DRIESENGA & ASSOCIATES, INC.
Engineering · Surveying · Testing

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June 3, 2024 ***via electronic mail***

Mr. Timothy A. Britain
VIRIDIS DESIGN GROUP
2925 West Main Street
Kalamazoo, Michigan 49006

Re: Geotechnical Report
Fennville LEO Community Center Grant Projects
City Square and Fennville Public Library, Fennville, Michigan
Driesenga & Associates, Inc. Project No. 2410439.3A

Dear Mr. Britain:

Driesenga & Associates, Inc. is pleased to submit the attached report of subsurface exploration performed for the above-referenced project. The report presents the exploration procedures, subsurface conditions encountered, and our recommendations for redevelopment of the two (2) sites with respect to proposed earthwork, foundation construction, and pavement design (as applicable). As the project nears construction you can contact Jake Stocking at 616-396-0255 in our local office to provide a quote for construction materials testing and survey needs.

Proper execution of our recommendations will affect the design, construction and performance of the structure and related facilities, and the potential associated risks involved. Therefore, the issues and recommendations presented in this report should be discussed with the project team, including Driesenga & Associates, Inc. This will increase the likelihood that the issues are understood and our recommendations are applied in a manner consistent with the project budget, tolerance of risk, and expectations for performance and maintenance.

We appreciate the opportunity to be of service to you. If you have any questions concerning this report, or if we can be of further service as design and construction progresses, please contact our office.

Sincerely,
DRIESENGA & ASSOCIATES, INC.

Michael Stork
Senior Project Geologist

Musana Nabil
Senior Project Engineer

Randy Pail, P.E
Director of Geotechnical Engineering

GEOTECHNICAL REPORT

SITE:

FENNVILLE LEO COMMUNITY CENTER GRANT PROJECTS
CITY SQUARE AND FENNVILLE PUBLIC LIBRARY
FENNVILLE, MICHIGAN

JUNE 3, 2024
PROJECT NO. 2410439.3A

PREPARED FOR:

VIRIDIS DESIGN GROUP
2925 WEST MAIN STREET
KALAMAZOO, MICHIGAN 49006

Prepared by:

DRIESENGA & ASSOCIATES, INC.
Engineering · Surveying · Testing

TABLE OF CONTENTS

1.0 INTRODUCTION 1
1.1 LOCATION 1
1.2 PURPOSE 1
1.3 SCOPE 1
1.4 DESIGN INFORMATION 2
2.0 SITE CONDITIONS 3
2.1 GENERAL 3
2.2 SURFACE CONDITIONS 3
2.3 DESCRIPTION OF SUBSURFACE SOILS 3
2.4 GROUNDWATER OBSERVATIONS 4
2.5 LIMITATIONS 4
3.0 RECOMMENDATIONS 6
3.1 SITE PREPARATION 6
3.2 FOUNDATIONS 8
3.3 FLOORS 10
3.4 PAVEMENTS 10
3.5 GROUNDWATER CONTROL 13
3.6 TEMPORARY EXCAVATION STABILITY 13
4.0 GENERAL COMMENTS 15

APPENDICES

APPENDIX A	Figure 1 – Site Location
	Figure 2 – Boring Locations
APPENDIX B	Soil Boring Logs
APPENDIX C	Field and Laboratory Procedures

1.0 INTRODUCTION

1.1 LOCATION

This report presents the results of the geotechnical investigation completed for the proposed new park at 116 S. Maple Street which is to include a small water feature/jet only splash pad and outdoor fireplace and landscaping and a complete parking lot redesign at the Fennville Public Library. The sites are located at 116 S. Maple Street and 400 West Main Street in Fennville, Michigan as shown on Figure 1 – Site Location (Appendix A).

1.2 PURPOSE

The purpose of this investigation was to determine the subsurface profile, the engineering characteristics of the subsurface soils, and to provide recommendations in regard to the proposed design and construction based on our interpretation of the test results. This report was prepared in general accordance with our proposal dated May 9, 2024, as authorized by Mr. Timothy A. Britain of VIRIDIS Design Group on May 9, 2024.

1.3 SCOPE

The field exploration to estimate engineering characteristics of the site soils included performing a site reconnaissance, advancing the soil borings, performing standard penetration tests, and recovering split-spoon samples. Soil boring locations were determined in the field by measuring from existing site features. Existing ground surface elevations were not provided and obtaining them was beyond the scope of this investigation.

Five (5) soil borings, designated SB-1 to SB-5, were advanced in the vicinity of the proposed new pavement areas and park improvements, at the approximate locations shown on Figure 2 - Boring Locations (Appendix A). The soil borings were advanced with solid-stem augers to depths ranging from five (5) to ten (10) feet below the ground surface. During drilling, soil samples were collected from split-spoon sampling via standard penetration testing (ASTM method D 1586) at intervals of 2.5 feet to a depth of 10 feet. The soil boring logs are contained in Appendix B. The field and laboratory procedures are described in Appendix C.

1.4 DESIGN INFORMATION

It is understood the proposed park features will include a new splash pad and outdoor fireplace. We anticipate that the fireplace will be supported with a poured concrete foundation. The splash pad will include a grade level slab. The library parking lot will be completely restructured and redesigned, including an upper-level pavement area along West 1st Street.

Structural load information for the new fireplace was not available as of the time of this report, but should be provided to Driesenga & Associates, Inc. for review in light of the recommendations contained herein as soon as available. For calculation purposes, maximum loads of 2,000 pounds per lineal foot of wall were assumed. Understanding that the new construction will not include any below-grade areas, exterior footing depths are assumed to be a minimum of 3.5 feet below the final ground surface elevation.

We have assumed maximum tolerable settlements of 1 inch total and ½ inch differential for the new fireplace structure. We do not anticipate any significant cuts or fills will be required to establish site grades at the park, but some leveling and grading will be required for the parking lot reconstruction. Any significant deviation from these assumptions should be brought to the attention of Driesenga & Associates, Inc. as soon as possible.

2.0 SITE CONDITIONS

2.1 GENERAL

The stratification of the soils, as shown on the soil boring logs in Appendix B, represents the soil conditions at the actual soil boring locations. Variations may occur away from or between the soil borings. Stratigraphic lines shown on the soil boring logs represent the approximate boundary between the soil types, but the transition may be gradual. They are not intended to show exact depths of change from one soil type to another. In addition, changes in soil type may occur between the sample intervals that are consequently not observed by the driller.

The soil boring logs in Appendix B include the drilling method, materials encountered, penetration resistances, and pertinent field observations made during the drilling operations along with the results of the laboratory testing.

2.2 SURFACE CONDITIONS

The area of the new park is a vacant, relatively flat, maintained grass covered square of land surrounded by concrete and asphalt pavement. The Fennville Library parking lot area is comprised of existing asphalt pavement, maintained grass and an undeveloped wooded lot, further to the north. The library is elevated above West Main Street by around 8 feet and the site continues to rise upward as you move north toward West 1st Street. The existing parking lot is in moderately worn condition with regular cracking throughout.

2.3 DESCRIPTION OF SUBSURFACE SOILS

Soils encountered at the site generally consist of either topsoil, gravel or asphalt pavement underlain by loose to dense sand to a depth of at least 10 feet below grade. At several of the boring locations, fill sand with trace organic material and clay were encountered just below the surface materials and above the native sand.

The estimated group symbol, according to the USCS, is shown in the USCS column just before the textural description of the various strata on the soil boring logs in Appendix B.

2.4 GROUNDWATER OBSERVATIONS

Groundwater was only encountered at boring location SB-5 at a depth of 7.3 feet below grade. Groundwater was not encountered in the remainder of the soil borings during or after completion of drilling operations. Hydrostatic groundwater levels and the elevations and volumes of groundwater should be expected to fluctuate throughout the year, based on variations in precipitation, evaporation, run-off, and other factors. The groundwater levels (or lack thereof) indicated by the soil borings and presented in this section represent conditions at the time the readings were taken. The actual groundwater levels at the time of construction may vary.

Groundwater measurements were collected during drilling and attempted shortly after completion of the drilling operations. After drilling and collection of groundwater readings, the boreholes were backfilled with auger cuttings and the surface was repaired approximating previous conditions. Since the boreholes were backfilled shortly after drilling, long-term groundwater level information is not available from the soil borings. To obtain long-term groundwater levels, groundwater observation wells would be required.

2.5 LIMITATIONS

Soil and groundwater conditions have been observed and interpreted at the soil boring locations only. This information has been used as the basis for our analyses and the recommendations that follow. Although we have allowed for minor variations in subsurface conditions in the development of our recommendations, conditions can vary away from and between soil boring locations. Should this become evident during construction, we should be contacted to review our recommendations. This geotechnical evaluation and report were prepared for geotechnical purposes only. We did not perform environmental related borings or analytical tests.

3.0 RECOMMENDATIONS

3.1 SITE PREPARATION

To increase the likelihood that the recommended allowable soil bearing capacities are achieved and tolerable settlements are not exceeded, the recommendations contained herein should be followed. Within the building footprint and any areas to receive fill, all existing building material, topsoil, old fill, organic-containing material, frozen soil and other unsuitable material should be removed. The clearing should extend a minimum of 5 feet beyond the limits of proposed structure and pavement areas and areas to receive structural fill.

It is strongly recommended that the building pad and pavement subgrade areas be evaluated by Driesenga & Associates, Inc. after the area has been cleared and stripped. This evaluation may be performed by proofrolling with a loaded tandem axle dump truck or another method selected by the geotechnical engineer to identify any areas of soft subgrade soil. Where soft subgrade soils are encountered, remedial actions as recommended by the geotechnical engineer will be required.

We understand there were previous structures on the park site. Any existing foundations, floor slabs, utilities, and other below-grade structures from previous construction should be completely removed from the footprint of the proposed structures. In proposed pavement areas, existing utilities and other below-grade structures should be removed to at least 2.5 feet below the final subgrade level. Alternatively, utilities can be left in place below pavement areas if the void space of the utility is completely grouted. Depressions or excavations from the demolition and removal operations should be backfilled with granular structural fill meeting the requirements of MDOT Class II sand compacted in accordance with the recommendations below.

Existing fill was encountered in the soil borings and extended about 2 to more than 5 feet below the existing ground surface. Without documentation of the placement of the fill, we consider it to be "uncontrolled fill." If documentation of the existing fill is available, we would be pleased to review it to determine its suitability of slab, pavement, and/or structural fill support.

Deeper and/or looser uncontrolled fill may be encountered at the site, particularly adjacent to existing or former structures, or in the vicinity of existing utilities. The existing fill ***may*** be suitable for support of slabs, pavements, and/or structural fill after additional evaluation and special preparation and only where it is not underlain by buried topsoil or other organic, deleterious or otherwise unsuitable soils and the owner accepts the risks in doing so. Some of the soil samples in the existing fill contained trace brick, concrete and organic material. Existing fill with excessive organics (over 4%), voids or debris should be removed and replaced with structural fill. Test pits should be performed to identify unsuitable fill. The test pits could be performed prior to construction. However, suitability of the existing fill will need to be determined on a case-by-case basis during construction. The remaining fill, after removing unsuitable fill, is anticipated to be suitable to support floor slabs, pavements and structural fill, provided an increased risk of unsatisfactory performance is acceptable. We believe the risk of unsatisfactory performance such as cracking and settlement associated with the construction of slabs-on-grade and pavements on or above the existing fill is relatively low after preparation.

Ultimately, if the risk of poor slab and/or pavement performance is not acceptable, complete removal of the existing fill and replacement with structural fill should be performed. Based on the soil borings, the existing fill could extend 5 feet or more below the existing ground surface. If performed, the removal of the existing fill should extend a minimum of 10 feet beyond the edges of the proposed building, or laterally on a two vertical to one horizontal slope from the bottom outside edge of the foundation, whichever is greater. This action should reduce the amount and depth of undercutting during foundation construction since the unsuitable fill and any unsuitable soils directly beneath fill would be removed. For this case, the test pit evaluation would not be necessary. However, a test pit evaluation could be performed to provide a better estimate of the nature, depth and extent of the existing fill.

Trees were located within the project area when this investigation was conducted. Large trees may have relatively widespread root structures and related organic veins. The earthwork activities within the building and pavement areas should include complete removal of the tree roots and organic veins.

In all general fill areas, the exposed granular soil surface should be scarified to a depth of 12 inches and recompacted to a minimum of 95% of Modified Proctor maximum dry density (MDD) per ASTM D 1557 method, or 98% of MDD as determined by the Michigan Cone Method. Sand soils were encountered at or near the final subgrade level in some of the soil borings in the proposed building area. Within the proposed building area the native sand should be proof-compacted by at least six (6) passes of a 10-ton vibratory roller.

The contractor should remove standing water from the subgrade and prevent surface water from reaching the footing excavations and the prepared subgrade. In addition, construction traffic should use haul roads and should not haphazardly traffic the site. Subgrade soils that become disturbed should be removed and replaced with structural fill or crushed aggregate. Under wet weather conditions, the subgrade may be protected by placing crushed aggregate on the exposed subgrade.

It is recommended that any fill materials be placed in or near horizontal maximum 8-inch-thick loose lifts and compacted to a minimum of 95% of Modified Proctor MDD, or 98% of Michigan Cone MDD. If a vibratory roller is used for compaction, the loose lift thickness may be increased to 12 inches. Soils used for structural fill should consist of clean sand meeting SW or SP classification in accordance with USCS criteria.

3.2 FOUNDATIONS

Considering the subsurface conditions on this site, the assumed proposed construction and the recommended site preparation activities, it is acceptable for the proposed fireplace structure to be supported on conventional spread footings. Footings bearing on newly placed structural fill placed over suitable native soils or directly on the native sand may be designed for a maximum net allowable soil bearing pressure of 2,500 psf. The allowable bearing pressure may be increased by one-third for seismic or wind loads. The footings should not be placed on the existing fill material. The project team should anticipate undercutting old fill soils from the fireplace footprint to an approximate depth of 3 feet or more.

At some locations, the native sand soils may be in relatively loose condition and not suitable for support of foundations at the recommended design soil bearing pressure. In addition, these soils may become loosened below the bottom of footing level from the excavation activities or from construction traffic, especially if allowed to dry out. Therefore, the excavated footing bearing surfaces should be compacted to a minimum of 95% of Modified Proctor MDD, or 98% of MDD as determined by the Michigan Cone Method, just prior to concrete placement. A hand-operated plate compactor may be used for loose or disturbed soil that is less than 6 inches in thickness. For deeper compaction, we recommend using a hoe-pac mounted on a backhoe. Water may need to be added to achieve the desired compaction for the allowable bearing capacity.

All footings in unheated areas should bear at least 42 inches below finished grade for protection from frost action. To reduce the likelihood of frost heave, trench footings should be formed vertically and should not be allowed to widen near the top. If interior footings are to bear on compacted fill, the fill should be placed in accordance with the recommendations of Section 3.1. Interior foundations can be constructed on suitable natural soils or on structural fill overlying suitable natural subgrade just below the floor slab. However, the footings and proposed bearing soils should be protected from freezing during construction if work is conducted in the cold winter months. Due to the sands encountered at the site, construction of trench footings is probably not feasible. Therefore, we anticipate footing excavations will need to be sloped back and the foundations formed. The placement of footing concrete should be done as soon as footing excavations have been completed and approved to reduce the potential for disturbance or freezing of the footing subgrade.

Prior to concrete placement, the bearing surface should be free of loose soil and standing water. The contractor should avoid stockpiling excavated materials immediately adjacent to the excavation walls. It is recommended that stockpiled materials be kept back from the excavation a minimum distance equal to half the excavation depth to prevent surcharging the excavation walls.

Total and differential settlement of foundations properly designed and constructed based on our recommendations are not expected to exceed 1 inch and ½ inch, respectively.

3.3 FLOORS

The soil below the splash pad should be prepared in accordance with the recommendations in Section 3.1. A noncohesive soils mat such as MDOT Class II sand should be provided directly below the floor slabs. The mat should be a minimum of 8 inches in thickness and compacted to a minimum of 95% of Modified Proctor MDD.

The concrete slab should be suitably reinforced and proper joints should be provided at the junctions of the slab and foundation system so that a small amount of independent movement can occur without causing damage. A minimum of 6 inches of structural fill should be provided between the bottom of the slab and the top of the shallow spread footing below. Otherwise, other arrangements should be made to allow for potential relative settlements, such as grade beams, thickened slabs with appropriate reinforcing steel or other appropriate details. A modulus of subgrade reaction of 200 pci should be used in the design of slabs-on-grade.

3.4 PAVEMENTS

Specific traffic information was not available in developing these pavement recommendations. For design purposes, we have assumed that passenger vehicles and light trucks will traffic all light/medium duty pavement areas. Heavy duty pavement areas will include entrances, service drives and bus parking areas, and will be trafficked by semi-tractor trailers, buses, refuse trucks, and fire engines. The following Design Inputs were used in our evaluation.

- Estimated Native Subgrade CBR = 3 to 5 percent
- Design Subgrade Resilient Modulus (MR) = 4,000 to 6,000 psi
- Reliability = 85% flexible
- Standard Deviation = 0.49 flexible
- Initial Serviceability Index = 4.2
- Terminal Serviceability Index = 2.0
- New HMA Layer Coefficient = 0.42
- New Aggregate Base Layer Coefficient = 0.14

The pavement subgrade should be prepared as described in Section 3.1. Above the subgrade, the sand subbase should be constructed using a minimum of 12 inches of Michigan Department of Transportation (MDOT) Class II Fine Aggregate fill (MDOT Division 3, Section 301 "2012 Standard Specifications for Construction", April 1, 2011) compacted to a minimum of 95% of the material's MDD as determined by Modified Proctor.

The aggregate base for pavement areas should follow MDOT Dense-Graded Aggregate Base Course Materials – Division 3, Section 302 and Division 9, Section 902, using a 22A (Grading Requirements per MDOT Table 902-1) Dense-Graded Aggregate material with a minimum compacted thickness of 8 inches. This gravel base may be placed in one (1) lift and should be compacted to a minimum of 95% of the material's MDD as determined by Modified Proctor.

Light/medium duty bituminous pavement should consist of a 1.5 inch base course and a 1.5 inch surface course for a total thickness of 3.0 inches. Heavy duty bituminous pavement should consist of a 2.5 inch base course and a 1.5 inch surface course for a total thickness of 4.0 inches. Both the base course and surface course should utilize an MDOT 13A asphalt mix. Compaction of asphalt courses should range between 92% and 96% of the Theoretical Maximum Density (TMD).

Construction traffic should be minimized on the new pavement. If excessive construction traffic is anticipated on the pavement structure, the initial asphalt lift thickness could be increased and placement of the final lift could be delayed until the majority of the construction activities have been completed. This action will allow repair of localized failure, if any does occur, as well as reduce load damage on the pavement system.

A bond coat of emulsion should be used between the base course and wearing course when more than 48 hours have elapsed between placement of the courses, or the surface of the base course has been contaminated by soil or dust. Performance grade asphalt cement should be used in the production of all bituminous mixtures. Reclaimed Asphalt Pavement (RAP) may be permitted in percentages in accordance with MDOT guidelines and specifications for use in the surface course mix design. We recommend following MDOT Tier 1 or Tier 2 criteria.

After the pavement is complete, we recommend instituting a regular maintenance program that includes sealing of cracks and patching of distressed areas. This should reduce the effect of water infiltration and associated frost action.

In areas where the durability of Portland cement concrete (PCC) is desired over bituminous pavement (i.e., loading areas, dumpster pads) a rigid pavement is recommended. Concrete pavement should be constructed on a base layer of at least 6 inches of Michigan Department of Transportation (MDOT) Class II sand subbase (Division 9, Section 902, Grading Requirements per Table 902-3). The concrete slab should consist of a minimum of 6 inches of 4,000 psi, air entrained concrete (MDOT Division 6, Section 601 – PCC Pavement and Division 9, Section 901 – Cement and Lime); however, actual design of the slab including reinforcement type and spacing should be performed by the Project Structural Engineer.

These recommendations assume typical conditions during the June through September construction season. Any substitution of materials or deviation from these stated assumptions should be reviewed to assess potential impact on the recommended design.

3.5 GROUNDWATER CONTROL

Groundwater was encountered at 7.3 feet below existing ground surface elevation at the location of the new park. As such, groundwater problems are not expected to be a significant issue with respect to fireplace foundation construction. Any water which enters the footing excavation can likely be controlled by a gravity drain system, sump pump, or other minor dewatering procedure. Concrete should not be poured in footing excavations containing water. Upon removal of any trapped water, the soils should be reviewed by a geotechnical engineer and any soft areas replaced with structural fill per Section 3.1, as necessary.

Perimeter foundation drains should be installed along foundations where interior finished floor elevations are lower than perimeter grades, or where exterior grades slope toward the building. In addition, all roof drains should be diverted to downspouts which carry water away from foundations and supporting walls. Where granular engineered fill is placed within the native clay soils, adequate drainage of the granular material should be provided so as to avoid creating an area for water to collect.

3.6 TEMPORARY EXCAVATION STABILITY

If excavations are anticipated for the proposed structure and/or utilities, shoring and bracing or flattening (laying back) of the slopes may be required to obtain a safe working environment. Excavations should be sloped or shored in accordance with local, state and federal regulations, including OSHA (CFR Part 1926) excavation trench safety standards. We recommend that all excavated soils be placed away from the edges of the excavation at a distance equaling or exceeding the depth of the excavation. In addition, surface runoff water should be diverted away from the crest of the excavated slopes to prevent erosion and sloughing.

Localized areas of soft or unsuitable soils not detected by our borings or in unexplored areas may be encountered once construction begins. Vertical cuts in these soils may be unstable and may present a significant hazard because they can fail without warning. Therefore, temporary construction slopes greater than 5 feet high should not be steeper than one horizontal to one vertical (1H: 1V) and excavated material should not be placed within 10 feet of the crest of any excavated slope.

Unbraced excavations may experience some minor localized instability (i.e., sloughing). To reduce potential sloughing, excavated slopes should be covered with plastic for protection from rainfall and moisture changes. It should be emphasized that continuous observations by personnel from our office are important during trenching or excavation operations at the site.

4.0 GENERAL COMMENTS

If significant changes are made in the plans and specifications, the location of the proposed structure, or the loading conditions outlined in Section 1.4 are exceeded, a consultation should be arranged to review such changes with respect to the prevailing soil conditions. It may then be necessary to submit supplementary recommendations. If deviations from the noted subsurface conditions are encountered during construction, they should also be brought to the attention of Driesenga & Associates, Inc.

Driesenga & Associates, Inc. should be afforded the opportunity to review the project design drawings and specifications to verify the factors affecting subgrade and foundation performance comply with our recommendations.

It is recommended that the services of Driesenga & Associates, Inc. be engaged to observe excavation for the footings and to test and evaluate the soils in the footing excavations prior to placement of foundations in order to determine that the soils have the required bearing capacities. Monitoring and testing should also be performed to verify that suitable materials are used for controlled fills and that they are properly placed and compacted.

This report and any future reports or addenda performed for this site should be supplied to potential bidders prior to them submitting their proposals. We also recommend the construction contract include provisions for dealing with differing conditions. Contingency funds should be reserved for potential problems during earthwork and foundation construction.

This report was for geotechnical purposes only. We did not sample for environmental purposes or perform any analytical testing. However, the contractor should be prepared to handle environmental conditions encountered at this site that may affect the excavation, removal, or disposal of soil; dewatering of excavations; and health and safety of workers. Any Environmental

Assessment reports prepared for this property should be made available for review by bidders and the successful contractor.

This report has been prepared solely for the use of the client for the project specifically described in this report. This report cannot be relied upon by other parties not involved in this project, unless written permission is granted by Driesenga & Associates, Inc. If this report or any of its contents are utilized by parties other than our original client and the project team members, Driesenga & Associates, Inc. can not be held responsible for the suitability of the field exploration, scope of services, or recommendations made for the new project. Driesenga & Associates, Inc. also is not responsible for the interpretation of our soil boring logs and the recommendations provided herein by other parties.

Driesenga & Associates, Inc. will evaluate this report for other parties and developments at this site, provided our original Client agrees to release this information in writing. However, before this report can be relied upon by other parties. Driesenga & Associates, Inc. must review the proposed development since the new project will likely require additional field exploration, laboratory tests, analysis, and modifications to our recommendations to adequately address the needs of the new project.

APPENDIX A

·FIGURE NUMBER 1 – SITE LOCATION·

·FIGURE NUMBER 2 – BORING LOCATIONS·

Scale: NTS

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Figure Number: 1

Site Location

Project Name:

Fennville LEO Community Grant Projects

Project Number:

2410439.3A

Project Location

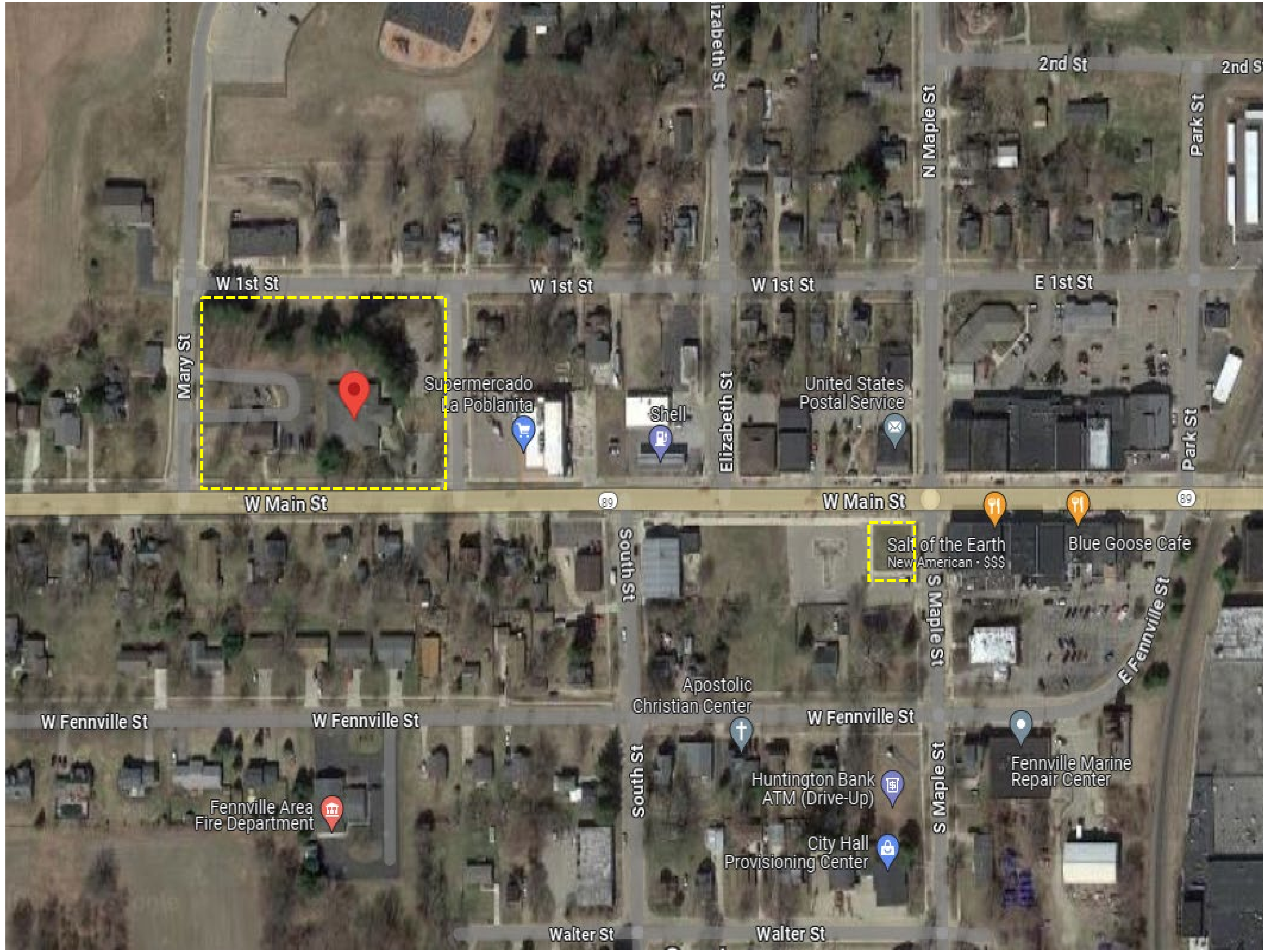
116 S Maple St & 400 W Main St

Fennville, Michigan

Date: 5/15/2024

Sheet: 1 of 1

Modified by: SBE



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W E
S

Scale: NTS

Boring Location

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Figure Number: 2

Boring Locations

Project Name:

Fennville LEO Community Grant Projects

Project Number:

2410439.3A

Project Location

116 S Maple St & 400 W Main St

Fennville, Michigan

Date: 5/15/2024

Sheet: 1 of 1

Modified by: SBE

APPENDIX B
·SOIL BORING LOGS·

DRIESENGA & ASSOCIATES, INC.
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SB-1

Project Name: Fennville LEO Comm Grant Projects
116 S Maple St & 400 W Main St
Fennville, Michigan

Project No. 2410439.3A

Client Name: Viridis Design Group

Date Started	: May 24, 2024	Drilling Company	: Great Lakes Drilling
Date Completed	: May 24, 2024	Field Sampling	: J. Cook
Hole Diameter	: 4-inches	Reviewed By	: S. Ellison
Drilling Method	: Hand Auger	GW Encountered	: Dry
Sampling Method	: Auger Cuttings	GW Completion	:

Water Levels
▼ During Drilling
▽ After Completion

Standard-Hammer Used for SPT

Depth in Feet	Surf. Elev.	USCS	GRAPHIC	DESCRIPTION	Samples	Blow Count	N Value	Pocket Pen (tsf)	Water Level	Moisture Content %
0				GRAVEL - 15 inches						
		SP		Possible Fill - SAND, brown, fine grained, moist.	1					
5										
10										

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SB-2

Project Name: Fennville LEO Comm Grant Projects
116 S Maple St & 400 W Main St
Fennville, Michigan

Project No. 2410439.3A

Client Name: Viridis Design Group

Date Started	: May 24, 2024	Drilling Company	: Great Lakes Drilling
Date Completed	: May 24, 2024	Field Sampling	: J. Cook
Hole Diameter	: 4-inches	Reviewed By	: S. Ellison
Drilling Method	: Hand Auger	GW Encountered	: Dry
Sampling Method	: Auger Cuttings	GW Completion	:

Water Levels
▼ During Drilling
▽ After Completion

Standard-Hammer Used for SPT

Depth in Feet	Surf. Elev.	USCS	GRAPHIC	DESCRIPTION	Samples	Blow Count	N Value	Pocket Pen (tsf)	Water Level	Moisture Content %
0				GRAVEL - 13 inches						
		SW/Fill		Fill - SAND, brown to dark brown, fine to medium grained, moist.	1					
		SW/Fill		Fill - SAND, brown, fine to medium grained, little clay, trace gravel, moist.						
5										
10										

DRIESENGA & ASSOCIATES, INC.
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SB-3

Project Name: Fennville LEO Comm Grant Projects
116 S Maple St & 400 W Main St
Fennville, Michigan

Project No. 2410439.3A

Client Name: Viridis Design Group

Date Started	: May 24, 2024	Drilling Company	: Great Lakes Drilling
Date Completed	: May 24, 2024	Field Sampling	: J. Cook
Hole Diameter	: 6-inches	Reviewed By	: S. Ellison
Drilling Method	: Solid Stem Auger	GW Encountered	: Dry
Sampling Method	: Split-Spoon Sampler	GW Completion	:

Water Levels
▼ During Drilling
▽ After Completion

Standard-Hammer Used for SPT

Depth in Feet	Surf. Elev.	USCS	GRAPHIC	DESCRIPTION	Samples	Blow Count	N Value	Pocket Pen (tsf)	Water Level	Moisture Content %
0				ASPHALT - 4.5 inches						
				GRAVEL - 5 inches						
		SW		SAND, loose to dense, brown, fine to medium grained, trace gravel, moist.	1	7, 20, 18	38			
					2	4, 4, 3	7			
5										
10										

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SB-4

Project Name: Fennville LEO Comm Grant Projects
116 S Maple St & 400 W Main St
Fennville, Michigan

Project No. 2410439.3A

Client Name: Viridis Design Group

Date Started	: May 24, 2024	Drilling Company	: Great Lakes Drilling
Date Completed	: May 24, 2024	Field Sampling	: J. Cook
Hole Diameter	: 6-inches	Reviewed By	: S. Ellison
Drilling Method	: Solid Stem Auger	GW Encountered	: Dry
Sampling Method	: Split-Spoon Sampler	GW Completion	:

Water Levels
▼ During Drilling
▽ After Completion

Standard-Hammer Used for SPT

Depth in Feet	Surf. Elev.	USCS	GRAPHIC	DESCRIPTION	Samples	Blow Count	N Value	Pocket Pen (tsf)	Water Level	Moisture Content %
0				TOPSOIL - 8 inches						
		SW/Fill		Fill - SAND, medium dense, brown to dark brown, fine to medium grained, trace bricks, trace gravel, moist.	1	6, 8, 5	13			
		SP		SAND, medium dense, brown, fine grained, moist.						
		SW		SAND, loose, brown, fine to medium grained, moist.	2	3, 4, 4	8			
5										
10										

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DRIESENGA & ASSOCIATES, INC.
Engineering · Surveying · Testing

SB-5

Project Name: Fennville LEO Comm Grant Projects
116 S Maple St & 400 W Main St
Fennville, Michigan

Project No. 2410439.3A

Client Name: Viridis Design Group

Date Started	: May 24, 2024	Drilling Company	: Great Lakes Drilling
Date Completed	: May 24, 2024	Field Sampling	: J. Cook
Hole Diameter	: 6-inches	Reviewed By	: S. Ellison
Drilling Method	: Solid Stem Auger	GW Encountered	: 7.3'
Sampling Method	: Split-Spoon Sampler	GW Completion	: Dry cave-in at 5.8'

Water Levels
▼ During Drilling
▽ After Completion

Standard-Hammer Used for SPT

Depth in Feet	Surf. Elev.	USCS	GRAPHIC	DESCRIPTION	Samples	Blow Count	N Value	Pocket Pen (tsf)	Water Level	Moisture Content %
0		SW/Fill		Fill - SAND, loose, dark brown, fine to medium grained, trace bricks, trace concrete, trace gravel, moist.	1	4 4 3	7			
		SW		SAND, medium dense, brown to dark brown, fine to medium grained, trace clay, moist.	2	4 5 6	11			
5		SP		SAND, medium dense, light brown, fine grained, moist to wet.	3	6 6 8	14		▼	
		SP		SAND, medium dense, brown, fine grained, wet.	4	8 10 12	22			
10										

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APPENDIX C

·FIELD AND LABORATORY PROCEDURES·

FIELD PROCEDURES

The soil borings were performed using a truck-mounted drill rig –or- All-Terrain Vehicle (ATV)-mounted drill rig equipped with an auto-hammer OR standard hammer. Split-barrel samples were obtained in the soil below the bottom of the augers in general accordance with the Standard Method for Penetration and Split-Barrel Sampling of Soils. Samples were collected at 2.5 feet intervals to 10 feet below grade, and every 5 feet thereafter. After recovery, the samples were removed from the split-spoon sampler, visually reviewed and classified, placed in glass jars and transported to our laboratory for additional review.

Soil samples stored for extended periods are susceptible to moisture loss and are no longer indicative of the conditions originally encountered in the soil borings. Therefore, soil samples are usually stored in our laboratory for a period of 60 days, unless instructed otherwise.

Soil boring logs were prepared based on field notes and visual classification of the samples in the laboratory. Indicated on each soil boring log is the description of each stratum observed, the approximate depth and/or elevation of each stratum change observed, Standard Penetration Test resistance values, and the observed groundwater levels. The soil boring logs are presented in Appendix B.

LABORATORY PROCEDURES

The laboratory testing program included supplementary visual classification of the samples in general accordance with the Unified Soil Classification System. The following two pages describe the soils classification procedure.

CLASSIFICATION OF SOILS FOR ENGINEERING PURPOSES

Per ASTM D 2487—00
(Based on Unified Soil Classification System)

Soil Description: Secondary Soil Type BASIC SOIL TYPE, Consistency/Relative Density, Color, Supplemental Soil Type, Moisture, Miscellaneous comments.

Ex. Silty SAND, loose, brown, fine to medium, trace gravel, moist.

Secondary Soil Type – adjective for the BASIC SOIL TYPE describing material making up greater than 12% but less than 50% of the primary soil type by weight. For sands this also includes a description of grain size (fine, medium or coarse).

BASIC SOIL TYPE – primary constituent of sample; material making up greater than 50% of the sample by weight. Material is classified by grain size and material properties.

Consistency/Relative Density – a measurement of in-situ consistency or density of cohesive or cohesionless soils, respectively, based upon Standard Penetration Testing blow counts (N) per ASTM D 1586.

Color – visual inspection of soil appearance.

Supplementary Soil Type – a description of any other material that may be mixed with the BASIC SOIL TYPE. Qualifying terms are based on the percentage of the supplementary soil type in the sample by weight.

Moisture – description of the in-situ moisture content of the sample (dry, moist or wet).

Miscellaneous Comments – anything observed in the sample or in the field that does not fit into the above categories but should be noted (odor, etc.).

CALIBRATED AUTO HAMMER CONSISTENCY/RELATIVE DENSITY				
COHESIONLESS SOILS		**COHESIVE SOILS**		
SPT N-VALUES	**IN-SITU RELATIVE DENSITY**	**SPT N-VALUES**	**SHEAR STRENGTH (PSF)**	**IN-SITU CONSISTENCY**
0-3	VERY LOOSE	0-1	BELOW 250	VERY SOFT
4-8	LOOSE	2-3	250 - 500	SOFT
9-23	MEDIUM DENSE	4-6	500 - 1,000	MEDIUM STIFF
24-38	DENSE	7-12	1,000 - 2,000	STIFF
>38	VERY DENSE	13-25	2,000 - 4,000	VERY STIFF
		>26	OVER 4,000	HARD

SUPPLEMENTAL TEXTURE QUALIFYING TERMS	
DESCRIPTOR	**PERCENTAGE BY WEIGHT**
TRACE	1-10%
LITTLE	10-20%
SOME	20-35%
AND	35-50%

STANDARD HAMMER CONSISTENCY/RELATIVE DENSITY				
COHESIONLESS SOILS		**COHESIVE SOILS**		
SPT N-VALUES	**IN-SITU RELATIVE DENSITY**	**SPT N-VALUES**	**SHEAR STRENGTH (PSF)**	**IN-SITU CONSISTENCY**
0-4	VERY LOOSE	0-2	BELOW 250	VERY SOFT
5-10	LOOSE	3-4	250 - 500	SOFT
11-30	MEDIUM DENSE	5-8	500 - 1,000	MEDIUM STIFF
31-50	DENSE	9-16	1,000 - 2,000	STIFF
>50	VERY DENSE	17-32	2,000 - 4,000	VERY STIFF
		>32	OVER 4,000	HARD

SOIL CLASSIFICATION CHART (Per ASTM D2487)

Criteria for Assigning Symbols and Group Names Using Laboratory Tests[A]				Soil Classification: Group Symbol	Soil Classification: Group Name
COHESIONLESS SOILS More than 50% retained on No. 200 sieve	Gravels More than 50% of coarse fraction retained on No. 4 Sieve	Clean Gravels Less than 5% fines[C]	Cu ≥ 4 and 1 ≤ Cc ≤ 3[E]	GW	Well-graded gravel[F]
			Cu < 4 and/or 1 > Cc > 3[E]	GP	Poorly graded gravel[F]
		Gravels with Fines More than 12% fines[C]	Fines classify as ML or MH	GM	Silty gravel[F,G,H]
			Fines classify as CL or CH	GC	Clayey gravel[F,G,H]
	Sands More than 50% of coarse fraction retained on No. 4 Sieve	Clean Sands Less than 5% fines[D]	Cu ≥ 6 and 1 ≤ Cc ≤ 3[E]	SW	Well-graded sand[F]
			Cu < 6 and/or 1 > Cc > 3[E]	SP	Poorly graded sand[F]
		Sands with Fines More than 12% fines[D]	Fines classify as ML or MH	SM	Silty sand[G,H,I]
			Fines classify as CL or CH	SC	Clayey sand[G,H,I]
COHESIVE SOILS 50% or more passes the No. 200 Sieve	Silts and Clays Liquid limit less than 50	Inorganic	PI ≥ 7 and plots on or above 'A' line[J]	CL	Lean clay[K,L,M]
			PI < 4 or plots below 'A' line[J]	ML	Silt[K,L,M]
		Organic	Liquid limit - oven dried < 0.75	OL	Organic clay[K,L,M,N]
			Liquid limit - not dried < 0.75		Organic silt[K,L,M,0]
	Silts and Clays Liquid limit 50 or more	Inorganic	PI plots on or above 'A' line	CH	Fat clay[K,L,M]
			PI plots below 'A' line	MH	Elastic Silt[K,L,M]
		Organic	Liquid limit - oven dried < 0.75	OH	Organic Clay[K,L,M,P]
			Liquid limit - not dried < 0.75		Organic silt[K,L,M,0]
HIGHLY ORGANIC SOILS	Primarily organic matter, dark in color, and organic odor			PT	Peat

A Based on the material passing the 3-in. sieve

B If field sample contained cobbles or builders, or both, add "with cobbles or boulders or both" to group name

C Gravels with 5 to 12% fines require dual symbols:
GW-GM well-graded gravel with silt
GW-GC well-graded gravel with clay
GP-GM poorly graded gravel with silt
GP-GC poorly graded gravel with clay

D Sands with 5 to 12% fines require dual symbols:
SW-SM well-graded sand with silt
SW-SC well-graded sand with clay
SP-SM poorly graded sand with silt
SP-SC poorly graded sand with clay

E $Cu = D_{60}/D_{10}$ $Cc = (D_{30})^2/(D_{10}*D_{60})$

F If soil contains ≥ 15% sand, add "with sand" to group name.

G If fines classify as CL-ML, use dual symbol GC-GM or SC-SM

H If fines are organic, add "with organic fines" to group name.

I If soil contains ≥ 15% gravel, add "with gravel" to group name.

J If Atterberg limits plot in hatched area, soil is a CL-ML, silty clay.

K If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel" whichever is predominant

L If soil contains ≥ 30% plus No. 200, predominantly sand, add "sandy" to group name.

M If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name

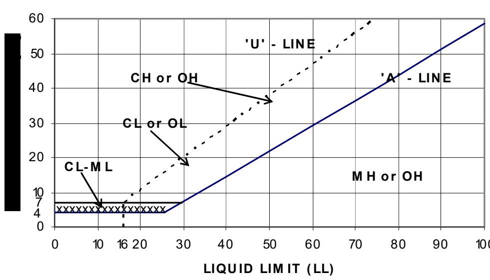
N PI ≥ 4 and plots on or above 'A' line.

O PI < 4 or plots below 'A' line.

P PI plots on or above 'A' line.

Q PI plots below 'A' line.

For classification of fine-grained soils and fine-grained fraction of coarse-grained soils



SIEVE ANALYSIS