Attachment 4

REPORT OF PRELIMINARY GEOTECHNICAL INVESTIGATION

Proposed Vista Bella Apartment Building
503 Vista Bella
Oceanside, California

JOB NO. 21-13294
03 March 2023
Revised 14 February 2025

Prepared for:

Luxview Properties

03 March 2023
Revised 14 February 2025

Luxview Properties
11230 Sorrento Valley Road, Suite 140
San Diego, CA 92121
Attn: Mr. Tim Barzal

Job No. 21-13294

Subject: **Report of Preliminary Geotechnical Investigation**
Vista Bella Apartment Building
503 Vista Bella
Oceanside, California

Dear Mr. Barzal:

In accordance with your request ***Geotechnical Exploration, Inc***. is issuing this revised report of the preliminary geotechnical investigation performed for the subject project in Oceanside, California in regards to the revised scope of work. The field work was performed on January 3, 2023.

If the conclusions and recommendations presented in this report are incorporated into the design and construction of the proposed development, it is our opinion that the site is suitable for the project.

This opportunity to be of service is sincerely appreciated. Should you have any questions concerning the following report, please do not hesitate to contact us. Reference to our **Job No. 21-13294** will expedite a response to your inquiries.

Respectfully submitted,

GEOTECHNICAL EXPLORATION, INC.

Richard A. Cerros, P.E.
R.C.E. 94223

Leslie D. Reed, President
P.G. 3391/ C.E.G. 999

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The following revised report presents the findings and recommendations of ***Geotechnical Exploration, Inc.*** for the subject project.

I. PROJECT SUMMARY AND SCOPE OF SERVICES

Based on our review of preliminary plans provided to us, the project will consist of a 6-story apartment building with a sub-surface parking garage and associated pavements. Based on the preceding, the scope of work performed for this investigation included a site reconnaissance and subsurface exploration program, laboratory testing, geotechnical engineering analysis of the field and laboratory data, and the preparation of this report. The data obtained and the analyses performed were for the purpose of providing design and construction criteria for the project earthwork, seismic design, building foundations, slab on-grade floors, retaining walls, and pavements.

II. SITE DESCRIPTION AND HISTORY

The property is known as Assessor's Parcel Nos. 160-140-02 and 160-140-06. The property is trapezoidal in shape with a plan area of 1.7 acres (see Vicinity Map, Figure No. I) and is currently occupied by a two-story commercial building with paved parking and drives. The site consists of a relatively flat pad at an existing elevation of about 229 feet above Mean Sea Level (MSL), with cut slopes at an inclination of 1.5H to 1V descending down to an adjacent property occupied by a gas station on the west; a cut slope at an inclination of 2H to 1V descending down to Vista Rey on the north; a cut slope at an inclination of 1.5H to 1V descending down from an adjacent development on the south; and Vista Bella on the east.

III. FIELD INVESTIGATION

The field investigation consisted of a surface reconnaissance and a subsurface exploration program utilizing a truck-mounted, continuous-flight auger drill rig. Four exploratory borings were drilled at the site to depths ranging from approximately 11½ to 19 feet on January 3, 2023. The soils encountered in the borings were continuously logged in the field by our geologist and described in accordance with the Unified Soil Classification System (refer to Appendix A). The approximate locations of the borings are shown on Figure No. II.

Representative samples were obtained from the exploratory borings at selected depths appropriate to the investigation. Samples collected from borings were recovered by driving a 2-inch outer diameter Standard Penetration Test (SPT) split-spoon sampler (ASTM D1586-18) and a 3-inch outer diameter ring-lined Modified California split-tube sampler (ASTM D3550-17) 18 inches into the soil using a 140-pound hammer dropping through a 30-inch free fall. The samplers were driven a maximum of 18 inches and the number of blows for each 6-inch interval was recorded.

The number of blows required to drive the samplers the last 12 inches or portion thereof was recorded for use in evaluation of the soil consistency. The following chart provides an in-house correlation between the number of blows and the consistency of the soil for the 3-inch O.D. Modified California sampler and 2-inch O.D. Standard Penetration Test.

Bulk samples were also collected from the exploratory borings to aid in classification and for appropriate laboratory testing. All samples were returned to our laboratory for evaluation and testing. Exploratory boring logs were prepared on the basis of our observations and laboratory test results and are attached as Figure Nos. IIIa-d.

Boring logs have been prepared on the basis of our observations and laboratory test results. Logs of the borings are attached as Figure Nos. IIIa-d. The following chart provides an in-house correlation between the number of blows and the relative density of the soil for the Standard Penetration Test and the 3-inch sampler.

SOIL	***DENSITY DESIGNATION***	***2-INCH O.D. SAMPLER BLOWS/FOOT***	***3-INCH O.D. SAMPLER BLOWS/FOOT***
Sand and Nonplastic Silt	Very loose Loose Medium Dense Very Dense	0-4 5-10 11-30 31-50 Over 50	0-7 8-20 21-53 54-98 Over 98
Clay and Plastic Silt	Very soft Soft Firm Stiff Very stiff Hard Very Hard	0-2 3-4 5-8 9-15 16-30 31-60 Over 60	0-2 3-4 5-9 10-18 19-45 46-90 Over 90

IV. LABORATORY TESTS

Laboratory tests were performed on relatively undisturbed and bulk samples of the soils encountered in order to evaluate their strength, expansion, and compressibility properties. The following tests were conducted on the sampled soils:

1. *Determination of Percentage of Particles Smaller than No. 200 Sieve (ASTM D1140-17)*
2. *Laboratory Compaction Characteristics (ASTM D1557-12)*
3. *Expansion Index (ASTM D4829-19)*

The particle size smaller than a No. 200 sieve grain size analyses aid in classifying the tested materials in accordance with the Unified Soil Classification System and provides qualitative information related to engineering characteristics such as expansion potential, permeability, and shear strength. The test results are presented on the boring logs at the appropriate sample depths.

Laboratory compaction tests establish the laboratory maximum dry density and optimum moisture content of the tested soils and are also used to aid in evaluating the strength characteristics of the soils. The test results are presented on the boring logs at the appropriate sample depth.

The expansion potential of soils is determined, when necessary, utilizing the Standard Test Method for Expansion Index of Soils (ASTM D4829-19). In accordance with the Standard (Table 5.3), potentially expansive soils are classified as follows:

EXPANSION INDEX (EI)	***POTENTIAL EXPANSION***
0 to 20	Very low
21 to 50	Low
51 to 90	Medium
91 to 130	High
Above 130	Very high

Our laboratory analysis of a representative sample of the more clayey soils obtained yielded an expansion index (EI) of 68. Based on the table shown above, our visual classification of the site soils and our past experience with similar soils, it is our opinion that the silty and clayey sand formational materials encountered have a low potential for expansion and the sandy clay formational materials possess a medium expansion potential. The test results are presented on the boring logs at the appropriate sample depth.

V. SOIL DESCRIPTION

Fill soils consisting of stiff sandy clay and medium dense clayey sands were encountered in all the borings to depths of 2 to 2½ feet. The materials encountered below the fill soils to the depths explored of 11½ to 19 feet consisted of interfingered dense to very dense silty and clayey sands and hard sandy clays of the Santiago Formation.

The exploratory boring logs and related information depict subsurface conditions only at the specific locations shown on the site plan and on the particular date designated on the logs. Subsurface conditions at other locations may differ from conditions occurring at these boring locations. Also, the passage of time may result in changes in the subsurface conditions due to environmental changes.

VI. GROUNDWATER

Free groundwater was not encountered in the exploratory borings. It must be noted, however, that fluctuations in the level of groundwater may occur due to variations in ground surface topography, subsurface stratification, rainfall, and other possible factors which may not have been evident at the time of our field investigation.

It should be kept in mind that grading operations can change surface drainage patterns and/or reduce permeabilities due to the densification of compacted soils. Such changes of surface and subsurface hydrologic conditions, plus irrigation of landscaping or significant increases in rainfall, may result in the appearance of surface or near-surface water at locations where none existed previously. The appearance of such water is expected to be localized and cosmetic in nature, if good positive drainage is implemented, as recommended in this report, during and at the completion of construction.

It must be understood that unless discovered during initial site exploration or encountered during site grading operations, it is extremely difficult to predict if or where perched or true groundwater conditions may appear in the future. When site fill or formational soils are fine-grained and of low permeability, water problems may not become apparent for extended periods of time.

Water conditions, where suspected or encountered during construction, should be evaluated and remedied by the project civil and geotechnical consultants. The project developer and property owner, however, must realize that post-construction appearances of groundwater may have to be dealt with on a site-specific basis.

VII. GEOLOGIC HAZARDS AND SEISMIC CONSIDERATIONS

Our review of available published information including the "*Geologic Map of Oceanside, 30'x60' Quadrangle,* (Kennedy and Tan, 2007), Figure No. IV, indicates that the site is underlain by materials of the Eocene-age Santiago Formation. Based on the *"Geologic Map of Oceanside,"* there are no faults mapped on the site.

The Oceanside area, as most of California, is located in a seismically active region. The San Diego area has been referred to as the eastern edge of the Southern California Continental Borderland, an extension of the Peninsular Ranges Geomorphic Province. The borderland is part of a broad tectonic boundary between the North American and Pacific Plates. The plate boundary is dominated by a complex system of active major strike-slip (right lateral), northwest-trending faults extending from the San Andreas Fault about 70 miles east, to the San Clemente Fault, about 50 miles west of the San Diego metropolitan area.

The prominent fault zones generally considered having the most potential for earthquake damage in the vicinity of the site are the active Newport-Inglewood-Rose Canyon and Coronado Bank fault zones mapped approximately 8 and 24 miles southwest of the site, respectively, and the active Elsinore and San Jacinto fault zones mapped approximately 21 and 43 miles northeast of the site, respectively.

Although research on earthquake prediction has greatly increased in recent years, geologists and seismologists have not yet reached the point where they can predict when and where an earthquake will occur. Nevertheless, on the basis of current technology, it is reasonable to assume that the site may be subject to the effects of at least one moderate to major earthquake during the design life of the project. During such an earthquake, the danger from fault offset through the site is remote, but relatively strong ground shaking is likely to occur.

Strong ground shaking not only can cause structures to shake, but it also has the potential for including other phenomena that can indirectly cause substantial ground movements or other hazards resulting in damage to structures. These phenomena include seismically induced waves such as tsunamis and seiches, inundation due to dam or embankment failure, soil liquefaction, landsliding, lateral spreading, differential compaction and ground cracking. Available information indicates that the location of, and geotechnical conditions at the site, are not conducive to any of these phenomena.

VIII. INFILTRATION FEASIBILITY

With regard to the feasibility of stormwater infiltration at the site, in addition to the relatively impermeable nature of the underlying dense sandstone of the Santiago Formation (Hydrologic Soil Group D), any potential location for infiltration would be in proximity to descending slopes, retaining walls and basement walls. Based on the preceding, it is our opinion that the site is not suitable for any attempted infiltration and that any attempted infiltration at the site would result in unmitigateable geotechnical hazards including but not limited to potentially damaging effects of excess accumulation of water behind retaining/basement walls, and the negative effects on the stability of descending slopes.

IX. CONCLUSIONS AND RECOMMENDATIONS

The following conclusions and recommendations are based on the field investigation conducted by our firm, our laboratory test results, our analysis of the field and laboratory data, and our experience with similar soils and formational materials.

The opinions, conclusions, and recommendations presented in this report are contingent upon ***Geotechnical Exploration, Inc.*** being retained to review the final plans and specifications as they are developed and to observe the site earthwork and installation of foundations. Accordingly, we recommend that the following paragraph be included on the grading and foundation plans for the project.

If the geotechnical consultant of record is changed for the project, the work shall be stopped until the replacement has agreed in writing to accept responsibility within their area of technical competence for approval upon completion of the work. It shall be the responsibility of the permittee to notify the City Engineer in writing of such change prior to the recommencement of grading and/or foundation installation work.

A. ***Earthwork***

1. *Clearing and Stripping:* Those areas of the site to receive any new improvements should be cleared of the existing building slabs and footings, abandoned existing utilities, pavements and flatwork and miscellaneous debris that may be present at the time of construction and stripped of all vegetation. The cleared and stripped materials should be properly disposed of off-site.

2. *Excavation:* Based on the results of our exploratory borings, as well as our experience with similar materials, it is our opinion that the natural formational materials can be excavated utilizing ordinary heavy earthmoving equipment. Contractors should not, however, be relieved of making their own independent evaluation of the excavatability of the on-site materials prior to submitting their bids.

3. *Removal and Recompaction of Existing Fill Soils and Loose Natural Soils:* In order to provide suitable foundation support for the proposed building and other improvements, we recommend that all existing fill soils that remain after the necessary site excavations have been made be removed and recompacted to a minimum degree of compaction of 90 percent. The lateral extent of the recompaction work should be no less than 5 feet beyond the perimeter of all new improvements. The areal extent and depth required to remove the fill soils and any loose natural soils should be determined by our representatives

during the excavation work based on their examination of the soils being exposed. Any unsuitable materials (such as oversize rubble and/or organic matter) should be selectively removed as directed by our representative and disposed of off-site.

4. *Subgrade Preparation:* After the site has been cleared, stripped, and the required excavations made, the exposed subgrade soils in areas to receive fill and/or building improvements should be scarified to a depth of 8 inches, moisture conditioned to at least 2 percent above the laboratory optimum, and compacted to the requirements for structural fill.

5. *Material for Fill:* All existing on-site soils with an organic content of less than 3 percent by volume are in general suitable for use as fill. We recommend that sufficient low expansion potential soil generated from the planned excavations be stockpiled for use as retaining/basement wall backfill and geogrid wall construction. Any required imported fill materials should not contain rocks or lumps more than 3 inches in greatest dimension, not more than 15 percent larger than 2½ inches, and no more than 25 percent of the fill should be larger than ¼-inch. All materials for use as fill should be approved by our representative prior to filling.

6. *Fill Compaction:* All structural fill should in general be compacted to a minimum degree of compaction of 90 percent at a moisture content at least 2 percent above the optimum based upon ASTM D1557-12. Fill material should be spread and compacted in uniform horizontal lifts not exceeding 8 inches in uncompacted thickness. Before compaction begins, the fill should be brought to a moisture content that will permit proper compaction by either: (1) aerating and drying the fill if it is too wet, or (2) moistening the fill with water if it is too

dry. Each lift should be thoroughly mixed before compaction to ensure a uniform distribution of moisture.

7. *Trench and Retaining/Basement Wall Backfill:* All backfill soils placed in utility trenches or behind retaining/basement walls should be compacted to a minimum degree of compaction of 90 percent. Backfill material should be placed in lift thicknesses appropriate to the type of compaction equipment utilized and compacted to a minimum degree of 90 percent by mechanical means. In pavement areas, that portion of the trench backfill within the pavement section should conform to the material and compaction requirements of the adjacent pavement section.

   Our experience has shown that even shallow, narrow trenches, such as for irrigation and electrical lines, that are not properly compacted can result in problems, particularly with respect to shallow groundwater accumulation and migration.

8. *Surface Drainage:* Positive surface gradients should be provided adjacent to the building, and roof gutters and downspouts should be installed so as to direct water away from foundations and slabs toward suitable discharge facilities. Ponding of surface water should not be allowed anywhere on the site. Appropriate erosion control measures should be taken at all times during and after construction to prevent surface runoff waters from entering footing excavations or ponding on finished building pad areas.

9. *Temporary Slopes*: Based on our subsurface investigation work, laboratory test results, and engineering analysis, temporary cut slopes should be stable for a maximum slope height of up to 15 feet at a slope ratio of 0.75:1.0 in

dense/hard formational materials. However, some localized sloughing or raveling of the soils exposed on the slopes may occur.

Since the stability of temporary construction slopes will depend largely on the contractor's activities and safety precautions (storage and equipment loadings near the tops of cut slopes, surface drainage provisions, etc.), it should be the contractor's responsibility to establish and maintain all temporary construction slopes at a safe inclination appropriate to his methods of operation. No soil stockpiles or surcharge may be placed within a horizontal distance of 10 feet from the excavation.

If these recommendations are not feasible due to space constraints, temporary shoring may be required for safety and to protect adjacent property improvements. Similarly, footings near temporary cuts should be underpinned or protected with shoring.

10. *New Permanent Slopes:* We recommend that any required new permanent cut and fill slopes be constructed to an inclination no steeper than 2.0:1.0 (horizontal to vertical). The project plans and specifications should contain all necessary design features and construction requirements to prevent erosion of the on-site soils both during and after construction. Slopes and other exposed ground surfaces should be appropriately planted with a protective groundcover.

    Fill slopes should be constructed to assure that the recommended minimum degree of compaction is attained out to the finished slope face. This may be accomplished by "backrolling" with a sheepsfoot roller or other suitable equipment as the fill is raised. Placement of fill near the tops of slopes should be carried out in such a manner as to assure that loose, uncompacted soils are not sloughed over the tops and allowed to accumulate on the slope face.

B. Foundation Recommendations

We recommend that the proposed building be supported on conventional, individual-spread and/or continuous footing foundations and/or drilled piers bearing on dense undisturbed formational materials. We anticipate that drilled piers may be a desirable alternative to footings on slopes.

11. *Footings*: All footings should be founded at least 24 inches below the lowest adjacent finished grade soils. At the recommended depth, footings may be designed for allowable bearing pressures of 6,000 pounds per square foot (psf) for combined dead and live loads and 8,000 psf for all loads, including wind or seismic. The footings should, however, have a minimum width of 24 inches.

12. *General Criteria for All Footings*: Footings located adjacent to the tops of slopes should be extended sufficiently deep so as to provide at least 10 feet of horizontal cover between the slope face and outside edge of the footing at the footing bearing level. Footings located adjacent to utility trenches should have their bearing surfaces situated below an imaginary 1.5 to 1.0 plane projected upward from the bottom edge of the adjacent utility trench.

    All continuous footings should contain top and bottom reinforcement to provide structural continuity and to permit spanning of local irregularities. We recommend that a minimum of four No. 5 reinforcing bars be provided in the footings (two near the top and two near the bottom). A minimum clearance of 3 inches should be maintained between steel reinforcement and the bottom or sides of the footing. In order for us to offer an opinion as to whether the footings are founded on soils of sufficient load bearing capacity, it is essential that our representative inspect the footing excavations prior to the placement of reinforcing steel or concrete.

13. *Drilled Piers*: Drilled piers, if utilized, should bear on undisturbed formational materials at a minimum depth of three times the pier diameter or 10 feet below the lowest adjacent finish grade, whichever is greater. The piers should have a minimum shaft diameter of 24 inches. Prior to placing concrete in the excavations, the bottoms of all end-bearing piers should be cleaned of loose soil and be free of excess quantities of water. Piers constructed in accordance with the preceding recommendations may be designed for an allowable dead plus live bearing pressure of 12,000 pounds per square foot (psf) with a one-third increase including transient loads such as wind or seismic.

NOTE: The project Civil/Structural Engineer should review all reinforcing schedules. The reinforcing minimums recommended herein are not to be construed as structural designs, but merely as minimum reinforcement to reduce the potential for cracking and separations.

14. *Seismic Design Criteria:* Site-specific seismic design criteria for the proposed structure are presented in the following table in accordance with the 2022 CBC, which incorporates by reference ASCE 7-16 for seismic design. We have determined the mapped spectral acceleration values for the site, based on a latitude of 33.218 degrees and longitude of -117.331 degrees, utilizing a tool provided by the USGS, which provides a solution for ASCE 7-16 (2022 CBC) utilizing digitized files for the Spectral Acceleration maps. We have assigned a Site Soil Classification of C.

TABLE I
Mapped Spectral Acceleration Values and Design Parameters

S_s	S_1	F_a	F_v	S_{ms}	S_{m1}	S_{ds}	S_{d1}
0.955g	0.352g	1.2	1.5	1.146g	0.529g	0.764g	0.352g

15. *Lateral Loads:* Lateral load resistance for the structure supported on footing foundations may be developed in friction between the foundation bottoms and the supporting subgrade. An allowable friction coefficient of 0.35 is considered applicable. An additional allowable passive resistance equal to an equivalent fluid weight of 350 pounds per cubic foot (pcf) acting against the foundations may be used in design provided the footings are poured neat against the adjacent firm walls of excavations in undisturbed formational materials. These lateral resistance values assume a level surface in front of the footing for a minimum distance of three times the embedment depth of the footing and any shear keys.

    Lateral load resistance for piers will be developed by passive pressures against the embedded portion of the piers. We recommend that an allowable passive pressure equal to an equivalent fluid weight of 700 pounds per cubic foot (pcf) be used in design, up to a maximum value of 8,400 psf allowable lateral pressure. The upper 7 feet of embedment should be neglected in computing lateral resistance.

16. *Settlement:* Settlement under building loads is expected to be within tolerable limits for the proposed structure. For footings and piers designed in accordance with the recommendations presented in the preceding paragraphs, we anticipate that total post construction settlements should not exceed 1 inch and post-construction differential settlement angular rotation should be less than 1/240.

17. *Retaining/Basement Walls*: Retaining walls must be designed to resist lateral earth pressures and any additional lateral pressures caused by surcharge loads on the adjoining retained surface. We recommend that unrestrained (cantilever) walls with level backfill be designed for an equivalent fluid pressure of 35 pcf. We recommend that restrained walls (i.e., basement walls or any walls with angle points that restrain them from rotation) with level backfill be designed for an equivalent fluid pressure of 35 pcf plus an additional uniform lateral pressure of 8H pounds per square foot, where H is equal to the height of backfill above the top of the wall footing in feet. Wherever walls will be subjected to surcharge loads, they should also be designed for an additional uniform lateral pressure equal to one-third the anticipated surcharge pressure in the case of unrestrained walls and one-half the anticipated surcharge pressure in the case of restrained walls.

For seismic design of unrestrained walls, we recommend that the seismic pressure increment be taken as a fluid pressure distribution utilizing an equivalent fluid weight of 12 pcf. For restrained walls we recommend that the seismic pressure increment be taken as a fluid pressure distribution utilizing an equivalent fluid weight of 19 pcf added to the active static fluid pressure utilizing an equivalent fluid weight of 35 pcf.

The preceding design pressures assume that the walls are backfilled with low expansion potential materials (Expansion Index less than 50) and that there is sufficient drainage behind the walls to prevent the build-up of hydrostatic pressures from surface water infiltration. We recommend that drainage be provided by a composite drainage material such as J-Drain 200/220 and J-Drain SWD, or equivalent. No perforated pipes are utilized with the J-Drain system. The drain material should terminate 12 inches below the finish surface where the surface is covered by slabs or 18 inches below the finish surface in landscape areas.

Backfill placed behind the walls should be compacted to a minimum degree of compaction of 90 percent using light compaction equipment. If heavy equipment is used, the walls should be appropriately temporarily braced.

18. *Geogrid Retaining Wall:* For design of the proposed reinforced earth retaining wall we recommend that an internal friction angle of 30 degrees and a soil density of 120 pcf be used for the reinforced, foundation and retained zones. We recommend that the wall be founded on undisturbed formational material below any existing fill and that the fill material for the reinforced zone consist of granular low-expansion potential soil stockpiled from the planned excavations. The gravel base for the walls should be no more than 6 inches in thickness and the gravel drainage zone behind the blocks should not exceed one foot in width. All gravel/soil interfaces should be separated by filter fabric such as Mirafi 140N or equivalent, and all gravel cell fill and drainage fill should be densified with a vibratory plate compactor as the blocks are brought up.

C. Concrete Slab on-grade Criteria

19. *Minimum Floor Slab Thickness and Reinforcement:* Based on our experience, we have found that, for various reasons, floor slabs occasionally crack, causing brittle surfaces such as ceramic tiles to become damaged. Therefore, we recommend that all slabs on-grade contain at least a minimum amount of reinforcing steel to reduce the separation of cracks, should they occur.

19.1 Interior floor slabs should be a minimum of 5 inches actual thickness and be reinforced with No. 4 bars on 18-inch centers, both ways, placed at midheight in the slab. Slab subgrade soil should be verified by a ***Geotechnical Exploration, Inc.*** representative to have the proper moisture content within 48 hours prior to placement of the vapor barrier and pouring of concrete.

19.2 Following placement of any concrete floor slabs, sufficient drying time must be allowed prior to placement of floor coverings. Premature placement of floor coverings may result in degradation of adhesive materials and loosening of the finish floor materials.

20. *Concrete Isolation Joints:* We recommend the project Civil/Structural Engineer incorporate isolation joints and sawcuts to at least one-fourth the thickness of the slab in any floor designs. The joints and cuts, if properly placed, should reduce the potential for and help control floor slab cracking. We recommend that concrete shrinkage joints be spaced no farther than approximately 20 feet apart, and also at re-entrant corners. However, due to a number of reasons (such as base preparation, construction techniques, curing procedures, and normal shrinkage of concrete), some cracking of slabs can be expected.

21. *Slab Moisture Protection and Vapor Barrier Membrane:* Although it is not the responsibility of geotechnical engineering firms to provide moisture protection recommendations, as a service to our clients we provide the following discussion and suggested minimum protection criteria. Actual recommendations should be provided by the architect and waterproofing consultants.

Soil moisture vapor can result in damage to moisture-sensitive floors, some floor sealers, or sensitive equipment in direct contact with the floor, in addition to mold and staining on slabs, walls and carpets. The common practice in Southern California is to place vapor retarders made of PVC, or of polyethylene. PVC retarders are made in thickness ranging from 10- to 60-mil. Polyethylene retarders, called visqueen, range from 5- to 10-mil in thickness. These products are no longer considered adequate for moisture protection and can actually deteriorate over time.

Specialty vapor retarding products possess higher tensile strength and are more specifically designed for and intended to retard moisture transmission into and through concrete slabs. The use of such products is highly recommended for reduction of floor slab moisture emission.

The following American Society for Testing and Materials (ASTM) and American Concrete Institute (ACI) sections address the issue of moisture transmission into and through concrete slabs: ASTM E1745-17 Standard Specification for Plastic Water Vapor Retarders Used in Contact Concrete Slabs; ASTM E154-08a(2019) Standard Test Methods for Water Vapor Retarders Used in Contact with Earth; ASTM E96-95 Standard Test Methods for Water Vapor Transmission of Materials; ASTM E1643-18a Standard Practice for Installation of Water Vapor Retarders Used in Contact Under Concrete Slabs; and ACI 302.2R-06 Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.

21.1 Based on the above, we recommend that the vapor barrier consist of a minimum 15-mil extruded polyolefin plastic (no recycled content or woven materials permitted). Permeance as tested before and after mandatory conditioning (ASTM E1745 Section 7.1 and sub-paragraphs

7.1.1-7.1.5) should be less than 0.01 perms (grains/square foot/hour in Hg) and comply with the ASTM E1745 Class A requirements. Installation of vapor barriers should be in accordance with ASTM E1643. The basis of design is 15-mil StegoWrap vapor barrier placed per the manufacturer's guidelines. Reef Industries Vapor Guard membrane has also been shown to achieve a permeance of less than 0.01 perms. We recommend that the slab be poured directly on the vapor barrier, which is placed directly on the prepared subgrade soil; no sand or gravel layers are used.

21.2 Common to all acceptable products, vapor retarder/barrier joints must be lapped and sealed with mastic or the manufacturer's recommended tape or sealing products. In actual practice, stakes are often driven through the retarder material, equipment is dragged or rolled across the retarder, overlapping or jointing is not properly implemented, etc. All these construction deficiencies reduce the retarder's effectiveness. In no case should retarder/barrier products be punctured or gaps be allowed to form prior to or during concrete placement.

21.3 Vapor retarders/barriers do not provide full waterproofing for structures constructed below free water surfaces. They are intended to help reduce or prevent vapor transmission and/or capillary migration through the soil and through the concrete slabs. Waterproofing systems must be designed and properly constructed if full waterproofing is desired. The owner and project designers should be consulted to determine the specific level of protection required.

21.4 Following placement of concrete floor slabs, sufficient drying time must be allowed prior to placement of any floor coverings. Premature placement of floor coverings may result in degradation of adhesive materials and loosening of the finish floor materials.

22. *Exterior Slab Thickness and Reinforcement:* As a minimum for protection of on-site improvements, we recommend that all exterior pedestrian concrete slabs be 4½ inches thick, founded on properly compacted and tested fill, and contain No. 3 bars at 18-inch centers, both ways, at the center of the slab, and contain adequate isolation and control joints. The performance of on-site improvements can be greatly affected by soil base preparation and the quality of construction. It is therefore important that all improvements are properly designed and constructed for the existing soil conditions. The improvements should not be built on loose soils or fills placed without our observation and testing.

For exterior slabs with the minimum shrinkage reinforcement, control joints should be placed at spaces no farther than 15 feet apart or the width of the slab, whichever is less, and also at re-entrant corners. Control joints in exterior slabs should be sealed with elastomeric joint sealant. The sealant should be inspected every 6 months and be properly maintained.

D. Pavements

23. *Concrete Pavement:* We recommend that the garage floor slab subject to automobile traffic be 6 inches thick and be supported directly on properly prepared on-site subgrade soils. To control shrinkage cracking we recommend that the slab be reinforced with No. 4 bars on 18-inch centers, both ways,

placed at midheight in the slab. The upper 8 inches of the subgrade below the slab should be compacted to a minimum degree of compaction of 95 percent just prior to paving. The concrete should conform to Section 201 of The Standard Specifications for Public Works Construction, 2015 Edition, for Class 560-C-3250.

24. <u>*Asphalt Concrete (AC) Pavement*</u>: Based on the results of our exploratory borings and laboratory tests as well as our experience with soils similar to those encountered at the site, we anticipate that AC pavement sections for the proposed development will be on the order of 2½ inches of asphalt concrete on 5 to7 inches of aggregate base for parking stalls and minor traffic channels (Traffic Index of 4.0), 2½ inches on 8 to10 inches for major automobile traffic channels (Traffic Index of 5.0), and 3 inches on 9 to 11 inches for pavement subject to occasional heavy truck traffic such as trash trucks or fire access (Traffic Index of 5.5). Final pavement section recommendations should be based on R-value (Resistance) tests performed on bulk samples of the soils that are exposed at the finished subgrade elevations across the site at the completion of the mass grading operations.

Asphalt concrete should consist of Type III-C2-PG64-10 conforming to the Standard Specifications for Public Works Construction, 2000 Edition (Standard Specifications), Section 400-4 and be placed in accordance with Section 302-5. Aggregate base should conform to the requirements for Crushed Aggregate Base or Crushed Miscellaneous Base in Section 200-2 of the Standard Specifications. The upper 6 inches of the pavement subgrade soil as well as the aggregate base layer should be compacted to a minimum degree of compaction of 95 percent. Preparation of the subgrade and placement of the asphalt concrete and base materials should be performed under the observation of our representative.

E. Temporary Shoring

25. *Retaining Wall Shoring:* Shoring will be required for the planned retaining wall along the southern site boundary. We recommend that the shoring be designed using an angle of internal friction of 32 degrees and a unit soil weight of 120 pounds per cubic foot. If needed, additional recommendations could be provided to the shoring design consultant.

F. General Recommendations

26. *Project Start Up Notification:* In order to minimize any work delays during site development, this firm should be contacted 24 hours prior to any need for observation of footing excavations or field density testing of compacted fill soils. If possible, placement of formwork and steel reinforcement in footing excavations should not occur prior to observing the excavations; in the event that our observations reveal the need for deepening or redesigning foundation structures at any locations, any formwork or steel reinforcement in the affected footing excavation areas would have to be removed prior to correction of the observed problem (i.e., deepening the footing excavation, recompacting soil in the bottom of the excavation, etc.).

X. GRADING NOTES

Geotechnical Exploration, Inc. recommends that we be retained to verify the actual soil conditions revealed during site grading work and footing excavations to be as anticipated in this "*Report of Preliminary Geotechnical Investigation*" for the project. In addition, the compaction of any fill soils placed during site grading work must be observed and tested by the soil engineer. It is the responsibility of the grading contractor to comply with the requirements on the grading plans and the local grading ordinance. All retaining wall and trench backfill should be properly compacted. ***Geotechnical Exploration, Inc.*** will assume no liability for damage occurring due to improperly or uncompacted backfill placed without our observations and testing.

XI. LIMITATIONS

Our conclusions and recommendations have been based on available data obtained from our document review, field investigation and laboratory analysis, as well as our experience with similar soils and formational materials located in this area of Oceanside. Of necessity, we must assume a certain degree of continuity between exploratory excavations.

It is, therefore, necessary that all observations, conclusions, and recommendations be verified at the time grading operations begin or when footing excavations are placed. In the event discrepancies are noted, additional recommendations may be issued, if required.

The work performed and recommendations presented herein are the result of an investigation and analysis that meet the contemporary standard of care in our profession within the City of Oceanside. No warranty is provided.

This report should be considered valid for a period of two (2) years, and is subject to review by our firm following that time. If significant modifications are made to the building plans, especially with respect to the height and location of any proposed structures, this report must be presented to us for immediate review and possible revision.

It is the responsibility of the owner and/or developer to ensure that the recommendations summarized in this report are carried out in the field operations and that our recommendations for design of this project are incorporated in the structural plans. We should be retained to review the project plans once they are available, to verify that our recommendations are adequately incorporated in the plans and to provide additional recommendations if needed.

This firm does not practice or consult in the field of safety engineering. We do not direct the contractor's operations, and we cannot be responsible for the safety of personnel other than our own on the site; the safety of others is the responsibility of the contractor. The contractor should notify the owner if any of the recommended actions presented herein are considered to be unsafe.

The firm of ***Geotechnical Exploration, Inc.*** shall not be held responsible for changes to the physical condition of the property, such as addition of fill soils or changing drainage patterns, which occur subsequent to issuance of this report and the changes are made without our observations, testing, and approval.

Once again, should any questions arise concerning this report, please feel free to contact the undersigned. Reference to our **Job No. 21-13294** will expedite a reply to your inquiries.

Respectfully submitted,

GEOTECHNICAL EXPLORATION, INC.

Richard A. Cerros, P.E.
R.C.E. 94223

Leslie D. Reed, President
P.G. 3391/ C.E.G. 999

Jay K. Heiser
Senior Project Geologist

VICINITY MAP

Thomas Bros. Guide San Diego County, pg 1086-G4

Vista Bella Apartments
503 Vista Bella
Oceanside, CA.

Figure No. I
Job No. 21-13294

Geotechnical Exploration, Inc.

PLANNING CASE NO. D23-00009/CUP21-______

Revision 10
Revision 9
Revision 8
Revision 7
Revision 6
Revision 5
Revision 4
Revision 3 4-20-2023
Revision 2 1-26-2023
Revision 1

Original Date 6-11-2021

Sheet 4 of 5

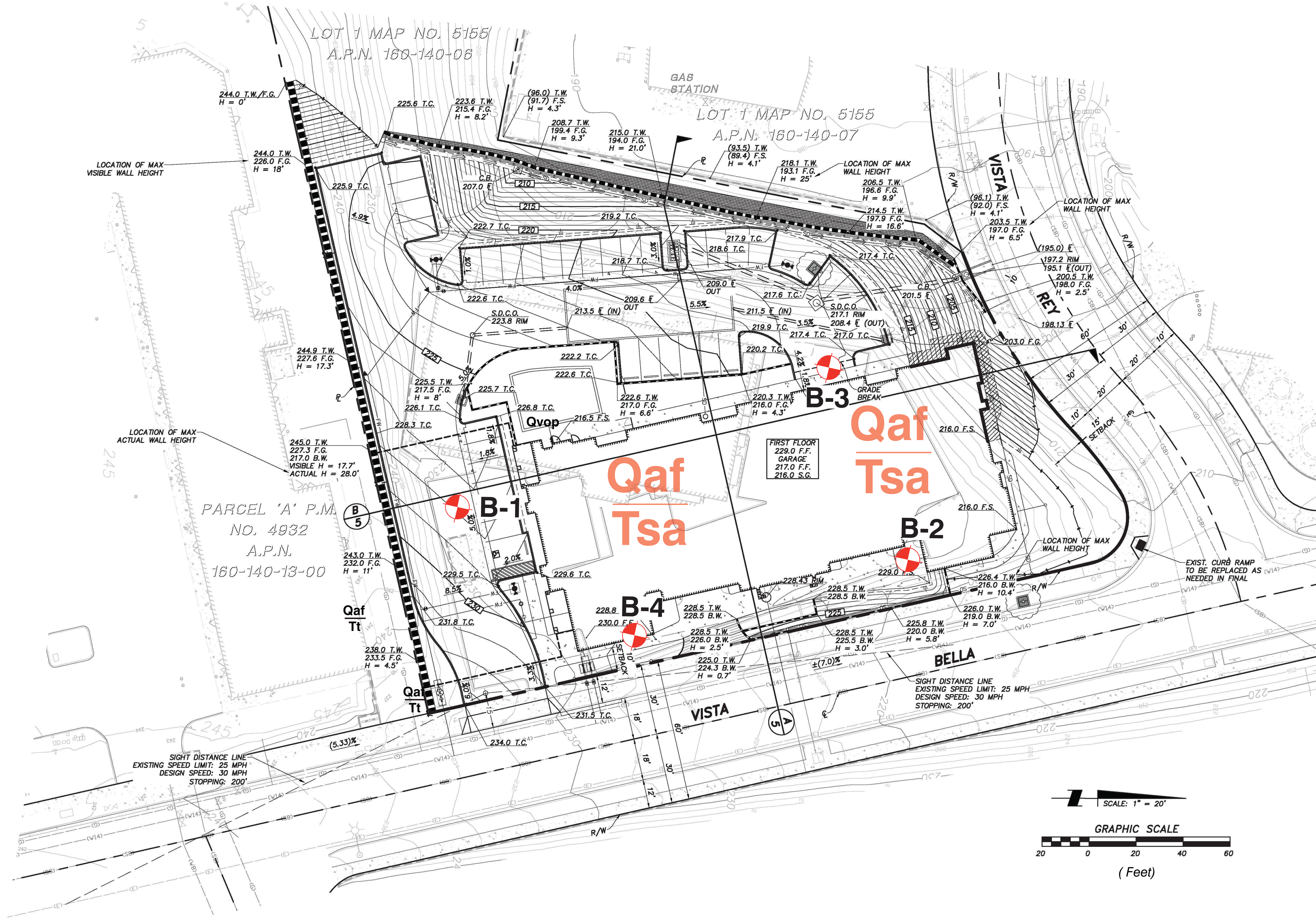
TITLE GRADING AND DRAINAGE PLAN

SB&O INC.

PLANNING ENGINEERING SURVEYING
3990 Ruffin Road, Suite 120
San Diego, Ca. 92123
858-560-1141 858-560-8157
Fax

REGISTERED PROFESSIONAL ENGINEER
AARON PARKER
No. 68547
CIVIL
STATE OF CALIFORNIA

AARON PARKER DATE



SCALE: 1" = 20'

GRAPHIC SCALE

20 0 20 40 60

(Feet)

LEGEND

B-4 Indicates Approximate Location of Exploratory Boring

GEOLOGIC LEGEND

Qaf Artificial Fill

Tsa Santiago Formation

NOTE: This Plot Plan is not to be used for legal purposes. Locations and dimensions are approximate. Actual property dimensions and locations of utilities may be obtained from the Approved Building Plans or the "As-Built" Grading Plans.

REFERENCE: This Plot Plan was prepared from an existing GRADING PLAN AND DRAINAGE PLAN by SB&O INC. dated 4-20-2023 and from on-site field reconnaissance performed by GEI.

PLOT PLAN AND SITE SPECIFIC GEOLOGIC MAP

Vista Bella Apartments
503 Vista Bella
Oceanside, CA.
Figure No. II
Job No. 21-13294

Geotechnical Exploration, Inc.

March 2023

(updated February 2025)

77402.10

Plotted: 1/29/2025 10:30 AM D:\77402 503 VISTA BELLA\03 DWG\DP\77402DP04.DWG - gdlemer

21-13294-p2-2-7-2025.ai

Geotechnical Exploration, Inc.	**EQUIPMENT:** Ingersoll Rand A-300	**METHOD:** ASTM D5784-16, D6151-15
	HAMMER: Safety	**AUGER:** 8" diameter hollow stem
DATE LOGGED: 1/3/2023	**WEIGHT AND DROP HEIGHT:** 140lbs, 30"	**DRILLER:** North County Drilling. Kimbel
WEATHER:		
LOGGED BY: JKH	**GROUND SURFACE ELEVATION:** ± 230' above mean sea level	
REVIEWED BY: DH	**GROUNDWATER/SEEPAGE DEPTH:** Not encountered	

DEPTH (feet)	SYMBOL	SAMPLE	**U.S.C.S. CLASSIFICATION, FIELD DESCRIPTION AND GEOLOGIC UNIT** (Grain Size, Relative Density/Consistency, Moisture, Color, Other)	FINES CONTENT (%)	IN-PLACE MOISTURE (%)	IN-PLACE DRY DENSITY (pcf)	OPTIMUM MOISTURE (%)	MAXIMUM DRY DENSITY (pcf)	RELATIVE COMPACTION (% of MDD)	EXPANSION INDEX	BLOW COUNTS (1.) 6" INCREMENTS	N-VALUE	SAMPLE O.D. (inches)
0–2			*SANDY CLAY (CL); fine to coarse grained; stiff, slightly moist; gray-brown.* *Fill (Qaf)*										
2–3.5		Modified California	*CLAYEY SAND (SC); fine to coarse grained; dense; slightly moist; light gray.*								13 21 50/5"	71/11"	3"
3.5				24	9.0								
3.5–5		Standard Penetration Test									19 21 23	44	2"
5–10		Bulk	*SANTIAGO FORMATION (Tsa)*	41			10.0	124.5					
10–11.5		Modified California									18 40 50/4"	90/10"	3"
11.5–13			*Bottom of boring at 11.5'.* *No groundwater, no caving.* *Backfilled with on-site soils.*										

▼ **GROUNDWATER**	**JOB NUMBER:** 21-13294	**EXPLORATORY BORING LOG**
CONTINUOUS CORE SAMPLE	**JOB NAME:** Vista Bella Apartments	**B-1**
CB **CARVED BLOCK (CHUNK) SAMPLE**		
MODIFIED CALIFORNIA SAMPLE (ASTM D3550/D3550-17)	**SITE LOCATION:** 503 Vista Bella, Oceanside, CA	
STANDARD PENETRATION TEST (ASTM D1586/D1586M-18)		**FIGURE NO. IIIa**
H **HAND DRIVEN BARREL SAMPLE** (ASTM D4700-15)		

(1.) Blow counts to drive sampler in 6" increments. REF indicates refusal. No Standard Penetration Test correction factors apply when refusal encountered.
(2.) N-value for Standard Penetration Test is the recorded number of blows to drive sampler final 12 inches. N_{60} is the recorded N-value corrected for 60% drill rod energy transfer calculated using Skempton (1986) correction factors, and where applicable, Biringen and Davie (2008) automatic hammer correction factor if energy transfer ratio not known. $(N_1)_{60}$ calculated using Liao and Whitman (1986) overburden correction factor in cohesionless sands. $(N_1)_{60(CORR)}$ calculated using Terzaghi and Peck (1967) dilatancy correction factor for saturated, dense to very dense, silty fine sands and fine sands below the water table.

Geotechnical Exploration, Inc.	**EQUIPMENT:** Ingersoll Rand A-300	**METHOD:** ASTM D5784-16, D6151-15
	HAMMER: Safety	**AUGER:** 8" diameter hollow stem
DATE LOGGED: 1/3/2023	**WEIGHT AND DROP HEIGHT:** 140lbs, 30"	**DRILLER:** North County Drilling. Kimbel
WEATHER:		
LOGGED BY: JKH	**GROUND SURFACE ELEVATION:** ± 230' above mean sea level	
REVIEWED BY: DH	**GROUNDWATER/SEEPAGE DEPTH:** Not encountered	

DEPTH (feet)	SYMBOL	SAMPLE	**U.S.C.S. CLASSIFICATION, FIELD DESCRIPTION AND GEOLOGIC UNIT** (Grain Size, Relative Density/Consistency, Moisture, Color, Other)	FINES CONTENT (%)	IN-PLACE MOISTURE (%)	IN-PLACE DRY DENSITY (pcf)	OPTIMUM MOISTURE (%)	MAXIMUM DRY DENSITY (pcf)	RELATIVE COMPACTION (% of MDD)	EXPANSION INDEX	BLOW COUNTS [1.] 6" INCREMENTS	N-VALUE	SAMPLER (O.D.) (inches)
0			*CLAYEY SAND (SC); fine to coarse grained; medium dense; slightly moist; light-brown.*										
1													
2			*Fill (Qaf)*	49	16.9						40 50/2"	50/2"	3"
			CLAYEY SAND (SC); fine to medium grained; very dense; moist; light brown and gray.		12.3								
3											42 50/2"	50/2"	2"
				24									
4													
5			*SANTIAGO FORMATION (Tsa)*				11.6	121.6		68			
6			*- Weak Cementation*	41									
7			*SILTY SAND (SM); fine to medium grained; very dense; moist; light yellowish.*								50/5"		2"
8													
9													
10													
11			*SANTIAGO FORMATION (Tsa)*										
12				12							50/4"		2"
13			*Bottom of boring at 12' 4". No groundwater, no caving. Backfilled with on-site soils.*										

▼	**GROUNDWATER**	**JOB NUMBER:** 21-13294	**EXPLORATORY BORING LOG**
	CONTINUOUS CORE SAMPLE	**JOB NAME:** Vista Bella Apartments	**B-2**
CB	**CARVED BLOCK (CHUNK) SAMPLE**		
	MODIFIED CALIFORNIA SAMPLE (ASTM D3550/D3550-17)	**SITE LOCATION:** 503 Vista Bella, Oceanside, CA	
	STANDARD PENETRATION TEST (ASTM D1586/D1586M-18)		**FIGURE NO. IIIb**
H	**HAND DRIVEN BARREL SAMPLE** (ASTM D4700-15)		

(1.) Blow counts to drive sampler in 6" increments. REF indicates refusal. No Standard Penetration Test correction factors apply when refusal encountered.
(2.) N-value for Standard Penetration Test is the recorded number of blows to drive sampler final 12 inches. N_{60} is the recorded N-value corrected for 60% drill rod energy transfer calculated using Skempton (1986) correction factors, and where applicable, Biringen and Davie (2008) automatic hammer correction factor if energy transfer ratio not known. $(N_1)_{60}$ calculated using Liao and Whitman (1986) overburden correction factor in cohesionless sands. $(N_1)_{60(CORR)}$ calculated using Terzaghi and Peck (1967) dilatancy correction factor for saturated, dense to very dense, silty fine sands and fine sands below the water table.

Geotechnical Exploration, Inc.	EQUIPMENT: Ingersoll Rand A-300	METHOD: ASTM D5784-16, D6151-15
	HAMMER: Safety	AUGER: 8" diameter hollow stem
DATE LOGGED: 1/3/2023	WEIGHT AND DROP HEIGHT: 140lbs, 30"	DRILLER: North County Drilling. Kimbel
WEATHER:		
LOGGED BY: JKH	GROUND SURFACE ELEVATION: ± 230' above mean sea level	
REVIEWED BY: DH	GROUNDWATER/SEEPAGE DEPTH: Not encountered	

DEPTH (feet)	SYMBOL	SAMPLE	U.S.C.S. CLASSIFICATION, FIELD DESCRIPTION AND GEOLOGIC UNIT (Grain Size, Relative Density/Consistency, Moisture, Color, Other)	FINES CONTENT (%)	IN-PLACE MOISTURE (%)	IN-PLACE DRY DENSITY (pcf)	OPTIMUM MOISTURE (%)	MAXIMUM DRY DENSITY (pcf)	RELATIVE COMPACTION (% of MDD)	EXPANSION INDEX	BLOW COUNTS [1.] 6" INCREMENTS	N-VALUE	SAMPLER (O.D.) (inches)
			2" of A/C over 5" of Concrete										
1			*CLAYEY SAND (SC); fine to medium grained; medium dense; moist; brown.*										
			Fill (Qaf)										
2			*SILTY SAND (SM); fine to medium grained; very dense; moist; light yellowish-brown and gray.*	10	5.1						50/2"		3"
3				11	5.8						27 50/2"	50/2"	2"
4													
5													
			SANTIAGO FORMATION (Tsa)										
6													
7													
8													
9			*Weak Cementation*										
10			*SANDY CLAY (CL); hard, moist, brown*	60	15.8						50/5.5"		2"
11													
12													
13			*SANTIAGO FORMATION (Tsa)*										

Legend	JOB NUMBER: 21-13294	EXPLORATORY BORING LOG
GROUNDWATER	JOB NAME: Vista Bella Apartments	B-3
CONTINUOUS CORE SAMPLE		
CB CARVED BLOCK (CHUNK) SAMPLE	SITE LOCATION: 503 Vista Bella, Oceanside, CA	FIGURE NO. IIIc
MODIFIED CALIFORNIA SAMPLE (ASTM D3550/D3550-17)		
STANDARD PENETRATION TEST (ASTM D1586/D1586M-18)		
H HAND DRIVEN BARREL SAMPLE (ASTM D4700-15)		

(1.) Blow counts to drive sampler in 6" increments. REF indicates refusal. No Standard Penetration Test correction factors apply when refusal encountered.

(2.) N-value for Standard Penetration Test is the recorded number of blows to drive sampler final 12 inches. N_{60} is the recorded N-value corrected for 60% drill rod energy transfer calculated using Skempton (1986) correction factors, and where applicable, Biringen and Davie (2008) automatic hammer correction factor if energy transfer ratio not known. $(N_1)_{60}$ calculated using Liao and Whitman (1986) overburden correction factor in cohesionless sands. $(N_1)_{60(CORR)}$ calculated using Terzaghi and Peck (1967) dilatancy correction factor for saturated, dense to very dense, silty fine sands and fine sands below the water table.

Geotechnical Exploration, Inc.	**EQUIPMENT:** Ingersoll Rand A-300	**METHOD:** ASTM D5784-16, D6151-15
	HAMMER: Safety	**AUGER:** 8" diameter hollow stem
DATE LOGGED: 1/3/2023	**WEIGHT AND DROP HEIGHT:** 140lbs, 30"	**DRILLER:** North County Drilling. Kimbel
WEATHER:		
LOGGED BY: SO	**GROUND SURFACE ELEVATION:** ± 229' above mean sea level	
REVIEWED BY: DH	**GROUNDWATER/SEEPAGE DEPTH:** Not encountered	

DEPTH (feet)	SYMBOL	SAMPLE	U.S.C.S. CLASSIFICATION, FIELD DESCRIPTION AND GEOLOGIC UNIT (Grain Size, Relative Density/Consistency, Moisture, Color, Other)	FINES CONTENT (%)	IN-PLACE MOISTURE (%)	IN-PLACE DRY DENSITY (pcf)	OPTIMUM MOISTURE (%)	MAXIMUM DRY DENSITY (pcf)	RELATIVE COMPACTION (% of MDD)	EXPANSION INDEX	BLOW COUNTS [1.] 6" INCREMENTS	N-VALUE	SAMPLER (O.D.) (inches)
14													
15		SPT		56	13.2						50/5.5"		2"
16													
17													
18		SPT	*SANTIAGO FORMATION (Tsa)*								50/4"		2"
19			*Bottom of boring at 18' 10".* *No groundwater, no caving.* *Backfilled with on-site soils.*										
20													
21													
22													
23													
24													
25													
26													

Legend		
GROUNDWATER	**JOB NUMBER:** 21-13294	**EXPLORATORY BORING LOG**
CONTINUOUS CORE SAMPLE	**JOB NAME:** Vista Bella Apartments	**B-3 cont.**
CB CARVED BLOCK (CHUNK) SAMPLE		
MODIFIED CALIFORNIA SAMPLE (ASTM D3550/D3550-17)	**SITE LOCATION:** 503 Vista Bella, Oceanside, CA	
STANDARD PENETRATION TEST (ASTM D1586/D1586M-18)		**FIGURE NO.** **IIId**
H HAND DRIVEN BARREL SAMPLE (ASTM D4700-15)		

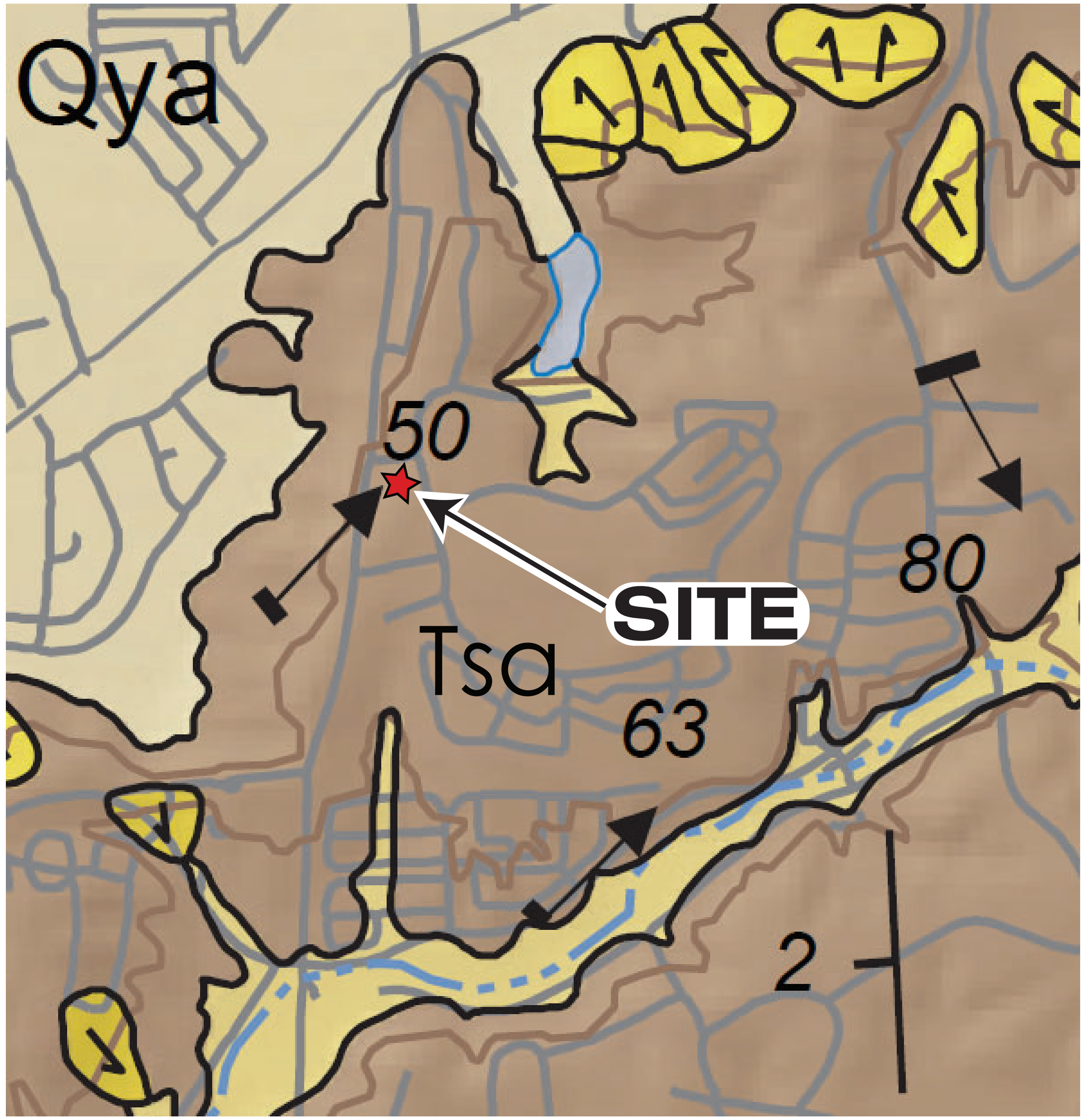
(1.) Blow counts to drive sampler in 6" increments. REF indicates refusal. No Standard Penetration Test correction factors apply when refusal encountered.
(2.) N-value for Standard Penetration Test is the recorded number of blows to drive sampler final 12 inches. N_{60} is the recorded N-value corrected for 60% drill rod energy transfer calculated using Skempton (1986) correction factors, and where applicable, Biringen and Davie (2008) automatic hammer correction factor if energy transfer ratio not known. $(N_1)_{60}$ calculated using Liao and Whitman (1986) overburden correction factor in cohesionless sands. $(N_1)_{60(CORR)}$ calculated using Terzaghi and Peck (1967) dilatancy correction factor for saturated, dense to very dense, silty fine sands and fine sands below the water table.

Geotechnical Exploration, Inc.	**EQUIPMENT:** Ingersoll Rand A-300	**METHOD:** ASTM D5784-16, D6151-15
	HAMMER: Safety	**AUGER:** 8" diameter hollow stem
DATE LOGGED: 1/3/2023	**WEIGHT AND DROP HEIGHT:** 140lbs, 30"	**DRILLER:** North County Drilling. Kimbel
WEATHER:		
LOGGED BY: SO	**GROUND SURFACE ELEVATION:** ± 230' above mean sea level	
REVIEWED BY: DH	**GROUNDWATER/SEEPAGE DEPTH:** Not encountered	

DEPTH (feet)	SYMBOL	SAMPLE	U.S.C.S. CLASSIFICATION, FIELD DESCRIPTION AND GEOLOGIC UNIT (Grain Size, Relative Density/Consistency, Moisture, Color, Other)	FINES CONTENT (%)	IN-PLACE MOISTURE (%)	IN-PLACE DRY DENSITY (pcf)	OPTIMUM MOISTURE (%)	MAXIMUM DRY DENSITY (pcf)	RELATIVE COMPACTION (% of MDD)	EXPANSION INDEX	BLOW COUNTS (1.) 6" INCREMENTS	N-VALUE	SAMPLER (O.D.) (inches)
0			*1.5" of A/C over 5" of Concrete*										
1			*CLAYEY SAND (SC); fine to medium grained; medium dense; slightly moist to moist; light brown.* *Fill (Qaf)*										
2		Modified California	*CLAYEY SAND (SC); fine to medium grained; very dense; moist; light yellowish-brown and gray.*	12	10.1						50/5"		3"
3		SPT		15	9.5						33 50/5.5"	50/5.5"	2"
6			*-Weak Cementation*										
7–8			*SANTIAGO FORMATION (Tsa)*										
8–9		SPT	*SANDY CLAY (CL); hard; moist; brown.*	76	19.9						23 39 50/5"	89/11"	2"
10–12													
12–13		SPT	*SANTIAGO FORMATION (Tsa)*	45	18.3						34 50/5"	50/5"	2"
13			*Bottom of boring at 12' 11".* *No groundwater, no caving.* *Backfilled with on-site soils.*										

Legend			
GROUNDWATER	**JOB NUMBER:** 21-13294	**EXPLORATORY BORING LOG**	
CONTINUOUS CORE SAMPLE	**JOB NAME:** Vista Bella Apartments	**B-4**	
CB CARVED BLOCK (CHUNK) SAMPLE			
MODIFIED CALIFORNIA SAMPLE (ASTM D3550/D3550-17)	**SITE LOCATION:** 503 Vista Bella, Oceanside, CA	**FIGURE NO. IIIe**	
STANDARD PENETRATION TEST (ASTM D1586/D1586M-18)			
H HAND DRIVEN BARREL SAMPLE (ASTM D4700-15)			

(1.) Blow counts to drive sampler in 6" increments. REF indicates refusal. No Standard Penetration Test correction factors apply when refusal encountered.
(2.) N-value for Standard Penetration Test is the recorded number of blows to drive sampler final 12 inches. N_{60} is the recorded N-value corrected for 60% drill rod energy transfer calculated using Skempton (1986) correction factors, and where applicable, Biringen and Davie (2008) automatic hammer correction factor if energy transfer ratio not known. $(N_1)_{60}$ calculated using Liao and Whitman (1986) overburden correction factor in cohesionless sands. $(N_1)_{60(CORR)}$ calculated using Terzaghi and Peck (1967) dilatancy correction factor for saturated, dense to very dense, silty fine sands and fine sands below the water table.



Vista Bella Apartments
503 Vista Bella
Oceanside, CA.

EXCERPT FROM

GEOLOGIC MAP OF THE OCEANSIDE 30' × 60' QUADRANGLE, CALIFORNIA

Compiled by
Michael P. Kennedy[1] and Siang S. Tan[1]
2007
Digital preparation by
Kelly R. Bovard[2], Rachel M. Alvarez[2], Michael J. Watson[2], and Carlos I. Gutiérrez[1]

1. Department of Conservation, California Geological Survey
2. U.S. Geological Survey, Department of Earth Sciences, University of California, Riverside

ONSHORE MAP SYMBOLS

Contact - Contact between geologic units; dotted where concealed.

Fault - Solid where accurately located; dashed where approximately located; dotted where concealed. U = upthrown block, D = downthrown block. Arrow and number indicate direction and angle of dip of fault plane.

Anticline - Solid where accurately located; dashed where approximately located; dotted where concealed. Arrow indicates direction of axial plunge.

Syncline - Solid where accurately located; dotted where concealed. Arrow indicates direction of axial plunge.

Landslide - Arrows indicate principal direction of movement. Queried where existence is questionable.

Strike and dip of beds

70 Inclined

Strike and dip of igneous joints

60 Inclined

Vertical

Strike and dip of metamorphic foliation

55 Inclined

DESCRIPTION OF MAP UNITS

Tsa Santiago Formation

Base Map

Onshore base (hypsography, hydrography, and transportation) from U.S.G.S. digital line graph (DLG) data, Oceanside 30' x 60' metric quadrangle. Shaded topographic base from U.S.G.S. digital elevation models (DEM's). Offshore bathymetric contours and shaded bathymetry from N.O.A.A. single and multibeam data. Projection is UTM, zone 11, North American Datum 1927.

This map was funded in part by the U.S. Geological Survey National Cooperative Geologic Mapping Program, STATEMAP Award no. 01NQAG0092.

Prepared in cooperation with the U.S. Geological Survey, Southern California Areal Mapping Project.

Figure No. IV
Job No. 21-13294

Geotechnical Exploration, Inc.
March 2023

APPENDIX A
UNIFIED SOIL CLASSIFICATION SYSTEM (U.S.C.S.)
SOIL DESCRIPTION

Coarse-grained (More than half of material is larger than a No. 200 sieve)

GRAVELS, CLEAN GRAVELS (More than half of coarse fraction is larger than No. 4 sieve size, but smaller than 3”)	GW	Well-graded gravels, gravel and sand mixtures, little or no fines.
	GP	Poorly graded gravels, gravel and sand mixtures, little or no fines.
GRAVELS WITH FINES	GC	Clay gravels, poorly graded gravel-sand-silt mixtures
SANDS, CLEAN SANDS (More than half of coarse fraction is smaller than a No. 4 sieve)	SW	Well-graded sand, gravelly sands, little or no fines
	SP	Poorly graded sands, gravelly sands, little or no fines.
SANDS WITH FINES	SM	Silty sands, poorly graded sand and silty mixtures.
	SC	Clayey sands, poorly graded sand and clay mixtures.

Fine-grained (More than half of material is smaller than a No. 200 sieve)

SILTS AND CLAYS

Liquid Limit Less than 50	ML	Inorganic silts and very fine sands, rock flour, sandy silt and clayey-silt sand mixtures with a slight plasticity
	CL	Inorganic clays of low to medium plasticity, gravelly clays, silty clays, lean clays.
	OL	Organic silts and organic silty clays of low plasticity.
Liquid Limit Greater than 50	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
	CH	Inorganic clays of high plasticity, fat clays.
	OH	Organic clays of medium to high plasticity.
HIGHLY ORGANIC SOILS	PT	Peat and other highly organic soils