs) 140		Drop (in) 30		Drilling Foreman Matt Michelotti						
Sampler 2in OD Split Spoon				Field Engineer Rebecca Blocker								
Sampler Hammer Automatic		Weight (lbs) 140				Drop (in) 30						
Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Sample Data						Remarks (Drilling Fluid, Casing Depth, Fluid Loss, Drilling Resistance, etc.)		
				Number	Type	Recov. (in)	Penetr- resist BL/6in	N-Value (Blows/ft) 10 20 30 40				
	+522.0	Dark brown Silty fine to medium SAND, trace clay, with root pieces (moist) [TOPSOIL]	0				1					Began drilling 12/17/2024 at 10:41 AM. S-1 at 0 ft
			1	S-1	SS	5	2					
	+520.0	Light brown SILT, some fine to coarse sand, some clay, trace gravel (moist) [ML]	2	S-2	SS	10	6					S-2 at 2 ft
	+519.0	[POSSIBLE COBBLES]	3									
			4									Hard drilling, rig chattering.
	+517.0	Light brown Silty SAND, some gravel, trace clay (moist) [SM]	5				15					Drove casing to 5 ft. Drilled to 5 ft. S-3 at 5 ft
			6	S-3	SS	2	24					
		Light brown Silty SAND, some gravel, trace clay (moist) [SM]	7	S-4	SS	7	57					S-4 at 7 ft
			8									Hard drilling, rig chattering.
			9									
		Light brown Silty SAND, some gravel, trace clay (moist) [SM]	10				21					Drove casing to 10 ft. Drilled to 10 ft. S-5 at 10 ft
			11	S-5	SS	2	20					
		Light brown to gray fine to coarse SAND, some silt, some gravel (dry) [SM]	12				19					S-6 at 12 ft
			13	S-6	SS	12	39					
			14				32					
	+507.0	Brown fine to coarse SAND, some gravel, trace silt (moist) [SP]	15				18					Drove casing to 15 ft. Drilled to 15 ft. S-7 at 15 ft
			16				25					

Project			Project No.							
West Essex Highlands			101049801							
Location			Elevation and Datum							
New Jersey, West Orange			Approx. el. 522.0 (NAVD 88)							
Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Sample Data					Remarks (Drilling Fluid, Casing Depth, Fluid Loss, Drilling Resistance, etc.)	
				Number	Type	Recov. (in)	Penetr- resist BL/6in	N-Value (Blows/ft)		
	+506.0	No Recovery	16	S-7		19	28			Drilled to 20 ft. S-8 at 20 ft
	17						29			
	18									
	19									
	20				15					
	21		S-8	SS		0	10			
	22					12				
	23									
	24									
	25									
	+492.0	Light reddish brown fine to medium SAND, trace silt (moist) [SP]	26	S-9	SS		20	18		Drilled to 25 ft. S-9 at 25 ft
	27					27				
	28									
	29									
	30									
	31		S-10	SS		20	24			
	32					38				
	33									
	34									
	35									
		Reddish brown Silty fine to coarse SAND, trace gravel, trace clay (moist) [SM]	36							Drilled to 30 ft S-10 at 30 ft
	37									
	38									
	39									
	40									
	41									
	42									
	43									
	44									
	45									
		Reddish brown Silty fine to coarse SAND, some clay, trace fine to coarse gravel (moist) [SM]	46	S-11	SS		3	80/3"		Drilled to 35 ft. S-11 at 35 ft. Spoon bouncing.
	47									
	48									
	49									
	50									
	51									
	52									
	53									
	54									
	55									

Project West Essex Highlands			Project No. 101049801																		
Location New Jersey, West Orange			Elevation and Datum Approx. el. 522.0 (NAVD 88)																		
Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Sample Data					Remarks (Drilling Fluid, Casing Depth, Fluid Loss, Drilling Resistance, etc.)												
				Number	Type	Recov. (in)	Penetr- resist BL/6in	N-Value (Blows/ft) 10 20 30 40													
	+486.0	No Recovery	36																		
			37																		
			38																		
			39																		
			40	S-12	SS	0	50/1"														
			41																		
			42																		
			43																		
			44																		
			45	S-13	SS	0	50/1"														
	+477.0	No Recovery [POSSIBLE DECOMPOSED ROCK]	46																		
			47																		
			48																		
			49																		
			50	S-14	SS	0	50/1"														
			51																		
			52																		
			53																		
			54																		
			55																		
	+471.9	No Recovery [POSSIBLE DECOMPOSED ROCK] End of Boring at 50.1ft.	56																		

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Project West Essex Highlands				Project No. 101049801								
Location West Orange, New Jersey				Elevation and Datum Approx. el. 614.0 (NAVD 88)								
Drilling Company Craig Geotechnical Drilling Co., Inc.				Date Started 12/12/2024		Date Finished 12/13/2024						
Drilling Equipment ATV Rig				Completion Depth 19.0 ft		Rock Depth 9.0 ft						
Size and Type of Bit 3-7/8in Tricone Roller Bit				Number of Samples Disturbed 4		Undisturbed 0 Core 2						
Casing Diameter (in) 4" diameter steel			Casing Depth (ft) 9.0	Water Level (ft.) First ▽ -		Completion ▼ -	24 HR. ▽ -					
Casing Hammer Automatic		Weight (lbs) 140		Drop (in) 30		Drilling Foreman Matt Michelotti						
Sampler 2in OD Split Spoon				Field Engineer Brian McGlew								
Sampler Hammer Automatic		Weight (lbs) 140		Drop (in) 30								
Material Symbol	Elev. (ft)	Sample Description	Coring (min)	Depth Scale	Sample Data					Remarks (Drilling Fluid, Casing Depth, Fluid Loss, Drilling Resistance, etc.)		
					Number	Type	Recov. (in)	Penetr- resist BL6in	N-Value (Blows/ft) 10 20 30 40			
	+614.0	Tannish brown SILT, some fine to coarse sand, trace clay (moist) [TOPSOIL]		0				5			Began drilling 12/12/2024 at 11:51 AM. S-1 at 0 ft	
		1		S-1	SS	15	3			6		
		2					4					S-2 at 2 ft
		3		S-2	SS	24	28			53	Rig Chattering from 3 ft to 4 ft .	
	+612.0	Light brown fine to coarse SAND, some fine to coarse gravel, trace silt (dry) [SP]		4				29				
		5					13				Drove casing to 5 ft. Drilled to 5 ft . S-3 at 5 ft	
		6		S-3	SS	15	18			35		
		7		S-4	SS	4	70			70	S-4 at 7 ft	
	+607.0	Decomposed Rock in form, brown to gray fine to coarse GRAVEL, some fine to coarse sand, trace silt (moist) [DECOMPOSED ROCK]		8							Rig Chattering. Stopped drilling for the day at 1:50 pm on 12/12/2024. Resumed drilling at 7:25 am on 12/13/24.	
		9									Drove casing to 9 ft. Drilled to 9 ft. C-1 at 9 ft	
		10										
		11		C-1	NQ						Brownish gray wash.	
	+605.0	Gray BASALT [BEDROCK]	02:18 03:01 02:03 01:35 01:43 01:28 02:35	12								
		13										
		14									C-2 at 14 ft	
		15										
		16										

Project West Essex Highlands				Project No. 101049801									
Location New Jersey, West Orange				Elevation and Datum Approx. el. 614.0 (NAVD 88)									
Material Symbol	Elev. (ft)	Sample Description	Coring (min)	Depth Scale	Sample Data						Remarks (Drilling Fluid, Casing Depth, Fluid Loss, Drilling Resistance, etc.)		
					Number	Type	Recov. (in)	Penetr- resist BL/ft	N-Value (Blows/ft)				
	+598.0		02:01	16	C-2	NQ	REC=52"/60"=87%	ROD=40"/60"=67%					Light gray wash.
				17									
				18									
				19									
	+595.0	End of Boring at 19.0ft.		19					Stopped drilling on 12/13/2024 at 9:15 AM. Upon completion, borehole backfilled with cuttings and hole plug.				
				20									
				21									
				22									
				23									
				24									
				25									
				26									
				27									
				28									
				29									
				30									
				31									
				32									
				33									
				34									
				35									
				36									

Project West Essex Highlands				Project No. 101049801							
Location West Orange, New Jersey				Elevation and Datum Approx. el. 548.0 (NAVD 88)							
Drilling Company Craig Geotechnical Drilling Co., Inc.				Date Started 12/13/2024		Date Finished 12/17/2024					
Drilling Equipment ATV Rig				Completion Depth 45.1 ft		Rock Depth Not Encountered					
Size and Type of Bit 3-7/8in Tricone Roller Bit				Number of Samples Disturbed 13		Undisturbed 0 Core 1					
Casing Diameter (in) 4" diameter steel			Casing Depth (ft) 25.0	Water Level (ft.) First ▽ -		Completion ▴ -	24 HR. ▴ -				
Casing Hammer Automatic		Weight (lbs) 140		Drop (in) 30		Drilling Foreman Matt Michelotti					
Sampler 2in OD Split Spoon				Field Engineer Rebecca Blocker							
Sampler Hammer Automatic		Weight (lbs) 140		Drop (in) 30							
Material Symbol	Elev. (ft)	Sample Description	Coring (min)	Depth Scale	Sample Data					Remarks (Drilling Fluid, Casing Depth, Fluid Loss, Drilling Resistance, etc.)	
					Number	Type	Recov. (in)	Penetr- resist BL6/in	N-Value (Blows/ft) 10 20 30 40		
	+548.0	Tannish brown SILT, some fine to coarse sand, trace coarse gravel (moist) [TOPSOIL]		0				2			Began drilling 12/13/2024 at 10:23 AM. S-1 at 0 ft
	+546.0	Brown Gravelly fine to medium SAND, trace silt (moist) [SP]		1	S-1	SS	5	3	2	5	
				2					11		S-2 at 2 ft
				3	S-2	SS	12	27	3	47	Rig Chattering from 3 ft to 4 ft.
				4					53		
		Brown fine to coarse SAND, trace silt, some fine gravel (moist) [SP]		5					7		Drove casing to 5 ft. Drilled to 5 ft. S-3 at 5 ft
				6	S-3	SS	14	13	10	23	
				7					18		S-4 at 7 ft. Rig Chattering from 7 ft to 9 ft. Brown wash.
				8	S-4	SS	12	26	30	56	
	+536.0	No Recovery		9					26		Dark brown wash.
				10					40		Drove casing to 10 ft. Drilled to 10 ft. S-5 at 10 ft
				11	S-5	SS	0	60	56	116	Rig chattering from 11 ft to 15 ft. Spoon bouncing.
				12					15		S-6 at 12 ft
	+533.0	Reddish brown fine to coarse SAND, some silt, some fine to coarse gravel (moist) [SM]		13	S-6	SS	5	23	29	52	
				14					19		
				15					11		Drove casing to 15 ft. Drilled to 15 ft. S-7 at 15 ft
				16					10		

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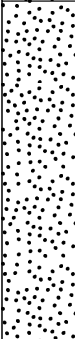
Project				Project No.						
West Essex Highlands				101049801						
Location				Elevation and Datum						
New Jersey, West Orange				Approx. el. 548.0 (NAVD 88)						
Material Symbol	Elev. (ft)	Sample Description	Coring (min)	Depth Scale	Sample Data					Remarks (Drilling Fluid, Casing Depth, Fluid Loss, Drilling Resistance, etc.)
					Number	Type	Recov. (in)	Penetr-resist BL/6in	N-Value (Blows/ft)	
	+532.0			16	S-7		1	12		
				17				15		
				18						
				19						
	+528.0 +527.8	No Recovery SANDSTONE [BOULDER]		20	S-8	SS	0	40/3"	40/3"	Drove casing to 20 ft. Drilled to 20 ft. S-8 at 20 ft Spoon bouncing. Drove casing to 20 ft. Drilled to 20 ft. C-1 at 20.25 ft
21										
	+525.0		02:08	22	C-1	NQ	REC=8%	ROD=0%		
01:49			23							
00:48			24							
00:07			25							
		Reddish brown fine to medium SAND, some silt (moist) [SM]		26	S-9	SS	7	9	21	Drove casing to 25 ft. Drilled to 25 ft. S-9 at 25 ft
				27					18	
				28						
				29						
				30						Drilled to 30 ft. S-10 at 30 ft
				31	S-10	SS	12	88 50/2"	50/2"	
				32						
				33						
				34						
				35	S-11	SS	2	80/3"	80/3"	Drilled to 35 ft. S-11 at 35 ft
			Reddish brown fine to medium SAND, some silt (moist) [SM]		36					

Project West Essex Highlands				Project No. 101049801							
Location New Jersey, West Orange				Elevation and Datum Approx. el. 548.0 (NAVD 88)							
Material Symbol	Elev. (ft)	Sample Description	Coring (min)	Depth Scale	Sample Data					Remarks (Drilling Fluid, Casing Depth, Fluid Loss, Drilling Resistance, etc.)	
					Number	Type	Recov. (in)	Penetr- resist BL/6in	N-Value (Blows/ft) 10 20 30 40		
	+512.0	Reddish brown fine to medium SAND, some silt (moist) [SM]		36							Drilled to 40 ft. S-12 at 40 ft
				37							
				38							
				39							
				40	S-12	SS	4	120/5"	120/5"		
				41							
				42							
				43							
				44							
				45	S-13	SS	0	50/1"	50/1"		
				46							
				47							
				48							
				49							
				50							
				51							
				52							
				53							
				54							
				55							
56											
	+503.0 +502.9	No Recovery End of Boring at 45.1ft.									Drilled to 45 ft. S-13 at 45 ft Stopped drilling 12/17/2024 at 10:08 AM. Upon completion, borehole backfilled with soil cuttings and hole plug.

APPENDIX B

LOGS OF LANGAN TEST PITS

Project		West Essex Highlands		Project No.		101049801		Date		11/15/2024													
Location				West Orange, New Jersey				Elevation and Datum				Approx. el. 606.0 (NAVD 88)											
Excavation Company				Frank Semeraro Construction				Depth		13.0 ft		Water Level - First		11 ▽		Water Level - Completion		11 ▼					
Excavation Equipment				John Deere 75G				Excavation Foreman				Roy Westervelt				Field Engineer				Jordy Moina			

SYMBOL	Elev. (ft)	DESCRIPTION	Depth Scale	SAMPLE		REMARKS
				Number	Type	
	+606.0		0			Began excavating 11/15/2024 at 7:15 AM.
	+605.3	Light Brown fine SAND, some silt, some fine to coarse gravel, some cobbles with roots (dry) [SM]	1			Cobbles and boulders (12" to 60") observed on the surface.
			2			Roots 1" to 1.5" in diameter extend to 2 ft bgs.
			3			Fine roots extend to 3 ft bgs.
	+602.2	Reddish brown fine to medium SAND, some fine to coarse gravel, trace silt, trace clay (moist) [SP]	4			
			5			
			6			
			7			
	+597.3	Reddish brown to Dark reddish brown SILT, some clay, some fine to coarse sand, some fine to coarse gravel (wet) [DECOMPOSED ROCK]	8			
			9			Boulders extend to 9 ft bgs.
			10			
	+594.9	Gray ROCK FRAGMENTS some f-c sand, some silt, trace clay (wet) [DECOMPOSED ROCK]	11			Water seepage observed at 11 ft bgs.
			12			
	+593.0	End of Test Pit at 13.0ft.	13			Max reach of excavator at 13 ft.
			14			End of test pit 11/15/2024 at 8:07 AM.
			15			
			16			
			17			
			18			
			19			
			20			

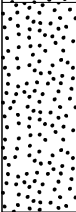
Project		West Essex Highlands		Project No.		101049801		Date		11/15/2024													
Location				West Orange, New Jersey				Elevation and Datum				Approx. el. 582.0 (NAVD 88)											
Excavation Company				Frank Semeraro Construction				Depth		5.5 ft		Water Level - First		-		Water Level - Completion		-					
Excavation Equipment				John Deere 75G				Excavation Foreman				Roy Westervelt				Field Engineer				Jordy Moina			

SYMBOL	Elev. (ft)	DESCRIPTION	Depth Scale	SAMPLE		REMARKS
				Number	Type	
	+582.0		0			Began excavating 11/15/2024 at 8:20 AM.
	+581.0	Topsoil (Approx. 12") [TOPSOIL]	1			Thick roots observed at 1 ft bgs.
		Light brown fine SAND, some silt, some fine to coarse gravel with roots (dry) [SM]	2			
			3			Fine roots observed to 32" bgs.
	+578.0		4			Cobbles and boulders observed to 3.5 ft bgs.
		Reddish brown BOULDER, some fine to medium sand, some silt (dry) [BOULDER]	5			
	+576.5		6			Bucket refusal at 5.5 ft.
		End of Test Pit at 5.5ft.	7			
			8			
			9			
			10			
			11			
			12			
			13			
			14			
			15			
			16			
			17			
			18			
			19			
			20			

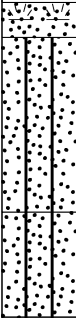
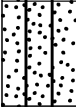
Project		West Essex Highlands		Project No.		101049801		Date		11/15/2024													
Location				West Orange, New Jersey				Elevation and Datum				Approx. el. 550.0 (NAVD 88)											
Excavation Company				Frank Semeraro Construction				Depth		12.0 ft		Water Level - First		- ▽		Water Level - Completion		- ▼					
Excavation Equipment				John Deere 75G				Excavation Foreman				Roy Westervelt				Field Engineer				Jordy Moina			

SYMBOL	Elev. (ft)	DESCRIPTION	Depth Scale	SAMPLE		REMARKS
				Number	Type	
	+550.0		0			Began excavating 11/15/2024 at 1:00 PM.
	+549.5	Brown SILT, some fine to medium sand, some fine to coarse gravel, with roots (dry) [TOPSOIL]	1	S-1	GRAB	S-1 at 1 ft
		Light brown fine to medium SAND, some silt, some fine to coarse gravel, with roots (dry) [SM]	2			
	+547.3	Light reddish brown fine to medium SAND, some fine to coarse gravel, trace silt (dry) [SP]	3			Cobbles and boulders observed to 40" bgs.
			4	S-2	GRAB	S-2 at 3.5 ft
	+542.0	Light brownish gray SILT, some fine sand, some fine to coarse gravel with fine roots (dry) [ML]	8			Fine roots observed to 8 ft bgs.
			9	S-3	GRAB	S-3 at 8.5 ft
	+538.0	End of Test Pit at 12.0ft.	12			Excavator max reach at 12 ft bgs.
			13			End of test pit 11/15/2024 at 1:41 PM.
			14			
			15			
			16			
			17			
			18			
			19			
			20			

Project		West Essex Highlands		Project No.		101049801		Date		11/15/2024													
Location				West Orange, New Jersey				Elevation and Datum				Approx. el. 614.0 (NAVD 88)											
Excavation Company				Frank Semeraro Construction				Depth		3.7 ft		Water Level - First		- ▽		Water Level - Completion		- ▼					
Excavation Equipment				John Deere 75G				Excavation Foreman				Roy Westervelt				Field Engineer				Jordy Moina			

SYMBOL	Elev. (ft)	DESCRIPTION	Depth Scale	SAMPLE		REMARKS
				Number	Type	
	+614.0		0			Began excavating 11/15/2024 at 2:00 PM.
	+613.5	Topsoil (Approx. 6") [TOPSOIL]				
		Light brown fine to medium SAND, some fine to coarse gravel, trace silt, with fine roots (dry) [SP]	1			Thick roots observed to 1 ft bgs.
			2			
			3			
	+610.5			S-1	GRAB	S-1 at 3.2 ft
	+610.3	Reddish brown BOULDER mixed with some fine to coarse sand, trace silt (dry) [BOULDER]	4			Cobbles and boulders observed to 3.5 ft bgs.
		End of Test Pit at 3.7ft.	5			Hard excavating
			6			Excavator bucket refusal at 3.66 ft.
			7			End of test pit 11/15/2024 at 2:50 PM.
			8			
			9			
			10			
			11			
			12			
			13			
			14			
			15			
			16			
			17			
			18			
			19			
			20			

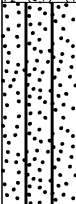
Project		West Essex Highlands		Project No.		101049801		Date		11/18/2024													
Location				West Orange, New Jersey				Elevation and Datum				Approx. el. 584.0 (NAVD 88)											
Excavation Company				Frank Semeraro Construction				Depth		4.8 ft		Water Level - First		-		Water Level - Completion		-					
Excavation Equipment				John Deere 75G				Excavation Foreman				Roy Westervelt				Field Engineer				Jordy Moina			

SYMBOL	Elev. (ft)	DESCRIPTION	Depth Scale	SAMPLE		REMARKS
				Number	Type	
	+584.0		0			Began excavating 11/18/2024 at 9:30 AM.
	+583.5	Topsoil [TOPSOIL]				
		Light brown fine to medium SAND, some silt, some fine to coarse gravel (dry) [SM]	1			
			2			
	+581.0		3			Fine to thick roots observed to 3 ft bgs.
		Light reddish brown fine to medium SAND, some silt, some fine to coarse gravel (dry) [SM]	4			
	+579.5		5			Cobbles and boulders (up to 18") observed to 52" bgs.
	+579.2	Reddish brown BOULDER mixed with some fine to medium sand, some silt [BOULDER]	6			
		End of Test Pit at 4.8ft.	7			Bucket refusal at 4.8 ft bgs. End of test pit 11/18/2024 at 10:05 AM.
			8			
			9			
			10			
			11			
			12			
			13			
			14			
			15			
			16			
			17			
			18			
			19			
			20			

Project		West Essex Highlands		Project No.		101049801		Date		11/18/2024													
Location				West Orange, New Jersey				Elevation and Datum				Approx. el. 528.0 (NAVD 88)											
Excavation Company				Frank Semeraro Construction				Depth		12.0 ft		Water Level - First		-		Water Level - Completion		-					
Excavation Equipment				John Deere 75G				Excavation Foreman				Roy Westervelt				Field Engineer				Jordy Moina			

SYMBOL	Elev. (ft)	DESCRIPTION	Depth Scale	SAMPLE		REMARKS
				Number	Type	
	+528.0		0			Began excavation 11/18/2024 at 7:40 AM.
	+527.3	Topsoil (Approx. 8") [TOPSOIL]	1			
		Yellow brown fine to medium SAND, some fine to coarse gravel, trace silt (dry) [SP]	2			
			3			Fine roots observed to 2.5 ft bgs.
			4			
	+523.0	Reddish brown fine to medium SAND, some fine to coarse gravel, trace silt (dry) [SP]	5			
			6			
			7			
			8			
			9			
		Reddish brown fine to medium SAND, some fine to coarse gravel, trace silt (moist)	10			
			11			
	+516.0	End of Test Pit at 12.0ft.	12			Cobbles and boulders (6" to 20" diameter) observed to 12 ft bgs. Excavator max reach at 12 ft bgs.
			13			End of test pit 11/18/2024 at 8:12 AM.
			14			
			15			
			16			
			17			
			18			
			19			
			20			

Project		West Essex Highlands		Project No.		101049801		Date		11/18/2024													
Location				West Orange, New Jersey				Elevation and Datum				Approx. el. 616.0 (NAVD 88)											
Excavation Company				Frank Semeraro Construction				Depth		5.0 ft		Water Level - First		- ▽		Water Level - Completion		- ▼					
Excavation Equipment				John Deere 75G				Excavation Foreman				Roy Westervelt				Field Engineer				Jordy Moina			

SYMBOL	Elev. (ft)	DESCRIPTION	Depth Scale	SAMPLE		REMARKS
				Number	Type	
	+616.0		0			Began excavating 11/18/2024 at 11:45 AM.
	+615.2	Topsoil (Approx. 10") [TOPSOIL]	1			Hard excavating. Cobbles and boulder (up to 30" diameter) observed to 40" bgs.
		Light brown to light reddish brown fine to medium SAND, some silt, some fine to coarse gravel (dry) [SM]	2			
	+612.2	Reddish brown fine to medium sand, some silt (dry) [SP]	3			
		Reddish brown fine to medium sand, some silt (dry) [SP]	4			
	+611.0	POSSIBLE BOULDER @ 5 ft	5			Excavator bucket refusal at 5 ft bgs.
		End of Test Pit at 5.0ft.	6			End of test pit 11/18/2024 at 11:58 AM.
			7			
			8			
			9			
			10			
			11			
			12			
			13			
			14			
			15			
			16			
			17			
			18			
			19			
			20			

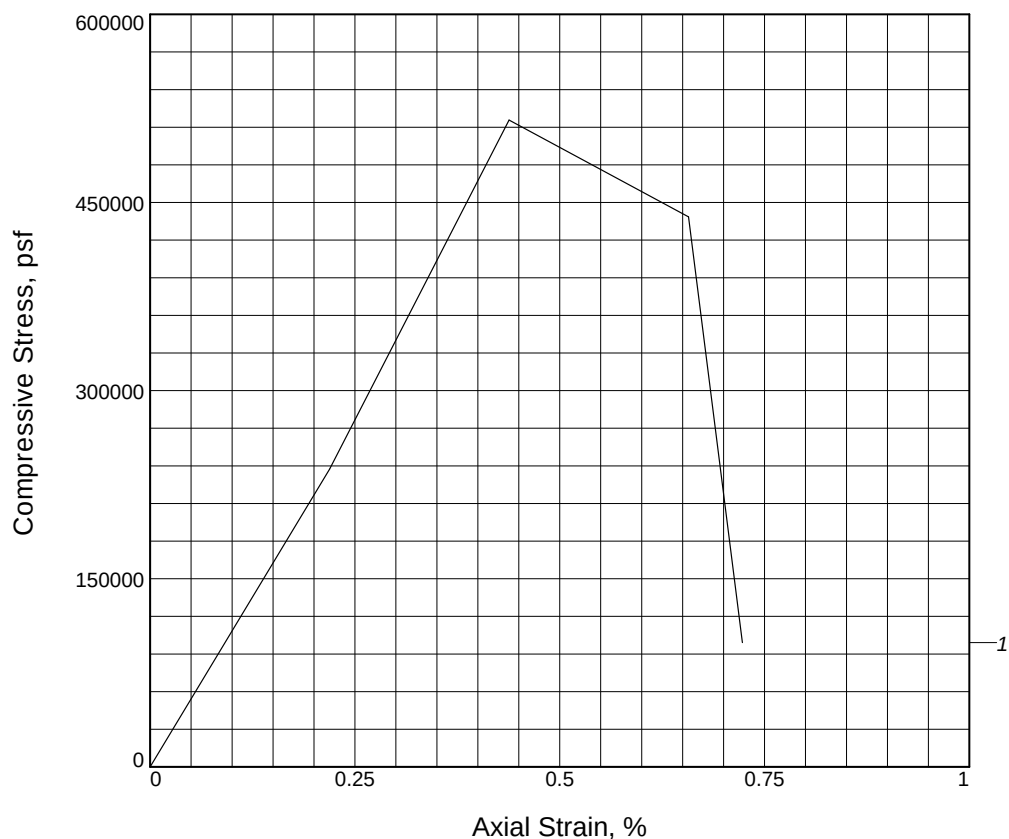
Project		West Essex Highlands		Project No.		101049801		Date		11/18/2024													
Location				West Orange, New Jersey				Elevation and Datum				Approx. el. 606.0 (NAVD 88)											
Excavation Company				Frank Semeraro Construction				Depth		9.0 ft		Water Level - First		- ▽		Water Level - Completion		- ▼					
Excavation Equipment				John Deere 75G				Excavation Foreman				Roy Westervelt				Field Engineer				Jordy Moina			

SYMBOL	Elev. (ft)	DESCRIPTION	Depth Scale	SAMPLE		REMARKS
				Number	Type	
	+606.0		0			Began excavating 11/18/2024 at 12:14 PM.
	+605.5	Topsoil (Approx 6") [TOPSOIL]				
		Light orange brown fine to medium SAND, some silt, some fine to coarse gravel (dry) [SM]	1			
			2			
			3			
			4			
	+601.4	Reddish brown fine to coarse SAND, some fine to coarse gravel, some silt, trace clay (moist) [SP]	5			
			6			
	+599.0	BOULDER	7			
			8			
	+597.0	End of Test Pit at 9.0ft.	9			Approx. 5 ft diameter boulder encountered.
			10			Cobbles and boulder observed to 9 ft bgs.
			11			Stopped excavating at 9 ft bgs due to large boulders in test pit.
			12			End of test pit 11/18/2024 at 1:02 PM.
			13			
			14			
			15			
			16			
			17			
			18			
			19			
			20			

APPENDIX C

LABORATORY TESTING RESULTS

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, psf	515719			
Undrained shear strength, psf	257859			
Failure strain, %	0.4			
Strain rate, in./min.	0.050			
Water content, %	N/A			
Wet density, pcf	182.8			
Dry density, pcf	N/A			
Saturation, %	N/A			
Void ratio	N/A			
Specimen diameter, in.	1.98			
Specimen height, in.	4.57			
Height/diameter ratio	2.31			

Description: Gray Rock Core

LL =	PL =	PI =	Assumed GS= 2.7	Type: ASTM D7012
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Project No.: 869

Date Sampled: 1-8-25

Remarks:

Client: Langan Engineering

Project: West Essex Highlands, West Orange, NJ
Project#101049801

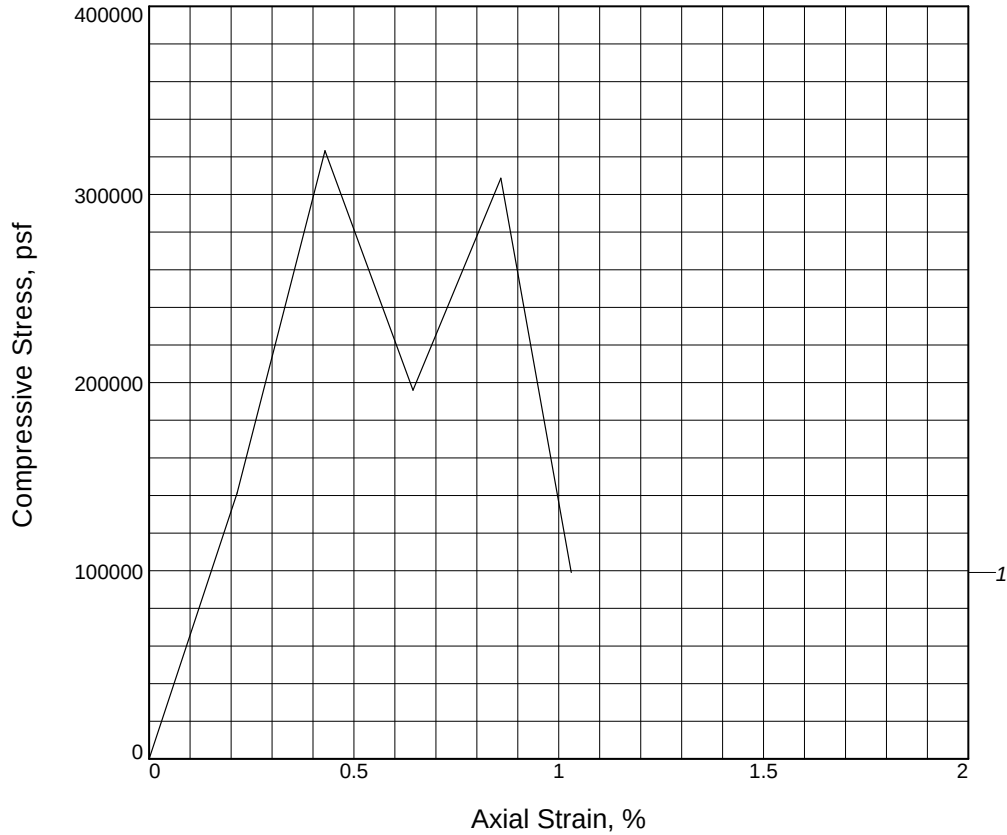
Sample Number: LB-3 C-1A 8.5-10.5'

UNCONFINED COMPRESSION TEST
RSA Geolab
Union, New Jersey

Figure _____

Tested By: SP _____ **Checked By:** KP _____

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, psf	323263			
Undrained shear strength, psf	161632			
Failure strain, %	0.4			
Strain rate, in./min.	0.050			
Water content, %	N/A			
Wet density, pcf	182.3			
Dry density, pcf	N/A			
Saturation, %	N/A			
Void ratio	N/A			
Specimen diameter, in.	1.98			
Specimen height, in.	4.66			
Height/diameter ratio	2.35			

Description: Gray Rock Core

LL =	PL =	PI =	Assumed GS= 2.7	Type: ASTM D7012
-------------	-------------	-------------	------------------------	-------------------------

Project No.: 869

Date Sampled: 1-8-25

Remarks:

Client: Langan Engineering

Project: West Essex Highlands, West Orange, NJ
Project#101049801

Sample Number: LB-3 C-1B 8.5-10.5'

UNCONFINED COMPRESSION TEST
RSA Geolab
Union, New Jersey

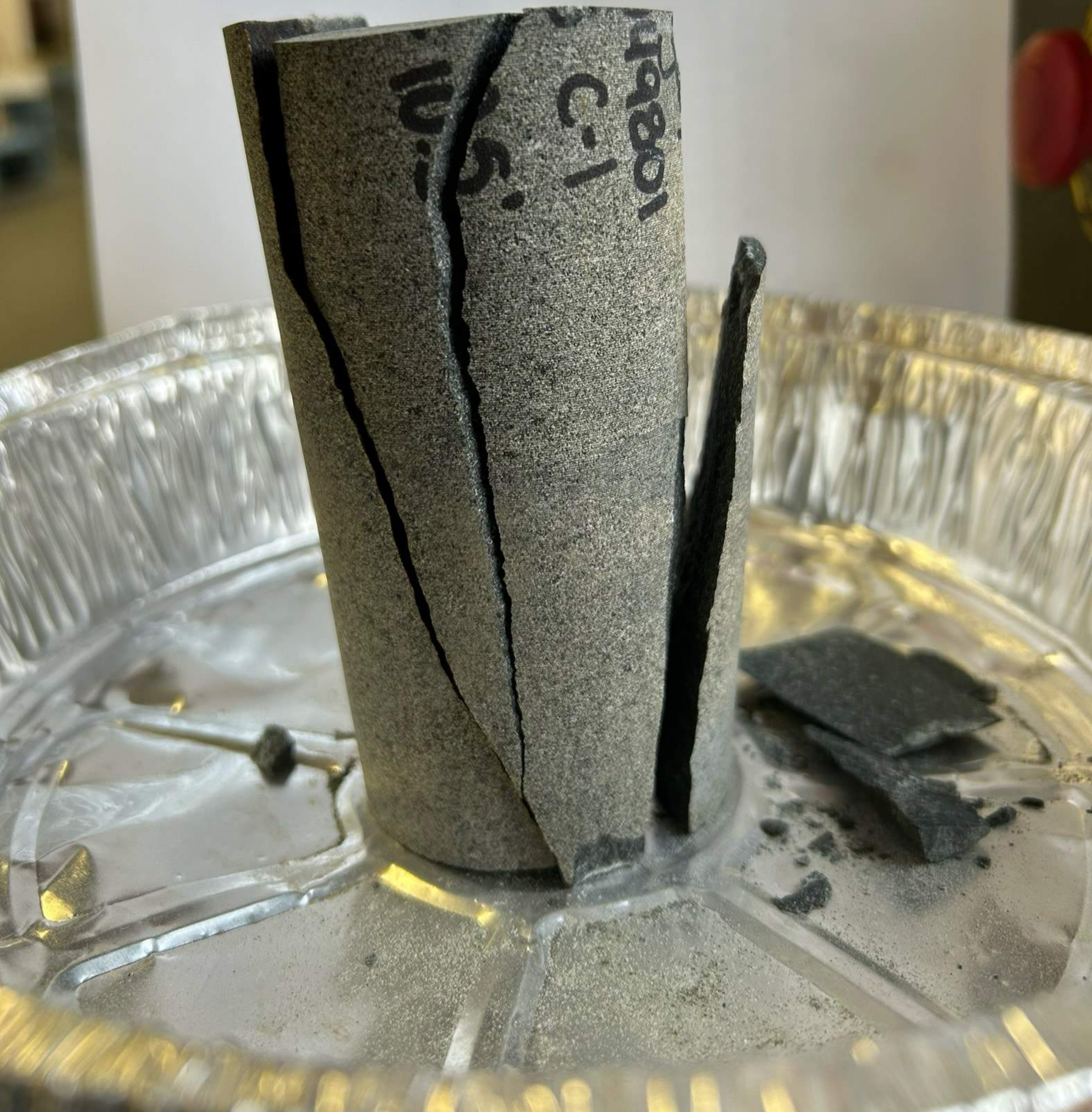
Figure _____

Tested By: SP **Checked By:** KP

L#25-3966
LB-3 C-1 A



L#25-3966
LB-3 C-1 A



L#25-3966

LB-3 C-1 B



L#25-3966
LB-3 C-1 B

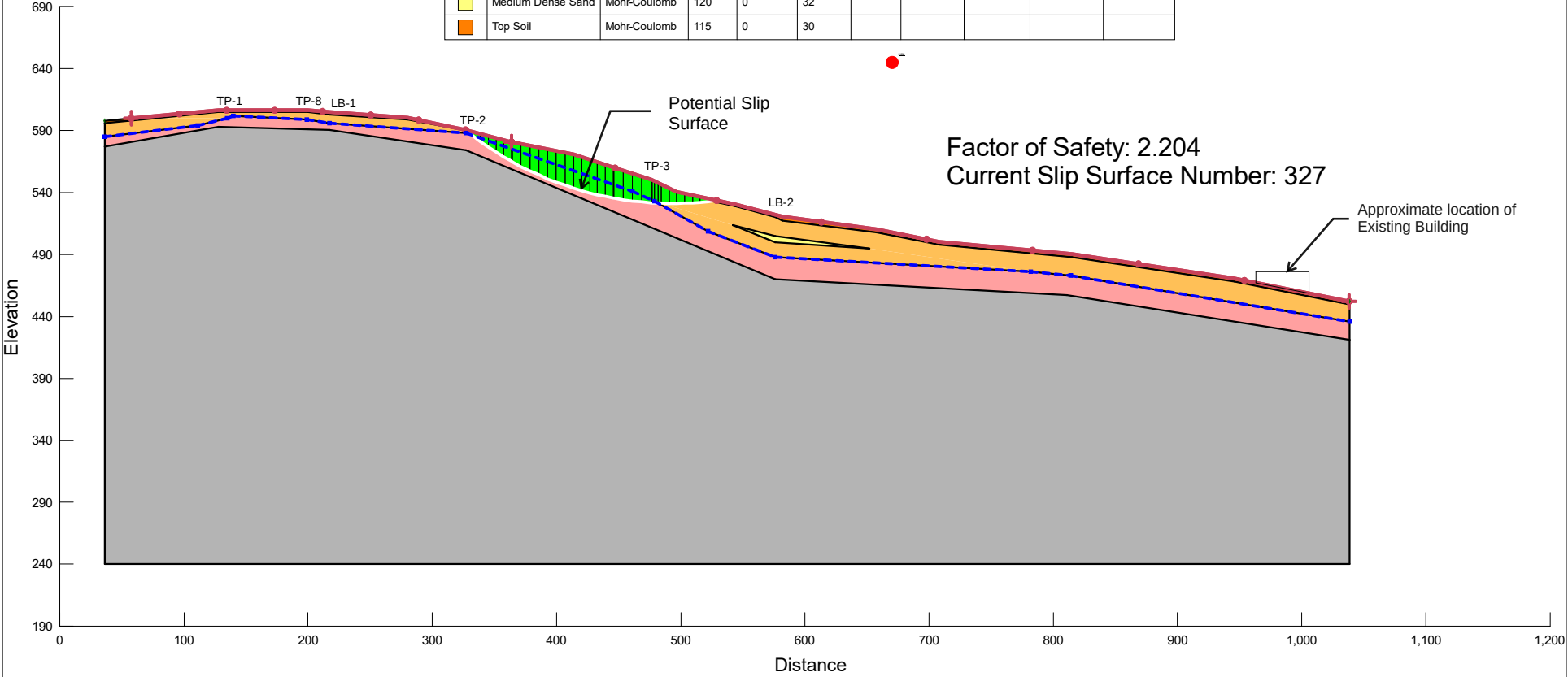


APPENDIX D

RESULTS OF LEM ANALYSIS FOR STATIC CONDITION

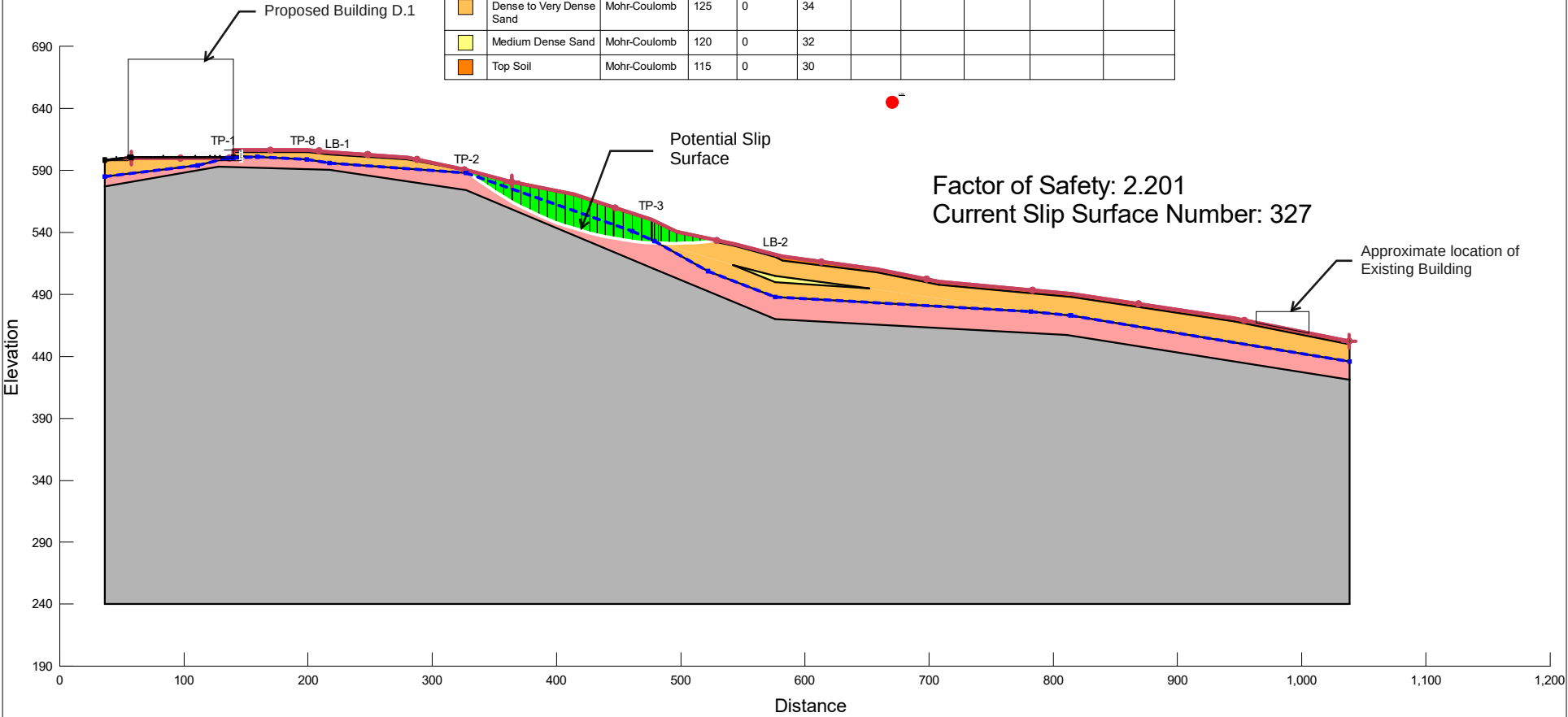
Cross Section A (Static Condition)

Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	UCS Intact (psf)	Intact Rock Parameter mi	Geological Strength Index GSI	Disturbance Factor D	Piezometric Surface
Gray	Bedrock	Hoek-Brown	180			323,263	17	65	1	1
Light Red	Decomposed Rock/Very Dense Granular Soil	Mohr-Coulomb	135	0	38					1
Orange	Dense to Very Dense Sand	Mohr-Coulomb	125	0	34					
Yellow	Medium Dense Sand	Mohr-Coulomb	120	0	32					
Dark Orange	Top Soil	Mohr-Coulomb	115	0	30					



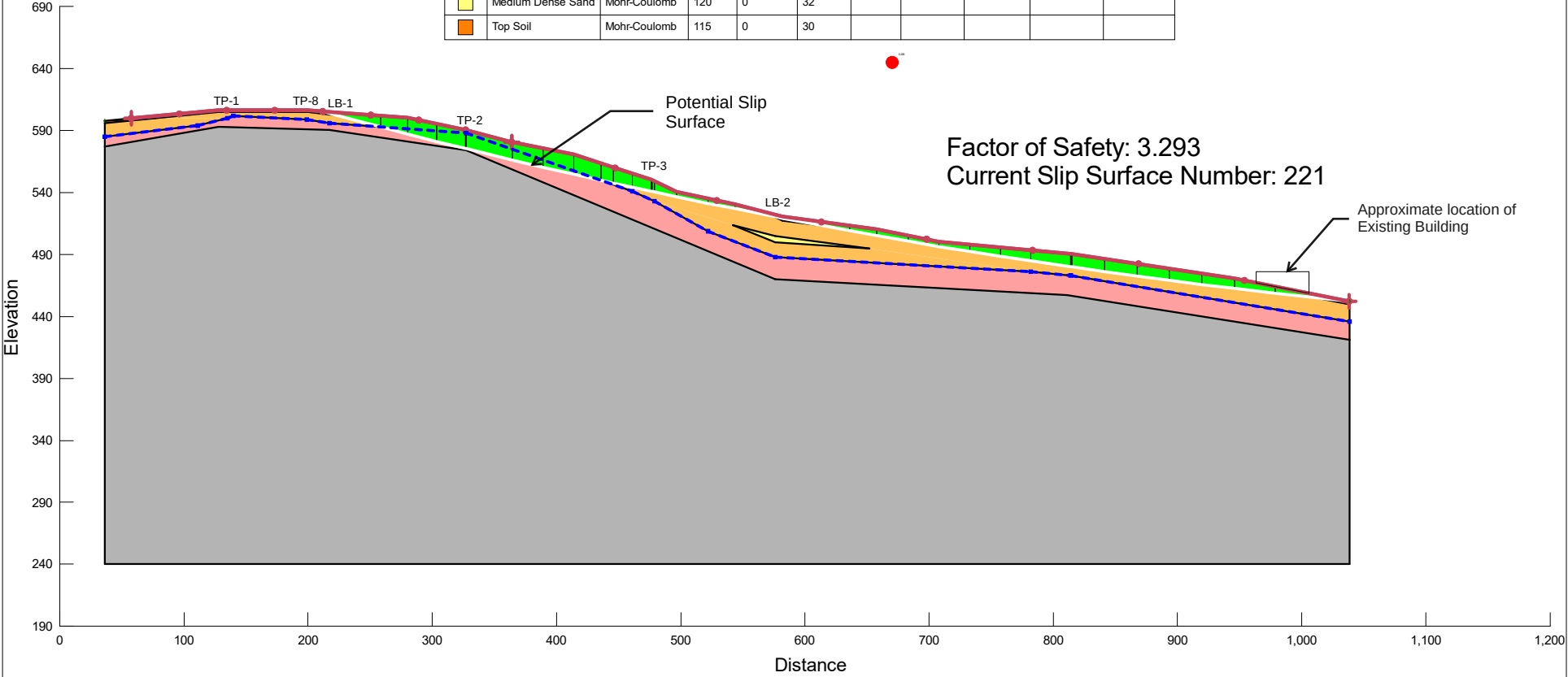
Cross Section A_Existing Condition

Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	UCS Intact (psf)	Intact Rock Parameter mi	Geological Strength Index GSI	Disturbance Factor D	Piezometric Surface
Gray	Bedrock	Hoek-Brown	180			323,263	17	65	1	1
Red	Decomposed Rock/Very Dense Granular Soil	Mohr-Coulomb	135	0	38					1
Orange	Dense to Very Dense Sand	Mohr-Coulomb	125	0	34					
Yellow	Medium Dense Sand	Mohr-Coulomb	120	0	32					
Dark Orange	Top Soil	Mohr-Coulomb	115	0	30					



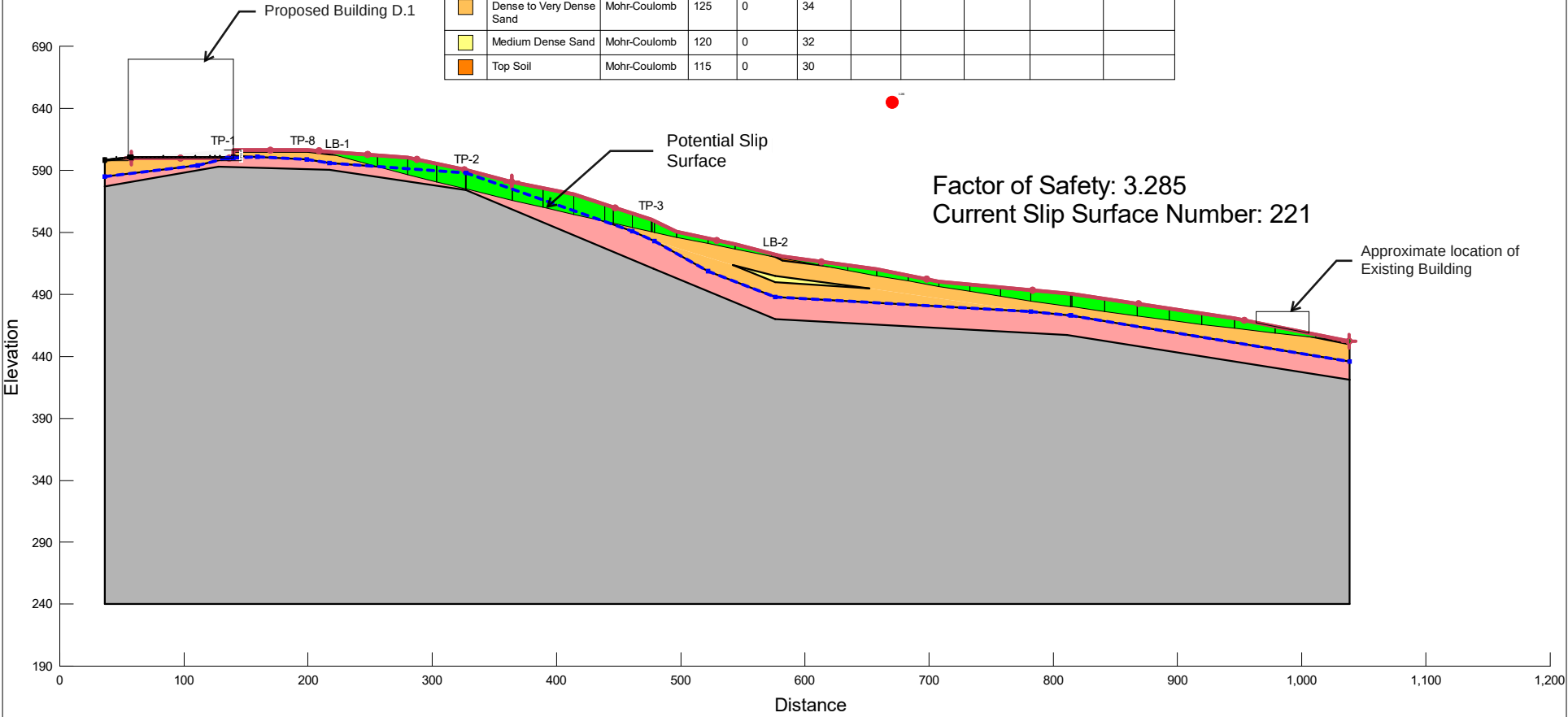
Cross Section A_Proposed Condition

Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	UCS Intact (psf)	Intact Rock Parameter mi	Geological Strength Index GSI	Disturbance Factor D	Piezometric Surface
Gray	Bedrock	Hoek-Brown	180			323,263	17	65	1	1
Light Red	Decomposed Rock/Very Dense Granular Soil	Mohr-Coulomb	135	0	38					1
Orange	Dense to Very Dense Sand	Mohr-Coulomb	125	0	34					
Yellow	Medium Dense Sand	Mohr-Coulomb	120	0	32					
Dark Orange	Top Soil	Mohr-Coulomb	115	0	30					



Cross Section A_Existing Condition

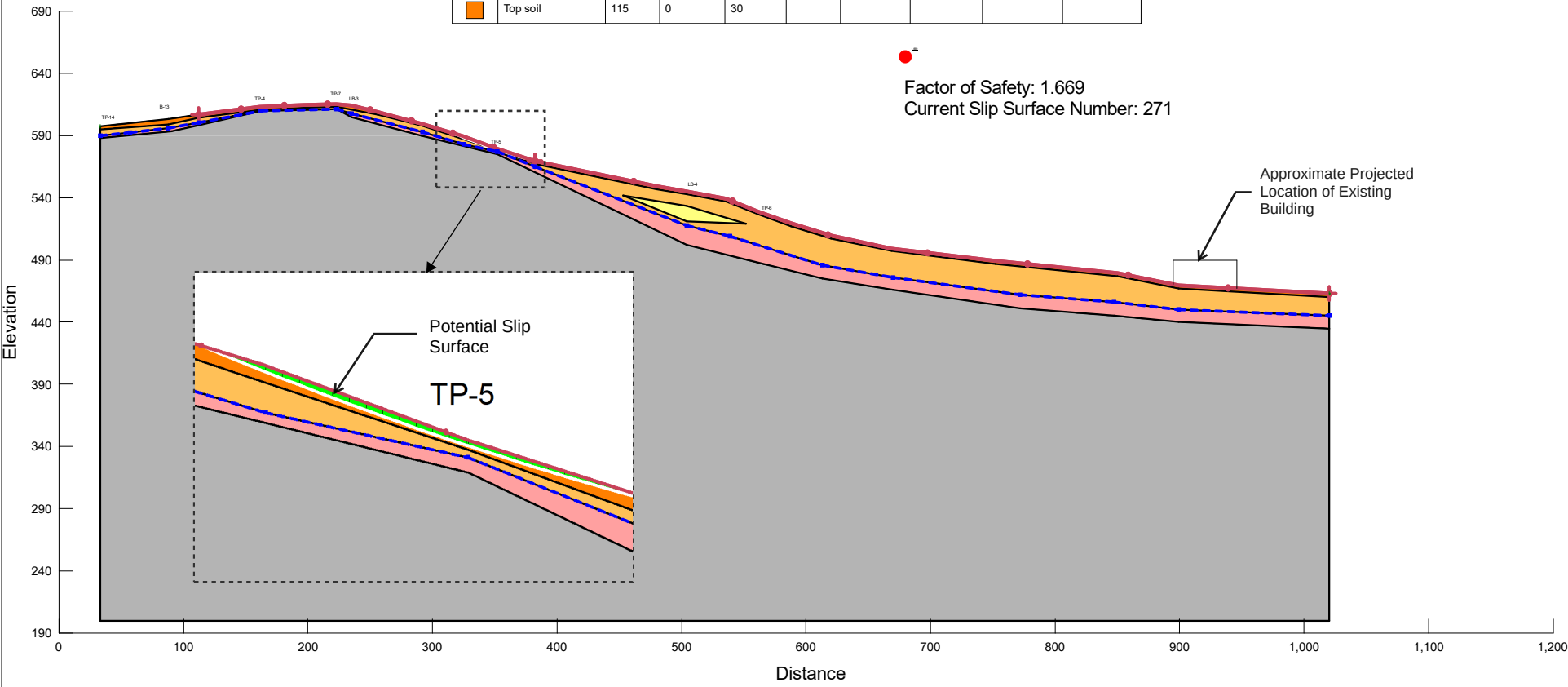
Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	UCS Intact (psf)	Intact Rock Parameter mi	Geological Strength Index GSI	Disturbance Factor D	Piezometric Surface
Gray	Bedrock	Hoek-Brown	180			323,263	17	65	1	1
Red	Decomposed Rock/Very Dense Granular Soil	Mohr-Coulomb	135	0	38					1
Orange	Dense to Very Dense Sand	Mohr-Coulomb	125	0	34					
Yellow	Medium Dense Sand	Mohr-Coulomb	120	0	32					
Dark Orange	Top Soil	Mohr-Coulomb	115	0	30					



Cross Section A_Proposed Condition

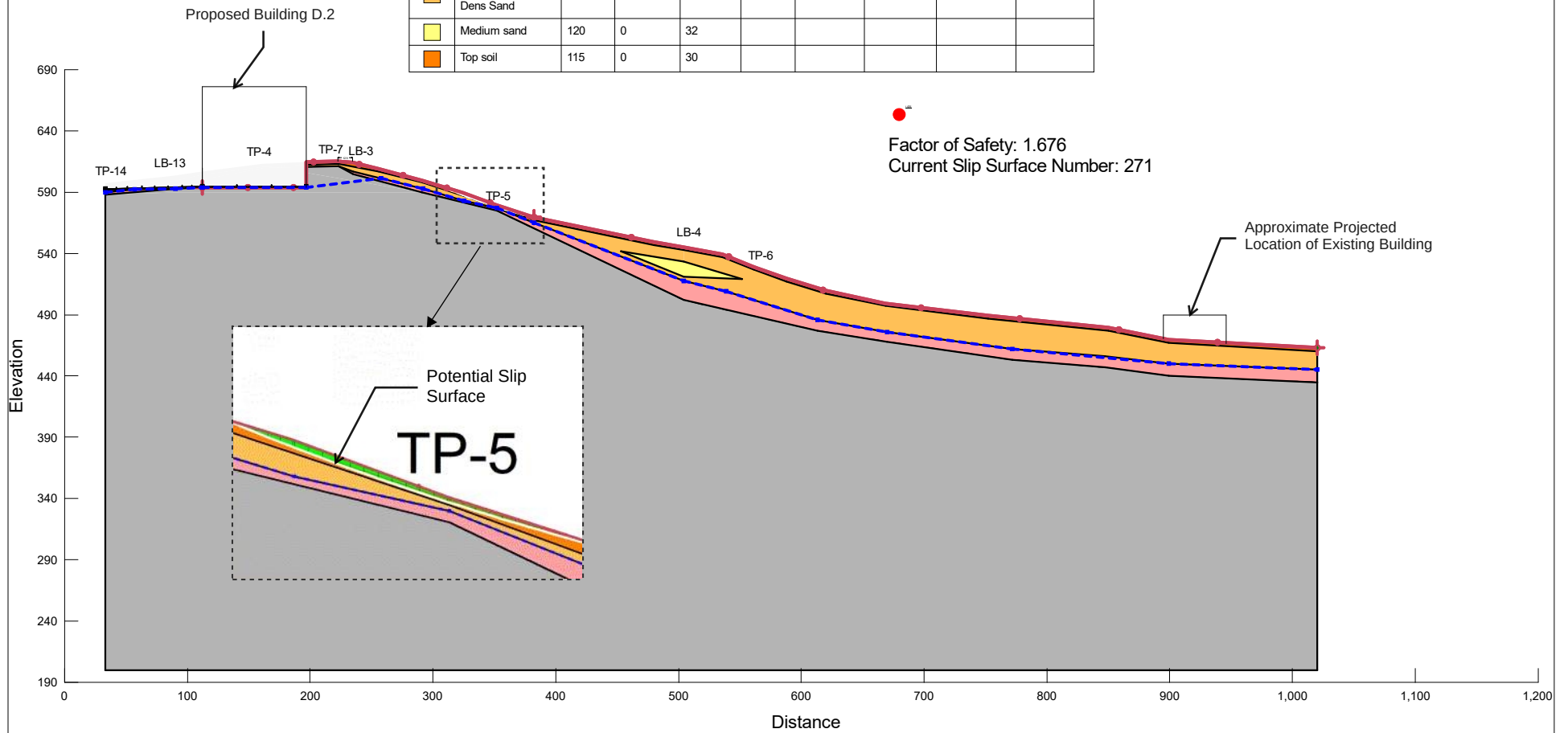
Cross Section B (Static Condition)

Color	Name	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	UCS Intact (psf)	Intact Rock Parameter mi	Geological Strength Index GSI	Disturbance Factor D	Piezometric Surface
Gray	Bedrock	180			323,263	17	65	1	1
Red	Decomposed Rock/Very Dense Granular Soil	135	0	38					1
Orange	Dense to Very Dens Sand	125	0	34					
Yellow	Medium sand	120	0	32					
Dark Orange	Top soil	115	0	30					



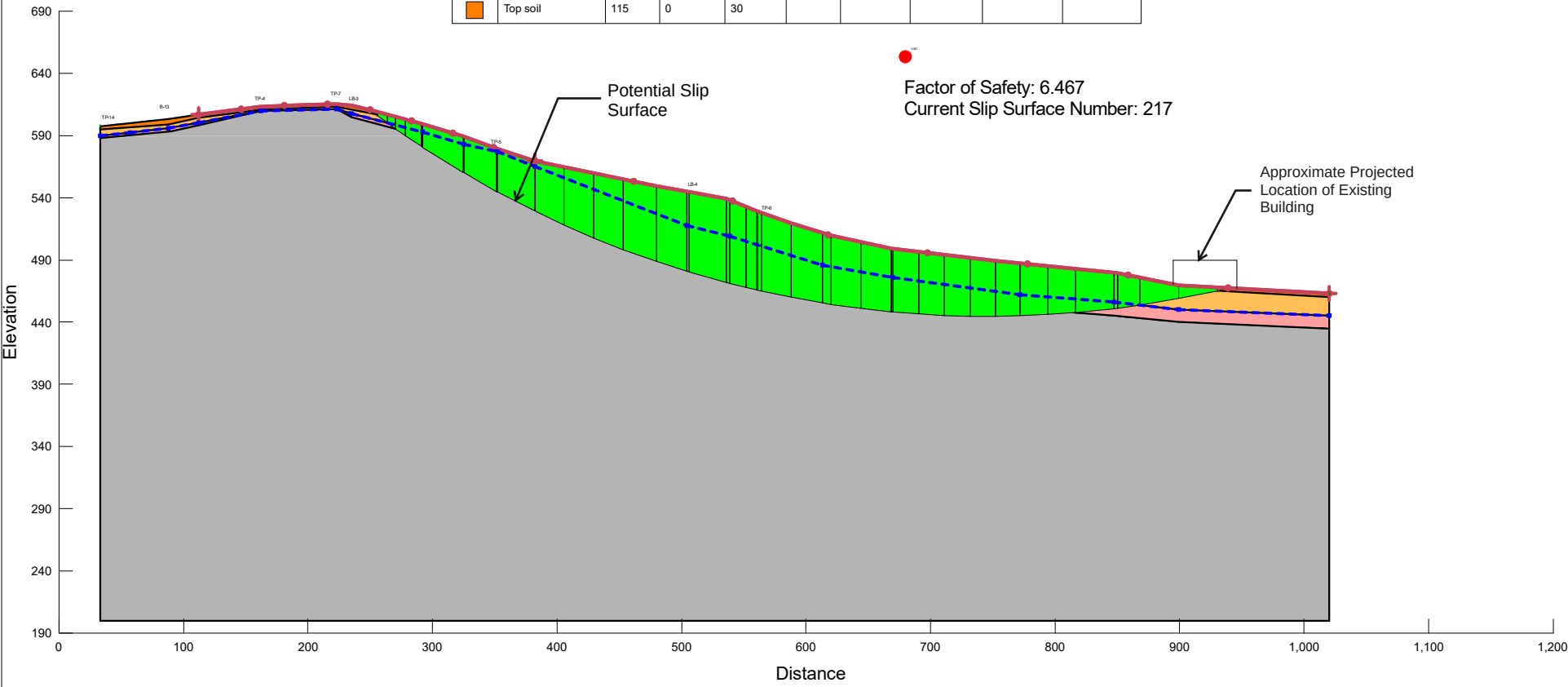
Cross Section B_Existing Condition

Color	Name	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	UCS Intact (psf)	Intact Rock Parameter mi	Geological Strength Index GSI	Disturbance Factor D	Piezometric Surface
Gray	Bedrock	180			323,263	17	65	1	1
Pink	Decomposed Rock/Very Dense Granular Soil	135	0	38					1
Orange	Dense to Very Dense Sand	125	0	34					
Yellow	Medium sand	120	0	32					
Dark Orange	Top soil	115	0	30					



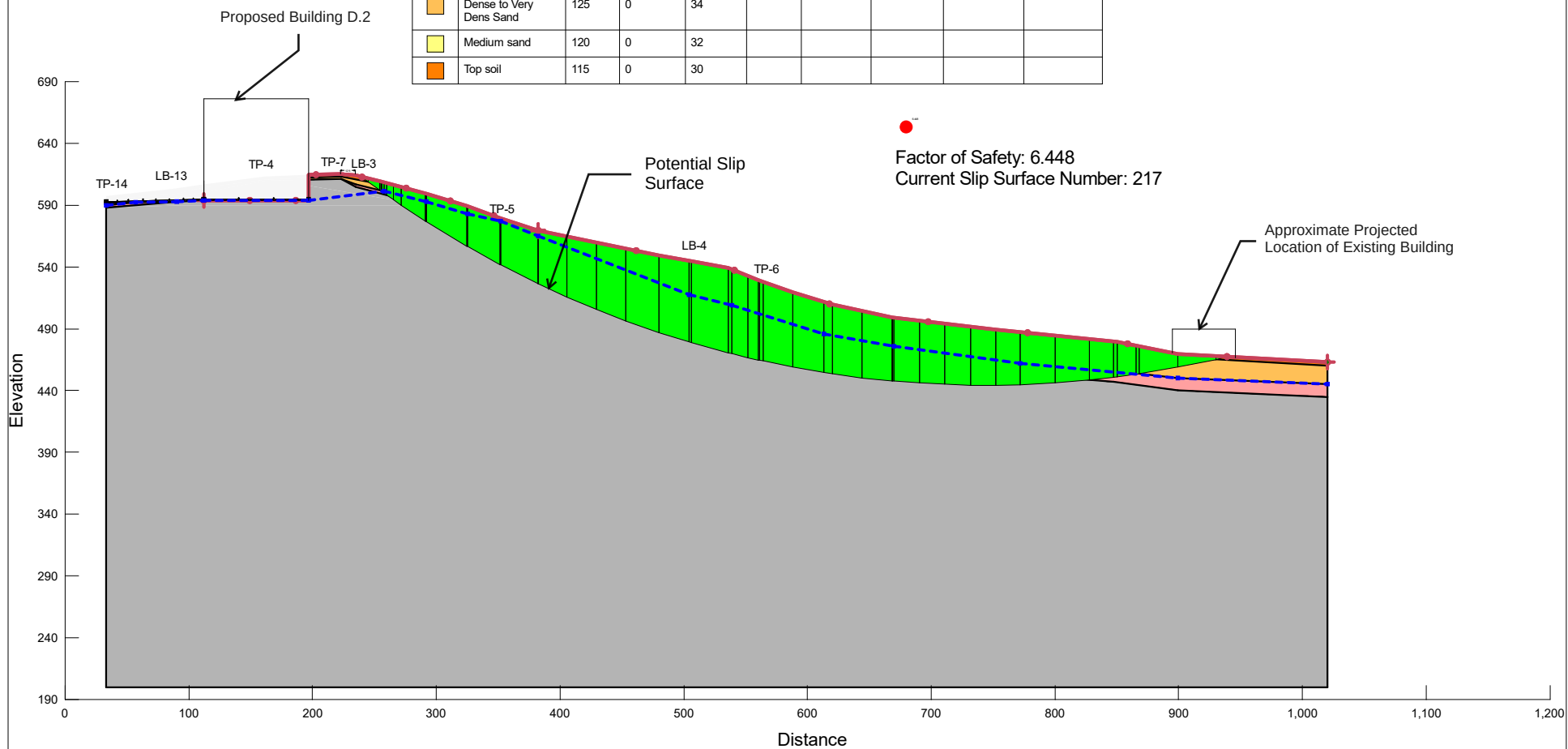
Cross Section B_Proposed Condition

Color	Name	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	UCS Intact (psf)	Intact Rock Parameter mi	Geological Strength Index GSI	Disturbance Factor D	Piezometric Surface
Grey	Bedrock	180			323,263	17	65	1	1
Red	Decomposed Rock/Very Dense Granular Soil	135	0	38					1
Orange	Dense to Very Dense Sand	125	0	34					
Yellow	Medium sand	120	0	32					
Dark Orange	Top soil	115	0	30					



Cross Section B_Existing Condition

Color	Name	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	UCS Intact (psf)	Intact Rock Parameter mi	Geological Strength Index GSI	Disturbance Factor D	Piezometric Surface
Gray	Bedrock	180			323,263	17	65	1	1
Light Red	Decomposed Rock/Very Dense Granular Soil	135	0	38					1
Orange	Dense to Very Dense Sand	125	0	34					
Yellow	Medium sand	120	0	32					
Dark Orange	Top soil	115	0	30					



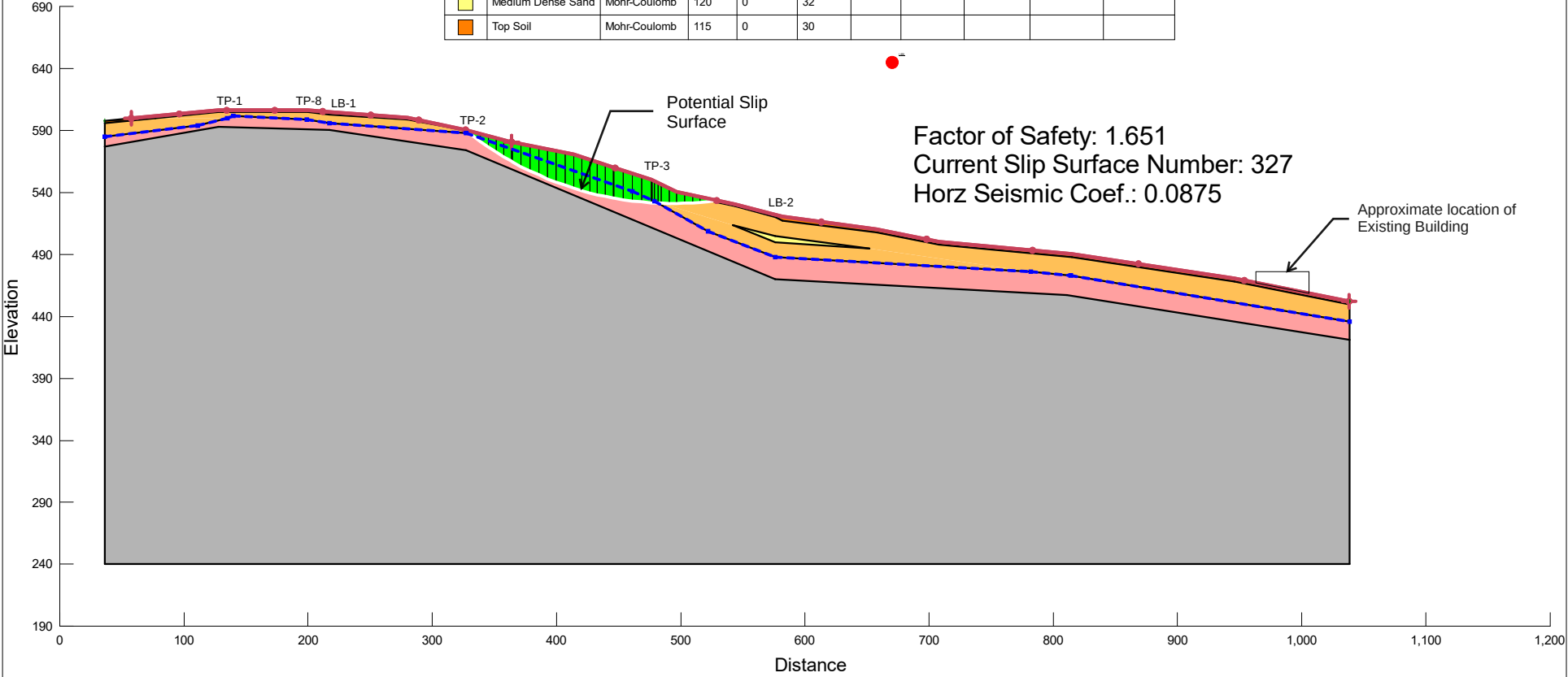
Cross Section B_Proposed Condition

APPENDIX E

RESULTS OF LEM ANALYSIS FOR SEISMIC CONDITION

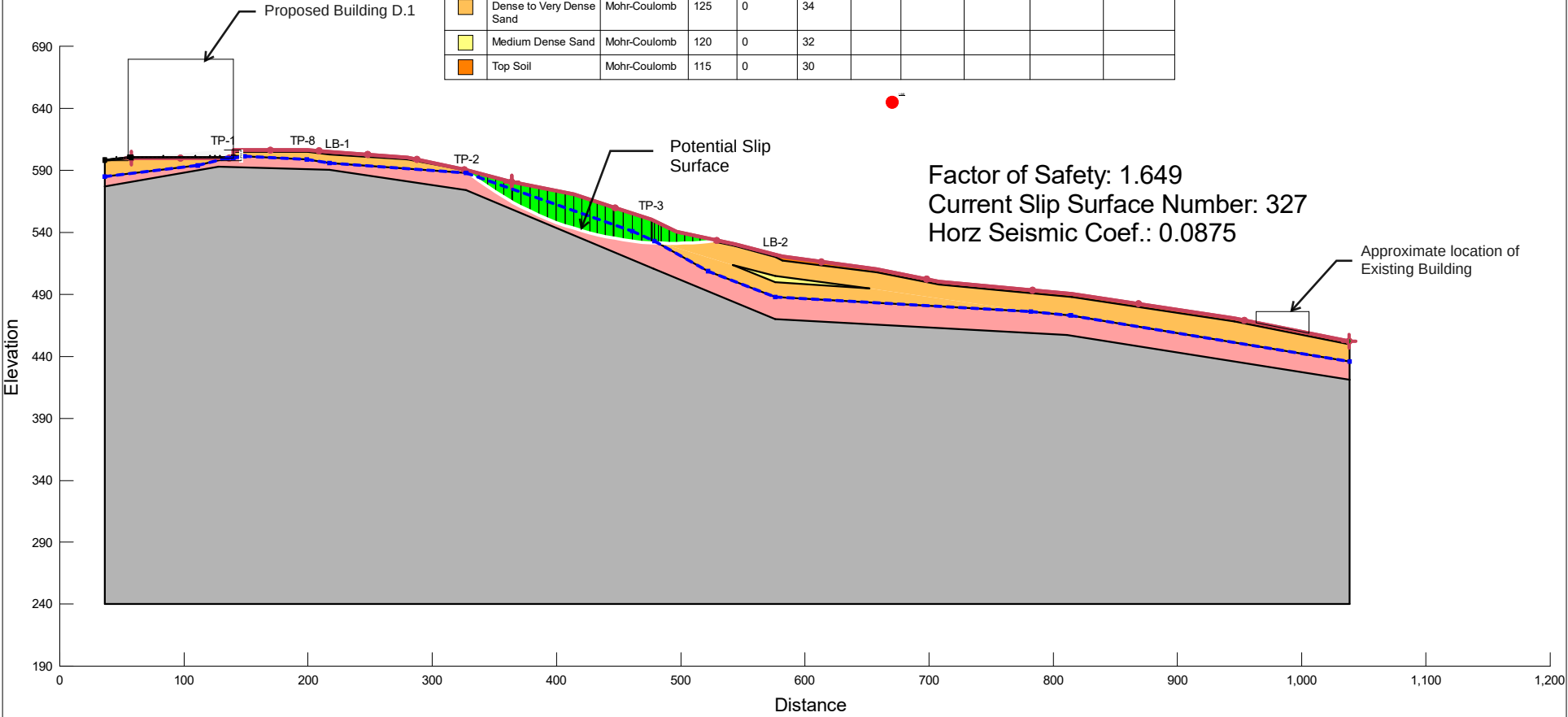
Cross Section A (Seismic Condition)

Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	UCS Intact (psf)	Intact Rock Parameter mi	Geological Strength Index GSI	Disturbance Factor D	Piezometric Surface
Gray	Bedrock	Hoek-Brown	180			323,263	17	65	1	1
Red	Decomposed Rock/Very Dense Granular Soil	Mohr-Coulomb	135	0	38					1
Orange	Dense to Very Dense Sand	Mohr-Coulomb	125	0	34					
Yellow	Medium Dense Sand	Mohr-Coulomb	120	0	32					
Dark Orange	Top Soil	Mohr-Coulomb	115	0	30					



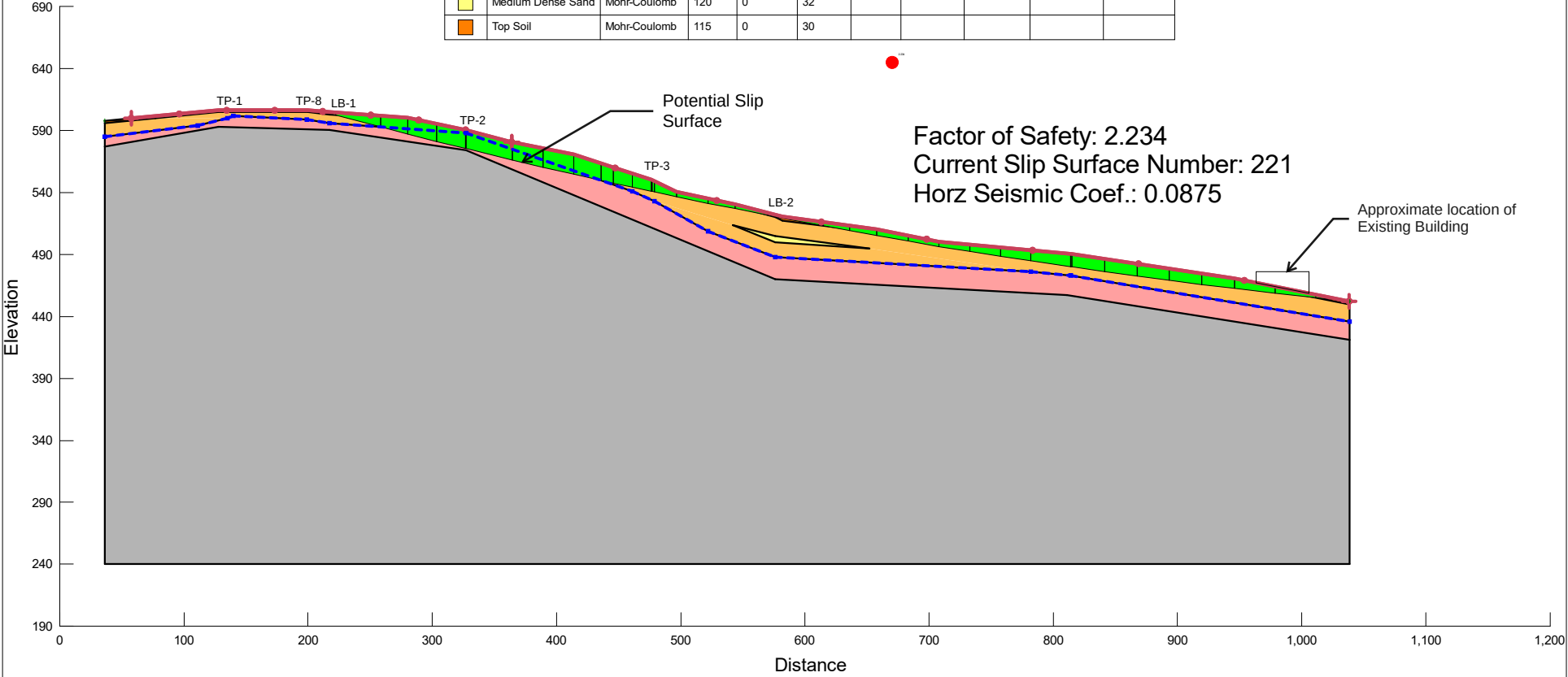
Cross Section A_Existing Condition

Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	UCS Intact (psf)	Intact Rock Parameter mi	Geological Strength Index GSI	Disturbance Factor D	Piezometric Surface
Gray	Bedrock	Hoek-Brown	180			323,263	17	65	1	1
Red	Decomposed Rock/Very Dense Granular Soil	Mohr-Coulomb	135	0	38					1
Orange	Dense to Very Dense Sand	Mohr-Coulomb	125	0	34					
Yellow	Medium Dense Sand	Mohr-Coulomb	120	0	32					
Dark Orange	Top Soil	Mohr-Coulomb	115	0	30					



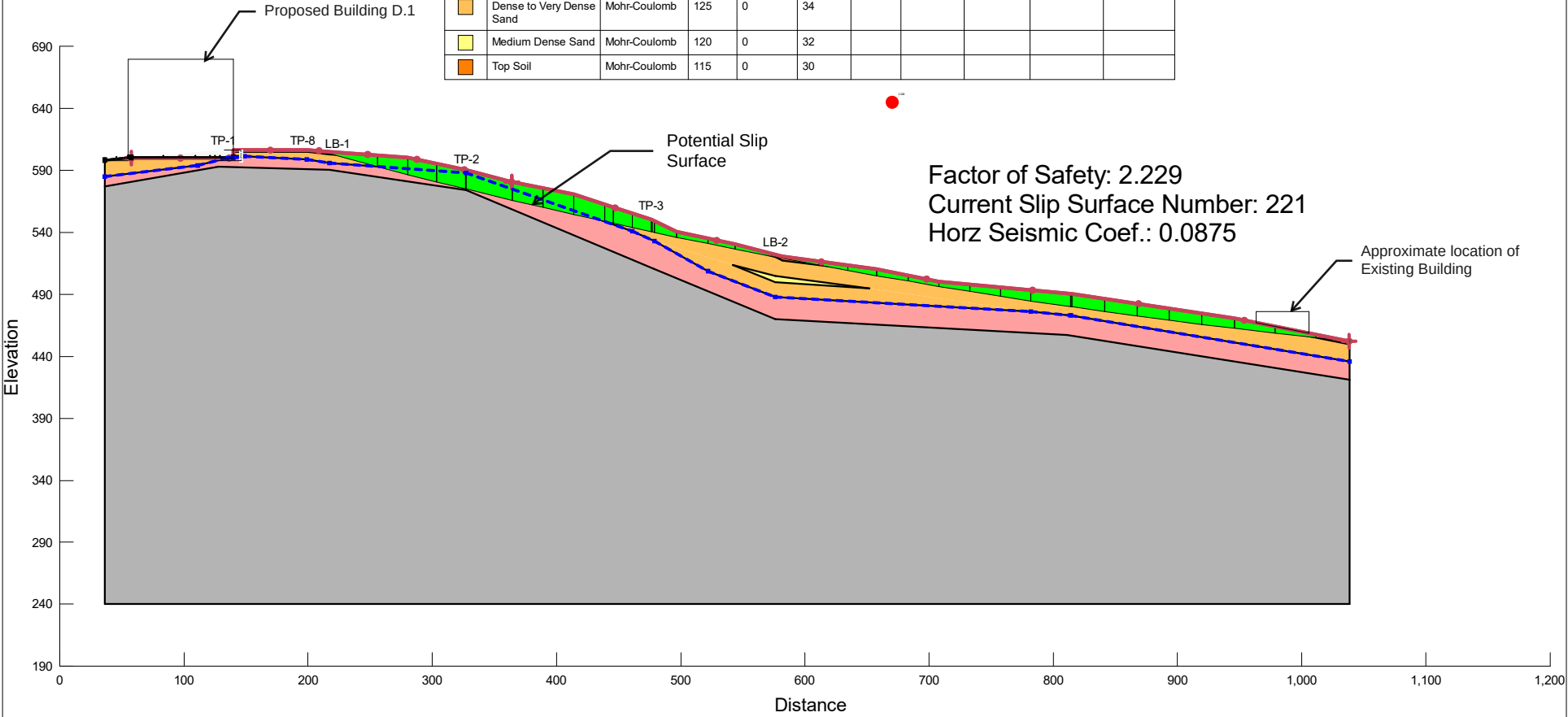
Cross Section A_Proposed Condition

Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	UCS Intact (psf)	Intact Rock Parameter mi	Geological Strength Index GSI	Disturbance Factor D	Piezometric Surface
Gray	Bedrock	Hoek-Brown	180			323,263	17	65	1	1
Light Red	Decomposed Rock/Very Dense Granular Soil	Mohr-Coulomb	135	0	38					1
Orange	Dense to Very Dense Sand	Mohr-Coulomb	125	0	34					
Yellow	Medium Dense Sand	Mohr-Coulomb	120	0	32					
Dark Orange	Top Soil	Mohr-Coulomb	115	0	30					



Cross Section A_Existing Condition

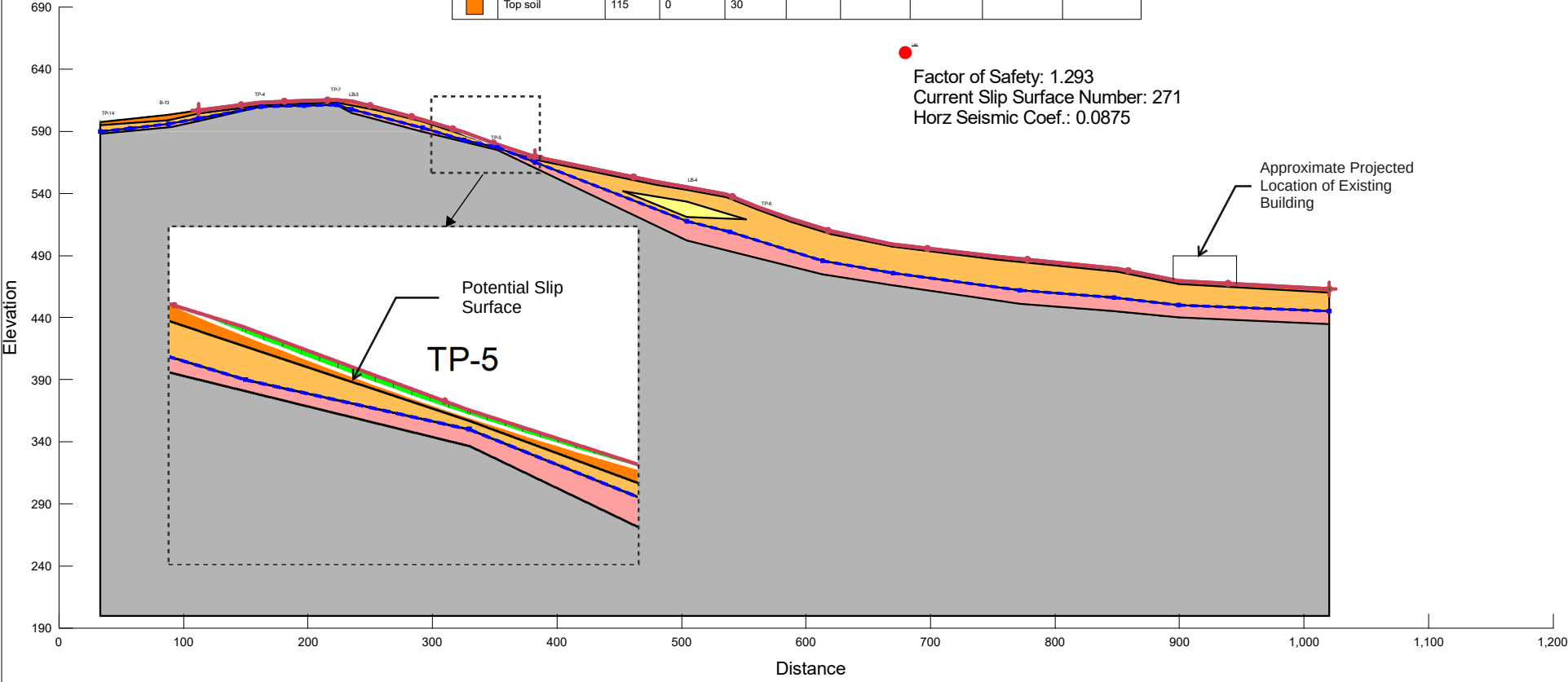
Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	UCS Intact (psf)	Intact Rock Parameter mi	Geological Strength Index GSI	Disturbance Factor D	Piezometric Surface
Gray	Bedrock	Hoek-Brown	180			323,263	17	65	1	1
Red	Decomposed Rock/Very Dense Granular Soil	Mohr-Coulomb	135	0	38					1
Orange	Dense to Very Dense Sand	Mohr-Coulomb	125	0	34					
Yellow	Medium Dense Sand	Mohr-Coulomb	120	0	32					
Dark Orange	Top Soil	Mohr-Coulomb	115	0	30					



Cross Section A_Proposed Condition

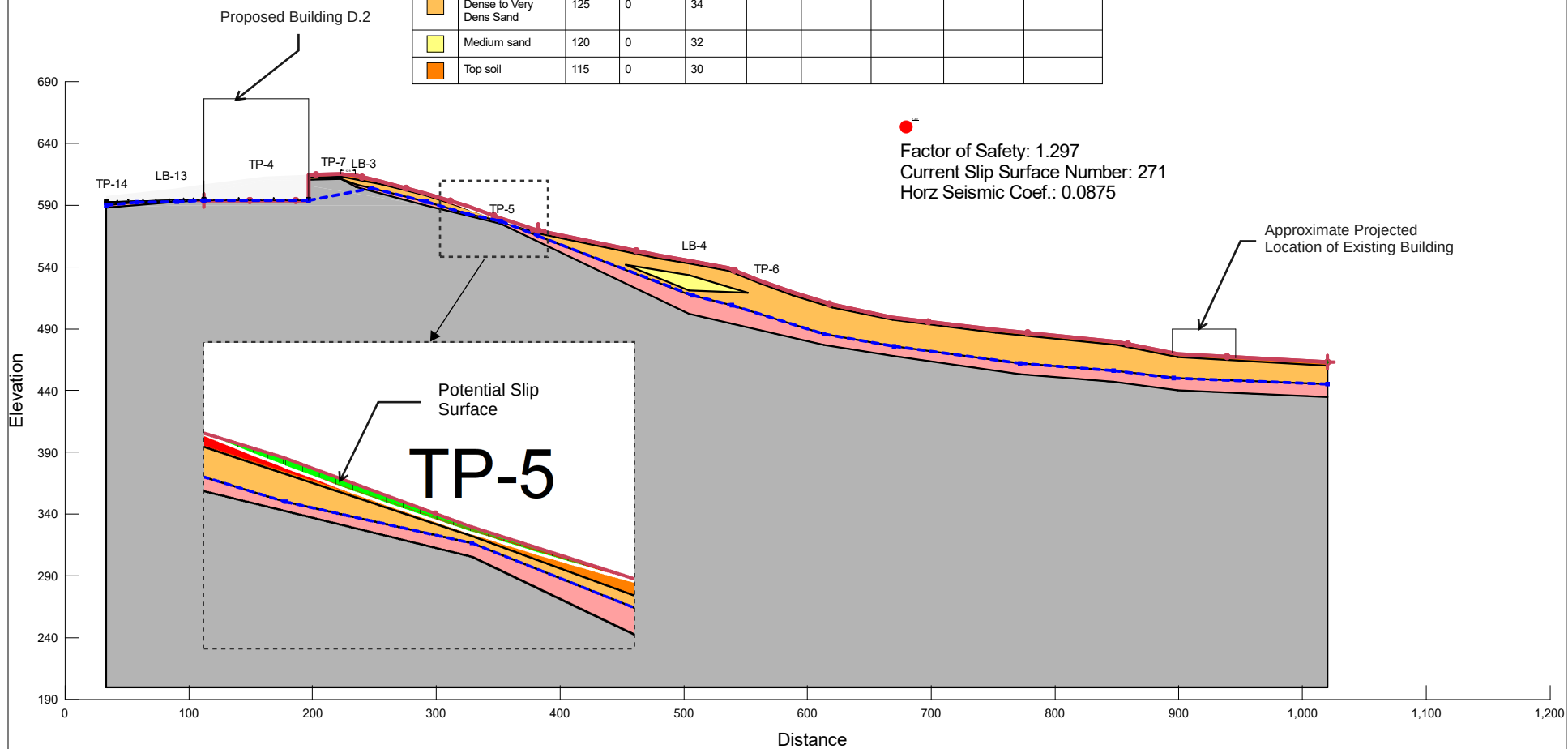
Cross Section B (Seismic Condition)

Color	Name	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	UCS Intact (psf)	Intact Rock Parameter mi	Geological Strength Index GSI	Disturbance Factor D	Piezometric Surface
Gray	Bedrock	180			323,263	17	65	1	1
Red	Decomposed Rock/Very Dense Granular Soil	135	0	38					1
Orange	Dense to Very Dense Sand	125	0	34					
Yellow	Medium sand	120	0	32					
Dark Orange	Top soil	115	0	30					



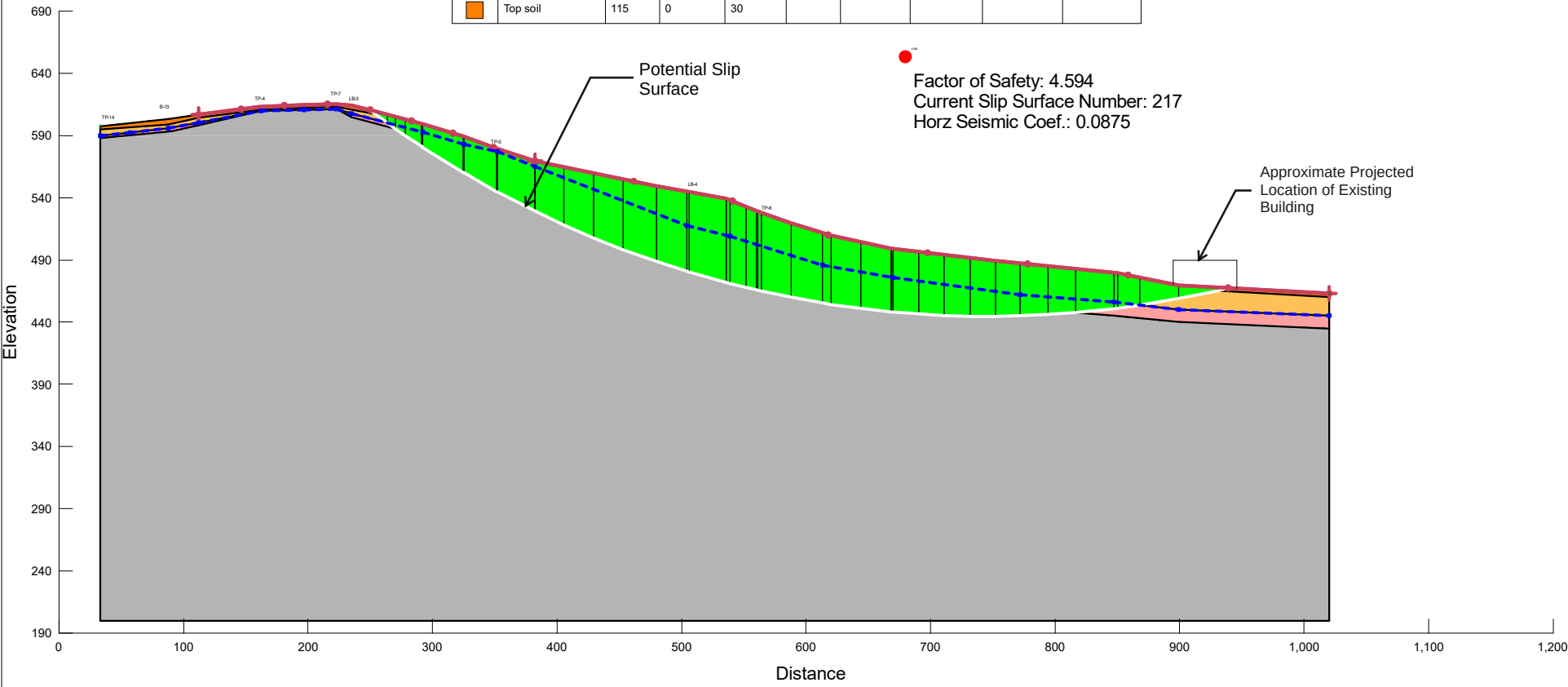
Cross Section B_Existing Condition

Color	Name	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	UCS Intact (psf)	Intact Rock Parameter mi	Geological Strength Index GSI	Disturbance Factor D	Piezometric Surface
Grey	Bedrock	180			323,263	17	65	1	1
Pink	Decomposed Rock/Very Dense Granular Soil	135	0	38					1
Orange	Dense to Very Dense Sand	125	0	34					
Yellow	Medium sand	120	0	32					
Dark Orange	Top soil	115	0	30					



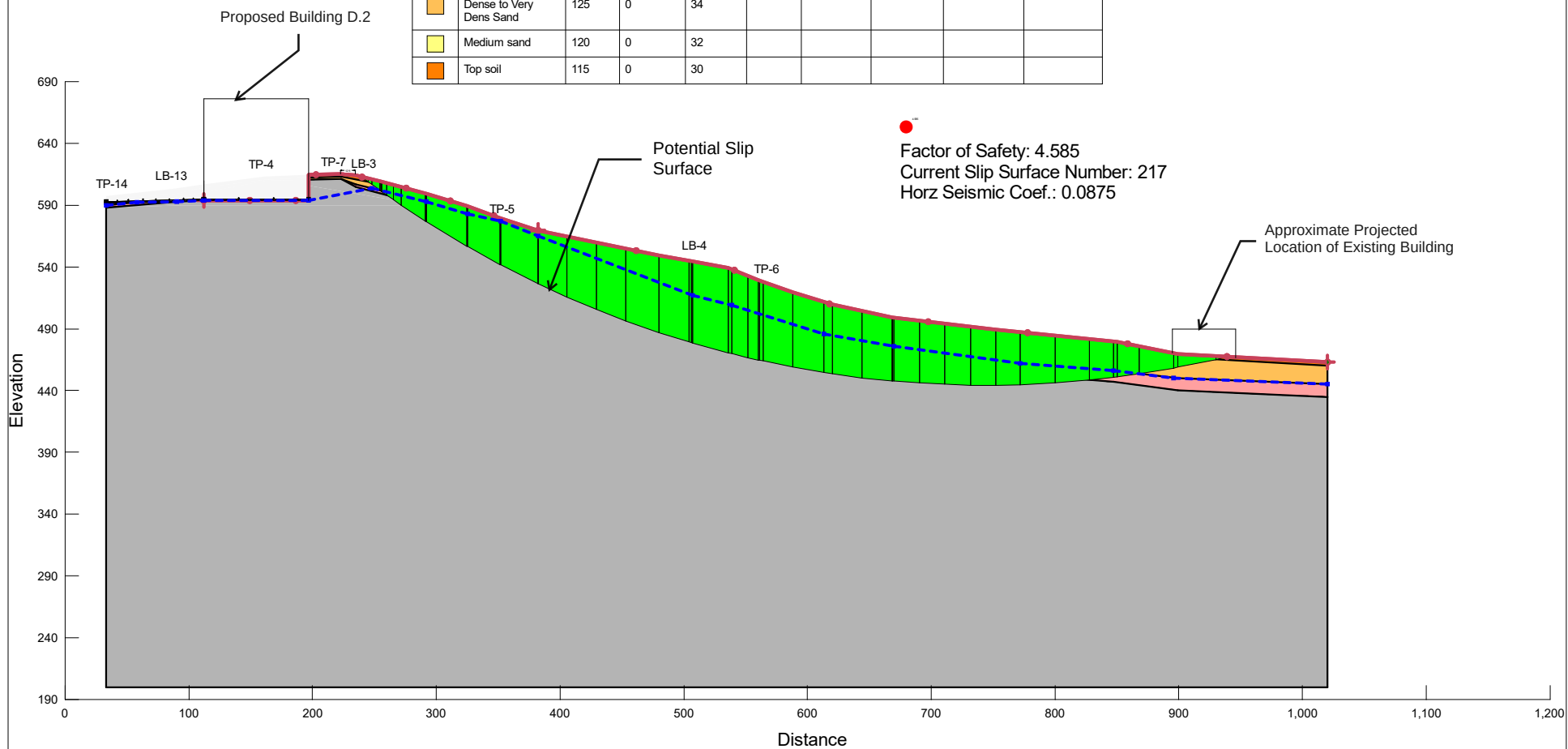
Cross Section B_Proposed Condition

Color	Name	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	UCS Intact (psf)	Intact Rock Parameter mi	Geological Strength Index GSI	Disturbance Factor D	Piezometric Surface
Gray	Bedrock	180			323,263	17	65	1	1
Red	Decomposed Rock/Very Dense Granular Soil	135	0	38					1
Orange	Dense to Very Dense Sand	125	0	34					
Yellow	Medium sand	120	0	32					
Dark Orange	Top soil	115	0	30					



Cross Section B_Existing Condition

Color	Name	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	UCS Intact (psf)	Intact Rock Parameter mi	Geological Strength Index GSI	Disturbance Factor D	Piezometric Surface
Gray	Bedrock	180			323,263	17	65	1	1
Light Red	Decomposed Rock/Very Dense Granular Soil	135	0	38					1
Orange	Dense to Very Dense Sand	125	0	34					
Yellow	Medium sand	120	0	32					
Dark Orange	Top soil	115	0	30					



Cross Section B_Proposed Condition