Geotechnical Investigation

Proposed Water Trailhead Upgrades

Venoy-Dorsey Park
Wayne & Westland, Michigan

John Gundry, Associate ASLA
Wayne County Department of Public Service
33175 Ann Arbor Trail
Westland, MI 48185

PEA Group Project No. 2020-0310

PEA GROUP

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September 23, 2021
Project No.: 2020-0310

via email: jgundry@waynecounty.com

John Gundry, Associate ASLA
Wayne County Department of Public Service
33175 Ann Arbor Trail
Westland, MI 48185

RE: Geotechnical Investigation
Proposed Water Trailhead Upgrades
Venoy-Dorsey Park
Wayne & Westland, Wayne County, Michigan

Dear Mr. Gundry:

The PEA Group has performed a geotechnical investigation for the proposed Water Trailhead featuring canoe/kayak launches and parking area improvements located in Venoy-Dorsey Park in Wayne and Westland, Michigan. The purpose of our investigation was to determine the general subsurface conditions at the launch and parking lot locations to provide related site preparation recommendations.

Based on our investigation, the site soils generally consist of surficial topsoil overlying cohesive soils with layers of sand. Dead wood, urban debris and other deleterious matter were observed along the shoreline.

Groundwater was encountered in 1 of the 8 soil borings during drilling activities in TB-2 at a depth of 6 feet below the existing ground surface (bgs). Immediately after drilling, water was noted at depths of 3 and 6 feet in TB-1 and TB-2, respectively. The water was encountered in sand layers or seams. We do not expect any significant groundwater to be encountered during construction or utility installation.

We anticipate a moderate amount of earthwork will be needed to achieve final design grades. We anticipate cuts of up to 6 foot in the pavement areas, up to 12 feet in the launch areas, and fills of up to 2 feet in the pavement areas. Following successful completion of earthwork operations, we recommend that the proposed kayak shelters be supported by shallow foundations bearing on engineered fill or on the native soils.

We recommend that earthwork be performed in the dry season. We caution that if site conditioning and earthwork operations are during wet or cold weather (i.e. any time other that late spring to early fall) significant difficulty should be anticipated.

The data obtained during this investigation along with our evaluations, analysis and recommendations are presented in the subsequent portions of this report.

SITE CONDITIONS AND PROPOSED CONSTRUCTION

The site for the proposed water trailheads is located in Venoy-Dorsey Park located north of Michigan Avenue and the Lower River Rouge. The western launch is proposed east of Venoy Road, and the eastern launch is proposed west of Merriman Road. Venoy-Dorsey Park is bordered to the north by residential neighborhoods; to the south by the Lower Rouge River; to the east by Merriman Road and to the west by Venoy Road.

We understand a watermain generally runs east-west through the proposed Merriman launch location. Other underground utilities, such as storm and sanitary sewers, water mains and gas lines currently exist along the adjacent right-of-way locations. The ground surface generally appears to slope towards the south at both locations. Refer to the Test Boring Location Plan for the existing site features.

We understand present plans include constructing two new water trailheads in the park as part of the Venoy-Dorsey Recreation Area Master Plan. The trailheads are proposed to include a parking lot and drive approach, ADA boat slide rail and concrete launch ramp, floating launch, and associated landscape elements at each of the locations. A kayak structure is proposed to be constructed as part of the water trailhead construction at the Venoy site. We anticipated the shelter to be constructed of wood or other similar light-gauge material and to be lightly loaded.

Each of the parking areas are proposed to have approximately 11 parking spaces in the parking lots, with each parking lot draining to a bioretention area. Concrete curb and gutter are proposed around the parking areas, and concrete sidewalks are proposed to provide access from the parking lot to the launch areas. The launches will consist of poured concrete.

We anticipate minimal cuts and fills to achieve design grades for the area where the proposed water trailhead improvements will be constructed. Bituminous concrete pavement will be added to the site for parking areas as well as concrete pavement for the proposed launch ramps.

REGIONAL GEOLOGY AND SEISMIC ACTIVITY

A review of available sources indicates that several ice sheets (i.e. glaciers) advanced and retreated over the site with the most recent being during the late Wisconsin period. Based on the 1982 Quaternary Geology Map of Southern Michigan, the site soils were generally deposited as lacustrine sediments of silt. clay, sand, and gravel. According to the 1969 Wayne County Drift Thickness map, the top of rock is at about elevation or 500 about 120 feet below the surface. Any sand and gravel strata are generally attributed to a succession of gradually receding lakes creating beach ridges.

Southern Michigan, Wayne, and Wetland are considered to have a relatively low seismic risk. The appropriate geotechnical design considerations for seismic conditions should be applied based on the Michigan Building Code. Based on our interpretation of the test borings and understanding of the soil conditions below the depth of exploration, we recommend the site be classified as a Class D Site.

FIELD INVESTIGATION

We investigated subsurface conditions at the site by completing 8 test borings, designated TB-1 to TB-8. Three of the test borings TB-4, TB-7, and TB-8 were performed with a bucket style hand-auger due to dense tree and vegetative cover. GeoServ Drilling Company drilled the accessible test borings on September 13, 2021. PEA Group excavated the hand auger locations on September 17, 20121. TB-1 through TB-4 were performed at the proposed Venoy Launch, and TB-5 through TB-8 were performed at the proposed Merriman launch. The test borings were located in the field by using a survey grade handheld

GPS unit. The locations are shown on the Test Boring Location Plan sheets. Separate maps for each of the launch locations are provided. Ground surface elevations were estimated from the topographic survey of the site completed by PEA Group dated 3-2-2021.

The test borings were extended to depths ranging from 5 to 10 feet bgs. The borings were advanced with 3 ¼ inch inside-diameter direct push casings. Soil samples were taken at intervals of generally 2.5 feet within the upper 10 feet and at 5-foot intervals below 10 feet. These test boring samples were taken by the Standard Penetration Test method (ASTM D-1586). The drill rig used during the investigation to sample at borings TB-1, TB-2, TB-3, TB-5, and TB-6 utilized an auto hammer.

Hand auger samples were obtained from the heavily wooded test boring locations. Hand augering results in disturbed samples which do not provide information for relative densities.

The soil samples obtained with the split-barrel sampler and hand auger were sealed in containers and transported to our laboratory for further classification and testing. We will retain these soil samples for 60 days after the date of this report. At that time, we will dispose of the samples unless otherwise instructed.

PRESENTATION OF DATA

We evaluated the soil and groundwater conditions encountered in the test borings and have presented these conditions in the form of individual Logs of Test Borings on Figures 1 through 8. The nomenclature used on the boring logs and elsewhere are presented on the Soil Terminology sheet, Figure 9. The stratification shown on the test boring logs represents the soil conditions at the actual boring locations. Variations may occur between the borings. The stratigraphic lines represent the approximate boundary between the soil types, however, the transition may be more gradual than what is shown.

We have prepared the logs included with the report based on field classification supplemented by laboratory classification and testing.

LABORATORY TESTING

The soil samples obtained from the test borings were also classified in our laboratory. Selected samples were tested to determine natural moisture contents. Testing was performed in accordance with current ASTM standards. The results of these tests are presented on the individual Logs of Test Borings.

In addition to the laboratory testing, pocket penetrometer measurements of the unconfined compressive strengths of cohesive soils were determined in the field. The strength values determined by the penetrometer are also presented on the test boring logs.

SOIL CONDITIONS AND EVAULATIONS

From the information obtained during this investigation, subsoil conditions are generally similar throughout the site.

The surface is blanketed with moderately organic topsoil. The topsoil generally consists of dark brown to brown silty sand and ranges between 6 to 10 inches thick at the boring locations. Near the river the ground surface is covered with layers of grey sandy topsoil. Dead wood, urban debris and other deleterious matter were observed along the shoreline. We do not consider the topsoil, dead wood, debris, or deleterious matter suitable for the support of pavements or for use as engineered fill material. However, this material can be reused for landscaping.

Underlying the topsoil native soils were encountered and consisted of hard to medium clay soils with

interbedded layers of sand or silty sand. The silty clay and sandy clay soils encountered in borings TB-1, TB-2, TB-5, TB-6, located further away from the river, were generally stiff, hard, very stiff in their consistency. Medium strength clay soils were also encountered.

Sandy soils were encountered closer the riverbanks in TB-3, TB-4, TB-7 and TB-8. Relative density of the silty sand encountered in TB-3 was very loose, the remaining sand samples were obtained from hand augering which does not provide useful information for relative density. The sandy soil encountered consisted of sand with little silt and trace gravel to silty sand.

The native soils underlying the topsoil are considered suitable for the direct support of kayak shelter foundations, pavement, and for reuse as compacted fill.

SITE PREPARATION

We recommend that all earthwork operations be performed under adequate specifications and be properly monitored in the field. We expect the earthwork to consist of moderate cuts and fills to bring the site to grade preparing for pavements and kayak launches. We recommend the following earthwork operations be performed.

- Any surface vegetation should be cleared. Topsoil or any other organic soils, if encountered, should be removed in their entirety from the pavement and parking areas.

- Where cohesive soils are present prior to fill placement in fill areas, and after rough grade has been achieved in cut areas, the cohesive subgrade should be thoroughly proof-rolled. A heavy rubber-tired vehicle such a loaded dump truck should be used for proof-rolling.

- Where granular soils are exposed prior to fill placement in fill areas, and after rough grade has been achieved in cut areas (if any), the subgrade should be thoroughly compacted with vibratory roller by making a minimum of 10 passes in each of two perpendicular directions covering the proposed floor area. In addition to detecting unstable areas, the proof-compaction operation should serve to densify the shallow granular deposits that overlie the site.

- We expect that some areas of the site will not proof-roll satisfactorily. Any areas that exhibit excessive pumping and yielding during proof-rolling and compaction should be stabilized by aeration, drying, and compaction if weather conditions are favorable, or removal and replacement with engineered fill (undercutting).

- Undercutting can include the use of geotextiles and geogrids. Removing wet pumping soils to find suitable stable soil may not work on this site. Thus, in order to backfill an undercut excavation, 1-inch by 3-inch concrete or a geogrid is recommended to stabilize the bottom before the refilling process begins.

- Following proof rolling and repair of unsuitable subgrade areas, the upper foot of the subgrade should be compacted to 90 percent of the maximum dry density as determined by the Modified Proctor Compaction Test, (ASTM D-1557) prior to placement of engineered fill.

We recommend materials meeting the following criteria be used for backfill or engineered fill to achieve design grades:

- The material should be non-organic and free of debris.

- Frozen material should not be used as fill nor should fill be placed on a frozen subgrade.

- The on-site soils may be used for engineered fill provided that they are approximately at the optimum moisture content. The silty/sandy clay soils may require aeration and drying before they can be properly compacted.

- Free-draining granular soils should be used for trench backfill and in confined spaces.

- Pea gravel is not recommended as engineered fill. Although pea gravel can easily be compacted, since it is rounded and very narrowly graded, it is unstable under wheel loads. In order to support loads, it must be confined laterally.

- Common Fill: The on-site soils may be used for common fill material. Common fill should be used in large areas that can be compacted by large earth moving equipment.

- Granular Fill: Granular fill should be used in confined areas such as trenches and backfill around foundations. Granular fill should meet the following gradation:

Sieve Size	Percent Passing
6 inch	100
3 inch	95-100
Loss by Wash	0-15

MDOT Class III meets the requirements for Granular Fill.

Alternately the following also can be used:

Sieve Size	Percent Passing
3 inch	100
1 inch	60-100
No. 30	0-30
Loss by Wash	0-10

MDOT Class II meets the requirements for Granular Fill. Some restrictions apply to some applications

- Sand-Gravel Fill: Sand-gravel fill should be used where free-draining material is required. Free-draining material is recommended for underfloor fill and retaining wall backfill. Sand and gravel fill should meet the following gradation:

Sieve Size	Percent Passing
2 inch	100
1/2 inch	45-85
No. 4	20-85
No. 30	5-30
Loss by Wash	0-5

MDOT Class I material meets the requirements for sand and gravel.

- Crushed Stone Fill: Crushed stone fill should be used for aggregate base and for any over-excavated foundations. Crushed stone should meet the following gradations:

Sieve Size	Percent Passing
1-1/2 inch	100
1 inch	85-100
1/2 inch	50-75
No. 8	20-45
Loss by Wash	0-10

MDOT 21AA meets the gradation.

The fill should be placed in uniform horizontal layers. The thickness of each layer should be in accordance with the following:

Compaction Method	Maximum Loose Lift Thickness
Hand-operated vibratory plate or light roller In confined areas	4 inches
Hand-operated vibratory roller weighing at Least 1,000 pounds	6 inches
Vibratory roller drum roller, minimum dynamic Force, 2,000 pounds	9 inches
Vibratory drum roller, minimum dynamic force, 30,000 pounds	12 inches
Sheeps-foot roller	8 inches

The vibrating roller thicknesses indicated are for compacting granular soils. If vibrating drum rollers are used for cohesive soils, the recommended lift thickness is one-third of the tabulated value. The lift thicknesses may be increased if field compaction testing demonstrates the specified compaction is achieved throughout the lift.

The fill should be compacted to achieve the specified compaction percentage of the maximum dry density as determined by the Modified Proctor compaction test (ASTM D-1557). The specified compaction for fill placed in various area should be as follows:

Area	Percent Compaction
Pavement base	95
Within one foot of pavement subgrade	95
Below one foot of pavement subgrade	92
Landscaped area	88

Trench backfill shall also be compacted to the above standards. The building is considered to extend 10 feet beyond the foundations of the structure. Pavement is considered to extend 5 feet beyond the edge plus a one-on-one slope to the original grade.

The site conditioning procedures discussed above are expected to result in fairly stable subgrade conditions throughout most of the site. However, the on-site silty cohesive soils are sensitive to softening when wet or disturbed by construction traffic. Depending on weather conditions and the type of equipment and construction procedures used, surface instability may develop in parts of the site. If this occurs, additional corrective procedures may be required, such as in-place stabilization or undercutting. Surface instability for pavement preparation commonly results from poor surface water management as underground utilities are installed, and when sensitive subgrades are not protected from excessive construction traffic. Corrective procedures can be limited by careful attention to water management and construction traffic.

If site conditioning and earthwork operations are to be performed during wet or cold weather (i.e. any time other than late spring to early fall), significant difficulty should be anticipated in drying or stabilizing the on-site silty cohesive clay soils. Under such circumstances, it may become necessary to undercut the wet soils and backfill with clean granular soils to achieve proper stabilization.

If site preparation operations are performed during dry summer months, it may be possible to stabilize wet soils in place and to use cohesive soils as fill with proper conditioning and moisture control in the field. However, using on-site cohesive soils that require moisture conditioning as engineered fill may not be cost effective.

FOUNDATION RECOMMENDATIONS

Based on an evaluation of the subsurface data obtained and successful completion of the earthwork procedures previously outlined, we recommend that the proposed kayak shelters be supported on shallow spread and/or strip footings. Foundation excavations adjacent to utilities, streets, driveways, and sidewalks require caution, and care shall be given.

Exterior footings should be founded at a depth of at least 3.5 feet below the exposed finished grade for protection against frost penetration. To help mitigate frost heave, the sides of all footings should be vertical, and not be allowed to be larger at the top.

We recommend a uniform net allowable soil bearing pressure of 1,500 pounds per square foot (psf) be used for the design of footings bearing on undisturbed native soil and engineered fill. In using a net allowable soil pressure, the weight of the footing, backfill over the footing, or floor slabs need not be included in the structural loads for sizing footings. For both the vertical load and the horizontal load, the allowable bearing may be increased by one third for transient loads resulting from wind or seismic loads. However, strip footings should be at least 12 inches in width, and isolated spread footings should be at least 18 inches in their dimension, regardless of the resulting bearing pressure. All foundation excavations should be observed and tested to verify that adequate in-situ bearing pressures, compatible with the design value, are achieved.

If the recommendations outlined in this report are adhered to, total and differential settlements for the completed structure should be within approximately 1 inch and 1/2 inches, respectively. We recommend that all strip footings be suitably reinforced to minimize the effects of differential settlements associated with local variations in subsoil conditions.

GROUNDWATER CONDITIONS AND CONTROL

Water level observations were made at each of the test borings during and following the completion of drilling operations. Groundwater was encountered at approximately 6 feet bgs during drilling at 1 of the 8 boring locations. Immediately after drilling, water was noted at depths of 3 and 6 feet in TB-1 and TB-2,

respectively. Boring TB-1, TB-2, TB-3, and TB-6 caved to depths of 4 to 8 feet at the completion of drilling operations. The observed water level in TB-2 was encountered at about 6 feet bgs or Elevation 623 feet. which is about the same elevation of the river. The results of the individual water level measurements are shown on the respective Logs of Test Borings. We do not expect groundwater to be encountered during foundation construction. Fluctuations in groundwater levels should be anticipated due the seasonal variations and following periods of prolonged precipitation or drought.

PAVEMENT CONSIDERATIONS

The subgrade resulting from the satisfactory completion of site preparation operations can also be used for the support of pavements. The cohesive subgrade soils consist of low plasticity silty/sandy clays which can be classified as CL or CL-ML, according to the Unified Soil Classification System (USCS). Soils of these types tend to have poor drainage characteristics, are frost susceptible, and are generally unstable under repeated loading. Although sand was encountered in some areas of the site, the clay soils control the design of the pavement. Based on the results of our investigation and the anticipated frost and moisture conditions, these soils may be assigned an estimated California Bearing Ratio (CBR) value of 4 for the design of pavements.

Typical pavements for similar projects have included:

Conventional Asphalt on Aggregate Base

Parking:	1.5 inches of Asphalt Surface Course 2.5 inches of Asphalt Leveling Course 8 inches of Aggregate Base

Acceptable asphalt pavement mixes should be sourced from a registered and approved Michigan Department of Transportation (MDOT) supplier and meet the specifications for MDOT Marshall or Low Volume Super Pave mixes. The aggregate base should meet criteria for MDOT 21AA.

The above aggregate base thicknesses are based on using natural aggregate as discussed in the Site Preparation Section. At present the readily available natural aggregate is limestone. If crushed concrete is used, it should meet all the MDOT requirements for gradation that includes the loss by wash and percent building material. **We recommend increasing the aggregate layer thickness by 20% when using crushed concrete instead of natural stone. Crushed concrete shall not be utilized within influence of the waterway.**

For pavements, we recommend that “stub” or “finger” drains be provided around catch basins and other low parts of the site to minimize the accumulation of water above and within the frost susceptible subgrade soils. We also recommend edge drains along parking perimeters where upgrade surface water can flow onto or under pavement. Consideration should also be given to providing subdrains around the perimeter of any proposed landscaped islands within the parking area since they can become a source of water infiltration into the pavement. Such subdrains could be connected to nearby catch basins. The pavement should be properly sloped to promote effective surface drainage and prevent water ponding.

The pavement recommendations provided in this report are intended to provide serviceable pavement for about 20 years. However, all pavements require regular maintenance and occasional repairs. The need for such maintenance is not necessarily indicative of premature pavement failure. If such activities are not performed in a timely manner, the service life of the pavement can be substantially reduced. Most pavements require preservation treatments about 10 years into their life from environmental causes.

FIELD MONITORING

Soil conditions at the site could vary from those generalized on the basis of test borings made at specific locations. We recommend that PEA Group be retained to provide soil engineering services during the site preparation, excavation, and foundation phases of the proposed project. This is to observe compliance with the design concepts, specifications, and recommendations. Also, this allows modifications to the made in the event that subsurface conditions differ from those anticipated prior to the start of construction. Additionally, PEA Group should be retained for material testing prior to and during subgrade preparation and utility construction (i.e. materials suitability assessment of on-site and imported fill, compaction testing, asphalt and concrete testing, etc.).

The foundation installations should also be monitored and evaluated by a qualified engineer or soils technician to ensure that the bearing material is consistent with the design bearing intended by the geotechnical report engineer. The on-site review of the condition of the bearing soils as the foundations are constructed is an integral part of the geotechnical design function.

LIMITATIONS OF THE REPORT

This report is intended solely for the use of the Wayne County Department of Public Service and other parties explicitly identified in this report. It is prohibited for others to use this report without the explicit written consent of PEA Group. Any unauthorized reuse, redistribution of or reliance on this report shall be at the Client and recipient's sole risk without liability to PEA Group. Client shall defend, indemnify and hold PEA Group harmless from any liability arising from or related to Client's unauthorized distribution of the report. No portion of this report may be used as a separate entity; it is to be read in its entirety and shall include all supporting drawings and attachments.

The recommendations made in this report are in accordance with our present understanding of the project and the current site use, conditions and ground surface elevations. Our recommendations are based on the work scope approved by the Client and described in this report. The services were performed in a manner consistent with the level of analysis typically exercised by geotechnical engineering professionals currently practicing under similar conditions in the same locality. No other representations and no warranties or representations of any kind, either expressed or implied, are made. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties.

By issuing this report, PEA Group is the geotechnical engineer of record. It is recommended that PEA Group be retained during construction and earthwork operations to confirm the conditions of the subsoil are actually similar to those observed during construction and our interpolations were correct. The intent of this requirement is to verify that conditions encountered during construction are consistent with the findings in the report and that inherent knowledge developed as part of our study is correctly carried forward to the construction phases.

It is important to emphasize that a subsurface investigation is a random sampling of the site and the comments included in this report are based on the results obtained at the test locations only. The subsurface conditions may vary at other locations than what was observed in our soil borings. The subsurface conditions can be significantly altered due to construction activities or by exposing the soils to humidity, dry periods or frost. Soil and groundwater conditions between and beyond the soil boring locations may differ both horizontally and vertically from those encountered at the soil borings; these conditions may become apparent during construction which could not be detected or anticipated at the time of our investigation. Should any conditions at the site encountered during construction differ than those encountered during this investigation, we request that we be notified immediately in order to reassess our recommendations. If changed conditions are encountered during construction, no matter how minor, the

recommendations in this report shall be considered invalid until a sufficient review is completed by PEA Group and is documented in a written form.

GENERAL COMMENTS

We have formulated the evaluations and recommendations presented in this report, relative to site preparation and building foundations, on the basis of data provided to us relating to the location of the proposed building. Any significant change to this data should be brought to our attention for review and evaluation with respect to the prevailing subsurface conditions.

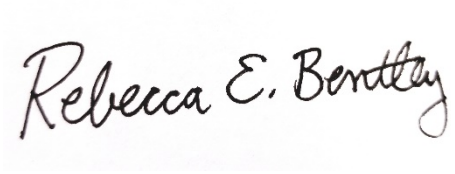
The scope of the present investigation was limited to evaluation of subsurface conditions for the support of building foundations, pavements, and other related aspects of development. No chemical, environmental, or hydrogeological testing or analysis was included in the scope of this investigation.

If you have any questions regarding this report, or if we may be of further assistance to you in any respect, please feel free to contact us. We appreciate the opportunity to have been of service to you.

Sincerely,

PEA Group

Jonathan Andare
Staff Engineer II



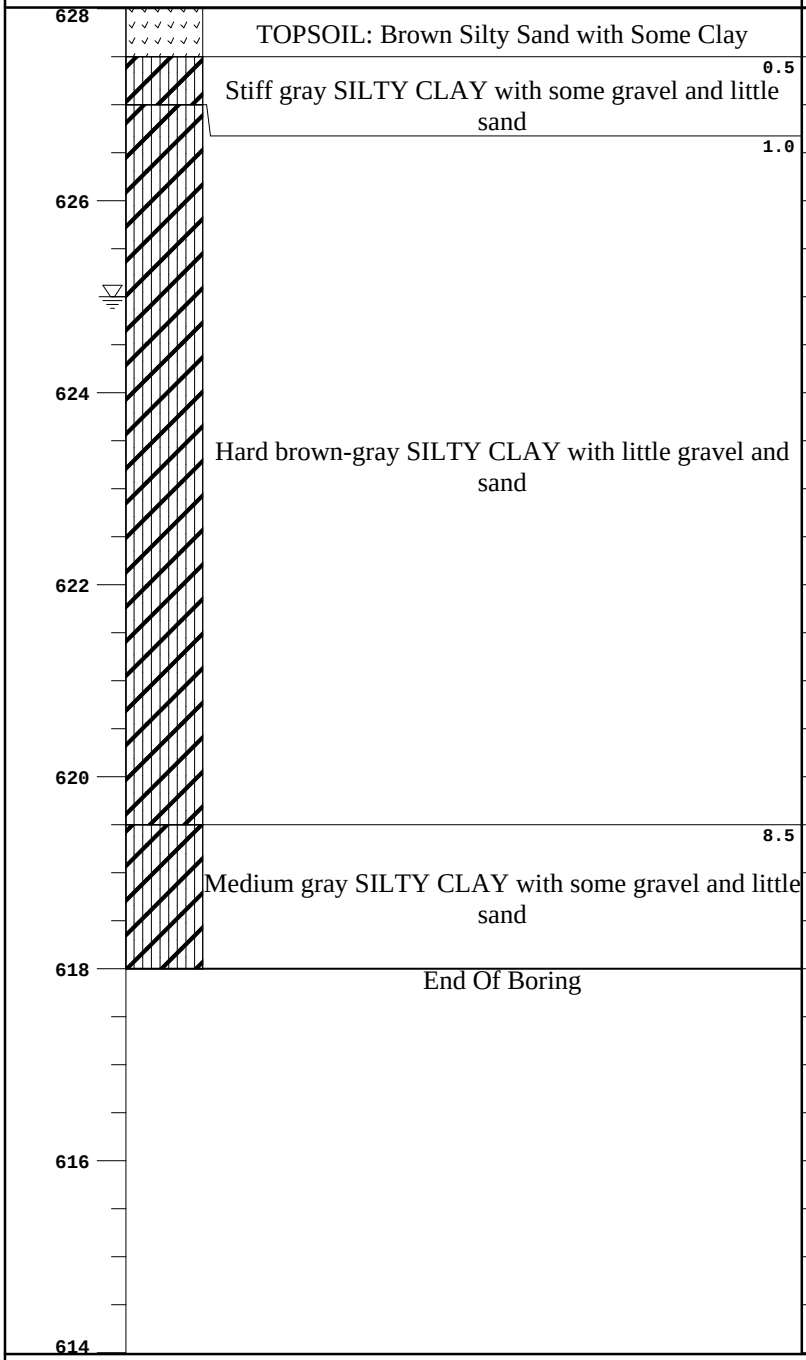
Rebecca Bentley, PE
Senior Geotechnical Project Manager

Attachments: Log of Test Boring
Soil Terminology
Location Plan

LOG OF TEST BORING NO. TB-1

PROJECT NAME: *Venoy-Dorsey Kayak Launch*
LOCATION: *Westland, Michigan*

PEA Job No.: *2020-0310*
Reviewed by: *REB*



SUBSURFACE PROFILE	SOIL SAMPLE DATA							
GROUND SURFACE ELEVATION 628	DEPTH FEET	SAMPLE	BLOWS /6"	SPT "N"	Moisture Content (%)	Dry Density (pcf)	Unconf. Comp. Str. (psf)	Failure Strain (%)
	0							
	2	1-S	2 2 3	5	18		*9000	
	4	2-S	0 1 1	2	17		*2000	
	6	3-S	0 1 1	2	17		*2000	
	8							
	10	4-S	1 2 4	6	19		*1500	
	12							
	14							

Total Depth: *10*
Drilling Date: *9/13/21*
Inspector: *SA*
Contractor: *Geoserv*

Drilling Method: *Direct Push Casings Autohammer*
Plugging procedure: *Bentonite Chips*

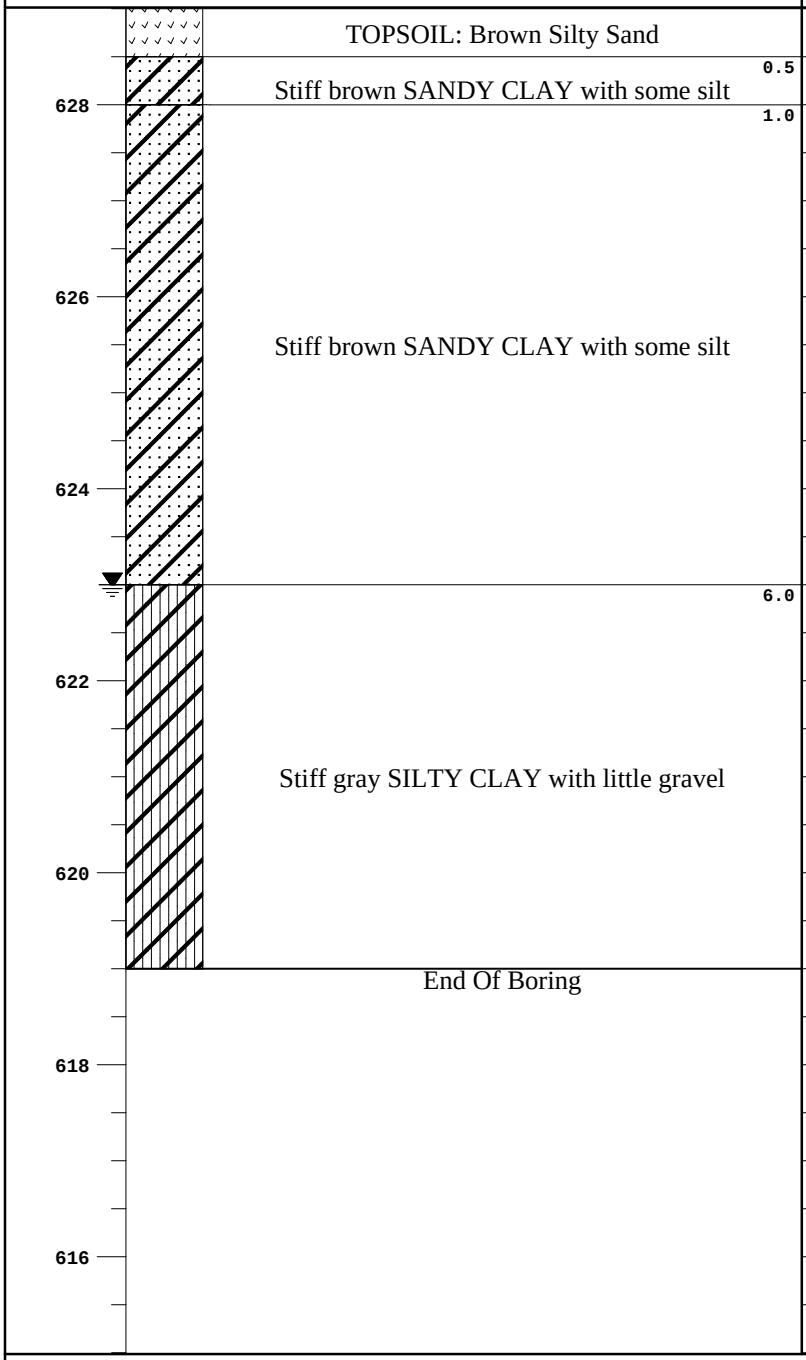
Water Level Observations:
During drilling: *None Encountered*
After drilling: *3 ft.*

Notes: **Pocket Penetrometer*
**6 ft. cave in*

LOG OF TEST BORING NO. TB-2

PROJECT NAME: *Venoy-Dorsey Kayak Launch*
LOCATION: *Westland, Michigan*

PEA Job No.: *2020-0310*
Reviewed by: *REB*



SUBSURFACE PROFILE	SOIL SAMPLE DATA						
GROUND SURFACE ELEVATION 629	DEPTH FEET	SAMPLE	BLOWS /6"	SPT "N"	Moisture Content (%)	Dry Density (pcf)	Unconf. Comp. Str. (psf)	Failure Strain (%)
	0							
	2	1-S	4 2 3	5	16		*2000	
	4	2-S	1 2 2	4	19		*2000	
	6	3-S	3 2 1	3	19		*2000	
	8							
	10	4-S	2 4 5	9	19		*3000	
	12							
	14							

Total Depth: *10*
Drilling Date: *9/13/21*
Inspector: *SA*
Contractor: *Geoserv*

Drilling Method: *Direct Push Casings Autohammer*
Plugging procedure: *Bentonite Chips*

Water Level Observations:
During drilling: *6 ft.*
After drilling: *6 ft.*

Notes: **Pocket Penetrometer*
**8 ft. cave in*

PEA GROUP

LOG OF TEST BORING NO. TB-3

PROJECT NAME: *Venoy-Dorsey Kayak Launch*
LOCATION: *Westland, Michigan*

PEA Job No.: *2020-0310*
Reviewed by: *REB*

GROUND SURFACE ELEVATION 628

DEPTH FEET	SAMPLE	BLOWS /6"	SPT "N"	Moisture Content (%)	Dry Density (pcf)	Unconf. Comp. Str. (psf)	Failure Strain (%)
0							
2	1-S	1 1 1	2	20			
4	2-S	1 1 0	1	21			
6							
8							
10							
12							
14							

628 — TOPSOIL: Brown Silty Sand — 0.5

626 — Very loose gray SILTY SAND with trace gravel

624

End Of Boring

622

620

618

616

614

Total Depth: *5*

Drilling Date: *9/13/21*

Inspector: *SA*

Contractor: *Geoserv*

Drilling Method: *Direct Push Casings*
Autohammer

Plugging procedure: *Bentonite Chips*

Water Level Observations:
During drilling: *None Encountered*

After drilling: *Dry*

Notes: **Pocket Penetrometer*
**4 ft. cave in*

PEA GROUP

LOG OF TEST BORING NO. TB-4

PROJECT NAME: *Venoy-Dorsey Kayak Launch*
LOCATION: *Westland, Michigan*

PEA Job No.: *2020-0310*
Reviewed by: *REB*

SUBSURFACE PROFILE

GROUND SURFACE ELEVATION 628

628 — TOPSOIL: Brown Silty Sand with trace roots and gravel

0.8

626 — Brown SAND with some silt and trace gravel

624 —

End Of Boring

622 —

620 —

618 —

616 —

614 —

DEPTH FEET	SAMPLE	BLOWS /6"	SPT "N"	Moisture Content (%)	Dry Density (pcf)	Unconf. Comp. Str. (psf)	Failure Strain (%)
0							
	1-D			8			
2							
	2-D			8			
4							
6							
8							
10							
12							
14							

Total Depth: *5*
Drilling Method: *Hand Auger*
Drilling Date: *9/17/21*
Inspector: *JA*
Plugging procedure: *Soil Spoils*
Contractor: *PEA Group*

Water Level Observations:
During drilling: *None Encountered*
After drilling: *Dry*

Notes: *Hand auger boring*

PEA GROUP

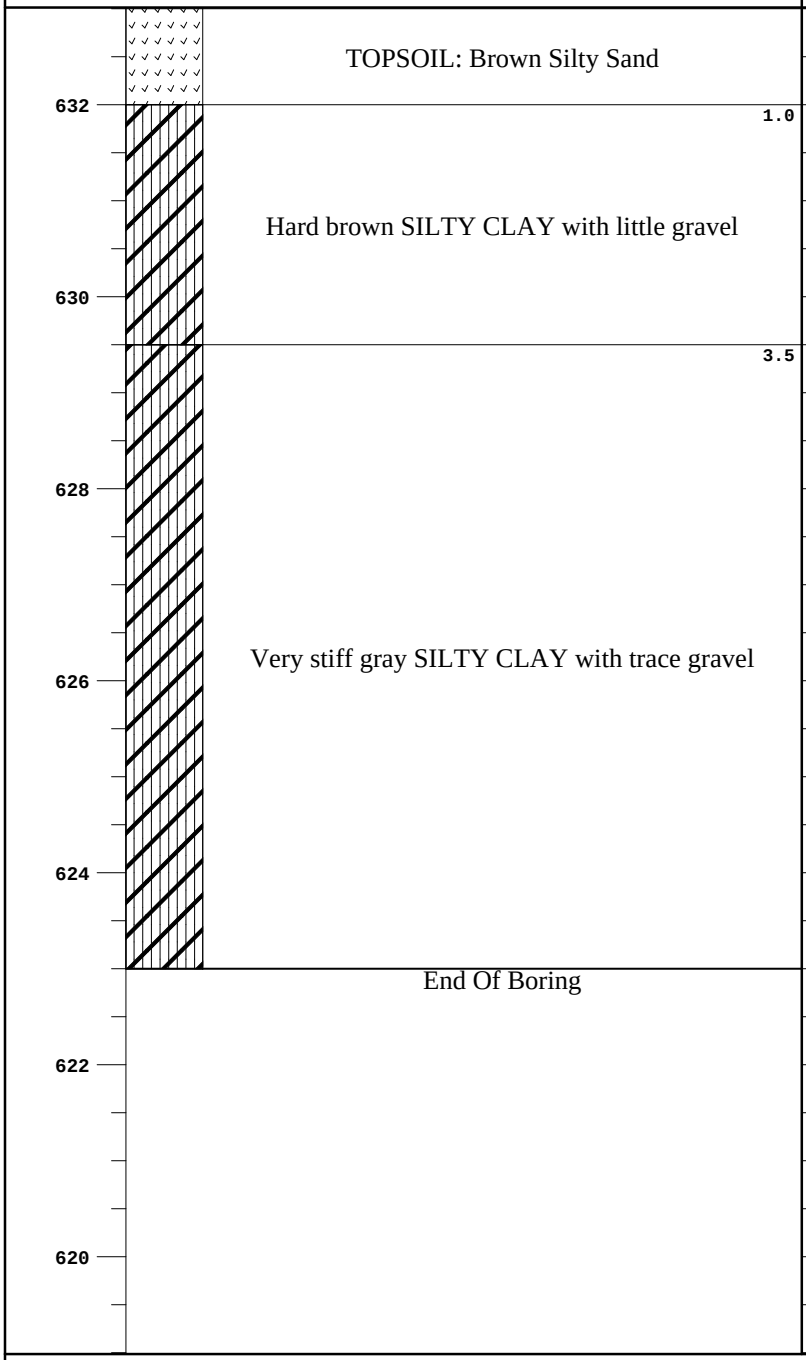
LOG OF TEST BORING NO. TB-5

PROJECT NAME: *Venoy-Dorsey Kayak Launch*
LOCATION: *Westland, Michigan*

PEA Job No.: *2020-0310*
Reviewed by: *REB*

SUBSURFACE PROFILE

GROUND SURFACE ELEVATION 633



SOIL SAMPLE DATA

DEPTH FEET	SAMPLE	BLOWS /6"	SPT "N"	Moisture Content (%)	Dry Density (pcf)	Unconf. Comp. Str. (psf)	Failure Strain (%)
2	1-S	5 4 5	9	14		*8000	
4	2-S	5 6 3	9	18		*6000	
6	3-S	3 3 3	6	16		*5000	
8	4-S	2 3 3	6	15		*8000	

Total Depth: *10*
Drilling Date: *9/13/21*
Inspector: *SA*
Contractor: *Geoserv*

Drilling Method: *Direct Push Casings Autohammer*
Plugging procedure: *Bentonite Chips*

Water Level Observations:
During drilling: *None Encountered*
After drilling: *Dry*

Notes: **Pocket Penetrometer*

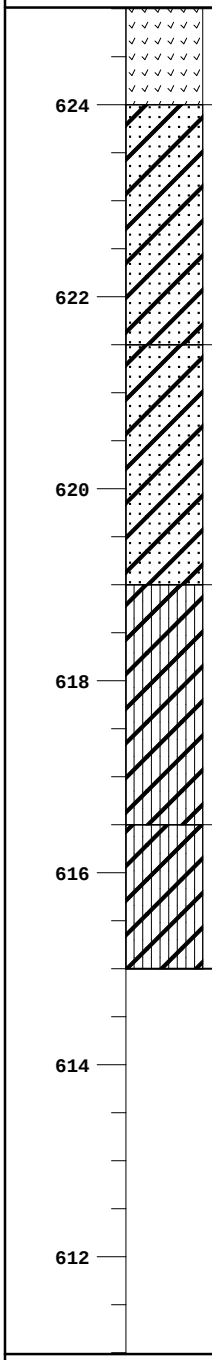
PEA GROUP

LOG OF TEST BORING NO. TB-6

PROJECT NAME: *Venoy-Dorsey Kayak Launch*
LOCATION: *Westland, Michigan*

PEA Job No.: *2020-0310*
Reviewed by: *REB*

GROUND SURFACE ELEVATION 625



DEPTH FEET	SAMPLE	BLOWS /6"	SPT "N"	Moisture Content (%)	Dry Density (pcf)	Unconf. Comp. Str. (psf)	Failure Strain (%)
0							
TOPSOIL: Brown Silty Sand							
1.0							
Very stiff brown SANDY CLAY	1-S	4 5 5	10	19		*6500	
2							
3.5							
Stiff brown SANDY CLAY with some silt and trace gravel	2-S	0 1 1	10	18		*2000	
4							
6.0							
Hard gray SILTY CLAY with little gravel	3-S	4 4 4	8	16		*8500	
6							
8.5							
Very stiff gray SILTY CLAY with little gravel	4-S	4 4 4	8	16		*5000	
8							
End Of Boring							
10							
12							
14							

Total Depth: *10*
Drilling Date: *9/13/21*
Inspector: *SA*
Contractor: *Geoserv*

Drilling Method: *Direct Push Casings Autohammer*
Plugging procedure: *Bentonite Chips*

Water Level Observations:
During drilling: *None Encountered*
After drilling: *Dry*

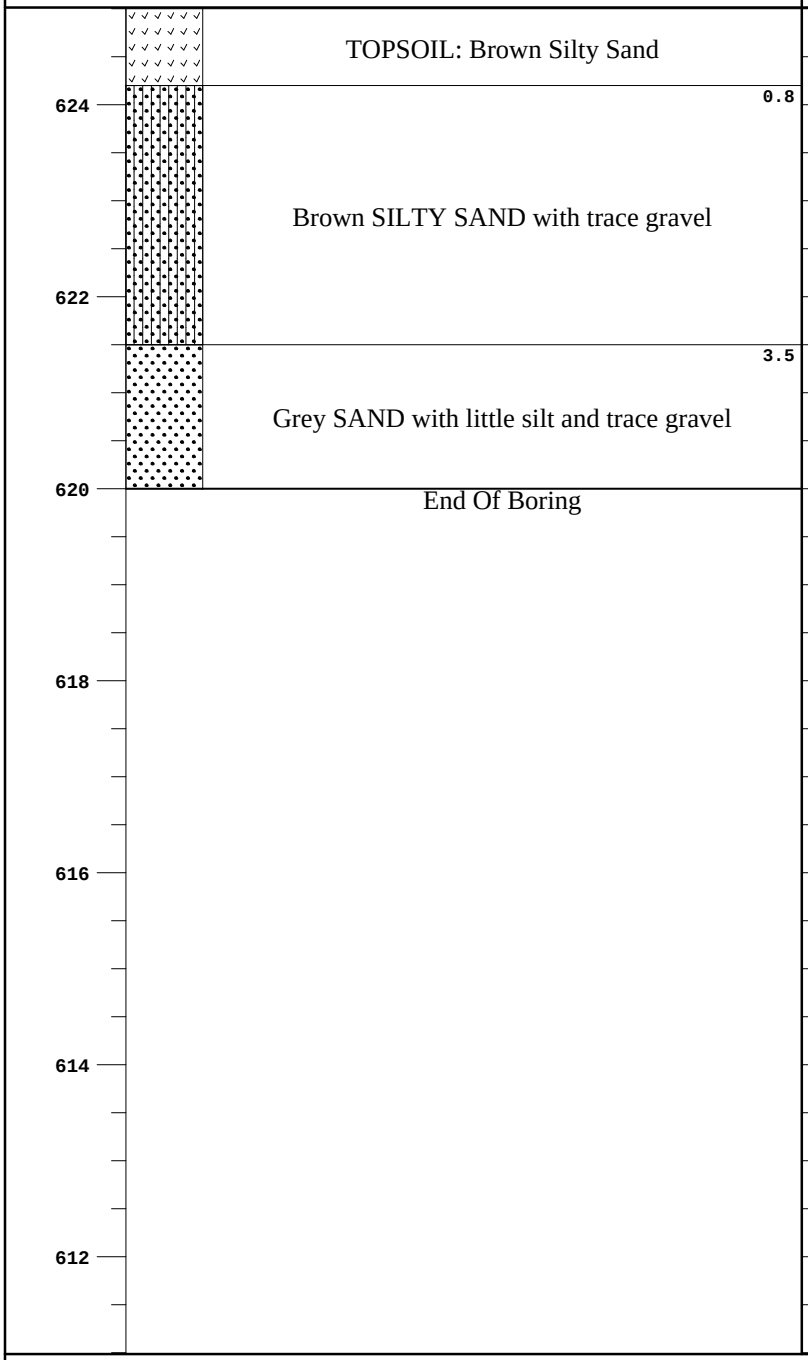
Notes: **Pocket Penetrometer*
**5 ft. cave in*

PEA GROUP

LOG OF TEST BORING NO. TB-7

PROJECT NAME: *Venoy-Dorsey Kayak Launch*
LOCATION: *Westland, Michigan*

PEA Job No.: *2020-0310*
Reviewed by: *REB*



SUBSURFACE PROFILE	SOIL SAMPLE DATA						
GROUND SURFACE ELEVATION 625	DEPTH FEET	SAMPLE	BLOWS /6"	SPT "N"	Moisture Content (%)	Dry Density (pcf)	Unconf. Comp. Str. (psf)	Failure Strain (%)
		1-D			18			
		2-D			15			

Total Depth: *5*
Drilling Method: *Hand Auger*
Drilling Date: *9/17/21*
Inspector: *JA*
Plugging procedure: *Soil Spoils*
Contractor: *PEA Group*

Water Level Observations:
During drilling: *None Encountered*
After drilling: *Dry*

Notes: *Hand auger boring*

PEA GROUP

LOG OF TEST BORING NO. TB-8

PROJECT NAME: *Venoy-Dorsey Kayak Launch*
LOCATION: *Westland, Michigan*

PEA Job No.: *2020-0310*
Reviewed by: *REB*

SUBSURFACE PROFILE		SOIL SAMPLE DATA						
GROUND SURFACE ELEVATION 625	DEPTH FEET	SAMPLE	BLOWS /6"	SPT "N"	Moisture Content (%)	Dry Density (pcf)	Unconf. Comp. Str. (psf)	Failure Strain (%)
TOPSOIL: Brown Silty Sand	0							
624	0.8							
Brown SILTY SAND with trace plant roots		1-D			13			
	2							
622								
Brown SAND with little silt and trace gravel		2-D			17			
620	4							
End Of Boring								
618	6							
616	8							
614	10							
612	12							
	14							

Total Depth: *5*
Drilling Method: *Hand Auger*
Drilling Date: *9/17/21*
Inspector: *JA*
Plugging procedure: *Soil Spoils*
Contractor: *PEA Group*

Water Level Observations:
During drilling: *None Encountered*
After drilling: *Dry*

Notes: *Hand auger boring*

SOIL TERMINOLOGY

Unless otherwise noted, all terms utilized herein refer to the Standard Definitions presented in ASTM D-653.

PARTICLE SIZES

Boulders - Greater than 12 inches (305 mm)

Cobbles - 3 inches (76.2 mm) to 12 inches (305 mm)

Gravel:

< Coarse - 3/4 inches (9.05 mm) to 3 inches (76.2 mm)
< Fine - No. 4 (4.75 mm) to 3/4 inches (19.05 mm)

Sand:

< Coarse - No. 10 (2.00 mm) to No. 4 (4.74 mm)
< Medium - No. 40 (0.425 mm) to No. 10 (2.00 mm)
< Fine - No .200 (0.074 mm) to No. 40 (0.425 mm)

Silt - 0.005 mm to 0.074 mm

Clay - Less than 0.005 mm

CLASSIFICATION

The major soil constituent is the principal noun (i.e., clay, silt, sand, gravel). The minor constituents are reported as follows:

Modifiers to Main Constituent
(Percent by Weight)

Trace	-	01 to 10%
Little	-	10 to 20%
Some	-	20 to 30%
Adjective	-	Over 30%

COHESIVE SOILS

If clay content is sufficient so that clay dominates soil properties, clay becomes the principal noun with the other major soil constituent as modifier (i.e., silty clay). Other minor soil constituents may be included in accordance with the classification breakdown for cohesionless soils (i.e., silty clay, trace of sand, little gravel).

Consistency	Unconfined Compressive Strength (PSF)	Approximate Range of N
Very Soft	Below 500	0 to 2
Soft	500 to 1,000	3 to 4
Medium	1,000 to 2,000	5 to 8
Stiff	2,000 to 4,000	9 to 15
Very Stiff	4,000 to 8,000	16 to 30
Hard	8,000 to 16,000	31 to 50
Very Hard	Over 16,000	Over 50

Consistency of cohesive soils is based upon as elevation of the observed resistance to deformation under load and not upon the Standard Penetration Resistance (N).

COHESIONLESS SOILS

Density Classification	Relative Density %	Approximate Range of N
Very Loose	0 to 15	0 to 4
Loose	16 to 35	5 to 10
Medium Compact	36 to 65	11 to 30
Compact	66 to 85	31 to 50
Very Compact	86 to 100	Over 50

Relative Density of Cohesionless Soils is based upon the evaluation of the Standard Penetration Resistance (N), modified as required for depth effects, sampling effects, etc.

SAMPLE DESIGNATIONS

C - Core
D - Directly from Auger Flight or Miscellaneous Sample
S - Split Spoon Sample - ASTM D-1586
LS - S - Sample with liner insert
ST - Shelby Tube Sample - 3 inch diameter unless otherwise noted
PS - Piston Sample - 3 inch diameter unless otherwise noted
RC - Rock Core - NX core unless otherwise noted

STANDARD PENETRATION TEST (ASTM D-1586) - a 2.0-inch outside diameter, 1-3/8-inch inside diameter split barrel sampler is driven into undisturbed soil by means of a 140-pound weight falling freely.

VENOY RD.
(VARIABLE WIDTH)

TB–1

TB–2

TB–3

TB–4

LOADING AREA

KAYAK SHELTER

BARRIER–FREE PARKING AREA

CURB CUT

PARALLEL CURB RAMP

CURB CUT

STANDARD DUTY ASPHALT PAVEMENT, TYP.

8'–WIDE SIDEWALK, TYP.

18" CURB AND GUTTER, TYP.

BIORETENTION AREA

STEP, TYP.

COVE

FLOATING LAUNCH

BOAT LAUNCH RAMP

RIDGE

5.5'r

22.5'

11.5'

22.5'

5.5'

11'

40'

5.5'r

23'

19.5'r

22'

67.5'

11.5'

8'

8'

BORING LEGEND

TB–1 TEST BORING BY PERFORMED BY GEOSERV DRILLING/PEA ON SEPTEMBER 13/17, 2021 UNDER TECHNICAL SUPERVISION OF PEA.

NOT TO SCALE

811 Know what's below. Call before you dig.

CAUTION!!
THE LOCATIONS AND ELEVATIONS OF EXISTING UNDERGROUND UTILITIES AS SHOWN ON THIS DRAWING ARE ONLY APPROXIMATE. NO GUARANTEE IS EITHER EXPRESSED OR IMPLIED AS TO THE COMPLETENESS OR ACCURACY THEREOF. THE CONTRACTOR SHALL BE EXCLUSIVELY RESPONSIBLE FOR DETERMINING THE EXACT UTILITY LOCATIONS AND ELEVATIONS PRIOR TO THE START OF CONSTRUCTION.

PEA GROUP
TROY ■ WASHINGTON TWP
BRIGHTON ■ DETROIT
t: 844.813.2949
www.peagroup.com

CLIENT
WAYNE COUNTY DEPT. OF PUBLIC SERVICE
33175 ANN ARBOR TRAIL
WESTLAND, MI

PROJECT TITLE
WATER TAILHEAD
VENOY-DORSEY PARK
MERRIMAN ROAD & MICHIGAN AVENUE
WESTLAND, MI

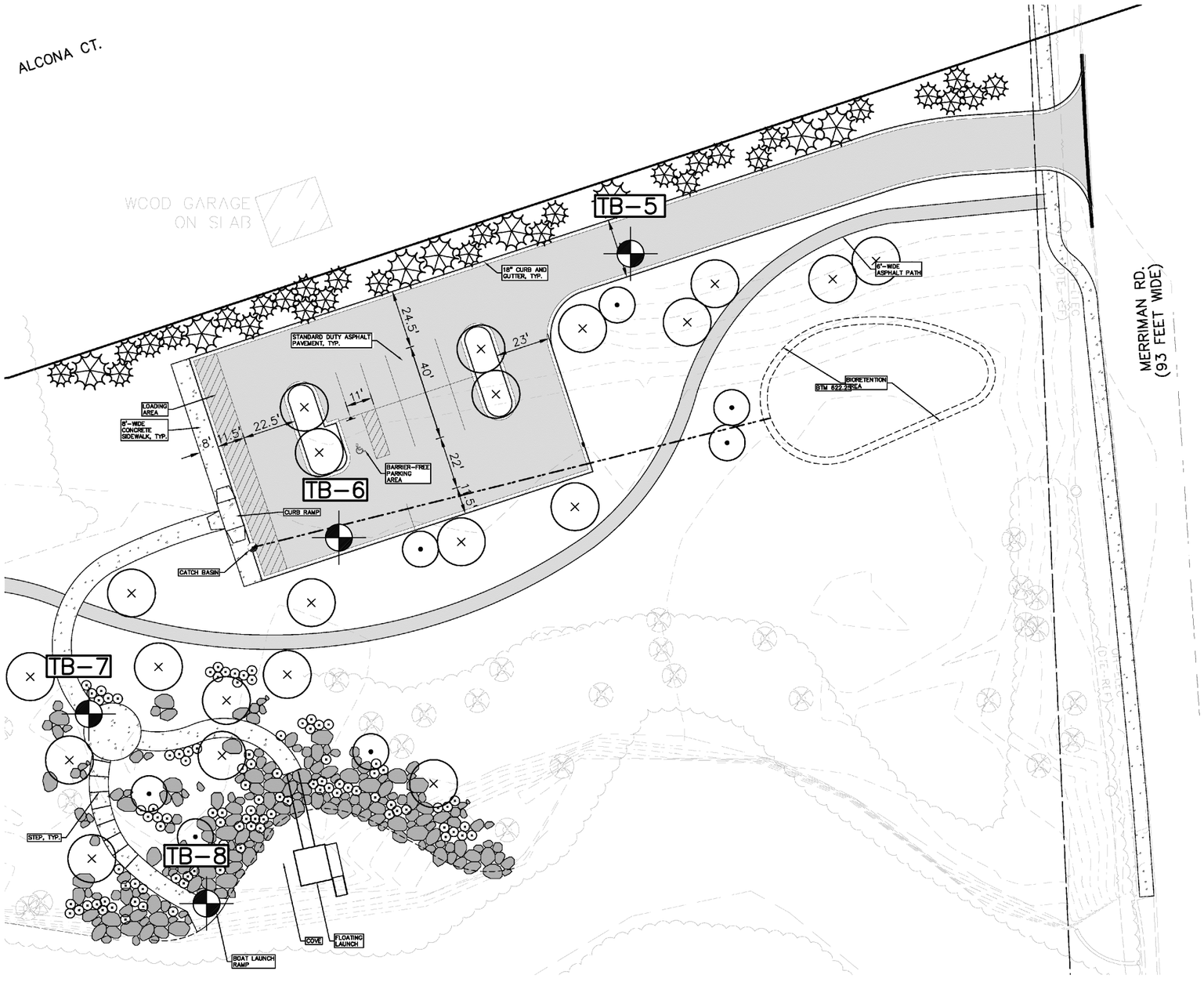
REVISIONS
- -

ORIGINAL ISSUE DATE:
SEPTMBER 23, 2021

DRAWING TITLE
TEST BORING LOCATION MAP VENOY LAUNCH

PEA JOB NO.	2020-310
P.M.	XXX
DN.	XXX
DES.	XXX

DRAWING NUMBER:
TBM 1



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CLIENT
WAYNE COUNTY DEPT. OF PUBLIC SERVICE
33175 ANN ARBOR TRAIL
WESTLAND, MI

PROJECT TITLE
WATER TAILHEAD VENOY-DORSEY PARK
MERRIMAN ROAD & MICHIGAN AVENUE
WESTLAND, MI

REVISIONS

-	-

ORIGINAL ISSUE DATE:
SEPTMBER 23, 2021

DRAWING TITLE
TEST BORING LOCATION MAP MERRIMAN LAUNCH

PEA JOB NO.	2020-310
P.M.	XXX
DN.	XXX
DES.	XXX

DRAWING NUMBER:
TBM 1