Soils/Geotechnical Study

PURPOSE:

This document provides guidance for the completion of a Soils/Geotechnical Study, which may be required for the submission of an application under the *Planning Act*. All Soils/Geotechnical Studies shall follow the requirements referenced in this document.

A Soils/Geotechnical Study provides information on the subsurface soil and groundwater conditions at a site and provides recommendations for design and construction purposes. Additionally, if a site contains a slope or erosion hazard, the Soils/Geotechnical Study will provide details on the stability of the slope and provide recommendations on the required setbacks for development.

A Soils/Geotechnical Study is required for a Planning Application to evaluate and address the subsurface conditions and how they may impact a proposed development. A Soils/Geotechnical Study may be required as part of the following development application types:

- Zoning By-law Amendment;
- Draft Plan of Subdivision;
- Site Plan Control; and,
- Consent to Sever.

PREPARED BY:

A Soils/Geotechnical Study must be prepared by a consultant registered as a Professional Engineer in the province of Ontario. The consultant must affix their stamp and seal and specifically identify the engineer who prepared the work. The consultant is expected to be a professional engineer experienced in geotechnical engineering.

CONTENTS:

The applicant is encouraged to discuss requirements for the Soils/Geotechnical Study with City staff and the Conservation Authority having jurisdiction over the lands prior to completion of fieldwork.

Consultation with provincial agencies such as Ministry of Environment, Conservation and Parks (MECP), Ministry of Natural Resources (MNR) and Ministry of Transportation (MTO) may be required.

The Soils/Geotechnical Study must provide sufficient information to establish the site

soil and groundwater characteristics and how they will impact the design and construction of the development. The Study shall:

1. Describe proposed development and location;

2. Describe the investigative fieldwork activities (including dates), which may include but not be limited to:
   - Site inspections;
   - Borehole drilling and location;.
   - Bedrock coring;
   - Monitoring well installations;
   - Test pit excavations; and,
   - Infiltration testing.

3. Describe the laboratory testing activities, which may include but not be limited to:
   - Moisture content of soil;
   - Grain size distribution of soils;
   - Atterberg limit testing;
   - Proctor analyses; and,
   - Bedrock compressive strength testing.

4. Provide a summary of the local and regional geological settings and formations.

5. Provide a summary of the encountered subsurface soil and groundwater conditions, including but not limited to:
   - Previously placed onsite fill;
   - Topsoil thicknesses;
   - Existing roadway composition;
   - Native soil conditions;
   - Bedrock depth;
   - Bedrock composition and formation;
   - Groundwater depth; and,
   - Groundwater conditions (i.e., perched, confined, unconfined, artesian, etc.).

6. Discuss regulatory agencies that may have jurisdiction over the proposed development such as (but not limited to):
   - City of Hamilton
   - Conservation Authorities
   - Ministry of Natural Resources
   - Ministry of the Environment
   - Niagara Escarpment Commission
   - Ministry of Transportation

7. For developments with identified slope hazards:
   - Establish limits of the hazard using Conservation Authority guidelines, if available, and in consultation with the City and Conservation Authority.

- Complete an initial site inspection and determine the appropriate slope stability rating in accordance with the Ontario Ministry of Natural Resources (MNR) *Technical Guide – River and Stream Systems: Erosion Hazard Limit 2002,* Table 4.2..
- Based on the slope stability rating, determine, and complete the required level of investigation according to the MNR guidelines. The investigation may include:
  - Detailed topographic survey (reference vertical and horizontal datums);
  - Staking/flagging of the physical top and toe of slope feature;
  - Boreholes and monitoring wells;
  - Soil property testing (grain size, Atterberg limit, etc.);
  - Detailed computer assisted slope modelling.;
  - Determination of minimum Factor of Safety based on proposed development;
  - Determination of stable slope inclination for slope feature;
  - Discussion on required setbacks, such as toe erosion allowance, stable slope allowance, access allowance, wave uprush allowance, etc.;
  - Determination of development setback limit from slopes for the site; and,
  - Document the investigation and recommendations.
    - The development setback limit, if required, shall be provided in geodetic CAD format and ArcGIS format, to be superimposed on relevant drawings for other disciplines (i.e., site plan, draft plan, etc.)

8. Recommendations/Conclusions
   - The Study should provide design and construction recommendations relevant to the project based on the encountered soil and groundwater conditions, including but not limited to:
     - Site grading, include reuse of onsite materials;
     - Excavations and dewatering;
     - Temporary shoring measures;
     - Foundation design (shallow and/or deep foundations, as applicable);
     - Seismic site classification;
     - Retaining walls;
     - Pavement structures;
     - Infiltration potential of onsite soils;
     - Stormwater management facilities;
     - Anti-seepage collars; and,
     - Development setbacks.
   - Describe existing features that could be impacted by the proposed development within and outside of the proposed development and provide recommended mitigation measures, such as vibration monitoring, pre/post condition surveys, etc.
   - Establish baseline requirements for construction inspection and testing.

OTHER INFORMATION:

Comprehensive Development Guidelines and Financial Policies Manual (City of Hamilton, current edition)
https://www.hamilton.ca/build-invest-grow/planning-development/planning-policies-guidelines/comprehensive-development

Conservation Halton Guidelines for Slope Stability Assessments for Valleys, June 2024
https://www.conservationhalton.ca/wp-content/uploads/2024/06/CH-Guidelines-for-Slope-Stability-Assessments-for-Valleys-v2.1-June-2024.pdf

Ontario Ministry of Natural Resources, Technical Guide – River and Stream Systems: Erosion Hazard Limit - 2002

Ontario Regulation 41/24
https://www.ontario.ca/laws/regulation/r24041

Conservation Halton Policies and Guidelines
Policies and Guidelines - Conservation Halton

REVIEWED AND APPROVED BY:

Development Planning, Planning and Economic Development Department
Development Approvals, Planning and Economic Development Department
The Conservation Authority with regulatory authority over the subject lands, namely:

- Hamilton Conservation Authority
- Conservation Halton
- Niagara Peninsula Conservation Authority
- Grand River Conservation Authority

CONTACT:

Development Planning, Planning and Economic Development
pdgening@hamilton.ca

Development Approvals, Planning and Economic Development
deveng@hamilton.ca

Hamilton Conservation Authority
nature@conservationhamilton.ca

Conservation Halton
envserv@hrca.on.ca

Niagara Peninsula Conservation Authority
planninginfo@npca.ca

Grand River Conservation Authority
grca@grandriver.ca

APPENDICES ATTACHED:

Soils/Geotechnical Study – Summary Checklist
Soils/Geotechnical Study – Standard Format for Table of Contents

GEOTECHNICAL INVESTIGATION – SUMMARY CHECKLIST

The form is to be completed by the Professional that prepared the Development Impact Monitoring Plan.

Use of the form by the City of Hamilton is not to be construed as verification of engineering content.

Refer to the Terms of Reference for the Geotechnical Investigation:
Link to Terms of Reference

IF ANY OF THE REQUIREMENTS LISTED BELOW HAVE NOT BEEN INCLUDED IN THE GEOTECHNICAL INVESTIGATION, THE STUDY WILL BE CONSIDERED INCOMPLETE.

Study Information	
Site Address	
Property Owner	
Project Description	
Land Use	
Date Prepared:	
Prepared By:	

Summary of Key Information:

Site Information		**Page # & Section # of Report**	**Report Includes this Information City Staff (Check)**
Is this a Preliminary or Final report?			
Have the subject lands been clearly identified?			
Has a Site Plan been included? Does the Site Plan clearly identify the property limits, proposed construction, investigation locations?			
References to documents or policies that govern the development			
Have any previous investigations been discussed and/or used?			

Site Information		Page # & Section # of Report	Report Includes this Information City Staff (Check)
Any consultation with the City of Hamilton regarding site specific issues and constraints?			
How many boreholes/test pits/monitoring well installations were completed?			
What was the depth of testing completed?			
Was the quantity and depth of investigation appropriate for the proposed development or is further work recommended?			
Was bedrock encountered? If yes, was the bedrock confirmed or inferred?			
Does the report discuss fill, native soil, bedrock, groundwater conditions?			
Does the report include recommendations for site grading (if required)?			
Does the report include recommendations for excavations and dewatering (if required)?			
Does the report include recommendations for shoring (if required)?			
Does the report include recommendations for foundations (if required)?			
Does the report include recommendations for seismic site classification (if required)?			
Does the report include recommendations for retaining walls (if required)?			
Does the report include recommendations for pavement design (if required)?			
Does the report include recommendations for infiltration potential (if required)?			
Does the report discuss potential impacts to adjacent properties/structures?			
Was the report sign/sealed by a Professional Engineer?			
For developments with identified slope hazards			
Does the property have slope/erosion hazards that need to be addressed?			
Was consultation completed with the City of Hamilton and Conservation Authority to establish the hazard limits			
Was a site inspection completed in accordance with MNR technical guideline			

Site Information		Page # & Section # of Report	Report Includes this Information City Staff (Check)
What was the slope rating?			
Is further work required based on slope rating? If yes, what level of supplemental investigation is required?			
Was a topographic survey of slope completed?			
Was the top and toe of the slope stakes/flagged?			
What investigative works were completed for the slope?			
What lab testing was completed?			
Were cross sections of the slope provided and computer modeling of the slope completed?			
What was the target factor of safety?			
Is a toe erosion allowance required? If yes, how much?			
Is a stable slope setback required? If yes, how much?			
Is an access allowance required? If yes, how much?			
Is a detailed plan demonstrating setbacks provided?			
Was the report sign/sealed by a Professional Engineer or Geoscientist?			

Qualified Professional who completed this report summary:

Name:_____

Email:_____

Phone:_____

Date:_____

Signature and Stamp:_____

Guideline for Applicants completing the Summary Checklist for Geotechnical Report

Site Address: provide municipal address, or lot and concession

Property Owner: provide company name if applicable and name of key contact person

Project Description: provide brief description – e.g. 20 Ha residential subdivision

Land Use: e.g. residential, industrial, commercial/ mixed use residential and commercial

Date Prepared: provide the date the study was completed

Prepared By: provide name of consulting firm that completed the study

1. **Is this a Preliminary or Final Report?**
   Indicate whether this is a Preliminary or Final report. If Final, also list the date of the Preliminary report.

2. **Have the subject lands been clearly identified?**
   Ensure the property is properly and adequately described in the Introduction.

3. **Has a Site Plan been included? Does the Site Plan clearly identify the property limits, owner(s), adjacent land uses and/or owner(s)?**
   Ensure a Site Plan is included, which clearly identifies the items listed above. Ensure the description in the text matches what is shown in the figure.

4. **Reference to documents or policies that govern the development.**
   List all relevant Municipality, Agency, Conservation Authority, etc. policies and/or reports that may be relevant to the design and/or property.

5. **Have any previous investigations been discussed and/or used?**
   If previous investigations have been completed and are able to be included, include relevant information.

6. **Has any consultation with the City of Hamilton regarding site specific issues and constraints occurred?**
   If yes, the results of any discussion is to be included in the report and the issues or constraints need to be have been addressed.

7. **How many boreholes/test pits/monitoring well installations were completed?**
   Discussion of field program to be included in report.

8. **What was the depth of testing completed?**
   Discussion of field program to be included in report.

9. **Was the quantity and depth of investigation appropriate for the proposed development or is further work recommended?**
Provide commentary on work program.

10. **Was bedrock encountered? If yes, was the bedrock confirmed or inferred?**
Confirmed bedrock would be via coring, inferred via auger refusal.

11. **Does the report discuss fill, native soil, bedrock, groundwater conditions?**
Indicate sections of this information.

12. **Does the report include recommendations for site grading (if required)?**
Indicate sections of this information.

13. **Does the report include recommendations for excavations and dewatering (if required)?**
Indicate sections of this information.

14. **Does the report include recommendations for shoring (if required)?**
Indicate sections of this information.

15. **Does the report include recommendations for foundations (if required)?**
Indicate sections of this information.

16. **Does the report include recommendations for seismic site classification (if required)?**
Indicate sections of this information.

17. **Does the report include recommendations for retaining walls (if required)?**
Indicate sections of this information.

18. **Does the report include recommendations for pavement design (if required)?**
Indicate sections of this information.

19. **Does the report include recommendations for infiltration potential (if required)?**
Indicate sections of this information.

20. **Does the report discuss potential impacts to adjacent properties/structures?**
Indicate sections of this information.

21. **Was the report sign/sealed by a Professional Engineer?**
Indicate sections of this information.

For Sites

22. **Does the property have slope/erosion hazards that need to be addressed?**
Yes or no?

23. **Was consultation completed with the City of Hamilton and Conservation Authority to establish the hazard limits?**
Include discussion regarding results of consultation.

24. **Was a site inspection completed in accordance with MNR technical guideline.**
Yes or No. If No, explain why?

25. **What was the slope rating?**
Slope rating to be in accordance with MNR Technical Guideline. Rating Chart to be provided.

26. **Is further work required based on slope rating? If yes, what level of supplemental investigation is required?**
Provide commentary on proposed work program.

27. **Was a topographic survey of slope completed?**
Yes or No. If No, explain why?

28. **Was the top and toe of the slope stakes/flagged?**
Yes or No. If No, explain why?

29. **What investigative works were completed for the slope?**
Provide commentary on work program.

30. **What lab testing was completed?**
Provide commentary on work program.

31. **Were cross sections of the slope provided and computer modeling of the slope completed?**
Yes or No. If No, explain why?

32. **What was the target factor of safety?**
Include justification for selection

33. **Is a toe erosion allowance required? If yes, how much?**
Include justification for selection

34. **Is a stable slope setback required? If yes, how much?**
Include justification for selection

35. **Is an access allowance required? If yes, how much?**
Include justification for selection

36. **Is a detailed plan demonstrating setbacks provided?**
Yes or No. If No, explain why?

37. **Was the report sign/sealed by a Professional Engineer or Geoscientist?**
Yes or No. If No, explain why?

Standard Format for Table of Contents

Title:

- Project Name
- Type of Report
- Project Location
- Prepared for: Client
- Prepared by: Company name
- Date of Original Report
- Date of Revised report (if applicable)

Table of Contents:

1.0 Introduction

1.1 Overview

- General description of the development and plans
- Description of location, site area, property owner(s)
- Description of larger development (if phased and/or applicable)
- Purpose of the study (**Why is it required**)
- Type of application that triggered a requirement for the study (**When is it required**)

1.2 Background Information

- Describe existing conditions related to the type of study
- History of a relevant Master Plan or any previous studies (if applicable)
- Is this a preliminary report? If final, was a Preliminary Analysis conducted? Speak to the history of the development or job itself
- Discuss any relevant historical changes and/or upgrades that may have implications

2.0 Investigation Work

2.1 Fieldwork

- Describe what fieldwork was done, including boreholes, test pits, monitoring wells?
- Include depths and quantity of testing completed
- Describe equipment and procedures utilized
- Describe surveying, including methodology and benchmark information

2.2 Laboratory testing

- Provide details on what testing was completed and what quantity
- What standards/procedures were followed (ie. ASTMs)

3.0 Field work Results

- Summarize subsurface conditions encountered on the site with discussion of testing results for each applicable soil/bedrock unit investigated
- Discuss groundwater conditions

4.0 Discussion and Recommendations

- Provide geotechnical recommendations as they pertain to the development based on the encountered subsurface conditions. Subsections may include but not be limited to:

4.1 Site preparation

4.2 Site servicing

4.2.1 Pipe Bedding

4.2.2 Trench Backfilling

4.2.3 Trenchless installations

4.2.4 Excavations and Dewatering

4.3 Foundation Design

4.3.1 Shallow Foundations

4.3.2 Deep foundations

4.4 Slope Stability Assessment

4.5 Pavement Design

4.6 Pavement Construction

4.7 Curbs, Gutters, Sidewalks

4.8 Settlement and Vibration Monitoring Requirements

4.9 Inspection and Testing Requirements

Appendices (as applicable)

Appendix A/1 Figures

Appendix B/2 Borehole and or/ Test Pit Logs

Appendix C/3 Tables

Appendix D/4 Laboratory Testing Results