

GEOTECHNICAL INVESTIGATION DESIGN PHASE

FOR
AGRICULTURAL CONSTRUCTION
350 MADERA LANE
SAN GREGORIO, SAN MATEO COUNTY, CALIFORNIA

PREPARED FOR
ERIK MARKEGARD
PROJECT NO. 22-228-SM



PREPARED BY

BUTANO GEOTECHNICAL ENGINEERING, INC.
SEPTEMBER 2022



BUTANO GEOTECHNICAL ENGINEERING, INC.

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September 23, 2022
Project No. 22-228-SM

Erik Markegard
350 Madera Lane
San Gregorio, CA 94074

SUBJECT: GEOTECHNICAL INVESTIGATION - DESIGN PHASE
Agricultural Construction
350 Madera Lane
San Gregorio, San Mateo, California

Dear Mr. Markegard:

In accordance with your authorization, we have completed a geotechnical investigation for the subject project. This report summarizes the findings, conclusions, and recommendations from our field exploration and engineering analysis. It is a pleasure being associated with you on this project. If you have any questions, or if we may be of further assistance, please do not hesitate to contact our office.

Sincerely,

BUTANO GEOTECHNICAL ENGINEERING, INC.



Greg Bloom, PE, GE
Principal Engineer

Appendices: 1. Appendix A Figures and Standard Details
2. Appendix B Field Exploration Program

Distribution: (4) Addressee

1.0 INTRODUCTION

This report presents the results of our geotechnical investigation for the agricultural construction at 350 Madera Lane in San Gregorio, San Mateo County, California.

The purpose of our investigation is to provide preliminary geotechnical design parameters and recommendations for the proposed construction. Conclusions and recommendations related to site grading, drainage, slab-on-grades, retaining walls (basement) and foundations are presented herein.

This work includes site reconnaissance, subsurface exploration, soil sampling, laboratory testing, engineering analysis, and preparation of this report. The scope of services for this investigation is outlined in our agreement as revised dated September 6, 2022.

The recommendations contained in this report are subject to the limitations presented in Section 8.0 of this report. The Association of Engineering Firms Practicing the Geosciences has produced a pamphlet for your information titled *Important Information About Your Geotechnical Report*. This pamphlet has been included with the copies of your report.

2.0 PROJECT DESCRIPTION

Based on our discussions with the client, the project consists of evaluating the newly constructed shipping container structure. The system consists of an at-grade two-story section adjacent to the pond and a basement with two above grade stories on the northeast side. The two structures are tied together with a roof and slab-on-grade between them.

3.0 FIELD EXPLORATION AND LABORATORY TESTING PROGRAMS

Our field exploration program included advancing a test pit to a depth of 3 feet with a mini excavator on September 16, 2022. Details of the field exploration program, including the Test Pit Logs and the Key to the Logs, are presented in Appendix B, Figures B-3 and B-4. Our firm also observed the sidewalls of the pond adjacent to the southwest side of the building.

4.0 SITE DESCRIPTION

4.1 Location

The project site is located north of Highway 84 at 350 Madera Lane in San Gregorio, San Mateo County, California. The site location is shown on the Site Location Plan, Appendix B, Figure B-1.

4.2 Surface Conditions

The shipping container structure is located north of La Honda Road (Highway 84) and west of Madera Lane on a relatively level knoll upslope of Highway 84. This area has been improved with agricultural storage sheds, buildings and a pond.

Recently a shipping container structure has been constructed between the pond and the driveway. There are moderate slopes to the north and west of the shipping container. The pond is located close to the south side of the structure and has near vertical side slopes. The area to the east of the structure is relatively flat.

The vegetation at the site is minimal and consists of bushes and grass.

4.3 Subsurface Conditions

The parcel is geologically mapped as being underlain by older flood plain deposits. Our geotechnical exploration did not encounter any flood plain deposits.

The test pit encountered approximately 1 foot of dark brown silty sand with some gravel (soil development) overlying a yellowish brown fine grained sandstone. The sandstone is cemented and dense. We interpret this material to be part of the Tunitas sandstone member.

The sandstone can also be seen on the sidewalls of the pond.

Groundwater was not encountered within the test pit. The pond (which is filled with runoff collected from the adjacent structures impervious surfaces) likely influences the depth to groundwater.

Complete soil profiles are presented in the Test Pit Log, Appendix B, Figure B-4. The test pit location is shown on the Test Pit Site Plan, Figure B-2.

5.0 GEOTECHNICAL HAZARDS

5.1 General

In our opinion the geotechnical hazards that could potentially affect the proposed project are:

- Intense seismic shaking
- Collateral seismic hazards

5.1.1 Intense Seismic Shaking

The hazard of intense seismic shaking is present throughout central California. Intense seismic shaking may occur at the site during the design lifetime of the proposed structure from an earthquake along one of the regions many faults. Generally, the intensity of shaking will increase the closer the site is to the epicenter of an earthquake; however, seismic shaking is a complex phenomenon and may be modified by local topography and soil conditions. The transmission of earthquake vibrations from the ground into the structure may cause structural damage.

The County of San Mateo has adopted the seismic provisions set forth in the 2019 California Building Code to address seismic shaking. The seismic provisions in the 2019 CBC are minimum load requirements for the seismic design for the proposed structure. The provisions set forth in the 2019 CBC will not prevent structural and nonstructural damage from direct fault ground surface rupture, coseismic ground cracking, liquefaction and lateral spreading, seismically induced differential compaction, seismically induced landsliding, or seismically induced inundation.

Table 1 has been constructed based on the 2019 CBC requirements for the seismic design of the proposed structure. The Site Class has been determined based on our field investigation and laboratory testing.

Table 1. Seismic Design Parameters

S _s	S ₁	Site Class	F _a	F _v	S _{DS}	S _{D1}	F _{PGA}	PGAM	Risk Category	Seismic Design Category
2.074	0.814	C	1.2	1.4	1.659	0.76	1.2	1.1	II	E

Design Coordinates - (Lat: 37.3188622, Lng: -122.3358945)

5.1.2 Collateral Seismic Hazards

In addition to intense seismic shaking, other seismic hazards that may have an adverse effect to the site and/or the structure are fault ground surface rupture, coseismic ground cracking, seismically induced liquefaction and lateral spreading, seismically induced differential compaction, seismically induced landsliding, and seismically induced inundation (tsunami and seiche). It is our opinion that the potential for collateral seismic hazards to affect the site and to damage the proposed structure is low.

6.0 DISCUSSIONS AND CONCLUSIONS

The existing structure is founded on in-situ sandstone which has a very low potential for expansion.

We have been presented the following plan set as part of our analysis:

Andrew Radovan, 350 Madera Lane, Sheets S1, S2 and S3, dated 7-13-22, Job No. 20-78

The plans show that the southern container is supported by drilled piers that are to be a minimum of 5 feet deep below the grade beam and embedded into the underlying bedrock a minimum of 18 inches.

The northern container includes a below grade basement with the foundation embedded into the sandstone and supported by a mat slab foundation. The basement walls are to be fully drained.

7.0 RECOMMENDATIONS

7.1 General

Based on the results of our field investigation and engineering analysis it is our opinion that from the geotechnical standpoint, the subject site is suitable for the existing construction.

7.2 Site Grading

7.2.1 Site Clearing

The site should be cleared of non-engineered fill, remaining root masses, loose soil, organics, and debris within the project limits.

7.2.2 Preparation of On-Site Soils

Areas to receive fill (subgrade) should be scarified, cleared of organics, moisture conditioned to 0 to 2 percent over optimum moisture, and compacted to a minimum of 90 percent relative compaction. The compacted subgrade should extend 2 feet laterally of any proposed improvements.

All fill should be compacted to a minimum of 90 percent relative compaction based on the optimum moisture and density in accordance with ASTM D1557. See Paved Areas for additional requirements.

Engineered fill should be well mixed and homogenous, moisture conditioned to 0 to 2 percent over optimum moisture, placed in relatively thin lifts, and compacted using heavy vibratory equipment.

Site Grading-General

The on-site soil may be re-used as engineered once the sandstone is broken down to clasts smaller than 2 ½ inches in diameter.

Imported fill material should be approved by a representative of Butano Geotechnical Engineering, Inc. prior to importing.

Imported fill should be primarily granular with **no material greater than 2½ inches in diameter** and no more than 20 percent of the material passing the #200 sieve. The fines fraction of fill should not consist of expansive

material. The Geotechnical Engineer should be notified not less than 5 working days in advance of placing any fill or base course material proposed for import. Each proposed source of import material should be sampled, tested, and approved by the Geotechnical Engineer prior to delivery of any soils imported for use on the site.

Any surface or subsurface obstruction, or questionable material encountered during grading, should be brought immediately to the attention of the Geotechnical Engineer for proper processing as required.

Paved Areas

The paved areas should be prepared as above and the upper 6 inches of subgrade and all aggregate baserock in paved areas should be compacted to a minimum of **95 percent** relative compaction. The subgrade compaction should extend a minimum of 2 feet laterally of all paved areas.

7.2.3 Cut and Fill Slopes

No significant unretained cuts or fills are anticipated for this project. The basement will require temporary cuts which should be shored.

7.2.4 Excavating Conditions

The on-site soil may be excavated with standard earthwork equipment. The underlying sandstone may require rock teeth and/or jacking to excavate and drill.

7.2.5 Surface Drainage

Positive drainage should be maintained away from the structures at a minimum gradient of 2 percent for 10 feet. If this is not feasible swales may be constructed to control drainage. Collected drainage should be released at approved locations as indicated by the project civil engineer or designer.

7.2.6 Utility Trenches

Utility trenches should be backfilled based on the County of San Mateo standard details. At a minimum this should consist of 4 inches of bedding sand below the utility and 8 inches of bedding sand above the utility.

Backfill of all exterior and interior trenches should be placed in thin lifts not to exceed 8 inches and mechanically compacted to achieve a relative compaction of not less than 95 percent in paved areas and 90 percent in other areas per ASTM D1557. Care should be taken not to damage utility lines.

The on-site native soils may be utilized for trench backfill above the bedding sand. If sand or granular material is used for trench backfill, a 3 feet concrete plug should be placed in each trench where it passes under the exterior footings.

Utility trenches that are parallel to the sides of a building should be placed so that they do not extend below a line sloping down and away at an inclination of 2:1 (V:H) from the bottom outside edge of all footings.

Trenches should be capped with 1 1/2 feet of relatively impermeable material. Import material must be approved by the Geotechnical Engineer prior to its use.

Trenches must be shored as required by the local regulatory agency, the State of California Division of Industrial Safety Construction Safety Orders, and Federal OSHA requirements.

7.3 Foundations

7.3.1 Conventional Shallow Foundations

General

Conventional shallow foundations may be used bearing on in-situ sandstone (basement foundation) per section 7.2.2.

Footing excavations must be checked by the Geotechnical Engineer before steel is placed and concrete is poured.

Footing Dimensions

Footing widths should be based on the allowable bearing value but not less than 15 inches. The minimum recommended depth of embedment is 12 inches into in-situ sandstone. Embedment depths should not be allowed to be affected adversely, such as through erosion, softening, digging, etc.

Should local building codes require deeper embedment of the footings or wider footings, the local codes must apply.

Bearing Capacity

The allowable bearing capacity used should not exceed 8,000 psf for footings bearing in-situ sandstone at the basement grade. The allowable bearing capacity may be increased by one-third in the case of short duration loads, such as those induced by wind or seismic forces. In the event that footings are founded in structural fill consisting of imported materials, the allowable bearing capacities will depend on the type of these materials and should be re-evaluated.

Lateral Resistance

Friction coefficient - 0.40, between the sandstone and rough concrete. A passive resistance of 450 pcf may be assumed. Where both friction and the passive resistance are utilized for sliding resistance, either of the values indicated should be reduced by one-third.

7.3.2 Drilled Pier Foundations (southern container)

Drilled piers may be used to support the container adjacent to the pond

The drilled, cast-in-place concrete shafts, should have a minimum embedment depth of 5 feet below the bottom of the grade beam and be embedded a minimum of 12 inches into the underlying sandstone. The minimum recommended shaft diameter is 18 inches. Shafts should be spaced no closer than 2 ½ diameters, with a minimum of 3 diameters, center to center.

An allowable bearing capacity of 10,000 psf may be assumed for shafts that bear on sandstone with a 1/3 increase for short term loading. An allowable passive resistance of 400 psf over 2 pier diameters may be assumed within the sandstone bedrock. **Passive resistance should be ignored until there is a minimum of 6 feet of cover measured horizontally to daylight.**

The drilled excavations for the cast-in-place concrete shafts should be clean, dry and free of debris of loose soil. The drilled excavations should not deviate more than 1 percent from vertical.

For drilled, cast-in-place concrete shafts, with depths in excess of 8 feet, concrete should be placed via a tremie. The end of the tube must remain embedded a minimum of 4 feet into the concrete at all times.

All shaft construction must be observed and approved by the Geotechnical Engineer. Any shafts constructed without the full knowledge and continuous observation of Butano Geotechnical Engineering, Inc. will render the recommendations of this report invalid.

7.3.3 Concrete Slabs-on-Grade

General

We recommend that first floor concrete slabs-on-grade be founded on the in-situ sandstone or engineered fill per section 7.2.2. Basement grade slabs-on-grade may be founded on in-situ sandstone.

The subgrade for slab-on-grades should be kept moist prior to pouring concrete.

The subgrade should be proof-rolled just prior to construction to provide a firm, relatively unyielding surface, especially if the surface has been loosened by the passage of construction traffic.

Capillary Break and Vapor Barrier (ground floor)

The following paragraph outlines the minimum capillary break and vapor barrier that shall be utilized for interior slab-on-grades, or slab-on-grades where moisture sensitive floor coverings are anticipated.

The vapor barrier shall consist of a waterproof membrane (Stegowrap 15 Mil or equivalent) placed directly below the floor slab and in direct contact with the concrete. Sheet overlap for the vapor barrier shall be a minimum of 6 inches. A 4-inch minimum layer of $\frac{3}{4}$ inch drainrock shall be placed below the waterproof membrane to act as a capillary break. Care must be taken to not rip the vapor barrier. A 6-inch layer of compacted Class II Baserock may be employed to prevent rips or tears in the vapor barrier if desired, and to keep the subgrade from becoming saturated prior to pouring concrete.

If the manufacturer's recommendations or the project requirements for the capillary break and vapor barrier are more stringent than the minimums outlined above, the designer should follow those recommendations and requirements. Recommendations by the manufacturer may include but is not limited to specifications for; concrete mix design, puncture resistance of vapor barrier, permeance of vapor barrier, soil flatness, capillary break section, structural section, and testing recommendations.

7.3.3 Settlements

Total and differential settlements beneath the new foundation elements are expected to be within tolerable limits. Vertical movements are not expected to exceed 1 inch. Differential movements are expected to be within the normal range ($\frac{1}{2}$ inch) for the anticipated loads.

7.4 Retaining Structures (basement)

The basement retaining walls may be supported by conventional shallow foundations or mat slabs per section 7.3.1.

7.4.1 Lateral Earth Pressures

The lateral earth pressures presented in Table 2 are recommended for the design of retaining structures retaining the on-site sandstone. Should the slope behind the retaining walls be other than level, supplemental design criteria will be provided for the active earth or at-rest pressures for the particular slope angle.

Table 2. Lateral Earth Pressures

Soil Profile	Soil Pressure (psf/ft)	
	Active	At-rest
Level	20	30

Pressure due to any surcharge loads from adjacent footings, traffic, etc., should be analyzed separately. Pressures due to these loading can be supplied upon receipt of the appropriate plans and loads. Refer to Appendix A, Figure A-1-Surcharge Pressure Diagram.

An earthquake load (ultimate) may be considered for retaining walls as follows:

For unrestrained walls over 6 feet, as measured from the base of the footing, a seismic load of $10H^2$ may be applied at a height of $0.6H$ from the base of the wall.

No evaluation of seismic earth pressure is needed for restrained walls under 12 feet in height, as measured from the base of the footing, provided a minimum static factor of safety of 1.5 is achieved. For rigidly restrained walls over 12 feet a seismic load of $15H^2$ should be added to the active earth pressure and applied at a height of $0.3H$ from the base of the wall. The greater of the seismic loading and at rest loading conditions should be used for design. The recommendations for restrained retaining walls are based on the SEAOC 2010 Conventions Proceedings: *Seismic Earth Pressures on Deep Building Basements*, Lew, Sitar.

A factor of safety of 1.1 is considered appropriate with respect to earthquake loading.

7.4.2 Backfill

Backfill should be placed under engineering control. Backfill should be compacted per Subsection 7.2.2, however, precautions should be taken to ensure that heavy compaction equipment is not used immediately adjacent to walls, so as to prevent undue pressures against, and movement of, the walls. Refer to Appendix A, Figure A-2.

The backfill should be capped with at least 12 inches of relatively impermeable material.

7.4.3 Backfill Drainage

As previously stated, the basement should be designed for a static groundwater table of 5 feet from existing grade and therefore no drainage system is anticipated for the walls. Instead, the basement should be waterproofed.

7.5 Plan Review

The recommendations presented in this report are based on preliminary design information for the proposed project and on the findings of our geotechnical investigation. When completed, the Grading Plans, Foundation Plans and design loads should be reviewed by Butano Geotechnical Engineering, Inc. prior to submitting the plans and contract bidding. Additional field exploration and laboratory testing may be required upon review of the final project design plans.

7.6 Observation and Testing

Field observation and testing should be provided by a representative of Butano Geotechnical Engineering, Inc. to enable them to form an opinion regarding the adequacy of the site preparation, the adequacy of fill materials, and the extent to which the earthwork is performed in accordance with the geotechnical conditions present, the requirements of the regulating agencies, the project specifications, and the recommendations presented in this report.

Butano Geotechnical Engineering, Inc. should be notified **at least 5 working days** prior to any site clearing or other earthwork operations on the subject project in order to observe the stripping and disposal of unsuitable materials and to ensure coordination with the grading contractor. During this period, a preconstruction meeting should be held on the site to discuss project specifications, observation and testing requirements and responsibilities, and scheduling.

8.0 LIMITATIONS

The recommendations contained in this report are based on our field explorations, laboratory testing, and our understanding of the proposed construction. The subsurface data used in the preparation of this report was obtained from the borings drilled during our field investigation. Variation in soil, geologic, and groundwater conditions can vary significantly between sample locations. As in most projects, conditions revealed during construction excavation may be at variance with preliminary findings. If this occurs, the changed conditions must be evaluated by the Project Geotechnical Engineer, and revised recommendations be provided as required. In addition, if the scope of the proposed construction changes from the described in this report, our firm should also be notified.

Our investigation was performed in accordance with the usual and current standards of the profession, as they relate to this and similar localities. No other warranty, expressed or implied, is provided as to the conclusions and professional advice presented in this report.

This report is issued with the understanding that it is the responsibility of the Owner, or of his Representative, to ensure that the information and recommendations contained herein are brought to the attention of the Engineer for the project and incorporated into the plans, and that it is ensured that the Contractor and Subcontractors implement such recommendations in the field. The use of information contained in this report for bidding purposes should be done at the Contractor's option and risk.

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

The findings of this report are considered valid as of the present date. However, changes in the conditions of a site can occur with the passage of time, whether they are due to natural events or to human activities on this or adjacent sites. In addition, changes in applicable or appropriate codes and standards may occur, whether they result from legislation or the broadening of knowledge. Accordingly, this report may become invalidated wholly or partially by changes outside our control. Therefore, this report is subject to review and revision as changed conditions are identified.

The scope of our services mutually agreed upon did not include any environmental assessment or study for the presence of hazardous to toxic materials in the soil, surface water, or air, on or below or around the site. Butano Geotechnical Engineering, Inc. is not a mold prevention consultant; none of our services performed in connection with the proposed project are for the purpose of mold prevention. Proper implementation of the recommendations conveyed in our reports will not itself be sufficient to prevent mold from growing in or on the structures involved.

REFERENCES

ASTM International (2015). *Annual Book of ASTM Standards, Section Four, Construction*.
Volume 4.08, Soil and Rock (I): D 430 - D 5611.

ASTM International (2016). *Annual Book of ASTM Standards, Section Four, Construction*.
Volume 4.09, Soil and Rock (II): D 5714 - Latest.

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Brabb, E.E., 1980, Preliminary geologic map of the La Honda and San Gregorio quadrangles, San Mateo County, California, U.S. Geological Survey, Open-File Report OF-80-245, 1:24,000.

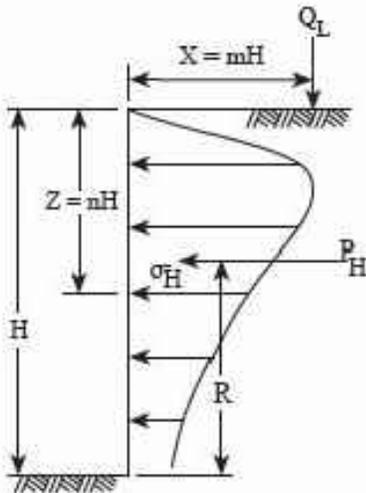
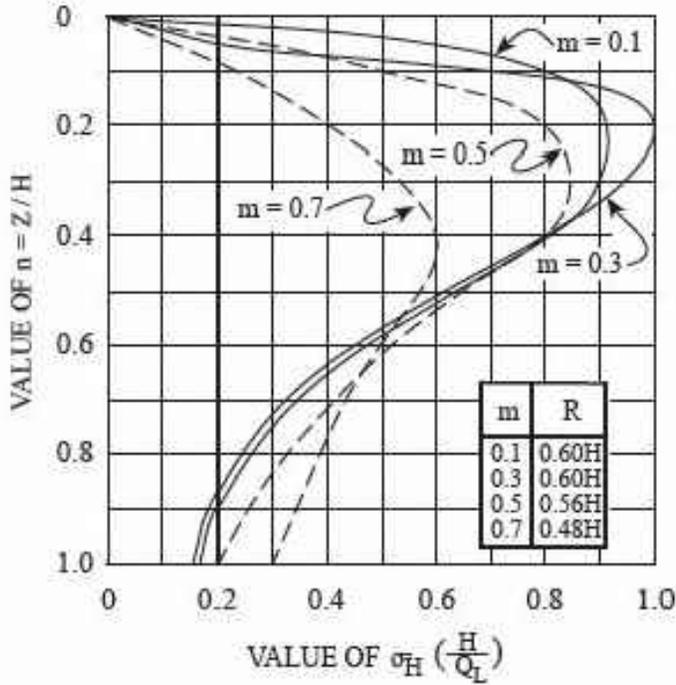
California Building Code (2019).

APPENDIX A

FIGURES AND STANDARD DETAILS

Surcharge Pressure Diagram	Figure A-1
Backdrain Detail Typical	Figure A-2

LINE LOAD



FOR $m \leq 0.4$:

$$\sigma_H \left(\frac{H}{Q_L} \right) = \frac{0.20 n}{(0.16 + n^2)^2}$$

$$P_H = 0.55 Q_L$$

FOR $m > 0.4$:

$$\sigma_H \left(\frac{H}{Q_L} \right) = \frac{1.28 m^3 n}{(m^2 + n^2)^2}$$

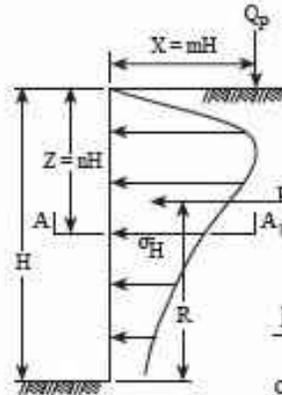
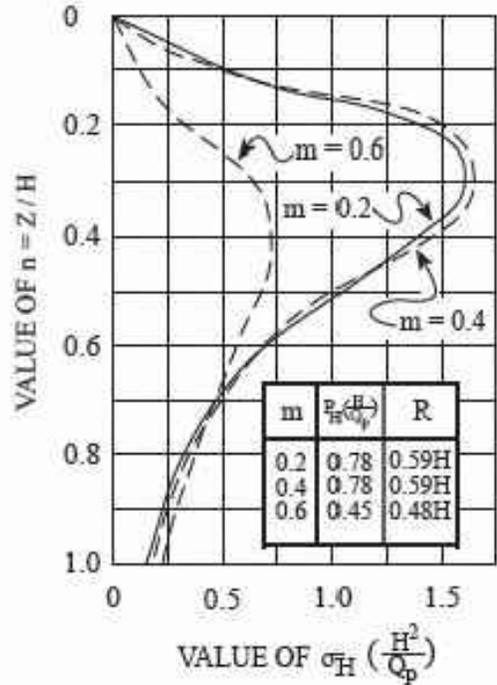
$$\text{RESULTANT } P_H = \frac{0.64 Q_L}{(m^2 + 1)}$$

PRESSURES FROM LINE LOAD Q_L

(BOISSINESQ EQUATION MODIFIED BY EXPERIMENT)

REFERENCE: Design Manual
NAVFAC DM-7.02
Figure 11
Page 7.2-74

POINT LOAD



FOR $m \leq 0.4$:

$$\sigma_H \left(\frac{H^2}{Q_p} \right) = \frac{0.28 n^2}{(0.16 + n^2)^3}$$

FOR $m > 0.4$:

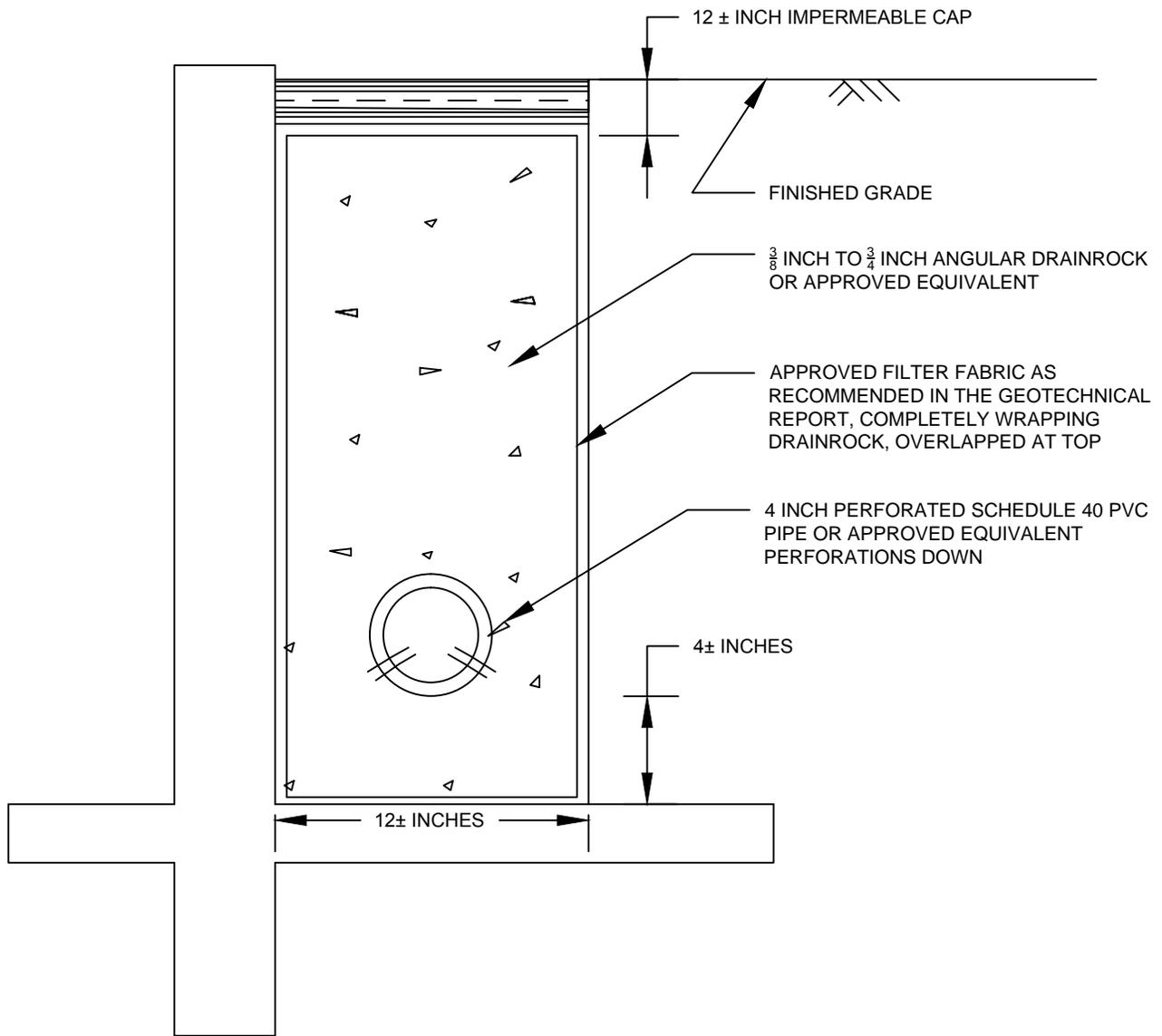
$$\sigma_H \left(\frac{H^2}{Q_p} \right) = \frac{1.77 m^3 n^2}{(m^2 + n^2)^3}$$

$$\sigma_H^1 = \sigma_H \cos^2(1.1 \theta)$$

SECTION A-A1

PRESSURES FROM POINT LOAD Q_p

(BOISSINESQ EQUATION MODIFIED BY EXPERIMENT)



NOTES:

1. DRAWING IS NOT TO SCALE.
2. 2±% GRADIENT TO PIPE AND TRENCH BOTTOM CONNECTED TO A CLOSED CONDUIT THAT DISCHARGES TO AN APPROVED LOCATION.

N.T.S.

<p style="text-align: center;">BUTANO GEOTECHNICAL ENGINEERING, INC.</p>	<p style="text-align: center;">TYPICAL RETAINING WALL BACKDRAIN DETAIL</p>	<p style="text-align: center;">FIGURE A-2</p>
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APPENDIX B

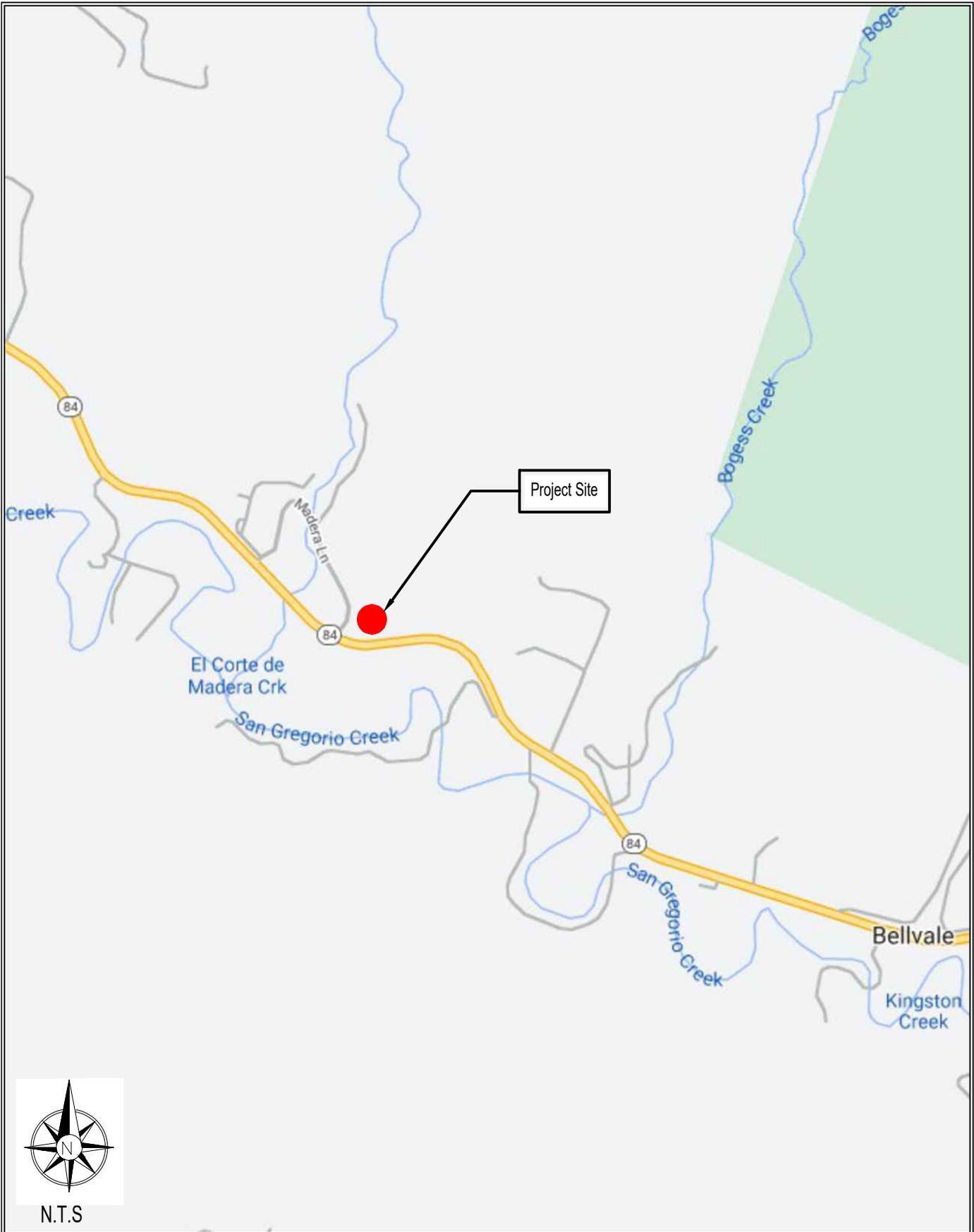
FIELD EXPLORATION PROGRAM

Field Exploration Procedures	Page B-1
Site Location Plan	Figure B-1
Test Pit Plan	Figure B-2
Key to the Logs	Figure B-3
Test Pit Log	Figure B-4

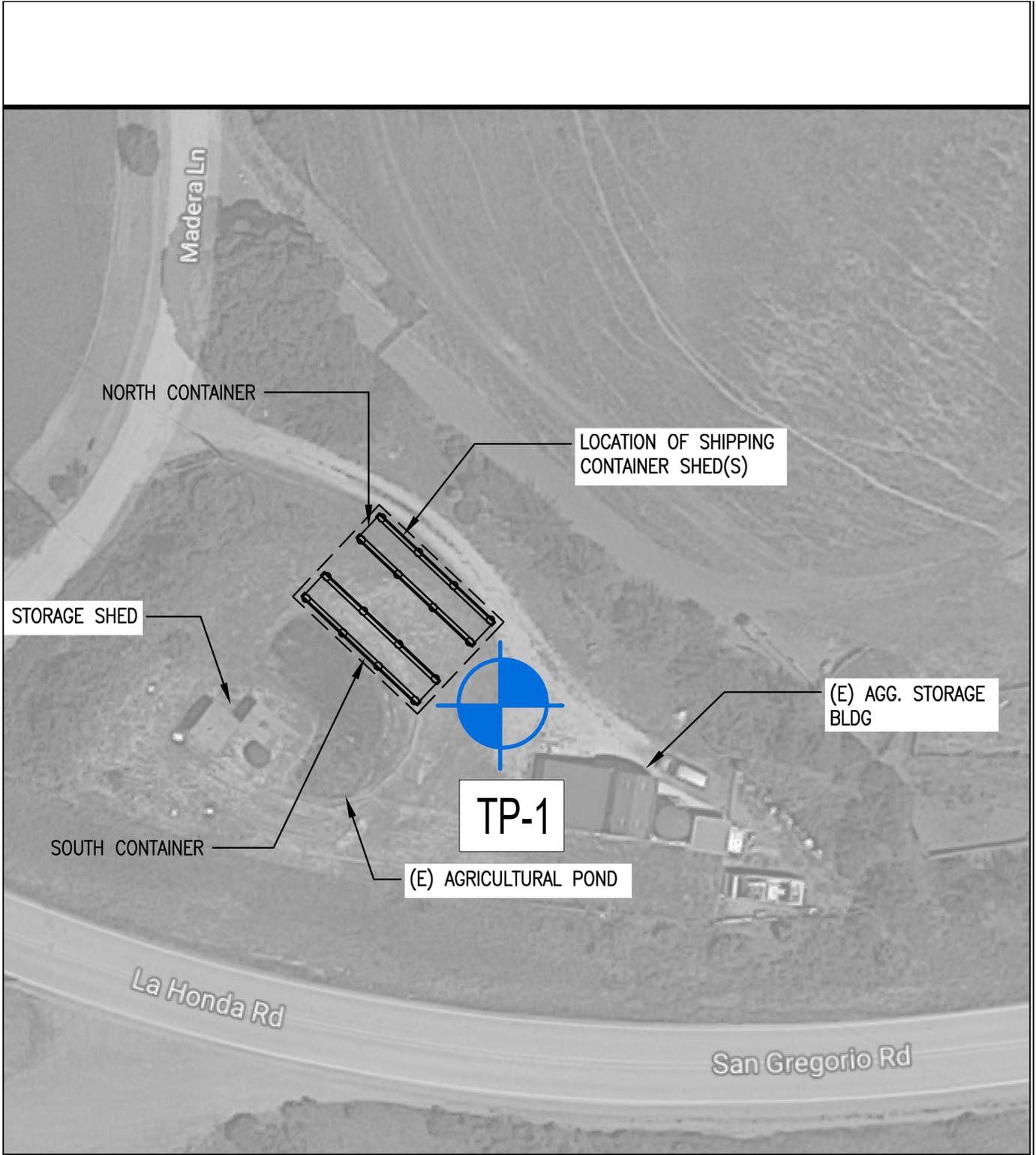
FIELD EXPLORATION PROCEDURES

Subsurface conditions were explored by advancing one test pit with a mini excavator. The Key to The Logs and the Test Pit Log are included in Appendix B, Figures B-3 and B-4. The approximate location of the test pit is shown on the Boring Site Plan, Figure B-2. The test pit was located in the field by tape measurements from known landmarks. Their locations as shown are therefore within the accuracy of such measurement.

The soils encountered in the borings were continuously logged in the field by a representative of Butano Geotechnical Engineering, Inc. Bulk and relatively undisturbed soil samples for identification and laboratory testing were obtained in the field. These soils were classified based on field observations and laboratory tests. The classifications are accordance with the Unified Soil Classification System (USCS: Figure 3).



<p>BUTANO</p>	<p>SITE LOCATION PLAN</p>	<p>FIGURE</p>
<p>GEOTECHNICAL ENGINEERING, INC.</p>	<p>350 Madera Lane</p>	<p>B-1</p>



 B-X Exploratory boring
 Scale: 1" = 10'



Plan by Andrew Radovan
 Civil Engineering Inc.

BUTANO GEOTECHNICAL ENGINEERING, INC.	TEST PIT SITE PLAN 350 Madera Lane	FIGURE B-2
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Important Information about Your Geotechnical Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you — should apply the report for any purpose or project except the one originally contemplated.*

Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,

- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ—sometimes significantly—from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final*, because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual

subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

A Geotechnical Engineering Report Is Subject to Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that

have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

Rely, on Your ASFE-Member Geotechnical Engineer for Additional Assistance

Membership in ASFE/THE BEST PEOPLE ON EARTH exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with your ASFE-member geotechnical engineer for more information.



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