February 7, 2019

TG182043

Regional Municipality of Niagara
P.O. Box 1042
1815 Sir Isaac Brock Way
Thorold, ON
L2V 4T7

Attention: Mr. Michael Wilson

RE: Test Pit Inspection
Martindale Road
St. Catharines, ON

Dear Mr. Wilson:

Authorization to proceed with this test pit investigation was received from Mr. Michael Wilson of the Regional Municipality of Niagara, via e-mail communication dated January 9, 2019.

As requested by the Regional Municipality of Niagara, Wood Environment & Infrastructure Solutions, a Division of Wood Canada Limited (Wood), visited the above referenced site on January 17, 2019.

Wood carried out a test pit investigation to conduct a check for the presence of any buried "McAdam" asphalt within the test pit locations, in support of the proposed road reconstruction of Martindale Road. The test pits were located within the existing roadway from approximately 75 m± north of Fourth Avenue to approximately 140 m± south of Fawell Avenue in St. Catharines, Ontario. The road structure of the current project site was investigated by means of sampled test pits through the existing roadway surface. The general site limits are shown on Figure 1, Appendix A.

The scope of this report is limited to the factual reporting of the field investigation and an estimate of the extent of any "McAdam" buried asphalt if encountered.

Field Investigation:

On January 17, 2019, a total of four (4) test pits were advanced to depths up to 1.0 m below ground surface (mbgs) through the existing roadway surface along Martindale

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Road. The locations of the test pits are shown on the Test Pit Location Plan, Figure 2, located in Appendix A.

Prior to carrying out any fieldwork, the client arranged for utility companies to be notified, and to carry out underground service clearances at the test pit locations.

The test pits were excavated using a Deere B71 310-SL backhoe, supplied by Rankin Construction Inc. As the test pits remained less than 1.2 m in depth, no sloping of the excavation side walls was required before entry. An experienced soil technician from Wood entered the excavation and logged the soil stratigraphy. Representative samples were obtained from the bottom of the test pits, to allow for delineation of contaminants. Wood personnel supervised the fieldwork, performed preliminary sample identification, and prepared field test pit logs. There was no ground surface elevation information available at the time of completion of this report and elevations with be reference to existing ground surface (road surface).

Groundwater conditions were noted during and upon completion of the excavations. No long term monitoring of water infiltration was performed. Upon completion of excavations, the test pits were backfilled with the excavated material to road surface and tamped into place with a "jumping-jack" plate tamper. A 100 mm layer of high performance cold mix asphalt was to be placed at surface of each test pit to match roadway grade by Rankin Construction Inc., this portion of work was not supervised by Wood.

General Subsurface Conditions:

Descriptions of the soil conditions encountered at each location during this investigation can be found on the Test Pit Logs of TP-1 through TP-4 in Appendix A. It should be noted that the soil conditions are based on soils encountered at the test pit locations, which may vary between and beyond the locations. All test pits were terminated below the existing pavement structure into the underlying subgrade fill. The following **Table 1** is a summary of those conditions.

Table 1: Test Pit Summary

Material	TP-1 641042 E 4779645 N	TP-2 641031 E 4779853 N	TP-3 641019 E 4780081 N	TP-4 640990 E 4780284 N
Asphalt (mm)	200	100	200	200
Granular Fill (mm) sand and gravel	400	550	750	500
Cohesive Fill (mm) silty clay / clayey silt	50*	100*	50*	-
Granular Fill (mm) granular processed pit material	-	-	-	250*
Total Depth of Excavation (mm)	650	750	1000	950

*test pit terminated at this material

No buried asphalt of any type/description (tar and chip / tar macadam / bitumen asphalt) was found at the locations investigated during the current delineation program. UTM co-ordinates provided for the test pit locations have an accuracy of +/- 3 m.

Asphalt

Approximately 100 to 200 mm of surface course asphalt was encountered in all test pits.

Granular Fill / Sand and Gravel

Uniform granular fill consisting of sand and gravel, with a thickness ranging from 400 to 750 mm was encountered underlying the asphalt in all test pits.

Silty Clay / Clayey Silt Fill

Brown silty clay / clayey silt fill with trace to some amounts of gravel was generally encountered under the granular fill layer in all test pits, with the exception of TP-4. Based on tactile inspection, the silty clay / clayey silt fill was found to be drier than the plastic limit. This deposit extended to at least the maximum depth investigated in the test pits. Trace amounts of organic rootlets were also noted in TP-1.

Granular Fill / Granular Processed Pit Material

Brown granular processed pit fill material was encountered underlying the granular fill sand and gravel in TP-4. This material could indicate the possibility of the test pit being put down within the proximity of a storm sewer trench. The test pit, TP-4, was terminated in this layer to avoid any damage to existing infrastructure.

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Groundwater

Upon completion of the excavations, all of the test pits remained open and dry. It should be noted that the groundwater conditions will vary subject to weather and seasonal fluctuations. Perched groundwater could be present within the more permeable fills overlying the silty clay / clayey silt fills.

Discussion:

During the test pit investigation, conducted by Wood, four (4) test pits were advanced through the road surface at an approximate spacing of 150 m to 200 m, as laid out by Rankin Construction Inc. TP-1 and TP-4 were put down in the northbound lane next to the curb, and TP-2 and TP-3 were put down on the centreline of Martindale Road. Test pits were advanced through the pavement structure into underlying cohesive fill at all test pits except TP-4, where the test pit was terminated in pit fill (possible storm sewer trench backfill). The thicknesses of the materials that comprised the pavement structure were recorded, as well as any other pertinent observations, as described in previous sections. Buried asphalt was not observed at any of the four (4) test pit locations, to the maximum depths investigated during this investigation. As a result, there were no samples submitted for chemical analysis.

If you have any questions regarding the above or to formulate a proposal for a subsequent subsurface investigation, please contact this office at your convenience.

Regards,

Wood Environment and Infrastructure Solutions
A Division of Wood Canada Limited

Prepared by:

Dwayne Neill, B.Eng., E.I.T.
Geotechnical Engineer-In-Training

Reviewed by:

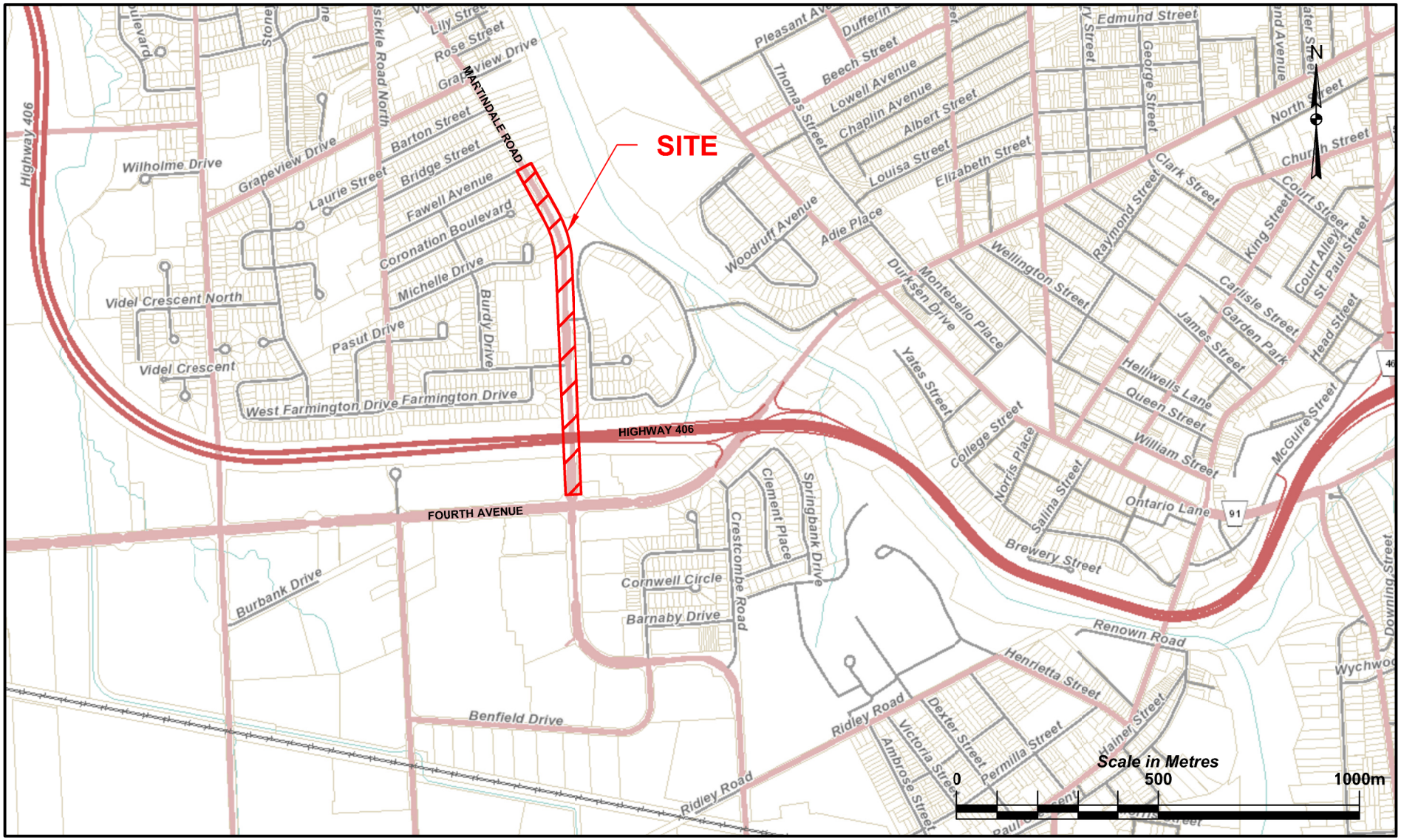
Thomas Ring, M.A.Sc., P.Eng.
Senior Geotechnical Engineer

Attached:

Appendix A:
Figure 1 – Site Location Plan
Figure 2 – Test Pit Location Plan
Test Pit Logs
Geotechnical Report Limitations

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APPENDIX A



REFERENCE: Base plan provided by NIAGARA NAVIGATOR, https://maps-beta.niagararegion.ca/Navigator/

FOR ILLUSTRATION PURPOSES ONLY, ALL LOCATIONS APPROXIMATE.

CLIENT: Regional Municipality of Niagara	LEGEND: Site Location	DWN BY: DN CHK'D BY: TR DATUM: NAD83 PROJECTION: UTM Zone 17 SCALE: As Shown	PROJECT: TEST PIT INVESTIGATION MARTINDALE ROAD ST. CATHARINES, ONTARIO TITLE: SITE LOCATION PLAN	REV. NO.: A DATE: FEBRUARY 2019 PROJECT NO.: TG182043 NO.: FIGURE 1

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3300 Merrittville Hwy, Unit 5
Thorold, Ontario



REFERENCE: Base plan provided by NIAGARA NAVIGATOR, https://maps-beta.niagararegion.ca/Navigator/

FOR ILLUSTRATION PURPOSES ONLY, ALL LOCATIONS APPROXIMATE.

CLIENT: Regional Municipality of Niagara	LEGEND: TP-1 Test Pit Location	DWN BY: DN	PROJECT: TEST PIT INVESTIGATION MARTINDALE ROAD ST. CATHARINES, ONTARIO	REV. NO.: A
		CHK'D BY: TR		DATE: FEBRUARY 2019
		DATUM: NAD83		PROJECT NO.: TG182043
Wood Environment & Infrastructure Solutions 3300 Merrittville Hwy, Unit 5 Thorold, Ontario		PROJECTION: UTM Zone 17	TITLE: TEST PIT LOCATION PLAN	NO.: FIGURE 2
		SCALE: As Shown		

TEST PIT INVESTIGATION
MARTINDALE ROAD
ST. CATHARINES, ONTARIO
TEST PIT LOGS

Test Pit: 1					
Client:	The Regional Municipality of Niagara				Date: January 17, 2019
Project:	Martindale Road, St. Catharines, Ontario				
Project No.	TG182043	Location	N 4779645	E 641042	Inspector: D. Neill





Soil and Groundwater Conditions

Depth (m) From - To	Description	Sample ID.	Sample Depth (m)	Sample Type
0.0 – 0.20	ASPHALT SURFACE	-	-	-
0.20 – 0.60	GRANULAR FILL	-	-	-
0.60 – 0.65	SILTY CLAY/CLAYEY SILT FILL, brown, some gravel, trace rootlets, dtpl, no odours or staining observed	GS1	0.65	Grab Sample
0.65	Test Pit terminated at 0.65 m depth **No evidence of McAdams Asphalt observed upon completion of test pit.**			

General Notes

1. Test Pit oriented North-South, 0.7m × 1.6m
2. No groundwater encountered. Test Pit remained open upon completion.
3. North and East coordinates obtained using a hand-held Garmin GPS – UTM; Zone 17; NAD 83.
4. Backhoe - Deere B71 310-SL – supplied by Rankin Construction Inc.
5. No surface elevations available at time of investigation.
6. Tet pit backfilled with excavated materials and surface reinstated with cold mix.

TEST PIT INVESTIGATION
MARTINDALE ROAD
ST. CATHARINES, ONTARIO
TEST PIT LOGS

Test Pit: 2					
Client:	The Regional Municipality of Niagara				Date: January 17, 2019
Project:	Martindale Road, St. Catharines, Ontario				
Project No.	TG182043	Location	N 4779853	E 641031	Inspector: D. Neill





Soil and Groundwater Conditions

Depth (m) From - To	Description	Sample ID.	Sample Depth (m)	Sample Type
0.0 – 0.10	ASPHALT SURFACE	-	-	-
0.10 – 0.65	GRANULAR FILL	-	-	-
0.65 – 0.75	SILTY CLAY/CLAYEY SILT FILL, brown, some gravel, dtpl, no odours or staining observed	GS1	0.70	Grab Sample
0.75	Test Pit terminated at 0.75 m depth **No evidence of McAdams Asphalt observed upon completion of test pit.**			

General Notes

1. Test Pit oriented North-South, 0.6m × 1.6m
2. No groundwater encountered. Test Pit remained open upon completion.
3. North and East coordinates obtained using a hand-held Garmin GPS – UTM; Zone 17; NAD 83.
4. Backhoe - Deere B71 310-SL – supplied by Rankin Construction Inc.
5. No surface elevations available at time of investigation.
6. Tet pit backfilled with excavated materials and surface reinstated with cold mix.

TEST PIT INVESTIGATION
MARTINDALE ROAD
ST. CATHARINES, ONTARIO
TEST PIT LOGS

Test Pit: 3					
Client:	The Regional Municipality of Niagara				Date: January 17, 2019
Project:	Martindale Road, St. Catharines, Ontario				
Project No.	TG182043	Location	N 4780081	E 641019	Inspector: D. Neill





Soil and Groundwater Conditions

Depth (m) From - To	Description	Sample ID.	Sample Depth (m)	Sample Type
0.0 – 0.20	ASPHALT SURFACE	-	-	-
0.20 – 0.95	GRANULAR FILL	-	-	-
0.95 – 1.00	SILTY CLAY/CLAYEY SILT FILL, brown, some gravel, dtpl, no odours or staining observed	GS1	1.00	Grab Sample
1.00	Test Pit terminated at 1.00 m depth **No evidence of McAdams Asphalt observed upon completion of test pit.**			

General Notes

1. Test Pit oriented North-South, 0.7m × 1.6m
2. No groundwater encountered. Test Pit remained open upon completion.
3. North and East coordinates obtained using a hand-held Garmin GPS – UTM; Zone 17; NAD 83.
4. Backhoe - Deere B71 310-SL – supplied by Rankin Construction Inc.
5. No surface elevations available at time of investigation.
6. Tet pit backfilled with excavated materials and surface reinstated with cold mix.

TEST PIT INVESTIGATION
MARTINDALE ROAD
ST. CATHARINES, ONTARIO
TEST PIT LOGS

Test Pit: 4					
Client:	The Regional Municipality of Niagara				Date: January 17, 2019
Project:	Martindale Road, St. Catharines, Ontario				
Project No.	TG182043	Location	N 4780284	E 640990	Inspector: D. Neill





Soil and Groundwater Conditions

Depth (m) From - To	Description	Sample ID.	Sample Depth (m)	Sample Type
0.0 – 0.20	ASPHALT SURFACE	-	-	-
0.20 – 0.70	GRANULAR FILL	-	-	-
0.70 – 0.95	GRANULAR PROCESSED PIT FILL, brown, moist, no odours or staining observed, possible storm sewer trench backfill	-	-	-
0.95	Test Pit terminated at 0.95 m depth due to proximity to possible storm sewer pipe. **No evidence of McAdams Asphalt observed upon completion of test pit.**			

General Notes

1. Test Pit oriented North-South, 0.7m × 1.5m
2. No groundwater encountered. Test Pit remained open upon completion.
3. North and East coordinates obtained using a hand-held Garmin GPS – UTM; Zone 17; NAD 83.
4. Backhoe - Deere B71 310-SL – supplied by Rankin Construction Inc.
5. No surface elevations available at time of investigation.
6. Tet pit backfilled with excavated materials and surface reinstated with cold mix.

Standard Limitations to Geotechnical Reports

The work performed in the preparation of this report and the conclusions presented herein are subject to the following:

a) The contract between Wood and the Client, including any subsequent written amendment or Change Order dully signed by the parties (hereinafter together referred as the "Contract");

b) Any and all time, budgetary, access and/or site disturbance, risk management preferences, constraints or restrictions as described in the contract, in this report, or in any subsequent communication sent by Wood to the Client in connection to the Contract; and

c) The limitations stated herein.

2. **Standard of care:** Wood has prepared this report in a manner consistent with the level of skill and are ordinarily exercised by reputable members of Wood's profession, practicing in the same or similar locality at the time of performance, and subject to the time limits and physical constraints applicable to the scope of work, and terms and conditions for this assignment. No other warranty, guaranty, or representation, expressed or implied, is made or intended in this report, or in any other communication (oral or written) related to this project. The same are specifically disclaimed, including the implied warranties of merchantability and fitness for a particular purpose.

3. **Limited locations:** The information contained in this report is restricted to the site and structures evaluated by Wood and to the topics specifically discussed in it, and is not applicable to any other aspects, areas, or locations.

4. **Information utilized:** The information, conclusions and estimates contained in this report are based exclusively on: i) information available at the time of preparation, ii) the accuracy and completeness of data supplied by the Client or by third parties as instructed by the Client, and iii) the assumptions, conditions, and qualifications/limitations set forth in this report.

5. **Accuracy of information:** No attempt has been made to verify the accuracy of any information provided by the Client or third parties, except as specifically stated in this report (hereinafter "Supplied Data"). Wood cannot be held responsible for any loss or damage, of either contractual or extra-contractual nature, resulting from conclusions that are based upon reliance on the Supplied Data.

6. **Report interpretation:** This report must be read and interpreted in its entirety, as some sections could be inaccurately interpreted when taken individually or out-of-context. The contents of this report are based upon the conditions known and information provided as of the date of preparation. The text of the final version of this report supersedes any other previous versions produced by Wood.

7. **No legal representations:** Wood makes no representations whatsoever concerning the legal significance of its findings, or as to other legal matters touched on in this report, including but not limited to, ownership of any property, or the application of any law to the facts set forth herein. With respect to regulatory compliance issues, regulatory statutes are subject to interpretation and change. Such interpretations and regulatory changes should be reviewed with legal counsel.

8. **Decrease in property value:** Wood shall not be responsible for any decrease, real or perceived, of the property or site's value or failure to complete a transaction, as a consequence of the information contained in this report.

9. **No third-party reliance:** This report is for the sole use of the party to whom it is addressed unless expressly stated otherwise in the report or Contract. Any use or reproduction which any third party makes of the report, in whole or in part, or any reliance thereon or decisions made based on any information or conclusions in the report is the sole responsibility of such third party. Wood does not represent or warrant the accuracy, completeness, merchantability, fitness for purpose or usefulness of this document, or any information contained in this document, for use or consideration by any third party. Wood accepts no responsibility whatsoever for damages or loss of any nature or kind suffered by any such third party as a result of actions taken or not taken or decisions made in reliance on this report or anything set out therein. including without limitation, any indirect, special, incidental, punitive, or consequential loss, liability or damage of any kind.

10. **Assumptions**: Where design recommendations are given in this report, they apply only if the project contemplated by the Client is constructed substantially in accordance with the details stated in this report. It is the sole responsibility of the Client to provide to Wood changes made in the project, including but not limited to, details in the design, conditions, engineering, or construction that could in any manner whatsoever impact the validity of the recommendations made in the report. Wood shall be entitled to additional compensation from Client to review and assess the effect of such changes to the project.

11. **Time dependence**: If the project contemplated by the Client is not undertaken within a period of 18 months following the submission of this report, or within the time frame understood by Wood to be contemplated by the Client at the commencement of Wood's assignment, and/or, if any changes are made, for example, to the elevation, design or nature of any development on the site, its size and configuration, the location of any development on the site and its orientation, the use of the site, performance criteria and the location of any physical infrastructure, the conclusions and recommendations presented herein should not be considered valid unless the impact of the said changes is evaluated by Wood, and the conclusions of the report are amended or are validated in writing accordingly.

    Advancements in the practice of geotechnical engineering, engineering geology and hydrogeology and changes in applicable regulations, standards, codes or criteria could impact the contents of the report, in which case, a supplementary report may be required. The requirements for such a review remain the sole responsibility of the Client or their agents.

    Wood will not be liable to update or revise the report to take into account any events or emergent circumstances or facts occurring or becoming apparent after the date of the report.

12. **Limitations of visual inspections:** Where conclusions and recommendations are given based on a visual inspection conducted by Wood, they relate only to the natural or man-made structures, slopes, etc. inspected at the time the site visit was performed. These conclusions cannot and are not extended to include those portions of the site or structures, which were not reasonably available, in Wood's opinion, for direct observation.

13. **Limitations of site investigations**: Site exploration identifies specific subsurface conditions only at those points from which samples have been taken and only at the time of the site investigation. Site investigation programs are a professional estimate of the scope of investigation required to provide a general profile of subsurface conditions.

    The data derived from the site investigation program and subsequent laboratory testing are interpreted by trained personnel and extrapolated across the site to form an inferred geological representation and an engineering opinion is rendered about overall subsurface conditions and their likely behaviour with regard to the proposed development. Despite this investigation, conditions between and beyond the borehole/test hole locations may differ from those encountered at the borehole/test hole locations and the actual conditions at the site might differ from those inferred to exist, since no subsurface exploration program, no matter how comprehensive, can reveal all subsurface details and anomalies.

    Final sub-surface/bore/profile logs are developed by geotechnical engineers based upon their interpretation of field logs and laboratory evaluation of field samples. Customarily, only the final bore/profile logs are included in geotechnical engineering reports.

    Bedrock, soil properties and groundwater conditions can be significantly altered by environmental remediation and/or construction activities such as the use of heavy equipment or machinery, excavation, blasting, pile-driving or draining or other activities conducted either directly on site or on adjacent terrain. These properties can also be indirectly affected by exposure to unfavorable natural events or weather conditions, including freezing, drought, precipitation and snowmelt.

    During construction, excavation is frequently undertaken which exposes the actual subsurface and groundwater conditions between and beyond the test locations, which may differ from those encountered at the test locations. It is recommended that Wood be retained during construction to confirm that the subsurface conditions throughout the site do not deviate materially from those encountered at the test locations, that construction work has no negative impact on the geotechnical aspects of the design, to adjust recommendations in accordance with conditions as additional site information is gained, and to deal quickly with geotechnical considerations if they arise.

Interpretations and recommendations presented herein may not be valid if an adequate level of review or inspection by Wood is not provided during construction.

14. **Factors that may affect construction methods, costs and scheduling**: The performance of rock and soil materials during construction is greatly influenced by the means and methods of construction. Where comments are made relating to possible methods of construction, construction costs, construction techniques, sequencing, equipment or scheduling, they are intended only for the guidance of the project design professionals, and those responsible for construction monitoring. The number of test holes may not be sufficient to determine the local underground conditions between test locations that may affect construction costs, construction techniques, sequencing, equipment, scheduling, operational planning, etc.

    Any contractors bidding on or undertaking the works should draw their own conclusions as to how the subsurface and groundwater conditions may affect their work, based on their own investigations and interpretations of the factual soil data, groundwater observations, and other factual information.

15. **Groundwater and Dewatering**: Wood will accept no responsibility for the effects of drainage and/or dewatering measures if Wood has not been specifically consulted and involved in the design and monitoring of the drainage and/or dewatering system.

16. **Environmental and Hazardous Materials Aspects**: Unless otherwise stated, the information contained in this report in no way reflects on the environmental aspects of this project, since this aspect is beyond the Scope of Work and the Contract. Unless expressly included in the Scope of Work, this report specifically excludes the identification or interpretation of environmental conditions such as contamination, hazardous materials, wild life conditions, rare plants or archeology conditions that may affect use or design at the site. This report specifically excludes the investigation, detection, prevention or assessment of conditions that can contribute to moisture, mould or other microbial contaminant growth and/or other moisture related deterioration, such as corrosion, decay, rot in buildings or their surroundings. Any statements in this report or on the boring logs regarding odours, colours, and unusual or suspicious items or conditions are strictly for informational purposes

17. **Sample Disposal**: Wood will dispose of all uncontaminated soil and rock samples after 30 days following the release of the final geotechnical report. Should the Client request that the samples be retained for a longer time, the Client will be billed for such storage at an agreed upon rate. Contaminated samples of soil, rock or groundwater are the property of the Client, and the Client will be responsible for the proper disposal of these samples, unless previously arranged for with Wood or a third party.

18. **Effect of iron minerals:** This report does not address issues related to the discovery or presence of iron minerals, such as pyrite, or the effects of iron minerals, if any, in the soil or to be used in concrete. Should specific information be required, additional testing may be requested by the Client for which Wood shall be entitled to additional compensation. **(Optional clause, inserted for use in Quebec, can be deleted if not applicable to project)**

Wood Environment & Infrastructure Solutions,
a Division of Wood Canada Limited

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, clients can benefit from a lowered exposure to the subsurface problems that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed below, contact your GBA-member geotechnical engineer. Active involvement in the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Geotechnical-Engineering Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. *Those who rely on a geotechnical-engineering report prepared for a different client can be seriously misled*. No one except authorized client representatives should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one – not even you – should apply this report for any purpose or project except the one originally contemplated.*

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read it *in its entirety*. Do not rely on an executive summary. Do not read selected elements only. *Read this report in full.*

You Need to Inform Your Geotechnical Engineer about Change

Your geotechnical engineer considered unique, project-specific factors when designing the study behind this report and developing the confirmation-dependent recommendations the report conveys. A few typical factors include:

- the client's goals, objectives, budget, schedule, and risk-management preferences;
- the general nature of the structure involved, its size, configuration, and performance criteria;
- the structure's location and orientation on the site; and
- other planned or existing site improvements, such as retaining walls, access roads, parking lots, and underground utilities.

Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.*

This Report May Not Be Reliable

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, that it could be unwise to rely on a geotechnical-engineering report whose reliability may have been affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If your geotechnical engineer has not indicated an "apply-by" date on the report, ask what it should be*, and, in general, *if you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying it. A minor amount of additional testing or analysis – if any is required at all – could prevent major problems.

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface through various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing were performed*. The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgment to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team from project start to project finish, so the individual can provide informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, *they are not final*, because the geotechnical engineer who developed them relied heavily on judgment and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* revealed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a full-time member of the design team, to:

- confer with other design-team members,
- help develop specifications,
- review pertinent elements of other design professionals' plans and specifications, and
- be on hand quickly whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction observation.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for informational purposes only*. To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report, but they may rely on the factual data relative to the specific times, locations, and depths/elevations referenced. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely*. Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures*. If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. As a general rule, *do not rely on an environmental report prepared for a different client, site, or project, or that is more than six months old.*

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, none of the engineer's services were designed, conducted, or intended to prevent uncontrolled migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration.*** Confront the risk of moisture infiltration by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are not building-envelope or mold specialists.***

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