SOIL BORING LOG

The following soil boring logs are provided for information purposes only. No liability is assumed or implied that the logs address all soil conditions that may be present on the site.

PIONEER
Engineering & Environmental Services, LLC

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May 15, 2017

Dresden Development & Construction, LLC
P.O. Box 790
Mokena, Illinois 60448
Attn: Paul Dresden

RE: **Geotechnical Investigation Report**
SE Corner of 5th Street and Pine Street
Michigan City, Indiana
Pioneer Project No. 17-0154-151

Dear Mr. Dresden:

Pioneer Engineering & Environmental Services, LLC (Pioneer) was contracted to conduct a geotechnical and groundwater infiltration investigation for the proposed residential development to be located at the southeast corner of 5th Street and Pine Street in Michigan City, Indiana. The investigation was performed in general accordance with Pioneer Proposal No. 11706 and 12622, dated April 12, 2017.

The scope of the geotechnical investigation included drilling, sampling and laboratory testing of soils at eighteen (18) locations in order to provide a geotechnical engineering evaluation of the subsurface materials. Field infiltration testing was conducted at two locations to measure the flow rate of water into soil for use in stormwater detention design. The approximate locations of these borings, soil test results, and graphic soil profiles have been incorporated into this report.

Project Overview

The Project Site consists of a currently undeveloped 2.9-acre parcel located at the southeast corner of 5th Street and Pine Street in Michigan City, Indiana. A small parking lot is located at the southwest corner of the property and the balance of the property is covered with grass.

Current plans include constructing one 3 to 4-story apartment building on each corner of the Site (4 buildings total). The western buildings are planned with commercial space on the ground floor with apartments on Floors 2 and 3. The eastern buildings are planned with parking on the first floor with apartments on Floors 2, 3 and 4. No basements are planned. No other information is available on structure types and building loads.

The planned stormwater management system includes below-grade storage vaults that will allow for stormwater infiltration into the subsurface soil. The base of the stormwater management system will be approximately 5 feet below existing grade.

Historical Aerial Photos

A cursory review of aerial photos from 1938 to present was made to help determine if the past history of the site, such as previous structures, may provide insight into the existing site subsurface conditions. The cursory review of historical aerial photos suggests that the Site was developed with residences prior to 1938. By 1969, a hospital was constructed in the northwest corner of the Site (reference the attached boring location diagram for approximate location of former hospital). The hospital reportedly had a full-depth basement. The structure was demolished sometime between 1998 and 2003. Based on a review of the

subsequent aerial photos, no significant changes to the subject property were noted since the demolition of the hospital, bringing the subject site to its current configuration.

Subsurface Investigation

Eight soil borings (Borings B-1, B-3, B-7, B-8, B-11, B-12, B-17 and B-18) were made within the limits of the proposed building areas and ten soil borings (Borings B-2, B-4 through B-6, B-9, B-10 and B-13 through B-16) were made within the limits of the proposed pavement areas, reference the Boring Location Diagram, Figure 1. In addition, the field work included two Infiltration Tests located near Borings B-6 and B-13. The borings were advanced with a small ATV-mounted Geoprobe 7822DT drill rig using 3 ¼-inch diameter hollow stem augers (HSAs).

Representative soil samples were obtained from each sampling interval using the split barrel sampling procedure performed in accordance with ASTM Standard D 1586, "Method for Penetration Test and Split Barrel Sampling of Soils". In the split barrel sampling procedure, a 140-pound hammer falls 30 inches and drives a two-inch outer diameter split barrel sampler 18 inches into the soil. The number of blows required to drive the barrel sampler the final 12 inches is the Standard Penetration Resistance (SPT N-value) for that interval. This test result indicates the soil's relative density and comparative consistency, and provides a basis for estimating the relative strength and compressibility of soil. Representative soil samples were obtained at 2.5-foot intervals to a depth of 15 feet and at 5-foot intervals thereafter.

The soil samples obtained from each interval were logged in the field according to their predominant geological characteristics. Soil samples obtained from the drilling operations were identified by boring number and sampling depth, and brought to Pioneer's laboratory for further examination and testing. The borings were backfilled immediately after drilling to prevent a hazard.

The soil samples were analyzed for physical soil parameters including moisture content and unconfined compressive strength. A natural moisture content was conducted for each sampling interval in accordance with ASTM Standard D 2216. Additional estimated unconfined compressive strength values for cohesive soil samples were obtained by using a spring-loaded pocket penetrometer and/or Rimac machine.

After completion of the laboratory testing, an experienced soil engineer visually classified each soil sample in accordance with the Unified Soil Classification System (ASTM Standards D 2487 and D 2488). A brief description of the Unified Soil Classification System has been included as an attachment to this report. The laboratory classification, in combination with the field logs and laboratory test results, were used to prepare the final Boring Logs that are also included as an attachment to the report.

Subsurface Conditions

Soil Conditions. The typical soil conditions encountered in the borings include a thin surface cover of Pavement Materials in Boring B-18 and Silty Sand Fill over successive deposits of granular soils in the rest of the borings. A detailed discussion of the deposits is as follows:

Pavement and Fill. Boring B-18 was located in the existing asphalt paved parking lot located at the southwestern corner of the project site. The pavement section included 5-inch thick bituminous concrete pavement over 6-inch thick layer of Crushed Stone or Gravel Base Course.

Boring B-1 and B-2 were located within the limits of the former hospital with full-depth basement. The borings were advanced to a depth of approximately 10 feet and were terminated upon auger refusal at this depth. In these borings, an 8-inch thick Topsoil Fill surface cover is underlain by Brown and Gray fine Sand Fill. The Fill possesses SPT N-Values ranging from 8 to 22 blows per foot (bpf). It is assumed that the

former basement floor slab was encountered at a depth of 10 feet, however this was not confirmed during the investigation.

The surface cover at the rest of the borings consisted of 2 to 13-inch thick layer of Dark Brown and Black Silty Sand Fill. Deeper Fill was encountered in Borings B-13 and B-15 extending to a depth of approximately 2.5 feet below existing surface grade.

Brown to Brown and Gray Medium to Fine Sand. At most locations, the Pavement Materials and Fill are underlain by a deposit of loose to medium dense Brown to Brown and Gray Sand to a depth of approximately 3 to 14 feet below existing grade. The deposit possesses SPT N-values ranging from 8 to 23 blows per foot and moisture contents ranging from 11.7 to 22.6 percent. Very loose Sand was encountered in Boring B-4 possessing SPT N-values of 2 to 3 bpf.

Gray Clayey Silt/Sand And Silt. The Brown to Brown and Gray Silty Sand is underlain by a 4.5 to 24.5-foot thick deposit of predominately Gray Silt containing a varying content of fine Sand. Zones of loose to medium dense Clayey Silt or tough to very tough Silty Clay are interbedded in the deposit. The deposit possesses SPT N-values ranging from 6 to 45 blows per foot (bpf) and moisture content of 10.2 to 28.3 percent. Most of the borings were terminated in the deposit.

Very Tough to Hard Gray Silty Clay. The upper profile soils are underlain by a deposit of very tough to hard Gray Silty Clay in Borings B-3, B-4, B-6, B-7, B-17 and B-18. The deposit possesses unconfined compressive strengths of 2.5 to 4.5 tons per square foot (tsf) and moisture contents of 14.5 to 20.5 percent. The borings were terminated in the deposit.

Groundwater Conditions. Groundwater was encountered while drilling the Brown medium Sand at a depth of 4 to 6 feet below existing grade in the borings. A delayed groundwater level ranging from 3 to 6 feet was measured in the borings after one-hour observation period. A long-term groundwater level of 5 feet below existing grade should be used for design purposes.

The borings were backfilled immediately after drilling to avoid any hazard to the public. Seasonal and yearly fluctuations in the water table can be expected due to variations in precipitation, evaporation, and surface runoff. Also, it is likely that pockets of perched groundwater may occur after precipitation events.

The 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 descriptions, stratifications, penetration resistance, 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.

Infiltration Test Procedure and Results

Infiltration Test Procedure. The infiltration testing was performed in accordance with procedures adopted from the City of Chicago Stormwater Management Ordinance Manual (Manual) where applicable.

Infiltration tests were conducted on April 18, 2017 at two locations. The tests were performed by: (1) advancing a 12.5-inch diameter borehole to a depth of approximately 3 feet below existing grade (Infiltration Test No. 2 near Boring B-13) and to a depth of 5 feet below existing grade (Infiltration Test No.1 near Boring B-6); (2) installing a 12-inch diameter casing; (3) filling the casing with water to saturate the soils below; and, (4) measuring the steady-state rate at which the water level dropped within the casing through the saturated

soils below. The water level was measured using a measuring tape and a stop watch. After infiltration testing was completed, the casing was removed and the borings were backfilled with soil cuttings.

Infiltration Test Results. The measured results of the infiltration tests are presented in the attached Single Ring Infiltrometer Infiltration Rate Determination sheets. A graph showing the cumulative amount of water infiltrated versus time is also attached. Calculations were performed in accordance with the Chicago Stormwater Manual to determine the infiltration test rate at each location. The calculations and test results are also shown on the determination sheets. The results are summarized as follows:

Table 1: Near Surface Soil Properties and Infiltration Rates

Test Number	Depth of Test (ft.)	Soil Type (USDA)	Estimated Hydraulic Conductivity	Estimated Infiltration Rate	Groundwater Level Below Ground Surface (feet)
I-1 (BORING 6)	5	Brown to Brown and Gray Sand	K 2.8 x 10^{-7} ft/s	0.01 in/hr	5.0
I-2 (BORING 13)	3	Brown to Brown and Gray Sand	K 4.5 x 10^{-5} ft/s	1.92 in/hr	5.0

Infiltration Test No. 1 was performed with the bottom of test at a depth of 5 feet below existing grade. This depth was chosen to coincide with the planned bottom of Stormwater Management system. The very low rate of infiltration (0.01 inches per hour) reflects close proximity to the groundwater table. Very little infiltration should be expected for stormwater systems located below a depth of 4 feet.

A relatively high infiltration rate (1.92 inches per hour) was measured at a depth of 3 feet below existing grade in Infiltration Test No. 2. This value reflect the relatively high hydraulic conductivity of the fine-grained Sand.

Conclusions and Recommendations

Demolition

The Topsoil should be removed from the limits of the proposed building and pavement. The existing bituminous concrete pavement located at the southwestern portion of the project site should also be removed. The underlying Crushed Stone/Gravel Base Course can generally be left in place in areas planned for additional fill. The surface should be proofrolled with a fully loaded truck to locate any unstable areas and to confirm stability in the rest of the Site. Unsuitable soils should be removed and replaced as discussed in Floor Slabs section of the report.

It appears as if the basement floor slab from the former hospital remains in place. It is not known if the footings and basement foundation walls remain in place.

Former foundation walls and footings that conflict with the proposed building foundation or underground utilities should be removed to the depth encountered and replaced with Structural Fill. In general, the former basement floor slab can remain in place and does not need to be removed. If encountered beneath pavement, the existing footings/foundation walls/slabs can generally be left in place unless they are located within 2 feet below the design subgrade for pavements or floor slabs.

Foundation System

Anticipated Design Scheme. The proposed four buildings are planned as a 3 to 4-story slab-on-grade structures. The structures will be surrounded by parking lots and access driveways. It is expected that the top-of-first floor slab will approximate that of the existing grade. Buildings of this type will typically consist of

perimeter foundation walls that will transfer building loads to continuous wall footings and column loads that will be supported by spread footings. For discussion purposes, the design bottom of perimeter wall footings are assumed to be at a depth of 4 feet below existing surface grade. Interior column footings are expected to be located near a depth of 3 feet below existing grade.

Foundation Support Soils. The following describes the major soil types encountered in the investigation and their applicability for support of the proposed structure.

- The Black Silty Sand encountered in the borings and the Crushed Stone Fill encountered below the Bituminous Concrete Pavement in lot 3 should not be used for footing support.
- The Sand Fill that was apparently used to backfill the former basement possesses variable engineering properties and should not be used to support the structures.
- The loose to medium dense Brown to Brown and Gray Silty Sand encountered near the design footing subgrade at the majority of the project area possesses adequate engineering properties for support of the foundations.

Table 1 summarizes the approximate depth to suitable foundation support soils.

Table 2 - Depth to Suitable Foundation Support Soils

Boring No.	Depth to Suitable Foundation Support Soils (Feet)
B-1	10
B-2	10
B-3	2
B-6	2
B-7	2
B-8	2
B-11	2
B-12	2
B-13	2
B-16	2
B-17	2
B-18	2

Frost-Depth Footings. Frost-depth footings should extend below the unsuitable soils as described above and founded in the underlying suitable soils. Alternately, if unsuitable soils are encountered at design footing subgrade, the unsuitable soils can be undercut and replaced with structural fill.

Footings founded on the recommended soil or on a pad of structural fill should be dimensioned using a net allowable bearing capacity of 3,000 psf. The net allowable bearing pressure refers to that pressure which may be imposed on the foundation soils in excess of the final minimum surrounding overburden pressure.

The following should be used where unsuitable soil is encountered below the design footing subgrade and an undercut-replacement scheme is used for footing support. Any unsuitable soils such as Fill or Organic soils that are encountered at the design footing subgrade should be removed to the depth encountered and replaced with Structural Fill. Typical Structural Fill, such as 3-inch crushed limestone or concrete choked with 1-inch nominal granular material should be placed in 18-inch lifts and compacted by use of a vibratory compactor or through the force of a backhoe's bucket to seat the stone. The width of the excavation should extend at least one foot horizontally beyond the perimeter of the footing on all sides for each one foot of vertical undercut below the bottom of the footing, thus providing for adequate lateral distribution of the foundation stresses.

An additional discussion of the placement and compaction of Structural Fill is included in the Earthwork Controls section of this report.

All footings should be founded a minimum depth of 3.5 feet below final exterior surface grade to eliminate the effects of frost action on footing behavior. In order to prevent local bearing failure, isolated column footings should have a minimum lateral dimension of 24-inches and continuous footings should have a minimum width of 18-inches. Any existing structures, footings and/or foundation walls encountered that are located within the zone of influence of the new footings should be removed in their entirety. If the building is constructed during winter months or if the footings will likely be subjected to freezing temperatures after construction is completed, then the footings should be protected from freezing.

Based on the subsurface conditions, laboratory testing and past experience, Pioneer anticipates that properly designed and constructed footings supported upon the recommended, inspected and approved soil or structural fill should experience a maximum total settlement of ½ inch or less. Differential settlements ranging from ½ to ⅔ the total settlement are possible across the building area due to variations in subsurface conditions and foundation loadings.

In order to limit the effects of differential movement that may occur due to variations in the character of the supporting soils and variations in seasonal moisture contents, Pioneer recommends that the foundation footings be suitably reinforced to make them as rigid as practical.

Floor Slabs

At-Grade Slab. The building areas should be graded to design floor slab subgrade and inspected for unsuitable soils. If possible the subgrade can also be proofrolled using a fully loaded truck. Any unstable soils containing a high content of organic material, or wood debris should be removed to the depth encountered or to a maximum depth of 2 feet and replaced with structural fill. Old footings or floor slabs, if any are encountered, should be removed to a depth of 2 feet below slab design subgrade.

All unsuitable soils or old foundations should be replaced with compacted structural fill. Structural fill should be an approved granular soil. Engineered fill should be placed and compacted in lifts with a maximum lift thickness of 8 inches. Each lift of Coarse Graded granular soil should be compacted to a minimum of 75 percent of the relative density in accordance with ASTM Standards D 4253 and D 4254. Dense Graded should be compacted to a minimum of 95 percent of the maximum density per ASTM D 1557 (Modified Proctor).

Assuming the floor slab subgrade is prepared as recommended, a modulus of subgrade reaction of 200 pounds per cubic inch (pci) should be used.

The floor slab should be supported by a minimum 6-inch thick granular base course of Dense Graded No. 53 aggregate or Coarse Graded No. 8. The base course will not only facilitate fine grading of the slab

subgrade surface, but will also serve as a capillary cutoff layer, which will minimize the migration of moisture through the floor slab. The use of a vapor barrier beneath the floor slab is also recommended. A simple polyethylene membrane can generally be installed at a minimal cost, further minimizing the migration of moisture through the floor slab, which may damage sensitive floor coverings. Floor slabs-on-grade should be isolated from the foundation system and contain the proper number of isolation and contraction joints to maintain the integrity of the slab should minor differential movements occur.

Construction Groundwater Control. Wet conditions will be encountered as excavation proceeds below the groundwater surface near a depth of 5 feet below existing grade. The frost-depth footings are expected to be located above this level, however utilities may extend deeper.

Pioneer anticipates that groundwater infiltrating into excavations less than 5 feet below existing grade during normal weather conditions may be managed using standard perimeter ditch, sump, and pump procedures. Excavations deeper than 5 feet below existing grade will require a more extensive groundwater dewatering system.

Precautions should also be taken so that the adjacent sidewalks, roadways, and utilities are not undermined. Pioneer recommends sloping the sides of all excavations in accordance with local ordinances and OSHA regulations. Materials removed from the excavation should not be stockpiled immediately adjacent to the excavation, since this surcharge load may cause a sudden collapse of the slope.

Pavement Design Considerations.

Pavement Support. The proposed pavement areas should be excavated to design subgrade to 2-feet outside the limits of the paved area. Any Topsoil or root mat should be removed from the pavement area to a maximum depth of 2 feet below design subgrade and replaced with structural fill. Uniformity in support characteristics for the pavement can be attained by using the following procedures.

After removing the Topsoil/Fill and excavating to pavement design subgrade, the exposed soil should be proofrolled with a vibratory steel drum roller or fully loaded truck. The subgrade should also be visually inspected for unsuitable soils. Any Fill containing a high content of topsoil, organic material or wood debris should be removed to the depth encountered to a maximum depth of 2 feet below design subgrade. Zones of instability (generally identified as more than 1 inch of pumping or rutting) should be disked, dried and recompacted.

All unsuitable soils should be replaced with compacted structural fill. Use of a woven geotextile fabric should be considered for additional stability. Engineered fill should be placed and compacted in lifts as described above for Floor Slabs.

Pavement Section. Pioneer recommends a flexible pavement section be constructed using the following pavement design. It is recommended that the completed site plans be analyzed to determine the most likely traffic patterns for heavy delivery trucks and garbage trucks. The recommended Heavy-Duty Pavement section should be used in these traffic corridors.

Table 3: Pavement Section Recommendations

Pavement Material	Compacted Material Thickness (Inches)		
	Flexible Pavement (Light Duty)	Flexible Pavement (Heavy Duty)	Rigid Pavement (Heavy Duty)
Portland Cement Concrete	-	-	6.5 -
Bituminous Surface Coarse	1.5	2	-
Bituminous Binder Coarse	1.5	3	-
Dense Graded Aggregate Base Coarse	8	10	6 -
Total Pavement Section Thickness	11	15	12.5

The bituminous concrete binder and surface courses should consist of Hot Mix Asphalt pavement as defined in the InDOT Standard Specifications. All placement and compaction activities should meet the requirements of the InDOT Standard Specifications.

The design of pavements should incorporate provisions for drainage of both the pavement surface and the base course layer. Should standing water be allowed to accumulate on the pavement surface or within the base course, the sub-grade will soften and it is likely that the pavement will deteriorate. The base course should be protected from water inflow along drainage paths. The base course should extend beyond the edges of the pavement in low areas to allow any water that enters the base course a path for exit.

Earthwork Controls.

Structural Fill should meet the following properties for use as floor slab support soils.

Table 4: Structural Fill Material Requirements

Fill Type	USCS Classification	Acceptable Location for Placement
Cohesive	CL, CL-ML	Below floor slabs and pavement
Granular	GW, GP, GM, GC SW, SP, SM, SC	Below floor slabs, pavement and foundations
Unsuitable	CH, MH, ML, OL, OH, PT	Non-structural areas

Structural Fill should be placed and compacted in accordance with the following requirements.

Table 5: Fill Placement and Compaction Requirements

Description	Requirement
Fill Lift Thickness	10 inches loose measurement when sheepsfoot or steel drum rollers are used 6 inches loose measurement when jumping jacks or plate compactors are used
Minimum Compaction Requirement Below Foundations and Slabs-on-Grade and Upper 12 Inches of Paved Areas	95% of the maximum dry density per ASTM D-1557 (Modified Proctor)
Minimum Compaction Requirement Below 12 Inches of Paved Areas and Landscaped Areas	90% of the maximum dry density per ASTM D 1557 (Modified Proctor)
Moisture Content of Cohesive Soils	-2% to +3 % of optimum moisture content per ASTM D 1557
Coarse-Graded Aggregate	Compact in 8-inch thick lifts loose measure to achieve stability through particle interlock

All subgrade surfaces should be protected during construction from deterioration or softening caused by frost or ponding of water. Water should not be allowed to stand in the excavations for a sustained period of time. All soft, loose, or disturbed soils should be removed to competent support materials. If the floor slab is prepared in the winter, exposed subgrade soils should be protected from freezing. Structural fill should not be placed on frozen soil

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Report Limitations

This geotechnical investigation report has been prepared to aid in the evaluation and design of this project. As a result, this report has provided generalized guidelines to be considered during the actual design and construction phases of the proposed building. The information provided in this report should be evaluated by, and the site improvements should be designed by a licensed structural engineer or architect. Should deviations from the noted subsurface conditions be encountered during construction, this information should be brought to Pioneer's attention. Pioneer would welcome the opportunity to provide field construction services for this project. The analysis and recommendations submitted in this report are based upon the data obtained from the soil borings performed at the locations indicated on the location diagram. It should be understood that this location was approximate, since the boring locations were not surveyed. This report does not reflect any variations that may occur between and beyond these borings.

This report has been prepared for the sole use of the client identified in the report and cannot be relied upon by other persons or entities without Pioneer's permission. The observations and conclusions contained herein are limited by the scope and intent of the work mutually agreed upon by the client and Pioneer and the work actually performed. There are no warranties, implied or expressed, concerning the integrity of the areas and/or mediums not analytically tested.

Pioneer appreciates the opportunity to provide our services for this project. Please feel free to contact us if you have any questions or concerns.

Respectfully Submitted,
Pioneer Engineering & Environmental Services, LLC

Youssef Banoub,
Project Manager

Robert L. Gay
Senior Geotechnical Engineer

Michael Ciserella, P.E.
Director
License No.
Expires

Attachments:
Boring Location Diagram (Figure 1)
Boring Location Diagram (Figure 2)
Boring Logs
Infiltration Test Data
Soil Classification Chart

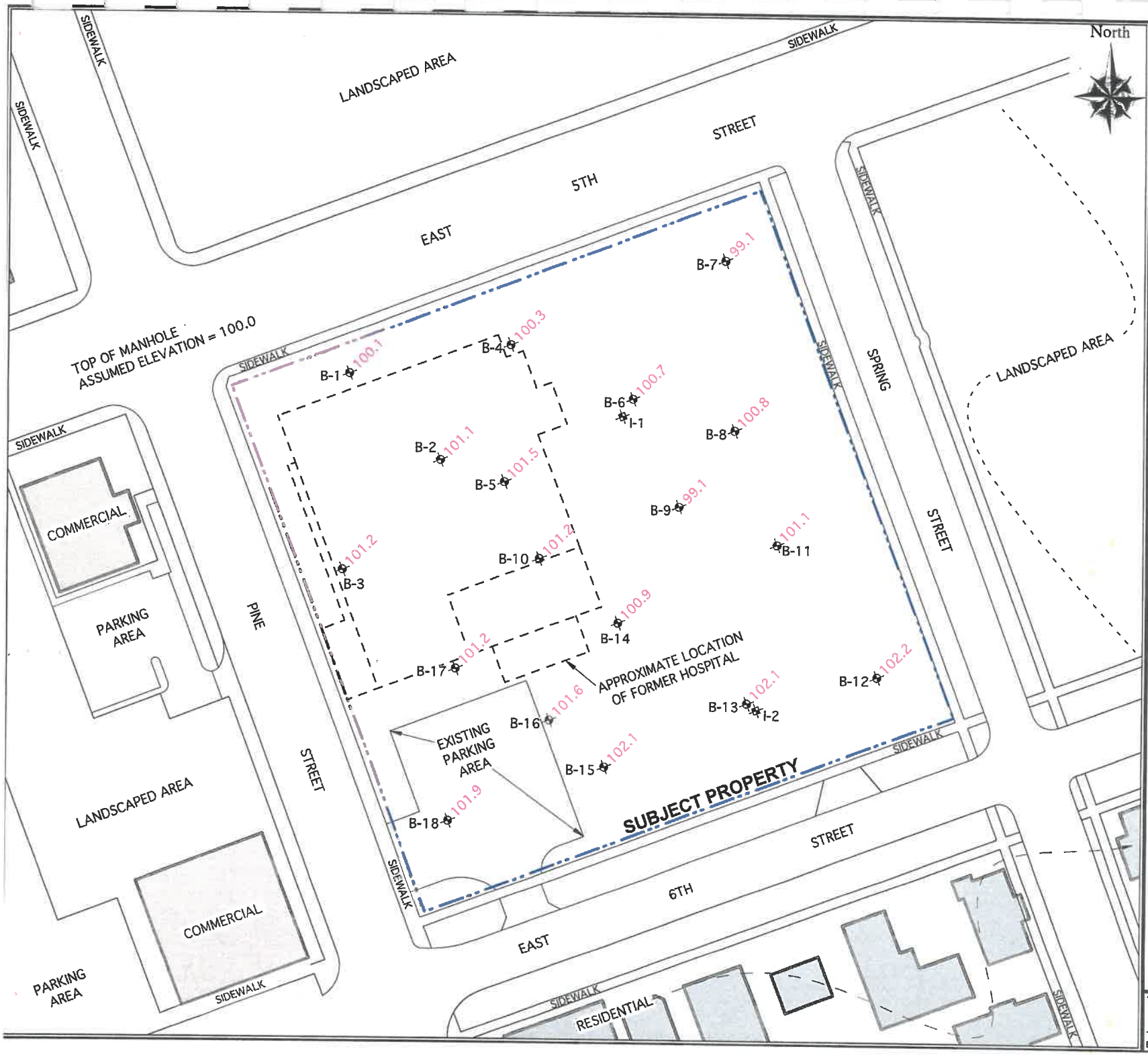

FIGURE 1
Soil Boring Locations Diagram
SEC East 5th Street & Pine Street
Michigan City, IN

Scale: 1"=80' (0' – 80')

Drawn by: M. Sanabria

Job No.: 17-0154-151

Date: May 2017

Checked by: Youssef Banoub

Legend:
- Approximate Property Line
- Geotechnical Soil Boring Location
- X = Ground Surface Elevation
- Infiltration Sample Location

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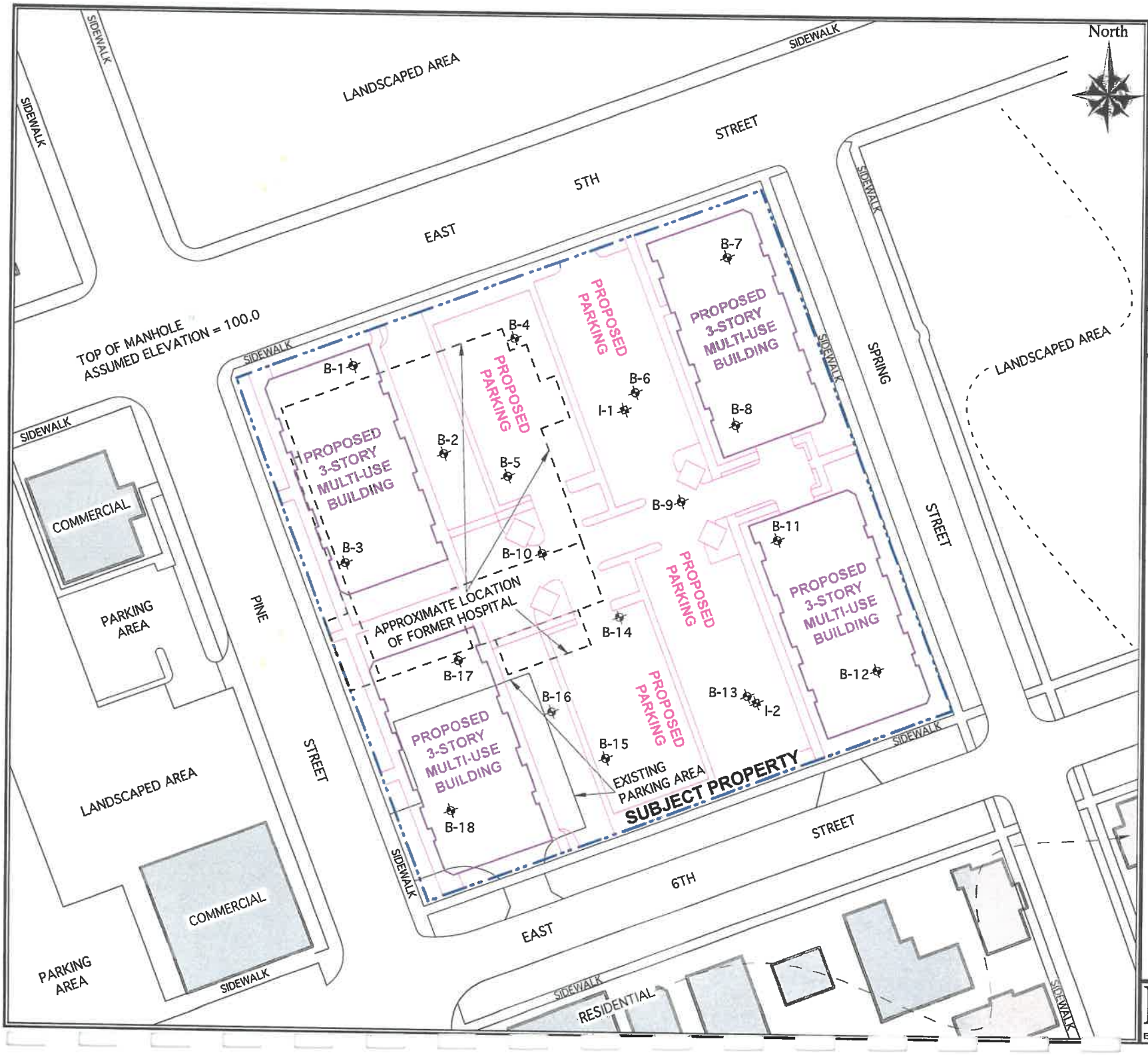

FIGURE 2
Soil Boring Locations Diagram
SEC East 5th Street & Pine Street
Michigan City, IN

Scale: 1"=80' (0' – 80')

Drawn by: M. Sanabria

Job No.: 17-0154-151

Date: May 2017

Checked by: Youssef Banoub

Legend:

- Approximate Property Line
- Geotechnical Soil Boring Location
- Infiltration Sample Location

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BORING LOG B-1

Project No.:	17-0154-151	**Drilling Method:**	3.25" Hollow Stem Augers
Project:	Proposed Apartment Development	**Sampling Method:**	Split Spoon
Location:	SE Corner of 5th Street and Pine Street Michigan City, Indiana	**Hammer Type:**	Automatic
		Drill Rig Type:	Geoprobe 7822DT
Client:	Dresden Development and Construction, LLC	**Backfill Method:**	Soil Cuttings

WATER LEVELS

During Drilling	5 ft
At Completion	ft
After 24 Hours	ft

Surface Elev.: 595.64 100.10 ft

Elevation, (feet)	Depth, (feet)	Graphic Log	Sample Type	USCS Classification	MATERIAL DESCRIPTION	Sample No.	Recovery (inches)	SPT Blows per 6-inch N-values	Hand Penetrometer Qp (tsf)	Unconfined Compressive Strength Qu (tsf)	Vane Shear (Peak) Su (tsf)	Moisture, %	Dry Density (pcf)
	0			FILL	8" Black Silty Sand FILL Brown medium to fine Sand FILL, little silt	1						15.5	
				FILL		2	17	3/4/4 N=8				21.5	
95	5			FILL	Gray fine Sand FILL, little silt	3	18	3/4/5 N=9				19.8	
				FILL		4	17	4/6/7 N=13				20.0	
	10			FILL	Brown Fine Sand FILL, little silt Auger refusal at 10 feet End of Boring at 10 feet	5	10	1/2/7 N=9				21.7	

STANDARD PENETRATION TEST DATA
N in blows/ft ◎
× Moisture ◪ PL ✚ LL
1 — 25 — 50

STRENGTH, tsf
▲ Qu ✳ Qp
0 — 2.0 — 4.0

Completion Depth:	10.0 ft
Date Boring Started:	4/21/17
Driller:	GA
Checked By:	YB
Logged By:	JV

Sample Types:
Vane Shear, Split-Spoon, Rock Core, Shelby Tube, Hand Auger, Auger Cutting

Remarks: Temp. Benchmark Assumed Elevation = 100 ft. CCD

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

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BORING LOG B-2

Project No.:	17-0154-151	**Drilling Method:**	3.25" Hollow Stem Augers
Project:	Proposed Apartment Development	**Sampling Method:**	Split Spoon
Location:	SE Corner of 5th Street and Pine Street Michigan City, Indiana	**Hammer Type:**	Automatic
		Drill Rig Type:	Geoprobe 7822DT
Client:	Dresden Development and Construction, LLC	**Backfill Method:**	Soil Cuttings

WATER LEVELS

During Drilling	5 ft
At Completion	ft
After 24 Hours	ft

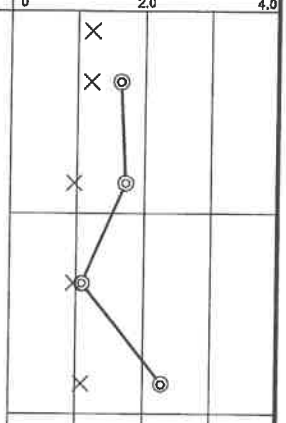
Surface Elev.: 596.24 / 101.10 ft

Elevation, (feet)	Depth, (feet)	USCS Classification	MATERIAL DESCRIPTION	Sample No.	Recovery (inches)	SPT Blows per 6-inch N-values	Moisture, %
100	0	FILL	8" Dark Brown Silty Sand FILL	1			15.6
		FILL	Brown medium to fine Sand FILL, trace silt	2	18	5/9/12 N=21	15.5
	5	FILL		3	18	6/9/13 N=22	12.4
95		FILL	Brown and Gray fine Sand FILL, little silt	4	16	2/6/8 N=14	12.4
	10	FILL	Brown and Gray coarse to fine Sand FILL, trace silt, little gravel	5	17	7/13/16 N=29	14.0
			Auger refusal at 10 feet End of Boring at 10 feet				

Hand Penetrometer Qp (tsf) | Unconfined Compressive Strength Qu (tsf) | Vane Shear (Peak) Su (tsf) | Dry Density (pcf)

STANDARD PENETRATION TEST DATA
N in blows/ft ◎
× Moisture ◪ PL ✚ LL
1 — 25 — 50

STRENGTH, tsf
▲ Qu ✳ Qp
0 — 2.0 — 4.0



Completion Depth:	10.0 ft
Date Boring Started:	4/21/17
Driller:	GA
Checked By:	YB
Logged By:	JV

Sample Types:
Vane Shear, Split-Spoon, Rock Core, Shelby Tube, Hand Auger, Auger Cutting

Remarks: Temp. Benchmark Assumed Elevation = 100 ft. CCD

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

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BORING LOG B-3

Project No.:	17-0154-151	**Drilling Method:**	3.25" Hollow Stem Augers
Project:	Proposed Apartment Development	**Sampling Method:**	Split-Spoon Sampling
Location:	SE Corner of 5th Street and Pine Street Michigan City, Indiana	**Hammer Type:**	Automatic Hammer
		Drill Rig Type:	Geoprobe 7822DT
Client:	Dresden Development and Construction, LLC	**Backfill Method:**	Soil Cuttings

WATER LEVELS

During Drilling	5 ft
At Completion	ft
After 24 Hours	ft

Surface Elev.: 596.51 / 101.20 ft

Elevation, (feet)	Depth, (feet)	USCS Classification	MATERIAL DESCRIPTION	Sample No.	Recovery (inches)	SPT Blows per 6-inch N-values	Hand Penetrometer Qp (tsf)	Unconfined Compressive Strength Qu (tsf)	Vane Shear (Peak) Su (tsf)	Moisture, %	Dry Density (pcf)
100	0	FILL	8" Dark Brown and Black Clayey Sand FILL, trace roots	1						10.2	
		SP	Brown medium to fine SAND, trace silt	2	18	4/6/6 N=12				14.2	
	5	SP		3	18	6/8/11 N=19				17.1	
95		SP-SM	Grayish Brown medium to fine SAND, little silt	4	17	8/10/10 N=20				18.2	
	10	SP-SM		5	15	8/10/12 N=22				12.8	
90		SP-SM	coarse to fine Sand at 11 feet	6	18	6/7/8 N=15				14.0	
	15	ML	Gray SILT, little fine sand	7	17	7/6/7 N=13				24.2	
85			Gray Clayey SILT, trace fine sand								
	20	CL-ML		8	16	3/3/5 N=8				26.5	
80											
	25	CL	Gray Silty CLAY, trace fine sand	9	18	2/3/4 N=7	1.75	2.7		24.8	104.0
75											
	30	CL		10	18	3/4/5 N=9	1.75	1.8		19.7	104.8
			End of Boring at 30 feet								

STANDARD PENETRATION TEST DATA
N in blows/ft ◎
× Moisture ◪ PL ✚ LL
1 — 25 — 50

STRENGTH, tsf
▲ Qu ✳ Qp
0 — 2.0 — 4.0

Completion Depth:	30.0 ft
Date Boring Started:	4/21/17
Driller:	GA
Checked By:	YB
Logged By:	JV

Sample Types:
Vane Shear; Split-Spoon; Rock Core; Shelby Tube; Hand Auger; Auger Cutting

Remarks: Temp. Benchmark Assumed Elevation = 100 ft. CCD

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

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BORING LOG B-4

Project No.:	17-0154-151	**Drilling Method:**	3.25" Hollow Stem Augers
Project:	Proposed Apartment Development	**Sampling Method:**	Split-Spoon Sampling
Location:	SE Corner of 5th Street and Pine Street Michigan City, Indiana	**Hammer Type:**	Automatic Hammer
		Drill Rig Type:	Geoprobe 7822DT
Client:	Dresden Development and Construction, LLC	**Backfill Method:**	Soil Cuttings

WATER LEVELS

During Drilling	4 ft
At Completion	3.5 ft
After 24 Hours	ft

595-70

Surface Elev.: 100.30 ft

Elevation, (feet)	Depth, (feet)	USCS Classification	MATERIAL DESCRIPTION	Sample No.	Recovery (inches)	SPT Blows per 6-inch N-values	Hand Penetrometer Qp (tsf)	Unconfined Compressive Strength Qu (tsf)	Vane Shear (Peak) Su (tsf)	Moisture, %	Dry Density (pcf)
100	0	FILL	8" Dark Brown and Black Silty Sand FILL, little gravel	1						7.6	
		FILL	Brown medium to fine Sand FILL, trace silt	2	17	2/2/1 N=3				11.7	
		FILL	Brown and Gray Silty Sand FILL, trace gravel	3	16	2/1/1 N=2				20.0	
95	5	FILL	Gray Silty Sand FILL with Clay seams, trace gravel	4	15	0/1/1 N=2				16.8	
		FILL		5	16	1/1/1 N=2				19.3	
90	10	CL	Gray Silty CLAY, trace sand, trace gravel	6	18	4/5/7 N=12	1.75	2.9		20.5	117.3
		CL		7	18	2/4/6 N=10	2.25	2.8		17.1	118.7
85	15	CL		8	18	2/4/7 N=11	2.25	2.5		17.5	118.0
	20		End of Boring at 20 feet								

STANDARD PENETRATION TEST DATA
N in blows/ft ◎
× Moisture ◪ PL ✚ LL
1 — 25 — 50

STRENGTH, tsf
▲ Qu ✳ Qp
0 — 2.0 — 4.0

Completion Depth:	20.0 ft
Date Boring Started:	4/19/17
Driller:	GA
Checked By:	YB
Logged By:	JV

Sample Types:
Vane Shear, Split-Spoon, Rock Core, Shelby Tube, Hand Auger, Auger Cutting

Remarks: Temp. Benchmark Assumed Elevation = 100 ft. CCD

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

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BORING LOG B-5

Project No.:	17-0154-151	**Drilling Method:**	3.25" Hollow Stem Augers
Project:	Proposed Apartment Development	**Sampling Method:**	Split-Spoon Sampling
Location:	SE Corner of 5th Street and Pine Street Michigan City, Indiana	**Hammer Type:**	Automatic Hammer
		Drill Rig Type:	Geoprobe 7822DT
Client:	Dresden Development and Construction, LLC	**Backfill Method:**	Soil Cuttings

WATER LEVELS

During Drilling	16 ft
At Completion	11 ft
After 24 Hours	ft

Surface Elev.: 595.48 / 101.50 ft

Elevation, (feet)	Depth, (feet)	Graphic Log	Sample Type	USCS Classification	MATERIAL DESCRIPTION	Sample No.	Recovery (inches)	SPT Blows per 6-inch N-values	Hand Penetrometer Qp (tsf)	Unconfined Compressive Strength Qu (tsf)	Vane Shear (Peak) Su (tsf)	Moisture, %	Dry Density (pcf)
100	0			FILL	6" Brown and Black Silty Sand FILL, trace gravel, trace roots	1						12.8	
				SM	Brown fine SAND, little to some silt	2	16	6/7/9 N=16				13.0	
	5			SM	coarse to fine Sand, trace gravel at 6 feet	3	18	5/8/9 N=17					
95				SM		4	17	4/7/11 N=18				13.5	
				SP-SM	Grayish Brown medium to fine SAND, some silt	5	16	5/8/10 N=18				15.1	
	10				Gray coarse to fine SAND, little gravel, little silt								
90				CL-ML		6	18	12/20/11 N=31				13.7	
				ML	Gray Clayey SILT with clay seams, trace fine sand	7	18	8/11/13 N=24				18.1	
	15				Gray SILT, little fine sand								
85				SP-SM		8	15	1/1/3 N=4				25.5	
	20				End of Boring at 20 feet								

STANDARD PENETRATION TEST DATA
N in blows/ft ◎
× Moisture ◪ PL ✚ LL
1 — 25 — 50

STRENGTH, tsf
▲ Qu ✳ Qp
0 — 2.0 — 4.0

Completion Depth:	20.0 ft
Date Boring Started:	4/21/17
Driller:	GA
Checked By:	YB
Logged By:	JV

Sample Types:
Vane Shear, Split-Spoon, Rock Core, Shelby Tube, Hand Auger, Auger Cutting

Remarks: Temp. Benchmark Assumed Elevation = 100 ft. CCD

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

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BORING LOG B-6

Project No.:	17-0154-151	**Drilling Method:**	3.25" Hollow Stem Augers
Project:	Proposed Apartment Development	**Sampling Method:**	Split-Spoon Sampling
Location:	SE Corner of 5th Street and Pine Street Michigan City, Indiana	**Hammer Type:**	Automatic Hammer
		Drill Rig Type:	Geoprobe 7822DT
Client:	Dresden Development and Construction, LLC	**Backfill Method:**	Soil Cuttings

WATER LEVELS

During Drilling	5 ft
At Completion	3 ft
After 24 Hours	ft

Surface Elev.: 595.69 100.70 ft

Elevation, (feet)	Depth, (feet)	Graphic Log	Sample Type	USCS Classification	MATERIAL DESCRIPTION	Sample No.	Recovery (inches)	SPT Blows per 6-inch N-values	Hand Penetrometer Qp (tsf)	Unconfined Compressive Strength Qu (tsf)	Vane Shear (Peak) Su (tsf)	Moisture, %	Dry Density (pcf)
100	0			FILL	7" Brown and Black Silty Sand FILL, trace woodchips, trace roots, trace gravel	1						7.0	
				SP	Light Brown medium to fine SAND, trace silt	2	16	6/10/9 N=19				20.3	
					Brown and Gray SILT, little fine sand								
	5			ML	590.69	3	16	5/9/9 N=18				23.3	
95					Gray SILT, little fine sand								
				ML		4	18	4/5/6 N=11				21.6	
				ML		5	17	5/6/7 N=13				20.8	
90	10				Gray Silty CLAY, trace sand, trace gravel								
				CL		6	18	4/5/6 N=11	1.75	3.1		17.1	123.5
				CL		7	16	2/3/5 N=8	4.5+			16.8	
	15				End of Boring at 15 feet								

STANDARD PENETRATION TEST DATA
N in blows/ft ◎
× Moisture ◪ PL ✚ LL
1 25 50

STRENGTH, tsf
▲ Qu ✳ Qp
0 2.0 4.0

Completion Depth:	15.0 ft
Date Boring Started:	4/19/17
Driller:	GA
Checked By:	YB
Logged By:	JV

Sample Types:
Vane Shear, Split-Spoon, Rock Core, Shelby Tube, Hand Auger, Auger Cutting

Remarks: Temp. Benchmark Assumed Elevation = 100 ft. CCD

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BORING LOG B-7

Project No.:	17-0154-151	**Drilling Method:**	3.25" Hollow Stem Augers
Project:	Proposed Apartment Development	**Sampling Method:**	Split-Spoon Sampling
Location:	SE Corner of 5th Street and Pine Street Michigan City, Indiana	**Hammer Type:**	Automatic Hammer
		Drill Rig Type:	Geoprobe 7822DT
Client:	Dresden Development and Construction, LLC	**Backfill Method:**	Soil Cuttings

WATER LEVELS

During Drilling	6 ft
At Completion	ft
After 24 Hours	ft

Surface Elev.: 99.10 ft (594.99)

Elevation, (feet)	Depth, (feet)	USCS Classification	MATERIAL DESCRIPTION	Sample No.	Recovery (inches)	SPT Blows per 6-inch N-values	Hand Penetrometer Qp (tsf)	Unconfined Compressive Strength Qu (tsf)	Vane Shear (Peak) Su (tsf)	Moisture, %	Dry Density (pcf)
	0	FILL	6" Dark Brown and Black Silty Sand FILL, trace roots, trace gravel	1						7.9	
		SP	Brown medium to fine SAND, trace silt	2	16	4/7/8 N=15				20.9	
95	5	CL	Gray Silty CLAY, trace sand, trace gravel	3	17	2/4/5 N=9	3.25	4.9		18.0	110.1
		CL		4	17	2/3/5 N=8	1.75	2.7		18.7	116.5
90	10	CL		5	16	2/2/4 N=6	2.0	3.4		19.3	117.2
		CL		6	18	2/4/6 N=10	1.75	3.0		14.5	118.0
85	15	CL		7	18	1/3/4 N=7	2.0	3.4		19.0	123.4
80	20	CL		8	18	3/4/5 N=9	2.0	3.3		19.2	111.8
75	25	CL		9	18	4/5/6 N=11	2.75			17.5	
70	30	CL		10	18	3/4/5 N=9	3.0	3.6		16.9	114.9
			End of Boring at 30 feet								

STANDARD PENETRATION TEST DATA
N in blows/ft ◎
× Moisture ◪ PL ✚ LL
1 25 50

STRENGTH, tsf
▲ Qu ✳ Qp
0 2.0 4.0

Completion Depth:	30.0 ft
Date Boring Started:	4/24/17
Driller:	GA
Checked By:	YB
Logged By:	JV

Sample Types:
Vane Shear; Split-Spoon; Rock Core; Shelby Tube; Hand Auger; Auger Cutting

Remarks: Temp. Benchmark Assumed Elevation = 100 ft. CCD

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

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BORING LOG B-8

Project No.:	17-0154-151	**Drilling Method:**	3.25" Hollow Stem Augers
Project:	Proposed Apartment Development	**Sampling Method:**	Split-Spoon Sampling
Location:	SE Corner of 5th Street and Pine Street Michigan City, Indiana	**Hammer Type:**	Automatic Hammer
		Drill Rig Type:	Geoprobe 7822DT
Client:	Dresden Development and Construction, LLC	**Backfill Method:**	Soil Cuttings

WATER LEVELS

During Drilling	5 ft
At Completion	4 ft
After 24 Hours	ft

Surface Elev.: 596.24 100.80 ft

Elevation, (feet)	Depth, (feet)	Graphic Log	Sample Type	USCS Classification	MATERIAL DESCRIPTION	Sample No.	Recovery (inches)	SPT Blows per 6-inch N-values	Hand Penetrometer Qp (tsf)	Unconfined Compressive Strength Qu (tsf)	Vane Shear (Peak) Su (tsf)	Moisture, %	Dry Density (pcf)
100	0			FILL	13" Brown and Black Silty Sand FILL, trace roots, trace gravel	1						6.1	
				SP	Brown and Gray medium to fine SAND, little silt	2	15	2/3/4 N=7				18.3	
	5			SP		3	18	3/4/6 N=10				18.5	
95				ML	Gray SILT, little fine sand	4	17	7/10/13 N=23	2.75	4.1		13.5	124.1
				ML		5	18	10/15/19 N=34				13.8	
90	10			SP-SM	Gray SAND And SILT with Clay seams, trace gravel	6	18	9/13/15 N=28				19.4	
				ML	Gray Clayey SILT, trace fine sand	7	16	4/5/6 N=11				16.0	
85	15												
				ML	Gray Clayey SILT with coarse sand seams	8	18	4/4/11 N=15				17.3	
80	20												
				ML	Gray Sandy SILT with clay seams	9	13	5/6/8 N=14					
75	25												
				ML		10	10	7/5/10 N=15				17.1	
	30				End of Boring at 30 feet								

STANDARD PENETRATION TEST DATA
N in blows/ft ©
× Moisture ◪ PL ✚ LL
1 25 50

STRENGTH, tsf
▲ Qu ✳ Qp
0 2.0 4.0

Completion Depth:	30.0 ft
Date Boring Started:	4/24/17
Driller:	GA
Checked By:	YB
Logged By:	JV

Sample Types:
Vane Shear, Split-Spoon, Rock Core, Shelby Tube, Hand Auger, Auger Cutting

Remarks: Temp. Benchmark Assumed Elevation = 100 ft. CCD

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

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BORING LOG B-9

Project No.:	17-0154-151	**Drilling Method:**	3.25" Hollow Stem Augers
Project:	Proposed Apartment Development	**Sampling Method:**	Split-Spoon Sampling
Location:	SE Corner of 5th Street and Pine Street Michigan City, Indiana	**Hammer Type:**	Automatic Hammer
		Drill Rig Type:	Geoprobe 7822DT
Client:	Dresden Development and Construction, LLC	**Backfill Method:**	Soil Cuttings

WATER LEVELS

During Drilling	5 ft
At Completion	ft
After 24 Hours	ft

Surface Elev.: 596.28 99.10 ft

Elevation, (feet)	Depth, (feet)	Graphic Log	Sample Type	USCS Classification	MATERIAL DESCRIPTION	Sample No.	Recovery (inches)	SPT Blows per 6-inch N-values	Hand Penetrometer Qp (tsf)	Unconfined Compressive Strength Qu (tsf)	Vane Shear (Peak) Su (tsf)	Moisture, %	Dry Density (pcf)
	0			FILL	2" Brown and Black Silty Sand FILL, trace roots	1						7.4	
				SP-SM	Brown medium to fine SAND, little silt	2	18	4/5/5 N=10				19.7	
95	5			ML	Brown and Gray Silty CLAY, little fine sand with silt seams	3	16	5/6/8 N=14				11.4	
				ML	Gray SILT, little fine sand	4	17	6/7/6 N=13				22.2	
90	10			ML		5	15	3/4/4 N=8				23.1	
				SM	Gray coarse to fine SAND And SILT, trace gravel	6	18	2/3/3 N=6				23.2	
85	15			CL	Gray SILT, little fine sand	7	18	2/3/3 N=6				23.5	
					End of Boring at 15 feet								

STANDARD PENETRATION TEST DATA
N in blows/ft ◎
× Moisture ◪ PL ✚ LL
1 25 50

STRENGTH, tsf
▲ Qu ✳ Qp
0 2.0 4.0

Completion Depth:	15.0 ft
Date Boring Started:	4/24/17
Driller:	GA
Checked By:	YB
Logged By:	JV

Sample Types:
Vane Shear, Split-Spoon, Rock Core, Shelby Tube, Hand Auger, Auger Cutting

Remarks: Temp. Benchmark Assumed Elevation = 100 ft. CCD

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

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BORING LOG B-10

Project No.:	17-0154-151	**Drilling Method:**	3.25" Hollow Stem Augers
Project:	Proposed Apartment Development	**Sampling Method:**	Split-Spoon Sampling
Location:	SE Corner of 5th Street and Pine Street Michigan City, Indiana	**Hammer Type:**	Automatic Hammer
		Drill Rig Type:	Geoprobe 7822DT
Client:	Dresden Development and Construction, LLC	**Backfill Method:**	Soil Cuttings

WATER LEVELS

During Drilling	5 ft
At Completion	ft
After 24 Hours	ft

Surface Elev.: 101.20 ft (596.24)

Elevation, (feet)	Depth, (feet)	Graphic Log	Sample Type	USCS Classification	MATERIAL DESCRIPTION	Sample No.	Recovery (inches)	SPT Blows per 6-inch N-values	Hand Penetrometer Qp (tsf)	Unconfined Compressive Strength Qu (tsf)	Vane Shear (Peak) Su (tsf)	Moisture, %	Dry Density (pcf)
	0			FILL	8" Brown and Black Silty Sand FILL, trace gravel	1						6.7	
100				SP-SM	Brown medium to fine SAND, little silt	2	18	3/4/5 N=9				14.9	
	5			SP-SM		3	17	3/5/6 N=11				18.0	
95				SP-SM	Gray fine SAND, little silt, trace gravel	4	18	4/6/7 N=13				19.6	
	10			SP	Brown fine SAND, little silt, trace gravel	5	18	7/9/11 N=20				16.6	
90				CL	Gray Silty CLAY, little fine sand	6	16	6/7/8 N=15				18.5	
	15			SP-SM	Gray SAND And SILT with clay seams	7	17	8/6/7 N=13				20.8	
					End of Boring at 15 feet								

STANDARD PENETRATION TEST DATA
N in blows/ft ◎
× Moisture ◪ PL ✚ LL
1 — 25 — 50

STRENGTH, tsf
▲ Qu ✳ Qp
0 — 2.0 — 4.0

Completion Depth:	15.0 ft
Date Boring Started:	4/21/17
Driller:	GA
Checked By:	YB
Logged By:	JV

Sample Types:
Vane Shear, Split-Spoon, Rock Core, Shelby Tube, Hand Auger, Auger Cutting

Remarks: Temp. Benchmark Assumed Elevation = 100 ft. CCD

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

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BORING LOG B-11

Project No.:	17-0154-151	**Drilling Method:**	3.25" Hollow Stem Augers
Project:	Proposed Apartment Development	**Sampling Method:**	Split-Spoon Sampling
Location:	SE Corner of 5th Street and Pine Street Michigan City, Indiana	**Hammer Type:**	Automatic Hammer
		Drill Rig Type:	Geoprobe 7822DT
Client:	Dresden Development and Construction, LLC	**Backfill Method:**	Soil Cuttings

WATER LEVELS

During Drilling	5 ft
At Completion	4 ft
After 24 Hours	ft

Surface Elev.: 101.10 ft (596.44)

Elevation, (feet)	Depth, (feet)	Graphic Log	Sample Type	USCS Classification	MATERIAL DESCRIPTION
100	0			FILL	6" Dark Brown and Black Silty Sand FILL, trace gravel
				SP	Brown and Gray fine SAND, trace silt
	5			SP	
95					Gray SILT, little fine sand
				ML	
	10			ML	
90				ML	
				ML	
	15				
85					Gray Clayey SILT, trace fine sand
				CL-ML	
	20				
80					
				CL-ML	
	25				
75					
				SP-SM	Gray medium Silty SAND, trace gravel
	30				End of Boring at 30 feet

Sample No.	Recovery (inches)	SPT Blows per 6-inch N-values	Hand Penetrometer Qp (tsf)	Unconfined Compressive Strength Qu (tsf)	Vane Shear (Peak) Su (tsf)	Moisture, %	Dry Density (pcf)
1						7.5	
2	18	3/4/5 N=9				21.5	
3	15	3/4/6 N=10				21.9	
4	18	4/5/6 N=11				16.7	
5	17	4/6/8 N=14				19.2	
6	18	6/6/7 N=13				20.9	
7	18	5/5/6 N=11				25.0	
8	18	4/5/7 N=12				28.3	
9	18	4/4/5 N=9				21.8	
10		// N=				18.6	

STANDARD PENETRATION TEST DATA
N in blows/ft ◎
× Moisture ◪ PL ✚ LL
1 — 25 — 50

STRENGTH, tsf
▲ Qu ✳ Qp
0 — 2.0 — 4.0

Completion Depth:	30.0 ft
Date Boring Started:	4/24/17
Driller:	GA
Checked By:	YB
Logged By:	JV

Sample Types:
Vane Shear; Split-Spoon; Rock Core; Shelby Tube; Hand Auger; Auger Cutting

Remarks: Temp. Benchmark Assumed Elevation = 100 ft. CCD

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

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BORING LOG B-12

Project No.:	17-0154-151	**Drilling Method:**	3.25" Hollow Stem Augers
Project:	Proposed Apartment Development	**Sampling Method:**	Split-Spoon Sampling
Location:	SE Corner of 5th Street and Pine Street Michigan City, Indiana	**Hammer Type:**	Automatic Hammer
		Drill Rig Type:	Geoprobe 7822DT
Client:	Dresden Development and Construction, LLC	**Backfill Method:**	Soil Cuttings

WATER LEVELS

During Drilling	6 ft
At Completion	5 ft
After 24 Hours	ft

Surface Elev.: 597.87 102.20 ft

Elevation, (feet)	Depth, (feet)	USCS Classification	MATERIAL DESCRIPTION	Sample No.	Recovery (inches)	SPT Blows per 6-inch N-values	Moisture, %	Dry Density (pcf)
	0	FILL	6" Black Silty Sand FILL, trace gravel, trace roots	1			13.1	
100		SP	Brown fine SAND, trace silt	2	18	4/6/7 N=13	19.2	
	5	SP		3	16	7/7/8 N=15	19.7	
95		ML	Gray SILT, little fine sand	4	15	8/10/11 N=21	18.0	
	10	ML	Gray SILT, trace to little fine sand	5	17	15/17/19 N=36	12.2	
90		ML		6	18	11/15/17 N=32	18.8	
	15	ML		7	18	16/20/25 N=45	20.0	115.1
85		SP-SM	Gray fine SAND, little silt	8	15	13/16/19 N=35	20.9	
80	20		Gray SILT, little fine sand					
	25	ML		9	18	11/15/17 N=32	17.2	
75		ML		10	18	10/15/10 N=25	16.6	
	30		End of Boring at 30 feet					

Hand Penetrometer Qp (tsf)	Unconfined Compressive Strength Qu (tsf)	Vane Shear (Peak) Su (tsf)
2.0	2.7	

STANDARD PENETRATION TEST DATA
N in blows/ft ◎
× Moisture ◪ PL ✚ LL
1 25 50

STRENGTH, tsf
▲ Qu ✳ Qp
0 2.0 4.0

Completion Depth:	30.0 ft
Date Boring Started:	4/24/17
Driller:	GA
Checked By:	YB
Logged By:	JV

Sample Types:
Vane Shear; Split-Spoon; Rock Core; Shelby Tube; Hand Auger; Auger Cutting

Remarks: Temp. Benchmark Assumed Elevation = 100 ft. CCD

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

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Pioneer Engineering & Environmental Services
700 North Sacramento Blvd.
Chicago, Illinois 60612
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Fax: 773-722-9201

BORING LOG B-13

Project No.:	17-0154-151	**Drilling Method:**	3.25" Hollow Stem Augers
Project:	Proposed Apartment Development	**Sampling Method:**	Split-Spoon Sampling
Location:	SE Corner of 5th Street and Pine Street Michigan City, Indiana	**Hammer Type:**	Automatic Hammer
		Drill Rig Type:	Geoprobe 7822DT
Client:	Dresden Development and Construction, LLC	**Backfill Method:**	Soil Cuttings

WATER LEVELS

During Drilling	5 ft
At Completion	4 ft
After 24 Hours	ft

Surface Elev.: 102.10 ft (597.66)

Elevation, (feet)	Depth, (feet)	USCS Classification	MATERIAL DESCRIPTION	Sample No.	Recovery (inches)	SPT Blows per 6-inch N-values	Hand Penetrometer Qp (tsf)	Unconfined Compressive Strength Qu (tsf)	Vane Shear (Peak) Su (tsf)	Moisture, %	Dry Density (pcf)
	0	FILL	Dark Brown Silty Sand FILL	1						8.7	
100		FILL		2	16	6/7/9 N=16				16.1	
		ML	Gray SILT, little fine sand 594.66 1.92"/hr [2] 592.66	3	14	5/9/11 N=20				14.3	
	5	ML	Gray SILT, trace fine sand	4	17	9/12/18 N=30	3.25	4.8		13.5	122.3
95		CL	Gray Silty CLAY, trace fine sand	5	18	10/12/8 N=20	1.5	1.5		11.8	119.0
	10	ML	Gray SILT, trace to little fine sand	6	18	2/4/10 N=14				12.5	
90		ML		7	18	5/6/12 N=18				22.3	
	15		End of Boring at 15 feet								

STANDARD PENETRATION TEST DATA
N in blows/ft ◎
× Moisture ◪ PL ✚ LL
1 25 50

STRENGTH, tsf
▲ Qu ✳ Qp
0 2.0 4.0

Completion Depth:	15.0 ft
Date Boring Started:	4/19/17
Driller:	GA
Checked By:	YB
Logged By:	JV

Sample Types:
Vane Shear, Split-Spoon, Rock Core, Shelby Tube, Hand Auger, Auger Cutting

Remarks: Temp. Benchmark Assumed Elevation = 100 ft. CCD

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

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BORING LOG B-14

Project No.:	17-0154-151	**Drilling Method:**	3.25" Hollow Stem Augers	WATER LEVELS	
Project:	Proposed Apartment Development	**Sampling Method:**	Split-Spoon Sampling	During Drilling	7 ft
Location:	SE Corner of 5th Street and Pine Street Michigan City, Indiana	**Hammer Type:**	Automatic Hammer	At Completion	6 ft
		Drill Rig Type:	Geoprobe 7822DT	After 24 Hours	ft
Client:	Dresden Development and Construction, LLC	**Backfill Method:**	Soil Cuttings		

Surface Elev.: 100.90 ft (596.13)

Elevation, (feet)	Depth, (feet)	USCS Classification	MATERIAL DESCRIPTION	Sample No.	Recovery (inches)	SPT Blows per 6-inch N-values	Hand Penetrometer Qp (tsf)	Unconfined Compressive Strength Qu (tsf)	Vane Shear (Peak) Su (tsf)	Moisture, %	Dry Density (pcf)
100	0	FILL	5" Brown and Black Silty Sand FILL, trace roots	1						5.6	
		ML	Brown SILT, little fine sand	2	16	6/8/8 N=16		4.9		14.3	136.7
			Gray SILT, trace fine sand								
		ML		3	18	10/15/17 N=32		2.6		14.5	114.4
95	5		Grayish Brown Silty SAND, trace gravel (590.13)								
		SP	(589.13)	4	18	9/11/15 N=26				20.5	
			Gray SILT, trace fine sand								
		ML		5	17	10/17/22 N=39				14.2	
90	10		Brown medium to fine SAND, trace silt								
		SP		6	18	9/10/13 N=23				20.4	
			Gray medium to fine SAND, little silt								
		SP-SM		7	18	13/14/16 N=30				18.3	
85	15		Gray Clayey SILT, little to some fine sand								
		ML		8	16	10/11/12 N=23				21.2	
	20		End of Boring at 20 feet								

STANDARD PENETRATION TEST DATA
N in blows/ft ◎
× Moisture ◪ PL ✚ LL
1 — 25 — 50

STRENGTH, tsf
▲ Qu ✳ Qp
0 — 2.0 — 4.0

Completion Depth:	20.0 ft	**Sample Types:**	
Date Boring Started:	4/25/17	Vane Shear	Shelby Tube
Driller:	GA	Split-Spoon	Hand Auger
Checked By:	YB	Rock Core	Auger Cutting
Logged By:	JV		

Remarks: Temp. Benchmark Assumed Elevation = 100 ft. CCD

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

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BORING LOG B-15

Project No.:	17-0154-151	**Drilling Method:**	3.25" Hollow Stem Augers
Project:	Proposed Apartment Development	**Sampling Method:**	Split-Spoon Sampling
Location:	SE Corner of 5th Street and Pine Street Michigan City, Indiana	**Hammer Type:**	Automatic Hammer
		Drill Rig Type:	Geoprobe 7822DT
Client:	Dresden Development and Construction, LLC	**Backfill Method:**	Soil Cuttings

WATER LEVELS

During Drilling	12 ft
At Completion	ft
After 24 Hours	ft

Surface Elev.: 102.10 ft (597.52)

Elevation, (feet)	Depth, (feet)	USCS Classification	MATERIAL DESCRIPTION	Sample No.	Recovery (inches)	SPT Blows per 6-inch N-values	Moisture, %
100	0	FILL	8" Dark Brown and Black Silty Sand FILL, trace roots, trace gravel	1			6.1
		FILL	Black Silty Sand FILL, trace gravel	2	18	6/7/9 N=16	17.0
			Gray SILT, little fine sand				
95	5	ML		3	18	10/15/17 N=32	11.5
		ML		4	18	16/18/19 N=37	12.3
90	10	ML		5	18	15/19/21 N=40	11.9
		SP-SM	Gray fine SAND, trace silt	6	18	13/14/16 N=30	22.3
85	15	SP-SM		7	18	9/13/14 N=27	20.3
		SC	Gray Clayey fine SAND, some silt	8	16	10/11/12 N=23	21.4
	20		End of Boring at 20 feet				

Hand Penetrometer Qp (tsf) | Unconfined Compressive Strength Qu (tsf) | Vane Shear (Peak) Su (tsf) | Dry Density (pcf)

STANDARD PENETRATION TEST DATA
N in blows/ft ◎
× Moisture ◪ PL ✤ LL
1 — 25 — 50

STRENGTH, tsf
▲ Qu ✳ Qp
0 — 2.0 — 4.0

Completion Depth:	20.0 ft
Date Boring Started:	4/25/17
Driller:	GA
Checked By:	YB
Logged By:	JV

Sample Types:
Vane Shear | Shelby Tube
Split-Spoon | Hand Auger
Rock Core | Auger Cutting

Remarks: Temp. Benchmark Assumed Elevation = 100 ft. CCD

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

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BORING LOG B-16

Project No.:	17-0154-151	**Drilling Method:**	3.25" Hollow Stem Augers
Project:	Proposed Apartment Development	**Sampling Method:**	Split-Spoon Sampling
Location:	SE Corner of 5th Street and Pine Street Michigan City, Indiana	**Hammer Type:**	Automatic Hammer
		Drill Rig Type:	Geoprobe 7822DT
Client:	Dresden Development and Construction, LLC	**Backfill Method:**	Soil Cuttings

WATER LEVELS

During Drilling	6 ft
At Completion	ft
After 24 Hours	ft

Surface Elev.: 101.60 ft (596.69)

Elevation, (feet)	Depth, (feet)	USCS Classification	MATERIAL DESCRIPTION	Sample No.	Recovery (inches)	SPT Blows per 6-inch N-values	Moisture, %
	0	FILL	5" Dark Brown Silty Sand FILL, trace roots, little gravel	1			6.4
100		SP	Brown medium to fine SAND, trace gravel	2	18	5/6/8 N=14	17.9
		ML	Gray SILT, trace fine sand	3	18	9/13/15 N=28	13.6
	5		Light Brown fine SAND, trace silt				
95		SP-SM		4	18	11/10/13 N=23	21.7
		SP-SM		5	18	10/15/18 N=33	21.2
	10		Brownish Gray fine SAND, little silt				
90		SP-SM		6	15	8/10/11 N=21	21.0
		ML	Gray SILT, little fine sand	7	17	5/6/8 N=14	22.6
	15		End of Boring at 15 feet				

Hand Penetrometer Qp (tsf) | Unconfined Compressive Strength Qu (tsf) | Vane Shear (Peak) Su (tsf) | Dry Density (pcf)

STANDARD PENETRATION TEST DATA
N in blows/ft ◎
× Moisture ◪ PL ✚ LL
1 — 25 — 50

STRENGTH, tsf
▲ Qu ✳ Qp
0 — 2.0 — 4.0

Completion Depth:	15.0 ft
Date Boring Started:	4/25/17
Driller:	GA
Checked By:	YB
Logged By:	JV

Sample Types:
Vane Shear | Shelby Tube
Split-Spoon | Hand Auger
Rock Core | Auger Cutting

Remarks: Temp. Benchmark Assumed Elevation = 100 ft. CCD

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

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BORING LOG B-17

Project No.:	17-0154-151	**Drilling Method:**	3.25" Hollow Stem Augers
Project:	Proposed Apartment Development	**Sampling Method:**	Split-Spoon Sampling
Location:	SE Corner of 5th Street and Pine Street Michigan City, Indiana	**Hammer Type:**	Automatic Hammer
		Drill Rig Type:	Geoprobe 7822DT
Client:	Dresden Development and Construction, LLC	**Backfill Method:**	Soil Cuttings

WATER LEVELS

During Drilling	6 ft
At Completion	ft
After 24 Hours	ft

Surface Elev.: 101.20 ft (596.38)

Elevation, (feet)	Depth, (feet)	USCS Classification	MATERIAL DESCRIPTION	Sample No.	Recovery (inches)	SPT Blows per 6-inch N-values	Hand Penetrometer Qp (tsf)	Unconfined Compressive Strength Qu (tsf)	Vane Shear (Peak) Su (tsf)	Moisture, %	Dry Density (pcf)
100	0	FILL	7" Dark Brown Silty Sand FILL, trace roots, trace gravel	1						6.7	
		SP	Brown fine SAND, trace silt	2	18	5/6/8 N=14				13.0	
	5	SP	some silt at 3.5 feet	3	18	5/7/8 N=15				16.8	
95			Gray fine SAND, little silt								
		SP-SM		4	18	4/8/9 N=17				18.0	
	10	SP-SM		5	15	6/8/13 N=21				15.1	
90			Gray SILT, little silt								
		ML		6	18	5/7/8 N=15				22.6	
		ML	some fine sand at 13.5 feet	7	17	4/4/5 N=9				19.5	
85	15		Gray SILT, little fine sand								
		ML		8	18	4/5/6 N=11				24.9	
80	20										
		ML	Clayey Silt seam at 23.5 feet	9	18	3/4/5 N=9				22.0	
75	25		Gray Silty CLAY, trace fine sand								
		CL		10	15	3/4/4 N=8	1.75	1.8		26.9	97.8
	30		End of Boring at 30 feet								

STANDARD PENETRATION TEST DATA
N in blows/ft ◎
× Moisture ◪ PL ✚ LL
1 — 25 — 50

STRENGTH, tsf
▲ Qu ✳ Qp
0 — 2.0 — 4.0

Completion Depth:	30.0 ft
Date Boring Started:	4/25/17
Driller:	GA
Checked By:	YB
Logged By:	JV

Sample Types:
Vane Shear; Split-Spoon; Rock Core; Shelby Tube; Hand Auger; Auger Cutting

Remarks: Temp. Benchmark Assumed Elevation = 100 ft. CCD

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

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BORING LOG B-18

Project No.:	17-0154-151	**Drilling Method:**	3.25" Hollow Stem Augers
Project:	Proposed Apartment Development	**Sampling Method:**	Split-Spoon Sampling
Location:	SE Corner of 5th Street and Pine Street Michigan City, Indiana	**Hammer Type:**	Automatic Hammer
		Drill Rig Type:	Geoprobe 7822DT
Client:	Dresden Development and Construction, LLC	**Backfill Method:**	Soil Cuttings

WATER LEVELS

During Drilling	9 ft
At Completion	ft
After 24 Hours	ft

Surface Elev.: 597.29 / 101.90 ft

Elevation, (feet)	Depth, (feet)	Graphic Log	Sample Type	USCS Classification	MATERIAL DESCRIPTION	Sample No.	Recovery (inches)	SPT Blows per 6-inch N-values	Hand Penetrometer Qp (tsf)	Unconfined Compressive Strength Qu (tsf)	Vane Shear (Peak) Su (tsf)	Moisture, %	Dry Density (pcf)
	0			ASPHALT	5" Bituminous Concrete Pavement 6" Gravel Base Course	1						3.7	
100				SP	Brown medium SAND, trace silt	2	18	10/11/12 N=23				4.1	
	5			ML	Brown SILT, little fine sand	3	18	9/10/12 N=22				21.6	
95				SP-SM	Light Brown medium to fine SAND, little silt	4	18	10/11/13 N=24				24.5	
				SP-SM		5	18	11/18/20 N=38				22.2	
	10				Gray SILT, little fine sand								
90				ML		6	18	10/13/16 N=29				18.0	
					Gray SILT, some fine sand								
				ML		7	18	11/12/14 N=26				19.7	
	15												
85													
				ML		8	18	8/9/13 N=22				23.6	
	20												
80					Gray Clayey SILT, little fine sand								
				ML		9	18	8/8/9 N=17				34.3	
	25												
75													
				CL	Gray Silty CLAY, trace fine sand	10	18	7/4/5 N=9		2.4		26.4	101.8
	30				End of Boring at 30 feet								

STANDARD PENETRATION TEST DATA
N in blows/ft ◎
× Moisture ◪ PL ✚ LL
1 — 25 — 50

STRENGTH, tsf
▲ Qu ✳ Qp
0 — 2.0 — 4.0

Completion Depth:	30.0 ft	**Sample Types:**	
Date Boring Started:	4/25/17	Vane Shear	Shelby Tube
Driller:	GA	Split-Spoon	Hand Auger
Checked By:	YB	Rock Core	Auger Cutting
Logged By:	JV		

Remarks: Temp. Benchmark Assumed Elevation = 100 ft. CCD

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

Single Ring Infiltrometer Infiltration Rate Determination
SE Corner of 5th Street and Pine Street
Michigan City, Indiana

Infiltration Test No.1

Elapsed Time (seconds)	Change in Time (seconds)	Elapsed Time (minutes)	Change in Time (minutes)	Cumulative Water Decline (inches)	Cumulative Water Decline (feet)	Cumulative Volume (cubic feet)
0	0	0.00	0.00	0.00	0.00	0.000
300	300	5.00	5.00	0.00	0.00	0.000
600	300	10.00	5.00	0.13	0.01	0.008
900	300	15.00	5.00	0.13	0.01	0.008
1,200	300	20.00	5.00	0.13	0.01	0.008
2,400	1200	40.00	20.00	0.19	0.02	0.012
3,600	1200	60.00	20.00	0.38	0.03	0.025
4,800	1200	80.00	20.00	0.44	0.04	0.029
6,000	1200	100.00	20.00	0.50	0.04	0.033
7,200	1200	120.00	20.00	0.75	0.06	0.049
8,400	1200	140.00	20.00	1.00	0.08	0.065
9,600	1200	160.00	20.00	1.19	0.10	0.078
10,800	1200	180.00	20.00	1.31	0.11	0.086
				Totals:	**0.11**	**0.086**

Values for the following Calculations were selected after Steady State Infiltration began
Steady State Infiltration Began at 4,800 seconds Until Test Completion

12-inch Infiltrometer Volume Rate = 0.785 cubic feet / foot of drop

z = 2.00 feet (height of initial water column)

y_t = 0.07 feet (total water decline - 4,800 seconds to End of Test)

r = 0.5 feet (radius of pipe)

n = 0.3 (estimated porosity)

$i_n = y_n / t_n$

i_n = 0.000012 feet per second (fps)

$i_w = i_n \pi r^2 / \pi (r + 0.5r)^2$

i_w = 0.000005 feet per second (fps)

$L = y_t \pi r^2 / n \pi (r + 0.5r)^2$

L = 0.1 feet

$K = i_w L / (z + L)$

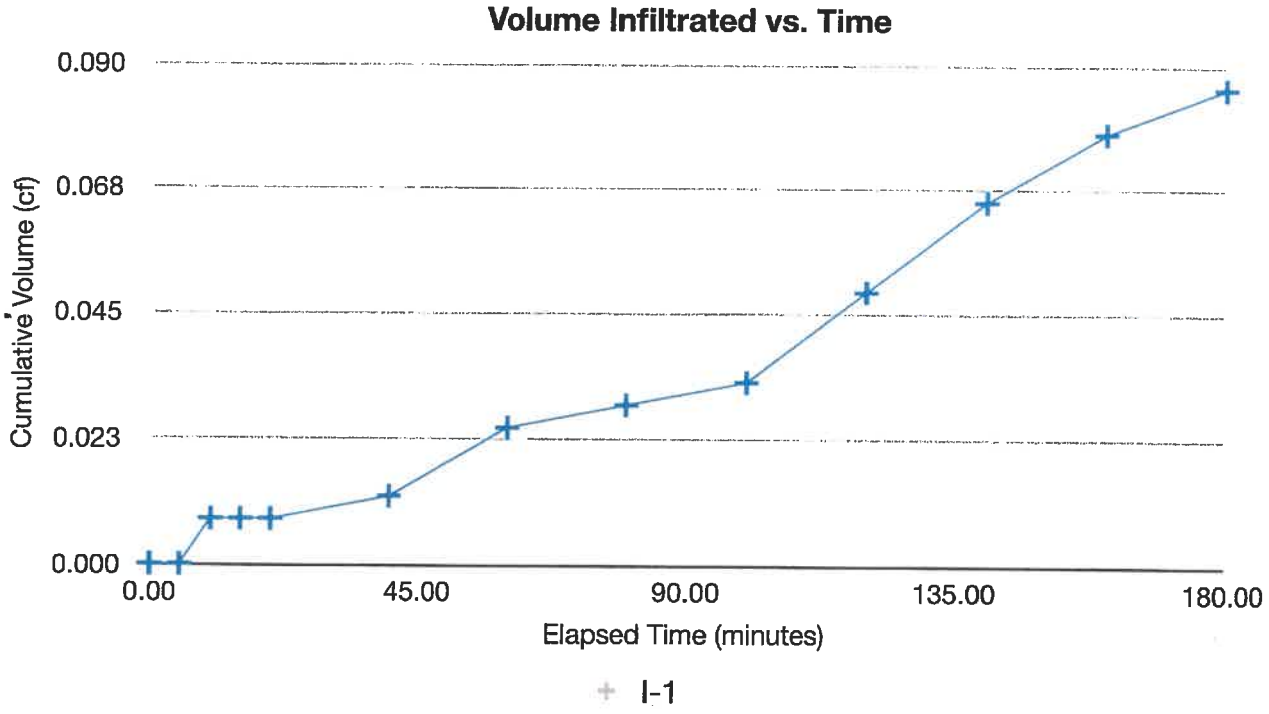
K = 2.8E-07 feet per second = **0.01** Inches/Hr

Pioneer Project No. 17-0041-151

Single Ring Infiltrometer Infiltration Rate Determination
SE Corner of 5th Street and Pine Street
Michigan City, Indiana

I-1

Elapsed Time (minutes)	Cumulative Volume (cubic feet
0.00	0.000
5.00	0.000
10.00	0.008
15.00	0.008
20.00	0.008
40.00	0.012
60.00	0.025
80.00	0.029
100.00	0.033
120.00	0.049
140.00	0.065
160.00	0.078
180.00	0.086



Single Ring Infiltrometer Infiltration Rate Determination
SE Corner of 5th Street and Pine Street
Michigan City, Indiana

Infiltration Test No.2

Elapsed Time (seconds)	Change in Time (seconds)	Elapsed Time (minutes)	Change in Time (minutes)	Cumulative Water Decline (inches)	Cumulative Water Decline (feet)	Cumulative Volume (cubic feet)
0	0	0.00	**0.00**	**0.00**	0.00	0.000
300	300	5.00	**5.00**	**2.88**	0.24	0.188
600	300	10.00	**5.00**	**5.25**	0.44	0.343
900	300	15.00	**5.00**	**7.50**	0.63	0.491
1,200	300	20.00	**5.00**	**10.13**	0.84	0.662
2,400	1200	40.00	**20.00**	**15.25**	1.27	0.998
3,600	1200	60.00	**20.00**	**20.88**	1.74	1.366
4,800	1200	80.00	**20.00**	**25.13**	2.09	1.644
6,000	1200	100.00	**20.00**	**29.13**	2.43	1.905
7,200	1200	120.00	**20.00**	**31.63**	2.64	2.069
8,400	1200	140.00	**20.00**	**34.13**	2.84	2.232
9,600	1200	160.00	**20.00**	**38.63**	3.22	2.527
10,800	1200	180.00	**20.00**	**40.13**	3.34	2.625
				Totals:	**3.34**	**2.625**

Values for the following Calculations were selected after Steady State Infiltration began
Steady State Infiltration Began at 4,800 seconds Until Test Completion

12-inch Infiltrometer Volume Rate = 0.785 cubic feet / foot of drop

z = 2.00 feet (height of initial water column)

y_t = 1.25 feet (total water decline - 4,800 seconds to End of Test)

r = 0.5 feet (radius of pipe)

n = 0.3 (estimated porosity)

$i_n = y_n / t_n$

i_n = 0.000208 feet per second (fps)

$i_w = i_n \pi r^2 / \pi (r + 0.5r)^2$

i_w = 0.000093 feet per second (fps)

$L = y_t \pi r^2 / n \pi (r + 0.5r)^2$

L = 1.9 feet

$K = i_w L / (z + L)$

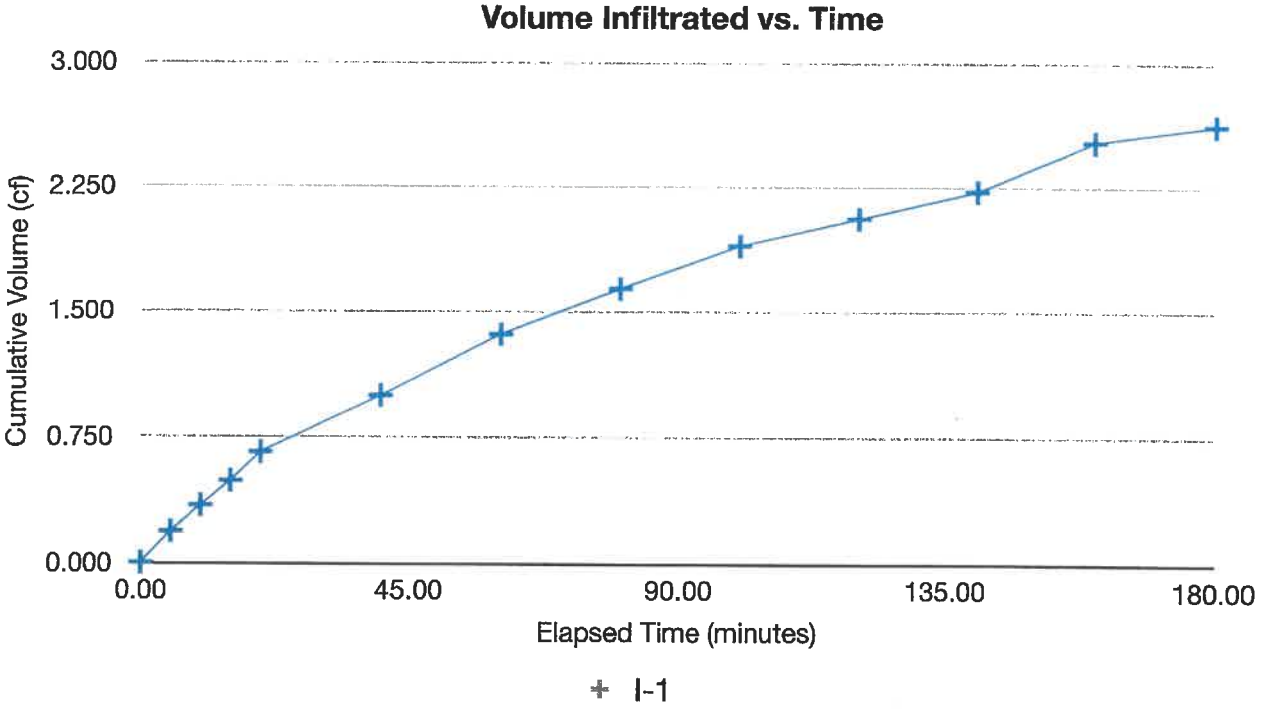
K = 4.5E-05 feet per second = **1.92** Inches/Hr

Pioneer Project No. 17-0041-151

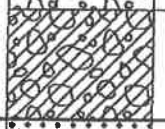
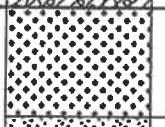
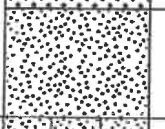
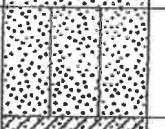
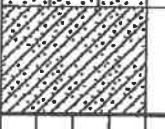
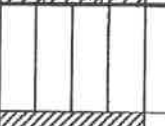
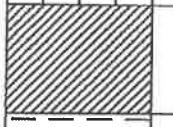
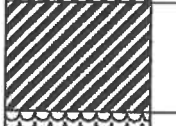
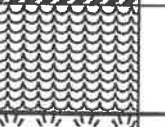
Single Ring Infiltrometer Infiltration Rate Determination
SE Corner of 5th Street and Pine Street
Michigan City, Indiana

I-2

Elapsed Time (minutes)	Cumulative Volume (cubic feet
0.00	0.000
5.00	0.188
10.00	0.343
15.00	0.491
20.00	0.662
40.00	0.998
60.00	1.366
80.00	1.644
100.00	1.905
120.00	2.069
140.00	2.232
160.00	2.527
180.00	2.625



NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

MAJOR DIVISIONS			SYMBOLS: GRAPH	SYMBOLS: LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	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
	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

PIONEER ENVIRONMENTAL SERVICES, LLC

SOIL CLASSIFICATION CHART

Drilling and Sampling Abbreviations:

Sample/Drilling:
SS- Split Spoon Sampler
ST- Shelby Tube Sampler
RC- Rock Core: NX, BX, AX
HSA- Hollow Stem Auger

In-Situ Tests:
SPT-Standard Penetration Test
PMT-Pressuremeter Test
VS-Vane Shear
DCP-Dynamic Cone Penetrometer
Q_p-Estimated Unconfined Compressive Strength using Pocket Penetrometer
Q_u-Estimated Unconfined Compressive Strength using Rimac Tester

Correlation of Penetration Resistances to Soil Properties:

Relative Density- Sands, Silts
More than 50% retained onto the No. 200 sieve

SPT-N Value	Relative Density
0-3	Very Loose
4-9	Loose
10-29	Medium Dense
30-49	Dense
50-80	Very Dense

Consistency of Cohesive Soils
More than 50% passing the No. 200 sieve

Unconfined Compressive Strength Q_p, tsf	Consistency
under 0.25	Very Soft
0.25-0.49	Soft
0.50-0.99	Stiff
1.00-1.99	Tough
2.00-3.99	Very Tough
4.00-8.00	Hard
over 8.00	Very Hard

Gradation Description and Terminology:

Major Component of Sample	Size Range
Boulders	Over 12 inches
Cobbles	12 inches to 3 inches
Gravel	3 inches to No. 4 sieve
Coarse	*3 inches to ¾ inches*
Fine	*¾ inches to No. 4 sieve*
Sand	No. 4 sieve to No. 200 sieve
Coarse	*No. 4 sieve to No. 10 sieve*
Medium	*No. 10 sieve to No. 40 sieve*
Fine	*No. 40 sieve to No. 200 sieve*
Silt/Clay	Passing No. 200 sieve

Description of Minor Components	Percent of Dry Weight
Trace	1-9
Little	10-19
Some	20-34
And	35-50

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REFERENCE NOTES FOR BORING LOGS