Appendix C: Geotechnical Report

STRUCTURAL OBSERVATION GROUP INC

We Just Do A Better Job!

September 27, 2019
Project 8304-04

Steelwave
4553 Glencoe Avenue
Marina del Rey, California 90292

Attention: Mr. Gene D. Bark, AIA, LEED AP
Vice President – Design & Construction

Subject: Geotechnical Evaluation
Proposed Mezzanine
1382 Bell Avenue
Tustin, California

Dear Mr. Bark:

1. INTRODUCTION

a) In accordance with your request, we are providing you with geotechnical recommendations relating to the construction of the proposed addition at the above referenced property located in the city of Tustin, California.

b) The proposed construction will include a mezzanine supported by either new footings or strengthened existing footings within the warehouse area.

c) We reviewed the city permit set prepared for the original building dated 1984. The quality of the permit is not very good and not all the information is legible.

d) The grading plan was prepared by K. W. Lawler and Associates, Inc. The plans indicated the building pad was recommended to be overexcavated but the depth of the overexcavation was not clear. It can be safely presumed that the building pad was overexcavated and the depth of it was extended below the bottom of the proposed footings.

e) Structural plans prepared for the original construction indicate that the prior geotechnical engineer, GeoSoils, Inc. prepared a geotechnical report on October 22, 1983 (Project No. 1041-OC) and recommended an allowable bearing capacity of 1,500 lb/ft^2. The interior footings were recommended to be 24 inches deep.

f) We reviewed the in-house geologic hazard map for the subject site. The site is located in a State of California delineated *Seismic Hazard Zone* for potential liquefaction. However, the proposed improvements are within the existing building, as such, liquefaction evaluation was not deemed necessary.

g) No subsurface exploration was conducted during the course of preparing this report. However, we presume that the stability of the underlying soils has been assessed and approved in conjunction with the development of the property. Detailed analysis of the fill settlement was beyond the scope of our work.

h) Evaluation of the structural and geotechnical aspects of the existing structure and other structures was beyond the scope of our services. The soils present below the planned construction were not investigated, and therefore the quality of the soils is not known. It is possible that the subgrade fill soils may impact the future performance of the planned addition.

i) This report is subject to the *Terms and Conditions* enclosed to this report and incorporated herein by reference.

2. SCOPE

The scope of services we provided was as follows:

a) Preliminary planning and preparation;

b) Review of available geologic maps covering the site area;

c) Site visit to observe the existing conditions and collect a representative soil sample for laboratory testing;

d) Limited laboratory testing to determine the sulphate content and expansion potential;

e) Geotechnical analyses of the field and the laboratory test data;

f) Preparation of a geotechnical report presenting our findings, conclusions and recommendations.

3. SITE DESCRIPTION

3.1 Location

a) The subject property is located along the southwest side of Bell Avenue, approximately 500 feet northwest of Redhill Avenue, in the city of Tustin, California.

b) An approximate location of the site is shown on the enclosed *Location Map, Figure 1.*

3.2 Surface Site Conditions

a) The subject site is developed with a two-story commercial building and an attached warehouse area at the rear (southwest) part of the structure. A loading dock is present at the southwestern end of the building.

b) The building is founded on relatively level ground. Grass, shrub and tree planters generally surround the outside of the structure. The building/planters are surrounded either by asphalt concrete pavement or concrete walkways.

c) The floor within the warehouse area exposes the slab-on-grade.

d) The existing structure appears to be in good fair condition with no significant distress noted.

e) No geotechnical restrictions are known to exist on the subject lot.

3.3 Geology

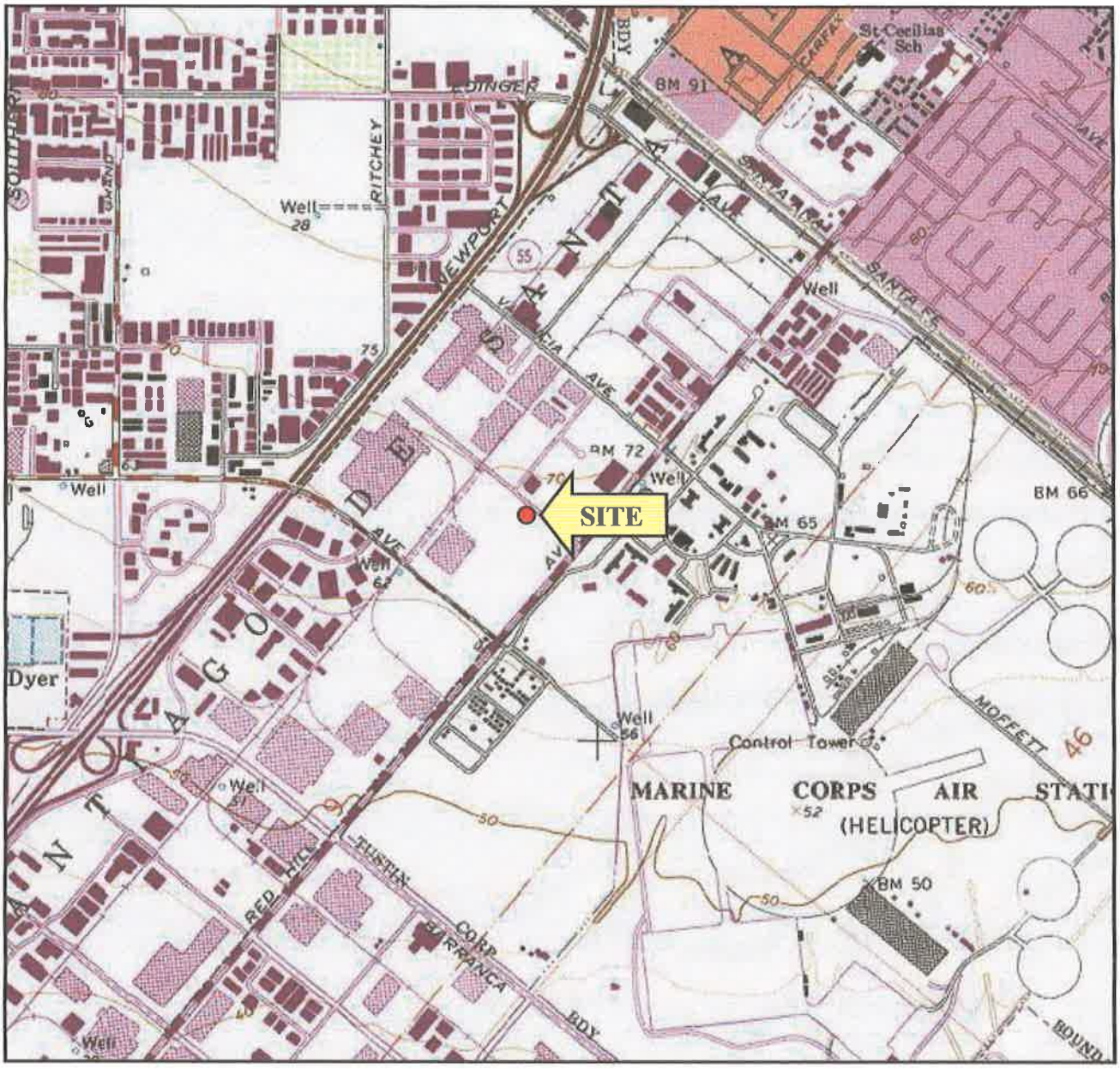
3.3.1 Regional Geologic Setting

The property is located within the northwestern portion of the Peninsular Ranges Geomorphic Province of California. The Peninsular Ranges consist of a series of mountain ranges separated by longitudinal valleys. The ranges trend northwest-southeast and are sub parallel to faults branching from the San Andreas Fault. The Peninsular Ranges extend from the southern side of the Santa Monica Mountains into Baja, California (CDMG, 1997).

3.3.2 Local Geologic Setting

Based on our review of a *Quaternary Geologic Map of the Tustin Quadrangle* enclosed in *Seismic Hazard Zone Report 012*, published by the California Geological Survey, the natural material underlying the site area is comprised of Holocene-aged alluvial fan deposits

LOCATION MAP



BASE MAP: USGS 7.5-Minute Topographic Map,
Tustin Quadrangle, 1981

2000 0 2000 4000

SCALE FEET

NORTH

STRUCTURAL OBSERVATION GROUP INC

1382 Bell Avenue
Tustin, California

Date: September 2019	**Figure No:**
Project No.: 8304-04	1

3.3.3 Subsurface Conditions

a) A shallow test pit was excavated within the landscape area existing along the south side of the building. Generally, the upper 24 inches of the soil was found to consist of damp to moist and soft to medium stiff Clayey SILT. The material present at approximately 24 inches below ground surface was found to be medium stiff.

b) Historical groundwater monitoring well data within the site area was researched on the California Department of Water Resources online water data library. The closest groundwater monitoring well with the most recent data is shown to be located approximately 2,700 feet northeast of the project site. Several measurements have been obtained and recorded from this well during the period from 1993 to 2019. Groundwater level data collected from the nearby well indicates that the groundwater levels have ranged from as shallow as 15.49 feet below ground surface (June 2006) to as deep as 37.83 feet below ground surface (November 2016).

c) The latest recorded groundwater level measurement is shown to be 31.58 feet below ground surface on March 19, 2019.

3.4 Potential Seismic Hazards

3.4.1 General

a) The property is located in the general proximity of several active and potentially active faults, which are typical for sites in the Southern California region. Earthquakes occurring on active faults within a 70-mile radius are capable of generating ground shaking of engineering significance to the proposed construction.

b) In Southern California, most of the seismic damage to manmade structures results from ground shaking and, to a lesser degree, from liquefaction and ground rupture caused by earthquakes along active fault zones. In general, the greater the magnitude of the earthquake, the greater the potential damage.

3.4.2 Ground Rupture

a) The subject property is not within an Earthquake Fault Zone (previously known as an Alquist-Priolo Special Studies Zone). The closest known active fault is the Newport-Inglewood Fault, located at a distance of approximately 8.8 miles southwest of the project site.

b) Other nearby active faults include the Elsinore Fault and the Whittier Fault, located 12.7 miles and 13.4 miles from the project site, respectively. Due to the distance of the closest active fault to the site, ground rupture is not considered a significant hazard at the site.

3.4.3 Deterministic Seismic Hazard Analysis

We utilized the California Office of Statewide Health Planning and Development (OSHPD) Seismic Design Maps internet program to calculate the peak ground acceleration (PGA) at the project site location. Using the ASCE 7-10 standard and Site Class D, the PGA at the subject property resulted to be 0.56g.

3.4.4 Liquefaction

The project site is located in a State of California delineated *Seismic Hazard Zone* for liquefaction potential.

3.4.5 Landslides

The project site is not located in a State of California delineated *Seismic Hazard Zone* for earthquake-induced landsliding.

4. LABORATORY TESTING

Sulfate Content

A representative soil sample was analyzed for the sulphate content in accordance with California Test Method CA417. The results are given below:

Sample No.	Sample Depth (ft)	Soil Description	Sulphate Content (%)
S-1	0.5-1.0	Clayey SILT	0.0308

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 General

a) It is our opinion that the site will be suitable for the proposed development from a geotechnical aspect, assuming that our recommendations are implemented during construction.

b) We are of the opinion that the proposed additions may be supported on the new footings founded in the competent soils.

c) We are also of the opinion that with due and reasonable precautions, the proposed construction will not endanger adjacent property nor will construction be affected adversely by adjoining property.

d) The earthwork operations should be observed by a representative of a geotechnical engineer.

e) The design recommendations in the report should be reviewed during the grading phase when soil conditions in the excavations become exposed.

5.2 Grading

5.2.1 Processing of On-Site Soils

a) At this time, no overexcavation is required below the bottom of the footings, provided the footings are founded in the existing competent soils.

b) No new slab-on-grade is proposed.

c) Wherever structural fills, if any, are to be placed, the upper 6 to 8 inches of the exposed subgrade should be scarified and reworked.

d) Any loosening of reworked or native material, consequent to the passage of construction traffic, weathering, etc., should be made good prior to further construction.

e) The depths of overexcavation, if any, should be reviewed by the Geotechnical Engineer during construction. Any surface or subsurface obstructions, or any variation of site materials or conditions encountered during grading should be brought immediately to the attention of the Geotechnical Engineer for proper exposure, removal or processing, as directed.

f) No underground obstructions or facilities should remain in any structural areas. Depressions and/or cavities created as a result of the removal of obstructions should be backfilled properly with suitable materials, and compacted.

5.2.2 Material Selection (for any new fills)

After the site has been stripped of any debris, excavated on-site soils are considered satisfactory for reuse in the construction of on-site fills. Concrete pieces greater than 4 inches in diameter should not be incorporated in compacted fill below slab-on-grade.

5.2.3 Compaction Requirements

a) Reworking/compaction shall include moisture-conditioning/drying as needed to bring the soils too slightly above the optimum moisture content. All reworked soils and structural fills should be densified to achieve at least 90 percent relative compaction with reference to laboratory compaction standard.

b) The optimum moisture content and maximum dry density should be determined in the laboratory in accordance with ASTM Test Designation D1557.

c) Fill should be compacted in lifts not exceeding 8 inches (loose).

5.2.4 Excavating Conditions

a) Excavation of on-site materials may be accomplished with standard earthmoving or trenching equipment.

b) Dewatering is not anticipated in excavations shallower than 15 feet below ground surface.

c) Portions of the demolished structures, if any, should be removed entirely from within the structural areas. Care should be taken not to undermine the foundations to be left in place.

5.2.5 Expansion Potential

Expansion testing of the subgrade soils was conducted as no slab-on-grade is proposed. However, the recommendations provided in the following paragraphs consider the effects of the subgrade soils with *medium* expansion potential.

5.2.6 Sulphate Content

a) The sulphate exposure of the subgrade soils was determined in the laboratory.

b) Based on test results, the sulphate exposure is considered to be *negligible*. However, we recommend using Type V cement.

5.2.7 Grading Control

a) All grading and earthwork should be performed under the observation of a Geotechnical Engineer in order to achieve proper subgrade preparation, selection of satisfactory materials, placement and compaction of all structural fill.

b) Sufficient notification prior to stripping and earthwork construction is essential to make certain that the work will be adequately observed and tested.

5.2.8 Surface Drainage

In accordance with Section 1804.3, 2016 CBC, the ground adjacent to the foundation should be sloped away at gradient of 5 percent. If the ground adjacent to the residence is covered with impervious material, the area adjacent to the foundations may be sloped away at 2 percent gradient.

5.3 Slab-on-Grade (if any)

a) The upper 12 inches of the slab subgrade should be overexcavated and replaced as compacted fill using the on-site soils.

b) A 4-inch thick SAND layer should be placed below slab-on-grade. 10-mil thick plastic vapor barrier is recommended to be installed at the mid height the SAND.

c) It is recommended that #4 bars on 12-inch on center or equivalent, both ways, be provided as minimum reinforcement in slabs-on-grade. Joints should be provided and slabs should be at least 6 inches thick. However, the recommendations from the project structural engineer may be more stringent. If any fork lift traffic is anticipated, the lab should be at least 6 inches thick and reinforced with #4 bars on 12-inch center bothways.

d) The slab should be dowelled into the existing footings/slab by #4 bars at a maximum spacing of 12 inches.

e) The FFL should be at least 6 inches above highest adjacent grade, if feasible.

f) The subgrade should be kept moist prior to the concrete pour.

5.4 Spread Foundations

The proposed addition can be founded on shallow spread footings. The minimum criteria are presented below.

5.4.1 Dimensions/Embedment Depths

	Minimum Width (ft)	Minimum Embedment Below Lowest Finished Surface (ft)
2-story Wall Footings	1.5	2.0
Square Column Footings to 50 kip	-	2.0

5.4.2 Allowable Bearing Capacity

The following bearing capacities, based on the presumptive 2016 CBC values are recommended for the foundation design.

Embedment Depth (ft)	Allowable Bearing Capacity (lb/ft^2)
1.0	1,500

Notes:

- The allowable bearing capacity may be increased by 300 lb/ft^2 for each additional foot increase in depth and by 300 lb/ft^2 for each additional foot increase in width, to a maximum value of 3,000 lb/ft^2;
- These values may be increased by one-third in the case of short-duration loads, such as induced by wind or seismic forces;
- Planter areas should not be sited adjacent to walls. In case planter areas are sited next to the walls the footings should be deepened by additional six inches;
- Footing excavations should be observed by the Geotechnical Engineer to verify the footings are excavated in the competent soils and are in one type of soils;
- Footing excavations should be kept moist prior to the concrete pour;

- It should be insured that the embedment depths do not become reduced or adversely affected by erosion, softening, planting, digging, etc.)

5.5 Seismic Coefficients

The following table provides the most recent seismic coefficients for the site area calculated in accordance with ASCE 7-10 Standards:

ITEM	VALUE
Site Latitude (Decimal-degrees)	33.71512
Site Longitude (Decimal-degrees)	-117.83783
Site Class	D
Seismic Design Category	D
Mapped Spectral Response Acceleration-Short Period (0.2 Sec) - S_S	1.503
Mapped Spectral Response Acceleration-1 Second Period – S_1	0.555
Short Period Site Coefficient-F_a	1.0
Long Period Site Coefficient F_v	1.5
Adjusted Spectral Response Acceleration @ 0.2 Sec. Period (Sms)	1.503
Adjusted Spectral Response Acceleration @ 1Sec.Period (S_{m1})	0.832
Design Spectral Response Acceleration @ 0.2 Sec. Period (S_{Ds})	1.002
Design Spectral Response Acceleration @ 1-Sec. Period (S_{D1})	0.555

6. LIMITATIONS

a) Soils and bedrock over an area show variations in geological structure, type, strength and other properties from what can be observed sampled and tested from specimens extracted from necessarily limited exploratory borings. Therefore, there are natural limitations inherent in making geologic and soil engineering studies and analyses. Our findings, interpretations, analyses and recommendations are based on observation, and our professional experience; and the projections we make are professional judgments conforming to the usual standards of the profession. No other warranty is herein expressed or implied.

b) In the event, that during if construction, conditions are exposed which are significantly different from those described in this report, they should be brought to the attention of the Geotechnical Engineer.

c) The recommendations included in this report are intended to minimize the potential of distress caused by the underlying soils. However, it should be noted that certain amount of cracking, uplifting and tilting of may be unavoidable and should be anticipated during the lifetime of the proposed structures.

The opportunity to be of service is sincerely appreciated. If you have any questions or if we can be of further assistance, please call.

Very truly yours,

STRUCTURAL OBSERVATION GROUP, INC.

Mohan B. Upasani
Principal Geotechnical Engineer
RGE 2301
(Exp. March 31, 2021)

REGISTERED PROFESSIONAL ENGINEER
MOHAN B. UPASANI
Exp. Date 03/31/21
2301
GEOTECHNICAL
STATE OF CALIFORNIA

MBU:mbu

Enclosures:

Location Map - Figure 1
Terms and Conditions

TERMS AND CONDITIONS OF AUTHORIZATION

Consultant shall serve Client by providing professional counsel and technical advice regarding subsurface conditions consistent with the scope of services agreed-to between the parties. Consultant will use his professional judgment and will perform his services using that degree of care and skill ordinarily exercised under similar circumstances, by reputable foundation engineers and/or engineering geologists practicing in this or similar localities.

- In assisting Client, the Consultant may include or rely on information and drawings prepared by others for the purpose of clarification, reference or bidding; however, by including the same, the Consultant assumes no responsibility for the information shown thereon and Client agrees that Consultant is not responsible for any defects in its services that result from reliance on the information and drawings prepared by others. Consultant shall not be liable for any incorrect advice; judgment or decision based on any inaccurate information furnished by the Client or any third party, and Client will indemnify Consultant against claims, demands, or liability arising out of, or contribute to, by such information.

- Unless otherwise negotiated in writing, Client agrees to limit any and all liability, claim for damages, cost of defense, or expenses to be levied against Consultant on account of design defect, error, omission, or professional negligence to a sum **not to exceed ten thousand dollars or charged fees whichever is less**. Further, Client agrees to notify any construction contractor or subcontractor who may perform work in connection with any design, report, or study prepared by Consultant of such limitation of liability for design defects, errors, omissions, or professional negligence, and require as a condition precedent to their performing the work a like limitation of liability on their part as against the Consultant. In the event the Client fails to obtain a like limitation of liability provision as to design defects, errors, omissions or professional negligence, any liability of the Client and Consultant to such contractor or subcontractor arising out of a negligence shall be allocated between Client and Consultant in such a manner that the aggregate liability of Consultant for such design defects to all parties, including the Client shall **not exceed ten thousand dollars or charged fees whichever is less**. No warranty, expressed or implied of merchantability or fitness, is made or intended in connection with the work to be performed by Consultant or by the proposal for consulting or other services or by the furnishing of oral or written reports or findings made by Consultant.

- The Client agrees, to the fullest extent permitted by law, to indemnify, defend and hold harmless the Consultant, its officers, directors, employees, agents and subconsultants from and against all claims, damages, liabilities or costs, including reasonable attorney's fees and defense costs, of any nature whatsoever arising from or in connection with the Project to the extent that said claims, damages, liabilities or costs arise out of the work, services, or conduct of Client or Client's contractors, subconsultants, or other third party not under Consultant's control. Client further agrees that the duty to defend set forth herein arises immediately and is not contingent on a finding of fault against Client or Client's contractors, subconsultants, or other third parties. Client shall not be obligated under this provision to indemnify Consultant for Consultant's sole negligence or willful misconduct.

- Client shall grant free access to the site for all necessary equipment and personnel and Client shall notify any and all possessors of the project site that Client has granted Consultant free access to the project site at no charge to Consultant unless expressly agreed to otherwise in writing.

- If Client is not the property owner for the subject Project, Client agrees that it will notify the property owner of the terms of this agreement and obtain said property owner's approval to the terms and conditions herein. Should Client fail to obtain the property owner's agreement as required herein, Client agrees to be solely responsible to Consultant for all damages, liabilities, costs, including litigation fees and costs, arising from such failure that exceed that limitation of Consultant's liability herein.

- Client shall locate for Consultant and shall assume responsibility for the accuracy of his representations as to the locations of all underground utilities and installations. Consultant will not be responsible for damage to any such utilities or installation not so located.

- Client and Consultant agree to waive claims against each other for consequential damages arising out of or relating to this agreement. Neither party to this agreement shall assign the contract without the express, written consent of the other party.

- Consultant agrees to cover all open test holes and place a cover to carry a 200-pound load on each hole prior to leaving project site unattended. Consultant agrees that all test holes will be backfilled upon completion of the job. However, Client may request test holes to remain open after completion of Consultants work. In the event Client agrees to pay for all costs associated with covering and backfilling said test holes at a later date, and Client shall indemnify, defend and hold harmless Consultant for all claims, demands and liabilities arising from his request, except for the sole negligence of the Consultant, to the extent permitted by law.

- Consultant shall not be responsible for the general safety on the job or for the work of Client, other contractors and third parties.

- Consultant shall be excused for any delay in completion of the contract caused by acts of God, acts of the Client or Client's agent and/or contractors, inclement weather, labor trouble, acts of public utilities, public bodies, or inspectors, extra work, failure of Client to make payments promptly, or other contingencies unforeseen by Consultant and beyond reasonable control of the Consultant.

- In the event that either party desires to terminate this contract prior to completion of the project, written notification of such intention to terminate must be tendered to the other party. In the event Client notifies Consultant of such intention to terminate Consultant's services prior to completion of the contract, Consultant reserves the right to complete such analysis and records as are necessary to place files in order, to dispose of samples, put equipment in order, and (where considered necessary to protect his professional reputation) to complete a report on the work performed to date. In the event that Consultant incurs cost in Client's termination of this Agreement, a termination charge to cover such cost shall be paid by Client.

- If the Client is a corporation, the individual or individuals who sign or initial this Contract, on behalf of the Client, guarantee that Client will perform its duties under this Contract. The individual or individuals so signing or initialing this Contract warrant that they are duly authorized agents of the Client.

LIMITATIONS

Our findings, interpretations, analyses, and recommendations are professional opinions, prepared and presented in accordance with generally accepted professional practices and are based on observation, laboratory data and our professional experience. Consultant does not assume responsibility for the proper execution of the work by others by undertaking the services being provided to Client under this agreement and shall in no way be responsible for the deficiencies or defects in the work performed by others not under Consultant's direct control. No other warranty herein is expressed or implied.