# Appendix H

Geology and Soils

# Appendix H.1

## Geotechnical Investigation

CITY OF LOS ANGELES
INTER-DEPARTMENTAL CORRESPONDENCE

# SOILS REPORT APPROVAL LETTER

April 8, 2024

LOG # 130012
SOILS/GEOLOGY FILE - 2
LIQ

**To:** Vincent P. Bertoni, AICP, Deputy Advisory Agency
Department of City Planning
200 N. Spring Street, 7th Floor, Room 750

**From:** Jesus Adolfo Acosta, Grading Division Chief
Department of Building and Safety

TRACT: TR 24434,
HAYS' SUBDIVISION OF LOTS 244, 251, 281 & 232 OF THE LANKERSHIM RANCH LAND & WATER COS SUBD OF THE E 12000 A OF THE S 1/2 OF THE RANCHO EX. MISSION OF SAN FERNA

LOT(S): 1, 13 (Arb 1,2&3), 14 (Arb1 &2), 15 (Arb1 &2) & 16 (Arb1 &2)

LOCATION: 4200-4024 N. Radford Ave.

| CURRENT REFERENCE REPORT/LETTER(S) | REPORT No. | DATE OF DOCUMENT | PREPARED BY |
|---|---|---|---|
| Preliminary Soils Report | 22241 | 01/22/2024 | Geotechnologies |

| PREVIOUS REFERENCE REPORT/LETTER(S) | REPORT No. | DATE OF DOCUMENT | PREPARED BY |
|---|---|---|---|
| Dept. Approval Letter | 124489 | 01/18/2023 | LADBS |
| Preliminary Soils Report | 22241 | 09/16/2022 | Geotechnologies |

The Grading Division of the Department of Building and Safety has reviewed the referenced preliminary report dated 01/22/2024 for the proposed CBS Studio Center. The Project entails the continuation of the existing studio use and the modernization and expansion of Radford Studio Center. The Project includes the development of up to approximately 1,667,010 square feet of new sound stage, production office, production support, creative media office, and retail uses. The proposed new buildings could range in height from approximately 60 feet to up to 135 feet. It is anticipated that some of the structures may be built near the existing grade while others may be built over one to three subterranean levels. The Project would result in excavation depths of up to approximately 50 feet below existing grade. The CBS studio center is subdivided into the south lot and the north lot. These two lots are divided by the LA River channel.

The consultants recommend to support the proposed structure(s) on conventional, mat-type and/or drilled-pile foundations bearing on native undisturbed soils or properly placed compacted fill.

The site is located in a designated liquefaction hazard zone as shown on the Seismic Hazard Zones map issued by the State of California.

The referenced report is acceptable, provided the following conditions are complied with during site development:

1. The design recommendations presented in the referenced report by Geotechnologies, dated 01/22/2024, are not approved at this time.

2. Prior to issuance of any building or grading permits, a comprehensive geotechnical report with detailed engineering analyses and grading and foundation recommendations shall be submitted to the Department for review and approval.

Leila Etaat
LE / le
Log No. 130012
213-482-0480

cc: Applicant
Geotechnologies, Project Consultant
VN District Office

Geotechnologies, Inc.
Consulting Geotechnical Engineers

439 Western Avenue
Glendale, California 91201-2837
818.240.9600 • Fax 818.240.9675

May 11, 2022
Revised January 22, 2024
File Number 22241

Eyestone Environmental
2121 Rosecrans Avenue, Suite 3355
El Segundo, California 90245

Attention: Stephanie Eyestone-Jones

Subject: Geotechnical Engineering Evaluation
Radford Studio Center Project
4024 – 4200 North Radford Avenue, Los Angeles, California

Ladies and Gentlemen:

This letter transmits the Geotechnical Engineering Evaluation for the Project Site prepared by Geotechnologies, Inc. The purpose of this evaluation is to discuss the subsurface conditions anticipated at the Project Site, discuss the potential for geologic and seismic hazards that could affect the Project Site, provide an opinion regarding the feasibility of the proposed Project from the geotechnical perspective, and provide general geotechnical engineering recommendations.

The subsurface conditions described herein have been projected from limited subsurface exploration and laboratory testing. The exploration and testing presented in this report should in no way be construed to reflect any variations which may occur between the exploration locations or which may result from changes in subsurface conditions.

Should you have any questions please contact this office.

Respectfully submitted,
GEOTECHNOLOGIES, INC.

REGISTERED PROFESSIONAL ENGINEER
GREGORIO VARELA
No. 81201
Exp. 9/30/25
CIVIL
STATE OF CALIFORNIA

GREGORIO VARELA
R.C.E. 81201

GV:km

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**LOS ANGELES, CALIFORNIA**

## INTRODUCTION

This report presents the Geotechnical Engineering Evaluation for Radford Studio Center located at 4024, 4064 and 4200 North Radford Avenue ("Project Site") prepared by Geotechnologies, Inc. The purpose of this evaluation is to discuss the subsurface conditions anticipated at the Project Site, discuss the potential for geologic and seismic hazards that could affect the Project Site, and provide an opinion regarding the feasibility of the proposed Project from the geotechnical perspective.

This evaluation is not intended for submission to the building official for building permit purposes. Once the plans are prepared for individual buildings during the City's regulatory building permit process, we recommend that a comprehensive geotechnical engineering investigation, suitable for submission to the building official, be prepared. Supplemental subsurface exploration and laboratory testing, as well as the re-evaluation of the design parameters provided herein, will be required to meet the standards of a final geotechnical investigation required prior to issuance of building permits. Separate investigations may be required pursuant to the City's regulatory building permit process to address the individual structures proposed under the Radford Studio Center Specific Plan (Specific Plan).

This evaluation included a review of 22 prior geotechnical engineering investigations conducted at the Project Site by this firm, excavation of five new exploratory borings, collection of representative samples, laboratory testing, engineering analysis, review of published geologic data, review of available geotechnical engineering information and the preparation of this report. The exploratory excavation locations are shown on the enclosed Site Plans (Exhibits 1 and 2). The results of the exploration and the laboratory testing are presented in Exhibits 7 through 10 of this report.

## PROPOSED PROJECT

Information concerning the proposed Radford Studio Center Project (Project) was furnished by Radford Studio Center, and by the office of Skidmore, Owings and Merrill Architects. The Project entails the continuation of the existing studio use and the modernization and expansion of Radford Studio Center through the proposed Specific Plan. The Project includes the development of up to approximately 1,667,010 square feet of new sound stage, production support, production office, creative office, and retail uses within the Project Site, as well as associated ingress/egress, circulation, parking, landscaping, and open space improvements. The proposed new buildings could range in height from approximately 60 feet to up to 135 feet. The Project would result in excavation depths of up to approximately 50 feet below existing grade.

## SITE CONDITIONS

The Project Site is located at 4024, 4064 and 4200 North Radford Avenue, in the Studio City area of the City of Los Angeles, California. As shown in the enclosed Vicinity Map (Exhibit 1), the Project Site is comprised of two addressed parcels located at 4024 and 4064 North Radford Avenue (APN 2368-005-011; referred to herein as the South Lot) and 4200 North Radford Avenue (APN 2368-001-028; referred to herein as the North Lot) and two unaddressed parcels located within and around the Los Angeles River (APN 2368-001-029) and Tujunga Wash (APN 2368-001-030). These two lots are divided by the Los Angeles River Channel. The Project Site is currently improved with approximately 1,179,110 square feet of studio-related uses, including sound stage, production support, production office and creative office uses, as well as parking and basecamp. The conditions for the South Lot and North Lot are described below.

South Lot

The South Lot is approximately 32.24 acres in area (post dedications/mergers), bounded by the Los Angeles River to the north and east, an alley to the south with varying commercial uses across the alley fronting Ventura Boulevard, and Radford Avenue to the west.

Based on a review of the Topographic Site Surveys prepared by KPFF, dated August 9, 2022, the majority of the South Lot generally slopes both from its southwest corner to its northwest corner with approximately 27 feet of elevation change (from approximately 617 to 590 feet above mean sea level [AMSL]), and from its southwest corner to its southeast corner with approximately 17 feet of elevation change (from approximately 617 to 600 feet AMSL). The access road on the north side of the South Lot slopes from northwest to southeast from approximately 595 to 585 feet AMSL before sloping back up to approximately 605 feet AMSL. From the edge of this access road on the southeast corner of the South Lot to the Los Angeles River, there is a steeper drop-off from approximately 600 to 583 feet AMSL. The existing area to the north of the Los Angeles River generally slopes from northwest to southeast from approximately 600 to 581 feet AMSL.

In the vicinity of the South Lot, the finished grade elevation observed at the bottom of the Los Angeles River Channel ranges between approximately 573 feet AMSL to the west, to approximately 565 feet AMSL to the east.

North Lot

The North Lot is approximately 12.7 acres in area (post-dedications/mergers), bounded by the Tujunga Wash to the north and east, the Los Angeles River to the south, and Radford Avenue to the west.

Based on a review of the Topographic Site Surveys prepared by KPFF, dated August 9, 2022, the majority of the North Lot is relatively level, sloping from the northwest corner to the southeast corner with approximately 15 feet of elevation change (from approximately 600 to 585 feet AMSL). The access road on the north side of the North Lot (south of the Tujunga Wash) also slopes from northwest to southeast from approximately 600 to 585 feet AMSL. The access road on the south side of the North Lot (north of the Los Angeles River) slopes from west to east from approximately 595 to 585 feet AMSL.

In the vicinity of the North Lot, the finished grade elevation observed at the bottom of the Los Angeles River Channel ranges between approximately 573 feet AMSL to the west, to approximately 570 feet AMSL to the east. The finished grade elevation observed at the bottom of the Tujunga Wash Channel ranges between approximately 581 feet AMSL to the north, to approximately 571 feet AMSL to the south.

## RESEARCH

Over the past 30 years, Geotechnologies, Inc. has prepared 22 geotechnical engineering investigations within the South Lot and North Lot. A total of 84 borings were excavated for the preparation of these previous investigations. Forty-five borings were excavated in the South Lot, while 39 borings were excavated in the North Lot. These previous borings were conducted to depths ranging between 10 and 120 feet below the ground surface.

The enclosed Site Plans (Exhibits 2 and 3) show the location of these previous borings, as well as a summary of the conditions observed for each boring, including fill depth, groundwater depth (if observed), and bedrock depth (if observed).

# GEOTECHNICAL EXPLORATION

## FIELD EXPLORATION

On March 16, 17, 18 and 19, 2022, six borings were drilled within the South Lot for the preparation of this current evaluation. The borings were drilled to depths between 30 and 80 feet below the existing grade, with the aid of a truck-mounted drilling machine using 8-inch diameter hollowstem augers. The location of these six borings is shown on the enclosed Site Plan - South Lot (Exhibit 2), and the geologic materials encountered are logged on Plates A-1 through A-6 (Exhibit 7).

The location and elevation of the borings were approximated from information presented in the Topographic Site Surveys prepared by KPFF, dated August 9, 2022.

### Geologic Materials

#### South Lot

During this and previous explorations, the South Lot was observed to be underlain by fill materials, native alluvial soils, and bedrock.

Fill materials are not considered to be suitable for the support of new foundations, slabs, or additional fill. The fill observed throughout the South Lot is relatively thin for most of its area, getting deeper in the vicinity of the Los Angeles River. For most of this lot, the fill depths generally range between 3 and 8 feet below grade. However, in the vicinity of the Los Angeles River, the fill was observed to depths ranging between 10 and 25½ feet below grade. Because the natural watercourse of the Los Angeles River was typically wider than the existing channel, it is the opinion of this firm that the deep fill observed in the vicinity of the Los Angeles River consists of backfill placed during the construction of the channel.

Native alluvial soils were observed underlying the fill in all exploratory borings. The observed native alluvial soils are considered suitable for the support of new foundations, slabs, or additional fill. The native alluvial soils consist of interlayered mixtures of sand, clay and silt, which are moist to wet, generally brown to grayish brown in color, medium dense to very dense, or stiff to very stiff, and fine to coarse grained, with occasional layers containing gravel and cobbles.

As noted in Exhibit 2, bedrock was encountered in six of the borings excavated within the southern portion of the South Lot, at depths ranging between 45 and 75 feet below grade. The bedrock consists of siltstone of the Miocene Monterey formation. The bedrock is light gray to dark gray in color, moist, and moderately hard to hard.

North Lot

Based on the number of borings previously excavated by this firm within the North Lot, the excavation of new borings was not considered to be necessary for the preparation of this evaluation. During previous explorations, the North Lot was observed to be underlain by fill materials and native alluvial soils.

Fill materials are generally considered not suitable for the support of new foundations, slabs, or additional fill. Within the North Lot, the fill was observed to be deep in the vicinity of the Los Angeles River and a portion of the Tujunga Wash, and relatively shallow throughout the rest of the lot. In the vicinity of the Los Angeles River and a portion of the Tujunga Wash, the fill was observed to range between 12½ and 34 feet in depth below grade. Throughout the rest of the lot, the fill depth ranged between 1 and 8½ feet below grade. Because the natural watercourse of the Los Angeles River was typically wider than the existing channel, it is the opinion of this firm that the deep fill observed in the vicinity of the Los Angeles River consists of backfill placed during the construction of the channel.

Native alluvial soils were observed underlying the fill in all exploratory borings. The observed native alluvial soils are considered suitable for the support of new foundations, slabs, or additional fill. The native alluvial soils consist of interlayered mixtures of sand, clay and silt, which are moist to wet, generally brown to grayish brown in color, medium dense to very dense, or stiff to very stiff, and fine to coarse grained, with occasional layers containing gravel and cobbles.

## Groundwater

### South Lot

The historically highest groundwater level for the South Lot was determined by reviewing the California Geological Survey Seismic Hazard Zone Report of the Van Nuys Quadrangle, Plate 1.2 entitled "Historically Highest Ground Water Contours" (2005). This plate demonstrates that the historically highest groundwater level at the South Lot ranges from a depth of 0 feet (the existing ground surface) at the northern portion of this lot, to a depth of 10 feet below the existing surface within the central portion of this lot, to a depth of 20 feet below the existing surface within the southern portion of this lot. A copy of this plate has been enclosed herein as Exhibit 5. In addition, the historically highest groundwater level contours have been over imposed in the enclosed Site Plans.

The table below provides a summary of the groundwater levels observed in exploratory borings drilled in the South Lot within the past 10 years:

| Boring No. | File No. | Year of Drilling | Depth to Groundwater (ft) | Top of Boring Elevation (ft)* | Groundwater Elevation (ft)* |
|---|---|---|---|---|---|
| B4 | 22241 | 2022 | 41.5 | 586 | 544.5 |
| B5 | 22241 | 2022 | 30.0 | 586 | 556.0 |
| B6 | 22241 | 2022 | 42.0 | 610 | 568.0 |
| B1 | 21365 | 2017 | 32.5 | 604 | 571.5 |
| B1 | 21234 | 2016 | 36.0 | 614 | 578.0 |
| B2 | 21234 | 2016 | 34.4 | 615 | 580.6 |
| B3 | 21234 | 2016 | 34.0 | 615 | 581.0 |

*Based on elevation contours presented in the NavigateLA Website

North Lot

The historically highest groundwater level for the North Lot was determined by reviewing the California Geological Survey Seismic Hazard Zone Report of the Van Nuys Quadrangle, Plate 1.2 entitled "Historically Highest Ground Water Contours" (2005). This plate demonstrates that the historically highest groundwater level for the entire North Lot corresponds to a depth of 0 feet (the existing ground surface). A copy of this plate has been enclosed herein as Exhibit 5. In addition, the historically highest groundwater level contours have been over imposed in the enclosed Site Plans.

Groundwater was encountered in only three of the 39 borings previously drilled at the North Lot. The groundwater was observed in these three borings at depths of 58, 65½ and 73 feet below the existing site grade. These groundwater levels were observed during explorations conducted in 1993 and 2003.

Fluctuations in the level of groundwater may occur due to variations in rainfall, temperature, and other factors not evident at the time of the measurements reported herein. Fluctuations also may occur across the Project Site.

## Caving

Some of the granular native soils are susceptible to caving. Caving is to be prevented during construction by stabilizing the proposed excavations using best practices.

## METHANE ZONES

This office has reviewed the City of Los Angeles Methane and Methane Buffer Zones map. Based on this review it appears that the Project Site is not located within a Methane Zone or Methane Buffer Zone, as designated by the City.

# SEISMIC EVALUATION

## REGIONAL GEOLOGIC SETTING

The Project Site is located in the Transverse Ranges Geomorphic Province (Transverse Ranges). The Transverse Ranges are characterized by roughly east-west trending mountains and the northern and southern boundaries are formed by reverse fault scarps. The convergent deformational features of the Transverse Ranges are a result of north-south shortening due to plate tectonics. This has resulted in local folding and uplift of the mountains along with the propagation of thrust faults (including blind thrusts). The intervening valleys have been filled with sediments derived from the bordering mountains (Yerkes, 1965).

## REGIONAL FAULTING

Based on criteria established by the California Division of Mines and Geology (CDMG) now called California Geologic Survey (CGS), faults may be categorized as Holocene-active, Pre-Holocene faults, and Age-undetermined faults. Holocene-active faults are those which show evidence of surface displacement within the last 11,700 years. Pre-Holocene faults are those that have not moved in the past 11,700 years. Age-undetermined faults are faults where the recency of fault movement has not been determined.

Buried thrust faults are faults without a surface expression but are a significant source of seismic activity. They are typically broadly defined based on the analysis of seismic wave recordings of hundreds of small and large earthquakes in the southern California area. Due to the buried nature of these thrust faults, their existence is usually not known until they produce an earthquake. The risk for surface rupture potential of these buried thrust faults is inferred to be low (Leighton, 1990). However, the seismic risk of these buried structures in terms of recurrence and maximum potential magnitude is not well established. Therefore, the potential for surface rupture on these surface-verging splays at magnitudes higher than 6.0 cannot be precluded.

The three Holocene-active faults located nearest to the Project Site are described below:

Hollywood Fault

The Hollywood Fault is part of the Transverse Ranges Southern Boundary fault system. The Hollywood Fault is located approximately 3.3 miles south of the Project Site. This fault trends east-west along the base of the Santa Monica Mountains from the West Beverly Hills Lineament in the West Hollywood–Beverly Hills area to the Los Feliz area of Los Angeles. The Hollywood Fault is the eastern segment of the reverse oblique Santa Monica–Hollywood fault. Based on geomorphic evidence, stratigraphic correlation between exploratory borings, and fault trenching studies, this fault is classified as active.

Until recently, the approximately 9.3-mile-long Hollywood Fault was considered to be expressed as a series of linear ground-surface geomorphic expressions and south-facing ridges along the south margin of the eastern Santa Monica Mountains and the Hollywood Hills. Multiple recent fault rupture hazard investigations have shown that the Hollywood Fault is located south of the ridges and bedrock outcroppings along portions of Sunset Boulevard. The Hollywood Fault has not produced any damaging earthquakes during the historical period and has had relatively minor micro-seismic activity. It is estimated that the Hollywood Fault is capable of producing a maximum 6.7 magnitude earthquake. In 2014, the CGS established an Earthquake Fault Zone for the Hollywood Fault.

Santa Monica Fault

The Santa Monica Fault, located approximately 4.6 miles to the southwest of the Project Site, is a part of the Transverse Ranges Southern Boundary fault system. The Santa Monica Fault extends east from the coastline in Pacific Palisades through Santa Monica and West Los Angeles and merges with the Hollywood fault at the West Beverly Hills Lineament in Beverly Hills where its strike is northeast. It is believed that at least six surface ruptures have occurred in the past 50 thousand years. In addition, a well-documented surface rupture occurred between 10 and 17 thousand years ago, although a more recent earthquake probably occurred 1 to 3 thousand years ago. This leads to an average earthquake recurrence interval of 7 to 8 thousand years.[a] It is thought that the Santa Monica Fault System may produce earthquakes with a maximum magnitude of 7.4.

The CGS has recently established an Earthquake Fault Zone for the Santa Monica Fault, as shown in the Earthquake Zones of Required Investigation for the Beverly Hills Quadrangle, dated January 11, 2018.

Newport-Inglewood Fault System

The Newport-Inglewood Fault System is located approximately 7.0 miles to the southwest of the Project Site. The Newport-Inglewood Fault Zone is a broad zone of discontinuous north to northwestern echelon faults and northwest to west trending folds. The fault zone extends southeastward from West Los Angeles, across the Los Angeles Basin, to Newport Beach and possibly offshore beyond San Diego (Barrows, 1974; Weber, 1982; Ziony, 1985).

The onshore segment of the Newport-Inglewood Fault Zone extends for about 37 miles from the Santa Ana River to the Santa Monica Mountains. Here it is overridden by, or merges with, the east-west trending Santa Monica zone of reverse faults.

The surface expression of the Newport-Inglewood Fault Zone is made up of a strikingly linear alignment of domal hills and mesas that rise on the order of 400 feet above the surrounding plains. From the northern end to its southernmost onshore expression, the Newport-Inglewood Fault Zone is made up of: Cheviot Hills, Baldwin Hills, Rosecrans Hills, Dominguez Hills, Signal Hill-

[a] *Southern California Earthquake Center, a National Science Foundation and U.S. Geological Survey Center. Active Faults in the Los Angeles Metropolitan Region, www.scec.org/research/special/SCEC001activefaultsLA.pdf; accessed May, 2022.*

Reservoir Hill, Alamitos Heights, Landing Hill, Bolsa Chica Mesa, Huntington Beach Mesa, and Newport Mesa. Several single and multiple fault strands, arranged in a roughly left stepping en echelon arrangement, make up the fault zone and account for the uplifted mesas.

The most significant earthquake associated with the Newport-Inglewood Fault Zone was the Long Beach earthquake of 1933 with a magnitude of 6.3 on the Richter scale. It is believed that the Newport-Inglewood Fault Zone is capable of producing a 7.5 magnitude earthquake.

## SEISMIC HAZARDS AND DESIGN CONSIDERATIONS

The primary geologic hazard at the Project Site is moderate to strong ground motion (acceleration) caused by an earthquake on any of the local or regional faults. The potential for other earthquake-induced hazards was also evaluated including surface rupture, liquefaction, dynamic settlement, inundation and landsliding.

### Surface Rupture

In 1972, the Alquist-Priolo Special Studies Zones Act (now known as the Alquist-Priolo Earthquake Fault Zoning Act) was passed into law. As revised in 2018, the Act defines "Holocene-active" faults utilizing the same aging criteria as that used by CGS. However, established state policy has been to zone only those faults which have direct evidence of movement within the last 11,700 years. It is this recency of fault movement that the CGS considers as a characteristic for faults that have a relatively high potential for ground rupture in the future.

CGS policy is to delineate a boundary from 200 to 500 feet wide on each side of the Holocene-active fault trace based on the location precision, the complexity, or the regional significance of the fault. If a site lies within an Earthquake Fault Zone, a geologic fault rupture investigation must be performed that demonstrates that the proposed building site is not threatened by surface displacement from the fault before building permits may be issued.

Ground rupture is defined as surface displacement which occurs along the surface trace of the causative fault during an earthquake. Based on research of available literature and results of Project Site reconnaissance, no known Holocene-active or Pre-Holocene faults underlie the Project Site. In addition, the subject site is not located within an Earthquake Fault Zone. The nearest Fault Zone is located approximately 3 miles to the south of the Project Site and corresponds to the Hollywood Fault.

Based on the absence of faults mapped near the Project Site, the potential for surface ground rupture at the Project Site is considered low.

**Liquefaction**

Liquefaction is a phenomenon in which saturated silty to cohesion less soils below the groundwater table are subject to a temporary loss of strength due to the buildup of excess pore pressure during cyclic loading conditions such as those induced by an earthquake. Liquefaction-related effects include loss of bearing strength, amplified ground oscillations, lateral spreading, and flow failures.

The Earthquake Zones of Required Investigation of the Van Nuys Quadrangle (CDMG, 1999) classifies the Project Site as part of a liquefiable area. This determination is based on groundwater depth records, soil type and distance to a fault capable of producing a substantial earthquake. A copy of the Earthquake Zones of Required Investigation Map is enclosed herein as Exhibit 6.

Two site-specific liquefaction analyses were recently performed following the Recommended Procedures for Implementation of the California Geologic Survey Special Publication 117A (SP117A), Guidelines for Analyzing and Mitigating Seismic Hazards in California (CGS, 2008), and the EERI Monograph (MNO-12) by Idriss and Boulanger (2008). This semi-empirical method is based on a correlation between measured values of Standard Penetration Test (SPT) resistance and field performance data. Both the historically highest groundwater level and the current groundwater level from each location were utilized for their individual liquefaction analysis. These analyses are presented in Exhibit 11.

Section 11.8.3 of ASCE 7-16 indicates that the potential for liquefaction shall be evaluated utilizing an acceleration consistent with the Maximum Considered Earthquake Geometric Mean ($MCE_G$) Peak Ground Acceleration (PGA). Utilizing the Office of Statewide Health Planning and Development (OSHPD) seismic utility program, this corresponds to a Site Modified Peak Ground Acceleration ($PGA_M$) of 0.96g. The United States Geological Survey (USGS) Probabilistic Seismic Hazard Deaggregation program (USGS, 2014) indicates a PGA of 0.90g (2 percent in 50 years ground motion) and a mean magnitude of 6.9 for the Project Site. The liquefaction potential evaluations were performed by utilizing a magnitude 6.9 earthquake, and a peak horizontal acceleration of 0.96g.

The enclosed "Empirical Estimations of Liquefaction Potential" are based on the recently excavated Borings B1 and B6. SPT data were collected at 5-foot intervals. Samples of the collected materials were conveyed to the laboratory for testing and analysis. The percent passing a Number 200 sieve is presented on the enclosed E-Plates (Exhibit 9).

The procedure presented in the SP117A guidelines was followed in analyzing the liquefaction potential of the Project Site. The SP117A guidelines were developed based on a paper titled, "Assessment of the Liquefaction Susceptibility of Fine-Grained Soils", by Bray and Sancio (2006). According to the SP117A guidelines, soils having a Plastic Index greater than 18 exhibit clay-like behavior, and the liquefaction potential of these soils are considered to be low. Therefore, where the results of Atterberg Limits testing showed a Plastic Index greater than 18, the soils would be considered non-liquefiable, and the analysis of these soil layers was turned off in the liquefaction susceptibility column. The results of Atterberg Limits testing are shown in Exhibit 10.

Based on SP117A, a factor of safety against the occurrence of liquefaction greater than about 1.3 can be considered an acceptable level of risk where high-quality, site-specific penetration resistance and geotechnical laboratory data is collected. The site-specific liquefaction analyses included in Exhibit 11 demonstrate that the Project Site soils analyzed would have a factor of safety significantly higher than 1.3. Therefore, the analyzed soils would not be prone to liquefaction during the ground motion expected during the design basis earthquake. Furthermore, the Project Site soils analyzed are not expected to be affected by potential impacts related to liquefaction, such as lateral spreading and surface manifestation. Please note that additional liquefaction analyses will be necessary for the preparation of future geotechnical engineering investigations for individual buildings.

## Dynamic Dry Settlement

Seismically-induced settlement or compaction of dry or moist, cohesionless soils can be an effect related to earthquake ground motion. Such settlements are typically most damaging when the settlements are differential in nature across the length of structures.

Some seismically-induced settlement of the proposed structures should be expected as a result of strong ground-shaking. However, due to the uniform nature of the underlying geologic materials, the differential settlement is expected to be negligible.

## Tsunamis, Seiches and Flooding

Tsunamis are large ocean waves generated by sudden water displacement caused by a submarine earthquake, landslide, or volcanic eruption. Review of the County of Los Angeles Flood and Inundation Hazards Map, Leighton (1990), demonstrates that the Project Site does not lie within the mapped tsunami inundation boundaries.

Seiches are oscillations generated in enclosed bodies of water which can be caused by ground shaking associated with an earthquake. Review of the County of Los Angeles Flood and Inundation Hazards Map, (Leighton, 1990), demonstrates that a portion of the South Lot, and the entire North Lot, lie within the mapped inundation boundaries of the Sepulveda and Hansen Dams.

Review of the applicable Flood Insurance Rate Map (06037C1320F) indicates that the entire Project Site lies within an area of minimal flood hazard.

### Landsliding

The probability of seismically-induced landslides occurring on the Project Site is considered to be remote since the future Project will improve the existing elevation profile of the Project Site by eliminating existing slopes.

## CONCLUSIONS AND RECOMMENDATIONS

Based upon the exploration, laboratory testing, and research, it is the preliminary finding of Geotechnologies, Inc. that construction of the proposed Radford Studio Center Project is considered feasible from a geotechnical engineering standpoint.

This evaluation is not intended for submission to the building official for building permit purposes. Once the plans are prepared for individual buildings during the City's regulatory building permit process, we recommend that a comprehensive geotechnical engineering investigation, suitable for submission to the building official, be prepared. Supplemental subsurface exploration and laboratory testing, as well as the re-evaluation of the design parameters provided herein, will be required to meet the standards of a final geotechnical investigation required prior to issuance of building permits. Separate investigations may be required pursuant to the City's regulatory building permit process to address the individual structures proposed under the Radford Studio Center Specific Plan (Specific Plan).

General Conclusion and Recommendations

The type of foundations suitable for an individual structure will primarily depend on the depth of the structure relative to the design-based groundwater level, the type of geologic materials that underlie the building site, and the loading demand of the proposed structure. It is our understanding that the depth of the proposed development will vary from at-grade to up to three subterranean levels. Both the design-based groundwater level and the distribution of geologic materials were found to be variable throughout the Project Site.

Both the South and North Lots are underlain by fill materials and native alluvial soils. Bedrock of the Monterey Formation was observed underlying the native alluvium only within the southern portion of the South Lot, at depths ranging between approximately 45 and 75 feet below grade. The existing fill is not considered suitable for support of new foundations, slabs on grade, or additional fill. However, the existing fill may be reutilized in the preparation of a compacted fill pad. The native alluvial soils and bedrock are considered suitable for support of the proposed development.

The depth of fill observed within the level portions of the Project Site is relatively shallow, ranging between approximately 3 and 8 feet below grade for the South Lot, and between approximately 1 and 8½ feet below grade for the North Lot. For both lots, the fill depth increases in the vicinity of the Los Angeles River and Tujunga Wash. For the South Lot, the depth of fill observed in the vicinity of the Los Angeles River ranged between approximately 10 and 25½ feet below grade. For the North Lot, the depth of fill observed in the vicinity of the Los Angeles River and a portion of the Tujunga Wash ranged between approximately 12½ and 34 feet below grade. Because the natural watercourse of the Los Angeles River was typically wider than the existing channel, it is the opinion of this firm that the deep fill observed in the vicinity of the Los Angeles River consists of backfill placed during the construction of the channel.

Groundwater was observed in a few of the borings excavated at both lots. In the case of the South Lot, groundwater was observed at depths ranging between approximately 30 and 42 feet below grade for borings drilled within the past 10 years. These depths correspond to approximate elevations ranging between 544.5 and 581.0 feet. In the case of the North Lot, the groundwater was observed at depths ranging between approximately 58 and 73 feet below grade, for borings drilled in 1993 and 2003.

It should be noted that the City of Los Angeles, Department of Building and Safety (LADBS) requires that the historically highest groundwater level is obtained for a project site. If this historically highest groundwater level is higher than the actual groundwater level, LADBS will require that the development be designed for the historically highest groundwater level. The historically highest groundwater level for both lots was established by reviewing CGS Seismic Hazard Zone Report of the Van Nuys Quadrangle, Plate 1.2 entitled "Historically Highest Ground Water Contours" (2005). Review of this plate demonstrates that the historically highest groundwater level at the South Lot ranges from a depth of 0 feet (the existing ground surface) at the northern portion of this lot, to a depth of approximately 10 feet below the existing surface within the central portion of this lot, to a depth of approximately 20 feet below the existing surface within the southern portion of this lot. The historically highest groundwater level for the entire North Lot corresponds to a depth of 0 feet (the existing ground surface). The historically highest groundwater level contours have been over imposed in the enclosed Site Plans.

For both lots, the historically highest groundwater level is substantially higher than the observed groundwater level. Where elements of a proposed structure extend below the historically highest groundwater levels and/or the current groundwater level, LADBS requires that the structure should either be designed to resist potential hydrostatic forces, or a permanent dewatering system should be installed so that external water pressure does not develop against the proposed retaining walls and floor slabs. It is the recommendation of this firm that where a structure will extend below the historically highest groundwater level, this structure be designed to resist hydrostatic forces in lieu of installation of a permanent dewatering system. This eliminates the need for maintenance of a permanent dewatering system and continuous handling, testing, and possible treatment of waters pumped from the system. In addition, it would not be necessary to comply with future changes in water quality standards for collected and released groundwater.

Under the hydrostatic design approach, the retaining walls, foundations and slabs-on-grade would be designed to resist hydrostatic uplift based on the historically highest groundwater level. Based on the potential hydrostatic uplift, it is anticipated that a mat foundation system will be required where the bottom of a structure will extend below the historically highest groundwater level. A mat foundation system should also be anticipated for the heavier structures, even if the bottom of these structures will be located above the historically highest groundwater level. Preliminarily, and for the purpose of the preparation of this report, these heavier structures may consist of structures which are more than 100 feet in height. Mat foundations must bear in undisturbed native alluvial soils, or a properly compacted fill pad.

A conventional foundation system will be feasible for support of the lighter structures, if the bottom of these structures will be located above the historically highest groundwater level. Preliminarily, and for the purpose of the preparation of this report, these lighter structures may consist of structures which are 100 feet, or less, in height. Conventional foundations shall bear in undisturbed native alluvial soils, or a properly compacted fill pad.

If the structures proposed in the vicinity of the Los Angeles River and Tujunga Wash will be built near the existing grade, and existing fill materials will be exposed at the subgrade of the proposed structure, it is recommended that these fill materials are completely removed and recompacted for support of conventional or mat foundations. As an alternative, the fill materials may be left in place if these structures are designed to be entirely supported on a deep pile foundation system. A structural slab would be required where the fill is left in place.

Where preparation of a compacted fill pad is required for support of a structure, all existing fill materials and upper native alluvial soils should be removed and recompacted to a minimum depth of 3 feet below the bottom of the proposed foundations. In addition, the compacted fill pad should extend horizontally beyond the edge of the foundations, for a minimum distance of 3 feet, or a distance equal to the depth of fill placed below the bottom of the foundations, whichever is greater.

Temporary unsurcharged vertical excavations are feasible up to a maximum height of 5 feet. Temporary excavations may be cut at a 1:1 gradient up to a height of 20 feet, at a 1½:1 (horizontal:vertical) up to a height of 30 feet, and at a 2:1 (h:v) up to a height of 40 feet. Vertical excavations exceeding a height of 5 feet must be shored.

## SEISMIC DESIGN CONSIDERATIONS

### California Building Code Seismic Parameters

Based on information derived from the subsurface investigation, the Project Site is classified as Site Class D, which corresponds to a "Stiff Soil" Profile, according to Table 20.3-1 of ASCE 7-16. This information and the Project Site coordinates were input into the OSHPD seismic utility program in order to calculate ground motion parameters for the Project Site.

| CALIFORNIA BUILDING CODE SEISMIC PARAMETERS | |
|---|---|
| California Building Code | 2022 |
| ASCE Design Standard | 7-16 |
| Risk Category | II |
| Site Class | D |
| Mapped Spectral Acceleration at Short Periods ($S_S$) | 2.071g |
| Site Coefficient ($F_a$) | 1.0 |
| Maximum Considered Earthquake Spectral Response for Short Periods ($S_{MS}$) | 2.071g |
| Five-Percent Damped Design Spectral Response Acceleration at Short Periods ($S_{DS}$) | 1.381g |
| Mapped Spectral Acceleration at One-Second Period ($S_1$) | 0.723g |
| Site Coefficient ($F_v$) | 1.7* |
| Maximum Considered Earthquake Spectral Response for One-Second Period ($S_{M1}$) | 1.229g* |
| Five-Percent Damped Design Spectral Response Acceleration for One-Second Period ($S_{D1}$) | 0.819g* |

* *According to ASCE 7-16, a Long Period Site Coefficient ($F_v$) of 1.7 may be utilized provided that the value of the Seismic Response Coefficient ($C_s$) is determined by Equation 12.8-2 for values of $T \leq 1.5T_s$ and taken as equal to 1.5 times the value computed in accordance with either Equation 12.8-3 for $T_L \geq T > 1.5T_s$ or equation 12.8-4 for $T > T_L$. Alternatively, a site-specific ground motion hazard analysis may be performed in accordance with ASCE 7-16 Section 21.1 and/or a ground motion hazard analysis in accordance with ASCE 7-16 Section 21.2 to determine ground motions for any structure.*

## EXPANSIVE SOILS

The upper geologic materials found in the Project Site typically range between the very low and moderate expansion range.

## COLLAPSIBLE SOILS

The native soils and bedrock are not considered collapsible, or prone to hydroconsolidation.

## WATER-SOLUBLE SULFATES

The Portland cement portion of concrete is subject to attack when exposed to water-soluble sulfates. Usually the two most common sources of exposure are from soil and marine environments.

The sources of natural sulfate minerals in soils include the sulfates of calcium, magnesium, sodium, and potassium. When these minerals interact and dissolve in subsurface water, a sulfate concentration is created, which will react with exposed concrete. Over time sulfate attack will destroy improperly proportioned concrete well before the end of its intended service life.

The water-soluble sulfate content of the upper geologic materials found in both lots typically ranges between less than 0.1 and less than 0.2 percentage by weight. Based on the most recent revision to American Concrete Institute (ACI) Standard 318, this sulfate exposure ranges from negligible to moderate, and Type II cement may be utilized for concrete foundations in contact with the site soils.

## TEMPORARY DEWATERING

Temporary dewatering should be expected where the groundwater level observed during exploration is higher than the anticipated bottom of a proposed structure.

Groundwater was observed in only three of the 39 borings previously drilled at the North Lot, at depths of 58, 65½ and 73 feet below the existing site grade. It is our understanding that the deepest structure proposed within the North Lot will have two subterranean levels. Therefore, temporary dewatering is not expected to be required at the North Lot. This is based on groundwater levels recorded in 1993 and 2003, and will be confirmed after supplemental exploration is conducted in the future for individual buildings during the regulatory building permit process.

For the South Lot, the groundwater level was observed to range between approximately 30 and 42 feet below the existing grade, which corresponds to an elevation ranging between approximately 544.5 and 581 feet AMSL. The current groundwater level generally descends to the northeast, with the shallowest groundwater level occurring within the southwestern portion of the South Lot. The deepest proposed structure will be located along the southern portion of the South Lot. The approximate subgrade of this structure will be at an elevation of 565 feet AMSL, which will extend up to 50 feet below the existing grade. Therefore, temporary dewatering should be expected to be required during construction of this structure. Temporary dewatering is not anticipated for the rest of the structures, as their proposed finished floor elevations are expected to be above the current groundwater level.

## GRADING GUIDELINES

### Site Preparation

- A thorough search should be made for possible underground utilities and/or structures. Any existing or abandoned utilities or structures located within the footprint of the proposed grading should be removed or relocated as appropriate.

- All vegetation, existing fill, and soft or disturbed geologic materials should be removed from the areas to receive controlled fill. All existing fill materials and any disturbed geologic materials resulting from grading operations should be completely removed and properly recompacted prior to foundation excavation.

- Any vegetation or associated root system located within the footprint of the proposed structures should be removed during grading.

- Subsequent to the indicated removals, the exposed grade should be scarified to a depth of six inches, moistened to optimum moisture content, and recompacted in excess of the minimum required comparative density.

- The excavated areas should be observed by the geotechnical engineer prior to placing compacted fill.

**Compaction**

LADBS requires a minimum comparative compaction of 95 percent of the laboratory maximum density where the soils to be utilized in the fill have less than 15 percent finer than 0.005 millimeters. Fill materials having more than 15 percent finer than 0.005 millimeters may be compacted to a minimum of 90 percent of the maximum density. Comparative compaction is defined as the ratio of the in-place density to the maximum density as determined by applicable the American Society of Testing and Materials (ASTM) testing.

All fill should be mechanically compacted in layers not more than 8 inches thick. The materials should be moisture-conditioned to within 3 percent of the optimum moisture content of the particular material placed. All fill should be compacted to at least 90 percent (or 95 percent for cohesionless soils having less than 15 percent finer than 0.005 millimeters) of the maximum laboratory density for the materials used. The maximum density should be determined by the laboratory operated by Geotechnologies, Inc. in general accordance with the most recent revision of ASTM D 1557.

Field observation and testing should be performed by a representative of the geotechnical engineer during grading to assist the contractor in obtaining the required degree of compaction and the proper moisture content. Where compaction is less than required, additional compactive effort should be made with adjustment of the moisture content, as necessary, until a minimum of 90 percent (or 95 percent for cohesionless soils having less than 15 percent finer than 0.005 millimeters) compaction is obtained.

**Acceptable Materials**

The excavated on-site materials are considered satisfactory for reuse in the controlled fills as long as any debris, organic matter and deleterious materials are removed. Cobbles were occasionally observed during exploration. The size of cobbles to be utilized in the controlled fill should not exceed 6 inches in dimension.

Any imported materials should be observed and tested by the representative of the geotechnical engineer prior to use in fill areas. Imported materials should contain sufficient fines (particles less than 0.075 millimeters in diameter) so as to be relatively impermeable and result in a stable subgrade when compacted. Any required import materials should consist of geologic materials with an expansion index of less than 50. The water-soluble sulfate content of the import materials should be less than 0.1% by weight.

Imported materials should be free from chemical or organic substances which could affect the proposed development. A competent professional should be retained in order to test imported materials and address environmental issues and organic substances which might affect the proposed development.

**Utility Trench Backfill**

Utility trenches should be backfilled with controlled fill. The utility should be bedded with clean sands at least one foot over the crown. The remainder of the backfill may be on-site soil compacted to 90 percent (or 95 percent for cohesionless soils having less than 15 percent finer than 0.005 millimeters) of the laboratory maximum density. Utility trench backfill should be tested by representatives of this firm in general accordance with the most recent revision of ASTM D 1557.

## Wet Soils

At the time of exploration some of the soils which may be exposed during grading or at the bottom of the excavation were locally above optimum moisture content. It is anticipated that some of the excavated material to be placed as compacted fill, and some of the materials exposed at the bottom of excavated plane may require drying and aeration prior to recompaction.

Pumping (yielding or vertical deflection) of the high-moisture content soils at the bottom of the excavation may occur during operation of heavy equipment. Where pumping is encountered, angular minimum ¾-inch gravel and/or crushed concrete should be placed and worked into the subgrade. A gravel layer thickness of 1 to 2 feet is typical. However, the exact thickness of the gravel layer would be determined in the field, subject to standard protocol.

The gravel will help to densify the subgrade as well as function as a stabilization material upon which heavy equipment may operate. It is not recommended that rubber tire construction equipment attempt to operate directly on the pumping subgrade soils prior to placing the gravel. Direct operation of rubber tire equipment on the soft subgrade soils will likely result in excessive disturbance to the soils, which in turn will result in a delay to the construction schedule since those disturbed soils would then have to be removed and properly recompacted. Extreme care should be utilized to place gravel as the subgrade becomes exposed.

## Shrinkage

Shrinkage results when a volume of soil removed at one density is compacted to a higher density. A shrinkage factor between 5 and 15 percent should be anticipated when excavating and recompacting the existing fill and underlying native geologic materials on the Project Site to an average comparative compaction of 95 percent.

**Weather Related Grading Considerations**

When rain is forecast during construction, all fill that has been spread and awaits compaction should be properly compacted prior to stopping work for the day or prior to stopping due to inclement weather. These fills, once compacted, should have the surface sloped to drain to an area where water can be removed.

Temporary drainage devices should be installed to collect and transfer excess water, subject to jurisdictional regulations. Drainage should not be allowed to pond anywhere on the Project Site, and especially not against any foundation or retaining wall. Drainage should not be allowed to flow uncontrolled over any descending slope.

Work may start again, after a period of rainfall, once the Project Site has been reviewed by a representative of this office. Any soils saturated by the rain should be removed and aerated so that the moisture content will fall within three percent of the optimum moisture content.

Surface materials previously compacted before the rain should be scarified, brought to the proper moisture content and recompacted prior to placing additional fill, if considered necessary by a representative of this firm.

**Abandoned Seepage Pits**

No abandoned seepage pits were encountered during exploration and none are known to exist on the Project Site. However, should such a structure be encountered during grading, options to permanently abandon seepage pits include complete removal and backfill of the excavation with compacted fill, or drilling out the loose materials and backfilling to within a few feet of grade with slurry, followed by a compacted fill cap.

If the subsurface structures are to be removed by grading, the entire structure should be demolished. The resulting void may be refilled with compacted soil. Concrete and brick generated during the seepage pit removal may be reused in the fill as long as all fragments are less than 6 inches in the longest dimension and the debris comprise less than 15 percent of the fill by volume. All grading should comply with the recommendations of this report.

Where the seepage pit structure is to be left in place, the seepage pits should be cleaned of all soil and debris. This may be accomplished by drilling. The pits should be filled with a minimum 1½ sack concrete slurry to within 5 feet of the bottom of the proposed foundations. In order to provide a more uniform foundation condition, the remainder of the void should be filled with controlled fill.

**Geotechnical Observations and Testing During Grading**

Geotechnical observations and testing during grading are considered to be a continuation of the geotechnical investigation. It is critical that the geotechnical aspects of the Project be reviewed by representatives of Geotechnologies, Inc. during the construction process. Compliance with the design concepts, specifications or recommendations during construction requires review by this firm during the course of construction. Any fill which is placed should be observed, tested, and verified if used for engineered purposes. Please advise this office at least twenty-four hours prior to any required Project Site visit.

Proper compaction is necessary to reduce settlement of overlying improvements. Some settlement of compacted fill should be anticipated. Any utilities supported therein should be designed to accept differential settlement. Differential settlement should also be considered at the points of entry to the structure.

**LEED Considerations**

The Leadership in Energy and Environmental Design (LEED) Green Building Rating System encourages adoption of sustainable green building and development practices. Credit for LEED Certification can be assigned for reuse of construction waste and diversion of materials from landfills in new construction.

In an effort to provide the design team with a viable option in this regard, demolition debris could be crushed on-site in order to use it in the ongoing grading operations. The demolition debris should be limited to concrete, asphalt and other non-deleterious materials. All deleterious materials should be removed including, but not limited to, paper, garbage, ceramic materials and wood.

For structural fill applications, the materials should be crushed to 2 inches in maximum dimension or smaller. The crushed materials should be thoroughly blended and mixed with on-site soils prior to placement as compacted fill. The amount of crushed material should not exceed 20 percent. The blended and mixed materials should be tested by this office prior to placement to ensure they are suitable for compaction purposes. The blended and mixed materials should be tested by Geotechnologies, Inc. during placement to ensure that they have been compacted in a suitable manner.

## FOUNDATION DESIGN

### Conventional Foundations

A conventional foundation system will be feasible for support of the lighter structures, if the bottom of these structures will be located above the historically highest groundwater level. Preliminarily, and for the purpose of the preparation of this report, these lighter structures may consist of structures which are 100 feet or less in height.

Depending on the location and final depth of a proposed structure, conventional foundations may bear in undisturbed native alluvial soils, or a properly compacted fill pad.

**Mat Foundations**

It is anticipated that a mat foundation system will be required where the bottom of a structure will extend below the historically highest groundwater level, or where a structure will be relatively heavy. Preliminarily, and for the purpose of the preparation of this report, these heavier structures may consist of structures which are more than 100 feet in height. Depending on the location and final depth of a proposed structure, mat foundations should bear in undisturbed native alluvial soils, or a properly compacted fill pad.

For the South Lot, the historically highest groundwater level depth ranges from 20 feet below grade at the southern area, to the ground surface at the northern area. For the entire North Lot, the historically highest groundwater level is mapped to be at the ground surface. Therefore, any structure proposed at the North Lot, which will be serviced by a subterranean, or semi-subterranean level, should be expected to be supported on a mat foundation system.

Where constructed below the historically highest groundwater level, mat foundations should be waterproofed and designed to withstand the hydrostatic uplift pressure based on the historically highest groundwater level. The uplift pressure to be used in the design should be 62.4(H) pounds per square foot, where “H” is the height of the historically highest groundwater level above the bottom of the mat foundation in feet.

**Deep Pile Foundation Systems**

If the structures proposed directly adjacent to the Los Angeles River and Tujunga Wash will be built near the existing grade, and existing fill materials will be exposed at the subgrade of the proposed structure, it is recommended that these fill materials are completely removed and recompacted for support of the conventional or mat foundations. As an alternative, the fill materials may be left in place if these structures are designed to be entirely supported on a deep pile foundation system.

A suitable type of deep pile foundation system will vary, depending on the geologic materials found at the location of the structure. A cast-in-place friction pile will be feasible for areas where excessive caving would not be expected during drilling of the piles. An auger-cast pile system would be better suited for areas where excessive caving would be anticipated. Driven or vibrated piles are not recommended.

## RETAINING WALL DESIGN

It is anticipated that some of the proposed structures may be serviced by up to three subterranean levels. Therefore, subterranean retaining walls up to 50 feet in height may be required for the proposed development.

As previously discussed, where the bottom of a structure will extend below the historically highest groundwater level, it is recommended that the subterranean walls for the structure are entirely designed for full hydrostatic pressure. As a result of the hydrostatic design, permanent subdrains behind the basement wall are not required.

Where the proposed subterranean retaining walls will not extend below the historically highest groundwater level, these walls may be designed for a drained condition, provided that a subdrain system is installed at their base.

Additional active pressure should be added to the retaining wall design for any additional surcharge conditions, such as adjacent traffic and structures. For retaining walls greater than 6 feet in height, their design should consider the additional earth pressure caused by seismic ground shaking.

## TEMPORARY EXCAVATIONS

The anticipated temporary excavations are expected to expose fill and dense native soils, which are suitable for vertical excavations up to 5 feet where not surcharged by adjacent traffic or structures.

Vertical excavations exceeding a height of 5 feet should be shored. One method of shoring would consist of steel soldier piles, placed in drilled holes and backfilled with concrete. The soldier piles may be designed as cantilever, or laterally braced utilizing drilled tie-back anchors or raker braces.

Where sufficient space is available, temporary excavations may be cut at a 1:1 gradient up to a height of 20 feet, at a 1½:1 (h:v) up to a height of 30 feet, and at a 2:1 (h:v) up to a height of 40 feet.

## SLABS-ON-GRADE

A conventional concrete slab-on-grade will be feasible if the bottom of the proposed structure will be located above the historically highest groundwater level, and the subgrade consists of undisturbed native alluvial soils, or properly recompacted fill materials.

A structural slab-on-grade will be required where fill materials will remain below the proposed structure and the structure will be supported on a deep pile foundation system. The structural slab should also be supported on the pile foundation system.

**SITE DRAINAGE**

Proper surface drainage is critical to the future performance of the Project. Saturation of a soil can cause it to lose internal shear strength and increase its compressibility, resulting in a change in the designed engineering properties. Proper Project Site drainage should be maintained at all times.

All Project Site drainage, with the exception of any required to be disposed of onsite by stormwater regulations, should be collected and transferred to the street in non-erosive drainage devices. The proposed structure should be provided with roof drainage. Discharge from downspouts, roof drains and scuppers should not be permitted on unprotected soils within five feet of the building perimeter. Drainage should not be allowed to pond anywhere on the Project Site, and especially not against any foundation or retaining wall. Drainage should not be allowed to flow uncontrolled over any descending slope. Planters which are located within a distance equal to the depth of a retaining wall should be sealed to prevent moisture adversely affecting the wall. Planters which are located within five feet of a foundation should be sealed to prevent moisture affecting the earth materials supporting the foundation.

**STORMWATER DISPOSAL**

Recently, regulatory agencies have been requiring the disposal of a certain amount of stormwater generated on a Project Site by infiltration into the site soils. Increasing the moisture content of a soil can cause it to lose internal shear strength and increase its compressibility, resulting in a change in the designed engineering properties. This means that any overlying structure, including buildings, pavements and concrete flatwork, could sustain damage due to saturation of the subgrade soils. Structures serviced by subterranean levels could be adversely impacted by stormwater disposal by increasing the design fluid pressures on retaining walls and causing leaks in the walls. Proper Project Site drainage is critical to the performance of any structure in the built environment.

The potential for on-site stormwater infiltration will be analyzed for each individual structure during the City's regulatory building permit process. The potential for on-site stormwater infiltration will depend on the depth of the proposed structures, the distribution of the geologic materials at the specific building site, and the depth to the current groundwater level.

## DESIGN REVIEW

Engineering of the proposed Project should not begin until approval of the geotechnical report by the Building Official is obtained in writing. Significant changes in the geotechnical recommendations may result during the building department review process.

It is recommended that the geotechnical aspects of the Project be reviewed by this firm during the design process. This review provides assistance to the design team by providing specific recommendations for particular cases, as well as review of the proposed construction to evaluate whether the intent of the recommendations presented herein are satisfied.

## CONSTRUCTION MONITORING

Geotechnical observations and testing during construction are considered to be a continuation of the geotechnical investigation. It is critical that this office review the geotechnical aspects of the Project during the construction process. Compliance with the design concepts, specifications or recommendations during construction requires review by this office during the course of construction. All foundations should be observed by a representative of this office prior to placing concrete or steel. Any fill which is placed should be observed, tested, and verified if used for engineered purposes. Please advise Geotechnologies, Inc. at least twenty-four hours prior to any required Project Site visit.

If conditions encountered during construction appear to differ from those disclosed herein, notify Geotechnologies, Inc. immediately so the need for modifications may be considered in a timely manner.

It is the responsibility of the contractor to ensure that all excavations and trenches are properly sloped or shored. All temporary excavations should be cut and maintained in accordance with applicable Occupational Safety and Health Administration (OSHA) rules and regulations.

## EXCAVATION CHARACTERISTICS

The exploration performed for this investigation is limited to the geotechnical excavations described. Direct exploration of the entire Project Site would not be economically feasible. The owner, design team and contractor must understand that differing excavation and drilling conditions may be encountered based on boulders, gravel, oversize materials, groundwater and many other conditions. Fill materials, especially when they were placed without benefit of modern grading codes, regularly contain materials which could impede efficient grading and drilling. Southern California sedimentary bedrock is known to contain variable layers which reflect differences in depositional environment. Such layers may include abundant gravel, cobbles and boulders. Similarly, bedrock can contain concretions. Concretions are typically lenticular and follow the bedding. They are formed by mineral deposits and can be very hard. Excavation and drilling in these areas may require full size equipment and coring capability. The contractor should be familiar with the Project Site and the geologic materials in the vicinity.

## GEOTECHNICAL TESTING

### Classification and Sampling

The soil is continuously logged by a representative of this firm and classified by visual examination in accordance with the Unified Soil Classification system. The field classification is verified in the laboratory, also in accordance with the Unified Soil Classification System. Laboratory classification may include visual examination, Atterberg Limit Tests and grain size distribution. The final classification is shown on the excavation logs.

Samples of the geologic materials encountered in the exploratory excavations were collected and transported to the laboratory. Undisturbed samples of soil are obtained at frequent intervals. Unless noted on the excavation logs as an SPT sample, samples acquired while utilizing a hollow-stem auger drill rig are obtained by driving a thin-walled, California Modified Sampler with successive 30-inch drops of a 140-pound automatic-trip hammer. The soil is retained in brass rings of 2.50 inches outside diameter and 1.00 inch in height. The central portion of the samples are stored in close fitting, waterproof containers for transportation to the laboratory. Samples noted on the excavation logs as SPT samples are obtained in general accordance with the most recent revision of ASTM D 1586. Samples are retained for 30 days after the date of the geotechnical report.

### Grain Size Distribution

These tests cover the quantitative determination of the distribution of particle sizes in soils. Sieve analysis is used to determine the grain size distribution of the soil larger than the Number 200 sieve.

General accordance with the most recent revision of ASTM D 422 is used to determine particle sizes smaller than the Number 200 sieve. A hydrometer is used to determine the distribution of particle sizes by a sedimentation process. The grain size distributions are plotted on the E-Plates presented in Exhibit 9 of this report.

**Moisture and Density Relationships**

The field moisture content and dry unit weight are determined for each of the undisturbed soil samples, and the moisture content is determined for SPT samples in general accordance with the most recent revision of ASTM D 4959 or ASTM D 4643. This information is useful in providing a gross picture of the soil consistency between exploration locations and any local variations. The dry unit weight is determined in pounds per cubic foot and shown on the "Excavation Logs", A-Plates (Exhibit 7). The field moisture content is determined as a percentage of the dry unit weight.

**Expansion Index Testing**

The expansion tests performed on the remolded samples are in accordance with the Expansion Index testing procedures, as described in the most recent revision of ASTM D 4829. The soil sample is compacted into a metal ring at a saturation degree of 50 percent. The ring sample is then placed in a consolidometer, under a vertical confining pressure of 1 lbf/square inch and inundated with distilled water. The deformation of the specimen is recorded for a period of 24 hours or until the rate of deformation becomes less than 0.0002 inches/hour, whichever occurs first. The expansion index, EI, is determined by dividing the difference between final and initial height of the ring sample by the initial height, and multiplied by 1,000. Results are presented in Plate D, in Exhibit 8 of this report.

## Laboratory Compaction Characteristics

The maximum dry unit weight and optimum moisture content of a soil are determined in general accordance with the most recent revision of ASTM D 1557. A soil at a selected moisture content is placed in five layers into a mold of given dimensions, with each layer compacted by 25 blows of a 10 pound hammer dropped from a distance of 18 inches subjecting the soil to a total compactive effort of about 56,000 pounds per cubic foot. The resulting dry unit weight is determined. The procedure is repeated for a sufficient number of moisture contents to establish a relationship between the dry unit weight and the water content of the soil. The data when plotted represent a curvilinear relationship known as the compaction curve. The values of optimum moisture content and modified maximum dry unit weight are determined from the compaction curve. Results are presented in Plate D, in Exhibit 8 of this report.

## Atterberg Limits

Depending on their moisture content, cohesive soils can be solid, plastic, or liquid. The water contents corresponding to the transitions from solid to plastic or plastic to liquid are known as the Atterberg Limits. The transitions are called the plastic limit and liquid limit. The difference between the liquid and plastic limits is known as the plasticity index. ASTM D 4318 is utilized to determine the Atterberg Limits. The results are shown on the enclosed F-Plate in Exhibit 10 of this report.

<u>**REFERENCES**</u>

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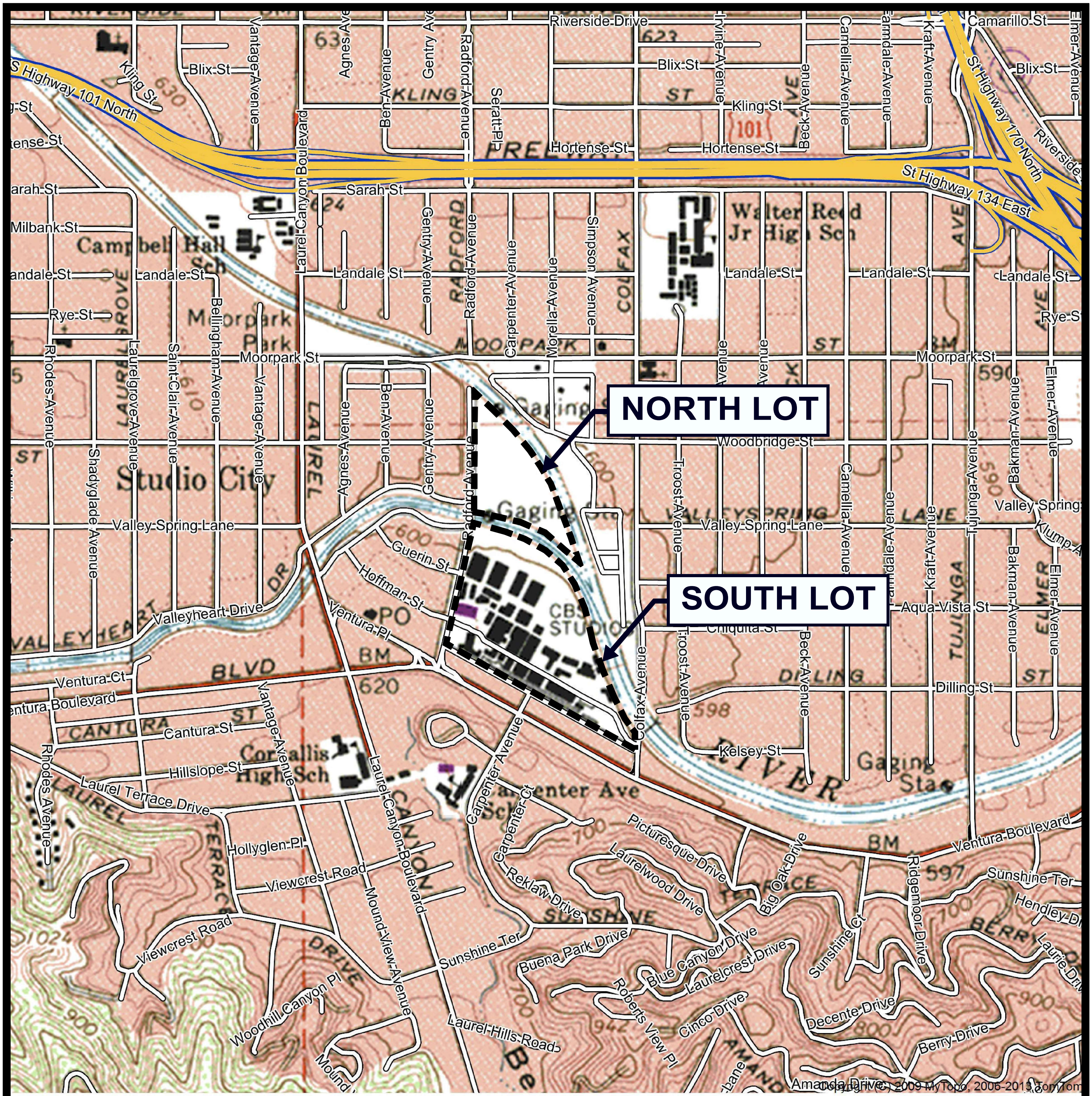



SCALE 1:12000

0.0 0.1 0.2 0.3 0.4 0.5 0.6
MILES

0 1000 2000 3000
FFFT

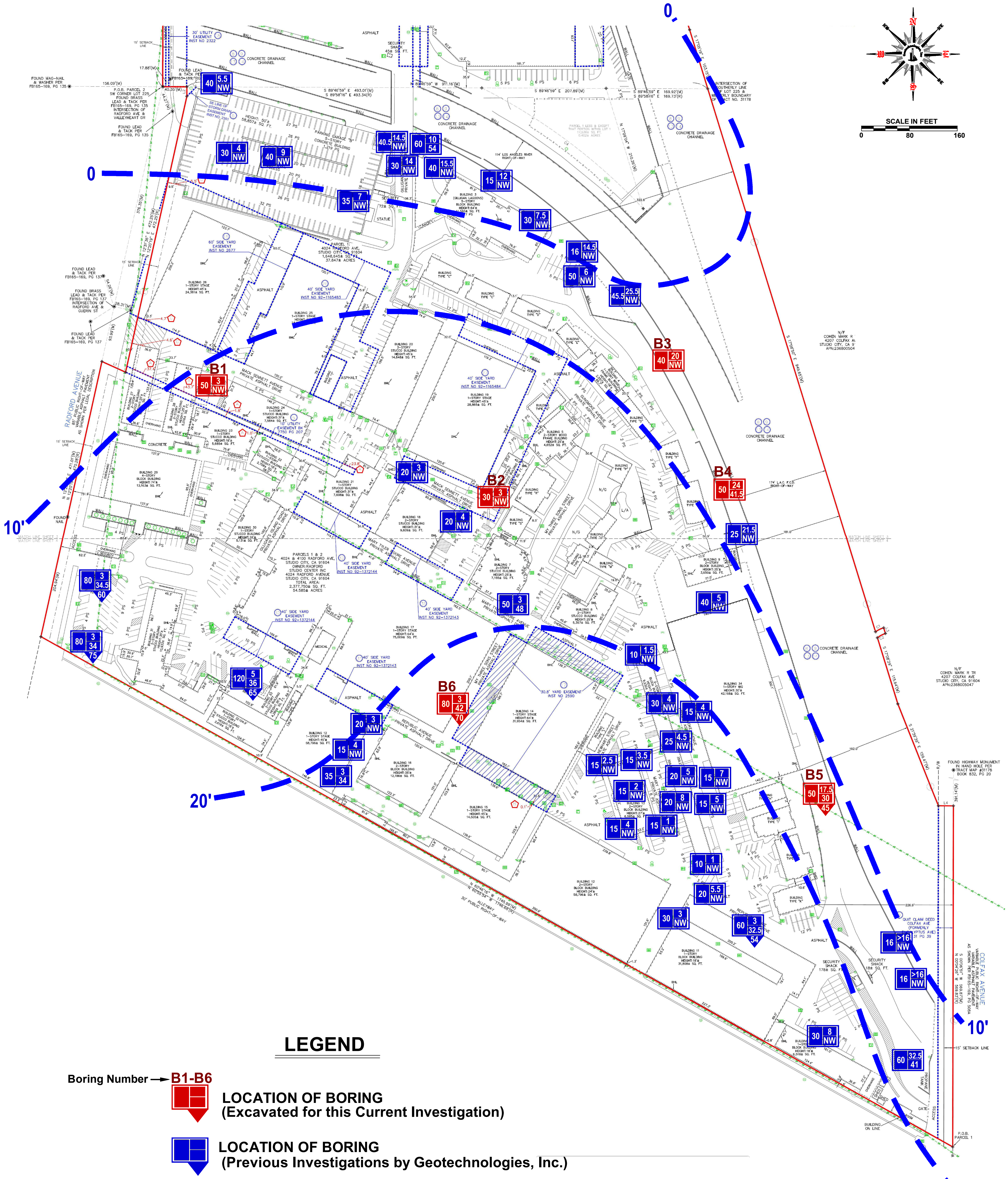
**REFERENCE:** U.S.G.S. TOPOGRAPHIC MAPS, 7.5 MINUTE SERIES, VAN NUYS, CA QUADRANGLE

# EXHIBIT 1 - VICINITY MAP

**Geotechnologies, Inc.**
Consulting Geotechnical Engineers

**RADFORD STUDIO CENTER PROJECT**

**FILE NO. 22241**




## LEGEND

Boring Number → **B1-B6**
LOCATION OF BORING
(Excavated for this Current Investigation)

LOCATION OF BORING
(Previous Investigations by Geotechnologies, Inc.)

Total Depth of Boring (ft) → 80 | 3 | 34 | 75
- 3 ← Depth of Fill (ft)
- 34 ← Depth to Groundwater (ft) (NW noted if none was observed)
- 75 ← Depth to Bedrock (ft) (Only where observed)

20' 20' DEPTH TO HISTORICALLY HIGHEST GROUNDWATER LEVEL (FT)

# EXHIBIT 2

REFERENCE: LAND TITLE SURVEY BY CDS, DATED DECEMBER 2, 2021.

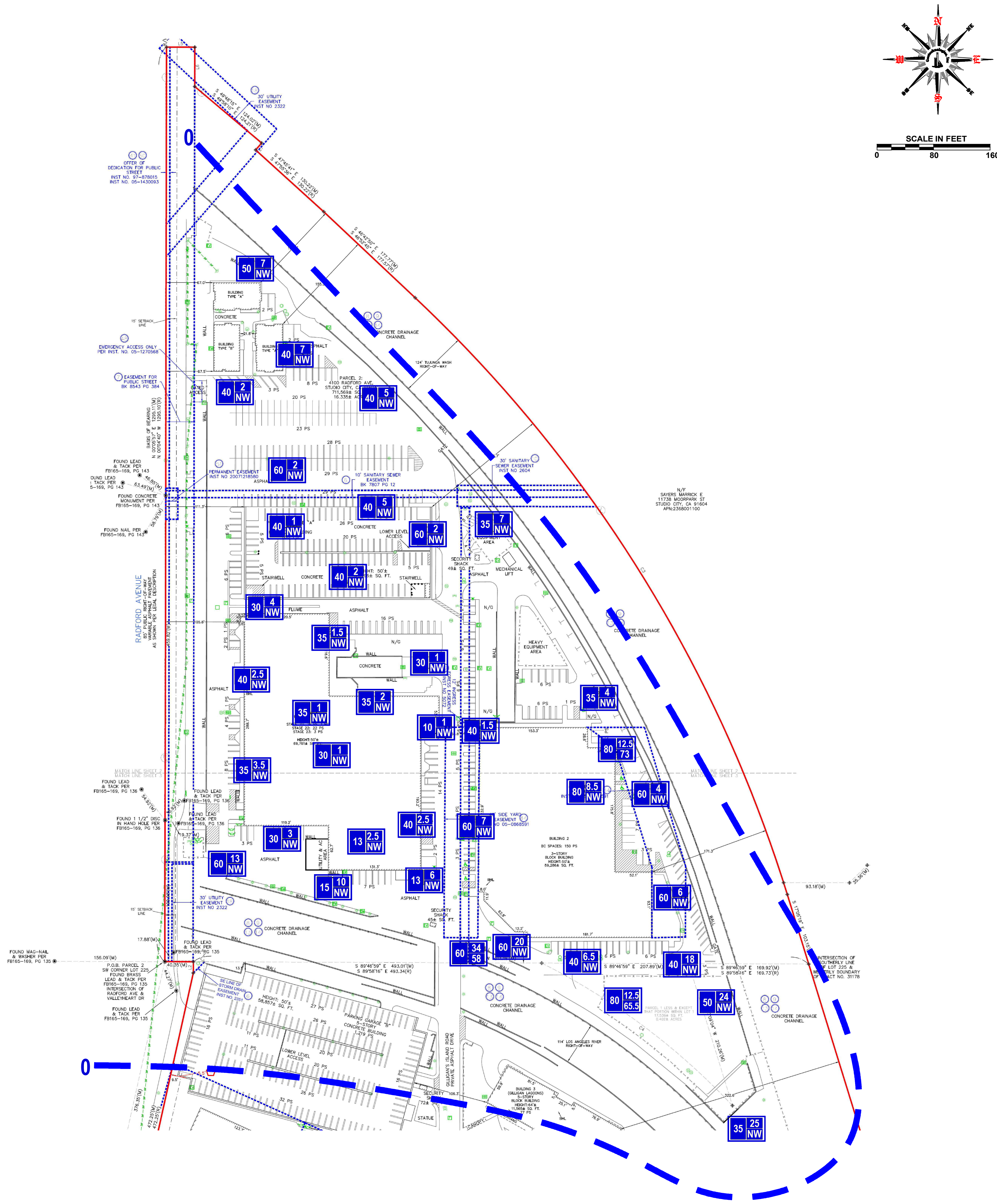
**Geotechnologies, Inc.**
*Consulting Geotechnical Engineers*

## SITE PLAN - SOUTH LOT

RADFORD STUDIO CENTER PROJECT

File No.: 22241

Date: May 2022




## LEGEND

LOCATION OF BORING
(Previous Investigations by Geotechnologies, Inc.)

Total Depth of Boring (ft) — 80
Depth of Fill (ft) — 3
Depth to Groundwater (ft) (NW noted if none was observed) — 34
Depth to Bedrock (ft) (Only where observed) — 75

DEPTH TO HISTORICALLY HIGHEST GROUNDWATER LEVEL (FT)

# EXHIBIT 3

REFERENCE: LAND TITLE SURVEY BY CDS, DATED DECEMBER 2, 2021.

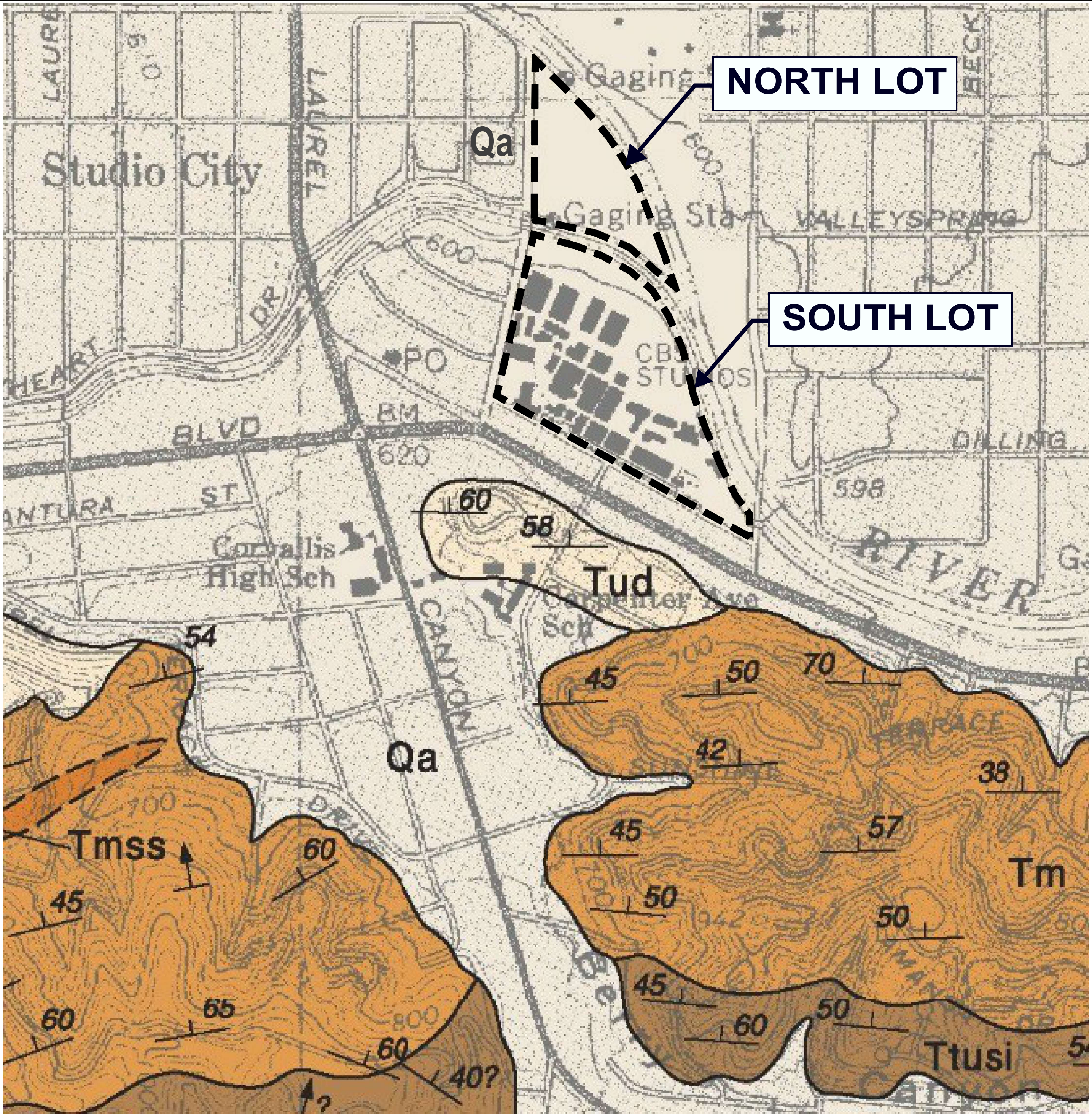
**Geotechnologies, Inc.**
*Consulting Geotechnical Engineers*

## SITE PLAN - NORTH LOT

RADFORD STUDIO CENTER PROJECT

File No.: 22241

Date: May 2022




**LEGEND**

| | |
|---|---|
| Qa: | Surficial Sediments - Alluvial gravel, sand and silt-clay |
| Tud: | Bedrock - Unnamed Shale of the Modelo Formation |
| Tm: | Bedrock - Monterey Formation. White weathered siliceous shale |
| Tmss: | Bedrock - Monterey Formation. Sandstone and locally interbeded shale |
| Ttusi: | Bedrock - Upper Topanga Formation. Mostly clay shale or claystone |

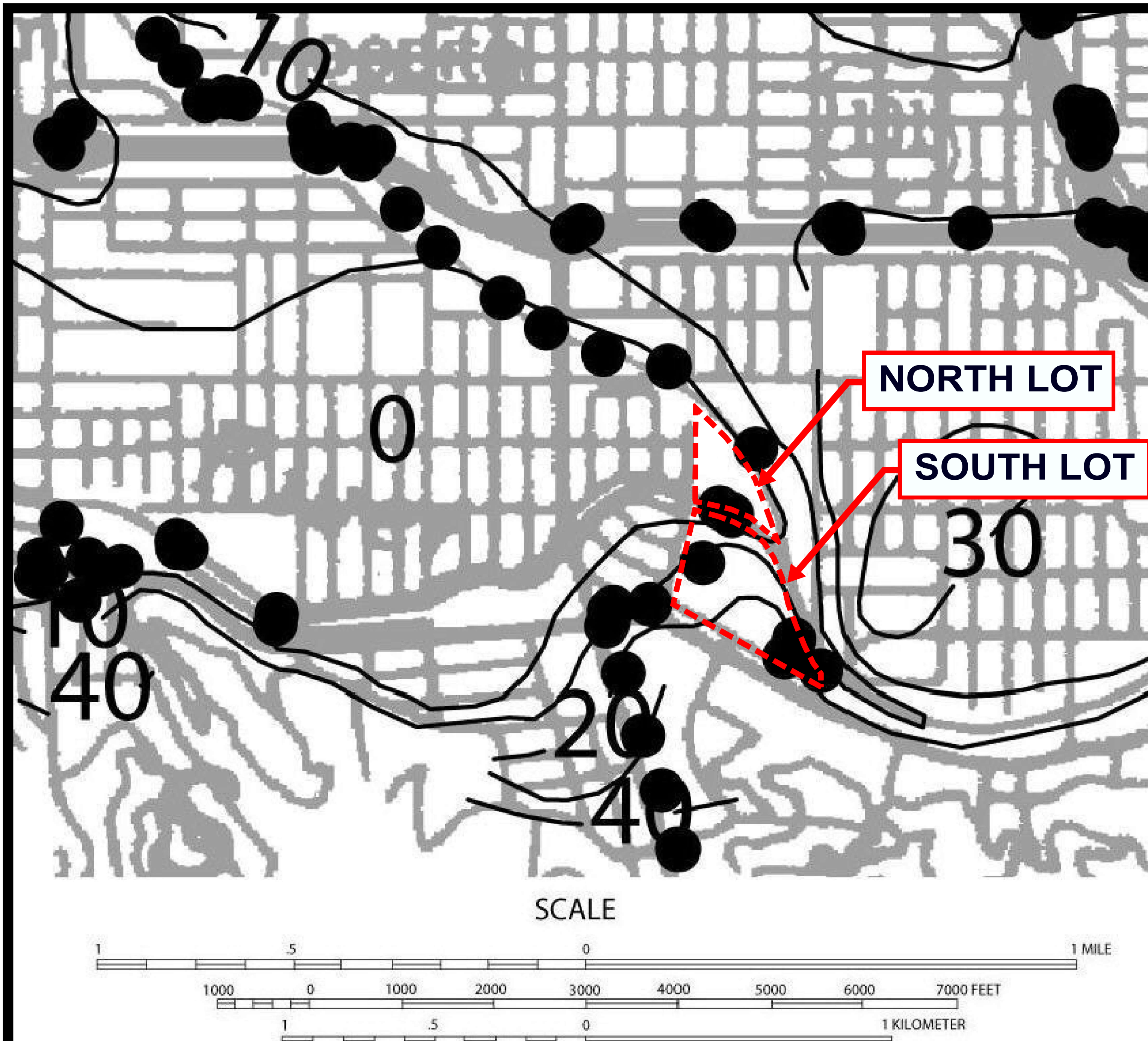
REFERENCE: DIBBLEE, T.W., (1991), GEOLOGIC MAP OF THE BEVERLY HILLS AND SOUTH 1/2 VAN NUYS QUADRANGLES, MAP #DF-31

# EXHIBIT 4 - LOCAL GEOLOGIC MAP

**Geotechnologies, Inc.**
*Consulting Geotechnical Engineers*

**RADFORD STUDIO CENTER PROJECT**

**FILE NO. 22241**




20 Depth to groundwater in feet

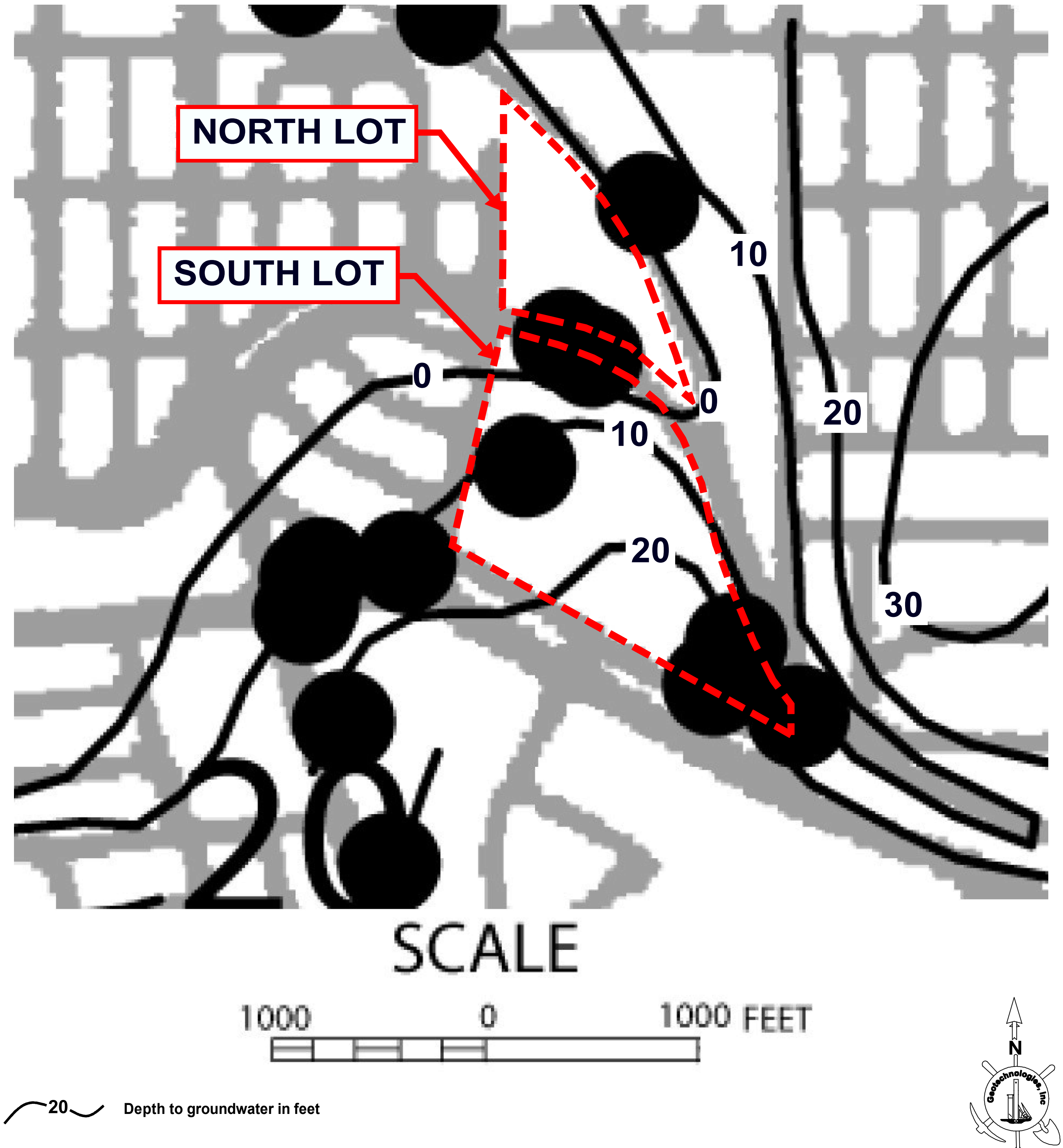
**REFERENCE:** CDMG, SEISMIC HAZARD ZONE REPORT, 008
VAN NUYS 7.5 - MINUTE QUADRANGLE, LOS ANGELES COUNTY, CALIFORNIA (1997, REVISED 2005)

# EXHIBIT 5 - HISTORICALLY HIGHEST GROUNDWATER LEVELS

**Geotechnologies, Inc.**
Consulting Geotechnical Engineers

RADFORD STUDIO CENTER PROJECT

FILE NO. 22241



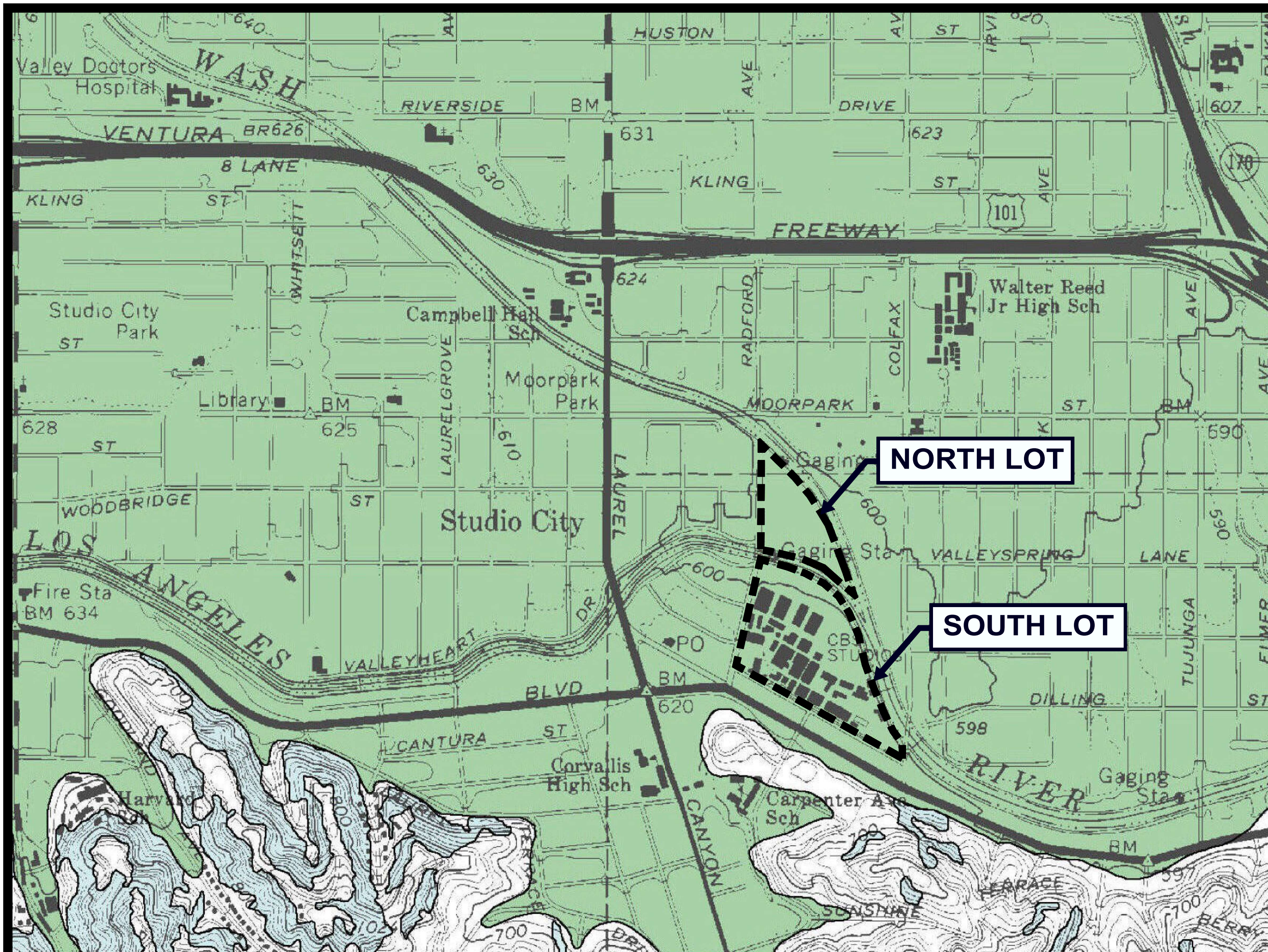

**REFERENCE:** CDMG, SEISMIC HAZARD ZONE REPORT, 008
VAN NUYS 7.5 - MINUTE QUADRANGLE, LOS ANGELES COUNTY, CALIFORNIA (1997, REVISED 2005)

# HISTORICALLY HIGHEST GROUNDWATER LEVELS (CLOSE UP)

**Geotechnologies, Inc.**
Consulting Geotechnical Engineers

RADFORD STUDIO CENTER PROJECT

FILE NO. 22241




SCALE 1:24,000

1 .5 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 .5 0 1 KILOMETER

LIQUEFACTION AREA

N

**REFERENCE:** SEISMIC HAZARD ZONES, VAN NUYS QUADRANGLE OFFICIAL MAP (CDMG, 1998)

# EXHIBIT 6 - SEISMIC HAZARD ZONE MAP

**Geotechnologies, Inc.**
Consulting Geotechnical Engineers

RADFORD STUDIO CENTER PROJECT

FILE NO. 22241

# EXHIBIT 7

## PLATES A-1 THROUGH A-6

## (13 PAGES)

# BORING LOG NUMBER 1

**Radford Studio Center Project** | **Date: 3/19/22** | **Elevation: 610'***

**File No. 22241** | **Method: 8-inch diameter Hollow Stem Auger**

ln/km | *Reference: Site Survey by KPFF dated 08/09/2022

| Sample Depth ft. | Blows per ft. | Moisture content % | Dry Density p.c.f. | Depth in feet | USCS Class. | Description<br>Surface Conditions: Asphalt for Paving |
|---|---|---|---|---|---|---|
| | | | | 0 -- | | 4-inch Asphalt over 3-inch Base |
| | | | | - | | |
| | | | | 1 -- | | |
| | | | | - | | FILL: Clayey Sand, dark brown, moist, medium dense, fine |
| | | | | 2 -- | | grained |
| 2.5 | 40 | 18.9 | 104.9 | - | | |
| | | | | 3 -- | | |
| | | | | - | CL | NATIVE SOILS: Sandy Clay, dark brown, moist, stiff |
| | | | | 4 -- | | |
| | | | | - | | |
| 5 | 16 | 16.2 | SPT | 5 -- | | — — — — — — — — — |
| | | | | - | | brown |
| | | | | 6 -- | | |
| | | | | - | | |
| | | | | 7 -- | | |
| 7.5 | 58 | 17.0 | 111.2 | - | | |
| | | | | 8 -- | SC/CL | Clayey Sand to Sandy Clay, brown, moist, medium dense, stiff, |
| | | | | - | | fine grained |
| | | | | 9 -- | | |
| | | | | - | | |
| 10 | 11 | 16.0 | SPT | 10 -- | | |
| | | | | - | SM/ML | Clayey Sand to Sand, light brown to brown, moist, medium |
| | | | | 11 -- | | dense, fine grained |
| | | | | - | | |
| | | | | 12 -- | | |
| 12.5 | 44 | 15.0 | 114.5 | - | | — — — — — — — — — |
| | | | | 13 -- | | brown |
| | | | | - | | |
| | | | | 14 -- | | |
| | | | | - | | |
| 15 | 12 | 20.0 | SPT | 15 -- | | |
| | | | | - | SC/CL | Clayey Sand to Sandy Clay, brown, moist, medium dense, stiff, |
| | | | | 16 -- | | fine grained |
| | | | | - | | |
| | | | | 17 -- | | |
| 17.5 | 54 | 18.2 | 105.5 | - | | |
| | | | | 18 -- | | |
| | | | | - | | |
| | | | | 19 -- | | |
| | | | | - | | |
| 20 | 13 | 22.0 | SPT | 20 -- | | |
| | | | | - | CL | Sandy Clay, brown, moist, stiff |
| | | | | 21 -- | | |
| | | | | - | | |
| | | | | 22 -- | | |
| 22.5 | 44 | 19.5 | 108.3 | - | | |
| | | | | 23 -- | | |
| | | | | - | | |
| | | | | 24 -- | | |
| | | | | - | | |
| 25 | 16 | 19.3 | SPT | 25 -- | | |
| | | | | - | | |

# BORING LOG NUMBER 1

**Radford Studio Center Project**

**File No. 22241**

ln/km

| Sample Depth ft. | Blows per ft. | Moisture content % | Dry Density p.c.f. | Depth in feet | USCS Class. | Description |
|---|---|---|---|---|---|---|
| | | | | - 26 -- - 27 -- | | NOTE: The stratification lines represent the approximate boundary between earth types; the transition may be gradual. |
| 27.5 | 68 | 21.9 | 102.5 | - 28 -- - 29 -- - | | Used 8-inch diameter Hollow-Stem Auger<br>140-lb. Automatic Hammer, 30-inch drop<br>Modified California Sampler used unless otherwise noted |
| 30 | 17 | 23.5 | SPT | 30 -- - 31 -- - 32 -- | | SPT=Standard Penetration Test |
| 32.5 | 72 | 18.0 | 107.7 | - 33 -- - 34 -- - | ML | Sandy Silt, light brown, moist, stiff |
| 35 | 24 | 21.6 | SPT | 35 -- - 36 -- - 37 -- | | |
| 37.5 | 64 | 18.9 | 105.8 | - 38 -- - 39 -- - | SM/ML | Silty Sand to Sandy Silt, light brown to brown, moist, dense, stiff |
| 40 | 27 | 17.4 | SPT | 40 -- - 41 -- - 42 -- | SP/SM | Sand to Silty Sand, brown, moist, medium dense, stiff, fine grained |
| 42.5 | 68<br>50/6" | 19.0 | 105.6 | - 43 -- - 44 -- - | | |
| 45 | 29 | 14.2 | SPT | 45 -- - 46 -- - 47 -- | SP | Sand, light brown, moist, medium dense, fine grained |
| 47.5 | 75 | 19.0 | 105.3 | - 48 -- - 49 -- - | SP/SM | Sand to Silty Sand, brown, moist, dense, stiff, fine grained |
| | | | | | SP | Sand, brown, moist, medium dense, fine to medium grained |
| 50 | 27 | 21.7 | SPT | 50 -- - | | Total Depth 50 feet<br>No Water<br>Fill to 3 feet |

# BORING LOG NUMBER 2

**Radford Studio Center Project** **Date: 3/19/22** **Elevation: 607.5'***

**File No. 22241** **Method: 8-inch diameter Hollow Stem Auger**

ln/km *Reference: Site Survey by KPFF dated 08/09/2022

| Sample Depth ft. | Blows per ft. | Moisture content % | Dry Density p.c.f. | Depth in feet | USCS Class. | Description<br>Surface Conditions: Asphalt for Paving |
|---|---|---|---|---|---|---|
| | | | | 0 -- | | 3-inch Asphalt over 8-inch Base |
| | | | | - | | |
| | | | | 1 -- | | |
| | | | | - | | FILL: Sandy Clay, dark brown, moist, stiff |
| | | | | 2 -- | | |
| 2.5 | 27 | 23.5 | 94.3 | - | | |
| | | | | 3 -- | | |
| | | | | - | | |
| | | | | 4 -- | | |
| | | | | - | | |
| 5 | 48 | 20.2 | 104.3 | 5 -- | | |
| | | | | - | CL | NATIVE SOILS: Silty Clay, dark brown, moist, stiff |
| | | | | 6 -- | | |
| | | | | - | | |
| | | | | 7 -- | | |
| | | | | - | | |
| | | | | 8 -- | | |
| | | | | - | | |
| | | | | 9 -- | | |
| | | | | - | | |
| 10 | 29 | 17.7 | 110.1 | 10 -- | | |
| | | | | - | SM/ML | Silty Sand to Sandy Silt, dark brown, moist, medium dense, |
| | | | | 11 -- | | stiff, fine grained |
| | | | | - | | |
| | | | | 12 -- | | |
| | | | | - | | |
| | | | | 13 -- | | |
| | | | | - | | |
| | | | | 14 -- | | |
| | | | | - | | |
| 15 | 48 | 21.0 | 103.9 | 15 -- | | |
| | | | | - | SC/CL | Clayey Sand to Sandy Clay, brown, moist, stiff, fine grained |
| | | | | 16 -- | | |
| | | | | - | | |
| | | | | 17 -- | | |
| | | | | - | | |
| | | | | 18 -- | | |
| | | | | - | | |
| | | | | 19 -- | | |
| | | | | - | | |
| 20 | 51 | 24.3 | 99.4 | 20 -- | | |
| | | | | - | | |
| | | | | 21 -- | | |
| | | | | - | | |
| | | | | 22 -- | | |
| | | | | - | | |
| | | | | 23 -- | | |
| | | | | - | | |
| | | | | 24 -- | | |
| | | | | - | | |
| 25 | 46 | 28.4 | 95.5 | 25 -- | | |
| | | | | - | CL | Clay, dark brown, moist, stiff |

# BORING LOG NUMBER 2

**Radford Studio Center Project**

**File No. 22241**

ln/km

| Sample Depth ft. | Blows per ft. | Moisture content % | Dry Density p.c.f. | Depth in feet | USCS Class. | Description |
|---|---|---|---|---|---|---|
| | | | | - | | |
| | | | | 26 -- | | |
| | | | | - | | |
| | | | | 27 -- | | |
| | | | | - | | |
| | | | | 28 -- | | |
| | | | | - | | |
| | | | | 29 -- | | |
| | | | | - | ML/CL | Silty Clay, dark brown, moist, stiff |
| 30 | 46 | 23.3 | 101.3 | 30 -- | | |
| | | | | - | | Total Depth 30 feet |
| | | | | 31 -- | | No Water |
| | | | | - | | Fill to 3 feet |
| | | | | 32 -- | | |
| | | | | - | | |
| | | | | 33 -- | | NOTE: The stratification lines represent the approximate |
| | | | | - | | boundary between earth types; the transition may be gradual. |
| | | | | 34 -- | | |
| | | | | - | | Used 8-inch diameter Hollow-Stem Auger |
| | | | | 35 -- | | 140-lb. Automatic Hammer, 30-inch drop |
| | | | | - | | Modified California Sampler used unless otherwise noted |
| | | | | 36 -- | | |
| | | | | - | | |
| | | | | 37 -- | | |
| | | | | - | | |
| | | | | 38 -- | | |
| | | | | - | | |
| | | | | 39 -- | | |
| | | | | - | | |
| | | | | 40 -- | | |
| | | | | - | | |
| | | | | 41 -- | | |
| | | | | - | | |
| | | | | 42 -- | | |
| | | | | - | | |
| | | | | 43 -- | | |
| | | | | - | | |
| | | | | 44 -- | | |
| | | | | - | | |
| | | | | 45 -- | | |
| | | | | - | | |
| | | | | 46 -- | | |
| | | | | - | | |
| | | | | 47 -- | | |
| | | | | - | | |
| | | | | 48 -- | | |
| | | | | - | | |
| | | | | 49 -- | | |
| | | | | - | | |
| | | | | 50 -- | | |
| | | | | - | | |

# BORING LOG NUMBER 3

**Radford Studio Center Project** | **Date: 3/16/22** | **Elevation: 586'***

**File No. 22241** | **Method: 8-inch diameter Hollow Stem Auger**

ln/km

*Reference: Site Survey by KPFF dated 08/09/2022

| Sample Depth ft. | Blows per ft. | Moisture content % | Dry Density p.c.f. | Depth in feet | USCS Class. | Description<br>Surface Conditions: Asphalt for Driveway |
|---|---|---|---|---|---|---|
| | | | | 0 -- | | 4-inch Asphalt over 5-inch Base |
| | | | | - | | |
| | | | | 1 -- | | |
| | | | | - | | FILL: Silty Sand to Sandy Silt, dark brown, moist, medium |
| | | | | 2 -- | | dense, fine grained, few gravel |
| 2.5 | 40 | 5.1 | 115.3 | - | | |
| | | | | 3 -- | | Silty Sand to Clayey Silt, dark brown, moist, medium dense, |
| | | | | - | | stiff, fine grained, few gravel |
| | | | | 4 -- | | |
| | | | | - | | |
| 5 | 32<br>50/5" | 5.2 | 119.8 | 5 -- | | |
| | | | | - | | Sand With Cobbles, dark and yellowish brown, moist, very |
| | | | | 6 -- | | dense, fine grained |
| | | | | - | | |
| | | | | 7 -- | | |
| 7.5 | 40<br>50/3" | 8.6 | 128.9 | - | | |
| | | | | 8 -- | | Clayey Sand to Sand, dark brown and gray, moist, very dense, |
| | | | | - | | fine grained, minor cobbles |
| | | | | 9 -- | | |
| | | | | - | | |
| 10 | 43<br>50/3" | 10.8 | 122.0 | 10 -- | | |
| | | | | - | | Silty Sand to Sand, gray, moist, very dense, fine grained, |
| | | | | 11 -- | | minor gravel |
| | | | | - | | |
| | | | | 12 -- | | |
| 12.5 | 48 | 8.6 | 118.7 | - | | Silty Sand to Sand, dark and grayish brown, moist, medium |
| | | | | 13 -- | | dense, fine grained, few gravel |
| | | | | - | | |
| | | | | 14 -- | | |
| | | | | - | | |
| 15 | 56 | 13.1 | 115.6 | 15 -- | | |
| | | | | - | | Clayey Sand, brown, moist, medium dense, fine grained |
| | | | | 16 -- | | |
| | | | | - | | |
| | | | | 17 -- | | |
| 17.5 | 100/8" | No Recovery | | - | | |
| | | | | 18 -- | | |
| | | | | - | | |
| | | | | 19 -- | | |
| | | | | - | | |
| 20 | 85 | 3.1 | 106.0 | 20 -- | | |
| | | | | - | SP | NATIVE SOILS: Sand, dark and light brown, moist, dense, |
| | | | | 21 -- | | fine grained |
| | | | | - | | |
| | | | | 22 -- | | |
| | | | | - | | |
| | | | | 23 -- | | |
| | | | | - | | |
| | | | | 24 -- | | |
| | | | | - | | |
| 25 | 45<br>50/3" | 5.7 | 106.0 | 25 -- | | |
| | | | | - | | light brown, very dense |

# BORING LOG NUMBER 3

**Radford Studio Center Project**

**File No. 22241**

ln/km

| Sample Depth ft. | Blows per ft. | Moisture content % | Dry Density p.c.f. | Depth in feet | USCS Class. | Description |
|---|---|---|---|---|---|---|
| | | | | 26 | | |
| | | | | 27 | | |
| | | | | 28 | | |
| | | | | 29 | | |
| 30 | 46<br>50/3" | 3.7 | 111.1 | 30 | | - - - - - - - - - -<br>yellowish brown |
| | | | | 31 | | |
| | | | | 32 | | |
| | | | | 33 | | |
| | | | | 34 | | |
| 35 | 100/8" | 7.1 | 103.5 | 35 | | |
| | | | | 36 | | |
| | | | | 37 | | |
| | | | | 38 | | |
| | | | | 39 | SP/SW | Sand to Cobbly Sand, dark and yellowish brown, moist, very dense, fine to coarse grained |
| 40 | 100/8" | 4.6 | 125.7 | 40 | | |
| | | | | 41 | | Total Depth 40 feet<br>No Water<br>Fill to 20 feet |
| | | | | 42 | | |
| | | | | 43 | | NOTE: The stratification lines represent the approximate boundary between earth types; the transition may be gradual. |
| | | | | 44 | | |
| | | | | 45 | | Used 8-inch diameter Hollow-Stem Auger<br>140-lb. Automatic Hammer, 30-inch drop<br>Modified California Sampler used unless otherwise noted |
| | | | | 46 | | |
| | | | | 47 | | |
| | | | | 48 | | |
| | | | | 49 | | |
| | | | | 50 | | |

# BORING LOG NUMBER 4

**Radford Studio Center Project** **Date: 3/16/22** **Elevation: 586'***

**File No. 22241** **Method: 8-inch diameter Hollow Stem Auger**

ln/km *Reference: Site Survey by KPFF dated 08/09/2022

| Sample Depth ft. | Blows per ft. | Moisture content % | Dry Density p.c.f. | Depth in feet | USCS Class. | Description<br>Surface Conditions: Asphalt for Driveway |
|---|---|---|---|---|---|---|
| | | | | 0 -- | | 4-inch Asphalt over 5-inch Base |
| | | | | - | | |
| | | | | 1 -- | | |
| | | | | - | | FILL: Silty Sand to Sandy Silt, dark brown, moist, medium |
| | | | | 2 -- | | dense, stiff, fine grained |
| 2.5 | 40 | 4.9 | 119.0 | - | | - - - - - - - - - - - - - - - |
| | 50/3" | | | 3 -- | | Silty Sand, dark brown, moist, dense, fine grained, minor |
| | | | | - | | rock fragments |
| | | | | 4 -- | | |
| | | | | - | | |
| 5 | 92 | 8.8 | 117.7 | 5 -- | | - - - - - - - - - - - - - - - |
| | | | | - | | few cobbles |
| | | | | 6 -- | | |
| | | | | - | | |
| | | | | 7 -- | | |
| | | | | - | | |
| | | | | 8 -- | | |
| | | | | - | | |
| | | | | 9 -- | | |
| | | | | - | | |
| 10 | 93 | 6.9 | 124.2 | 10 -- | | |
| | 50/5" | | | - | | |
| | | | | 11 -- | | |
| | | | | - | | |
| | | | | 12 -- | | |
| | | | | - | | |
| | | | | 13 -- | | |
| | | | | - | | |
| | | | | 14 -- | | |
| | | | | - | | |
| 15 | 69 | 10.9 | 119.3 | 15 -- | | |
| | | | | - | | |
| | | | | 16 -- | | |
| | | | | - | | |
| | | | | 17 -- | | |
| 17.5 | 100/10" | 13.7 | Disturbed | - | | - - - - - - - - - - - - - - - |
| | | | | 18 -- | | Clayey Sand, dark brown, moist, very dense, fine grained |
| | | | | - | | |
| | | | | 19 -- | | |
| | | | | - | | |
| 20 | 63 | 16.7 | 112.9 | 20 -- | | - - - - - - - - - - - - - - - |
| | | | | - | | gray to dark gray, dense |
| | | | | 21 -- | | |
| | | | | - | | |
| | | | | 22 -- | | |
| 22.5 | 78 | 11.6 | 114.6 | - | | |
| | | | | 23 -- | | |
| | | | | - | | |
| | | | | 24 -- | | |
| | | | | - | SP | NATIVE SOILS: Sand, yellow and grayish brown, moist, very |
| 25 | 100/8" | 5.1 | 100.7 | 25 -- | | dense, fine grained |
| | | | | - | | |

# BORING LOG NUMBER 4

**Radford Studio Center Project**

**File No. 22241**

ln/km

| Sample Depth ft. | Blows per ft. | Moisture content % | Dry Density p.c.f. | Depth in feet | USCS Class. | Description |
|---|---|---|---|---|---|---|
| | | | | - | | |
| | | | | 26 -- | | |
| | | | | - | | |
| | | | | 27 -- | | |
| | | | | - | | |
| | | | | 28 -- | | |
| | | | | - | | |
| | | | | 29 -- | | |
| | | | | - | | |
| 30 | 100/11" | 2.8 | 125.7 | 30 -- | | |
| | | | | - | SW | Gravelly Sand, dark and yellowish brown, moist, very dense, |
| | | | | 31 -- | | fine to coarse grained |
| | | | | - | | |
| | | | | 32 -- | | |
| | | | | - | | NOTE: The stratification lines represent the approximate |
| | | | | 33 -- | | boundary between earth types; the transition may be gradual. |
| | | | | - | | |
| | | | | 34 -- | | Used 8-inch diameter Hollow-Stem Auger |
| | | | | - | | 140-lb. Automatic Hammer, 30-inch drop |
| 35 | 100/9" | 7.1 | 121.6 | 35 -- | | Modified California Sampler used unless otherwise noted |
| | | | | - | | |
| | | | | 36 -- | | |
| | | | | - | | |
| | | | | 37 -- | | |
| | | | | - | | |
| | | | | 38 -- | | |
| | | | | - | | |
| | | | | 39 -- | | |
| | | | | - | | |
| 40 | 90 | 10.8 | 120.1 | 40 -- | | |
| | | | | - | SP | Sand, yellowish brown, very moist, very dense, fine to |
| | | | | 41 -- | | medium grained, minor gravel |
| | | | | - | | |
| | | | | 42 -- | | |
| | | | | - | | |
| | | | | 43 -- | | |
| | | | | - | | |
| | | | | 44 -- | | |
| | | | | - | | |
| 45 | 73 | 8.7 | 134.1 | 45 -- | | |
| | 100/5" | | | - | | grayish brown, wet |
| | | | | 46 -- | | |
| | | | | - | | |
| | | | | 47 -- | | |
| | | | | - | | |
| | | | | 48 -- | | |
| | | | | - | | |
| | | | | 49 -- | | |
| | | | | - | | |
| 50 | 40 | 12.0 | 121.0 | 50 -- | | |
| | 50/5" | | | - | | Total Depth 50 feet |
| | | | | | | Water at 41½ feet |
| | | | | | | Fill to 24 feet |

# BORING LOG NUMBER 5

**Radford Studio Center Project** **Date: 3/17/22** **Elevation: 586'***

**File No. 22241** **Method: 8-inch diameter Hollow Stem Auger**

ln/km *Reference: Site Survey by KPFF dated 08/09/2022

| Sample Depth ft. | Blows per ft. | Moisture content % | Dry Density p.c.f. | Depth in feet | USCS Class. | Description<br>Surface Conditions: Asphalt for Driveway |
|---|---|---|---|---|---|---|
| | | | | 0 -- | | 6-inch Asphalt over 6-inch Base |
| | | | | - | | |
| | | | | 1 -- | | |
| | | | | - | | FILL: Sandy Clay, dark and yellowish brown, moist, stiff |
| | | | | 2 -- | | |
| | | | | - | | |
| | | | | 3 -- | | |
| | | | | - | | |
| | | | | 4 -- | | |
| | | | | - | | |
| 5 | 57 | 14.6 | 116.1 | 5 -- | | |
| | | | | - | | |
| | | | | 6 -- | | |
| | | | | - | | |
| | | | | 7 -- | | |
| 7.5 | 92 | 9.3 | 131.1 | - | | |
| | | | | 8 -- | | Silty Sand to Sand with Rock Fragments, yellow and grayish brown, moist, very dense, fine grained |
| | | | | - | | |
| | | | | 9 -- | | |
| | | | | - | | |
| 10 | 45<br>50/4" | 11.5 | 126.9 | 10 -- | | |
| | | | | - | | |
| | | | | 11 -- | | |
| | | | | - | | |
| | | | | 12 -- | | |
| 12.5 | 81 | 19.2 | 110.1 | - | | |
| | | | | 13 -- | | |
| | | | | - | | |
| | | | | 14 -- | | |
| | | | | - | | |
| 15 | 86 | 28.6 | 92.1 | 15 -- | | |
| | | | | - | | minor asphalt fragments |
| | | | | 16 -- | | |
| | | | | - | | |
| | | | | 17 -- | | |
| 17.5 | 75 | 4.5 | 107.3 | - | | |
| | | | | 18 -- | SP | NATIVE SOILS: Sand, yellowish brown, moist, dense, fine grained |
| | | | | - | | |
| | | | | 19 -- | | |
| | | | | - | | |
| 20 | 63 | 8.7 | 109.2 | 20 -- | | |
| | | | | - | SP/ML | Sand to Sandy Silt, dark and yellowish brown, moist, medium dense to dense, stiff, fine grained |
| | | | | 21 -- | | |
| | | | | - | | |
| | | | | 22 -- | | |
| 22.5 | 49 | 19.6 | 100.8 | - | | |
| | | | | 23 -- | | |
| | | | | - | | |
| | | | | 24 -- | | |
| | | | | - | | |
| 25 | 49 | 16.6 | 99.1 | 25 -- | | |
| | | | | - | | wet |

# BORING LOG NUMBER 5

**Radford Studio Center Project**

**File No. 22241**

ln/km

| Sample Depth ft. | Blows per ft. | Moisture content % | Dry Density p.c.f. | Depth in feet | USCS Class. | Description |
|---|---|---|---|---|---|---|
| | | | | - | | |
| | | | | 26 -- | | |
| | | | | - | | |
| | | | | 27 -- | | |
| | | | | - | | |
| | | | | 28 -- | | |
| | | | | - | | |
| | | | | 29 -- | | |
| | | | | - | | |
| 30 | 47 | 44.0 | 79.4 | 30 -- | | |
| | | | | - | ML | Silt, gray to dark gray, very moist, stiff |
| | | | | 31 -- | | |
| | | | | - | | |
| | | | | 32 -- | | |
| | | | | - | | |
| | | | | 33 -- | | |
| | | | | - | | |
| | | | | 34 -- | | |
| | | | | - | | |
| 35 | 72 | 14.3 | 118.5 | 35 -- | | |
| | | | | - | SP | Sand, gray, wet, dense, fine to medium grained |
| | | | | 36 -- | | |
| | | | | - | | |
| | | | | 37 -- | | |
| | | | | - | | |
| | | | | 38 -- | | |
| | | | | - | | |
| | | | | 39 -- | | |
| | | | | - | | |
| 40 | 88 | 8.2 | 133.5 | 40 -- | | |
| | | | | - | SP/ML | Sand to Sandy Silt, gray to dark gray, wet, very dense, very stiff, fine to medium grained |
| | | | | 41 -- | | |
| | | | | - | | |
| | | | | 42 -- | | |
| | | | | - | | |
| | | | | 43 -- | | |
| | | | | - | | |
| | | | | 44 -- | | |
| | | | | - | | |
| 45 | 100/10" | 68.6 | 46.8 | 45 -- | | |
| | | | | - | | BEDROCK: Siltstone, gray to dark gray, moist, hard |
| | | | | 46 -- | | |
| | | | | - | | NOTE: The stratification lines represent the approximate boundary between earth types; the transition may be gradual. |
| | | | | 47 -- | | |
| | | | | - | | |
| | | | | 48 -- | | Used 8-inch diameter Hollow-Stem Auger |
| | | | | - | | 140-lb. Automatic Hammer, 30-inch drop |
| | | | | 49 -- | | Modified California Sampler used unless otherwise noted |
| | | | | - | | |
| 50 | 45 | 67.2 | 59.1 | 50 -- | | |
| | 50/4" | | | - | | Total Depth 50 feet |
| | | | | | | Water at 30 feet |
| | | | | | | Fill to 17½ feet |

# BORING LOG NUMBER 6

**Radford Studio Center Project** — **Date: 3/18/22** — **Elevation: 610'***

**File No. 22241** — **Method: 8-inch diameter Hollow Stem Auger**

ln/km

*Reference: Site Survey by KPFF dated 08/09/2022

| Sample Depth ft. | Blows per ft. | Moisture content % | Dry Density p.c.f. | Depth in feet | USCS Class. | Description<br>Surface Conditions: Asphalt for Paving |
|---|---|---|---|---|---|---|
| | | | | 0 -- | | 4½-inch Asphalt over 6½-inch Base |
| | | | | - | | |
| | | | | 1 -- | | |
| | | | | - | | FILL: Silty Sand to Sandy Silt, dark brown, moist, medium dense, fine grained, stiff |
| | | | | 2 -- | | |
| 2.5 | 23 | 17.2 | 104.1 | - | | |
| | | | | 3 -- | SM/ML | NATIVE SOILS: Silty Sand to Sandy Silt, dark brown, moist, medium dense, stiff, fine grained |
| | | | | - | | |
| | | | | 4 -- | | |
| | | | | - | | |
| 5 | 9 | 16.4 | SPT | 5 -- | | |
| | | | | - | SC | Clayey Sand, yellowish brown, moist, medium dense, fine grained |
| | | | | 6 -- | | |
| | | | | - | | |
| | | | | 7 -- | | |
| 7.5 | 52 | 12.4 | 110.7 | - | | |
| | | | | 8 -- | | |
| | | | | - | | |
| | | | | 9 -- | | |
| | | | | - | | |
| 10 | 9 | 20.9 | SPT | 10 -- | | |
| | | | | - | | |
| | | | | 11 -- | | |
| | | | | - | | |
| | | | | 12 -- | | |
| 12.5 | 15 | 19.2 | 106.0 | - | | |
| | | | | 13 -- | CL | Sandy Clay, dark brown, moist, stiff |
| | | | | - | | |
| | | | | 14 -- | | |
| | | | | - | | |
| 15 | 9 | 18.3 | SPT | 15 -- | | |
| | | | | - | | |
| | | | | 16 -- | | |
| | | | | - | | |
| | | | | 17 -- | | |
| 17.5 | 53 | 20.4 | 101.3 | - | | |
| | | | | 18 -- | SC/CL | Clayey Sand to Sandy Clay, dark brown, moist, medium dense, stiff, fine grained |
| | | | | - | | |
| | | | | 19 -- | | |
| | | | | - | | |
| 20 | 15 | 21.8 | SPT | 20 -- | | |
| | | | | - | | |
| | | | | 21 -- | | |
| | | | | - | | |
| | | | | 22 -- | | |
| 22.5 | 51 | 21.3 | 96.5 | - | | |
| | | | | 23 -- | CL | Sandy Clay, dark brown, moist, stiff |
| | | | | - | | |
| | | | | 24 -- | | |
| | | | | - | | |
| 25 | 16 | 26.2 | SPT | 25 -- | | |
| | | | | - | | |

# BORING LOG NUMBER 6

**Radford Studio Center Project**

**File No. 22241**

ln/km

| Sample Depth ft. | Blows per ft. | Moisture content % | Dry Density p.c.f. | Depth in feet | USCS Class. | Description |
|---|---|---|---|---|---|---|
| | | | | 26 -- | | |
| | | | | 27 -- | | |
| 27.5 | 89 | 14.8 | 112.5 | | | |
| | | | | 28 -- | SC/CL | Clayey Sand to Sandy Clay, dark brown, moist, medium dense, stiff, fine grained |
| | | | | 29 -- | | |
| 30 | 18 | 25.0 | SPT | 30 -- | | |
| | | | | | CL | Sandy Clay, dark brown, moist, stiff |
| | | | | 31 -- | | |
| | | | | 32 -- | | |
| 32.5 | 72 | 28.8 | 88.8 | | | |
| | | | | 33 -- | | |
| | | | | 34 -- | | |
| 35 | 10 | 34.2 | SPT | 35 -- | | |
| | | | | 36 -- | | |
| | | | | 37 -- | | |
| 37.5 | 73 | 20.0 | 108.8 | | | |
| | | | | 38 -- | | |
| | | | | 39 -- | | |
| 40 | 24 | 28.9 | SPT | 40 -- | | |
| | | | | | SP/SC | Sand to Clayey Sand, brown, very moist, medium dense, fine grained |
| | | | | 41 -- | | |
| | | | | 42 -- | | |
| 42.5 | 90 | 42.8 | 81.3 | | | |
| | | | | 43 -- | CL | Sandy Clay, dark brown, wet, stiff |
| | | | | 44 -- | | |
| 45 | 16 | 46.0 | SPT | 45 -- | | |
| | | | | 46 -- | | |
| | | | | 47 -- | | |
| 47.5 | 47 | 33.8 | 89.4 | | | |
| | | | | 48 -- | | |
| | | | | 49 -- | | |
| 50 | 72 | 20.0 | SPT | 50 -- | | |
| | | | | | SP | Sand, brown to gray, fine to medium grain, wet, dense |

# BORING LOG NUMBER 6

**Radford Studio Center Project**

**File No. 22241**

ln/km

| Sample Depth ft. | Blows per ft. | Moisture content % | Dry Density p.c.f. | Depth in feet | USCS Class. | Description |
|---|---|---|---|---|---|---|
| | | | | - | | |
| | | | | 51 -- | | |
| | | | | - | | |
| | | | | 52 -- | | |
| 52.5 | 88 | 18.4 | 107.3 | - | | |
| | 50/6" | | | 53 -- | SP/SW | Sand to Gravelly Sand, brown, dense, wet |
| | | | | - | | |
| | | | | 54 -- | | |
| | | | | - | | |
| 55 | 50 | 24.7 | SPT | 55 -- | | |
| | | | | - | | |
| | | | | 56 -- | | |
| | | | | - | | |
| | | | | 57 -- | | |
| 57.5 | 38 | 15.2 | 104.1 | - | | |
| | 50/6" | | | 58 -- | SW | Gravelly Sand, wet, dense, well graded |
| | | | | - | | |
| | | | | 59 -- | | |
| | | | | - | | |
| 60 | 55 | 23.0 | SPT | 60 -- | | |
| | | | | - | | |
| | | | | 61 -- | | |
| | | | | - | | |
| | | | | 62 -- | | |
| 62.5 | 45 | 19.1 | 108.6 | - | | |
| | 50/3" | | | 63 -- | SP | Sand, wet, brown, dense, fine grained |
| | | | | - | | |
| | | | | 64 -- | | |
| | | | | - | | |
| 65 | 68 | 15.0 | SPT | 65 -- | | |
| | | | | - | SW | Gravelly Sand, dark gray, wet, dense, fine grained |
| | | | | 66 -- | | |
| | | | | - | | |
| | | | | 67 -- | | |
| 67.5 | 100/8" | No Recovery | | - | | |
| | | | | 68 -- | | |
| | | | | - | | |
| | | | | 69 -- | | |
| | | | | - | | |
| 70 | 85 | 77.3 | SPT | 70 -- | | |
| | | | | - | | BEDROCK: Siltstone, dark gray, wet, moderately hard |
| | | | | 71 -- | | |
| | | | | - | | |
| | | | | 72 -- | | |
| 72.5 | 100/8" | No Recovery | | - | | - - - - - - - - - - - |
| | | | | 73 -- | | hard |
| | | | | - | | |
| | | | | 74 -- | | |
| | | | | - | | |
| 75 | 50/6" | 22.1 | SPT | 75 -- | | |
| | | | | - | | |

# BORING LOG NUMBER 6

**Radford Studio Center Project**

**File No. 22241**

ln/km

| Sample Depth ft. | Blows per ft. | Moisture content % | Dry Density p.c.f. | Depth in feet | USCS Class. | Description |
|---|---|---|---|---|---|---|
| | | | | 76 -- | | |
| | | | | 77 -- | | |
| 77.5 | 100/8" | 23.0 | 97.5 | 78 -- | | |
| | | | | 79 -- | | |
| 80 | 35<br>50/6" | 35.3 | SPT | 80 -- | | |
| | | | | 81 -- | | Total Depth 80 feet<br>Water at 42 feet<br>Fill to 2½ feet |
| | | | | 82 -- | | |
| | | | | 83 -- | | NOTE: The stratification lines represent the approximate boundary between earth types; the transition may be gradual. |
| | | | | 84 -- | | |
| | | | | 85 -- | | Used 8-inch diameter Hollow-Stem Auger<br>140-lb. Automatic Hammer, 30-inch drop<br>Modified California Sampler used unless otherwise noted |
| | | | | 86 -- | | |
| | | | | 87 -- | | SPT=Standard Penetration Test |
| | | | | 88 -- | | |
| | | | | 89 -- | | |
| | | | | 90 -- | | |
| | | | | 91 -- | | |
| | | | | 92 -- | | |
| | | | | 93 -- | | |
| | | | | 94 -- | | |
| | | | | 95 -- | | |
| | | | | 96 -- | | |
| | | | | 97 -- | | |
| | | | | 98 -- | | |
| | | | | 99 -- | | |
| | | | | 100 -- | | |

| ASTM D-1557 | | | |
|---|---|---|---|
| SAMPLE | B1 @ 1'-5' | B2 @ 1'-5' | B4 @ 1'-5' |
| SOIL TYPE | SC/CL | CL | SM |
| MAXIMUM DENSITY PCF. | 119.5 | 119.6 | 135.7 |
| OPTIMUM MOISTURE % | 13.4 | 12.3 | 7.5 |

| ASTM D 4829 | | | |
|---|---|---|---|
| SAMPLE | B1 @ 1'-5' | B2 @ 1'-5' | B4 @ 1'-5' |
| SOIL TYPE | SC/CL | CL | SM |
| EXPANSION INDEX UBC STANDARD 18-2 | 82 | 86 | 7 |
| EXPANSION CHARACTER | MODERATE | MODERATE | VERY LOW |

| SULFATE CONTENT | | | |
|---|---|---|---|
| SAMPLE | B1 @ 1'-5' | B2 @ 1'-5' | B4 @ 1'-5' |
| SULFATE CONTENT: (PERCENTAGE BY WEIGHT) | >0.1% | >0.2% | >0.1% |

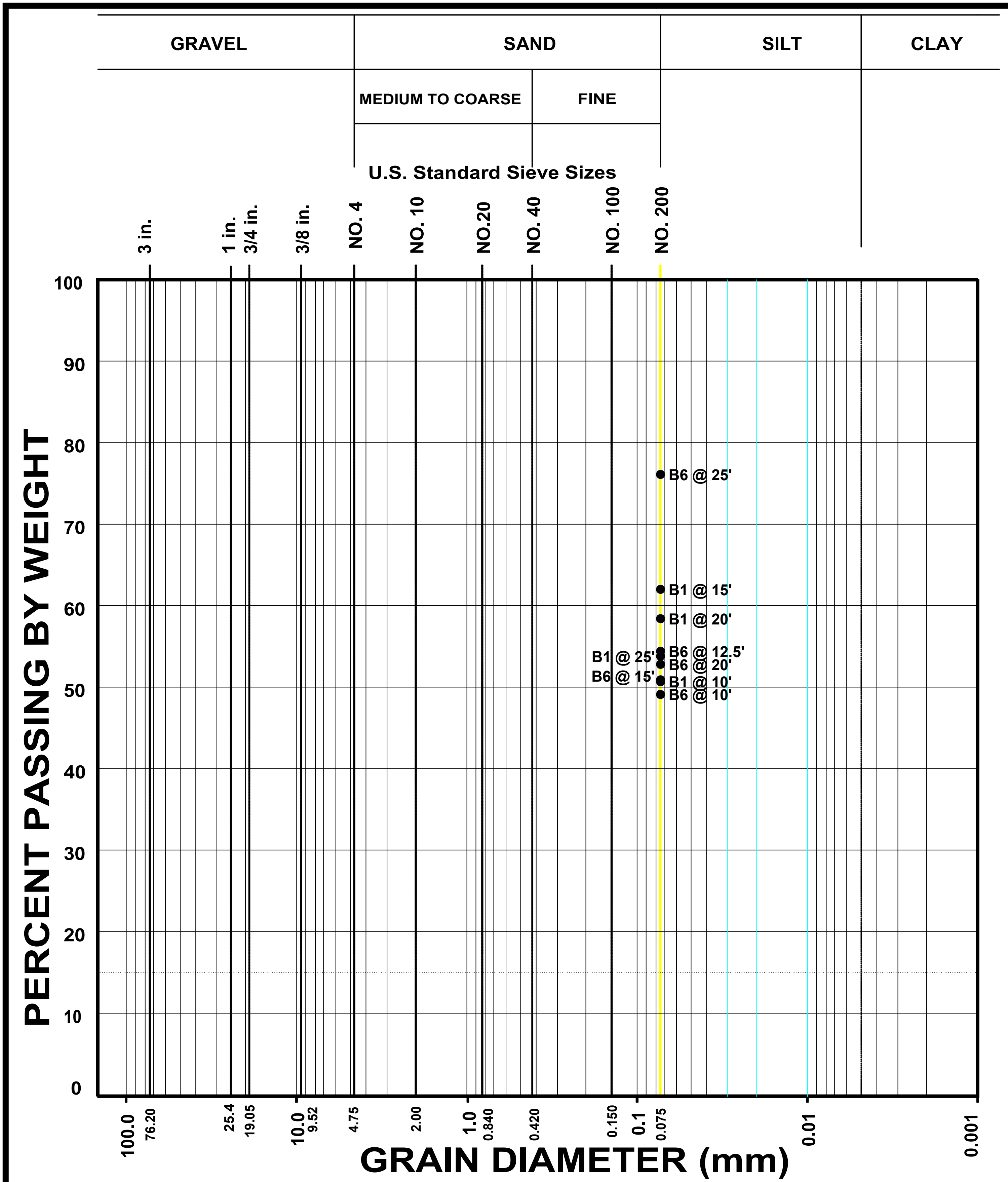
**EXHIBIT 8**

# COMPACTION/EXPANSION/SULFATE DATA SHEET

**Geotechnologies, Inc.**
*Consulting Geotechnical Engineers*

**RADFORD STUDIO CENTER PROJECT**

FILE NO: 22241 | PLATE: D



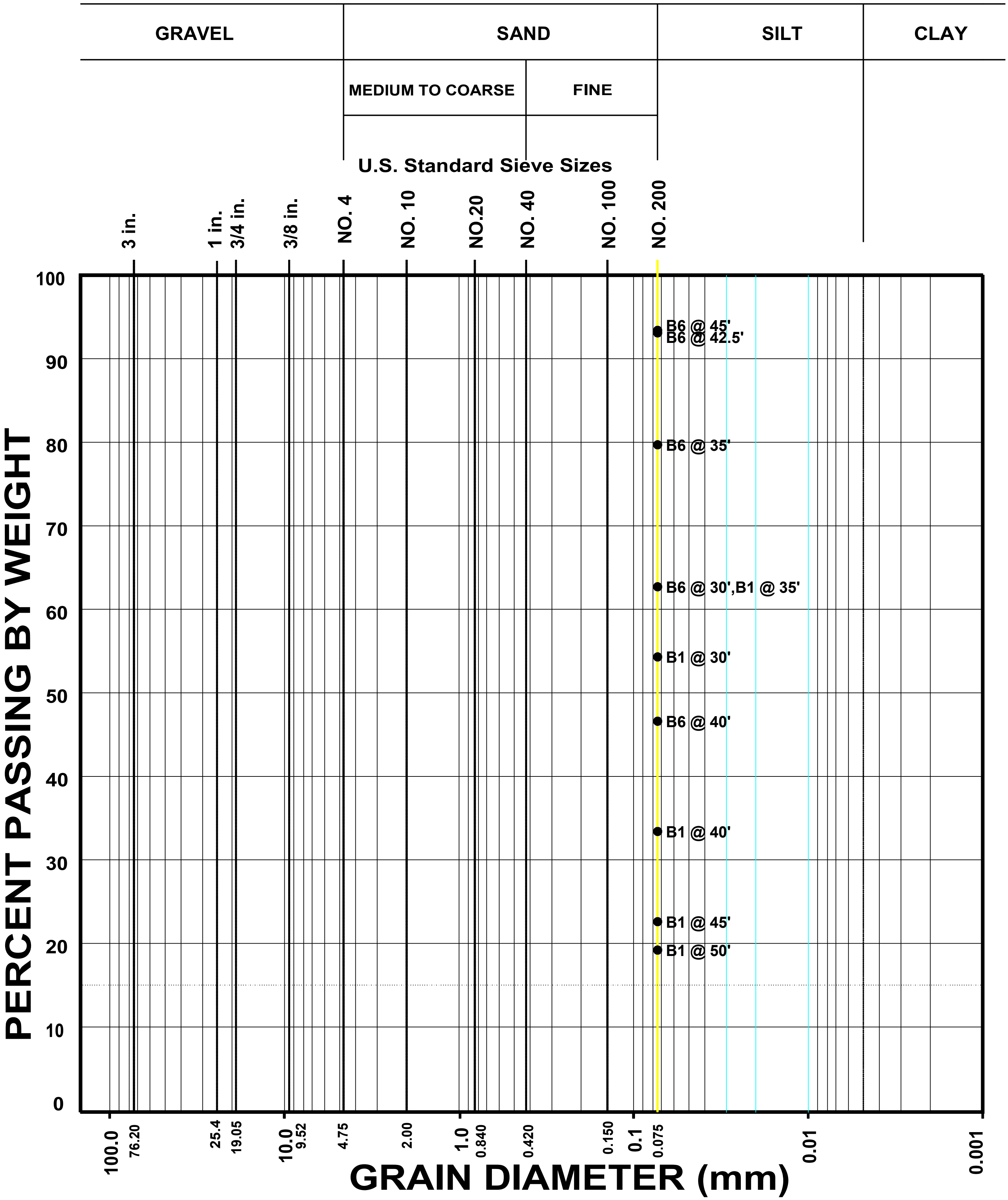

# EXHIBIT 9 - GRAIN SIZE DISTRIBUTION

**Geotechnologies, Inc.**
Consulting Geotechnical Engineers

**RADFORD STUDIO CENTER PROJECT**

FILE NO. 22241

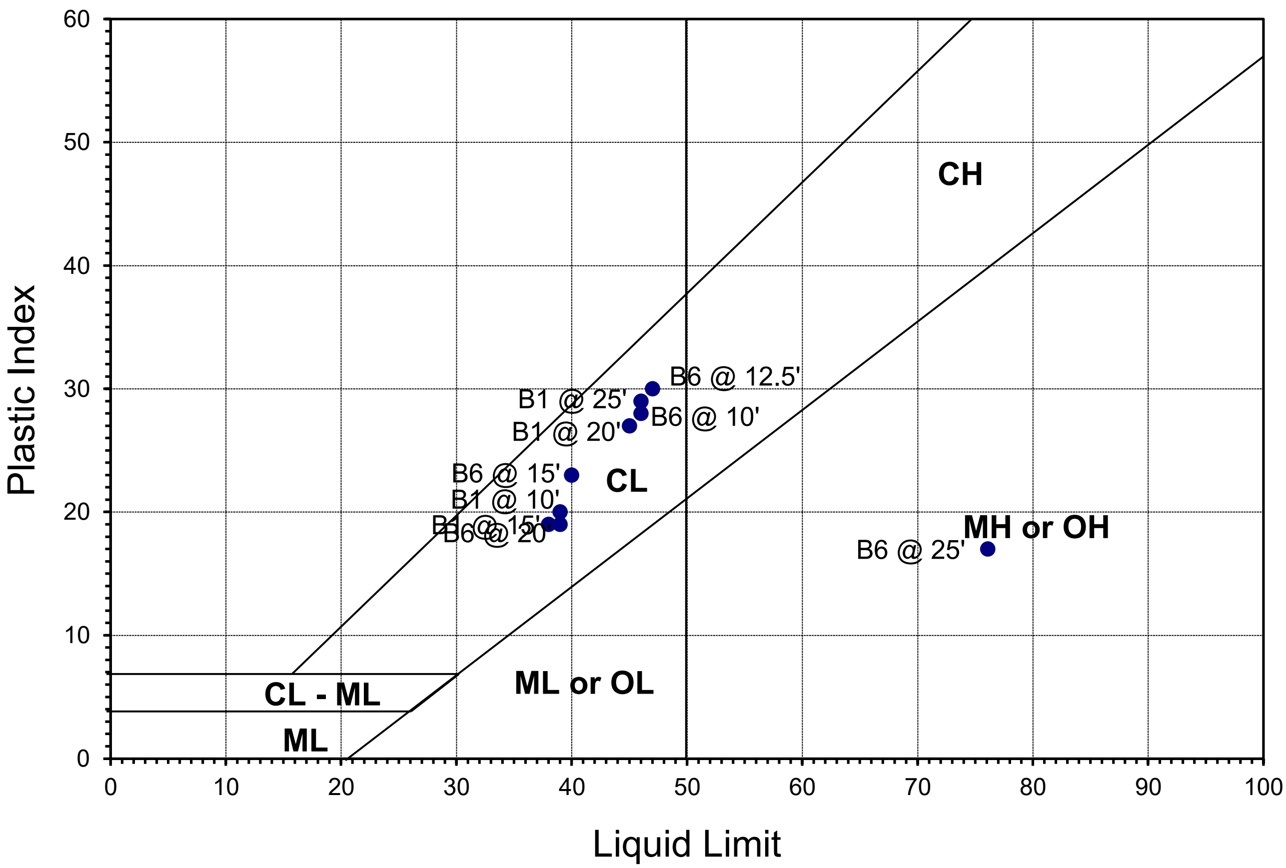
PLATE: E-1




# EXHIBIT 9 - GRAIN SIZE DISTRIBUTION

**Geotechnologies, Inc.**
Consulting Geotechnical Engineers

| RADFORD STUDIO CENTER PROJECT | |
|---|---|
| FILE NO. 22241 | PLATE: E-2 |




| Sample ID | Descriptions | Passing #200 | Liquid Limit | Plastic Limit | Plastic Index |
|---|---|---|---|---|---|
| B1 @ 10' | CL | 50.6 | 39.0 | 19.0 | 20.0 |
| B6 @ 10' | CL | 49.1 | 46.0 | 18.0 | 28.0 |
| B6 @ 12.5' | CL | 54.4 | 47.0 | 17.0 | 30.0 |
| B1 @ 15' | CL | 62.0 | 38.0 | 19.0 | 19.0 |
| B6 @ 15' | CL | 50.9 | 40.0 | 17.0 | 23.0 |
| B1 @ 20' | CL | 58.4 | 45.0 | 18.0 | 27.0 |
| B6 @ 20' | CL | 52.8 | 39.0 | 20.0 | 19.0 |
| B1 @ 25' | CL | 53.8 | 46.0 | 17.0 | 29.0 |
| B6 @ 25' | CH | 76.1 | 51.0 | 17.0 | 34.0 |
| | | | | | |

# EXHIBIT 10 - ATTERBERG LIMITS

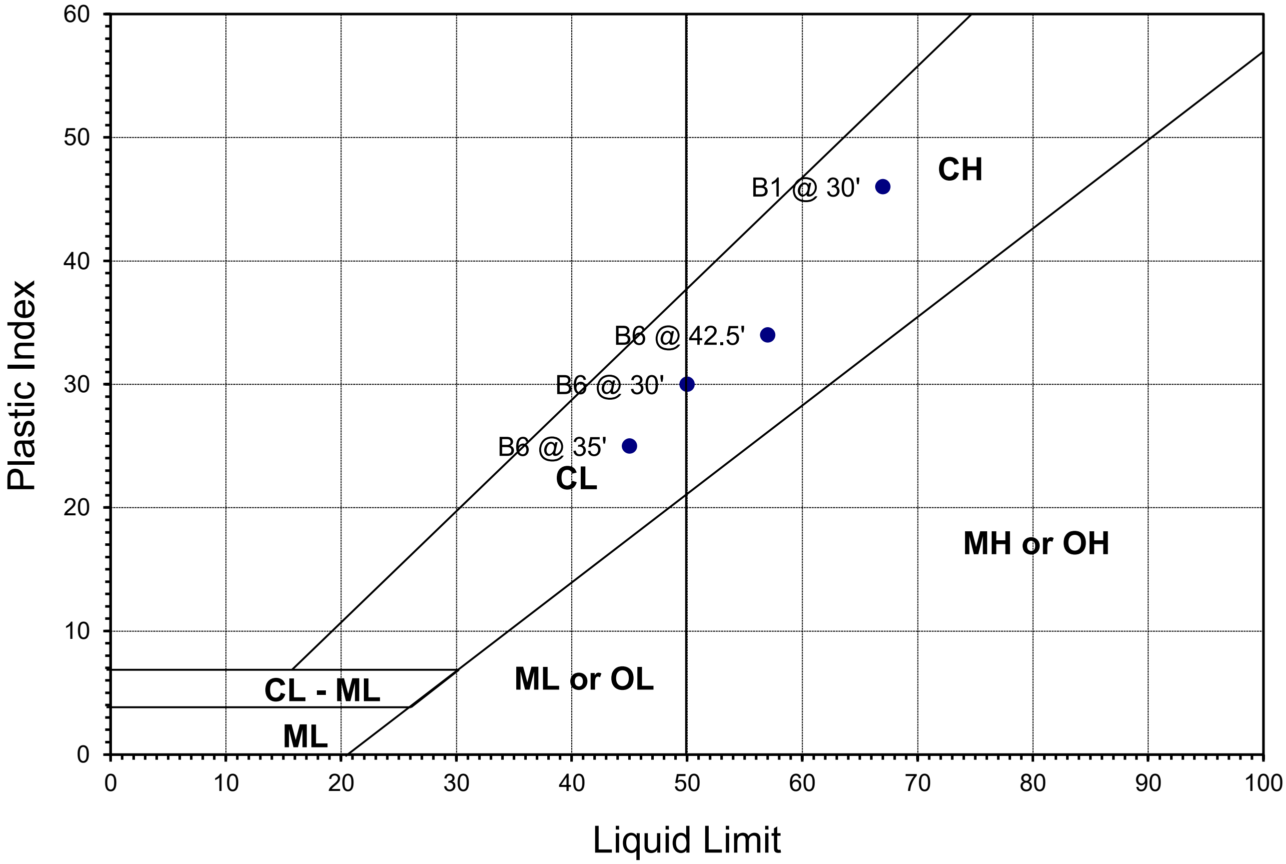
**Geotechnologies, Inc.**

*CONSULTING GEOTECHNICAL ENGINEERS*

PROJECT: RADFORD STUDIO CENTER PROJECT

FILE NO.: 22241

PLATE: F-1




| Sample ID | Descriptions | Passing #200 | Liquid Limit | Plastic Limit | Plastic Index |
|---|---|---|---|---|---|
| B1 @ 30' | CH | 54.3 | 67.0 | 21.0 | 46.0 |
| B6 @ 30' | CH | 62.7 | 50.0 | 20.0 | 30.0 |
| B6 @ 35' | CL | 79.7 | 45.0 | 20.0 | 25.0 |
| B6 @ 42.5' | CH | 93.1 | 57.0 | 23.0 | 34.0 |
| B6 @ 45' | CH | 93.4 | 87.0 | 26.0 | 61.0 |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

# EXHIBIT 10 - ATTERBERG LIMITS

**Geotechnologies, Inc.**

*CONSULTING GEOTECHNICAL ENGINEERS*

PROJECT: RADFORD STUDIO CENTER PROJECT

FILE NO.: 22241

PLATE: F-2

# EXHIBIT 11

## LIQUEFACTION ANALYSES

## (2 PAGES)

**Geotechnologies, Inc.**

Project: RADFORD STUDIO CENTER PROJECT
File No.: 22241
Description: Liquefaction Analysis
Boring No: B1

# LIQUEFACTION EVALUATION (Idriss & Boulanger, EERI NO 12)

**EARTHQUAKE INFORMATION:**

| | |
|---|---|
| Earthquake Magnitude (M): | 6.9 |
| Peak Ground Horizontal Acceleration, PGA (g): | 0.96 |
| Calculated Mag.Wtg.Factor: | 1.171 |

**GROUNDWATER INFORMATION:**

| | |
|---|---|
| Current Groundwater Level (ft): | 51.0 |
| Historically Highest Groundwater Level* (ft): | 10.0 |
| Unit Weight of Water (pcf): | 62.4 |

* Based on California Geological Survey Seismic Hazard Evaluation Report

**BOREHOLE AND SAMPLER INFORMATION:**

| | |
|---|---|
| Borehole Diameter (inches): | 8 |
| SPT Sampler with room for Liner (Y/N): | Y |

**LIQUEFACTION BOUNDARY:**

| | |
|---|---|
| Plastic Index Cut Off (PI): | 18 |
| Minimum Liquefaction FS: | 1.3 |

| Depth to Base Layer (feet) | Total Unit Weight (pcf) | Current Water Level (feet) | Historical Water Level (feet) | Field SPT Blowcount N | Depth of SPT Blowcount (feet) | Fines Content #200 Sieve (%) | Plastic Index (PI) | Vetical Stress $\sigma_{vc}$, (psf) | Effective Vert. Stress $\sigma_{vc}'$, (psf) | Fines Corrected $(N_1)_{60-cs}$ | Stress Reduction Coeff, $r_d$ | Cyclic Shear Ratio CSR | Mag. Scaling Factor (Sand) MSF | Overburden Corr. Factor $K_\sigma$ | Cyclic Resist. Ratio $CRR_{M7.5,\sigma vc'=1}$ | Cyclic Resistance Ratio (CRR) | Factor of Safety CRR/CSR (F.S.) | Liquefaction Settlment $\Delta S_i$ (inches) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 124.7 | Unsaturated | Unsaturated | 16 | 5 | 0.0 | 0 | 124.7 | 124.7 | 37.9 | 1.00 | 0.625 | 1.17 | 1.10 | 2.000 | 2.000 | Non-Liq. | 0.00 |
| 2 | 124.7 | Unsaturated | Unsaturated | 16 | 5 | 0.0 | 0 | 249.4 | 249.4 | 37.9 | 1.00 | 0.623 | 1.17 | 1.10 | 2.000 | 2.000 | Non-Liq. | 0.00 |
| 3 | 124.7 | Unsaturated | Unsaturated | 16 | 5 | 0.0 | 0 | 374.1 | 374.1 | 37.9 | 1.00 | 0.621 | 1.17 | 1.10 | 2.000 | 2.000 | Non-Liq. | 0.00 |
| 4 | 124.7 | Unsaturated | Unsaturated | 16 | 5 | 0.0 | 0 | 498.8 | 498.8 | 35.7 | 0.99 | 0.619 | 1.17 | 1.10 | 1.278 | 1.646 | Non-Liq. | 0.00 |
| 5 | 124.7 | Unsaturated | Unsaturated | 16 | 5 | 0.0 | 0 | 623.5 | 623.5 | 35.6 | 0.99 | 0.617 | 1.17 | 1.10 | 1.255 | 1.618 | Non-Liq. | 0.00 |
| 6 | 124.7 | Unsaturated | Unsaturated | 16 | 5 | 0.0 | 0 | 748.2 | 748.2 | 33.9 | 0.99 | 0.614 | 1.17 | 1.10 | 0.894 | 1.152 | Non-Liq. | 0.00 |
| 7 | 124.7 | Unsaturated | Unsaturated | 16 | 5 | 0.0 | 0 | 872.9 | 872.9 | 32.1 | 0.98 | 0.612 | 1.17 | 1.10 | 0.650 | 0.837 | Non-Liq. | 0.00 |
| 8 | 130.2 | Unsaturated | Unsaturated | 16 | 5 | 0.0 | 0 | 1003.1 | 1003.1 | 30.4 | 0.98 | 0.610 | 1.17 | 1.10 | 0.509 | 0.656 | Non-Liq. | 0.00 |
| 9 | 130.2 | Unsaturated | Unsaturated | 16 | 5 | 0.0 | 0 | 1133.3 | 1133.3 | 30.8 | 0.98 | 0.607 | 1.17 | 1.10 | 0.542 | 0.699 | Non-Liq. | 0.00 |
| 10 | 130.2 | Unsaturated | Unsaturated | 16 | 5 | 0.0 | 0 | 1263.5 | 1263.5 | 29.5 | 0.97 | 0.605 | 1.17 | 1.10 | 0.455 | 0.586 | Non-Liq. | 0.00 |
| 11 | 130.2 | Unsaturated | Saturated | 11 | 10 | 50.6 | 20 | 1393.7 | 1331.3 | 24.5 | 0.97 | 0.630 | 1.17 | 1.07 | 0.279 | 0.349 | Non-Liq. | 0.00 |
| 12 | 130.2 | Unsaturated | Saturated | 11 | 10 | 50.6 | 20 | 1523.9 | 1399.1 | 23.7 | 0.96 | 0.653 | 1.17 | 1.05 | 0.262 | 0.323 | Non-Liq. | 0.00 |
| 13 | 131.6 | Unsaturated | Saturated | 11 | 10 | 50.6 | 20 | 1655.5 | 1468.3 | 23.0 | 0.96 | 0.673 | 1.17 | 1.04 | 0.249 | 0.302 | Non-Liq. | 0.00 |
| 14 | 131.6 | Unsaturated | Saturated | 11 | 10 | 50.6 | 20 | 1787.1 | 1537.5 | 22.3 | 0.95 | 0.690 | 1.17 | 1.02 | 0.237 | 0.285 | Non-Liq. | 0.00 |
| 15 | 131.6 | Unsaturated | Saturated | 11 | 10 | 50.6 | 20 | 1918.7 | 1606.7 | 23.8 | 0.95 | 0.706 | 1.17 | 1.01 | 0.264 | 0.313 | Non-Liq. | 0.00 |
| 16 | 131.6 | Unsaturated | Saturated | 12 | 15 | 62.0 | 19 | 2050.3 | 1675.9 | 25.0 | 0.95 | 0.720 | 1.17 | 1.00 | 0.289 | 0.340 | Non-Liq. | 0.00 |
| 17 | 131.6 | Unsaturated | Saturated | 12 | 15 | 62.0 | 19 | 2181.9 | 1745.1 | 24.3 | 0.94 | 0.732 | 1.17 | 0.99 | 0.275 | 0.321 | Non-Liq. | 0.00 |
| 18 | 124.7 | Unsaturated | Saturated | 12 | 15 | 62.0 | 19 | 2306.6 | 1807.4 | 23.8 | 0.94 | 0.743 | 1.17 | 0.99 | 0.264 | 0.305 | Non-Liq. | 0.00 |
| 19 | 124.7 | Unsaturated | Saturated | 12 | 15 | 62.0 | 19 | 2431.3 | 1869.7 | 23.3 | 0.93 | 0.753 | 1.17 | 0.98 | 0.254 | 0.292 | Non-Liq. | 0.00 |
| 20 | 124.7 | Unsaturated | Saturated | 12 | 15 | 62.0 | 19 | 2556.0 | 1932.0 | 22.8 | 0.93 | 0.762 | 1.17 | 0.97 | 0.246 | 0.280 | Non-Liq. | 0.00 |
| 21 | 124.7 | Unsaturated | Saturated | 13 | 20 | 58.4 | 27 | 2680.7 | 1994.3 | 24.0 | 0.92 | 0.770 | 1.17 | 0.96 | 0.269 | 0.303 | Non-Liq. | 0.00 |
| 22 | 124.7 | Unsaturated | Saturated | 13 | 20 | 58.4 | 27 | 2805.4 | 2056.6 | 23.6 | 0.92 | 0.777 | 1.17 | 0.96 | 0.260 | 0.291 | Non-Liq. | 0.00 |
| 23 | 129.4 | Unsaturated | Saturated | 13 | 20 | 58.4 | 27 | 2934.8 | 2123.6 | 23.1 | 0.91 | 0.783 | 1.17 | 0.95 | 0.252 | 0.280 | Non-Liq. | 0.00 |
| 24 | 129.4 | Unsaturated | Saturated | 13 | 20 | 58.4 | 27 | 3064.2 | 2190.6 | 22.7 | 0.90 | 0.787 | 1.17 | 0.94 | 0.244 | 0.271 | Non-Liq. | 0.00 |
| 25 | 129.4 | Unsaturated | Saturated | 13 | 20 | 58.4 | 27 | 3193.6 | 2257.6 | 22.3 | 0.90 | 0.792 | 1.17 | 0.94 | 0.238 | 0.262 | Non-Liq. | 0.00 |
| 26 | 129.4 | Unsaturated | Saturated | 16 | 25 | 53.8 | 29 | 3323.0 | 2324.6 | 26.7 | 0.89 | 0.795 | 1.17 | 0.92 | 0.338 | 0.364 | Non-Liq. | 0.00 |
| 27 | 129.4 | Unsaturated | Saturated | 16 | 25 | 53.8 | 29 | 3452.4 | 2391.6 | 26.3 | 0.89 | 0.798 | 1.17 | 0.92 | 0.324 | 0.348 | Non-Liq. | 0.00 |
| 28 | 125.0 | Unsaturated | Saturated | 16 | 25 | 53.8 | 29 | 3577.4 | 2454.2 | 27.3 | 0.88 | 0.801 | 1.17 | 0.91 | 0.355 | 0.377 | Non-Liq. | 0.00 |
| 29 | 125.0 | Unsaturated | Saturated | 16 | 25 | 53.8 | 29 | 3702.4 | 2516.8 | 26.8 | 0.88 | 0.803 | 1.17 | 0.90 | 0.341 | 0.360 | Non-Liq. | 0.00 |
| 30 | 125.0 | Unsaturated | Saturated | 16 | 25 | 53.8 | 29 | 3827.4 | 2579.4 | 26.5 | 0.87 | 0.805 | 1.17 | 0.90 | 0.329 | 0.346 | Non-Liq. | 0.00 |
| 31 | 125.0 | Unsaturated | Saturated | 17 | 30 | 54.3 | 46 | 3952.4 | 2642.0 | 27.8 | 0.87 | 0.806 | 1.17 | 0.89 | 0.374 | 0.388 | Non-Liq. | 0.00 |
| 32 | 125.0 | Unsaturated | Saturated | 17 | 30 | 54.3 | 46 | 4077.4 | 2704.6 | 27.4 | 0.86 | 0.807 | 1.17 | 0.88 | 0.360 | 0.372 | Non-Liq. | 0.00 |
| 33 | 127.1 | Unsaturated | Saturated | 24 | 35 | 62.6 | 0 | 4204.5 | 2769.3 | 40.2 | 0.85 | 0.807 | 1.17 | 0.80 | 2.000 | 1.866 | 2.3 | 0.00 |
| 34 | 127.1 | Unsaturated | Saturated | 24 | 35 | 62.6 | 0 | 4331.6 | 2834.0 | 39.7 | 0.85 | 0.807 | 1.17 | 0.79 | 2.000 | 1.845 | 2.3 | 0.00 |
| 35 | 127.1 | Unsaturated | Saturated | 24 | 35 | 62.6 | 0 | 4458.7 | 2898.7 | 39.2 | 0.84 | 0.807 | 1.17 | 0.78 | 2.000 | 1.825 | 2.3 | 0.00 |
| 36 | 127.1 | Unsaturated | Saturated | 24 | 35 | 62.6 | 0 | 4585.8 | 2963.4 | 38.7 | 0.84 | 0.806 | 1.17 | 0.77 | 2.000 | 1.806 | 2.2 | 0.00 |
| 37 | 127.1 | Unsaturated | Saturated | 24 | 35 | 62.6 | 0 | 4712.9 | 3028.1 | 38.2 | 0.83 | 0.805 | 1.17 | 0.76 | 2.000 | 1.787 | 2.2 | 0.00 |
| 38 | 125.9 | Unsaturated | Saturated | 24 | 35 | 62.6 | 0 | 4838.8 | 3091.6 | 37.8 | 0.83 | 0.804 | 1.17 | 0.76 | 2.000 | 1.769 | 2.2 | 0.00 |
| 39 | 125.9 | Unsaturated | Saturated | 24 | 35 | 62.6 | 0 | 4964.7 | 3155.1 | 37.4 | 0.82 | 0.803 | 1.17 | 0.75 | 1.915 | 1.676 | 2.1 | 0.00 |
| 40 | 125.9 | Unsaturated | Saturated | 24 | 35 | 62.6 | 0 | 5090.6 | 3218.6 | 36.9 | 0.81 | 0.801 | 1.17 | 0.74 | 1.721 | 1.494 | 1.9 | 0.00 |
| 41 | 125.9 | Unsaturated | Saturated | 27 | 40 | 33.4 | 0 | 5216.5 | 3282.1 | 42.6 | 0.81 | 0.800 | 1.17 | 0.73 | 2.000 | 1.717 | 2.1 | 0.00 |
| 42 | 125.9 | Unsaturated | Saturated | 27 | 40 | 33.4 | 0 | 5342.4 | 3345.6 | 42.2 | 0.80 | 0.798 | 1.17 | 0.73 | 2.000 | 1.700 | 2.1 | 0.00 |
| 43 | 125.7 | Unsaturated | Saturated | 27 | 40 | 33.4 | 0 | 5468.1 | 3408.9 | 41.7 | 0.80 | 0.795 | 1.17 | 0.72 | 2.000 | 1.684 | 2.1 | 0.00 |
| 44 | 125.7 | Unsaturated | Saturated | 27 | 40 | 33.4 | 0 | 5593.8 | 3472.2 | 41.3 | 0.79 | 0.793 | 1.17 | 0.71 | 2.000 | 1.669 | 2.1 | 0.00 |
| 45 | 125.7 | Unsaturated | Saturated | 27 | 40 | 33.4 | 0 | 5719.5 | 3535.5 | 40.9 | 0.79 | 0.791 | 1.17 | 0.71 | 2.000 | 1.653 | 2.1 | 0.00 |
| 46 | 125.7 | Unsaturated | Saturated | 29 | 45 | 22.6 | 0 | 5845.2 | 3598.8 | 44.2 | 0.78 | 0.788 | 1.17 | 0.70 | 2.000 | 1.638 | 2.1 | 0.00 |
| 47 | 125.7 | Unsaturated | Saturated | 29 | 45 | 22.6 | 0 | 5970.9 | 3662.1 | 43.8 | 0.77 | 0.785 | 1.17 | 0.69 | 2.000 | 1.624 | 2.1 | 0.00 |
| 48 | 125.4 | Unsaturated | Saturated | 29 | 45 | 22.6 | 0 | 6096.3 | 3725.1 | 43.4 | 0.77 | 0.782 | 1.17 | 0.69 | 2.000 | 1.609 | 2.1 | 0.00 |
| 49 | 125.4 | Unsaturated | Saturated | 29 | 45 | 22.6 | 0 | 6221.7 | 3788.1 | 43.0 | 0.76 | 0.779 | 1.17 | 0.68 | 2.000 | 1.595 | 2.0 | 0.00 |
| 50 | 125.4 | Unsaturated | Saturated | 27 | 50 | 19.2 | 0 | 6347.1 | 3851.1 | 37.8 | 0.76 | 0.776 | 1.17 | 0.67 | 2.000 | 1.581 | 2.0 | 0.00 |

**Geotechnologies, Inc.**

Project: RADFORD STUDIO CENTER PROJECT
File No.: 22241
Description: Liquefaction Analysis
Boring No: B6

# LIQUEFACTION EVALUATION (Idriss & Boulanger, EERI NO 12)

**EARTHQUAKE INFORMATION:**

| | |
|---|---|
| Earthquake Magnitude (M): | 6.9 |
| Peak Ground Horizontal Acceleration, PGA (g): | 0.96 |
| Calculated Mag.Wtg.Factor: | 1.171 |

**GROUNDWATER INFORMATION:**

| | |
|---|---|
| Current Groundwater Level (ft): | 42.0 |
| Historically Highest Groundwater Level* (ft): | 20.0 |
| Unit Weight of Water (pcf): | 62.4 |

* Based on California Geological Survey Seismic Hazard Evaluation Report

**BOREHOLE AND SAMPLER INFORMATION:**

| | |
|---|---|
| Borehole Diameter (inches): | 8 |
| SPT Sampler with room for Liner (Y/N): | Y |

**LIQUEFACTION BOUNDARY:**

| | |
|---|---|
| Plastic Index Cut Off (PI): | 18 |
| Minimum Liquefaction FS: | 1.3 |

| Depth to Base Layer (feet) | Total Unit Weight (pcf) | Current Water Level (feet) | Historical Water Level (feet) | Field SPT Blowcount N | Depth of SPT Blowcount (feet) | Fines Content #200 Sieve (%) | Plastic Index (PI) | Vetical Stress $\sigma_{vc}$, (psf) | Effective Vert. Stress $\sigma_{vc}'$, (psf) | Fines Corrected $(N_1)_{60-cs}$ | Stress Reduction Coeff, $r_d$ | Cyclic Shear Ratio CSR | Mag. Scaling Factor (Sand) MSF | Overburden Corr. Factor $K_\sigma$ | Cyclic Resist. Ratio $CRR_{M7.5,\sigma vc'=1}$ | Cyclic Resistance Ratio (CRR) | Factor of Safety CRR/CSR (F.S.) | Liquefaction Settlment $\Delta S_i$ (inches) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 122.1 | Unsaturated | Unsaturated | 9 | 5 | 0.0 | 0 | 122.1 | 122.1 | 19.2 | 1.00 | 0.625 | 1.17 | 1.10 | 0.197 | 0.253 | Non-Liq. | 0.00 |
| 2 | 122.1 | Unsaturated | Unsaturated | 9 | 5 | 0.0 | 0 | 244.2 | 244.2 | 19.2 | 1.00 | 0.623 | 1.17 | 1.10 | 0.197 | 0.253 | Non-Liq. | 0.00 |
| 3 | 122.1 | Unsaturated | Unsaturated | 9 | 5 | 0.0 | 0 | 366.3 | 366.3 | 19.2 | 1.00 | 0.621 | 1.17 | 1.10 | 0.197 | 0.253 | Non-Liq. | 0.00 |
| 4 | 122.1 | Unsaturated | Unsaturated | 9 | 5 | 0.0 | 0 | 488.4 | 488.4 | 19.2 | 0.99 | 0.619 | 1.17 | 1.10 | 0.197 | 0.253 | Non-Liq. | 0.00 |
| 5 | 122.1 | Unsaturated | Unsaturated | 9 | 5 | 0.0 | 0 | 610.5 | 610.5 | 20.7 | 0.99 | 0.617 | 1.17 | 1.10 | 0.215 | 0.276 | Non-Liq. | 0.00 |
| 6 | 122.1 | Unsaturated | Unsaturated | 9 | 5 | 0.0 | 0 | 732.6 | 732.6 | 19.5 | 0.99 | 0.614 | 1.17 | 1.10 | 0.200 | 0.257 | Non-Liq. | 0.00 |
| 7 | 122.1 | Unsaturated | Unsaturated | 9 | 5 | 0.0 | 0 | 854.7 | 854.7 | 18.3 | 0.98 | 0.612 | 1.17 | 1.10 | 0.187 | 0.240 | Non-Liq. | 0.00 |
| 8 | 124.4 | Unsaturated | Unsaturated | 9 | 5 | 0.0 | 0 | 979.1 | 979.1 | 17.1 | 0.98 | 0.610 | 1.17 | 1.09 | 0.175 | 0.224 | Non-Liq. | 0.00 |
| 9 | 124.4 | Unsaturated | Unsaturated | 9 | 5 | 0.0 | 0 | 1103.5 | 1103.5 | 17.2 | 0.98 | 0.607 | 1.17 | 1.08 | 0.176 | 0.222 | Non-Liq. | 0.00 |
| 10 | 124.4 | Unsaturated | Unsaturated | 9 | 10 | 49.1 | 28 | 1227.9 | 1227.9 | 21.9 | 0.97 | 0.605 | 1.17 | 1.08 | 0.232 | 0.293 | Non-Liq. | 0.00 |
| 11 | 124.4 | Unsaturated | Unsaturated | 9 | 10 | 49.1 | 28 | 1352.3 | 1352.3 | 21.2 | 0.97 | 0.602 | 1.17 | 1.06 | 0.221 | 0.275 | Non-Liq. | 0.00 |
| 12 | 124.4 | Unsaturated | Unsaturated | 9 | 10 | 49.1 | 28 | 1476.7 | 1476.7 | 20.5 | 0.96 | 0.599 | 1.17 | 1.05 | 0.212 | 0.260 | Non-Liq. | 0.00 |
| 13 | 126.4 | Unsaturated | Unsaturated | 9 | 10 | 54.4 | 30 | 1603.1 | 1603.1 | 19.8 | 0.96 | 0.597 | 1.17 | 1.04 | 0.204 | 0.247 | Non-Liq. | 0.00 |
| 14 | 126.4 | Unsaturated | Unsaturated | 9 | 10 | 54.4 | 30 | 1729.5 | 1729.5 | 19.2 | 0.95 | 0.594 | 1.17 | 1.03 | 0.197 | 0.237 | Non-Liq. | 0.00 |
| 15 | 126.4 | Unsaturated | Unsaturated | 9 | 10 | 54.4 | 30 | 1855.9 | 1855.9 | 20.4 | 0.95 | 0.591 | 1.17 | 1.02 | 0.211 | 0.252 | Non-Liq. | 0.00 |
| 16 | 126.4 | Unsaturated | Unsaturated | 9 | 15 | 50.9 | 23 | 1982.3 | 1982.3 | 19.9 | 0.95 | 0.588 | 1.17 | 1.01 | 0.205 | 0.242 | Non-Liq. | 0.00 |
| 17 | 126.4 | Unsaturated | Unsaturated | 9 | 15 | 50.9 | 23 | 2108.7 | 2108.7 | 19.4 | 0.94 | 0.585 | 1.17 | 1.00 | 0.199 | 0.233 | Non-Liq. | 0.00 |
| 18 | 121.9 | Unsaturated | Unsaturated | 15 | 20 | 52.8 | 19 | 2230.6 | 2230.6 | 29.6 | 0.94 | 0.582 | 1.17 | 0.99 | 0.463 | 0.536 | Non-Liq. | 0.00 |
| 19 | 121.9 | Unsaturated | Unsaturated | 15 | 20 | 52.8 | 19 | 2352.5 | 2352.5 | 29.0 | 0.93 | 0.579 | 1.17 | 0.98 | 0.429 | 0.492 | Non-Liq. | 0.00 |
| 20 | 121.9 | Unsaturated | Unsaturated | 15 | 20 | 52.8 | 19 | 2474.4 | 2474.4 | 28.4 | 0.93 | 0.576 | 1.17 | 0.97 | 0.401 | 0.456 | Non-Liq. | 0.00 |
| 21 | 121.9 | Unsaturated | Saturated | 15 | 20 | 52.8 | 19 | 2596.3 | 2533.9 | 27.9 | 0.92 | 0.587 | 1.17 | 0.96 | 0.378 | 0.426 | Non-Liq. | 0.00 |
| 22 | 121.9 | Unsaturated | Saturated | 15 | 20 | 52.8 | 19 | 2718.2 | 2593.4 | 27.3 | 0.92 | 0.597 | 1.17 | 0.95 | 0.358 | 0.400 | Non-Liq. | 0.00 |
| 23 | 117.1 | Unsaturated | Saturated | 15 | 20 | 52.8 | 19 | 2835.3 | 2648.1 | 26.9 | 0.91 | 0.606 | 1.17 | 0.95 | 0.342 | 0.379 | Non-Liq. | 0.00 |
| 24 | 117.1 | Unsaturated | Saturated | 15 | 20 | 52.8 | 19 | 2952.4 | 2702.8 | 26.4 | 0.90 | 0.615 | 1.17 | 0.94 | 0.327 | 0.361 | Non-Liq. | 0.00 |
| 25 | 117.1 | Unsaturated | Saturated | 15 | 20 | 52.8 | 19 | 3069.5 | 2757.5 | 26.0 | 0.90 | 0.623 | 1.17 | 0.94 | 0.315 | 0.345 | Non-Liq. | 0.00 |
| 26 | 117.1 | Unsaturated | Saturated | 16 | 25 | 76.1 | 34 | 3186.6 | 2812.2 | 27.2 | 0.89 | 0.630 | 1.17 | 0.93 | 0.352 | 0.382 | Non-Liq. | 0.00 |
| 27 | 117.1 | Unsaturated | Saturated | 16 | 25 | 76.1 | 34 | 3303.7 | 2866.9 | 26.7 | 0.89 | 0.637 | 1.17 | 0.92 | 0.338 | 0.365 | Non-Liq. | 0.00 |
| 28 | 129.1 | Unsaturated | Saturated | 16 | 25 | 76.1 | 34 | 3432.8 | 2933.6 | 27.7 | 0.88 | 0.643 | 1.17 | 0.91 | 0.371 | 0.396 | Non-Liq. | 0.00 |
| 29 | 129.1 | Unsaturated | Saturated | 16 | 25 | 76.1 | 34 | 3561.9 | 3000.3 | 27.2 | 0.88 | 0.648 | 1.17 | 0.91 | 0.355 | 0.377 | Non-Liq. | 0.00 |
| 30 | 129.1 | Unsaturated | Saturated | 16 | 25 | 76.1 | 34 | 3691.0 | 3067.0 | 26.8 | 0.87 | 0.653 | 1.17 | 0.90 | 0.341 | 0.360 | Non-Liq. | 0.00 |
| 31 | 129.1 | Unsaturated | Saturated | 18 | 30 | 62.7 | 30 | 3820.1 | 3133.7 | 29.9 | 0.87 | 0.657 | 1.17 | 0.88 | 0.482 | 0.497 | Non-Liq. | 0.00 |
| 32 | 129.1 | Unsaturated | Saturated | 18 | 30 | 62.7 | 30 | 3949.2 | 3200.4 | 29.5 | 0.86 | 0.661 | 1.17 | 0.88 | 0.456 | 0.468 | Non-Liq. | 0.00 |
| 33 | 114.4 | Unsaturated | Saturated | 18 | 30 | 62.7 | 30 | 4063.6 | 3252.4 | 29.1 | 0.85 | 0.664 | 1.17 | 0.87 | 0.436 | 0.446 | Non-Liq. | 0.00 |
| 34 | 114.4 | Unsaturated | Saturated | 18 | 30 | 62.7 | 30 | 4178.0 | 3304.4 | 28.8 | 0.85 | 0.668 | 1.17 | 0.87 | 0.418 | 0.426 | Non-Liq. | 0.00 |
| 35 | 114.4 | Unsaturated | Saturated | 18 | 30 | 62.7 | 30 | 4292.4 | 3356.4 | 28.4 | 0.84 | 0.671 | 1.17 | 0.87 | 0.402 | 0.408 | Non-Liq. | 0.00 |
| 36 | 114.4 | Unsaturated | Saturated | 10 | 35 | 79.7 | 25 | 4406.8 | 3408.4 | 16.2 | 0.84 | 0.674 | 1.17 | 0.91 | 0.167 | 0.179 | Non-Liq. | 0.00 |
| 37 | 114.4 | Unsaturated | Saturated | 10 | 35 | 79.7 | 25 | 4521.2 | 3460.4 | 16.1 | 0.83 | 0.676 | 1.17 | 0.91 | 0.165 | 0.177 | Non-Liq. | 0.00 |
| 38 | 130.5 | Unsaturated | Saturated | 10 | 35 | 79.7 | 25 | 4651.7 | 3528.5 | 15.9 | 0.83 | 0.677 | 1.17 | 0.91 | 0.164 | 0.174 | Non-Liq. | 0.00 |
| 39 | 130.5 | Unsaturated | Saturated | 10 | 35 | 79.7 | 25 | 4782.2 | 3596.6 | 15.7 | 0.82 | 0.678 | 1.17 | 0.91 | 0.162 | 0.172 | Non-Liq. | 0.00 |
| 40 | 130.5 | Unsaturated | Saturated | 10 | 35 | 79.7 | 25 | 4912.7 | 3664.7 | 15.6 | 0.81 | 0.679 | 1.17 | 0.90 | 0.161 | 0.170 | Non-Liq. | 0.00 |
| 41 | 130.5 | Unsaturated | Saturated | 24 | 40 | 93.1 | 34 | 5043.2 | 3732.8 | 37.0 | 0.81 | 0.680 | 1.17 | 0.74 | 1.750 | 1.523 | Non-Liq. | 0.00 |
| 42 | 130.5 | Unsaturated | Saturated | 24 | 40 | 93.1 | 34 | 5173.7 | 3800.9 | 36.6 | 0.80 | 0.680 | 1.17 | 0.74 | 1.576 | 1.370 | Non-Liq. | 0.00 |
| 43 | 116.1 | Saturated | Saturated | 16 | 45 | 93.1 | 61 | 5289.8 | 3854.6 | 22.9 | 0.80 | 0.680 | 1.17 | 0.86 | 0.247 | 0.250 | Non-Liq. | 0.00 |
| 44 | 116.1 | Saturated | Saturated | 16 | 45 | 93.1 | 61 | 5405.9 | 3908.3 | 22.7 | 0.79 | 0.681 | 1.17 | 0.86 | 0.245 | 0.248 | Non-Liq. | 0.00 |
| 45 | 116.1 | Saturated | Saturated | 16 | 45 | 93.1 | 61 | 5522.0 | 3962.0 | 22.6 | 0.79 | 0.681 | 1.17 | 0.86 | 0.243 | 0.246 | Non-Liq. | 0.00 |
| 46 | 116.1 | Saturated | Saturated | 16 | 45 | 93.4 | 61 | 5638.1 | 4015.7 | 22.5 | 0.78 | 0.681 | 1.17 | 0.86 | 0.241 | 0.244 | Non-Liq. | 0.00 |
| 47 | 116.1 | Saturated | Saturated | 16 | 45 | 93.4 | 61 | 5754.2 | 4069.4 | 22.4 | 0.77 | 0.681 | 1.17 | 0.86 | 0.240 | 0.242 | Non-Liq. | 0.00 |
| 48 | 119.6 | Saturated | Saturated | 16 | 45 | 93.4 | 61 | 5873.8 | 4126.6 | 22.3 | 0.77 | 0.680 | 1.17 | 0.86 | 0.238 | 0.240 | Non-Liq. | 0.00 |
| 49 | 119.6 | Saturated | Saturated | 16 | 45 | 93.4 | 61 | 5993.4 | 4183.8 | 22.2 | 0.76 | 0.680 | 1.17 | 0.86 | 0.236 | 0.238 | Non-Liq. | 0.00 |
| 50 | 119.6 | Saturated | Saturated | 16 | 45 | 93.4 | 61 | 6113.0 | 4241.0 | 22.1 | 0.76 | 0.679 | 1.17 | 0.86 | 0.235 | 0.236 | Non-Liq. | 0.00 |
| 51 | 119.6 | Saturated | Saturated | 72 | 50 | 0.0 | 0 | 6232.6 | 4298.2 | 103.7 | 0.75 | 0.678 | 1.17 | 0.71 | 2.000 | 1.659 | 2.4 | 0.00 |
| 52 | 119.6 | Saturated | Saturated | 72 | 50 | 0.0 | 0 | 6352.2 | 4355.4 | 103.4 | 0.75 | 0.677 | 1.17 | 0.71 | 2.000 | 1.652 | 2.4 | 0.00 |
| 53 | 127.1 | Saturated | Saturated | 72 | 50 | 0.0 | 0 | 6479.3 | 4420.1 | 103.1 | 0.74 | 0.675 | 1.17 | 0.70 | 2.000 | 1.644 | 2.4 | 0.00 |
| 54 | 127.1 | Saturated | Saturated | 72 | 50 | 0.0 | 0 | 6606.4 | 4484.8 | 102.8 | 0.73 | 0.673 | 1.17 | 0.70 | 2.000 | 1.637 | 2.4 | 0.00 |
| 55 | 127.1 | Saturated | Saturated | 72 | 50 | 0.0 | 0 | 6733.5 | 4549.5 | 102.5 | 0.73 | 0.672 | 1.17 | 0.70 | 2.000 | 1.629 | 2.4 | 0.00 |
| 56 | 127.1 | Saturated | Saturated | 50 | 55 | 0.0 | 0 | 6860.6 | 4614.2 | 71.0 | 0.72 | 0.670 | 1.17 | 0.69 | 2.000 | 1.622 | 2.4 | 0.00 |
| 57 | 127.1 | Saturated | Saturated | 50 | 55 | 0.0 | 0 | 6987.7 | 4678.9 | 70.8 | 0.72 | 0.668 | 1.17 | 0.69 | 2.000 | 1.614 | 2.4 | 0.00 |
| 58 | 119.9 | Saturated | Saturated | 50 | 55 | 0.0 | 0 | 7107.6 | 4736.4 | 70.6 | 0.71 | 0.666 | 1.17 | 0.69 | 2.000 | 1.608 | 2.4 | 0.00 |
| 59 | 119.9 | Saturated | Saturated | 50 | 55 | 0.0 | 0 | 7227.5 | 4793.9 | 70.5 | 0.71 | 0.664 | 1.17 | 0.68 | 2.000 | 1.601 | 2.4 | 0.00 |
| 60 | 119.9 | Saturated | Saturated | 50 | 55 | 0.0 | 0 | 7347.4 | 4851.4 | 70.3 | 0.70 | 0.662 | 1.17 | 0.68 | 2.000 | 1.595 | 2.4 | 0.00 |
| 61 | 119.9 | Saturated | Saturated | 55 | 60 | 0.0 | 0 | 7467.3 | 4908.9 | 77.1 | 0.70 | 0.660 | 1.17 | 0.68 | 2.000 | 1.588 | 2.4 | 0.00 |
| 62 | 119.9 | Saturated | Saturated | 55 | 60 | 0.0 | 0 | 7587.2 | 4966.4 | 76.9 | 0.69 | 0.658 | 1.17 | 0.68 | 2.000 | 1.582 | 2.4 | 0.00 |
| 63 | 129.3 | Saturated | Saturated | 55 | 60 | 0.0 | 0 | 7716.5 | 5033.3 | 76.7 | 0.69 | 0.656 | 1.17 | 0.67 | 2.000 | 1.575 | 2.4 | 0.00 |
| 64 | 129.3 | Saturated | Saturated | 55 | 60 | 0.0 | 0 | 7845.8 | 5100.2 | 76.5 | 0.68 | 0.654 | 1.17 | 0.67 | 2.000 | 1.568 | 2.4 | 0.00 |
| 65 | 129.3 | Saturated | Saturated | 55 | 60 | 0.0 | 0 | 7975.1 | 5167.1 | 76.3 | 0.68 | 0.651 | 1.17 | 0.67 | 2.000 | 1.561 | 2.4 | 0.00 |
| 66 | 129.3 | Saturated | Saturated | 68 | 65 | 0.0 | 0 | 8104.4 | 5234.0 | 94.1 | 0.67 | 0.648 | 1.17 | 0.66 | 2.000 | 1.554 | 2.4 | 0.00 |
| 67 | 129.3 | Saturated | Saturated | 68 | 65 | 0.0 | 0 | 8233.7 | 5300.9 | 93.9 | 0.67 | 0.646 | 1.17 | 0.66 | 2.000 | 1.547 | 2.4 | 0.00 |
| 68 | 129.3 | Saturated | Saturated | 68 | 65 | 0.0 | 0 | 8363.0 | 5367.8 | 93.6 | 0.66 | 0.643 | 1.17 | 0.66 | 2.000 | 1.540 | 2.4 | 0.00 |
| 69 | 129.3 | Saturated | Saturated | 68 | 65 | 0.0 | 0 | 8492.3 | 5434.7 | 93.4 | 0.66 | 0.641 | 1.17 | 0.65 | 2.000 | 1.533 | 2.4 | 0.00 |
| 70 | 129.3 | Saturated | Saturated | 68 | 65 | 0.0 | 0 | 8621.6 | 5501.6 | 93.1 | 0.65 | 0.638 | 1.17 | 0.65 | 2.000 | 1.526 | 2.4 | 0.00 |
| 71 | 129.3 | Saturated | Saturated | 85 | 70 | 0.0 | 0 | 8750.9 | 5568.5 | 116.1 | 0.65 | 0.636 | 1.17 | 0.65 | 2.000 | 1.519 | 2.4 | 0.00 |
| 72 | 129.3 | Saturated | Saturated | 85 | 70 | 0.0 | 0 | 8880.2 | 5635.4 | 115.8 | 0.65 | 0.633 | 1.17 | 0.65 | 2.000 | 1.513 | 2.4 | 0.00 |
| 73 | 129.3 | Saturated | Saturated | 85 | 70 | 0.0 | 0 | 9009.5 | 5702.3 | 115.5 | 0.64 | 0.631 | 1.17 | 0.64 | 2.000 | 1.506 | 2.4 | 0.00 |
| 74 | 129.3 | Saturated | Saturated | 85 | 70 | 0.0 | 0 | 9138.8 | 5769.2 | 115.2 | 0.64 | 0.628 | 1.17 | 0.64 | 2.000 | 1.500 | 2.4 | 0.00 |
| 75 | 119.9 | Saturated | Saturated | 85 | 70 | 0.0 | 0 | 9258.7 | 5826.7 | 115.0 | 0.63 | 0.626 | 1.17 | 0.64 | 2.000 | 1.494 | 2.4 | 0.00 |
| 76 | 119.9 | Saturated | Saturated | 100 | 75 | 0.0 | 0 | 9378.6 | 5884.2 | 135.0 | 0.63 | 0.624 | 1.17 | 0.64 | 2.000 | 1.489 | 2.4 | 0.00 |
| 77 | 119.9 | Saturated | Saturated | 100 | 75 | 0.0 | 0 | 9498.5 | 5941.7 | 134.7 | 0.63 | 0.622 | 1.17 | 0.63 | 2.000 | 1.483 | 2.4 | 0.00 |
| 78 | 119.9 | Saturated | Saturated | 100 | 75 | 0.0 | 0 | 9618.4 | 5999.2 | 134.5 | 0.62 | 0.620 | 1.17 | 0.63 | 2.000 | 1.478 | 2.4 | 0.00 |
| 79 | 119.9 | Saturated | Saturated | 100 | 75 | 0.0 | 0 | 9738.3 | 6056.7 | 134.2 | 0.62 | 0.618 | 1.17 | 0.63 | 2.000 | 1.472 | 2.4 | 0.00 |
| 80 | 119.9 | Saturated | Saturated | 85 | 80 | 0.0 | 0 | 9858.2 | 6114.2 | 113.8 | 0.61 | 0.616 | 1.17 | 0.63 | 2.000 | 1.467 | 2.4 | 0.00 |

# Appendix H.2

Dewatering Report

# DEWATERING SIMULATION AND ANALYSIS FOR EXCAVATION AND UNDERGROUND CONSTRUCTION

## 4024, 4064 AND 4200 N. RADFORD AVENUE

## STUDIO CITY, CALIFORNIA

*Prepared by:*

Geosyntec consultants

engineers | scientists | innovators

211 East Ocean Boulevard, Suite 300
Long Beach, CA 90802
Telephone: 562.257.1401
www.geosyntec.com

Project Number: LB1048

13 March 2024

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# LIST OF ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| 3D | three-dimensional |
| A.E. Schmidt | A.E. Schmidt Environmental Inc. |
| AMSL | above mean sea level |
| bgs | below ground surface |
| cm/sec | centimeters per second |
| DEIR | Draft Environmental Impact Report |
| DWR | Department of Water Resources |
| EM | electromagnetic |
| ft | feet |
| $ft^3$ | cubic feet |
| ft/d | feet per day |
| ft/ft | feet per foot |
| ft/min | feet per minute |
| GAMA | State Groundwater Ambient Monitoring and Assessment database |
| Geosyntec | Geosyntec Consultants, Inc. |
| Geotechnologies | Geotechnologies, Inc. |
| gpd | gallons per day |
| gpm | gallons per minute |
| HFB | horizontal flow barrier |
| K | hydraulic conductivity |
| $K_h$ | horizontal hydraulic conductivity |
| $K_v$ | vertical hydraulic conductivity |
| KPFF | KPFF Consulting Engineers |
| LADWP | Los Angeles Department of Water and Power |
| LARWQCB | Los Angeles Regional Water Quality Control Board |
| Leader | Leader Professional Services, Inc. |
| msl | mean sea level |
| M | million |
| NPDES | National Pollutant Discharge Elimination System |
| Project Site | Radford Studio Center |
| sq-ft | square feet |
| Ss | Specific Storage |
| Sy | Specific yield |

# 1. INTRODUCTION

## 1.1 Overview and Purpose

Geosyntec Consultants, Inc. (Geosyntec) has prepared this Dewatering Simulation and Analysis for Excavation and Underground Parking Structure Construction (Report) in support of the Radford Studio Center Project (Project) located at 4024, 4064, and 4200 N. Radford Avenue in Studio City (Los Angeles), California (Project Site). This Report presents the methods, assumptions, results, and limitations of a preliminary evaluation of temporary dewatering for construction of the Project, including, among other things, construction of an underground parking structure.[1]

The results presented herein are preliminary to support the Draft Environmental Impact Report (DEIR) for the Project. Additional confirmatory analysis may be conducted as individual Project buildings are designed and permitted as part of the City of Los Angeles building permit process. Detailed dewatering analyses are typically performed after project entitlements are approved and its EIR is certified, and would typically be based on a site-specific groundwater pumping test, which can take months to implement.

This Report presents the results of a preliminary dewatering simulation in Excavation Area 1, which is the largest by saturated volume of the relatively deep excavations along the southern perimeter of the South Lot of the Project Site, and thus provides a representative example taking into account conservative influx rates of groundwater and dewatering influence, discussed further below. The Report also presents preliminary estimates for dewatering quantities that would result from simultaneous dewatering at Excavation Areas 1, 2, and 3 in the South Lot. The Project Site location is shown on **Figure 1**, and the proposed excavation areas for the underground parking structures within the Project Site are shown on **Figure 2**. This Report, prepared on behalf of Radford Studio Center, LLC, was prepared by Andy Simons, PG, and Daria Akhbari, PhD, and reviewed by Gordon Thrupp, PhD, PG, CHg, in accordance with Geosyntec's review policy.

[1] The underground parking structures may also include facilities for production support, such as storage and mills.

## 1.2 Summary of Approach

A preliminary simulation of construction dewatering was performed for the Excavation Area 1 (**Figure 2**).[2] Excavation Area 1 is the largest of the excavations by volume in the South Lot of the Project Site and where the recent groundwater occurs at a depth shallower than 50 feet (ft) below ground surface (ft bgs). In the absence of Project Site-specific hydraulic conductivity data, this preliminary evaluation assumed a range of estimated hydraulic conductivities, based on measurements at nearby sites and published hydraulic conductivity values consistent with the Project Site lithology. Geosyntec developed a Project Site-specific, three-dimensional (3D) numerical groundwater model in order to:

- Estimate the influx of groundwater with time into Excavation Area 1;
- Estimate the time required to lower the groundwater table to the target dewatering depth below the base of the excavation;
- Estimate the extent of groundwater drawdown and resulting change in groundwater flow directions (i.e., cone of depression) that would result from temporary construction dewatering activities;
- Simulate the lateral infiltration control measures;
- Conduct sensitivity analyses to the dewatering simulations using a range of hydraulic conductivities and initial groundwater levels; and
- Estimate the extent of groundwater drawdown and resulting change in groundwater flow directions (i.e., cone of depression) that would result from simultaneous dewatering at Excavation Areas 1, 2, and 3 in the South Lot.

## 1.3 Report Organization

The remainder of this Report is organized into the following sections:

- Section 2, *Project Site Setting and Hydrogeology*, discusses the Project Site setting and surrounding land uses, pertinent prior subsurface investigations, topography, geology and hydrogeology, and Project Site development and use.
- Section 3, *Construction Dewatering Analysis*, presents the methodology for simulating construction dewatering conditions in Excavation Area 1 and

[2] Also as shown in Figure 3 of the Soil Management Plan [Geosyntec, 2024a], included in Appendix A of the Environmental Subsurface Assessment Report [Geosyntec, 2024b].

simultaneous construction dewatering conditions at Excavation Areas 1, 2, and 3 in the South Lot.

- Section 4, *Construction Dewatering Analysis Results and Discussions*, presents the model findings.
- Section 5, *Conclusions and Recommendations*, provides conclusions and recommendations from this preliminary evaluation.
- Section 6, *Limitations and Signatures*, presents limitations of this Report and the signatures of the environmental professionals who prepared and reviewed it.
- Section 7, *References*, presents a list of documents referenced in this Report.

The table and figures are included at the end of this Report.

# 2. PROJECT SITE SETTING AND HYDROGEOLOGY

## 2.1 Setting and Surrounding Properties

The Project Site is located at 4024, 4064 and 4200 N. Radford Avenue in an urbanized area of Studio City, California (**Figure 1**). The Project Site consists of northern and southern parcels (the "North Lot" and "South Lot," respectively) that together comprise approximately 55 acres (approximately 52.25 acres after dedications/mergers). The Project Site is currently developed with studio uses and surface/structured parking, including numerous ancillary buildings and structures. There are currently five excavation areas (**Figure 2**) proposed for the underground parking structures within the Project Site as follow:

- Excavation Area 1 in the South Lot with an approximate area of 6.3 acres
- Excavation Area 2 in the South Lot with an approximate area of 1.6 acres
- Excavation Area 3 in the South Lot with an approximate area of 5.2 acres
- Excavation Area 4 in the North Lot with an approximate area of 0.4 acres
- Excavation Area 5 in the North Lot with an approximate area of 1.2 acres

The Project Site is bisected, north-south, by the Los Angeles River (**Figure 1**). The Project Site is bounded by Radford Avenue to the west, an alley with commercial uses fronting Ventura Boulevard to the south, Colfax Avenue to the east, and the Tujunga Wash and Los Angeles River to the north and east. Commercial buildings are located adjacent to the Project Site along the alley, with additional commercial buildings across Ventura Boulevard and Radford Avenue. Residential uses are located to the west across Radford Avenue and to the north and east across the Tujunga Wash.

## 2.2 Topography

Per the findings of the Project's topographic survey, the majority of the North Lot slopes from its northwest corner to its southeast corner with approximately 15 ft of elevation change (from 600 to 585 ft above mean sea level [AMSL]). The access road on the north side of the North Lot (south of the Tujunga Wash) also slopes from northwest to southeast from about 600 to 585 ft AMSL. The access road on the south side of the North Lot (north of the Los Angeles River) slopes from west to east from approximately 595 to 585 ft AMSL.

The majority of the South Lot generally slopes both from its southwest corner to its northwest corner with approximately 27 ft of elevation change (from 617 to 590 ft AMSL), and from its southwest corner to its southeast corner with approximately 17 ft of elevation change (from 617 to 600 ft AMSL). The access road on the north side of the South Lot slopes from northwest to southeast from approximately 595 to 585 ft AMSL before sloping back up to approximately 605 ft AMSL. From the edge of this access road on the southeast corner of the South Lot to the Los Angeles River, there is a steeper drop-off from approximately 600 to 583 ft AMSL.

The existing area to the north of the Los Angeles River generally slopes from northwest to southeast from approximately 600 to 581 ft AMSL.

## 2.3 Regional Geology and Hydrogeology

The Project Site is located at the northern end of Fryman Canyon of the Santa Monica Mountains within the Transverse Ranges geomorphic province. The Santa Monica Mountains are located south of the Project Site and are a structurally elevated block of the Transverse Ranges of regional faulting. Faults of the Transverse Ranges may be categorized as active, potentially active, or inactive. Faults in the region consist of buried thrust faults. The geology consists of alluvial sands and silty clay and gravel derived from the Santa Monica Mountains underlain by Miocene Monterey Formation.

## 2.4 Summary of Previous Geologic and Hydrogeologic Investigations at the Project Site

Previous subsurface investigations at the Project Site have identified four distinct types of sediments [Geotechnologies, 2024a; A.E. Schmidt Environmental Inc. (A.E. Schmidt), 1996; Geosyntec, 2024b]:

- Artificial fill is present throughout the Project Site. In the North Lot, the artificial fill is deeper near the Los Angeles River and a portion of the Tujunga Wash, at approximately 12.5 to 34 ft bgs, but relatively shallow, between approximately 1 and 8.5 ft bgs, throughout the rest of the North Lot. The artificial fill in the South Lot is generally thin across most of its area, deepening near the Los Angeles River. Fill depths range from approximately 3 to 8 ft below grade in most of the South Lot but increase to approximately 10 to 25.5 ft bgs near the Los Angeles River. The artificial fill is predominantly comprised of grayish-brown to black sandy silt.
- Construction debris was observed to be approximately 5 to 10 ft thick at depths ranging from approximately 15 to 30 ft bgs at certain locations. Debris was

observed to consist of brick, concrete, glass, wire, nails, wood, and incinerated wood. The source of debris is likely past construction activities.

- Native alluvial soils are present beneath the fill and debris at the Project Site. The alluvial soils generally consist of layers of gray to grayish brown sand, clay, and silt, with occasional gravel and cobbles.
- Bedrock, composed of Miocene Monterey Formation siltstone, was encountered at depths ranging from approximately 45 and 75 ft bgs in exploratory borings in the South Lot.

The Project Site is located within the San Fernando Valley Groundwater Basin [Department of Water Resources (DWR) Bulletin 118, 2004]. The San Fernando Valley Groundwater Basin is bounded to the north and northwest by the Santa Susana Mountains, on the north and northeast by the San Gabriel Mountains, on the east by the San Rafael Hills, on the south by the Santa Monica Mountains and Chalk Hills, and on the west by the Simi Hills. The valley is drained by the Los Angeles River and its tributaries.

Investigations at the Project Site have indicated varying groundwater depths. Historically, the highest groundwater level for the entire North Lot was 0 ft bgs (existing ground surface) and 0 to 10 ft bgs within the central portion of the South Lot and to a depth of 20 ft within the southern portion of the South Lot [Geotechnologies, 2024a]. Previous explorations conducted in 1993 and 2003 noted groundwater depths of approximately 58 to 73 ft bgs in the North Lot. In 2022, Geotechnologies' exploratory borings in the South Lot noted groundwater levels ranged from approximately 30 to 42 ft bgs.

Geosyntec's May 2022 subsurface investigation found groundwater at depths ranging from approximately 38 to 42 ft bgs. Excluding the historically highest groundwater depth ranges of 0 and 20 ft bgs, groundwater across the Project Site ranges from approximately 30 to 73 ft, depending on the location. Fluctuations in groundwater level may occur due to variations in rainfall and/or the impact of the nearby Los Angeles River and Tujunga Wash. Groundwater flow was determined to flow N23°E with a hydraulic gradient of 0.0091 ft per foot (ft/ft) [A.E. Schmidt, 1996].

## 2.5 Summary of Previous Hydrogeologic Investigations at Nearby Sites

Geosyntec accessed the State of California database GeoTracker on November 29, 2023 to review available data that characterized hydrogeologic conditions in the vicinity, including existing boring logs, soil and groundwater testing, and groundwater contour maps. This section provides a summary of our review.

### 2.5.1 Shell Service Station Investigations

A Shell service station (Shell Site, **Figure 2)** is situated approximately 200 ft from the southwestern edge of the Project Site, at the intersection of Ventura Boulevard and Ventura Place in Studio City, California [DELTA Environmental Consultants, Inc., 2005]. Groundwater monitoring investigations conducted at the Shell Site reported groundwater elevations ranging from 26.68 ft bgs to 32.19 ft bgs between 2007 and 2011. The estimated direction of groundwater flow was towards the northeast, with a groundwater gradient ranging from 0.01 to 0.03 ft/ft [DELTA Environmental Consultants, Inc, 2008, 2009; URS, 2011].

### 2.5.2 Former Texaco Service Station Investigations

A Former Texaco Service Station (Former Texaco Site, **Figure 2**) was approximately 50 ft from the southwestern edge of the Project Site, at the intersection of Ventura Boulevard and Ventura Place in Studio City, California [Texaco Environmental Services, 1992]. Groundwater monitoring investigations conducted at the Former Texaco Site reported groundwater elevations ranging from 24 ft bgs to 27.93 ft bgs between 1992 and 1995. The estimated direction of groundwater flow was towards the northwest/northeast, with a groundwater gradient ranging from 0.02 to 0.04 ft/ft [Texaco Environmental Services, 1992; W.W. Irwin, Inc, 1993; TRAK Environmental Group, 1996].

In 1995, electromagnetic (EM) logging and aquifer slug tests were conducted at the Former Texaco Site to estimate the hydraulic conductivity and aquifer transmissivity. The slug tests were performed by injecting 5 gallons of water into four existing monitoring wells. Based on the slug test analysis, the reported estimates of hydraulic conductivity ranged from 0.000656 to 0.00823 ft per minute (ft/min), equivalent to approximately 0.94 to 11.86 ft per day (ft/d) [AQUI-VER, 1995].

## 2.6 Preliminary Project Site Conceptual Model

The preliminary Project Site conceptual model is summarized below, which is based on available Project Site data, including publicly available data for the nearby sites, and provides the basis for development of the groundwater model and dewatering simulations:

- Depth to groundwater in recent years ranges from approximately 30 to 42 ft bgs in the South Lot. The hydraulic gradient and inferred groundwater flow direction is typically toward the northeast at an average gradient of approximately 0.0091 ft/ft.

- The Project Site is underlain by artificial fill, stratified and interbedded soils ranging from clay to clayey sands with limited occurrences of sands and gravelly sands.
- This preliminary evaluation assumed an estimated hydraulic conductivity in the range of 1 to 10 ft/d, based on measurements at nearby sites and published hydraulic conductivity values for clayey and silty sands [Freeze and Cherry, 1979; Heath, 2004; and Domenico and Schwartz, 1990].
- The interbedded nature of the alluvial sediments results in anisotropy of hydraulic conductivity. On a large scale, the horizontal hydraulic conductivity ($K_h$) is likely orders of magnitude higher than the vertical hydraulic conductivity ($K_v$). The lower $K_v$ is expected to impede upward groundwater flow rates into the excavations during construction dewatering.
- In addition, engineering measures such as sheet piles, secant walls, or slurry walls may be implemented to provide a lower permeability around the excavations to impede horizontal influx of groundwater during construction dewatering.

# 3. CONSTRUCTION DEWATERING ANALYSIS

## 3.1 Construction Dewatering Assumptions

Dewatering measures will likely be implemented during the construction of the sub-grade parking structures. The analyses presented herein include the simulation of a low-permeability cut-off wall around the perimeter of the excavation installed to the target dewatering depth, which is approximately 2 ft below the bottom of the excavation. A cut-off wall will limit both the influx of groundwater to the excavation and the drawdown of the water beneath adjacent properties. The representation of the cut-off wall in the model is conceptual.

A cut-off wall may not be necessary to reduce influx of groundwater during excavation for some areas, particularly if soils consist predominantly of low-permeability silts and clays and if the depth of the excavation is only a few ft below groundwater.

In addition, the analyses presented herein include the simulation of simultaneous dewatering of Excavation Areas 1, 2, and 3, the largest excavations by volume situated in the South Lot of the Project Site, where the recent groundwater occurs at a depth shallower than 50 ft bgs (see **Figure 2**). For the two proposed excavations in the North Lot (i.e., Excavation Areas 4 and 5), no groundwater extraction or drawdown is expected under the current Project Site conditions, as the previous explorations conducted in 1993 and 2003 encountered groundwater depths of approximately 58 to 73 ft bgs in the North Lot, which is deeper than the proposed excavation depth of 50 ft. The current groundwater depth is expected to be similar to the depths in 1993 and 2003 since boring SB-21, installed to 50 ft bgs in the North Lot in 2022, did not encounter an appreciable amount of groundwater for sample collection [Geosyntec, 2024b]. Therefore, this analysis provides an estimate of the overall groundwater dewatering quantity required for the simultaneous dewatering of all the proposed Project Site excavations.

As discussed in Sections IV.F, Geology and Soils, IV.H, Hazards and Hazardous Materials, and IV.I, Hydrology and Water Quality, of the DEIR, temporary dewatering would likely be necessary during construction of the Project, and the DEIR's analysis accounted for such dewatering activities. Per Project Design Feature GEO-PDF-1, which is included in Section IV.F of the DEIR, permanent structures will be designed for hydrostatic pressure such that the temporary construction dewatering system will be terminated at the completion of construction. Thus, no dewatering would occur during Project operation.

## 3.2 Numerical Groundwater Model Design

A five-layer numerical groundwater model was developed to simulate the excavation and construction dewatering in Excavation Area 1. The proposed Excavation Area 1 is the largest by saturated volume of the relatively deep excavations along the southern perimeter of the South Lot of the Project Site, and thus provides a representative example taking into account conservative influx rates of groundwater and dewatering influence. The five-layer numerical groundwater model was also utilized to simulate the excavation and simultaneous dewatering at Excavation Areas 1, 2, and 3 in the South Lot. The modeling was conducted using the 3D numerical groundwater modeling program, MODFLOW 2005 [Harbaugh, 2005], under the Groundwater Vistas[3] Version 7 graphical user interface. The transient model uses MODFLOW-NWT, the Newton formulation of MODFLOW 2005.

The design of the model is summarized below:

- Horizontal Extent: 7,150 ft by 7,150 ft, with the Excavation Area 1 situated in the center of the model domain (**Figure 3A**). The model grid size is designed to minimize potential influence from the model simulated boundary conditions on dewatering behavior predicted in the excavation.
- Grid cells horizontal dimensions: 75 rows and 75 columns. Grid cells are 50 ft by 50 ft in the horizontal dimension in the central portion of the model. They gradually increase in size towards the margins to a maximum of 500 ft by 500 ft (**Figure 3A**).
- Model layers: Overall, the model encompasses five layers and simulates conditions within depths of 0 to 70 ft bgs (**Figure 3C**). The uppermost layer (Layer 1) is unconfined, and the deeper layers are convertible (confined or unconfined). Transmissivity of unconfined portions of layers varies with the saturated thickness. The number of layers were selected based on the geometry of the excavation and professional judgment to represent vertical gradients in the vicinity of the excavation and low permeability cut-off walls during simulated construction dewatering.
    - Layer 1, which is the uppermost layer, is 40 ft thick;
    - Layer 2 is 10 ft thick with the bottom at 50 ft bgs, which is the assumed depth of the excavation;

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[3] https://www.groundwatermodels.com/

  - Layer 3 is 5 ft thick with the bottom at 55 ft bgs, which is the assumed depth of the cut-off wall, and the target depth of dewatering;
  - Layer 4 is 5 ft thick with the bottom at 60 ft bgs; and
  - Layer 5 is 10 ft thick with the bottom at 70 ft bgs.

- Initial groundwater condition: Northeastward groundwater flow direction with a gradient of 0.0091 (**Figure 3B**) was assumed, which is based on monitoring data from previous investigations [A.E. Schmidt, 1996]. The elevation of the water table in Layer 1 and the hydraulic head in the underlying layers were assigned using constant head boundaries along the four margins of the model domain with the same values for all 5 layers, which results in no initial vertical hydraulic gradients prior to pumping for the construction dewatering. As discussed in Section 2.4, the most recently documented depth to groundwater in the South Lot is approximately 30 to 42 ft bgs. Accordingly, the boundary conditions were assigned to produce an initial depth of approximately 36 ft bgs at Excavation Area 1 (**Figures 3A** and **3B**).
- Excavation Area 1 (**Figure 3B**), which is approximately 1,350 ft long and approximately 200 to 400 ft wide, is simulated by 114 cells. The target dewatering level of 50 ft bgs is assigned in each cell by using pumping wells.
- Hydraulic conductivity (K): A uniform bulk K value was assigned to the model domain. The estimated hydraulic conductivity measured at nearby sites ranging from approximately 1 to 10 ft/d was assumed for this preliminary evaluation. This range of hydraulic conductivity is consistent with the published values for silty and clayey sand soils [Freeze and Cherry, 1979; Heath, 2004; and Domenico and Schwartz, 1990]. An average horizontal K value of 1 ft/d was used for the base simulations and $K_h$ values of 0.1 ft/d and 10 ft/d were used for the sensitivity analyses.
- A conservatively low value of 10:1 was used for the horizontal to vertical anisotropy ($K_h/K_v$) [e.g., Freeze and Cherry, 1979, pg. 32]. This ratio results in a bulk $K_v$ value of 0.1 ft/d for the base case $K_h$ of 1 ft/d. It is noted that the $K_h/K_v$ ratio can be 100:1 or greater where clay layers occur, such as has been identified at the Project Site [e.g., Todd and Mays, 2005]. A higher $K_h/K_v$ ratio would impede upward inflow of groundwater into the base of the excavation, thus reducing actual dewatering quantities and cone of depression dimensions, compared to the modeled simulations.
- A specific yield (Sy) of 10% and specific storage (Ss) of $1 \times 10^{-6}$ was assigned to the model. This is based on the average range of reported Sy values for the range

of materials found at the Project Site, including 2% for clay, 8% for silt, and 21 to 27% for fine, medium, coarse, and gravelly sand. The Sy for mixtures of clays, silts and sands vary within these values. Note that the Sy for short-term draining, such as temporary dewatering considered here, may be lower compared to the literature-reported long-term drainage values [e.g., Johnson, 1967].

- Low permeability cut-off walls are simulated along the outer perimeter of Excavation Area 1 using the horizontal flow barrier (HFB) package of MODFLOW (Hsieh and Freckleton, 1993). The barriers are simulated as 2 ft thick with a permeability of 1 x $10^{-7}$ centimeters per second (cm/sec) (approximately 0.0003 ft/d) extending to a depth of 55 ft bgs.
- To simulate groundwater extraction rates to achieve the target dewatering depth, extraction wells were assigned to model grid cells within Excavation Area 1. Wells were simulated using a well screen extending to a depth of 57.5ft bgs. The actual configuration of dewatering wells will be based on excavation-specific criteria (i.e., excavation dimensions, construction phasing, hydrogeology, schedule, etc.) and will vary among the specific excavations and during Project Site preparation/demolition, excavation, construction phases, and per dewatering contractor recommendations.

### 3.3 Model Simulations

The modeling simulations for the dewatering analysis include a steady-state simulation to approximate the pre-dewatering initial conditions, and transient runs with groundwater pumping to lower and maintain the groundwater level to the design dewatering depth within Excavation Area 1 during the approximately 15-month dewatering period.

The modeling of temporary dewatering occurs in two general phases:

- Dewatering Phase 1: This initial dewatering phase involves relatively high pumping rates to lower the groundwater table from the initial static conditions. Based on the model simulations, the Phase 1 dewatering may require up to 4 months to lower the water table to below the base of the deepest portions of Excavation Area 1.
- Dewatering Phase 2: This dewatering phase involves maintaining the groundwater levels for the completion of the below-grade parking structure construction. During Phase 2 dewatering, lower pumping rates are required to maintain drawdown of the groundwater table at or near the base of the excavation. The Phase 2 period is estimated to be approximately 11 months.

The model encompasses three stress periods:[4]

- Stress period 1 – The initial steady-state period to establish the static groundwater levels prior to initiating dewatering activities.
- Stress period 2 – A transient-state stress period with pumping rates to lower the water table to the base of the excavation.
- Stress period 3 – A transient-state stress period with pumping rates to maintain dewatering below the base of the excavation for construction of the underground parking structure.

The total initial pumping rates to achieve the target dewatering depth in the Excavation Area 1 were approximately 90 gallons per minute (gpm) total. Thereafter, the pumping rates were reduced to approximately 18 gpm to maintain the design construction dewatering depth. **Figure 4** demonstrates the simulated pumping rates through time.

#### 3.3.1 Hydraulic Conductivity Sensitivity Analyses

A $K_h$ value of 1 ft/d was used for the base case simulations. Simulations were also run with $K_h$ values of 0.1 ft/d and 10 ft/d to evaluate the sensitivity of the groundwater influx and drawdown to the K values. In each case, $K_v$ was ten times lower than $K_h$.

#### 3.3.2 Initial Groundwater Levels Sensitivity Analyses

As discussed in Section 2.4, historically, the highest groundwater level for the South Lot was 0 to 20 ft bgs. During most recent explorations, the shallowest documented depth to groundwater is approximately 30 ft bg. Therefore, to assess the influence of initial groundwater levels on the construction dewatering, two additional cases were simulated: initial groundwater levels at 10 ft bgs (i.e., the average of 0 and 20 ft bgs) and initial groundwater levels at 30 ft bgs. For both of these scenarios, the average bulk $K_h$ value of 1 ft/d was used.

Historically, the highest groundwater level for the North Lot was 0 ft bgs. The two excavation areas proposed in the North Lot are Excavation Areas 4 and 5 with estimated areas of approximately 53,000 and 18,000 square ft (sq-ft), respectively. These areas are significantly smaller than the area of Excavation Area 1 in the South Lot, which is approximately 276,000 sq-ft and was used as the representative example for the modeling

[4] A stress period is a computational time period that defines certain groundwater conditions and pumping simulations.

described in this Report. Therefore, the dewatering quantities and cone of depression dimensions for the case of the historically highest groundwater level of 0 ft bgs in the North Lot are expected to be smaller compared to the modeled simulations of the historically highest groundwater level of 10 ft bgs for Excavation Area 1 in the South Lot. Therefore, the dewatering analysis for the South Lot is conservative in comparison and applicable to the North Lot excavations.

#### 3.3.3 Assessment of Influence of Cut-Off Walls

As described in Section 3.3, the base case model includes low-permeability cut-off walls to limit groundwater influx into the excavation. In order to evaluate the influence of cut-off walls on groundwater influx to the excavation, model simulations were run without the low-permeability cut-off walls at the outer perimeter of the excavation.

#### 3.3.4 Assessment of Impact of Simultaneous Dewatering in Excavation Areas in South Lot

As described in Section 3.1, the base case model includes a preliminary dewatering simulation in Excavation Area 1. To assess the impact of simultaneous dewatering of Excavation Areas 1, 2, and 3 in the South Lot, the base case model design described in Section 3.2 was modified to include Excavation Areas 2 and 3, totaling approximately 298,000 sq-ft, with Excavation Area 1 totaling 574,000 sq-ft. This was simulated by an additional 120 cells. The target dewatering level was assigned in each cell using pumping wells. The assigned K value of 1 ft/d and initial groundwater level at 36 ft bgs remained unchanged.

To evaluate the influence of cut-off walls on groundwater influx to these excavation areas, model simulations for the simultaneous dewatering scenario were run for two cases: with and without low-permeability cut-off walls at the outer perimeter of the excavations.

# 4. CONSTRUCTION DEWATERING ANALYSIS RESULTS AND DISCUSSION

## 4.1 Model Findings

The results of the simulations of construction dewatering are presented in **Table 1** and **Figures 4, 5, 6A & B,** and **7A through G**. Key findings are summarized below:

- For the initial groundwater level of 36 ft bgs and K value of 1 ft/d, the model simulation used an initial pumping rate of 90 gpm. The pumping rate gradually decreased and stabilized at approximately 18 gpm to maintain the target dewatering level after approximately 1 year. **Figure 4** illustrates the simulated pumping rates with time for assigned $K_h$ values of 0.1, 1, and 10 ft/d. For a K value of 0.1 ft/d the simulated pumping rate began at approximately 45 gpm and stabilized at 4 to 5 gpm. For a K value of 10 ft/d the simulated pumping rate began at approximately 170 gpm and stabilized at 95 gpm.
- The base case groundwater model used a uniform initial gradient (0.0091 ft/ft), bulk $K_h$ of 1 ft/d, $K_v$ of 0.01 ft/d, and Sy of 10%. Based on the results of the simulation, the maximum initial pumping rate is approximately 140 gpm (201,600 gallons per day [gpd]). The achievable pumping rate decreases with time as dewatering progressed, and a pumping rate of approximately 20 gpm (28,880 gpd) sustains the target dewatering level of 55 ft bgs below the excavation.
- Predicted drawdown of groundwater levels due to the temporary dewatering of Excavation Area 1 decreases with distance from the excavation (**Table 1**, **Figures 5**, **6A**, and **6B**). The predicted drawdown is time-dependent, with both the magnitude and spatial extent of drawdown increasing as dewatering continues. After 4 months of dewatering, the base case model predicts a drawdown of less than 10 ft just outside the cut-off wall around Excavation Area 1 perimeter and approximately 4 ft at a distance of up to approximately 150 to 175 ft from the perimeter of Excavation Area 1 (**Figure 6A**). At the end of the 15-month dewatering period, the model predicts drawdown of approximately 10 ft extending at a distance of approximately 125 to 150 ft from the perimeter of Excavation Area 1 and approximately 4 ft at a distance of approximately 400 to 425 ft (**Figure 6B**).
- The predicted drawdown depends on the $K_h$ values (**Table 1**, **Figures 7A** and **7B**). With a lower $K_h$ value ($K_h$= 0.1 ft/d), the drawdown cone is steeper, and after 15 months of dewatering, the model predicts approximately 4 ft of drawdown at a distance of approximately 100 to 125 ft from the perimeter of

Excavation Area 1 (**Figure 7A**). With a higher K value (10 = ft/d) the drawdown cone is wider, and after 15 months of dewatering, the model predicts approximately 10 ft of drawdown at a distance of approximately 500 to 550 ft from the perimeter of Excavation Area 1 and approximately 4 ft of drawdown at a distance of up to approximately 1,800 ft (**Figure 7B**).

- Because the drawdown is the difference between initial groundwater levels and the groundwater levels during dewatering, for a given target construction dewatering depth, higher initial groundwater levels result in greater drawdown and greater volumes of pumped water. For an initial groundwater level of 30 ft bgs, after 15 months of dewatering, the model predicts approximately 4 ft of drawdown at a distance of approximately 450 to 500 ft from the perimeter of Excavation Area 1 and approximately 10 ft of drawdown at a distance of approximately 200 to 250 ft (**Figure 7C**). For an initial groundwater level of 10 ft bgs, after 15 months of dewatering, the model predicts approximately 4 ft of drawdown at a distance of approximately 725 to 750 ft from the perimeter of Excavation Area 1 and approximately 10 ft of drawdown at a distance of approximately 400 to 425 ft (**Figure 7D**).
- While low-permeability perimeter cut-off walls (to reduce influx of groundwater during construction dewatering) can reduce required pumping rates and extent of drawdown, their influence is estimated to be immaterial for the conditions and target dewatering depth at the Project Site because the majority of influx occurs from below the excavation. (**Table 1** and **Figure 7E**). With no cut-off wall, after 15 months of dewatering, the model predicts drawdown of approximately 10 ft extending approximately 150 to 200 ft from the perimeter of Excavation Area 1 and drawdown of approximately 4 ft of drawdown at a distance of approximately 425 to 450 ft from the perimeter of Excavation Area 1 (**Figure 7E**).
- The base model (K value of 1 ft/d and initial groundwater level at 36 ft bgs) predicts a total pumping volume of approximately 20.3 million (M) gallons (62.3 acre-ft)[5] of groundwater during 15 months for construction dewatering at Excavation Area 1. This predicted volume includes the groundwater within the soils that would be excavated beneath Excavation Area 1 as well as the lateral influx through the cut-off walls and upward influx of groundwater from below the excavation. For $K_h$ values of 0.1 and 10 ft/d, the predicted volume to achieve

[5] 1 acre-ft is approximately 325,851 gallons.

and maintain the target dewatering level is approximately 7.9 M gallons (24.1 acre-ft) and 80 M gallons (245.6 acre-ft), respectively.

- The model for simultaneous dewatering of Excavation Areas 1, 2, and 3 predicts a total pumping volume of approximately 35.7 M gallons (110 acre-ft) of groundwater during 15 months for construction dewatering. Below is a summary of estimated drawdowns for simultaneous dewatering of excavation areas in the South Lot:
    - For the scenario with low-permeability cut-off walls, the model predicts drawdowns of approximately 10 ft extending from approximately 100 to 150 ft from the cut-off wall perimeter, and approximately 4 ft at distances of approximately 450 to 500 ft at the end of the 15-month dewatering period (**Figure 7F**).
    - For the scenario without low-permeability cut-off walls, the model predicts drawdowns of approximately 10 ft extending from approximately 200 to 250 ft from the perimeter of Excavation Area 3, and approximately 4 ft at distances of approximately 500 to 600 ft at the end of the 15-month dewatering period (see **Figure 7G**).

## 4.2 Groundwater Basin and Production

This section summarizes information pertaining to the local groundwater basin and provides context for the overall estimated quantity of groundwater pumping for the construction dewatering for all the Project Site excavations (35.7 M gallons or 110 acre-ft). The San Fernando Valley Groundwater Basin surface area is approximately 226 square miles (145,000 acres), and the total basin groundwater storage capacity is reported to be 3,670,000 acre-ft [DWR Bulletin 118, 2004]. Thus, the quantity of groundwater removed via dewatering would be approximately 0.003 percent of the basin storage capacity, which should not interfere with any groundwater supply pumping in the vicinity.

A review of the State of California well database GeoTracker and Groundwater Ambient Monitoring and Assessment (GAMA) database (accessed January 26, 2024) found no records of groundwater supply wells, including domestic, irrigation, industrial, municipal, or other supply well types, within 1 mile of the Project Site. Thus, the construction dewatering should not interfere with any groundwater supply pumping in the Project Site vicinity, as of the date the GAMA database was accessed.

Removing approximately 35.7 M gallons of water in the Excavation Areas 1, 2, and 3 during excavation and construction of the underground parking structures equates to approximately 79,000 gpd. In comparison, the maximum projected operational water demand for the Project is approximately 312,890 gpd (see Table IV.O.1-6 in Section IV.O.1, Utilities and Service Systems – Water Supply and Infrastructure, of the DEIR). Thus, the estimated dewatering groundwater demand is substantially less than the operational demand for the Project.

## 5. CONCLUSIONS AND RECOMMENDATIONS

The following conclusions and recommendations are based on the example dewatering modeling:

- Dewatering of Excavation Area 1, being the largest by saturated volume of the relatively deep excavations along the southern perimeter of the South Lot of the Project Site, was modeled as a representative example, taking into account conservative influx rates of groundwater and extent of dewatering influence.
- As expected, the predicted drawdown was found to be time-dependent, with both the magnitude and spatial extent of drawdown increasing as dewatering continues. For the $K_h$ and $K_v$ values of 1 and 0.1 ft/d, at the completion of the underground parking structure construction (i.e., at the end of the simulated 15-month dewatering period), the model predicts drawdown of approximately 10 ft at approximately 125 to 150 ft from the perimeter of Excavation Area 1 and approximately 4 ft of drawdown at a distance of approximately 400 to 425 ft.
- As summarized in **Table 1**, the predicted drawdown depends on both the K values and initial groundwater elevations. At the end of the simulated 15-month dewatering period, the model predicts drawdown of approximately 4 ft at a distance of approximately 125 ft from the perimeter of Excavation Area 1 for $K_h$ and $K_v$ values of 0.1 and 0.01. This distance was approximately 1,800 ft for $K_h$ and $K_v$ values of 10 and 1 ft/d.
- The estimated volume of groundwater during 15 months of construction dewatering for Excavation Area 1 also depends on the K values. During the 15 months of construction dewatering, the base case model ($K_h$ value of 1 ft/d and initial groundwater level at 36 ft bgs) predicts approximately 20.3 M gallons (62.3 acre-ft) of groundwater would be pumped for construction of Excavation Area 1. For $K_h$ values of 0.1 and 10 ft/d, the model predicts approximately 7.9 M gallons (24.1 acre-ft) and 80 M gallons (245.6 acre-ft) of groundwater would be extracted during construction dewatering for Excavation Area 1, respectively.
- Simultaneous dewatering of Excavation Areas 1, 2, and 3 was modeled to conservatively estimate the overall groundwater dewatering quantity required for all Project Site excavations. These areas, the largest by volume, are located in the South Lot where recent groundwater occurs at a depth shallower than 50 ft bgs. The model predicts a total pumping volume of approximately 35.7 M gallons (110 acre-ft) over 15 months of simultaneous dewatering. Additionally, at the end of the 15-month dewatering period, the model predicts drawdowns of

approximately 10 ft extending approximately 100 to 150 ft from the cut-off wall perimeter, and approximately 4 ft at distances of approximately 450 to 500 ft. While low-permeability perimeter cut-off walls influence drawdowns, their effect is estimated to be immaterial.

- Geotechnologies reviewed the Project Site groundwater conditions and preliminary temporary construction dewatering findings presented in this Report in the *Subsidence Evaluation based on Dewatering Simulations Evaluation, Radford Studio Center Project* [Geotechnologies, 2024b], included as Appendix A, and concluded the following: "This small amount of groundwater drawdown will have less than significant subsidence effects on the surrounding properties. Excavations Areas 1, 2 and 3 are located within the South Lot. Temporary dewatering is not anticipated in the excavations proposed in the North Lot. The properties located to the east are separated from the South Lot by the approximately 150-foot-wide Los Angeles River Channel; properties to the south are separated from the South Lot by the varying 28- to 30-footwide alley. It is anticipated that the drawdown effects, as simulated by Geosyntec, will result in less than ⅓-inch of settlement for areas located in the immediate surrounding vicinity of the excavation. The magnitude of any potential settlement will decrease with increased distance away from the excavation. The settlement anticipated approximately 200 to 250 feet away from the perimeter of the dewatering excavation is expected to be less than ¼-inch. The settlement anticipated approximately 500 to 600 feet away from the perimeter of the dewatering excavation is expected to be less than ⅛-inch."

Geosyntec provides the following recommendations and closing comments:

- As a part of the City's regulatory building permit process once construction plans for individual buildings are finalized, Geosyntec recommends conducting an aquifer pumping test to confirm the Project Site-specific hydrogeologic properties and K values and inform an excavation and dewatering program.
- Defining the details of dewatering methods prior to the Project entitlement approval and the preparation of final construction plans is premature and not reasonable. The method of dewatering will be presented in a National Pollutant Discharge Elimination System (NPDES) permit application for the Los Angeles Regional Water Quality Control Board (LARWQCB) or in a sanitary sewer industrial discharge permit application for LA City Sanitation. The methods for dewatering will be evaluated by the Local Agency and/or the LARWQCB and conform with applicable regulatory requirements. All shoring design, infiltration cut-off methods, and dewatering methods will be designed and submitted to the local jurisdictions for review and approval and will be

performed, inspected, and monitored to comply with the applicable regulatory requirements.

## 6. LIMITATIONS AND SIGNATURES

Geosyntec's services were performed, and this preliminary evaluation report has been prepared, in accordance with generally accepted professional standards of care applicable to the scope of services authorized by Radford Studios, LLC, and no other warranty is provided in connection therewith. Consistent with applicable professional standards of care, our opinions and recommendations were based in part on data furnished by others. Although we were not able to independently verify such data, we did evaluate it to determine whether it was consistent with other information that we developed in the course of our performance of the scope of services. Subsurface investigations and interpretations are inherently limited to data derived from samples taken or tests performed at selected locations. Due to these inherent limitations, it must be recognized the actual subsurface conditions may vary from those predicted, despite the use of professional care.

This preliminary evaluation document was prepared by the staff of Geosyntec Consultants under the supervision of persons whose signatures appear below. The findings or professional opinions are based upon: a) preliminary data, analyses, and interpretations of subsurface conditions, b) approximations of data collected by others, and c) the use of groundwater model simulations to preliminarily estimate and project future dewatering methods and conditions (e.g., estimated dewatering quantities and cone of depression dimensions). Thus, the actual hydrogeologic and dewatering conditions and methods used at the Project Site during future excavation and construction activities may vary from the interpretations, projections, and concepts presented herein. The groundwater influx control measures described in this analysis are among a number of potential approaches that could be considered, if regulatory control measures are deemed necessary.

No warranty, expressed or implied, is made regarding the professional opinions expressed in this document by Geosyntec or the references cited in this document, or concerning the completeness of the data presented to us. If actual conditions are found to differ from those described in this document or if new information regarding the Project Site is obtained, Geosyntec should be notified and additional analyses or recommendations, if required, will be provided.

Signatures appear on the next page.

Daria Akhbari, PhD
Project Scientist

Andy Simons, P.G. (CA)
Senior Geologist

Gordon Thrupp, PhD, PG, CHg
Senior Consultant

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**TABLE**

# Table 1 - Preliminary Excavation Dewatering Drawdown Estimates

| Associated Figure Number | Excavation Area | Horizontal Hydraulic Conductivity (ft/day) | Initial Depth to Groundwater (ft bgs) | Cut-off Wall | Months after Pumping Started | Distance to 10 ft Groundwater Drawdown (ft) | Distance to 4 ft Groundwater Drawdown (ft) |
|---|---|---|---|---|---|---|---|
| 6A (Base Model) | Excavation Area 1 | 1 | 36 | Yes | 4 | < 50 | 150 - 175 |
| 6B | Excavation Area 1 | 1 | 36 | Yes | 15 | 125 - 150 | 400 - 425 |
| 7A | Excavation Area 1 | 0.1 | 36 | Yes | 15 | < 50 | 100 - 125 |
| 7B | Excavation Area 1 | 10 | 36 | Yes | 15 | 500 - 550 | 1,800 |
| 7C | Excavation Area 1 | 1 | 30 | Yes | 15 | 200 - 250 | 450 - 500 |
| 7D | Excavation Area 1 | 1 | 10 | Yes | 15 | 400 - 425 | 725 - 750 |
| 7E | Excavation Area 1 | 1 | 36 | No | 15 | 150 - 200 | 425 - 450 |
| 7F | Excavation Areas 1, 2, & 3 | 1 | 36 | Yes | 15 | 100 - 150 | 450 - 500 |
| 7G | Excavation Areas 1, 2, & 3 | 1 | 36 | No | 15 | 200 -250 | 500 - 600 |

Notes and Abbreviations:
Vertical Hydraulic Conductivity is 10 times less than Horizontal Hydraulic Conductivity
All distances are from the northern perimeter of the simulated excavation area

| | |
|---|---|
| ft | feet |
| ft bgs | feet below ground surface |
| ft/day | feet per day |

# FIGURES


**Site Vicinity**

Radford Studio Center
4024, 4064 and 4200 N. Radford Avenue
Studio City, California

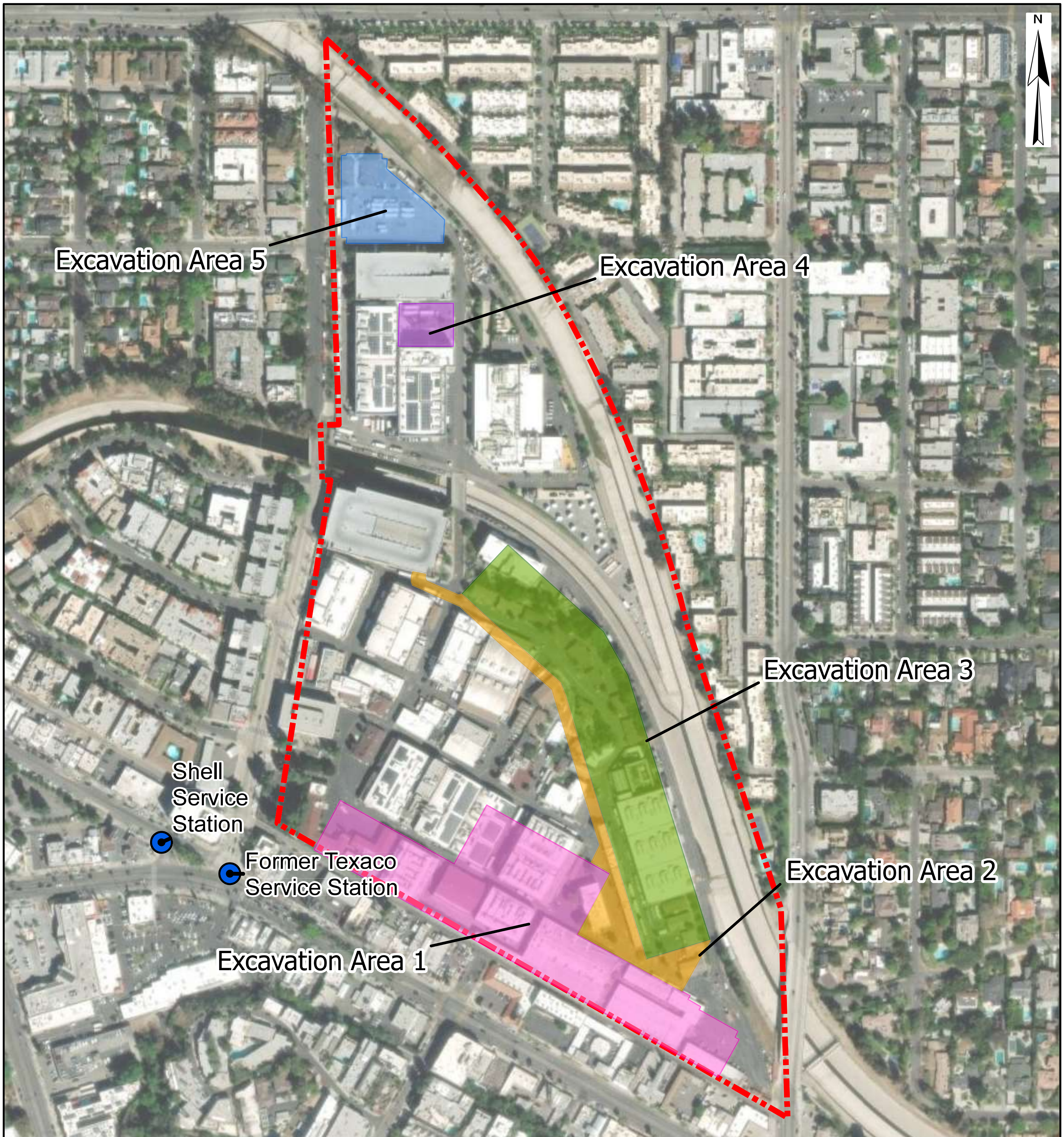
Geosyntec consultants

Project No: LB1048

March 2024

**Figure 1**

L:\GIS\LB1048\Project\2023\




Legend

Site Boundary

Source: Maxar

**Site Facilities and Nearby Sites**

Radford Studio Center
4024, 4064 and 4200 N. Radford Avenue
Studio City, California

0 200 400 800 Feet

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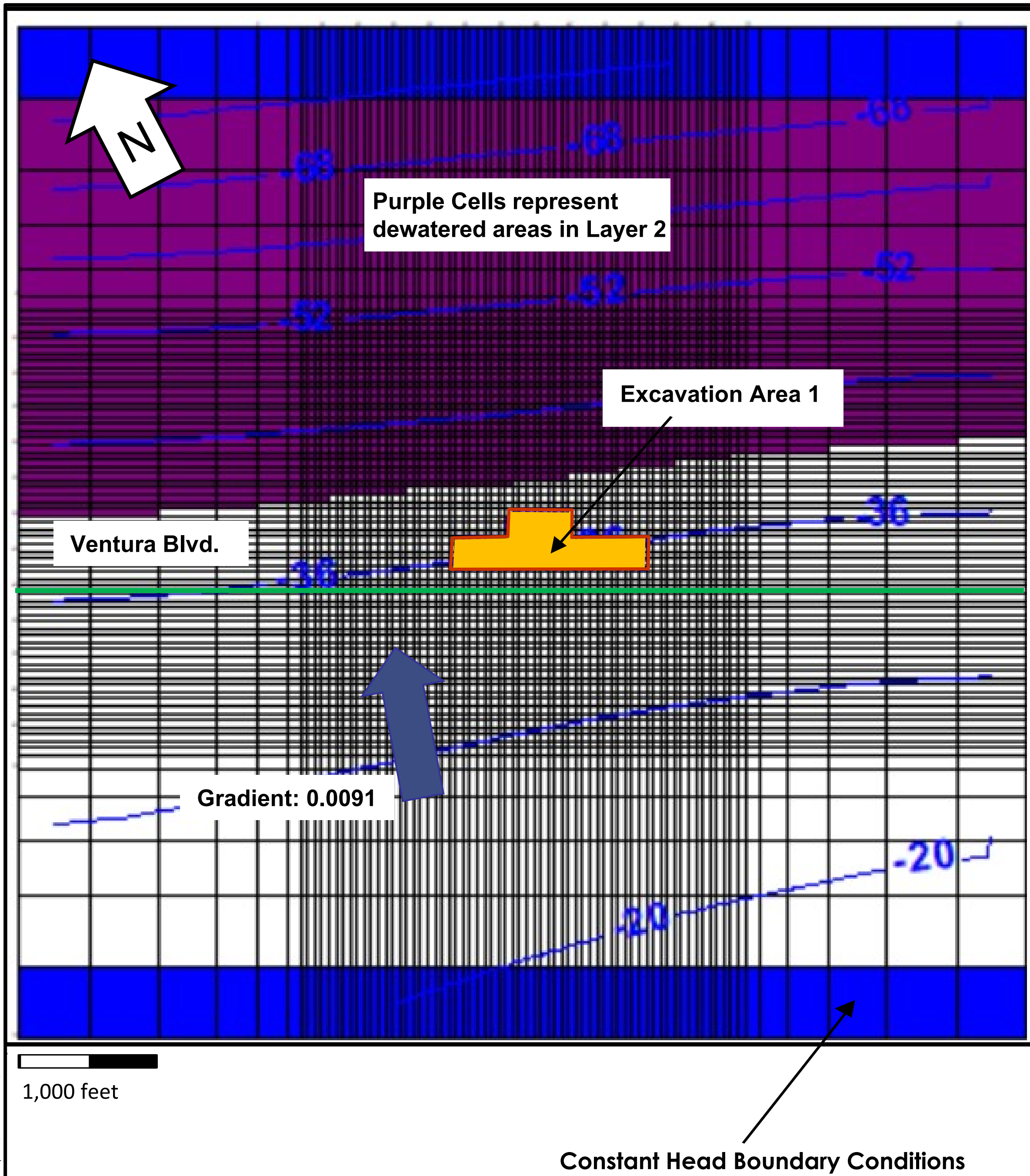
**Figure 2**

L:\GIS\LB1048\Project\2023\Figure 2 - Site Features.aprx 1/25/2024 (Author: DAkhbari)




## Groundwater Model Grid – Full Model Domain

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Figure 3A

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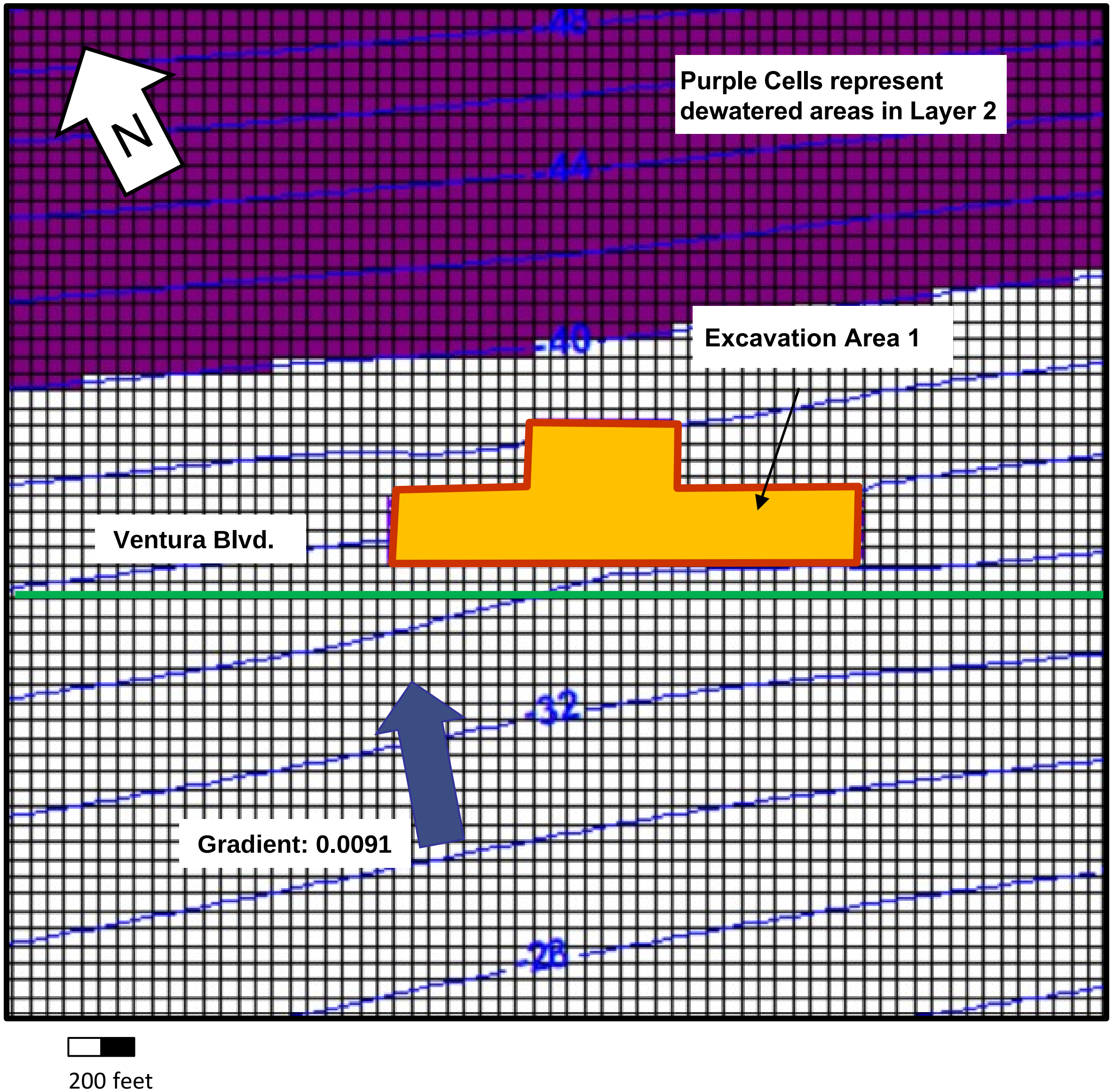


**Notes:**
This figure shows a central portion approximately 3,300 ft by 3,300 ft of the model domain. The entire domain is 7,150 ft by 7,150 ft

# Groundwater Model Grid (Zoom In)
# Initial Water Table Elevation

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Figure 3B

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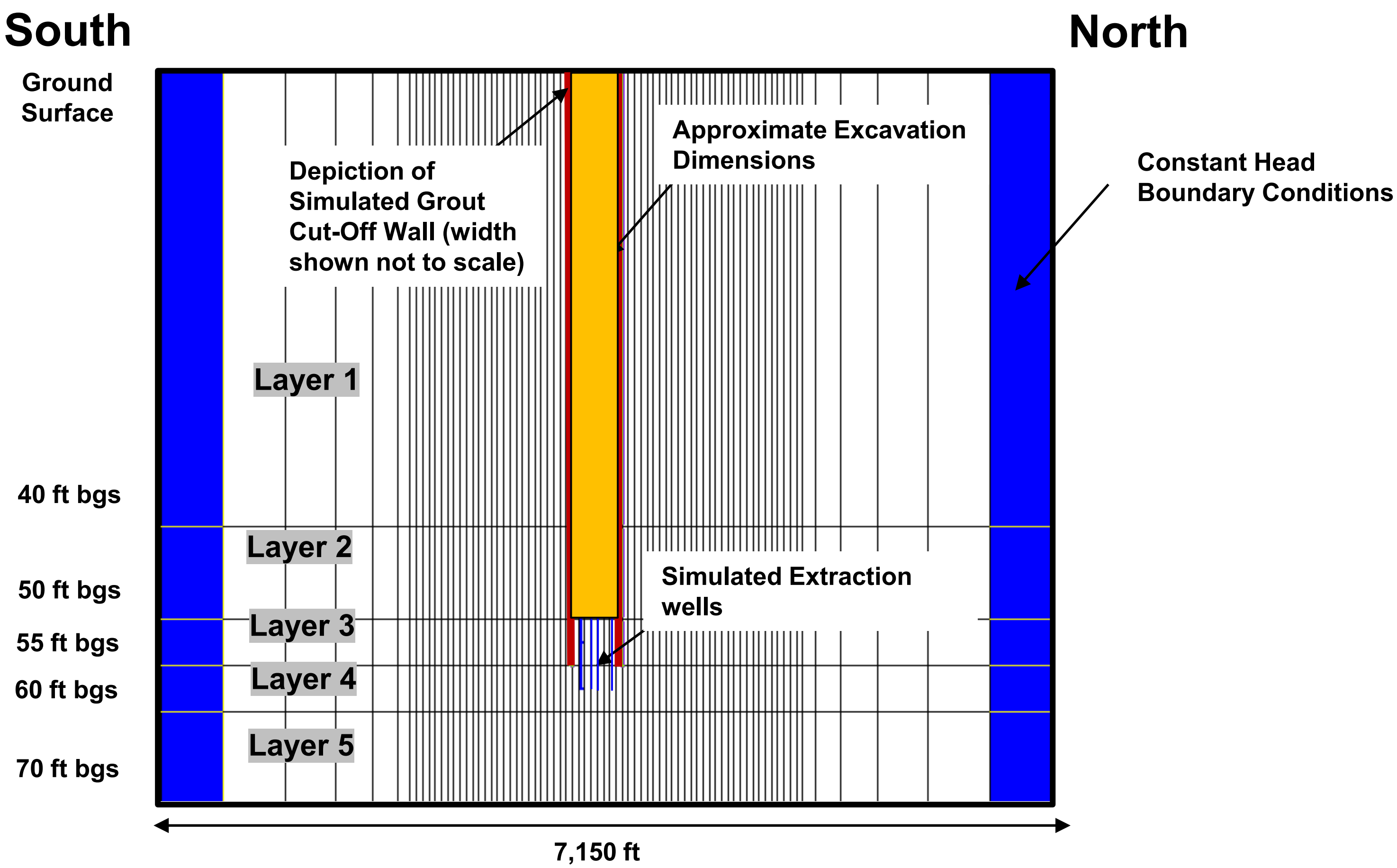
internal info: path, date revised, author




# Groundwater Model Grid Cross Section

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Figure 3C

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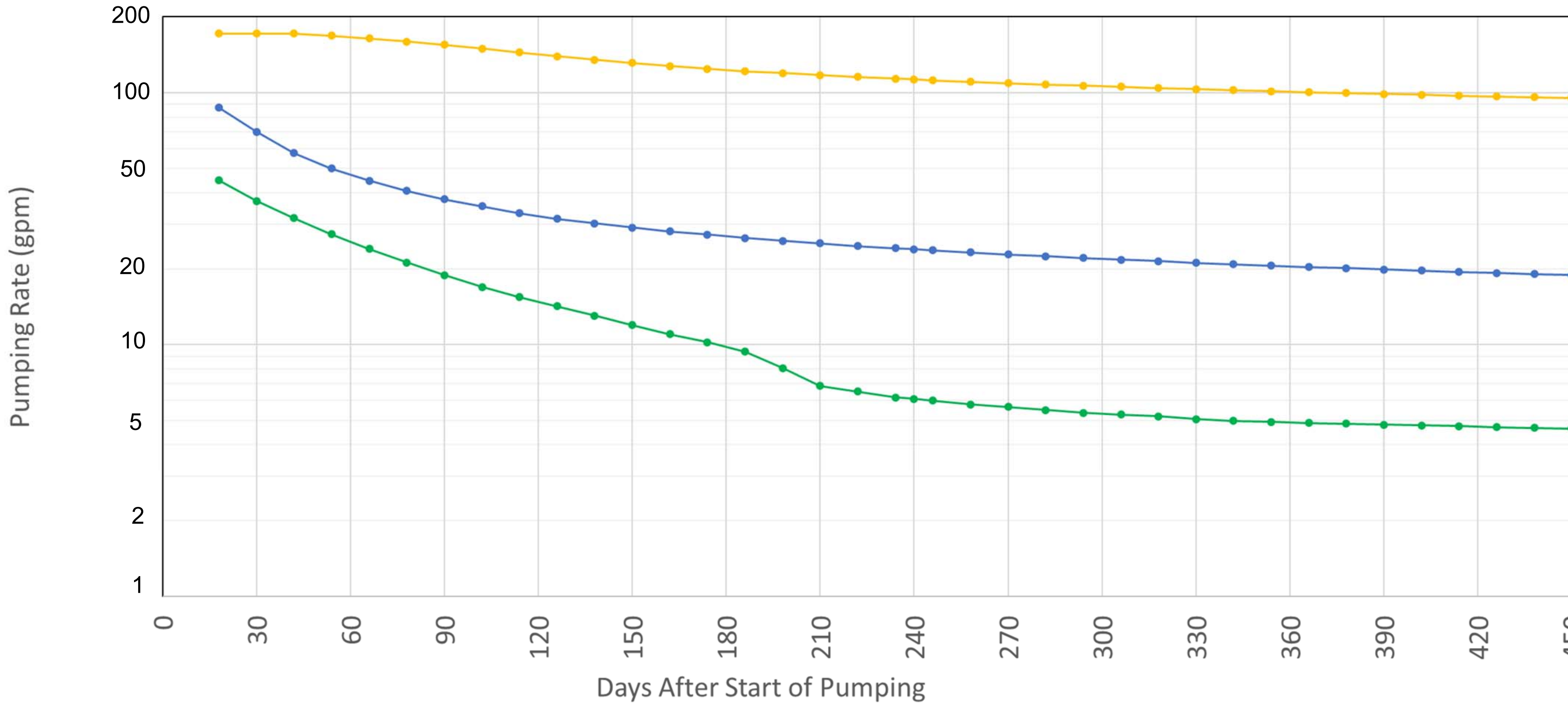


**Legend**

Initial Head = 36 ft bgs

- K = 0.1 ft/day
- K = 1 ft/day
- K = 10 ft/day

**Simulated Pumping Rates**

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Figure 4

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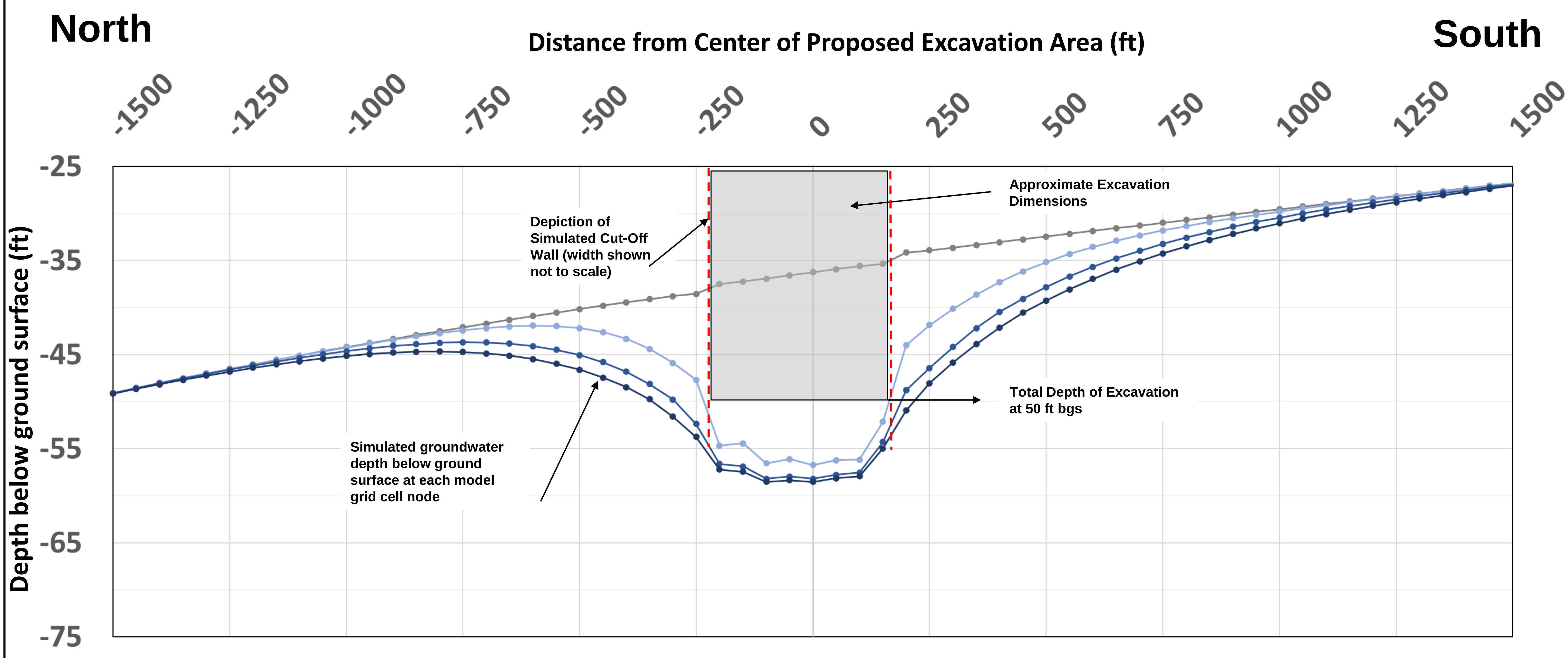


## Legend

Head Profiles

- Initial Heads
- After 4 Month
- After 10 Month
- After 15 Month

Notes:
1. Graphic uses a 20X vertical to horizontal exaggeration to better show head profiles.
2. This north-south profile is located along the Excavation Area 1 centerline between the southwest and northeast perimeters.
3. Model assumes a flat ground surface

**Simulated Head Profiles (K = 1 ft/d) North/South Profile View**

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Figure 5

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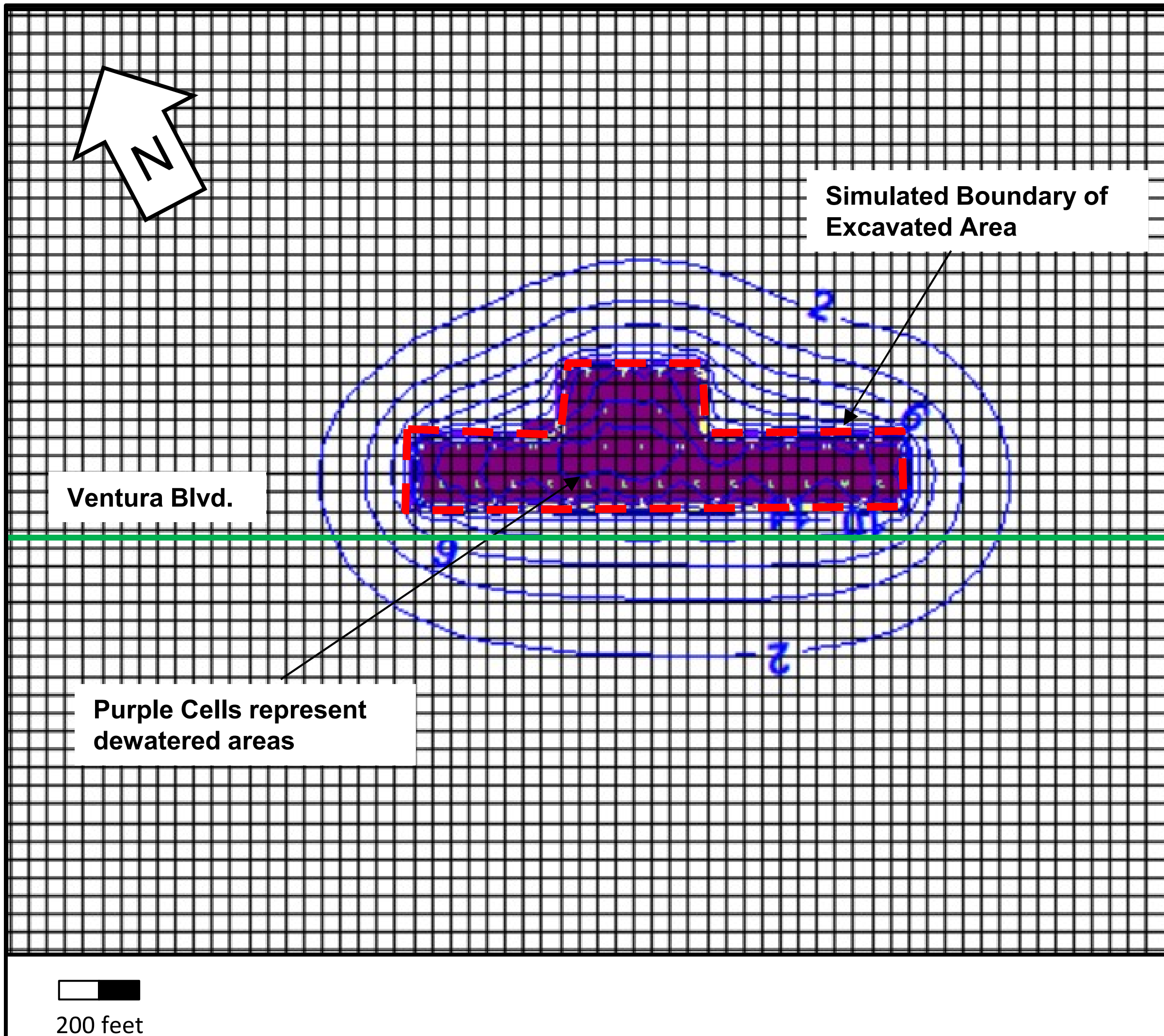


Note:
Simulated Drawdown of the Water Table is shown.

## Transient Groundwater Drawdown Simulation at 4 Months (K = 1 ft/d)

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Figure 6A

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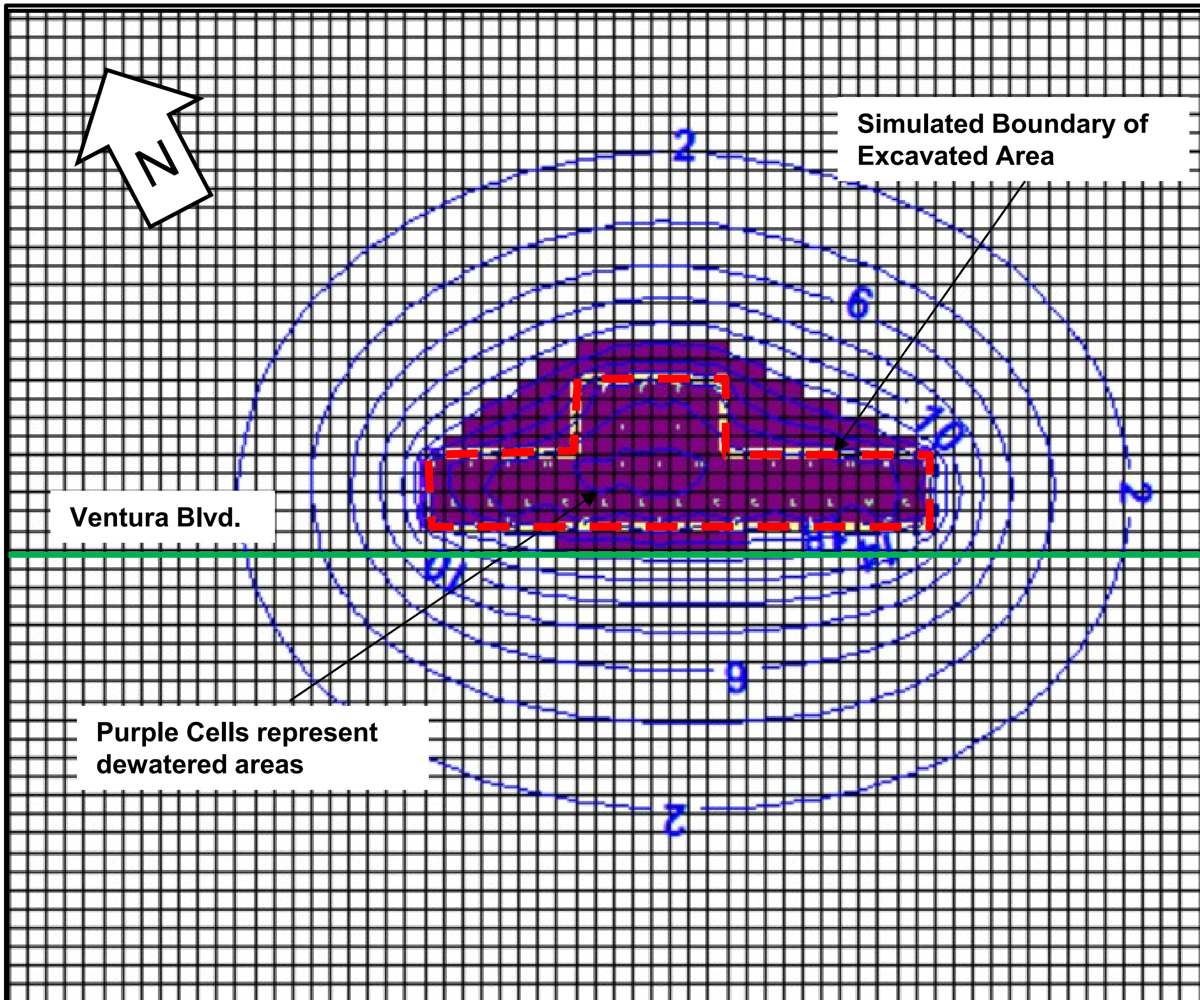


200 feet

Note:
Simulated Drawdown of the Water Table is shown.

# Transient Groundwater Drawdown Simulation at 15 Months (K = 1 ft/d)

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Figure 6B

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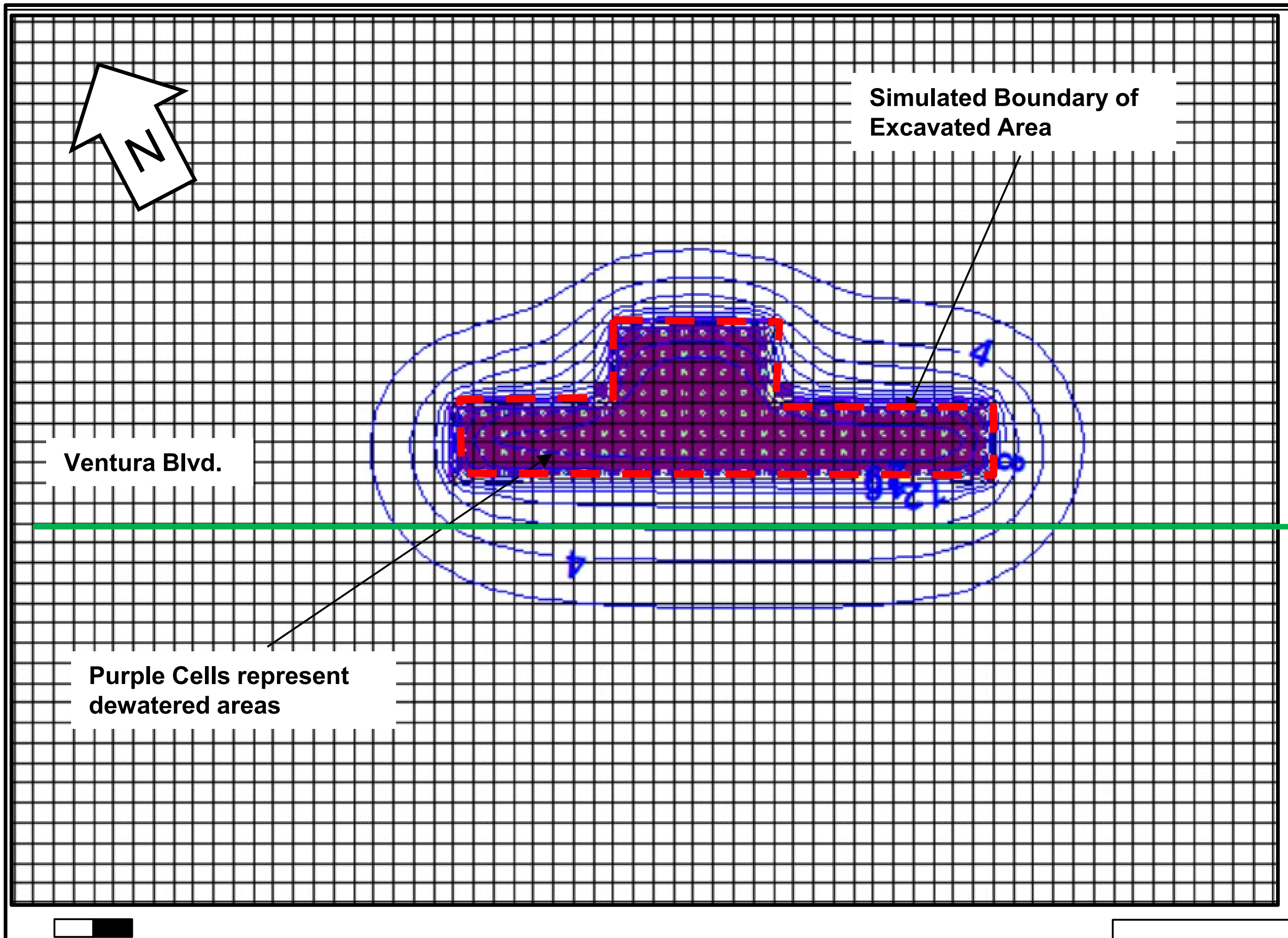


Note:
Simulated Drawdown of the Water Table is shown.

# Transient Groundwater Drawdown Simulation at 15 Months (K = 0.1 ft/d)

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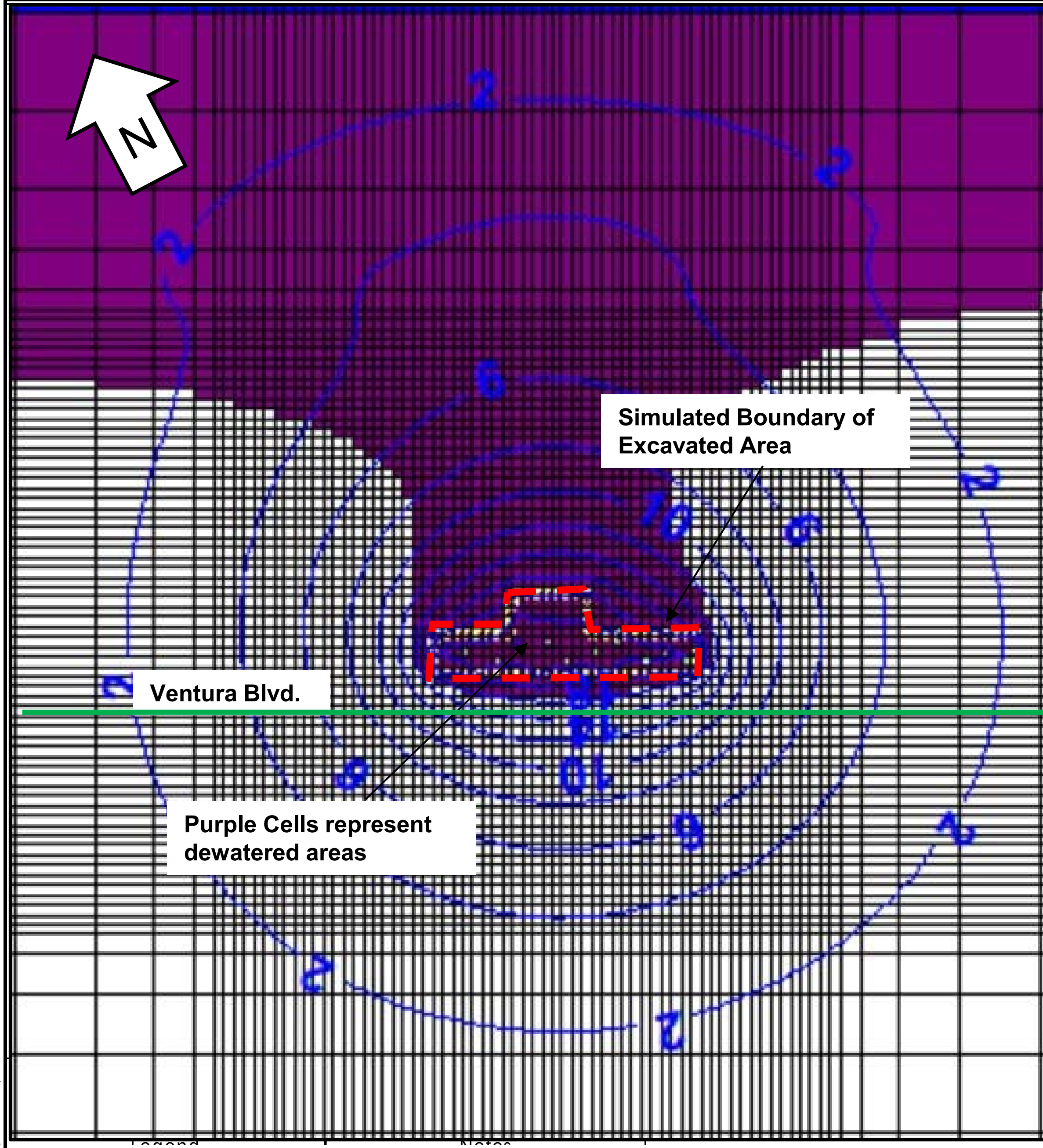
Figure 7A

LB1048

March 2024




200 feet

Note:
Simulated Drawdown of the Water Table is shown.

## Transient Groundwater Drawdown Simulation at 15 Months (K = 10 ft/d)

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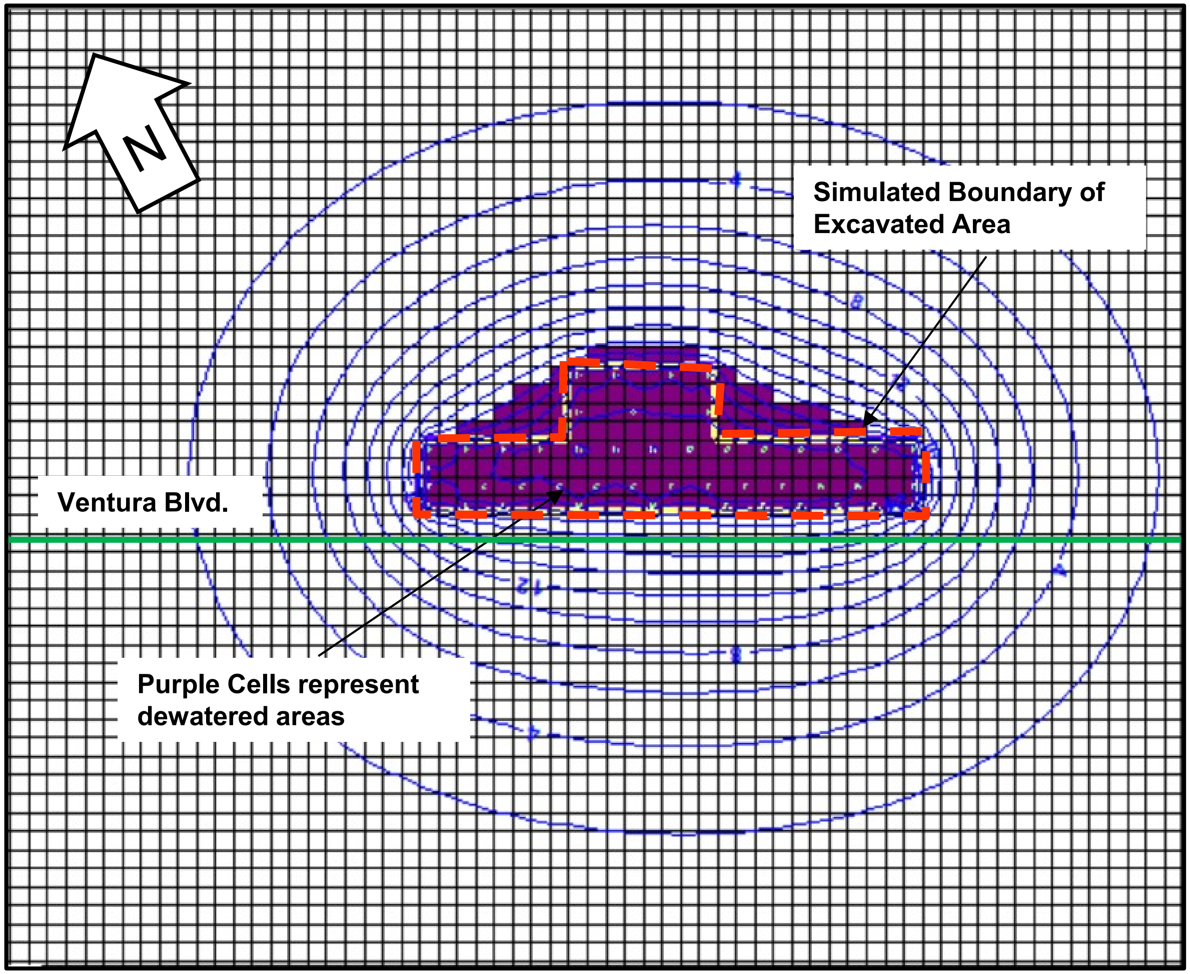
Figure
7B

LB1048

March 2024




200 feet

Note:
Simulated Drawdown of the Water Table is shown.

# Transient Groundwater Drawdown Simulation at 15 Months (Initial Head = 30 ft bgs)

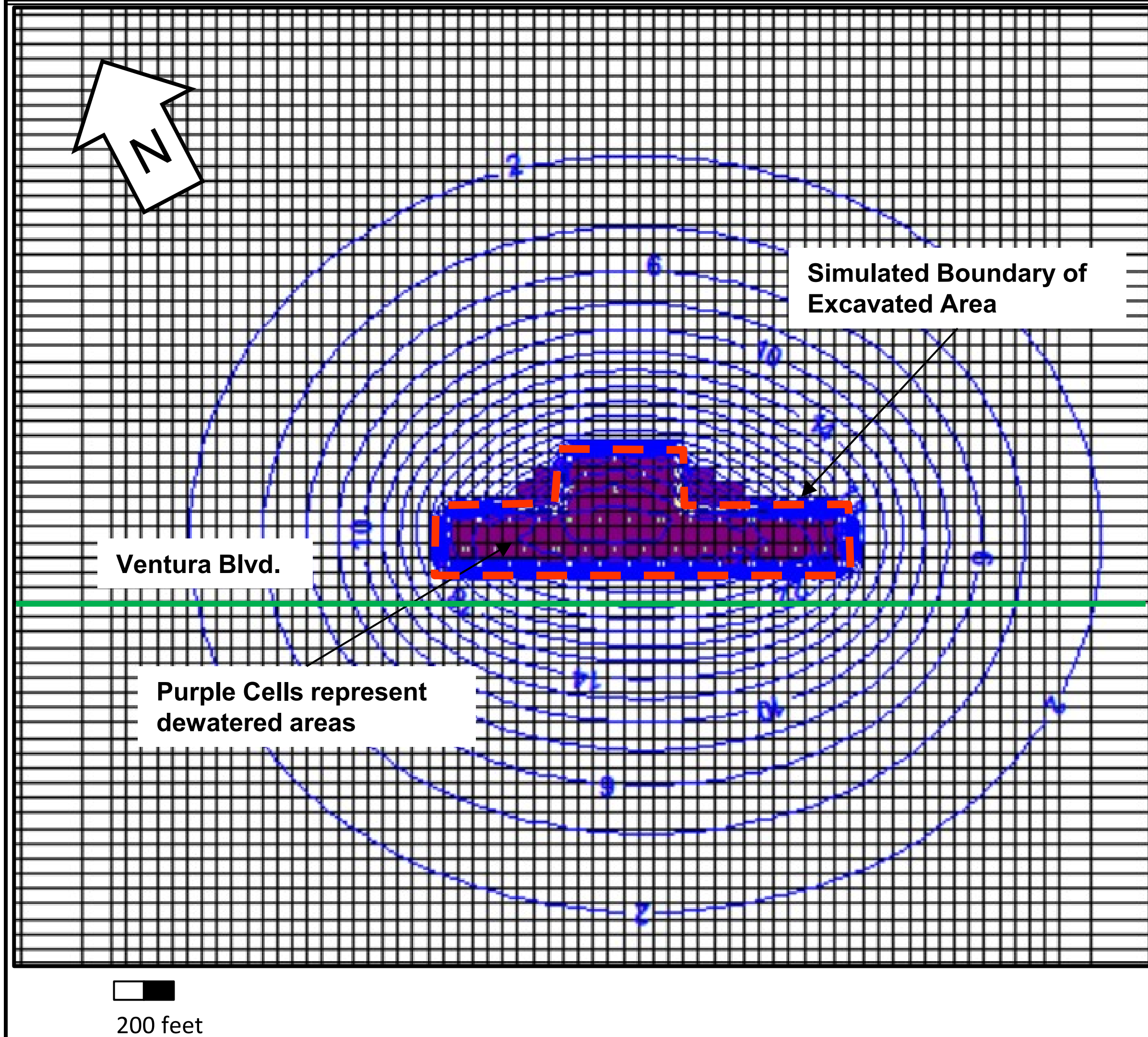
Radford Studio Center
4024, 4064 and 4200 N. Radford Avenue
Studio City, California

Geosyntec consultants
engineers | scientists | innovators

Figure 7C

LB1048

March 2024




Note:
Simulated Drawdown of the Water Table is shown.

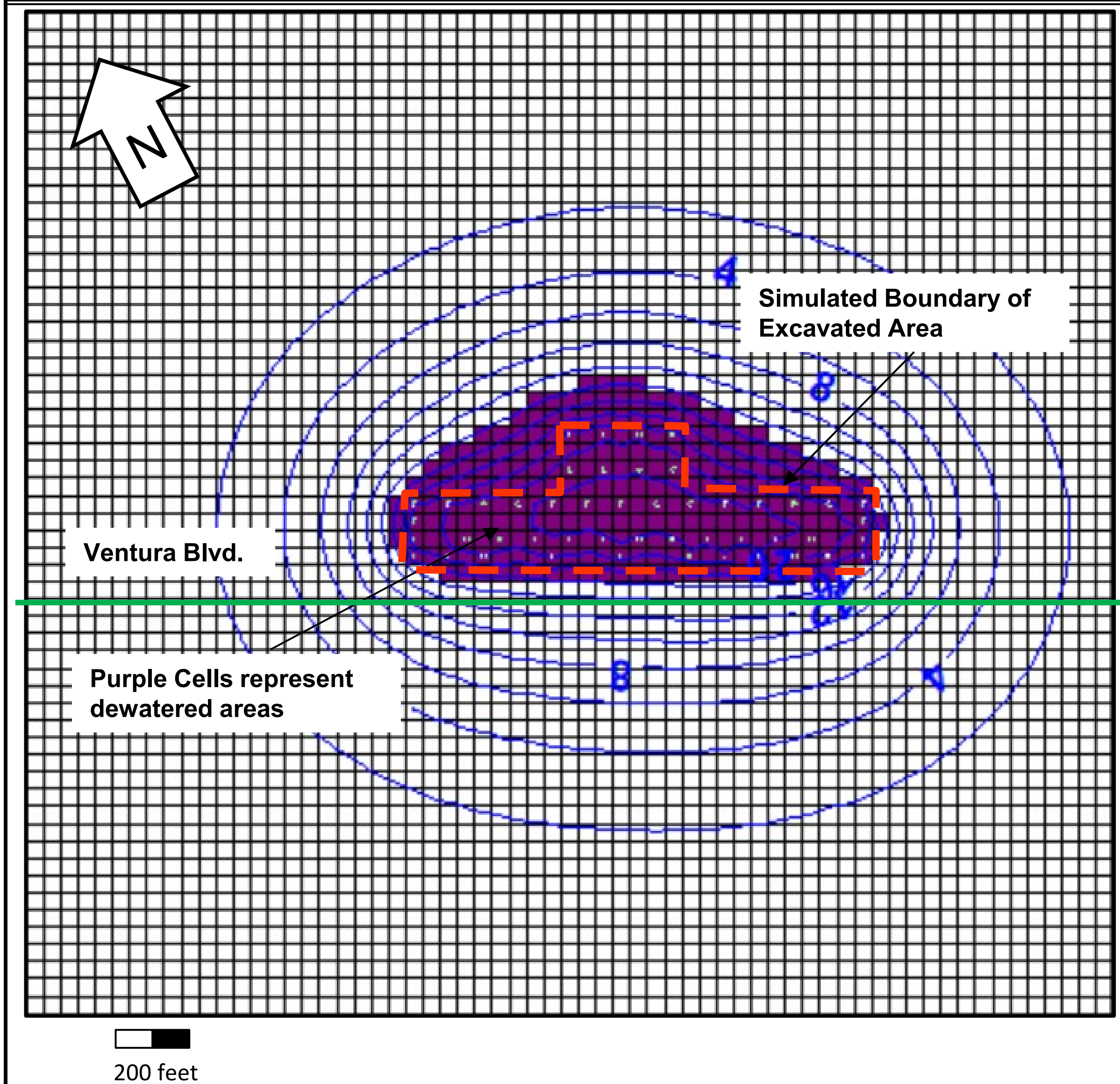
**Transient Groundwater Drawdown Simulation at 15 Months (Initial Head = 10 ft bgs )**

Radford Studio Center
4024, 4064 and 4200 N. Radford Avenue
Studio City, California

Geosyntec consultants
engineers | scientists | innovators

Figure 7D

LB1048 | March 2024




Note:
Simulated Drawdown of the Water Table is shown.

**Transient Groundwater Drawdown Simulation at 15 Months (No Cut-off Walls)**

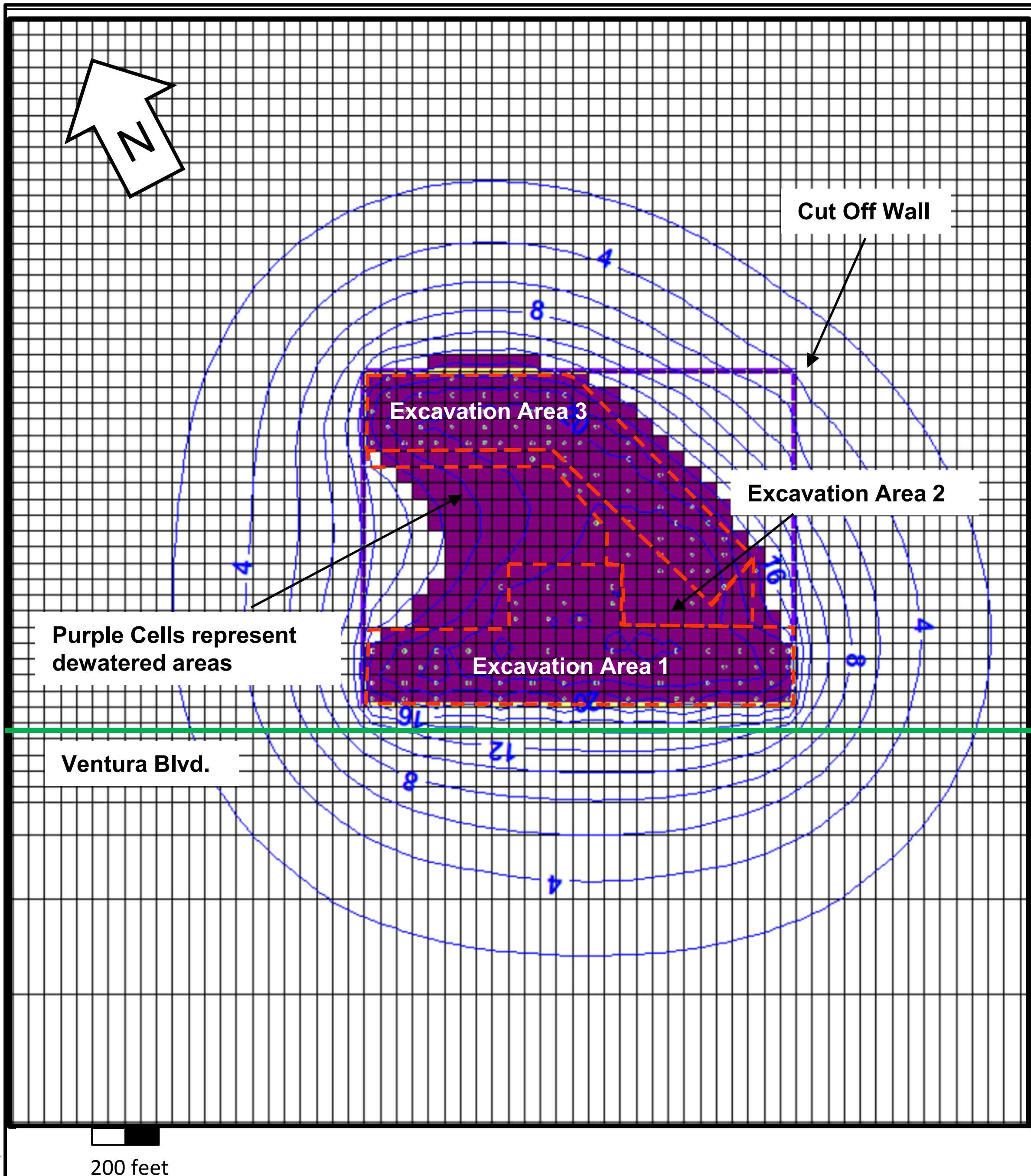
Radford Studio Center
4024, 4064 and 4200 N. Radford Avenue
Studio City, California

Geosyntec consultants
engineers | scientists | innovators

Figure 7E

LB1048

March 2024




Note:
Simulated Drawdown of the Water Table is shown.

**Transient Groundwater Drawdown Simulation at 15 Months (Simultaneous Dewatering with Cut-off Walls)**

Radford Studio Center
4024, 4064 and 4200 N. Radford Avenue
Studio City, California

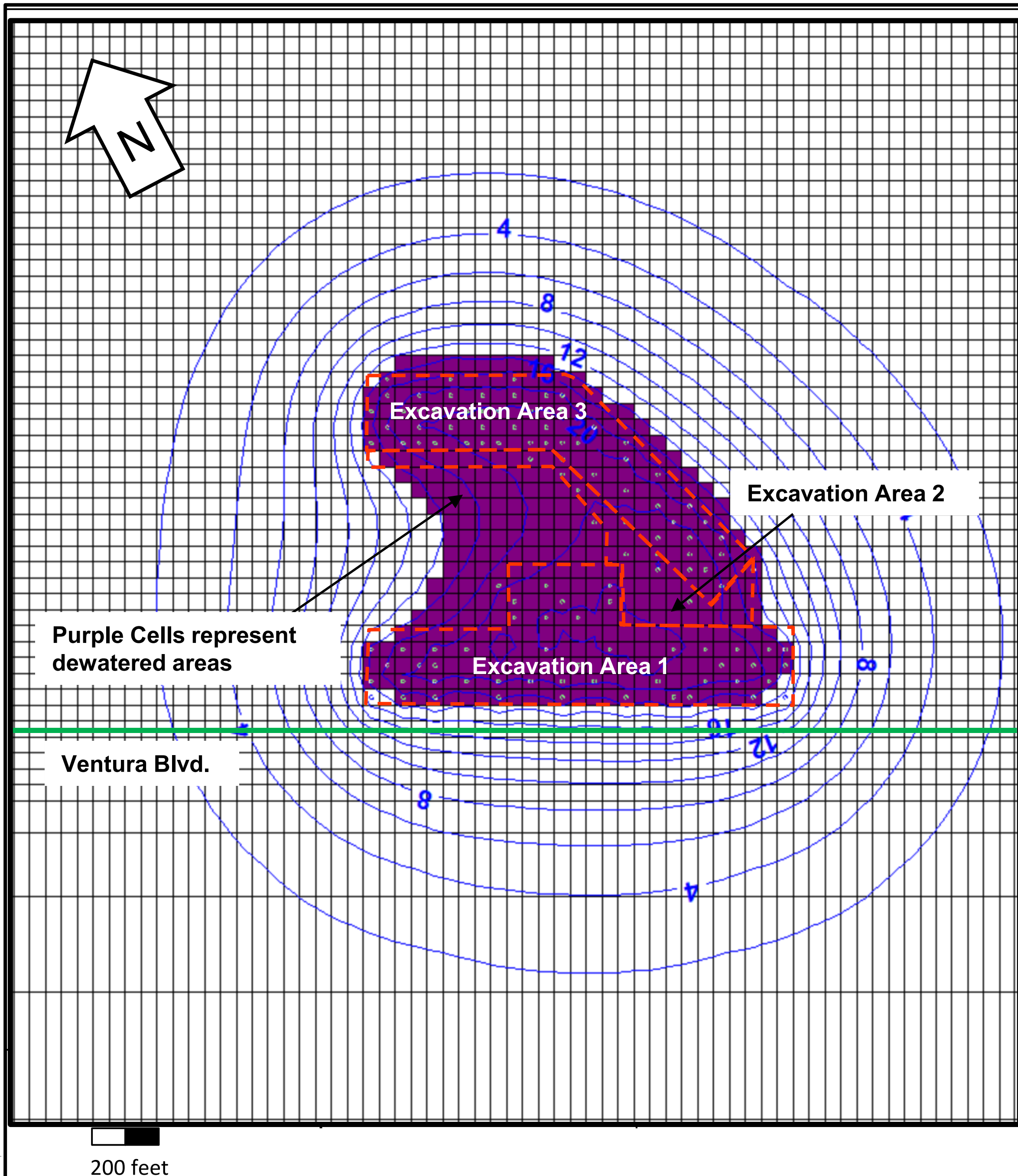
Geosyntec consultants
engineers | scientists | innovators

Figure 7F

LB1048

March 2024

Note:
Simulated Drawdown of the Water Table is shown.




**Transient Groundwater Drawdown Simulation at 15 Months (Simultaneous Dewatering without Cut-off Walls)**

Radford Studio Center
4024, 4064 and 4200 N. Radford Avenue
Studio City, California

Geosyntec consultants
engineers | scientists | innovators

Figure 7G

LB1048

March 2024

# APPENDIX A
# Subsidence Evaluation based on Dewatering Simulations Evaluation

**Geotechnologies, Inc.**
*Consulting Geotechnical Engineers*

439 Western Avenue
Glendale, California 91201-2837
818.240.9600 • Fax 818.240.9675

March 21, 2024
File No. 22241

Eyestone Environmental
2121 Rosecrans Avenue, Suite 3355
El Segundo, California 90245

Attention: Stephanie Eyestone-Jones

Subject: Subsidence Evaluation based on Dewatering Simulations Evaluation
Radford Studio Center Project
4024 – 4200 North Radford Avenue, Los Angeles, California

References: *Reports by Geotechnologies, Inc.:*
Preliminary Geotechnical Engineering Evaluation, revised September 16, 2022;
Geotechnical Engineering Evaluation, revised January 22, 2024.

*City of Los Angeles, Department of Building and Safety:*
Soils Report Approval Letter (Log # 124489), dated January 18, 2023.

*Report by Geosyntec Consultants:*
Dewatering Simulation and Analysis for Excavation and Underground Parking Structure Construction (Project Number: LB1048), dated March 13, 2024.

This report has been prepared to support the Draft EIR (DEIR) regarding potential subsidence due to temporary dewatering during excavation and construction of the subterranean parking structures proposed in the South Lot. This evaluation is based on the results of explorations performed by this firm and a review of the referenced dewatering evaluation report prepared by Geosyntec Consultants (Geosyntec).

Detailed discussions of simulations and evaluations of a representative excavation and temporary construction dewatering using a sample method of extracting groundwater are presented in the referenced Geosyntec report. The simulations were conducted to evaluate Excavation Area 1 independently, as well as a combination of Excavation Areas 1, 2 and 3 in conjunction. The evaluations include scenarios where excavation infiltration is controlled by using a low-permeability grout cut-off wall, and also where this low-permeability grout cut-off wall system is not utilized. The Geosyntec report presents the results of the simultaneous dewatering quantities and drawdown.

To provide a conservative analysis, this document evaluates the scenario in which Excavation Areas 1, 2 and 3 are dewatered simultaneously without the low-permeability grout cut-off walls, which is the scenario that would result in the greatest drawdown. According to the groundwater extraction simulation by Geosyntec, the predicted groundwater drawdown due to the temporary dewatering was found to decrease with distance from the excavation. The predicted drawdown was found to be time-dependent, with both the magnitude and spatial extent of drawdown increasing as dewatering continued. The model estimated a cone of depression drawdown of approximately 10 feet extending up to approximately 200 to 250 feet from the outer perimeters of Excavation Areas 1, 2 and 3. The anticipated drawdown at a distance of approximately 500 to 600 from the outer perimeters of Excavation Areas 1, 2 and 3 is approximately 4 feet. These drawdowns occur following 15 months of dewatering. The numerical model and groundwater drawdown simulation and analyses are described in detail in the referenced Geosyntec report.

This small amount of groundwater drawdown will have less than significant subsidence effects on the surrounding properties. Excavations Areas 1, 2 and 3 are located within the South Lot. Temporary dewatering is not anticipated in the excavations proposed in the North Lot. The properties located to the east are separated from the South Lot by the approximately 150-foot-wide Los Angeles River Channel; properties to the south are separated from the South Lot by the varying 28- to 30-footwide alley. It is anticipated that the drawdown effects, as simulated by Geosyntec, will result in less than ⅓-inch of settlement for areas located in the immediate surrounding vicinity of the excavation. The magnitude of any potential settlement will decrease with increased distance away from the excavation. The settlement anticipated approximately 200 to 250 feet away from the perimeter of the dewatering excavation is expected to be less than ¼-inch. The settlement anticipated approximately 500 to 600 feet away from the perimeter of the dewatering excavation is expected to be less than ⅛-inch.

Section 1812 of the California Building Code (CBC) presents the regulatory requirements for the design and inspections of earth retaining shoring system for Office of Statewide Health Planning and Development (OSHPD) projects. Section 1812.6 of the CBC states that, "[i]f the total cumulative horizontal or vertical movement (from start of construction) of the existing buildings reaches ½ inch or soldier piles movement reaches 1 inch all excavation activities shall be suspended. The geotechnical and shoring design engineers shall determine the cause of movement, if any, and recommend corrective measures, if necessary, before excavation continues."

Even though this section of the CBC is a requirement for OSHPD projects, the City of Los Angeles Department of Building and Safety (LADBS) has adopted the same ½ inch deflection requirement for all shoring systems where a structure is located within a 1:1 surcharge plane (45-degree angle) projected up from the base of the excavation. Where there are no structures located within a 1:1 surcharge plane extending up from the base of the excavation, the maximum lateral deflection of 1 inch at the top of the shoring system is accepted by LADBS. The Project would be required to comply with this requirement and all other applicable regulatory requirements related to the temporary dewatering.

One half inch of horizontal or vertical movement is widely accepted and adopted by design professionals and construction industry standard of acceptance and is considered to be well within the structural tolerance of a well-designed structure.

As part of the regulatory requirements for temporary shoring and excavation, construction surveying and monitoring of the surrounding properties immediately surrounding the Project are required for compliance with this industry standard.

Through the dewatering simulation discussed above, Geosyntec and Geotechnologies, Inc. have demonstrated that the depth and extent of groundwater drawdown would result in less than significant impacts and subsidence effects on the surrounding properties and structures.

The Project is currently in the entitlement phase and not the building permit process. The simulation and modeling presented by Geosyntec is only one example of a potential regulatory infiltration control measure, based on the groundwater and soil conditions found at the Project Site and the anticipated excavation dimensions of the Excavation Areas 1, 2 and 3. Once the individual Project buildings are designed and permitted, a dewatering consultant and a shoring engineer will be engaged, and the method of temporary dewatering system and shoring system will be evaluated as part of the City's regulatory building permit process to ensure that any impact on the surrounding development is less than significant.

Additional confirmatory hydrogeologic testing studies will be performed, and excavation dewatering approaches and methods, as necessary, will be evaluated in the future as part of the City's regulatory building permit process. Other regulatory control methods and designs may be considered as additional subsurface and design information becomes available (i.e., when individual building construction plans are prepared following Project entitlement approval). The final dewatering system methods, and shoring design, which are subject to regulatory control for safety and subsidence, will be submitted to LADBS for review and approval as part of the building permit processes prior to construction.

Should you have any questions please contact this office.

Respectfully submitted,
GEOTECHNOLOGIES, INC.

GREGORIO VARELA
R.C.E. 81201

GV:km

# Appendix H.3

Paleontological Resources Report

# Paleontological Resources Report
## Radford Studio Center Project

City of Los Angeles, California

**Prepared For:** Statistical Research, Inc.
617 Texas St.
Redlands, CA 92374

**Report Date:** December 2023

BARGAS
Environmental Consulting

Sacramento · Orange · Pasadena · San Bernardino · Temecula · San Diego
**www.BargasConsulting.com**

# Project Team

**Report Author(s):** Joseph El Adli, Ph.D.; Joshua Corrie, Ph.D.; Courtney Richards, M.S.

**Field Surveyor(s):** N/A

**Principal Investigator:** Joseph El Adli, Ph.D.

**GIS:** David Duncan, B.A.

**Recommended Citation:** El Adli, J., J. Corrie, and C. Richards. 2023. Paleontological Resources Assessment for the Radford Studio Center Project, City of Los Angeles, California. Prepared for Statistical Research, Inc. November 2023.

# Paleontological Resources Summary Information

**USGS 7.5-Minute Quadrangle(s):** Van Nuys

**City and County:** City of Los Angeles, Los Angeles County

**Dates of Fieldwork:** N/A

**Total Acreage of Lands Surveyed:** N/A

**Total Linear Miles Surveyed:** N/A

**Geologic Units in Project Area:** Holocene-age alluvial fan deposits (Qf; low paleontological potential, high at depth); late Pleistocene- to Holocene-age young alluvial fan deposits, undivided (Qyf; low paleontological potential, high at depth)

**Paleontological Resources Identified in Project Area:** 0

**Previously Recorded Resources in Project Area:** 0

**Newly Recorded Resources in Project Area:** 0

# EXECUTIVE SUMMARY

Bargas Environmental Consulting, LLC (Bargas) completed a paleontological resources assessment at the request of Statistical Research, Inc. for the Radford Studio Center Project (Project) in the City of Los Angeles, Los Angeles County, California. The purpose of the assessment was to determine if the Project has the potential to impact paleontological resources within the Project Site. All work was completed in compliance with the California Environmental Quality Act (CEQA) and City of Los Angeles (City) requirements.

The Project Site is composed of two addressed parcels located at 4200 N. Radford Avenue (APN 2368-001-028; referred to herein as the North Lot) and 4024 and 4064 N. Radford Avenue (APN 2368-005-011; referred to herein as the South Lot) and two unaddressed parcels located within and around the Los Angeles River (APN 2368-001-029) and Tujunga Wash (APN 2368-001-030), which are also included within the scope of this study. The North Lot and the South Lot are separated by the Los Angeles River. The current Project Site area (prior to dedications/mergers that would occur as part of the Project) is approximately 55 acres and the Project Site area after dedications/mergers would be approximately 52.25 acres. The proposed Project consists of the continuation of the existing studio use and the modernization and expansion of Radford Studio Center through the proposed Radford Studio Center Specific Plan. The Project includes the development of up to approximately 1,667,010 square feet of new sound stage, production support, production office, creative office, and retail uses within the Project Site, as well as associated ingress/egress, circulation, parking, landscaping and open space improvements.

Bargas completed a desktop-level paleontological study that included reviews of geologic maps and scientific literature, and a records search at the Natural History Museum of Los Angeles County (NHMLA). The literature reviews and NHMLA records search were negative for paleontological localities within the Project Site and 1-mile buffer. However, multiple specimens discovered within similar geologic units nearby were noted within the record search. Geologic mapping indicates the Project Site is underlain by Holocene-age alluvial fan deposits (Qf) and late Pleistocene- to Holocene-age young alluvial fan deposits, undivided (Qyf). It is possible that the late Miocene-age Modelo Formation (Tm) may be encountered at depths as shallow as 45 feet, especially in the southeastern portions of the South Lot.

Based on the results of the study, there are no known paleontological resources within the Project Site boundaries, and the Holocene-age alluvial fan deposits (Qf) and the Holocene-age sections of the late Pleistocene- to Holocene-age young alluvial fan deposits (Qyf) at the surface of the Project Site have a low potential for significant paleontological resources. However, Pleistocene-age portions of either alluvial fan deposit are assigned a high paleontological potential given the vertebrate fossil-bearing localities known from similar deposits in Los Angeles County. Based on NHMLA record search data, this transition could occur as shallow as 20 feet below grade. Beyond this, the Project Site is likely underlain by the late Miocene-age Modelo Formation (Tm) at an unknown depth. This formation is also assigned high paleontological resource potential.

Given these data, paleontological monitoring is recommended for all Project construction activities involving ground disturbance (e.g., excavation) extending 20 feet or more below the existing grade. In the event of an unanticipated paleontological resource discovery, work within 50 feet of the resource shall stop until a qualified paleontologist can evaluate the significance of the find. Construction activities may continue in other areas. If the discovery is identified as potentially significant, additional work, such as recovery, laboratory preparation, fossil identification, curation, and reporting, may be necessary. Recovered paleontological resources should be deposited in an appropriate fossil repository to be determined by the lead agency in consultation with the qualified paleontologist.

# Table of Contents



## List of Tables

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## Attachments

Appendix A. Natural History Museum of Los Angeles County Records Search Results

# 1 Introduction

Bargas Environmental Consulting, LLC (Bargas) completed a paleontological resources assessment at the request of Statistical Research, Inc. for the Radford Studio Center Project (Project) in the City of Los Angeles, Los Angeles County, California. The purpose of the assessment was to determine if the Project has the potential to impact paleontological resources within the Project Site. All work was completed in compliance with the California Environmental Quality Act (CEQA) and City of Los Angeles (City) requirements.

## 1.1 Project Location and Description

The Project Site is located at 4024, 4064 and 4200 N. Radford Avenue in Studio City, California (APNs 2368-005-011, 2368-001-028, 2368-001-029, and 2368-001-030). The Project Site is bounded by the Los Angeles River and Tujunga Wash to the north and east, Colfax Avenue to the east, Radford Avenue to the west, and an alley to the south with various commercial uses across the alley fronting Ventura Boulevard, and the North and South Lots are separated by the Los Angeles River. Specifically, the site is located within Township 1 North, Range 14 West, Sections 19 and 30, San Bernardino Base and Meridian, of the U.S. Geological Survey's (USGS) Van Nuys, California 7.5-minute quadrangle (Figures 1 and 2). The proposed Project consists of the continuation of the existing studio use and the modernization and expansion of Radford Studio Center through the proposed Radford Studio Center Specific Plan. The proposed Project includes the construction of up to approximately 1,667,010 square feet of new sound stage, production support, production office, creative office, and retail uses within the Project Site, as well as associated ingress/egress, circulation, parking, landscaping and open space improvements. The Project would include the removal of approximately 646,120 square feet of existing sound stage, production support, production office, and creative office uses.

# 2 Methods

Bargas completed a desktop-level paleontological study that included reviews of geologic maps and paleontological literature and a records search at the Natural History Museum of Los Angeles County (NHMLA) to identify any known paleontological resources within the Project Site boundaries or from the same geologic unit within a 1-mile buffer. Paleontological potential rankings were assigned using the Society of Vertebrate Paleontology (SVP) (2010) procedures for paleontological resource assessment (see Section 2.1).

## 2.1 Paleontological Potential and Impact Methods

In general, paleontological resources are preserved in sedimentary rocks; however, they can occasionally be preserved in low-grade metamorphic rocks and can, on rare occasions, be preserved in volcanic rocks. Beyond acting as a vessel for the preservation of fossil remains, sedimentary strata record telltale information reflecting the environment in which they were deposited (e.g., sedimentary structures, maturity, and lithology). For example, fossil remains found within the fine-grained sediments of a floodplain deposit represent organisms that died and were later buried on an ancient floodplain. Because of the interwoven relationship between fossil remains and their geologic contexts, paleontological sensitivity is generally assigned to geologic units rather than to specific regions, areas, or localities.

For this Project, the paleontological potential of the geologic units within the Project Site, both at the surface and at depth, were assigned using the SVP (2010) procedures for paleontological resource assessment. SVP rankings are assigned to geologic units based on the relative abundance of significant paleontological resources within a given geologic unit and their sensitivity to impacts. The rankings and typical management recommendations are summarized in Table 1.


Source: ESRI ArcGIS Online Basemap - World Topographic Map, World Street Map

BARGAS Environmental Consulting

USGS Quad(s): Van Nuys (1976)

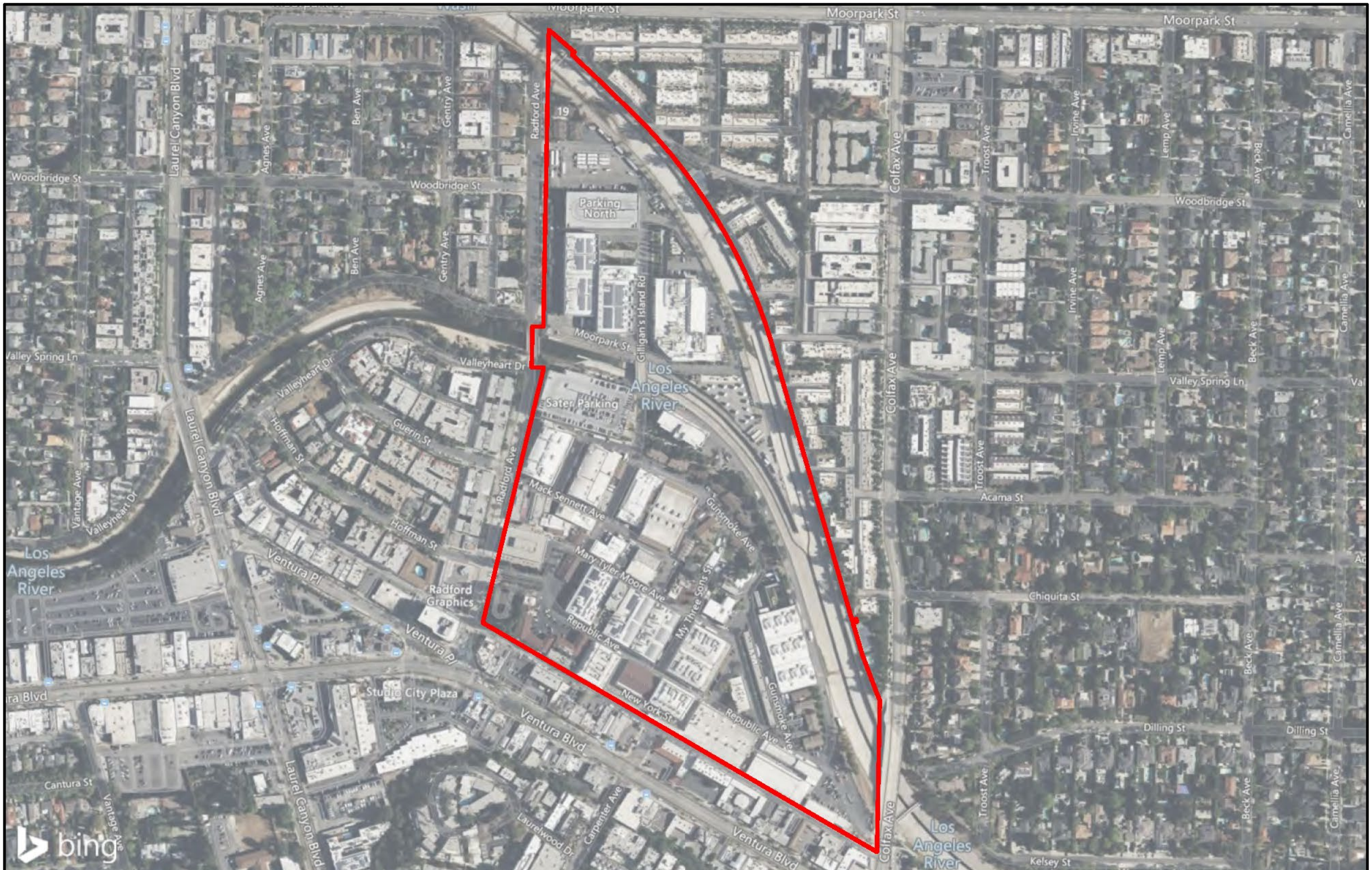
Watershed: Los Angeles (18070105)

Project Site Coordinates: -118.39°W 34.146°N

**Figure 1**
**Project Site and Vicinity**

*Radford Studio Center*

Map Created: 5/8/2023, Created By:DavidDuncan, Map Revised: N/A, Bargas Project Number: 1814-23




Source: Bing Maps Hybrid

0 250 500 Feet

1 inch = 500 feet

BARGAS Environmental Consulting

Study Area

**Figure 2**
**Study Area**

*Radford Studio Center*

Map Created: 5/8/2023, Map Revised: 3/22/2023, Bargas Project Number: 1814-23

*Table 1. SVP Classification for Paleontological Resource Sensitivity*

| Paleontological Potential | Criteria | Recommendations |
|---|---|---|
| High | Geologic formations that are known to yield vertebrate or significant invertebrate, plant, or trace fossils. Highly sensitive formations also may be those that are likely to produce new vertebrate materials, traces, or trackways. | A field survey as well as on-site construction monitoring is required. Any significant specimens discovered will require preparation, identification, and curation, as well as eventual accession into an appropriate museum collection. A final report documenting the significance of any finds is required. |
| Undetermined | Geologic formations for which available literature on paleontological resources is scarce, making it difficult to determine whether or not it is potentially fossiliferous. Under these circumstances, further study is needed to determine the unit's paleontological resource potential (i.e., field survey). | A field survey is required to further assess the unit's paleontological potential. |
| Low | Geologic formations that have yielded few fossils in the past, based upon review of available literature and museum collections records. Low potential also may include formations that yield fossils only under unusual circumstances. This also includes formations that, based on their relative youthful age or high-energy depositional history, are unlikely to produce important fossil remains. | Mitigation is not typically required. |
| No | Geologic formations that are formed under or exposed to immense heat and pressure, such as high-grade metamorphic rocks and plutonic igneous rocks. Artificial fill materials also are assigned as having no potential because of the loss of stratigraphic context of any contained organic remains. | No mitigation required. |

*Note:* Modified from SVP (2010).

## 2.2 Paleontological Resources Definition and Significance Criteria

Fossils are generally defined here as the remains or trace remains (both physical and chemical) of prehistoric organisms (i.e., animals, plants, and microorganisms) (University of California Museum of Paleontology [UCMP] 2023). These resources can be preserved as body fossils, such as bones, teeth, shells, and plant matter, or as trace fossils, such as burrows and footprints. Geologic deposits make up the context in which these fossil remains were originally buried and provide information about the environment in which an organism lived. In the broadest sense, a fossil can be defined as any remains documenting past life. Typically, to be considered within the scope of paleontology, fossils must be at least 10,000 years in age (i.e., dating from before the beginning of the modern Holocene Epoch). However, some Holocene-age remains are also considered of paleontological interest if they contribute to our understanding of the record of past life. Alteration or replacement (e.g., permineralization, petrification, or "fossilization") of the original organic material is not required for determination of whether an object is a fossil or not.

Fossils are important scientific and educational resources because they serve as direct and indirect evidence of prehistoric life and are used to understand the history of life on Earth, the nature of past environments and climates, the membership and structure of ancient ecosystems, and the pattern and process of organic evolution and extinction. Fossils are limited, nonrenewable resources, because they typically represent organisms that are now extinct or life in a context that no longer exists. Therefore, if destroyed, a particular fossil can never be replaced, and the information associated with it is forever lost. However, not all fossils are regarded as significant resources or offered protection under existing laws and regulations. CEQA, the National Environmental Policy Act (NEPA) of 1969, and many other regulations do not define what constitutes unique or significant paleontological resources, instead leaving it to agencies to determine or adopt appropriate criteria. Many agencies have adopted the SVP standards, which define significant paleontological resources as:

> "... fossils and fossiliferous deposits, here defined as consisting of identifiable vertebrate fossils, large or small, uncommon invertebrate, plant, and trace fossils, and other data that provide taphonomic, taxonomic, phylogenetic, paleoecologic, stratigraphic, and/or biochronologic information. Paleontological resources are considered to be older than recorded human history and/or older than middle Holocene (i.e., older than about 5,000 radiocarbon years)." (SVP 2010)

# 3 Regulatory Framework

## 3.1 Federal Regulations

The Project Site contains federally-managed public lands. As such, federal standards and regulations applicable to paleontological resources are listed here for completeness.

In general, management of paleontological resources on public lands is governed under multiple laws, regulations, and standards. These include the NEPA (as amended [42 USC 4321 et seq.]), the Federal Land Management and Policy Act of 1976 (FLPMA), the Paleontological Resources Preservation Act of 2009 (PRPA) (16 USC 470aaa et seq.), and several Bureau of Land Management (BLM) publications, including Manual 8720 (BLM 1998a), Handbook H-8720-1 (BLM 1998b), Instruction Memoranda (IM) No. 2009-011 (BLM 2008), and Permanent Instruction Memoranda (PIM) No. 2022-009 (BLM 2022). NEPA concerns paleontological resources as it recognizes the federal government's continued responsibility to "preserve important historic, cultural, and natural aspects of national heritage" (42 USC 4331). The FLPMA (43 USC 1701–1784) further requires that:

> "public lands be managed in a manner that will protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archeological values; that, where appropriate, will preserve and protect certain public lands in their natural condition."

Like many federal land managing agencies, the USACE issues permits for paleontological investigations and mitigation on lands under their jurisdiction. However, regulations and protocols for such investigations are not strictly defined and are often at the discretion of the local USACE district office.

## 3.2 State Regulations

### 3.2.1 California Environmental Quality Act

The purpose of CEQA is to 1) inform governmental decision makers and the public about the potential, significant environmental effects of proposed projects; 2) identify ways to avoid or reduce environmental damage; 3) prevent significant, avoidable damage to the environment by requiring changes in projects through the use of alternatives or mitigation measures when feasible; and 4) disclose to the public the reason why a governmental agency approved the project if significant environmental effects are involved (CEQA Guidelines, Article 1, Section 15002(a)). The CEQA Environmental Checklist Form includes one question regarding proposed project effects on paleontological resources:

> "Would the project directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?" (CEQA Guidelines, Appendix G, Section VII, Part F)

The answer to this question must take account of the whole action involved, including on-site, off-site, direct, indirect, construction, operational, project-level, and cumulative impacts. If a project would result in significant adverse effects on paleontological resources, then alternative plans or mitigation measures must be considered. The level of consideration may vary with the importance of the paleontological resource.

### 3.2.2 California Public Resources Code

California Public Resources Code (PRC) Section 5097.5 provides protection for paleontological resources located on public lands in California, which are defined as lands owned by, or under the jurisdiction of, the state, or any city, county district, authority, or public corporation, or any agency thereof. Under PRC Section 5097.5, it is a misdemeanor for a person to knowingly and willfully excavate upon, or remove, destroy, injure, or deface, any vertebrate paleontological site, including fossilized footprints, or any other paleontological feature situated on public lands without the express permission of the public agency having jurisdiction of the lands.

## 3.3 Local Regulations

### 3.3.1 City of Los Angeles

The City of Los Angeles General Plan Conservation Element recognizes paleontological resources in Section 3: "Archeological and Paleontological" (II-3), specifically the La Brea Tar Pits, and identifies protection of paleontological resources as an objective (II-5). The General Plan identifies site protection as important, stating, "Pursuant to CEQA, if a land development project is within a potentially significant paleontological area, the developer is required to contact a bona fide paleontologist to arrange for assessment of the potential impact and mitigation of potential disruption of or damage to the site. Section 3 of the Conservation Element, adopted in September 2001, includes policies for the protection of paleontological resources. As stated therein, it is the City's policy that paleontological resources be protected for historical, cultural research, and/or educational purposes. Section 3 sets as an objective the identification and protection of significant paleontological sites and/or resources known to exist or that are identified during "land development, demolition, or property modification activities."

# 4 Geological and Paleontological Setting

## 4.1 Regional Overview

The City of Los Angeles is a sprawling, 1,295-$km^2$ (500-square-mile) municipality in southern California encompassing portions of the San Fernando Valley, the Los Angeles Basin, and a corridor connecting to the Port of Los Angeles in San Pedro. Several independent cities and unincorporated sections of Los Angeles County are located within the larger boundaries of the City of Los Angeles, including the cities of Santa Monica, Culver City, and Beverly Hills.

At the regional scale, the Project Site is situated within the northern portion of the Los Angeles Basin, within the Transverse Ranges Geomorphic Province just north of the junction with the Peninsular Ranges. The Transverse Ranges Geomorphic Province is composed primarily of a series of east-west trending mountain ranges and valleys, which sit in stark contrast to the generally northwest oriented structural features of coastal California (Yerkes et al. 1965). The mountain ranges of the Transverse Ranges are composed dominantly of plutonic igneous rocks (often granites and granitoids) of Cretaceous age (approximately 120 to 90 million years ago [Ma]) and older metamorphic rocks of Jurassic to earliest Cretaceous age (approximately 200 to 140 Ma), as well as Cenozoic age sedimentary rocks (Norris and Webb 1990). In the basins and valleys beneath these mountain ranges, these igneous and metamorphic basement rocks are often overlain by sedimentary deposits of late Mesozoic to Cenozoic age (approximately 90 Ma to 10 thousand years ago [ka]) (Tweet et al. 2014). While the Los

Angeles Basin is traditionally considered most closely associated with the Peninsular Ranges Geomorphic Province, its formation is also closely tied to the clockwise rotation and northward drift of the western Transverse Ranges, which opened the basin, and the subsequent uplift of the Transverse Ranges, which contributed to the rapid and thick accumulation of sediment in the basin (Harden 2004; Sylvester and O'Black Gans 2016).

Structurally, the Los Angeles Basin is divided into four major blocks that are bounded and divided by fault zones. The Project lies within the Northwestern Block, which includes portions of the Santa Monica Mountains, as well as the Verdugo Mountains and San Fernando Valley (Yerkes et al. 1965). The sediments of the Northwestern Block are relatively thick, especially at the eastern base of the Santa Monica Mountains, where sedimentary strata have been estimated at 14,500 feet in thickness. These sediments are late Cretaceous to Pleistocene in age (approximately 90 Ma to 10 ka) and are occasionally interbedded with middle Miocene-age volcanics. Strata within the Northwestern Block were laid down in a variety of marine and terrestrial depositional contexts, which has given rise to a rich fossil record for the region.

## 4.2 Geologic Map and Paleontological Literature Review

The Project Site is mapped as Holocene-age alluvial fan deposits (Qf) and late Pleistocene- to Holocene-age young alluvial fan deposits (Qyf) (Figure 3; Yerkes et al. 2005). Both deposits are likely underlain at depth by Pleistocene-age alluvial fan deposits, as well as the late Miocene-age Modelo Formation (Tm) which is mapped less than 500 feet south of the Project Site (Figure 3; Yerkes et al. 2005). The geotechnical report for the Project (Geotechnologies, Inc. 2023) provided site-specific information about the local geology beneath the Project Site.

### 4.2.1 Artificial Fill

Artificial fill materials are present immediately below the existing grade due to previous development associated the existing Project Site. The extent of these deposits beneath the surface was documented in a geotechnical report for the Project and was noted as being highly variable across the Project Site (Geotechnologies, Inc. 2023). In the North Lot, the artificial fill was noted to range between 1 and 8.5 feet below the existing grade but was considerably thicker (12.5 to 34 feet) in the vicinity of the Los Angeles River Channel and along portions of Tujunga Wash Channel. For the South Lot, fill was documented to depths of 3 to 8 feet below grade across most of the lot, but thickened to 10 to 25.5 feet near the Los Angeles River Channel. Such deposits are presumably derived from prior construction activities and are thus not naturally forming. These disturbed fill sediments could potentially contain fossil materials that were unintentionally introduced during earlier excavations. However, such fossil materials would be removed from their original geologic and stratigraphic contexts and thus would not be of paleontological interest or significance. Artificial fill materials are thus assigned as having no paleontological resource sensitivity, and monitoring of such deposits would not be required.

### 4.2.2 Alluvial Fan Deposits (Qf, Qyf)

Alluvial fans are cone- or fan-shaped deposits of sediment that form at the boundaries between areas of high and low topography. The detrital sediments of the alluvial fan are transported and deposited by gravity, wind, and (most often) water. Such features are common in mountainous regions of the world and, in tectonically active regions, alluvial fans can reach over 50 kilometers (31 miles) in width and 60 kilometers (37 miles) in length.

Quaternary alluvial fan deposits are extensively exposed throughout portions of the Los Angeles Basin and encompass the entirety of the non-fill deposits beneath the Project Site. These deposits have been subdivided into two units by relative age based on geomorphic relationships and relative degree of soil formation (Yerkes et al. 2005). The youngest of these units are the Holocene-age alluvial fan deposits (Qf), which are mapped in the northern and eastern portions of the Project Site (Figure 3) and are associated with the modern Los Angeles River. The Holocene-age alluvial fan deposits (Qf) consist of "unconsolidated bouldery, cobbley, gravelly, sandy, or silty alluvial deposits on active and recently active alluvial fans and in some connected headward channel segments" (Yerkes et al. 2005). The older late Pleistocene- to Holocene-age young alluvial fan deposits (Qyf) are exposed in the southern and western portions of the Project Site. These deposits are typically composed of “unconsolidated gravel, sand, and silt” and may additionally contain boulders near mountain fronts. Unlike the Holocene-age alluvial fan deposits (Qf), the young alluvial fan deposits (Qyf) can show slight to moderate pedogenic soil development.

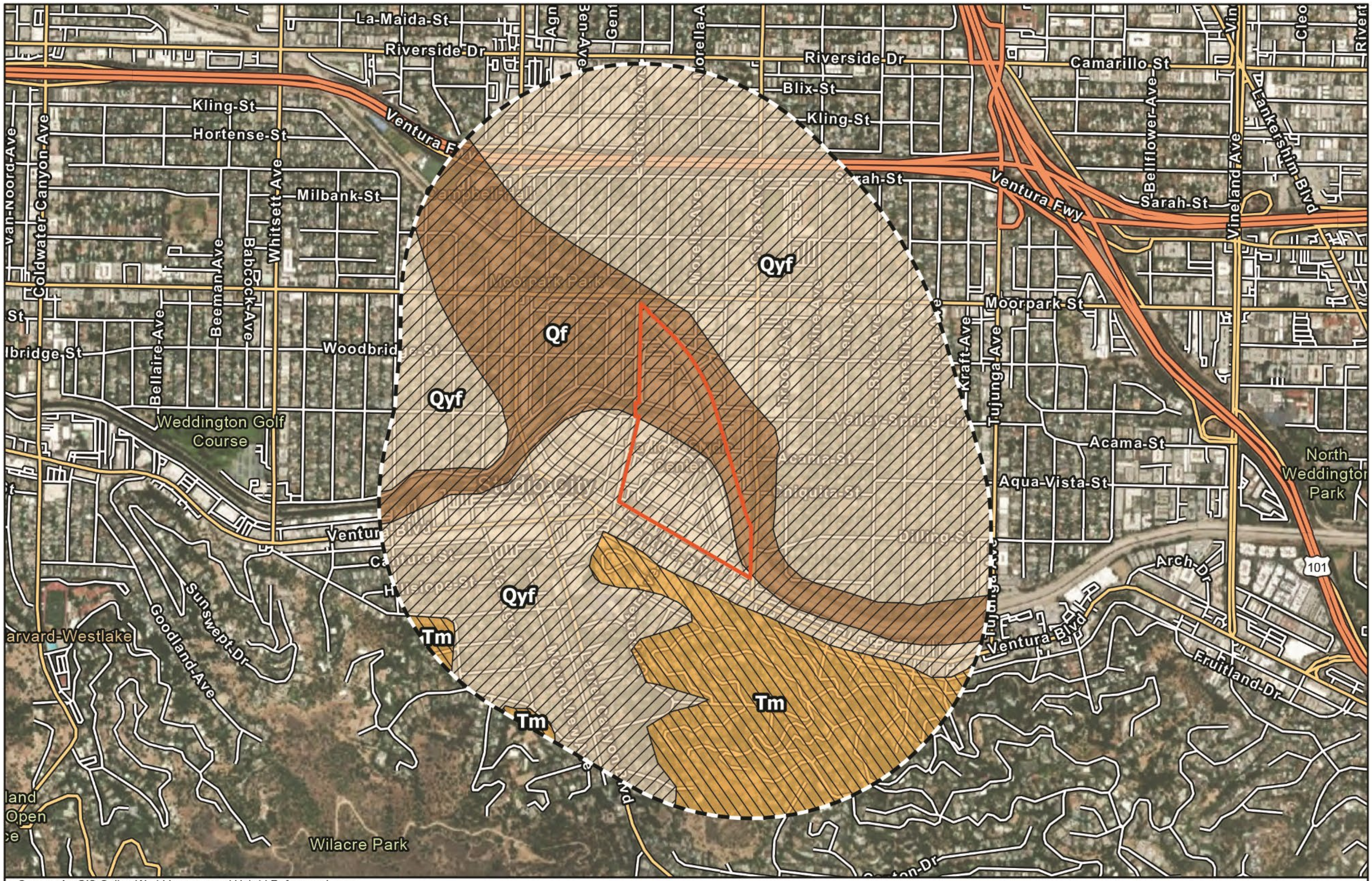
Holocene-age deposits typically do not contain fossils at or near the surface due to their relatively young age. Holocene-age remains may occasionally be of scientific interest, but such discoveries are relatively rare and are addressed on a case-by-case basis. Reworked or transported fossils may also be present in these young deposits. However, such fossils lack geologic context and are generally not considered to be significant. Therefore, the Holocene-age alluvial fan deposits (Qf) and Holocene-age portions of the young alluvial fan deposits, undivided (Qyf) are assigned a low paleontological potential using the SVP classification for paleontological resource sensitivity (2010).

Pleistocene-age alluvial deposits have produced paleontological significant finds of well-preserved large-bodied land mammals throughout Los Angeles County, as well as in nearby Orange and Riverside Counties (Jefferson 1991). Such deposits have yielded remains of mammoths, mastodons, camels, bison, ground sloths, dire wolves, and American lions, among others. Plant remains, terrestrial invertebrates, and microfossils (especially micro-mammals) are also known from similar deposits throughout the Los Angeles Basin (Miller 1971). Thus, any alluvial fan deposits of Pleistocene-age are assigned a high paleontological potential.

### 4.2.3 Modelo Formation (Tm)

The Modelo Formation is a series of late Miocene-age marine deposits which were initially described for sediments exposed in Hopper Canyon and at the head of Modelo Canyon in Ventura County. The precise extent of exposures of the Modelo Formation, as with many Miocene-age formations across southern California, is highly debated and it is not uncommon for various authors to disagree on the identity of exposed strata in a given location. This nomenclatural inconsistency has led to confusion within the scientific literature, which has then propagated across geologic maps and technical reports. For the sake of simplicity, we adopt the nomenclature utilized by Yerkes et al. (2005) for the Miocene-age sediments exposed to the south of the Project Site. This is in contrast to the mapping of Dibblee and Ehrenspeck (1991), which assign these deposits to the Monterey Formation. Yerkes et al. (2005) rectify this discrepancy by noting that “Monterey strata are only exposed south of Malibu Coast Fault… [and] rocks of equivalent age north of fault are referred to [the] Topanga Group and Modelo Formation.” Those authors note the Modelo Formation as a “predominantly gray to brown thin-bedded mudstone, diatomaceous clay shale, or siltstone, containing interbeds of very fine-grained to coarse-grained sandstone” (Yerkes et al. 2005). Similarly, the geotechnical report for the Project (Geotechnologies, Inc. 2023) identifies the bedrock deposits underlying the Project Site as the Monterey Formation after Dibblee and Ehrenspeck (1991). This paleontological resource assessment uses the more recent nomenclature of Yerkes et al. (2005) and term these deposits the Modelo Formation.

Though not exposed within the Project Site, the Modelo Formation is mapped less than 500 feet from the southern boundary of the South Lot and was discovered at depth during geotechnical borings by Geotechnologies, Inc. (2023). No evidence of the Modelo Formation was discovered during geotechnical borings in the North Lot which extended up to 80 feet below grade. However, in the South Lot, the geotechnical investigation reported the contact between the Modelo Formation and the overlying alluvium at depths as shallow as 45 feet below grade, especially in the southeastern corner of the Project Site. The Modelo Formation (and Monterey Formation) are known to produce scientifically significant marine fossils, including fish, sharks, and marine mammals, among others (Bramlette 1946; Dibblee 1973). Based on the known discoveries of significant paleontological resources from similar Miocene-age units within the region, the Modelo Formation is assigned a high paleontological potential.




Source: ArcGIS Online World Imagery and Hybrid Reference Layer

0 750 1,500 Feet

1 inch = 1,500 feet

BARGAS Environmental Consulting

Study Area

Half-mile Buffer

Qf: Alluvial-fan deposits (Holocene)

Qyf: Young alluvial-fan deposits, undivided (Holocene and late Pleistocene)

Tm: Modelo Formation, undivided (late Miocene)

Sensitivity

High Sensitivity

Low Sensitivity (High at Depth)

**Geology Source**

*Title:* Preliminary Geologic Map of the Los Angeles 30' x 60' Quadrangle, Southern California
*Author(s):* Robert F. Yerkes and Russell H. Campbell
*Publishing Organization:* Digital preparation by Rachel M. Alvarez and Kelly R. Bovard
*Publication Date:* 2005
*Map Scale:* 1:24,000

**Figure 3**
**Geologic Map and Paleontological Sensitivity**

*Radford Studio Center*

Map Created: 5/9/2023, Map Revised: n/a, Bargas Project Number: 1814-23

# 5 Records Search Results

A records search of the Project Site and an approximately 1-mile buffer was completed by NHMLA staff member Dr. Alyssa Bell on April 16, 2023. Dr. Bell's report is summarized in Table 2 and provided in full in Appendix A. The search found no previously recorded vertebrate fossil localities directly underlying the Project Site. However, seven paleontological localities were noted from similar geologic units to those underlying and surrounding the Project Site, which were noted in the search results. Four of these localities (LACM VP 3263, 6386, 6970, and 6208) occurred in Holocene- to Pleistocene-age alluvial deposits and produced specimens of fossil horse (Equidae), bison (*Bison*), ground sloth (*Glossotherium*), camel (*Camelops*), and rodents (Rodentia). Two localities were identified from the Modelo Formation (LACM IP 4888 and 5094), which produced specimens of marine invertebrates. Finally, a seventh locality was noted from the Miocene-age Topanga Formation (LACM VP 6969) that contained multiple fossil fish taxa. However, the nearest exposure of the Topanga Formation to the Project Site is approximately 0.8 miles to the southeast and it is unlikely that this unit would be encountered at expected construction depths of up to 50 feet.

*Table 2. Fossil Localities Reported within the Vicinity of the Project Site*

| Locality (Record No.) | Distance from Project Site (mi) | Unit | Age | Taxa | Depth (ft) |
|---|---|---|---|---|---|
| LACM VP 6386 | 1.7 | unknown sandy mudstone | early Holocene | Rodentia (rodent) | 60 |
| LACM VP 6208, 3263 | 4.2 | unknown | Pleistocene | *Bison* (bison), Equidae (horse) | 20 |
| LACM VP 6970 | 1.5 | Old alluvium | Pleistocene | *Bison* (bison), *Camelops* (camel), and *Glossotherium* (ground sloth) | 60–80 |
| LACM IP 4888, 5094 | 0.9 | Modelo Formation | late Miocene | invertebrates | unknown |
| LACM VP 6969 | 1.7 | Topanga Formation | late Miocene | *Estringus* (herring), *Ganolytes* (herring), *Sardinella* (sardinella), Gadoidei, Atherinidae (silverside), Bregmacerotidae (codlet), Scombridae (mackerel), Scianidae (drumfish), and Capridae (boarfish) | unknown |

*Key*: LACM = Natural History Museum of Los Angeles County; IP = Invertebrate Paleontology; VP = Vertebrate Paleontology

# 6 Paleontological Impact Analysis

Impacts under CEQA are classified as direct, indirect, or cumulative. Direct impacts are the primary effects of a project. For paleontological resources, direct impacts are typically the result of ground-disturbing construction or maintenance activities that damage or destroy paleontological resources at the surface or in the subsurface. Indirect impacts are the secondary effects of a project, including project-induced changes such as increased public access to paleontologically sensitive areas and increased susceptibility of fossil-bearing geologic units to erosion due to activities like vegetation removal, which may result in adverse impacts to paleontological resources from illegal collection and damage from weathering, respectively. Cumulative impacts are the incremental effects of a project in combination with the effects of past, current, and probable future projects.

The City of Los Angeles CEQA Significance Thresholds Guide (2006) requires that the significance of impacts on paleontological resources be determined on a case-by-case basis, considering the following factors:

- Whether, or the degree to which, the project might result in the permanent loss of, or loss of access to, a paleontological resource; and
- Whether the paleontological resource is of regional or statewide significance.

There are no known paleontological resources within the Project Site, and both the Holocene-age alluvial fan deposits (Qf) and the Holocene-age sections of the late Pleistocene- to Holocene-age young alluvial fan deposits, undivided (Qyf), have a low paleontological potential at the surface (Table 1). However, late-Pleistocene sections of the young alluvial fan deposits (Qyf) have a high paleontological potential since numerous vertebrate fossil-bearing localities have been recovered from Pleistocene-age sediments elsewhere in Los Angeles County, in addition to nearby Orange and Riverside Counties. These alluvial deposits are known to occur at depths as shallow as 1 foot below grade in the North Lot and 3 feet below grade in the South Lot (Geotechnologies, Inc. 2023). The base of these deposits were not encountered during geotechnical borings to expected maximum construction depths of 50 feet (and beyond), except where they were underlain by strata of the Modelo Formation in the southeastern corner of the South Lot. Portions of the Holocene-age alluvial fan deposits (Qf), as well as the Holocene-age sections of the undivided late Pleistocene- to Holocene-age young alluvial fan deposits (Qyf), likely transition into older Pleistocene-age deposits at depth or could be unconformably underlain by even older geologic units. The depth of this transition is not clear given currently available data. However, based on the locality data provided in the NMHLA records search, this transition could occur at depths of 20 feet below existing grade. Therefore, both of these alluvial deposits should be considered to have a high paleontological potential at depths of 20 feet or greater below existing grade.

The alluvial deposits, especially along the southern margin of the Project Site, are underlain by the late Miocene-age Modelo Formation (Tm). The precise depth of this contact is unknown across most of the Project Site but is expected to occur at depths greater than 50 feet below existing grade (i.e., the proposed maximum extent of excavation for the Project) within the entirety of the North Lot and across most of the South Lot. However, geotechnical borings revealed the contact between the alluvial deposits and the Modelo Formation at depths as shallow as 45 feet below grade in the southeastern portion of the South Lot, which could be encountered within the proposed maximum excavation depths (Geotechnologies, Inc. 2023). Given the historic nomenclatural confusion between the Modelo Formation and Monterey Formation within the literature in this area and the known significant paleontological resources discovered from these units, the Modelo Formation within the vicinity of the Project Site is assigned a high paleontological potential at all depths where it is encountered. Therefore, Project-related excavations have the potential to result in the permanent loss of scientifically important and regionally significant paleontological resources, including identifiable vertebrate fossils, uncommon invertebrate fossils, plant fossils, and trace fossils, which would represent a significant, adverse impact.

With regard to cumulative impacts, CEQA Guidelines (Appendix G, Section XVIII. Mandatory Findings of Significance) state that a project would result in cumulative impacts if impacts were individually limited, but cumulatively considerable. Cumulatively considerable impacts are defined as "incremental effects of a project [that] are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects" (CEQA Guidelines, Appendix G, Section XVIII, Part b). The cumulative setting for paleontological resources associated with the Project includes the Pleistocene-age portions of the alluvial deposits and the Modelo Formation, which are significant because of the information about the history of life, paleoenvironment, and paleoclimate that they can provide. Due to this fact, these deposits are both assigned a high paleontological resources potential. Cumulative development within the local Pleistocene-age alluvial deposits and the Modelo Formation has the potential to destroy or impact significant, nonrenewable paleontological resources. Proposed excavations associated with the Project, combined with other large-scale proposed, in-process, and future projects in the region, have the potential to contribute to the progressive loss of paleontological resources from these deposits. Cumulative impacts to paleontological resources could occur if the Project and other cumulative projects would damage or destroy significant paleontological resources. However, with implementation of the suggested mitigation measure described in Section 7, the Project would have a less than cumulatively considerable impact to paleontological resources. Furthermore, other projects within the cumulative setting would need to comply with existing regulations and undergo CEQA review in order to ensure that potential impacts to paleontological resources were appropriately evaluated and mitigated on a project-to-project basis. As such, compliance with regulatory requirements would reduce cumulative impacts to paleontological resources during construction to a less than cumulatively considerable level.

With implementation of the paleontological resource monitoring and treatment recommendations described in Section 7, direct impacts on paleontological resources would be reduced to less than significant levels. Implementation of the Project would not increase public access to paleontologically sensitive geologic units or erosion; therefore, no indirect impacts to significant paleontological resources are anticipated.

# 7 Summary and Recommendations

Bargas completed a desktop-level paleontological study that included reviews of geologic maps, geotechnical reports, scientific literature, and a records search at the NHMLA to identify any known paleontological resources within the Project Site or within a 1-mile buffer. However, seven paleontological localities were noted from similar geologic units to those surrounding and underlying the Project Site at a greater distance (Table 2). Paleontological potential rankings were assigned using the SVP classification for paleontological resource sensitivity (Table 1).

Previously published geologic maps indicate that the Project Site is underlain by Holocene-age alluvial fan deposits (Qf) and late Pleistocene- to Holocene-age young alluvial fan deposits, undivided (Qyf). Both the Holocene-age alluvial fan deposits and the Holocene-age portions of the young alluvial fan deposits have a low paleontological potential, which accounts for the entirety of the mapped surface of the Project Site (Figure 3). However, late Pleistocene-age sections of the young alluvial fan deposits and Pleistocene extensions of the Holocene-age alluvial fan deposits are likely present at depth beneath the Project Site. These Pleistocene sediments are well known for producing significant paleontological remains within the region (including those localities reported in Table 2) and are thus assigned a high paleontological potential. The record search results provided by the NHMLA suggest that significant paleontological resources from these alluvial deposits could be discovered at depths of 20 feet or greater below the surface. Therefore, both the Holocene-age alluvial fan deposits (Qf) and late Pleistocene- to Holocene-age young alluvial fan deposits, undivided (Qyf) are considered to have a low paleontological sensitivity from the surface to a depth of 20 feet and a high paleontological sensitivity at depths of 20 feet and greater. Similarly, the Modelo Formation (Tm) is known to unconformably underlie the alluvial deposits within proposed maximum construction depths in the southeastern portion of the South Lot, where it was documented at 45 feet below existing grade (Geotechnologies, Inc. 2023). The contact with the Modelo Formation appears to occur at depths greater than those for proposed Project excavations (i.e., up to 50 feet below grade) in all other areas of the Project Site. As discussed above, the Modelo Formation is assigned a high paleontological potential at any depth that it is encountered. Given this, the entire Project Site is considered to have a low paleontological sensitivity from the surface to a depth of 20 feet and a high paleontological sensitivity at depths of 20 feet and greater. However, should suspected undisturbed sediments of the Modelo Formation, Pleistocene portions of the alluvial-fan deposits or any paleontological resources be encountered at shallower depths, then these discoveries should be immediately evaluated by a qualified paleontologist in order to determine if the shallower strata have a high paleontological potential, and, as such, should follow all recommendations for high sensitivity geologic units discussed below.

The collected data indicate that there is a potential to encounter paleontologically significant remains should proposed excavations extend to impact native Pleistocene- or Miocene-age deposits, which are expected to be encountered at depths of 20 feet or greater below the surface. Proposed excavations for the Project are expected to extend up to 50 feet below grade in certain areas of the Project Site and therefore are likely to encounter sediments with a high paleontological sensitivity and have the potential to impact significant paleontological resources. Therefore, Bargas recommends that a comprehensive Paleontological Resources Monitoring and Treatment Plan (PRMTP) be prepared and implemented prior to any Project ground disturbance activity as a mitigation measure in the event unanticipated discoveries are made during construction. The following recommendations regarding paleontological resources, developed in accordance with SVP (2010) guidelines, satisfy the requirements for mitigating impacts to paleontological remains under CEQA.

## 7.1 Recommended Mitigation Measure

### 7.1.1 Mitigation Measure 1

The services of a Qualified Professional Paleontologist who meets Society of Vertebrate Paleontology ([SVP] 2010) standards, shall be retained prior to ground disturbance activities associated with Project construction in order to develop a site-specific Paleontological Resource Mitigation and Treatment Plan. As defined by SVP (2010), a Qualified Professional Paleontologist, also Principal Investigator, or Project Paleontologist, is described as:

"a practicing scientist who is recognized in the paleontological community as a professional and can demonstrate familiarity and proficiency with paleontology in a stratigraphic context. A paleontological Principal Investigator shall have the equivalent of the following qualifications:

1. A graduate degree in paleontology or geology, and/or a publication record in peer reviewed journals; and demonstrated competence in field techniques, preparation, identification, curation, and reporting in the state or geologic province in which the project occurs. An advanced degree is less important than demonstrated competence and regional experience.
2. At least two full years professional experience as assistant to a Project Paleontologist with administration and project management experience; supported by a list of projects and referral contacts.
3. Proficiency in recognizing fossils in the field and determining their significance.
4. Expertise in local geology, stratigraphy, and biostratigraphy.
5. Experience collecting vertebrate fossils in the field."

The Paleontological Resource Mitigation and Treatment Plan shall specify the levels and types of mitigation efforts based on the types and depths of ground disturbance activities and the geologic and paleontological sensitivity of the Project Site. The Paleontological Resource Mitigation and Treatment Plan shall also include a description of the professional qualifications required of key staff, communication protocols during construction, fossil recovery protocols, sampling protocols for microfossils, laboratory procedures, reporting requirements, and curation provisions for any collected fossil specimens. The Paleontological Resource Mitigation and Treatment Plan shall be reviewed by the curatorial staff of the Vertebrate Paleontology Section of the Natural History Museum of Los Angeles County and/or the La Brea Tar Pits and Museum. The Draft Paleontological Resource Mitigation and Treatment Plan will be provided to the curatorial staff no later than four weeks before the start of excavation. A Worker Environmental Awareness Program (WEAP) shall be conducted at the preconstruction meeting for the Project.

The Qualified Professional Paleontologist shall supervise a Qualified Paleontological Resource Monitor who shall monitor all ground disturbance activities within high sensitivity deposits (e.g., Pleistocene age alluvial deposits or the Modelo Formation) in order to identify potential paleontological remains. As defined by the SVP (2010), a Qualified Paleontological Resource Monitor has the following qualifications (or their equivalent):

1. BS or BA degree in geology or paleontology and one year experience monitoring in the state or geologic province of the specific project. An associate degree and/or demonstrated experience showing ability to recognize fossils in a biostratigraphic context and recover vertebrate fossils in the field may be substituted for a degree. An undergraduate degree in geology or paleontology is preferable, but is less important than documented experience performing paleontological monitoring, or
2. AS or AA in geology, paleontology, or biology and demonstrated two years of experience collecting and salvaging fossil materials in the state or geologic province of the specific project, or

3. Enrollment in upper division classes pursuing a degree in the fields of geology or paleontology and two years of monitoring experience in the state or geologic province of the specific project.
4. Monitors must demonstrate proficiency in recognizing various types of fossils, in collection methods, and in other paleontological field techniques.

In the event of the discovery a paleontological resource, the monitor has the authority to divert and/or re-direct ground-disturbing activities in the area of the find and rope off a protective barrier of at least 50 feet to evaluate the unanticipated find.

If significantly disturbed deposits or younger deposits too recent to contain paleontological resources are encountered during construction, the Qualified Professional Paleontologist may reduce or curtail monitoring in those affected areas, after consultation with the Applicant and the Los Angeles Department of City Planning's Office of Historic Resources.

Post-construction, a report shall be prepared detailing paleontological resources discovered during construction. The paleontological resources must be prepared, identified, curated, and donated to a repository, such as the Natural History Museum of Los Angeles County or the La Brea Tar Pits and Museum.

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# 9 Project Personnel

Dr. Joseph El Adli, Principal Paleontologist
Ph.D., Earth and Environmental Sciences, University of Michigan (2018)
M.S., Earth and Environmental Sciences, University of Michigan (2017)
B.S., Geological Sciences (Paleontology emphasis), San Diego State University (2010)
Years of Experience: 16

Dr. Joshua Corrie, Paleontologist
Ph.D., Geology, University of Otago (2019)
M.S., Biological Sciences, Marshall University (2013)
B.S., Earth and Environmental Sciences, University of Illinois Chicago (2010)
Years of Experience: 13

Courtney Richards, Principal Paleontologist
M.S., Biological Sciences (Paleontology Emphasis), Marshall University (2011)
B.S., Earth and Space Science, University of Washington (2006)
Years of Experience: 18

# Appendix A. Natural History Museum of Los Angeles County Records Search Results

Natural History Museum
of Los Angeles County
900 Exposition Boulevard
Los Angeles, CA 90007

tel 213.763.DINO
www.nhm.org

Research & Collections

e-mail: paleorecords@nhm.org

April 16, 2023

Bargas Consulting

Attn: Joseph El Adli

re: Paleontological resources for the Radford Studios Center Project (1814-23)

Dear Joseph:

I have conducted a thorough search of our paleontology collection records for the locality and specimen data for proposed development at the Radford Studios Center project area as outlined on the portion of the Van Nuys 2022 USGS topographic quadrangle map that you sent to me via e-mail on April 13, 2023. We do not have any fossil localities that lie directly within the proposed project area, but we do have fossil localities nearby from the same sedimentary deposits that occur in the proposed project area, either at the surface or at depth.

The following table shows the closest known localities in the collection of the Natural History Museum of Los Angeles County (NHMLA).

| Locality Number | Location | Formation | Taxa | Depth |
|---|---|---|---|---|
| LACM IP 4888, 5094 | On hillside W of intersection of Ventura Blvd. & Whitsett Ave; South of Ventura Blvd | Modelo Formation | Unspecified invertebrates | Unknown |
| LACM VP 6386 | Universal City Station for the Red Line subway | Unknown formation (early Holocene; sandy mudstone) | Rodent (Rodentia) | 60 feet bgs |
| LACM VP 6969 | Metrorail Redline Universal City subway station | Topanga Formation (dark gray siltstone shale with sandstone lens) | Herring family (Etringus, *Ganolytes*), Sardinella (*Sardinella*), ray-finned fish (Gadoidei), silverside (Atherinidae), codlet (Bregmacerotidae),mackerel family (Scombridae), drums (Sciaenidae), boarfish (Caproidae) | Unknown |
| LACM VP 6970 | Lankershim Blvd & Bloomfield St | Old alluvium (pebble - gravel; sand; silt & clay) | Ground Sloth (*Glossotherium*); Camel (*Camelops*); Bison (*Bison*) | 60-80 feet bgs (tunnel for |

| | | | | |
|---|---|---|---|---|
| | | | | Metrorail Redline) |
| LACM VP 6208, 3263 | Burbank Blvd. & Kester Ave. in Van Nuys | Unknown formation (Pleistocene) | Bison (*Bison*), horse family (Equidae) | 20 feet bgs |

*VP, Vertebrate Paleontology; IP, Invertebrate Paleontology; bgs, below ground surface*

This records search covers only the records of the NHMLA. It is not intended as a paleontological assessment of the project area for the purposes of CEQA or NEPA. Potentially fossil-bearing units are present in the project area, either at the surface or in the subsurface. As such, NHMLA recommends that a full paleontological assessment of the project area be conducted by a paleontologist meeting Bureau of Land Management or Society of Vertebrate Paleontology standards.

Sincerely,

Alyssa Bell, Ph.D.
Natural History Museum of Los Angeles County

enclosure: invoice