GEOTECHNOLOGY

A Universal Engineering Sciences Company

# GEOTECHNICAL EXPLORATION

## PROPOSED DENTAL OFFICE
## LAKE ST. LOUIS, MISSOURI

Prepared for:

**MAP REALTY LLC**
**LAKE ST. LOUIS, MISSOURI**

Prepared by:

**GEOTECHNOLOGY, LLC**
**ST. LOUIS, MISSOURI**

Date:

**SEPTEMBER 30, 2022**

Geotechnology Project No.:

**J041772.01**

SAFETY
QUALITY
INTEGRITY
PARTNERSHIP
OPPORTUNITY
RESPONSIVENESS

September 30, 2022

Mr. Michael Pernoud and Mrs. Angela Pernoud
MAP Realty LLC
8631 State Highway N
Lake St. Louis, Missouri 63367

Re: Geotechnical Exploration
Proposed Dental Office
Lake St. Louis, Missouri
Geotechnology Project No. J041772.01

Dear Mr. and Mrs. Pernoud:

Presented in this report are the results of a geotechnical exploration conducted for the referenced project. This report includes our project understanding, observed site conditions, conclusions and/or recommendations, and support data as given in the Table of Contents.

It has been our pleasure to provide geotechnical services to you, and we would welcome the opportunity to provide other services during the course of the project. Please contact us if you need further information or clarification about this document.

Very truly yours,

**GEOTECHNOLOGY, LLC**

STATE OF MISSOURI
DANIEL W. GREENWOOD
NUMBER
EN-26451
REGISTERED PROFESSIONAL ENGINEER

Tanner N. Merz, E.I.
Engineer

Daniel W. Greenwood, P.E., R.G.
Geotechnical Manager

TNM/DWG:tnm/jlf

Copies submitted: (1) pdf

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## EXECUTIVE SUMMARY

The executive summary is provided solely for the purpose of overview and a number of details are omitted, each of which could be crucial to the recommended application of this report. A party who relies on this report should read the entire report.

- The project consists of the construction of a proposed office building facility at 8635 Highway N in Lake St. Louis, Missouri. The subject property consists of an approximately 1.4-acre parcel located northeast of Highway N and Lake Saint Louis Boulevard. The proposed office facility will consist of a one-story, 7,500 square-foot (sf) building with parking surrounding the north, west and south sides of the building.

- Detailed loading information is not currently available; for purposes of this report, maximum column loads have been assumed to be 100 kips and maximum wall loads have been assumed to be 5 kips per linear foot.

- Borings B-1 through B-4, B-6, and B-7 are surfaced with 3 to 4 inches of topsoil. Lean clay fill with occasional gravel is encountered in all borings to approximate depths ranging from 1 to 3 feet. The fill is underlain by natural, medium stiff silt in Boring B-1, and natural, medium stiff to stiff, lean clay in Borings B-3 through B-6. Soft to very stiff, fat clay is encountered in all borings to their termination depths. Boring B-5 terminates in the lean clay stratum. Sampler refusal on apparent bedrock occurs in Boring B-2 at an approximate depth of 19.25 feet.

- Groundwater was not encountered in the borings during drilling. The groundwater level might not have stabilized before backfilling, which is typical in less permeable cohesive soil. Consequently, the lack of indicated groundwater levels might not represent present or future levels.

- Strip and spread footings may be proportioned for a net allowable bearing pressure of 2,000 pounds per square foot (psf), provided they bear on natural or compacted soil.

- Based on the results of the borings, our local knowledge of the soil conditions and the general procedures of the 2018 Edition of the International Building Code (IBC), the soil profile at the site may be defined as Class C, Very Dense Soil and Soft Rock.

# GEOTECHNICAL EXPLORATION
# PROPOSED DENTAL OFFICE
# LAKE ST. LOUIS, MISSOURI

**September 30, 2022 | Geotechnology Project No. J041772.01**

## 1.0 INTRODUCTION

The services documented in this report were provided in accordance with the terms, conditions and scope of services described in Geotechnology's July 20, 2022 proposal numbered P041772.01, and signed on July 27, 2022.

The purposes of the geotechnical exploration were to develop a general subsurface profile at the site and prepare recommendations for the geotechnical aspects of the design and construction of the project as defined in our proposal. Our scope of services included site reconnaissance, geotechnical borings, laboratory testing, engineering analyses, and preparation of this report.

A copy of "Important Information about This Geotechnical-Engineering Report," published by the Geotechnical Business Council (GBC) of the Geoprofessional Business Association (GBA), is included in Appendix A for your review. The publication discusses report limitations and ways to manage risk associated with subsurface conditions.

## 2.0 PROJECT INFORMATION

The project consists of the construction of a proposed office building facility at 8635 Highway N in Lake St. Louis, Missouri. The subject property consists of an approximately 1.4-acre parcel located northeast of Highway N and Lake St. Louis Boulevard. The proposed office facility will consist of a one-story 7,500 square-foot (sf) building with parking surrounding the north, west and south sides of the building. Detailed loading information is not currently available; but we have assumed maximum column loads of 100 kips and maximum wall loads of 5 kips per linear foot.

The site is currently a vacant, relatively level, grass-covered field. Historic aerial photography of the area shows a one-story building previously occupied the subject property and was razed in 2007. The site location and general topography of the area as per the 2021 USGS map of the vicinity are shown on Figure 1 included in Appendix B. Proposed finished grades have not been provided, but are assumed to be within 2 feet of existing grade.

## 3.0 GEOTECHNICAL EXPLORATION

The field exploration consisted of seven borings, designated as Borings B-1 through B-7, at the approximate locations shown on Figure 2 in Appendix B. Elevations were gathered using

Google Earth®. If more precise data are required, the client should retain a registered surveyor to establish the boring locations and elevations.

The borings were drilled to auger refusal using a Geoprobe rotary drill rig equipped with hollow stem augers. Standard Penetration Tests (SPTs) were performed using an automatic hammer. Split-spoon samples and relatively undisturbed Shelby tube samples were obtained at the depths indicated on the boring logs presented in Appendix C. An explanation of the terms and symbols used on the boring logs is also provided in Appendix C.

A geologist from Geotechnology provided direction during field exploration and prepared field logs of the material encountered. The boring logs represent conditions observed at the time of exploration, and has been edited to incorporate results of the laboratory tests.

Unless noted on the boring logs, the lines designating the changes between various strata represent approximate boundaries. The transition between materials could be gradual or could occur between recovered samples. The stratification given on the boring logs, or described herein, is for use by Geotechnology in its analyses and should not be used as the basis of design or construction cost estimates without realizing that there can be variation from that shown or described.

The boring logs and related information depict subsurface conditions only at the specific locations and times where sampling was conducted. The passage of time could result in changes in conditions, interpreted to exist, at or around the locations where sampling was conducted.

## 4.0 LABORATORY REVIEW AND TESTING

Laboratory testing was performed on the soil samples obtained from the borings to estimate engineering and index properties. Moisture contents and Atterberg limits tests were performed on selected cohesive samples. Unconfined compression tests were performed on selected Shelby tube samples. Laboratory test results are presented on the boring logs.

## 5.0 SUBSURFACE CONDITIONS

### 5.1 Stratigraphy

Borings B-1 through B-4, B-6, and B-7 are surface with 3 to 4 inches of topsoil. Fill consisting of lean clay with occasional gravel is present in all borings to approximate depths ranging from 1 to 3 feet. SPT 'N'-values[1] in the fill are between 5 and 8 blows per foot (bpf).

[1] The standard penetration resistance, or N-value, is defined as the number of blows required to drive the split-spoon sampler 12 inches with a 140-pound hammer falling 30 inches. Since the split spoon sampler is driven 18 inches or until refusal, the blows for the first 6 inches are for seating the sampler, and the number of blows for the final 12 inches is the N-value. Additionally, "refusal" of the split-spoon sampler occurs when the sampler is driven less than 6 inches with 50 blows of the hammer.

Natural, low plastic, medium stiff silt underlies the fill in Boring B-1 to an approximate depth of 3 feet. Medium stiff to stiff lean clay underlies the fill in Borings B-3 through B-6 to approximate depths between 3 to 6 feet. Fat clay is encountered in all borings and extends to the borings' termination depths. The fat clay ranges from soft to very stiff, but is generally medium stiff to stiff. SPT 'N'-values in the clays range from 4 to 11 bpf and moisture contents range from 19 to 43 percent.

Sampler refusal occurs in Boring B-2 at 19.25 feet. Sampler refusal could represent either a hard soil layer or bedrock. Since rock coring was not performed, the character of the refusal materials could not be determined.

### 5.2 Groundwater

Groundwater was not observed in the borings. Groundwater levels might not have stabilized before backfilling, which is typical in low permeability, cohesive soils. Consequently, the lack of observed groundwater levels might not represent present or future levels. Groundwater levels could vary over time due to the effects of seasonal variation in precipitation, recharge, proximity to the Mississippi River, or other factors not evident at the time of exploration. Groundwater can be perched within permeable zones of fill. Excavations that remain open might collect water.

## 6.0 CONCLUSIONS AND RECOMMENDATIONS

Geotechnology has prepared the following conclusions and recommendations based on our understanding of the proposed project, the field and laboratory data presented in this report, engineering analyses, and our experience and judgment. At this time, the finished grades and anticipated structural loads are not known.

### 6.1 Site Preparation and Earthwork

Existing Fill. Existing fill materials consisting of lean clay with occasional gravel were encountered in the borings ranging from approximate depths of 1 to 3 feet. The N-values suggest that the fill might have received some compactive effort during placement. The age, quality, and compactive effort of the fill, however, cannot be accurately determined.

The stability of the existing fill in this area should be evaluated in the field by performing test pits and a proofroll. Removal and replacement might be required based on observation during proofrolling and footing excavation. Pending the positive results of the test pits and proofroll, the existing fill might be determined to be suitable for supporting the floor slab and pavements; otherwise, the fill should be removed and replaced as discussed herein. The foundations should be lowered in these areas to bear on the underlying medium stiff to stiff natural soil.

Site Preparation. In general, cut areas and areas to receive fill should be stripped of vegetation, topsoil, soft soil, and other deleterious materials. The exposed subgrade should be proofrolled. Soft soil or yielding areas should be excavated and backfilled with fill or crushed rock compacted to the levels provided in Table 1, Compaction Summary.

Suitable Fill Materials. In general, fill materials should consist of low-plastic (liquid limit less than 45 percent), cohesive soils or well-graded crushed rock. Acceptable fill soils include non-organic materials designated as CL, ML, CL-ML, SW, GW, and GM by ASTM D 2487. The on-site lean clay can be reused, although moisture conditioning to near optimum may be required. Poorly graded "clean" granular materials should not be used as fill, as these materials tend to create a reservoir for water, resulting in softening of the underlying cohesive soil subgrade or, in the presence of high-plastic clay, could lead to heaving.

Fill and Backfill Placement. Fill or backfill should be placed in maximum 8-inch-thick loose lifts and compacted to the levels given in Table 1, Compaction Summary. The soil should be placed at a moisture content compatible with the required unit weight. Depending on the soil moisture at the time of construction, aeration or wetting might be required to achieve compaction. Deleterious material should not be included in fill, and the fill should not be placed on soft materials or frozen ground.

**Table 1. Compaction Summary**

| Category | Minimum Compaction [a] |
|---|---|
| General soil fill | 90% |
| Rock backfill | 95% |
| Floor slab subgrade | 90%[b] |
| Floor slab rock base course | 95% |

[a] Measured as a percent of the maximum dry unit weight as determined by the modified Proctor test in a laboratory (ASTM D 1557).
[b] Moisture content within 3% of optimum moisture content

Trench Backfill. Utilities might be located under the floor slab. Settlement of trench backfill can result in localized slab failures. The magnitude of settlement can be reduced by mechanically compacting the trench backfill. In this method, the soil or granular material is placed and compacted in horizontal layers. The degree of compaction should be similar to that required in the fill adjacent to the trench or as recommended in Table 1, Compaction Summary. Permeable backfill (i.e., clean rock and sand) should not be used for backfill. Permeable backfill can collect water and promote subgrade softening and/or result in the migration of fines and loss of subgrade support.

Subgrade Protection. Drainage of the construction areas should be provided to protect the slab-on-grade subgrades from the detrimental effects of weather conditions during construction. Finished subgrades should be kept free of standing water at all times.

Slab-on-grade areas will be exposed to weather and disturbances from installation of utilities and normal construction traffic. Disturbance is generally relatively easy to repair in summer and fall months by reworking of the upper soils. Considerably more difficulty will be experienced in the wetter seasons, such as spring and winter. We recommend minimizing construction traffic on the prepared subgrades.

Collection and Disposal of Site Water. Management of the site water is important in the successful performance of pavement and foundations. Water from surface runoff, downspouts, and subsurface drains, if any, should be collected and discharged through an effective site drainage system. Control of surface runoff should be maintained in compliance with the rules and regulations set forth in the Federal Water Pollution Control Act. Additionally, permits related to site grading activities and control of storm water during construction activities should be obtained from the applicable governmental jurisdiction(s).

### 6.2 Fat Clay Remediation

Based on the boring information, potentially expansive fat clay was encountered approximately 3 feet below the anticipated subgrade. Depending on final grades, fat clay remediation may be required if the building pad is lowered. Geotechnology recommends reviewing the need for fat clay remediation once final grades are established.

### 6.3 Shallow Foundations

Bearing Capacity. Strip and spread footings should be proportioned for a net allowable bearing pressure of 2,000 psf, provided they bear on natural or compacted soil. The minimum lateral dimensions for strip and spread footings should be 18 and 24 inches, respectively. Exterior footings and footings in unheated interior areas should be embedded 30 inches below the lowest adjacent exterior grade to provide protection from seasonal moisture variations and frost penetration.

The subgrade of each footing excavation should be observed by a representative of Geotechnology, to verify that the exposed soil is consistent with that described in the subsurface exploration and has the required strength to develop the design bearing capacity. If encountered, zones of soft soil should be excavated until soils capable of supporting the required bearing capacity are exposed.

Shallow foundations, proportioned and constructed as recommended above, are expected to settle approximately 1 inch. Differential settlement between any two adjacent footings could be approximately 3/4-inch. Estimated values of settlement contained in this report are based on our experience. Consolidation tests and corresponding settlement calculations have not been made.

Uplift Capacity. Uplift loads can be resisted with the dead weight of the footing, and the weight of soil above the footing. A unit weight of 120 pounds per cubic foot (pcf) can be used for determining the soil weight above the footing, and the volume of soil acting on the footing can include a wedge of material within a line that extends from the top of footing and away from the footing edge to the ground surface at an angle of 30 degrees from the vertical. Buoyant densities should be used for materials below the groundwater table.

Lateral Capacity. Lateral loads can be resisted considering frictional resistance between the base of the foundation and supporting soil and passive resistance acting on the side of the footing. Resistance to sliding can be computed assuming an ultimate coefficient of friction of 0.3; however, the ultimate resistance must be limited to 500 psf. The ultimate passive resistance may be computed based on an equivalent fluid pressure of 225 pcf but the upper 30 inches should be

neglected. Safety factors of 2 and 3 should be applied to determine the allowable sliding and passive resistance, respectively.

### 6.4 Floor Slabs

The slab-on-grade should be underlain by 4- to 6-inch layer of crushed rock placed atop properly prepared subgrades and compacted as indicated in Table 1, Compaction Summary. A 15-mil or thicker plastic sheet should be placed below the floor to reduce the potential for moisture to permeate the slab and reduce the potential for mold growth in the building. Notwithstanding other structural considerations, the slab-on-grade floor should be designed to allow for differential movements that normally occur between the floor slab, columns, and foundation walls.

### 6.5 Pavement Design and Construction

A pavement design and analysis were beyond the scope of our services. Standard asphaltic concrete pavement design for a given service life requires evaluation of the soil by California Bearing Ratio (CBR) tests or other methods, estimates of daily traffic volumes and axle weights, drainage requirements, and the desired level of maintenance.

Asphaltic pavement sections are frequently used in the St. Louis region that are thinner than would typically result from a pavement design. These reduced thickness sections often perform adequately; however, maintenance or an overlay is generally required sooner than would be required for a thicker, designed section. Based on our experience with projects of similar nature, pavement sections consisting of 3 inches of asphalt over 6 inches of well-graded crushed rock and 4 inches of asphalt over 8 inches of well-graded, crushed rock are often used in parking areas and main drive lanes, respectively, subjected to automobile traffic only. The pavement performance can be enhanced by lime treating the subgrade soils or incorporating a geogrid below the crushed rock. Where heavy wheel loads are concentrated, particularly at approaches to trash dumpsters and truck loading areas, concrete pavement should be used.

Regardless of which pavement sections are selected, the soil subgrade should be stable and the top 12 inches compacted to the levels provided in Table 1, Compaction Summary. Pavement service life can decrease substantially if the pavement is constructed on a poor subgrade, if it has poor surface or subsurface drainage, and/or if the pavement is not maintained. Periodic maintenance, such as filling cracks and sealing, is required for any pavement section.

If pavements are not constructed immediately after grading, the subgrade should be shaped to prevent ponding. Minor ponding, of even short duration, can cause softening of a soil subgrade. If there is a lapse of time between grading and paving, or if the subgrade is disturbed by construction activities, the subgrade should be proof-rolled with a loaded, tandem-wheeled dump truck. Soft spots observed during initial construction or proof-rolling should be removed and replaced with compacted soil or rock, possibly combined with a geotextile or geogrid. The rock base course and soil subgrade should be compacted to the levels provided in Table 1, Compaction Summary.

Depending on when the pavement is constructed, the subgrade might not support construction equipment such as rock trucks or asphalt trucks which have heavier axle loads than those vehicles which the pavement section is expected to support. Such conditions will be more apparent during wetter periods of the year. Overexcavation of soft subgrade and placement of additional base course and/or geogrid could be required to construct the pavement during these periods.

### 6.6 Seismic Site Classification and Seismic Design Parameters

Site Class. The site soil is defined as Class C, Very Dense Soil and Soft Rock. The site class designation is based on the results of the borings and our local knowledge of the geologic conditions in the area. The assessment of the soil and/or rock properties below the boring termination depths is based on our professional opinion in accordance with the International Building Code (IBC).

Spectral Acceleration Values. Based on the results of the borings, our local knowledge of the soil conditions and the general procedures of the 2018 Edition of the International Building Code (IBC), the mapped maximum considered spectral response acceleration at short periods ($S_s$), and at 1-second periods ($S_1$) of 0.310 g and 0.137 g, respectively, should be used.

## 7.0 RECOMMENDED ADDITIONAL SERVICES

The conclusions and recommendations given in this report are based on: Geotechnology's understanding of the proposed design and construction, as outlined in this report; site observations; interpretation of the exploration data; and our experience. Since the intent of the design recommendations is best understood by Geotechnology, we recommend that Geotechnology be included in the final design and construction process, and be retained to review the project plans and specifications to confirm that the recommendations given in this report have been correctly implemented. We recommend that Geotechnology be retained to participate in prebid and preconstruction conferences to reduce the risk of misinterpretation of the conclusions and recommendations in this report relative to the proposed construction of the subject project.

Since actual subsurface conditions between boring locations could vary from those encountered in the borings, our design recommendations are subject to adjustment in the field based on the subsurface conditions encountered during construction. Therefore, we recommend that Geotechnology be retained to provide construction observation services as a continuation of the design process to confirm the recommendations in this report and to revise them accordingly to accommodate differing subsurface conditions. Construction observation is intended to enhance compliance with project plans and specifications. It is not insurance, nor does it constitute a warranty or guarantee of any type. Regardless of construction observation, contractors, suppliers, and others are solely responsible for the quality of their work and for adhering to plans and specifications.

## 8.0 LIMITATIONS

This report has been prepared on behalf of, and for the exclusive use of, the client for specific application to the named project as described herein. If this report is provided to other parties, it

should be provided in its entirety with all supplementary information. In addition, the client should make it clear that the information is provided for factual data only, and not as a warranty of subsurface conditions presented in this report.

Geotechnology has attempted to conduct the services reported herein in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality and under similar conditions. The recommendations and conclusions contained in this report are professional opinions. The report is not a bidding document and should not be used for that purpose.

Our scope for this phase of the project did not include any environmental assessment or investigation for the presence or absence of wetlands or hazardous or toxic materials in the soil, surface water, groundwater, or air, on or below or around this site. Any statements in this report or on the boring logs regarding odors noted or unusual or suspicious items or conditions observed are strictly for the information of our client. Our scope did not include an assessment of the effects of flooding and erosion of creeks or rivers adjacent to or on the project site.

Our scope did not include: any services to investigate or detect the presence of mold or any other biological contaminants (such as spores, fungus, bacteria, viruses, and the by-products of such organisms) on and around the site; or any services, designed or intended, to prevent or lower the risk of the occurrence of an infestation of mold or other biological contaminants.

The analyses, conclusions, and recommendations contained in this report are based on the data obtained from the geotechnical exploration. The field exploration methods used indicate subsurface conditions only at the specific locations where samples were obtained, only at the time they were obtained, and only to the depths penetrated. Consequently, subsurface conditions could vary gradually, abruptly, and/or nonlinearly between sample locations and/or intervals.

The conclusions or recommendations presented in this report should not be used without Geotechnology's review and assessment if the nature, design, or location of the facilities is changed, if there is a lapse in time between the submittal of this report and the start of work at the site, or if there is a substantial interruption or delay during work at the site. If changes are contemplated or delays occur, Geotechnology must be allowed to review them to assess their impact on the findings, conclusions, and/or design recommendations given in this report. Geotechnology will not be responsible for any claims, damages, or liability associated with any other party's interpretations of the subsurface data or with reuse of the subsurface data or engineering analyses in this report.

The recommendations included in this report have been based in part on assumptions about variations in site stratigraphy that can be evaluated further during earthwork and foundation construction. Geotechnology should be retained to perform construction observation and continue its geotechnical engineering service using observational methods. Geotechnology cannot assume liability for the adequacy of its recommendations when they are used in the field without Geotechnology being retained to observe construction.

# APPENDIX A – IMPORTANT INFORMATION ABOUT THIS GEOTECHNICAL-ENGINEERING REPORT

# Important Information about This

# 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 constructor — 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 this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply this 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.

## Geotechnical Engineers Base Each Report on a Unique Set of Project-Specific Factors

Geotechnical engineers consider many 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;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the 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 geotechnical engineer performed the study. *Do not rely on a geotechnical-engineering report whose adequacy may have been affected by*: the passage of time; man-made events, such as construction on or adjacent to the site; or natural events, such as floods, droughts, earthquakes, or groundwater fluctuations. *Contact the geotechnical engineer before applying this 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 geotechnical-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 confirmation-dependent recommendations included in your report. *Confirmation-dependent 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 confirmation-dependent recommendations if that engineer does not perform the geotechnical-construction observation required to confirm the recommendations' applicability.*

## A Geotechnical-Engineering Report Is Subject to Misinterpretation

Other design-team members' misinterpretation of geotechnical-engineering reports has resulted in costly

problems. Confront 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. Constructors can also misinterpret a geotechnical-engineering report. Confront that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing geotechnical 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 Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make constructors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give constructors the complete geotechnical-engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise constructors 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 constructors have sufficient time* to perform additional study. Only then might you be in a position to give constructors 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 constructors fail to 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.

## Environmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform an *environmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical-engineering report does not usually relate any environmental 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 environmental 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, many 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 GBC-Member Geotechnical Engineer for Additional Assistance

Membership in the Geotechnical Business Council of the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project. Confer with you GBC-Member geotechnical engineer for more information.

GEOTECHNICAL BUSINESS COUNCIL
of the Geoprofessional Business Association

8811 Colesville Road/Suite G106, Silver Spring, MD 20910
Telephone: 301/565-2733 Facsimile: 301/589-2017
e-mail: info@geoprofessional.org www.geoprofessional.org

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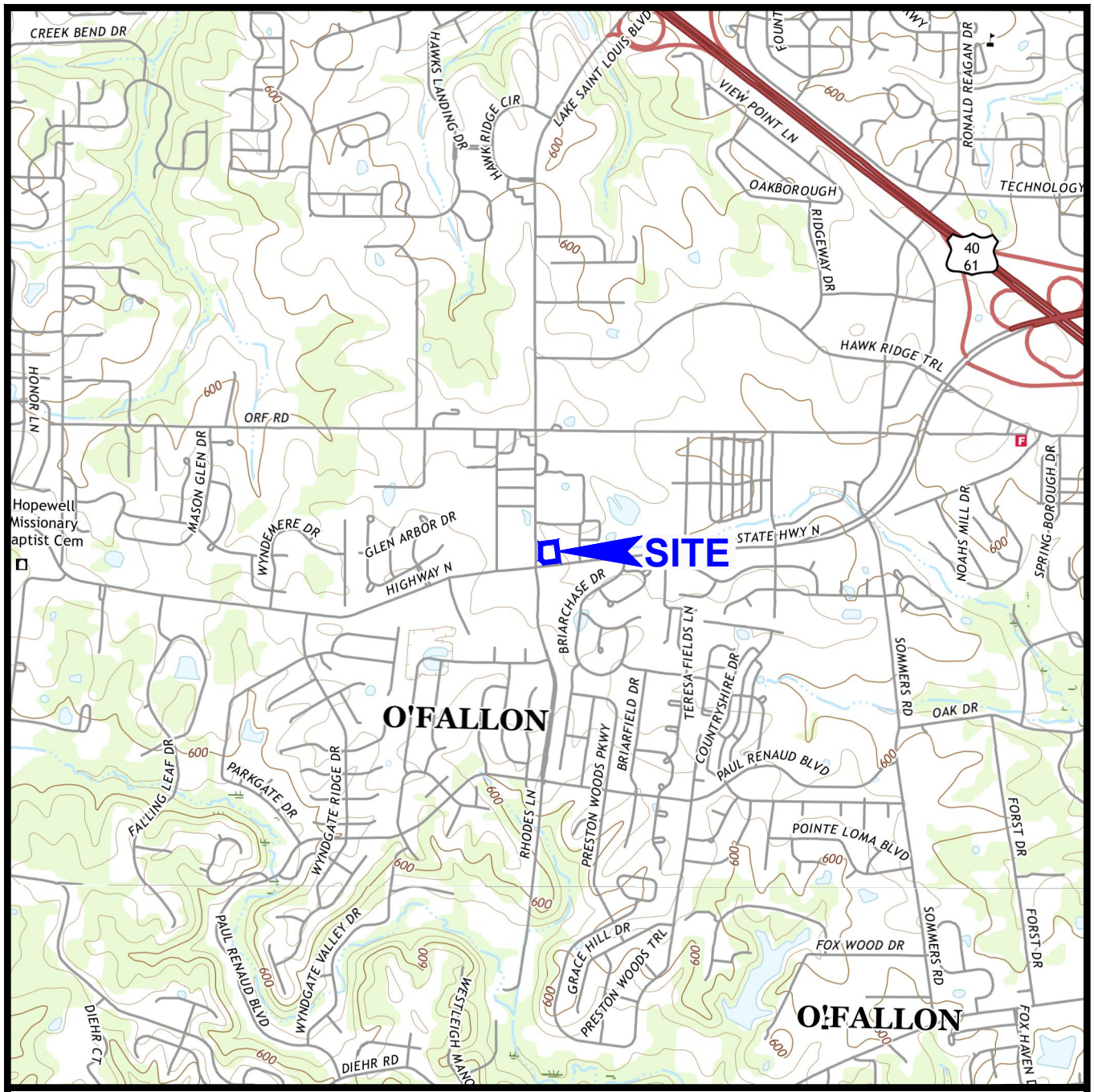
**APPENDIX B – FIGURES**

Figure 1 - Site Location

Figure 2 - Boring Locations




NOTES

1. Plan adapted from 7.5 minute U.S.G.S. maps for Wentzville and Defiance, Missouri quadrangles, last revised in 2021.

0 2,000 4,000

SCALE IN FEET

N

| Drawn By: WAH | Ck'd By: TNM | App'vd By: DWG |
|---|---|---|
| Date: 9-20-22 | Date: 9-20-22 | Date: 9-20-22 |

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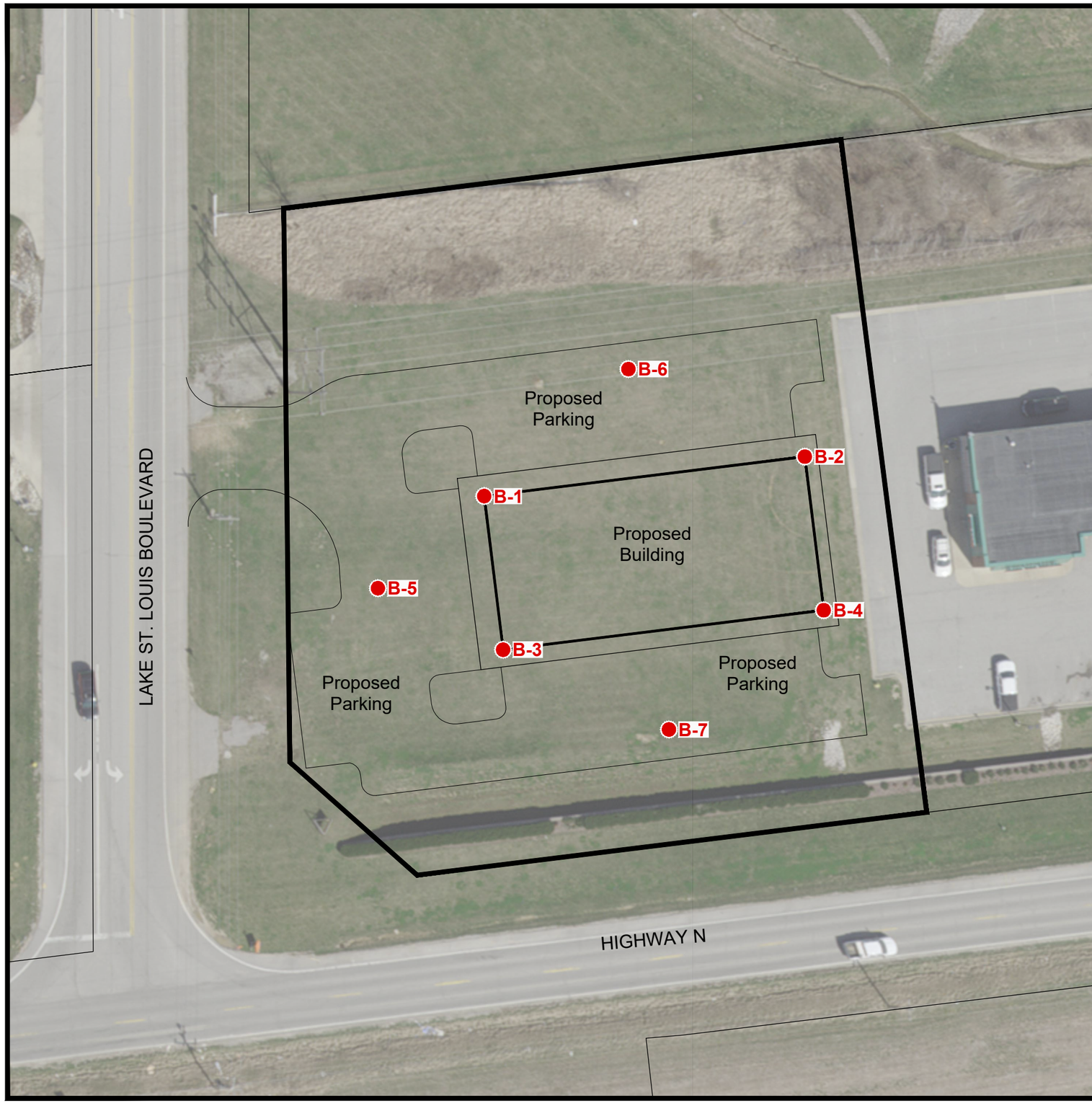
**SUBJECT PROPERTY LOCATION AND TOPOGRAPHY**

Project Number
J041772.01

FIGURE 1




NOTES

1. Plan adapted from "2015 Aerial Imagery for the St. Louis Region" supplied by East-West Gateway Council of Governments and a drawing dated April 28, 2021, titled "Conceptual Site Plan", prepared by Baalman Architects.

2. Borings were located in the field with reference to site features and are shown approximate only.

LEGEND

● Boring Location

N

0 20 40 80

SCALE IN FEET

| Drawn By: WAH | Ck'd By: TNM | App'vd By: DWG |
|---|---|---|
| Date: 9-20-22 | Date: 9-20-22 | Date: 9-20-22 |

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**AERIAL PHOTOGRAPH OF SITE AND BORING LOCATIONS**

| Project Number J041772.01 | FIGURE 2 |
|---|---|

# APPENDIX C – BORING INFORMATION

Boring Logs

Boring Log Terms and Symbols

Surface Elevation: 624 | Completion Date: 9/15/2022

Datum: WGS84 EGM96 (Geoid)

| DEPTH IN FEET | DESCRIPTION OF MATERIAL | DRY UNIT WEIGHT (pcf) / SPT BLOW COUNTS / CORE RECOVERY/RQD | SAMPLES |
|---|---|---|---|
| | Topsoil - 4 inches | | |
| | FILL: gray, lean clay | | |
| | Medium stiff, gray SILT - ML | 4-4-4 | SS1 |
| | Stiff to medium stiff, brown and gray, FAT CLAY - CH | 3-5-6 | SS2 |
| 5 | | 3-3-5 | SS3 |
| | Very stiff, gray and orange-brown, FAT CLAY - CH | 102 | ST4 |
| 10 | | | |
| | Medium stiff to soft, reddish-brown, FAT CLAY, with gravel - CH | 3-2-3 | SS5 |
| 15 | | | |
| | | 0-2-2 | SS6 |
| 20 | Boring terminated at 20 feet. | | |

SHEAR STRENGTH, tsf

△ - UU/2 ○ - QU/2 □ - SV

0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE

▲ N-VALUE (BLOWS PER FOOT)

(ASTM D 1586)

WATER CONTENT, %

PL 10 20 30 40 50 LL

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

**GROUNDWATER DATA**

X FREE WATER NOT ENCOUNTERED DURING DRILLING

**DRILLING DATA**

___ AUGER 3 3/4" HOLLOW STEM

WASHBORING FROM ___ FEET

NU DRILLER EER LOGGER

Geoprobe DRILL RIG

HAMMER TYPE Auto

HAMMER EFFICIENCY 98 %

**REMARKS: Rough drilling from 12.5 to 15.5 feet and from 17.5 to 18 feet.**

| Drawn by: WAH | Checked by: TNM | App'vd. by: DWG |
|---|---|---|
| Date: 9/20/2022 | Date: 9/20/2022 | Date: 9/20/2022 |

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**LOG OF BORING: B-1**

**Project No. J041772.01**

Surface Elevation: 623 | Completion Date: 9/15/2022

Datum: WGS84 EGM96 (Geoid)

| DEPTH IN FEET | DESCRIPTION OF MATERIAL | DRY UNIT WEIGHT (pcf) / SPT BLOW COUNTS / CORE RECOVERY/RQD | SAMPLES |
|---|---|---|---|
| | Topsoil - 3 inches | | |
| | FILL: brown, LEAN CLAY, with gravel | 3-4-4 | SS1 |
| | Stiff to medium stiff, brown and gray, FAT CLAY, trace gravel - (CH) | 99 | ST2 |
| 5 | | 1-2-3 | SS3 |
| | | 1-2-4 | SS4 |
| 10 | | | |
| | Stiff, reddish-brown to brown, FAT CLAY, with gravel - CH | 2-2-7 | SS5 |
| 15 | | | |
| | Medium stiff, brown, FAT CLAY, with limestone ledges - CH | 2-50/3" | SS6 |
| | Sampler refusal at 19.25 feet. | | |
| 20 | | | |

GRAPHIC LOG

SHEAR STRENGTH, tsf

Δ - UU/2 ○ - QU/2 □ - SV

0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE

▲ N-VALUE (BLOWS PER FOOT)
(ASTM D 1586)

WATER CONTENT, %

PL 10 20 30 40 50 LL

65 >>

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

**GROUNDWATER DATA**

X FREE WATER NOT ENCOUNTERED DURING DRILLING

**DRILLING DATA**

___ AUGER 3 3/4" HOLLOW STEM

WASHBORING FROM ___ FEET

NU DRILLER EER LOGGER

Geoprobe DRILL RIG

HAMMER TYPE Auto

HAMMER EFFICIENCY 98 %

**REMARKS: Rough drilling from 12 to 16 feet.**

| Drawn by: WAH | Checked by: TNM | App'vd. by: DWG |
|---|---|---|
| Date: 9/20/2022 | Date: 9/20/2022 | Date: 9/20/2022 |

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**LOG OF BORING: B-2**

**Project No. J041772.01**

Surface Elevation: 623 | Completion Date: 9/15/2022

Datum: WGS84 EGM96 (Geoid)

SHEAR STRENGTH, tsf: Δ - UU/2, ○ - QU/2, □ - SV (0.5, 1.0, 1.5, 2.0, 2.5)

STANDARD PENETRATION RESISTANCE: ▲ N-VALUE (BLOWS PER FOOT) (ASTM D 1586)

WATER CONTENT, %: PL (10, 20, 30, 40, 50) LL

| DEPTH IN FEET | DESCRIPTION OF MATERIAL | DRY UNIT WEIGHT (pcf) / SPT BLOW COUNTS / CORE RECOVERY/RQD | SAMPLES |
|---|---|---|---|
| | Topsoil - 3 inches | | |
| | FILL: brown, lean clay, with gravel | 5-4-3 | SS1 |
| | Medium stiff, brown and gray, LEAN CLAY - CL | 2-2-3 | SS2 |
| 5 | | | |
| | Stiff to medium stiff, brown and gray, FAT CLAY - (CH) | 103 | ST3 |
| | | 1-2-4 | SS4 |
| 10 | | | |
| | Medium stiff, orange-brown, FAT CLAY, with gravel - CH | 1-2-5 | SS5 |
| 15 | Stiff, brown, FAT CLAY, with limestone ledges and chert - CH | 3-4-7 | SS6 |
| 20 | Boring terminated at 20 feet. | | |

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

**GROUNDWATER DATA**

X FREE WATER NOT ENCOUNTERED DURING DRILLING

**DRILLING DATA**

___ AUGER 3 3/4" HOLLOW STEM

WASHBORING FROM ___ FEET

NU DRILLER EER LOGGER

Geoprobe DRILL RIG

HAMMER TYPE Auto

HAMMER EFFICIENCY 98 %

**REMARKS: Rough drilling from 11 to 13 feet, from 15 to 15.5 feet, and from 17 to 18 feet.**

| Drawn by: WAH | Checked by: TNM | App'vd. by: DWG |
|---|---|---|
| Date: 9/16/2022 | Date: 9/20/2022 | Date: 9/20/2022 |

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**LOG OF BORING: B-3**

**Project No. J041772.01**

Surface Elevation: 623 | Completion Date: 9/15/2022

Datum: WGS84 EGM96 (Geoid)

SHEAR STRENGTH, tsf: △ - UU/2 ○ - QU/2 □ - SV (0.5, 1.0, 1.5, 2.0, 2.5)

STANDARD PENETRATION RESISTANCE: ▲ N-VALUE (BLOWS PER FOOT) (ASTM D 1586)

WATER CONTENT, %: PL 10 20 30 40 50 LL

| DEPTH IN FEET | DESCRIPTION OF MATERIAL | DRY UNIT WEIGHT (pcf) / SPT BLOW COUNTS / CORE RECOVERY/RQD | SAMPLES |
|---|---|---|---|
| | Topsoil- 3 inches | | |
| | FILL: gray, lean clay, trace gravel | | |
| | Medium stiff, brown and gray, LEAN CLAY - CL | 3-4-3 | SS1 |
| | Medium stiff, brown and gray, FAT CLAY - (CH) | 2-3-4 | SS2 |
| 5 | | 1-3-4 | SS3 |
| | | 1-2-4 | SS4 |
| 10 | Stiff, reddish-brown, FAT CLAY, with gravel - CH | 2-6-4 | SS5 |
| 15 | | | |
| | Soft, brown, FAT CLAY, with gravel - CH | 1-2-2 | SS6 |
| 20 | Boring terminated at 20 feet. | | |

**GROUNDWATER DATA**

X FREE WATER NOT ENCOUNTERED DURING DRILLING

**DRILLING DATA**

___ AUGER 3 3/4" HOLLOW STEM

WASHBORING FROM ___ FEET

NU DRILLER EER LOGGER

Geoprobe DRILL RIG

HAMMER TYPE Auto

HAMMER EFFICIENCY 98 %

**REMARKS: Rough drilling from 11 to 11.5 feet and from 14 to 15 feet.**

| Drawn by: WAH | Checked by: TNM | App'vd. by: DWG |
|---|---|---|
| Date: 9/16/2022 | Date: 9/20/2022 | Date: 9/20/2022 |

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**Lake St. Louis, Missouri**

**LOG OF BORING: B-4**

**Project No. J041772.01**

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

Surface Elevation: 624 | Completion Date: 9/16/2022

Datum: WGS84 EGM96 (Geoid)

| DEPTH IN FEET | DESCRIPTION OF MATERIAL | GRAPHIC LOG | DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD | SAMPLES |
|---|---|---|---|---|
| | FILL: brown, lean clay, with gravel | | | |
| | | | 3-2-3 | SS1 |
| | Medium stiff, gray, LEAN CLAY- CL | | | |
| | Medium stiff, brown and gray, FAT CLAY - CH | | | |
| | | | 2-3-4 | SS2 |
| 5 | | | | |
| | | | 1-2-3 | SS3 |
| | | | 1-3-3 | SS4 |
| 10 | Boring terminated at 10 feet. | | | |

SHEAR STRENGTH, tsf

Δ - UU/2 ○ - QU/2 □ - SV

0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE

▲ N-VALUE (BLOWS PER FOOT)
(ASTM D 1586)

WATER CONTENT, %

PL 10 20 30 40 50 LL

**GROUNDWATER DATA**

X FREE WATER NOT ENCOUNTERED DURING DRILLING

**DRILLING DATA**

___ AUGER 3 3/4" HOLLOW STEM

WASHBORING FROM ___ FEET

NU DRILLER EER LOGGER

Geoprobe DRILL RIG

HAMMER TYPE Auto

HAMMER EFFICIENCY 98 %

**REMARKS:**

| Drawn by: WAH | Checked by: TNM | App'vd. by: DWG |
|---|---|---|
| Date: 9/16/2022 | Date: 9/20/2022 | Date: 9/20/2022 |

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**LOG OF BORING: B-5**

**Project No. J041772.01**

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

Surface Elevation: 624 | Completion Date: 9/15/2022

Datum: WGS84 EGM96 (Geoid)

| DEPTH IN FEET | DESCRIPTION OF MATERIAL | GRAPHIC LOG | DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD | SAMPLES |
|---|---|---|---|---|
| | Topsoil - 3 inches | | | |
| | FILL: gray, lean clay - CL | | 3-4-7 | SS1 |
| | Stiff, brown, LEAN CLAY - CL | | | |
| | Medium stiff, brown, FAT CLAY - CH | | 2-3-4 | SS2 |
| 5 | Boring terminated at 5 feet. | | | |
| 10 | | | | |

SHEAR STRENGTH, tsf

Δ - UU/2 ○ - QU/2 □ - SV

0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE

▲ N-VALUE (BLOWS PER FOOT)
(ASTM D 1586)

WATER CONTENT, %

PL 10 20 30 40 50 LL

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

**GROUNDWATER DATA**

X FREE WATER NOT ENCOUNTERED DURING DRILLING

**DRILLING DATA**

___ AUGER 3 3/4" HOLLOW STEM

WASHBORING FROM ___ FEET

NU DRILLER EER LOGGER

Geoprobe DRILL RIG

HAMMER TYPE Auto

HAMMER EFFICIENCY 98 %

**REMARKS:**

| Drawn by: WAH | Checked by: | App'vd. by: |
|---|---|---|
| Date: 9/16/2022 | Date: | Date: |

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**Lake St. Louis, Missouri**

**LOG OF BORING: B-6**

**Project No. J041772.01**

Surface Elevation: 622 | Completion Date: 9/15/2022

Datum: WGS84 EGM96 (Geoid)

| DEPTH IN FEET | DESCRIPTION OF MATERIAL | GRAPHIC LOG | DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD | SAMPLES |
|---|---|---|---|---|
| | Topsoil - 3 inches | | | |
| | FILL: gray, lean clay and gravel | | | |
| | Medium stiff, brown and gray, FAT CLAY - CH | | 2-3-4 | SS1 |
| | | | 2-2-4 | SS2 |
| 5 | Boring terminated at 5 feet. | | | |
| 10 | | | | |

SHEAR STRENGTH, tsf

△ - UU/2 ○ - QU/2 □ - SV

0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE

▲ N-VALUE (BLOWS PER FOOT)
(ASTM D 1586)

WATER CONTENT, %

PL 10 20 30 40 50 LL

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

**GROUNDWATER DATA**

X FREE WATER NOT ENCOUNTERED DURING DRILLING

**DRILLING DATA**

___ AUGER 3 3/4" HOLLOW STEM

WASHBORING FROM ___ FEET

NU DRILLER EER LOGGER

Geoprobe DRILL RIG

HAMMER TYPE Auto

HAMMER EFFICIENCY 98 %

**REMARKS:**

| Drawn by: WAH | Checked by: TNM | App'vd. by: DWG |
|---|---|---|
| Date: 9/16/2022 | Date: 9/20/2022 | Date: 9/20/2022 |

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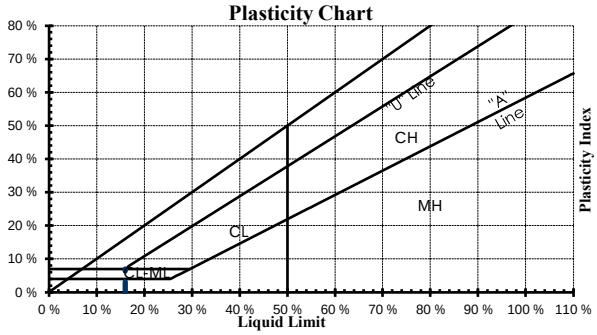
**LOG OF BORING: B-7**

**Project No. J041772.01**

# BORING LOG: TERMS AND SYMBOLS

## LEGEND

| | |
|---|---|
| CS | Continuous Sampler |
| GB | Grab Sample |
| NQ | NQ Rock Core |
| PST | Three-Inch Diameter Piston Tube Sample |
| SS | Split-Spoon Sample (Standard Penetration Test) |
| ST | Three-Inch Diameter Shelby Tube Sample |
| * | Sample Not Recovered |
| PL | Plastic Limit (ASTM D4318) |
| LL | Liquid Limit (ASTM D4318) |
| SV | Shear Strength from Field Vane (ASTM D2573) |
| UU | Shear Strength from Unconsolidated-Undrained Triaxial Compression Test (ASTM D2850) |
| QU | Shear Strength from Unconfined Compression Test (ASTM D2166) |




## SOIL GRAIN SIZE

US STANDARD SIEVE

12" 3" 3/4" 4 10 40 200

| BOULDERS | COBBLES | GRAVEL | | SAND | | | SILT | CLAY |
|---|---|---|---|---|---|---|---|---|
| | | COARSE | FINE | COARSE | MEDIUM | FINE | | |

300 76.2 19.1 4.76 2.00 0.42 0.074 0.005

SOIL GRAIN SIZE IN MILLIMETERS

## UNIFIED SOIL CLASSIFICATION SYSTEM

| Major Divisions | | | Symbol | Description |
|---|---|---|---|---|
| Coarse-Grained Soils (More than 50% Larger than No. 200 Sieve Size) | Gravel and Gravelly Soil | Clean Gravels Little or no Fines | GW | Well-Graded Gravel, Gravel- Sand Mixture |
| | | | GP | Poorly-Graded Gravel, Gravel-Sand Mixture |
| | | Gravels with Appreciable Fines | GM | Silty Gravel, Gravel-Sand-Silt Mixture |
| | | | GC | Clayey-Gravel, Gravel-Sand-Clay Mixture |
| | Sand and Sandy Soils | Clean Sands Little or no Fines | SW | Well-Graded Sand, Gravelly Sand |
| | | | SP | Poorly-Graded Sand, Gravelly Sand |
| | | Sands with Appreciable Fines | SM | Silty Sand, Sand-Silt Mixture |
| | | | SC | Clayey-Sand, Sand-Clay Mixture |
| Fine-Grained Soils (More than 50% Smaller than No. 200 Sieve Size) | Silts and Clays | Liquid Limit Less Than 50 | ML | Silt, Sandy Silt, Clayey Silt, Slight Plasticity |
| | | | CL | Lean Clay, Sandy Clay, Silty Clay, Low to Medium Plasticity |
| | | | OL | Organic Silts or Lean Clays, Low Plasticity |
| | Silts and Clays | Liquid Limit Greater Than 50 | MH | Silt, High Plasticity |
| | | | CH | Fat Clay, High Plasticity |
| | | | OH | Organic Clay, Medium to High Plasticity |
| | Highly Organic Soils | | PT | Peat, Humus, Swamp Soil |

## STRENGTH OF COHESIVE SOILS

| Consistency | Undrained Shear Strength (tsf) | Unconfined Comp. Strength (tsf) |
|---|---|---|
| Very Soft | less than 0.125 | less then 0.25 |
| Soft | 0.125 to 0.25 | 0.25 to 0.5 |
| Medium Stiff | 0.25 to 0.5 | 0.5 to 1.0 |
| Stiff | 0.5 to 1.0 | 1.0 to 2.0 |
| Very Stiff | 1.0 to 2.0 | 2.0 to 3.0 |
| Hard | greater than 2.0 | greater than 4.0 |

## DENSITY OF GRANULAR SOILS

| Descriptive Term | Approximate $N_{60}$-Value Range |
|---|---|
| Very Loose | 0 to 4 |
| Loose | 5 to 10 |
| Medium Dense | 11 to 30 |
| Dense | 31 to 50 |
| Very Dense | >50 |

N-Value (Blow Count) is the last two, 6-inch drive increments (i.e. 4/7/9, N = 7 + 9 = 16). Values are shown as a summation on the grid plot and shown in the Unit Dry Weight/SPT column.

## RELATIVE COMPOSITION

| | |
|---|---|
| Trace | 0 to 10% |
| Little | 10 to 20% |
| Some | 20 to 35% |
| And | 35 to 50% |

## OTHER TERMS

Layer - Inclusion greater than 3 inches thick.
Seam - Inclusion 1/8-inch to 3 inches thick
Parting - Inclusion less than 1/8-inch thick
Pocket - Inclusion of material that is smaller than sample diameter

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Relative composition and Unified Soil Classification System (USCS) designations are based on visual descriptions and are approximate only. If laboratory tests were performed to classify the soil, the USCS designation is shown in parenthesis.