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September 15, 2021
Project No. WB-21-054
(SJB Project No. BE-21-054

William T. Severyn
Severyn Development, Inc.
43 Central Avenue
Lancaster, New York 14086

Re: Geotechnical Engineering Report
Proposed Site Development
Sawyer's Landing
Sweet Home Road and Dodge Road
Amherst, New York

Dear Mr. Severyn:

Empire Geotechnical Engineering Services (Empire), is pleased to submit the enclosed Geotechnical Engineering Report for the above referenced project to Severyn Development, on behalf of SJB Services, Inc. (SJB). An electronic copy (pdf file format) of this report has also been emailed, for your use and for distribution, as appropriate.

Please contact me should you have any questions or wish to discuss this report. Thank you for considering SJB/Empire for this work and we look forward to working with you throughout the completion of this project.

Sincerely,

Empire Geotechnical Engineering Services

Wanda M. Allen, P.E.
Geotechnical Engineer

Enc.: Geotechnical Engineering Report

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Geotechnical Evaluation Report for Proposed Site Development Sawyer's Landing Sweet Home Road and Dodge Road Amherst, New York

Prepared For:

Severyn Development, Inc.
43 Central Avenue
Lancaster, New York 14086

Prepared By:

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Empire Geotechnical Engineering Services
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STATE OF NEW YORK
WANDA M. ALLEN
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LICENSED PROFESSIONAL ENGINEER
9/15/21

Project No.: WB-21-054
Ref. SJB Project No.: BE-21-054
September 2021

A Woman Owned Firm

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1.00 INTRODUCTION

1.10 GENERAL

This report summarizes the results of a subsurface exploration program and geotechnical engineering evaluation completed by Empire Geotechnical Engineering Services (Empire) for the proposed Sawyers Landing Housing project planned at Sweet Home Road and Dodge Road in Amherst, New York.

The geotechnical engineering evaluation was completed by Empire at the request of and as authorized by SJB Services, Inc. (SJB), our affiliated drilling and testing company, who was retained by Severyn Development, Inc. (Severyn) to complete this work. Our evaluation and recommendations are based on a total of seven (7) test borings completed by SJB at the proposed project site. In addition, SJB competed laboratory testing on selected soil samples to aid in our evaluation.

Empire prepared this report, which summarizes the subsurface conditions encountered by the test borings and presents geotechnical engineering considerations and recommendations to assist Severyn in the development of the site.

1.20 SITE DESCRIPTION AND PROPOSED DEVELOPMENT

The proposed Sawyer’s Landing Housing project site is located off the north side of Dodge Road, east of Sweet Home Road in Amherst, Erie County, New York. The entrance to the project site is located at the northeast corner of the intersection of Sweet Home Road and Dodge Road. The approximate location of the project site is shown on Figure No. 1. The project site is heavily wooded.

The proposed site development is planned to include construction of forty-nine, two-story, wood framed duplex structures. Three, four-story apartment buildings are also planned which will consist of a combination of steel and wood framed construction. The proposed housing structures are planned to be supported on a shallow spread foundation system. The duplexes may contain a basement structure. The ground floors will be constructed as slab-on-grade.

Based on the subsurface conditions encountered, it appears a shallow spread foundation system should be conducive for the lightly loaded, wood frame type buildings provided the site grade filling is limited and/or completed in a controlled manner with sufficient time provided to allow consolidation of the underlying very soft clay soils, as discussed further below. Depending on the actual wall and column loads, a deep foundation system to support the proposed four-story apartment buildings may be necessary.

The site appears to be relatively level based on the ground surface elevations (El.) obtained at the test boring locations which vary from El. 570.8 feet (B-1) and 571.8 feet (B-3 and B-5). It is our understanding the existing site grades are to be raised six feet, and therefore, if sufficient time is not allotted for consolidation of the underlying very soft clay soils due to site grade fill, then a deep foundation may also be necessary to support the duplex structures, as discussed further below.

A Google Earth™ aerial photograph of the existing site conditions, along with the test boring locations, is presented as Figure 2. A site plan, showing the proposed site development, along with the test boring locations completed as part of this study, is presented on Figure 3.

2.00 SUBSURFACE EXPLORATION

The subsurface exploration program completed consisted of a total of seven (7) test borings, designated as B-1 through B-7. The test borings were completed by SJB between June 1st and 4th, 2021.

The test boring locations were established by Empire on a site plan provided by Severyn. The borings were located to provide general coverage of the proposed site. SJB then established the coordinates of the exploration locations using Google Earth™. The exploration locations were then located / staked in the field, using a handheld GPS instrument with slight modifications for access. The GPS coordinates of the boring locations were then obtained and recorded and used to prepare Figure 2 using a Google Earth™ aerial photograph. The aerial was then overlaid on the site plan provided by Severyn to create Figure 3. The GPS coordinates are summarized on Figure 2. The locations should be considered approximate based on the methodologies utilized.

A laser level was used to determine the ground surface elevation at the test boring locations using the top of the fire hydrant located off the east side of Dodge Road, near the northwest corner of the project site, as a benchmark. The approximate benchmark location is shown on Figure 3. The benchmark has a reported elevation (El.) of 577.69 feet.

The test borings were made with a Central Mine Equipment model 550X, rubber tire all-terrain type vehicle mounted drill rig. The borings were advanced in the overburden soils using hollow stem auger and split spoon sampling techniques until a depth of at least 25 feet below the existing ground surface. Test borings B-1 and B-4 were further advanced until auger refusal was met at depths of 58.0 feet and 59.0 feet, respectively. Split spoon samples and Standard Penetration Tests (SPTs) were taken continuously from the ground surface to a depth of 16 feet or 18 feet and then in intervals of five feet or less until boring completion or until sample spoon refusal was met at depths of 56.1 feet and 56.2 feet. The split spoon samples and SPTs were completed in general accordance with *ASTM D1586 – "Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils"*.

A relatively undisturbed Shelby tube sample of the very soft clay soils was obtained between depths of 30.0 feet and 32.0 feet from test boring B-4 for laboratory testing. The Shelby tube sample was obtained in general accordance with *ASTM D 1587 - "Standard Practice for Thin-Walled Tube Geotechnical Sampling of Soils"*.

The refusal material encountered in boring B-4 was cored using a NQ size double tube core barrel in accordance with *ASTM D 2113 – "Standard Practice for Rock core Drilling and Sampling of Rock for Site Investigation"*. Three (3) feet of the refusal material was cored at this location after reaching auger refusal.

A geologist from SJB prepared the test boring logs based on visual observation of the recovered soil and rock samples and review of the driller's field notes. The soil samples were described based on visual/manual estimation of the grain size distribution, along with characteristics such as color, relative density, consistency, moisture, etc. In addition, the Unified Soil Classification System (USCS) group symbols were also established and are presented on the logs for the soil types encountered. The recovered core sample was also described, including characteristics such as color, rock type, hardness, weathering, bedding thickness, core recovery and rock quality designation (RQD). The test boring logs are presented in Appendix A, along with general information and a key of terms and symbols used to prepare the logs.

3.00 LABORATORY TESTING

Selected recovered soil samples from the test borings, including the clay soil collected from the Shelby tube sample were tested in SJB's geotechnical testing laboratory to confirm soil classifications and provide index properties to aid in our recommendations. The laboratory testing program included the following tests:

- Moisture content testing in general accordance with *ASTM D 2216 – "Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass"*;

- Grain size analysis in general accordance with *ASTM D 6913 – "Standard Test Method for Particle-Size Distribution (Gradation) of Soils using Sieve Analysis"*;

- Liquid limit, plastic limit and plasticity index of cohesive fine grained soil samples in accordance with *ASTM D 4318 – "Standard Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils"*;

- Torvane shear and pocket penetrometer testing of undisturbed portions of the clay soil extracted from the Shelby tube sample to provide an estimated indication of the undrained shear strength of the clay soil. The torvane shear testing was performed in general accordance with *ASTM D 4648 – Standard Test Method for Laboratory Miniature Vane Shear Test for Saturated Fine-Grained Cohesive Soils*;

- Consolidation testing of an undisturbed portion of the clay soil extracted from the Shelby tube sample in accordance with *ASTM D 2435 – "Standard Test Method for One-Dimensional Consolidation Properties of Soils Using Incremental Loading";* and

The results of the laboratory test data are summarized further below and are presented in Appendix B.

4.00 SUBSURFACE CONDITIONS

The general stratigraphy encountered in the test borings consisted of surface topsoil followed by indigenous sand, silty clay and gravel soil deposits overlying Shale rock. Man placed fill soils were not apparent at the test boring locations. However, it should be expected that fill soils and/or possible reworked indigenous soils will be encountered near the adjacent, previously developed properties. The soil and bedrock stratigraphy encountered, and the groundwater conditions observed are described in more detail below and on the test boring logs in Appendix A.

The upper indigenous soils consisted predominately of brown to gray, fine to coarse sand with varying amounts of silt, clay and gravel. Beneath the sand soils, at depths varying from about 2 feet to 8 feet, brown to brown-gray, silty clay soil deposits were encountered. The silty clay soils extend to boring completion at the shallower test boring locations. At test boring locations B-1 and B-4, brown to gray, fine gravel intermixed with varying proportions of fine-coarse sand and silty clay was recovered in the split spoons collected below depths of about 40 feet. The indigenous soils are classified as CL, SC-SM, SM-SC, SP-SW, GC-GM and GP group soils using the Unified Soil Classification System (ASTM D2488).

The SPT "N" values obtained in the indigenous silty clay soil deposits ranged from "w.o.h. - weight of hammer" (i.e. the sample spoon was advanced with only the weight of the drop hammer and drill rods applied statically to the sample spoon) to 22, indicating the cohesive soils vary from a very soft to very stiff consistency. The medium to very soft consistency clay soils were encountered generally at and below a depth of about 10 to 12 feet at the test boring locations. The relative density of the upper sand soils varies from loose to firm based on SPT "N" values ranging from 5 to 25. The underlying, gravel soil deposits are of a firm to very compact relative density based on SPT "N" values ranging from 21 to greater than 50. Sample Spoon Refusal – "REF" (i.e. 50 blows to advance the split spoon with 6-inches or less of penetration) was also encountered within the gravel soil deposits which can be an indication that some cobbles and boulders are present.

Auger refusal was encountered in test borings B-1 and B-4 at depths of 58.0 feet and 59.0 feet, respectively, corresponding to El. 512.8 feet and El. 512.6 feet. The refusal material encountered at boring B-4 was cored after auger refusal was met.

The upper 6-inches or so of the material recovered consisted of brown, fine-coarse sand with some silty clay and little fine gravel. Beneath the sand, gray Shale rock was recovered. The Shale rock is described as gray, hard, highly weathered, laminated to bedded. Both natural and mechanical fractures were noted within the rock core recovered. The core recovery for the Shale rock was 83%, while the rock quality designation (RQD) value was 14%, indicating the recovered rock core has a very poor rock mass quality.

Water level measurements were made in the test borings at the completion of overburden drilling and soil sampling and are noted on the subsurface exploration logs in Appendix A. Freestanding water was present in borings B-1 and B-4 at depths of about 6 feet and 10.8 feet, respectively. Freestanding water was not present in the remaining test holes immediately following the completion of drilling operations. Given the fine grained indigenous clay soils present, which can partially seal the sides of the boreholes, it appears groundwater did not have sufficient time to accumulate or fully stabilize in the boring holes within the time that had elapsed from the completion of drilling operations and the time of the observations/measurements. It appears that the clay soils are saturated at a depth of about 10 feet and below, based on the moist-wet to wet nature and relatively softer consistency of the clay soils obtained at and below this depth.

In addition, based on the moist-wet to wet nature of the upper sand soil deposits, it should be expected that some zones of perched or trapped groundwater could be present at various times and locations in the upper more permeable indigenous sand soils, which overlie the less permeable clay soil deposits. Perched groundwater conditions can be particularly more prevalent following heavy or extended periods of precipitation and during seasonally wet periods.

The installation of a groundwater observation well(s) would help to better define the groundwater conditions present on the site. It should be expected that groundwater conditions could vary with location and with changes in soil conditions, precipitation and seasonal conditions, including site drainage conditions.

5.00 LABORATORY TESTING RESULTS

The grain size analyses of the samples obtained at test boring locations B-5 and B-7 generally confirmed our visual soil classifications as summarized on test boring logs included in Appendix A.

The moisture content of the silty clay soil samples tested from test boring B-4, between depths of about 8 feet to 37 feet, generally increase with depth from 23.9% to 48.9% The moisture content, liquid limit, plastic limit and plasticity index of the silty clay soil samples tested from the borings are as follows:

Summary of Moisture Contents and Atterberg Limits					
Boring	Sample Depth	Moisture Content	Liquid Limit	Plastic Limit	Plasticity Index
B-1	10'-12'	39.4 %	44	18	26
B-4	14'-16'	40.0 %	36	17	19
B-4	30'-32'	46.5 %	49	23	26

The plasticity indices indicate the silty clay deposits vary from a medium (plasticity index less than 20) to high plasticity (plasticity index greater than 20).

Consolidation testing and the undrained shear strength (Torvane and Pocket Penetrometer values) of the Shelby tube sample obtained within the very soft clay soil (B-4, 30'-32'), suggest that these soil deposits have a pre-consolidation pressure in the range of about 0.7 to 1.0 tsf. Based on the current overburden stress, the stratum of soft to very soft silty clay is considered to be normally consolidated. Accordingly, the settlement from placement of the site grading fill load is expected to the result in predominately virgin consolidation within this stratum.

The modified recompression index ($C_r/1+e_o$), obtained from the consolidation test was 0.026 and the modified compression index ($C_c/1+e_o$) was 0.141. The time rate coefficient of consolidation within the virgin loading range of around 1.5 tsf was about 0.05 ft^2/day.

The Torvane shear strength and Pocket Penetrometer unconfined compressive strength tests performed on the Shelby tube samples resulted in an undrained shear strength in the range of 180 (psf) to 280 psf. The Torvane and Pocket Penetrometer tests are considered to be a crude test indicator and therefore may not be fully representative of the undrained shear strength.

Refer to the laboratory test data presented in Appendix B for additional information.

6.00 GEOTECHNICAL CONSIDERATIONS AND RECOMMENDATIONS

6.10 GENERAL

Development of the proposed Sawyer's Landing project site will be impacted primarily by the very soft to medium clay soils encountered at and below a depth of about 10 to 12 feet. These soil conditions are considered marginal for the support of building structures on a spread foundation system, particularly if heavier structure loads would be planned, such as associated with multiple story steel frame and concrete/masonry buildings and large spans. Support of the relatively lightly loaded, wood framed building structures, as currently planned, however, can be accomplished using a spread foundation system, provided a relatively low bearing pressure [1,250 pounds per square foot (psf)] is used for the spread foundation design and that net site grade fills are limited to around 1 to 2 feet or less.

In addition, foundations should also not be designed to bear at grades lower than about El. 564 feet to provide sufficient separation from the underlying very soft to medium clay soils with regard to bearing capacity and settlement. Continuous wall footings should also not be greater than 2.5 feet in width, and column footings should not be greater than 5.0 feet in width, in order to limit potential bearing/shearing failure and excess settlement. Accordingly, the wall and column loads would be limited to about 3.1 kips per square feet and 31 kips, respectively.

In all cases a minimum of 30-inches of separation between the bottom of the footings and the very soft to soft clay soils will need to be maintained. Accordingly, if the foundations are to be constructed below an elevation of about 564 feet, corresponding to a depth of about 7 to 8 feet below existing site grades, the existing soils would need to be removed a minimum of 30-inches and replaced with Engineered fill (i.e. compacted Structural Fill or flowable fill), to provide the necessary separation between the bottom of the footings and the softer clay soils.

As mentioned above, currently about 6 feet of site grade fill is planned for site development. Therefore, it does not appear any of the building foundations will bear below about El. 564 feet. However, the proposed site grading should be reviewed for each individual building to determine if undercutting maybe required. Additional test borings, or excavation of test pits at the time of construction, could be completed to determine the actual depth/elevation of the medium to very soft clay soils as compared to the proposed bearing grade elevations, at each building location where footings may bear near El. 564 feet. In addition, due to the upper generally loose soil conditions in correlation with the poorly graded silty sand soils, which are highly sensitive to disturbance and strength degradation when groundwater is present, it should be anticipated that the foundation bearing grades may need to be undercut in localized areas to establish a firm and stable subgrade for the foundations. The subsurface conditions between and away from the test boring locations are also expected to vary and may require adjustments in the suitable subgrade elevation based on actual conditions encountered at the time of construction. Accordingly, close inspection of the foundation bearing grades by qualified geotechnical personnel should be required at the time of construction.

Placement of subgrade fill to raise site grades, as anticipated, will need to proceed sufficiently ahead of foundation and slab on grade construction. Currently, net grade increases of about 6 feet of fill are planned across the proposed project site.

The surcharge weight of approximately 2 feet of fill is expected to result in a total of around 2-inches of consolidation settlement within the underlying soft to very soft clay soil deposits. It is estimated that 6 feet of fill could potentially result in a total of about 5 to 6-inches of consolidation settlement. The settlement from the surcharge weight of the site grading fill placement will be independent of the additional settlement (i.e. about ¾-inch) that will occur from the duplexes' structural loads.

It is anticipated that where site grade increases within an individual building structure is generally uniform, the settlement should be relatively uniform and therefore would have minimal impacts on the building foundations and ground floor slabs. However, if the site grade fill within an individual building would vary from about nil to 2 feet, differential settlement on the order of 2-inches could occur and therefore may result in cracking and distortion of the building foundations and floor slabs. The Structural Engineer should be consulted to determine a tolerable range for differential settlement.

The time rate for about 60% to 70% of the consolidation settlement to occur from the site filling is estimated to be about 3 to 4 years. "Surcharging" the building site(s) to decrease the time allotted for consolidation of the clay soils could be considered. Accordingly, the site grade fill could be overbuilt 4 to 5 feet above the finished floor grades to provide some additional surcharging to further induce, and help accelerate, the settlement. Any additional fill should extend out about 20 feet from the building limits and should then be removed a few weeks prior to the foundation and building construction. The site grade fill can proceed following proper preparation of the subgrades as summarized in Section 6.70.3. All fill placement and compaction should be closely monitored and tested on a "full-time" basis by qualified geotechnical personnel, as recommended in Appendix C.

The installation of wick drains could also be considered to shorten the time period to allow consolidation settlement to occur. A settlement monitoring program (i.e. installation of settlement plates and piezometers) should be implemented for the fill construction to monitor the settlement and confirm that the settlement has generally stabilized. This should be implemented especially in any areas at which the amount of fill placement within an individual building will vary by more than 2 feet to limit differential settlement effects.

If the project schedule cannot accommodate a preloading waiting period, load compensation with geofoam blocks or depressed raft foundations may be a possible alternative. In this way, the geofoam block or raft foundation would be used in place of normal weight fill and used to replace existing soils as necessary such that there is no increase in net load beneath the foundations and floor slabs. Lightweight aggregate fill may also be an option to mitigate settlement.

Alternatively, support of the building foundations and floor slabs (structural floor) on a deep foundation system could be considered. However, negative skin friction (downdrag forces) due to the site filling settlement would need to be considered in the design of deep foundations. It should be anticipated that on-going maintenance of the pavement areas and underground utilities may also be necessary due to consolidation of the underlying subgrade soils if these areas are not preloaded.

Empire can be consulted to further assist in planning the site grade fill options (surcharging/wick drains/settlement monitoring plates and piezometers) to ensure the majority of the consolidation settlement will occur prior to foundation and slab on grade floor construction, or the options for use of a deep foundation system.

More detailed recommendations to assist in planning for site development and design of building foundations and slab-on-grade floor construction are provided in the following report sections.

6.20 SPREAD FOUNDATION DESIGN

Spread foundations should bear on suitable, relatively undisturbed, indigenous soil subgrades or they can bear on Engineered Fill (i.e. compacted Structural Fill or Flowable Backfill) placed over suitable indigenous soil subgrades. Suitable indigenous soil bearing grades should consist of generally stiff, silty clay and firm silty sand soil deposits, which are free of topsoil, fill, organics, loose, soft, wet, "mucky" or otherwise deleterious conditions.

Suitable indigenous bearing subgrades at the test boring locations were generally encountered at a depth of about 2 feet below existing site grades. However, as noted above, foundations should not be designed to bear below about El. 564 feet, corresponding to a depth of about 7 to 8 feet below existing site grades, due to influence of the softer clay soils with regard to bearing capacity and settlement.

In areas where the proposed foundations will bear on site grade fill, it is recommended the final 1.5 feet of fill consist of Structural fill. If Structural Fill is placed beneath spread foundations, it should extend beyond the foundation limits a horizontal distance equal to at least 0.75 times the thickness of the Structural Fill layer beneath the foundation. Excavations, therefore, will need to be planned and sized accordingly. Recommendations for Structural Fill material along with its placement and compaction are presented in Appendix C. An underlying stabilization geotextile (i.e. Mirafi 500X or suitable equivalent) should be placed beneath the compacted Structural Fill material.

Flowable backfill material, if used as Engineered fill beneath foundations, should consist of a non-swelling cement - fine aggregate type material and should have a minimum 28-day compressive strength (f'c) of 250 pounds per square inch (psi). The flowable backfill should extend at least 12 inches horizontally beyond the foundation limits for its entire depth.

Spread foundations constructed on suitable indigenous soil bearing grades or on properly constructed Engineered Fill materials placed over the suitable soil bearing grades can be sized based on a maximum net allowable bearing pressure of 1,250 psf. However, it is recommended that continuous wall footers not exceed 2.5 feet in width and isolated column foundations not exceed 5.0 feet in width.

Interior building foundations should be embedded a minimum of 1.0 foot below the finished floor elevation to develop adequate bearing capacity. Exterior foundations should be embedded a minimum of 4.0 feet below finished exterior grades for frost protection. All foundations, however, must bear on suitable bearing grades in accordance with our recommendations.

It is estimated that spread foundations sized and properly constructed in accordance with our site preparation recommendations would undergo normal consolidation settlement of around ¾-inch. The foundation settlement is independent from the settlement due to the surcharge weight of site grade fill, as discussed above.

6.30 SLAB-ON-GRADE FLOOR DESIGN

The slab-on-grade floor for the proposed buildings can be constructed over the existing soil subgrades or on properly placed and compacted site grade fill, which is placed to raise site grades following proper subgrade preparation, as outlined in Section 6.70.3. If any organic soils are present at the subgrade elevation, they should be removed and replaced with compacted Suitable Granular Fill or Structural Fill as described in Appendix C.

A minimum of 8 inches of Subbase Stone is recommended beneath the lightly loaded floor slabs. The subbase stone should be increased to 12 inches where heavier loading conditions are anticipated (i.e. mechanical rooms, storage areas, etc.). Recommendations for Subbase Stone are presented in Appendix C. A suitable stabilization/separation geotextile, such as Mirafi 500X, should be placed over the existing soil subgrades prior to placement of Suitable Granular Fill to raise the site grades, where necessary, or the subbase stone layer.

The floor slabs may be designed as slab-on-grade using a modulus of subgrade reaction of 150 pounds per cubic inch (pci) at the top of the subbase layer. It is recommended that the slab-on-grade floors be constructed such that they float on the subbase and subgrades and are not structurally connected to, or resting directly on, perimeter walls or column footings in order to limit potential differential settlement effects, unless the slab / wall or column interface is designed with sufficient reinforcement to bridge potential differential settlement effects at these interfaces.

It is noted that the above subbase stone thicknesses are not designed for carrying construction vehicle loads. Therefore, it may be desirable for the Contractor to temporarily increase the Subbase Stone thickness within the building pad areas to provide a suitable working surface to stage the construction, carry construction vehicle loads and protect the underlying subgrades. This will be particularly important if construction proceeds during seasonally wet periods. The additional subbase stone material could then be removed in preparation for the actual floor construction and re-used as foundation backfill, pavement subbase, or as otherwise determined appropriate.

6.40 LATERAL EARTH PRESSURES FOR BELOW GRADE WALL DESIGN

The below grade walls of the basement structure should be designed based on lateral earth pressures caused by the load of backfill against the wall and the surcharge effects from any permanent or temporary loads. In addition, due to the possible presence of perched groundwater conditions, foundation drains to relieve potential hydrostatic pressure against the walls, along with damp proofing, as discussed below, should be incorporated into the design. Alternatively, basement structures could be designed to resist potential full hydrostatic pressure. In such case it should also be waterproofed.

Below grade walls should be designed to resist “at rest” lateral earth pressure computed on the basis of an “equivalent fluid unit weight” of 65 pounds per cubic foot (pcf). This is based on the assumption that suitable perimeter exterior foundation drainage will be provided, and the wall backfill beyond the drainage system is a Suitable Granular Fill or Structural Fill, as described in Appendix C.

6.50 FOUNDATION DRAINS

Depressed foundation walls should include a foundation drainage system to intercept any perched groundwater and relieve potential hydrostatic pressures from developing against the walls. The foundation drainage system should be properly designed, installed and maintained for long-term performance and should drain to a sump and pump system or gravity drain to a down slope relief point. The foundation drainage system design should include the following:

1. It is recommended that the exterior of the foundation walls be coated with an appropriate damp proofing material.

2. The foundation drainage system should include a drainage/separation geotextile installed around drainage stone, which surrounds a slotted under-drainpipe. The drainage stone should be sized in accordance with the pipe slotting. A crushed aggregate conforming to NYSDOT Standard Specifications Section 703-02, Size Designation No. 1 (½-inch washed gravel or stone) is generally acceptable for slotted under-drainpipe. The foundation under-drainpipes should be set at a depth of about 1 foot below the top of the finish floor grade.

3. A pervious granular backfill or a suitable geosynthetic drainage composite (i.e. Miradrain, Delta MS, etc.) should be placed against the foundation wall, above the drainage system, to allow infiltration to the drainage system. Concrete Sand, which meets the minimum requirements of NYSDOT Standard Specifications Section 703-07 (100 percent passing 3/8 inch sieve to maximum of 3 percent passing a No. 200 sieve), is generally acceptable as pervious granular backfill. Crusher run stone Structural Fill is also acceptable. The pervious granular backfill against the wall should be a nominal 2 feet in width and should extend to about 1 to 2 feet below the finished grade surface, where it may be capped off with the on-site soil.

6.60 SEISMIC DESIGN CONSIDERATIONS

Based on the subsurface conditions encountered in the test borings, the proposed Sawyer's Landing Housing project site should be classified as Seismic Site Class "E" in accordance with ASCE 7-16, Table 20.3-1, as referenced in the 2020 Building Code of New York State (IBC 2018). Therefore, seismic design can be based on this seismic site classification.

The spectral response accelerations at the project site were obtained by Empire using the SEAOC / OSHPD web site application https://seismicmaps.org/. Using the site location, the spectral response accelerations are 0.169g for the short period (0.2 second) response (S_S) and 0.045g for the one second response (S_1). For design purposes, these spectral response accelerations must be adjusted for the Seismic Site Class "E" soil profile determined for the project site.

Accordingly, the adjusted spectral response accelerations for Site Class "E" are as follows:

- Short Period Response (S_{MS}) - 0.406g
- 1 Second Period Response (S_{M1}) - 0.190g

The corresponding five percent damped design spectral response accelerations (S_{DS} and S_{D1}) are as follows:

- S_{DS} - 0.271g
- S_{D1} - 0.126g

6.70 SITE PREPARATION AND CONSTRUCTION

6.70.1 Construction Dewatering

It is anticipated permanent groundwater conditions are present at a depth of about 8 to 10 feet below existing site grades. Therefore, deeper utility excavations may encounter permanent groundwater conditions. It is anticipated that shallow excavations will encounter perched groundwater. Accordingly, construction dewatering will be required for surface water control and for excavations, which encounter groundwater conditions.

Surface water should be diverted away from and prevented from accumulating on exposed soil subgrades. The exposed soil subgrades will be susceptible to strength degradation in the presence of excess moisture. Surface water should be controlled with diversion berms, swales, and proper site grading.

Dewatering should be implemented in conjunction with excavation work such that the work generally proceeds in the dry. Groundwater levels should be maintained at least 1 to 2 feet below the bottom of the foundation excavations. It is anticipated that diversion berms, proper site grading, and sump and pump methods of dewatering will be sufficient to control surface water and perched groundwater conditions, if encountered. Placement of a working mat of drainage stone, in the bottom of the excavation, in conjunction with sumps and pumps placed in the drainage layer, will also aid in dewatering these excavations. Surface water and groundwater dewatering plans should include implementation of measures to control erosion, sedimentation and the migration of soil fines.

6.70.2 Excavation and Foundation Construction

All topsoil, organics, disturbed soils, and any soft, loose, wet or otherwise deleterious indigenous soil material, beneath the proposed foundation bearing grades, should be undercut and removed. Resulting excavations should be backfilled with controlled Structural Fill or flowable backfill.

Excavation to the proposed foundation bearing grades should be performed using a method, which reduces disturbance to the indigenous soil bearing grades, such as a backhoe equipped with a smooth blade bucket. The proposed foundation bearing grades should be observed and evaluated by qualified geotechnical personnel, prior to placement of Engineered Fill and/or the foundation. Any placement and compaction of Structural Fill beneath foundations should be observed and tested by qualified personnel.

All soil bearing grades for foundation construction should be protected from precipitation and surface water. Water should not be allowed to accumulate on the soil bearing grades and the bearing grades should not be allowed to freeze, either prior to or after construction of foundations. If bearing grades are not protected and degrade, they must be undercut/removed accordingly.

After completion of the foundation construction, the excavations should be backfilled as soon as possible and prior to construction of the superstructure. It is recommended that the foundation excavations, within slab-on-grade and pavement areas, be backfilled with a Suitable Granular Fill or Structural Fill, as described in Appendix C.

6.70.3 Subgrade Preparation for Slab-On-Grade Construction

The site preparation work should be performed during dry periods to minimize potential degradation of the subgrade soils and undercuts which may be required to establish a stable base for construction. It should be understood that the existing subgrade soils will be sensitive and can be expected to degrade and lose strength when they are wet and disturbed by construction equipment traffic.

Accordingly, efforts should be made to maintain the subgrades in a dry and stable condition at all times and minimize construction traffic directly over these soils. These efforts should include installation of drainage swales and underdrains (i.e. “French drains”) to intercept and divert surface runoff and groundwater away from the construction areas, proper grading and sloping of the subgrade and “sealing” of the surface, at the end of each day or when rain is anticipated, with a smooth drum roller to promote runoff, and restricting construction equipment traffic from traveling directly over the subgrade surfaces, especially when they are wet.

All trees, stumps, tree root matter, vegetation, topsoil, and any other deleterious materials within the proposed slab-on-grade and pavement areas should be removed. It is noted that the upper surface soils (i.e. above a depth of about 2 feet) are relatively loose/soft. Standing water was also noted across the project site. In addition, organics were noted within the upper soil samples. Therefore, it should be anticipated that stripping the site beyond the topsoil layer will be necessary to remove the soft/wet and/or organic soils present. As noted, the site preparation work should be performed during seasonal dry periods to minimize potential degradation of the subgrade soils and undercuts which may be required to establish a stable base for construction. In addition, the surface soils are considered to have generally very poor drainage characteristics, and therefore, proper grading of the project site should be considered during the development of the project.

Following stripping of the surface materials and underlying organic indigenous soils, the exposed subgrades should be proof-rolled. The proof-rolling should be performed, prior to the any overlying fill placement, using a smooth drum roller weighing at least 10 tons. The roller should be operated in the static mode and complete at least two (2) passes over the exposed subgrades. The subgrade proof-rolling should be done under the guidance of, and observed by, qualified geotechnical personnel. It may be necessary to waive the proof-rolling requirement if wet subgrades are present. Any undercuts, which may be required as the result of the proof-rolling, should be performed based on guidance and evaluation of the conditions of qualified geotechnical personnel.

The placement of an initial lift of oversized stone fill material (i.e. "6-inch minus crusher run stone", No.3 & No.4 Stone, etc.), encased in stabilization geotextile (i.e. Mirafi 500X or suitable equivalent) top and bottom, as appropriate, can also be used to help stabilize subgrades prior placement of site grade fil or subbase material, if any of the existing subgrades are found to be in a soft/wet condition.

Subgrade fill placement may proceed following preparation and acceptance of the existing subgrades. As mentioned above, the fill required to raise site grades in the proposed building areas will need to proceed sufficiently prior to the foundation construction. This would allow the settlement associated with the site grade increases to occur prior to the foundation construction and thus minimize post construction foundation settlement. Suitable Granular Fill or Structural Fill, as described in Appendix C can be used as subgrade fill to raise the site grades, beneath the Subbase Stone course for slab-on-grade and pavement construction. Fill containing topsoil, organics, man-made rubble constituents, and otherwise unsuitable soils should not be used for subgrade fill within the building and pavement areas. All fill placement and compaction should be closely monitored and tested on a “full-time” basis by qualified geotechnical personnel.

In general, depending on the time of year (predominantly summer months), the on-site soils can be used for constructing the fills for establishing the building pad and pavement areas, provided they can be properly placed and compacted in a controlled manner and to a stable well engineered condition. However, it should be expected that the use of the fine grained on-site soils for site filling will be difficult to work with (i.e. dry for proper compaction) versus an imported Suitable Granular Fill or Structural fill, particularly during seasonally inclement or wet weather, which could delay construction.

In all cases, subgrade fill should be placed to a stable condition and should not “pump” or show signs of movement or significant deflection (i.e. unstable conditions) as it is being constructed. The contractor should take precautions to limit construction traffic over the subgrades. Any subgrades, including existing soil subgrades or new subbase, which become damaged, rutted or unstable should be undercut and repaired as necessary prior to placement of the subbase course or pavement. The fill subgrades should also be properly graded, drained and protected from moisture and frost. Placement of fill over wet, soft, snow covered, or frozen subgrades is not acceptable.

7.00 CONCLUDING REMARKS

This report was prepared to assist in development of the Sawyers Landing Housing Project planned at Sweet Home Road and Dodge Road in Amherst, New York. The report has been prepared for the exclusive use of Severyn Development, Inc. and other members of the design team, for specific application to this site and this project only.

The project information and recommendations presented in this report were prepared based on Empire’s understanding of the proposed project and the subsurface exploration work completed by SJB Services, Inc. as described herein, and through the application of generally accepted soils and foundation engineering practices. Empire should be consulted with any questions regarding the interpretation of the findings of our work, and/or the geotechnical considerations and recommendations presented. In addition, the recommendations presented are provided as guidance to the designer and should not be considered a project specification. No warranties expressed or implied are made regarding the subsurface conditions present, or by the conclusions, opinions, recommendations or services provided.

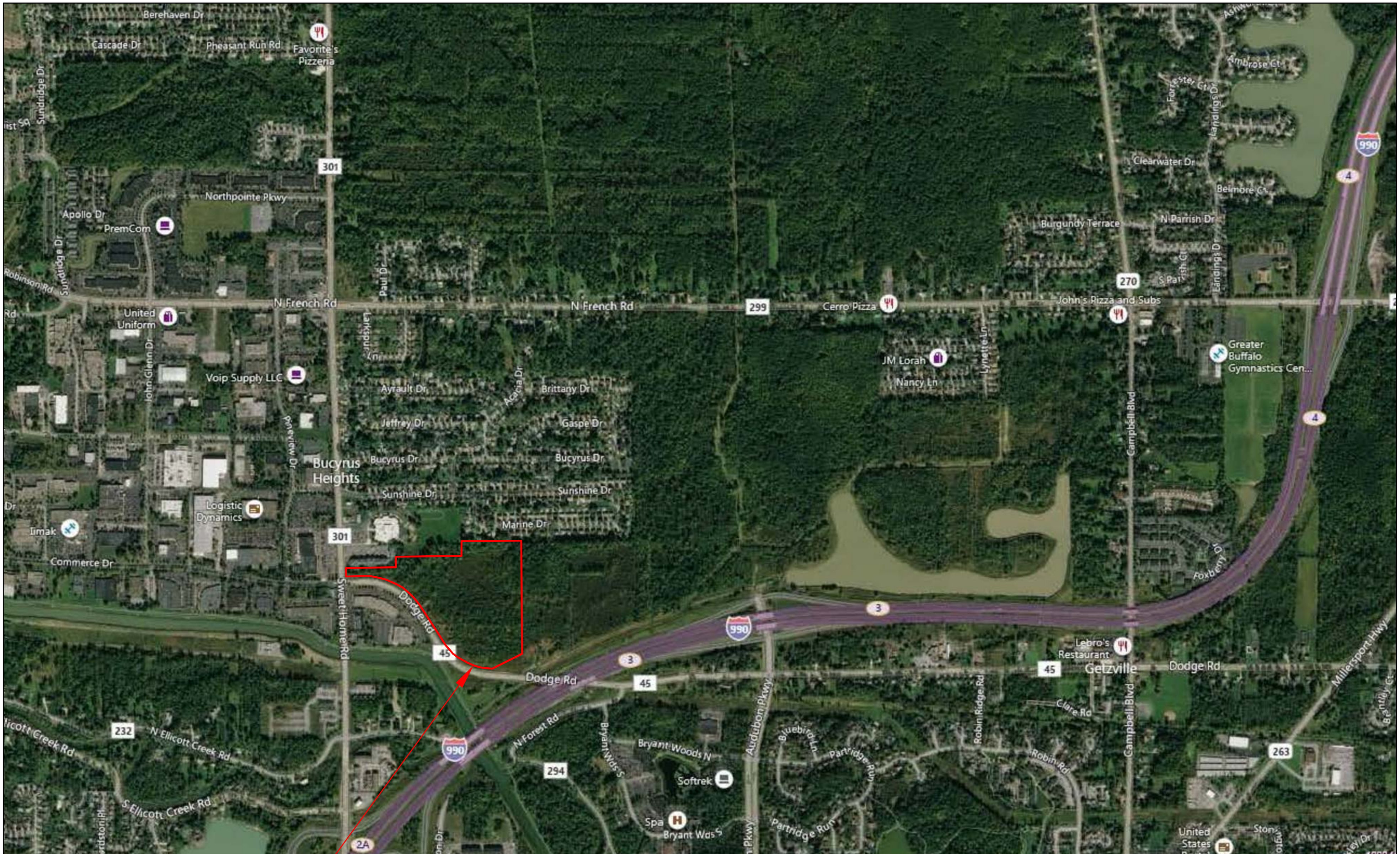
Additional information regarding the use and interpretation of this report is presented in Appendix D.

Respectfully Submitted:

WMA Engineering, DPC dba
EMPIRE GEOTECHNICAL ENGINEERING SERVICES

Wanda M. Allen, P.E.
Senior Geotechnical Engineer

FIGURES



APPROXIMATE LIMITS OF
PROPOSED DEVELOPMENT

N

NOTE:

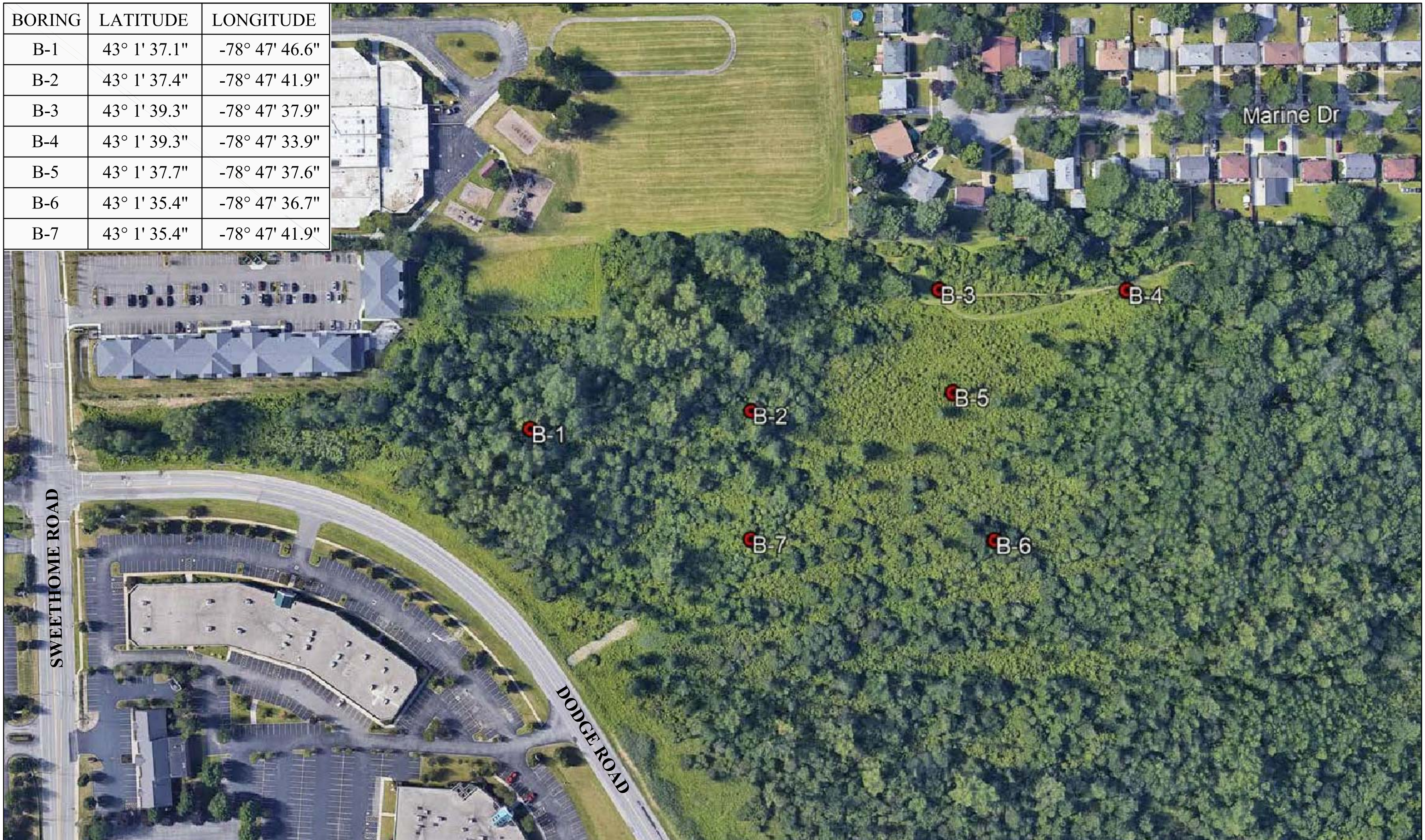
SITE LOCATION PLAN DEVELOPED FROM BING MAPS

WMA ENGINEERING DPC|DBA
EMPIRE GEO TECHNICAL
ENGINEERING SERVICES

PROPOSED SITE DEVELOPMENT
SAWYER'S LANDING
SWEET HOME ROAD & DODGE ROAD
AMHERST, NEW YORK

SITE LOCATION PLAN	DR BY: WMA	SCALE: NTS	PROJECT NO.: WB-21-054
	CHKD BY: WMA	DATE: 06/10/2021	FIGURE NO: 1

BORING	LATITUDE	LONGITUDE
B-1	43° 1' 37.1"	-78° 47' 46.6"
B-2	43° 1' 37.4"	-78° 47' 41.9"
B-3	43° 1' 39.3"	-78° 47' 37.9"
B-4	43° 1' 39.3"	-78° 47' 33.9"
B-5	43° 1' 37.7"	-78° 47' 37.6"
B-6	43° 1' 35.4"	-78° 47' 36.7"
B-7	43° 1' 35.4"	-78° 47' 41.9"



LEGEND:

B-1 ● INDICATES APPROXIMATE LOCATION AND DESIGNATION OF TEST BORING.

N

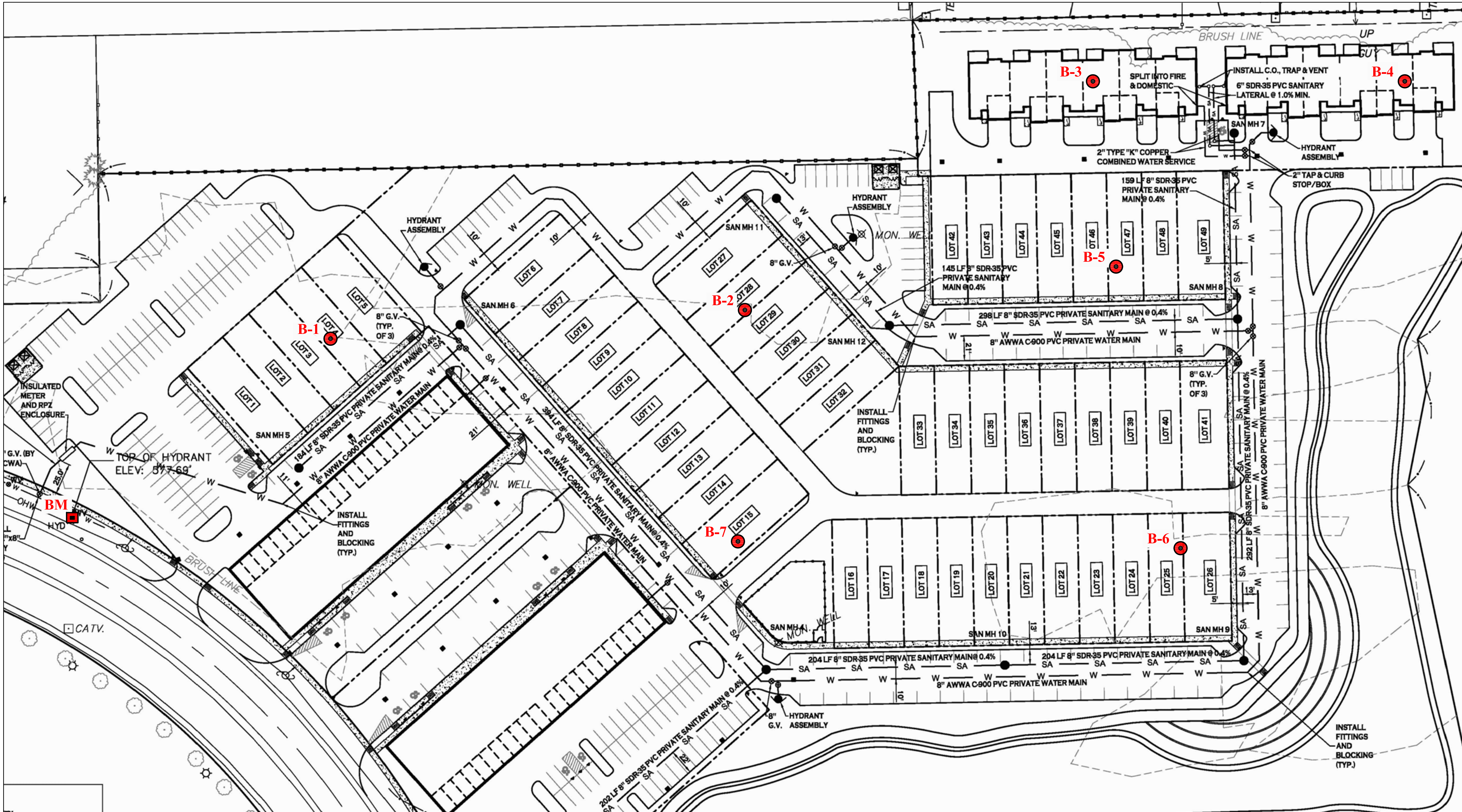
NOTE:

FIGURE DEVELOPED FROM GOOGLE EARTH

WMA ENGINEERING DPC|DBA
EMPIRE GEOTECHNICAL ENGINEERING SERVICES

PROPOSED SITE DEVELOPMENT
SAWYER'S LANDING
SWEET HOME ROAD & DODGE ROAD
AMHERST, NEW YORK

SUBSURFACE EXPLORATION PLAN (EXISTING SITE CONDITIONS)	DR BY: WMA	SCALE: NTS	PROJECT NO.: WB-21-054
	CHKD BY: WMA	DATE: 06/10/2021	FIGURE NO: 2



LEGEND:

B-1 ● INDICATES APPROXIMATE LOCATION AND DESIGNATION OF TEST BORING.

BM ■ BENCHMARK: TOP OF FIRE HYDRANT. REPORTED ELEVATION = 577.69 FEET.

NOTE:

FIGURE DEVELOPED FROM 2/15/21 "UTILITY PLAN" PREPARED BY CARMINA WOOD MORRIS, DPC.

N

80 0 80
SCALE FEET

WMA ENGINEERING DPC|DBA EMPIRE GEOTECHNICAL ENGINEERING SERVICES	PROPOSED SITE DEVELOPMENT SAWYER'S LANDING SWEET HOME ROAD & DODGE ROAD AMHERST, NEW YORK		
SUBSURFACE EXPLORATION PLAN (PROPOSED SITE DEVELOPMENT)	DR BY: WMA	SCALE: 1" ~ 80'	PROJECT NO.: WB-21-054
	CHKD BY: WMA	DATE: 06/10/2021	FIGURE NO: 3

APPENDIX A

SUBSURFACE EXPLORATION LOGS

GENERAL INFORMATION & KEY TO SUBSURFACE LOGS

The Subsurface Logs attached to this report present the observations and mechanical data collected by the driller at the site, supplemented by classification of the material removed from the borings as determined through visual identification by technicians in the laboratory. It is cautioned that the materials removed from the borings represent only a fraction of the total volume of the deposits at the site and may not necessarily be representative of the subsurface condition between adjacent borings or between the sampled intervals. The data presented of the Subsurface Logs together with the recovered samples provide a basis for evaluating the character of the subsurface conditions relative to the project. The evaluation must consider all the recorded details and their procedures to more accurately evaluate the subsurface conditions. Any evaluation of the contents of this report and recovered samples must be performed by qualified professionals. The following information defines some of the procedures and terms used of the Subsurface Logs to describe the conditions encountered, consistent with the numbered identifiers shown on the Key opposite this page.

1. **The figures in the Depth column define the scale of the Subsurface Log.**

2. **The Samples column shows, graphically, the depth range from which a sample was recovered. See Table I for descriptions of the symbols used to represent the various types of samples.**

3. **The Sample No. is used for identification on sample containers and/or Laboratory Test Reports.**

4. **Blows on Sampler – shows the results of the "Penetration Test", recording the number of blows required to drive a split spoon sampler into the soil. The number of blows required for each six inches is recorded. The first 6 inches of penetration is considered a seating drive. The number of blows required for the second and third 6 inches of penetration is termed the penetration resistance, N.**

5. **Blows on Casing – Shows the number of blows required to advance the casing a distance of 12 inches. The casing size, hammer weight, and length of drop are noted at the bottom of the Subsurface Log. If the casing is advanced by means other than driving, the method of advancement will be indicated in the Notes column or under the Method of Investigation at the bottom of the Subsurface Log. Alternatively, sample recovery may be shown in this column or other data consistent with the column heading.**

6. **All recovered soil samples are reviewed in the laboratory by an engineering technician, geologist, or geotechnical engineer, unless noted otherwise. Visual descriptions are made on the basis of a combination of the driller's field descriptions and noted observations together with the sample as received in the laboratory. The method of visual classification is based primarily on the Unified Soil Classification System (ASTM D 2487) with regard to the particle size and plasticity (See Table No. II), and the Unified Soil Classification System group symbols for the soil types are sometimes included with the soil classification. Additionally, the relative portion, by weight, of two or more soil types is described for granular soils in accordance with "Suggested Methods of Test for Identification of Soils" by D.M. Burmister, ASTM Special Technical Publication 479, June 1970. (See Table No. III). Description of the relative soil density or consistency is based upon the penetration records as defined in Table No. IV. The description of the soil moisture is based upon the relative wetness of the soil as recovered and is described as dry, moist, wet, and saturated. Water introduced into the boring either naturally or during drilling may have affected the moisture condition of the recovered sample. Special terms are used as required to describe soil deposition in greater detail; several such terms are listed in Table V. When sampling gravelly soils with a standard two inch diameter split spoon, the true percentage of gravel is often not recovered due to the relatively small sampler diameter. The presence of boulders and large gravel is sometimes, but not necessarily, detected by an evaluation of the casing and sampler blows or through the "action" of the drill rig as reported by the driller.**

7. **Rock description is based on review of the recovered rock core and the driller's notes. Frequently used rock classification terms are included in Table VI.**

8. **The stratification lines represent the approximate boundary between soil types and the transition may be gradual. Solid stratification lines delineate apparent changes in soil type, based upon review of recovered soil samples and the driller's notes. Dashed lines convey a lesser degree of certainty with respect to either a change in soil type or where such change may occur.**

9. **Miscellaneous observations and procedures noted by the driller are shown in this column, including water level observations. It is important to realize the reliability of the water level observations depends upon the soil type (water does not readily stabilize in a hole through fine grained soils), and that any drill water used to advance the boring may have influenced the observations. The ground water level will fluctuate seasonally, typically. One or more perched or trapped water levels may exist in the ground seasonally. All the available readings should be evaluated. If definite conclusions cannot be made, it is often prudent to examine the conditions more thoroughly through test pit excavations or groundwater observation wells.**

10. **The length of core run is defined as the length of penetration of the core barrel. Core recovery is the length of core recovered divided by the core run. The RQD (Rock Quality Designation) is the total length of pieces of NX core exceeding 4 inches divided by the core run. The size core barrel used is also noted in the Method of Investigation at the bottom of the Subsurface Log.**

SJB SERVICES, INC.
SUBSURFACE LOG

DATE STARTED ____ FINISHED ____ SHEET ____ OF ____	SJB SERVICES, INC.	PROJ. No. ____ HOLE No. ____ SURF. ELEV. ____ G.W. DEPTH ____

PROJECT ____ LOCATION ____

DEPTH (ft)	SAMPLES	SAMPLE No.	BLOWS ON SAMPLER 0/6	6/12	12/18	18/24	N	BLOWS ON CASING C	SOIL OR ROCK CLASSIFICATION	NOTES
0		1	3	3	4	8	7	10	3" TOPSOIL	Groundwater at 10' upon completion, and 5' 24 hrs. after completion
								15	Brown SILT, some Sand, trace clay, ML (Moist-Loose)	
								50/.5		
5									Gray SHALE, medium hard, weathered, thin bedded, some fractures	Run#1, 2.5'-5.0' 95% Recovery 50% RQD

1 2 3 4 5 6 7 8 9 10

(numbered features explained on reverse)

TABLE I

Split Spoon Sample	
Shelby Tube Sample	
Geoprobe Macro-Core	
Auger or Test Pit Sample	
Rock Core	

TABLE II

Identification of soil type is made on basis of an estimate of particle sizes, and in the case of fine grained soils also on basis of plasticity.

Soil Type	Soil Particle Size	
Boulder	>12"	Coarse Grained (Granular)
Cobble	3" - 12"	
Gravel - Coarse	3" - 3/4"	
- Fine	3/4" - #4	
Sand - Coarse	#4 - #10	
- Medium	#10 - #40	
- Fine	#40 - #200	
Silt - Non Plastic (Granular) Clay - Plastic (Cohesive)	<#200	Fine Grained

TABLE III

The following terms are used in classifying soils consisting of mixtures of two or more soil types. The estimate is based on weight of total sample.

Term	Percent of Total Sample
"and"	35 - 50
"some"	20 - 35
"little"	10 - 20
"trace"	less than 10

(When sampling gravelly soils with a standard split spoon, the true percentage of gravel is often not recovered due to the relatively small sampler diameter.)

TABLE IV

The relative compactness or consistency is described in accordance with the following terms:

Granular Soils Term	Blows per Foot, N	Cohesive Soils Term	Blows per Foot, N
Very Loose	0 - 4	Very Soft	0 - 2
Loose	4 - 10	Soft	2 - 4
Firm	10 - 30	Medium	4 - 8
Compact	30 - 50	Stiff	8 - 15
Very Compact	>50	Very Stiff	15 - 30
		Hard	>30

(Large particles in the soils will often significantly influence the blows per foot recorded during the penetration test)

TABLE V

Varved	Horizontal uniform layers or seams of soil(s).
Layer	Soil deposit more than 6" thick.
Seam	Soil deposit less than 6" thick.
Parting	Soil deposit less than 1/8" thick.
Laminated	Irregular, horizontal and angled seams and partings of soil(s).

TABLE VI

Rock Classification Term		Meaning
Hardness	- Soft	Scratched by fingernail
	- Medium Hard	Scratched easily by penknife
	- Hard	Scratched with difficulty by penknife
	- Very Hard	Cannot be scratched by penknife
Weathering	- Very Weathered - Weathered - Sound	Judged from the relative amounts of disintegration, iron staining, core recovery, clay seams, etc.

Rock Classification Term		Meaning	
Bedding	- Laminated	(<1")	Natural breaks in Rock Layers
	- Thin Bedded	(1" - 4")	
	- Bedded	(4" - 12")	
	- Thick Bedded	(12" - 36")	
	- Massive	(>36")	

(Fracturing refers to natural breaks in the rock oriented at some angle to the rock layers)

SJB SERVICES, INC.
SUBSURFACE LOG

DATE:
START 6/1/2021
FINISH 6/1/2021
SHEET 1 OF 2

HOLE NO. B-1
SURF. ELEV 570.8'
G.W. DEPTH See Notes

PROJECT: SAWYER'S LANDING HOUSING PROJECT
PROJ. NO.: BE-21-054
LOCATION: DODGE RD & SWEET HOME RD
AMHERST, NEW YORK

DEPTH FT.	SMPL NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	SOIL OR ROCK CLASSIFICATION	NOTES
	1	1	1			Brown-Gray Silty CLAY, some fine Sand, tr. organics	
		3	2		4	(moist, medium, CL)	
	2	4	5			Brown f-m SAND, little Clayey Silt, tr. organics	
		4	4		9	(wet, loose, SM-SC)	
5	3	5	4			Brown-Gray Silty CLAY, some fine Sand, tr. organics	S-3: Contains Wood
		6	6		10	(moist-wet, stiff, CL)	
	4	7	10			Contains little fine Sand, no organics (v. stiff)	
		12	15		22		
	5	1	4			Contains tr. sand (stiff)	
10		7	8		11		
	6	1	2			Becomes Brown (wet, medium)	
		2	4		4		
	7	1	2			(moist-wet)	
		2	2		4		
15	8	2	1			(wet, soft)	
		1	2		2		
20							
	9	WOH/2.0				(v. soft)	WOH = Weight of
					WOH		Hammer and Rods
25							
	10	WOH/2.0				Contains tr. gravel	
					WOH		
30							
	11	WOH/2.0					
					WOH		
35							
	12	WOH/2.0				Contains no gravel	
					WOH		
40							

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW CLASSIFIED BY: Geologist

DRILLER: S. WOLKIEWICZ JR. DRILL RIG TYPE : CME-550X

METHOD OF INVESTIGATION ASTM D-1586 USING HOLLOW STEM AUGERS

DATE			SJB SERVICES, INC. SUBSURFACE LOG	HOLE NO.	B-1
START	6/1/2021			SURF. ELEV	570.8'
FINISH	6/1/2021			G.W. DEPTH	See Notes
SHEET	2 OF 2				

PROJECT: SAWYER'S LANDING HOUSING PROJECT
LOCATION: DODGE RD & SWEET HOME RD, AMHERST, NEW YORK
PROJ. NO.: BE-21-054

DEPTH FT.	SMPL NO.	0/6	6/12	12/18	N	SOIL OR ROCK CLASSIFICATION	NOTES
40	13	WOH	1			Brown fine GRAVEL, some Silty Clay, little f-c Sand	
		20	25		21	(moist, firm, GC-GM)	WOH = Weight of Hammer and Rods
45							
	14	50/0.4			REF		S-14: No Recovery
							REF = Sample Spoon Refusal
	15	40	50			Gray fine GRAVEL, some f-c Sand, tr. silty clay	
50		40	45		90	(moist, compact, GP)	
55							
	16	40	45			Brown fine GRAVEL, some Silty Clay, little f-c Sand	
		50/0.2			REF	(moist, v. compact, GC-GM)	
						Boring Complete at 58.0' with Auger Refusal	Free Standing Water recorded at 6.0' at boring completion
60							
65							
70							
75							
80							

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW

CLASSIFIED BY: Geologist

DRILLER: S. WOLKIEWICZ JR.

DRILL RIG TYPE : CME-550X

METHOD OF INVESTIGATION ASTM D-1586 USING HOLLOW STEM AUGERS

DATE:		SJB SERVICES, INC. SUBSURFACE LOG	HOLE NO.	B-2
START	6/2/2021		SURF. ELEV	571.1'
FINISH	6/2/2021			
SHEET	1 OF 1		G.W. DEPTH	See Notes

PROJECT: SAWYER'S LANDING HOUSING PROJECT   LOCATION: DODGE RD & SWEET HOME RD
PROJ. NO.: BE-21-054   AMHERST, NEW YORK

DEPTH FT.	SMPL NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	SOIL OR ROCK CLASSIFICATION	NOTES
	1	1	2			TOPSOIL	Driller noted Topsoil
		3	5		5	Brown-Gray f-m SAND, little Silty Clay, tr. organics	at the surface
	2	6	6			(moist, loose, SC-SM)	
		5	6		11	Brown f-m SAND, little Clayey Silt (wet, firm, SM-SC)	
5	3	7	7			Gray f-c SAND, tr. clayey silt (wet, firm, SP-SW)	
		7	7		14		
	4	6	8			Brown Silty CLAY, tr. sand, Silt Partings	
		10	10		18	(wet, firm, CL)	
	5	3	4			(moist-wet, stiff)	
10		6	8		10		
	6	3	3			(medium)	
		4	3		7		
	7	4	4			Contains no Silt Partings (wet)	
		2	2		6		
15	8	1	1			(soft)	
		1	1		2		WOH = Weight of
	9	WOH/2.0				(v. soft)	Hammer and Rods
					WOH		
20							
	10	WOH/2.0					
					WOH		
	11	WOH/2.0					
25					WOH		
						Boring Complete at 25.0'	No Free Standing Water encountered at boring completion
30							
35							
40							

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW   CLASSIFIED BY: Geologist

DRILLER: S. WOLKIEWICZ JR.   DRILL RIG TYPE : CME-550X

METHOD OF INVESTIGATION ASTM D-1586 USING HOLLOW STEM AUGERS

DATE:
START 6/3/2021
FINISH 6/3/2021
SHEET 1 OF 1

SJB SERVICES, INC.
SUBSURFACE LOG

HOLE NO. B-3
SURF. ELEV 571.8'
G.W. DEPTH See Notes

PROJECT: SAWYER'S LANDING HOUSING PROJECT
LOCATION: DODGE RD & SWEET HOME RD, AMHERST, NEW YORK
PROJ. NO.: BE-21-054

DEPTH FT.	SMPL NO.	0/6	6/12	12/18	N	SOIL OR ROCK CLASSIFICATION	NOTES
	1	1	2			TOPSOIL	Driller noted Topsoil
		3	3		5	Brown Silty CLAY, some f-m Sand, tr. organics	at the surface
	2	5	5			(moist, medium, CL)	
		6	7		11	Brown f-m SAND, little Clayey Silt (wet, firm, SM-SC)	
5	3	6	8			Brown-Gray f-m SAND, tr. clayey silt	
		11	11		19	(wet, firm, SP-SW)	
	4	7	5			Becomes Gray (moist-wet)	
		4	4		9	Brown Silty CLAY, tr. sand, Silt Partings	
	5	2	3			(moist, stiff, CL)	
10		5	6		8		
	6	2	3				
		6	6		9		
	7	3	4			(moist-wet)	
		4	3		8		
15	8	WOH/2.0				(wet, v. soft)	
					WOH		WOH = Weight of Hammer and Rods
20							
	9	WOH/2.0					
					WOH		
	10	WOH/2.0					
25					WOH		
						Boring Complete at 25.0'	No Free Standing Water encountered at boring completion
30							
35							
40							

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW

CLASSIFIED BY: Geologist

DRILLER: S. WOLKIEWICZ JR.

DRILL RIG TYPE : CME-550X

METHOD OF INVESTIGATION ASTM D-1586 USING HOLLOW STEM AUGERS

DATE:	**SJB SERVICES, INC.**	HOLE NO. B-4
START 6/3/2021	**SUBSURFACE LOG**	SURF. ELEV 571.6
FINISH 6/4/2021		
SHEET 1 OF 2		G.W. DEPTH See Notes

PROJECT: SAWYER'S LANDING HOUSING PROJECT LOCATION: DODGE RD & SWEET HOME RD
PROJ. NO.: BE-21-054 AMHERST, NEW YORK

DEPTH FT.	SMPL NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	SOIL OR ROCK CLASSIFICATION	NOTES
	1	1	2			TOPSOIL	Driller noted Topsoil
		4	5		6	Brown-Gray Silty CLAY, some f-m Sand, tr. organics	at the surface
	2	4	7			(moist, medium, CL)	
		7	5		14	Brown f-m SAND, little Clayey Silt (wet, firm, SM-SC)	
5	3	6	6				
		8	8		14		
	4	11	9			Gray f-m SAND, tr. clayey silt (moist-wet, firm, SP)	
		8	6		17		
	5	6	8			Brown Silty CLAY, tr. sand, Silt Partings	
10		9	8		17	(moist, v. stiff, CL)	
	6	2	3			(moist-wet, stiff)	
		5	5		8		
	7	3	3			Contains no Silt Partings (medium)	
		2	2		5		
15	8	WOH/1.5				(wet, v. soft)	
			2		WOH		WOH = Weight of
							Hammer and Rods
20							
	9	WOH/2.0					
					WOH		
25							
	10	WOH/1.0					
		WOH	1		WOH		
30							
	11	Shelby Tube					Shelby Tube T-1: 30'-32'
		T-1					REC: 2.0'
35							
	12	WOH/2.0					
					WOH		
40							

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW CLASSIFIED BY: Geologist

DRILLER: S. WOLKIEWICZ JR. DRILL RIG TYPE : CME-550X

METHOD OF INVESTIGATION ASTM D-1586 USING HOLLOW STEM AUGERS

DATE	
START	6/3/2021
FINISH	6/3/2021
SHEET	2 OF 2

SJB SERVICES, INC.
SUBSURFACE LOG

SERVICES, INC.

HOLE NO.	B-4
SURF. ELEV	571.6'
G.W. DEPTH	See Notes

PROJECT: SAWYER'S LANDING HOUSING PROJECT
PROJ. NO.: BE-21-054
LOCATION: DODGE RD & SWEET HOME RD
AMHERST, NEW YORK

DEPTH FT.	SMPL NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	SOIL OR ROCK CLASSIFICATION	NOTES
40	13	WOH	7			Brown fine GRAVEL, some Silty Clay, little f-c Sand	
		28	50/0.2		21	(moist-wet, compact, GC-GM)	WOH = Weight of Hammer and Rods
45	14	50/0.3			REF	Gray fine GRAVEL, little f-c Sand, tr. silty clay (moist, v. compact, GP)	REF = Sample Spoon Refusal
50	15	50/0.4			REF	Brown fine GRAVEL, some f-c Sand, little Silty Clay (moist, v. compact, GC-GM)	
55	16	27	45			Brown Silty CLAY, some fine Gravel, little f-c Sand	
		50/0.1			REF	(moist, hard, CL)	NQ '2' Size Rock Core
60						Brown f-c SAND, some Silty Clay, little fine Gravel (moist-wet)	Run #1: 59' - 62' REC = 83% RQD = 14%
						Gray SHALE Rock, hard, highly weathered, laminated to bedded, both natural and mechanical fractures	
65						Boring Complete at 62.0'	Free Standing Water recorded at 10.8' before coring Free Standing Water recorded at 14.0' after coring
70							
75							
80							

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW

CLASSIFIED BY: Geologist

DRILLER: S. WOLKIEWICZ JR.

DRILL RIG TYPE : CME-550X

METHOD OF INVESTIGATION ASTM D-1586 USING HOLLOW STEM AUGERS

DATE: START 6/3/2021 FINISH 6/3/2021 SHEET 1 OF 1	**SJB SERVICES, INC.** **SUBSURFACE LOG**	HOLE NO. B-5 SURF. ELEV 571.8' G.W. DEPTH See Notes

PROJECT: SAWYER'S LANDING HOUSING PROJECT — LOCATION: DODGE RD & SWEET HOME RD, AMHERST, NEW YORK

PROJ. NO.: BE-21-054

DEPTH FT.	SMPL NO.	0/6	6/12	12/18	N	SOIL OR ROCK CLASSIFICATION	NOTES
	1	WOH	3			TOPSOIL	Driller noted Topsoil
		4	5		7	Brown-Gray f-m SAND, little Silty Clay, tr. organics	at the surface
	2	4	5			(moist-wet, loose, SC-SM)	
		7	10		12	Brown f-m SAND, little Clayey Silt (wet, firm, SM-SC)	
5	3	8	10			Contains "and" Clayey Silt	
		11	7		21		
	4	6	8			Brown Silty CLAY, tr. sand, Silt Partings	
		8	10		16	(moist-wet, v. stiff, CL)	
	5	4	5			(stiff)	
10		7	7		12		
	6	2	4				
		4	4		8		
	7	3	3			Contains no Silt Partings (wet, medium)	
		2	2		5		
15	8	WOH/2.0				(v. soft)	
					WOH		WOH = Weight of Hammer and Rods
20							
	9	WOH/2.0					
					WOH		
	10	WOH/2.0					
25					WOH		
						Boring Complete at 25.0'	No Free Standing Water encountered at boring completion
30							
35							
40							

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW — CLASSIFIED BY: Geologist

DRILLER: S. WOLKIEWICZ JR. — DRILL RIG TYPE : CME-550X

METHOD OF INVESTIGATION ASTM D-1586 USING HOLLOW STEM AUGERS

DATE:
START 6/2/2021
FINISH 6/2/2021
SHEET 1 OF 1

SJB SERVICES, INC.
SUBSURFACE LOG

HOLE NO. B-6
SURF. ELEV 571.6'
G.W. DEPTH See Notes

PROJECT: SAWYER'S LANDING HOUSING PROJECT — LOCATION: DODGE RD & SWEET HOME RD, AMHERST, NEW YORK
PROJ. NO.: BE-21-054

DEPTH FT.	SMPL NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	SOIL OR ROCK CLASSIFICATION	NOTES
	1	WOH	5			TOPSOIL	Driller noted Topsoil
		7	7		12	Brown-Gray f-m SAND, little Silty Clay, tr. organics	at the surface
	2	7	8			(moist, firm, SC-SM)	
		10	13		18	Brown f-m SAND, little Clayey Silt (wet, firm, SM-SC)	
5	3	5	6			Brown Silty CLAY, tr. sand, Silt Parings	
		5	5		11	(moist, stiff, CL)	
	4	5	6				
		6	6		12		
	5	4	6			Becomes Brown-Gray (v. stiff)	
10		10	10		16		
	6	4	4			(moist-wet, medium)	
		3	5		7		
	7	3	2			Contains no Silt Partings (wet)	
		3	2		5		
15	8	WOH/1.0				Becomes Brown (v. soft)	
		WOH	1		WOH		WOH = Weight of Hammer and Rods
20							
	9	WOH/1.0				(soft)	
		2	1		2		
	10	WOH	1				
25		1	1		2		
						Boring Complete at 25.0'	No Free Standing Water encountered at boring completion
30							
35							
40							

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW — CLASSIFIED BY: Geologist

DRILLER: S. WOLKIEWICZ JR. — DRILL RIG TYPE : CME-550X

METHOD OF INVESTIGATION ASTM D-1586 USING HOLLOW STEM AUGERS

DATE:
START 6/2/2021
FINISH 6/2/2021
SHEET 1 OF 1

SJB SERVICES, INC.
SUBSURFACE LOG

HOLE NO. B-7
SURF. ELEV 571.2'
G.W. DEPTH See Notes

PROJECT: SAWYER'S LANDING HOUSING PROJECT
LOCATION: DODGE RD & SWEET HOME RD
AMHERST, NEW YORK
PROJ. NO.: BE-21-054

DEPTH FT.	SMPL NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	SOIL OR ROCK CLASSIFICATION	NOTES
	1	1	2			TOPSOIL	Driller noted Topsoil
		3	4		5	Brown-Gray f-m SAND, some Silty Clay, little fine Gravel,	at the surface
	2	4	6			tr. organics (moist, loose, SC-SM)	
		7	6		13	Brown f-m SAND, some Clayey Silt, tr. organics	
5	3	5	12			(wet, firm, SM-SC)	
		13	13		25	Gray f-m SAND, tr. clayey silt (wet, firm, SP)	
	4	5	7			(moist-wet)	
		10	11		17	Brown Silty CLAY, tr. sand, Silt Partings	
	5	5	7			(moist, v. stiff, CL)	
10		7	6		14	(stiff)	
	6	2	5			Becomes Brown-Gray, Contains no Silt Partings	
		6	6		11	(moist-wet)	
	7	4	3			Becomes Brown (wet, medium)	
		3	3		6		
15	8	1	1			Contains tr. gravel (soft)	
		1	1		2		WOH = Weight of Hammer and Rods
20							
	9	WOH/1.0				Contains no gravel (v. soft)	
		WOH	1		WOH		
	10	1	1			(soft)	
25		1	1		2		
						Boring Complete at 25.0'	No Free Standing Water encountered at boring completion
30							
35							
40							

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW CLASSIFIED BY: Geologist

DRILLER: S. WOLKIEWICZ JR. DRILL RIG TYPE : CME-550X

METHOD OF INVESTIGATION ASTM D-1586 USING HOLLOW STEM AUGERS

APPENDIX B

LABORATORY TEST DATA

Western New York Office
5167 South Park Avenue
Hamburg, NY 14075
Phone: (716) 649-8110
Fax: (716) 649-8051

Laboratory Test Report

PROJECT: **Sawyer's Landing**

CLIENT: **Severyn Development**

DATE: **June 24, 2021**

PROJECT NO.: BE-21-054
REPORT NO.: LTR-1

SJB Sample Number: 21-302
Sample Location: B-1, S-6: 10' - 12'

ASTM D-2216:Laboratory Determination of Water (Moisture) Content of Soil &Rock
ASTM D-4318: Liquid Limit, Plastic Limit, and Plasticity Index of Soil

Moisture Content	Liquid Limit	Plastic Limit	Plasticity Index
39.4 %	44	18	26

ASTM D-2216:Laboratory Determination of Water (Moisture) Content of Soil &Rock

SJB Sample Number	Sample Location	Moisture Content
21-303	B-4, S-5: 8' – 10'	23.9 %
21-304	B-4, S-6: 10' – 12'	29.1 %
21-305	B-4, S-7: 12' – 14'	39.2 %
21-306	B-4, S-8: 14' – 16'	40.0 %
21-307	B-4, S-9: 20' – 22'	48.9 %
21-308	B-4, S-10: 25' – 27'	46.0 %
21-309	B-4, T-1: 30' – 32'	46.5 %
21-310	B-4, S-12: 35' – 37'	38.7 %

Western New York Office
5167 South Park Avenue
Hamburg, NY 14075
Phone: (716) 649-8110
Fax: (716) 649-8051

Laboratory Test Report

PROJECT: **Sawyer's Landing**

CLIENT: **Severyn Development**

DATE: **June 24, 2021**

PROJECT NO.: BE-21-054
REPORT NO.: LTR-1

SJB Sample Number: 21-306
Sample Location: B-4, S-8: 14' – 16'

ASTM D-2216:Laboratory Determination of Water (Moisture) Content of Soil &Rock
ASTM D-4318: Liquid Limit, Plastic Limit, and Plasticity Index of Soil

Moisture Content	Liquid Limit	Plastic Limit	Plasticity Index
40.0 %	36	17	19

SJB Sample Number: 21-309
Sample Location: B-4, T-1: 30' – 32'

ASTM D-2216:Laboratory Determination of Water (Moisture) Content of Soil &Rock
ASTM D-4318: Liquid Limit, Plastic Limit, and Plasticity Index of Soil

Moisture Content	Liquid Limit	Plastic Limit	Plasticity Index
46.5 %	49	23	26

ASTM D 4648: Standard Test Method for Laboratory Miniature Vane Shear Test for Saturated Fine-Grained Clayey Soil
EGE TM-1: Measure of Approximate Unconfined Compressive Strength of Cohesive Soils

Undrained Shear Strength = 0.14 tons/ft^2
Approximate Unconfined Compressive Strength = 0.18 tons/ft^2

Western New York Office
5167 South Park Avenue
Hamburg, NY 14075
Phone: (716) 649-8110
Fax: (716) 649-8051

Laboratory Test Report

PROJECT: **Sawyer's Landing**
CLIENT: **Severyn Development**
DATE: **June 24, 2021**

SJB Sample Number: 21-311
Sample Location: B-5, S-3: 4' - 6'

ASTM D-2216:Laboratory Determination of Water (Moisture) Content of Soil &Rock
Moisture Content = 21.0 %

ASTM D-6913: Particle Size Distribution (Gradation) of Soils Using Sieve Analysis

Sieve Size	Percent Passing
¼"	100.0
#4	99.7
#10	98.8
#20	96.8
#40	94.3
#100	79.5
#200	39.0

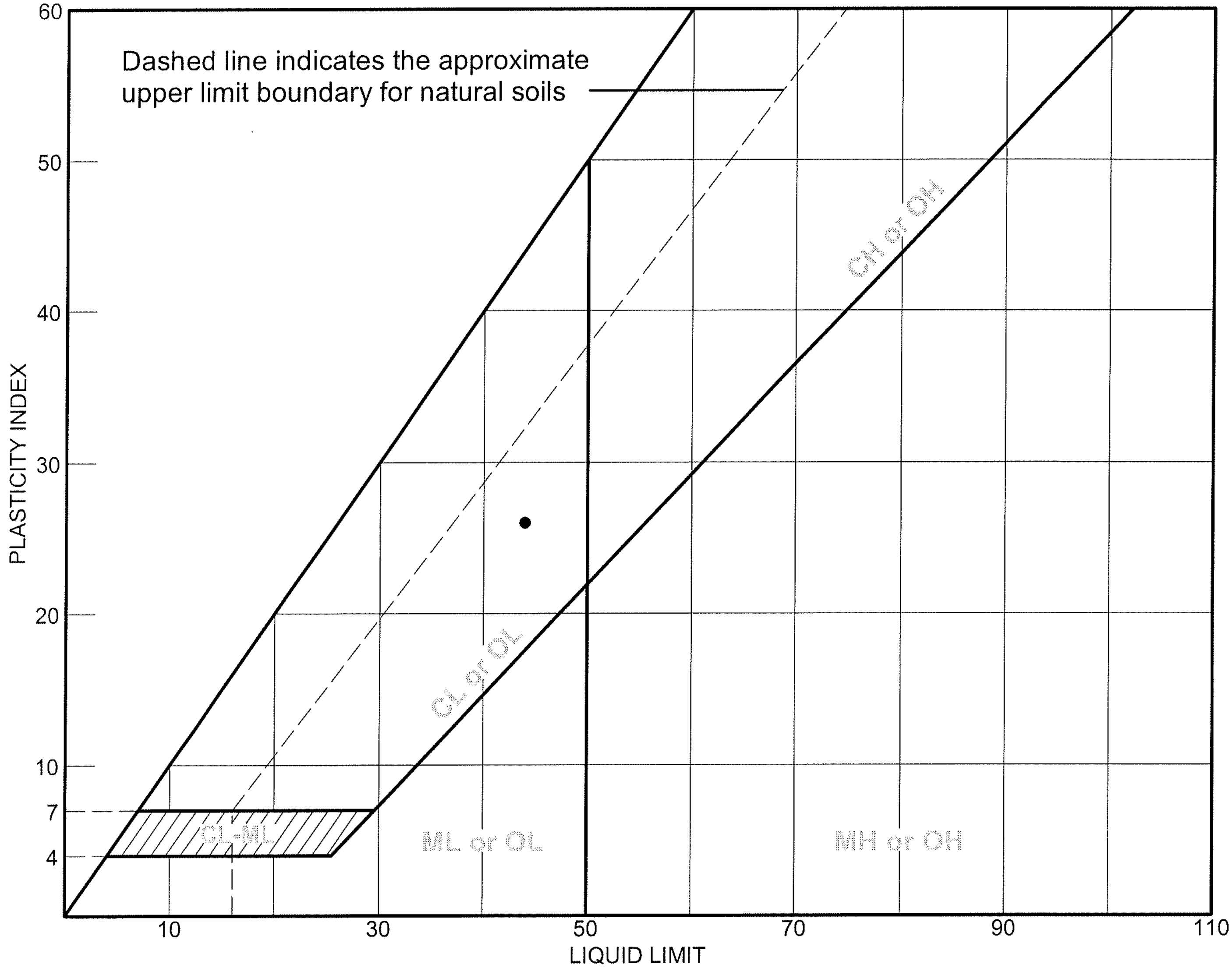
SJB Sample Number: 21-312
Sample Location: B-7, S-2: 2' - 4'

ASTM D-2216:Laboratory Determination of Water (Moisture) Content of Soil &Rock
Moisture Content = 19.5 %

ASTM D-6913: Particle Size Distribution (Gradation) of Soils Using Sieve Analysis

Sieve Size	Percent Passing
¼"	100.0
#4	99.9
#10	99.5
#20	98.8
#40	94.8
#100	42.0
#200	22.7

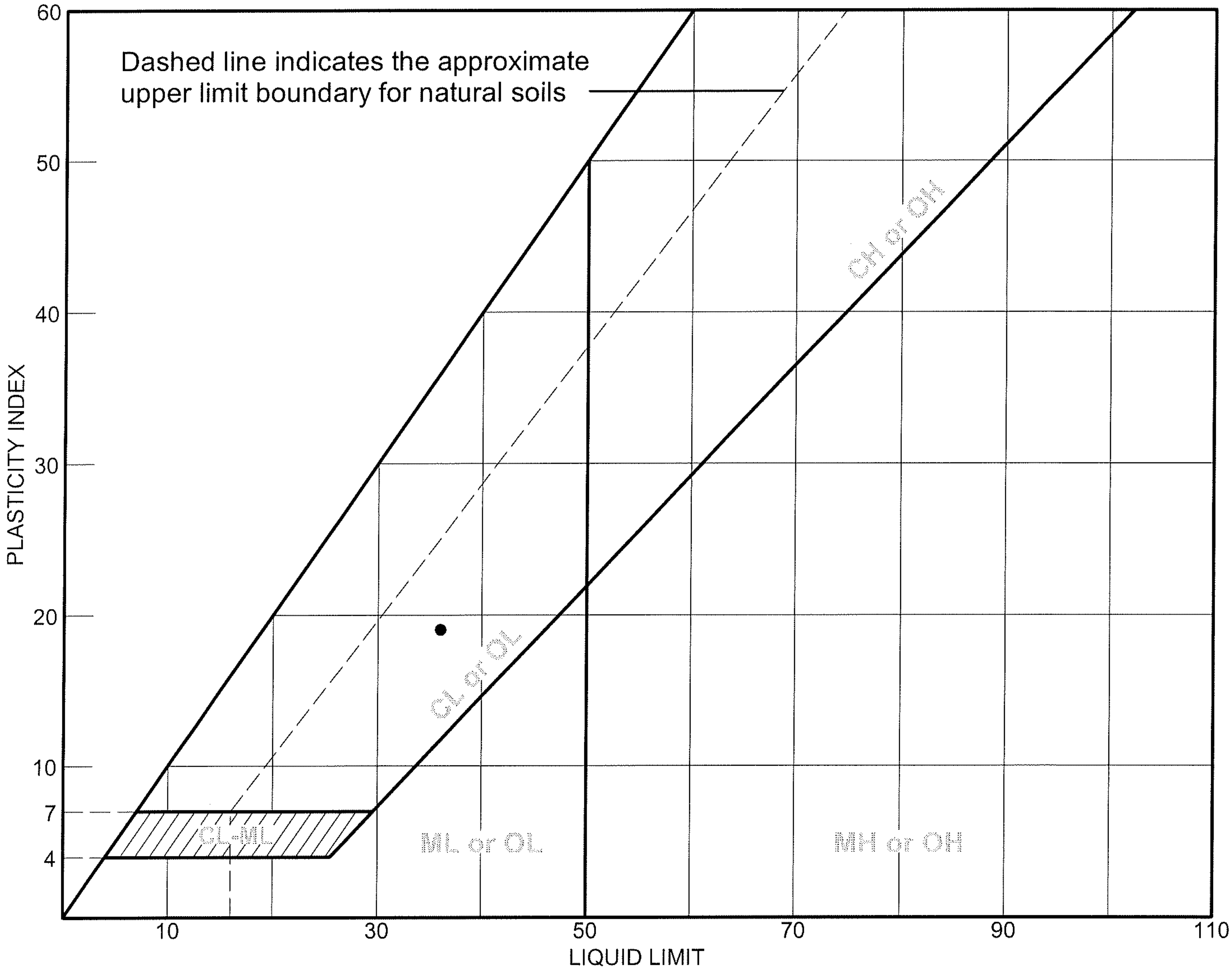
LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA								
SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	B-1	S-6	10' - 12'	39.4 %	18	44	26	

LIQUID AND PLASTIC LIMITS TEST REPORT **SJB SERVICES, INC.**	**Client:** SEVERYN DEVELOPMENT **Project:** SAWYER'S LANDING **Project No.:** BE-21-054 **Plate**

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	B-4	S-8	14' - 16'	40.0 %	17	36	19	

LIQUID AND PLASTIC LIMITS TEST REPORT

SJB SERVICES, INC.

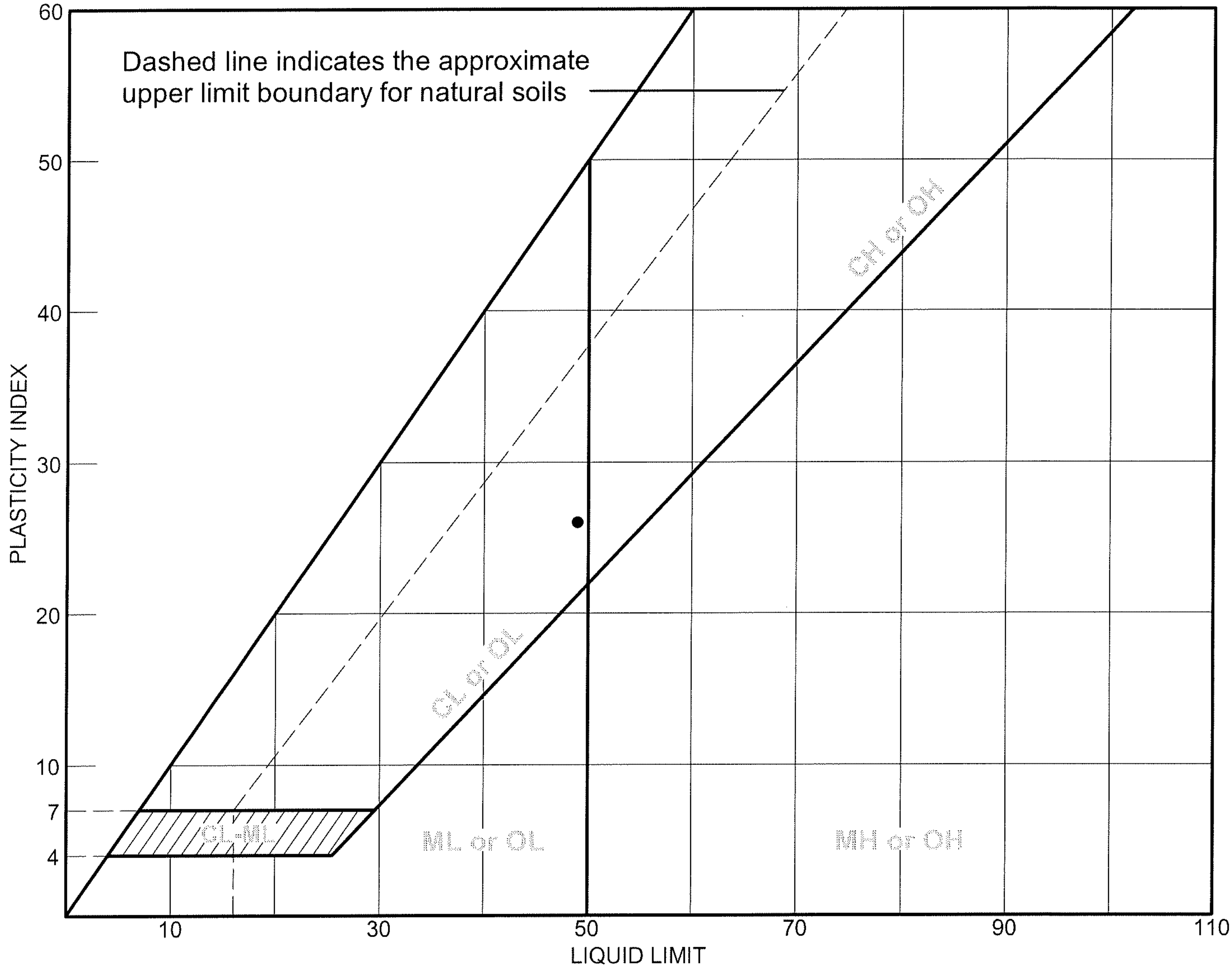
Client: SEVERYN DEVELOPMENT

Project: SAWYER'S LANDING

Project No.: BE-21-054

Plate

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	B-4	T-1	30' - 32'	46.5 %	23	49	26	

LIQUID AND PLASTIC LIMITS TEST REPORT

SJB SERVICES, INC.

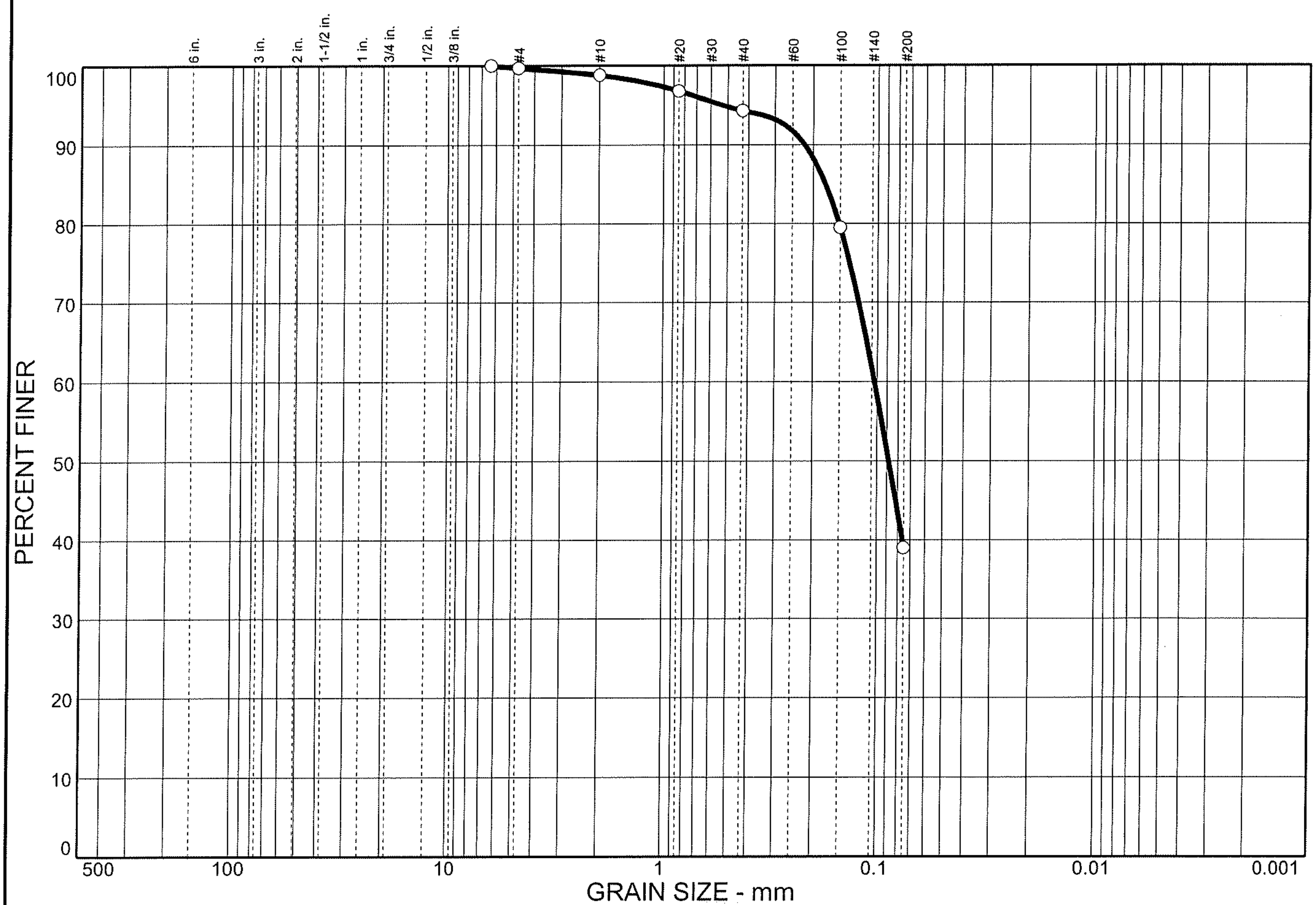
Client: SEVERYN DEVELOPMENT

Project: SAWYER'S LANDING

Project No.: BE-21-054

Plate

Particle Size Distribution Report ASTM D-6913



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.3	60.7	39.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.25 in.	100.0		
#4	99.7		
#10	98.8		
#20	96.8		
#40	94.3		
#100	79.5		
#200	39.0		

* (no specification provided)

Soil Description

B-5, S-3: 4' - 6'

MOISTURE CONTENT = 21.0 %

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.176 D_{60}= 0.103 D_{50}= 0.0884
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= AASHTO=

Remarks

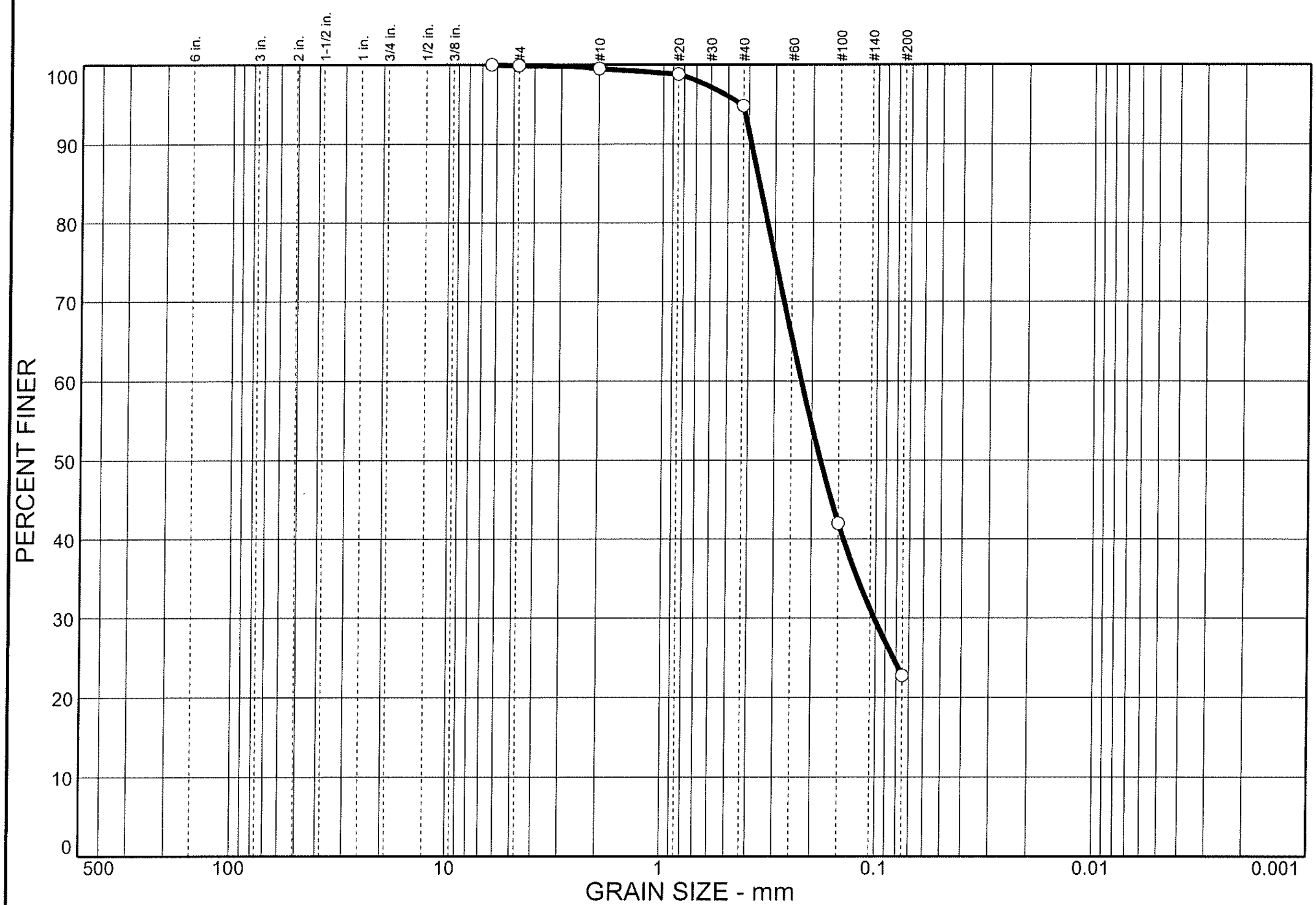
LTR-1
SAMPLE NUMBER: 21-311

Sample No.: S-3 **Source of Sample:** B-5 **Date:** 6-21-2021
Location: B-5, S-3: 4' - 6' **Elev./Depth:** 4' - 6'

SJB SERVICES, INC.

Client: SEVERYN DEVELOPMENT
Project: SAWYER'S LANDING
Project No: BE-21-054 **Plate**

Particle Size Distribution Report ASTM D-6913



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.1	77.2	22.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.25 in.	100.0		
#4	99.9		
#10	99.5		
#20	98.8		
#40	94.8		
#100	42.0		
#200	22.7		

* (no specification provided)

Soil Description

B-7, S-2: 2' - 4'

MOISTURE CONTENT = 19.5 %

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.357 D_{60}= 0.225 D_{50}= 0.182
D_{30}= 0.102 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= AASHTO=

Remarks

LTR-1
SAMPLE NUMBER: 21-312

Sample No.: S-2 **Source of Sample:** B-7 **Date:** 6-21-2021
Location: B-7, S-2: 2' - 4' **Elev./Depth:** 2' - 4'

SJB SERVICES, INC.

Client: SEVERYN DEVELOPMENT
Project: SAWYER'S LANDING
Project No: BE-21-054 **Plate**

Western New York Office
5167 South Park Avenue
Hamburg, NY 14075
Phone: (716) 649-8110
Fax: (716) 649-8051

Laboratory Test Report

PROJECT: **Sawyer's Landing**

CLIENT: **Severyn Development**

DATE: **July 7, 2021**

PROJECT NO.: BE-21-054
REPORT NO.: LTR-2

SJB Sample Number: 21-309
Sample Location: B-4, T-1: 30' – 32'

ASTM D-2216:Laboratory Determination of Water (Moisture) Content of Soil &Rock
ASTM D-4318: Liquid Limit, Plastic Limit, and Plasticity Index of Soil

Moisture Content	Liquid Limit	Plastic Limit	Plasticity Index
46.5 %	49	23	26

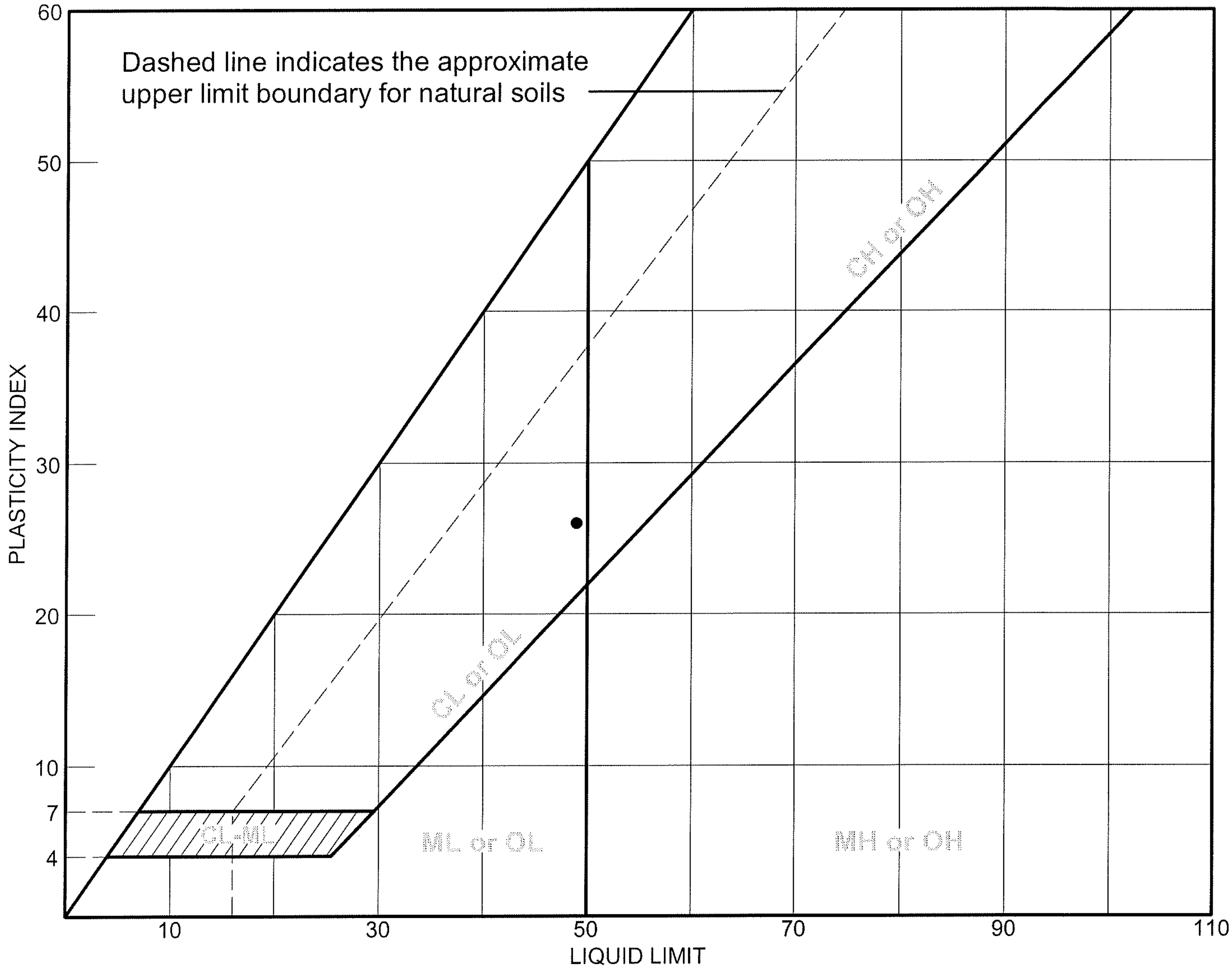
ASTM D 4648: Standard Test Method for Laboratory Miniature Vane Shear Test for Saturated Fine-Grained Clayey Soil
EGE TM-1: Measure of Approximate Unconfined Compressive Strength of Cohesive Soils

Undrained Shear Strength = 0.14 tons/ft^2
Approximate Unconfined Compressive Strength = 0.18 tons/ft^2

ASTM D-2435
One-Dimensional Consolidation Properties of Soils Using Incremental Loading

Refer to attached paperwork for test results

LIQUID AND PLASTIC LIMITS TEST REPORT

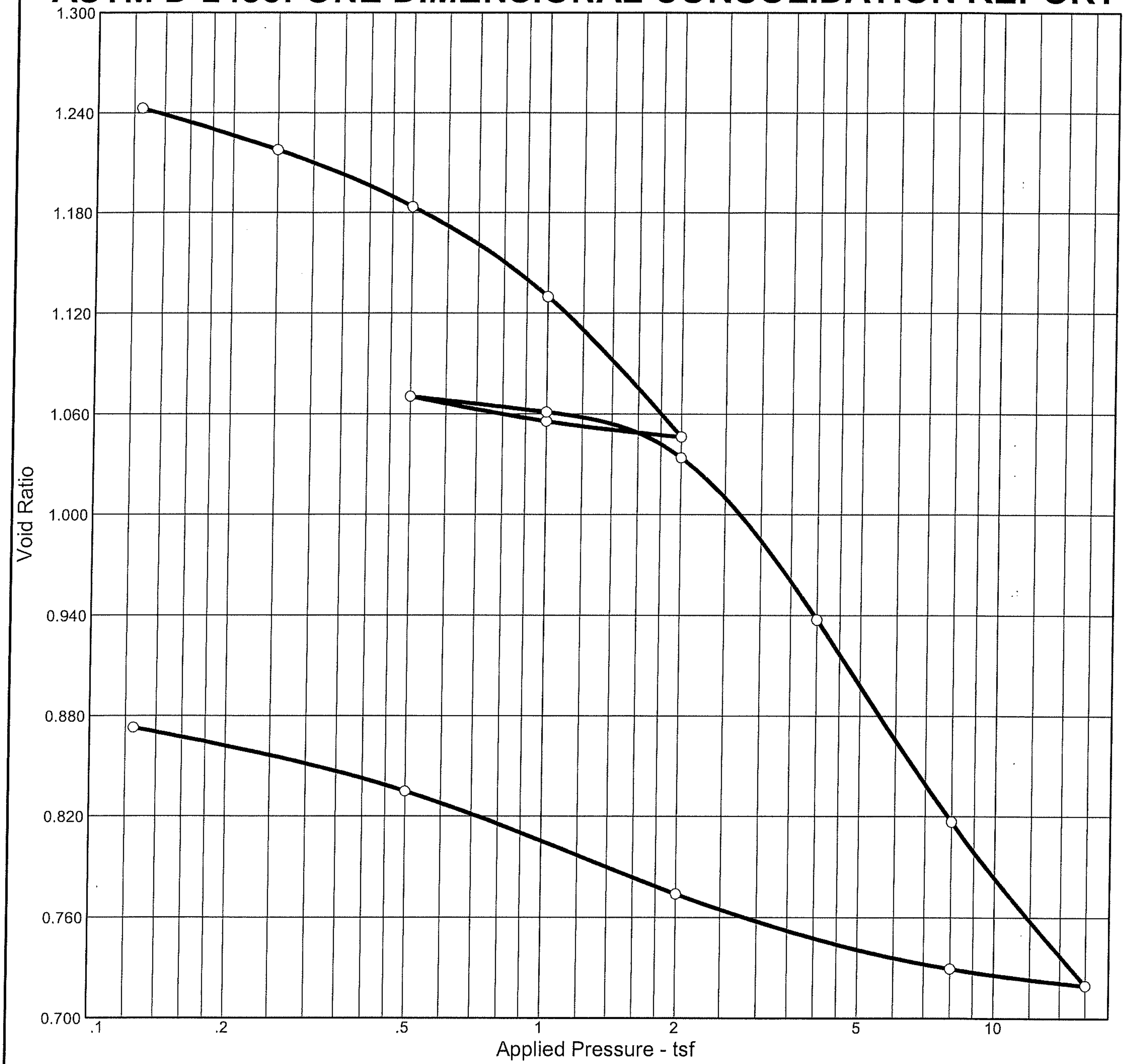


SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	B-4	T-1	30' - 32'	46.5 %	23	49	26	

LIQUID AND PLASTIC LIMITS TEST REPORT **SJB SERVICES, INC.**	**Client:** SEVERYN DEVELOPMENT **Project:** SAWYER'S LANDING **Project No.:** BE-21-054 **Plate**

ASTM D-2435: ONE DIMENSIONAL CONSOLIDATION REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (tsf)	P_c (tsf)	C_c	C_r	Swell Press. (tsf)	Heave %	e_o
Sat.	Moist.											
99.2 %	46.5 %	74.5	49	26	2.7		0.72	0.32				1.267

MATERIAL DESCRIPTION	USCS	AASHTO
B-4, T-1: 30' - 32'		

Project No. BE-21-054 **Client:** SEVERYN DEVELOPMENT

Project: SAWYER'S LANDING

Location: B-4, T-1: 30' - 32'

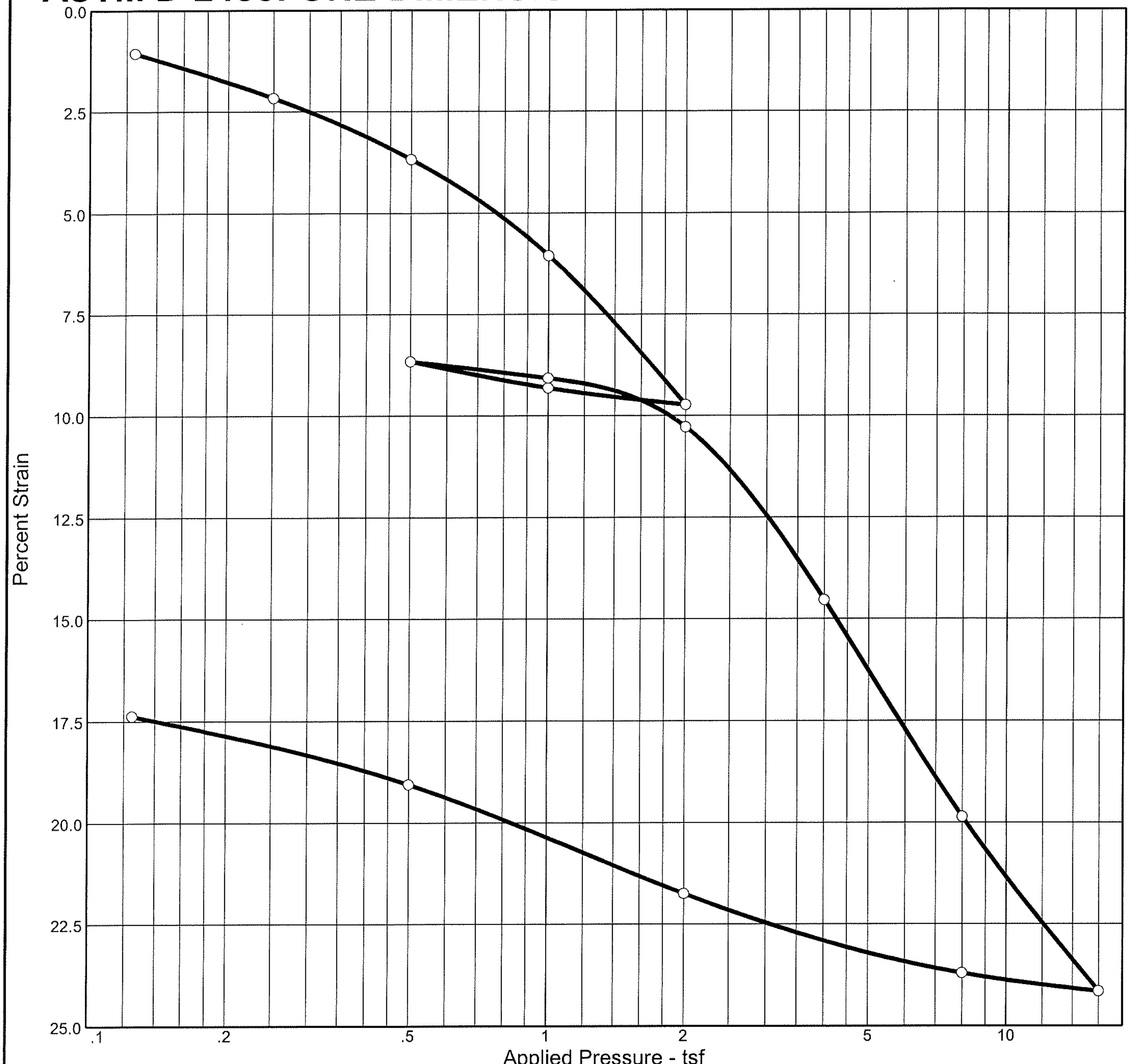
Remarks:
LTR-2
SAMPLE NUMBER: 21-309

ASTM D-2435: ONE DIMENSIONAL CONSOLIDATION REPORT

SJB SERVICES, INC.

Plate

ASTM D-2435: ONE DIMENSIONAL CONSOLIDATION REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (tsf)	P_c (tsf)	C_c	C_r	Swell Press. (tsf)	Heave %	e_o
Sat.	Moist.											
99.2 %	46.5 %	74.5	49	26	2.7		0.72	0.32				1.267

MATERIAL DESCRIPTION	USCS	AASHTO
B-4, T-1: 30' - 32'		

Project No. BE-21-054 **Client:** SEVERYN DEVELOPMENT

Project: SAWYER'S LANDING

Location: B-4, T-1: 30' - 32'

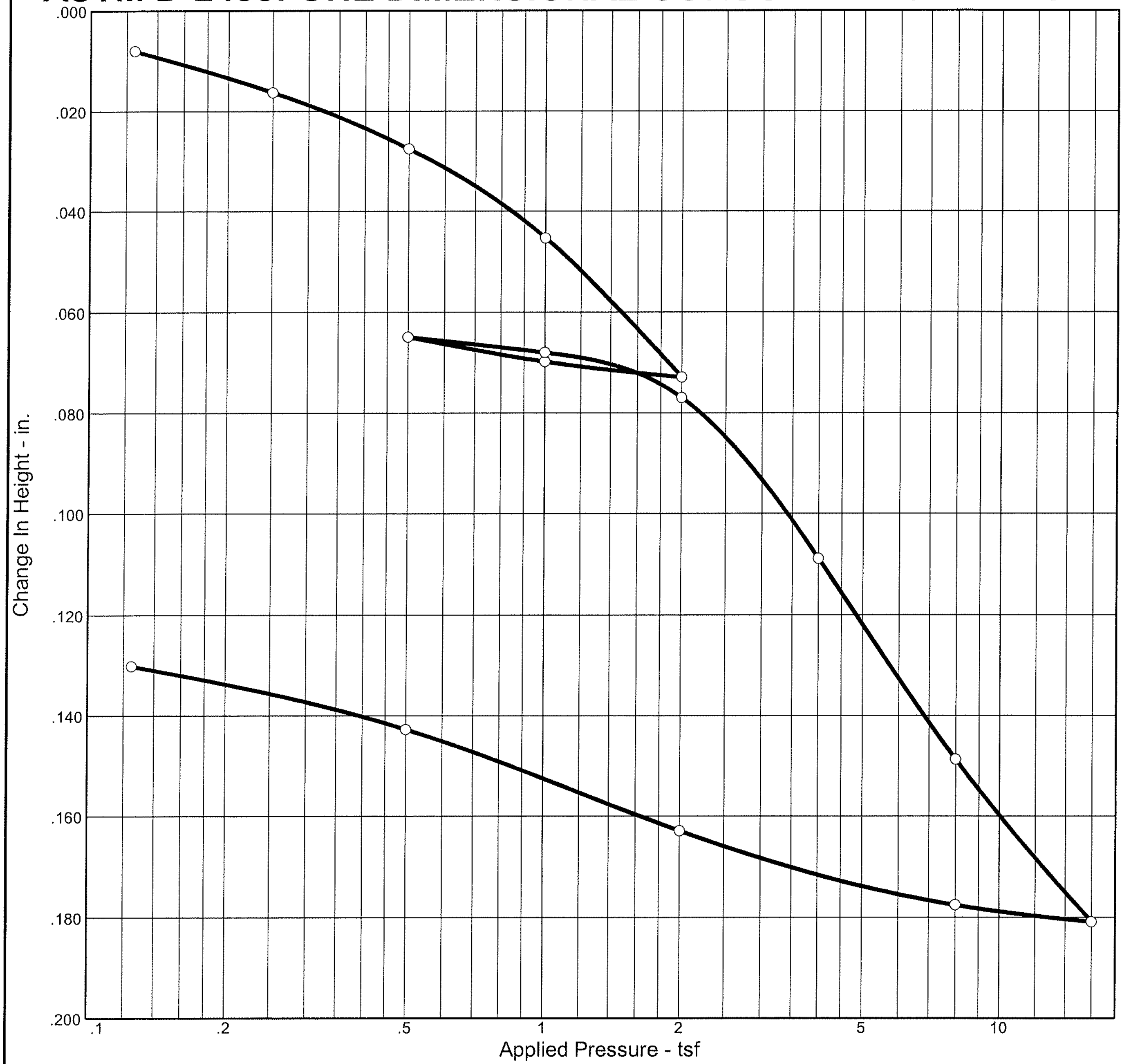
ASTM D-2435: ONE DIMENSIONAL CONSOLIDATION REPORT

SJB SERVICES, INC.

Remarks:
LTR-2
SAMPLE NUMBER: 21-309

Plate

ASTM D-2435: ONE DIMENSIONAL CONSOLIDATION REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (tsf)	P_c (tsf)	C_c	C_r	Swell Press. (tsf)	Heave %	e_o
Sat.	Moist.											
99.2 %	46.5 %	74.5	49	26	2.7		0.72	0.32				1.267

MATERIAL DESCRIPTION	USCS	AASHTO
B-4, T-1: 30' - 32'		

Project No. BE-21-054 **Client:** SEVERYN DEVELOPMENT

Project: SAWYER'S LANDING

Location: B-4, T-1: 30' - 32'

Remarks:
LTR-2
SAMPLE NUMBER: 21-309

ASTM D-2435: ONE DIMENSIONAL CONSOLIDATION REPORT

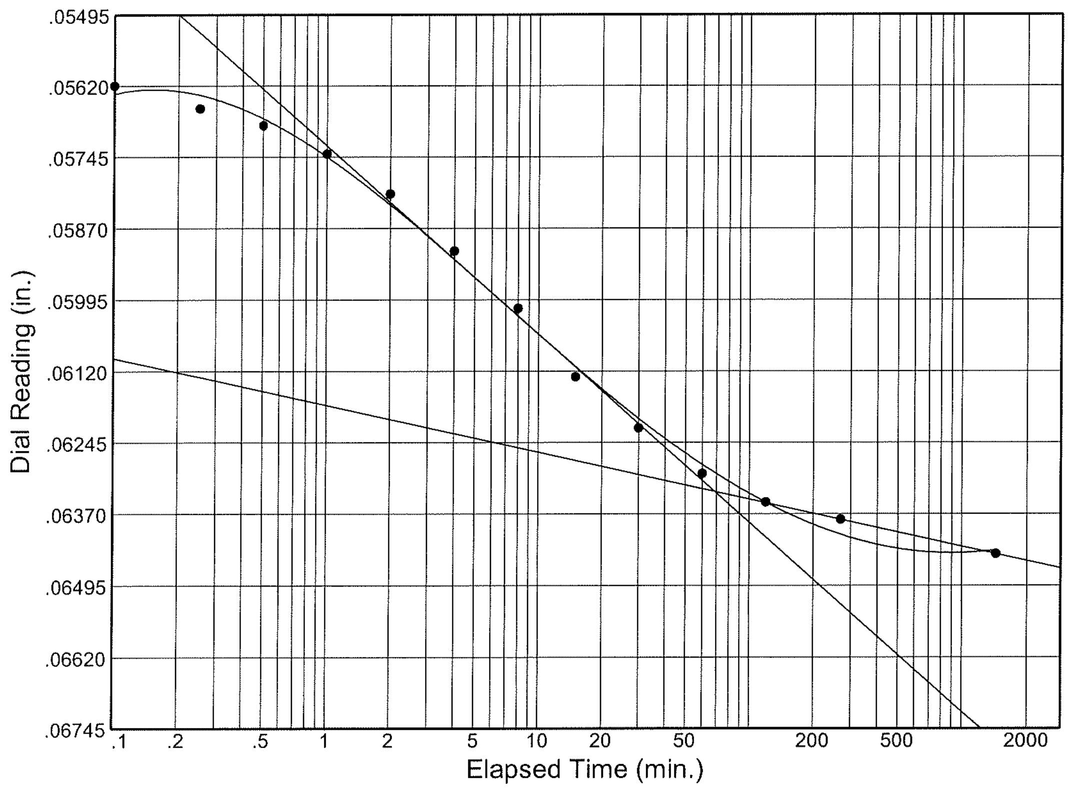
SJB SERVICES, INC.

Plate

Dial Reading vs. Time

Project No.: BE-21-054
Project: SAWYER'S LANDING

Location: B-4, T-1: 30' - 32'



Load No.= 1

Load= 0.13 tsf

D_0 = 0.05640

D_{50} = 0.05985

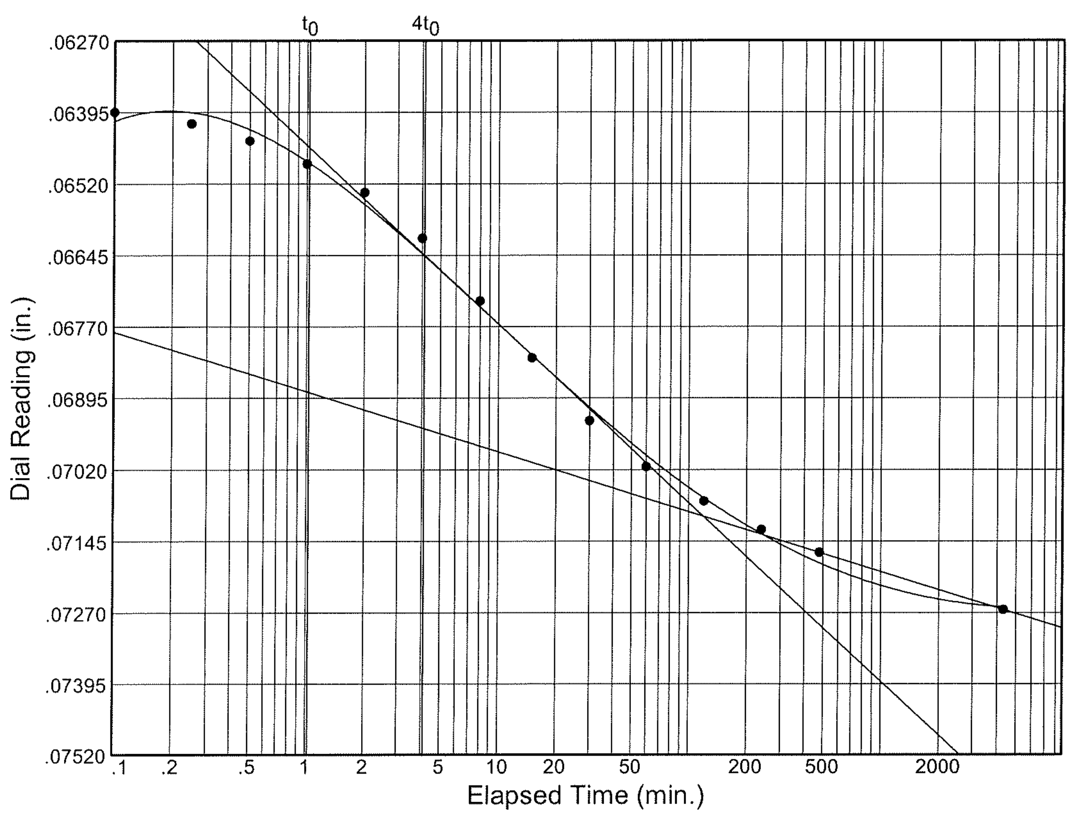
D_{100} = 0.06331

T_{50} = 6.13 min.

C_v @ T_{50}

0.04 ft.^{2}/day

C_α = 0.001



Load No.= 2

Load= 0.25 tsf

D_0 = 0.06321

D_{50} = 0.06711

D_{100} = 0.07101

T_{50} = 6.69 min.

C_v @ T_{50}

0.04 ft.^{2}/day

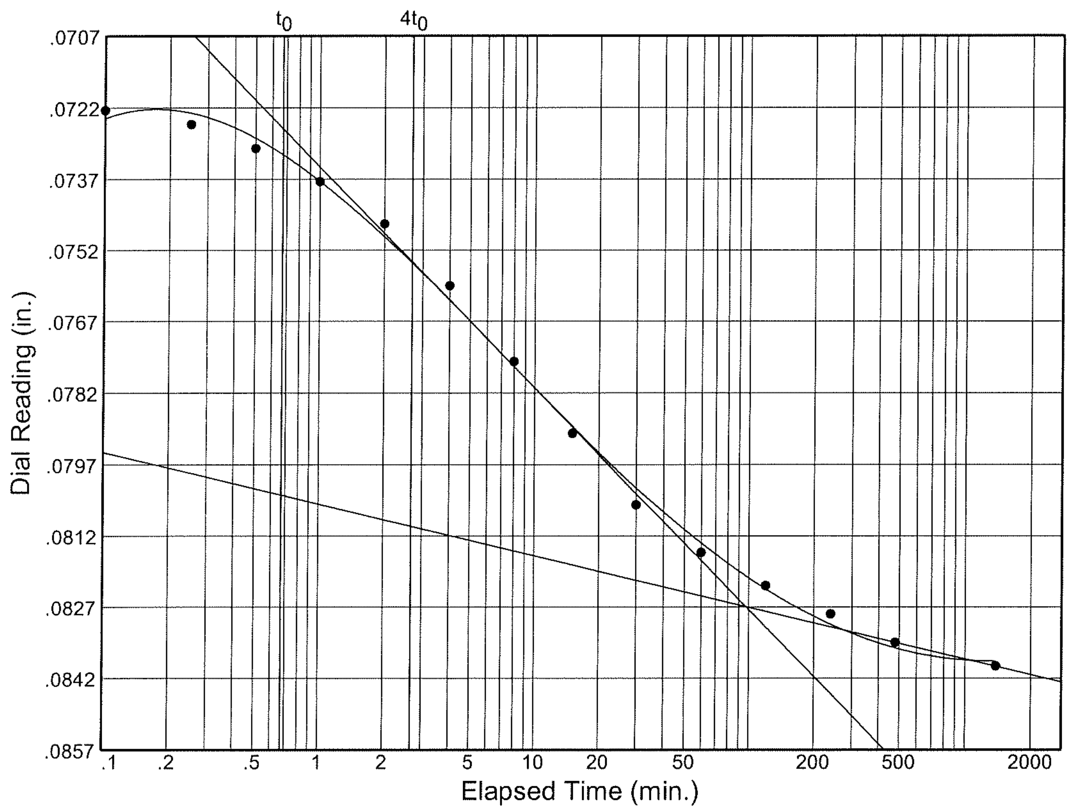
C_α = 0.001

Plate

Dial Reading vs. Time

Project No.: BE-21-054
Project: SAWYER'S LANDING

Location: B-4, T-1: 30' - 32'



Load No.= 3

Load= 0.50 tsf

D_0 = 0.07089

D_{50} = 0.07679

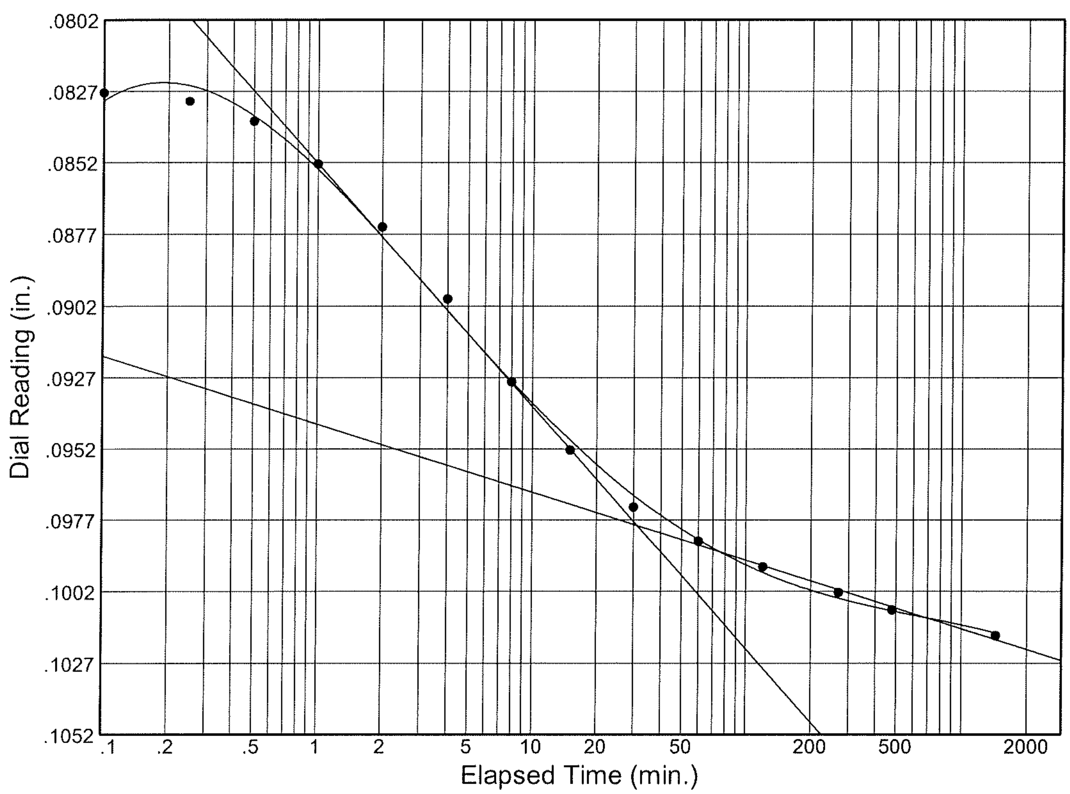
D_{100} = 0.08269

T_{50} = 5.22 min.

C_v @ T_{50}

0.05 ft.^{2}/day

C_α = 0.001



Load No.= 4

Load= 1.00 tsf

D_0 = 0.08395

D_{50} = 0.09092

D_{100} = 0.09790

T_{50} = 4.69 min.

C_v @ T_{50}

0.05 ft.^{2}/day

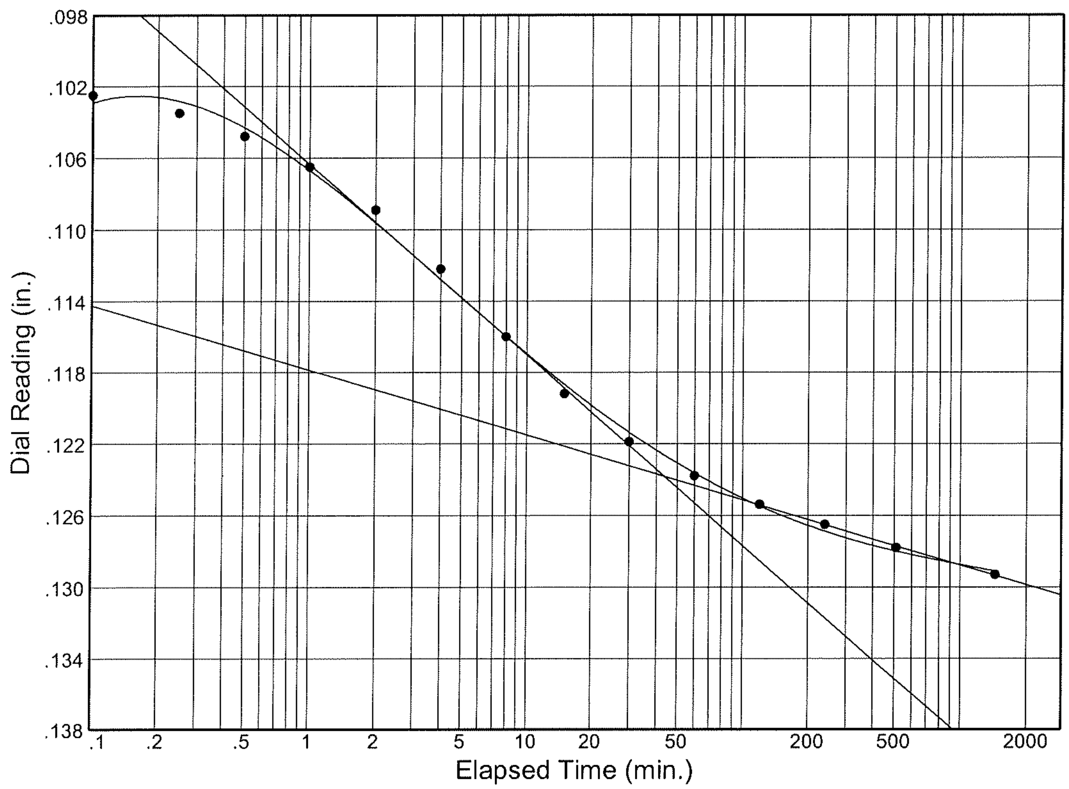
C_α = 0.003

Plate

Dial Reading vs. Time

Project No.: BE-21-054
Project: SAWYER'S LANDING

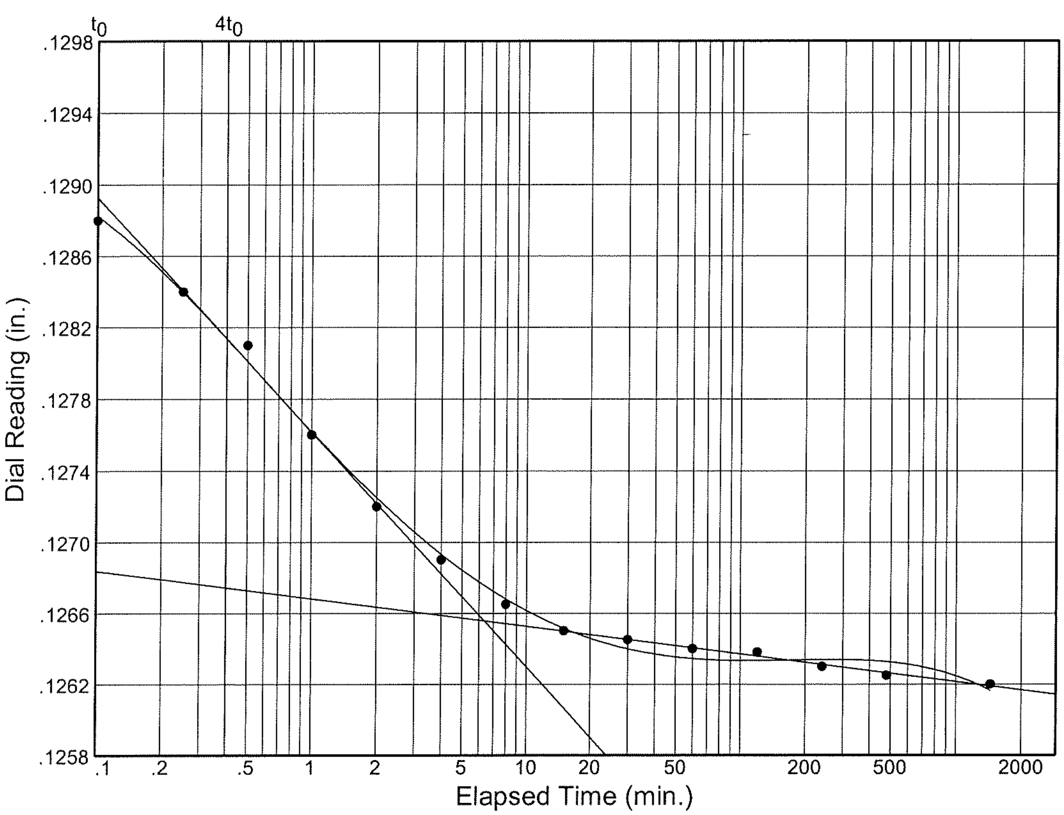
Location: B-4, T-1: 30' - 32'



Load No.= 5
Load= 2.00 tsf
D_0 = 0.10175
D_{50} = 0.11278
D_{100} = 0.12382
T_{50} = 3.99 min.

C_v @ T_{50}
0.06 ft.^{2}/day

C_α = 0.005



Load No.= 6
Load= 1.00 tsf
D_0 = 0.12951
D_{50} = 0.12803
D_{100} = 0.12656
T_{50} = 0.48 min.

C_v @ T_{50}
0.47 ft.^{2}/day

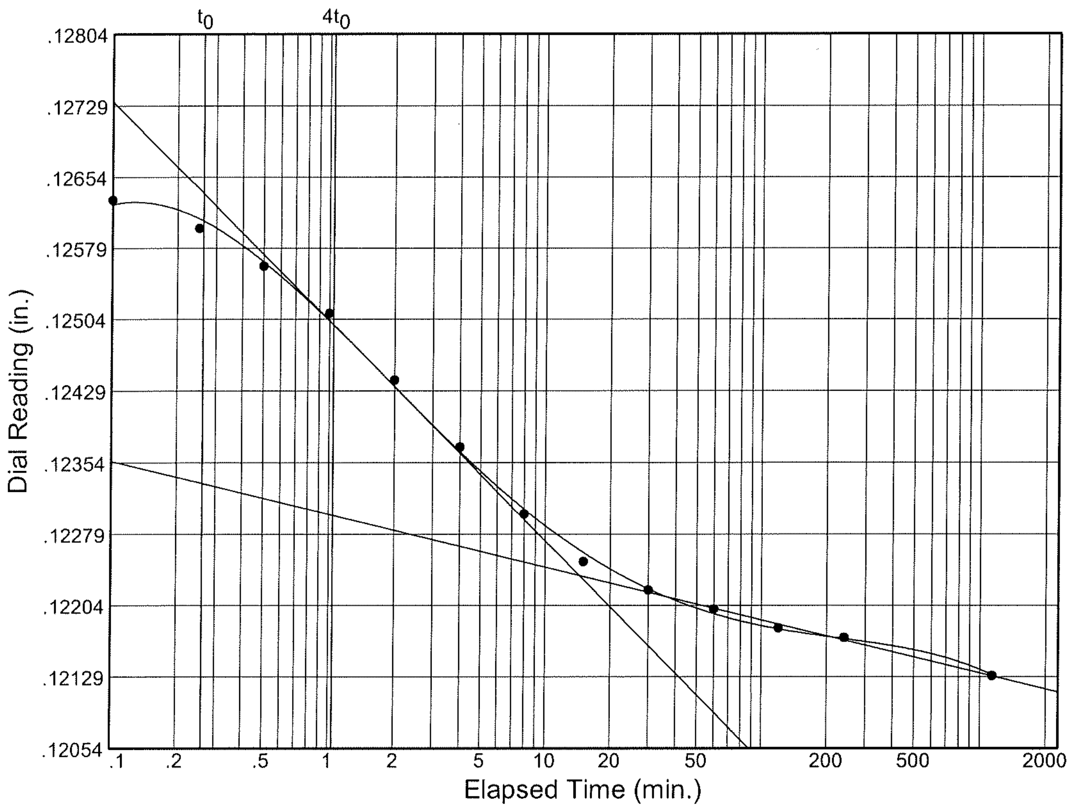
Plate

SJB Services, Inc.

Dial Reading vs. Time

Project No.: BE-21-054
Project: SAWYER'S LANDING

Location: B-4, T-1: 30' - 32'



Load No.= 7

Load= 0.50 tsf

D_0 = 0.12718

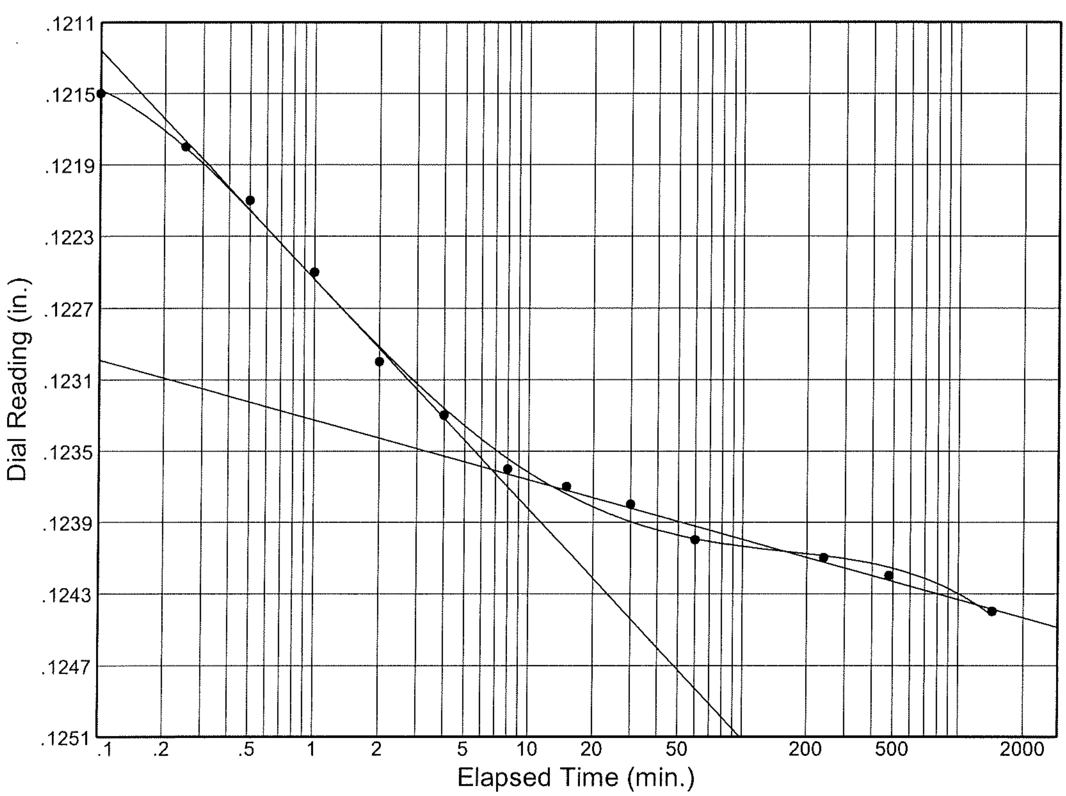
D_{50} = 0.12477

D_{100} = 0.12236

T_{50} = 1.29 min.

C_v @ T_{50}

0.18 ft.^{2}/day



Load No.= 8

Load= 1.00 tsf

D_0 = 0.12130

D_{50} = 0.12245

D_{100} = 0.12360

T_{50} = 0.85 min.

C_v @ T_{50}

0.27 ft.^{2}/day

C_α = 0.000

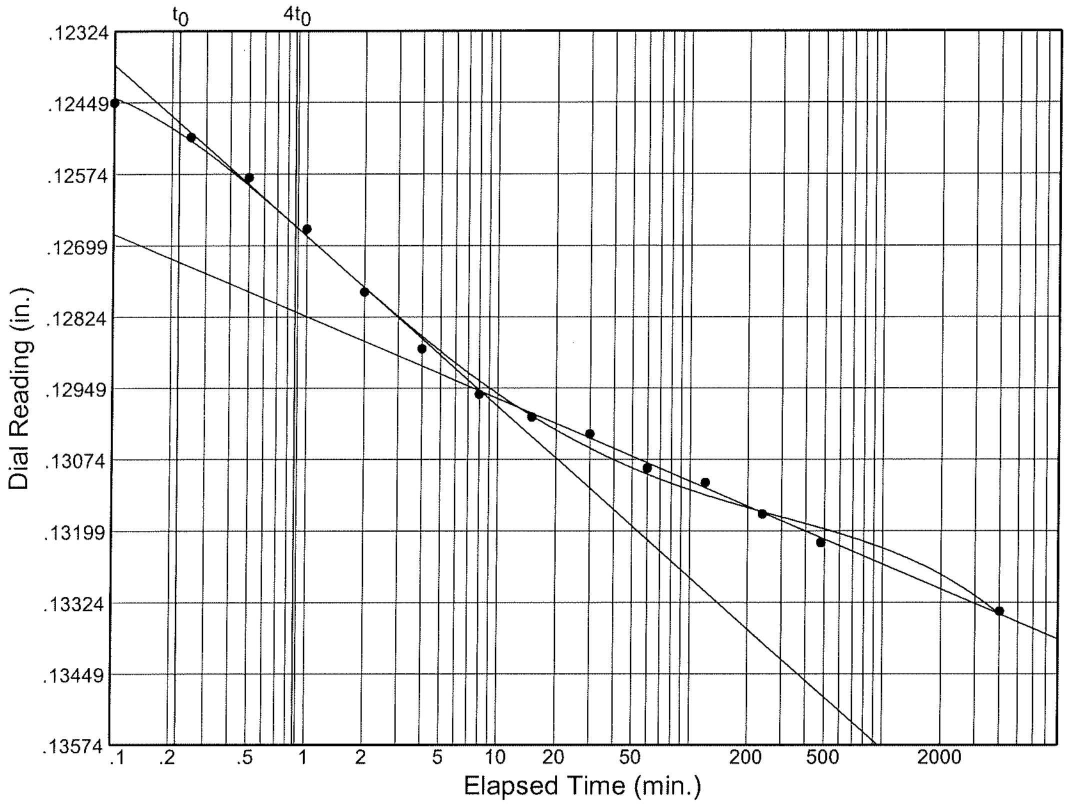
Plate

SJB Services, Inc.

Dial Reading vs. Time

Project No.: BE-21-054
Project: SAWYER'S LANDING

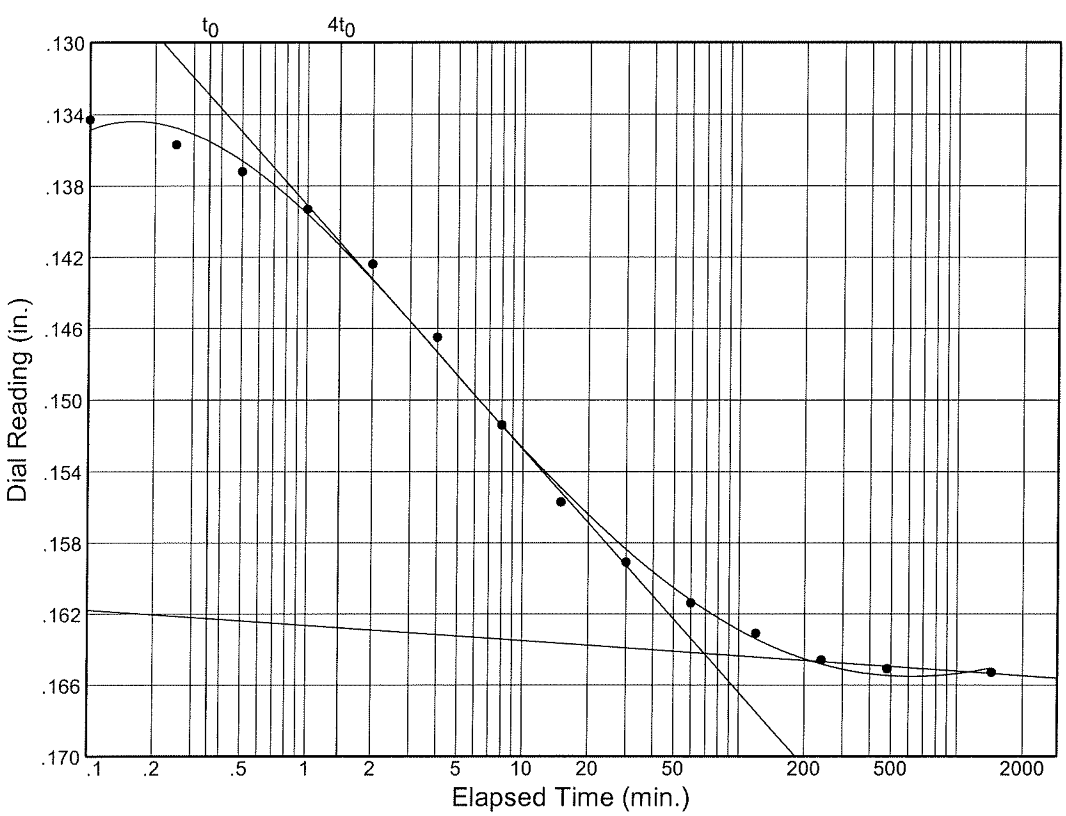
Location: B-4, T-1: 30' - 32'



Load No.= 9
Load= 2.00 tsf
D_0 = 0.12340
D_{50} = 0.12647
D_{100} = 0.12955
T_{50} = 0.76 min.

C_v @ T_{50}
0.30 ft.^{2}/day

C_α = 0.002



Load No.= 10
Load= 4.00 tsf
D_0 = 0.12966
D_{50} = 0.14694
D_{100} = 0.16423
T_{50} = 3.75 min.

C_v @ T_{50}
0.06 ft.^{2}/day

C_α = 0.001

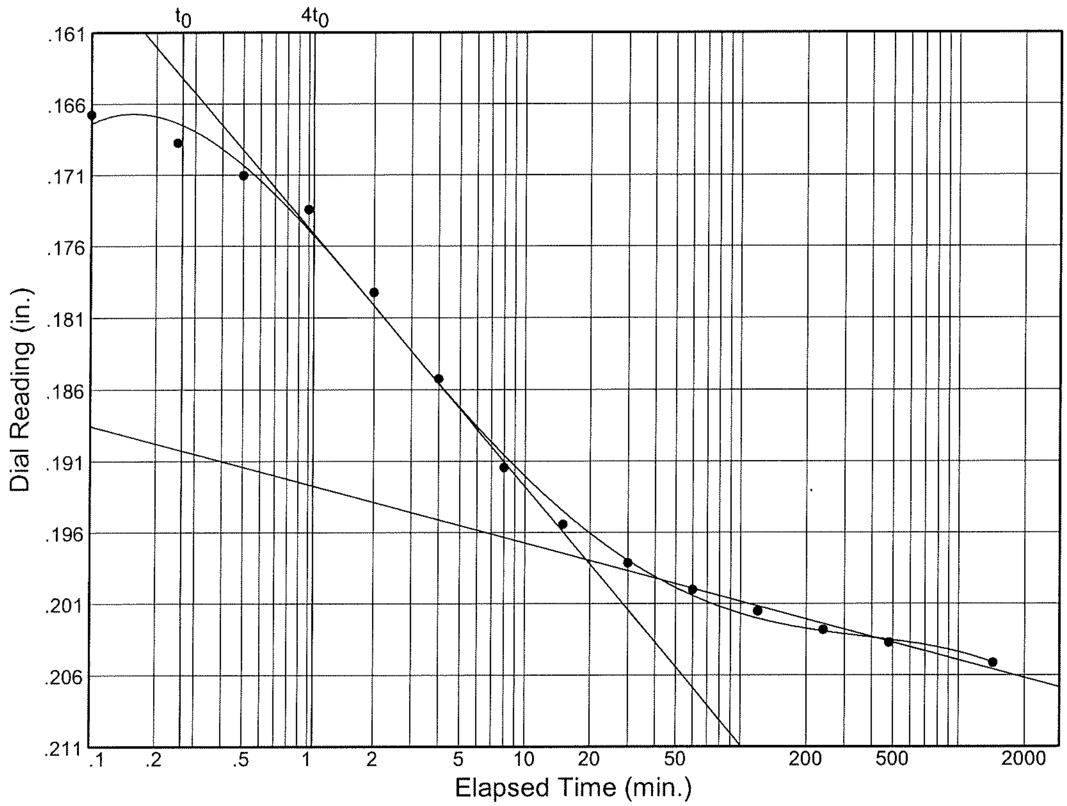
Plate

SJB Services, Inc.

Dial Reading vs. Time

Project No.: BE-21-054
Project: SAWYER'S LANDING

Location: B-4, T-1: 30' - 32'



Load No.= 11

Load= 8.00 tsf

D_0 = 0.15978

D_{50} = 0.17884

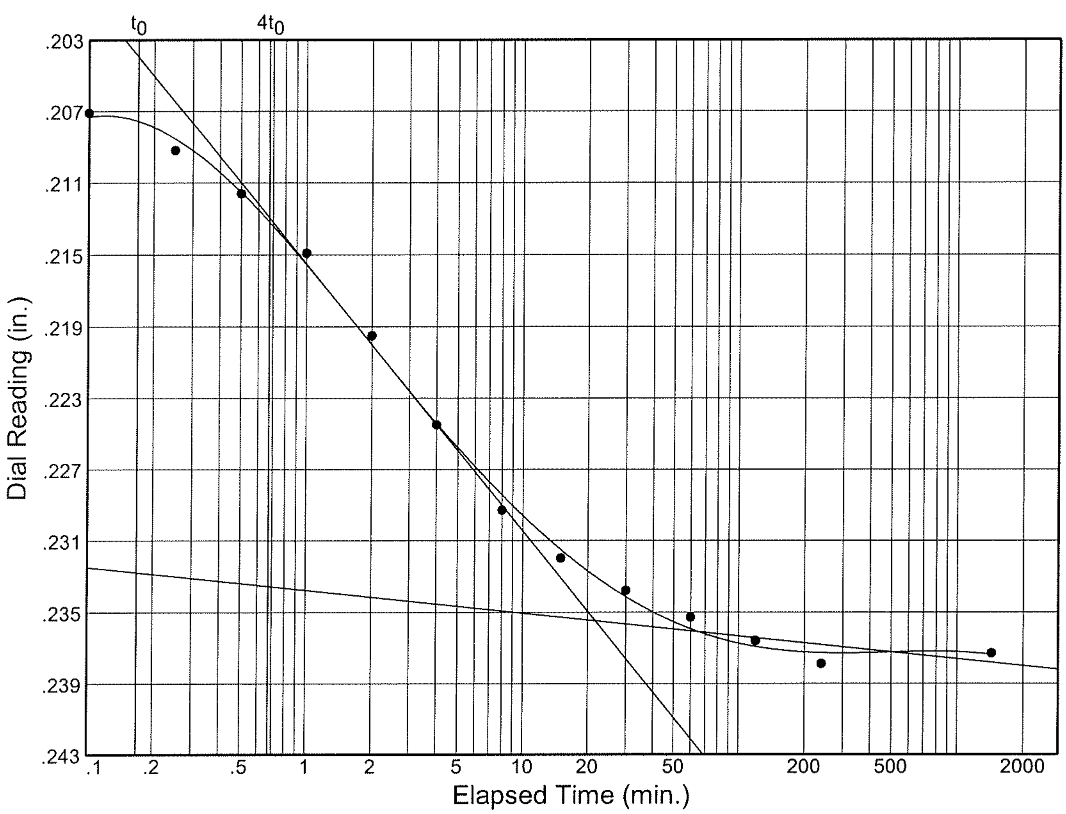
D_{100} = 0.19791

T_{50} = 1.69 min.

C_v @ T_{50}

0.11 ft.^{2}/day

C_α = 0.006



Load No.= 12

Load= 16.00 tsf

D_0 = 0.20193

D_{50} = 0.21870

D_{100} = 0.23548

T_{50} = 1.64 min.

C_v @ T_{50}

0.10 ft.^{2}/day

C_α = 0.002

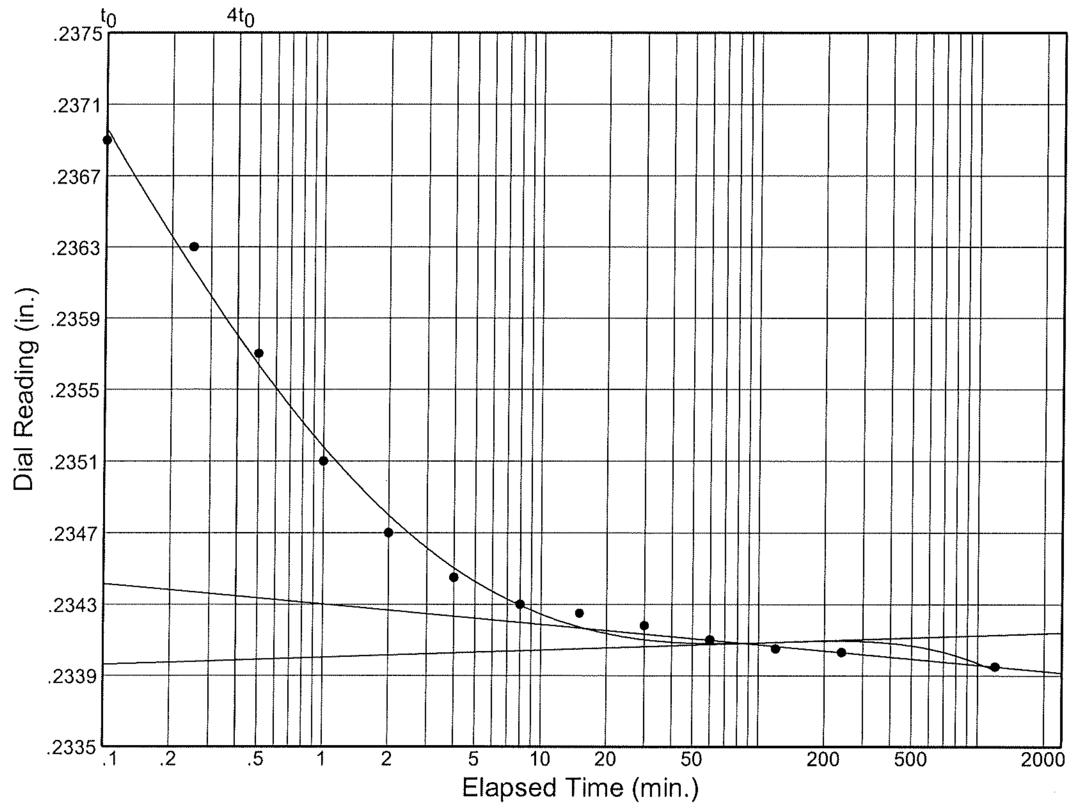
Plate

SJB Services, Inc.

Dial Reading vs. Time

Project No.: BE-21-054
Project: SAWYER'S LANDING

Location: B-4, T-1: 30' - 32'



Load No.= 13

Load= 8.00 tsf

D_0 = 0.23813

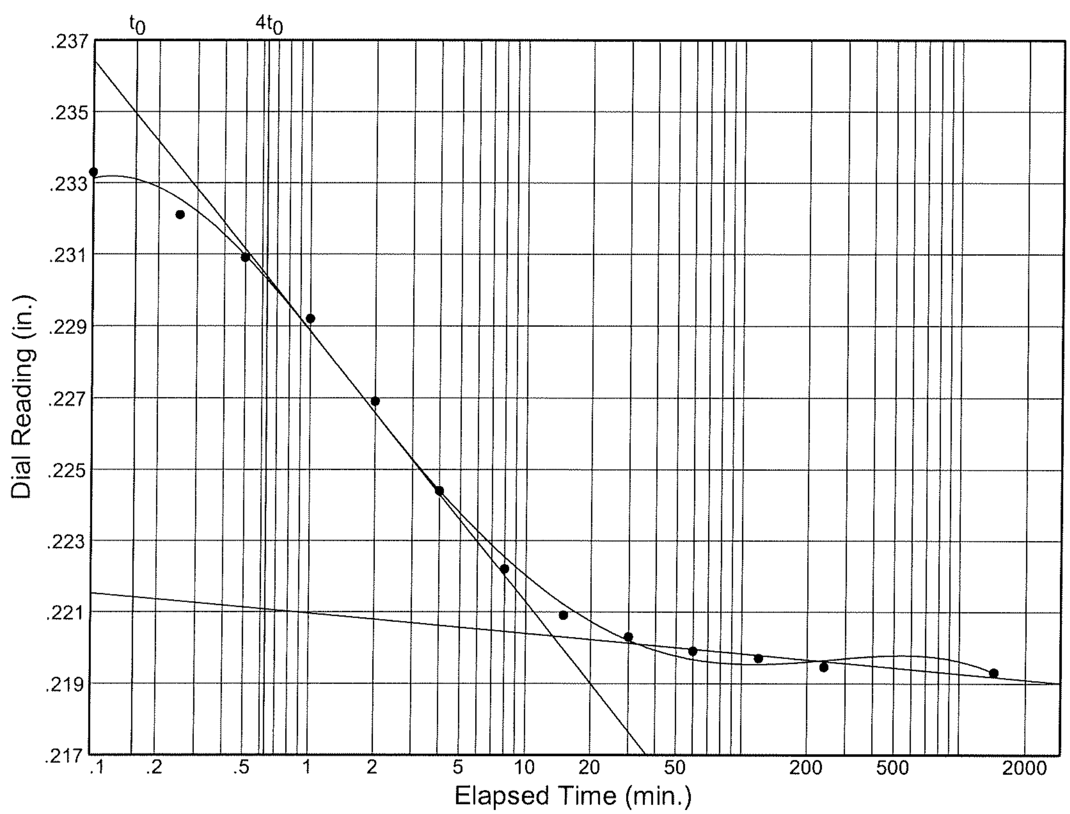
D_{50} = 0.23611

D_{100} = 0.23408

T_{50} = 0.24 min.

C_v @ T_{50}

0.66 ft.^{2}/day



Load No.= 14

Load= 2.00 tsf

D_0 = 0.23592

D_{50} = 0.22812

D_{100} = 0.22032

T_{50} = 1.25 min.

C_v @ T_{50}

0.13 ft.^{2}/day

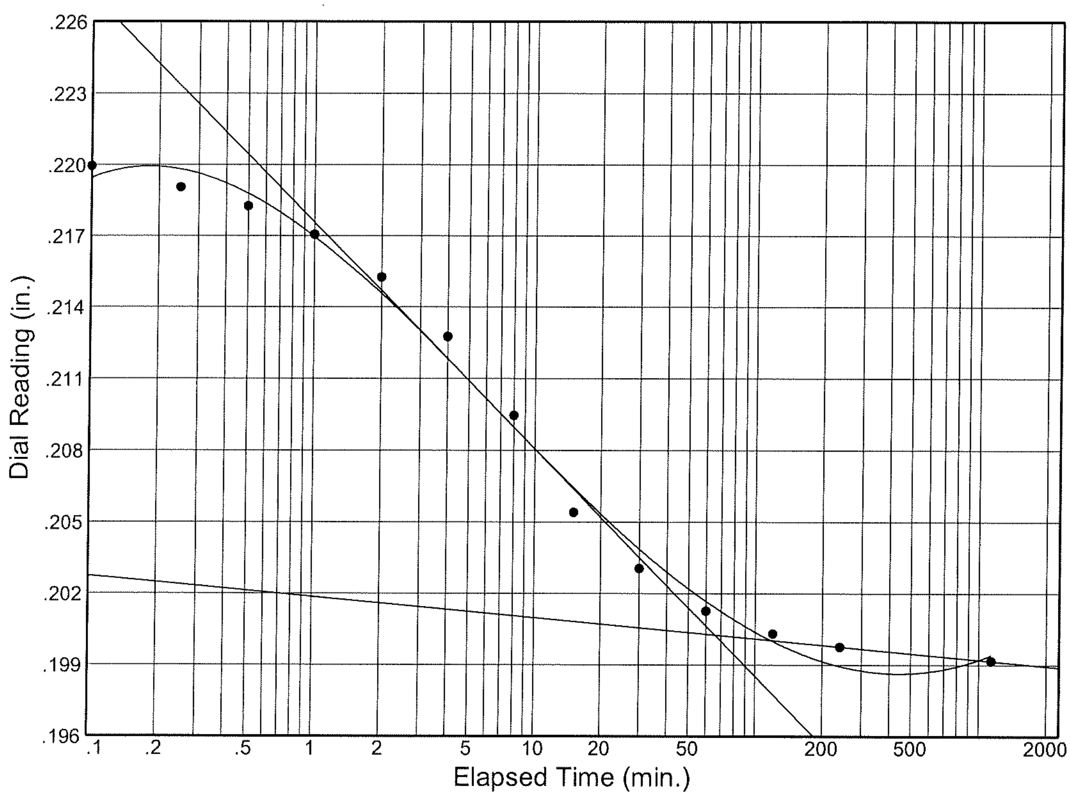
Plate

SJB Services, Inc.

Dial Reading vs. Time

Project No.: BE-21-054
Project: SAWYER'S LANDING

Location: B-4, T-1: 30' - 32'



Load No.= 15

Load= 0.50 tsf

D_0 = 0.21930

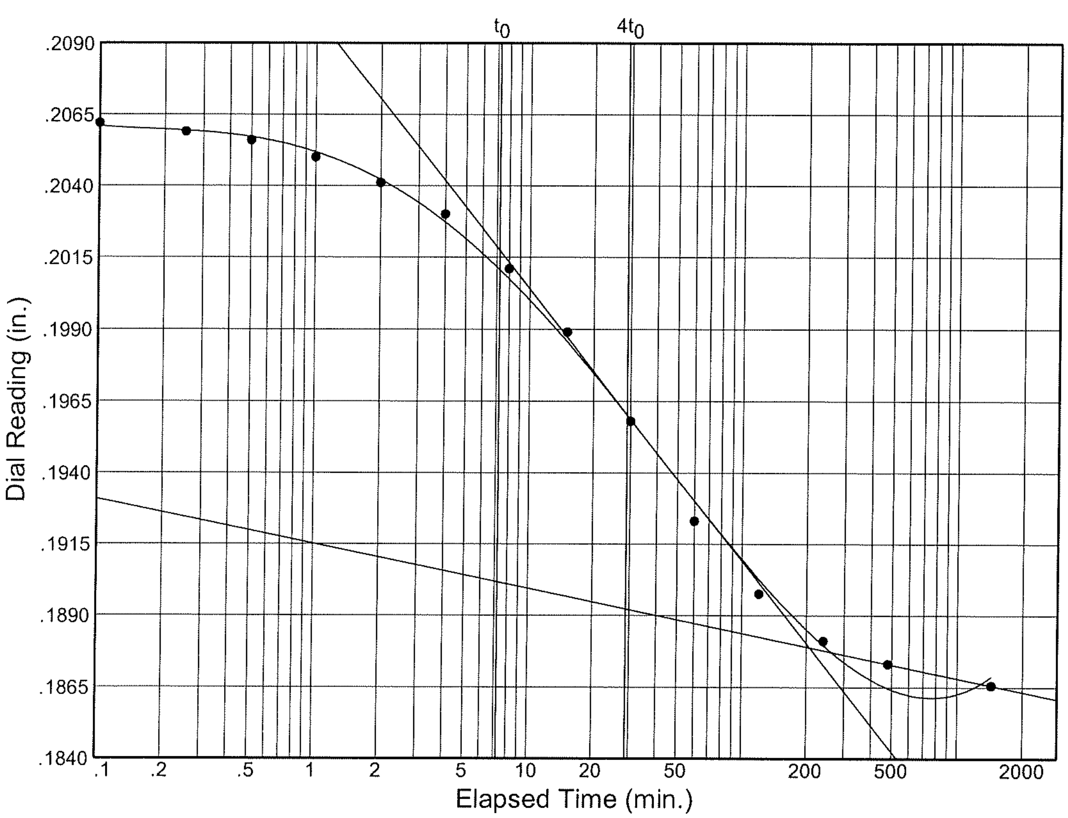
D_{50} = 0.20977

D_{100} = 0.20025

T_{50} = 6.58 min.

C_v @ T_{50}

0.03 ft.^{2}/day



Load No.= 16

Load= 0.13 tsf

D_0 = 0.20613

D_{50} = 0.19700

D_{100} = 0.18787

T_{50} = 22.51 min.

C_v @ T_{50}

0.01 ft.^{2}/day

Plate

SJB Services, Inc.

APPENDIX C

FILL MATERIAL AND EARTHWORK RECOMMENDATIONS

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FILL MATERIAL AND EARTHWORK RECOMMENDATIONS

I. Material Recommendations

A. Structural Fill

Structural Fill should consist of a crusher run stone, free of clay, organics and friable or deleterious particles. As a minimum, the crusher stone should meet the requirements of New York State Department of Transportation, Standard Specifications, Item 304.12 – Type 2 Subbase, with the following gradation requirements.

Sieve Size Distribution	Percent Finer by Weight
2 inch	100
¼ inch	25-60
No. 40	5-40
No. 200	0-10

B. Subbase Stone

The subbase stone course placed as the aggregate course beneath slab-on-grade and pavement construction should conform to the same material requirements as Structural Fill as stated above.

C. Suitable Granular Fill

Suitable soil material, which is well graded from coarse to fine, and classified as GW, GP, GM, SW, SP and SM soils using the Unified Soil Classification System (ASTM D-2487) and having no more than 85- percent by weight material passing the No. 4 sieve, no more than 20- percent by weight material passing the No. 200 sieve and which is generally free of particles greater than 4 inches, will be acceptable as Suitable Granular Fill. It should also be free of topsoil, asphalt, concrete rubble, wood, debris, clay and other deleterious materials. Suitable Granular Fill can be used as foundation backfill and as subgrade fill to raise site grades beneath slab-on-grade and pavement construction.

Material meeting the requirements of New York State Department of Transportation, Standard Specifications, Item 203.07 – Select Granular Fill is acceptable for use as Suitable Granular Fill.

II. Placement and Compaction Requirements

Structural Fill placed beneath foundations, slab on grade floors and pavement, or used as foundation backfill should be compacted to a minimum of 95 percent of the maximum dry density as measured by the modified Proctor test (ASTM D1557). Fill placed in non-loaded grass areas can be compacted to a minimum of 90 percent of the maximum dry density (ASTM D1557).

Placement of fill should not exceed a maximum loose lift thickness of 8 to 10 inches with the exception of subgrade undercuts and the subbase courses beneath slab-on-grade and pavement construction, which can be placed in a single or initial lift not exceeding 12 inches. The loose lift thickness should be reduced in conjunction with the compaction equipment used so that the required density is attained.

Fill should have a moisture content within two percent of the optimum moisture content prior to compaction. Subgrades should be properly drained and protected from moisture and frost. Placement of fill on frozen subgrades is not acceptable. It is recommended that all fill placement and compaction be monitored and tested by a representative of Empire Geotechnical Engineering Services.

III. Quality Assurance Testing

The following minimum laboratory and field quality assurance testing frequencies are recommended to confirm fill material quality and post placement and compaction conditions. These minimum frequencies are based on generally uniform material properties and placement conditions. Should material properties vary or conditions at the time of placement vary (i.e. moisture content, placement and compaction, procedures or equipment, etc.) Then additional testing is recommended. Additional testing, which may be necessary, should be determined by qualified geotechnical personnel, based on evaluation of the actual fill material and construction conditions.

A. Laboratory Testing of Material Properties

- Moisture content (ASTM D-2216) - 1 test per 2,000 cubic yards or no less than 2 tests per each material type.
- Grain Size Analysis (ASTM D-422) - 1 test per 3,000 cubic yards or no less than 2 tests per each material type.
- Liquid and Plastic Limits (ASTM D-4318) 1 test per 3,000 cubic yards or no less than 2 tests per each material type. Liquid and Plastic Limit testing is necessary only if appropriate, based on material composition (i.e. clayey or silty soils).

- Modified Proctor Moisture Density Relationship (ASTM D-1557) 1 test per 4,000 cubic yards or no less than 1 test per each material type. A maximum/minimum density relationship (ASTM D-4253 and ASTM D-4254) may be an appropriate substitute for ASTM D-1557 depending on material gradation.

B. Field In-Place Moisture/Density Testing (ASTM D-3017 and ASTM D-2922)

- Backfilling along trenches and foundation walls - 1 test per 50 lineal feet per lift.
- Backfilling Isolated Excavations (i.e. column foundations, manholes, etc.) 1 test per lift.
- Filling in open areas for slab-on-grade and pavement construction - 1 test per 2,500 square feet per lift.

APPENDIX D

GEOTECHNICAL REPORT LIMITATIONS

GEOTECHNICAL REPORT LIMITATIONS

WMA Engineering DPC / DBA Empire Geotechnical Engineering Services (Empire) has endeavored to meet the generally accepted standard of care for the services completed, and in doing so is obliged to advise the geotechnical report user of our report limitations. Empire believes that providing information about the report preparation and limitations is essential to help the user reduce geotechnical-related delays, cost over-runs, and other problems that can develop during the design and construction process. Empire would be pleased to answer any questions regarding the following limitations and use of our report to assist the user in assessing risks and planning for site development and construction.

PROJECT SPECIFIC FACTORS: The conclusions and recommendations provided in our geotechnical report were prepared based on project specific factors described in the report, such as size, loading, and intended use of structures; general configuration of structures, roadways, and parking lots; existing and proposed site grading; and any other pertinent project information. Changes to the project details may alter the factors considered in development of the report conclusions and recommendations. *Accordingly, Empire cannot accept responsibility for problems which may develop if we are not consulted regarding any changes to the project specific factors that were assumed during the report preparation.*

SUBSURFACE CONDITIONS: The site exploration investigated subsurface conditions only at discrete test locations. Empire has used judgement to infer subsurface conditions between the discrete test locations, and on this basis the conclusions and recommendations in our geotechnical report were developed. It should be understood that the overall subsurface conditions inferred by Empire may vary from those revealed during construction, and these variations may impact on the assumptions made in developing the report conclusions and recommendations. *For this reason, Empire should be retained during construction to confirm that conditions are as expected, and to refine our conclusions and recommendations in the event that conditions are encountered that were not disclosed during the site exploration program.*

USE OF GEOTECHNICAL REPORT: Unless indicated otherwise, our geotechnical report has been prepared for the use of our client for specific application to the site and project conditions described in the report. *Without consulting with Empire, our geotechnical report should not be applied by any party to other sites or for any uses other than those originally intended.*

CHANGES IN SITE CONDITIONS: Surface and subsurface conditions are subject to change at a project site subsequent to preparation of the geotechnical report. Changes may include, but are not limited to, floods, earthquakes, groundwater fluctuations, and construction activities at the site and/or adjoining properties. *Empire should be informed of any such changes to determine if additional investigative and/or evaluation work is warranted.*

MISINTERPRETATION OF REPORT: The conclusions and recommendations contained in our geotechnical report are subject to misinterpretation. *To limit this possibility, Empire should review project plans and specifications relative to geotechnical issues to confirm that the recommendations contained in our report have been properly interpreted and applied.*

Subsurface exploration logs and other report data are also subject to misinterpretation by others if they are separated from the geotechnical report. This often occurs when copies of logs are given to contractors during the bid preparation process. *To minimize the potential for misinterpretation, the subsurface logs should not be separated from our geotechnical report and the use of excerpted or incomplete portions of the report should be avoided.*

OTHER LIMITATIONS: Geotechnical engineering is less exact than other design disciplines, as it is based partly on judgement and opinion. For this reason, our geotechnical report may include clauses that identify the limits of Empire's responsibility, or that may describe other limitations specific to a project. These clauses are intended to help all parties recognize their responsibilities and to assist them in assessing risks and decision making. Empire would be pleased to discuss these clauses and to answer any questions that may arise.