PATRIOT ENGINEERING and Environmental, Inc.
Engineering Value for Project Success
Consulting Environmental, Geotechnical and Materials Engineers

Report of
Geotechnical Engineering Investigation
Knox County Jail Additions and Site Improvements
2375 South Old Decker Rd.
Vincennes, Indiana
Patriot Project No. 21-0879-02G

Prepared For:

Mr. Trent Hinkle
President
Knox County Commissioners
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July 14, 2021

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and ENVIRONMENTAL, Inc.
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Mr. Trent Hinkle
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RE: Report of
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Dear Kellie:

Attached is the report of our geotechnical engineering investigation for the proposed building additions and site improvements at the Knox County Jail. This investigation was completed in general accordance with our Proposal Number P21-1009-02G dated June 4th, 2021. Approval to conduct this investigation was given through a signed agreement dated June 15th, 2021.

This report includes detailed logs of the test borings drilled at the proposed project site. Also included in the report are the results of laboratory analysis of samples obtained from the site, and geotechnical recommendations pertinent to the site development, design, and construction.

We appreciate the opportunity to perform this geotechnical engineering investigation and look 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 and Environmental, Inc.

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TABLE OF CONTENTS

REPORT OF GEOTECHNICAL ENGINEERING INVESTIGATION

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1.0 INTRODUCTION

1.1 General

Knox County Indiana is planning to expand its existing correctional facilities and add new site pavements and stormwater management features at the existing facility located on Old Decker Road in Vincennes. The Knox County Commissioners have employed Patriot Engineering & Environmental, Inc. (*Patriot*) to perform a Geotechnical investigation of the proposed project site to assist in the design and construction processes. The results of our geotechnical engineering investigation for the project are presented in this report.

1.2 Purpose and Scope

The purpose of this investigation has been 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 project structures, pavements, and site features. This was achieved by drilling test borings, and by conducting laboratory analysis of samples collected 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 additions and improvements.

2.0 PROJECT INFORMATION

The proposed project is expected to include a new intake addition and pod addition attached to the existing jail building, as well as a new stand-alone community corrections building to the south of the jail. Some slight pavement alterations will accompany the jail building additions, and new pavements will be involved with the community corrections structure. The project will also include increasing the footprint of the existing stormwater basin to accommodate the new building and pavement impacts to site runoff.

Based on information furnished by *JPS Consulting Engineers* in the project Request for Proposal (RFP), the building is expected to include slab-on-grade construction, with no lower levels. Mezzanines and elevator pits will also be included in the structures. The wall loads will not exceed 4-kips per lineal feet (klf), isolated column loads will not exceed 250-kips, and floor loads will not exceed 150-pounds per square foot (psf). The proposed finished floor elevations for the new additions are expected to match the existing jail floor at elevation 496-msl. The community corrections building will be at or near the existing grade.

Contours of the original site prior to the jail construction included a maximum of about 9-feet of grade change. Based on observations during the fieldwork phase of our investigation, we estimate that current site contours vary about 5 to 6-feet across the overall site, but only about 1 to 2-feet within the building footprints themselves. It is assumed that any cuts or grade raise building pad fill will not exceed 2-feet above the existing ground surface.

3.0 INVESTIGATIONAL PROCEDURES

3.1 Field Work

A total of (**16**) borings were drilled, sampled, and tested at the project site on June 29th & 30th, 2021, at the approximate locations shown on the Boring Location Map in Appendix A. Eight (8) borings were performed to represent planned buildings (B-1 through B-8) and eight (8) others were completed in proposed pavement or stormwater basin areas (S-1 through S-8). Each of the borings was drilled at the preplanned locations, as marked by our representative except for Boring S-6 which was moved due to vehicle conflicts. The soil borings were drilled to depths ranging from 5-feet to 20-feet below the existing grades at the time of drilling. All depths are given as feet below the existing ground surface.

The borings were advanced using 3¼" I.D. (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" O.D. (outside diameter) by 1-3/8" I.D. 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, then at 5-foot intervals thereafter to the termination of the boring. Shelby tube sampling was attempted but did not collect usable samples in the granular soils at the site. Water levels were monitored at each borehole location during drilling, upon completion of the boring and the following day. The boreholes were backfilled with auger cuttings prior to demobilization.

3.2 Laboratory Evaluation

Upon completion of the boring program, all 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.

4.0 SITE AND SUBSURFACE CONDITIONS

4.1 Site Conditions

The current Knox County Jail, constructed in 2006 – 2007, occupies a parcel covering about 13-acres positioned on the west side of South Old Decker Road. The existing jail occupies a footprint of about 48,000-square feet, situated in the north-central portion of the property. Prior to the jail construction, the site supported two (2) rural homes or farmsteads at the northeast and southeast corners of the parcel. The balance of the site was grass or agricultural plots. The area surrounding the jail is a blend of commercial and manufacturing facilities, retail stores, civic halls, and single-family dwellings with appreciable undeveloped fields and manmade lakes (borrow pits) dispersed among the developments.

The site is located in the Wabash River terrain feature, just west of the upland zone. As such, the topography at the site and to the west is typically flat and level to gently rolling, representing floodplain deposition. The area to the east upon the upland topography is comprised of appreciably higher elevations with greater contours. The lowland area surrounding the project site is known to have high groundwater conditions.

4.2 Subsurface Conditions

Our interpretation of the subsurface conditions is based upon widely spaced soil borings drilled at the approximate locations shown on the Boring Location Map in Appendix A. The following discussion is general; 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. All depths discussed below refer to depths below the existing ground surface.

Our project soil borings were conducted in lawn areas covered with topsoil. This layer is a surficial blend of silts, sands, and clays, with varying amounts of organic matter. The topsoil layer was 4 to 10-inches thick in the borings.

Below the topsoil, our borings subsequently encountered a profile comprised of generally loose to medium dense SILTY SAND (SM), CLAYEY SAND (SC), and SAND (SP-SM, SW-SM) with silt. These generally “dirtier”, silty and clayey granular deposits provided Standard Penetration Test (SPT) N-values of 5 to 19 blows per foot (bpf) with an average of 10-bpf. This general profile was observed to depths ranging from about 3 to 10-feet below the surface. Six (6) of the shallow borings representing future pavements and stormwater basin terminated within these soils at 5 to 10-feet below the surface.

Below the previously mentioned profile, the soils generally transitioned to “cleaner” SANDS with gravels and minor silt fractions (SP, SP-SM, SW-SM) as is typical of floodplain deposition. This lower profile indicated SPT N-values ranging from 10 blows per foot to 50-blows per 3-inch advancement. The average N-value for these granular deposits was 20-bpf. Ten (10) borings, including all that represent the planned buildings, terminated in these soils at 20-feet below the existing surface.

4.3 Groundwater Conditions

During the drilling process, sampling tools were routinely observed for the existence of free water which would indicate groundwater presence. Additionally, the open boreholes were also observed for water above the collapse depth after the removal of the augers upon the completion of each hole and the following day. Based on these methods, groundwater was encountered in 10 of the 16 test borings drilled at the site. The six (6) that did not indicate water were all shallow, pavement area borings. Where present, the groundwater depths in the borings ranged from 5 to 10-feet below the existing ground surface during and at the completion of the drilling process. None of the borings indicated groundwater above the borehole collapse depth the day after drilling.

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.

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 level of the Wabash River from precipitation north of the site and local precipitation will impact groundwater at this site. Highest groundwater conditions would typically coincide with wet upstream weather conditions which raise the Wabash River level while combined with upgradient local rainfall which would pass through the site to reach the natural flow of water to the Wabash River. 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.

5.0 DESIGN RECOMMENDATIONS

5.1 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.

5.2 Foundations

The use of shallow, spread footings is typically considered the most cost and time efficient means of structural support for structures like the one proposed for this project. Although the existence of the loose granular soils at this project site will pose certain challenges, the use of conventional spread footings will be viable. Additional remedial efforts during the construction phase of the project will be necessary to accommodate the loads and reduce settlement potential. <u>These efforts will include in-place compaction to densify the bearing surface of all foundation excavations in order to reduce the total and differential settlement potential beneath the footings</u>. All foundations must be prepared in accordance with the applicable directions given in Section 6 of this report. Other foundation support methods, such as helical piers or rammed aggregate piers, could also be considered. *Patriot* could provide additional recommendations upon request.

Upon proper preparation, testing and inspection of the bearing surface, the proposed structure can be supported on conventional spread footings bearing on the natural soils or on newly placed and properly compacted fill at shallow depths. These footings should be proportioned using a net allowable soil bearing pressure not exceeding 2,000 pounds per square foot (psf) for column footings or for strip (wall) footings. For proper performance at the recommended bearing pressure, foundations must be constructed in compliance with the recommendations for footing excavation inspection that are discussed in the Construction Considerations Section 6.0 of this report.

In using the above net allowable soil bearing pressures, the weight of the foundation and backfill over the foundation need not be considered. Hence, only loads applied at or above the minimum finished grade adjacent to the footing need to be used for dimensioning the foundations. Each new foundation should be positioned so it does not induce significant pressure on adjacent foundations; otherwise the stress overlap must be considered in the design.

All exterior foundations and foundations in unheated areas should be located at a depth of at least 24-inches below final exterior grade for frost protection. However, interior foundations in heated areas can bear at depths of approximately 12-inches below the finished floor. We recommend that strip footings be at least 18-inches wide and column footings be at least 24-inches wide for bearing capacity considerations. These minimum bearing dimensions shall dictate dimensioning regardless of the actual bearing pressure that is imposed. Therefore, the proportions of lightly loaded footings may be determined by minimum dimension rather than recommended bearing pressure.

We estimate that the total foundation settlement should not exceed approximately 1-inch and that differential settlement should not exceed about ¾-inch. Careful field control during construction is necessary to minimize the actual settlement that will occur.

Positive drainage of surface water, including downspout discharge, should be maintained away from structure foundations to avoid wetting and weakening of the foundation soils both during construction and after construction is complete.

5.3 Slabs-on-Grade

In general, the shallow soils below the topsoil appear suitable for floor slab support, however in-place compaction is recommended (see Section 6.3 of this report). It will be important that the subgrade soils are properly prepared to maintain the suitability.

We recommend that all floor slabs be designed as "floating", that is, fully ground supported and not structurally connected to walls or foundations. This is to minimize the possibility of cracking and displacement of the floor slab because of differential movements between the slab and the foundation. Although the movements are estimated to be within the tolerable limits for the structural safety, such movements could be detrimental to the slabs if they were rigidly connected to the foundations.

A modulus of subgrade reaction, "K_{30}" value of 100-pounds per cubic inch (pci), is recommended for the design of ground supported floor slabs. It should be noted that the "K_{30}" modulus is based on a 30-inch diameter plate load. Adjustments to design may be necessary to accommodate larger are loads.

The building floor slabs should be supported on a minimum 6-inch thick, granular base course, bearing on a suitably prepared subgrade (refer to Section 6.0 Construction Considerations). The granular base course is expected to help distribute loads and equalize moisture conditions beneath the slab. All slabs should be liberally jointed and designed with the appropriate reinforcement for the anticipated loading conditions.

5.4 Lateral Earth Pressures

The magnitude of the lateral earth pressure is dependent on the method of backfill placement, the type of backfill soil, drainage provisions and whether the wall is permitted to yield during and/or after placement of the backfill. When a wall is held rigidly against horizontal movement, the lateral pressure against the wall is greater than the "active" earth pressure that is typically used in the design of free-standing retaining walls. Therefore, rigid walls should be designed for higher "at-rest" pressures (using an at-rest lateral earth pressure coefficient, K_o), while yielding walls can be designed for active pressures (using an active lateral earth pressure coefficient, K_a).

The foundation walls proposed for the project site are expected to be rigid walls. Therefore, provided **a clean well-graded granular material is used for backfill**, a total soil unit weight (γ_t) of 125-pcf, an at-rest lateral earth pressure coefficient (K_o) of 0.45, an active lateral earth pressure coefficient (K_a) of 0.30, and a passive lateral earth pressure coefficient (K_p) of 3.4 can be used for calculating the lateral earth pressures. An equivalent fluid active pressure of 38-psf per foot of wall height is recommended for design purposes in conditions where the top of the wall is allowed to yield during backfilling. However, if the top of the wall will be fixed, an equivalent fluid at-rest pressure of 57-psf per foot of wall height is recommended for design purposes. This equivalent fluid pressure would increase linearly from zero (0) psf at the ground surface, to a maximum at the base of the wall.

When calculating passive earth pressure, the upper 2.5-feet of soil should be neglected. Note also that the wall must move laterally about 0.04H (where H equals the wall height) for passive earth pressures to be fully developed. In most cases, passive earth pressures behind walls should not be considered.

If hydrostatic pressure due to water build-up against the wall is anticipated, the equivalent fluid pressure method will be changed for the soil. Rather, the lateral earth pressure should be computed using a total soil unit weight of 125-pcf above the highest anticipated water level, and a buoyant soil unit weight of 63-pcf below the highest anticipated water level. The earth pressure coefficient indicated above should be used above and below the water level to compute the lateral earth pressure. The hydrostatic pressure should be computed using the highest anticipated water level. The lateral earth pressure and hydrostatic pressure should be added to obtain the total lateral pressure on the wall.

As an alternative to hydrostatic pressure design, perimeter footing drains could be installed to remove potential water build-up against the wall. It is essential that the tile system be correctly designed and installed such that water is efficiently removed from the soils. Tiles should be placed at the base of the wall, preferably at the bottom of the footing, for maximum effectiveness, and be bedded and backfilled full depth with clean granular fill, as suggested above. The use of filter fabric is also recommended to reduce infiltration potential and subsequent “silting” of the tiles. Adequate outfall is also obviously imperative for the success of the tile network.

It has been assumed that the static weight per axle of equipment utilized for the compaction of the backfill materials adjacent to the below-grade wall will not exceed 2 tons per axle for non-vibratory equipment and 1 ton per axle for vibratory equipment. All heavy equipment, including compaction equipment heavier than recommended above, should not be allowed closer to the wall (horizontal distance) than the vertical distance from the backfill surface to the bottom of the wall.

The shear resistance against base sliding can be computed by multiplying the minimum normal force on the base of the footing times the appropriate coefficient of friction for the contact soil. Lateral earth pressures can be computed as discussed above. A minimum factor of safety of 1.5 is recommended for sliding stability.

Table 5.4: Summary of Lateral Earth Design Pressures:

Backfill Material	Soil Unit Weight (γ_t) (pcf)	At-Rest Coefficient (K_o)	Active Coefficient (K_a)	Passive Coefficient (K_p)	Coefficient of Friction
Clean, granular fill (SP, SW, GP, GW)	125	0.45	0.30	3.2	0.37
On-site granular soils (SM, SC, SP-SM)	130	0.50	0.33	3.0	0.35

5.5 Seismic Considerations

For structural design purposes, we recommend using a ***Site Classification of "D"*** as defined by the 2014 Indiana Building Code (modified 2012 International Building Code (IBC)). Furthermore, along with using a Site Classification of "D", we recommend the use of the maximum considered spectral response acceleration and design spectral response acceleration coefficients provided in Table No. 5.5 below.

TABLE NO. 5.5: SEISMIC DESIGN SPECTRAL RESPONSE ACCELARATION COEFFICIENTS

PERIOD (SECOND)	MAXIMUM CONSIDERED SPECTRAL RESPONSE ACCELERATION COEFFICIENT	SOIL FACTOR	DESIGN SPECTRAL RESPONSE ACCELERATION COEFFICIENT
0.2	S_S = 0.465 g	1.428	S_{DS} = 0.442 g
1.0	S_1 = 0.164 g	2.143	S_{D1} = 0.235 g

The values listed in Table 5.5 were obtained from on-line seismic hazard calculation software utilizing latitude 38.6405° North and longitude 87.5266° West as the designation for identifying the location of the parcel, applying IBC 2015 references. Other earthquake resistant design parameters should be applied consistent with the minimum requirements of the governing Indiana Building Code.

5.6 Pavements

5.6.1 Flexible Pavements

The near surface soils encountered below the topsoil during our investigation are generally suitable for pavement support. If construction is performed during a wet or cold period, the contractor will need to exercise care during the grading and fill placement activities to achieve the necessary subgrade soil support for the pavement system. (See Section 6.0 for Construction Considerations) The base soil for the pavement section will need to be firm and dry. The subgrade should be sloped properly to provide good base drainage. To minimize the effects of groundwater or surface water conditions, the base section for the roadway should be sufficiently high above adjacent ditches and properly graded to provide pavement surface and pavement base drainage.

We have used the American Associates of State Highway Transportation Officials (AASHTO) Guide for Design of Pavement Structures (1993) as a basis for our pavement thickness analysis. The AASHTO design guide was developed based on the findings of the American Associates of State Highway Officials (AASHO) Road Test. It defines pavement performance in terms of the present serviceability index (PSI), which varies from 0 to 5. The PSI of newly constructed flexible (asphaltic concrete) pavements was found to be about 4.2 in the Road Test. The end service life was considered to be reached at a terminal PSI value of 2.0. Serviceability loss (ΔPSI), the required input parameter, is the difference between the initial and terminal serviceability.

The AASHTO design guide incorporates a reliability factor to account for uncertainties in traffic prediction and pavement performance. The reliability factor (R) indicates the probability that the pavement will not reach the terminal serviceability level before the end of the design period. We have assumed a design reliability of 85 percent at an overall standard deviation (So) of 0.45 for flexible pavements.

The total flexible pavement thickness requirement is a function of the resilient modulus (Mr) of the subgrade soils. We have estimated Mr through the empirical correlation with the California Bearing Ratio (CBR) suggested by AASHTO for fine-grained soils with a soaked CBR of 10 or less. Based upon the near surface soil encountered in the borings, we recommend using a CBR value of **4** for pavement design purposes. It should be recognized though, that the recommended CBR value is based on empirical relationships only, and a laboratory CBR test may determine a higher allowable CBR value.

The total pavement thickness requirement was obtained from the AASHTO methodology using a structural number (SN), a weighted sum of the pavement layer thicknesses accounting for their structural and drainage properties. We have assumed layer coefficients of 0.39, 0.36 and 0.14 for plant mix asphalt and crushed stone, respectively, and a drainage coefficient of 1 for the crushed stone base. The possible effect of drainage on the asphaltic concrete surface is not considered.

Traffic data has not been provided as of this writing. Based on the anticipated use for the building we have assumed traffic consisting of 5 package delivery trucks per day and 2 semi-trucks per day yielding an estimated two-way 18-kips equivalent single axle load (ESAL) applications during the 15-year analysis period to be approximately 124,000 for flexible pavements. Based on these assumptions and our experience with similar projects we recommend the following pavement thicknesses for heavy duty pavement:

Table 5.6.1.1 Heavy Duty Flexible Pavement Section

CBR	Inches of compacted Aggregate Base Course	Inches of Asphalt Base Course	Inches of Asphalt Surface Course
4	6	4	1

For the purpose of light duty pavement designs, predominantly in administrative parking lot areas, we have assumed 75 cars per day which will have an estimated two-way ESAL application of less than 5,000. The pavement thicknesses appearing on the following table can be used for a light duty pavement application with or without stabilization.

Table 5.6.1.2 Light Duty Flexible Pavement Section

Inches of compacted Aggregate Base Course	Inches of Asphalt Base Course	Inches of Asphalt Surface Course
6	3	1

Our recommendations are based on the assumption that the paved areas will be constructed on successfully proofrolled natural soil, or on structural fill overlaying the same. Serviceable pavements can be achieved by different combinations of materials and thicknesses, varied to provide roughly equivalent strengths.

5.6.2 Rigid Pavements

Although flexible pavements should be sufficient for the proposed facility, *Patriot* has included an option for rigid (concrete) pavement. The total rigid pavement thickness requirement is a function of the modulus of subgrade reaction (k). An effective modulus of subgrade reaction is used in design to account for the depth to rock, the characteristics of the subbase layer, and the resilient modulus (Mr) of the subgrade soils. We have estimated Mr through the empirical correlation with the CBR suggested by AASHTO for fine-grained soils with a soaked CBR of 10 or less. As with the flexible pavement our recommendations are based on a CBR of **4** for the in-situ soils.

The elastic modulus (Ec) and modulus of rupture (S’c) of concrete are required pavement material input parameters. We have estimated Ec and S’c through empirical correlations with the 28-day compressive strength (f’c) of concrete. We have assumed the concrete will have a 28-day compressive strength of 4,000 pounds per square inch (psi) and an S’c value of at least 550 psi in typical pavement areas. The load transfer coefficient (J) is a factor used to account for the ability of concrete pavement to distribute load across discontinuities. We have assumed a load transfer coefficient of 3.2 for reinforced concrete pavement with doweled joints, and a drainage coefficient of 1 for the crushed stone base.

The rigid pavement section has been performed according to previously noted traffic loads yielding an 18-kip ESAL application during a 15-year period to be approximately 15,000 for rigid pavements. Based on these assumptions and our experience with similar projects, we recommend the following pavement thicknesses:

Table 5.6.2.1 Heavy Duty Rigid Pavement Section

CBR	Inches of compacted Aggregate Base Course	Inches of Concrete (4000 psi)
4	8	5

As is the case with the light duty flexible pavement analysis, a light duty parking lot can be constructed on the following minimum thicknesses:

Table 5.6.2.2 Light Duty Rigid Pavement Section

Inches of compacted Aggregate Base Course	Inches of Concrete (4000 psi)
6	5

Reinforcement for the rigid pavements should consist of a wire mesh or fiber-reinforced concrete. If wire mesh is utilized, the mesh must be positioned in the middle third of the concrete section. Based on our experience and a review of the Design and Control of Concrete Mixtures, published by the Portland Cement Association (PCA), we recommend that control joints be placed at 15-foot intervals in heavy duty areas each way in the apron and pad areas to control cracking. These control joints should be filled with a fuel resistant seal to prevent intrusion of liquids into the subgrade.

Our recommendations are based on the assumption that the paved areas will be constructed on successfully proofrolled natural soil, or on structural fill overlying the same.

5.7 Stormwater Management

Boring Numbers S-1 and S-5 were performed within the planned expansion area of the stormwater basin in the southeastern portion of the project site. These borings indicate a soil profile comprised of granular soils possessing notable contents of silt and clay ("fines") to the boring termination depth of 10-ft.

While granular soils are typically conducive to positive infiltration, the silt and clay content appreciably reduce the overall permeability of the soil profile. More importantly, however, are the groundwater conditions that were observed in the site-specific borings. At these locations, groundwater was present at 7.5 to 8-feet below the surface, with corresponding borehole collapse depths of 7-feet below the surface. The collapse depth often corresponds to soil saturation at or above the groundwater table.

The available site information along with our experience with shallow groundwater at nearby sites would indicate that soil saturation will inhibit or prevent efficient stormwater infiltrations, particularly during wet seasons (when infiltration would be most necessary). A soil infiltration rate of Kperm = 10^{-4} cm/sec, or an infiltration rate of ½ -inch per hour could be used for dissipation rate into the underlying soil. It should be recognized that during very wet local weather patterns, when the Wabash River stage is high and back-charging the valley feature, the underlying soils may not be capable of accepting any stormwater infiltration until hydraulic pressures are eased. Therefore, the stormwater basin would need to be sized accordingly to hold the runoff for an appreciable duration. We would recommend that evaporation be used as a significant means of volume management. Emergency overflow into ditches may also be a means of managing the site stormwater, depending on regulatory agency requirements.

6.0 CONSTRUCTION CONSIDERATIONS

6.1 Site Preparation

All areas that will support foundations, floors, 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.

Four (4) to (10) inches of loose surficial topsoil were encountered in the project borings. The topsoil was measured at discrete locations as shown on the Boring Plan (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. Therefore, it is possible that the actual stripping depth will significantly vary from this data. The data presented should be viewed only as a guide to the approximate 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. It is also important that the site is not overly stripped based merely on visual observations, particularly by dark coloration. The extent of stripping should be determined by Patriot during the site preparation activities through sampling and testing to determine organic content or other deleterious matter.

Given the typically loose nature of the surficial soils of the site, we recommend that the building pad areas be compacted in place after topsoil stripping, and **prior to** the excavation of footings or the placement of grade raise fill. This effort should involve repeated rolling of the building pad footprints plus a 5-foot margin beyond the outer edge of the proposed footings. A large, riding, vibratory, smooth steel drum with an operating weight of at least 24,000-pounds should be used to provide the densification effort, and the soils should be sufficiently moist but not wet. Wetting or drying may be necessary, depending on the weather conditions at the time of construction. Vibratory rolling should proceed with repeated passes in perpendicular travel patterns to evenly cover the entire footprint. Care must be taken for the building pads immediately adjacent to the existing jail building so that the compactive effort does not induce negative settlement upon the existing footings and walls. It may be necessary to static roll the soils immediately adjacent to the existing structures or orient the rolling patterns such that the dynamic energy is not directed at the existing structure.

A *Patriot* representative should observe the equipment, procedures and effort being applied, while conducting in-place density testing to evaluate effect. Compaction should continue until the density testing indicates no further density gain, or if the rolling effort begins to deteriorate the subgrade. Upon completion of the in-place densification, footing excavation and/or grade-raise fill could proceed per specifications.

Prior to construction of floor slabs, 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 below.

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 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 building and 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.

6.2 Foundation Excavations

A *Patriot* representative should be present during the excavation of all foundations for the project. This will allow our representative to observe the excavated soils and view the bearing conditions on an ongoing basis and make corrections as needed during digging. This will ultimately provide more efficient and timely effort if undercutting and over-excavation are necessary to remove unsuitable soils. Inspections will include hand auger probing, visual inspection, comparison to the findings of the project soil borings and possible testing with dynamic cone penetrometer or other engineering equipment. Any localized soft soil zones encountered at the bearing elevations should be further excavated until adequate support soils are encountered. The cavity should be backfilled with structural fill as defined below, or the footing can be poured at the excavated depth. Structural fill used as backfill beneath footings should be limited to lean concrete, well graded sand and gravel, or crushed stone placed and compacted in accordance with Section 6.3.

If it is necessary to support spread footings on structural fill, the fill pad must extend laterally a minimum distance beyond the edge of the footing. The minimum structural pad width would correspond with a point at which an imaginary line extending downward from the outside edge of the footing at a 1H:2V slope intersects the surface of the natural soils. For example, if the depth to the bottom of excavation is 4 feet below the bottom of the foundation, the excavation would need to extend laterally beyond the edge of the footing at least 2 feet, as shown in Illustration A found at the conclusion of this report.

<u>In order to reduce total and differential settlement, the bottoms of all footings must be compacted in-place</u> using a vibratory steel plate or vibratory roller. Compaction should continue until 100% of a Standard Proctor maximum dry density has been attained. In the event that the materials are highly variable making accurate proctor values difficult to maintain, compaction should continue until the effort indicates no further gain in density using the effort. The soils must be sufficiently moist but not wet during the compaction

effort. Wetting and drying may be necessary. Compaction efforts and procedures should be observed by a *Patriot* representative to verify equal coverage and adequate effort.

We recommend that all footings should be poured the same day as they are excavated to protect the bearing surface from desiccation or wetting, weathering or other disturbance that could compromise the soils supporting the new foundation. If it is not possible to complete the forming, reinforcement installation and placement of concrete in the same day as digging, the foundation excavation must be protected from all disturbances or other forms of deterioration. Construction traffic on the exposed surface of the bearing soil will potentially cause some disturbance of the subgrade and consequently loss of bearing capacity. However, the degree of disturbance can be minimized by proper protection of the exposed surface and/or limiting construction activities on the bearing surface.

Excavation slopes should be maintained within OSHA requirements. Based on the findings of the soil borings, we believe that the soil conditions at this site should be classified as Type C in accordance with OSHA 29 CFR parts 1926.650 through 1926.652. It should be recognized, however, that this information is provided as preliminary as determined by discrete borings of in situ materials. The contractor's "competent person", as defined by law, must classify the actual soils and conditions in the field relating to excavation protection, health, and safety. We recommend that any surcharge fill or heavy equipment be kept at least 5-feet away from the edge of any excavation.

Also, excavations that occur near existing in-use foundations should be carefully performed making a conscious effort not to undermine the support of the in-use foundations. If it is necessary to excavate soil adjacent to and below the bearing elevation of any in-use foundations, *Patriot* should be contacted to make further recommendations regarding these excavations. Please refer to Illustration B at the end of this report for further details.

6.3 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.

In general, the on-site soils appear suitable for use as structural fill for the project, although not directly behind free-standing walls. Some soils may contain excessive clay and silt content that will inhibit compaction efforts when wet. These soils may need to be discarded and replaced with cleaner, imported material.

All structural fill beneath floor slabs, adjacent to foundations and over foundations, should be compacted to at least 95-percent of its maximum Standard Proctor dry density (ASTM D-698). This minimum compaction requirement should be increased to 100-percent of the maximum Standard Proctor dry density for fill supporting footings, provided these are designed as outlined in Recommendations, Section 5.0.

In cut areas, where pavement sections are planned, the upper 10-in. of subgrade should be scarified and compacted to a dry density of at least 100-percent of the Standard Proctor maximum dry density (ASTM D-698). Any grade-raise fill placed within 1-ft of the base of the pavement section should also be compacted to at least 100 percent of the Standard Proctor maximum dry density. This can be reduced to 95-percent for engineered fill placed more than 1-ft 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 eight (8) inches in loose thickness. All fill placement should be monitored by a *Patriot* representative.

Fill placement control and field density (compaction) testing should be conducted by a *Patriot* representative during construction. Fill placement inspection should involve full-time observation of newly placed materials during fill and/or backfill operations to control lift thickness, material quality and compaction effort. Field density testing should be performed in accordance with ASTM D6938, nuclear gauge method, or ASTM 1556, sand-cone method. The frequency of testing should produce a minimum of one (1) density test result per 2,500-square feet, per material-lift, and as necessary to adequately represent the area and compaction effort.

Compaction can be attained through various means of compaction equipment and techniques. In general, sheepsfoot rollers perform more efficiently in cohesive soils, while vibratory smooth drums and plates perform better with granular soils. “Flooding” or “jetting” with water as a means of compaction is generally considered unacceptable.

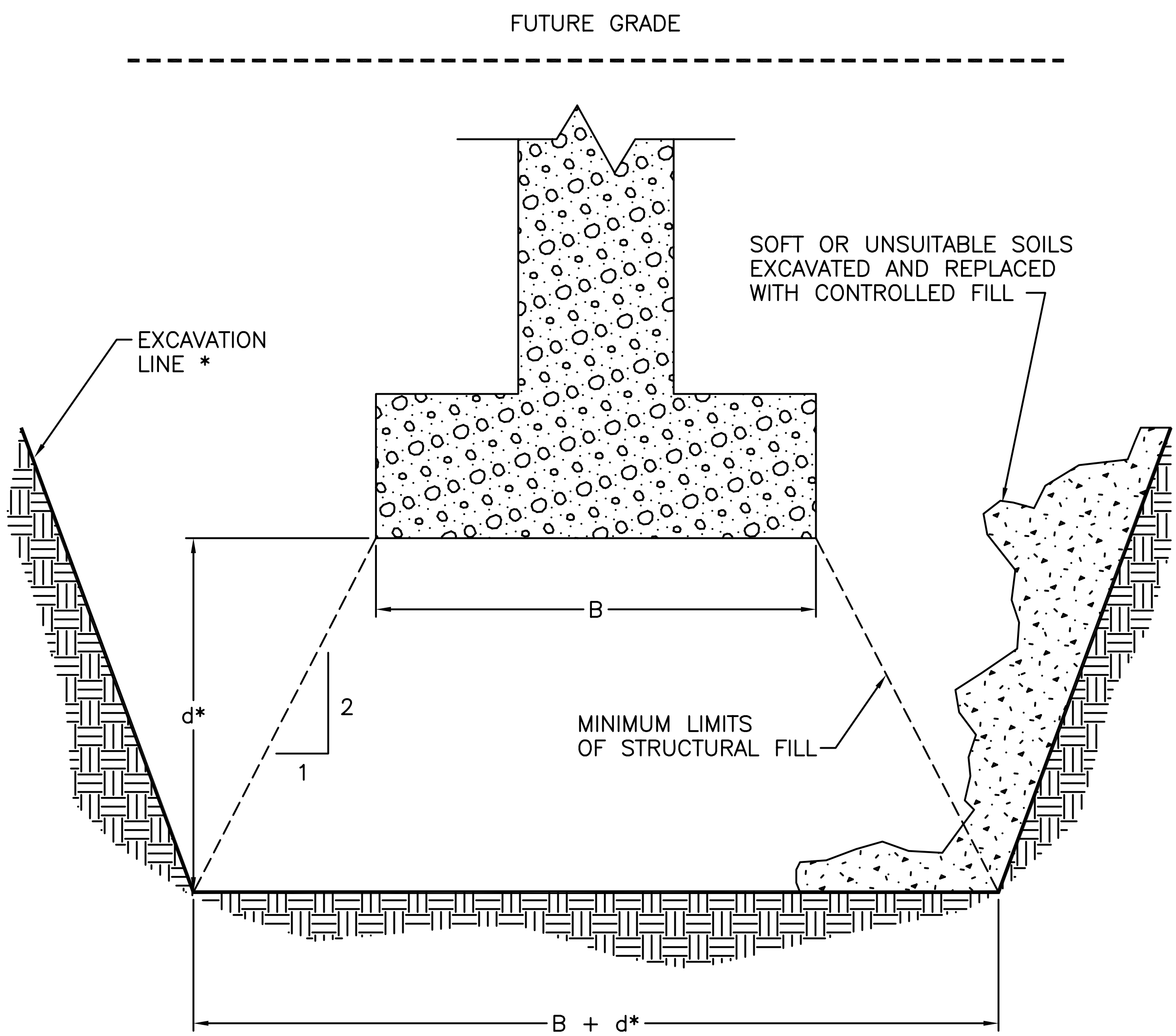
6.4 Groundwater

It is worth noting that our borings were performed during a period of moderate, normal precipitation. USGS gauge data at the Vincennes Memorial Bridge indicates that the Wabash River was at about 10 to 12-feet during the time of our drilling, below the flood stage of 16-feet. Therefore, our groundwater data from borings performed on June 29th and 30th, 2021 likely represent median or perhaps below median groundwater depth.

Groundwater was encountered during drilling in (10) of the (16) borings at depths between 7.5 and 10-feet below the existing ground surface. After the borings were completed and the augers were removed from the boreholes, water was measured at only one (1) boring location, at 5-feet below the existing ground surface. The rest of the borings were dry at the cave in depths shown on the boring logs. The available data indicates that groundwater is below the anticipated excavation depth associated with the project. However, localized, and sporadic groundwater infiltration may occur into the excavations on this site, 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.

7.0 ILLUSTRATIONS

See Illustrations A and B on the following pages. These illustrations are presented to further visually clarify several of the construction considerations presented in Section 6.2.



*d IS DEPTH TO SUITABLE SOILS

* IN COMPLIANCE WITH OSHA STANDARDS

PATRIOT ENGINEERING
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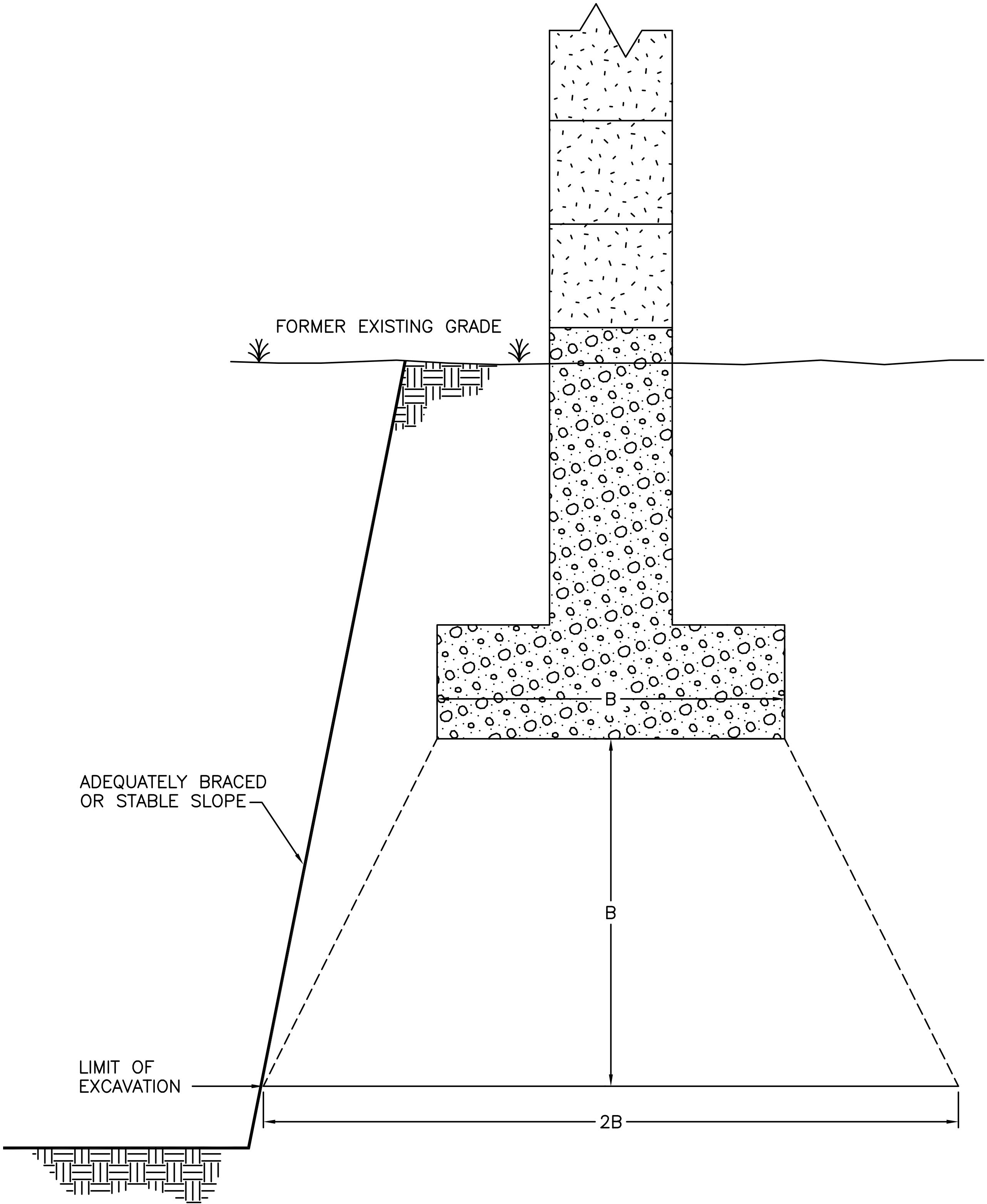
Excavation for Footings
In an Area of Fill
ILLUSTRATION A

PROJECT NO.	FIGURE
PAT-UC	1



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Excavation Near Existing
In Use Foundations
ILLUSTRATION B

PROJECT NO.	FIGURE
PAT–UC1	1

APPENDIX A

Site Vicinity Map

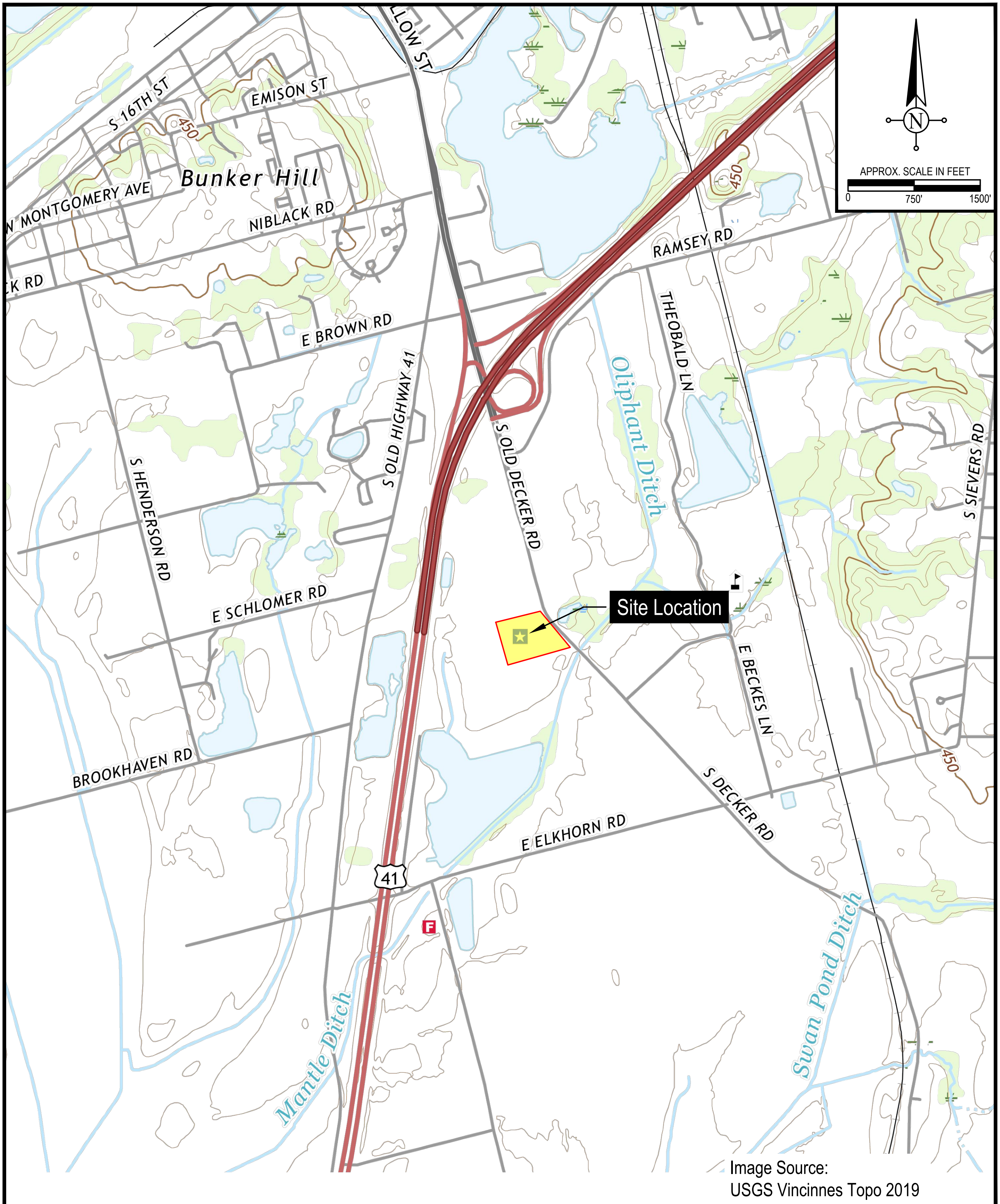
Boring Log Key

Unified Soil Classification

Boring Location Map

Boring Logs

Geologic Profile



Patriot Engineering & Environmental, Inc.	Project: Knox County Jail Additions 2375 Old Decker Road Vincennes, Indiana	Figure 1 Site Vicinity Map
	Drawn By: J. DuMond	
	Project Number: 21-0879-02 / Approved: T. Govert	
	Date: July 8, 2021 / DWG: 21-0879-02_geo	

BORING LOG KEY

UNIFIED SOIL CLASSIFICATION SYSTEM
FIELD CLASSIFICATION SYSTEM
FOR SOIL EXPLORATION

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

Density

Very Loose	-4 blows/ft. or less
Loose	-5 to 10 blows/ft.
Medium Dense	-11 to 30 blows/ft.
Dense	-31 to 50 blows/ft.
Very Dense	-51 blows/ft. or more

Grain Size Terminology

Soil Fraction		Particle Size	US Standard Sieve Size
Boulders		Larger than 12”	Larger than 12”
Cobbles		3” to12”	3” to 12”
Gravel:	Coarse	¾” to 3”	¾” to 3”
	Small	4.76mm to ¾”	#4 to ¾”
Sand:	Coarse	2.00mm to 4.76mm	#10 to #4
	Medium	0.42mm to 2.00mm	#40 to #10
	Fine	0.074mm to 0.42mm	#200 to #40
Silt		0.005mm to 0.074 mm	Smaller than #200
Clay		Smaller than 0.005mm	Smaller than #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/sq. ft.)	Field Identification (Approx.) 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 on logs are made by visual inspection.

Standard Penetration Test - Driving a 2.0” O.D., $1^{3/8}$” I.D., sampler a distance of 1.0 foot into undisturbed soil with a 140 pound hammer free falling a distance of 30.0 inches. It is customary for **Patriot** to drive the spoon 6.0 inches to seat into undisturbed soil, then perform the test. The number of hammer blows for seating the spoon and making the tests are recorded for each 6.0 inches of penetration on the drill log (Example - 6/8/9). The standard penetration test results can be obtained by adding the last two figures (i.e. 8 + 9 = 17 blows/ft.).

Strata Changes - In the column “Soil Descriptions” on the drill log the horizontal lines represent strata changes. A solid line (————) represents an actually observed change, a dashed line (- - - - - -) represents an estimated change.

Groundwater observations were made at the times indicated. Porosity of soil strata, weather conditions, site topography, etc., may cause changes in the water levels indicated on the logs.

Groundwater symbols: ▼-observed groundwater elevation, encountered during drilling; ∇-observed groundwater elevation upon completion of boring.

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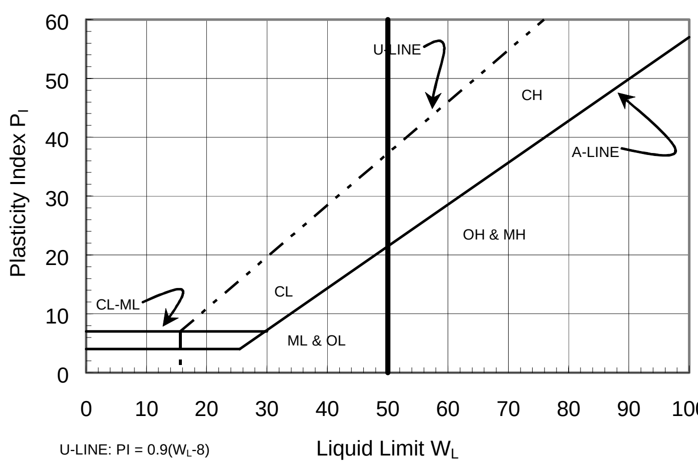
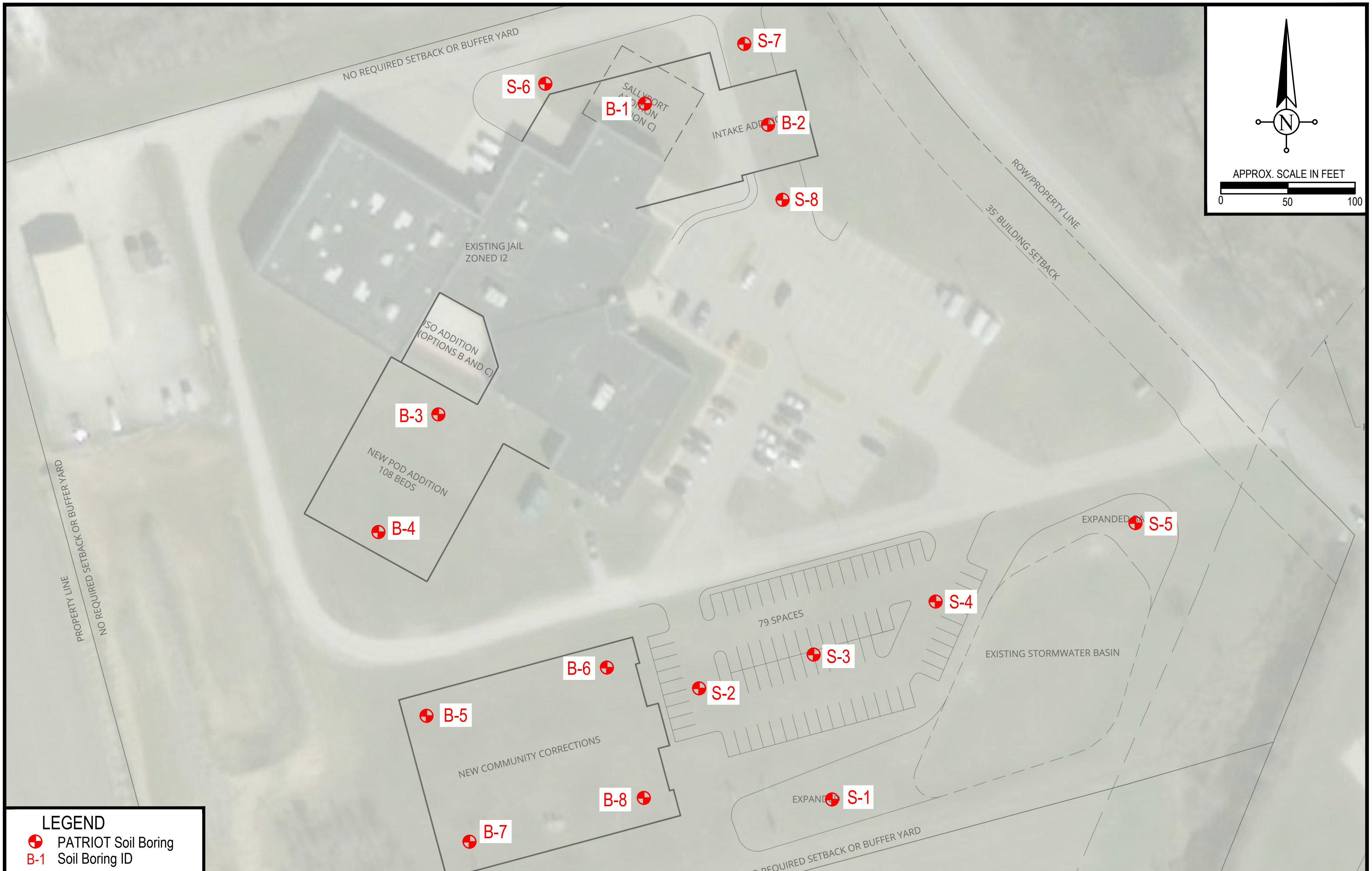
Unified Soil Classification

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 *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 *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	



U-LINE: PI = 0.9(W_L-8)
A-LINE: PI = 0.73(W_L-20)

Plasticity Chart



Patriot Engineering & Environmental, Inc.

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: RQAW Site Layout
4. Scale as shown.

Project: Knox County Jail Additions
2375 Old Decker Road
Vincennes, Indiana

	Drawn By: J. DuMond
Project Number:21-0879-02	Approved: T. Govert
Date: July 8, 2021	DWG: 21-0879-02_geo

Figure 2

Soil Boring Location Map

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LOG OF BORING B-1

Knox County Jail Additions
2375 Old Decker Rd.
Vincennes, Indiana

Client Name	: Knox County Commissioners	Driller	: Korey
Project Number	: 21-0879-02G	Sampling	: Splitspoon
Logged By	: T. Govert	Weather	: Cloudy, 75°
Start Date	: 6/30/12		
Drilling Method	: HSA		

Water Levels
▼ During Drilling: 10-ft.
▽ After Completion: Dry

Depth in Feet	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0				TOPSOIL (6")						
		SM		Brown, moist, loose SILTY SAND with trace clay	1	72	4/4/3			
		SM		Brown, moist, loose SILTY SAND and GRAVEL with trace clay	2	67	3/4/4			Borehole collapsed to 4-ft after auger removal
5		SW-SM		Brown, moist to wet, medium dense well graded SAND with some gravel, trace silt	3	50	5/8/6			
					4	67	3/7/7			
10	▼	SP-SM		Brown, wet, loose SAND with some gravel, trace silt	5	67	7/4/6			
15										

Boring terminated at 15-ft.

20

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LOG OF BORING B-2

Knox County Jail Additions
2375 Old Decker Rd.
Vincennes, Indiana

Client Name	: Knox County Commissioners	Driller	: Korey
Project Number	: 21-0879-02G	Sampling	: Splitspoon
Logged By	: T. Govert	Weather	: Sunny, 75°
Start Date	: 6/30/12		
Drilling Method	: HSA		

Water Levels
▼ During Drilling: 10-ft.
▽ After Completion: 5-ft

Depth in Feet	Water Level	USCS	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0			TOPSOIL (6")						
		SC	Brown, moist, loose SANDY CLAY with trace small gravel	1	61	5/4/5			
		SP-SM	Brown, moist, loose SAND with a little gravel , trace silt & clay	2	56	2/3/3			
5	▽								Borehole collapsed to 5-ft after auger removal
		SP-SM	Brown, moist to wet, medium dense SAND with a little gravel, trace silt	3	56	3/4/8			
				4	72	5/8/8			
10	▼								
		SP-SM	Brown, wet, medium dense SAND with trace to a little gravel & silt	5	67	13/14/14			
15									
				6	39	8/11/12			
20									

Boring terminated at 20-ft.

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LOG OF BORING B-3

Knox County Jail Additions
2375 Old Decker Rd.
Vincennes, Indiana

Client Name	: Knox County Commissioners	Driller	: Korey
Project Number	: 21-0879-02G	Sampling	: Splitspoon
Logged By	: T. Govert	Weather	: Sunny, 80°
Start Date	: 6/29/12		
Drilling Method	: HSA		

Water Levels
▼ During Drilling: 10-ft.
▽ After Completion: Dry

Depth in Feet	Water Level	USCS	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0			TOPSOIL (5")						
		SM	Reddish Brown, moist, loose fine to medium grained SILTY SAND with trace small gravel & clay	1	94	7/5/5			
5		SP-SM	Brown, moist, loose SAND with a little gravel, trace silt & clay	2	67	3/4/6			Borehole collapsed to 5-ft after auger removal
		SP	Light Brown, slightly moist, medium dense SAND with some gravel	3	61	8/11/12			
10	▼	SP-SM	Grayish Brown, wet, medium dense SAND and GRAVEL with trace silt	4	67	5/6/14			
15				5	61	7/7/8			
20		SP-SM	Grayish Brown, saturated, medium dense fine to medium grained SAND with trace silt	6	33	8/10/15			

Boring terminated at 20-ft.

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LOG OF BORING B-4

Knox County Jail Additions
2375 Old Decker Rd.
Vincennes, Indiana

Client Name	: Knox County Commissioners	Driller	: Korey
Project Number	: 21-0879-02G	Sampling	: Splitspoon
Logged By	: T. Govert	Weather	: Sunny, 80°
Start Date	: 6/29/12		
Drilling Method	: HSA		

Water Levels
▼ During Drilling: 7.5-ft.
▽ After Completion: Dry

Depth in Feet	Water Level	USCS	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0			TOPSOIL (5")						
		SC	Reddish Brown, moist, medium dense CLAYEY SAND	1	56	10/8/5			
5		SC	Brown, moist, medium dense CLAYEY SAND and GRAVEL	2	33	8/10/3			Borehole collapsed to 4-ft after auger removal
	▼	SW-SM	Brown, moist, medium dense well graded SAND and GRAVEL with trace silt	3	61	16/10/3			
10		SP-SM	Grayish Brown, wet, dense fine to medium grained SAND with trace silt	4	33	8/14/16			
15		SP-SM	Grayish Brown, saturated, very dense SAND and GRAVEL with trace silt	5	6	50-3"			

Boring terminated at 15-ft.

20

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LOG OF BORING B-5

Knox County Jail Additions
2375 Old Decker Rd.
Vincennes, Indiana

Client Name	: Knox County Commissioners	Driller	: Korey
Project Number	: 21-0879-02G	Sampling	: Splitspoon
Logged By	: T. Govert	Weather	: Sunny, 85°
Start Date	: 6/29/12		
Drilling Method	: HSA		

Water Levels
▼ During Drilling: 7.5-ft.
▽ After Completion: Dry

Depth in Feet	Water Level	USCS	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0			TOPSOIL (6")						
0.5		SC	Brown, moist, medium dense CLAYEY SAND	1	100	18/10/9			
3		SC	Brown, moist, loose SILTY CLAYEY SAND with a little gravel	2	67	7/6/4			
5.5	▼ (7.5)	SP-SM	Brown, moist, medium dense SAND with some gravel, trace silt	3	72	4/5/7			Borehole collapsed to 4-ft after auger removal
8		SP-SM	Grayish Brown, wet, medium dense SAND and GRAVEL with trace silt	4	67	20/10/12			
13		SP-SM	Brown, very moist, very dense fine to medium grained SAND with trace silt	5	33	50-5"			
				6	33	50-5"			
20			Boring terminated at 20-ft.						

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LOG OF BORING B-6

Knox County Jail Additions
2375 Old Decker Rd.
Vincennes, Indiana

Client Name	: Knox County Commissioners	Driller	: Korey
Project Number	: 21-0879-02G	Sampling	: Splitspoon
Logged By	: T. Govert	Weather	: Sunny, 80°
Start Date	: 6/29/12		
Drilling Method	: HSA		

Water Levels

▼ During Drilling: 10-ft.

▽ After Completion: Dry

Depth in Feet	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0				TOPSOIL (6")						
		SM		Reddish Brown to Light Brown, moist, medium dense SILTY SAND with a little gravel, trace clay	1	100	9/8/8			
		SP-SM		Brown, moist, loose fine to medium grained SAND with a little silt & small gravel	2	56	3/4/5			Borehole collapsed to 4-ft after auger removal
5		SP-SM		Brown, moist to wet, medium dense SAND with some gravel, trace silt	3	50	2/5/10			
					4	67	8/5/8			
10	▼									
		SP-SM		Brown, saturated, fine to medium grained SAND with trace silt	5	33	5/6/4			
15					6	33	5/8/10			
20										

Boring terminated at 20-ft.

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LOG OF BORING B-7

Knox County Jail Additions
2375 Old Decker Rd.
Vincennes, Indiana

Client Name	: Knox County Commissioners	Driller	: Korey
Project Number	: 21-0879-02G	Sampling	: Splitspoon
Logged By	: T. Govert	Weather	: Sunny, 80°
Start Date	: 6/29/12		
Drilling Method	: HSA		

Water Levels
▼ During Drilling: 10-ft.
▽ After Completion: Dry

Depth in Feet	Water Level	USCS	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0			TOPSOIL (7")						
		SM	Brown, moist, medium dense fine to medium grained CLAYEY SILTY SAND	1	100	7/7/5			
		SC	Brown, moist, loose CLAYEY SAND with some gravel	2	61	6/5/5			
5		SP	Brown, moist, loose SAND and GRAVEL with trace silt	3	67	5/10/10			Borehole collapsed to 5-ft after auger removal
10	▼	SP-SM	Grayish Brown, wet, medium dense fine to medium grained SAND with trace silt & small gravel	4	72	3/5/8			
15		SP-SM	Grayish Brown, wet, medium dense SAND and GRAVEL with trace silt	5	78	5/8/9			
		SP-SM	Brown, saturated, medium dense fine to medium grained SAND with trace silt	6	33	5/8/10			
20			Boring terminated at 20-ft.						

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LOG OF BORING B-8

Knox County Jail Additions
2375 Old Decker Rd.
Vincennes, Indiana

Client Name	: Knox County Commissioners	Driller	: Korey
Project Number	: 21-0879-02G	Sampling	: Splitspoon
Logged By	: T. Govert	Weather	: Sunny, 80°
Start Date	: 6/29/12		
Drilling Method	: HSA		

Water Levels
▼ During Drilling: 7.5-ft.
▽ After Completion: Dry

Depth in Feet	Water Level	USCS	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0–0.5			TOPSOIL (6")						
0.5–5.5		SM	Reddish Brown, moist, loose fine grained SILTY SAND with trace clay	1	100	1/2/3			
				2	44	2/2/4			
5.5–7.5	▼ (7.5)	SC	Grayish Brown, very moist, loose SILTY CLAYEY SAND with a little gravel	3	61	2/4/6			Borehole collapsed to 7-ft after auger removal
7.5–12		SP	Brown, moist, medium dense SAND with some gravel	4	67	5/6/8			
12–20		SP-SM	Brown, wet, medium dense SAND with some gravel, trace silt	5	67	7/6/9			
				6	72	14/6/5			

Boring terminated at 20-ft.

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LOG OF BORING S-1

Knox County Jail Additions
2375 Old Decker Rd.
Vincennes, Indiana

Client Name	: Knox County Commissioners	Driller	: Korey
Project Number	: 21-0879-02G	Sampling	: Splitspoon
Logged By	: T. Govert	Weather	: Sunny, 75°
Start Date	: 6/30/12		
Drilling Method	: HSA		

Water Levels
▼ During Drilling: 7.5-ft.
▽ After Completion: Dry

Depth in Feet	Water Level	USCS	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0			TOPSOIL (5")						
		SM	Brown, moist, loose SILTY SAND with trace clay & small gravel	1	89	4/4/4			
				2	72	4/5/5			
5									
	▼ (7.5)	SP-SM	Grayish Brown, saturated, loose to medium dense fine to medium grained SAND with trace gravel & silt	3	67	3/3/5			Borehole collapsed to 7-ft after auger removal
				4	67	4/5/6			
10									

Boring terminated at 10-ft.

15

20

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LOG OF BORING S-2

Knox County Jail Additions
2375 Old Decker Rd.
Vincennes, Indiana

Client Name	: Knox County Commissioners	Driller	: Korey
Project Number	: 21-0879-02G	Sampling	: Splitspoon
Logged By	: T. Govert	Weather	: Sunny, 80°
Start Date	: 6/29/12		
Drilling Method	: HSA		

Water Levels
▼ During Drilling: Dry
▽ After Completion: Dry

Depth in Feet	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0				TOPSOIL (6")						
		SM		Reddish Brown, moist, medium dense fine to medium grained SILTY SAND with trace clay & gravel	1	100	6/5/6			
5		SP		Brown, moist, medium dense SAND with trace gravel	2	61	6/8/11			Borehole collapsed to 4-ft after auger removal

Boring terminated at 5-ft.

10

15

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LOG OF BORING S-3

Knox County Jail Additions
2375 Old Decker Rd.
Vincennes, Indiana

Client Name	: Knox County Commissioners	Driller	: Korey
Project Number	: 21-0879-02G	Sampling	: Splitspoon
Logged By	: T. Govert	Weather	: Sunny, 80°
Start Date	: 6/29/12		
Drilling Method	: HSA		

Water Levels
▼ During Drilling: Dry
▽ After Completion: Dry

Depth in Feet	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0				TOPSOIL (4")						
		SM		Brown, dry, medium dense fine to medium grained SILTY SAND						Borehole collapsed to 1-ft after auger removal
					1	17	12/8/7			
					2	17	8/7/7			
5										

Boring terminated at 5-ft.

10

15

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LOG OF BORING S-4

Knox County Jail Additions
2375 Old Decker Rd.
Vincennes, Indiana

Client Name	: Knox County Commissioners	Driller	: Korey
Project Number	: 21-0879-02G	Sampling	: Splitspoon
Logged By	: T. Govert	Weather	: Sunny, 80°
Start Date	: 6/29/12		
Drilling Method	: HSA		

Water Levels
▼ During Drilling: Dry
▽ After Completion: Dry

Depth in Feet	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0				TOPSOIL (5")						
		SM		Reddish Brown, moist, medium dense SILTY SAND with trace clay & small gravel	1	100	4/6/6			Borehole collapsed to 1-ft after auger removal
		SP-SM		Reddish Brown, moist, loose SAND with trace sand & gravel	2	61	1/3/4			
5										

Boring terminated at 5-ft.

10

15

20

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LOG OF BORING S-5

(Page 1 of 1)

Knox County Jail Additions
2375 Old Decker Rd.
Vincennes, Indiana

Client Name	: Knox County Commissioners	Driller	: Korey
Project Number	: 21-0879-02G	Sampling	: Splitspoon
Logged By	: T. Govert	Weather	: Sunny, 80°
Start Date	: 6/29/12		
Drilling Method	: HSA		

Water Levels
▼ During Drilling: 7.5-ft
▽ After Completion: Dry

Depth in Feet	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0				TOPSOIL (6")						
		SM		Brown, very moist, loose SILTY SAND with trace gravel	1	78	4/5/4			
		SP-SM		Brown, moist, loose SAND and GRAVEL with trace silt	2	22	3/4/6			
5										
		SW-SM		Grayish Brown, wet, loose well graded SAND with some gravel, trace silt	3	56	2/3/4			Borehole collapsed to 7-ft after auger removal
	▼									
					4	67	2/3/5			
10										

Boring terminated at 10-ft.

15

20

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LOG OF BORING S-6

Knox County Jail Additions
2375 Old Decker Rd.
Vincennes, Indiana

Client Name	: Knox County Commissioners	Driller	: Korey
Project Number	: 21-0879-02G	Sampling	: Splitspoon
Logged By	: T. Govert	Weather	: Sunny, 80°
Start Date	: 6/29/12		
Drilling Method	: HSA		

Water Levels
▼ During Drilling: Dry
▽ After Completion: Dry

Depth in Feet	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0				TOPSOIL (6")						
		SM		Reddish Brown, very moist, loose CLAYEY SILTY SAND with a little gravel	1	78	3/4/6			Borehole collapsed to 1-ft after auger removal Boring location moved east to edge of pavement due to vehicle conflicts
5					2	72	4/4/4			

Boring terminated at 5-ft.

10

15

20

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LOG OF BORING S-7

Knox County Jail Additions
2375 Old Decker Rd.
Vincennes, Indiana

Client Name	: Knox County Commissioners	Driller	: Korey
Project Number	: 21-0879-02G	Sampling	: Splitspoon
Logged By	: T. Govert	Weather	: Sunny, 80°
Start Date	: 6/29/12		
Drilling Method	: HSA		

Water Levels
During Drilling: Dry
After Completion: Dry

Depth in Feet	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0				TOPSOIL (5")						
		SM		Reddish Brown, moist, medium dense to loose fine to medium grained SILTY SAND with trace gravel	1	100	6/6/7			Borehole collapsed to 2-ft after auger removal
					2	72	3/4/5			
5										

Boring terminated at 5-ft.

Depth scale: 0, 5, 10, 15, 20

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LOG OF BORING S-8

Knox County Jail Additions
2375 Old Decker Rd.
Vincennes, Indiana

Client Name	: Knox County Commissioners	Driller	: Korey
Project Number	: 21-0879-02G	Sampling	: Splitspoon
Logged By	: T. Govert	Weather	: Sunny, 75°
Start Date	: 6/30/12		
Drilling Method	: HSA		

Water Levels
During Drilling: Dry
After Completion: Dry

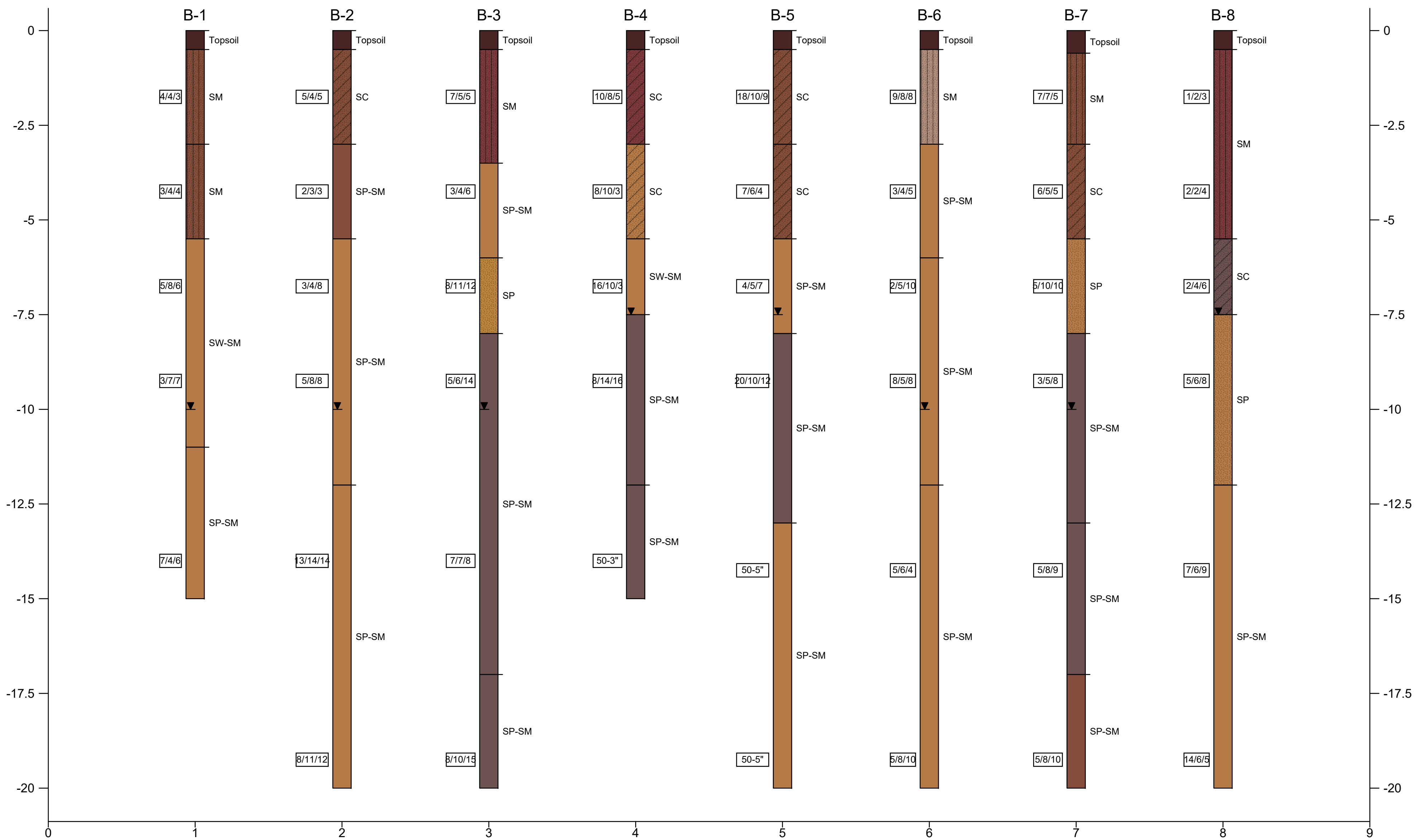
Depth in Feet	Water Level	USCS	GRAPHIC	DESCRIPTION	Samples	Rec %	SPT Results	qp tsf	w %	REMARKS
0				TOPSOIL (6")						
				Aggregate (8")						
		SM		Brown, moist, medium dense to loose CLAYEY SILTY SAND with trace gravel	1	78	12/8/4			
					2	44	4/2/5			Borehole collapsed to 4-ft after auger removal
5										

Boring terminated at 5-ft.

10

15

20



Knox County Jail Additions
2375 Old Decker Rd.
Vincennes, Indiana

Geologic Profile

Building Borings

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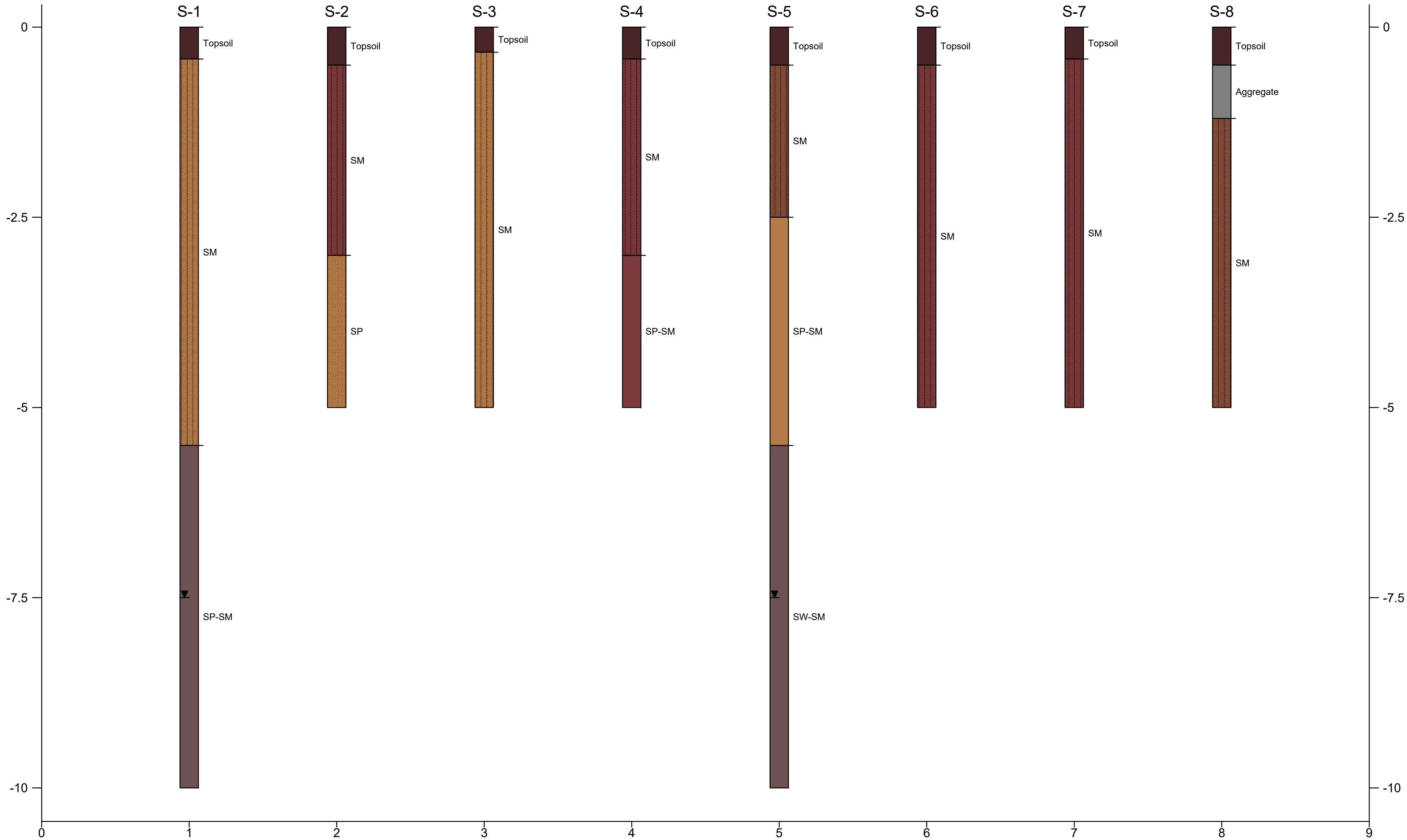

Knox County Jail Additions
2375 Old Decker Rd.
Vincennes, Indiana

Geologic Profile

Site Civil Borings

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APPENDIX B

General Qualifications

and

Standard Clause for Unanticipated Subsurface Conditions

GENERAL QUALIFICATIONS

<u>of Patriot Engineering's Geotechnical Engineering Investigation</u>

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.