CITY OF RAYMORE
100 Municipal Circle · Raymore, MO. 64083
Phone · 816-892-3045 · Fax · 816-892-3093

ADDENDUM NO. 1
T.B. Hanna Station - Site Work
Project #19-276-203

All plan holders are hereby notified and agree by signature below, that the proposal includes consideration of the following changes, amendments, and/or clarifications and costs associated with these changes and are included in the proposal.

Addendum No. 1 - Question and clarification.

QUESTIONS

1. Question: What is the new electrical service size between the existing power pole and Station House (storage building)? What is the conduit size preferred?

Response: The electrical needs of the existing renovation will be less than the previous house requirements. Please match the existing wire size to the demoed overhead line. Install wire with appropriately sized conduit down the power pole, underground at a depth of at least 18-inches and up building façade into the existing electric meter.

2. Question: What is the connection point to the electrical power junction boxes behind the new retaining wall?

Response: Connect the junction boxes to the electric panel mounted at the base of the electric power pole.

3. Question: May we receive a copy of the site geotechnical report?

Response: Attached.

4. Question: Do we need to remove the gas connection and meter at the Station House (storage building)?

Response: No.

5. Question: Can a contractor bid only specific bid items?

Response: This is a single contract and successfully completed bids needed to include all scopes filling in all totals for the base bid on Form E. As described in Proposal Form D "Bidder hereby proposed and agrees to furnish all labor, tools, materials and supplies to successfully complete all requirements defined in City Project No. 19-276-203– TB Hanna Station Site Work**.**

6. Question: What are the permit fees?

Response: This is a City project, no fee permits

CLARIFICATION

1. Site work concept view: Attached

2. Clarification: The Sanitary Sewer lines for the prefab bathroom will stop at 6' from the building line. See attached Sheet C300.

3. Revise Anticipated Scope of Services, Item B:

Within the Anticipated Scope of Services Item "B. Prefab building site preparation" **DELETE** the first bullet in its entirety and **SUBSTITUTE** with the following:

- Construct concrete building footing per sheet C501 to an elevation 8-inches below finished floor elevation. Install sleeves for 2", 4" and 6" sewer lines and potable water line. Install sleeve for electrical feed into building. Also see Addendum #1, Exhibit #1 for further direction. Fill building sub base area within the footing perimeter with engineered fill or native soil compacted to 95% modified proctor density to a maximum of 2-inches below the top of footing.

Within the Anticipated Scope of Services Item "B. Prefab building site preparation" **ADD** the following bullets:

- Public Restroom Company installers will provide water and sewer piping from 6-foot building line through footing to prefab building connection points. Public Restrooms installers will provide electrical conduit from 6-foot line through footing through floor area below electrical panel. After Public Restrooms Company installers have set the prefab building, contractor shall connect all utilities at the 6-foot building line. Contractor to pull electrical and connect power to prefab building electric panel.

4. Revise Anticipated Scope of Services, Item C:

Within the Anticipated Scope of Services Item "C. Sprayground Site Preparation" **ADD** the following bullets:

- Sprayground contractor will install all plumbing, electrical lines, drain lines, trench backfill and concrete footings for feature embeds. Coordinate timing with site preparation.
- Install the 8-inch clean compacted aggregate as detailed on drawing P500, detail #3.

5. Revise Anticipated Scope of Services, Item F:

Within the Anticipated Scope of Services Item "F. Earthwork, Grading, Site Concrete including walks and retaining wall" **ADD** the following bullet:

- Install 6-inch thick sprayground concrete pad per drawing C100 and as detailed on drawing P500, detail #3 with the 18-inch thickened edge.

6. Revise Anticipated Scope of Services:

Within the Anticipated Scope of Services, **ADD** Article XII. 'Schedule of Alternatives'

- Alternate 1 – Electrical Connection between the shelter and refrigeration units: Contractor to provide electrical power connection from the single phase, 200 amp service panel box mounted to the NW shelter support to the location recommended location for the two refrigeration units within the landscaped area, northwest of the existing drinking fountain. The scope includes sawcutting, removal of concrete, installation of conduit with electrical wire a minimum of 18-inches deep, and concrete patching as needed. Boring is acceptable. The refrigeration units will be located about 35 linear feet from the panel box with about 25 feet of concrete pavement between the two locations. Stub conduit out of ground 24-inches. Once the refrigeration units have been installed, electrical contractor will connect power to the power panels of each refrigeration unit using flexible conduit.

7. Revised Bid Proposal Form E - Attached.

Any other questions regarding this proposal shall be submitted to Kim Quade, CPPB by email at kquade@raymore.com or by phone at (816) 892-3045. There will be no questions allowed after April 22nd, 2019 at 5 p.m.

I hereby certify that the above have been considered and associated costs have been included in this bid.

Company Name: ____

By: ____

Title: ____

Address: ____

City, State, Zip: ____

Date: ____________________ Phone: _______________________

Signature of Bidder: ____

ADDENDUM MUST BE SUBMITTED WITH BID

REVISED BID PROPOSAL FORM E – Project No. 19-276-203

T.B. Hanna Station Site Work

Bid Items	Units	Estimated Quantities	$/Units	Total
Site demo and erosion control				$
Prefab building site preparation				$
Sprayground site preparation				$
Playground site preparation				$
Earthwork, grading, site concrete including walks and retaining wall				$
Site Electrical				$
Landscaping				$
Mobilization, Bonds and Insurance (not to exceed 5%)				$
Site Improvements BASE BID				$

Total Bid for Site Improvements
Number: 19-276-203

$____
In blank above insert numbers for the sum of the bid.

($____)

In blank above write out the sum of the bid.

ALTERNATE #1

The undersigned Bidder proposes the amount below be added to the Base Bid if particular alternates are accepted by Owner. Amounts listed for each alternate include costs of related coordination, modification, or adjustment.

The City of Raymore, in its sole discretion, may include any, all or none of the Alternates in determining the lowest and best bid. In determining the lowest and best Bid, the City of Raymore may include the Alternates in any combination and in any order or priority or choose none of the Alternates. The City of Raymore may make this determination at any time after the bid closing and prior to Contract award. The City of Raymore will act in the best interest of the City of Raymore in determining whether to include any, all or none of the Alternates and the combination and priority of any Alternates selected. If additional funding becomes available after Contract award, the City of Raymore may add any or all of the Alternates to the Contract by change order.

Electrical connection between the shelter and two real ice rink refrigeration units.

____ Dollars ($__________).

Electrical Contractor: ______________________________

BID PROPOSAL FORM E – RFP 19-276-203
CONTINUED

Company Name ______________________________

By ____
Authorized Person's Signature

____
Print or type name and title of signer

Company Address ____________________________

____

____

Phone _______________________________________

Fax ____

Email _______________________________________

Date ____

ADDENDA
Bidder acknowledges receipt of the following addendum:

Addendum No. ____

Addendum No. ____

Addendum No. ____

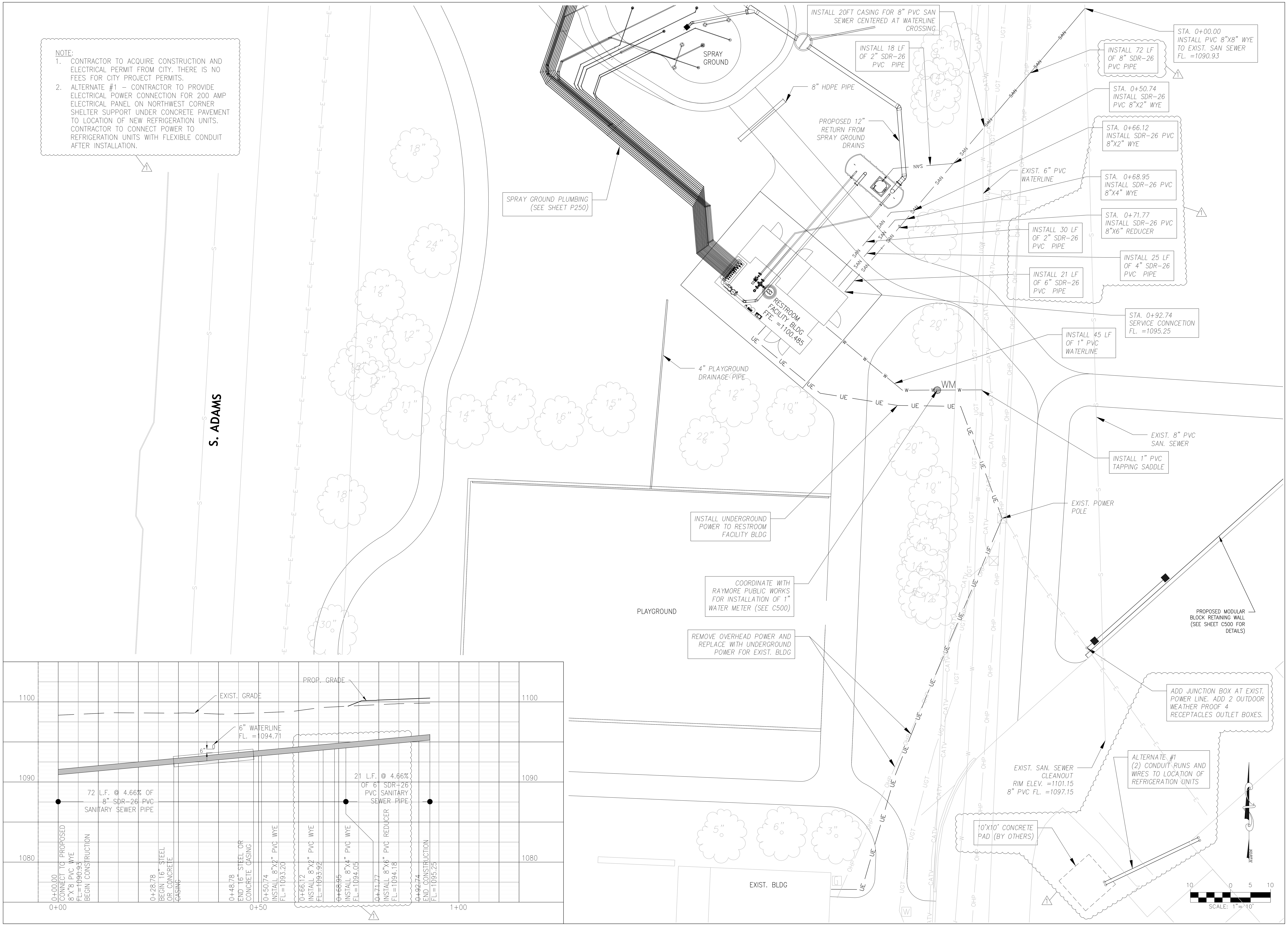
Addendum No. ____

Addendum No. ____

Addendum No. ____

<u>LATE BIDS CANNOT BE ACCEPTED!</u>


W. MAPLE
SPRAY GROUND
FARMER'S MARKET
S. ADAMS
RESTROOM / CONCESSIONS
RR
RR
PUMP ROOM
PLAYGROUND
S. WASHINGTON
THE DEPOT
(Winter Ice Rink)
STATION HOUSE
40' 0 20' 40' 80'
W. OLIVE



CFS ENGINEERS
cfse.com

TODD R. POLK
NUMBER E-2001018789
4/17/2019
PROFESSIONAL ENGINEER

Mark	Description	Date
1	Addendum #1	4/17/19

Designed by: TRP
Dwn by: EJD
Ckd by: TRP
Submitted by: TRP
Date: 4/17/19
Reviewed by:
Plot scale: 1"=10'
File name: 185073-SH-UTILITY PLAN.dwg
Plot date: 4/17/19

T.B. HANNA STATION PARK
RAYMORE, MISSOURI
Park Improvements

UTILITY PLAN

Sheet reference number:
C300

Intertek-PSI
1211 W. Cambridge Circle Drive
Kansas City, Kansas 66103

Tel +1 913 310 1600
Fax +1 913 310 1601
intertek.com/building

May 14, 2018

Mr. Steve Rulo
City of Raymore, Missouri
100 Municipal Circle
Raymore, Missouri 64083

Re: **Geotechnical Engineering Services Report**
TB Hanna Station Park Project
214 South Washington Street
Raymore, Missouri
PSI Project Number: 03381732

Dear Mr. Rulo:

Thank you for choosing Professional Service Industries, Inc. (PSI), an Intertek company, as your consultant for the TB Hanna Station Park project in Raymore, Missouri. Per your authorization, PSI has completed a geotechnical engineering study for the referenced project. The results of the study are discussed in the accompanying report, two copies of which are enclosed.

Should there be questions pertaining to this report, please contact our office at (913) 310-1600. PSI would be pleased to continue providing geotechnical services throughout the implementation of the project, and we look forward to working with you and your organization on this and future projects.

Respectfully submitted,
Professional Service Industries, Inc.

AJ Rahman
Department Manager
Geotechnical Services

Kelly E. Rotert, PE, DBIA
Vice President

Distribution: (2 hard copies, 1 copy via email)

Geotechnical Services Report
TB Hanna Station Park Project
214 S. Washington Street
Raymore, Missouri
PSI Report No. 03381732
May 14, 2018

Geotechnical Engineering Services Report

for the
T.B. Hanna Station Park Project
214 South Washington Street
Raymore, Missouri

Prepared for

City of Raymore, MO
100 Municipal Circle
Raymore, Missouri 64083

Prepared by

Professional Service Industries, Inc.
1211 West Cambridge Circle Drive
Kansas City, Kansas 66103

May 14, 2018

Intertek-PSI Project 03381732

intertek psi

STATE OF MISSOURI
IAN SUTHERLAND
NUMBER
PE-2018013641
PROFESSIONAL ENGINEER

5-14-18

Ian M. Sutherland, P.E.
Staff Engineer
Geotechnical Services
License No. PE-2018013641
Expires 12/31/18

for: **Reviewed by:**
Kelly E. Rotert
Vice President

The above Professional Engineering Seal and signature is an electronic reproduction of the original seal and signature. An original hard copy was sent to the client listed on this document. This electronic reproduction shall not be construed as an original or certified document.

TABLE OF CONTENTS

LIST OF APPENDICES

PROJECT INFORMATION

Project Authorization

The following table summarizes, in chronological order, the Project Authorization History for the services performed and represented in this report by Professional Service Industries, Inc. (PSI).

PROJECT TITLE: TB HANNA STATION PARK PROJECT		
Document and Reference Number	**Date**	**Requested/Provided By**
Request for Proposal	4/15/18	Mr. Jim Schuessler of CFS Engineers
PSI Proposal Number: 33823883	4/15/18	Mr. AJ Rahman and Mr. Kelly Rotert of PSI
Notice to Proceed	4/4/18	Mr. Nathan Musteen with the City of Raymore, Missouri

Project Description

PSI understands that the project includes the construction of a new restroom building and children's spray ground at the existing T.B. Hannah Station Park. The following table lists the material and information provided for this project:

DESCRIPTION OF MATERIAL	PROVIDER/SOURCE	DATE/DATE PROVIDED
Exhibit B (General Site Layout)	CFS Engineers	3/13/18
Geotech Scope of Work	City of Raymore, Missouri	3/13/18
Restroom Floor and Elevation Plan	Public Restroom Company	3/15/18

The following table lists the structural loads and site features that are required for or are the design basis for the conclusions of this report:

STRUCTURAL LOAD/PROPERTY	REQUIREMENT/REPORT BASIS		
BUILDING		**R***	**B***
Maximum Column Loads	40 Kips		X
Maximum Wall Loads	2 Kips per Foot		X
Finish Floor Type	Slab-on-Grade		X
Maximum Floor Loads	150 psf		X
Settlement Tolerances	1 inch total, ¾ inch differential		X
GRADING			
Planned Grade Variations at Site, Feet	Up to 3 Feet		X

*"R" = Requirement indicates specific design information was supplied.
"B" = Report Basis indicates specific design information was not supplied; therefore, this report is based on this parameter.

The following imageS of the site layout and restroom building plan was provided to PSI for the preparation of this project:

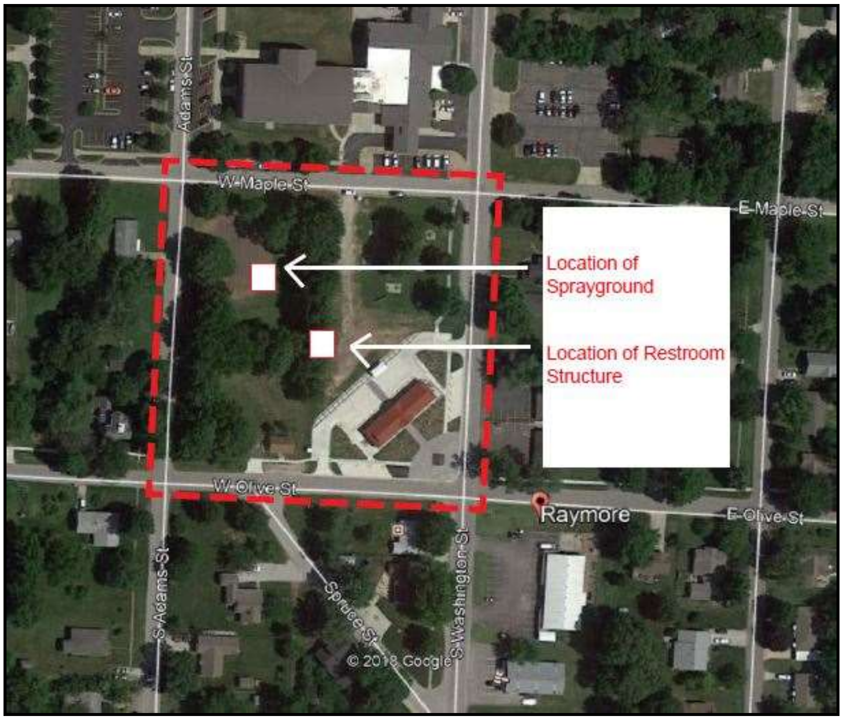


Figure 1. Provided Restroom Building and Sprayground Locations

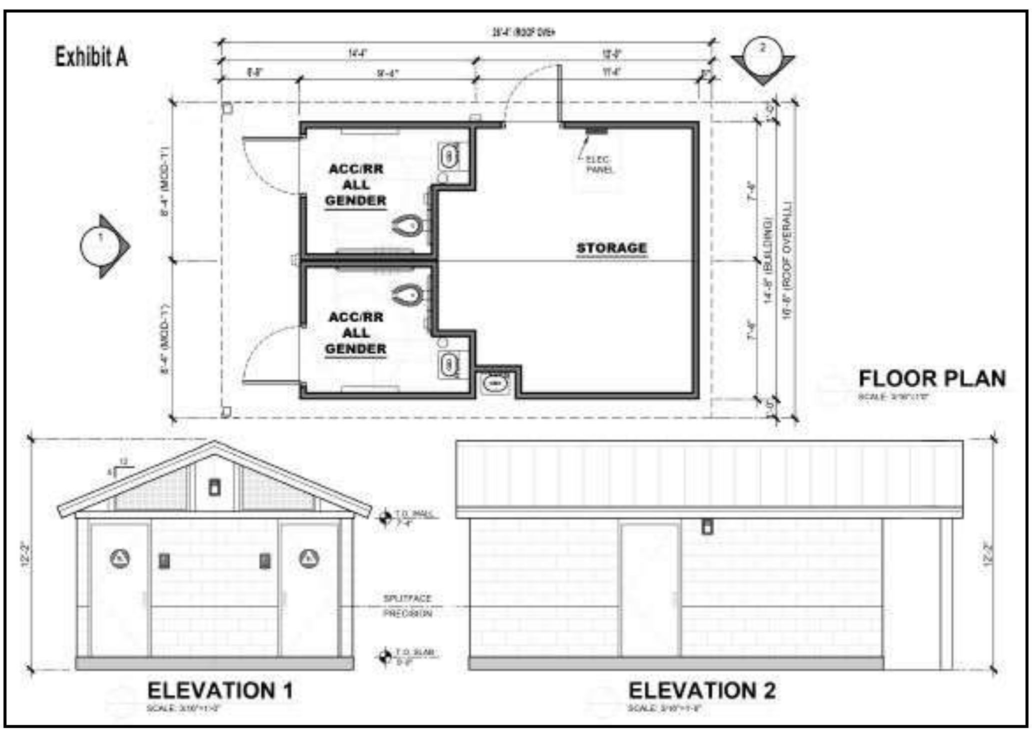


Figure 2. Provided Restroom Building Plan

The geotechnical recommendations presented in this report are based on the available project information, building location, and the subsurface materials described in this report. If the noted information is incorrect, please inform PSI in writing so that we may amend the recommendations presented in this report if appropriate and if desired by the client. PSI will not be responsible for the implementation of its recommendations when it is not notified of changes in the project.

Purpose and Scope of Services

The purpose of this study was to explore the subsurface conditions within the site to evaluate and provide recommendations for site preparation and grading and for design of foundation systems for the proposed construction. PSI's contracted scope of services included drilling four (4) soil test borings at the site to depths of approximately 15 feet below the ground surface, select laboratory testing, and preparation of this geotechnical report. This report briefly outlines the testing procedures, presents available project information, describes the site and subsurface conditions, and presents recommendations regarding the following:

- A summary of the project information
- A summary description of the site and subsurface conditions
- An evaluation of the data as it relates to the proposed site development
- Recommendations for site preparation, including placement and compaction of fill soils
- Geotechnical recommendations to support foundations and slabs-on-grade
- Recommendations for site coefficient for use in seismic design (IBC 2012)
- Comments and recommendations relating to other observed geotechnical conditions which could impact construction and site development
- Recommended frost depth for foundations
- Subgrade treatment and/or preparation for slab-on-grade floor slabs or pavements
- Groundwater levels encountered
- Recommendations and treatments of expansive soils if encountered

The scope of services did not include an environmental assessment for determining the presence or absence of wetlands, or hazardous or toxic materials in the soil, bedrock, surface water, groundwater, or air on, below, or around this site. Any statements in this report or on the boring logs regarding odors, colors, and unusual or suspicious items or conditions are strictly for informational purposes. PSI's scope also did not provide any service to investigate or detect the presence of moisture, mold or other biological contaminants in or around any structure, or any service that was designed or intended to prevent or lower the risk of the occurrence or the amplification of the same. Client should be aware that mold is ubiquitous to the environment with mold amplification occurring when building materials are impacted by moisture.

SITE AND SUBSURFACE CONDITIONS

Site Location and Description

The approximately 2½-acre site for the park is located at 214 South Washington Street in Raymore, Missouri. The property is bordered by West Maple Street to the north, West Olive Street to the south, South Washington Street to the east, and South Adams Street to the west. Park benches were located northeast of the proposed development area and a paved shelter area was located southeast of the proposed development area. PSI observed existing trees on the site and an existing building near the south end of the site. The site was relatively flat. The site latitude and longitude are approximately 38.8026° and -94.4568°, respectively. The following is an aerial image from 2017 and generally illustrates the site conditions at the time of drilling:

Figure 3. Aerial Image Dated June 2017

<u>History of Site (Timeline)</u>

Based on historical images obtained from Google Earth™, multiple buildings and parking lots were located east of the proposed restroom and sprayground and a house was located at the northwest corner of the block dating back to at least March of 1990. Portions of the previous parking and drives may have been within the proposed project area. The previous buildings and parking areas to the east of the proposed project area were removed some time between March 2008 and August 2009. The existing park benches and slabs were installed between October 2010 and June 2011. The house at the northwest corner of the lot was demolished between March 2016 and June 2017.

Figure 4. Aerial Image Dated March 1990

Figure 5. Aerial Image Dated March 2008

Figure 6. Aerial Image Dated August 2009

Figure 7. Aerial Image Dated March 2015

Geology

According to the Geologic Map of Missouri, 2003, the bedrock within the project area primarily include the Argentine Limestone Member and Raytown Limestone Member of the Kansas City Group. These typically comprise interbedded limestone and shale, with less frequent layers of coal and sandstone.

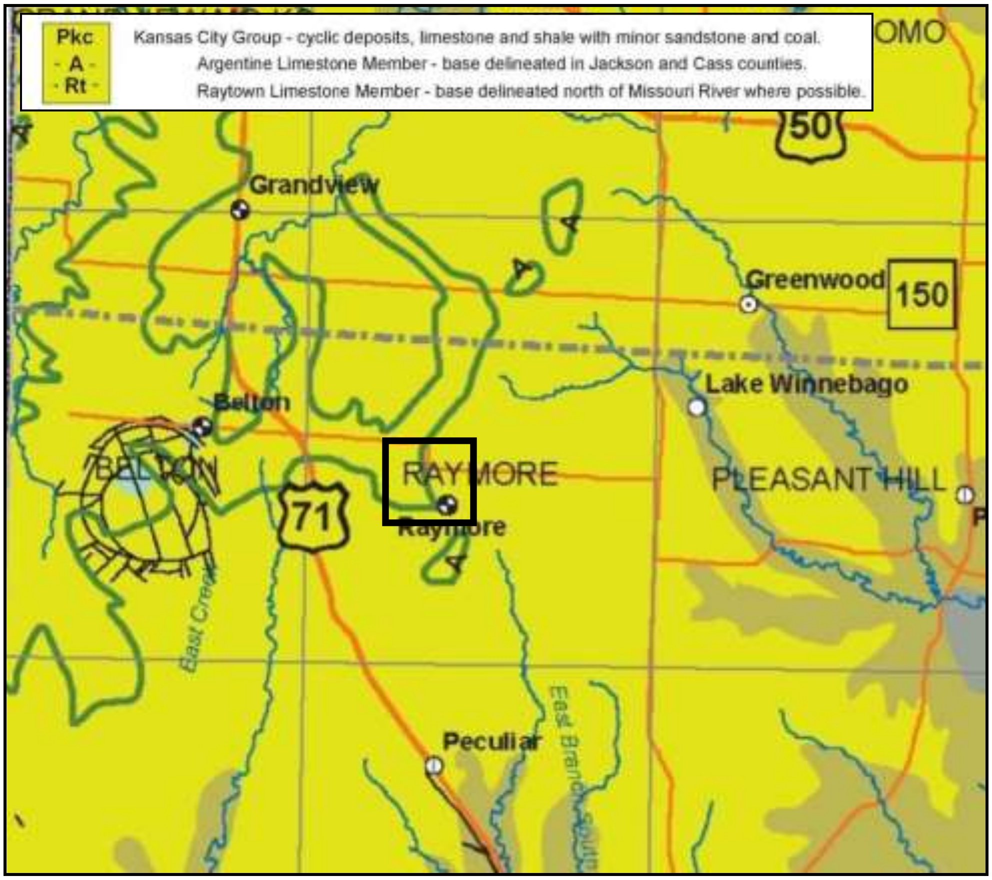


Figure 8. Geologic Map of Missouri, 2003

Subsurface Conditions

The site subsurface conditions were explored with four (4) soil test borings. Two (2) of these borings were drilled within the proposed restroom building area and two (2) borings were drilled within the proposed sprayground. Restroom building borings were drilled to depths of 10 feet and 13 feet and sprayground borings were drilled to depths of 11 and 15 feet. The boring locations and depths were staked in the field by the City of Raymore, Missouri and the boring depths were suggested by PSI.

An organic layer was encountered at the surface of the borings. In general, the thickness of the organic layer ranged from 5 inches to 6 inches. The soils encountered in the borings beneath the organic layer primarily included fine-grained soils that extended to the termination depth of boring B-2 at approximately 15 feet and to depths of approximately 10½ to 11½ feet in the other borings. Based on results of Atterberg limits and visual classification, the soils were classified as high plasticity clay (CH) in accordance with the Unified Soil Classification System (USCS). The standard penetration N-values within these fine-grained soils generally indicate consistencies of firm to stiff. Overall, the moisture contents of the fine-grained soils generally ranged from 22 to 36 percent; however, a moisture content of 49 was measured at a depth of approximately 13 ½ feet in boring B-2.

PSI encountered weathered limestone in borings B-1, B-3, and B-4 at depths between approximately 9½ feet and 11½ feet below site grade and extended to the termination depth of the borings where we encountered auger refusal. Auger refusal was encountered between depths of approximately 10 and 13 feet below site grade Refusal is a designation applied to materials that cannot be further penetrated by the power auger with ordinary effort and is normally indicative of a very hard or very dense material, such as boulders or gravel lenses or the upper surface of bedrock. Rock coring was beyond the scope of this exploration; therefore, the character and continuity of the refusal materials could not be determined.

The following table briefly summarizes the range of results from the field and laboratory testing programs. Please refer to the attached boring logs and laboratory data sheets for more specific information:

T.B. HANNAH STATION PARK SOIL STRATA TYPE	Approximate Depths Encountered (ft.)	RANGE OF PROPERTY VALUES			
		Standard Penetration, N_{60}	Moisture Content, %	Liquid Limit, %	Plastic Limit, %
High Plasticity Clay	½ - 15	7 - 16	22 - 49	54 - 79	22 - 28
Weathered Limestone	9 ½ - 13	38	--	--	--

The above subsurface description is of a generalized nature to highlight the major subsurface stratification features and material characteristics. The boring logs included in the Appendix should be reviewed for specific information at individual boring locations. These records include soil/rock descriptions, stratifications, penetration resistances, and locations of the samples and laboratory test data. The stratifications shown on the boring logs represent the conditions only at the actual boring locations. Variations may occur and should be expected between boring locations. The stratifications represent the approximate boundary between subsurface materials and the actual transition may be gradual. Water level information obtained during field operations is also shown on these boring logs. The samples that were not altered by laboratory testing will be retained for sixty (60) days from the date of this report and then will be discarded.

<u>Water Level Measurements</u>

Free groundwater was not observed in the borings upon completion, indicating that groundwater at the site at the time of the exploration was either below the terminated depths of the borings, or that the soils encountered are relatively impermeable. Although free water was not encountered at this time, water can be present within the depths explored during other times of the year depending upon climatic and rainfall conditions. It should be noted that saturated soils were identified during laboratory analysis at depths as shallow as one foot below the ground surface. Additionally, discontinuous zones of perched water may exist within the overburden materials and/or at the contact with bedrock. The water level measurements presented in this report are the levels that were measured at the time of PSI's field activities.

GEOTECHNICAL EVALUATION

Geotechnical Discussion

There are four (4) primary geotechnical characteristics at this site, which will affect the selection and performance of the foundations for this structure and the development of the site. The following summarizes those concerns:

1. The shear strength and compressibility of the upper soils will control the behavior of the proposed structure.
2. High plasticity "fat" clays were encountered in the exploration that could require remediation.
3. Drying of some of the on-site soils may be required to achieve proper compaction during grading.
4. Existing trees on the site will impact grading and site preparation.

Shear Strength and Compressibility of Soil

The primary geotechnical property controlling the bearing capacity and compressibility of the soils bearing the applied loads is the shear strength of the clay soil. Based on 2 feet of cut or fill and a shallow foundation bearing at a depth of 3 feet below exterior or adjacent grades, the applied foundation load on a shallow foundation up to 4 feet wide will be distributed through the 8 to 12 feet of soil generally beneath the footing. PSI believes the shear strength of the soils in this zone ranges from 1,200 psf to 1,500 psf, with shear strength exceeding 2,500 psf in the limestone zones. PSI anticipates that an engineered fill placed as recommend in this report would have a minimum shear strength of 1,800 psf. This shear strength is considered "undrained" or a "total stress" parameter and will be used in conjunction with other physical and geometric parameters to calculate an allowable bearing capacity.

High Plasticity Clay

High plasticity "fat" clays are present in the project area that may expand and shrink thereby impacting the proposed construction. Where these soils are within about two feet of lightly loaded structural features or slabs and 1 foot of pavements, remediation is recommended or class "C" fly ash or lime-treatment of the high plastic clays can be performed. Class "C" fly ash or lime-treatment of the high plastic clay would reduce the plasticity index, improve workability, promote drying, and reduce shrink/swell potential. Lightly loaded structures are defined as having normal operating loads of less than 2 kips per linear foot for walls and 50 kips for columns. Fat clays have the potential for volume change with changes in the soil moisture content. In severe cases, movement and distress to footings and foundation walls can occur, although a severe case is not obviously apparent at this site. Remedial measures are recommended in select areas of the site to reduce the shrink/swell potential. Grading the subgrade to drain and not trap water below the slabs and pavements is recommended to further reduce the potential of distress from these soils.

Soil Compaction

Since the surface soils at the site predominantly consist of high moisture content clay soils and high plasticity clays, it may become difficult to achieve the desired compaction of the soils due to high current moisture contents. After stripping activities the surface soils may also not pass a proof roll in their high moisture content state. The soils may need to be scarified and dried to a moisture content that will facilitate compaction in accordance with the structural fill requirements of this report. If scarifying, drying and recompacting of the soils does not stabilize the soils, removing and replacement with new structural fill or treating the soils with class "C" fly ash or lime-treatment of the soils clays may need to be performed.

Existing Trees

Due to the existing trees, additional remediation will likely be required during site grading. The trees on site are mature and could have an extensive root system that will be required to be removed during the stripping of the site. Any roots greater than ¼ inch in thickness or pockets of rootlets great than 5 percent by volume should be planned to be removed from the site.

GEOTECHNICAL RECOMMENDATIONS

The following geotechnical related recommendations have been developed based on the subsurface conditions encountered and PSI's understanding of the proposed development. Should changes in the project criteria occur, a review must be made by PSI to determine if modifications to our recommendations will be required.

Site Preparation

PSI recommends that topsoil, vegetation, roots, soft, organic, frozen, or unsuitable soils in the construction areas be stripped from the site and either wasted or stockpiled for later use in non-structural areas. If roots/rootlets are observed within the existing soils, it would be acceptable for the soils to consist of 5 percent by unit weight of root/rootlets to be left in place of roots that are ½ inch or less in diameter. Larger roots or tree root bulbs should be removed and replaced with new structural fill as recommended below. Depth of the organic layer in our borings ranged from approximately 5 to 6 inches. It is typical for topsoil thickness to vary from these values. A representative of the geotechnical engineer should evaluate and document the required depth of removal at the time of construction.

After stripping to the proposed subgrade level, as required, the restroom building and sprayground area should be proof-rolled with a loaded tandem axle dump truck or similar heavy rubber-tired vehicle (typically with an axial load greater than nine (9) tons). Soils that are observed to rut or deflect excessively (typically greater than one (1) inch) under the moving load should be undercut and replaced with properly compacted low plasticity fill material. The proof-rolling and undercutting activities should be witnessed by a representative of the geotechnical engineer and should be performed during a period of dry weather. Care should be taken during construction activities not to allow excessive drying or wetting of exposed soils. The subgrade soils should be scarified and compacted to at least 95% of the materials' standard Proctor maximum dry density, in general accordance with ASTM procedures, to a depth of at least twelve (12) inches below the surface. New fill for building structures, asphalt, and concrete should not be placed on frozen ground.

High plasticity fat clays should be removed where they are present within a depth of two (2) feet beneath proposed slabs or lightly loaded structural features. This material should be replaced with a low plasticity compacted soil, a dense positively-drained graded crushed stone or class "C" fly ash or lime-treatment of the high plastic clays can be performed. Class "C" fly ash or lime-treatment of the high plastic clay would reduce the plasticity index, improve workability, promote drying, and reduce shrink/swell potential. A representative of PSI's geotechnical engineer should observe the subgrade soils, perform plasticity index tests, and estimate the approximate extent of the exposed fat clays. If it is desirable to modify the fat clays with a commercially available class "C" fly ash or lime product, PSI recommends that actual application amounts be set by conducting a laboratory class "C" fly ash or lime series test. However, for preliminary purposes, the amount of class "C" fly ash will likely range from 10 to 15 percent by weight. There are many variables including water and soils chemistry and the variable nature of class "C" fly ash. Therefore, a laboratory test is recommended. The geotechnical engineer's representative should observe the remediation procedures for compliance with the project plans and specifications.

Moisture content changes, typically either higher than 3% above the plastic limit or lower than the plastic limit, in the highly plastic soils should not be permitted during or after construction. Increases in moisture content can cause swelling of the high plasticity soils during construction and increase shrinkage potentials due to drying after construction. If the exposed fat clays become inundated or desiccated, PSI recommends they be removed prior to new fill placement. Ideally, excavation should be performed during a period of dry weather.

After subgrade preparation and observation have been completed, fill placement required to establish grade may begin. Low-plasticity structural fill materials placed beneath the lightly loaded structural features or slabs should be free of organic or other deleterious materials and have a maximum particle size of less than three (3) inches. Low-plasticity soils are defined as having a liquid limit less than forty-five (45) and plasticity index less than twenty-five (25). The on-site high plasticity fat clay soils may be utilized as fill material to within 2 feet below the final subgrade for building slabs or sprayground slabs. If high plasticity fat clays are utilized as fill, they should have a liquid limit no greater than seventy-five (75) and a plasticity index no greater than forty-five (45). A representative of PSI should be on-site to observe, test, and document the placement of the fill. If the fill is too dry, water should be uniformly applied and thoroughly mixed into the soil by disking or scarifying. Close moisture content control will be required to achieve the recommended degree of compaction. It should be noted that high plasticity clays are typically more difficult to compact and achieve the optimum moisture content during the placement of fill.

Fill should be placed in maximum loose lifts of eight (8) inches and compacted to at least 95% of the materials' standard Proctor maximum dry density, and within a range of the optimum moisture content as designated in the table below, as determined in general accordance with ASTM procedures. Each lift of compacted-engineered fill should be tested and documented by a representative of the geotechnical engineer prior to placement of subsequent lifts. The edges of compacted fill should extend a minimum of five (5) feet beyond the building footprint, or a distance equal to the depth of fill beneath the footings, whichever is greater. The measurement should be taken from the outside edge of the footing to the toe of the excavation prior to sloping.

The fill placed should be tested and documented by a geotechnical technician and directed by a geotechnical engineer to evaluate the placement of fill material. It should be noted that the geotechnical engineer of record can only certify the testing that is performed and the work observed by that engineer or staff in direct report to that engineer. The fill should be evaluated in accordance with the following table:

MATERIAL TESTED	PROCTOR TYPE	MIN % DRY DENSITY	PLACEMENT MOISTURE CONTENT RANGE	FREQUENCY OF TESTING *[1]
Structural Lean Clay Fill* (Cohesive)	Standard	95%	-1 to +3 %	1 per 2,500 ft^2 of fill placed / lift
Structural Fat Clay Fill* (Cohesive)	Standard	95%	0 to +3%	1 per 2,500 ft^2 of fill placed / lift
Structural Fill (Granular)*	Standard	95%	-2 to +2 %	1 per 2,500 ft^2 of fill placed / lift
Random Fill (non load bearing)	Standard	90%	-3 to +3 %	1 per 6,000 ft^2 of fill placed / lift
Utility Trench Backfill	Standard	95%	-1 to +2 %	1 per 150 lineal foot / lift

*Structural Fill is defined as fill beneath or supporting any improvements on site such as foundation, slabs, pavements, etc.
*[1] Minimum 3 per lift.

The test frequency for the laboratory reference should be one laboratory Proctor or Relative Density test for each material used on the site. If the borrow or source of fill material changes, a new reference moisture/density test should be performed.

Tested fill materials that do not achieve either the required dry density or moisture content range shall be recorded, the location noted, and reported to the Contractor and Owner. A re-test of that area should be performed after the Contractor performs remedial measures.

High Plasticity Clay Considerations

Due to the presence of high plasticity clays, consideration should be given to measures that can reduce the long term shrink/swell potential of the clay soils. High plasticity clays expand or shrink by absorbing or losing moisture; therefore, reducing the moisture content variation of a soil will reduce its volume change. Although it is not possible to prevent soil moisture changes, steps may be taken to aid in the reduction of subsoil moisture content variations. These steps are intended to help reduce the shrink/swell potential, not eliminate it. Some of these measures are:

1. During construction, a positive drainage scheme should be implemented and maintained to prevent ponding of water on subgrades.

2. The building subgrade should not be allowed to dry out; backfill should proceed as soon as possible to minimize changes in the natural moisture regime.

3. Permanent positive drainage should be maintained around the building through a roof/gutter system connected to drainage piping or discharging upon paved surfaces, thereby transmitting water away from the foundation perimeter. In addition, site grading should provide rapid drainage of surface water away from foundation areas.

4. Utility trenches should be backfilled with low plasticity clays or lean concrete to reduce the potential of the trenches to act as aqueducts transmitting water beneath the structures due to excess surface water infiltration.

5. Shrubbery, flower beds and sprinkler systems surrounding the structures should be eliminated or at least limited and should be designed so that the bedding soils drain away from the building areas. The planters should have impermeable bases with weep holes discharging into drainage pipes or onto paved surfaces.

6. Trees and/or large bushes should not be planted adjacent to the structures.

7. Since plumbing and other water leaks can cause excessive heaving of high plasticity soils, every effort should be made to maintain the plumbing in good working order and prevent or minimize water leaks and discharges. It is recommended that all water supply lines and waste water lines be tested for leaks prior to backfilling the utility trenches.

Foundation Recommendations

The planned construction can be supported on conventional spread-type footing foundations bearing on either competent naturally deposited soils or properly compacted and documented fill. If soft unsuitable or fill soils are encountered they should be removed and replaced with compacted engineered fill. Spread footings for building columns and continuous footings for bearing walls can be designed for allowable soil bearing pressures of 2,500 pounds per square foot (psf) and 2,000 psf, respectively, based on dead load plus design live load.

PSI recommends a minimum dimension of twenty-four (24) inches for square footings and eighteen (18) inches for continuous footings to minimize the possibility of a local bearing capacity failure.

Footing Excavations and Backfilling

It is recommended that PSI personnel evaluate the soils conditions at and below footing grade at the time the excavations are performed. If unsuitable materials (such as, soft to medium stiff cohesive soils, loose granular soils that cannot be densified, or debris/organic laden fill materials) are encountered below the design bottom of footing elevation, the footing excavations should be extended deeper to reach adequate bearing soils or an overexcavation and backfill procedure could be performed with lean clay, lean concrete or compacted granular fill to the design bearing elevation. If lean concrete (minimum f'_c = 1,500 psi) is used, the excavation should be widened at least 6 inches from all edges of the design footing width. For the overexcavation and either lean clay or granular backfill options, we recommend the excavation extend laterally at least 8 inches beyond all edges of the footing for each 12 inches of additional excavation required below foundation design elevation. The overexcavation should then be backfilled up to design elevation. Common practice in the area is to use coarse crushed stone backfill, placed in lifts of 9 inches or less in loose thickness and compacted to at least 95 percent of the material's maximum dry density per ASTM D698.

Exterior footings and footings in unheated areas should be located at a depth of thirty-six (36) inches or deeper below the final exterior grade to provide adequate frost protection. If the building is to be constructed during the winter months or if footings will likely be subjected to freezing temperatures after foundation construction, then the footings should be protected from freezing. PSI recommends that interior footings be a minimum depth of eighteen (18) inches below the finished floor elevation.

The foundation excavations should be observed and documented by a representative of PSI prior to steel or concrete placement to assess that the foundation materials are consistent with the materials discussed in this report, and therefore are capable of supporting the design loads. Soft or loose soil zones encountered at the bottom of the footing excavations should be removed to the level of competent naturally deposited soils or properly compacted structural fill as directed by the geotechnical engineer. Cavities formed as a result of excavation of soft or loose soil zones should be backfilled with lean concrete or dense graded compacted crushed stone.

After opening, footing excavations should be observed and concrete placed as quickly as possible to avoid exposure of the footing bottoms to wetting and drying. Surface run-off water should be drained away from the excavations and not be allowed to pond. If possible, the foundation concrete should be placed during the same day the excavation is made. If it is required that footing excavations be left open for more than one day, they should be protected to reduce evaporation or entry of moisture.

Based on the known subsurface conditions and site geology, laboratory testing and our experience, PSI anticipates that properly designed and constructed footings supported on the recommended materials should experience total and differential settlement between adjacent columns of less than one (1) inch and ¾ inch, respectively.

Earthquake and Seismic Design Consideration

The 2012 International Building Code (IBC) requires that a site class be determined for the calculation of earthquake design forces in structures. The site class designation is a function of soil type (i.e., depth of soil and strata types). Based on PSI's borings and experience in this area, Site Class "D" is recommended. The USGS-NEHRP probabilistic ground motion values interpolated between the nearest four grid points from latitude 38.8026° and longitude –-94.4568° are as follows:

Period (Seconds)	2% Probability of Event in 50 Years (%g)	Site Coefficients	Max. Spectral Acceleration Parameters	Design Spectral Acceleration Parameters	
0.2 (S_s)	11.4	F_a = 1.6	S_{ms} = 0.182	S_{Ds}= 0.121	T_0= 0.177
1.0 (S_1)	6.7	F_v = 2.4	S_{m1} = 0.161	S_{D1}= 0.107	T_s= 0.884
			$S_{ms} = F_a S_s$ $S_{m1} = F_v S_1$	S_{Ds} = ⅔*S_{ms} S_{D1} = ⅔*S_{m1}	T_0= 0.2*S_{D1}/S_{Ds} T_s= S_{D1}/S_{Ds}

The Site Coefficients, F_a and F_v were interpolated for IBC 2012 Tables 1613.3.3(1) and 1613.3.3(2) as a function of the site classifications and the mapped spectral response acceleration at the short (S_s) and 1-second (S_1) periods.

Based on the Spectral Acceleration values for this site, structures with a Risk Category of I, II, and III (Table 1604.5) should be designed as a Seismic Design Category B as defined in Tables 1613.3.5(1) and 1613.3.5(2). Structures with a Risk Category IV should be designed as a Seismic Design Category C. The Risk Category is based on the nature of the occupancy of the structure and is typically determined by the design team (Architect/Structural Engineer) or building official. The determination of the Risk Category is beyond PSI's scope of service.

Floor Slab Recommendations

The floor slab can be grade supported on a minimum of twenty-four (24) inches of properly compacted low plasticity structural fill. Alternatively, class "C" fly ash or lime-treatment of the high plastic clay can be accomplished to reduce the plasticity index, improve workability, promote drying, and reduce shrink/swell potential. Proof-rolling, as discussed earlier in this report, should be accomplished to identify soft or unstable soils that should be removed from the floor slab area prior to fill placement and/or floor slab construction. These soils should be replaced with properly compacted structural fill as described earlier in this report. Fat clays below slabs-on-grade should be remediated, as discussed earlier.

PSI recommends that a minimum four (4) inch thick free-draining granular mat be placed beneath the floor slab to enhance drainage. This 4-inch mat can be included in the 24 inches of remediation recommended in the areas of fat clay. The soil surface shall be graded to drain away from the building without low spots that can trap water prior to placing the granular drainage layer. Polyethylene sheeting should be placed to act as a vapor retarder where the floor will be in contact with moisture sensitive equipment or products such as tile, wood, carpet, etc., as directed by the design professional. The decision to locate the vapor retarder in direct contact with the slab or beneath the layer of granular fill should be made by the design professional after considering the moisture sensitivity of subsequent floor finishes, anticipated project conditions, and the potential effects of slab curling and cracking. The floor slabs should have an adequate number of joints to reduce cracking resulting from differential movement and shrinkage.

For subgrade prepared as recommended and properly compacted fill, a modulus of subgrade reaction, *k* value, of 140 pounds per cubic inch (pci) may be used in the grade slab design based on correlation to values typically resulting from a 1 ft. x 1 ft. plate load test. However, depending on how the slab load is applied, the value will have to be geometrically modified. Where slab loading is distributed over more than a 1 foot by 1 foot area, the value k should be adjusted for larger areas using the following expression for cohesive and cohesionless soil:

Modulus of Subgrade Reaction, $k_s = \left(\frac{k}{B}\right)$ for cohesive soil and

$k_s = k\left(\frac{B+1}{2B}\right)^2$ for cohesionless soil

Where: k_s = coefficient of vertical subgrade reaction for loaded area,
k = coefficient of vertical subgrade reaction for 1 square foot area, and
B = effective width of area loaded, in feet

The precautions listed below should be followed for construction of slab-on-grade pads. These details will not reduce the amount of movement but are intended to reduce potential damage should some settlement of the supporting subgrade take place. Some increase in moisture content is inevitable as a result of development and associated landscaping. However, extreme moisture content increases can be largely controlled by proper and responsible site drainage, building maintenance and irrigation practices.

- Cracking of slab-on-grade concrete is normal and should be expected. Cracking can occur not only as a result of heaving or compression of the supporting soil and/or bedrock material, but also as a result of concrete curing stresses. The occurrence of concrete shrinkage crack, and problems associated with concrete curing may be reduced and/or controlled by limiting the slump of the concrete, proper concrete placement, finishing, and curing, and by the placement of crack control joints at frequent intervals, particularly where re-entrant slab corners occur. The American Concrete Institute (ACI) recommends a maximum panel size (in feet) equal to approximately three times the thickness of the slab (in inches) in both directions. For example, joints are recommended at a maximum spacing of twelve (12) feet based on having a four-inch slab. PSI also recommends that the slab be independent of the foundation walls. Using fiber reinforcement in the concrete can also control shrinkage cracking.

- Areas supporting slabs should be properly moisture conditioned and compacted. Backfill in all interior and exterior water and sewer line trenches should be carefully compacted to reduce the shear stress in the concrete extending over these areas.

Exterior slabs should be isolated from the building. These slabs should be reinforced to function as independent units. Movement of these slabs should not be transmitted to the building foundation or superstructure.

Utilities Trenching

Excavation for utility trenches shall be performed in accordance with OSHA regulations as stated in 29 CFR Part 1926. It should be noted that utility trench excavations have the potential to degrade the properties of the adjacent fill materials. Utility trench walls that are allowed to move laterally can lead to reduced bearing capacity and increased settlement of adjacent structural elements and overlying slabs.

Backfill for utility trenches is as important as the original subgrade preparation or structural fill placed to support either a foundation or slab. Therefore, it is imperative that the backfill for utility trenches be placed to meet the project specifications for the structural fill of this project. PSI recommends that flowable fill or lean mix concrete be utilized for utility trench backfill. If on-site soils are placed as trench backfill, the backfill for the utility trenches should be placed in four (4) to six (6) inch loose lifts and compacted to a minimum of 95% of the maximum dry density achieved by the standard Proctor test. The backfill soil should be moisture conditioned to be within 2% of the optimum moisture content as determined by the standard Proctor test. Up to four (4) inches of bedding material placed directly under the pipes or conduits placed in the utility trench can be compacted to the 90% compaction criteria with respect to the standard Proctor. Compaction testing should be performed for every 200 cubic yards of backfill place or each lift within 200 linear feet of trench, whichever is less. Backfill of utility trenches should not be performed with water standing in the trench. If granular material is used for the backfill of the utility trench, the granular material should have a gradation that will filter protect the backfill material from the adjacent soils. If this gradation is not available, a geosynthetic non-woven filter fabric should be used to reduce the potential for the migration of fines into the backfill material. Granular backfill material shall be compacted to meet the above compaction criteria. The clean granular backfill material should be compacted to achieve a relative density greater than 75% or as specified by the geotechnical engineer for the specific material used.

CONSTRUCTION CONSIDERATIONS

PSI should be retained to provide observation and testing of construction activities involved in the foundation, earthwork, and related activities of this project. PSI cannot accept responsibility for conditions that deviate from those described in this report, nor for the performance of the foundation system if not engaged to also provide construction observation and testing for this project.

Moisture Sensitive Soils/Weather Related Concerns

The upper fine-grained soils encountered at this site are expected to be sensitive to disturbances caused by construction traffic and to changes in moisture content. During wet weather periods, increases in the moisture content of the soil can cause significant reduction in the soil strength and support capabilities. In addition, soils that become wet may be slow to dry and thus significantly retard the progress of grading and compaction activities. It will, therefore, be advantageous to perform earthwork and foundation construction activities during dry weather.

Drainage and Groundwater Considerations

PSI recommends that the Contractor determine the actual groundwater levels at the site at the time of the construction activities to assess the impact groundwater may have on construction. Water should not be allowed to collect in the foundation excavation, on slab-on-grades or on prepared subgrades of the construction area either during or after construction. Undercut or excavated areas should be sloped toward one corner to facilitate removal of collected rainwater, groundwater, or surface runoff. Positive site drainage should be provided to reduce infiltration of surface water around the perimeter of the building and beneath the floor slabs. The grades should be sloped away from the building and surface drainage should be collected and discharged such that water is not permitted to infiltrate the backfill and floor slab areas of the building.

Excavations

In Federal Register, Volume 54, Number 209 (October 1989), the United States Department of Labor, Occupational Safety and Health Administration (OSHA) amended its "Construction Standards for Excavations, 29 CFR, part 1926, Subpart P". This document was issued to better enhance the safety of workers entering trenches or excavations. It is mandated by this federal regulation that excavations, whether they be utility trenches, basement excavation or footing excavations, be constructed in accordance with the new OSHA guidelines. It is PSI's understanding that these regulations are being strictly enforced and if they are not closely followed, the owner and the contractor could be liable for substantial penalties.

The contractor is solely responsible for designing and constructing stable, temporary excavations and should shore, slope, or bench the sides of the excavations as required to maintain stability of both the excavation sides and bottom. The contractor's "responsible person", as defined in 29 CFR Part 1926, should evaluate the soil exposed in the excavations as part of the contractor's safety procedures. In no case should slope height, slope inclination, or excavation depth, including utility trench excavation depth, exceed those specified in local, state, and federal safety regulations.

PSI is providing this information solely as a service to our client. PSI does not assume responsibility for construction site safety or the contractor's or other parties' compliance with local, state, and federal safety or other regulations.

GEOTECHNICAL RISK

The concept of risk is an important aspect of the geotechnical evaluation. The primary reason for this is that the analytical methods used to develop geotechnical recommendations do not comprise an exact science. The analytical tools which geotechnical engineers use are generally empirical and must be used in conjunction with engineering judgment and experience. Therefore, the solutions and recommendations presented in the geotechnical evaluation should not be considered risk-free and, more importantly, are not a guarantee that the interaction between the soils and the proposed construction will perform as planned. The engineering recommendations presented in the preceding section constitutes PSI's professional estimate of those measures that are necessary for the proposed improvements to perform according to the proposed design based on the information generated and referenced during this evaluation, and PSI's experience in working with these conditions.

REPORT LIMITATIONS

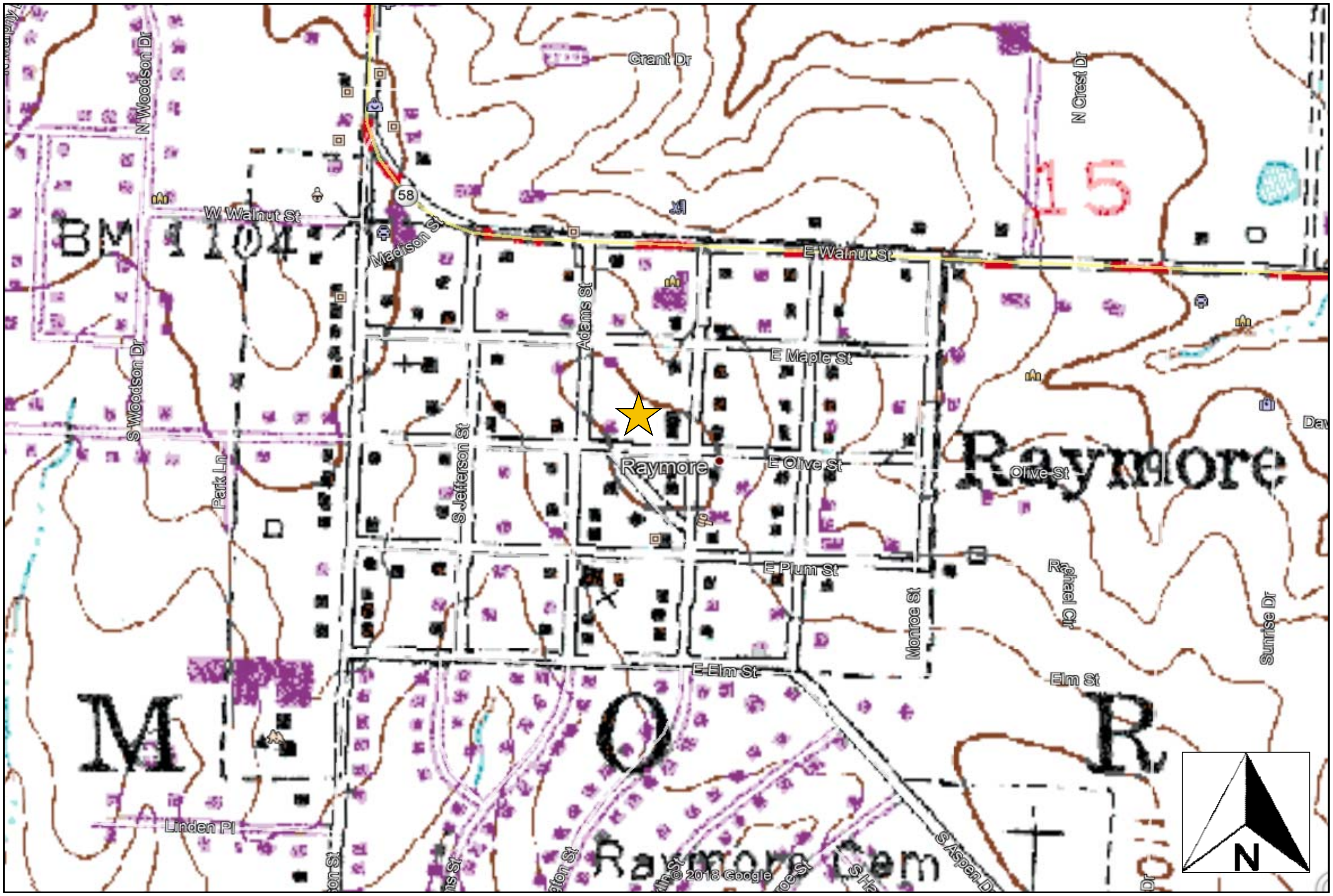
The recommendations submitted are based on the available subsurface information obtained by PSI and design details furnished by CFS Engineers, the City of Raymore, Missouri and the Public Restroom Company. If there are revisions to the plans for this project or if deviations from the subsurface conditions noted in this report are encountered during construction, PSI should be notified immediately to determine if changes in the recommendations are required. If PSI is not retained to perform these functions, PSI will not be responsible for the impact of those conditions on the project.

The geotechnical engineer warrants that the findings, recommendations, specifications, or professional advice contained herein have been made in accordance with generally accepted professional geotechnical engineering practices in the local area. No other warranties are implied or expressed.

After the plans and specifications are more complete, the geotechnical engineer should be retained and provided the opportunity to review the final design plans and specifications to check that our engineering recommendations have been properly incorporated into the design documents. At that time, it may be necessary to submit supplementary recommendations. This report has been prepared for the exclusive use of the City of Raymore, Missouri for the specific application to the proposed additions to the T.B. Hannah Station Park in Raymore, Missouri.

APPENDIX A - TOPOGRAPHIC MAP

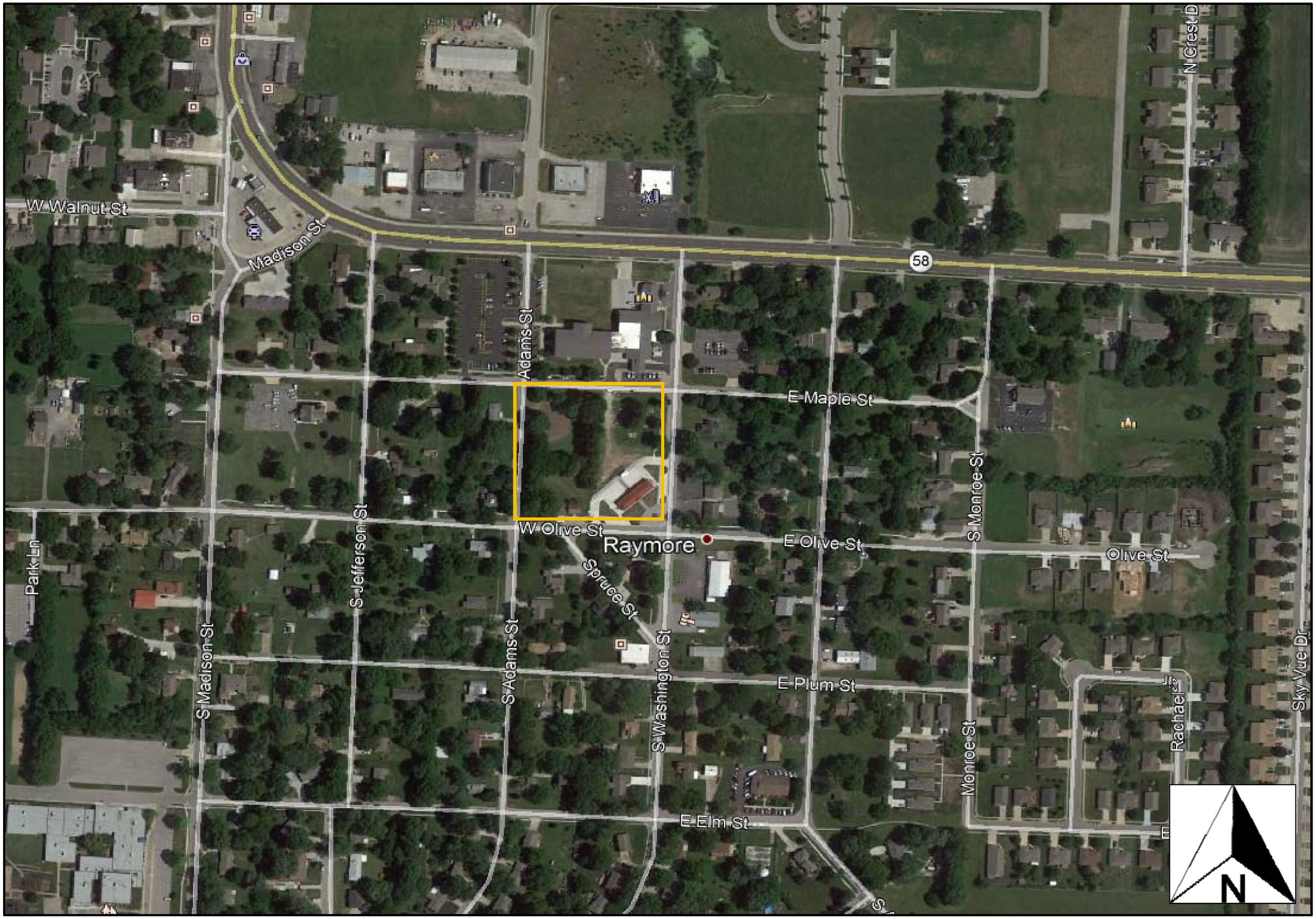
Intertek-PSI



Topographic Drawing TB Hanna Station Park 214 S. Washington Street Raymore, Missouri	Intertek-PSI Project No.:	338-1732
	Year of Topo --	Drawn By: DMW

APPENDIX B - SITE VICINITY MAP

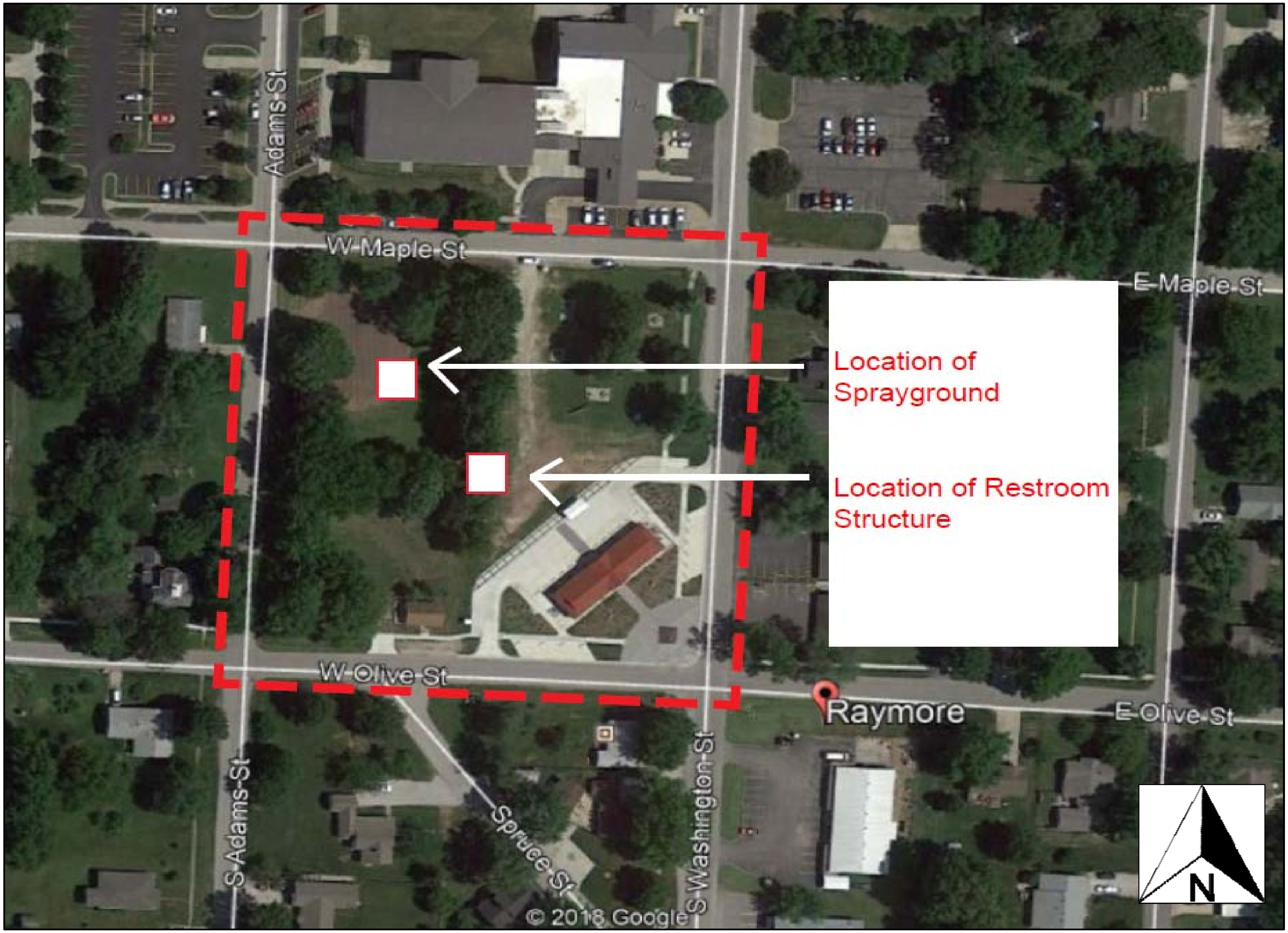
Intertek-PSI



Site Vicinity Plan TB Hanna Station Park 214 S. Washington Street Raymore, Missouri	Intertek-PSI Project No.:	338-1732	
	Aerial Year:	2017	Drawn By:
	Drawing Date:	4/25/18	DMW

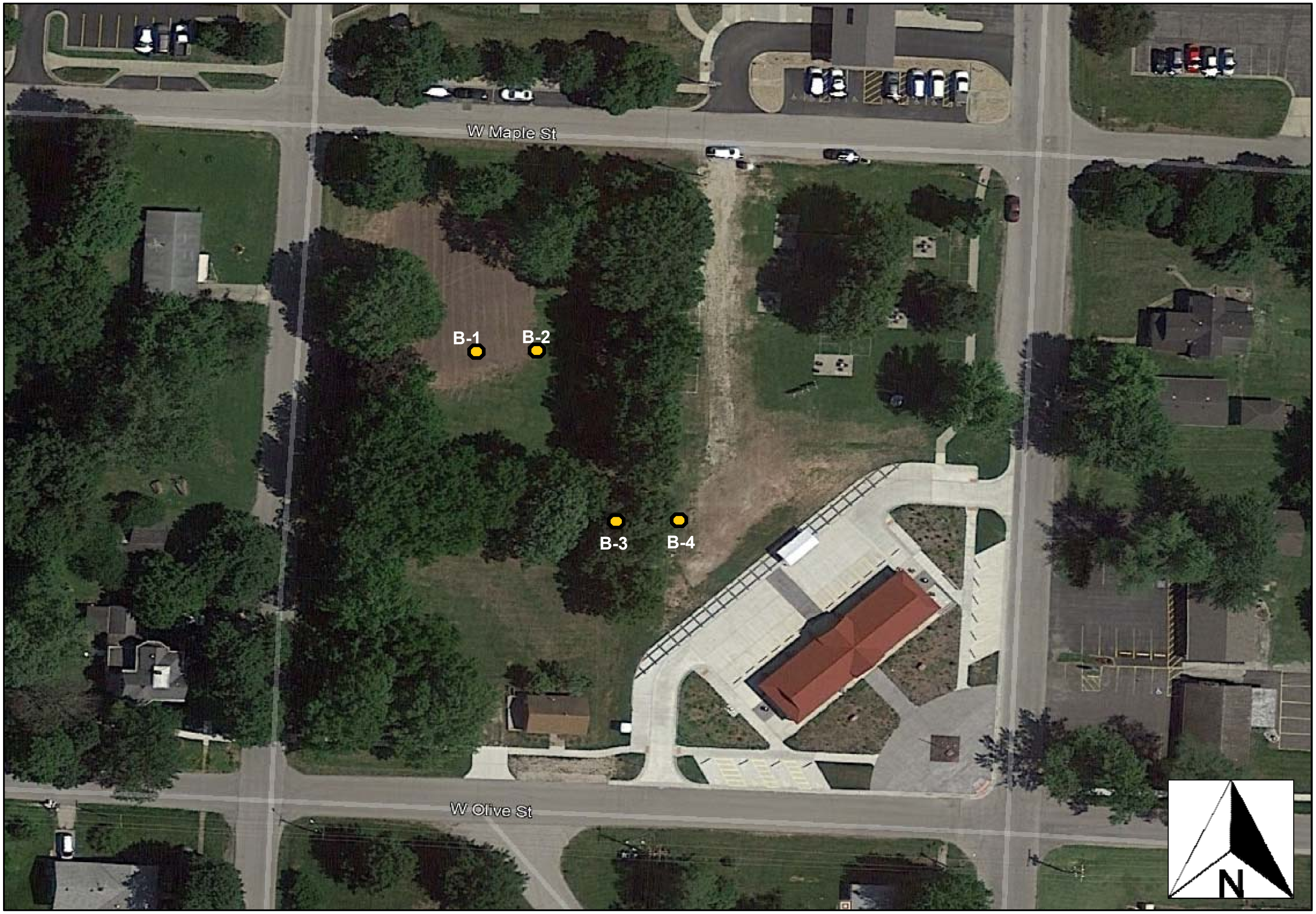
APPENDIX C – BORING LOCATION PLAN

Intertek-PSI



Boring Location Diagram TB Hanna Station Park 214 S. Washington Street Raymore, Missouri	Intertek-PSI Project No.:	338-1732
	Date: 4/25/2018	Drawn By: DMW

Intertek-PSI



Boring Location Diagram TB Hanna Station Park 214 S. Washington Street Raymore, Missouri	Intertek-PSI Project No.:	338-1732
	Date: 4/25/2018	Drawn By: DMW

APPENDIX D – BORING LOGS

BORING B-01

DATE STARTED:	4/20/18	**DRILL COMPANY:**	PSI, Inc.
DATE COMPLETED:	4/20/18	**DRILLER:** SD **LOGGED BY:**	JF
COMPLETION DEPTH	11.0 ft	**DRILL RIG:**	CME-55LC
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	N/A	**SAMPLING METHOD:**	SS
LATITUDE:		**HAMMER TYPE:**	Automatic
LONGITUDE:		**EFFICIENCY**	85%
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	IS

Water

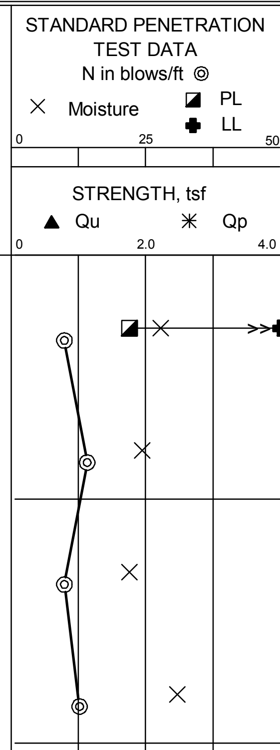
While Drilling		not observed
Upon Completion		not observed
Delay		N/A

BORING LOCATION:

REMARKS: N_{60} denotes the normalization to 60% efficiency as described in ASTM D4633.

Elevation (feet)	Depth, (feet)	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0				**ORGANIC LAYER- APPROXIMATELY 5 INCHES**				
					HIGH PLASTICITY CLAY				
		SS	1	7	High plasticity clay, brown	CH	3-3-4 N_{60}=10	28	LL = 54 PL = 22
	5	SS	2	14	High plasticity clay, brown to light brown	CH	3-4-6 N_{60}=14	24	
		SS	3	18	High plasticity clay, brown	CH	4-3-4 N_{60}=10	22	
	10	SS	4	18	High plasticity clay, light brown	CH	3-4-5 N_{60}=13	31	
					WEATHERED LIMESTONE				
					Auger refusal at approximately 11 feet.				

STANDARD PENETRATION TEST DATA



Professional Service Industries, Inc.
1211 W. Cambridge Circle Drive
Kansas City, KS 66103
Telephone: (913) 310-1600

PROJECT NO.: 338-1732
PROJECT: TB Hanna Station Park
LOCATION: 214 S. Washington St.
Raymore, MO

The stratification lines represent approximate boundaries. The transition may be gradual.

BORING B-02

DATE STARTED:	4/20/18	**DRILL COMPANY:**	PSI, Inc.
DATE COMPLETED:	4/20/18	**DRILLER:** SD	**LOGGED BY:** JF
COMPLETION DEPTH	15.0 ft	**DRILL RIG:**	CME-55LC
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	N/A	**SAMPLING METHOD:**	SS
LATITUDE:		**HAMMER TYPE:**	Automatic
LONGITUDE:		**EFFICIENCY**	85%
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	IS

Water

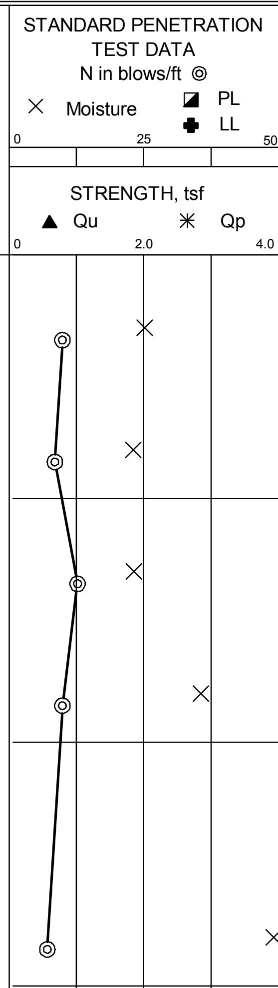
While Drilling	not observed
Upon Completion	not observed
Delay	N/A

BORING LOCATION:

REMARKS: N_{60} denotes the normalization to 60% efficiency as described in ASTM D4633.

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0					**ORGANIC LAYER- APPROXIMATLEY 6 INCHES**				
						HIGH PLASTICITY CLAY	CH			
				1	6	High plasticity clay, brown		2-3-4 N_{60}=10	25	
				2	13	High plasticity clay, brown to light brown		3-3-3 N_{60}=8	23	
	5			3	17	High plasticity clay, brown to light brown		3-4-5 N_{60}=13	23	
				4	18	High plasticity clay, brown, iron staining		3-3-4 N_{60}=10	36	
	10			5	18	High plasticity clay, brown, iron staining		3-2-3 N_{60}=7	49	
	15					Boring terminated at approximately 15 feet.				

STANDARD PENETRATION TEST DATA



intertek psi
Professional Service Industries, Inc.
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Telephone: (913) 310-1600

PROJECT NO.: 338-1732
PROJECT: TB Hanna Station Park
LOCATION: 214 S. Washington St.
Raymore, MO

The stratification lines represent approximate boundaries. The transition may be gradual.

BORING B-03

DATE STARTED:	4/20/18	**DRILL COMPANY:**	PSI, Inc.
DATE COMPLETED:	4/20/18	**DRILLER:**	SD **LOGGED BY:** JF
COMPLETION DEPTH	10.0 ft	**DRILL RIG:**	CME-55LC
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	N/A	**SAMPLING METHOD:**	SS
LATITUDE:		**HAMMER TYPE:**	Automatic
LONGITUDE:		**EFFICIENCY**	85%
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	IS

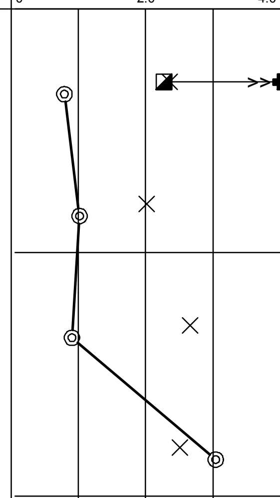
Water	
While Drilling	not observed
Upon Completion	not observed
Delay	N/A

BORING LOCATION:

REMARKS: N_{60} denotes the normalization to 60% efficiency as described in ASTM D4633.

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0					**ORGANIC LAYER- APPROXIMATELY 6 INCHES**				
						HIGH PLASTICITY CLAY				
				1	6	High plasticity clay, brown		3-3-4 N_{60}=10	30	LL = 79 PL = 28
				2	14	High plasticity clay, borwn to light brown		3-4-5 N_{60}=13	25	
	5						CH			
				3	12	High palsticity clay, brown to light brown		3-4-4 N_{60}=11	33	
				4	16			4-10-17 N_{60}=38	31	
	10					**WEATHERED LIMESTONE**				
						Auger refusal at approximately 10 feet.				

STANDARD PENETRATION TEST DATA
N in blows/ft ◎
× Moisture ◪ PL ✚ LL
0 25 50
STRENGTH, tsf
▲ Qu ✳ Qp
0 2.0 4.0



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1211 W. Cambridge Circle Drive
Kansas City, KS 66103
Telephone: (913) 310-1600

PROJECT NO.:	338-1732
PROJECT:	TB Hanna Station Park
LOCATION:	214 S. Washington St.
	Raymore, MO

The stratification lines represent approximate boundaries. The transition may be gradual.

BORING B-04

DATE STARTED:	4/20/18	**DRILL COMPANY:**	PSI, Inc.
DATE COMPLETED:	4/20/18	**DRILLER:** SD	**LOGGED BY:** JF
COMPLETION DEPTH	13.0 ft	**DRILL RIG:**	CME-55LC
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	N/A	**SAMPLING METHOD:**	SS
LATITUDE:		**HAMMER TYPE:**	Automatic
LONGITUDE:		**EFFICIENCY**	85%
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	IS

Water

While Drilling	not observed
Upon Completion	not observed
Delay	N/A

BORING LOCATION:

REMARKS: N_{60} denotes the normalization to 60% efficiency as described in ASTM D4633.

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	STANDARD PENETRATION TEST DATA: N in blows/ft ◎, × Moisture, PL, LL (0, 25, 50); STRENGTH, tsf: ▲ Qu, ✳ Qp (0, 2.0, 4.0)	Additional Remarks
	0					**ORGANIC LAYER- APPROXIMATELY 6 INCHES**					
						HIGH PLASTICITY CLAY					
				1	9	High plasticity clay, brown	CH	2-3-4 N_{60}=10	31		
				2	14	High plasticity clay, brown to light brown	CH	4-4-7 N_{60}=16	26		
	5										
				3	18	High plasticity clay, brown to light brown	CH	2-3-4 N_{60}=10	31		
				4	18	High plasticity clay, brown to light brown	CH	3-3-4 N_{60}=10	26		
	10										
						WEATHERED LIMESTONE					
						Auger refusal at approximately 13 feet.					

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Kansas City, KS 66103
Telephone: (913) 310-1600

PROJECT NO.: 338-1732
PROJECT: TB Hanna Station Park
LOCATION: 214 S. Washington St.
Raymore, MO

The stratification lines represent approximate boundaries. The transition may be gradual.

APPENDIX E – GENERAL NOTES/SOIL CLASSIFICATION CHART

GENERAL NOTES

SAMPLE IDENTIFICATION

The Unified Soil Classification System (USCS), AASHTO 1988 and ASTM designations D2487 and D-2488 are used to identify the encountered materials unless otherwise noted. Coarse-grained soils are defined as having more than 50% of their dry weight retained on a #200 sieve (0.075mm); they are described as: boulders, cobbles, gravel or sand. Fine-grained soils have less than 50% of their dry weight retained on a #200 sieve; they are defined as silts or clay depending on their Atterberg Limit attributes. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size.

DRILLING AND SAMPLING SYMBOLS

SFA: Solid Flight Auger - typically 4" diameter flights, except where noted.
HSA: Hollow Stem Auger - typically 3¼" or 4¼ I.D. openings, except where noted.
M.R.: Mud Rotary - Uses a rotary head with Bentonite or Polymer Slurry
R.C.: Diamond Bit Core Sampler
H.A.: Hand Auger
P.A.: Power Auger - Handheld motorized auger

SS: Split-Spoon - 1 3/8" I.D., 2" O.D., except where noted.
ST: Shelby Tube - 3" O.D., except where noted.
RC: Rock Core
TC: Texas Cone
BS: Bulk Sample
PM: Pressuremeter
CPT-U: Cone Penetrometer Testing with Pore-Pressure Readings

SOIL PROPERTY SYMBOLS

N: Standard "N" penetration: Blows per foot of a 140 pound hammer falling 30 inches on a 2-inch O.D. Split-Spoon.
N_{60}: A "N" penetration value corrected to an equivalent 60% hammer energy transfer efficiency (ETR)
Q_u: Unconfined compressive strength, TSF
Q_p: Pocket penetrometer value, unconfined compressive strength, TSF
w%: Moisture/water content, %
LL: Liquid Limit, %
PL: Plastic Limit, %
PI: Plasticity Index = (LL-PL),%
DD: Dry unit weight, pcf
▼,▽,▼: Apparent groundwater level at time noted

RELATIVE DENSITY OF COARSE-GRAINED SOILS

Relative Density	N - Blows/foot
Very Loose	0 - 4
Loose	4 - 10
Medium Dense	10 - 30
Dense	30 - 50
Very Dense	50 - 80
Extremely Dense	80+

ANGULARITY OF COARSE-GRAINED PARTICLES

Description	Criteria
Angular:	Particles have sharp edges and relatively plane sides with unpolished surfaces
Subangular:	Particles are similar to angular description, but have rounded edges
Subrounded:	Particles have nearly plane sides, but have well-rounded corners and edges
Rounded:	Particles have smoothly curved sides and no edges

GRAIN-SIZE TERMINOLOGY

Component	Size Range
Boulders:	Over 300 mm (>12 in.)
Cobbles:	75 mm to 300 mm (3 in. to 12 in.)
Coarse-Grained Gravel:	19 mm to 75 mm (¾ in. to 3 in.)
Fine-Grained Gravel:	4.75 mm to 19 mm (No.4 to ¾ in.)
Coarse-Grained Sand:	2 mm to 4.75 mm (No.10 to No.4)
Medium-Grained Sand:	0.42 mm to 2 mm (No.40 to No.10)
Fine-Grained Sand:	0.075 mm to 0.42 mm (No. 200 to No.40)
Silt:	0.005 mm to 0.075 mm
Clay:	<0.005 mm

PARTICLE SHAPE

Description	Criteria
Flat:	Particles with width/thickness ratio > 3
Elongated:	Particles with length/width ratio > 3
Flat & Elongated:	Particles meet criteria for both flat and elongated

RELATIVE PROPORTIONS OF FINES

Descriptive Term	% Dry Weight
Trace:	< 5%
With:	5% to 12%
Modifier:	>12%

GENERAL NOTES

(Continued)

CONSISTENCY OF FINE-GRAINED SOILS

Q_U - TSF	N - Blows/foot	Consistency
0 - 0.25	0 - 2	Very Soft
0.25 - 0.50	2 - 4	Soft
0.50 - 1.00	4 - 8	Firm (Medium Stiff)
1.00 - 2.00	8 - 15	Stiff
2.00 - 4.00	15 - 30	Very Stiff
4.00 - 8.00	30 - 50	Hard
8.00+	50+	Very Hard

MOISTURE CONDITION DESCRIPTION

Description	Criteria
Dry:	Absence of moisture, dusty, dry to the touch
Moist:	Damp but no visible water
Wet:	Visible free water, usually soil is below water table

RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Term	% Dry Weight
Trace:	< 15%
With:	15% to 30%
Modifier:	>30%

STRUCTURE DESCRIPTION

Description	Criteria
Stratified:	Alternating layers of varying material or color with layers at least ¼-inch (6 mm) thick
Laminated:	Alternating layers of varying material or color with layers less than ¼-inch (6 mm) thick
Fissured:	Breaks along definite planes of fracture with little resistance to fracturing
Slickensided:	Fracture planes appear polished or glossy, sometimes striated

Description	Criteria
Blocky:	Cohesive soil that can be broken down into small angular lumps which resist further breakdown
Lensed:	Inclusion of small pockets of different soils
Layer:	Inclusion greater than 3 inches thick (75 mm)
Seam:	Inclusion 1/8-inch to 3 inches (3 to 75 mm) thick extending through the sample
Parting:	Inclusion less than 1/8-inch (3 mm) thick

SCALE OF RELATIVE ROCK HARDNESS

Q_U - TSF	Consistency
2.5 - 10	Extremely Soft
10 - 50	Very Soft
50 - 250	Soft
250 - 525	Medium Hard
525 - 1,050	Moderately Hard
1,050 - 2,600	Hard
>2,600	Very Hard

ROCK BEDDING THICKNESSES

Description	Criteria
Very Thick Bedded	Greater than 3-foot (>1.0 m)
Thick Bedded	1-foot to 3-foot (0.3 m to 1.0 m)
Medium Bedded	4-inch to 1-foot (0.1 m to 0.3 m)
Thin Bedded	1¼-inch to 4-inch (30 mm to 100 mm)
Very Thin Bedded	½-inch to 1¼-inch (10 mm to 30 mm)
Thickly Laminated	1/8-inch to ½-inch (3 mm to 10 mm)
Thinly Laminated	1/8-inch or less "paper thin" (<3 mm)

ROCK VOIDS

Voids	Void Diameter
Pit	<6 mm (<0.25 in)
Vug	6 mm to 50 mm (0.25 in to 2 in)
Cavity	50 mm to 600 mm (2 in to 24 in)
Cave	>600 mm (>24 in)

GRAIN-SIZED TERMINOLOGY

(Typically Sedimentary Rock)

Component	Size Range
Very Coarse Grained	>4.76 mm
Coarse Grained	2.0 mm - 4.76 mm
Medium Grained	0.42 mm - 2.0 mm
Fine Grained	0.075 mm - 0.42 mm
Very Fine Grained	<0.075 mm

ROCK QUALITY DESCRIPTION

Rock Mass Description	RQD Value
Excellent	90 -100
Good	75 - 90
Fair	50 - 75
Poor	25 -50
Very Poor	Less than 25

DEGREE OF WEATHERING

Slightly Weathered:	Rock generally fresh, joints stained and discoloration extends into rock up to 25 mm (1 in), open joints may contain clay, core rings under hammer impact.
Weathered:	Rock mass is decomposed 50% or less, significant portions of the rock show discoloration and weathering effects, cores cannot be broken by hand or scraped by knife.
Highly Weathered:	Rock mass is more than 50% decomposed, complete discoloration of rock fabric, core may be extremely broken and gives clunk sound when struck by hammer, may be shaved with a knife.

SOIL CLASSIFICATION CHART

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

MAJOR DIVISIONS			SYMBOLS: GRAPH	SYMBOLS: LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		(LITTLE OR NO FINES)		GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
		(APPRECIABLE AMOUNT OF FINES)		GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	SAND AND SANDY SOILS	CLEAN SANDS		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
		(LITTLE OR NO FINES)		SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	SANDS WITH FINES		SM	SILTY SANDS, SAND - SILT MIXTURES
		(APPRECIABLE AMOUNT OF FINES)		SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				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
MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

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Graphic Symbols for Materials and Rock Deposits

CONCRETE Portland Cement Concrete	METAMORPHIC ROCK Amphibolite, Gneiss, Marble, Phyllite, Quartzite, Schist, Serpentinite, Slate
BITUMINOUS CONCRETE	CHERT
CLAYSTONE	SANDSTONE Sandstone, Orthoquarzite (Sandstone)
COAL Coal, Anthracite Coal	SHALE
CONGLOMERATE/BRECCIA Conglomerate, Breccia	SILTSTONE
IGNEOUS ROCK Anorthsite, Basalt, Metabasalt, Diabase (Gabbro), Gabbro, Granite/Granodionite, Homfels, Pegmatite, Rhyolite/Metarhyolite	NO RECOVERY
LIMESTONE Limestone, Dolomite	VOID

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APPENDIX F – DRILL, FIELD AND LAB TESTING PROCEDURES

Drilling and Sampling Procedures

The soil borings were performed with a truck-mounted rotary head drill rig. Borings were advanced using 3¼-inch inside diameter hollow-stem augers. Representative samples were obtained employing split-spoon and thin-wall tube sampling procedures in general accordance with ASTM procedures.

Field Tests and Measurements

Penetration Tests and Split-Barrel Sampling of Soils

During the sampling procedure, Standard Penetration Tests (SPT) were performed at regular intervals (2½-foot intervals to 10 feet and 5-foot intervals thereafter) to obtain the standard penetration value (N) of the soil. The results of the standard penetration test indicate the relative density and comparative consistency of the soils, and thereby provide a basis for estimating the relative strength and compressibility of the soil profile components. The split-barrel sampler provides a soil sample for identification purposes and for laboratory tests appropriate for soil obtained from a sampler that may produce large shear strain while obtaining the sample.

Water Level Measurements

Water level observations were attempted during and upon completion of the drilling operation using a 100-foot tape measure. The depths of observed water levels in the boreholes are noted on the boring logs presented in the appendix of this report. In the borings where water was unable to be observed during the field activities, in relatively impervious soils, the accurate determination of the groundwater elevation may not be possible even after several days of observation. Seasonal variations, temperature and recent rainfall conditions may influence the levels of the groundwater table and volumes of water will depend on the permeability of the soils.

Laboratory Testing Program

In addition to the field investigation, a supplemental laboratory-testing program was conducted to determine additional engineering characteristics of the foundation materials necessary in analyzing the behavior of the soils as it relates to the construction of the proposed structures. The laboratory testing program is as follows:

Laboratory Determination of Water (Moisture) Content of Soil by Mass

The water content is a significant index property used in establishing a correlation between soil behavior and its index properties. The water content is used in expressing the phase relationship of air, water, and solids in a given volume of material. In fine grained cohesive soils, the behavior of a given soil type often depends on its water content. The water content of a soil along with its liquid and plastic limits as determined by Atterberg Limit testing, is used to express its relative consistency or liquidity index.

Atterberg Limits

The Atterberg Limits are defined by the liquid limit (LL) and plastic limit (PL) states of a given soil. These limits are used to determine the moisture content limits where the soil characteristics changes from behaving more like a fluid on the liquid limit end to where the soil behaves more like individual soil particles on the plastic limit end. The liquid limit is often used to indicate if a soil is a low or high plasticity soil. The plasticity index (PI) is difference between the liquid limit and the plastic limit. The plasticity index is used in conjunction with the liquid limit to assess if the material will behave like a silt or clay. The material can also be classified as an organic material by comparing the liquid limit of the natural material to the liquid limit of the sample after being oven-dried.