SOILS INVESTIGATION
PROPOSED 3-STORY APARTMENT BUILDING
4777 EAST OUTER DRIVE
DETROIT, MICHIGAN

BENJAMIN O. DAVIS VETERANS VILLAGE, LDHA
4777 EAST OUTER DRIVE
DETROIT, MICHIGAN 48234

JULY 27, 2020
BY
McDOWELL & ASSOCIATES

McDowell & Associates
Geotechnical, Environmental & Hydrogeological Services • Material
21355 Hatcher Avenue • Ferndale, MI 48220
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July 27, 2020

Benjamin O. Davis Veterans Village, LDHA
4777 East Outer Drive
Detroit, Michigan
Detroit, Michigan 48234

Job No. 20-147

Attention: Mr. Raymond McLemore

Subject: Soils Investigation
Proposed 3-Story Apartment Building
4777 East Outer Drive
Detroit, Michigan

Gentlemen:

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

Field Work and Laboratory Testing

Five Soil Test Borings, designated as 1 through 5, 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 selected by others and field located by our drillers. Boring 5 was offset roughly sixteen feet (16') east of the planned location due to access. Borings 1 and 5 were drilled with a rig utilizing an automatic hammer while Borings 2 through 4 were drilled with a rig utilizing a standard rope and cathead safety hammer. The borings were advanced to depths of about twenty feet (20') or twenty five feet (25') 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 encountered three inches (3") to six inches (6") of asphalt at the ground surface followed by fill and possible fill materials extending to depths ranging from two feet six inches (2'6") to five feet (5'). The fill and possible fill soils generally consisted of discolored silty clay, fine sand with topsoil, sandy topsoil, sand and gravel with brick and concrete and aggregate base. In Boring 4, about six inches (6") of concrete was encountered directly below the surficial asphalt. The underlying apparent native soils in each boring generally consisted of stiff to extremely stiff silty clay.

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. 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 each of the borings at initial depths r six feet six inches (6'6") below the existing ground surface. U groundwater levels were recorded in Borings 1 and 2 at respective depths of twenty feet two inches (20'2") and fourteen feet (14') and In Boring 5 at one foot (1') below existing ground surface. Borings 3 and 4 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 clay soils, 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) made during the sampling operation indicate that the fill and possible fill soils have variable strengths and densities while the underlying apparent native site soils have good to very good strengths and densities. The tests at a depth of two feet six inches (2'6") resulted in values from 5 to 30 blows per foot. The five foot (5') test values varied from 9 to 27 blows per foot. At depths of seven feet six inches (7'6") and below, the test results ranged from 8 blows per foot to 44 blows for nine inches (9'). It should be noted that an automatic hammer was used for SPTs in Borings 1 and 5. Considering our drilling equipment and procedures, it has been seen that blow counts with an automatic hammer should be increased by a factor of about 1.4 to be comparable with typical blow counts using a safety hammer. SPTs in Borings 2 through 4 were performed with a rope and cathead safety hammer.

Project Description

It is understood that the project will consist of constructing a new three-story, slab-on-grade apartment building at the subject property. It is anticipated that the structure will transmit relatively light loads to the supporting soils.

Foundation Recommendations

Based on the project information provided and the results of field and laboratory tests, the indications are that the structure could be supported by conventional to deeper 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.

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 Pres
1	2'6" to 8'0"	5,000
2	4'0" to 6'0"	4,500
	6'0" to 8'0"	5,000
3	4'0" to 8'0"	5,000
4	5'0" to 7'6"	4,500
	7'6" to 8'0"	5,000
5	3'4" to 6'2"	3,000
	6'2" to 8'0"	5,000

A maximum design soil pressure of 5,000 psf was considered. Higher design soil pressures are available at various depths in the borings and could be detailed, if desired.

Engineered Fill

As an alternative to deeper than normal footings where fill is present, the building 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 six inches (6") for every foot below the footing. 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 Type 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 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 Type 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 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 the drain

tiles. We suggest that the brick content should be less than 5% and ce
than 3%. The large crushed material will need to be separated from th
a geotextile fabric. We suggest that a Mirafi 500 type fabric or equivalent 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 for the basement drains and sump pump. 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 for discussion of these problems. Since the new structure 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 3,000 psf 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.

Seismic Site Class

Based on the limited data obtained from these borings along with deeper boring we have performed in the general area, we recommend considering a seismic site class of D at the subject site. This recommendation was developed in accordance with ASCE 7-16 (Table 20.3-1).

Groundwater Considerations

With the exception of Boring 5, footing excavations are expected to be well above groundwater elevations measured upon completion of drilling. It should be noted that the encountered water level can often be the actual groundwater elevation and it either seals off or dissipates into the borehole. In Boring 5, it is expected that the significant amount of groundwater encountered is perched on the underlying clay and that you will be able to readily handle the water; however, this is not known for certain. Water seepage from perched water or from wet sand or silt seams is not expected to be a major issue, but if significant 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.

Below-grade structures, such as elevator pits, should be provided with an adequate drainage system to protect the floors and walls from the possible effects of hydrostatic pressure. The drainage system should be designed and installed to minimize the potential for soil fines to erode into the underdrainage system.

Floor Slabs

Fill soils were encountered in each of the borings to depths ranging from two feet six inches (2'6") to five feet (5') below the existing ground surface. Based on aerial photos available on Google Earth, it appears that the existing fill could have been in place for at least 20 years. If the fill has been in place

for at least 20 years and if the possibility of more than normal differen slab-on-grade floors or floor-supporting backfill could be placed at, o vicinity of these borings. First, the surficial asphalt and concrete should be stripped along with any topsoil located within eighteen inches (18") of the proposed slab. Next, any remaining highly organic 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 and organic soils should be removed and replaced with engineered fill meeting the requirements outlined above, or the floor slab should be structurally supported.

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 could consist of pea stone, MDOT Class I sand, 2NS sand or 6AA crushed stone.

Moisture contents greater than 20% were found in shallow soils at Borings 2 and 4. 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.

Closing

Experience indicates that actual subsurface conditions at the site could vary from those found at the five test borings made 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 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, M.S., P.E.
Geotechnical Engineer

Robert McDowell, M.S., P.E.
CEO McDowell & Associates

DQ/

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LOG OF BORING

PROJECT

JOB NO. 20-147

LOCATION

SURFACE ELEV. _____ DATE 7/20/2020

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. %
			0'3" ASPHALT						
	1		0'6" Moist to wet discolored brown fine to medium SAND with gravel, aggregate fill						
A	2			2					
UL			Stiff moist discolored brown silty CLAY with trace of sand and pebbles and topsoil seams, fill	3	19.9	128			
	3		2'6"	6			*	(7500)	
	4								
B			Stiff moist variegated silty CLAY with traces of sand and pebbles	3					
UL	5			5	18.8	130			
	6		6'0"	7			*	(9000+)	
C	7			8					
UL				12					
	8			14					
	9								
D			Extremely stiff moist brown silty CLAY with sand and pebbles	5					
UL	10			9	9.4	140			
	11			9			*	(4000)	
	12								
	13		13'0"						
	14								
E				3					
UL	15			5					
	16			7					
	17		Very stiff moist blue silty CLAY with sand and pebbles						
	18								
	19								
F				3					
UL	20			6					
	21			10					
	22		Stiff moist blue silty CLAY with traces of sand and pebbles						
	23		23'0"						
	24								
G				2					
UL	25			3					
			25'6"	5					

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" OD Sampler 1' With 140# Hammer Falling 30": Count Made at 6" Intervals

NOTES:

1) Used Automatic Hammer.
2) Patched boring upon completion with cold patch.

GROUND WATER OBSERVATIONS

G.W. ENCOUNTERED AT	0	FT.	6	INS.
G.W. ENCOUNTERED AT		FT.		INS.
G.W. AFTER COMPLETION	20	FT.	2	INS.
G.W. AFTER HRS.		FT.		INS.
G.W. VOLUMES	Heavy			

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LOG OF S
BORING I
PROJECT
LOCATIC

JOB NO. 20-147

SURFACE ELEV. _____ DATE 7/20/2020

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. %
			0'5" ASPHALT						
	1		Moist brown and dark brown silty CLAY with topsoil, fill						
			1'6"						
A	2		Compact moist discolored brown fine SAND with trace of clay and topsoil seams, fill	3					
UL				4	18.2	110			
	3			6					
			3'0"						
	4		Moist brown fine SAND, possible fill						
			4'0"						
B				5					
UL	5		Stiff moist variegated silty CLAY	6	20.5	131			
				9			*	(8000)	
	6		6'0"						
C	7			6					
UL				18					
	8			25					
			Extremely stiff moist brown silty CLAY with wet brown silty fine sand seams						
	9								
D				10					
UL	10			20					
				15/ 3"					
	11								
	12								
	13								
			13'0"						
	14								
E			Very stiff moist blue silty CLAY with sand and pebbles and wet gray fine sand seams	7					
UL	15			10					
				13					
	16		15'6"						
	17								
	18								
	19								
	20								
	21								
	22								
	23								
	24								
	25								

NOTE:

Patched boring upon completion with cold patch asphalt.

TYPE OF SAMPLE
D. - DISTURBED
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Standard Penetration Test - Driving 2" OD Sampler 1' With 140# Hammer Falling 30": Count Made at 6" Intervals

GROUND WATER OBSERVATIONS

G.W. ENCOUNTERED AT	6	FT.	6	INS.
G.W. ENCOUNTERED AT	9	FT.	0	INS.
G.W. AFTER COMPLETION	14	FT.	0	INS.
G.W. AFTER	HRS.		FT.	INS.
G.W. VOLUMES	Medium - Light			

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LOG OF S
BORING I
PROJECT
LOCATIC

JOB NO. 20-147

SURFACE ELEV. _____ DATE 7/20/2020

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. %
			0'5" ASPHALT						
	1		1'6" Moist dark brown TOPSOIL with trace of asphalt millings (slight odor), fill						
A	2			6					
UL			2'6" Compact moist dark brown sandy TOPSOIL with trace of clay and moist variegated silty clay seams, fill	6	17.6				
	3			9			*	(5500)	
	4		Very stiff moist variegated silty CLAY with sand and pebbles						
B			4'0"	10					
UL	5			10	11.6	135			
	6			17			*	(9000+)	
C	7			16					
UL				26					
	8			18/ 3"					
	9		Extremely stiff moist brown silty CLAY with sand and pebbles and wet brown silty fine sand seams						
D				20					
UL	10			28					
	11			--					
	12								
	13								
			13'0"						
	14								
E			Extremely stiff moist variegated silty CLAY with sand and pebbles	13					
UL	15			15					
			15'6"	19					
	16								
	17								
	18								
	19								
	20		NOTE: Patched boring upon completion with cold patch asphalt.						
	21								
	22								
	23								
	24								
	25								

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GROUND WATER OBSERVATIONS

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

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JOB NO. 20-147

SURFACE ELEV. _____ DATE 7/20/2020

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. %
			0'6" ASPHALT						
	1		← 1'0" CONCRETE						
			← 1'6" Moist dark brown sandy TOPSOIL						
A	2			2					
UL				2	18.1				
	3			3			*	(4000)	
			Firm to stiff moist brown and discolored silty CLAY with traces to seams of topsoil, fill						
	4								
B				7					
UL	5			7	21.3	126			
			5'0"	10			*	(5700)	
	6		Stiff to very stiff moist variegated silty CLAY with sand and pebbles and wet brown silty fine sand streaks						
C	7			7					
UL			7'6"	8					
	8			21					
	9								
D				16					
UL	10			26					
			Extremely stiff moist brown silty CLAY with sand and pebbles and wet brown fine sand seams	10/ 3"					
	11								
	12								
	13								
			13'0"						
	14								
E			Extremely stiff moist blue silty CLAY with sand and pebbles	13					
UL	15			14					
				19					
			15'6"						
	16								
	17								
	18								
	19								
	20								
	21								
	22								
	23								
	24								
	25								

NOTE:

Patched boring upon completion with cold patch asphalt.

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REMARKS: *Calibrated Penetrometer

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GROUND WATER OBSERVATIONS

G.W. ENCOUNTERED AT	6	FT.	6	INS.
G.W. ENCOUNTERED AT	9	FT.	0	INS.
G.W. AFTER COMPLETION	Dry	FT.		INS.
G.W. AFTER HRS.		FT.		INS.
G.W. VOLUMES	Light			

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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. %
			0'5½" ASPHALT						
	1		Moist to wet brown SAND & GRAVEL, aggregate fill						
			1'6"						
A	2			23					
UL			Extremely compact wet discolored brown SAND & GRAVEL with traces of concrete and brick, fill	13	15.1	129			
	3			17					
			3'4"						
	4								
B			Stiff moist variegated silty CLAY with traces of sand and pebbles	2					
UL	5			3	17.1				
				6			*	(5000)	
	6								
			6'2"						
C	7		Very stiff moist variegated silty CLAY with traces of sand and pebbles	8					
UL				12	12.5	139			
	8		7'6"	14			*	(8500)	
	9								
D				5					
UL	10			9					
				9					
	11		Extremely stiff moist brown silty CLAY with sand and pebbles						
	12								
	13								
	14								
E				3					
UL	15			5					
			15'0"	7					
	16								
	17								
	18								
	19								
F				3					
UL	20		Very stiff moist blue silty CLAY with traces of sand and pebbles	6					
				10					
	21								
	22								
	23		NOTES:						
	24		(1) Offset boring 16' east of planned location due to parked trailer at planned location.						
G			(2) Used Automatic Hammer.						
UL	25		(3) Patched boring upon completion with cold patch asphalt.	3					
			25'6"	6					
				10					

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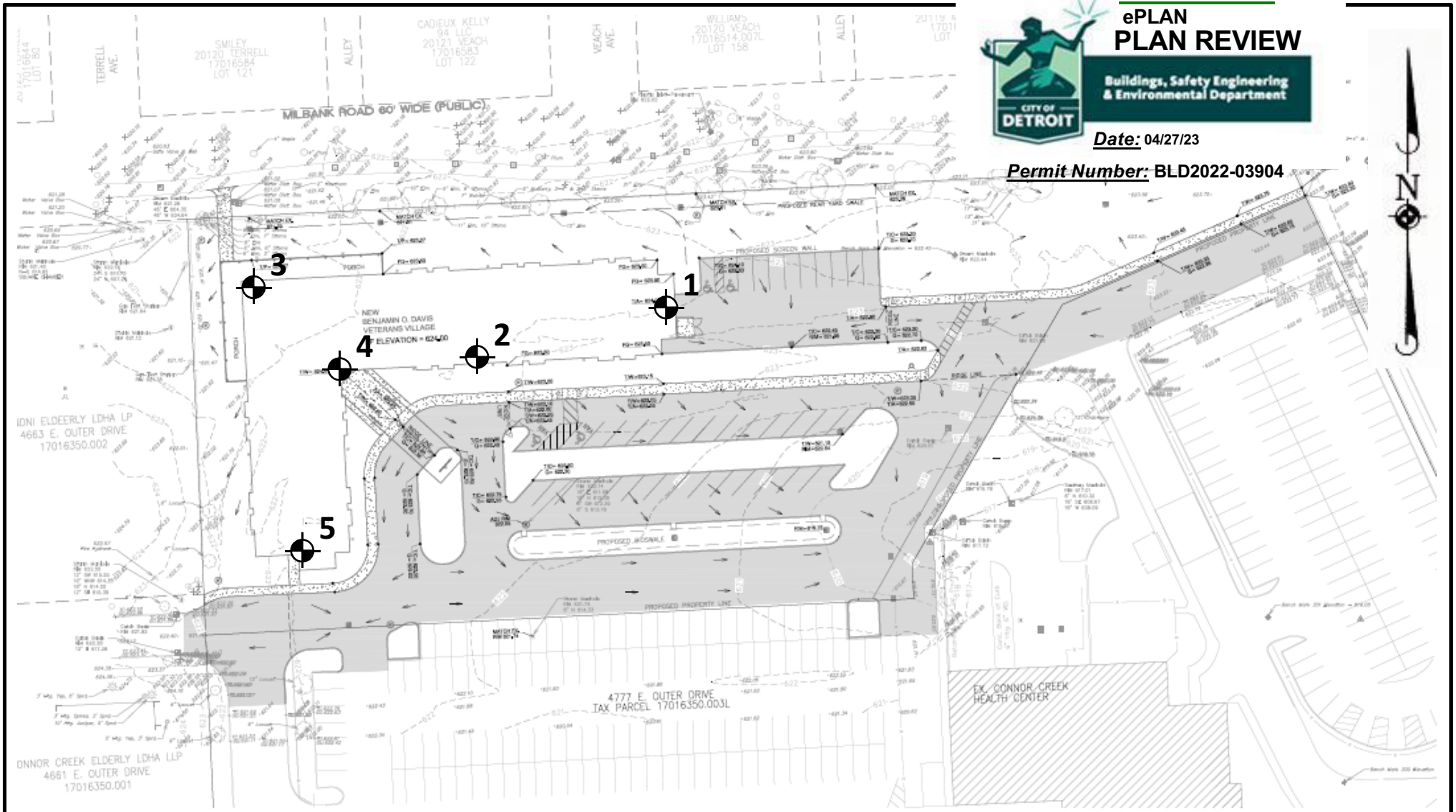
GROUND WATER OBSERVATIONS

G.W. ENCOUNTERED AT	1	FT.	2	INS.
G.W. ENCOUNTERED AT		FT.		INS.
G.W. AFTER COMPLETION	1	FT.	0	INS.
G.W. AFTER HRS.		FT.		INS.
G.W. VOLUMES	Heavy			

APPROVED
ePLAN
PLAN REVIEW
Buildings, Safety Engineering & Environmental Department
CITY OF DETROIT

Date: 04/27/23

Permit Number: BLD2022-03904



Note: Base drawing prepared by others.

LEGEND

Soil Boring Locations, 1 through 5:
Drilled by McDowell & Associates

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

Soil Boring Location Plan

Job No. 20-147