PATRIOT ENGINEERING, PC

REPORT

GEOTECHNICAL ENGINEERING INVESTIGATION

Springfield MS Tennis Courts
1023 Avenue A
Springfield, Michigan

PROJECT NUMBER

25-1504-15G

PREPARED FOR:

Mr. Josh Bowman
Battle Creek Public Schools
3 Van Buren Street West
Battle Creek, Michigan 49017

REPORT DATE

October 7, 2025

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PORTAGE, MI 49002

PATRIOT ENGINEERING, PC

October 7, 2025

Mr. Josh Bowman
Battle Creek Public Schools
3 Van Buren Street West
Battle Creek, Michigan 49017

Re: **Report of Geotechnical Engineering Exploration**
Springfield MS Tennis Courts
1023 Avenue A
Springfield, Michigan
Patriot Project No.: 25-1504-15G

Dear Josh:

Attached is the report of our geotechnical engineering exploration for the above referenced project. This exploration was completed in general accordance with our Proposal No. 25-1504-15G dated September 18. 2025.

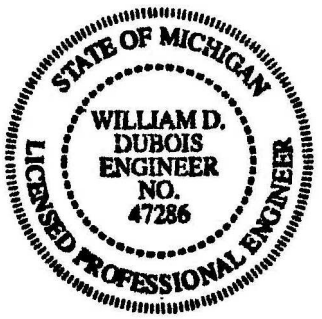
This report includes detailed and graphic logs of five (5) soil borings and three (3) pavement cores drilled at the proposed project site. Also included in the report are the results of laboratory tests performed on samples obtained from the site, and geotechnical recommendations pertinent to the site development, foundation design, and construction.

We appreciate the opportunity to perform this geotechnical engineering investigation and are looking forward to working with you during the construction phase of the project. If you have any questions regarding this report or if we may be of any additional assistance regarding any geotechnical aspect of the project, please do not hesitate to contact our office.

Respectfully submitted,
Patriot Engineering, PC

Mark Jonard, P.E.
Project Engineer

William D. Dubois, P.E.
Senior Principal Engineer



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REPORT OF GEOTECHNICAL ENGINEERING EXPLORATION

Springfield MS Tennis Courts
1023 Avenue A
Springfield, Michigan
Patriot Project No.: 25-1504-15G

1.0 INTRODUCTION

1.1 General

Battle Creek Public Schools, in conjunction with AR Engineering, is planning the construction of a demolition of existing and construction of new tennis courts located at Springfield Middle School near Battle Creek, Michigan. The results of our geotechnical engineering exploration for the project are presented in this report.

1.2 Purpose and Scope

The purpose of this investigation is to determine the general near surface and subsurface conditions within the project area and to develop the geotechnical engineering recommendations necessary for the design and construction of the proposed courts. This was achieved by drilling soil borings, and by conducting laboratory tests on samples taken from the borings. This report contains the results of our findings, an engineering interpretation of these results with respect to the available project information, and recommendations to aid in the design and construction of the proposed facility.

2.0 PROJECT INFORMATION

The project consists of a demolition of the existing tennis courts. Following, new tennis courts will be constructed inside the project area. Final location and quantity of tennis courts are unknown at this time, but will remain inside the footprint of the soil borings. Based on visual observations of the existing site, it is assumed that any grade raise fill to complete the construction of finished pavement subgrades will not exceed 2 feet above the existing ground surface.

3.0 SITE AND SUBSURFACE CONDITIONS

3.1 Site Conditions

The project site is located at the Springfield Middle School, southwest of the middle school building. The surrounding area is generally residential development. The topography in the area proposed for construction is generally flat with little variation in elevation between boring locations. A swale is located north of the tennis courts, and a berm to the east. Isolated trees are situated to the north and west sides of the tennis courts. Elevations are approximated through Google Earth Pro and verified with a handheld GPS.

3.2 General Subsurface Conditions

Our interpretation of the subsurface conditions is based upon five (5) soil borings drilled at the approximate locations shown on the Boring Location Map (Figure No. 2) in Appendix "A". All depths discussed below refer to depths below the existing ground surface. Based on the results of the soil borings completed at the site, the following subsurface profile is presented. A description of each general soil unit has been identified and is described below:

Topsoil, a surficial layer of material that is a blend of silts, sands, and clays, with varying amounts of organic matter, was encountered at the ground surface at all five (5) boring locations. The topsoil layer was about 10 to 11 inches thick in the borings.

Below the surficial layer, brown, slightly moist, very loose to medium dense, sand was encountered to the boring termination depth of 10 feet below the ground surface. Standard Penetration Test N-values in the sand layer varied between 4 and 16 blow per foot (bpf), with an average of 9 bpf.

The soil conditions described above are general, and some variations in the descriptions should be expected; for more specific information, please refer to the boring logs presented in Appendix "A". It should be noted that the dashed stratification lines shown on the soil boring logs indicate approximate transitions between soil types. In-situ stratification changes could occur gradually or at different depths.

As previously mentioned, very loose sand was encountered in one (1) of the five (5) borings, at a depth up to 3.5 feet below the existing ground surface. The following table presents the extent of the unsuitable soils encountered in the borings:

Table No. 1: Summary of Unsuitable Soils Encountered in Borings

Boring Number	Soil Classification	Approximate Depth of Unsuitable Soils (feet)[1]
B-4	Very Loose Sand (SP-SM)	0 to 3.5

[1] Represents depth below existing ground surface.

3.3 Pavement Cores

In addition to soil borings, several pavement cores were taken inside the tennis courts at locations provided by the client. Thickness of each pavement core is recorded below:

Table No. 2: Summary of Pavement Thickness

Core Location	Asphalt Thickness (in)	Aggregate Base Present?
C-1	3.0	Yes
C-2	3.0	Yes
C-3	3.0	Yes

3.4 Groundwater Conditions

The term groundwater pertains to any water that percolates through the soil found on site. This includes any overland flow that permeates through a given depth of soil, perched water, and water that occurs below the “water table”, a zone that remains saturated and water-bearing year-round.

Groundwater was not observed during drilling, nor upon completion of drilling activities. It should be recognized that fluctuations in the groundwater level should be expected over time due to variations in rainfall and other environmental or physical factors. ***The true static groundwater level can only be determined through observations made in cased holes over a long period of time, the installation of which was beyond the scope of this investigation.***

4.0 DESIGN RECOMMENDATIONS

4.1 Basis

Our recommendations are based on data presented in this report, which include soil borings, laboratory testing, and our experience with similar projects. Subsurface variations that may not be indicated by a dispersive exploratory boring program can exist on any site. If such variations or unexpected conditions are encountered during construction, or if the project information is incorrect or changed, we should be informed immediately since the validity of our recommendations may be affected.

4.2 Tennis Courts

As previously mentioned, very loose sand was encountered in Boring B-4 from a depth of about 0 to 3.5 feet below existing grade. ***If these very loose sands or other unsuitable materials are encountered at the pavement subgrade, they must be undercut and replaced with well-compacted structural fill or improved in-place prior to construction of pavements.***

Provided the above recommendations are followed, the near surface or shallow subgrade soils encountered, which generally consist of loose and medium dense sands, are suitable for pavement support, if properly prepared.

If construction is performed during a wet or cold period, the contractor will need to exercise care during the grading and fill placement activities in order to achieve the necessary subgrade soil support for the pavement section (Refer to Section 5.0 "Construction Considerations"). The base soil for the pavement section will need to be firm and dry. The subgrade should be sloped properly in order to provide good base drainage. To minimize the effects of groundwater or surface water conditions, the base section for the pavement system should be sufficiently high above adjacent ditches and properly graded to provide pavement surface and pavement base drainage.

Based upon the near surface soils encountered in the borings, we recommend using a California Bearing Ratio (CBR) value of 4 for the design of flexible (hot mix asphalt (HMA)) pavement sections. It should be recognized though, that the recommended CBR value provided is based on empirical relationships only, and laboratory tests may determine higher allowable values.

Table No. 3: Tennis Court Flexible Pavement (Minimum Thickness)

Pavement Type	Asphalt Surface Course HMA 9.5 MM (inches)	Asphalt Base Course HMA 19 MM (inches)	Aggregate Base Course (inches)
HMA	1	2	6

Construction Considerations:

Because tennis court pavements are lightly loaded (little to no vehicular traffic), long-term performance of asphalt pavement tennis courts will be most influenced by materials and environmental factors such as surface drainage and pavement joints, aggregates and pavement material, the subgrade conditions and preparation, and the subsurface drainage conditions.

Subgrade preparation and as necessary grade raise fill requirements for the tennis courts should be in accordance with Sections 5.1 and 5.2, respectively. Surface preparation for application of the tennis court surface coating should be in accordance with the surface manufacturer's recommendations.

Chain link fence and tennis court net post foundations should be installed to a minimum depth of 36 inches below the surface. If vertical holes (foundation excavations) for the post foundations cannot be maintained until concrete placement due to sloughing, then the foundations should be formed with sonotubes or similar type casings to prevent a “mushrooming” effect near the ground surface. These procedures are recommended to prevent frost heaving of the concrete foundations which can lead to premature cracking of the concrete around the posts.

Drainage:

The tennis courts pavement system must be properly drained to reduce the potential for frost heaving and softening of the subgrade soil due to water infiltrating through cracks. The infiltrated water, if not properly drained, is expected to adversely affect the tennis courts’ performance. Where feasible, we recommend re-grading surrounding greenbelt areas to slope downward away from the tennis courts’ pavement surface to provide drainage away from the courts.

The tennis court subgrade should be sloped similar to the surface to encourage drainage of water that accumulates within the aggregate base. Additionally, we recommend installation of underdrains below the proposed tennis court pavement. We recommend the underdrains consist of a minimum of 6-inch diameter perforated plastic drainpipe, wrapped with a filter fabric (e.g. Mirafi® 140N or equivalent) and surrounded by 6 inches of a filter material, such as AASHTO #57 crushed stone wrapped with a filter fabric. The underdrains should be connected to a storm-sewer or daylighted to a drainage swale or basin.

5.0 CONSTRUCTION CONSIDERATIONS

5.1 Site Preparation

All areas that will support pavements or newly placed structural fill must be properly prepared. All loose surficial soil or "topsoil" and other unsuitable materials must be removed. Unsuitable materials include: frozen soil, relatively soft material, relatively wet soils, deleterious material, or soils that exhibit a high organic content. ***Additionally, all existing trees, under-brush and associated root-mass must also be completely removed within the proposed pavement areas prior to construction.***

Approximately 10 to 11 inches of loose surficial topsoil was encountered in the borings. The topsoil was measured at discrete locations as shown on the Boring Location Map (Figure No. 2) in Appendix "A". The topsoil thickness measured at the boring locations may or may not be representative of the overall average topsoil thickness at the site. More extensive stripping should be expected in swales and ravines as well as heavily wooded areas. Therefore, it is possible that the actual stripping depth could significantly vary from this data. The data presented should be viewed only as a guide to the minimum stripping depth that will be required to remove organic material at the surface. Additional field exploration by *Patriot* would be required to provide an accurate estimate of the stripping depth. This limited data indicates that a minimum stripping depth will be required to remove the organic material at the surface, followed by the potential for additional stripping and/or scarification and recompaction as may be required to achieve suitable subgrade support. ***Additionally, if saturated conditions exist with the surface soils, light tracked equipment could be required to avoid pushing organics deeper into the suitable subgrade soils.*** A *Patriot* representative should verify the stripping depth at the time grading operations occur.

Prior to construction of pavements or the placement of new structural fill, the exposed subgrade must be evaluated by a Patriot representative; which will include proofrolling of the subgrade. Proofrolling should consist of repeated passes of a loaded, pneumatic-tired vehicle such as a tandem-axle dump-truck or scraper. The proofrolling operations should be observed by a *Patriot* representative, and the proofrolling vehicle should be loaded as directed by *Patriot*. Any area found to rut, pump, or deflect excessively should be compacted in-place or, if necessary, undercut and replaced with structural fill, compacted as specified in Section 5.2 *"Structural Fill and Fill Placement Control"*.

Care must be exercised during grading and fill placement operations. ***The combination of heavy construction equipment traffic and excess surface moisture can cause pumping and deterioration of the near surface soils. The severity of this potential problem depends to a great extent on the weather conditions prevailing during construction.*** The contractor must exercise discretion when selecting equipment sizes and also make a concerted effort to control construction traffic and surface water while the subgrade soils are exposed. We recommend that heavy construction equipment (i.e. dump trucks, scrapers, etc.) be rerouted away from the pavement areas. If such problems do arise, the operations in the affected area should be halted and the *Patriot* representative contacted to evaluate the condition.

5.2 Structural Fill and Fill Placement Control

Structural fill, defined as any fill which will support structural loads, should be clean and free of organic material, debris, deleterious materials and frozen soils. Samples of the proposed fill materials should be tested prior to initiating the earthwork and backfilling operations to determine the classification, the natural and optimum moisture contents and maximum dry density and overall suitability as a structural fill. ***Structural fill should have a liquid limit less than 40 and a plasticity index less than 20.***

Structural fill supporting, around and over utilities should be compacted to at least 95 percent (%) of its maximum Modified Proctor dry density (ASTM D-1557) for utilities underlying structural areas (i.e. buildings, pavements, sidewalks, etc.). However, the minimum compaction requirement can be reduced for backfill around and over the utilities to 90 percent (%) of the maximum Standard Proctor dry density where utilities underlie greenbelt areas (i.e. grassy lawns, landscaping, etc.). It is recommended that a clean well-grade granular material be utilized as the bedding material, as well as the backfill material around and over the utility lines.

In cut areas, where pavement sections are planned, the upper 10 inches of subgrade should be scarified and compacted to a dry density of at least 95 percent (%) of the Modified Proctor maximum dry density (ASTM D-1557). Any grade-raise fill placed within 2 foot of the base of the pavement section should also be compacted to at least 95 percent (%) of the Standard Proctor maximum dry density. This can be reduced to 90 percent (%) for structural fill placed more than 2 foot below the base of the pavement section.

To achieve the recommended compaction of the structural fill, we suggest that the fill be placed and compacted in layers not exceeding 8 inches in loose thickness (the loose lift thickness should be reduced to 6 inches when utilizing small hand compactors) and within the range of 3 percentage (%) points below or above the optimum moisture content value. All fill placement should be monitored by a *Patriot* representative. ***Each lift should be tested for proper compaction at a frequency of at least one (1) test every 2,500 square feet (ft^2) per lift for the building areas, at least one (1) test every 10,000 square feet (ft^2) per lift for the parking and roadway areas, and at a frequency of at least one (1) test for every 50 lineal feet of utility installation*.**

5.3 Groundwater Considerations

Groundwater was not encountered in the borings during drilling activities. However, localized and sporadic groundwater infiltration may occur into excavations depending on seasonal conditions. Groundwater inflow into shallow excavations **above** the groundwater table is expected to be adequately controlled by conventional methods such as gravity drainage and/or pumping from sumps. More significant inflow can be expected in deeper excavations **below** the groundwater table requiring more aggressive dewatering techniques, such as well or wellpoint systems. For groundwater to have minimal effects on the construction, foundation excavations should be constructed and poured in the same day, if possible.

6.0 INVESTIGATIONAL PROCEDURES

6.1 Field Work

A total of five (5) soil borings and three (3) pavement cores were drilled, sampled, and tested at the project site between September 30 and October 1, 2025 at the approximate locations shown on the Boring Location Map (Figure No. 2) in Appendix “A”. The depths that the soil borings were advanced to are shown on the Boring Logs in Appendix “A”. The

soil borings were drilled to depths 10 feet in the proposed tennis court area. All depths are given as feet below the existing ground surface.

The borings were advanced using 3¼ inch inside diameter hollow-stem augers. Samples were recovered in the undisturbed material below the bottom of the augers using the standard drive sample technique in accordance with ASTM D 1586-74. A 2 inch outside diameter by $1^3/_8$ inch inside diameter split-spoon sampler was driven a total of 18 inches with the number of blows of a 140 pound hammer falling 30 inches recorded for each 6 inches of penetration. The sum of blows for the final 12 inches of penetration is the Standard Penetration Test result commonly referred to as the N-value (or blow-count). Split-spoon samples were recovered at 2.5 feet intervals, beginning at a depth of 1 foot below the existing surface grade, extending to a depth of 10 feet, and at 5 feet intervals thereafter to the termination of the boring.

Water levels were monitored at each borehole location during drilling and upon completion of the boring. The boreholes were backfilled with auger cuttings and boring performed in pavement areas were patched prior to demobilization for safety considerations.

Upon completion of the boring program, all of the samples retrieved during drilling were returned to *Patriot*'s soil testing laboratory where they were visually examined and classified. A laboratory-generated log of each boring was prepared based upon the driller's field log, laboratory test results, and our visual examination. Test boring logs and a description of the classification system are included in Appendix "A" in this report. Indicated on each log are: the primary strata encountered, the depth of each stratum change, the depth of each sample, the Standard Penetration Test results, groundwater conditions, and selected laboratory test data. The laboratory logs were prepared for each boring giving the appropriate sample data and the textural description and classification.

6.2 Laboratory Testing

Representative samples recovered in the borings were selected for testing in the laboratory to evaluate their physical properties and engineering characteristics. Laboratory analysis included: natural moisture content determinations (ASTM D 2216) and an estimate of the unconfined compressive strength (q_u) of the cohesive soil samples utilizing a calibrated hand penetrometer (q_p) were obtained. The results of laboratory tests are summarized in Section 3.2 *"General Subsurface Conditions"*. Soil descriptions on the boring logs are in accordance with the Unified Soil Classification System (USCS).

APPENDIX A

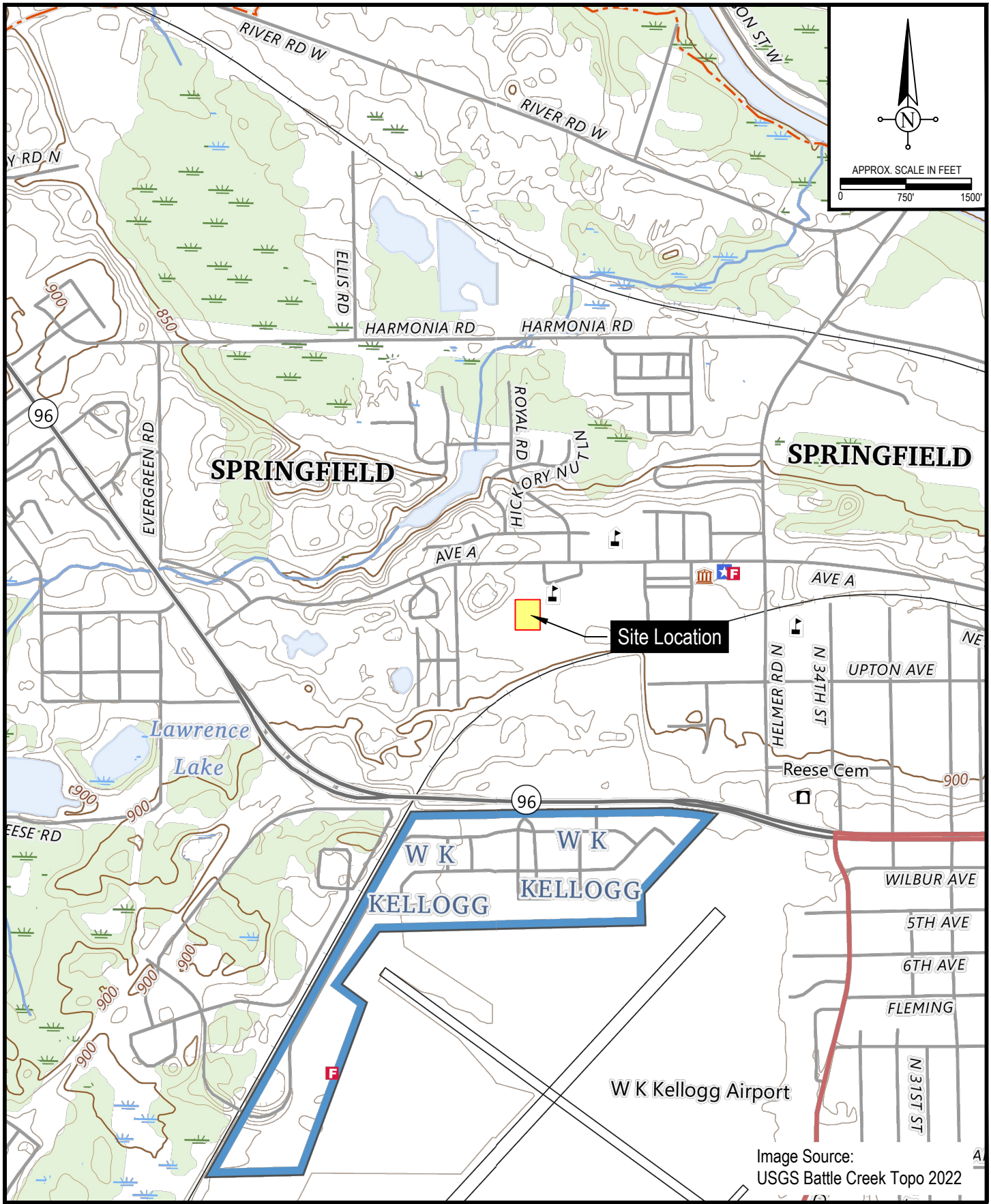
SITE VICINITY MAP (FIGURE NO. 1)

BORING LOCATION MAP (FIGURE NO. 2)

BORING LOGS

BORING LOG KEY

UNIFIED SOIL CLASSIFICATION SYSTEM (USCS)



PATRIOT ENGINEERING, PC

Project: Springfield MS Tennis Courts
1023 Avenue A
Springfield, Michigan

	Drawn By: J. DuMond
Project Number:25-1504-15	Approved: M. Jonard
Date: October 2, 2025	DWG: 25-1504-15_geo

Figure 1

Site Vicinity Map

PATRIOT ENGINEERING, PC

NOTES:
1. Boring locations were staked by PATRIOT. All locations are shown as approximate.
2. All locations were determined in the field with references to existing landmarks.
3. Image Source: Google Earth
4. Scale as shown.

Project: Springfield MS Tennis Courts
1023 Avenue A
Springfield, Michigan

	Drawn By: J. DuMond
Project Number: 25-1504-15	Approved: M. Jonard
Date: October 2, 2025	DWG: 25-1504-15_geo

Figure 2

Soil Boring Location Map

PATRIOT ENGINEERING, PC

LOG OF BORING B-1

Springfield MS Tennis Courts
1023 Avenue A
Springfield, Michigan

Client Name	: AR Engineering	Driller	: E. Thomas
Project Number	: 25-1504-15G	Sampling	: Splitspoon
Logged By	: E. Bergel	Approx. Elevation	: +/- 895 feet
Start Date	: 09/29/2025	Latitude	: 42.3252442
Drilling Method	: HSA	Longitude	: -85.2489864

Water Levels
- During Drilling - Dry
- After Completion - Dry
- After 24 Hours - N/A

Depth (Feet)	Elevation (Feet) 895	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0	895				TOPSOIL (10")						
			SP-SM		Brown, slightly moist, medium dense, fine to medium grained, SAND with trace silt and trace gravel	1	56	3/5/6			
5	890		SP-SM		Brown, slightly moist, loose, fine to medium grained, SAND with trace silt and trace gravel	2	78	4/4/4			
			SP-SM		Brown, slightly moist, medium dense, fine to medium grained, SAND with trace silt and trace gravel	3	78	5/6/5			Boring caved to 8 feet upon auger removal.
						4	100	12/8/7			
10	885				Boring terminated at 10 feet.						Groundwater was not encountered during drilling, nor upon completion.
15											

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PATRIOT ENGINEERING, PC

LOG OF BORING B-2

Springfield MS Tennis Courts
1023 Avenue A
Springfield, Michigan

Client Name	: AR Engineering	Driller	: E. Thomas
Project Number	: 25-1504-15G	Sampling	: Splitspoon
Logged By	: E. Bergel	Approx. Elevation	: +/- 895 feet
Start Date	: 09/29/2025	Latitude	: 42.3249348
Drilling Method	: HSA	Longitude	: -85.2494861

Water Levels
- During Drilling - Dry
- After Completion - Dry
- After 24 Hours - N/A

Depth (Feet)	Elevation (Feet) 895	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0	895				TOPSOIL (11")						
			SP-SM		Brown, slightly moist, loose, fine to medium grained, SAND with trace silt and trace gravel	1	78	3/2/4			
						2	67	3/4/4			
5	890					3	89	5/4/3			
			SP-SM		Brown, slightly moist, medium dense, fine to medium grained, SAND with trace silt and trace gravel	4	78	6/6/7			Boring caved to 9 feet upon auger removal.
10	885				Boring terminated at 10 feet.						Groundwater was not encountered during drilling, nor upon completion.
15											

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PATRIOT ENGINEERING, PC

LOG OF BORING B-3

Springfield MS Tennis Courts
1023 Avenue A
Springfield, Michigan

Client Name	: AR Engineering	Driller	: E. Thomas
Project Number	: 25-1504-15G	Sampling	: Splitspoon
Logged By	: E. Bergel	Approx. Elevation	: +/- 895 feet
Start Date	: 09/29/2025	Latitude	: 42.3249050
Drilling Method	: HSA	Longitude	: -85.2489017

Water Levels
- During Drilling - Dry
- After Completion - Dry
- After 24 Hours - N/A

Depth (Feet)	Elevation (Feet)	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0					TOPSOIL (11")						
			SP-SM		Brown, slightly moist, medium dense, fine to medium grained, SAND and GRAVEL with trace silt	1	100	5/7/9			
			SP-SM		Brown, slightly moist, loose, fine to medium grained, SAND with trace silt and trace gravel	2	78	2/2/3			
5			SP-SM			3	56	4/6/4			Boring caved to 8 feet upon auger removal.
						4	67	3/2/4			
10					Boring terminated at 10 feet.						Groundwater was not encountered during drilling, nor upon completion.
15											

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PATRIOT ENGINEERING, PC

LOG OF BORING B-4

Springfield MS Tennis Courts
1023 Avenue A
Springfield, Michigan

Client Name	: AR Engineering	Driller	: E. Thomas
Project Number	: 25-1504-15G	Sampling	: Splitspoon
Logged By	: E. Bergel	Approx. Elevation	: +/- 895 feet
Start Date	: 09/30/2025	Latitude	: 42.3243629
Drilling Method	: HSA	Longitude	: -85.2494835

Water Levels
- During Drilling - Dry
- After Completion - Dry
- After 24 Hours - N/A

Depth (Feet)	Elevation (Feet) 895	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0	895				TOPSOIL (11")						
			SP-SM		Brown, slightly moist, very loose, fine to medium grained, SAND with trace silt and trace gravel	1	78	2/2/2			
			SP-SM		Dark brown, slightly moist, loose, fine to medium grained, SAND with trace silt, trace gravel and trace plant roots	2	89	3/4/3			
5	890		SP-SM		Brown, slightly moist, loose, fine to medium grained, SAND with trace silt and trace gravel	3	89	4/4/5			Boring caved to 7.5 feet upon auger removal.
			SP-SM		Brown, slightly moist, medium dense, fine to medium grained, SAND with trace silt and trace gravel	4	56	7/8/7			
10	885				Boring terminated at 10 feet.						Groundwater was not encountered during drilling, nor upon completion.
15											

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PATRIOT ENGINEERING, PC

LOG OF BORING B-5

Springfield MS Tennis Courts
1023 Avenue A
Springfield, Michigan

Client Name	: AR Engineering	Driller	: E. Thomas
Project Number	: 25-1504-15G	Sampling	: Splitspoon
Logged By	: E. Bergel	Approx. Elevation	: +/- 895 feet
Start Date	: 09/30/2025	Latitude	: 42.3241991
Drilling Method	: HSA	Longitude	: -85.2489260

Water Levels
- During Drilling - Dry
- After Completion - Dry
- After 24 Hours - N/A

Depth (Feet)	Elevation (Feet) 895	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0	895				TOPSOIL (10")						
			SP-SM		Brown, slightly moist, loose, fine to medium grained, SAND with trace silt and trace gravel	1	89	3/3/3			
						2	67	2/4/5			
5	890					3	78	2/3/3			Boring caved to 8 feet upon auger removal.
			SP-SM		Brown, slightly moist, medium dense, fine to medium grained, SAND with trace silt and trace gravel	4	56	8/6/7			
10	885				Boring terminated at 10 feet.						Groundwater was not encountered during drilling, nor upon completion.
15											

10-03-2025 C:\Users\mjonard\Patriot Engineering\GEO - Documents\Mtech\2025 Mtech\1504-15G\b5.bor

BORING LOG KEY

UNIFIED SOIL CLASSIFICATION SYSTEM (USCS)
FIELD CLASSIFICATION SYSTEM
FOR SOIL EXPLORATION

NON-COHESIVE SOILS
(Silt, Sand, Gravel, and Combinations)

Density	Field Identification (SPT Blows/ft)
Very Loose	0 - 4
Loose	5 - 10
Medium Dense	11 - 30
Dense	31 - 50
Very Dense	> 51

Grain Size Terminology

Soil Fraction	Particle Size	US Standard Sieve Size
Boulders	> 12 inches	> 12 inches
Cobbles	3 - 12 inches	3 - 12 inches
Gravel: Coarse	¾ - 3 inches	¾ - 3 inches
Small	4.76 mm - ¾ inch	No. 4 - ¾ inches
Sand: Coarse	2.00 - 4.76 mm	No. 10 - No. 4
Medium	0.42 - 2.00 mm	No. 40 - No. 10
Fine	0.074 - 0.42 mm	No. 200 – No. 40
Silt	0.005 - 0.074 mm	< No. 200
Clay	< 0.005 mm	< No. 200

RELATIVE PROPORTIONS FOR SOILS

Descriptive Term	Percent
Trace	1 - 10
Little	11 - 20
Some	21 - 35
And	36 - 50

COHESIVE SOILS
(Clay, Silt and Combinations)

Consistency	Unconfined Compressive Strength (tons/ft^2)	Field Identification (SPT Blows/ft)
Very Soft	Less than 0.25	0 - 2
Soft	0.25 – < 0.5	3 - 4
Medium Stiff	0.5 - < 1.0	5 - 8
Stiff	1.0 - < 2.0	9 -15
Very Stiff	2.0 - < 4.0	16 - 30
Hard	Over 4.0	> 30

Classification: Provided on Boring Logs are made by visual inspection.

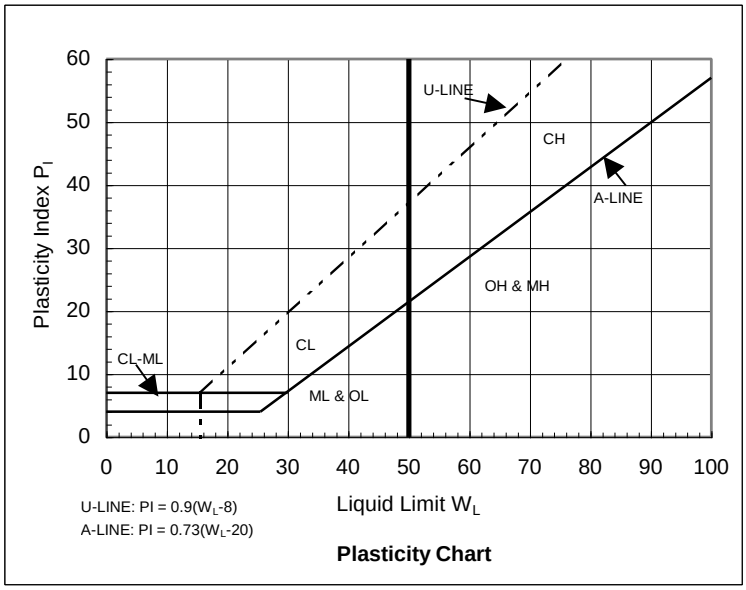
Standard Penetration Test: Driving a 2 inch outer-diameter (O.D.) by 1⅜ inch inner-diameter (I.D.) split-spoon sampler a total of 18 inches into undisturbed soil with the number of blows of a 140 pound hammer free-falling a distance of 30 inches recorded for each 6 inches of penetration. The sum of blows for the final 12 inches of penetration is the Standard Penetration Test result commonly referred to as the "N"-value (or blow-count).

Strata Changes: In the column "Descriptions" on the Boring Logs the horizontal lines represent strata changes. A solid line (———) represents an observed change, a dashed line (- - - - -) represents an estimated change.

Groundwater: Observations were made at the times indicated on the Boring Logs. Fluctuations in the groundwater level should be expected over time due to variations in rainfall and other environmental or physical factors. *Groundwater symbols*: (▼)-observed groundwater level and/or elevation during drilling; (∇)-observed groundwater level and/or elevation upon completion of boring.

Unified Soil Classification System (USCS)

Major Divisions			Group Symbol	Typical Names	Classification Criteria for Coarse-Grained Soils		
Coarse-grained soils (more than half of material is larger than No. 200)	Gravels (more than half of coarse fraction is larger than No. 4 sieve size)	Clean gravels (little or no fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines	$C_U \geq 4$ $1 \leq C_C \leq 3$	$C_U = \frac{D_{60}}{D_{10}}$	$C_C = \frac{D^2_{30}}{D_{10} D_{60}}$
			GP	Poorly graded gravels, gravel-sand mixtures, little or no fines	Not meeting all gradation requirements for GW ($C_U < 4$ or $1 > C_C > 3$)		
		Gravels with fines (appreciable amount of fines)	GM $\frac{d}{u}$	Silty gravels, gravel-sand-silt mixtures	Atterberg limits below A line or $P_I < 4$	Above A line with $4 < P_I < 7$ are borderline cases requiring use of dual symbols	
			GC	Clayey gravels, gravel-sand-clay mixtures	Atterberg limits above A line or $P_I > 7$		
	Sands (more than half of coarse fraction is smaller than No. 4 sieve size)	Clean sands (little or no fines)	SW	Well-graded sands, gravelly sands, little or no fines	$C_U \geq 6$ $1 \leq C_C \leq 3$	$C_U = \frac{D_{60}}{D_{10}}$	$C_C = \frac{(D_{30})^2}{D_{10} D_{60}}$
			SP	Poorly graded sands, gravelly sands, little or no fines	Not meeting all gradation requirements for SW ($C_U < 6$ or $1 > C_c > 3$)		
		Sands with fines (appreciable amount of fines)	SM $\frac{d}{u}$	Silty sands, sand-silt mixtures	Atterberg limits below A line or $P_I < 4$	Limits plotting in hatched zone with $4 \leq P_I \leq 7$ are borderline cases requiring use of dual symbols	
			SC	Clayey sands, sand-clay mixtures	Atterberg limits above A line with $P_I > 7$		
Fine-grained soils (more than half of material is smaller than No. 200)	Silt and clays (liquid limit <50)		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity	1. Determine percentages of sand and gravel from grain size curve. 2. Depending on percentages of fines (fraction smaller than 200 sieve size), coarse-grained soils are classified as follows: Less than 5% - GW, GP, SW, SP More than 12% - GM, GC, SM, SC 5-12% - Borderline cases requiring dual symbols		
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays			
			OL	Organic silts and organic silty clays of low plasticity			
	Silts and clays (liquid limit >50)		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts			
			CH	Inorganic clays or high plasticity, fat clays			
			OH	Organic clays of medium to high plasticity, organic silts			
	Highly organic soils		PT	Peat and other highly organic soils			



Plasticity Chart

APPENDIX B

GENERAL QUALIFICATIONS

STANDARD CLAUSE FOR UNANTICIPATED SUBSURFACE CONDITIONS

GENERAL QUALIFICATIONS

of Patriot Engineering's Geotechnical Engineering Investigation

This report has been prepared at the request of our client for his use on this project. Our professional services have been performed, findings obtained, and recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices. This warranty is in lieu of all other warranties either expressed or implied.

The scope of our services did not include any environmental assessment or investigation for the presence or absence of wetlands, hazardous or toxic materials in the soil, groundwater, or surface water within or beyond the site studied. Any statements in this report or on the test borings logs regarding vegetation types, odors or staining of soils, or other unusual conditions observed are strictly for the information of our client and the owner.

This report may not contain sufficient information for purposes of other parties or other uses. This company is not responsible for the independent conclusions, opinions or recommendations made by others based on the field and laboratory data presented in this report. Should there be any significant differences in structural arrangement, loading or location of the structure, our analysis should be reviewed.

The recommendations provided herein were developed from the information obtained in the test borings, which depict subsurface conditions only at specific locations. The analysis, conclusions, and recommendations contained in our report are based on site conditions as they existed at the time of our exploration. Subsurface conditions at other locations may differ from those occurring at the specific drill sites. The nature and extent of variations between borings may not become evident until the time of construction. If, after performing on-site observations during construction and noting the characteristics of any variation, substantially different subsurface conditions from those encountered during our explorations are observed or appear to be present beneath excavations, we must be advised promptly so that we can review these conditions and reconsider our recommendations where necessary.

If there is a substantial lapse of time between the submission of our report and the start of work at the site, or if conditions have changed due to natural causes or construction operations at or adjacent to the site, we urge that our report be reviewed to determine the applicability of the conclusions and recommendations considering the changed conditions and time lapse.

We urge that Patriot be retained to review those portions of the plans and specifications that pertain to earthwork and foundations to determine whether they are consistent with our recommendations. In addition, we are available to observe construction, particularly the compaction of structural backfill and preparation of the foundations, and such other field observations as may be necessary.

In order to fairly consider changed or unexpected conditions that might arise during construction, we recommend the following verbiage (Standard Clause for Unanticipated Subsurface Conditions) be included in the project contract.

STANDARD CLAUSE FOR UNANTICIPATED SUBSURFACE CONDITIONS

"The owner has had a subsurface exploration performed by a soils consultant, the results of which are contained in the consultant's report. The consultant's report presents his conclusions on the subsurface conditions based on his interpretation of the data obtained in the exploration. The contractor acknowledges that he has reviewed the consultant's report and any addenda thereto, and that his bid for earthwork operations is based on the subsurface conditions as described in that report. It is recognized that a subsurface exploration may not disclose all conditions as they actually exist and further, conditions may change, particularly groundwater conditions, between the time of a subsurface exploration and the time of earthwork operations. In recognition of these facts, this clause is entered in the contract to provide a means of equitable additional compensation for the contractor if adverse unanticipated conditions are encountered and to provide a means of rebate to the owner if the conditions are more favorable than anticipated.

At any time during construction operations that the contractor encounters conditions that are different than those anticipated by the soils consultant's report, he shall immediately (within 24 hours) bring this fact to the owner's attention. If the owner's representative on the construction site observes subsurface conditions which are different than those anticipated by the consultant's report, he shall immediately (within 24 hours) bring this fact to the contractor's attention. Once a fact of unanticipated conditions has been brought to the attention of either the owner or the contractor, and the consultant has concurred, immediate negotiations will be undertaken between the owner and the contractor to arrive at a change in contract price for additional work or reduction in work because of the unanticipated conditions. The contract agrees that the following unit prices would apply for additional or reduced work under the contract. For changed conditions for which unit prices are not provided, the additional work shall be paid for on a time and materials basis."

Another example of a changed conditions clause can be found in paper No. 4035 by Robert F. Borg, published in ASCE Construction Division Journal, No. CO2, September 1964, page 37.

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