# SOILS INVESTIGATION
# PROPOSED MUSEUM ANNEX DEVELOPMENT
# 56516 NORTH BAY DRIVE
# CHESTERFIELD TOWNSHIP, MICHIGAN

STAHL'S AUTOMOTIVE MUSEUM
48300 STRUCTURAL DRIVE
CHESTERFIELD TOWNSHIP, MICHIGAN 48051

SEPTEMBER 17, 2024
BY
McDOWELL & ASSOCIATES

# McDowell & Associates

***Geotechnical, Environmental & Hydrogeological Services • Materials Testing & Inspection***

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September 17, 2024

Stahl's Automotive Museum
48300 Structural Drive
Chesterfield Township, Michigan 48051

Job No. 24-332

Attention: Mr. Ted Stahl

Subject: Soils Investigation
Proposed Museum Annex Development
56516 North Bay Drive
Chesterfield Township, Michigan

Dear Mr. Stahl:

In accordance with your request, we have conducted a Soils Investigation at the subject project.

**Field Work and Laboratory Testing**

Ten Soil Test Borings, designated as 1 through 10, were performed at the subject property at the approximate locations shown on the Soil Boring Location Plan which accompanies this report. The boring locations were staked by the client. The borings were advanced to depths ranging from five feet six inches (5'6") to twenty feet six inches (20'6") below the existing ground surface at the boring locations.

Soil descriptions, groundwater observations and the results of field and laboratory tests are to be found on the accompanying Logs of Soil Test Borings.

The borings generally encountered one foot one inch (1'1") to four feet (4') of fill soils consisting of surficial clayey topsoil and clay- and sand-type soils with varying silt content underlain by apparent native soft to extremely stiff primarily silty clay-type soils with varying sand content. Borings 1 and 3 encountered some moderate strata of compact and extremely compact sand-type and silt soils.

Soil descriptions and depths shown on the boring logs are approximate indications of change from one soil type to another and are not intended to represent an area of exact geologic change or stratification. The transition from one soil type to the next may be gradual rather than abrupt and subsurface conditions may be different from those found by the borings at locations between or beyond the actual boring locations. Also, the site shows some signs of modification which could indicate fill and soil conditions different from those encountered at the boring locations.

Groundwater was encountered in Borings 1, 2, 3, and 5 through 9 at initial depths ranging from one foot six inches (1'6") to ten feet (10') below the existing ground surface. Upon completion of drilling, groundwater levels were recorded in Borings 1, 2, 3, and 7 at depths ranging from ten feet seven inches (10'7") to fourteen feet three inches (14'3") below the existing ground surface. Groundwater was not encountered in Borings 4 and 10 and Borings 5, 6, 8, and 9 were dry upon

completion of drilling. It should be noted that short-term groundwater observations may not provide a reliable indication of the depth of the water table. In soils with significant fines content (clay and/or silt), this is due to the slow rate of infiltration of water into the borehole as well as the potential for water to become trapped in overlying layers of granular soils during periods of heavy rainfall. Water levels in granular soils fluctuate with seasonal and climatic changes as well as the amount of rainfall in the area immediately prior to the measurements. It should be expected that groundwater fluctuations could occur on a seasonal basis and that seams of water-bearing sands or silts could be found within the various clay strata at the site.

Standard Penetration Tests (SPTs) performed during the sampling operation indicate that the site soils have poor to very good strengths and densities. The tests at a depth of two feet six inches (2'6") resulted in penetration indices ranging from 3 to 16 blows per foot. The five-foot (5') test values varied from 5 to 29 blows per foot. At a depth of seven feet six inches (7'6"), the results ranged from 8 blows per foot to 26 blows per nine inches (9"). At ten feet (10') and below, penetration indices varied from 6 blows per foot to 40 blows for the initial six-inch (6") drive. All SPTs were performed with a rope and cathead safety hammer.

Following completion of Borings 6 and 8, a second adjacent borehole was drilled to the test depth determined by our engineer. The pond invert elevation was unknown at the time of drilling/testing. PVC standpipes were then inserted into the adjacent boreholes and penetrated a few inches into the soil, and the borehole was partially backfilled. Potable water was poured into the standpipes and water level versus time measurements were made at each location. The results are provided on the accompanying Cased Borehole Infiltration Test Logs.

| Location | Ground Surface Elevation (ft) | Approximate Test Depth (ft) | Field Infiltration Rate (in/hr) |
|---|---|---|---|
| 6 | N/A | 4.0 | 0.0 |
| 8 | N/A | 5.0 | 0.0 |

**Project Description**

It is understood that the project will consist of constructing an approximately 40,000ft² two-story slab-on-grade museum building, a one-story slab-on-grade Sinclair Gas Station building, a parking lot, an asphalt roadway driving course with a covered bridge, and a large detention pond at the subject property. It is anticipated that the structures will transmit relatively light loads to the supporting soils and pavements will support mostly automobile traffic with occasional delivery, sanitation, and plow trucks.

**Foundation Recommendations**

Based on the project information provided and the results of field and laboratory tests, the indications are that the structures could be supported by conventional to slightly deeper and/or wider than normal spread or strip footings. All exterior footings should be constructed at, or below, a minimum frost penetration depth of three feet six inches (3'6") below finished grade. All interior and exterior load-bearing footings should extend through non-engineered fill soils, soils containing significant amounts of organic substances, or excessively weak soils. All strip footings should be continuously reinforced in order to minimize any noticeable effects of differential settlement.

Where sand-type soils are overlying clay soils, it is suggested that footing inverts be at least one foot (1') above the top of clay. If this is not possible, it is suggested that the footings extend down to the underlying clay.

Footings constructed at the following boring locations could be proportioned for the design soil pressures shown below, provided this results in the footings bearing on native, non-organic soils:

| Boring | Depth | Soil Pressure (psf) |
|---|---|---|
| 1 | 2'6" to 10'0" | 4,000 |
| 2 | 2'6" to 4'0" | 1,000 |
| | 4'0" to 7'0" | 3,000 |
| | 7'0" to 10'0" | 3,500 |
| 3 | 2'6" to 4'0" | 2,000 |
| | 4'0" to 7'0" | 3,500 |
| | 7'0" to 10'0" | 3,000 |
| 4 | 2'0" to 3'6" | 2,000 |
| | 3'6" to 6'0" | 2,500 |
| | 6'0" to 10'0" | 3,000 |
| 5 | 4'0" to 6'0" | 2,000 |
| | 6'0" to 10'0" | 3,500 |
| 7 | 2'6" to 6'0" | 2,000 |
| | 6'0" to 10'0" | 3,000 |

Based on the above chart, it appears that lower strength soils may be encountered in the vicinity of Boring 2 which will necessitate deeper and/or wider than normal footing sizes. A maximum design soil pressure of 4,000psf was considered for this project. Higher design soil pressures are available at various depths in the borings and could be detailed, if desired.

The Soil Survey for Macomb County, prepared by the U.S. Department of agriculture Soil Conservation Services, indicate the site soils consist of Lenawee (Lg), Del Rey (DlA), and Fulton (FuA) clay soils. The soil survey indicates that these clay soils are moderately to highly susceptible to shrink-swell tendencies. Our laboratory tests indicate that the deeper site clay soils have generally high moisture contents and relatively low unit weights, which could tend to indicate shrinkage-type soils, especially at Borings 2 through 10.

Our experience has been that low unit weight, high moisture content clay soils in Michigan may shrink and cause significant stress to structures. Rarely have we experienced conditions where swell has been a problem. Our experience with Michigan soils has indicated that these soils could vary widely within a short distance. In order for these clay soils to cause a problem, the moisture contents must vary. Our experience has been that the normal summer drying process may affect frost depth footings in these clay soils.

In areas of the country where major shrink-swell problems occur, foundations typically consist of drilling piers with compressible material under the grade beams and special floor interior partition design. We have not found this type of construction necessary in Michigan. We have typically done some, or all, of the following to minimize the potential problem:

1. Heavily reinforced continuous footings.

2. Extended frost footings deeper than normal. Often, they are taken four feet (4') to four feet six inches (4'6") below the finished exterior grade.

3. Kept trees away from foundations to prevent their root system from removing moisture from the soils near the footings.

***Engineered Fill***

As an alternative to slightly deeper and/or wider than normal footings, the buildings' spread or strip footings could be supported on engineered fill. All existing non-engineered fill, organic soils, soft soils and loose granular soils should be excavated and removed from the proposed foundation area. The excavations should extend beyond the edge of the structure's proposed footings at least six inches (6") for every foot below the footing. Groundwater flow into the excavation is expected to be manageable with construction pumping and sumps. The removal of the unsuitable soils should be done in the presence of a qualified soils engineer or technician to limit the potential for uncontrolled fill or highly organic soils being left behind before the placement of engineered fill. After the unsuitable soils have been removed, the excavation should preferably be filled with compacted bank run sand similar to MDOT Class I or II granular soils. If clay material is utilized, it should be placed within 3% of its optimum moisture content. If the bottom of the excavation is not sufficiently stable to install the fill material, then a layer of coarse stone fill such as MDOT 6AA crushed stone could be installed. Geotextile filter fabric should be placed between the coarse stone engineered fill material and lower native granular soils to minimize the amount of fines infiltrating into the aggregate material. If granular material is to be placed above the stone, a six-inch (6") layer of MDOT 21AA or an additional layer of filter fabric should be placed above the stone, overlapping the underlying fabric to further minimize the amount of material infiltrating into the aggregate material. The fill soils should be deposited in horizontal lifts not to exceed nine inches (9") in thickness with each lift being compacted uniformly to a minimum density of 95% of its maximum value as determined by the Modified Proctor Test (ASTM D-1557).

One inch by three-inch (1" x 3") size crushed stone or crushed concrete could be used in lieu of the MDOT 6AA aggregate and bank run sand that we recommended above. The crushed material would need to be placed and compacted in lifts not exceeding nine inches (9") up to about one foot (1') below the planned footings and/or floor slabs. About a one foot (1') thick layer of MDOT 21AA dense-graded aggregate could then be placed above the crushed material in an effort to choke off the stone. The crushed stone or crushed concrete material should not contain significant amounts of brick and should be relatively clean of lime or cement dust which could potentially foul up or clog potential drain tiles. We suggest that the brick content should be less than 5% and cement/lime dust should be less than 3%. The large, crushed material will need to be separated from the existing site granular soils by a geotextile filter fabric. We suggest that a filter fabric be

placed along the bottom and sides of the engineered fill excavation in an effort to minimize fines from migrating into the voids within the crushed material. It should be noted that the use of crushed concrete could cause problems with any potential drain tiles. When water percolates through crushed concrete, the pH of the water can increase and minerals can precipitate out of the solution (mostly calcium salts and, in some cases, calcium hydroxide). Mineral deposits precipitating from the solution can shorten the life of sump pumps and plug drain tiles. High pH water can also corrode metal pipes. See AASHTO M 319-02 (2023) for discussion of these problems. Since the new structures will have a slab-on-grade, precipitating mineral deposits should not be a major concern.

Foundations placed on the engineered fill could be proportioned for a design soil pressure of 3,000psf provided the strength is not limited by the presence of weaker underlying materials. Engineered fill should be placed and compacted up to footing and floor invert elevations.

**Groundwater Considerations**

Based on the indications from the borings, footing and potential engineered fill excavations should be in primarily clay-type soils. Water seepage from wet sand or silt seams was encountered as shallow as one foot six inches (1’6”) in Borings 2 and 3. If significant, seepage from wet sand seams should be manageable with construction pumping and sumps. However, this is not known for certain. If large volumes of water or saturated granular soils are encountered, special dewatering techniques may be required. Care must be taken to minimize the removal of soil fines during any pumping operations. If standing water remains on the clay-type footing invert soils for an extended period of time, it may result in a couple inches of “slop” material at the footing invert. This material should be removed prior to the placement of concrete.

**Floor Slabs**

Concrete floors or floor-supporting backfill could be placed near the present grade at Borings 4 and 7. The existing topsoil, encountered to respective depths of one foot one inch (1’1”) and two feet three inches (2’3”), or other obviously objectionable materials should be removed, and the subgrade should then be thoroughly proof-compacted. If, during the proof-compaction operation, areas are found where the soils yield excessively, the yielding materials should be scarified, dried, and recompacted or removed and replaced with engineered fill. Where fill or backfill is required to raise the subgrade for concrete floors or backfill utility trenches, it is suggested that clean, well-graded granular soils be used. If clay material is utilized, it should be placed within 3% of its optimum moisture content. The fill should be deposited in horizontal lifts not to exceed nine inches (9”) in thickness with each lift being compacted uniformly to a minimum density of 95% of its maximum value as determined by the Modified Proctor Test (ASTM D-1557).

Fill soils were encountered in Borings 1, 2, 3, and 5 to depths ranging from two feet two inches (2’2”) to four feet (4’). If the possibility of more than normal differential settlement can be tolerated, slab-on-grade floors or floor-supporting backfill could be placed at, or near, the present grade in the vicinity of Borings 1, 2, and 3. Any topsoil or other obviously objectionable material should be removed and the subgrade thoroughly proof-compacted. If, during the proof-compaction operation, areas are found where the soils yield excessively, the yielding materials should be scarified, dried, and recompacted or removed and replaced with engineered fill as outlined above.

If the possibility of more than normal differential movement cannot be tolerated, then all existing fill soils should be removed and replaced with engineered fill meeting the requirements outlined above, or the floor slab should be structurally supported.

The low-density fill soils encountered in Boring 5 should be removed in their entirety and replaced with engineered fill placed to meet the specifications outlined above.

If any existing structures are found, they should be entirely removed from the proposed building area. Buried utilities should be removed or grouted in place. Resulting excavations should be backfilled with engineered fill meeting the requirements outlined above.

To minimize capillary action under floor slabs, we suggest placing at least four inches (4") of clean material on the subgrade followed by a suitable plastic vapor barrier between the clean material and the concrete slab. The clean material would preferably consist of MDOT 6AA crushed stone or MDOT Class II sand.

Moisture contents greater than 20% were found in shallow soils at all of the borings. High moistures may tend to make these soils unstable under vehicular loading. During periods of wet weather in the spring and fall, these soils could rut and pump under construction traffic. Undercutting and compacted crushed stone may be required in various areas to stabilize driveway, roadway and pavement subgrades or entail the complete removal of these soils.

**Pavement Design**

It appears that the subgrade soils consist of silty clay soils. We would expect the clay soils to have low California Bearing Ratios (CBRs) on the order of 3% and a modulus of subgrade reaction of about one hundred pounds per cubic inch (100pci). It appears these soils have a high percentage of silt-sized particles which would indicate they would tend to have a severe frost heave potential.

The following pavement sections are suggested and are per latest Chesterfield Township Standard Paving Details (2018):

A. Light Duty – Automobile Parking Areas (2 trucks per day)

| | | | |
|---|---|---|---|
| 1. | Asphaltic Pavement | 4" | Asphalt<br>Wearing Course: MDOT 5E3 or LVSP<br>Base Course: MDOT 2E3 |
| | | 6" | Compacted MDOT 21AA Type Crushed Stone |
| | | 12" | Compacted Subgrade |
| 2. | Concrete Pavement | 6" | Concrete |
| | | 6" | Compacted MDOT Class II Sand Base |
| | | 12" | Compacted Subgrade |

B. Medium Duty – Drive Areas (10 trucks per day)

| | | | |
|---|---|---|---|
| 1. | Asphaltic Pavement | 6” | Asphalt<br>Wearing Course: MDOT 5E3 or LVSP<br>Leveling Course: MDOT 4E3<br>Base Course: MDOT 2E3 |
| | | 8” | Compacted MDOT 21AA Crushed Stone Base |
| | | 12” | Compacted Subgrade |
| 2. | Concrete Pavement | 8” | Concrete |
| | | 6” | Compacted MDOT Class II Sand Base |
| | | 12” | Compacted Subgrade |

Fill soils were encountered in the borings to depths up to four feet (4’) below the existing ground surface. In the areas to be paved, if the possibility of more than normal settlement can be tolerated, the site could be prepared in a manner similar to that recommended above. The subgrade should be reworked until approximately the upper one foot (1’) of the subgrade is compacted to at least 95% of its maximum dry density as determined by the Modified Proctor Test. If the possibility of more than normal settlement cannot be tolerated, then the fill soils should be removed and replaced with engineered fill as outlined above. The granular/aggregate base material should be compacted to a minimum of 98% of the Modified Proctor Value. The asphalt should be placed in accordance with MDOT specifications as well as applicable local requirements and compacted to a minimum of 92% of the Theoretical Maximum Density (TMD).

It is recommended, as a minimum, that stub drains be provided at the storm sewer catch basins to provide some drainage for the pavement base. The subgrade should be properly sloped to allow drainage of surface water. Eight inches (8”) of concrete pavement should be used in the dumpster area and other intensive truck wheel load areas. Edge drains should be installed in watered and landscaped areas.

**Stormwater Management System**

To be suitable for infiltration, it is our understanding that a minimum infiltration rate of 0.24 inch/hour as well as a minimum clearance of two feet (2’) between the seasonal high water table and the invert of the proposed system is required by the county.

Each of the infiltration tests were performed in clay-type soils and each test resulted in an infiltration rate of 0.0 in/hr. We would typically expect clay-type soils to have permeability coefficients of less than $1.0 \times 10^{-6}$ cm/s which is consistent with the infiltration test results. Based on the indications from the two cased borehole infiltration tests performed at specific locations, the existing site soils do not appear to be suitable for infiltration.

It is recommended that any proposed infiltration surface be visually inspected upon excavation to verify that appropriate soils are present. This would be done to ensure that significant variations in either soil texture or soil type do not exist at locations other than those actually tested by the infiltration tests.

**Closing**

Experience indicates that actual subsurface conditions at the site could vary from those found at the ten test borings performed at specific locations. It is, therefore, essential that McDowell & Associates be notified of any variation of soil conditions to determine their effects on the recommendations presented in this report. The evaluations and recommendations presented in this report have been formulated on the basis of reported or assumed data relating to the proposed project. Any significant change in the final design plans should be brought to our attention for review and evaluation with respect to the prevailing subsoil conditions.

It is recommended that the services of McDowell & Associates be engaged to observe the soils in the footing excavations prior to concreting or engineered fill placement in order to test the soils for the required bearing capacities. Testing should also be performed to check that suitable materials are being used for controlled fills and that they are properly placed and compacted.

If we can be of any further service, please feel free to call.

Very truly yours,

McDOWELL & ASSOCIATES

David Quintal, P.E.
Senior Engineer

Loran Stenzel-Sebastian
Staff Geologist

LS/jb

McDOWELL & ASSOCIATES
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**LOG OF SOIL BORING NO.** 1

**PROJECT** Soils Investigation
Proposed Museum Annex Development

**LOCATION** 56516 North Bay Drive
Chesterfield Township, Michigan

**JOB NO.** 24-332

**SURFACE ELEVATION** _____ **DATE** 9/9/2024

| Sample & Type | Depth | Legend | SOIL DESCRIPTION | Penetration Blows for 6" | Moisture % | Natural Wt. P.C.F. | Dry Den Wt. P.C.F. | Unc. Comp. Strength PSF. | Str. % |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | | Moist brown fine SAND with traces of topsoil and vegetation, fill | | | | | | |
| A | 2 | | | 6 | | | | | |
| UL | | | 2'2" | 6 | 24.3 | --- | | | |
| | 3 | | Compact moist brown fine SAND with moist variegated clayey sand seams | 10 | | | * | (9000+) | |
| | 4 | | 4'0" | | | | | | |
| B | | | | 11 | | | | | |
| UL | 5 | | | 14 | 21.0 | 124 | | | |
| | | | | 15 | | | * | (9000+) | |
| | 6 | | Extremely stiff moist variegated silty CLAY with traces of sand and pebbles | | | | | | |
| C | 7 | | | 12 | | | | | |
| UL | | | | 16 | | | | | |
| | 8 | | | 10/3" | | | | | |
| | 9 | | | | | | | | |
| D | | | 9'0" Very stiff moist variegated silty CLAY with wet brown and gray silty fine sand seams | 5 | | | | | |
| UL | 10 | | | 9 | 13.8 | 127 | | | |
| | | | 10'0" | 12 | | | * | (5000) | |
| | 11 | | | | | | | | |
| | 12 | | Very stiff moist blue silty CLAY | | | | | | |
| | 13 | | | | | | | | |
| | 14 | | | | | | | | |
| E | | | 14'0" | 22 | | | | | |
| UL | 15 | | Extremely compact wet gray sandy SILT with trace of clay | 23 | | | | | |
| | | | 15'3" | 10/3" | | | | | |
| | 16 | | | | | | | | |
| | 17 | | | | | | | | |
| | 18 | | | | | | | | |
| | 19 | | | | | | | | |
| | 20 | | | | | | | | |
| | 21 | | | | | | | | |
| | 22 | | | | | | | | |
| | 23 | | | | | | | | |
| | 24 | | | | | | | | |
| | 25 | | | | | | | | |

TYPE OF SAMPLE
D. - DISTURBED
U.L. - UNDIST. LINER
S.T. - SHELBY TUBE
S.S. - SPLIT SPOON
R.C. - ROCK CORE
( ) - PENETROMETER

REMARKS: *Calibrated Penetrometer

Standard Penetration Test - Driving 2" O.D. Sampler 1' With 140lb Hammer Falling 30": Count Made at 6" Intervals

GROUND WATER OBSERVATIONS

| | | | | |
|---|---|---|---|---|
| G.W. ENCOUNTERED AT | 10 | FT. | 0 | INS. |
| G.W. ENCOUNTERED AT | | FT. | | INS. |
| G.W. AFTER COMPLETION | 11 | FT. | 8 | INS. |
| G.W. AFTER HRS. | | FT. | | INS. |
| G.W. VOLUMES | Medium-Heavy - Cave-In at 11'8" | | | |

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Phone: (248) 399-2066 • Fax: (248) 399-2157

**LOG OF SOIL BORING NO.** 2

**PROJECT** Soils Investigation
Proposed Museum Annex Development

**LOCATION** 56516 North Bay Drive
Chesterfield Township, Michigan

**JOB NO.** 24-332

**SURFACE ELEVATION** _____ **DATE** 9/9/2024

| Sample & Type | Depth | Legend | SOIL DESCRIPTION | Penetration Blows for 6" | Moisture % | Natural Wt. P.C.F. | Dry Den Wt. P.C.F. | Unc. Comp. Strength PSF. | Str. % |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | | Moist dark brown clayey TOPSOIL with vegetation, fill | | | | | | |
| | | | 1'6" | | | | | | |
| A | 2 | | Soft moist discolored silty sandy CLAY with topsoil, fill | 2 | | | | | |
| UL | | | | 2 | 19.4 | --- | | | |
| | 3 | | 2'6" | 2 | | | * | (6000) | |
| | | | Soft moist brown silty CLAY with wet brown silty fine sand seams | | | | | | |
| | 4 | | | | | | | | |
| | | | 4'0" | | | | | | |
| B | | | | 4 | | | | | |
| UL | 5 | | | 4 | 26.4 | 123 | | | |
| | | | | 6 | | | * | (9000+) | |
| | 6 | | | | | | | | |
| | | | | | | | | | |
| C | 7 | | | 3 | | | | | |
| UL | | | | 5 | 28.9 | 121 | | | |
| | 8 | | Stiff moist variegated silty CLAY | 8 | | | * | (7000) | |
| | | | | | | | | | |
| | 9 | | | | | | | | |
| D | | | | 4 | | | | | |
| UL | 10 | | | 5 | | | | | |
| | | | | 6 | | | | | |
| | 11 | | | | | | | | |
| | | | | | | | | | |
| | 12 | | | | | | | | |
| | | | | | | | | | |
| | 13 | | | | | | | | |
| | | | 13'0" | | | | | | |
| | 14 | | | | | | | | |
| E | | | | 4 | | | | | |
| UL | 15 | | Stiff moist blue silty CLAY with traces of sand and pebbles and wet gray silt seams | 4 | | | | | |
| | | | | 5 | | | | | |
| | 16 | | | | | | | | |
| | | | | | | | | | |
| | 17 | | | | | | | | |
| | | | | | | | | | |
| | 18 | | | | | | | | |
| | | | 18'0" | | | | | | |
| | 19 | | Extremely stiff moist blue silty CLAY with traces of sand and pebbles | | | | | | |
| F | | | | 40 | | | | | |
| UL | 20 | | 19'6" | - | | | | | |
| | | | | - | | | | | |
| | 21 | | | | | | | | |
| | | | | | | | | | |
| | 22 | | | | | | | | |
| | | | | | | | | | |
| | 23 | | | | | | | | |
| | | | | | | | | | |
| | 24 | | | | | | | | |
| | | | | | | | | | |
| | 25 | | | | | | | | |

TYPE OF SAMPLE
D. - DISTURBED
U.L. - UNDIST. LINER
S.T. - SHELBY TUBE
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REMARKS: *Calibrated Penetrometer

Standard Penetration Test - Driving 2" O.D. Sampler 1' With 140lb Hammer Falling 30": Count Made at 6" Intervals

GROUND WATER OBSERVATIONS

| | | | | |
|---|---|---|---|---|
| G.W. ENCOUNTERED AT | 1 | FT. | 6 | INS. |
| G.W. ENCOUNTERED AT | 14 | FT. | 0 | INS. |
| G.W. AFTER COMPLETION | 10 | FT. | 7 | INS. |
| G.W. AFTER HRS. | | FT. | | INS. |
| G.W. VOLUMES | | Medium-Heavy | | |

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**LOG OF SOIL BORING NO.** 3

**PROJECT** Soils Investigation
Proposed Museum Annex Development

**LOCATION** 56516 North Bay Drive
Chesterfield Township, Michigan

**JOB NO.** 24-332

**SURFACE ELEVATION** _____ **DATE** 9/10/2024

| Sample & Type | Depth | Legend | SOIL DESCRIPTION | Penetration Blows for 6" | Moisture % | Natural Wt. P.C.F. | Dry Den Wt. P.C.F. | Unc. Comp. Strength PSF. | Str. % |
|---|---|---|---|---|---|---|---|---|---|
| | | | Moist brown fine SAND with trace of topsoil and vegetation, fill | | | | | | |
| | 1 | | 0'6" | | | | | | |
| | | | Firm moist brown sandy CLAY with topsoil, fill | | | | | | |
| A | 2 | | | 2 | | | | | |
| UL | | | | 3 | 24.5 | 124 | | | |
| | 3 | | 2'6" | 4 | | | * | (7000) | |
| | | | Firm moist variegated silty CLAY with wet brown silty fine sand seams | | | | | | |
| | 4 | | | | | | | | |
| B | | | 4'0" | 5 | | | | | |
| UL | 5 | | Very stiff moist variegated silty CLAY with traces of sand and pebbles | 9 | 25.8 | 123 | | | |
| | | | | 9 | | | * | (8500) | |
| | 6 | | | | | | | | |
| | | | 6'6" | | | | | | |
| C | 7 | | | 4 | | | | | |
| UL | | | | 5 | 31.0 | 118 | | | |
| | 8 | | Stiff moist variegated silty CLAY with traces of sand and pebbles | 6 | | | * | (6500) | |
| | | | | | | | | | |
| | 9 | | | | | | | | |
| D | | | | 3 | | | | | |
| UL | 10 | | 9'6" | 5 | 31.3 | 115 | | | |
| | | | | 4 | | | * | (3500) | |
| | 11 | | | | | | | | |
| | | | | | | | | | |
| | 12 | | | | | | | | |
| | | | Stiff moist blue silty CLAY with traces of sand and pebbles | | | | | | |
| | 13 | | | | | | | | |
| | | | | | | | | | |
| | 14 | | | | | | | | |
| E | | | | 4 | | | | | |
| UL | 15 | | | 4 | | | | | |
| | | | | 5 | | | | | |
| | 16 | | | | | | | | |
| | | | 16'0" | | | | | | |
| | 17 | | Extremely compact wet gray SAND & GRAVEL | | | | | | |
| | | | | | | | | | |
| | 18 | | | | | | | | |
| | | | 18'0" | | | | | | |
| | 19 | | | | | | | | |
| F | | | Extremely stiff moist blue sandy CLAY with pebbles | 40 | | | | | |
| UL | 20 | | | - | | | | | |
| | | | | - | | | | | |
| | 21 | | 20'6" | | | | | | |
| | | | | | | | | | |
| | 22 | | | | | | | | |
| | | | | | | | | | |
| | 23 | | | | | | | | |
| | | | | | | | | | |
| | 24 | | | | | | | | |
| | | | | | | | | | |
| | 25 | | | | | | | | |

TYPE OF SAMPLE
D. - DISTURBED
U.L. - UNDIST. LINER
S.T. - SHELBY TUBE
S.S. - SPLIT SPOON
R.C. - ROCK CORE
( ) - PENETROMETER

REMARKS: *Calibrated Penetrometer

Standard Penetration Test - Driving 2" O.D. Sampler 1' With 140lb Hammer Falling 30": Count Made at 6" Intervals

GROUND WATER OBSERVATIONS

| | | | | |
|---|---|---|---|---|
| G.W. ENCOUNTERED AT | 1 | FT. | 6 | INS. |
| G.W. ENCOUNTERED AT | 16 | FT. | 1 | INS. |
| G.W. AFTER COMPLETION | 14 | FT. | 3 | INS. |
| G.W. AFTER HRS. | | FT. | | INS. |
| G.W. VOLUMES | | Medium-Heavy | | |

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**LOG OF SOIL BORING NO.** 4

**PROJECT** Soils Investigation
Proposed Museum Annex Development

**LOCATION** 56516 North Bay Drive
Chesterfield Township, Michigan

**JOB NO.** 24-332

**SURFACE ELEVATION** _____ **DATE** 9/10/2024

| Sample & Type | Depth | Legend | SOIL DESCRIPTION | Penetration Blows for 6" | Moisture % | Natural Wt. P.C.F. | Dry Den Wt. P.C.F. | Unc. Comp. Strength PSF. | Str. % |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | | Moist dark brown clayey TOPSOIL with traces of sand and pebbles and vegetation | | | | | | |
| | | | 1'1" | | | | | | |
| A | 2 | | | 2 | | | | | |
| UL | | | Firm moist variegated silty CLAY | 3 | 19.0 | --- | | | |
| | 3 | | | 3 | | | * | (5500) | |
| | | | 3'6" | | | | | | |
| | 4 | | | | | | | | |
| B | | | | 2 | | | | | |
| UL | 5 | | | 4 | 24.8 | 122 | | | |
| | | | | 5 | | | * | (6500) | |
| | 6 | | | | | | | | |
| C | 7 | | | 3 | | | | | |
| UL | | | | 6 | 28.7 | 114 | | | |
| | 8 | | Stiff moist variegated silty CLAY with traces of sand and pebbles | 7 | | | * | (6500) | |
| | 9 | | | | | | | | |
| D | | | | 4 | | | | | |
| UL | 10 | | | 4 | 28.3 | 121 | | | |
| | | | | 5 | | | * | (4000) | |
| | 11 | | | | | | | | |
| | 12 | | | | | | | | |
| | | | 12'0" | | | | | | |
| | 13 | | | | | | | | |
| | 14 | | Stiff moist blue silty CLAY with traces of sand and pebbles | | | | | | |
| E | | | | 4 | | | | | |
| UL | 15 | | | 4 | | | | | |
| | | | | 5 | | | | | |
| | 16 | | | | | | | | |
| | | | 15'6" | | | | | | |
| | 17 | | | | | | | | |
| | 18 | | | | | | | | |
| | 19 | | | | | | | | |
| | 20 | | | | | | | | |
| | 21 | | | | | | | | |
| | 22 | | | | | | | | |
| | 23 | | | | | | | | |
| | 24 | | | | | | | | |
| | 25 | | | | | | | | |

TYPE OF SAMPLE
D. - DISTURBED
U.L. - UNDIST. LINER
S.T. - SHELBY TUBE
S.S. - SPLIT SPOON
R.C. - ROCK CORE
( ) - PENETROMETER

REMARKS: *Calibrated Penetrometer

Standard Penetration Test - Driving 2" O.D. Sampler 1' With 140lb Hammer Falling 30": Count Made at 6" Intervals

GROUND WATER OBSERVATIONS

| | | |
|---|---|---|
| G.W. ENCOUNTERED AT | FT. | INS. |
| G.W. ENCOUNTERED AT | FT. | INS. |
| G.W. AFTER COMPLETION | FT. | INS. |
| G.W. AFTER HRS. | FT. | INS. |
| G.W. VOLUMES | None | |

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**LOG OF SOIL BORING NO.** 5

**PROJECT** Soils Investigation
Proposed Museum Annex Development

**LOCATION** 56516 North Bay Drive
Chesterfield Township, Michigan

**JOB NO.** 24-332

**SURFACE ELEVATION** _____ **DATE** 9/10/2024

| Sample & Type | Depth | Legend | SOIL DESCRIPTION | Penetration Blows for 6" | Moisture % | Natural Wt. P.C.F. | Dry Den Wt. P.C.F. | Unc. Comp. Strength PSF. | Str. % |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | | Moist dark brown clayey TOPSOIL with vegetation | | | | | | |
| A | 2 | | | 1 | | | | | |
| UL | | | 2'0" | 2 | 22.8 | --- | | | |
| | 3 | | Soft moist variegated silty CLAY with wet brown and gray silty fine sand seams, fill | 1 | | | * | (3000) | |
| | 4 | | | | | | | | |
| B | | | 4'0" | 2 | | | | | |
| UL | 5 | | Firm moist variegated silty CLAY with wet brown silty fine sand seams | 3 | 25.5 | 124 | | | |
| | | | | 3 | | | * | (3500) | |
| | 6 | | 6'0" | | | | | | |
| C | 7 | | | 4 | | | | | |
| UL | | | Stiff moist variegated silty CLAY with wet brown silty fine sand seams | 5 | 26.3 | 120 | | | |
| | 8 | | | 7 | | | * | (7000) | |
| | 9 | | | | | | | | |
| D | | | 9'0" | 3 | | | | | |
| UL | 10 | | | 5 | 33.7 | 115 | | | |
| | | | | 7 | | | * | (3500) | |
| | 11 | | | | | | | | |
| | 12 | | Stiff moist blue silty CLAY with traces of sand and pebbles and wet gray silt seams | | | | | | |
| | 13 | | | | | | | | |
| | 14 | | | | | | | | |
| E | | | | 4 | | | | | |
| UL | 15 | | | 5 | | | | | |
| | | | 15'6" | 6 | | | | | |
| | 16 | | | | | | | | |
| | 17 | | | | | | | | |
| | 18 | | | | | | | | |
| | 19 | | | | | | | | |
| | 20 | | | | | | | | |
| | 21 | | | | | | | | |
| | 22 | | | | | | | | |
| | 23 | | | | | | | | |
| | 24 | | | | | | | | |
| | 25 | | | | | | | | |

TYPE OF SAMPLE
D. - DISTURBED
U.L. - UNDIST. LINER
S.T. - SHELBY TUBE
S.S. - SPLIT SPOON
R.C. - ROCK CORE
( ) - PENETROMETER

REMARKS: *Calibrated Penetrometer

Standard Penetration Test - Driving 2" O.D. Sampler 1' With 140lb Hammer Falling 30": Count Made at 6" Intervals

GROUND WATER OBSERVATIONS

| | | | | |
|---|---|---|---|---|
| G.W. ENCOUNTERED AT | 2 | FT. | 0 | INS. |
| G.W. ENCOUNTERED AT | 4 | FT. | 0 | INS. |
| G.W. AFTER COMPLETION | Dry | | | |
| G.W. AFTER HRS. | | FT. | | INS. |
| G.W. VOLUMES | Light | | | |

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**LOG OF SOIL BORING NO.** 6

**PROJECT** Soils Investigation
Proposed Museum Annex Development

**LOCATION** 56516 North Bay Drive
Chesterfield Township, Michigan

**JOB NO.** 24-332

**SURFACE ELEVATION** _____ **DATE** 9/10/2024

| Sample & Type | Depth | Legend | SOIL DESCRIPTION | Penetration Blows for 6" | Moisture % | Natural Wt. P.C.F. | Dry Den Wt. P.C.F. | Unc. Comp. Strength PSF. | Str. % |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | | Moist dark brown clayey TOPSOIL with vegetation | | | | | | |
| A | 2 | | 1'6" | 4 | | | | | |
| UL | | | Medium compact wet brown fine SAND with moist variegated silty clay seams, fill | 3 | 18.6 | --- | | | |
| | 3 | | 3'0" | 3 | | | | | |
| | 4 | | | | | | | | |
| B | | | Firm moist variegated silty CLAY with wet brown silty fine sand seams | 3 | | | | | |
| UL | 5 | | | 3 | 23.1 | 124 | | | |
| | | | | 4 | | | * | (2500) | |
| | 6 | | 6'0" | | | | | | |
| C | 7 | | Stiff moist variegated silty CLAY with wet brown silty fine sand seams | 2 | | | | | |
| UL | | | | 5 | 23.6 | 125 | | | |
| | 8 | | | 6 | | | * | (6500) | |
| | 9 | | 8'6" | | | | | | |
| D | | | | 2 | | | | | |
| UL | 10 | | | 3 | 36.3 | 107 | | | |
| | | | | 3 | | | * | (3000) | |
| | 11 | | | | | | | | |
| | 12 | | | | | | | | |
| | 13 | | Firm moist blue silty CLAY with wet gray silt seams | | | | | | |
| | 14 | | | | | | | | |
| E | | | | 2 | | | | | |
| UL | 15 | | | 3 | | | | | |
| | | | | 3 | | | | | |
| | 16 | | | | | | | | |
| | 17 | | | | | | | | |
| | 18 | | 18'0" | | | | | | |
| | 19 | | | | | | | | |
| F | | | Stiff moist blue silty CLAY | 3 | | | | | |
| UL | 20 | | | 4 | | | | | |
| | | | | 5 | | | | | |
| | 21 | | 20'6" | | | | | | |
| | 22 | | | | | | | | |
| | 23 | | | | | | | | |
| | 24 | | | | | | | | |
| | 25 | | | | | | | | |

TYPE OF SAMPLE
D. - DISTURBED
U.L. - UNDIST. LINER
S.T. - SHELBY TUBE
S.S. - SPLIT SPOON
R.C. - ROCK CORE
( ) - PENETROMETER

REMARKS: *Calibrated Penetrometer

Standard Penetration Test - Driving 2" O.D. Sampler 1' With 140lb Hammer Falling 30": Count Made at 6" Intervals

GROUND WATER OBSERVATIONS

| | | | | |
|---|---|---|---|---|
| G.W. ENCOUNTERED AT | 1 | FT. | 6 | INS. |
| G.W. ENCOUNTERED AT | 4 | FT. | 0 | INS. |
| G.W. AFTER COMPLETION | Dry | | | |
| G.W. AFTER HRS. | | FT. | | INS. |
| G.W. VOLUMES | Medium-Light | | | |

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**LOG OF SOIL BORING NO.** 7

**PROJECT** Soils Investigation
Proposed Museum Annex Development

**LOCATION** 56516 North Bay Drive
Chesterfield Township, Michigan

**JOB NO.** 24-332

**SURFACE ELEVATION** _____ **DATE** 9/9/2024

| Sample & Type | Depth | Legend | SOIL DESCRIPTION | Penetration Blows for 6" | Moisture % | Natural Wt. P.C.F. | Dry Den Wt. P.C.F. | Unc. Comp. Strength PSF. | Str. % |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | | Moist dark brown clayey TOPSOIL with vegetation | | | | | | |
| A | 2 | | | 2 | | | | | |
| UL | | | 2'3" | 3 | 19.6 | --- | | | |
| | 3 | | | 3 | | | * | (7000) | |
| | 4 | | Firm moist variegated silty CLAY with wet brown and gray silt and fine sand seams | | | | | | |
| B | | | | 2 | | | | | |
| UL | 5 | | | 3 | 24.1 | 120 | | | |
| | | | | 3 | | | * | (3500) | |
| | 6 | | 6'0" | | | | | | |
| C | 7 | | | 3 | | | | | |
| UL | | | Stiff moist variegated silty CLAY | 5 | 37.2 | 113 | | | |
| | 8 | | | 5 | | | * | (7000) | |
| | 9 | | 9'0" | | | | | | |
| D | | | | 4 | | | | | |
| UL | 10 | | | 4 | | | | | |
| | | | | 5 | | | | | |
| | 11 | | | | | | | | |
| | 12 | | Stiff moist blue silty CLAY with wet gray silty fine sand seams | | | | | | |
| | 13 | | | | | | | | |
| | 14 | | | | | | | | |
| E | | | | 3 | | | | | |
| UL | 15 | | | 3 | | | | | |
| | | | 15'6" | 5 | | | | | |
| | 16 | | | | | | | | |
| | 17 | | | | | | | | |
| | 18 | | | | | | | | |
| | 19 | | | | | | | | |
| | 20 | | | | | | | | |
| | 21 | | | | | | | | |
| | 22 | | | | | | | | |
| | 23 | | | | | | | | |
| | 24 | | | | | | | | |
| | 25 | | | | | | | | |

TYPE OF SAMPLE
D. - DISTURBED
U.L. - UNDIST. LINER
S.T. - SHELBY TUBE
S.S. - SPLIT SPOON
R.C. - ROCK CORE
( ) - PENETROMETER

REMARKS: *Calibrated Penetrometer

Standard Penetration Test - Driving 2" O.D. Sampler 1' With 140lb Hammer Falling 30": Count Made at 6" Intervals

GROUND WATER OBSERVATIONS

| | | | | |
|---|---|---|---|---|
| G.W. ENCOUNTERED AT | 2 | FT. | 0 | INS. |
| G.W. ENCOUNTERED AT | 4 | FT. | 0 | INS. |
| G.W. AFTER COMPLETION | 13 | FT. | 8 | INS. |
| G.W. AFTER HRS. | | FT. | | INS. |
| G.W. VOLUMES | | Light-Medium | | |

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**LOG OF SOIL BORING NO.** 8

**PROJECT** Soils Investigation
Proposed Museum Annex Development

**LOCATION** 56516 North Bay Drive
Chesterfield Township, Michigan

**JOB NO.** 24-332

**SURFACE ELEVATION** _____ **DATE** 9/9/2024

| Sample & Type | Depth | Legend | SOIL DESCRIPTION | Penetration Blows for 6" | Moisture % | Natural Wt. P.C.F. | Dry Den Wt. P.C.F. | Unc. Comp. Strength PSF. | Str. % |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | | Moist dark brown clayey TOPSOIL with vegetation | | | | | | |
| A | 2 | | | 2 | | | | | |
| UL | | | 2'0" | 3 | 23.9 | 120 | | | |
| | 3 | | Stiff moist variegated silty CLAY | 5 | | | * | (5000) | |
| | 4 | | | | | | | | |
| B | | | 4'0" | 2 | | | | | |
| UL | 5 | | | 2 | 30.3 | --- | | | |
| | | | Firm moist variegated silty CLAY with wet brown and gray silt seams | 3 | | | * | (5000) | |
| | 6 | | | | | | | | |
| C | 7 | | | 2 | | | | | |
| UL | | | 7'0" | 3 | 33.2 | 113 | | | |
| | 8 | | | 5 | | | * | (5000) | |
| | 9 | | | | | | | | |
| D | | | | 4 | | | | | |
| UL | 10 | | | 7 | | | | | |
| | | | | 7 | | | | | |
| | 11 | | | | | | | | |
| | | | Stiff moist variegated silty CLAY with moist brown and gray silt seams | | | | | | |
| | 12 | | | | | | | | |
| | 13 | | | | | | | | |
| | 14 | | | | | | | | |
| E | | | | 4 | | | | | |
| UL | 15 | | | 4 | | | | | |
| | | | | 5 | | | | | |
| | 16 | | | | | | | | |
| | 17 | | | | | | | | |
| | 18 | | | | | | | | |
| | | | 18'0" | | | | | | |
| | 19 | | | | | | | | |
| F | | | Firm moist blue silty CLAY | 3 | | | | | |
| UL | 20 | | | 3 | | | | | |
| | | | | 4 | | | | | |
| | 21 | | 20'6" | | | | | | |
| | 22 | | | | | | | | |
| | 23 | | | | | | | | |
| | 24 | | | | | | | | |
| | 25 | | | | | | | | |

TYPE OF SAMPLE
D. - DISTURBED
U.L. - UNDIST. LINER
S.T. - SHELBY TUBE
S.S. - SPLIT SPOON
R.C. - ROCK CORE
( ) - PENETROMETER

REMARKS: *Calibrated Penetrometer

Standard Penetration Test - Driving 2" O.D. Sampler 1' With 140lb Hammer Falling 30": Count Made at 6" Intervals

GROUND WATER OBSERVATIONS

| | | | | |
|---|---|---|---|---|
| G.W. ENCOUNTERED AT | 4 | FT. | 0 | INS. |
| G.W. ENCOUNTERED AT | 6 | FT. | 6 | INS. |
| G.W. AFTER COMPLETION | Dry | | | |
| G.W. AFTER HRS. | | FT. | | INS. |
| G.W. VOLUMES | Light | | | |

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**LOG OF SOIL BORING NO.** 9

**PROJECT** Soils Investigation
Proposed Museum Annex Development

**LOCATION** 56516 North Bay Drive
Chesterfield Township, Michigan

**JOB NO.** 24-332

**SURFACE ELEVATION** _____ **DATE** 9/10/2024

| Sample & Type | Depth | Legend | SOIL DESCRIPTION | Penetration Blows for 6" | Moisture % | Natural Wt. P.C.F. | Dry Den Wt. P.C.F. | Unc. Comp. Strength PSF. | Str. % |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | | Moist dark brown clayey TOPSOIL with vegetation | | | | | | |
| | | | 1'3" | | | | | | |
| A | 2 | | | 2 | | | | | |
| UL | | | Soft moist variegated silty CLAY with wet brown to gray | 2 | 23.7 | 125 | | | |
| | 3 | | silty fine sand seams | 2 | | | * | (3500) | |
| | | | | | | | | | |
| | 4 | | | | | | | | |
| | | | 4'0" | | | | | | |
| B | | | | 2 | | | | | |
| UL | 5 | | Stiff moist variegated silty CLAY with traces of sand and pebbles | 3 | 31.8 | 119 | | | |
| | | | | 5 | | | * | (5500) | |
| | | | 5'6" | | | | | | |
| | 6 | | | | | | | | |
| | 7 | | | | | | | | |
| | 8 | | | | | | | | |
| | 9 | | | | | | | | |
| | 10 | | | | | | | | |
| | 11 | | | | | | | | |
| | 12 | | | | | | | | |
| | 13 | | | | | | | | |
| | 14 | | | | | | | | |
| | 15 | | | | | | | | |
| | 16 | | | | | | | | |
| | 17 | | | | | | | | |
| | 18 | | | | | | | | |
| | 19 | | | | | | | | |
| | 20 | | | | | | | | |
| | 21 | | | | | | | | |
| | 22 | | | | | | | | |
| | 23 | | | | | | | | |
| | 24 | | | | | | | | |
| | 25 | | | | | | | | |

TYPE OF SAMPLE
D. - DISTURBED
U.L. - UNDIST. LINER
S.T. - SHELBY TUBE
S.S. - SPLIT SPOON
R.C. - ROCK CORE
( ) - PENETROMETER

REMARKS: *Calibrated Penetrometer

Standard Penetration Test - Driving 2" O.D. Sampler 1' With 140lb Hammer Falling 30": Count Made at 6" Intervals

GROUND WATER OBSERVATIONS

| | | | | |
|---|---|---|---|---|
| G.W. ENCOUNTERED AT | 1 | FT. | 6 | INS. |
| G.W. ENCOUNTERED AT | | FT. | | INS. |
| G.W. AFTER COMPLETION | Dry | | | |
| G.W. AFTER HRS. | | FT. | | INS. |
| G.W. VOLUMES | Light | | | |

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**LOG OF SOIL BORING NO.** 10

**PROJECT** Soils Investigation
Proposed Museum Annex Development

**LOCATION** 56516 North Bay Drive
Chesterfield Township, Michigan

**JOB NO.** 24-332

**SURFACE ELEVATION** _____ **DATE** 9/10/2024

| Sample & Type | Depth | Legend | SOIL DESCRIPTION | Penetration Blows for 6" | Moisture % | Natural Wt. P.C.F. | Dry Den Wt. P.C.F. | Unc. Comp. Strength PSF. | Str. % |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | | Moist dark brown clayey TOPSOIL with vegetation | | | | | | |
| | | | 1'3" | | | | | | |
| A | 2 | | Firm moist brown to dark brown silty CLAY with topsoil, fill | 2 | | | | | |
| UL | | | | 3 | 26.6 | --- | | | |
| | 3 | | 2'6" | 3 | | | * | (6000) | |
| | | | Firm moist variegated silty CLAY | | | | | | |
| | 4 | | | | | | | | |
| | | | 4'0" | | | | | | |
| B | | | Firm moist variegated silty CLAY with traces of sand and pebbles | 3 | | | | | |
| UL | 5 | | | 3 | 28.4 | 119 | | | |
| | | | | 4 | | | * | (5500) | |
| | | | 5'6" | | | | | | |
| | 6 | | | | | | | | |
| | 7 | | | | | | | | |
| | 8 | | | | | | | | |
| | 9 | | | | | | | | |
| | 10 | | | | | | | | |
| | 11 | | | | | | | | |
| | 12 | | | | | | | | |
| | 13 | | | | | | | | |
| | 14 | | | | | | | | |
| | 15 | | | | | | | | |
| | 16 | | | | | | | | |
| | 17 | | | | | | | | |
| | 18 | | | | | | | | |
| | 19 | | | | | | | | |
| | 20 | | | | | | | | |
| | 21 | | | | | | | | |
| | 22 | | | | | | | | |
| | 23 | | | | | | | | |
| | 24 | | | | | | | | |
| | 25 | | | | | | | | |

TYPE OF SAMPLE
D. - DISTURBED
U.L. - UNDIST. LINER
S.T. - SHELBY TUBE
S.S. - SPLIT SPOON
R.C. - ROCK CORE
( ) - PENETROMETER

REMARKS: *Calibrated Penetrometer

Standard Penetration Test - Driving 2" O.D. Sampler 1' With 140lb Hammer Falling 30": Count Made at 6" Intervals

GROUND WATER OBSERVATIONS

| | | |
|---|---|---|
| G.W. ENCOUNTERED AT | FT. | INS. |
| G.W. ENCOUNTERED AT | FT. | INS. |
| G.W. AFTER COMPLETION | FT. | INS. |
| G.W. AFTER HRS. | FT. | INS. |
| G.W. VOLUMES | None | |

# Cased Borehole Infiltration Test Log

McDowell & Associates

**Soil Boring No.:** 6

**Job Number:** 24-332
**Project:** Infiltration Study
Proposed Museum Annex Development
**Location:** 56516 North Bay Drive
Chesterfield Township, Michigan

**Date:** 9/13/2024
**Weather:** Temperature > 32 degrees
**Ground Elv.:** N/A

**Soil Stratigraphy:**

See Logs of Soil Borings for soil and groundwater conditions

**Pipe Installation #1**

Soil Depth: 5'0"
Inner Pipe Dia.: 0'3"
Casing Length: 7'6"
Embedment: 0'2"
Stick-up: 2'4"

**Pipe Installation #2**

Soil Depth:
Inner Pipe Dia.:
Casing Length:
Embedment:
Stick-up:

Pipe Distance: N/A

**Soak Period (Pipe #1)**

Start Date: Start Time:
Notes: Fill to 2'4" below top of casing
Time: 30 min Water Drop: 0.00 inches
Notes:
Time: 30 min Water Drop: 0.00 inches
Notes:

**Soak Period (Pipe #2)**

Start Date: Start Time:
Notes:
Time: Water Drop: feet
Notes:
Time: Water Drop: feet
Notes:

**Test Period (Pipe #1)**

Time: Water Drop: inches
Notes:
Time: Water Drop: inches
Notes:
Time: Water Drop: inches
Notes:
Time: Water Drop: inches
Notes:
Time: Water Drop: inches

Notes: No noticeable infiltration in 30 minute soak period.

**Test Period (Pipe #2)**

Time: Water Drop: feet
Notes:
Time: Water Drop: feet
Notes:
Time: Water Drop: feet
Notes:
Time: Water Drop: feet
Notes:
Time: Water Drop: feet

Notes:

# Cased Borehole Infiltration Test Log

McDowell & Associates

**Soil Boring No.:** 8

**Job Number:** 24-332
**Project:** Infiltration Study
Proposed Museum Annex Development
**Location:** 56516 North Bay Drive
Chesterfield Township, Michigan

**Date:** 9/13/2024
**Weather:** Temperature > 32 degrees
**Ground Elv.:** N/A

**Soil Stratigraphy:**

See Logs of Soil Borings for soil and groundwater conditions

**Pipe Installation #1**

Soil Depth: 4'0"
Inner Pipe Dia.: 0'3"
Casing Length: 6'0"
Embedment: 0'2"
Stick-up: 1'10"

**Pipe Installation #2**

Soil Depth:
Inner Pipe Dia.:
Casing Length:
Embedment:
Stick-up:

Pipe Distance: N/A

**Soak Period (Pipe #1)**

Start Date: Start Time:
Notes: Fill to1'10" below top of casing
Time: 30 min Water Drop: 0.06 inches
Notes:
Time: 30 min Water Drop: 0.00 inches
Notes:

**Soak Period (Pipe #2)**

Start Date: Start Time:
Notes:
Time: Water Drop: feet
Notes:
Time: Water Drop: feet
Notes:

**Test Period (Pipe #1)**

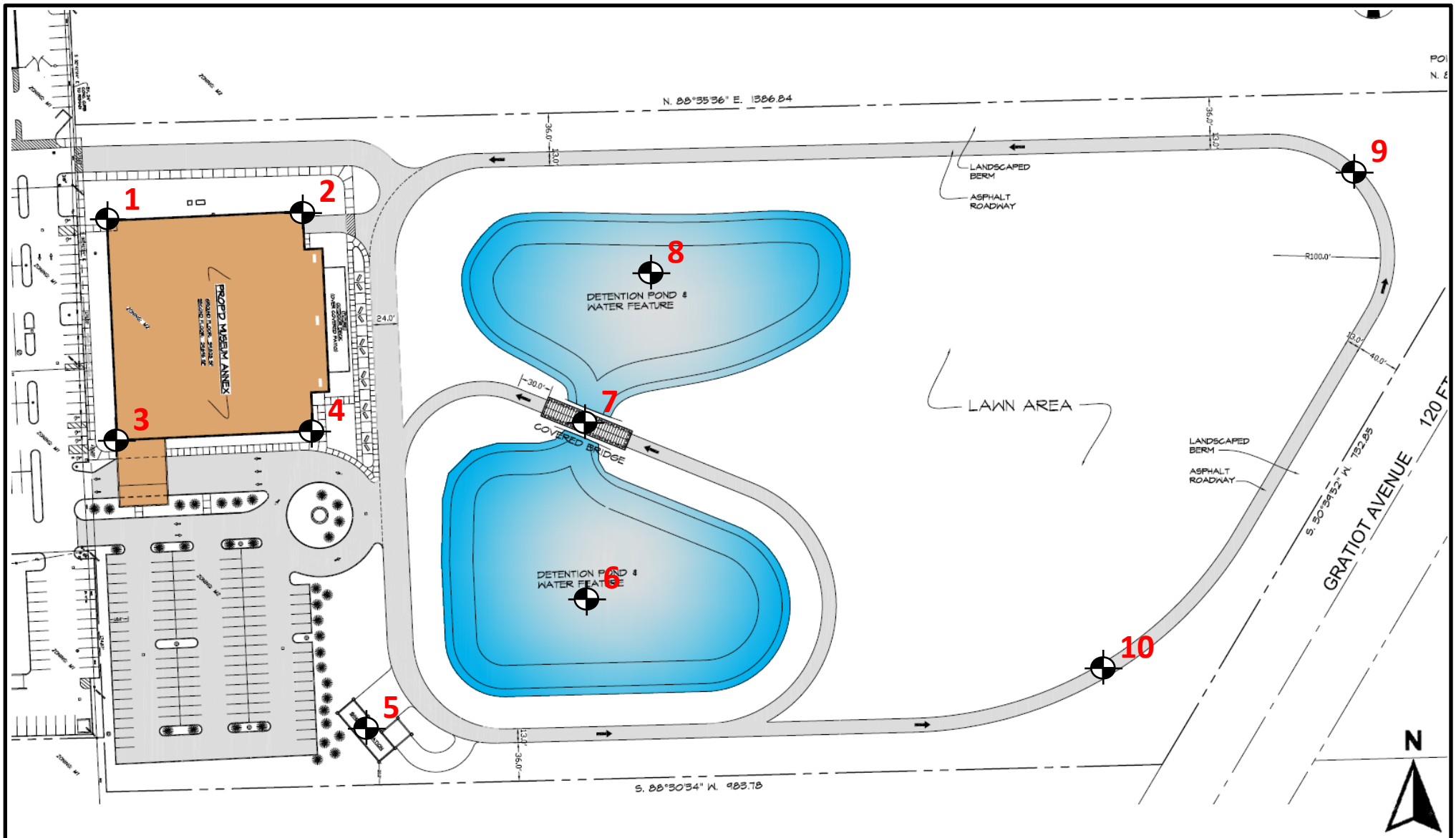
Time: Water Drop: inches
Notes:
Time: Water Drop: inches
Notes:
Time: Water Drop: inches
Notes:
Time: Water Drop: inches
Notes:
Time: Water Drop: inches

Notes: No noticeable infiltration in 30 minute soak period.

**Test Period (Pipe #2)**

Time: Water Drop: feet
Notes:
Time: Water Drop: feet
Notes:
Time: Water Drop: feet
Notes:
Time: Water Drop: feet
Notes:
Time: Water Drop: feet

Notes:




Note: Base drawing prepared by others.

**LEGEND**

Approximate Soil Boring Locations, 1 through 10:
Drilled by McDowell & Associates

**McDowell & Associates**
21355 Hatcher Avenue
Ferndale, Michigan 48220
Phone: (248) 399-2066
Fax: (248) 399-2157

# Soil Boring Location Plan

Job No. 24-332