SOIL EXPLORATION
VILLAGE OF HAMLER
WASTEWATER TREATMENT LAGOON
HAMLER, HENRY COUNTY, OHIO

SUBMITTED TO:

VILLAGE OF HAMLER
Attn: Mr. Ken Griffith
500 East Hubbard Street
Hamler, Ohio 43524

BMI Report No. 205019-0822-9580

August 15, 2022

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Report To: Village of Hamler
Attention: Mr. Ken Griffith
500 East Hubbard Street
Hamler, Ohio 43524

Date: August 15, 2022
Laboratory Job No.:
BMI Report No.: 205019-0822-9580
Report Consists of 79 Pages

Report On: SOIL EXPLORATION
Village of Hamler
Wastewater Treatment Lagoon
Hamler, Henry County, Ohio

Dear Mr. Griffith:

Bowser-Morner, Inc. (BMI) has completed the authorized subsurface exploration and geotechnical engineering evaluation at the above-referenced project. The following report briefly reviews our exploration procedures, describes existing site and subsurface conditions, and presents our evaluations, conclusions, and recommendations.

1.0 AUTHORIZATION

The purpose of this subsurface exploration and geotechnical engineering evaluation was to determine the subsurface conditions at the project site and to analyze these conditions as they relate to foundation design and construction. All work was performed in accordance with BMI technical proposal No. T-27599-Revised dated April 12, 2022 and its attached *Proposal Acceptance Sheet* between the Villager of Hamler and Bowser-Morner, Inc. Authorization to proceed with the necessary work was given by G. Jeff Brubaker of the Village of Hamler on April 12, 2022. The scope of the exploration included subsurface drilling and sampling, limited laboratory testing, engineering evaluation of the field and laboratory data, and the preparation of this report.

2.0 WORK PERFORMED

2.1 Field Exploration

During this exploration, 13 soil test borings were drilled at the approximate locations shown on the attached *Boring Location Plan*. The borings were drilled to a depth of 30 feet each. Boring locations were staked, and elevations were surveyed by Jones & Henry Engineers, LTD (Jones & Henry). The locations shown on the *Boring Location Plan* should be considered approximate.

All soil sampling and standard penetration testing was conducted in general accordance with American Society for Testing and Materials (ASTM) Standard D1586. The borings were advanced by an all-terrain vehicle (ATV) mounted drilling rig by mechanically twisting hollow-stem augers into the soil. At regular intervals, soil samples were obtained with a standard 2-inch outside diameter (O.D.) split spoon sampler driven 18 inches into the soil with blows of a 140-pound hammer falling 30 inches. The number of hammer blows required to drive the sampler the final foot was recorded and designated the "standard penetration resistance." The standard penetration resistance, or "N" value, when properly evaluated, is an index of the soil's strength, density, and ability to support foundations. The disturbed samples recovered by the split spoon sampler were visually classified in the field, logged, sealed in glass jars, and returned to the laboratory for testing and evaluation by a geotechnical engineer.

Four relatively undisturbed Shelby tube samples were obtained by hydraulically pressing at a constant rate, 3-inch O. D. thin-walled samplers, through the soil strata at desired sampling depths. After the samples were obtained, the ends of the tubes were cleaned to remove loose cuttings, capped, and taped. The relatively undisturbed samples obtained were marked for identification and transported to the laboratory for testing.

Four bulk soil samples were obtained at borings 6, 9, 10, and 12 from auger cuttings between depths of 5 to 10 feet. The bulk samples were bagged and returned to the laboratory for testing.

Boring Logs indicating soil descriptions, penetration resistances, and observed groundwater levels are attached.

2.2 Laboratory Testing

In the laboratory, each of the samples recovered from the borings was examined and visually classified by a geotechnical engineer. In addition, samples of cohesive soils from the split spoon samplers were tested to determine the soil's approximate strength using a hand-held, calibrated spring penetrometer. These values were used by the geotechnical engineer to assist in the evaluation of the relative strengths of the subsurface soils and to aid in classification of the samples.

Four Unified Soil Classifications (including washed sieve, hydrometer, and Atterberg limits analyses) were performed on representative samples from the borings in general accordance with ASTM specifications D 422, D 2487, and D 4318. Test results are detailed on the attached Grain Size Distribution Test Report sheets.

Two standard moisture-density relationship tests were performed on bulk soil samples in general accordance with ASTM D698-Method B. Test results are presented on the attached Proctor Test Report sheets.

Two falling head permeability tests were performed on representative undisturbed samples. In addition, two falling head permeability tests were performed on two remolded samples obtained from bulk soil samples. The remolded soil samples were remolded to 95 percent of the standard Proctor dry density. The samples were enclosed in rubber membranes and placed in flexible wall permeameters with chamber pressure then applied. Back pressure, slightly less than the chamber pressure, was applied at one end of the specimen while the other end was open to a back pressure burette 5 pounds per square inch (psi) less than the incoming burette. Water was allowed to flow

through the specimen from the high pressure end to the low pressure end until a stabilized flow was achieved. The coefficients of permeability determined by this analysis are listed below:

Boring	Sample	Condition	Coefficient of Permeability (cm/sec)
6	1C	Undisturbed	3.6×10^{-8}
12	1C	Undisturbed	4.3×10^{-7}
6	Bulk	Remolded	4.4×10^{-8}
10	Bulk	Remolded	4.8×10^{-8}

cm/sec = centimeters per second

Two bulk soil samples were tested for soil resistivity, pH, water soluble sulfate ion content, and water soluble chloride ion content in accordance with ASTM D512, ASTM D516, ASTM D2216, ASTM D4972, and ASTM G187, respectively. Test results are summarized below.

Test Method	B-9 (bulk sample) (5' -10')	B-12 (bulk sample) (5' -10')
Moisture Content, As Received, %:	14.9	15.7
Resistivity (As Received), ohm-cm:	6,800	1,632
Resistivity (100% Saturation), ohm-cm:	3,876	1,428
pH (in Distilled Water):	8.1	8.0
pH (in Calcium Chloride Solution):	7.8	7.6
Water Soluble Sulfate Ion, mg/kg (ppm):	795	219
Water Soluble Chloride Ion, mg/kg (ppm)	15	10

ohm-cm= ohm centimeters
ppm= parts per million
mg/kg= milligrams per kilogram

The soil resistivity indicates that the corrosivity varies from mildly corrosive to corrosive. The table below shows the relative corrosivity as a function of soil resistivity. It should be noted that the relationships given below are approximate and intended as a general reference. Actual field performance can vary based on location specific conditions.

Soil Corrosivity as a Function of Soil Resistivity

Resistivity	Corrosivity
0 to 1,000 ohm-cm	Very corrosive
1,000 to 2,000 ohm-cm	Corrosive
2,000 to 10,000 ohm-cm	Mildly Corrosive
10,000 ohm-cm and above	Progressively Less Corrosive

Natural moisture content determinations were made on 101 split spoon samples recovered from the soil test borings. The results of the moisture content determination tests are shown on the attached *Moisture Content Summary Sheets*.

Soil samples are normally retained in our laboratory for a period of 60 days before they are discarded. To view the samples or arrange for longer storage of samples, please contact us.

3.0 SITE AND SUBSURFACE CONDITIONS

3.1 Site Description

The site is located at the existing wastewater treatment lagoons west of State Route 109 and north of County Road F in Hamler, Henry County, Ohio. The new lagoon will be located adjacent to and east of the existing lagoon. The proposed construction area is currently used as agricultural land.

3.2 Soil Profile

Data from the soil test borings are shown on the attached *Boring Logs*. The subsurface conditions discussed in the following paragraphs and those shown on the *Boring Logs* represent an estimate of the subsurface conditions based on interpretation of the boring data using normally accepted geotechnical engineering judgments. Although individual test borings are representative of the subsurface conditions at the boring locations on the dates shown, they are not necessarily indicative of subsurface conditions at other locations or at other times.

Geologically, the project site is situated in a glacial ground moraine consisting of till containing an unsorted, unstratified mixture of clay, silt, sand, and coarser fragments deposited discontinuously by advancing ice.

Borings 1 through 4 were drilled through the dike of the existing lagoon. Borings 5 through 13 were drilled for the new lagoon. Approximately 4 to 10 inches of topsoil was encountered at the ground surface at each of the borings. Below the topsoil at borings 1 through 4 was the existing dike fill. The consistency of the dike fill was stiff to very stiff. The fill extended to a depth of about 8 feet below existing grade.

Beneath the dike fill at borings 1 through 4 and the topsoil at the remaining borings was a glacial till deposit that consisted of brown to gay silt and clay with some sand and traces of gravel. The glacial till had an existed undrained shear strength of 1,500 to 4,500 psf to an elevation of about 698, more than 4,500 psf between elevation 698 and 690, and 2,000 to more than 4,500 psf below elevation 690. The glacial till extended to the bottoms of all of the borings.

3.3 Groundwater Observations

During the field exploration, the drilling rods and sampling equipment were continuously checked by the drillers for indications of groundwater or seepage. The *Boring Logs* list our driller's observations of groundwater or seepage. Three readings are recorded on the logs. The initial groundwater level indicates the depth(s) at which groundwater or seepage was initially noted by the drillers as the boring was being advanced and the intensity of the seepage. The completion groundwater level represents the depth groundwater was observed in the borehole immediately after the completion of the hole. The last reading on the *Boring Logs* represents the depth groundwater was observed in the borehole after an increment of time has passed. In this case, both the depth and time are listed.

Groundwater was not encountered in any of the borings during drilling or at the completion of drilling.

Groundwater levels fluctuate with seasonal and climatic variations and may be different at other times. More specific information regarding groundwater levels, standard penetration resistances, and soil descriptions are detailed on the attached *Boring Logs*.

4.0 PROPOSED CONSTRUCTION

It is our understanding that the proposed construction is to consist of a new wastewater treatment lagoon. The lagoon will have two cells. Both cells will have a bottom elevation of 701.5 feet, which will match the bottom elevation of the adjacent existing lagoon. The lagoon dike will have a top elevation of about 711 feet and a crest width of about 20 feet except on the west side. On the west side of the new lagoon, the area between the new and old lagoons will be fill in to match the height of the tops of the dikes. The dikes will have interior slopes of about 3 horizontal (H) to 1 vertical(V), and exterior slopes of about 4H to 1V.

If this information is not appropriate for the intended construction, please contact us so we can re-evaluate our recommendations.

5.0 EVALUATIONS AND CONCLUSIONS

The following evaluations and conclusions are based on our interpretation of the field and laboratory data obtained during the exploration and our experience with similar subsurface conditions. Soil penetration data and laboratory data have been used to estimate allowable bearing pressures using commonly accepted geotechnical engineering practices. Subsurface conditions in uninvestigated locations between borings may vary considerably from those encountered in the borings. If structure location, loadings, or levels are changed, we request we be advised so we may re-evaluate our recommendations.

5.1 Site and Subgrade Preparation

Before proceeding with construction, all vegetation, root systems, topsoil, refuse, and other deleterious non-soil materials should be stripped from proposed construction areas, as indicated by the attached *Model Clearing and Grading Specifications*.

After the completion of clearing and stripping, the exposed soils should be thoroughly compacted and areas intended to support new fill should be carefully evaluated by the geotechnical engineer. At that time, the engineer will require proof-rolling of the subgrade with a 20- to 30-ton loaded truck or other pneumatic-tired vehicle of similar size and weight. The purpose of the proof-rolling is to locate soft, weak, or excessively wet soils present at the time of construction. Any unsuitable materials observed during the evaluation and proof-rolling operations should be undercut and replaced with a compacted fill or stabilized in place.

As previously described, the soil profile consists of glacial till soil material that is moderately plastic clay and silt. In general, this material is strong and will support construction equipment. It also has a low permeability. During site preparation, the embankment areas should be checked for any existing drainage tiles. In addition, any existing underground utilities need to be relocated.

5.2 Structural Fill

Fill used to replace undercut areas or to achieve finished grades should be select cohesive soils. The cohesive fill should be low plasticity soils (PI less than 25), and free of organics and rock fragments larger than 3 inches in diameter. Based on our review of the soil samples, the on-site original clay soils will be suitable for use as structural fill, provided they are properly moisture-conditioned and are placed, compacted, and tested in accordance with the recommendations of this report. The optimum moisture content of the on-site soils is in the range of about 10 to 12 percent. The existing moisture content of the soils in the top 10 feet of the soil profile varies from about 14 percent to 24 percent. Some of the on-site fill will require drying prior to use as new structural fill for the lagoon.

Additional fill will be placed on the east side of the existing dike to fill in the area between the lagoons to the height of the top of the dikes. **Where the new fill meets the existing dike, all topsoil from the existing slope should be removed and the new fill should be properly keyed into the existing slope.**

Structural fill should be placed in lifts of 6 to 8 inches loose measure. All fill material should be placed in horizontal lifts and adequately keyed into stripped and scarified subgrade soils. In no instance should puddling or jetting of the backfill materials be allowed as a compaction method. Proper drainage should be maintained during and after construction.

Structural fill for the lagoon liner and embankment dikes should be compacted to a minimum of 95 percent of the standard Proctor maximum dry density of the soil, as determined by a laboratory moisture-density relationship test (ASTM D698). Structural fill should be moisture-conditioned prior to placement to between optimum moisture content and 4 percent above optimum moisture content for the material. No material should be placed that is less than less than optimum moisture content or greater than 4 percent over optimum moisture.

Compaction equipment and methods used should be appropriate for the types of fill materials being placed. Discing and pulverizing of cohesive soils may be required prior to fill placement. Cohesive soils should be compacted using non-vibratory sheepsfoot rollers. Discing and pulverization may be needed to achieve uniform compaction. In confined areas such as utility trenches, granular fill materials should be used and portable compaction equipment and thin lifts may be required to achieve specified degrees of compaction. In general, it is BMI's experience that hand-operated compaction equipment is typically only effective in compacting the uppermost 3 to 4 inches of a fill lift. Therefore, if hand-operated equipment is used, the lift thickness should be reduced. In no instance should puddling or jetting of the backfill materials be allowed as a compaction method. Proper drainage should be maintained during and after fill placement.

During fill placement, density tests should be performed by a qualified soils technician to determine the degree of compaction and compliance with the project specifications. At least one field density test should be made per 2,500 square yards of fill area for each lift of compacted soil. Testing frequency should be increased in confined areas. Any areas that do not meet the compaction specifications should be recompacted to achieve compliance.

5.3 Lagoon Embankments and Liner Construction

The in situ permeability of the existing soils is 4.3×10^{-7} to 3.6×10^{-8} cm/sec. When the on-site soils are reused as fill, the recompacted permeability, when compacted to 95 percent of the standard Proctor dry density, is between 4.4×10^{-8} and 4.8×10^{-8} cm/sec. The permeability of both the in situ and recompacted soils are relatively low and will be adequate for lagoon construction. All fill material for the dikes and liner should be placed and compacted in accordance with Section 5.2 of this report.

Although the lagoon floor soils have a low in situ permeability, the soils will have natural drainage features that will increase the permeability of the system. For a wastewater lagoon, a liner is recommended. The liner may consist of a geosynthetic liner, bentonite, or compacted clay soils. The on-site soils are suitable for use in the liner.

The *Recommended Standards for Wastewater Facilities (2014)* specifies that pond bottoms shall be sealed such that seepage loss through the seal is as low as practicably possible. The limiting value of the hydraulic conductivity, k, of the seal is given by the following equation, where L is the thickness of the seal in centimeters.

$$k = 2.6 \times 10^{-9} L$$

When using recompacted onsite soils in the pond as a liner, the above equation yields a minimum seal thickness of about 8 inches. Clay liners are subject to shrinkage and swelling as the moisture in the soil fluctuates. Care should be taken to prevent desiccation of the liner during construction to minimize cracking, or a thicker liner should be used.

Dike embankment slopes should be no steeper than 3 horizontal (H) to 1 vertical (V). Dikes should be seeded to prevent erosion. Interior slopes should be protected with riprap at the waterline.

The slope stability of the proposed dike was analyses using the computer program Geostase. For an inside slope of 3H:1V and a water elevation in the lagoon of 707.75 feet, was have calculated the following minimum factors of safety.

Summary of Slope Stability Results

Condition	Factor of Safety
Short Term (Undrained)	2.1
Long Term (Drained)	1.5
Long Term with Rapid Draw Down	1.0

The recommended factors of safety for both short term and long term conditions exceed the minimum required factor of safety of 1.3. If rapid draw down occurs, the factor of safety is about 1.0, assuming full dike saturation below elevation 707.75 and a complete draw down. We do not anticipate that full draw down is likely for the treatment lagoon, but should it ever be required for maintenance or repairs, a more detailed analysis and staged drawn down will need to be performed. Slope stability analysis results are attached to this report.

Consolidation testing was not performed for this project. Based on an assumed recompression ratio of 0.03 and an initial void ration of 0.405, we estimate that the total settlement below the centerline of the dike will be about 2.5 inches.

5.5 Special Inspections

The International Building Code (IBC) requires "Special Inspections." These inspections are required in 14 major categories of work and are over and above the inspections that building officials commonly provide per Section 109. The purpose of the special inspector is to review aspects of construction that require special knowledge and training that the code official does not possess.

For each project, the Ohio Department of Commerce's Division of Industrial Compliance requires the principal designer to identify which materials and contracted work require special inspections and specify the frequency of inspection. The designer is to submit this completed list with the building permit application.

At the completion of the project, a *Final Report of Special Inspections* must be submitted by the registered design professional in responsible charge of the project in order to receive the final occupancy permit.

BMI is capable of providing the special inspection services. Based on our current understanding of your project, we have developed the following summary of the Special Inspections that may be required by the principal designer:

SOILS AND FOUNDATIONS – 1705.6	
Item	**Scope**
1. Controlled Structural Fill	*Perform sieve tests (ASTM D422 and D1140) and modified Proctor tests (ASTM D1557) of each source of fill material.* *Inspect placement, lift thickness, and compaction of controlled fill.* *Test density of each lift of fill by nuclear methods (ASTM D2922).* *Verify extent of fill placement.*

5.6 Soil Seismic Site Classification

We have evaluated the available soil profile data developed during this study to determine the Site Class in accordance with the 2018 IBC. The test borings for this project did not extend to 100 feet deep; therefore, we have estimated the depth to rock based on records we keep on file. We have also estimated the soil strength and soil types below the bottoms of the on-site borings. Based on this analysis, we have determined the Site Class is D. We may be able to upgrade the class to C with seismic wave testing. We can perform this service.

5.9 Groundwater Control

During the field exploration, groundwater was not encountered in any of the borings during drilling or at the completion of drilling. We do not anticipate significant difficulties with groundwater during construction. However, groundwater will tend to accumulate in open excavations. We anticipate the amount of water, if any, that does accumulate will be light and can be controlled by pumping from prepared sumps as needed.

The amount and type of dewatering required during construction will depend on the weather and groundwater levels at the time of construction and the effectiveness of the contractor's techniques in preventing surface runoff from entering open excavations. Typically, groundwater levels are highest during winter and spring months and lower in summer and early fall.

5.10 Slopes and Temporary Excavation

The owner and the contractor should make themselves aware of and become familiar with applicable local, state, and federal safety regulations, including current Occupational Safety and Health Administration (OSHA) excavation and trench safety standards. Construction site safety generally is the sole responsibility of the contractor. The contractor shall also be solely responsible for the means, methods, techniques, sequences, and operations of construction operations. BMI is providing the following information solely as a service to the client. Under no circumstances should BMI's provision of the following information be construed to mean BMI is assuming responsibility for construction site safety or the contractor's activities; such responsibility is not implied and should not be inferred.

The contractor should be aware that slope height, slope inclination, and excavation depths (including utility trench excavations) should in no case exceed those specified in local, state, or federal safety regulations such as OSHA Health and Safety Standards for Excavations, Chapter 29 of the Code of Federal Regulations (CFR) Part 1926, or successor regulations. Such regulations are strictly enforced and, if not followed, the owner, the contractor, or earthwork or utility subcontractors could be liable for substantial penalties.

For this site, the overburden soil encountered in our exploration is mostly glacial till silty clay. The naturally occurring undisturbed silty clay soils would be likely classified as Type B.

Note: Soils encountered in the construction excavations may vary significantly across the site. Our preliminary soil classifications are based solely on the materials encountered in widely spaced borings. The contractor should verify similar conditions exist throughout the proposed area of excavation. If different subsurface conditions are encountered at the time of construction, BMI recommends we be contacted immediately to evaluate the conditions encountered.

If any excavation, including a utility trench, is extended to a depth of more than 20 feet, OSHA requires the side slopes of such excavation be designed by a Professional Engineer.

6.0 QUALIFICATIONS

The evaluations, conclusions, and recommendations in this report are based on our interpretation of the field and laboratory data obtained during the exploration, our understanding of the project, and our experience with similar sites and subsurface conditions. Data used during this exploration included, but was not necessarily limited to:

- thirteen exploratory borings performed during this study;
- observations of the project site by our staff;
- results of limited laboratory soil testing;
- preliminary site plans and drawings furnished by Jones & Henry;
- limited interaction with Mr. Christopher Mann of Jones & Henry; and
- published soil or geologic data of this area.

In the event changes in the project characteristics are planned, or if additional information or differences from the conditions anticipated in this report become apparent, BMI should be notified so the conclusions and recommendations contained in this report can be reviewed and, if necessary, modified or verified in writing.

The subsurface conditions discussed in this report and those shown on the *Boring Logs* represent an estimate of the subsurface conditions based on interpretation of the boring data using normally accepted geotechnical engineering judgments. Although individual test borings are representative of the subsurface conditions at the boring locations on the dates shown, they are not necessarily indicative of subsurface conditions at other locations or at other times.

Regardless of the thoroughness of a subsurface exploration, there is the possibility that subsurface conditions between borings will differ from those at the boring locations, conditions are not as anticipated

by designers, or the construction process has altered the soil conditions. As variations in the soil profile are encountered, additional subsurface sampling and testing may be necessary to provide data required to re-evaluate the recommendations of this report. Consequently, after submission of this report, it is recommended BMI be authorized to perform additional services to work with the designer(s) to minimize errors and/or omissions regarding the interpretation and implementation of this report.

Prior to construction, we recommend that BMI:

- work with the designers to implement the recommended geotechnical design parameters into plans and specifications;
- consult with the design team regarding interpretation of this report;
- establish criteria for the construction observation and testing for the soil conditions encountered at this site; and
- review final plans and specifications pertaining to geotechnical aspects of design.

During construction, we recommend that BMI:

- observe the construction, particularly site preparation, fill placement, and foundation excavation or installation;
- perform in-place density testing of all compacted fill;
- perform materials testing of soil and other materials as required; and
- consult with the design team to make design changes in the event differing subsurface conditions are encountered.

If BMI is not retained for these services, we shall assume no responsibility for construction compliance with the design concepts, specifications, or recommendations.

Our professional services have been performed, our findings obtained, and our recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices. No other warranty, expressed or implied, is made.

The scope of our services did not include an environmental site assessment for the presence or absence of hazardous substances in the soil, surface water, groundwater, or air, on, within, or beyond the site studied. Our scope of services also did not include an evaluation for the presence or absence of mold, wetlands, or protected species. Any statements in the report or on the *Boring Logs* regarding odors, staining of soils, or other unusual items or conditions observed are strictly for the information of our client.

To evaluate the site for possible environmental liabilities, we recommend conducting an environmental site assessment. Additional subsurface drilling and sampling, including groundwater sampling, may be required to evaluate environmental conditions. The presence or absence of wetlands or protected species should be determined by a water resources delineation and may represent additional state and Federal waterway permitting obligations. BMI can provide these services and would be pleased to provide a cost proposal to perform these studies, if requested.

This report has been prepared for the exclusive use of the Village of Hamler for specific application to the proposed wastewater treatment lagoon in Hamler, Ohio. Specific design and construction recommendations have been provided in the various sections of the report. The report should, therefore, be used in its entirety. This report is not a bidding document and shall not be used for that purpose. Anyone reviewing this report must interpret and draw their own conclusions regarding specific construction techniques and methods chosen. BMI is not responsible for the independent conclusions, opinions, or recommendations made by others based on the field exploration and laboratory test data presented in this report.

Respectfully submitted,

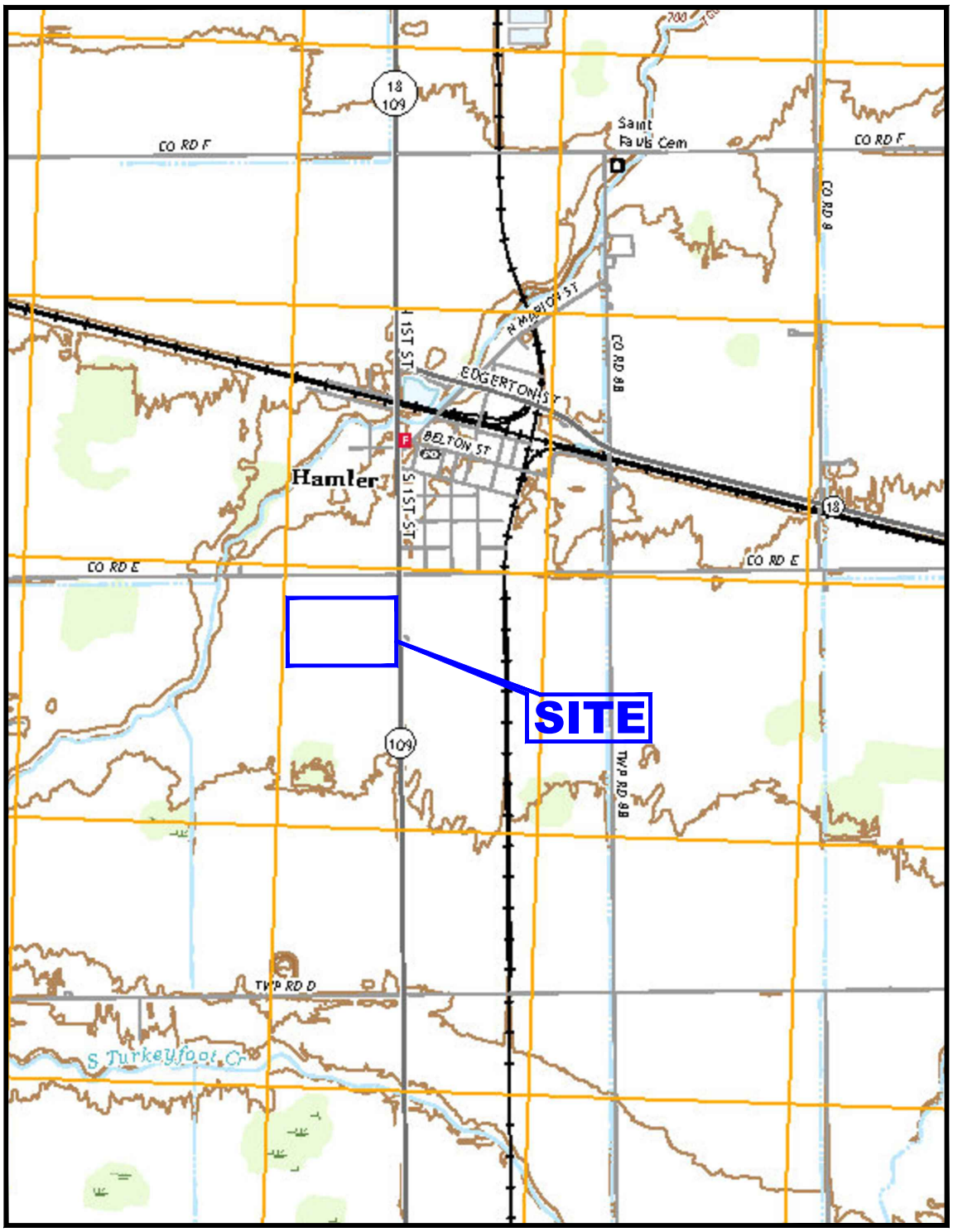
BOWSER-MORNER, INC.

Tricia A. Cosgrove
Sr. Geotechnical Engineer

Ahmad K. Rashid, P.E.
Chief Geotechnical Engineer
Manager, Toledo Engineering & Environmental Services

TAC/AKR:kko
Attachments: *Boring Location Plan*
Boring Log Terminology
Boring Logs
Grain Size Distribution Test Reports
Proctor Test Reports
Moisture Content Summary Sheets
Model Clearing and Grading Specifications
Slope Stability Results
Client (via email: hamlerwater@gmail.com)
Jones & Henry, Attn: Christopher Mann (via email: cmann@jheng.com)

This document has been provided in an electronic format to expedite delivery of results and/or recommendations to Bowser-Morner's Client. Because electronic files can be altered, if there is any question about the validity of the document you are reviewing, please contact our office to view the reference copy of the document stored at 1419 Miami Street, Toledo, Ohio 43605



USGS QUAD: Hamler, Ohio

Latitude: 41°13'25"N Longitude: 84°02'21"W

VICINITY MAP

Soil Exporation
Village of Hamler
Wastewater Treatment Lagoon
Hamler, Henry County, Ohio

05-2022/SR

PROJECT NO.	205019
SCALE	1"=2000'
FIGURE NO.	1

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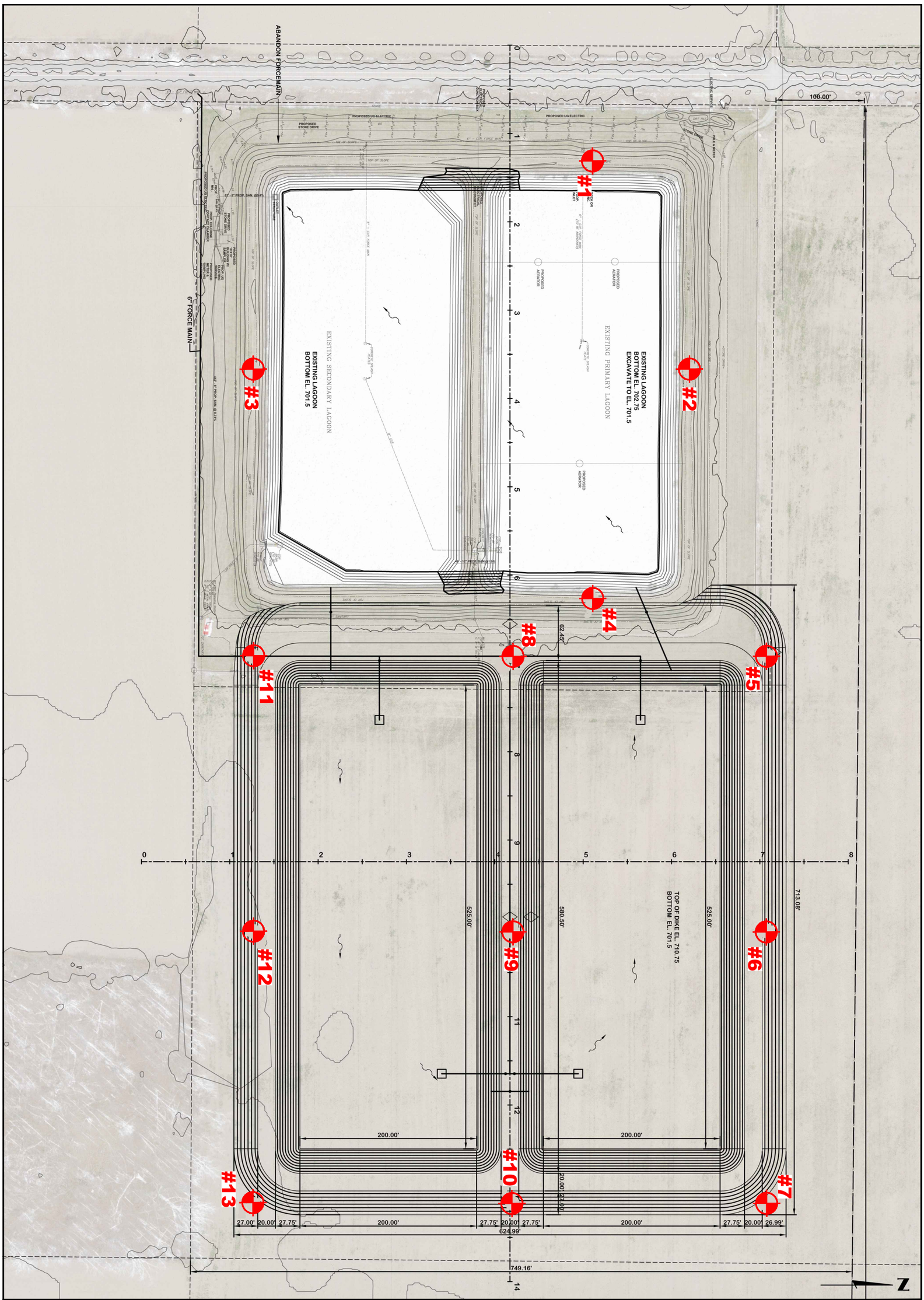

BORING LOCATION PLAN

Soil Exporation
Village of Hamler
Wastewater Treatment Lagoon
Hamler, Henry County, Ohio

0 100 200
Approx. Graphic Scale in Feet

05-2022/SR

PROJECT NO.	205019
SCALE	GRAPHIC
FIGURE NO.	2

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BORING LOG TERMINOLOGY

Stratum Depth:

Distance in feet and/or inches below ground surface.

Description of Materials:

When the color of the soil is uniform throughout, the color recorded will be such as brown, gray, or black and may be modified by adjectives such as light and dark. If the soil's predominant color is shaded by a secondary color, the secondary color precedes the primary color, such as gray and brown, yellow and brown. If two major and distinct colors are swirled throughout the soil, the colors will be modified by the term mottled, such as mottled brown and gray.

There are two types of visual classification methods currently used by Bowser-Morner, Inc. The first is ASTM D2488. This method results in classifications such as "lean clay". The second method is the ASEE system or Burmister system. This system results in classifications such as "silt and clay, with traces of sand" and is described below.

Particle Size		Visual
Boulders		Larger than 8"
Cobbles		8" to 3"
Gravel:	Coarse	3" to 3/4"
	Fine	3/4" to 2 mm
Sand:	Coarse	2 mm to 0.6 mm (pencil size)
	Medium	0.6 mm to 0.2 mm (table sugar & salt size)
	Fine	0.2 mm to 0.06 mm (powdered sugar size)
Silt		0.06 mm to 0.002 mm
Clay		0.002 mm and smaller (particles of silt and clay size are not visible to the naked eye)

Soil Components	
Major Components	**Minor Component Term**
Gravel Sand Silt Clay	Trace……1 - 10% Some……11 - 35% And……36 - 50%

Moisture Content	
Term	**Relative Moisture**
Dry	Powdery
Damp	Moisture content below plastic limit
Moist	Moisture content above plastic limit, but below liquid limit
Wet	Moisture content above liquid limit

Condition of Soil Relative to Compactness (Granular Material)	
Condition	**N**
Very Loose	5 blows/ft or less
Loose	6 to 10 blows/ft
Medium Dense	11 to 30 blows/ft
Dense	31 to 50 blows/ft
Very Dense	51 blows/ft of more

Condition of Soil Relative to Consistency (Cohesive Material)	
Condition	**Approximate Undrained Shear Strength**
Very Soft	Less than 250 psf
Soft	250 to 500 psf
Medium Stiff	500 to 1,000 psf
Stiff	1,000 to 2,000 psf
Very Stiff	2,000 to 4,000 psf
Hard	Greater than 4,000 psf

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Sample Number:

Sample numbers are designated consecutively, increasing with depth for each boring.

Sample Type:

"A" Split spoon, 2-inch O.D., 1-3/8-inch I.D., 18 inches in length.
"B" One of the following:
- Power Auger Sample
- Piston Sample
- Liner Sample
- Denison Sample
- Sonic Sample

"C" Shelby Tube 3-inch O.D., except where noted.

Sample Depth:

The depth below top of ground at which the sample was taken.

Blows per 6 inches on Sampler:

The number of blows required to drive a 2-inch O.D., 1-3/8-inch I.D., split spoon sampler, using a 140-pound hammer with a 30-inch free fall, is recorded for 6 inch drive increments. (Example: 3/8/9)

"N" Blows/Feet:

Standard penetration resistance. This value is based on the total number of blows required for the last 12 inches of penetration. (Example: 3/8/9 : N = 8 + 9 = 17)

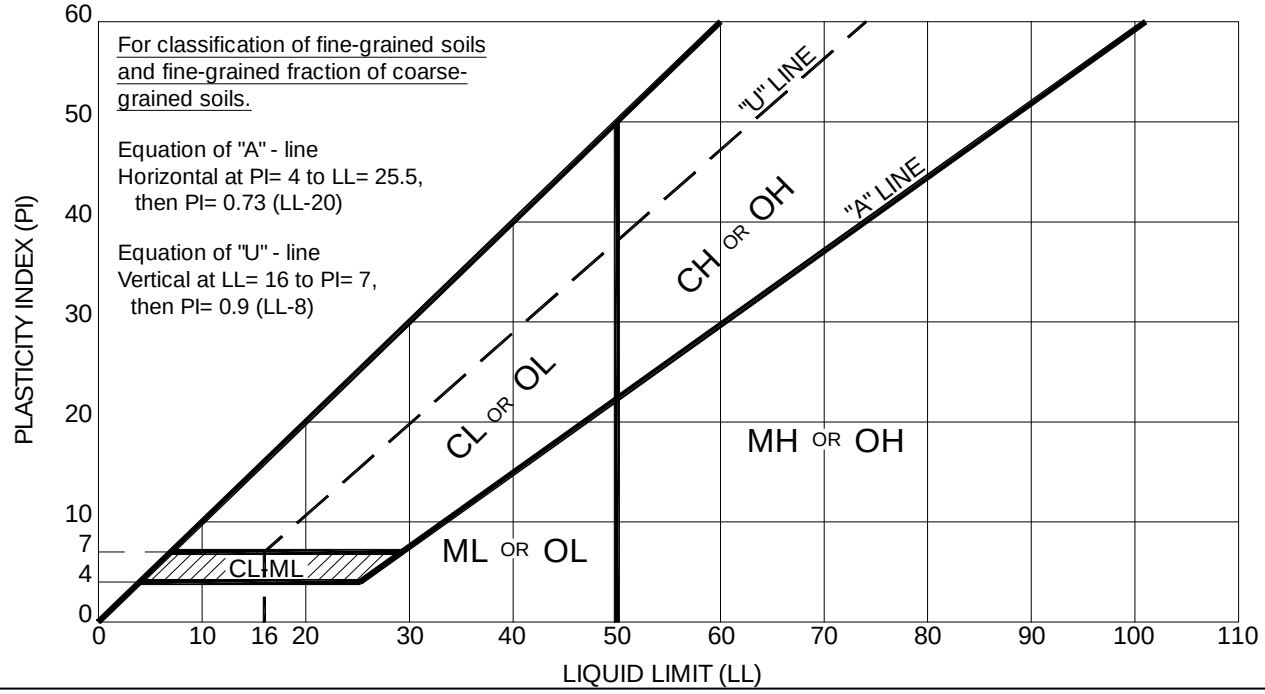
Water Observations:

The depth of water recorded in the test boring is measured from the top of ground to the top of the water level. Initial depth indicates the water level during boring, completion depth indicates the water level immediately after boring, and depth after "X" number of hours indicates the water level after letting the water rise or fall over a time period. Water observations in pervious (sand and gravel) soils are considered reliable ground water levels for that date, Water observations in impervious (silt and clay) soils cannot be considered accurate unless records are made over a time period of several days to a month. Factors such as weather, soil porosity, etc. will cause the ground water level to fluctuate for both pervious and impervious soils.

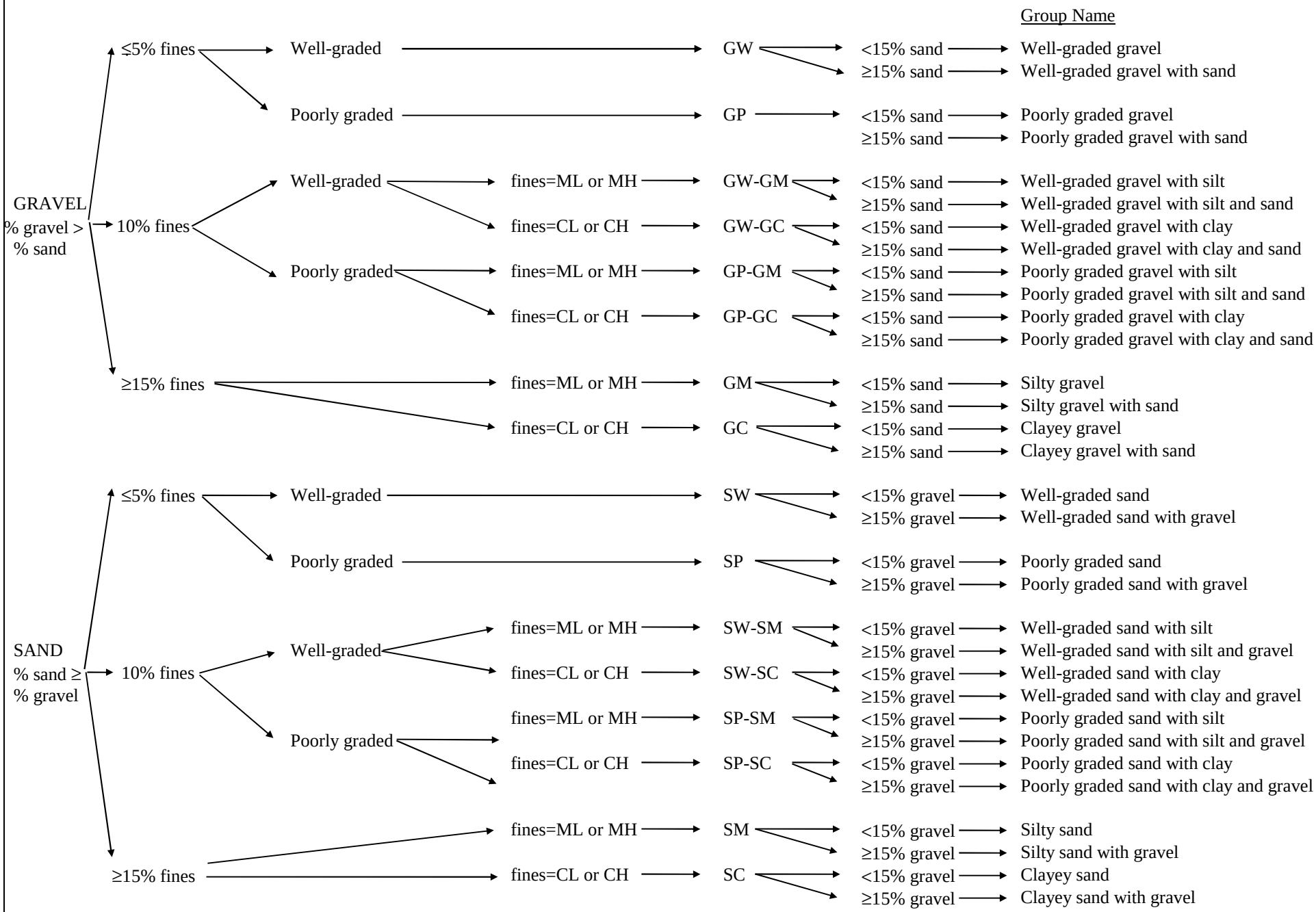
BOWSER MORNER

UNIFIED CLASSIFICATION SYSTEM

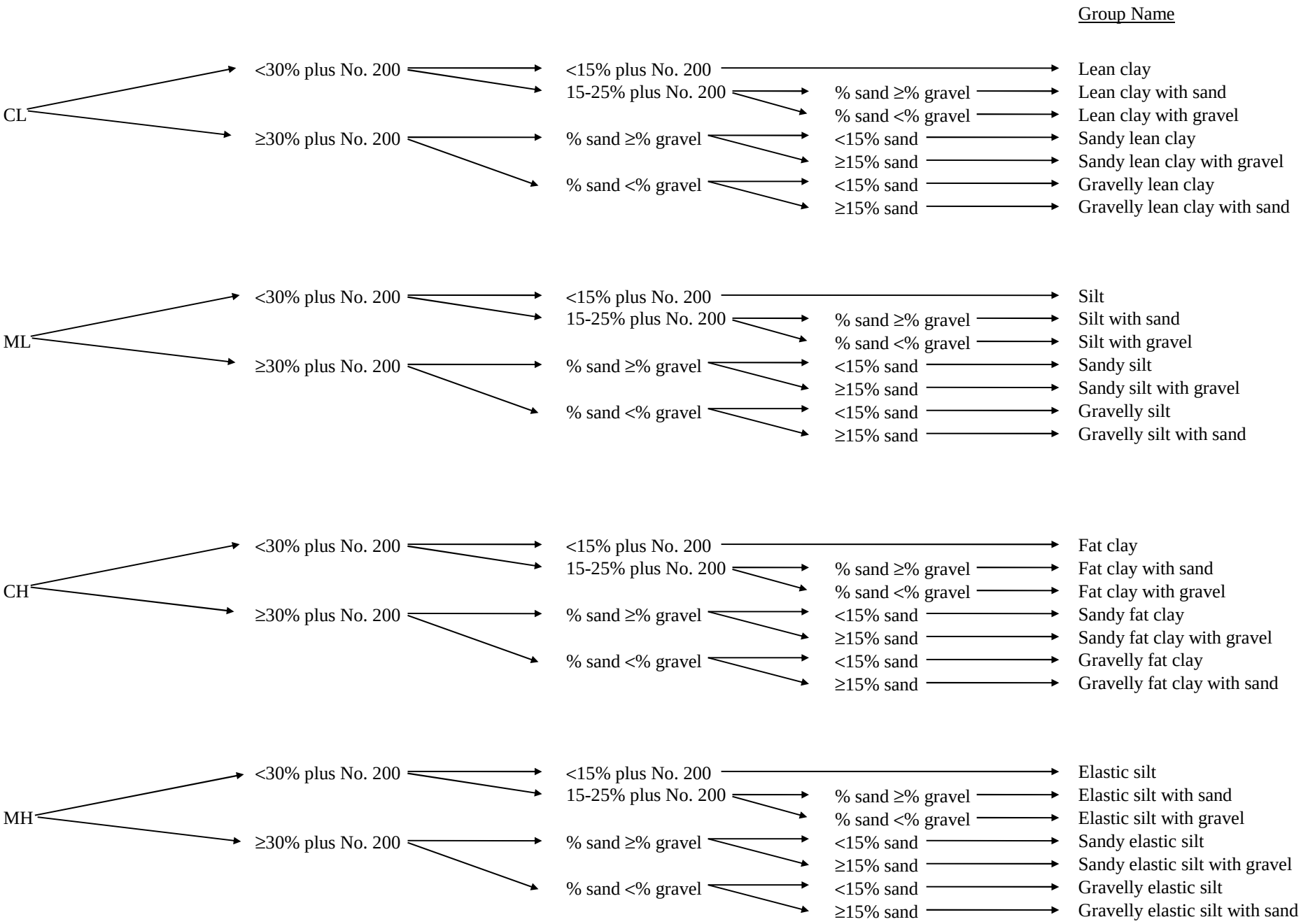
MAJOR DIVISIONS			GRAPH SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVEL WELL-GRADED GRAVEL WITH SAND
				GP	POORLY GRADED GRAVEL POORLY GRADED GRAVEL WITH SAND
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES APPRECIABLE AMT. OF FINES)		GM	SILTY GRAVEL SILTY GRAVEL WITH SAND
				GC	CLAYEY GRAVEL CLAYEY GRAVEL WITH SAND
	SAND AND SANDY SOILS	CLEAN SAND (LITTLE OR NO FINES)		SW	WELL-GRADED SAND WELL-GRADED SAND WITH GRAVEL
				SP	POORLY GRADED SAND POORLY GRADED SAND WITH GRAVEL
	MORE THAN 50% OF COARSE FRACTION PASSING NO. 4 SIEVE	SANDS WITH FINES (APPRECIABLE AMT. OF FINES)		SM	SILTY SAND SILTY SAND WITH GRAVEL
				SC	CLAYEY SAND CLAYEY SAND WITH GRAVEL
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILT AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	SILT, SILT WITH SAND, SANDY SILT GRAVELLY SILT, GRAVELLY SILT WITH SAND
				CL	LEAN CLAY WITH SAND, SANDY LEAN CLAY GRAVELLY LEAN CLAY WITH SAND
				OL	ORGANIC CLAY, SANDY ORGANIC CLAY ORGANIC SILT, SANDY ORGANIC SILT WITH GRAVEL
	SILT AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	ELASTIC SILT WITH SAND, SANDY ELASTIC SILT GRAVELLY ELASTIC SILT WITH SAND
				CH	FAT CLAY WITH SAND, SANDY FAT CLAY GRAVELLY FAT CLAY WITH SAND
				OH	ORGANIC CLAY WITH SAND, SANDY ORGANIC CLAY, ORGANIC SILT, SANDY ORGANIC SILT
	HIGHLY ORGANIC SOILS			PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS



Flow Chart for Visually Identifying Soils Based on ASTM D-2488



Flow Chart for Visually Identifying Soils Based on ASTM D-2488



STANDARD PENETRATION RESISTANCE (ASTM D1586)

The purpose of this test is to determine the relative consistency of the soils in a boring, or from boring over the site. This method consists of making a hole in the ground and driving a 2-inch O.D. split spoon sampler into the soil with a 140-pound hammer dropped from a height of 30 inches. The sampler is driven 18 inches and the number of blows recorded for each 6 inches of penetration. Values of standard penetration (N) are determined in blows per foot, summarizing the flows required for the last two 6-inche increments of penetration.

Example : 2-6-8; N = 14

THIN-WALLED SAMPLER (ASTM D1587)

The purpose of the thin-walled sampler is to recover a relatively undisturbed soil sample for laboratory tests. The sampler is a thin-walled seamless tube with a 3-inch outside diameter, which is hydraulically pressed into the ground, at a constant rate. The ends are then sealed to prevent soil moisture loss, and the tube is returned to the laboratory for tests.

BOWSER MORNER

UNCONFINED COMPRESSION OR TRIAXIAL TESTS (ASTM D 2166)

The unconfined compression test and the triaxial tests are performed to determine the shearing strength of the soil, to use in establishing its safe bearing capacity. In order to perform the unconfined compression test, it is necessary that the soil exhibit sufficient cohesion to stand in an unsupported cylinder. These tests are normally performed on samples which are 6.0 inches in height and 2.85 inches in diameter. In the triaxial test, various lateral stresses can be applied to more closely simulate the actual field conditions. There are several different types of triaxial tests. These are, however, normally performed on constant strain apparatus with a deformation rate of 0.05 inches per minute.

CONSOLIDATION TEST (ASTM D 2435)

The purpose of this test is to determine the compressibility of the soil. This test is performed on a sample of soil which is 2.5 inches in diameter and 1.0 inch in height, and has been trimmed from relatively "undisturbed" samples. The test is performed with a lever system or an air activated piston for applying load. The loads are applied in increments and allowed to remain on the sample for a period of 24 hours. The consolidation of the sample under each individual load is measured and a curve of void ratio vs. Pressure is obtained. From the information obtained in this manner and the column loads of the structure, it is possible to calculate the settlement of each individual building column. This information, together with the shearing strength of the soil, is used to determine the safe bearing capacity for a particular structure.

BOWSER MORNER

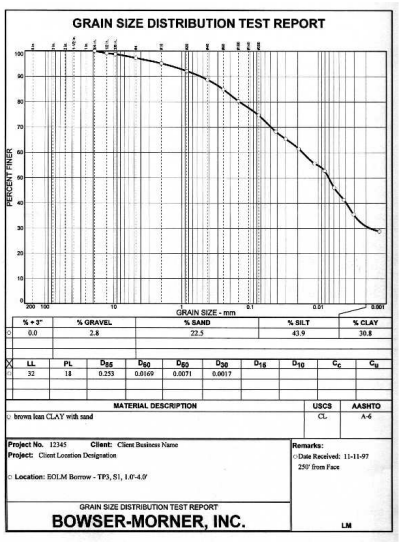
REVISED TO ASTM D4318

ATTERBERG LIMITS (ASTM D423 AND D424)

These tests determine the liquid and plastic limits of soils having a predominant percentage of fine particle (silt and clay) sizes. The liquid limit of a soil is the moisture content expressed as a percent at which the soil changes from a liquid to a plastic state, and the plastic limit is the moisture content at which the soil changes from a plastic to a semi-solid state. Their difference is defined as the plasticity index (P.I. = L.L. - P.L.), which is the change in moisture content required to change the soil from a "semi-solid" to a liquid. These tests furnish information about the soil properties which is important in determining their relative swelling potential and their classifications.

MECHANICAL ANALYSIS (ASTM D422)

This test determines the percent of each particle size of a soil. A sieve analysis is conducted on particle sizes greater than a No. 200 sieve (0.074 mm), and a hydrometer test on particles smaller than the No.200 sieve. The gradation curve is drawn through the points of cumulative percent of particle size, and plotted on semi-logarithmic paper for the combined sieve and hydrometer analysis. This test, together with the Atterberg Limits tests, is used to classify a soil.


GRAIN SIZE DISTRIBUTION TEST REPORT

PERCENT FINER

GRAIN SIZE - mm

% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	2.8	22.5	43.9	30.8

LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_C	C_U
32	18	0.253	0.0169	0.0071	0.0017				

MATERIAL DESCRIPTION	USCS	AASHTO
brown lean CLAY with sand	CL	A-6

Project No. 12345 Client: Client Business Name
Project: Client Location Designation
Location: BOLM Borrow - TP3, S1, 1.0'-4.0'

Remarks:
Date Received: 11-11-97
250' from Face

GRAIN SIZE DISTRIBUTION TEST REPORT
BOWSER-MORNER, INC.

LM

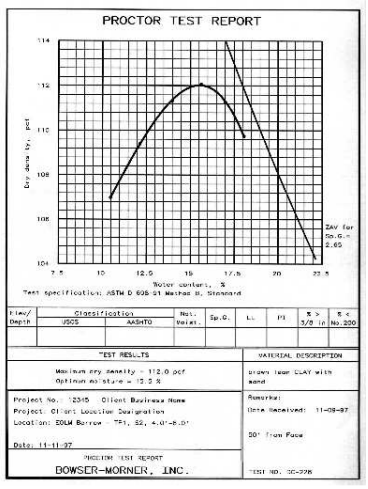
BOWSER MORNER

NATURAL MOISTURE CONTENT (ASTM D2216)

The purpose of this test is to indicate the range of moisture contents present in the soil. A wet sample is weighed, placed in the constant temperature oven at 105^{o} for 24 hours, and re-weighed. The moisture content is the change in weight divided by the dry weight.

PROCTOR TESTS

The purpose of these tests is to determine the maximum density and optimum moisture content of a soil. The Modified Proctor test is performed in accordance with ASTM D1557. The test is performed by dropping a 10-pound hammer 25 times from an 18-inch height on each of 5 equal layers of soil in a 1/30 cubic foot mold, which represents a compaction effort of 56,250 foot pounds per cubic foot. The moisture content is then raised, and this procedure is repeated. A moisture density curve is then plotted, with the density on the ordinate axis and the moisture on the abscissa axis. The moisture content at which the maximum density requirement can be achieved with a minimum compactive effort is designated as the optimum moisture content (O.M.C.). The Standard Proctor test is performed in accordance with ASTM D698. This test is similar to the Modified Proctor test and is performed by dropping a 5.5 pound hammer 25 times from a height of 12 inches on 3 equal layers of soil in a 1/30 cubic foot mold, which represents a compaction effort of 12,375 foot pounds per cubic foot. This test gives proportionately lower results than the Modified Proctor test.


PROCTOR TEST REPORT

Dry Density, pcf

Water content, %

ZAV for Sp.G.= 2.65

Test specification: ASTM D 698-91 Method B, Standard

Proj/ Depth	Classification USCS	Classification AASHTO	Nat. Moist.	Sp.G.	LL	PI	% > 3/8 in	% < No.200

TEST RESULTS

Maximum dry density = 112.0 pcf

Optimum moisture = 13.0 %

MATERIAL DESCRIPTION

Brown Sandy CLAY with sand

Project No. 12345 Client Business Name

Project: Client Location Designation

Location: SOUM Borrow - TP1, S2, 4.0'-8.0'

Date: 11-11-97

Remarks:

Date Received: 11-08-97

50' from Face

PROCTOR TEST REPORT

BOWSER-MORNER, INC.

TEST NO. 96-226

BOWSER MORNER

CLIENT
VILLAGE OF HAMLER

PROJECT
WASTEWATER TREATMENT LAGOON, HAMLER, HENRY COUNTY, OHIO

JOB NO. **205019**

BORING STARTED **5/10/22** | BORING COMPLETED **5/10/22**

DRILLER **CRR, CR** | METHOD **3 1/4" HSA**

TYPED BY **kko**

B-1 Boring No.

Sheet 1 of 1

PROJECT LOCATION
LAT. LONG.
SURFACE ELEVATION **710.6'**
BORING LOCATION
As shown on Boring Location Plan.
It has been necessary to interpolate between samples. Therefore, the contacts between the various soil strata should not be taken as absolute.
VISUAL CLASSIFICATION OF THE MATERIAL

DEPTH	SAMPLE NO.	SAMPLER TYPE / RECOVERY	GRAPHIC LOG	VISUAL CLASSIFICATION OF THE MATERIAL	BLOW COUNTS	N VALUE, blows/ft. (10 20 30 40 50 60 70 80 90)
1.0				(FILL) Topsoil		
2.0	SS-1			(FILL) Very stiff brown silt and clay, some sand, trace of gravel, moist	2 2 3	5
3.0						
4.0	SS-2				3 4 5	9
5.0						
6.0	ST-1			(Becomes stiff at 6')		
7.0						
8.0	SS-3			(FILL) Stiff gray silt and clay, some sand, trace of gravel, trace organics, moist	4 5	11
9.0	SS-4			Very stiff brown and gray silt and clay, some sand, trace of gravel, moist	4 6 4 7	11
10.0						
11.0						
12.0						
13.0						
14.0	SS-5			(Becomes hard at 13.5')	10 11 14	25
15.0						
16.0						
17.0						
18.0						
19.0	SS-6				7 11 14	25
20.0				(Becomes gray at 20')		
21.0						
22.0						
23.0						
24.0	SS-7			(Becomes very stiff at 23.5')	5 7 11	18
25.0						
26.0						
27.0						
28.0						
29.0	SS-8				5 7	17
30.0				Bottom of boring at 30.0 feet	10	
31.0						
32.0						
33.0						
34.0						
35.0						

COMMENTS

REMARKS

WATER LEVEL MEASUREMENTS

	DEPTH	DATE
INITIAL	NONE	5/10/2022
AT COMPLETION	NONE	5/10/2022
OTHER		

SS — SPLIT SPOON
SL — SPLIT SPOON W/SOIL LINER
NQ— ROCK CORE
ST — SHELBY TUBE
AS — AUGER CUTTINGS
SC— SONIC

BOWSER MORNER

GINT Report Used: NEWLOGIN Report No.: 205019-XXXX-XXXX.GPJ GINT Template Used: NATALIE_EDITS.GDT Date Printed: 8/15/22

CLIENT
VILLAGE OF HAMLER

PROJECT
WASTEWATER TREATMENT LAGOON, HAMLER, HENRY COUNTY, OHIO

JOB NO. **205019**

BORING STARTED **5/10/22** | BORING COMPLETED **5/10/22**

DRILLER **CRR, CR** | METHOD **3 1/4" HSA**

TYPED BY **kko**

B-2 Boring No.

Sheet 1 of 1

PROJECT LOCATION
LAT. LONG.
SURFACE ELEVATION **711.0'**
BORING LOCATION
As shown on Boring Location Plan.
It has been necessary to interpolate between samples. Therefore, the contacts between the various soil strata should not be taken as absolute.

DEPTH	SAMPLE NO.	SAMPLER TYPE / RECOVERY	GRAPHIC LOG	VISUAL CLASSIFICATION OF THE MATERIAL	BLOW COUNTS	N VALUE, blows/ft. (10 20 30 40 50 60 70 80 90)	REMARKS
0.0				(FILL) TOPSOIL			
1.0	SS-1			(FILL) Very stiff brown silt and clay, some sand, trace of gravel, moist	3 4 5	9	
4.0	SS-2				4 4 6	10	
6.0	SS-3			(Becomes brown and gray at 6')	3 4 7	11	
8.0	SS-4			Hard brown and gray silt and clay, some sand, trace of gravel, moist	5 7 9	16	
14.0	SS-5				10 12 16	28	
19.0	SS-6			(Becomes very stiff and gray at 18.5')	6 8 12	20	
24.0	SS-7				5 7 11	18	
29.0	SS-8				6 6 10	16	
30.0				Bottom of boring at 30.0 feet			

WATER LEVEL MEASUREMENTS

	DEPTH	DATE
INITIAL	NONE	5/10/2022
AT COMPLETION	NONE	5/10/2022
OTHER		

SS — SPLIT SPOON
SL — SPLIT SPOON W/SOIL LINER
NQ— ROCK CORE
ST — SHELBY TUBE
AS — AUGER CUTTINGS
SC— SONIC

BOWSER MORNER

GINT Report Used: NEWLOGIN Report No.: 205019-XXXX-XXXX.GPJ GINT Template Used: NATALIE_EDITS.GDT Date Printed: 8/15/22

CLIENT
VILLAGE OF HAMLER

PROJECT
WASTEWATER TREATMENT LAGOON, HAMLER, HENRY COUNTY, OHIO

JOB NO.
205019

BORING STARTED **5/10/22** | BORING COMPLETED **5/10/22**

DRILLER **CRR, CR** | METHOD **3 1/4" HSA**

TYPED BY **kko**

B-3
Boring No.

Sheet 1 of 1

PROJECT LOCATION
LAT. LONG.
SURFACE ELEVATION **711.1'**
BORING LOCATION
As shown on Boring Location Plan.
It has been necessary to interpolate between samples. Therefore, the contacts between the various soil strata should not be taken as absolute.
VISUAL CLASSIFICATION OF THE MATERIAL

DEPTH	SAMPLE NO.	SAMPLER TYPE / RECOVERY	GRAPHIC LOG	VISUAL CLASSIFICATION OF THE MATERIAL	BLOW COUNTS	N VALUE, blows/ft. (10 20 30 40 50 60 70 80 90)	REMARKS
0.0				(FILL) Topsoil			
1.0	SS-1			(FILL) Very stiff brown silt and clay, some sand, trace of gravel, moist	3 4 4	8	
4.0	SS-2			(With trace of brick at 3.5-5')	3 4 6	10	
7.0	SS-3				4 4 7	11	
8.0				Very stiff brown silt and clay, some sand, trace of gravel, moist			
9.0	SS-4				6 6 8	14	
14.0	SS-5			(Becomes hard at 13.5')	10 14 19	33	
19.0	SS-6			(Becomes very stiff and gray at 18.5')	7 9 12	21	
24.0	SS-7				5 7 9	16	
29.0	SS-8				5 9 12	21	
30.0				Bottom of boring at 30.0 feet			

COMMENTS

WATER LEVEL MEASUREMENTS

	DEPTH	DATE
INITIAL	NONE	5/10/2022
AT COMPLETION	NONE	5/10/2022
OTHER		

SS — SPLIT SPOON
SL — SPLIT SPOON W/SOIL LINER
NQ— ROCK CORE
ST — SHELBY TUBE
AS — AUGER CUTTINGS
SC— SONIC

BOWSER MORNER

GINT Report Used: NEWLOGIN Report No.: 205019-XXXX-XXXX.GPJ GINT Template Used: NATALIE_EDITS.GDT Date Printed: 8/15/22

CLIENT
VILLAGE OF HAMLER

PROJECT
WASTEWATER TREATMENT LAGOON, HAMLER, HENRY COUNTY, OHIO

JOB NO. **205019**

BORING STARTED **5/10/22** | BORING COMPLETED **5/10/22**

DRILLER **CRR, CR** | METHOD **3 1/4" HSA**

TYPED BY **kko**

B-4 Boring No.

Sheet 1 of 1

PROJECT LOCATION
LAT. LONG.
SURFACE ELEVATION **710.4'**
BORING LOCATION
As shown on Boring Location Plan.
It has been necessary to interpolate between samples. Therefore, the contacts between the various soil strata should not be taken as absolute.
VISUAL CLASSIFICATION OF THE MATERIAL

DEPTH	SAMPLE NO.	SAMPLER TYPE / RECOVERY	GRAPHIC LOG	VISUAL CLASSIFICATION OF THE MATERIAL	BLOW COUNTS	N VALUE, blows/ft. (10 20 30 40 50 60 70 80 90)	REMARKS
1.0				(FILL) Topsoil			
2.0	SS-1			(FILL) Very stiff brown and gray silt and clay, some sand, trace of gravel, moist	4 3 4	7	
4.0	SS-2				4 3 5	8	
6.0	SS-3				2 3 5	8	
8.0				Very stiff brown and gray silt and clay, some sand, trace of gravel, moist			
9.0	SS-4				3 4 9	13	
14.0	SS-5			(Becomes hard at 13.5')	9 13 19	32	
19.0	SS-6			(Becomes very stiff and gray at 18.5')	6 8 11	19	
24.0	SS-7				4 6 10	16	
29.0	SS-8				4 7 12	19	
30.0				Bottom of boring at 30.0 feet			

WATER LEVEL MEASUREMENTS

	DEPTH	DATE
INITIAL	NONE	5/10/2022
AT COMPLETION	NONE	5/10/2022
OTHER		

SS — SPLIT SPOON
SL — SPLIT SPOON W/SOIL LINER
NQ— ROCK CORE
ST — SHELBY TUBE
AS — AUGER CUTTINGS
SC— SONIC

BOWSER MORNER

GINT Report Used: NEWLOGIN Report No.: 205019-XXXX-XXXX.GPJ GINT Template Used: NATALIE_EDITS.GDT Date Printed: 8/15/22

CLIENT
VILLAGE OF HAMLER

PROJECT
WASTEWATER TREATMENT LAGOON, HAMLER, HENRY COUNTY, OHIO

JOB NO. **205019**

BORING STARTED **5/10/22** | BORING COMPLETED **5/10/22**

DRILLER **CRR, CR** | METHOD **3 1/4" HSA**

TYPED BY **kko**

B-5 Boring No.

Sheet 1 of 1

PROJECT LOCATION
LAT. LONG.
SURFACE ELEVATION **704.3'**
BORING LOCATION
As shown on Boring Location Plan.
It has been necessary to interpolate between samples. Therefore, the contacts between the various soil strata should not be taken as absolute.

DEPTH	SAMPLE NO.	SAMPLER TYPE / RECOVERY	VISUAL CLASSIFICATION OF THE MATERIAL	BLOW COUNTS	N VALUE, blows/ft. (10 20 30 40 50 60 70 80 90)	REMARKS
0.0			(FILL) Topsoil			
1.0	SS-1		(FILL) Very stiff brown silt and clay, some sand, trace of gravel, moist	4 4 4	8	
4.0	SS-2		Very stiff brown and gray silt and clay, some sand, trace of gravel, moist	4 5 5	10	
6.0			(Becomes hard at 6')			
7.0	SS-3			10 15 20	35	
9.0	SS-4			3 11 20	31	
14.0	SS-5		(Becomes gray at 14')	10 11 11	22	
19.0	SS-6		(Becomes very stiff at 18.5')	6 8 11	19	
24.0	SS-7			6 11 13	24	
29.0	SS-8			8 12	24	
30.0			Bottom of boring at 30.0 feet	12		

COMMENTS

WATER LEVEL MEASUREMENTS

	DEPTH	DATE
INITIAL	NONE	5/10/2022
AT COMPLETION	NONE	5/10/2022
OTHER		

SS — SPLIT SPOON
SL — SPLIT SPOON W/SOIL LINER
NQ— ROCK CORE
ST — SHELBY TUBE
AS — AUGER CUTTINGS
SC— SONIC

BOWSER MORNER

GINT Report Used: NEWLOGIN Report No.: 205019-XXXX-XXXX.GPJ GINT Template Used: NATALIE_EDITS.GDT Date Printed: 8/15/22

CLIENT
VILLAGE OF HAMLER

PROJECT
WASTEWATER TREATMENT LAGOON, HAMLER, HENRY COUNTY, OHIO

JOB NO.
205019

BORING STARTED **5/10/22**	BORING COMPLETED **5/10/22**
DRILLER **CRR, CR**	METHOD **3 1/4" HSA**
TYPED BY **kko**	

B-6
Boring No.

Sheet 1 of 1

PROJECT LOCATION
LAT. LONG.
SURFACE ELEVATION **704.3'**
BORING LOCATION
As shown on Boring Location Plan.
It has been necessary to interpolate between samples. Therefore, the contacts between the various soil strata should not be taken as absolute.

VISUAL CLASSIFICATION OF THE MATERIAL

COMMENTS

N VALUE, blows/ft.
10 20 30 40 50 60 70 80 90

DEPTH	SAMPLE NO.	BLOW COUNTS	N VALUE	VISUAL CLASSIFICATION OF THE MATERIAL
0.0				Topsoil
1.0	SS-1	4 5 6	11	Very stiff brown and gray silt and clay, some sand, trace of gravel, moist
4.0	SS-2	6 7 8	15	(Becomes hard at 3.5')
7.0	SS-3	5 8 14	22	
9.0	SS-4	10 14 18	32	
14.0	SS-5	7 8 12	20	(Becomes very stiff and gray at 13.5')
19.0	SS-6	6 7 9	16	
24.0	SS-7	6 7 12	19	
29.0	SS-8	7 8 14	22	
30.0				Bottom of boring at 30.0 feet

REMARKS

WATER LEVEL MEASUREMENTS

	DEPTH	DATE
INITIAL	NONE	5/10/2022
AT COMPLETION	NONE	5/10/2022
OTHER		

SS — SPLIT SPOON
SL — SPLIT SPOON W/SOIL LINER
NQ— ROCK CORE
ST — SHELBY TUBE
AS — AUGER CUTTINGS
SC— SONIC

BOWSER MORNER

GINT Report Used: NEWLOGIN Report No.: 205019-XXXX-XXXX.GPJ GINT Template Used: NATALIE_EDITS.GDT Date Printed: 8/15/22

CLIENT
VILLAGE OF HAMLER

PROJECT
WASTEWATER TREATMENT LAGOON, HAMLER, HENRY COUNTY, OHIO

JOB NO.
205019

BORING STARTED **5/11/22**	BORING COMPLETED **5/11/22**
DRILLER **CRR, CR**	METHOD **3 1/4" HSA**
TYPED BY **kko**	

B-7
Boring No.
Sheet 1 of 1

PROJECT LOCATION
LAT. LONG.
SURFACE ELEVATION **704.3'**
BORING LOCATION
As shown on Boring Location Plan.
It has been necessary to interpolate between samples. Therefore, the contacts between the various soil strata should not be taken as absolute.

VISUAL CLASSIFICATION OF THE MATERIAL

COMMENTS

N VALUE, blows/ft.
10 20 30 40 50 60 70 80 90

DEPTH	SAMPLE NO.	SAMPLER TYPE / RECOVERY	BLOW COUNTS	N VALUE	VISUAL CLASSIFICATION OF THE MATERIAL
1.0					Topsoil
2.0	SS-1		3 4 6	10	Very stiff brown silt and clay, some sand, trace of gravel, moist
3.0					
4.0	ST-1				
5.0					
6.0					(Becomes hard at 6')
7.0	SS-2		6 8 13	21	
8.0					
9.0	SS-3		10 12 14	26	
10.0					
11.0					
12.0					
13.0					
14.0	SS-4		13 12 14	26	
15.0					
16.0					
17.0					
18.0					
19.0	SS-5		5 7 10	17	(Becomes very stiff and gray at 18.5')
20.0					
21.0					
22.0					
23.0					
24.0	SS-6		4 7 11	18	
25.0					
26.0					
27.0					
28.0					
29.0	SS-7		7 8 13	21	
30.0					Bottom of boring at 30.0 feet
31.0					
32.0					
33.0					
34.0					
35.0					

REMARKS

WATER LEVEL MEASUREMENTS

	DEPTH	DATE
INITIAL	NONE	5/11/2022
AT COMPLETION	NONE	5/11/2022
OTHER		

SS — SPLIT SPOON
SL — SPLIT SPOON W/SOIL LINER
NQ— ROCK CORE
ST — SHELBY TUBE
AS — AUGER CUTTINGS
SC— SONIC

BOWSER MORNER

GINT Report Used: NEWLOGIN Report No.: 205019-XXXX-XXXX.GPJ GINT Template Used: NATALIE_EDITS.GDT Date Printed: 8/15/22

CLIENT
VILLAGE OF HAMLER

PROJECT
WASTEWATER TREATMENT LAGOON, HAMLER, HENRY COUNTY, OHIO

JOB NO. **205019**

BORING STARTED **5/10/22** | BORING COMPLETED **5/10/22**

DRILLER **CRR, CR** | METHOD **3 1/4" HSA**

TYPED BY **kko**

B-8 Boring No.

Sheet 1 of 1

PROJECT LOCATION
LAT. LONG.
SURFACE ELEVATION **704.9'**
BORING LOCATION
As shown on Boring Location Plan.
It has been necessary to interpolate between samples. Therefore, the contacts between the various soil strata should not be taken as absolute.

DEPTH	SAMPLE NO.	SAMPLER TYPE / RECOVERY	VISUAL CLASSIFICATION OF THE MATERIAL	BLOW COUNTS	N VALUE, blows/ft.
0.0			Topsoil		
1.0	SS-1		Very stiff brown and gray silt and clay, some sand, trace of gravel, moist	3 4 6	10
4.0	SS-2		(Becomes hard at 3.5')	5 7 7	14
7.0	SS-3			7 10 16	26
9.0	SS-4			9 14 16	30
14.0	SS-5		(Becomes gray at 13.5')	5 6 9	15
19.0	SS-6		(Becomes very stiff at 18.5')	7 7 9	16
24.0	SS-7			5 6 7	13
29.0	SS-8			10 16 20	36
30.0			Bottom of boring at 30.0 feet		

COMMENTS

REMARKS

WATER LEVEL MEASUREMENTS

	DEPTH	DATE
INITIAL	NONE	5/10/2022
AT COMPLETION	NONE	5/10/2022
OTHER		

SS — SPLIT SPOON
SL — SPLIT SPOON W/SOIL LINER
NQ— ROCK CORE
ST — SHELBY TUBE
AS — AUGER CUTTINGS
SC— SONIC

BOWSER MORNER

GINT Report Used: NEWLOGIN Report No.: 205019-XXXX-XXXX.GPJ GINT Template Used: NATALIE_EDITS.GDT Date Printed: 8/15/22

CLIENT
VILLAGE OF HAMLER

PROJECT
WASTEWATER TREATMENT LAGOON, HAMLER, HENRY COUNTY, OHIO

JOB NO. **205019**

BORING STARTED **5/12/22** | BORING COMPLETED **5/12/22**

DRILLER **CRR, CR** | METHOD **3 1/4" HSA**

TYPED BY **kko**

B-9
Boring No.

Sheet 1 of 1

PROJECT LOCATION
LAT. LONG.
SURFACE ELEVATION **704.1'**
BORING LOCATION
As shown on Boring Location Plan.
It has been necessary to interpolate between samples. Therefore, the contacts between the various soil strata should not be taken as absolute.

DEPTH	SAMPLE NO.	SAMPLER TYPE / RECOVERY	VISUAL CLASSIFICATION OF THE MATERIAL	BLOW COUNTS	N VALUE, blows/ft. (10 20 30 40 50 60 70 80 90)	REMARKS
0.0			Topsoil			
1.0 – 2.0	SS-1		Very stiff brown silt and clay, some sand, trace of gravel, moist	5 7 5	12	
3.0 – 4.0	ST-1					
5.0 – 6.0			(Becomes hard at 6')			
6.0 – 7.0	SS-2			9 12 14	26	
8.0 – 9.0	SS-3			8 10 16	26	
10.0 – 11.0						
12.0 – 13.0						
13.0 – 14.0	SS-4		(Becomes very stiff and gray at 13.5')	5 7 10	17	
15.0 – 16.0						
17.0 – 18.0						
18.0 – 19.0	SS-5			4 6 11	17	
20.0 – 21.0						
21.0 – 22.0						
22.0 – 23.0						
23.0 – 24.0	SS-6			4 8 10	18	
25.0 – 26.0						
26.0 – 27.0						
27.0 – 28.0						
28.0 – 29.0	SS-7			8 10	22	
30.0			Bottom of boring at 30.0 feet	12		
31.0 – 35.0						

WATER LEVEL MEASUREMENTS

	DEPTH	DATE
INITIAL	NONE	5/12/2022
AT COMPLETION	NONE	5/12/2022
OTHER		

SS — SPLIT SPOON
SL — SPLIT SPOON W/SOIL LINER
NQ— ROCK CORE
ST — SHELBY TUBE
AS — AUGER CUTTINGS
SC— SONIC

BOWSER MORNER

GINT Report Used: NEWLOGIN Report No.: 205019-XXXX-XXXX.GPJ GINT Template Used: NATALIE_EDITS.GDT Date Printed: 8/15/22

CLIENT
VILLAGE OF HAMLER

PROJECT
WASTEWATER TREATMENT LAGOON, HAMLER, HENRY COUNTY, OHIO

JOB NO.
205019

BORING STARTED **5/11/22**	BORING COMPLETED **5/11/22**
DRILLER **CRR, CR**	METHOD **3 1/4" HSA**
TYPED BY **kko**	

B-10
Boring No.

Sheet 1 of 1

PROJECT LOCATION
LAT. LONG.
SURFACE ELEVATION **704.1'**
BORING LOCATION
As shown on Boring Location Plan.
It has been necessary to interpolate between samples. Therefore, the contacts between the various soil strata should not be taken as absolute.

DEPTH	SAMPLE NO.	SAMPLER TYPE / RECOVERY	VISUAL CLASSIFICATION OF THE MATERIAL	BLOW COUNTS	N VALUE, blows/ft. (10 20 30 40 50 60 70 80 90)	REMARKS
1.0	SS-1		Topsoil Very stiff brown silt and clay, some sand, trace of gravel, moist	3 4 6	10	
4.0	SS-2			4 6 8	14	
6.0	SS-3		(Becomes hard at 6')	5 9 13	22	
9.0	SS-4			10 11 17	28	
14.0	SS-5		(Becomes very stiff and gray at 13.5')	6 9 11	20	
19.0	SS-6			5 7 8	15	
24.0	SS-7			6 6 10	16	
29.0	SS-8			7 7 8	15	
30.0			Bottom of boring at 30.0 feet			

COMMENTS

WATER LEVEL MEASUREMENTS

	DEPTH	DATE
INITIAL	NONE	5/11/2022
AT COMPLETION	NONE	5/11/2022
OTHER		

SS — SPLIT SPOON
SL — SPLIT SPOON W/SOIL LINER
NQ— ROCK CORE
ST — SHELBY TUBE
AS — AUGER CUTTINGS
SC— SONIC

BOWSER MORNER

GINT Report Used: NEWLOGIN Report No.: 205019-XXXX-XXXX.GPJ GINT Template Used: NATALIE_EDITS.GDT Date Printed: 8/15/22

CLIENT
VILLAGE OF HAMLER

PROJECT
WASTEWATER TREATMENT LAGOON, HAMLER, HENRY COUNTY, OHIO

JOB NO.
205019

BORING STARTED **5/10/22** | BORING COMPLETED **5/10/22**

DRILLER **CRR, CR** | METHOD **3 1/4" HSA**

TYPED BY **kko**

B-11
Boring No.

Sheet 1 of 1

PROJECT LOCATION
LAT. LONG.

SURFACE ELEVATION **704.4'**

BORING LOCATION
As shown on Boring Location Plan.

It has been necessary to interpolate between samples. Therefore, the contacts between the various soil strata should not be taken as absolute.

VISUAL CLASSIFICATION OF THE MATERIAL

COMMENTS

N VALUE, blows/ft.
10 20 30 40 50 60 70 80 90

DEPTH	SAMPLE NO.	SAMPLER TYPE / RECOVERY	GRAPHIC LOG	VISUAL CLASSIFICATION OF THE MATERIAL	BLOW COUNTS	N VALUE	REMARKS
0.0				Topsoil			
1.0	SS-1			Very stiff brown silt and clay, some sand, trace of gravel, moist	3 4 4	8	
4.0	SS-2				4 6 8	14	
6.0	SS-3			(Becomes hard at 6')	7 9 14	23	
9.0	SS-4				6 10 14	24	
14.0	SS-5			(Becomes gray at 13.5')	5 7 9	16	
19.0	SS-6			(Becomes very stiff at 18.5')	5 7 10	17	
24.0	SS-7				6 8 10	18	
29.0	SS-8				7 8	20	
30.0				Bottom of boring at 30.0 feet	12		

WATER LEVEL MEASUREMENTS

	DEPTH	DATE
INITIAL	NONE	5/10/2022
AT COMPLETION	NONE	5/10/2022
OTHER		

SS — SPLIT SPOON
SL — SPLIT SPOON W/SOIL LINER
NQ— ROCK CORE
ST — SHELBY TUBE
AS — AUGER CUTTINGS
SC— SONIC

BOWSER MORNER

GINT Report Used: NEWLOGIN Report No.: 205019-XXXX-XXXX.GPJ GINT Template Used: NATALIE_EDITS.GDT Date Printed: 8/15/22

CLIENT
VILLAGE OF HAMLER

PROJECT
WASTEWATER TREATMENT LAGOON, HAMLER, HENRY COUNTY, OHIO

JOB NO.
205019

BORING STARTED **5/12/22**	BORING COMPLETED **5/12/22**
DRILLER **CRR, CR**	METHOD **3 1/4" HSA**
TYPED BY **kko**	

B-12
Boring No.
Sheet 1 of 1

PROJECT LOCATION
LAT. LONG.
SURFACE ELEVATION **703.8'**
BORING LOCATION
As shown on Boring Location Plan.
It has been necessary to interpolate between samples. Therefore, the contacts between the various soil strata should not be taken as absolute.

VISUAL CLASSIFICATION OF THE MATERIAL

DEPTH	SAMPLE NO.	BLOW COUNTS	N VALUE, blows/ft.	REMARKS
0.0				Topsoil
1.0	SS-1	3 3 4	7	Very stiff brown silt and clay, some sand, trace of gravel, moist
4.0	ST-1			
7.0	SS-2	6 8 16	24	
9.0	SS-3	10 12 16	28	(Becomes hard at 8.5')
14.0	SS-4	7 7 10	17	(Becomes very stiff and gray at 13.5')
19.0	SS-5	6 7 9	16	
24.0	SS-6	7 9 12	21	
29.0	SS-7	5 12 14	26	
30.0				Bottom of boring at 30.0 feet

COMMENTS

WATER LEVEL MEASUREMENTS

	DEPTH	DATE
INITIAL	NONE	5/12/2022
AT COMPLETION	NONE	5/12/2022
OTHER		

SS — SPLIT SPOON
SL — SPLIT SPOON W/SOIL LINER
NQ— ROCK CORE
ST — SHELBY TUBE
AS — AUGER CUTTINGS
SC— SONIC

BOWSER MORNER

GINT Report Used: NEWLOGIN Report No.: 205019-XXXX-XXXX.GPJ GINT Template Used: NATALIE_EDITS.GDT Date Printed: 8/15/22

CLIENT
VILLAGE OF HAMLER

PROJECT
WASTEWATER TREATMENT LAGOON, HAMLER, HENRY COUNTY, OHIO

JOB NO. **205019**

BORING STARTED **5/11/22** | BORING COMPLETED **5/11/22**

DRILLER **CRR, CR** | METHOD **3 1/4" HSA**

TYPED BY **kko**

B-13
Boring No.

Sheet 1 of 1

PROJECT LOCATION
LAT. LONG.
SURFACE ELEVATION **703.4'**
BORING LOCATION
As shown on Boring Location Plan.
It has been necessary to interpolate between samples. Therefore, the contacts between the various soil strata should not be taken as absolute.
VISUAL CLASSIFICATION OF THE MATERIAL

DEPTH	SAMPLE NO.	SAMPLER TYPE / RECOVERY	GRAPHIC LOG	VISUAL CLASSIFICATION OF THE MATERIAL	BLOW COUNTS	N VALUE, blows/ft. (10 20 30 40 50 60 70 80 90)	REMARKS
0.0				Topsoil			
1.0	SS-1			Very stiff brown silt and clay, some sand, trace of gravel, moist	3 4 5	9	
4.0	SS-2				3 4 5	9	
6.0	SS-3			(Becomes hard at 6')	5 8 14	22	
9.0	SS-4				9 12 17	29	
14.0	SS-5			(Becomes very stiff and gray at 13.5')	6 6 8	14	
19.0	SS-6				6 7 8	15	
24.0	SS-7				5 6 7	13	
29.0	SS-8				6 6 8	14	
30.0				Bottom of boring at 30.0 feet			
35.0							

COMMENTS

WATER LEVEL MEASUREMENTS

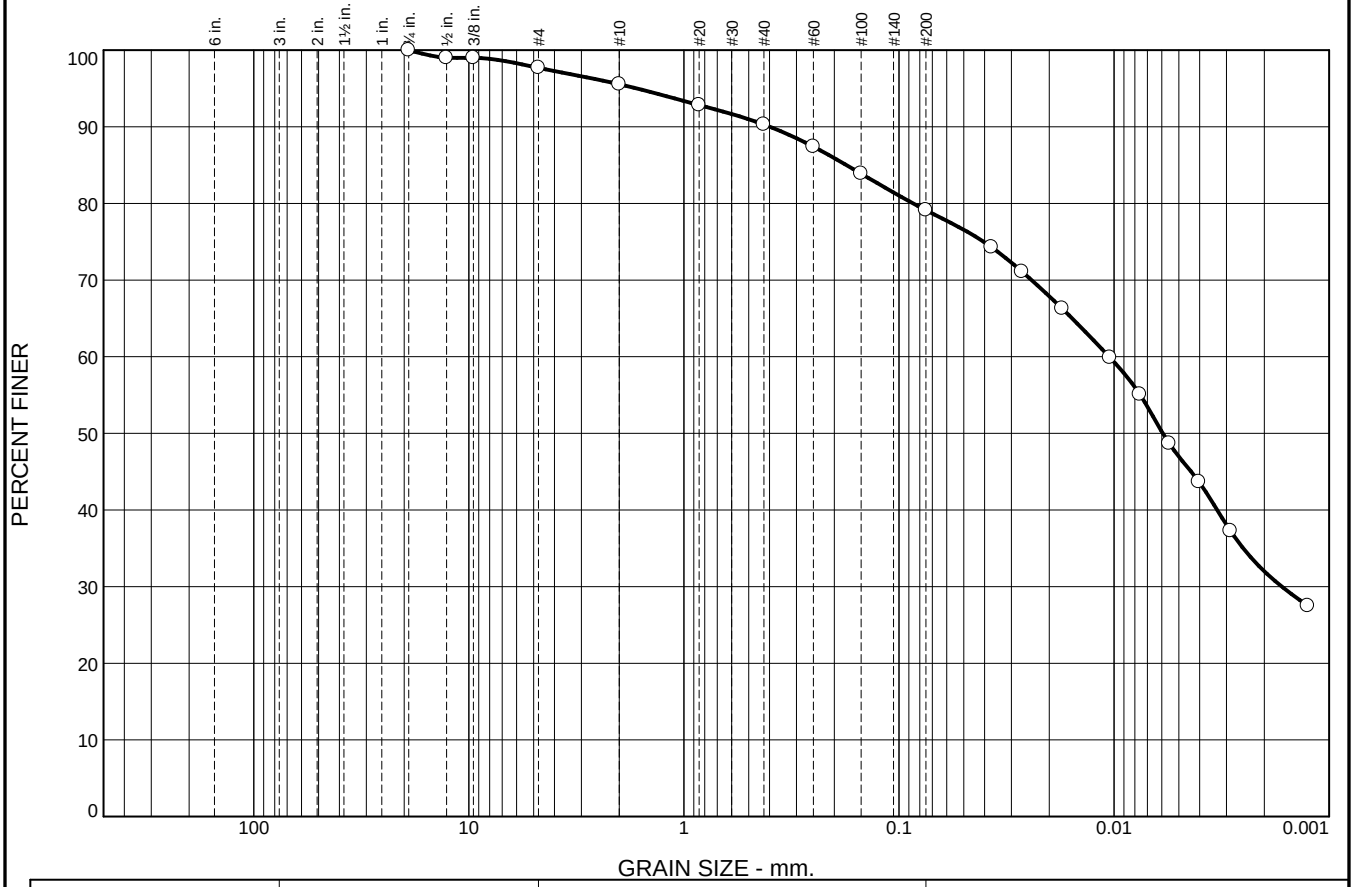
	DEPTH	DATE
INITIAL	NONE	5/11/2022
AT COMPLETION	NONE	5/11/2022
OTHER		

SS — SPLIT SPOON
SL — SPLIT SPOON W/SOIL LINER
NQ— ROCK CORE
ST — SHELBY TUBE
AS — AUGER CUTTINGS
SC— SONIC

BOWSER MORNER

GINT Report Used: NEWLOGIN Report No.: 205019-XXXX-XXXX.GPJ GINT Template Used: NATALIE_EDITS.GDT Date Printed: 8/15/22

GRAIN SIZE DISTRIBUTION REPORT



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	2.3	2.1	5.3	11.2	47.1	32.0

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_C	C_u
○	37	18	0.1755	0.0105	0.0059	0.0017				

Material Description	USCS	AASHTO
○ tan/gray lean CLAY with sand	CL	A-6(14)

Project No. 205019 **Client:** Village of Hamler

Project: Wastewater Treatment Lagoons

○ **Location:** Shelby Tube Sample B-6 **Sample Number:** B-6

BOWSER-MORNER, INC.

Dayton, Ohio

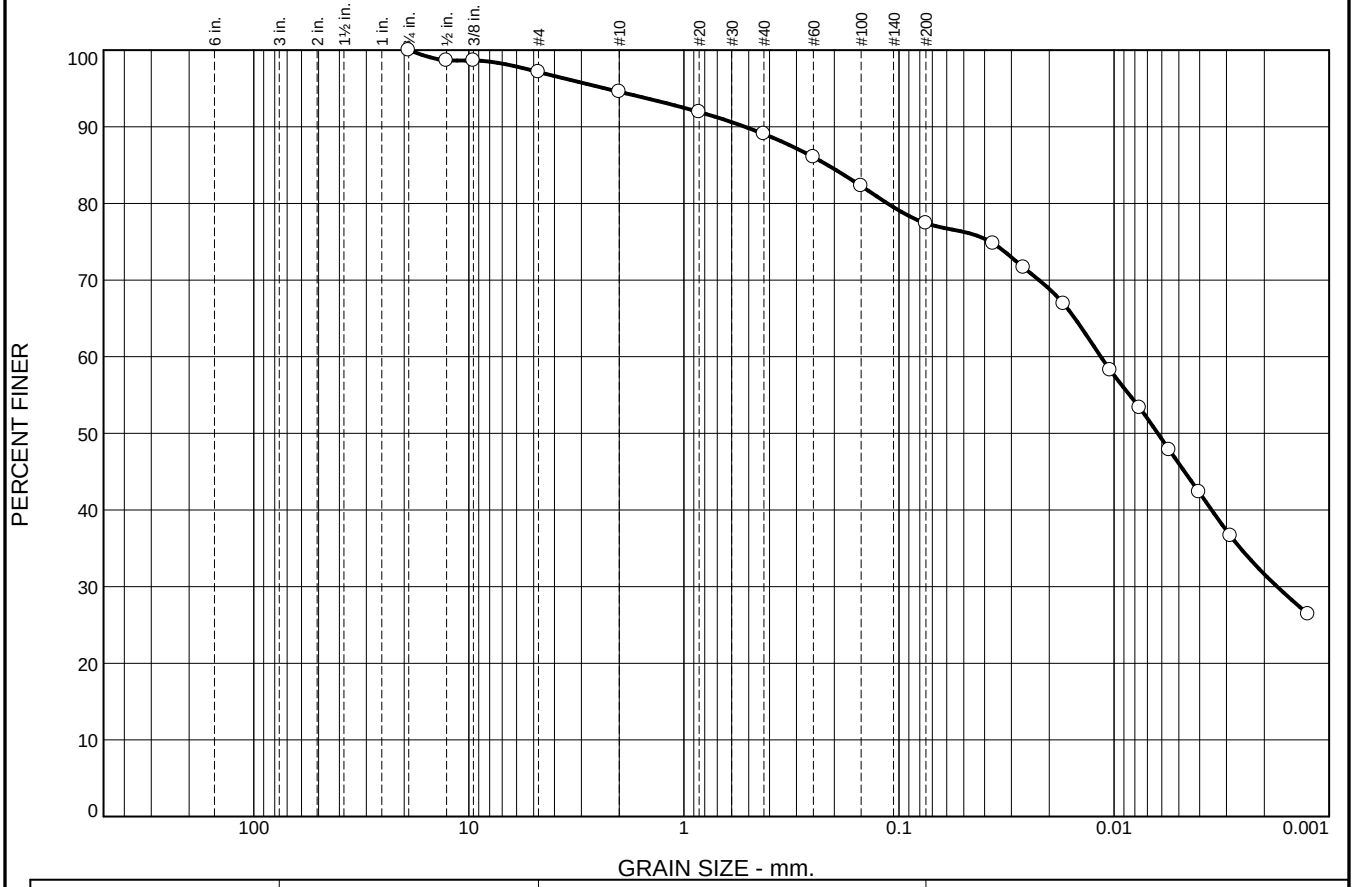
Remarks:

○As Received

Moisture Content: 14.4%

Tested By: HMR/AT **Checked By:** BLC

GRAIN SIZE DISTRIBUTION REPORT



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	2.8	2.6	5.5	11.7	45.8	31.6

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_C	C_u
○	31	18	0.2146	0.0115	0.0063	0.0017				

Material Description	USCS	AASHTO
○ gray lean CLAY with sand	CL	A-6(8)

Project No. 205019 **Client:** Village of Hamler

Project: Wastewater Treatment Lagoons

○ **Location:** Shelby Tube Sample B-12 **Sample Number:** B-12

BOWSER-MORNER, INC.

Dayton, Ohio

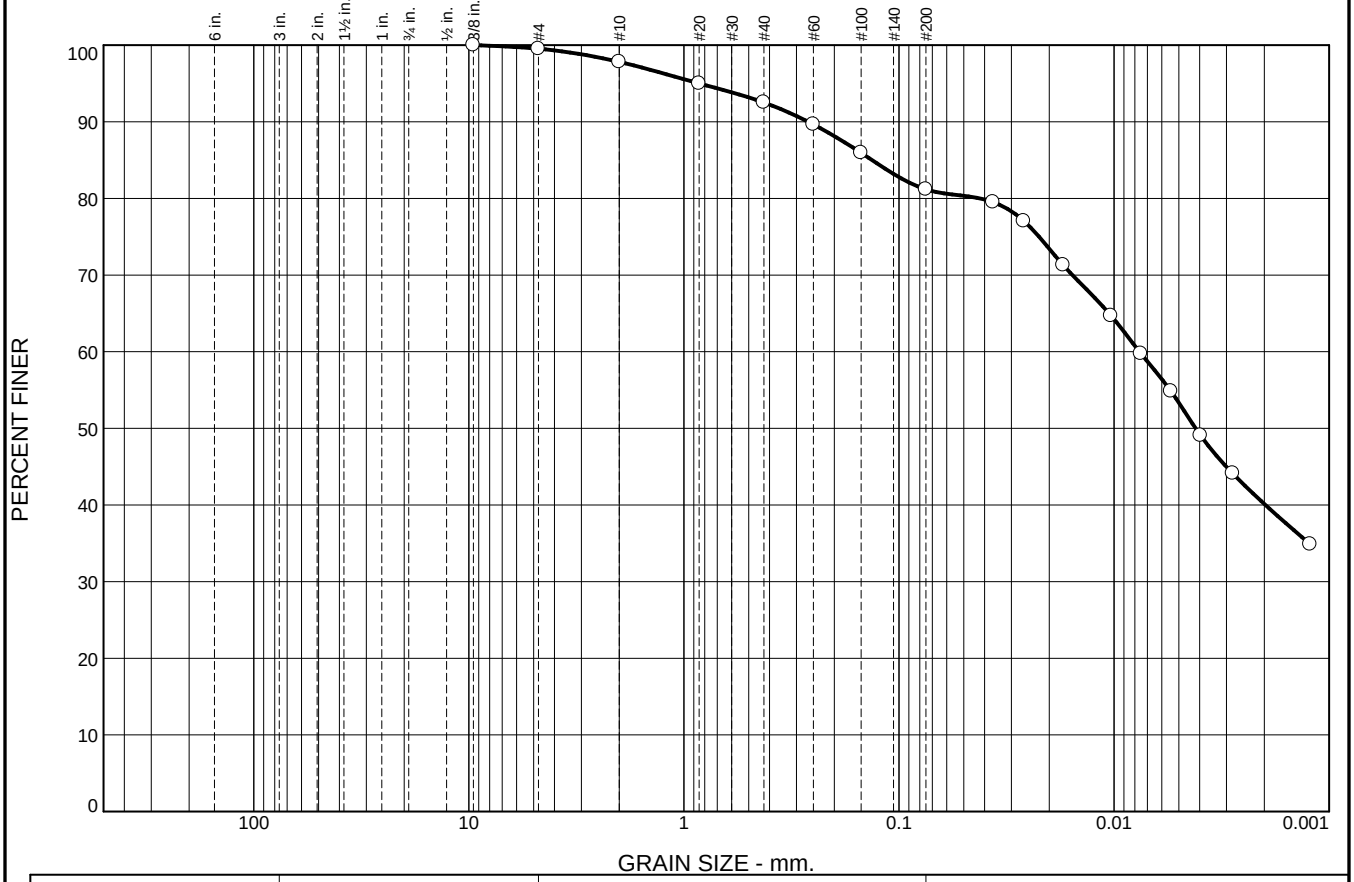
Remarks:

○As Received

Moisture Content: 5.4%

Tested By: HMR/AT **Checked By:** BLC

GRAIN SIZE DISTRIBUTION REPORT



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.5	1.7	5.3	11.3	41.1	40.1

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_C	C_u
○	34	17	0.1334	0.0076	0.0042					

Material Description	USCS	AASHTO
○ brown lean CLAY with sand	CL	A-6(12)

Project No. 205019 **Client:** Village of Hamler

Project: Wastewater Treatment Lagoons

○ **Location:** Bulk Sample B-10 **Sample Number:** B-10

BOWSER-MORNER, INC.

Dayton, Ohio

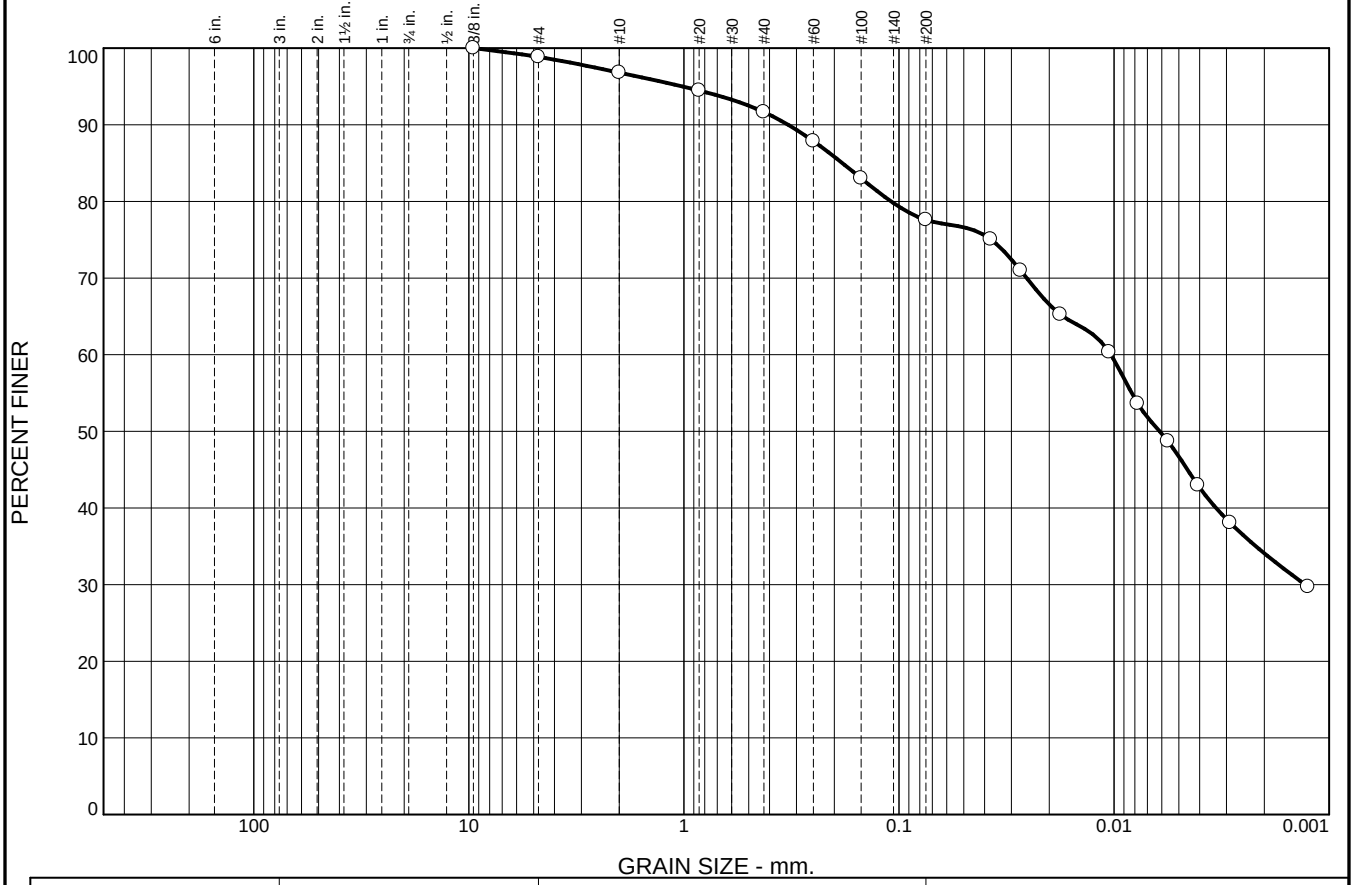
Remarks:

○As Received

Moisture Content: 15.7%

Tested By: HMR/AT **Checked By:** BLC

GRAIN SIZE DISTRIBUTION REPORT



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	1.1	2.1	5.1	14.1	43.5	34.1

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_C	C_u
○	39	20	0.1835	0.0103	0.0061	0.0013				

Material Description	USCS	AASHTO
○ brown lean CLAY with sand	CL	A-6(14)

Project No. 205019 **Client:** Village of Hamler

Project: Wastewater Treatment Lagoons

○ **Location:** Bulk Sample B-6 **Depth:** 5.0' - 10.0' **Sample Number:** B-6

Remarks:

○As Received

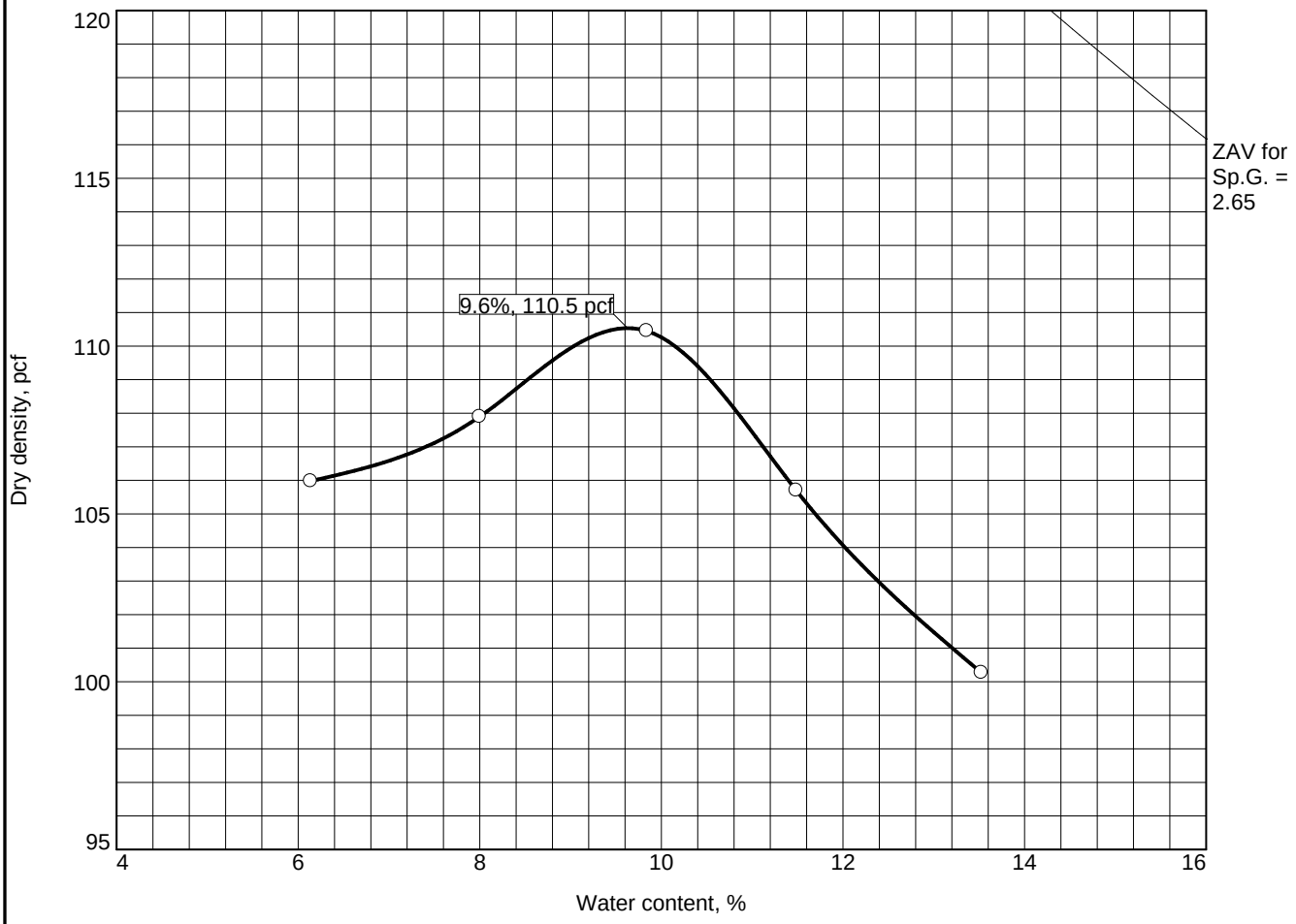
Moisture Content: 18.4%

BOWSER-MORNER, INC.

Dayton, Ohio

Tested By: HMR/AT **Checked By:** BLC

Moisture Density Report



Test specification: ASTM D 698-Method B Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/8 in.	% < No.200
	USCS	AASHTO						
	CL	A-6(12)			34	17	0.0	81.2

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 110.5 pcf Optimum moisture = 9.6 %	brown lean CLAY with sand

Project No. 205019 **Client:** Village of Hamler

Project: Wastewater Treatment Lagoons

○ **Location:** Bulk Sample B-10 **Sample Number:** B-10

BOWSER-MORNER, INC.

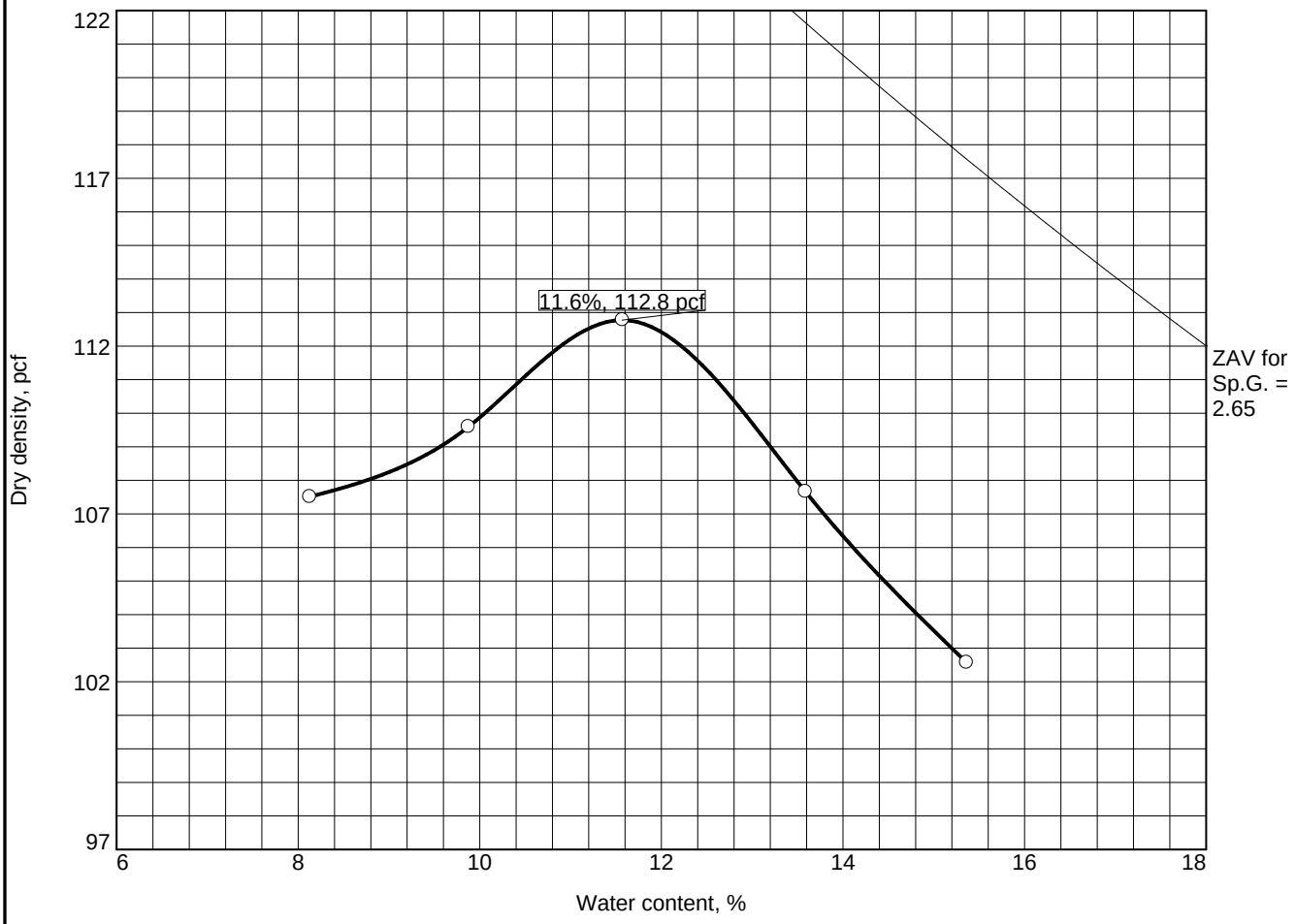
Dayton, Ohio

Remarks:

Date Received: 6/6/22

Curve No.: 2206-10002

Moisture Density Report



Test specification: ASTM D 698-Method B Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/8 in.	% < No.200
	USCS	AASHTO						
5.0' - 10.0'	CL	A-6(14)			39	19	0.0	77.6

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 112.8 pcf Optimum moisture = 11.6 %	brown lean CLAY with sand

Project No. 205019 **Client:** Village of Hamler

Project: Wastewater Treatment Lagoons

○ **Location:** Bulk Sample B-6 **Depth:** 5.0' - 10.0' **Sample Number:** B-6

BOWSER-MORNER, INC.

Dayton, Ohio

Remarks:

Date Received: 6/6/22

Curve No.: 2206-10001

MOISTURE CONTENT SUMMARY SHEET

Job No. 205219

Boring No.	Sample No.	Depth (Feet)	Moisture (%)
1	SS-1	1.0-2.5	21.5
	SS-2	3.5-5.0	20.9
	SS-3	6.0-7.5	22.7
	SS-4	8.5-10.0	20.2
	SS-5	13.5-15.0	15.7
	SS-6	18.5-20.0	16.4
	SS-7	23.5-25.0	15.6
	SS-8	28.5-30.0	17.7
2	SS-1	1.0-2.5	22.0
	SS-2	3.5-5.0	18.0
	SS-3	6.0-7.5	23.0
	SS-4	8.5-10.0	16.4
	SS-5	13.5-15.0	14.3
	SS-6	18.5-20.0	15.4
	SS-7	23.5-25.0	16.0
	SS-8	28.5-30.0	16.7
3	SS-1	1.0-2.5	21.3
	SS-2	3.5-5.0	21.7
	SS-3	6.0-7.5	22.3
	SS-4	8.5-10.0	17.1
	SS-5	13.5-15.0	15.6
	SS-6	18.5-20.0	15.0
	SS-7	23.5-25.0	16.2
	SS-8	28.5-30.0	17.4

BOWSER MORNER

MOISTURE CONTENT SUMMARY SHEET

Job No. 205219

Boring No.	Sample No.	Depth (Feet)	Moisture (%)
4	SS-1	1.0-2.5	19.3
	SS-2	3.5-5.0	20.7
	SS-3	6.0-7.5	23.7
	SS-4	8.5-10.0	19.8
	SS-5	13.5-15.0	13.0
	SS-6	18.5-20.0	13.9
	SS-7	23.5-25.0	15.3
	SS-8	28.5-30.0	16.3
5	SS-1	1.0-2.5	22.0
	SS-2	3.5-5.0	18.6
	SS-3	6.0-7.5	13.9
	SS-4	8.5-10.0	13.9
	SS-5	13.5-15.0	14.5
	SS-6	18.5-20.0	17.0
	SS-7	23.5-25.0	16.7
	SS-8	28.5-30.0	15.3
6	SS-1	1.0-2.5	16.6
	SS-2	3.5-5.0	16.3
	SS-3	6.0-7.5	15.2
	SS-4	8.5-10.0	14.9
	SS-5	13.5-15.0	14.8
	SS-6	18.5-20.0	15.4
	SS-7	23.5-25.0	16.2
	SS-8	28.5-30.0	16.3

BOWSER MORNER

MOISTURE CONTENT SUMMARY SHEET

Job No. 205219

Boring No.	Sample No.	Depth (Feet)	Moisture (%)
7	SS-1	1.0-2.5	22.8
	SS-2	3.5-5.0	*
	SS-3	6.0-7.5	15.7
	SS-4	8.5-10.0	15.3
	SS-5	13.5-15.0	8.3
	SS-6	18.5-20.0	16.3
	SS-7	23.5-25.0	17.0
	SS-8	28.5-30.0	14.6
8	SS-1	1.0-2.5	18.2
	SS-2	3.5-5.0	14.7
	SS-3	6.0-7.5	12.4
	SS-4	8.5-10.0	14.0
	SS-5	13.5-15.0	14.3
	SS-6	18.5-20.0	14.8
	SS-7	23.5-25.0	18.0
	SS-8	28.5-30.0	11.9
9	SS-1	1.0-2.5	20.8
	SS-2	3.5-5.0	*
	SS-3	6.0-7.5	14.3
	SS-4	8.5-10.0	15.4
	SS-5	13.5-15.0	14.5
	SS-6	18.5-20.0	16.2
	SS-7	23.5-25.0	16.2
* No Recovery	SS-8	28.5-30.0	16.2

BOWSER MORNER

MOISTURE CONTENT SUMMARY SHEET

Job No. 205219

Boring No.	Sample No.	Depth (Feet)	Moisture (%)
10	SS-1	1.0-2.5	17.0
	SS-2	3.5-5.0	17.1
	SS-3	6.0-7.5	14.7
	SS-4	8.5-10.0	15.3
	SS-5	13.5-15.0	16.0
	SS-6	18.5-20.0	16.7
	SS-7	23.5-25.0	16.5
	SS-8	28.5-30.0	17.3
11	SS-1	1.0-2.5	21.2
	SS-2	3.5-5.0	15.7
	SS-3	6.0-7.5	15.8
	SS-4	8.5-10.0	15.3
	SS-5	13.5-15.0	15.3
	SS-6	18.5-20.0	15.9
	SS-7	23.5-25.0	19.4
	SS-8	28.5-30.0	13.9
12	SS-1	1.0-2.5	21.5
	SS-2	3.5-5.0	*
	SS-3	6.0-7.5	15.3
	SS-4	8.5-10.0	15.6
	SS-5	13.5-15.0	15.3
	SS-6	18.5-20.0	15.2
	SS-7	23.5-25.0	16.8
* No Recovery	SS-8	28.5-30.0	17.1

BOWSER MORNER

MOISTURE CONTENT SUMMARY SHEET

Job No. 205219

Boring No.	Sample No.	Depth (Feet)	Moisture (%)
13	SS-1	1.0-2.5	20.5
	SS-2	3.5-5.0	22.1
	SS-3	6.0-7.5	16.0
	SS-4	8.5-10.0	15.4
	SS-5	13.5-15.0	15.6
	SS-6	18.5-20.0	16.9
	SS-7	23.5-25.0	17.1
	SS-8	28.5-30.0	18.2

BOWSER MORNER

MODEL CLEARING AND GRADING SPECIFICATIONS

I. GENERAL CONDITIONS

The contractor shall furnish supervision, labor, materials, and equipment, and shall perform all work and services necessary to complete in a satisfactory manner the site preparation, excavation, filling, compaction, and grading, as shown on the approved and issued for construction plans; as described therein.

This work shall consist of all clearing and grading, removal of existing structures unless otherwise stated, proper and approved disposal of materials not reused for the project, preparation of the land to be filled, filling of the land, spreading and compaction of the fill, and all subsidiary work necessary to complete the grading of the cut and fill areas to conform with the lines, grades, slopes, and specifications.

This work is to be accomplished under the constant and continuous observation of Bowser-Morner, Inc. Bowser-Morner's presence on-site, and the fact that they may conduct observations and tests for the benefit of the Owner, in no way releases or reduces the Contractor's obligation to perform the work in strict accordance with the plans and specifications.

In these specifications the terms "approved" and "as directed" shall refer to directions to the Contractor from the Owner or the designated representative.

II. SUBSURFACE CONDITIONS

Prior to bidding the work, the Contractor shall examine, investigate, and inspect the construction site as to the nature and location of the work and the general and local conditions at the construction site, including, without limitation, the character of surface or subsurface conditions and obstacles to be encountered on and around the construction site; and shall make such additional investigation necessary for the planning and proper execution of the work. Borings and/or soil investigations have been made for the purpose of the design of this project. Results of these borings and studies will be made available by the Owner to the Contractor upon request, but the Owner and Bowser-Morner, Inc. are not responsible for any interpretations or conclusions with respect thereto made by the Contractor on the basis of such information, and the Owner further has no responsibility for the accuracy of the borings and the soil investigations.

If conditions different than those indicated in the bid documents are discovered by the Contractor, the Owner should be notified immediately. The material which the Contractor believes to be a changed condition should not be disturbed, so that the Owner can investigate the condition.

III. SITE PREPARATION

Within the specified areas, all trees, brush, stumps, logs, tree root balls, roots larger than one-inch in diameter, and structures scheduled for demolition shall be removed and disposed of according to requirements of applicable governing agencies. Demolition shall consist of the removal and proper disposal of all building materials, slabs, foundations, refuse, and unsuitable backfill materials.

All cut and fill areas shall be properly stripped. Topsoil will be removed to its full depth and stockpiled for use in finish grading. Any rubbish, organic and other objectionable soils, and other deleterious material shall be disposed of off the site, or as directed by the Owner or his designated representative if on site disposal is provided. In no case shall such objectionable material be allowed in or under the fill unless specifically authorized in writing.

Objectionable material is defined as those materials which cannot be altered or utilized according to project specifications. In no circumstances can an organic material be utilized.

Prior to the addition of fill, the original ground shall be proof-rolled to job specifications as outlined below. Special notice shall be given to the proposed fill area at this time. If wet spots, spongy conditions, or ground water seepage is found, corrective measures must be taken before the placement of fill.

IV. FORMATION OF FILL AREAS

Fills shall be formed of satisfactory materials placed in successive horizontal layers of not more than eight (8) inches in loose depth for the full width of the cross section. The depth of lift may be increased if the Contractor can consistently demonstrate the ability to satisfactorily compact a thicker lift throughout the entire lift. If compaction is accomplished using hand-tamping equipment, lifts should be limited to 4-inch loose lifts.

All material entering the fill shall be free of organic matter such as leaves, grass, roots, and other objectionable material.

Frozen material shall not be placed in the fill nor shall the fill be placed upon frozen material. The operations on earthwork shall be suspended at any time when satisfactory results cannot be obtained because of rain, freezing weather, or other unsatisfactory conditions. The Contractor shall keep the work areas graded to provide drainage at all times.

The fill material shall be of the specified moisture content range before compaction efforts are started. Wetting or drying of the material and manipulation to secure uniform moisture content throughout the layer shall be required. Should the material

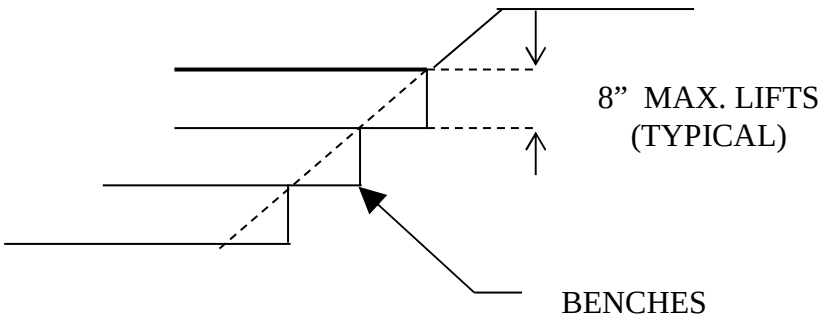
be too wet to permit proper compaction or rolling, all work on all portions of the embankment thus affected shall be delayed until the material has dried to the required moisture content. The moisture content of the fill material should be no more than two (2) percentage points higher or lower than optimum when using clay or silt material, nor three (3) when using granular material unless otherwise authorized. Sprinkling shall be done with equipment that will satisfactorily distribute the water over the disced area.

Compaction operations shall be continued until the fill is compacted to not less than (*refer to recommendations found in report text*) percent above foundation elevation and (*refer to recommendations found in report text*) percent below foundation elevation of the maximum density, as determined in accordance with the most current version of ASTM (*refer to report text*) Proctor. Any areas inaccessible to a roller shall be consolidated and compacted by mechanical tampers. The equipment shall be operated in such a manner that hardpan, cemented gravel, clay, or other chunky soil material will be broken up into small particles and become incorporated with the other material in the layer.

In the construction of filled areas, starting layers shall be placed in the deepest portion of the fill and, as placement progresses, additional layers shall be constructed in horizontal planes as illustrated in Figure IV-1. If directed, original slopes shall be continuously vertically benched to provide horizontal fill planes. The size of the benches shall be formed so that the base of the bench is horizontal and the back of the bench is vertical. As many benches as are necessary to bring the site to final grade shall be constructed. Filling operations shall begin on the lowest bench, with the fill being placed in horizontal eight (8) inch loose lifts unless otherwise authorized. The filling shall progress in this manner until the entire first bench has been filled, before any fill is placed on the succeeding benches. Proper drainage shall be maintained at all times during benching and filling of the benches, to insure that all water is drained away from the fill area.

FIGURE IV-1

TYPICAL LIFT PLACEMENT



When rock and other embankment materials are excavated at approximately the same time, the rock shall be incorporated into the outer portion of the areas. Stones or fragmentary rock larger than four (4) inches in their greatest dimensions will not be allowed in the fill unless specifically authorized in writing. Rock fill shall be brought up in layers as specified or as directed, and every effort shall be exerted to fill the voids with the finer material to form a dense, compact mass. Rock or boulders shall be disposed of as deleterious material per Item III.

The Contractor shall be responsible for the stability of all fills made under the contract, and shall replace any portion which, in the opinion of the Owner or his designated representative, has become displaced due to carelessness or negligence on the part of the Contractor. The Contractor shall meet all OSHA requirements for working in trenches and excavated areas. Fill damaged by inclement weather shall be repaired at the Contractor's expense.

V. SLOPE RATIO AND SURFACE WATER RUN-OFF

Temporary construction slopes less than 20 feet deep should not be steeper than 2 (horizontal) to 1 (vertical) in either cut or fill, and surface water shall not be drained over the slopes.

VI. GRADING

The Contractor shall furnish, operate, and maintain such equipment as is necessary to construct uniform layers and control smoothness of grade for maximum compaction and drainage. It is recommended that finish grades and intermediate grades subject to inclement weather condition be rolled with a smooth-drum roller to seal the compacted surface. Smooth surfaces should be "roughed up" by equipment cleats or sheeps-foot rollers prior to placement of the successive loose lift.

VII. COMPACTING

The compaction equipment shall be approved equipment of such design, weight, operational performance, and quantity to obtain the specified density in accordance with these specifications.

VIII. TESTING AND OBSERVATION SERVICES

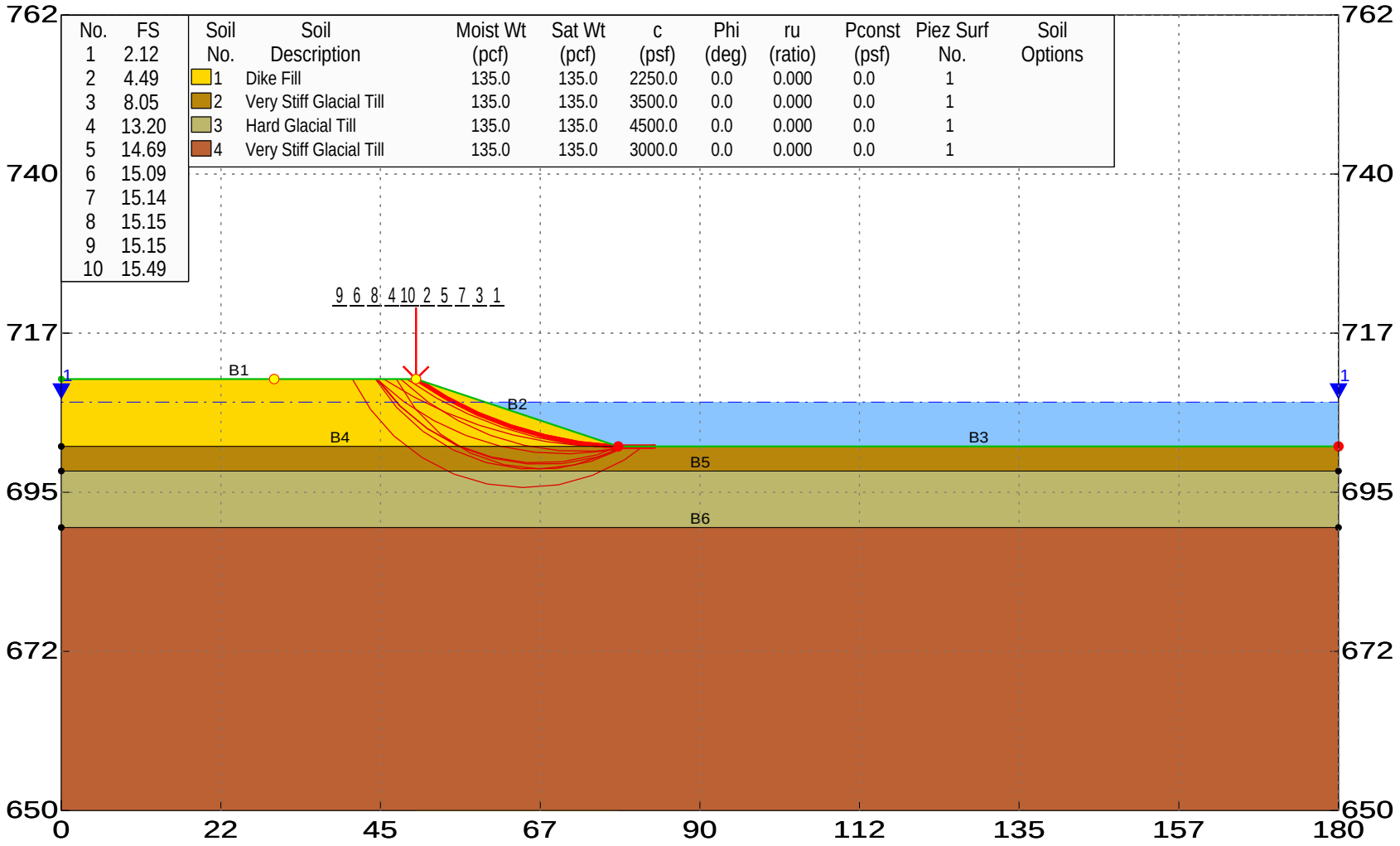
Testing and observation services will be provided by the Owner.

IX. SPECIAL CONDITIONS

205019 Village of Hamler Wastewater Treatment Lagoon
New Dike, Undrained (Short Term) Conditions - Inside Dike Slope 3H:1V

GREGORY GEOTECHNICAL - GHG

\205019 Hamler Slope Stability INSIDE SLOPE Short term.gsd



No.	FS
1	2.12
2	4.49
3	8.05
4	13.20
5	14.69
6	15.09
7	15.14
8	15.15
9	15.15
10	15.49

Soil No.	Soil Description	Moist Wt (pcf)	Sat Wt (pcf)	c (psf)	Phi (deg)	ru (ratio)	Pconst (psf)	Piez Surf No.	Soil Options
1	Dike Fill	135.0	135.0	2250.0	0.0	0.000	0.0	1	
2	Very Stiff Glacial Till	135.0	135.0	3500.0	0.0	0.000	0.0	1	
3	Hard Glacial Till	135.0	135.0	4500.0	0.0	0.000	0.0	1	
4	Very Stiff Glacial Till	135.0	135.0	3000.0	0.0	0.000	0.0	1	

GEOSTASE FS = 2.12

Simplified Bishop Method

GEOSTASE Slope Stability Analysis

*** GEOSTASE(R) ***

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** Current Version 4.30.22-Double Precision, June 2018 **
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SLOPE STABILITY ANALYSIS SOFTWARE
Simplified Bishop, Simplified Janbu, or General Equilibrium (GE) Options.
(Spencer, Morgenstern-Price, USACE, and Lowe & Karafiath)
Including Pier/Pile, Planar Reinf, Nail, Tieback, Line Loads
Applied Forces, Fiber-Reinforced Soil (FRS), Distributed Loads
Nonlinear Undrained Shear Strength, Curved Strength Envelope,
Anisotropic Strengths, Water Surfaces, 3-Stage Rapid Drawdown
2- or 3-Stage Pseudo-Static & Simplified Newmark Seismic Analyses.

****

Analysis Date: 8/ 12/ 2022
Analysis Time:
Analysis By: GREGORY GEOTECHNICAL - GHG

Input File Name: \\TOLEDO-SV1\CurrentYear\Toledo Job Files - 24 & 28\205000\205019 Village of Hamler WWT Lagoon\Slope Stability\205019 Hamler Slope Stability INSIDE SLOPE Short term.gsd

Output File Name: \\TOLEDO-SV1\CurrentYear\Toledo Job Files - 24 & 28\205000\205019 Village of Hamler WWT Lagoon\Slope Stability\205019 Hamler Slope Stability INSIDE SLOPE Short term.OUT

Unit System: English

PROJECT: 205019 Village of Hamler Wastewater Treatment Lagoon

DESCRIPTION: New Dike, Undrained (Short Term) Conditions - Inside Dike Slope 3H:1V

BOUNDARY DATA

3 Surface Boundaries

6 Total Boundaries

Boundary No.	X - 1 (ft)	Y - 1 (ft)	X - 2 (ft)	Y - 2 (ft)	Soil Type Below Bnd
1	0.000	711.000	50.000	711.000	1
2	50.000	711.000	78.500	701.500	1
3	78.500	701.500	180.000	701.500	2
4	0.000	701.500	78.500	701.500	2
5	0.000	698.000	180.000	698.000	3
6	0.000	690.000	180.000	690.000	4

User Specified X-Origin = 0.000(ft)

User Specified Y-Origin = 650.000(ft)

MOHR-COULOMB SOIL PARAMETERS

4 Type(s) of Soil Defined

Soil Number and Description	Moist Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Ratio(ru)	Pressure Water Constant (psf)	Water Surface Option No.
1 Dike Fill	135.0	135.0	2250.00	0.00	0.000	0.0	1 0
2 Very Stiff Glacial T	135.0	135.0	3500.00	0.00	0.000	0.0	1 0
3 Hard Glacial Till	135.0	135.0	4500.00	0.00	0.000	0.0	1 0
4 Very Stiff Glacial T	135.0	135.0	3000.00	0.00	0.000	0.0	1 0

WATER SURFACE DATA

1 Water Surface(s) Defined

Unit Weight of Water = 62.400 (pcf)

Water Surface No. 1 Specified by 2 Coordinate Points
Pore Pressure Inclination Factor = 0.00

Point	X-Water	Y-Water

No.	(ft)	(ft)
1	0.00	707.75
2	180.00	707.75

TRIAL FAILURE SURFACE DATA

Circular Trial Failure Surfaces Have Been Generated Using A Random Procedure.

1000 Trial Surfaces Have Been Generated.

1000 Surfaces Generated at Increments of 0.2402(in) Equally Spaced Within the Start Range

Along The Specified Surface Between X = 30.00(ft)
and X = 50.00(ft)

Each Surface Enters within a Range Between X = 78.50(ft)
and X = 180.00(ft)

Unless XCLUDE Lines Were Specified, The Minimum Elevation
To Which A Surface Extends Is Y = 650.00(ft)

Specified Maximum Radius = 5000.000(ft)

5.000(ft) Line Segments Were Used For Each Trial Failure Surface.

Restrictions Have Been Imposed Upon The Angle Of Initiation.
The Angle Has Been Restricted Between The Angles Of -60.0
And 0.0 deg.

The Simplified Bishop Method Was Selected for FS Analysis.

Total Number of Trial Surfaces Attempted = 1000

Number of Trial Surfaces With Valid FS = 1000

Statistical Data On All Valid FS Values:
FS Max = 469.189 FS Min = 2.119 FS Ave = 42.280
Standard Deviation = 41.350 Coefficient of Variation = 97.80 %

Critical Surface is Sequence Number 1000 of Those Analyzed.

*****BEGINNING OF DETAILED GEOSTASE OUTPUT FOR CRITICAL SURFACE FROM A SEARCH*****

BACK-CALCULATED CIRCULAR SURFACE PARAMETERS:

Circle Center At X = 80.837229(ft) ; Y = 755.691170(ft); and Radius = 54.297655(ft)

Circular Trial Failure Surface Generated With 9 Coordinate Points

Point No.	X-Coord. (ft)	Y-Coord. (ft)
1	50.000	711.000
2	54.242	708.353
3	58.709	706.107
4	63.364	704.282
5	68.167	702.892
6	73.078	701.951
7	78.054	701.465
8	83.054	701.439
9	83.757	701.500

Factor Of Safety For The Critical or Specified Surface = 2.119

Table 1 - Geometry Data on the 12 Slices

Slice No.	Width (ft)	Height (ft)	X-Cntr (ft)	Y-Cntr-Base (ft)	Y-Cntr-Top (ft)	Alpha (deg)	Beta (deg)	Base Length (ft)
1	4.24	0.62	52.12	709.68	710.29	-31.97	-18.43	5.00
2	1.20	1.33	54.84	708.05	709.39	-26.69	-18.43	1.34
3	3.27	1.71	57.08	706.93	708.64	-26.69	-18.43	3.66
4	1.04	2.02	59.23	705.90	707.92	-21.41	-18.43	1.12
5	3.61	2.16	61.56	704.99	707.15	-21.41	-18.43	3.88
6	4.80	2.16	65.77	703.59	705.74	-16.13	-18.43	5.00

7	4.91	1.70	70.62	702.42	704.13	-10.86	-18.43
5.00							
8	4.62	0.81	75.39	701.73	702.54	-5.58	-18.43
4.64							
9	0.36	0.23	77.87	701.48	701.71	-5.58	-18.43
0.36							
10	0.45	0.11	78.28	701.46	701.57	-0.30	-18.43
0.45							
11	4.55	0.05	80.78	701.45	701.50	-0.30	0.00
4.55							
12	0.70	0.03	83.41	701.47	701.50	4.98	0.00
0.71							

Table 2 - Force Data On The 12 Slices (Excluding Reinforcement)

Slice No.	Weight (lbs)	Ubeta Force Top (lbs)	Ualpha Force Bot (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Distributed Load (lbs)
1	353.1	0.0	0.0	0.0	0.0	0.0
2	216.1	0.0	0.0	0.0	0.0	0.0
3	755.8	0.0	187.5	0.0	0.0	0.0
4	283.9	0.0	128.9	0.0	0.0	0.0
5	1052.5	143.2	668.5	0.0	0.0	0.0
6	1399.1	633.5	1298.8	0.0	0.0	0.0
7	1129.8	1170.6	1662.4	0.0	0.0	0.0
8	506.5	1582.8	1743.9	0.0	0.0	0.0
9	11.0	142.8	141.3	0.0	0.0	0.0
10	6.7	181.2	175.0	0.0	0.0	0.0
11	30.3	1776.0	1790.0	0.0	0.0	0.0
12	2.9	274.1	276.5	0.0	0.0	0.0

TOTAL WEIGHT OF SLIDING MASS = 5747.62(lbs)

EFFECTIVE WEIGHT OF SLIDING MASS = 3744.91(lbs)

TOTAL AREA OF SLIDING MASS = 42.57(ft2)

TABLE 2A - SOIL STRENGTH & SOIL OPTIONS DATA ON THE 12 SLICES

Slice No.	Soil Type	Cohesion (psf)	Phi(Deg)	Options
1	1	2250.00	0.00	
2	1	2250.00	0.00	
3	1	2250.00	0.00	
4	1	2250.00	0.00	

5	1	2250.00	0.00
6	1	2250.00	0.00
7	1	2250.00	0.00
8	1	2250.00	0.00
9	2	3500.00	0.00
10	2	3500.00	0.00
11	2	3500.00	0.00
12	2	3500.00	0.00

SOIL OPTIONS: A = ANISOTROPIC, C = CURVED STRENGTH ENVELOPE (TANGENT PHI & C),
F = FIBER-REINFORCED SOIL (FRS), N = NONLINEAR UNDRAINED SHEAR STRENGTH,
R = RAPID DRAWDOWN OR RAPID LOADING (SEISMIC) SHEAR STRENGTH
NOTE: Phi and C in Table 4 are modified values based on specified
Soil Options (if any).

TABLE 3 - Effective and Base Shear Stress Data on the 12 Slices

Slice No. *	Alpha (deg)	X-Coord. Slice Cntr (ft)	Base Leng. (ft)	Effective Normal Stress (psf)	Available Shear Strength (psf)	Mobilized Shear Stress (psf)
1	-31.97	52.12	5.00	83.24	0.00	0.00
2	-26.69	54.84	1.34	180.20	0.00	0.00
3	-26.69	57.08	3.66	180.01	0.00	0.00
4	-21.41	59.23	1.12	157.51	0.00	0.00
5	-21.41	61.56	3.88	156.62	0.00	0.00
6	-16.13	65.77	5.00	156.65	0.00	0.00
7	-10.86	70.62	5.00	123.73	0.00	0.00
8	-5.58	75.39	4.64	58.99	0.00	0.00
9	-5.58	77.87	0.36	16.42	0.00	0.00
10	-0.30	78.28	0.45	8.03	0.00	0.00
11	-0.30	80.78	4.55	3.58	0.00	0.00
12	4.98	83.41	0.71	146.08	3500.00	1651.41

Table 4 - Base Force Data on the 12 Slices

Slice No.	Alpha (deg)	X-Coord. Slice Cntr (ft)	Base Leng. (ft)	Effective Normal Force (lbs)	Available Shear Force (lbs)	Mobilized Shear Force * (lbs)
1	-31.97	52.12	5.00	416.22	0.00	0.00
2	-26.69	54.84	1.34	241.86	0.00	0.00
3	-26.69	57.08	3.66	658.45	0.00	0.00
4	-21.41	59.23	1.12	176.12	0.00	0.00
5	-21.41	61.56	3.88	607.98	0.00	0.00
6	-16.13	65.77	5.00	783.24	0.00	0.00
7	-10.86	70.62	5.00	618.64	0.00	0.00
8	-5.58	75.39	4.64	273.66	0.00	0.00
9	-5.58	77.87	0.36	5.93	0.00	0.00
10	-0.30	78.28	0.45	3.58	0.00	0.00
11	-0.30	80.78	4.55	16.31	0.00	0.00
12	4.98	83.41	0.71	103.05	2469.01	1164.96

SUM OF MOMENTS = 0.710543E-14 (ft/lbs);Imbalance (Fraction of Total Weight) = 0.1236239E-17

Sum of the Resisting Forces = 2469.01 (lbs)

Average Available Shear Strength = 69.15(psf)

Sum of the Driving Forces = 1164.96 (lbs)

Average Mobilized Shear Stress = 32.63(psf)

Total length of the failure surface = 35.71(ft)

Factor of Safety Balance Check: FS = 2.11940

CAUTION - Factor Of Safety Is Calculated By The Simplified Bishop Method. This Method Is Valid Only If The Failure Surface Approximates A Circular Arc.

**** END OF GEOSTASE OUTPUT ****

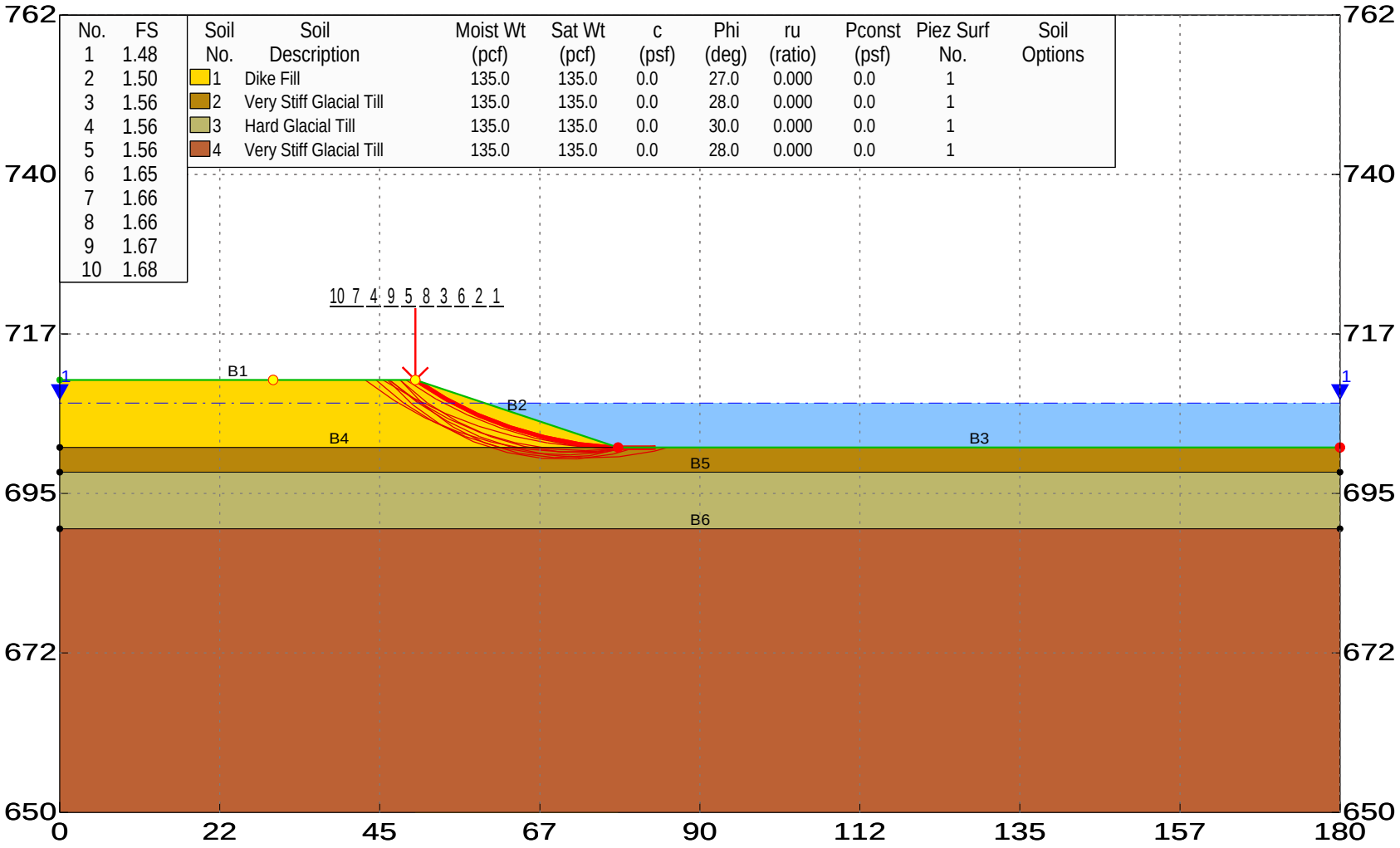
205019 Village of Hamler Wastewater Treatment Lagoon
New Dike, Drained (Long Term) Conditions - Inside Dike Slope 3H:1V

GREGORY GEOTECHNICAL - GHG

\205019 Hamler Slope Stability INSIDE SLOPE Long term.gsd

No.	FS
1	1.48
2	1.50
3	1.56
4	1.56
5	1.56
6	1.65
7	1.66
8	1.66
9	1.67
10	1.68

Soil No.	Soil Description	Moist Wt (pcf)	Sat Wt (pcf)	c (psf)	Phi (deg)	ru (ratio)	Pconst (psf)	Piez Surf No.	Soil Options
1	Dike Fill	135.0	135.0	0.0	27.0	0.000	0.0	1	
2	Very Stiff Glacial Till	135.0	135.0	0.0	28.0	0.000	0.0	1	
3	Hard Glacial Till	135.0	135.0	0.0	30.0	0.000	0.0	1	
4	Very Stiff Glacial Till	135.0	135.0	0.0	28.0	0.000	0.0	1	



GEOSTASE FS = 1.48

Simplified Bishop Method

GEOSTASE Slope Stability Analysis

*** GEOSTASE(R) ***

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** Current Version 4.30.22-Double Precision, June 2018 **
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SLOPE STABILITY ANALYSIS SOFTWARE
Simplified Bishop, Simplified Janbu, or General Equilibrium (GE) Options.
(Spencer, Morgenstern-Price, USACE, and Lowe & Karafiath)
Including Pier/Pile, Planar Reinf, Nail, Tieback, Line Loads
Applied Forces, Fiber-Reinforced Soil (FRS), Distributed Loads
Nonlinear Undrained Shear Strength, Curved Strength Envelope,
Anisotropic Strengths, Water Surfaces, 3-Stage Rapid Drawdown
2- or 3-Stage Pseudo-Static & Simplified Newmark Seismic Analyses.

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Analysis Date: 8/ 12/ 2022
Analysis Time:
Analysis By: GREGORY GEOTECHNICAL - GHG

Input File Name: \\TOLEDO-SV1\CurrentYear\Toledo Job Files - 24 & 28\205000\205019 Village of Hamler WWT Lagoon\Slope Stability\205019 Hamler Slope Stability INSIDE SLOPE Long term.gsd

Output File Name: \\TOLEDO-SV1\CurrentYear\Toledo Job Files - 24 & 28\205000\205019 Village of Hamler WWT Lagoon\Slope Stability\205019 Hamler Slope Stability INSIDE SLOPE Long term.OUT

Unit System: English

PROJECT: 205019 Village of Hamler Wastewater Treatment Lagoon

DESCRIPTION: New Dike, Drained (Long Term) Conditions - Inside Dike Slope 3H:1V

BOUNDARY DATA

3 Surface Boundaries

6 Total Boundaries

Boundary No.	X - 1 (ft)	Y - 1 (ft)	X - 2 (ft)	Y - 2 (ft)	Soil Type Below Bnd
1	0.000	711.000	50.000	711.000	1
2	50.000	711.000	78.500	701.500	1
3	78.500	701.500	180.000	701.500	2
4	0.000	701.500	78.500	701.500	2
5	0.000	698.000	180.000	698.000	3
6	0.000	690.000	180.000	690.000	4

User Specified X-Origin = 0.000(ft)

User Specified Y-Origin = 650.000(ft)

MOHR-COULOMB SOIL PARAMETERS

4 Type(s) of Soil Defined

Soil Number and Description	Moist Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Ratio(ru)	Pressure Water Constant (psf)	Water Surface Option No.
1 Dike Fill	135.0	135.0	0.00	27.00	0.000	0.0	1 0
2 Very Stiff Glacial T	135.0	135.0	0.00	28.00	0.000	0.0	1 0
3 Hard Glacial Till	135.0	135.0	0.00	30.00	0.000	0.0	1 0
4 Very Stiff Glacial T	135.0	135.0	0.00	28.00	0.000	0.0	1 0

WATER SURFACE DATA

1 Water Surface(s) Defined

Unit Weight of Water = 62.400 (pcf)

Water Surface No. 1 Specified by 2 Coordinate Points
Pore Pressure Inclination Factor = 0.00

Point	X-Water	Y-Water

No.	(ft)	(ft)
1	0.00	707.75
2	180.00	707.75

TRIAL FAILURE SURFACE DATA

Circular Trial Failure Surfaces Have Been Generated Using A Random Procedure.

1000 Trial Surfaces Have Been Generated.

1000 Surfaces Generated at Increments of 0.2402(in) Equally Spaced Within the Start Range

Along The Specified Surface Between X = 30.00(ft)
and X = 50.00(ft)

Each Surface Enters within a Range Between X = 78.50(ft)
and X = 180.00(ft)

Unless XCLUDE Lines Were Specified, The Minimum Elevation
To Which A Surface Extends Is Y = 650.00(ft)

Specified Maximum Radius = 5000.000(ft)

5.000(ft) Line Segments Were Used For Each Trial Failure Surface.

Restrictions Have Been Imposed Upon The Angle Of Initiation.
The Angle Has Been Restricted Between The Angles Of -60.0
And 0.0 deg.

The Simplified Bishop Method Was Selected for FS Analysis.

Total Number of Trial Surfaces Attempted = 1000

Number of Trial Surfaces With Valid FS = 1000

Statistical Data On All Valid FS Values:
FS Max = 26.282 FS Min = 1.481 FS Ave = 6.023
Standard Deviation = 3.703 Coefficient of Variation = 61.47 %

Critical Surface is Sequence Number 1000 of Those Analyzed.

*****BEGINNING OF DETAILED GEOSTASE OUTPUT FOR CRITICAL SURFACE FROM A SEARCH*****

BACK-CALCULATED CIRCULAR SURFACE PARAMETERS:

Circle Center At X = 80.837229(ft) ; Y = 755.691170(ft); and Radius = 54.297655(ft)

Circular Trial Failure Surface Generated With 9 Coordinate Points

Point No.	X-Coord. (ft)	Y-Coord. (ft)
1	50.000	711.000
2	54.242	708.353
3	58.709	706.107
4	63.364	704.282
5	68.167	702.892
6	73.078	701.951
7	78.054	701.465
8	83.054	701.439
9	83.757	701.500

Factor Of Safety For The Critical or Specified Surface = 1.481

Table 1 - Geometry Data on the 12 Slices

Slice No.	Width (ft)	Height (ft)	X-Cntr (ft)	Y-Cntr-Base (ft)	Y-Cntr-Top (ft)	Alpha (deg)	Beta (deg)	Base Length (ft)
1	4.24	0.62	52.12	709.68	710.29	-31.97	-18.43	5.00
2	1.20	1.33	54.84	708.05	709.39	-26.69	-18.43	1.34
3	3.27	1.71	57.08	706.93	708.64	-26.69	-18.43	3.66
4	1.04	2.02	59.23	705.90	707.92	-21.41	-18.43	1.12
5	3.61	2.16	61.56	704.99	707.15	-21.41	-18.43	3.88
6	4.80	2.16	65.77	703.59	705.74	-16.13	-18.43	5.00

7	4.91	1.70	70.62	702.42	704.13	-10.86	-18.43
5.00							
8	4.62	0.81	75.39	701.73	702.54	-5.58	-18.43
4.64							
9	0.36	0.23	77.87	701.48	701.71	-5.58	-18.43
0.36							
10	0.45	0.11	78.28	701.46	701.57	-0.30	-18.43
0.45							
11	4.55	0.05	80.78	701.45	701.50	-0.30	0.00
4.55							
12	0.70	0.03	83.41	701.47	701.50	4.98	0.00
0.71							

Table 2 - Force Data On The 12 Slices (Excluding Reinforcement)

Slice No.	Weight (lbs)	Ubeta Force Top (lbs)	Ualpha Force Bot (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Distributed Load (lbs)
1	353.1	0.0	0.0	0.0	0.0	0.0
2	216.1	0.0	0.0	0.0	0.0	0.0
3	755.8	0.0	187.5	0.0	0.0	0.0
4	283.9	0.0	128.9	0.0	0.0	0.0
5	1052.5	143.2	668.5	0.0	0.0	0.0
6	1399.1	633.5	1298.8	0.0	0.0	0.0
7	1129.8	1170.6	1662.4	0.0	0.0	0.0
8	506.5	1582.8	1743.9	0.0	0.0	0.0
9	11.0	142.8	141.3	0.0	0.0	0.0
10	6.7	181.2	175.0	0.0	0.0	0.0
11	30.3	1776.0	1790.0	0.0	0.0	0.0
12	2.9	274.1	276.5	0.0	0.0	0.0

TOTAL WEIGHT OF SLIDING MASS = 5747.62(lbs)

EFFECTIVE WEIGHT OF SLIDING MASS = 3744.91(lbs)

TOTAL AREA OF SLIDING MASS = 42.57(ft2)

TABLE 2A - SOIL STRENGTH & SOIL OPTIONS DATA ON THE 12 SLICES

Slice No.	Soil Type	Cohesion (psf)	Phi(Deg)	Options
1	1	0.00	27.00	
2	1	0.00	27.00	
3	1	0.00	27.00	
4	1	0.00	27.00	

5	1	0.00	27.00
6	1	0.00	27.00
7	1	0.00	27.00
8	1	0.00	27.00
9	2	0.00	28.00
10	2	0.00	28.00
11	2	0.00	28.00
12	2	0.00	28.00

SOIL OPTIONS: A = ANISOTROPIC, C = CURVED STRENGTH ENVELOPE (TANGENT PHI & C),
F = FIBER-REINFORCED SOIL (FRS), N = NONLINEAR UNDRAINED SHEAR STRENGTH,
R = RAPID DRAWDOWN OR RAPID LOADING (SEISMIC) SHEAR STRENGTH
NOTE: Phi and C in Table 4 are modified values based on specified
Soil Options (if any).

TABLE 3 - Effective and Base Shear Stress Data on the 12 Slices

Slice No.	Alpha (deg)	X-Coord. Slice Cntr (ft)	Base Leng. (ft)	Effective Normal Stress (psf)	Available Shear Strength (psf)	Mobilized Shear Stress * (psf)
1	-31.97	52.12	5.00	68.53	34.92	23.57
2	-26.69	54.84	1.34	153.64	78.28	52.84
3	-26.69	57.08	3.66	153.48	78.20	52.79
4	-21.41	59.23	1.12	138.80	70.72	47.74
5	-21.41	61.56	3.88	138.01	70.32	47.47
6	-16.13	65.77	5.00	142.47	72.59	49.00
7	-10.86	70.62	5.00	116.07	59.14	39.92
8	-5.58	75.39	4.64	57.08	29.08	19.63
9	-5.58	77.87	0.36	15.86	8.43	5.69
10	-0.30	78.28	0.45	8.02	4.26	2.88
11	-0.30	80.78	4.55	3.57	1.90	1.28
12	4.98	83.41	0.71	2.29	1.22	0.82

Table 4 - Base Force Data on the 12 Slices

Slice No.	Alpha (deg)	X-Coord. Slice Cntr (ft)	Base Leng. (ft)	Effective Normal Force (lbs)	Available Shear Force (lbs)	Mobilized Shear Force * (lbs)
1	-31.97	52.12	5.00	342.67	174.60	117.86
2	-26.69	54.84	1.34	206.21	105.07	70.92
3	-26.69	57.08	3.66	561.39	286.04	193.09
4	-21.41	59.23	1.12	155.19	79.07	53.38
5	-21.41	61.56	3.88	535.74	272.97	184.26
6	-16.13	65.77	5.00	712.37	362.97	245.01
7	-10.86	70.62	5.00	580.36	295.71	199.61
8	-5.58	75.39	4.64	264.77	134.90	91.06
9	-5.58	77.87	0.36	5.73	3.05	2.06
10	-0.30	78.28	0.45	3.58	1.90	1.28
11	-0.30	80.78	4.55	16.28	8.65	5.84
12	4.98	83.41	0.71	1.62	0.86	0.58

SUM OF MOMENTS = -0.275503E-02 (ft/lbs);Imbalance (Fraction of Total Weight) = -0.4793342E-06

Sum of the Resisting Forces = 1725.81 (lbs)

Average Available Shear Strength = 48.33(psf)

Sum of the Driving Forces = 1164.96 (lbs)

Average Mobilized Shear Stress = 32.63(psf)

Total length of the failure surface = 35.71(ft)

Factor of Safety Balance Check: FS = 1.48144

CAUTION - Factor Of Safety Is Calculated By The Simplified Bishop Method. This Method Is Valid Only If The Failure Surface Approximates A Circular Arc.

**** END OF GEOSTASE OUTPUT ****

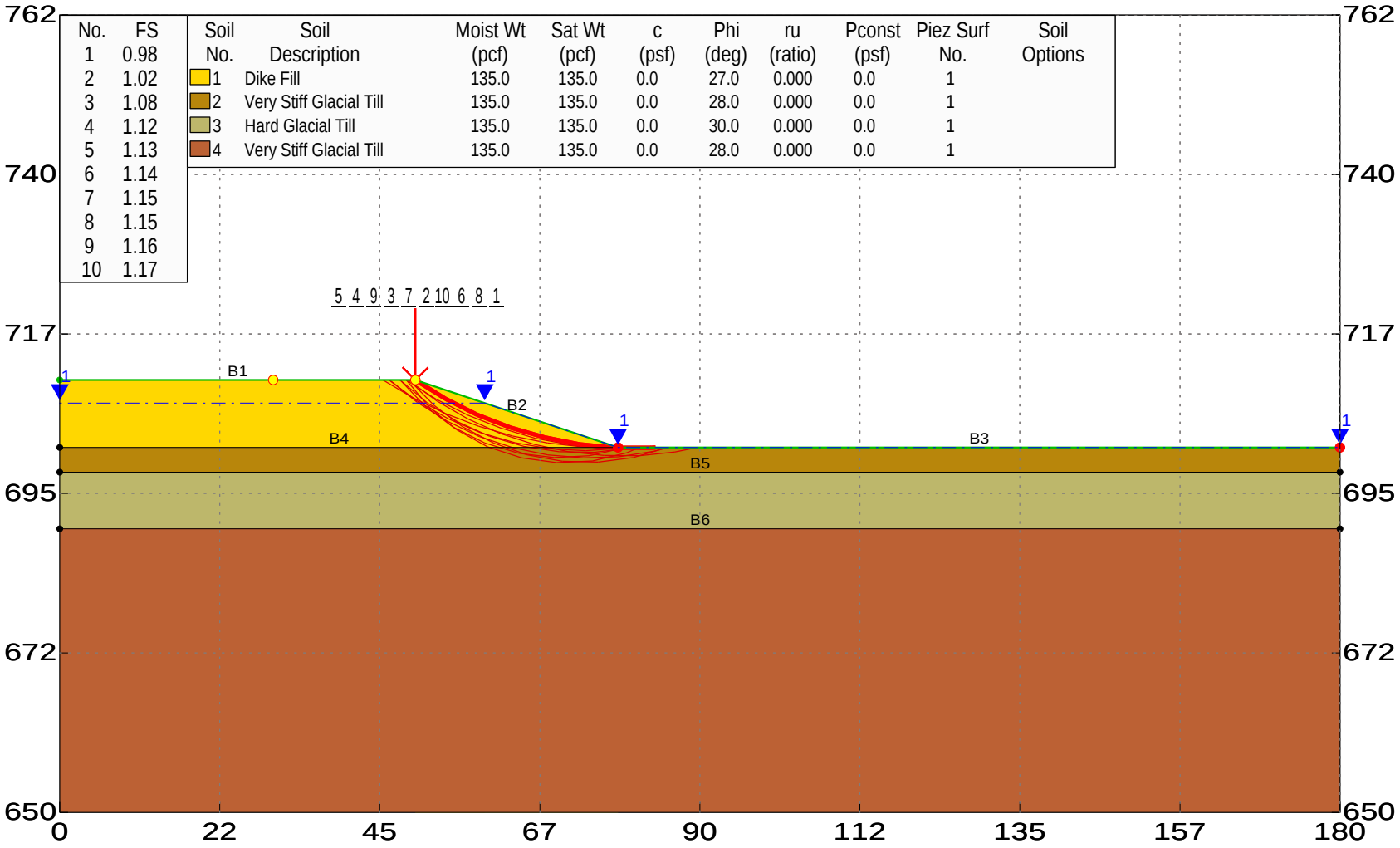
205019 Village of Hamler Wastewater Treatment Lagoon
New Dike, Drained (Long Term) Conditions w/ Full Rapid Drawn Down

GREGORY GEOTECHNICAL - GHG

\205019 Hamler Slope Stability INSIDE SLOPE Long term Rapid Draw Down.gsd

No.	FS
1	0.98
2	1.02
3	1.08
4	1.12
5	1.13
6	1.14
7	1.15
8	1.15
9	1.16
10	1.17

Soil No.	Soil Description	Moist Wt (pcf)	Sat Wt (pcf)	c (psf)	Phi (deg)	ru (ratio)	Pconst (psf)	Piez Surf No.	Soil Options
1	Dike Fill	135.0	135.0	0.0	27.0	0.000	0.0	1	
2	Very Stiff Glacial Till	135.0	135.0	0.0	28.0	0.000	0.0	1	
3	Hard Glacial Till	135.0	135.0	0.0	30.0	0.000	0.0	1	
4	Very Stiff Glacial Till	135.0	135.0	0.0	28.0	0.000	0.0	1	



GEOSTASE FS = 0.98

Simplified Bishop Method

GEOSTASE Slope Stability Analysis

*** GEOSTASE(R) ***

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** Current Version 4.30.22-Double Precision, June 2018 **
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SLOPE STABILITY ANALYSIS SOFTWARE
Simplified Bishop, Simplified Janbu, or General Equilibrium (GE) Options.
(Spencer, Morgenstern-Price, USACE, and Lowe & Karafiath)
Including Pier/Pile, Planar Reinf, Nail, Tieback, Line Loads
Applied Forces, Fiber-Reinforced Soil (FRS), Distributed Loads
Nonlinear Undrained Shear Strength, Curved Strength Envelope,
Anisotropic Strengths, Water Surfaces, 3-Stage Rapid Drawdown
2- or 3-Stage Pseudo-Static & Simplified Newmark Seismic Analyses.

****

Analysis Date: 8/ 12/ 2022
Analysis Time:
Analysis By: GREGORY GEOTECHNICAL - GHG

Input File Name: \\TOLEDO-SV1\CurrentYear\Toledo Job Files - 24 & 28\205000\205019 Village of Hamler WWT Lagoon\Slope Stability\205019 Hamler Slope Stability INSIDE SLOPE Long term Rapid Draw Down.gsd

Output File Name: \\TOLEDO-SV1\CurrentYear\Toledo Job Files - 24 & 28\205000\205019 Village of Hamler WWT Lagoon\Slope Stability\205019 Hamler Slope Stability INSIDE SLOPE Long term Rapid Draw Down.OUT

Unit System: English

PROJECT: 205019 Village of Hamler Wastewater Treatment Lagoon

DESCRIPTION: New Dike, Drained (Long Term) Conditions w/ Full Rapid Drawn Down

BOUNDARY DATA

3 Surface Boundaries

6 Total Boundaries

Boundary No.	X - 1 (ft)	Y - 1 (ft)	X - 2 (ft)	Y - 2 (ft)	Soil Type Below Bnd
1	0.000	711.000	50.000	711.000	1
2	50.000	711.000	78.500	701.500	1
3	78.500	701.500	180.000	701.500	2
4	0.000	701.500	78.500	701.500	2
5	0.000	698.000	180.000	698.000	3
6	0.000	690.000	180.000	690.000	4

User Specified X-Origin = 0.000(ft)

User Specified Y-Origin = 650.000(ft)

MOHR-COULOMB SOIL PARAMETERS

4 Type(s) of Soil Defined

Soil Number and Description	Moist Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Ratio(ru)	Pressure Water Constant (psf)	Water Surface Option No.
1 Dike Fill	135.0	135.0	0.00	27.00	0.000	0.0	1 0
2 Very Stiff Glacial T	135.0	135.0	0.00	28.00	0.000	0.0	1 0
3 Hard Glacial Till	135.0	135.0	0.00	30.00	0.000	0.0	1 0
4 Very Stiff Glacial T	135.0	135.0	0.00	28.00	0.000	0.0	1 0

WATER SURFACE DATA

1 Water Surface(s) Defined

Unit Weight of Water = 62.400 (pcf)

Water Surface No. 1 Specified by 4 Coordinate Points
Pore Pressure Inclination Factor = 0.00

Point	X-Water	Y-Water

No.	(ft)	(ft)
1	0.00	707.75
2	59.75	707.75
3	78.50	701.50
4	180.00	701.50

TRIAL FAILURE SURFACE DATA

Circular Trial Failure Surfaces Have Been Generated Using A Random Procedure.

1000 Trial Surfaces Have Been Generated.

1000 Surfaces Generated at Increments of 0.2402(in) Equally Spaced Within the Start Range

Along The Specified Surface Between X = 30.00(ft)
and X = 50.00(ft)

Each Surface Enters within a Range Between X = 78.50(ft)
and X = 180.00(ft)

Unless XCLUDE Lines Were Specified, The Minimum Elevation
To Which A Surface Extends Is Y = 650.00(ft)

Specified Maximum Radius = 5000.000(ft)

5.000(ft) Line Segments Were Used For Each Trial Failure Surface.

Restrictions Have Been Imposed Upon The Angle Of Initiation.
The Angle Has Been Restricted Between The Angles Of -60.0
And 0.0 deg.

The Simplified Bishop Method Was Selected for FS Analysis.

Total Number of Trial Surfaces Attempted = 1000

Number of Trial Surfaces With Valid FS = 1000

Statistical Data On All Valid FS Values:
FS Max = 19.256 FS Min = 0.978 FS Ave = 4.068
Standard Deviation = 2.382 Coefficient of Variation = 58.54 %

Critical Surface is Sequence Number 1000 of Those Analyzed.

*****BEGINNING OF DETAILED GEOSTASE OUTPUT FOR CRITICAL SURFACE FROM A SEARCH*****

BACK-CALCULATED CIRCULAR SURFACE PARAMETERS:

Circle Center At X = 80.837229(ft) ; Y = 755.691170(ft); and Radius = 54.297655(ft)

Circular Trial Failure Surface Generated With 9 Coordinate Points

Point No.	X-Coord. (ft)	Y-Coord. (ft)
1	50.000	711.000
2	54.242	708.353
3	58.709	706.107
4	63.364	704.282
5	68.167	702.892
6	73.078	701.951
7	78.054	701.465
8	83.054	701.439
9	83.757	701.500

Factor Of Safety For The Critical or Specified Surface = 0.978

Table 1 - Geometry Data on the 12 Slices

Slice No.	Width (ft)	Height (ft)	X-Cntr (ft)	Y-Cntr-Base (ft)	Y-Cntr-Top (ft)	Alpha (deg)	Beta (deg)	Base Length (ft)
1	4.24	0.62	52.12	709.68	710.29	-31.97	-18.43	5.00
2	1.20	1.33	54.84	708.05	709.39	-26.69	-18.43	1.34
3	3.27	1.71	57.08	706.93	708.64	-26.69	-18.43	3.66
4	1.04	2.02	59.23	705.90	707.92	-21.41	-18.43	1.12
5	3.61	2.16	61.56	704.99	707.15	-21.41	-18.43	3.88

6	4.80	2.16	65.77	703.59	705.74	-16.13	-18.43 5.00
7	4.91	1.70	70.62	702.42	704.13	-10.86	-18.43 5.00
8	4.62	0.81	75.39	701.73	702.54	-5.58	-18.43 4.64
9	0.36	0.23	77.87	701.48	701.71	-5.58	-18.43 0.36
10	0.45	0.11	78.28	701.46	701.57	-0.30	-18.43 0.45
11	4.55	0.05	80.78	701.45	701.50	-0.30	0.00 4.55
12	0.70	0.03	83.41	701.47	701.50	4.98	0.00 0.71

Table 2 - Force Data On The 12 Slices (Excluding Reinforcement)

Slice No.	Weight (lbs)	Ubeta Force Top (lbs)	Ualpha Force Bot (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Distributed Load (lbs)
1	353.1	0.0	0.0	0.0	0.0	0.0
2	216.1	0.0	0.0	0.0	0.0	0.0
3	755.8	0.0	187.5	0.0	0.0	0.0
4	283.9	0.0	128.9	0.0	0.0	0.0
5	1052.5	0.0	470.3	0.0	0.0	0.0
6	1399.1	0.0	605.9	0.0	0.0	0.0
7	1129.8	0.0	478.5	0.0	0.0	0.0
8	506.5	0.0	211.7	0.0	0.0	0.0
9	11.0	0.0	4.6	0.0	0.0	0.0
10	6.7	0.0	2.8	0.0	0.0	0.0
11	30.3	0.0	14.0	0.0	0.0	0.0
12	2.9	0.0	1.3	0.0	0.0	0.0

TOTAL WEIGHT OF SLIDING MASS = 5747.62(lbs)

EFFECTIVE WEIGHT OF SLIDING MASS = 3736.90(lbs)

TOTAL AREA OF SLIDING MASS = 42.57(ft2)

TABLE 2A - SOIL STRENGTH & SOIL OPTIONS DATA ON THE 12 SLICES

Slice No.	Soil Type	Cohesion (psf)	Phi(Deg)	Options
1	1	0.00	27.00	
2	1	0.00	27.00	

3	1	0.00	27.00
4	1	0.00	27.00
5	1	0.00	27.00
6	1	0.00	27.00
7	1	0.00	27.00
8	1	0.00	27.00
9	2	0.00	28.00
10	2	0.00	28.00
11	2	0.00	28.00
12	2	0.00	28.00

SOIL OPTIONS: A = ANISOTROPIC, C = CURVED STRENGTH ENVELOPE (TANGENT PHI & C),
F = FIBER-REINFORCED SOIL (FRS), N = NONLINEAR UNDRAINED SHEAR STRENGTH,
R = RAPID DRAWDOWN OR RAPID LOADING (SEISMIC) SHEAR STRENGTH
NOTE: Phi and C in Table 4 are modified values based on specified
Soil Options (if any).

TABLE 3 - Effective and Base Shear Stress Data on the 12 Slices

Slice No.	Alpha (deg)	X-Coord. Slice Cntr (ft)	Base Leng. (ft)	Effective Normal Stress (psf)	Available Shear Strength (psf)	Mobilized Shear Stress * (psf)
1	-31.97	52.12	5.00	62.84	32.02	32.73
2	-26.69	54.84	1.34	142.83	72.78	74.41
3	-26.69	57.08	3.66	142.68	72.70	74.33
4	-21.41	59.23	1.12	130.82	66.65	68.15
5	-21.41	61.56	3.88	141.26	71.97	73.59
6	-16.13	65.77	5.00	147.85	75.34	77.02
7	-10.86	70.62	5.00	122.17	62.25	63.64
8	-5.58	75.39	4.64	60.96	31.06	31.76
9	-5.58	77.87	0.36	16.93	9.00	9.20
10	-0.30	78.28	0.45	8.70	4.62	4.73
11	-0.30	80.78	4.55	3.57	1.90	1.94
12	4.98	83.41	0.71	2.33	1.24	

1.27

Table 4 - Base Force Data on the 12 Slices

Slice No.	Alpha (deg) *	X-Coord. Slice Cntr (ft)	Base Leng. (ft)	Effective Normal Force (lbs)	Available Shear Force (lbs)	Mobilized Shear Force (lbs)
1	-31.97	52.12	5.00	314.18	160.08	163.67
2	-26.69	54.84	1.34	191.71	97.68	99.87
3	-26.69	57.08	3.66	521.91	265.92	271.88
4	-21.41	59.23	1.12	146.27	74.53	76.20
5	-21.41	61.56	3.88	548.34	279.39	285.65
6	-16.13	65.77	5.00	739.27	376.68	385.12
7	-10.86	70.62	5.00	610.85	311.24	318.22
8	-5.58	75.39	4.64	282.81	144.10	147.33
9	-5.58	77.87	0.36	6.12	3.25	3.32
10	-0.30	78.28	0.45	3.88	2.06	2.11
11	-0.30	80.78	4.55	16.26	8.65	8.84
12	4.98	83.41	0.71	1.65	0.87	0.89

SUM OF MOMENTS = -0.330446E-01 (ft/lbs);Imbalance (Fraction of Total Weight) = -0.5749270E-05

Sum of the Resisting Forces = 1724.46 (lbs)

Average Available Shear Strength = 48.30(psf)

Sum of the Driving Forces = 1763.11 (lbs)

Average Mobilized Shear Stress = 49.38(psf)

Total length of the failure surface = 35.71(ft)

Factor of Safety Balance Check: FS = 0.97808

CAUTION - Factor Of Safety Is Calculated By The Simplified Bishop Method. This Method Is Valid Only If The Failure Surface Approximates A Circular Arc.

**** END OF GEOSTASE OUTPUT ****