Appendix C
Geotechnical Studies

NMG Geotechnical, Inc.

June 20, 2022

Project No. 22048-01

To: Avalon Bay Communities
11111 Santa Monica Boulevard Suite 1700
Los Angeles, California 90025

Attention: Mr. Christopher Bench

Subject: Preliminary Geotechnical Due Diligence Study, Proposed Commons Mixed-Use Apartment Development, City of Aliso Viejo, California

INTRODUCTION

At your request, NMG Geotechnical, Inc. (NMG) has prepared this preliminary geotechnical due diligence report for the proposed Commons project located northwest of the intersection of Aliso Creek Road and Enterprise in the city of Aliso Viejo. Our summary is based on review of available geotechnical reports and maps provided by you and the City of Aliso Viejo, review of historic aerial photographs and topographic maps; a site reconnaissance; our knowledge of geological conditions and constraints in the region; our experience during design, grading and construction of the Summit Business Park; and our experience with similar residential developments.

SITE LOCATION AND DESCRIPTION

The approximately 4.1-acre site is located northwest of the intersection of Aliso Creek Road and Enterprise in the city of Aliso Viejo, California. The site currently consists of an asphalt surface parking lot with planter medians and a 2H:1V slope that ascends up to 45 feet to Enterprise. The elevation across the asphalt parking lot is fairly flat, ranging from approximately 348 to 351 feet above mean sea level (msl).

The northwestern portion of the site consists of a 2H:1V buttress slope that ascends approximately 5 to 45 feet to Enterprise. We understand this compacted buttress fill slope was constructed with a subdrain system with subdrain outlets that extend to the slope face; some of these outlets were observed during our recent site reconnaissance. The fill material exposed in the slope and planters in the parking lot was observed to be white diatomaceous silt with small siltstone fragments. The asphalt surface and concrete V-ditches/curbs appear to be in moderately good condition, with some linear cracks throughout, generally consistent with aging improvements.

SITE HISTORY

Based on our knowledge of the development in Aliso Viejo, the site was mass graded in the early 1990s by the Mission Viejo Company under the geotechnical observation and testing of The Earth Technology Corporation (Earth Tech), who also performed the initial investigation during the design stages of the site. We have not been able to obtain copies of these reports through requests from the City of Aliso Viejo.

Based on review of historic aerial photographs dating to 1946 and topographic maps dating to 1949, the site originally consisted of gentle hillside terrain ranging from 340 to 400 feet above msl. The site sloped to the north to an incised channel in the location of the current State Route 73 Toll Road (SR 73). Historically, this region was used for dry farming and cattle grazing until the late 1980s when the Mission Viejo Company started development. The northeastern portion of the site was mass graded between 1988 and 1992, and included construction of Aliso Creek Road. By 1995, the entire site was graded to essentially its current condition, which included grading of the abutting slope and paving of Enterprise from Aliso Creek Road to the Town Center. Between 1996 and 1997, SR 73 was constructed and the adjacent commercial property to the northwest had been graded.

In 2006, Kleinfelder, Inc. (Kleinfelder) performed a feasibility study and provided design parameters specific to the subject site for a prior land use plan. The prior land use plan included two levels of subterranean development and retaining structures up to 55 feet high, essentially cutting out the buttress slope that ascends to Enterprise. Their study included three bucket-auger borings and slope stability analysis along the buttress slope. Their report did not include geotechnical borings logs, but provided a description of the fill and bedrock encountered and included cross-sections showing the bedrock layers dipping out of slope. They concluded that excavation into the buttress slope would render it unstable, and as such, they recommended a tie-back anchor wall be designed and constructed (Kleinfelder, 2006).

PROPOSED DEVELOPMENT

Based on review of the yield study exhibits, the proposed mixed-use apartment development will be a wrap-style construction with up to six stories of retail and apartments around the perimeter, and a central eight-story parking structure. No subterranean structures are anticipated at the site. The recreation area is anticipated to be constructed atop the parking structure. Although a grading study was not available for our review, the yield study exhibits show the buildings may encroach significantly into the adjacent buttress slope.

GEOLOGIC CONDITIONS

The subject site is located in the San Joaquin Hills within the coastal section of the Peninsular Range Province. This geomorphic province includes the Los Angeles Basin and has a long, active geologic history, including deep marine sedimentation followed by uplift and fluvial and marine erosion.

The subject site is underlain by artificial fill materials and interbedded diatomaceous siltstone/ claystone bedrock of the Monterey Formation. The bedrock was originally deposited within the Capistrano Embayment, which extended from San Clemente northward to the Santa Ana Mountains. During the Quaternary period, active faulting (associated with the San Andreas Fault system) subjected the embayment to compression and regional uplift. Also, during the Quaternary period, active streams channels cut canyons into the emergent bedrock. However, during past grading operations, the natural terrain was modified by cutting the ridges and filling canyon areas resulting in the current site configuration.

Geologic Units and Structure

We anticipate the northeast portion of the site and the buttress fill slope to consist of up to 20 to 40 feet of previously placed artificial fill primarily derived from bedrock of the Monterey Formation and placed under the observation and testing of Earth Tech (1995). Although we do not have the referenced report available, we have encountered the subject fill material during various phases of exploration for the adjacent Summit Business Park. Also, Kleinfelder encountered the fill during their site feasibility study (Kleinfelder, 2006) in two of their three borings. We anticipate the fill to consist of various mixtures of diatomaceous silt, elastic silt, clay, silty clay, and silty sand that is generally dry to moist, stiff, slightly to moderately plastic, and containing bedrock fragments.

The majority of the site may consist of sedimentary bedrock of the Monterey Formation, which also underlies the artificial fill. Within Aliso Viejo, the Monterey Formation consists predominately of light gray to light brown highly diatomaceous clayey siltstone, which is moist, stiff to hard, and locally highly fractured and jointed. The clayey siltstone is interbedded with abundant sheared clay beds and vitric tuff horizons. The material is locally highly laminated and well-bedded, and has been found to be compressible under significant loading. During their feasibility study, Kleinfelder (2006) encountered this bedrock in all three of their bucket-auger borings and described it as diatomaceous siltstone and shale deposits that are friable and relatively weak. They also encountered some very soft sheared clay beds every few feet within the siltstone and local lenses of volcanic ash, concretionary limestone, calcareous sandstone and thin sandstone beds.

The geologic structure within the area can be somewhat variable due to regional faulting and folding; however, bedding was identified and measured by Kleinfelder (2006) and found to dip 6 to 41 degrees consistently to the northeast. These dips correlate to an apparent dip of 8 to 39 degrees out of slope, for an adverse bedding condition within the slope adjacent to Enterprise.

Faulting

The site is not located within a fault-rupture hazard zone as defined by the Alquist-Priolo Special Studies Zones Act (California Geological Survey, 2018 and Hart and Bryant, 2007), and no evidence of active faulting was observed during this investigation or during rough grading operations. Also, based on mapping by the State (California Geological Survey, 2010), there are no active faults mapped at the site.

Using the USGS computer program (USGS, 2022) and the site coordinates of 33.5786 degrees north latitude and 117.7253 degrees west longitude, the controlling fault at the site is the San Joaquin Hills Blind Thrust Fault located 3.8 kilometers (≈ 2.4 miles) at depth below the site. The maximum moment magnitude for the Controlling Fault is 7.1 M_W. The other faults noted that can produce strong ground shaking at the site include the Newport-Inglewood (Offshore), Elsinore Glen Ivy and Oceanside. Based on review of published maps, historic aerial photographs, and topographic maps, the potential for primary ground rupture due to an earthquake is considered very low.

Seismic Hazards

The primary seismic hazard at the subject site is ground shaking due to a future earthquake on a major regional active fault, such as the San Joaquin Hills Blind Thrust Fault mentioned above. The site is not located in a seismic hazard zone for liquefaction as mapped by the State, but the slope adjacent to the site that ascends to Enterprise is located in a seismic hazard zone for earthquake induced landslides (CDMG, 2001a), likely due to the regional geology. Figure 2 shows the subject site in relation to the seismic hazard zones mapped by the State. Development of the site by the Mission Viejo Company included slope stabilization measures to mitigate this potential hazard.

Groundwater

Groundwater was encountered in the form of seepage zones by Kleinfelder (2006) at approximate elevations of 320 to 328 feet above msl, which is roughly 20 feet below the existing asphalt parking lot. Groundwater was not encountered by NMG during our prior study for the adjacent business development (NMG, 1997). Historic high groundwater is in excess of 30 feet below ground surface (bgs) (CDMG, 2001b).

LABORATORY TESTING

The Kleinfelder feasibility study did not include tabulated laboratory test results, but it did indicate the soils are corrosive to concrete and metals, have moderate to very high expansion potential, and have low shear strengths with an average friction angle of 12 degrees and a cohesion of 100 pounds per square foot (psf) along bedding and 25 degrees and 500 psf cohesion for across bedding (Kleinfelder, 2006).

Prior laboratory testing by NMG (1997) for the adjacent business development indicated the compacted fill soils are generally comprised of silty clay with liquid limits of 66 to 81 percent and plasticity indices of 37 to 49 percent (USCS classification of CH). Sieve analysis of the same compacted fill soils shows 74 to 82 percent passing the No. 200 sieve and 37 to 47 percent passing the two-micron sieve. Expansion indices ranged from 73 to 111, falling in the medium to high expansion potential range and direct shear tests indicated ultimate friction angles of 30 to 47 degrees with 0 to 200 psf cohesion.

GEOTECHNICAL CONDITIONS/CONSTRAINTS

Based on the geotechnical data provided in the referenced reports (References) and review of published geologic maps/reports, the following conditions are anticipated.

- Soil conditions across the site consist of artificial fill up to 20 to 40 feet thick within the buttress slope and the northeast portion of the site, and diatomaceous siltstone/claystone bedrock of the Monterey Formation exposed at existing grade for the southern and western portion of the existing parking lot.
- Overexcavation of both the bedrock and artificial fill materials should be anticipated, such that a minimum of 5 feet of new compacted fill underlies the building and footings.
- Groundwater in the form of seepage was previously encountered at a depth of 20 feet below the existing parking lot grades. Other nuisance seepage may be encountered in heavily landscaped areas.
- Storm water infiltration into the subsurface soils is not considered feasible due to the presence of clayey subgrade soils and diatomaceous siltstone bedrock.
- If grading/construction is proposed to encroach into the existing buttress slope, excavations into this slope may de-stabilize the slope and adversely impact Enterprise. Use of tie-back supported retaining structures and shoring should be anticipated during construction of the walls impacting this slope.
- The proposed parking structure and residential units may straddle a contact between siltstone bedrock and moderately deep artificial fill. Both of these earth units are considered compressible; thus, total and differential settlement under the heavy building load may be a significant constraint. Use of mat slab foundations, deep foundations and/or ground improvement (i.e., geopiers) may be required at the site.
- Laboratory testing by NMG and others indicates the expansion index (EI) for soils at the site range from medium to very high.
- Based on chemical testing by Kleinfelder and on our experience at the adjacent business park, the sulfate exposure of the onsite soils is in the severe ("S4") range and may also be categorized as "severely corrosive" with respect to ferrous metals.
- The site is not located in a seismic hazard zone for liquefaction, but the buttress slope along the western and northern border of the site is located in a seismic hazard zone for earthquake-induced landslides. We anticipate that the prior grading of the buttress slope has adequately mitigated the potential for earthquake induced landslides. The most significant seismic hazard at the site is strong ground shaking due to an earthquake on a nearby active fault, such as the San Joaquin Hills Blind Thrust, Newport-Inglewood (Offshore), Elsinore Glen Ivy and Oceanside Faults.

EXPLORATION, PLANNING AND DESIGN RECOMMENDATIONS

The following presents a summary of our recommendations during the next phase of due diligence and future design stages.

1. A detailed subsurface exploration and laboratory testing program should be performed to verify the geotechnical conditions described herein in light of the proposed development.
2. Coordination with the design team, including the structural engineers for the parking structure foundation, residential building foundation, and the perimeter retaining structure will be important during analysis of the collected data.
3. Engineering analysis should be performed based on the subsurface exploration and should include settlement analysis, slope stability analysis, seismic design parameters, and foundation and wall design parameters. A geotechnical exploration and design report should be prepared documenting the geotechnical findings and site-specific conditions.
4. Future rough and precise grading plans should be reviewed and a report prepared to provide geotechnical parameters for design in accordance with the most recent requirements of the California Building Code (CBC).
5. The structural and foundation plans should be reviewed to confirm that the parameters used for design are in accordance with the recommendations of the design report.
6. The street improvement and utility plans should be reviewed and recommendations provided as needed.

If you have any questions regarding this preliminary due diligence study, please contact our office. We appreciate the opportunity to offer our services.

Respectfully submitted,

NMG GEOTECHNICAL, INC.

Shahrooz "Bob" Karimi, RCE 54250
Principal Engineer

Lynne Yost, CEG 2317
Principal Geologist

LY/SBK/grd

Attachments: References
Figure 1 – Site Location Map
Figure 2 – Seismic Hazards Map

Distribution: Addressee (E-Mail)

REFERENCES

California Division of Mines and Geology, 1981, Geologic Map of Orange County, California, Showing Mines and Mineral Deposits, Bulletin 204, Plate 1.

California Division of Mines and Geology, 2001a, Seismic Hazard Zone Map for the San Juan Capistrano 7.5-Minute Quadrangle, Orange County, California, Official Map Released December 21, 2001.

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California Geological Survey (CGS), 2010, Fault Activity Map of California, Compiled and Interpreted by Charles W. Jennings and William A. Bryant.

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Kleinfelder, Inc., 2006, Geotechnical Feasibility, Phase 3 Redevelopment, Enterprise and Town Center Drive, Aliso Viejo, California, Project No. 65579, dated November 1, 2006.

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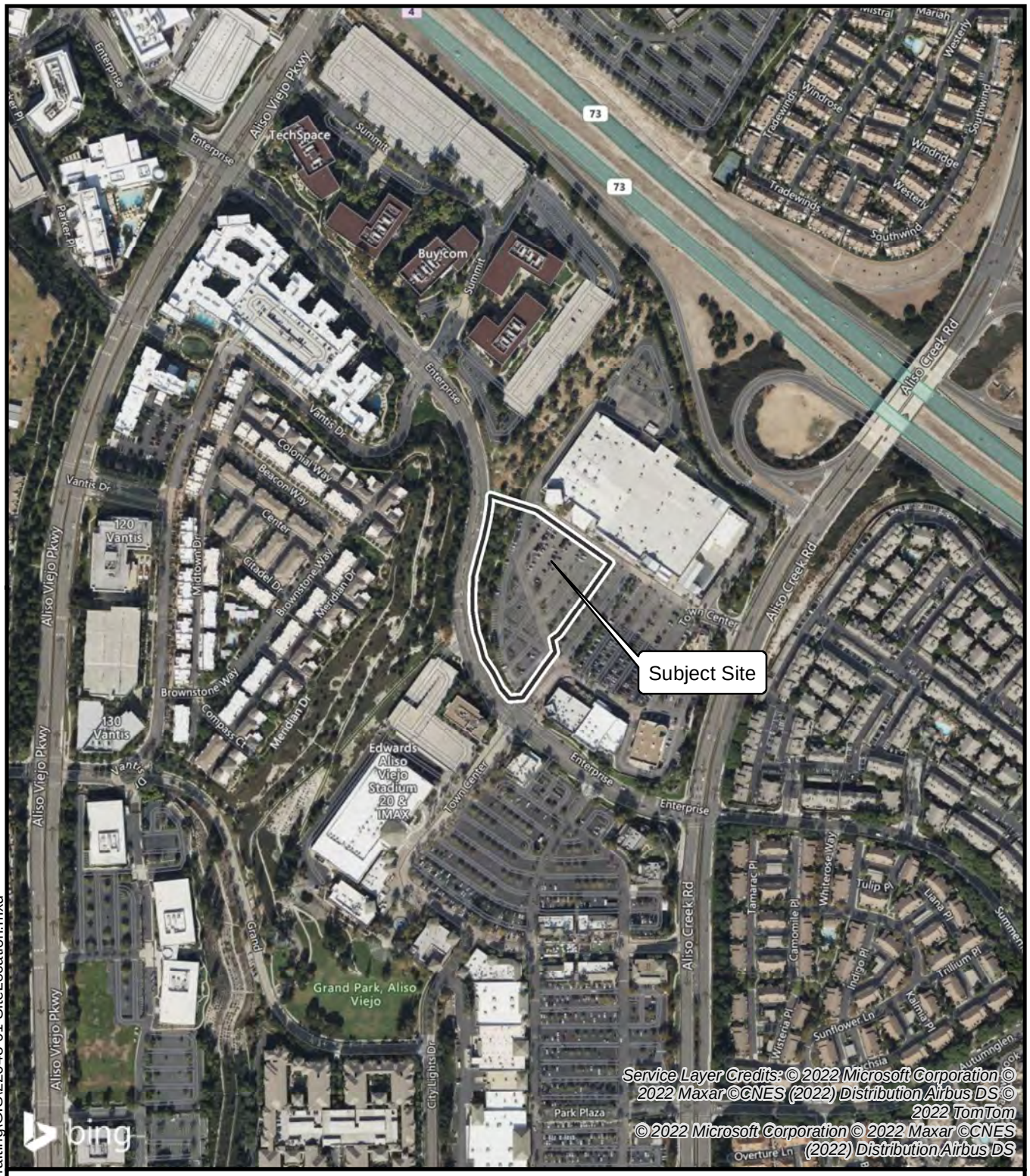

0 250 500 Feet

1 inch = 500 feet

N

SITE LOCATION MAP

PROPOSED RESIDENTIAL DEVELOPMENT
COMMONS AT ALISO VIEJO
ALISO VIEJO, California

Project Number: 22048-01 By: SBK/LY
Project Name: Avalon/Aliso Viejo
Date: 6/20/2022 Figure 1

NMG

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Legend

- Earthquake-Induced Landslide Zones
- Liquefaction Zones

0 250 500 Feet

1 inch = 1,000 feet

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SEISMIC HAZARDS AND FAULT ZONES MAP

Base: California Geological Survey, Earthquake Zones of Required Investigation, San Juan Capistrano Quadrangle
Dated: December 21, 2001

PROPOSED RESIDENTIAL DEVELOPMENT
COMMONS AT ALISO VIEJO
ALISO VIEJO, California

Project Number: 22048-01 By: WG/TM
Project Name: Avalon/Aliso Viejo
Date: 6/20/2022 Figure 2

NMG

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NMG Geotechnical, Inc.

August 30, 2022

Project No. 22048-01

To: Avalon Bay Communities
11111 Santa Monica Boulevard Suite 1700
Los Angeles, California 90025

Attention: Mr. Christopher Bench

Subject: Preliminary Summary of Geotechnical Findings, Proposed Commons Mixed-Use Apartment Development, City of Aliso Viejo, California

References: Kleinfelder, Inc., 2006, Geotechnical Feasibility, Phase 3 Redevelopment, Enterprise and Town Center Drive, Aliso Viejo, California, Project No. 65579, dated November 1, 2006.

NMG Geotechnical, Inc., 2022, Preliminary Geotechnical Due Diligence Study, Proposed Commons Mixed-Use Apartment Development, City of Aliso Viejo, California, Project No. 22048-01, dated June 30, 2022

INTRODUCTION

At your request, NMG Geotechnical, Inc. (NMG) has prepared this preliminary summary of geotechnical findings for the proposed Commons project located northwest of the intersection of Aliso Creek Road and Enterprise in the city of Aliso Viejo. This summary is based on our geotechnical exploration, laboratory testing, review of the site plan prepared by Tait and Associates received by NMG on August 25, 2022, our preliminary due diligence summary previously provided to you (NMG, 2022), and discussion with you.

SITE LOCATION AND HISTORY

The approximately 4.1-acre site is located northwest of the intersection of Aliso Creek Road and Enterprise in the city of Aliso Viejo, California. The site currently consists of an asphalt-surface parking lot with planter medians and a 2H:1V slope that ascends up to 45 feet to Enterprise. The elevation across the asphalt parking lot is fairly flat, ranging from approximately 345 to 349 feet above mean sea level (msl).

The northwestern portion of the site consists of a 2H:1V buttress slope that ascends approximately 5 to 50 feet to Enterprise. We understand this slope was originally a design cut slope but was replaced as a compacted buttress fill slope with a subdrain system. Based on our knowledge of the development in Aliso Viejo, the site was mass graded in the early 1990s by the Mission Viejo

Company under the geotechnical observation and testing of The Earth Technology Corporation (Earth Tech), who also performed the initial investigation during the design stages of the site. We have not been able to obtain copies of these reports through requests from the City of Aliso Viejo or the County of Orange.

In 2006, Kleinfelder, Inc. performed a feasibility study and provided design parameters specific to the subject site for a prior land use plan. Their study included three bucket-auger borings and slope stability analysis along the buttress slope. Their report did not include geotechnical borings logs, but provided a description of the fill and bedrock encountered and included cross-sections showing the bedrock layers dipping out of slope. They concluded that excavation into the buttress slope would render it unstable, and as such, they recommended a tie-back anchor wall be designed and constructed (Kleinfelder, 2006).

PROPOSED DEVELOPMENT

Based on review of the site plan and discussions with you, the proposed mixed-use apartment development will be a wrap-style construction with up to six stories of retail and apartments around the perimeter, and a central eight-story parking structure, with one level of subterranean parking. The recreation area is anticipated to be constructed atop the parking structure. The preliminary site plan shows the buildings may encroach significantly into the adjacent buttress slope.

SUBSURFACE EXPLORATION

Our subsurface study was conducted on July 22, 2022. Our study consisted of excavation of five hollow-stem-auger borings (H-1 through H-3) drilled to a depth of 16.5 to 51.5 feet below ground surface (bgs). The boring locations were marked with stakes and cleared with DigAlert. Sampling of the borings included collection of drive samples using the modified California ring sampler and bulk samples. California ring samples were obtained from the exploratory borings with a 2.5-inch-inside-diameter, split-barrel sampler. The samplers were driven with a 140-pound automatic-trip safety hammer, free-falling 30 inches. The bulk and drive samples were used to assess soil types beneath the site and obtain relatively undisturbed samples for laboratory testing. Blow counts were used to obtain a measure of resistance of the soil to penetration (recorded as blows-per-foot on the geotechnical boring logs). Bulk samples of onsite soils were collected from the cuttings and used for additional soil identification purposes and laboratory testing. Soil samples were visually classified in accordance with the Unified Soil Classification System (USCS). Upon completion of logging, the borings were backfilled with native soils and tamped.

Based on our drilling, the majority of the site consists of sedimentary bedrock of the Monterey Formation, with only a thin veneer of artificial fill, up to 7.5 feet thick, along the eastern portion of the proposed development. The Monterey Formation bedrock consists predominately of light gray to light brown highly diatomaceous clayey siltstone, which is moist, stiff, and locally highly fractured and jointed. The clayey siltstone is interbedded with abundant sheared clay beds. Bedding is variable due to regional faulting and folding; however, bedding was identified and measured by Kleinfelder dipping 6 to 41 degrees consistently to the northeast. These dips correlate to an apparent dip of 8 to 39 degrees out of slope, for an adverse bedding condition within the slope adjacent to Enterprise.

Groundwater was encountered in only one boring at a depth of 49.5 feet bgs. However, the prior study by Kleinfelder encountered groundwater seepage at approximate elevations of 320 to 328 feet above msl, which is roughly 20 feet below the existing grades.

LABORATORY TESTING

In-situ moisture contents of the subsurface soils ranged from 33.2 to 114.9 percent and dry densities ranged from 58.8 to 86.7 pounds per cubic foot (pcf). Grain-size distribution tests were conducted on two soil samples collected in the upper five feet at the site. The results indicate the near-surface soils have fines contents (passing No. 200 sieve) ranging from 78 to 86 percent with clay contents ranging from 24 to 44 percent. Atterberg limits tests performed on four samples of the upper 5 feet indicated liquid limits in the range of 62 to 78 percent with plasticity indices in the range of 38 to 49 (USCS classification of CH).

Direct shear tests were conducted on relatively undisturbed ring samples of bedrock to evaluate the strength properties of the onsite soil materials. The results of this testing indicate ultimate internal friction angles of 27 and 29 degrees at cohesions of 150 to 400 pounds per square foot (psf). Peak values for friction angles are 27 and 31 degrees at cohesions of 700 and 850 psf, respectively.

Consolidation tests were performed on six relatively undisturbed ring samples of artificial fill and bedrock materials in order to evaluate the settlement potential at the site.

Two bulk samples collected within the upper 6 feet of the existing subgrade soils indicate "medium" expansion potential, with expansion indices of 84 and 87. Note that these values are very close to "high" expansion potential, and our experience in the area indicates that soils with "high" expansion potential should be expected at the site.

INFILTRATION FEASIBILITY

Storm water infiltration into the subsurface soils is not considered feasible due to the presence of clayey subgrade soils and diatomaceous siltstone bedrock. Storm water capture, filtration and discharge into suitable drainage devices should be assumed for the proposed development.

SLOPE STABILITY

The existing slope, which ascends to Enterprise, consists of an earthen buttress approximately 5 feet deep by 40 to 80 feet wide. The clayey siltstone and sheared claystone bedrock dips roughly 10 to 40 degrees to the northeast and the strength parameters assigned by Kleinfelder (2006) for the bedrock indicate an internal friction angle of 12 degrees with a cohesion of 100 psf.

The site plan we reviewed indicates significant cuts into the toe of the slope, up to 60 feet horizontally, which would essentially remove the earthen buttress and potentially create an unstable condition for the slope and the improvements above. Cutting into the buttress slope as designed will require construction of a nearly 30- to 40-foot-high anchored retaining wall (i.e., tiebacks, etc.).

Alternatively, the site plan may be modified to minimize encroachment into the adjacent slope, near the existing toe of the slope.

SETTLEMENT

The majority of the development consists of approximately 2 to 10 feet of artificial fill overlying sedimentary bedrock. In estimating the settlement potential of underlying soils due to fill and structural loads, we have assumed that the thickness of new fill placed at the site will be less than 3 feet above existing grades, the first level of the parking structure will be subterranean and the future parking structure column loads will not exceed 1,000 kips. The total settlement at the site due to fill and structural loads is estimated to be 1¾ inches, the differential settlement is typically estimated as ½ of the total settlement over a 40-foot span, provided that the remedial grading is performed as described below.

REMEDIAL EARTHWORK

The recommended geotechnical remedial removals across the site include removal of the weathered artificial fill and overexcavation of the bedrock. The anticipated depth of removals and overexcavation is generally on the order of 5 feet below existing grades throughout the site. The parking garage footprint should be overexcavated a minimum of 3 feet to provide a uniform compacted fill blanket beneath the slab.

Please note that the diatomaceous nature of the sedimentary bedrock exhibits a high inherent moisture, due to encapsulated moisture in the diatoms. Grading within this material requires significant moisture-conditioning to obtain the required compaction.

PRELIMINARY FOUNDATION DESIGN

Based upon our experience, our site investigation, and laboratory testing, and provided that the unsuitable soils are removed and replaced with compacted fill, the continuous building foundations at the subject site may be designed for a maximum allowable bearing capacity of 3,000 psf. The foundations should be a minimum of 12 inches wide and have a minimum embedment of 18 inches below the lowest adjacent grade. For shear wall and column pad footings, an allowable bearing pressure of 4,000 psf may be used for footings with minimum depth of 24 inches (measured from the bottom of the slab) to bottom of footing and a minimum width of 24 inches.

The allowable bearing pressure may be increased by one-third for wind and seismic loading. A coefficient of resistance of 0.32 against sliding is considered appropriate.

The garage slab should be a minimum of 6 inches thick, reinforced with minimum No. 4 bars at 18 inches on-center, over a minimum 6-inch-thick granular layer.

The design of foundations and slabs-on-grade for the apartment buildings should verify that the final design, at minimum, meets the requirements for expansive soils and the estimated settlement provided in this report. The following table provides our general guidelines and recommendations for design of post-tensioned foundations and slabs on expansive soil in accordance with the 2019

California Building Code (CBC) and Post-Tension Institute (PTI) DC 10.5 Edition provisions. These parameters will be reviewed upon adoption of the 2022 CBC and may need be updated in accordance with the updated code.

GEOTECHNICAL GUIDELINES
FOR DESIGN OF POST-TENSIONED SLABS

Parameter	*Recommendation*
Center Lift	
* Edge Moisture Variation Distance, e_m	7.5 feet
* Center Lift, y_m	0.92 inches
Edge Lift	
* Edge Moisture Variation Distance, e_m	3.9 feet
* Edge Lift, y_m	1.22 inch
Subgrade Modulus, k	50 pci
Modulus of Elasticity of Soils, Es	1,000 psi
Presaturation, as needed, to obtain the minimum moisture down to the minimum depth	1.4 x optimum down to 24 inches
****Based on method in CBC 2019***	

The thickness of the slabs for the structures at the site is the purview of the project structural engineer. For uniform-thickness post-tensioned slabs, we recommend that the slabs have a thickened edge such that the slab is embedded a minimum of 12 inches below the lowest adjacent grade. The thickened edge should be tapered and have a minimum width of 12 inches. If non-uniform (ribbed) post-tensioned slabs are used, we recommend minimum embedment of 18 inches below adjacent grades for the thickened edges.

In addition, as indicated in the DC 10.5 Edition of PTI, shape factor calculations should be performed by the project structural engineer in order to determine if strengthening/modification of foundations are necessary. Per PTI guidelines, the modifications to the foundation design should be considered if the shape factor (ratio of square of foundation perimeter over foundation area) exceeds 24.

The slabs should also be designed to satisfy the settlement criteria discussed previously.

EXISTING AND PROPOSED UTILITIES

Existing utilities, including a trunk sewer and domestic waterline, are present within some of the drive aisles and electrical conduit is present throughout the site. The utilities to be abandoned, should include complete removal of the pipeline (in order to remove the backfill soils overlying the utility). Due to the potential adverse bedding conditions, excavations to remove abandoned utilities as well as excavations for proposed utilities should be no steeper than 1.5H:1V (unless shored) as the soils are anticipated to be classified as Type C for CalOSHA trenching and shoring excavation requirements.

FUTURE PLANNING AND DESIGN

Coordination with the design team, including the structural engineers for the parking structure foundation, residential building foundation, and the perimeter retaining structure will be important during analysis of the collected data. Engineering analysis should be performed based on the subsurface exploration and should include settlement analysis, slope stability analysis, seismic design parameters, and foundation and wall design parameters. A geotechnical exploration and design report should be prepared documenting the geotechnical findings and site-specific conditions.

If you have any questions regarding this summary of preliminary findings, please contact our office. We appreciate the opportunity to offer our services.

Respectfully submitted,

NMG GEOTECHNICAL, INC.

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