GEOTECHNICAL EXPLORATION REPORT

For a 0.97 + acres Parcel Residential Development

(APN: 140-05-803-007)

Located on Las Vegas Blvd/ North of Lamont St

Clark County, Nevada

Prepared by:

American Soils Engineering, LLC

Project No.: 2137-GEO

September 30, 2021

Prepared for:

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1.0 INTRODUCTION

This report presents the results of a geotechnical exploration for a proposed commercial development. The project is located on Las Vegas Blvd/ North of Lamont St, Clark County Nevada. The purpose of this study was to evaluate the subsurface conditions at the site and to provide design geotechnical recommendations based on study findings. The approximate location of the site is shown on the Vicinity Map, Figure 1.

1.1 Project Description

At the time of our field exploration, the 0.97 ± acres parcel is a relatively flat currently vacant. Property is bounded by the north side Las Vegas Blvd, by south side residential property, by east side Mobile Park and west side commercial development. It is our understanding that the proposed development will consist of one to two stories commercial structures of wood-frame or masonry/concrete and steel construction with slab-on-grade floors. No basements are planned. Structural loads for the proposed building were not provided. We have assumed maximum dead plus live loads for columns and wall loading at approximately 110 kips and 3 kips per lineal foot, respectively Grading plans were not available for our review during the preparation of this report. However, we anticipate that final grades will be at or near existing grades (+ 1 feet).

1.2 Scope of Services

The scope of services was established to provide information and to develop geotechnical engineering recommendations and included:

- Exploration of subsurface soil conditions was conducted by drilling two (2) borings to a depth of 15 feet below existing surface at the time of our exploration and obtaining samples of selected earth materials as the excavation were advanced.
- Standard Penetration Tests to evaluate the in-situ soil density and retrieve un-disturbed samples for further laboratory testing.
- Laboratory testing was performed on selected samples to evaluate the chemical, physical and engineering properties of the subsurface soils
- Engineering analysis was performed to plan site earthwork, building foundations, slabs-on-grade, retaining walls (N/A) and pavement structural sections.
- Seismic Site Class recommendation in accordance with Table 1613.2.2 of the Southern Nevada Amendments to the 2018 International Building Code.

This report was prepared to summarize our finding and present our conclusions and recommendations. Our recommendations are based on the assumption that the soil conditions are similar to those disclosed by the exploration. If differences are noted during construction, or if changes are made in site plan, loading, foundation type or elevation, we should be notified so that we can modify or supplement our recommendations if it is appropriate to do so.

2.0 SITE CONDITIONS

2.1 Exploration Program

Subsurface conditions were explored by using truck mounted drilling equipment. A total of two (2) exploratory borings were drilled to a depth of 15 feet below existing ground elevation within the subject site. Borings were backfilled with soil cuttings. Field studies were conducted on September 20, 2021 and field mapping, logging of borings and sampling for laboratory testing were performed by a representative of American Soils Engineering, LLC. The approximate boring locations are presented in Figure # 2.

2.2 Existing Surface Conditions

At the time of our field exploration, the 0.97 $\pm$ acre parcel was found vacant. The property is at an elevation of approximately 1860 feet above mean sea level. The site is relatively flat covered with vegetation, debris and trash.

2.3 Subsurface Conditions

The native soils encountered in the borings was classified as light brown lean clay with sand (CL) from sift to firm in both borings within upper 5.0 feet depth with top surface dry; light brown lean clay with sand (CL) stiff to very stiff in both borings from depth 5.0 to 10.0 feet soil appear to slightly moisture content condition and light brown lean clay with sand (CL) very stiff to moderate hard in both borings from depth 10.0 to 15.0 feet deep soil appear to 2% below optimum moisture content. Plasticity Index (PI) and swell tests performed on soil samples collected during exploration at depths ranging 0 to 5.0 feet below the existing surface indicate that the materials sampled were medium- plastic and exhibited moderate expansive potential.

2.4 Ground Water

Free groundwater was not encountered in the borings at the time of drilling to a depth of 15 feet, the maximum depth explored. Fluctuations in the level of the groundwater may occur due to variations in rainfall, underground drainage patterns and others factors.

2.5 Liquefaction

Liquefaction occurs when saturated sandy soils loose strength during earthquake shaking. Ground settlement often accompanies liquefaction. Soils most susceptible to liquefaction are saturated, loose, sandy silts, silty sands, and uniformly graded sands. There soils generally need to close to ground water and be subjected to a significant magnitude and duration during an earthquake. Since these conditions were not observed during our evaluation of the site.

Based on investigation of subject site that geotechnical exploration logs indicate that there are no soil strata present in the 0-15 feet that consist of low density silts and clay which possess soil cohesive properties that reduce the likelihood of liquefaction. In-situ soils within upper 15.0 feet have PI greater than 7 and in-situ moisture content is less than 85% of liquid limit, means in-situ soils behave like clay.

Nevada Hydrology well # 3190 data 0.25 mile approximately to northeast side of the subject site has been used to evaluate of ground water level of the subject site. Based on the review of wells data, static water level of well # 3190 was approximately 54 feet below ground surface of well and approximately 54 feet below of the subject site. Fluctuations in the level of the groundwater may occur due to variations in rainfall, underground drainage patterns and others factors.

Therefore, it is our opinion that likelihood of damage from liquefaction on this site is low.

3.0 GEOLOGY AND SEISMIC CONDITIONS

3.1 Geology

The site is located in the northern portion of Las Vegas Valley, a structural basin of late Mesozoic and Tertiary Block faulting origin. The valley is physiographically characteristic of the Basin and Range Province. However, the basin has been modified by the Las Vegas Shear, a right lateral strike-slip fault that re-oriented the northern portion of the valley from the typical north-south orientation typical of the Basin and Range to a northwest-southeast trend. Valley deposits are Tertiary and Quaternary age. Unconsolidated sediments derived from the surrounding mountains, the primary source being the Spring Mountains to the west. The alluvial and lacustrine sediments in the valley consist of clay and silt interspersed with fine sand to coarse gravel and calcareous cemented deposits. In general, the sediments grade increasingly finer with distance from the source area and with decreased elevation. The surficial deposits generally are composed of sand, silt, or gravel with varying degrees of cementation.

3.2 Local Faulting, Subsidence and Fissuring

The nearest fault is approximately 1.0 mile to the northwest side as per Clark County Soil Guidelines Map (Clark County Building Department, Plot Date 5/20/98). The nearest fault with published evidence of recent seismic activity is the Frenchman Mountain fault is 5.0 miles to the southeast. Based on the Clark County Soil guide line map the subject site is within 'Special geotechnical consideration area'. Fissures are surface expressions of differential stress resulting from local and regional subsidence. No fissures were observed on the project site.

3.3 Seismic Considerations

In accordance with the Southern Nevada Amendments to the 2018 International Building Code, the Registered Design Professional may determine the site class by utilizing values from the Clark County Shear Wave Velocity Profile Map (CCSWVPM). Based on the values of the CCSWVPM, a Site Class of "D" would be appropriate for use in design.

The subject site is located within special geotechnical consideration area of Clark County Soil Guidelines (Map Revision date 5/1/98).

The site is located in the special geotechnical consideration area which, in this case is the area represented by soils of "*Potential drainage or recent sediment deposits. May also have solubility, corrosion, gypsum salt, expansive or hydro-collapsible potential.*"

3.4 Latitude, Longitude, Mapped Spectral Response Acceleration and Spectral Response Coefficients

Approximately site Latitude and Longitude are as Follows:

Site Class: **D**

Latitude: **36.23345°**

Longitude: **-115.06659°**

The mapped spectral response acceleration and spectral response coefficients based on IBC 2018 are below:

S_S=0.618g, S_1=0.199g and S_{DS}=0.538g, S_{D1}=0.292g respectively

4.0 RESULTS OF LABORATORY TESTING

Laboratory tests were performed on representative samples of the onsite earth materials in order to evaluate their physical and chemical characteristics. Plasticity Index (PI) and swell tests performed on samples at depths ranging 0 to 30 feet below the existing surface indicate that the materials sampled were low- plastic and exhibited moderate expansion potential from depth 0-20.0 feet and high plastic and exhibited moderate expansive potential from depth 20.0 to bottom of drilling. Laboratory testing indicates also that the predominant near-surface soils exhibit low solubility, and a "negligible" to "moderate" water soluble sulfate content. The tests performed and the results obtained are presented in the report.

5.0 CORROSION

To evaluate the corrosive potential of the subsurface soils at the subject site, samples were submitted to *Veritas Laboratories* to test the soils for sodium (Na), water soluble sulfate (SO4), total available water soluble sulfate (Na2SO4) and water soluble chloride. A copy of the results provided by the Veritas Laboratories is enclosed in this report. Test results are summarized below in Table No. 1 and Table No. 2.

Table No.1 Results of Chemical Testing

Sample Location	Depth (feet)	Sodium (Na) (%)	Water Soluble Sulfate (SO_4) (%)	Total Available Water Soluble Sodium Sulfate (Na_2SO_4) (%)
B-2	3.0-5.0	0.065	0.41	0.20

Table No. 2 Results of Chemical Testing

Sample Location	Depth (feet)	Water Soluble Chloride (mg/kg)
B-2	3.0-5.0	420

Based on test results presented above and our knowledge of the Las Vegas soils, the onsite soils have "severe" potential to concrete and metal. We recommend the use of sulfate resistant concrete, Type V Portland Cement or equivalent, and that concrete in contact with the onsite soils exhibit the characteristics specified in the ACI318-14 for "severe" sulfate exposure conditions should use Type V cement and have a minimum specified compressive strength (f'c) of 4,500 psi. with maximum water cement ratio 0.45. Protection to buried metal pipes or the use of nonmetallic pipe where permitted by local building codes should also be considered.

All concrete should be designed, mixed, placed, finished, and cured in accordance with the guidelines presented by the Portland Cement Association (PCA) and the American Concrete Institute (ACI). It has been our experience that topsoil and landscape materials (and potentially other imported materials) can contain high sulfate contents. Materials imported to the site should be verified to not contain higher sulfate contents than what is appropriate for the concrete mix design.

Based on test results of water soluble chlorides on the sample and our knowledge of the Las Vegas soils, the onsite soils have a maximum of 420 ppm of water soluble chlorides content lower than permissible limit 500 ppm. Therefore, no specific recommendations are required regarding to foundation design and grading activities.

6.0 CONCLUSIONS AND DEVELOPMENT CONSIDERATIONS

Based on our field exploration, laboratory testing, geologic and engineering analyses, it is our opinion that the subject site is suited for development from a geotechnical engineering viewpoint. The recommendations presented herein should be incorporated into the final design, grading, and construction phases of development.

7.0 EARTHWORK

7.1 General

The level of special inspection for grading should be G-B based on Table 1705.6 of the Southern Nevada Building Code Amendments to the 2018 IBC. All earthworks should be performed in accordance with the guidelines presented in Chapter 18 of the 2018 IBC and the Southern Nevada Building Code Amendments to the 2018 IBC dated July 3, 2018. During earthwork construction; all removals, drain systems, slopes, and the general grading procedures of the contractor should be observed and the fill selectively tested by a representative of American Soils Engineering, LLC. If unusual or unexpected conditions are exposed in the field, this office should be notified so that we may review our report based on the existing conditions. It is recommended that the earthwork contractor(s) perform their own independent reconnaissance of the site to observe field conditions first hand. If the contractor(s) should have Any questions regarding site conditions, site preparation, or the remedial recommendations provided; they should contact a representative of American Soils Engineering for any necessary clarification's prior to submitting earthwork bids.

All applicable requirements of the Occupational Safety and Health Act, and the Construction Safety Act should be met. If contractor(s) have any questions regarding site conditions, site preparation, or recommendations in this report, they should contact a representative of American Soils Engineering, LLC (ASE).

All applicable requirements of the Occupational Safety and Health Act, and the Construction Safety Act should be met. If contractor(s) have any questions regarding site conditions, site preparation, or recommendations in this report, they should contact a representative of American Soils Engineering, LLC (ASE).

7.2 Demolition

Any structures found onsite that are not intended to remain within the area to be developed that should be demolished and moved off site. A representative of American Soils Engineering should be onsite full-time to observe demolition and removal based on recommendations provided by the Public Health Department or any other government agencies.

7.3 Clearing and Site Preparation

Presented below are clearing and site preparation recommendations for the various earth materials encountered on the project. Debris, vegetation, and other deleterious material should

be stripped and removed from the site. All "Artificial Fill", loose materials should be removed to expose competent material, as determined by the soil engineer.

7.4 Excavation and Fill Placement

a) Removal and Fill Placement-Building Pad Areas

Subsequent to completing the recommended clearing and ground preparation as stated in section 7.3 of this report, building pad areas (building footprint and beyond five (5) feet) should be over-excavated to minimum 3.0 (three) feet below the bottom of footing and exposed bottom should be scarified 12 (twelve) inches scarify, heavily watered, processed and compacted prior to fill placement. On site excavated or imported soils may be placed in relatively thin lifts (with a maximum lift thickness of 12 inches loose), cleaned of vegetation and debris, brought to above 2% for fine grain soil and to within 2% for coarse grain soils of optimum moisture content and compacted to a minimum relative compaction of 90 percent of the laboratory standard ASTM D-1557.

Oversized materials may be encountered onsite. Based on the Southern Nevada Amendments to the 2018 IBC, no rock or similar irreducible material with a maximum dimension greater than 6 inches shall be buried or placed in fills within five feet, measured vertically, from the bottom of the footing or the lowest finished floor elevation, whichever is lower, within the building pad. Oversize materials are to be placed in such a way as not to be "nested".

b) Frequency of density testing:

Field density tests should be performed at a minimum rate of one test for every 800 to 1000 cubic yards of fill material placed, or one for every two vertical loose lifts of material placed, whichever is greater. However, a sufficient number of field density tests shall be performed to provide an opinion to the degree of compaction achieved.

If any hard cemented materials are encountered during the over-excavation, excavation may be terminated; however, this will need to be determined on case-by-case basis by representative of American Soils Engineering, LLC. The proposed buildings may be supported on conventional or post tensioned mat foundations bearing entirely on compacted natural soil fill or cemented materials. Due to the potential for differential settlement, structure foundations should not bear on both cemented and un-cemented soils. If both are present at the foundation base, the cemented soil should be over-excavated by a depth of 12 inches and replaced by structural fill, or the un-cemented soils should be over-excavated to expose cemented soils. This can be best determined in the field bases upon the conditions exposed. Termination of the excavation on cemented soils will need to be reviewed by Geotechnical Engineer.

c) Transitional lot: (N/A)

Transitional lot which is partially cut and partially fill, to mitigate differential settlement which may occur on transitional lot, the cut side should be over-excavated as per recommendation of section 7.4 (a) in this report. On transitional lot with more than 5 feet of fill below footings, plans need to be reviewed by ASE and site-specific recommendations will be provided.

d) Street, Parking and Curb & Gutters:

Subsequent to completing the recommended clearing, ground preparation and removal of uncontrolled fill, then all street, parking and curb and gutters should be over-excavated two (2) feet below native grade and exposed scarified 12-inches minimum, moisture condition, processed and compacted to a minimum relative compaction of 90 percent of the laboratory standard ASTM D-1557, prior to fill placement. All aggregate bases should be compacted to a minimum relative compaction of 95 percent of the laboratory standard ASTM D-1557.

e) Concrete Flatwork:

Subsequent to completing the recommended clearing, ground preparation and removal of uncontrolled fill, concrete flatwork should be over-excavated one (1) feet below native grade and exposed scarified 12-inches minimum, moisture condition, processed and compacted to a minimum relative compaction of 90 percent of the laboratory standard ASTM D-1557, prior to fill placement. All aggregate bases should be compacted to a minimum relative compaction of 95 percent of the laboratory standard ASTM D-1557.

7.5 Excavation Difficulty

Soft to very soft materials were encountered during our subsurface exploration of the site. The contractors should satisfy themselves the relative difficulty of excavation and the equipment needed to accomplish excavation.

7.6 Earthwork Balance

The volume of excavated material changes based upon depth of excavation, engineering fill recommendations and type of the materials. During clearing grubbing operations will result in some loss of material. Excavation and recompaction of the on-site soils will result in shrinkage losses. The overall earthwork shrinkage may be approximated by using following parameters;

- 15% to 20% shrinkage losses on clearing grubbing operations upper 12 inches
- 20% to 25% shrinkage losses on artificial fill
- 10% to 15% shrinkage losses on alluvium
- 0% to 10% shrinkage losses on cemented alluvium

It should be noted that above percentage estimated based on our experience and it could vary. As an example, a shrinkage factor of 10 percent means it would require 1.10 cubic yards of excavated material to equal 1.0 cubic yard of properly compacted fill.

7.7 Fill Placement with Imported Material

Material proposed for import, if applicable, to the site should be sampled by an American Soils Engineering, LLC representative for laboratory testing prior to use at the site. Import materials should be of similar or better quality than the on-site materials for their intended purpose. Imported soils should conform to the following:

Gradation Requirements	
Sieve Size	Required Gradation
6"	100
3"	70-100
No. 4	35-100
No. 200	10-30 (max)
Swell Requirements (60 psf surcharge)	
Low expansive materials (swell less than 4.0 percent)	
Chemical Requirements	
Water Soluble Sulfate (SO4) content less then 0.2 percent	
Soluble Requirements	
Less than 3.0 percent Soluble material	
Chloride Requirements	
Water Soluble Chloride content less than 500 mg/kg	

Field density tests should be performed at a minimum rate of one test for every 800 cubic yards of fill material placed, or one for every two vertical loose lift feet of material placed, whichever is greater.

7.8 Slope Stability (N/A)

All slopes should be designed at gradients of 2 to 1 (Horizontal to Vertical) or flatter. All slopes should be constructed in accordance with the minimum requirements of Clark County and the 2012 International Building Code (IBC).

7.9 Footing Trench Excavation

All footing trench excavations should be observed by a representative of American Soils Engineering's office prior to placing reinforcement. Footing trench spoil and/or excess soils generated from trench excavations used for structural fill zones should be compacted to a minimum relative density of 90 percent if not removed from the site.

7.10 Select Backfill Report

One sample for every one thousand (1000) linear feet (two samples minimum for a report) should be obtained from excavated trenches or stockpiles intended to be used for trench backfill above the pipe zone. Samples should be tested in the laboratory in accordance to specifications of Select Backfill Material or Trench Backfill Material. A recommendation/report should be prepared based on laboratory results and approved by Clark County of Public Works officials prior to beginning backfilling operations.

Bedding and pipe embedment materials to be used around underground utility pipes should be well graded sand or gravel conforming to the pipe manufacturer's recommendation and should be placed and compacted in accordance with project specifications, local requirements.

7.11 Utility Trench Backfill

Onsite and offsite utility trench backfill should be brought to near optimum moisture content and then compacted to obtain a minimum relative compaction of 90 percent of the laboratory standard ASTM D-1557.

8.0 FOUNDATION RECOMMENDATIONS

Foundation design and construction recommendations are based on preliminary laboratory testing and engineering analysis performed on near surface earth materials. The proposed foundation systems should be designed and constructed in accordance with the guidelines contained herein, 2018 International Building Code (IBC) and Southern Nevada Amendments to the 2018 International Building Code (IBC) dated July 3, 2018

The proposed buildings may be supported on conventional or post tensioned mat foundations bearing entirely on prepared natural soil or compacted fill or cemented materials prepared in accordance with the recommendations presented in this report. Due to the potential for differential settlement, structure foundations should not bear on both cemented and uncemented soils. If both are present at the foundation base, the cemented soil should be overexcavated by a depth of 12 inches and replaced by structural fill, or the uncemented soils should be overexcavated to expose cemented soils.

Based on test results presented above and our knowledge of the Las Vegas soils, the onsite soils have "severe" potential to concrete and metal. We recommend the use of sulfate resistant concrete, Type V Portland Cement or equivalent, and that concrete in contact with the onsite soils exhibit the characteristics specified in the ACI318-14 for "severe" sulfate exposure conditions should use Type V cement and have a minimum specified compressive strength (f'c)

of 4,500 psi. with maximum water cement ratio 0.45. Protection to buried metal pipes or the use of nonmetallic pipe where permitted by local building codes should also be considered.

Based on test results of water soluble chlorides on the sample, it has 420 mg/Kg of water soluble chlorides content lower than permissible limit 500 ppm. Therefore, no specific recommendations are required regarding to foundation design and grading activities.

Foundation recommendations are based on results of laboratory testing of selected samples and the result of field exploration. Based on our laboratory testing, the soils onsite have a moderate expansive potential (less than 8.0 percent expansions under a 60 psf surcharge load).

Foundation recommendations that follow are for one-or two story residential structures and based on grading being performed as recommended in "Section 7.4" of this report.

Structural loads for the proposed building were not provided. We have assumed maximum dead plus live loads for columns and wall loading at approximately 110 kip and 3 kip per lineal foot, respectively.

We estimate that total post-construction differential movement should be less than 1-inch across the proposed buildings. Differential settlement should be less than ½-inch.

8.1 Post-Tensioned Recommendations

For slab constructed on low to moderate expansive (0 to <8 percent expansion under a 60 psf surcharge load) soils, post-tensioned foundations should be at least 12 inches wide and the bottom of the foundations should be established at least 18 inches below the lowest adjacent of compacted finish pad grade. Recommended parameters for post-tensioned slab design for moderately expansive soils are as follows:

- Allowable bearing value..... 1800 psf
- Modulus of subgrade reaction..... 125 pci
- Uplift Pressure..... 150 psf
- Passive Pressure..... 250 psf/ft
- Coefficient of friction (select sand/type II)..... 1.00
- Coefficient of friction (onsite soil)..... 0.35
- Coefficient of friction (low expensive import soil) 0.45
- Edge Lift (Ym).....0.5 inches
- Center Lift (Ym)..... 0.5 inches

- Edge Moisture Variation Distance (Em)..... 2.5 feet minimum
- Center Moisture Variation Distance (Em).....4.75 feet minimum

- Additional parameters for design of post tension post-tensioned slab criteria presented in Table 1808.6.2 of the Southern Nevada Amendments to the 2018 International Building Code (IBC) dated July 3, 2018.

The moisture content of the subgrade soils should be equal to or greater than 120 percent of the soil's optimum moisture content to a minimum depth of 24 inches below grade. This should be verified by a representative of American Soils Engineering, LLC within 120 hours of placing visqueen.

8.2 Conventional Foundations

For slab constructed on moderate expansive (0 to 8 percent expansion under a 60 psf load) soils, conventional foundations should be at least 12 inches wide and the bottom of the foundations should be established at least 18 inches below the lowest adjacent of compacted finish pad grade. Foundations which bear on properly compacted fill, or on moderately hard to hard cemented soils may be designed to impose a net dead plus live load pressure of 1800 pounds per square foot (psf). However, the allowable bearing pressure increases of 250 psf per foot of additional depth and width of to a maximum of 3000 psf. A one-third increase may be applied for wind or seismic loads. We estimate that total post-construction differential movement should be less than 1-inch across the proposed buildings.

The moisture content of the subgrade soils should be equal to or greater than 120 percent of the soil's optimum moisture content to a minimum depth of 24 inches below grade. This should be verified by a representative of American Soils Engineering, LLC within 120 hours of placing visqueen.

9.0 Moisture Protection Considerations

The purpose of these guidelines is to aid in producing a concrete mat of sufficient quality to allow successful installation of floor coverings and reduce the potential for floor covering failures due to moisture-related problems associated with mat foundation construction. These guidelines may be supplemented, as necessary, based on the specific project requirements.

- The moisture content of the subgrade soils should be equal to or greater than 120 percent of the soil's optimum moisture content to a minimum depth of 24 inches below grade. This should be verified by a representative of American Soils Engineering, LLC within 120 hours of placing visqueen.

- Minimum two inches of moist sand or Type II Aggregate Base should be placed directly below the concrete slab.

- Minimum 10-mil thick vapor barrier should be placed directly below the two inches sand or Type II Aggregate Base layer.

- Minimum 6 inches type II Aggregate Base or material approved by ASE, should be placed below the 10-mil thick vapor barrier (Visqueen). All aggregate bases should be compacted to a minimum relative compaction of 95 percent of the laboratory standard ASTM D-1557.

The guidelines presented above are based on information obtained from various technical sources, including the American Concrete Institute (ACI), and are intended to present information that can be used to reduce potential long-term impacts from slab moisture infiltration. It should be noted, the application of these guidelines does not affect the geotechnical aspects of the foundation performance, nor does it affect the amount of cracking in the concrete.

10.0 RETAINING AND BLOCK WALLS

Block wall or retaining wall foundations (if required) should be designed as follows:

- Retaining and block wall footing depth and width should be 12 inches minimum. The minimum depth of embedment is 18 inches below lowest adjacent finished grade, bearing on a minimum of 12 inches of compacted or cemented materials.

- All walls and footing should be reinforced per the design of structural engineer.

- Passive Pressure can be calculated using an equivalent fluid pressure of 250 psf/ft

- Unit weight of backfill (native soils) can be used 135 pcf.

- Lateral sliding resistance can be developed using a 0.35 coefficient of friction. The passive pressure and the frictional resistance of soils may be combined without reduction in determining total lateral resistance.

- The maximum allowable bearing pressure should be 1500 psf, with an increase of 250 psf per foot of additional depth and 250 psf per foot of additional width of to a maximum of 3000 psf. A one-third increase may be used for wind or seismic loads.

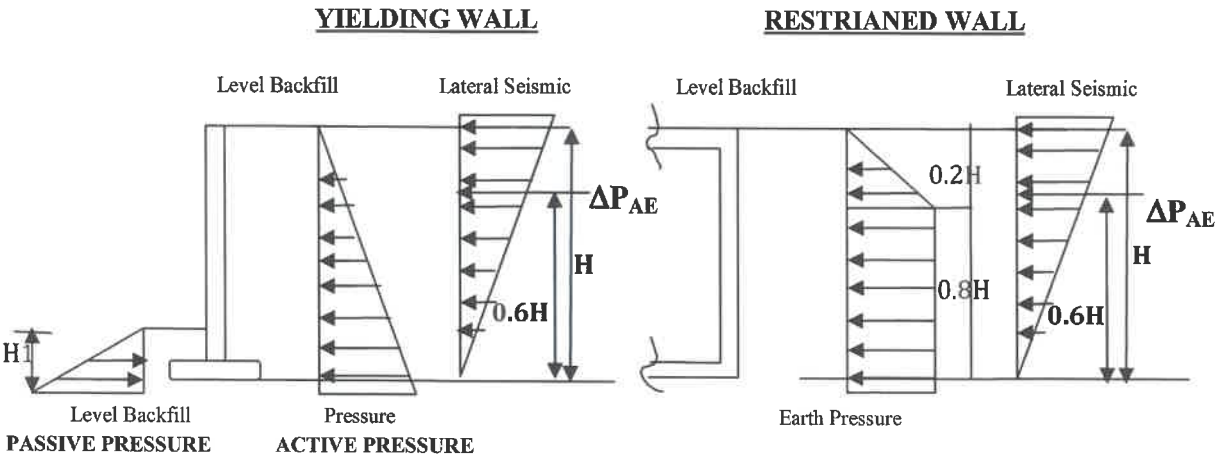
- For yielding walls, where no surcharge or sloping backfill exists and where the top of the walls are free to move at least 0.002 times the wall height, the minimum soil lateral pressure should be 35 psf per foot of depth retained. For yielding walls with 2 to 1 (horizontal to vertical) sloping backfill, the minimum soil lateral pressure should be 52 psf per foot of depth retained. For smooth, rigid, nonyielding walls, if used, , the minimum soil lateral pressure should be 60 psf per foot of depth retained.

- For level backfill yielding walls, the lateral seismic force can be determined by the equation: For yielding walls, the lateral seismic force can be determined by the equation: $\Delta P_{AE} = 7.9H^2$. ΔP_{AE} (lbs/linear foot of wall) is the dynamic incremental component of the total lateral thrust and H (in feet) is the height of the backfill from the base of the wall footings. For the distribution of the dynamic thrust, ΔP_{AE}, the resultant dynamic thrust should act at 0.6H above the base of the wall (i.e.; an inverted trapezoidal pressure distribution).

- The dynamic thrust (ΔP_{AE}) acting on smooth, rigid, nonyielding walls with level backfill is 21.1 H^2. As is the case for yielding walls, the dynamic thrust should act at 0.6H above the base of the wall (i.e.; an inverted trapezoidal pressure distribution). This applies to level backfill and walls retain no more than 15 feet.

- These loads do not include hydrostatic, building, traffic or other additional loads. Surcharge loads should be added to the pressure(s) above using a factor of 0.3.

  Refer to the diagram below for graphical representation of active pressure and lateral seismic earth pressures on yielding and non-yielding (restrained) wall.



H = HEIGHT OF WALL

H1 = DEPTH OF EMBEDMENT

10.1 Retaining walls Drainage (If applicable)

Adequate drainage may be provided by a subdrain system behind the walls. The subdrain outlet should be connected to a free-draining outlet or sump. As an alternative to a full-height gravel drain trench behind retaining structures, consideration may be given to utilizing a manufactured geosynthetic material for wall drainage, such as Miradrain, Geotech Drainage Panels, or Enkadrain drainage matting. The drainage panel should be connected to the perforated pipe at the base of the wall.

10.2 Retaining walls Backfill (If applicable)

Retaining wall backfill material should be free draining granular material. Backfill placed behind the walls should be compacted in relatively thin lifts (with a maximum lift thickness of 12 inches) a minimum relative compaction of 90 percent of the laboratory standard ASTM D-1557 using light compaction equipment. If heavy compaction equipment is used, the walls should be temporarily braced.

11.0 PAVEMENT DESIGN

Asphalt Concrete & Type II Aggregate Base

Based on the nature of the soils encountered onsite, the onsite materials will not meet specification for classification as Type I aggregate base. Pavement section presented in the following table are based on an estimated R-value 20, assumed traffic index(s), the guidelines presented in the latest revision to the Regional Transportation Commission Uniform Standard drawings (DWG. No. 200 and 200A dated 12-14-2000) for Public Works construction, offsite improvements, Clark County Area, Nevada. These preliminary pavement sections are presented for planning purposes only and should be verified based on sample collected from sub-grade and specific laboratory testing performed subsequent to rough grading of the site.

ROADWAY TYPE	TRAFIC INDEX	PAVEMENT DESIGN THICKNESS (Minimum)	
		Asphalt Concrete (inches)	Type II Base (inches)
Residential	Heavy Traffic (5.5)	2.5	9.0
Minor Collector	Heavy Traffic (6.5)	3.5	10.5
Major Collector	Heavy Traffic (8.5)	4.5	17.0
Arterial	Heavy Traffic (9.5)	5.5	22.0

12.0 SURFACE DRAINAGE

Foundation soils should not be allowed to become saturated during or after construction. Utility lines should be properly installed and the backfill properly compacted to avoid possible sources for subsurface saturation. Positive drainage for impervious surfaces (concrete and asphalt surfaces) with slope 2 percent minimum to 10 feet and positive drainage for pervious surfaces (ground surfaces) with slope 5 percent minimum to 10 feet away from the structures should be provided during construction and maintained throughout the life of the structures. Any roof drains should drain away from the structures.

Backfill against footings, exterior walls and in utility trenches should be properly compacted and free of all construction debris to reduce the possibility of moisture infiltration. If practical, planters, landscaping, and/or other surface features which could retain water should not be adjacent to the structures or pavements. If this is not practical, we recommend the following: Planters should be sealed, grades should drain away from the proposed structures at a 5 percent minimum slope and watering should be kept to a minimum.

13.0 LIMITATIONS

The recommendations presented in this report are based on results of field and laboratory explorations, combined with interpolation of subsurface conditions between boring locations. The nature and extent of variations between borings may not become evident until construction. If variations are then exposed, it will be necessary to re-evaluate the recommendations of the report. If changes in the nature, design, or location of the project are planned, the recommendations contained in this report shall not be considered valid unless the changes are reviewed and the recommendations of this report modified or verified in writing. This report is not intended for use as a bid document. Any person using this report for bidding or construction purposes should perform such independent investigation as he deems necessary to satisfy

himself as to the surface and subsurface conditions to be encountered, and the procedures to be used in the performance of work on this project.

If conditions are encountered during construction that appears to be different than indicated by this report, this office should be notified. Professional services for this project were performed using that degree of care and skill ordinarily exercised under similar circumstances by reputable geotechnical engineers practicing in this or similar localities.

No warranties, expressed or implied, are intended or made. The opportunity to be of service is greatly appreciated. If you have any questions concerning this report or if we may be of further assistance, please do not hesitate to contact the undersigned.

Respectfully submitted,
American Soils Engineering, LLC

Pardeep Verma P.E.
Engineering Manager

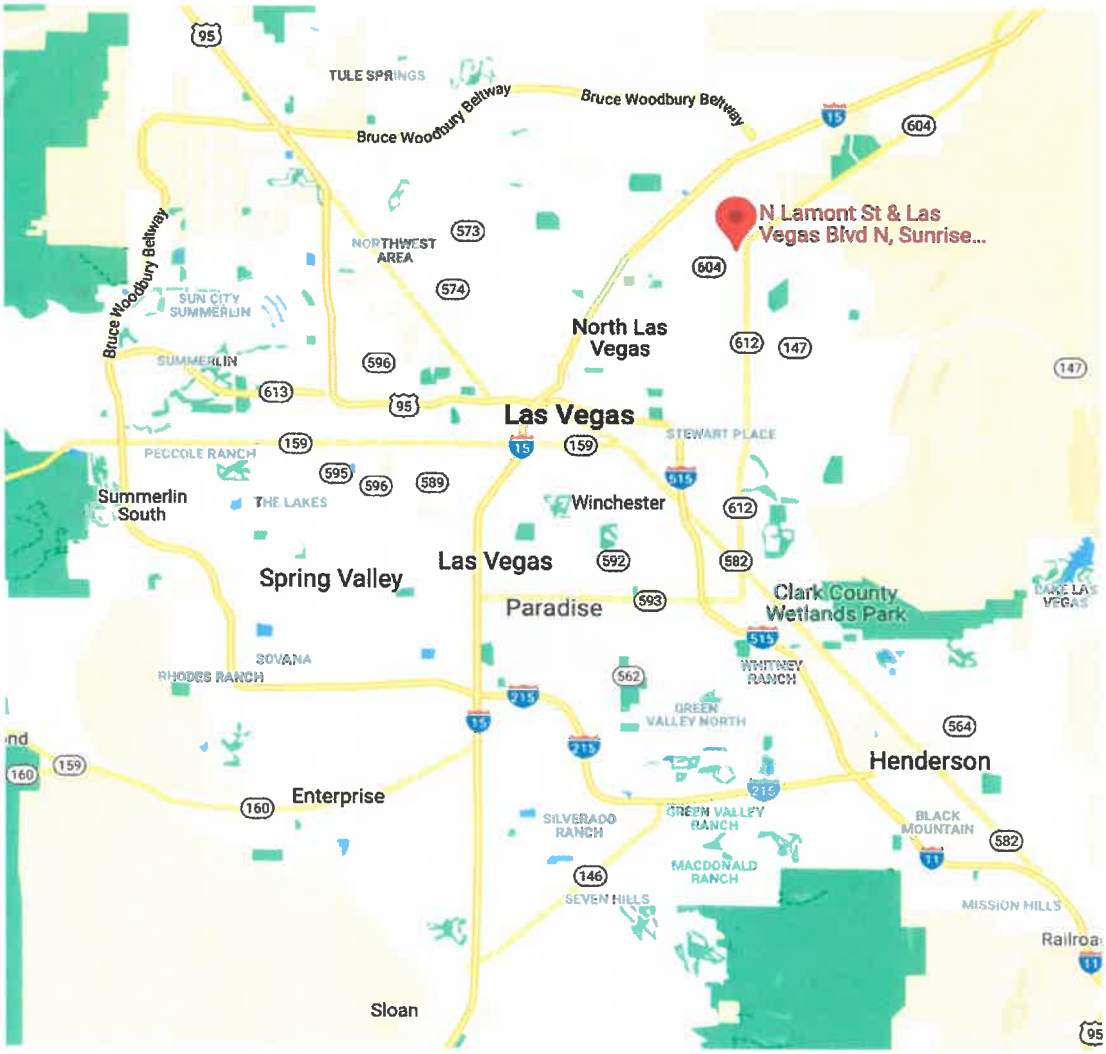
PROFESSIONAL ENGINEER - STATE OF NEVADA
PARDEEP K VERMA
Exp: 06/30/2022
CIVIL
No. 10900

9/30/21

Pardeep K Verma
Digitally signed by Pardeep K Verma
Date: 2021.10.05 15:10:18 -07'00'

Figure No.: 1

Not to Scale



N

Vicinity Map

	American Soils Engineering, LLC. 6000 S. Eastern Ave Suite 6B Las Vegas, NV. 89119	Project Name: **Las Vegas Blvd. / N of Lamont**	
	Project No. **2137-GEO**	Date: **9/22/2021**	Prepared For: **Jim Berookhim**

Figure No.: 2

Not to Scale

LEGEND: Represents Drilling Locations

N

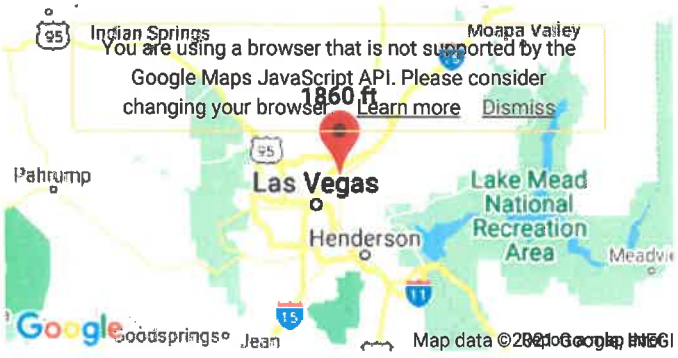
BORING LOCATION MAP

	American Soils Engineering, LLC. 6000 S. Eastern Ave Suite 6B Las Vegas, NV. 89119		Project Name: Las Vegas Blvd / N of Lamont St.
	Project No. 2137-GEO	Date: 9/22/2021	Prepared For: Jim Berookhim

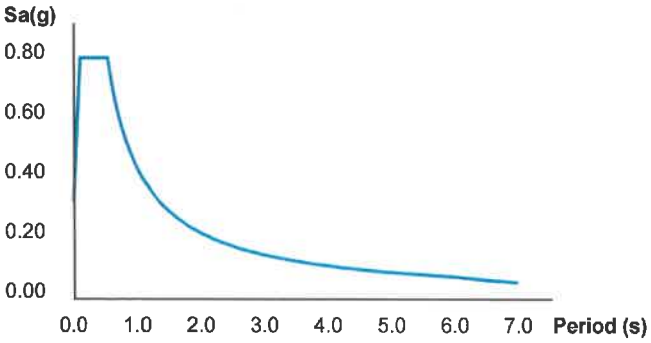
Hazards by Location

Search Information

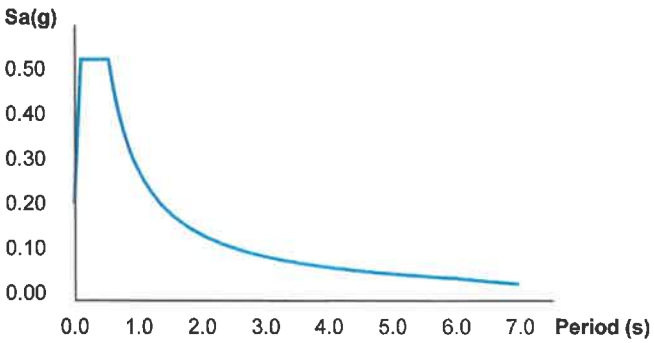
Coordinates:	36.23345, -115.06659
Elevation:	1860 ft
Timestamp:	2021-10-05T15:58:33.969Z
Hazard Type:	Seismic
Reference Document:	ASCE7-16
Risk Category:	II
Site Class:	D



MCER Horizontal Response Spectrum



Design Horizontal Response Spectrum



Basic Parameters

Name	Value	Description
S_S	0.618	MCE_R ground motion (period=0.2s)
S_1	0.199	MCE_R ground motion (period=1.0s)
S_{MS}	0.807	Site-modified spectral acceleration value
S_{M1}	0.438	Site-modified spectral acceleration value
S_{DS}	0.538	Numeric seismic design value at 0.2s SA
S_{D1}	0.292	Numeric seismic design value at 1.0s SA

▾Additional Information

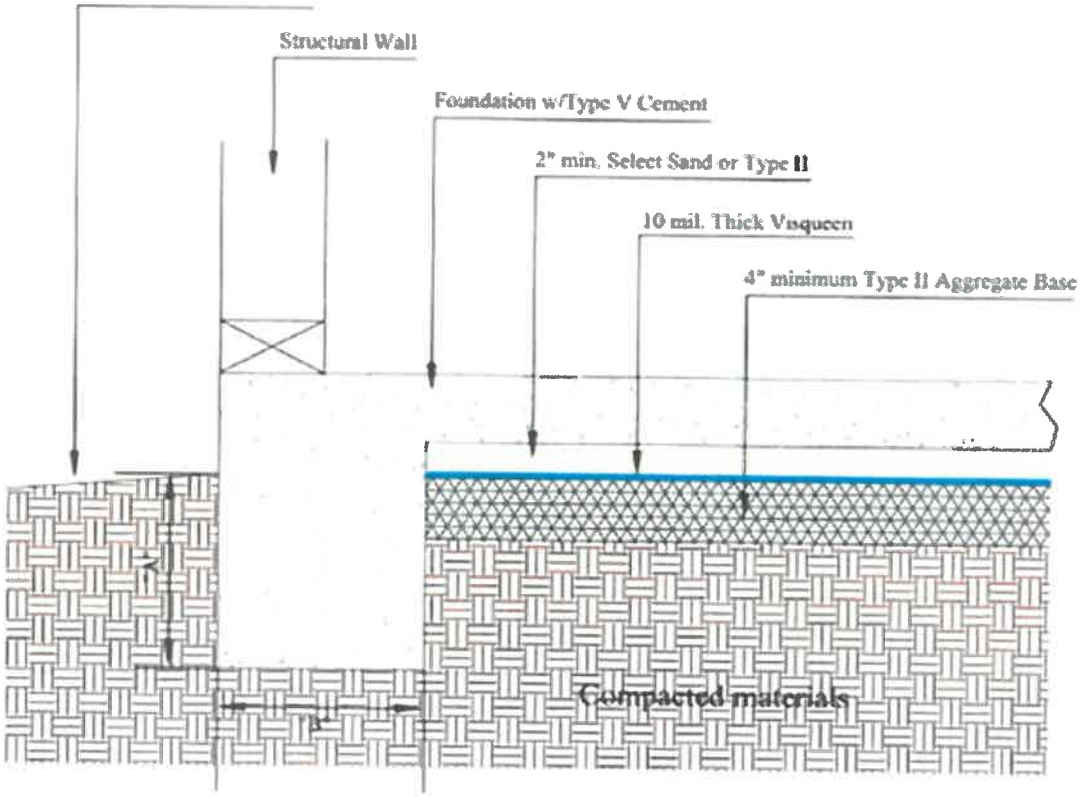
Name	Value	Description
SDC	D	Seismic design category
F_a	1.305	Site amplification factor at 0.2s
F_v	2.202	Site amplification factor at 1.0s
CR_S	0.895	Coefficient of risk (0.2s)
CR_1	0.917	Coefficient of risk (1.0s)
PGA	0.272	MCE_G peak ground acceleration

Hazard loads are provided by the U.S. Geological Survey Seismic Design Web Services.

Figure No.: 3

NOT TO SCALE

Positive drainage for impevious surfaces (concrete and asphalt surfaces) with slope 2 percent minimum and for pervious surfaces (ground) with slopes 5 percent minimum to 10 feet distance away from the structures



"A" – Depth of Footing

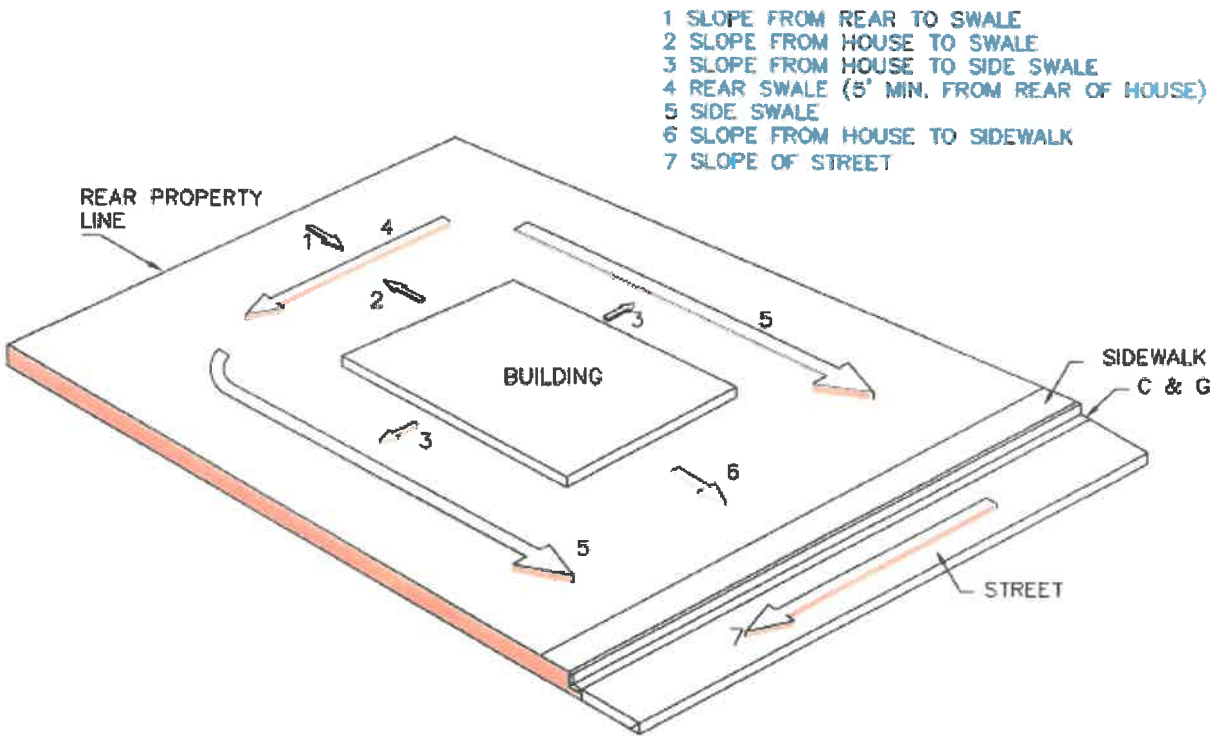
"B" – Width of Footing

Note: Concrete Foundation shown above as a "typical" detail only. Actual shape and dimensions to be designed by structural engineer and detailed in the project plans.

Foundation Map

	American Soils Engineering, LLC. 6000 S. Eastern Ave Suite 6B Las Vegas, NV. 89119		Project Name: Las Vegas Blvd / N of Lamont St.
	Project No. 2137-GEO	Date: 9/22/2021	Prepared For: Jim Berookhim

Figure No.: 4
NOT TO SCALE



TYPICAL SURFACE DRAINAGE
NO SCALE

Foundation Map

	American Soils Engineering, LLC. 6000 S. Eastern Ave Suite 6B Las Vegas, NV. 89119		Project Name: **Las Vegas Blvd / N of Lamont St.**
	Project No. **2137-GEO**	Date: **9/22/2021**	Prepared For: **Jim Berookhim**

APPENDIX

A

American Soils Engineering

BORING NUMBER B 1

CLIENT Jim Berookhim / Aron Corwell
PROJECT NAME Las vegas Blvd. West of Nellis Blvd.
PROJECT NUMBER pn 2137 GEO
PROJECT LOCATION Las vegas Blvd. West of Nellis Blvd.
DATE STARTED 9/3/21 **COMPLETED** 9/20/21
GROUND ELEVATION _____ **HOLE SIZE** 6" inches
DRILLING CONTRACTOR Eagle Drilling
GROUND WATER LEVELS:
DRILLING METHOD STP
AT TIME OF DRILLING ---
LOGGED BY Pardeep Verma **CHECKED BY** Pardeep Verma P. E.
AT END OF DRILLING ---
NOTES Native material some vegetation was present.
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0						
5	SS 18	8-8-8/0"	LL = 30 PL = 15 Fines = 76%	CL		(CL) Light Brown lean clay with sand. Stiff to firm. Top surface was dry. some vegetation on site. site slightly slopes to the west.
	SS 18	5-5-7/0"	LL = 28 PL = 16 Fines = 70%	CL		(CL) Light Brown lean clay with sand. Stiff to very stiff. soil was slightly moist.
10	SS 18	18-20-24/0"		CL		(CL) Light Brown lean clay with sand. Very stiff to moderate hard. soil was at approximately 2% below optimum moisture content.
15	SS 18	12-15-13/3"		CL		(CL) Light Brown lean clay with sand. Very stiff to moderate hard. soil was at approximately 2% below optimum moisture content. No water was encountered at the bottom of 15 feet deep. Bottom of borehole at 15.0 feet.

American Soils Engineering

BORING NUMBER B 2

CLIENT Jim Berookhim / Aron Corwell
PROJECT NAME Las vegas Blvd. West of Nellis Blvd.
PROJECT NUMBER pn 2137 GEO
PROJECT LOCATION Las vegas Blvd. West of Nellis Blvd.
DATE STARTED 9/3/21 **COMPLETED** 9/20/21
GROUND ELEVATION _____ **HOLE SIZE** 6" inches
DRILLING CONTRACTOR Eagle Drilling
GROUND WATER LEVELS:
DRILLING METHOD STP
AT TIME OF DRILLING ---
LOGGED BY Pardeep Verma **CHECKED BY** Pardeep Verma P. E.
AT END OF DRILLING ---
NOTES Native material some vegetation was present.
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0						
5	SS 18	7-8-11/0"	LL = 34 PL = 16 Fines = 72%	CL		(CL) Light Brown lean clay with sand. Stiff to firm. Top surface was dry.
10	SS 18	6-11-16/0"	LL = 35 PL = 16 Fines = 73%	CL		(CL) Light Brown lean clay with sand. Stiff to very stiff. soil was slightly moist.
15	SS 18	12-13-13/0"		CL		(CL) Light Brown lean clay with sand. Very stiff to moderate hard. soil was at approximately 2% below optimum moisture content.
	SS 18	10-8-25/3"				(CL) Light Brown lean clay with sand. Very stiff to moderate hard. soil was at approximately 2% below optimum moisture content. No water was encountered at the bottom of 15 feet deep. Bottom of borehole at 15.0 feet.

APPENDIX

B

LABORATORY TESTS RESULTS (PN 2137-GEO)

EXPANSION TESTS

Swell tests were performed on remolded samples, which were collected during subsurface exploration of the subject site. The samples were remolded at 90 percent of the material's maximum dry density. Samples were tested under a 60 pound per square foot surcharge. Based on our laboratory testing, the soils onsite were low expansive, results are listed below:

Sample Location	Sample Depth In Feet	Swell (%)	Expansion Classification
B-1	3.0	7.7	Moderate
B-1	5.0	7.8	Moderate
B-2	3.0	5.7	Moderate
B-2	5.0	6.0	Moderate

Atterberg Limits

Testing was performed on the samples in general accordance with ASTM test method D 4318-98, using the wet preparation method. Tests result as follows;

SAMPLES	Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)
B-1 at 3'	30	15	15
B-1 at 5'	28	16	12
B-2 at 3'	34	16	18
B-2 at 5'	35	16	19

Chemical Testing

To evaluate the corrosive potential of the subsurface soils at the subject site, samples were collected and submitted to *Veritas Laboratories* to test the soils for sodium (Na), water soluble sulfate (SO4), total available water soluble sulfate (Na2SO4) and water soluble chloride. A copy of the results provided by the Veritas Laboratories is enclosed in Appendix B. Test results are summarized below in Table 1 and Table 2.

Table-1. Results of Chemical Testing

Sample Location	Depth (feet)	Sodium (Na) (%)	Water Soluble Sulfate (SO4) (%)	Total Available Water Soluble Sodium Sulfate (Na2SO4) (%)
B-2	3.0-5.0	0.065	0.41	0.20

Table 2. Results of Chemical Testing

Sample Location	Depth (feet)	Water Soluble Chloride (mg/kg)
B-2	3.0-5.0	420

GRAIN SIZE DISTRIBUTION

American Soils Engineering

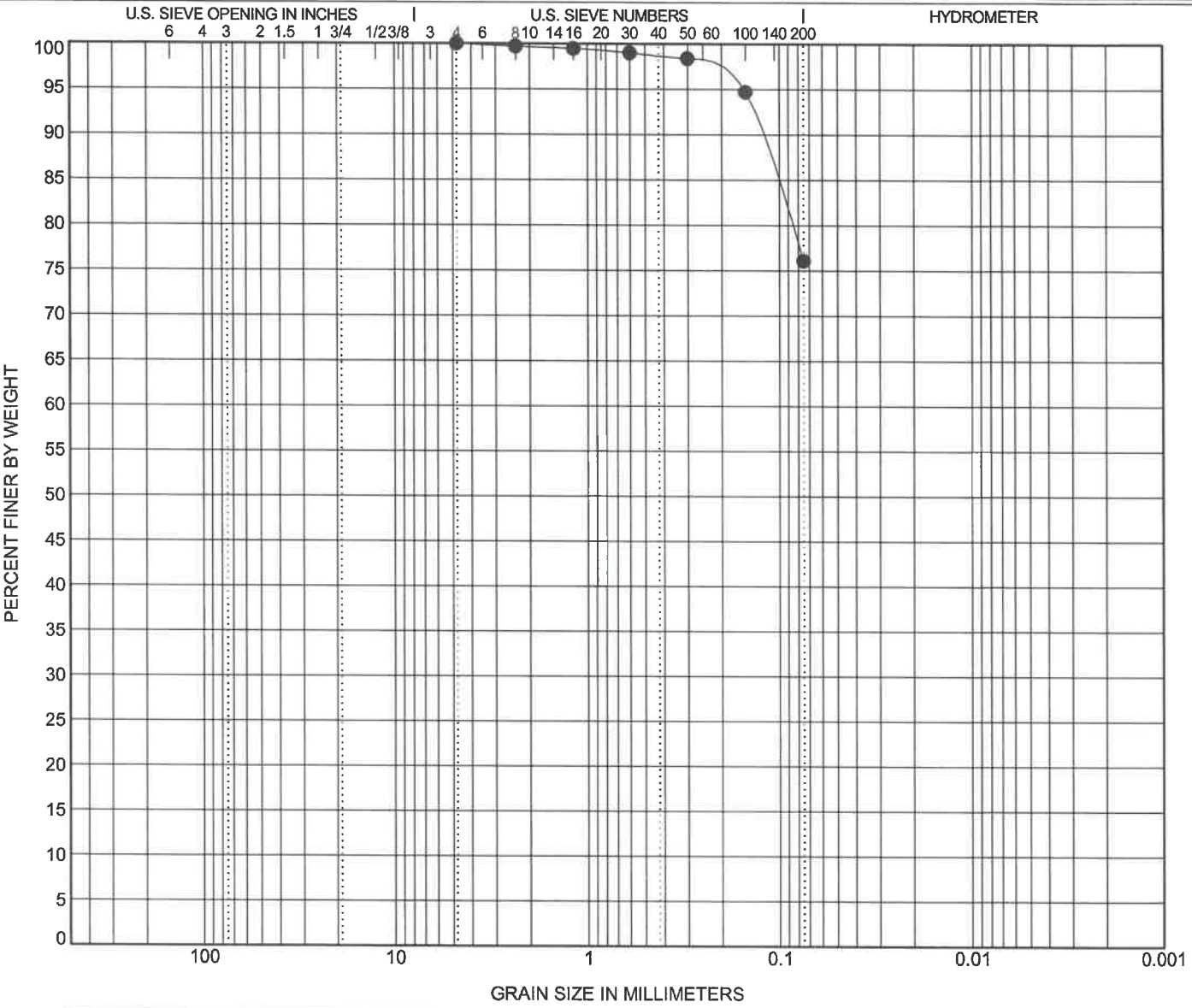
CLIENT Jim Berookhim / Aron Corwell

PROJECT NUMBER pn 2137 GEO

SAMPLED DATE 9/3/2021

PROJECT NAME Las vegas Blvd. West of Nellis Blvd.

PROJECT LOCATION Las vegas Blvd. West of Nellis Blvd.



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sieve Size	6"	3"	2"	1½"	1"	¾"	½"	3/8"	#4	#8	#10	#16	#30	#40	#50	#100	#200
Percent Passing									100	100	100	99	99	99	98	95	76
Spec. %																	
Result																	

Specimen Identification		Classification	LL	PL	PI
● B 1	3	LEAN CLAY with SAND(CL)	30	15	15

Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
		4.75				0.0	23.9	76.1	

GRAIN SIZE ONE PER PAGE - AMERICAN SOILS ENG.GDT - 9/21/21 11:40 - Y:\PN 2137 GEO LAS VEGAS BLVD.GPJ

GRAIN SIZE DISTRIBUTION

American Soils Engineering

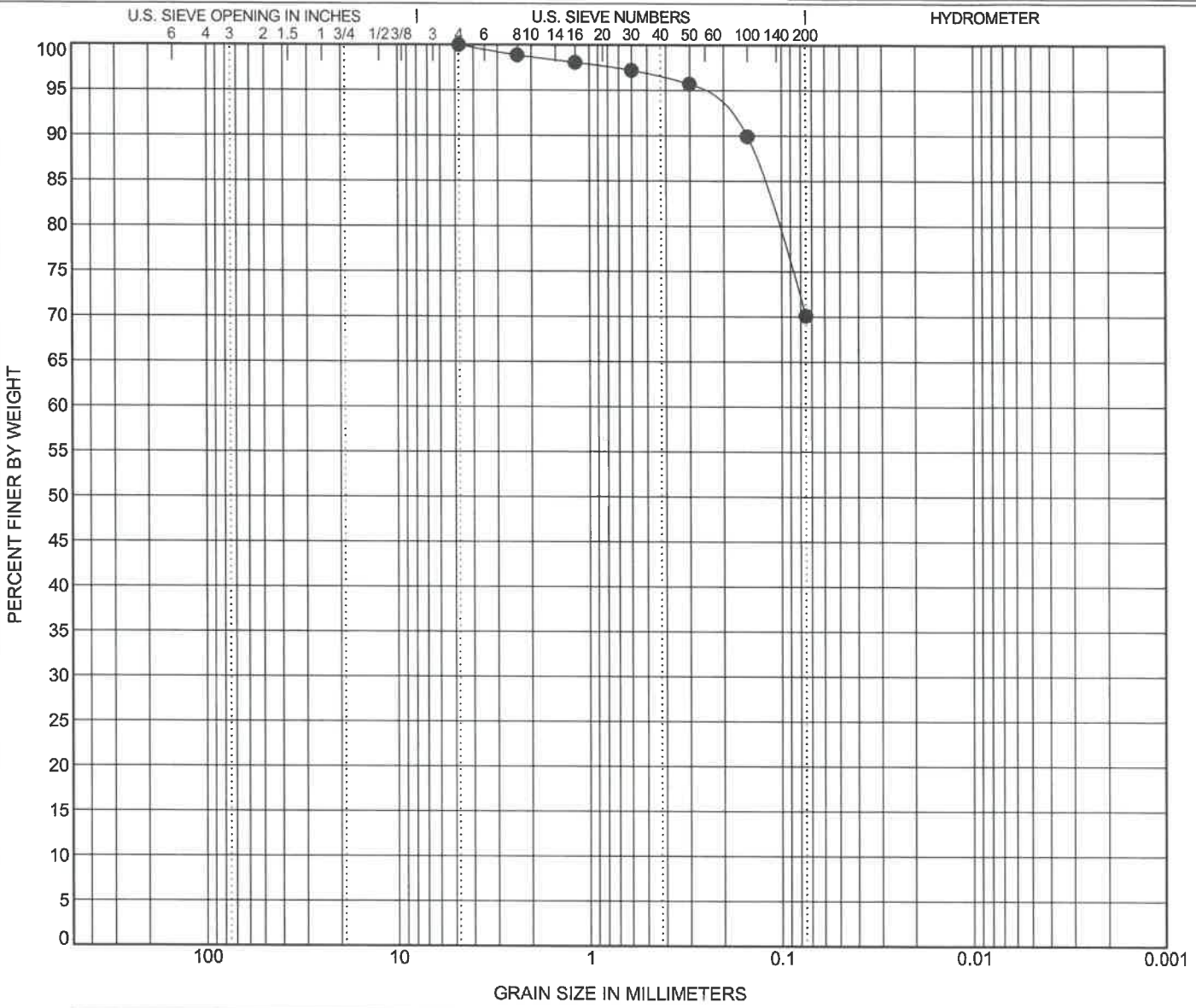
CLIENT Jim Berookhim / Aron Corwell

PROJECT NUMBER pn 2137 GEO

SAMPLED DATE 9/3/2021

PROJECT NAME Las vegas Blvd. West of Nellis Blvd.

PROJECT LOCATION Las vegas Blvd. West of Nellis Blvd.



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sieve Size	6"	3"	2"	1½"	1"	¾"	½"	3/8"	#4	#8	#10	#16	#30	#40	#50	#100	#200
Percent Passing									**100**	**99**	**99**	**98**	**97**	**96**	**96**	**90**	**70**
Spec. %																	
Result																	

Specimen Identification	Classification	LL	PL	PI
● B 1 5	**LEAN CLAY with SAND(CL)**	**28**	**16**	**12**

Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
		4.75				**0.0**	**29.9**	**70.1**	

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GRAIN SIZE DISTRIBUTION

American Soils Engineering

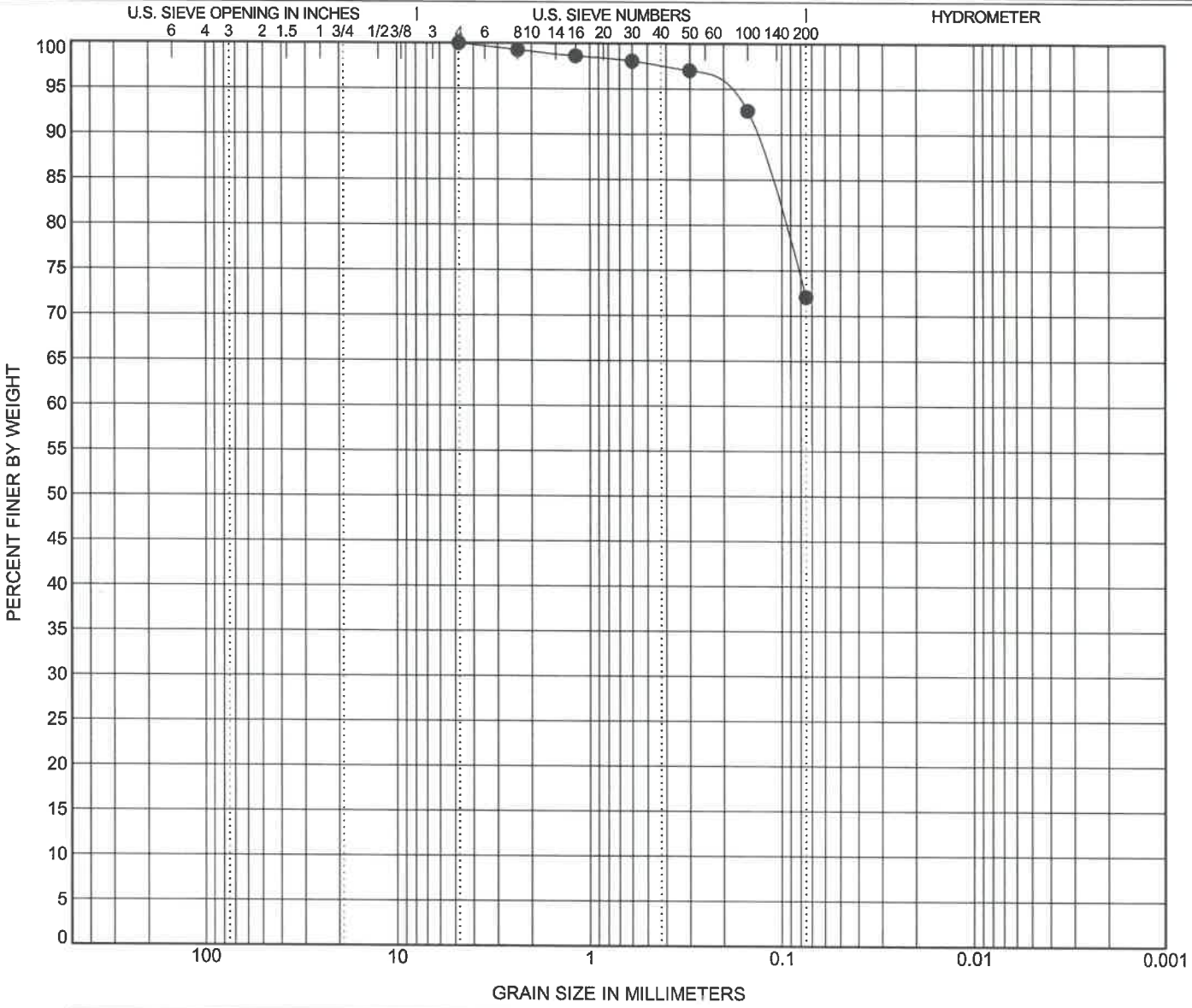
SAMPLED DATE 9/3/2021

CLIENT Jim Berookhim / Aron Corwell

PROJECT NAME Las vegas Blvd. West of Nellis Blvd.

PROJECT NUMBER pn 2137 GEO

PROJECT LOCATION Las vegas Blvd. West of Nellis Blvd.



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sieve Size	6"	3"	2"	1½"	1"	¾"	½"	3/8"	#4	#8	#10	#16	#30	#40	#50	#100	#200
Percent Passing									**100**	**99**	**99**	**99**	**98**	**98**	**97**	**93**	**72**
Spec. %																	
Result																	

Specimen Identification			Classification	LL	PL	PI
● **B 2**		**3**	**LEAN CLAY with SAND(CL)**	**34**	**16**	**18**

Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
		4.75				**0.0**	**27.9**	**72.1**	

GRAIN SIZE ONE PER PAGE - AMERICAN SOILS ENG.GDT - 9/21/21 11:41 - Y:\PN 2137 GEO LAS VEGAS BLVD.GPJ

GRAIN SIZE DISTRIBUTION

American Soils Engineering

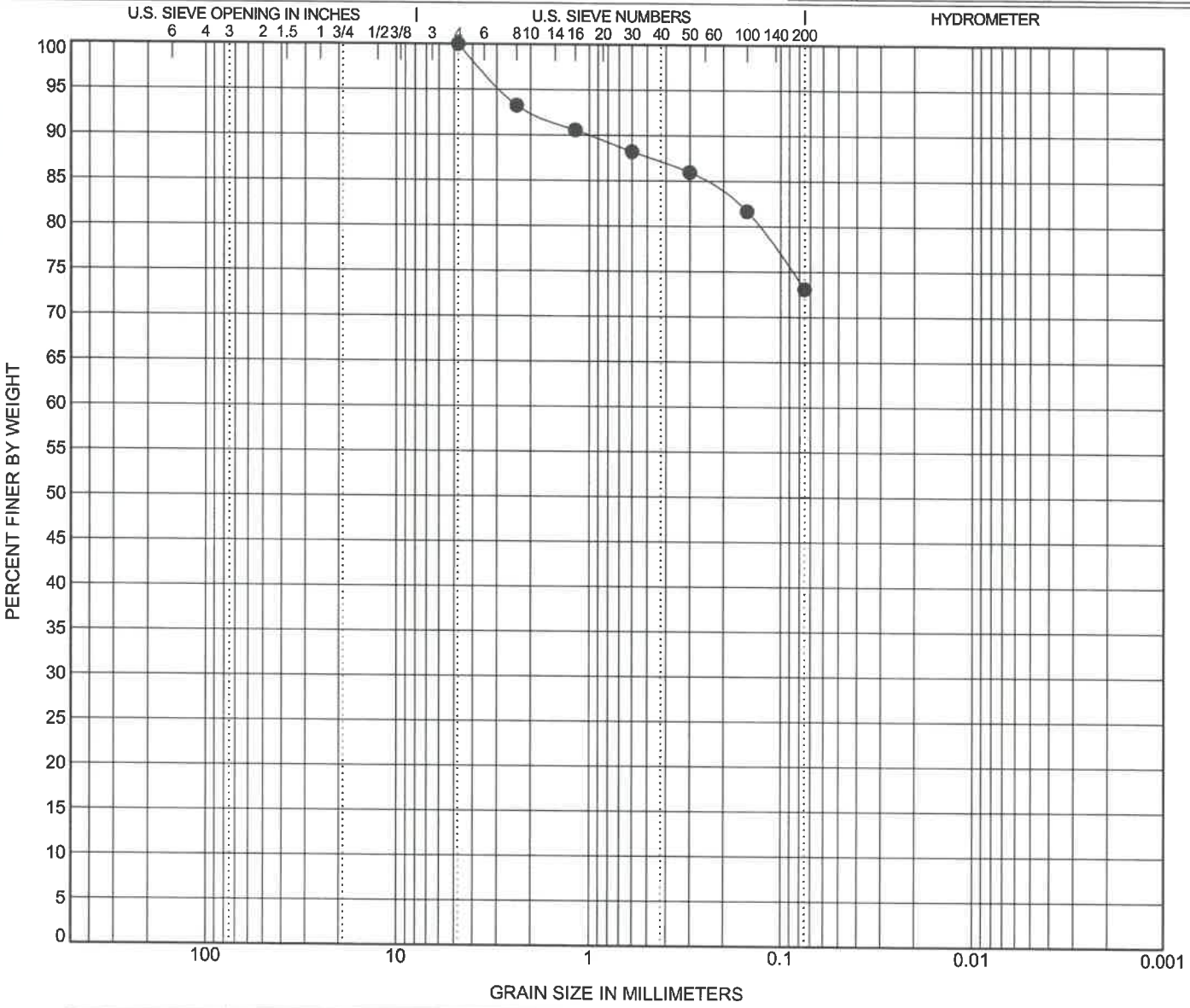
SAMPLED DATE 9/3/2021

CLIENT Jim Berookhim / Aron Corwell

PROJECT NAME Las vegas Blvd. West of Nellis Blvd.

PROJECT NUMBER pn 2137 GEO

PROJECT LOCATION Las vegas Blvd. West of Nellis Blvd.



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sieve Size	6"	3"	2"	1½"	1"	¾"	½"	3/8"	#4	#8	#10	#16	#30	#40	#50	#100	#200
Percent Passing									100	93	93	91	88	87	86	82	73
Spec. %																	
Result																	

Specimen Identification			Classification						LL	PL	PI
● B 2		5	LEAN CLAY with SAND(CL)						35	16	19
Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt		%Clay	
		4.75				0.0	26.9	73.1			

GRAIN SIZE ONE PER PAGE - AMERICAN SOILS ENG.GDT - 9/21/21 11:41 - Y:\PN 2137 GEO LAS VEGAS BLVD.GPJ

ATTERBERG LIMITS' RESULTS

American Soils Engineering

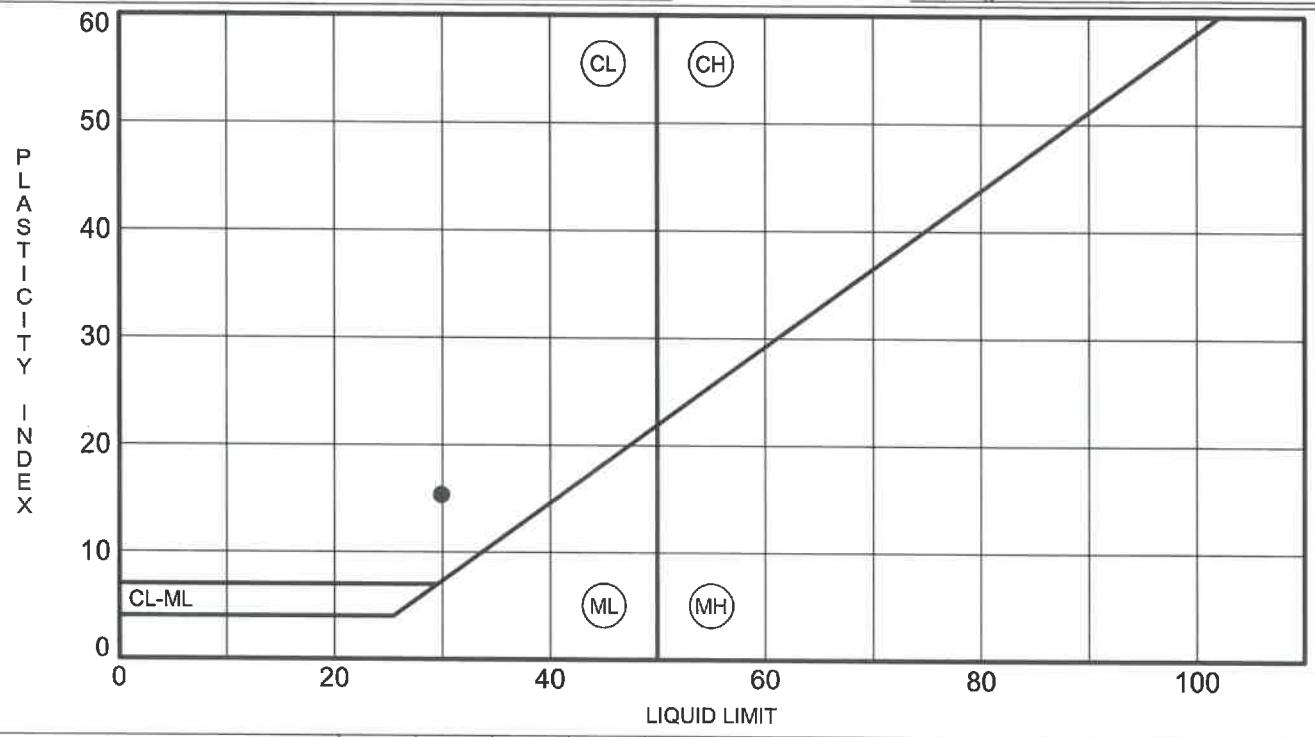
CLIENT Jim Berookhim / Aron Corwell

PROJECT NUMBER pn 2137 GEO

SAMPLED DATE 9/3/2021

PROJECT NAME Las vegas Blvd. West of Nellis Blvd.

PROJECT LOCATION Las vegas Blvd. West of Nellis Blvd.



	BOREHOLE	DEPTH	LL	PL	PI	Fines	Classification
●	**B 1**	**3.0**	**30**	**15**	**15**	**76**	**LEAN CLAY with SAND(CL)**

ATTERBERG LIMITS' RESULTS

American Soils Engineering

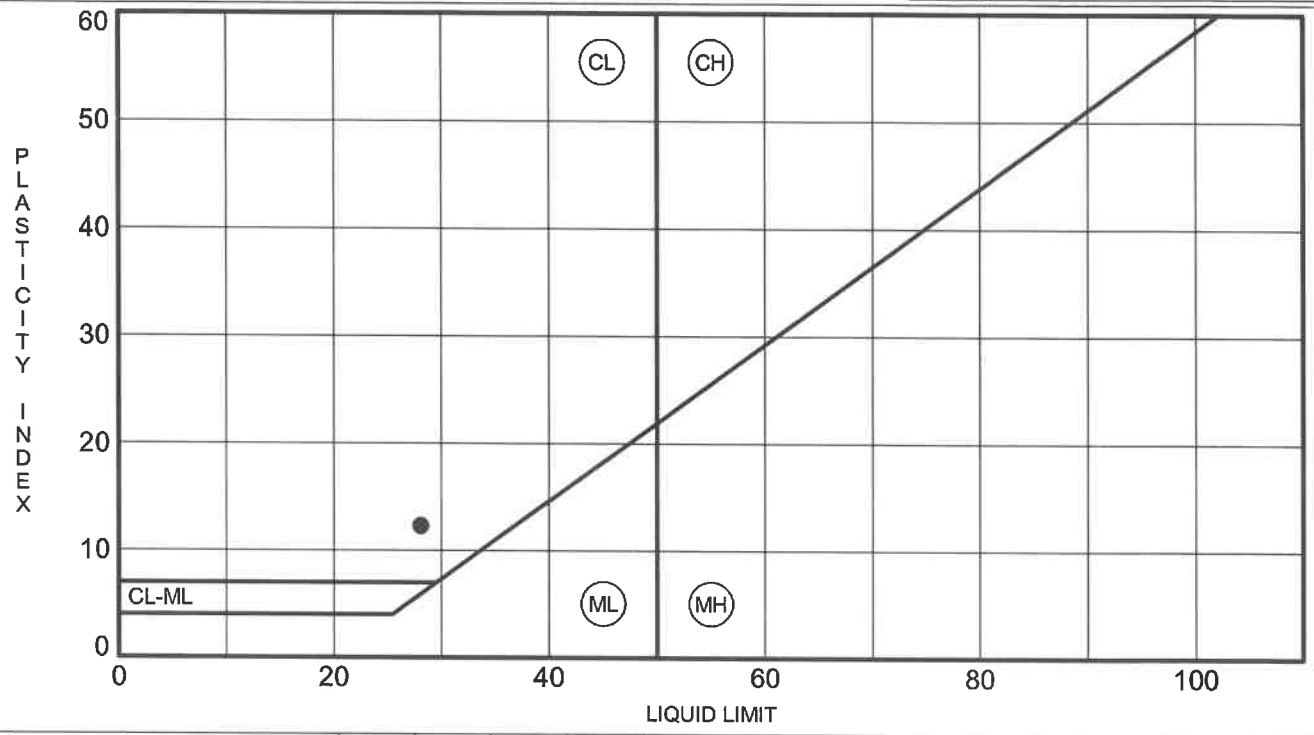
CLIENT Jim Berookhim / Aron Corwell

PROJECT NUMBER pn 2137 GEO

SAMPLED DATE 9/3/2021

PROJECT NAME Las vegas Blvd. West of Nellis Blvd.

PROJECT LOCATION Las vegas Blvd. West of Nellis Blvd.



	BOREHOLE	DEPTH	LL	PL	PI	Fines	Classification
●	**B 1**	**5.0**	**28**	**16**	**12**	**70**	**LEAN CLAY with SAND(CL)**

ATTERBERG LIMITS' RESULTS

American Soils Engineering

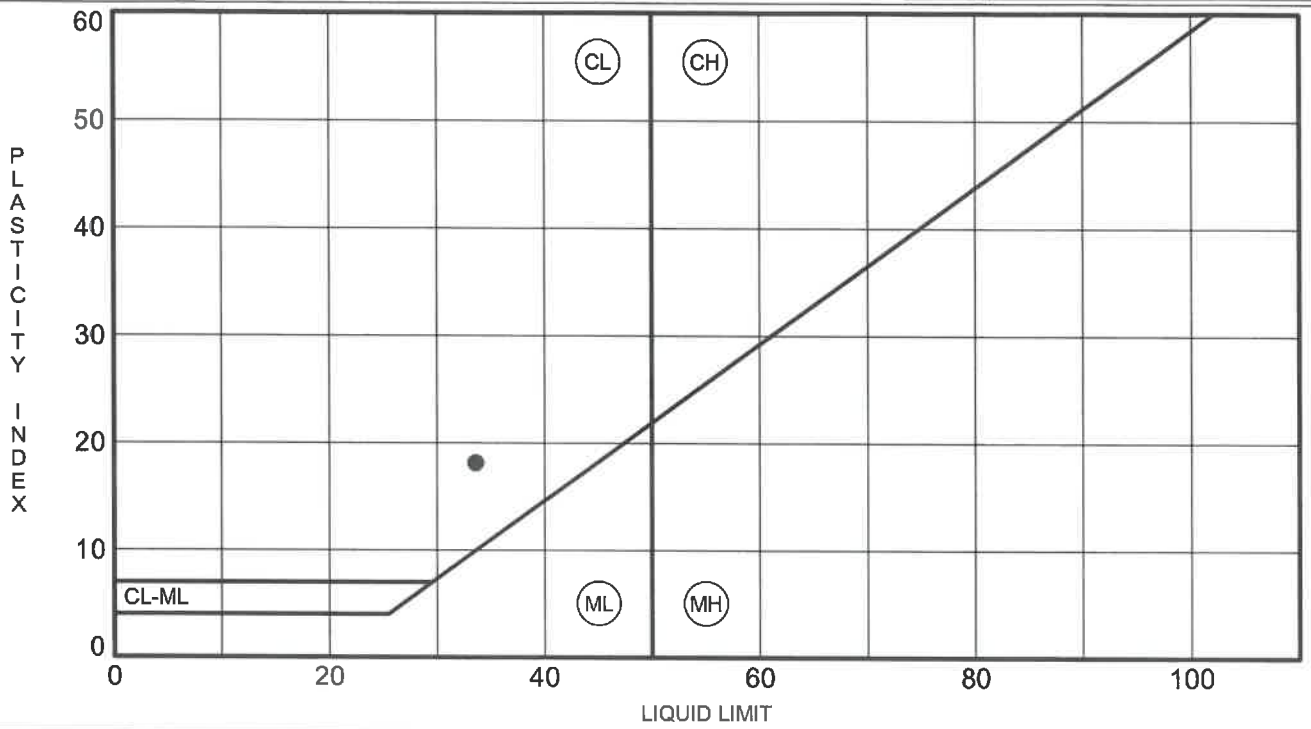
CLIENT Jim Berookhim / Aron Corwell

PROJECT NUMBER pn 2137 GEO

SAMPLED DATE 9/3/2021

PROJECT NAME Las vegas Blvd. West of Nellis Blvd.

PROJECT LOCATION Las vegas Blvd. West of Nellis Blvd.



	BOREHOLE	DEPTH	LL	PL	PI	Fines	Classification
●	B 2	3.0	34	16	18	72	LEAN CLAY with SAND(CL)

ATTERBERG LIMITS - AMERICAN SOILS ENG.GDT - 9/21/21 11:41 - Y:\PN 2137 GEO LAS VEGAS BLVD.GPJ

ATTERBERG LIMITS' RESULTS

American Soils Engineering

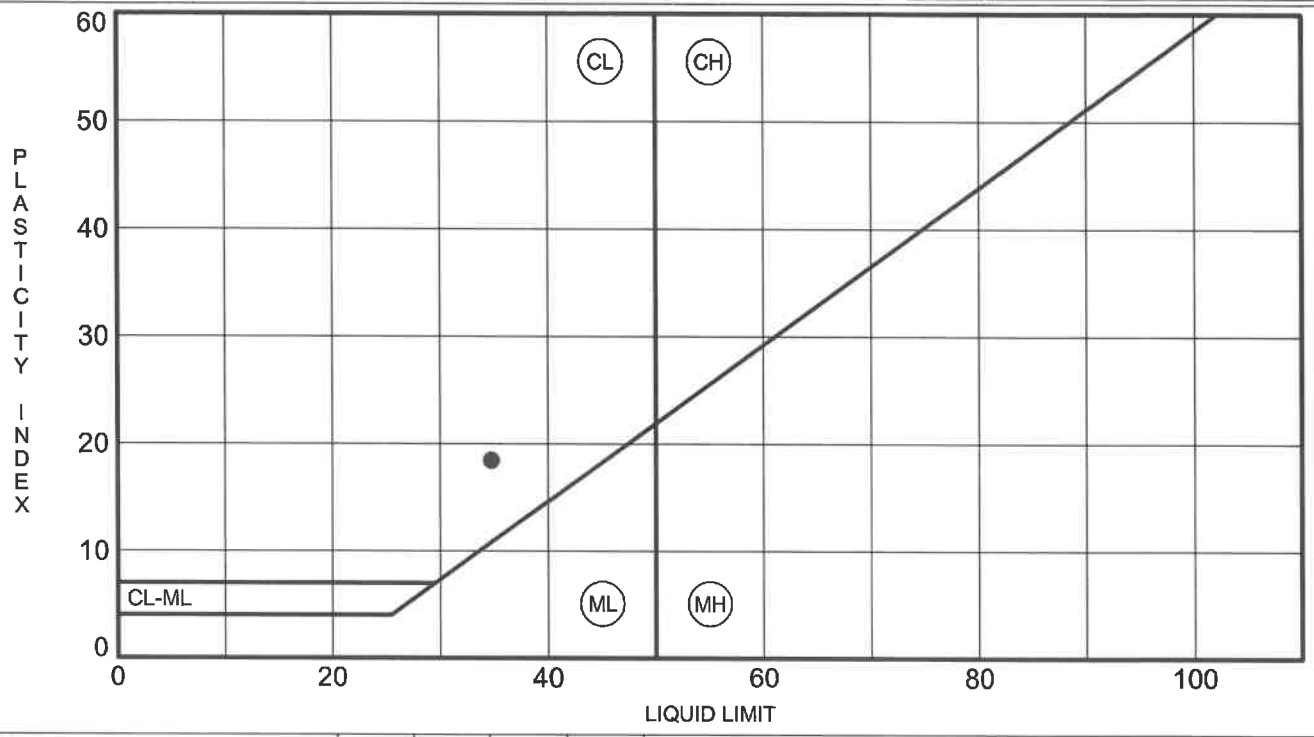
CLIENT Jim Berookhim / Aron Corwell

PROJECT NUMBER pn 2137 GEO

SAMPLED DATE 9/3/2021

PROJECT NAME Las vegas Blvd. West of Nellis Blvd.

PROJECT LOCATION Las vegas Blvd. West of Nellis Blvd.



	BOREHOLE	DEPTH	LL	PL	PI	Fines	Classification
●	**B 2**	**5.0**	**35**	**16**	**19**	**73**	**LEAN CLAY with SAND(CL)**

American Soils Engineering, LLC
6000 S. Eastern Ave. Suite 6B
Las Vegas, NV 89119
P.889-9617 F.889-9614

PN: 2137 Geo
Client: Jim Berookhim
Project: Las vegas Blvd. And Nellis
Location: Las vegas Blvd. And Nellis
Sample Date: 9/10/21 **Date** 9/15/2021
Tested by: FB **Tech:** Felix B.
Results to: PARDEEP VERMA

Swell Test

		1	2	3	4	5
1	Laboratory Number	17308	17309	17310	17311	
	Lot Number	B-1	B-1	B-2	B-2	
3	Depth	3'	5'	3'	5'	

Swell data.

4	% Swell	7.7	7.8	5.7	6.0	

Comments:

Veritas Laboratories
Truth in Quality, Truth in Service
6245 Harrison Drive, Suite 4, Las Vegas, NV 89120
(702) 321-8315 Phone
(702) 597-2098 Fax
Email: veritaslabs@msn.com

CLIENT COMPANY NAME: American Soils Engineering, LLC
CLIENT PROJECT NAME: **Las Vegas Blvd/Nellis**
CLIENT PROJECT NUMBER: 2134 GEO/Lab ID: 17308, 17310
VERITAS LAB ORDER ID: V21I065

ANALYTICAL RESULTS

CLIENT SAMPLE ID: **B2 @ 3' (17310)**
VERITAS SAMPLE ID: V21I065-02
DATE/TIME SAMPLED: 9/9/21 0:00
DATE/TIME RECEIVED: 9/9/21 15:50

Matrix: Soil

Analysis: Soil Solubility/Corrosion Parameters

PARAMETER	RESULT	UNITS	METHOD	DATE ANALYZED
Water Soluble Sodium	**0.065**	%	EPA 6010B	9/13/21
Water Soluble Sulfate	**0.41**	%	SM 4500-SO4 E	9/13/21
Total Available Water Soluble Sodium Sulfate	**0.20**	%	Calculation	9/13/21
Total Soluble Salts (Solubility)	**0.52**	%	SM 2540C	9/13/21
Water Soluble Chloride	**420**	mg/Kg	SM 4500-Cl B	9/13/21