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# Geotechnical Report Guidelines for Land Development Applications

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This document, prepared by Water Resources, Development Engineering, is intended to be a guideline for City of Calgary staff, developers and the consulting engineering industry for use in the preparation, submission and review of Geotechnical Reports. It is distributed with the understanding that the authors, editors, and publisher are not engaged in rendering legal, accounting, or other professional services. Where legal or other expert assistance is required, the services of a competent professional should be sought. This document contains information that was current as of the date of publication. While every effort has been made to make it as complete and accurate as possible, readers should be aware that all information that is contained herein is subject to change without notice.

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## 1.0 Background

### 1.1 Overview

The City of Calgary requires that Geotechnical Reports be submitted as part of Land Development Applications to provide confirmation that the lands in question can physically accommodate the proposed development while minimizing Risks to Public Safety. This document is intended as a guideline for City staff, developers and the consulting engineering industry for use in the preparation, submission and review of Geotechnical Reports.

This document is to be the definitive document on geotechnical requirements for land development within the City of Calgary. As such, this document shall supersede all previously issued documents by City of Calgary on the matter of geotechnical requirements for land development.

### 1.2 Definitions

For the purposes of the Geotechnical Report Guidelines:

- **“Acceptance”** means meeting the minimum requirements for Geotechnical Reports deemed to be satisfactory by the Director, Roads and the Director, Water Resources.
- **“APEGA”** means the Association of Professional Engineers and Geoscientists of Alberta.
- **“Applicant”** means person responsible for applying for the Land Development Application acting on behalf of the landowner.
- **“Approving Authority”** means a person or body appointed as a Development Authority or Subdivision Authority as contemplated by and in accordance with the Municipal Government Act.
- **“Borrow Pit”** means a pit from which native material is permanently taken from below finished grade design elevation and typically used as engineered material in fill locations.
- **“Certify”** or **“Certification”** means a professional engineer’s declaration of his professional judgment.
- **“Construction Completion Certificate” (CCC)** means the certificate issued according to the provisions and requirements of the Master Development Agreement
- **“Corporate Planning & Applications Group”** or **“CPAG”** means the team of City of Calgary employees from various business units responsible for the review of Land Development Applications.
- **“City”** means the municipal corporation of the City of Calgary.
- **“Deep Fills Report”** means a deep fills report as defined in Section 1.2 of these guidelines.
- **“Development”** means “Development” as defined in the City of Calgary Land Use Bylaw 1P2007, as amended or replaced.
- **“Development Completion Permit” (DCP)** is a permit issued by a Development Authority confirming that the requirements of a development permit (as defined in Bylaw 1P2007) have been satisfactorily completed.

- **“Development Engineering Generalist”** means the City employee who is the representative from the Development Engineering section at the Corporate Planning & Applications Group on a Land Development Application.
- **“Environmental Reserve”** or **“ER”** means land that qualifies as environmental reserve under Section 664(1) of the Municipal Government Act, as amended or replaced.
- **“Factor of Safety”** or **“FOS”** means the calculated ratio commonly used to indicate the stability of a slope. The FOS is the ratio of the shear strength of the soil or rock that comprises the slope divided by the shear stresses within the slope. A FOS greater than one indicates that the soil/rock strength is greater than that required to prevent failure. A FOS equal to or less than one indicates the slope is marginally stable or unstable.
- **“Geotechnical Covenant”** means a Development and Geotechnical Covenant Agreement in the City’s standard form executed by the owner of the proposed site and the City and registered on title of the affected parcel(s) pursuant to a condition of a development permit or subdivision approval.
- **“Geotechnical Engineering Consultant”** means a professional with appropriate education, training, and experience to conduct geotechnical engineering and who is a member in good standing of APEGA, practicing under a valid permit to practice.
- **“Geotechnical Evaluation Report”** means a geotechnical evaluation report as defined in Section 1.3 of these Guidelines.
- **“Geotechnical Report”** means any geotechnical report submitted to the City as part of a Land Development Application
- **“Geotechnical Report Submission Checklist”** means the geotechnical report submission checklist as found in Appendix A of these guidelines.
- **“Hydrogeological Report”** as means a hydrogeological report as defined in Section 1.3 of these Guidelines.
- **“Land Development Application”** means any development application submitted to the City including, but not limited to, land use/outline plans and associated area structure plans and/or area redevelopment plan amendments, tentative plans and development permits.
- **“Line of Stability”** means the boundary setback from the crest and/or toe of the slope beyond which Stable Land exists.
- **“Low Impact Development”** or **“LID”** means a development (residential or commercial) that minimizes the impact of stormwater on watersheds by integration of measures to detain, retain and treat stormwater using soil infiltration and percolation to redirect a portion of the stormwater back into the subsurface.
- **“Preliminary Hydrogeological Evaluation”** means a preliminary hydrogeological evaluation as described in Section 6.2.2 of these guidelines
- **“Preliminary Slope Stability Evaluation”** means a preliminary slope stability evaluation as described in Section 6.2.1 of these guidelines.
- **“Rely”** means to have a reasonable level of confidence or trust in the information provided.
- **“Risks to Public Safety”** means a safety concern arising from slope instability or other geotechnical issue on City or private land.

- **“Slope Stability Report”** as means a slope stability report as defined in Section 1.3 of these Guidelines.
- **“Stable Land”** means land that, in the opinion of a Geotechnical Engineering Consultant, meets or exceeds a long-term Factor of Safety of 1.5 (or 1.0 for seismic loading) with consideration of current and potential changes to existing conditions.
- **“Suitable for Development”** means that, in the opinion of the Geotechnical Engineering Consultant, the geotechnical conditions of the proposed site can reasonably accommodate the proposed Development within an acceptable level of geotechnical risk. The phrase “Suitable for Development” is, for the purposes of these Guidelines, limited to the Geotechnical Engineering Consultant’s evaluation of a site’s geotechnical conditions, in its natural state or otherwise, and does not speak to the Approving Authority’s overall assessment and evaluation of a site’s suitability for the proposed Development and any proposed engineered solutions to stability or other geotechnical concerns.

### 1.3 Types of Reports

There are three main types of Geotechnical Reports that may be required as part of a Land Development Application. They are defined as follows:

- **Geotechnical Evaluation Report** – An interpretative report that is completed by a qualified Geotechnical Engineering Consultant and is intended to evaluate the geotechnical conditions of the site and confirm that the land may be used safely for the intended use without undue risk of hazards.
- **Slope Stability Report** – A detailed report intended to assess Stable Land within the area set out in the report. This report is used to determine the boundaries of Development.
- **Deep Fills Report** – A geotechnical analysis of the soils within areas of the Development being filled more than two metres deep. The report contains recommendations on any Development restrictions, including bearing certificates and special foundation designs that may be necessary to provide integrity of any structure, including buildings, roads and utilities constructed on those fill areas. A Deep Fills Report will also typically contain a plan showing all areas of cuts and fills known as a **Cut-Fill Plan**.

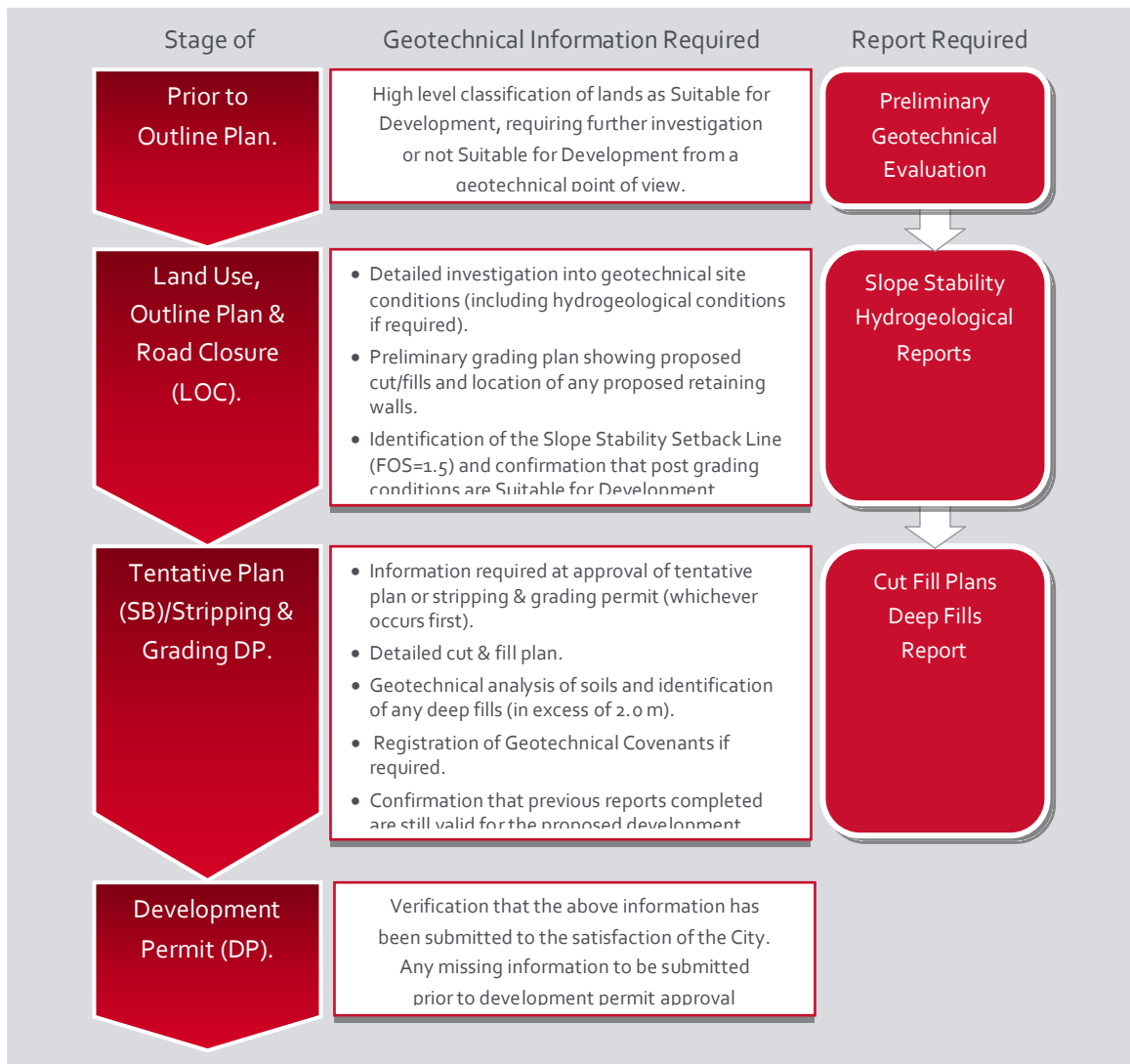
Depending on the characteristics of the parcel, more than one type of Geotechnical Report may be required in connection with a given Land Development Application.

Depending on the proposed Development, a Hydrogeological Report may be required as identified by a Preliminary Geotechnical Evaluation, Slope Stability Report or Stormwater Drainage Plan. A **Hydrogeological Report** is a report intended to assess the potential and direct impacts of a proposed Development on the existing hydrogeological setting of the area. The report shall be authored by a hydrogeologist or Geotechnical Engineering Consultant with appropriate experience in hydrogeology.

## 2.0 Geotechnical Requirements in the Land Development Process

Geotechnical Reports are required at various stages in the land development process to determine if the lands in question can physically accommodate the proposed Development and to identify any geotechnical restrictions on development. The following flow chart highlights the general sequence of Geotechnical Report submissions as it relates to the various stages of land development. The chart is intended as a general guideline for submission requirements. The sequence of required information may be advanced at the discretion of the Approving Authority or Geotechnical Engineering Consultant if more detailed information is required at a given stage to determine whether the land is developable.

**Figure 2.1: Geological Requirements in the Land Development Process**

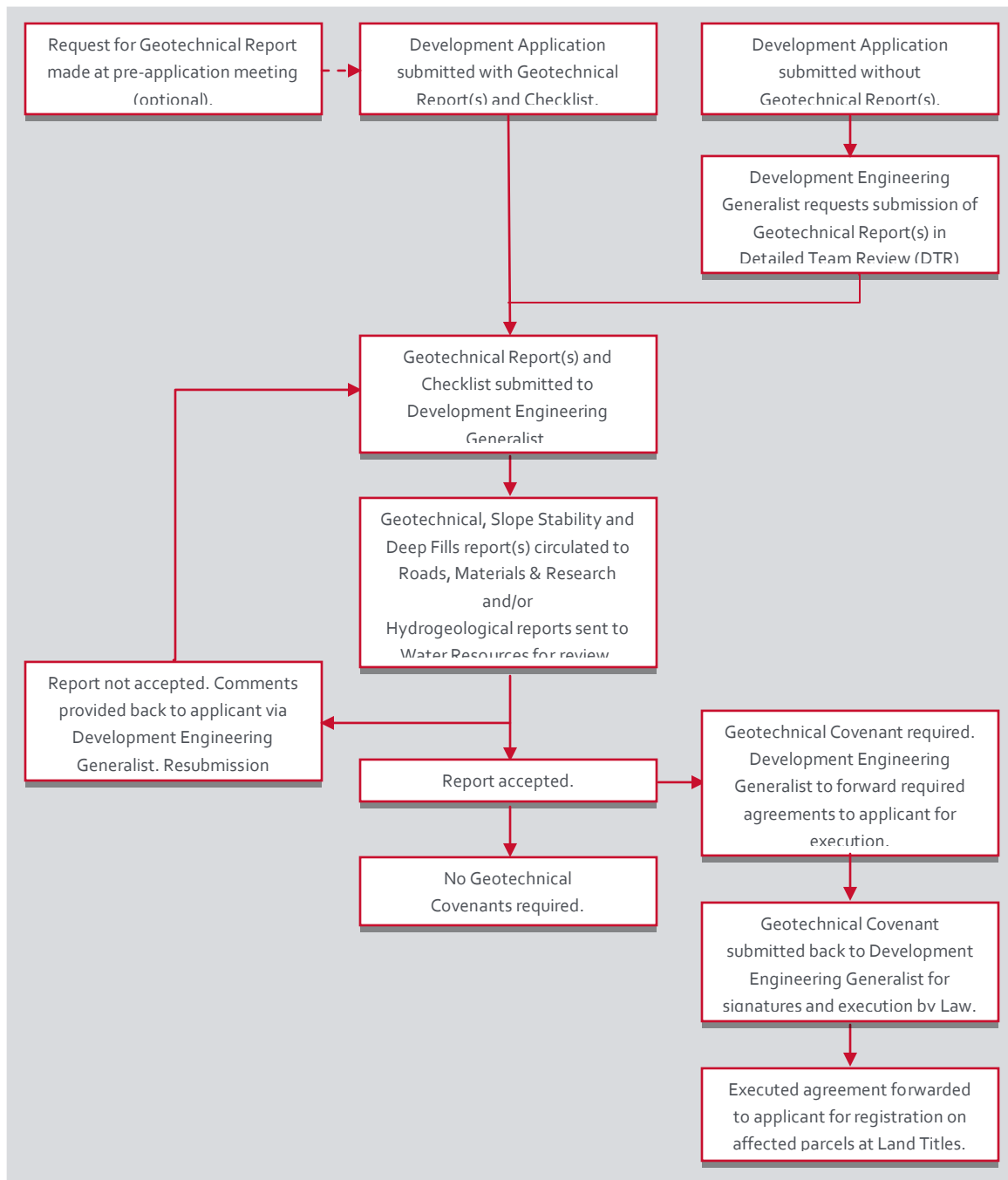


**Note:** Hydrogeological Reports may also be requested in support of a drainage report (Master Drainage Plan, Staged Master Drainage Plan, Pond Report or Stormwater Management Report) and requested by Water Resources at various stages within the land development process.

### 3.0 City of Calgary Review Process

The chart below illustrates the submission and review process for Geotechnical Reports submitted as part of Land Development Applications:

**Figure 3.1: Geotechnical Report Review Process as Part of Land Development Applications**





Concurrent with submission of a Geotechnical Report, the Geotechnical Engineering Consultant is required to submit a Geotechnical Report Submission Checklist. The checklist highlights key aspects from the report and is reviewed by the Development Engineering Generalist. A copy of the checklist can be found in Appendix A.

The Materials & Research section in Roads reviews Geotechnical Evaluation, Slope Stability and Deep Fill Reports submitted as part of Land Development Applications for their compliance with City requirements. Hydrogeological Reports submitted as part of Land Development Applications are reviewed by Water Resources.

As part of their review, the Materials & Research section, Water Resources, or the Approving Authority may recommend that a third-party review of the report(s) be completed by an independent third-party consultant. A third-party review may be required under the following circumstances: i) geotechnical failure of the proposed development result in substantial impact to public safety and/or public infrastructure and ii) the review of the report(s) requires knowledge and expertise beyond that of the City. The City will coordinate the resolution of differences between the Geotechnical Engineering Consultant report(s) and the third-party reviewer's report to ensure all substantial issues are addressed to satisfaction of the City. Third-party reviews are conducted at the expense of the Applicant.

Once a Geotechnical Report is accepted by the Approving Authority, it will be fully relied upon by the City as described in Section 5.3. The City will not undertake its own geotechnical review of the development proposed in the Land Development Application.

## 4.0 Geotechnical Covenant

Based on the recommendations of the Geotechnical Report, the City may require that a Development and Geotechnical Covenant be registered on title of the affected parcel(s) to notify future land owners of any development restrictions associated with the parcel.

The requirement for a Development and Geotechnical Covenant will be listed as a condition of approval on the associated Land Development Application. The Applicant will be required to register the Development and Geotechnical Covenant on title of all affected parcels prior to release of the development permit or concurrent with registration of the tentative plan.

The Development Engineering Generalist will prepare the covenant and, once it has been signed by the landowner, send to the appropriate parties within the City for execution.

Examples of circumstances where the City may require a Development and Geotechnical Covenant are listed below:

- **Line of Stability:** In the developed areas where the Slope Stability Report identifies a FOS of less than 1.5 within the existing property boundaries, a Development and Geotechnical Covenant is registered restricting Development to the area meeting the FOS of 1.5 only. In addition to registering the Development and Geotechnical Covenant, the Applicant will be required to prepare a plan of survey showing the bounds of the FOS 1.5 line and register this plan on title (refer to Section 7.2).
- **Deep Fills:** Registered on title of all affected lots within a plan area with compacted fills in excess of 2.0 m where the anticipated requirements for fill consolidation may exceed the proposed start date of construction. In developing areas, the Development and Geotechnical Covenant is registered concurrent with registration of the tentative plan. The building grade plan shall also identify all lots having deep fill.
- **Other Restrictions:** Including stormwater infiltration, watering restrictions, additional setback requirements, removal of vegetation, installation of underground sprinklers, placement of fill, or other specific recommendations from the Geotechnical Reports.

A sample of a Development and Geotechnical Covenant can be found in Appendix B.

## 5.0 Requirements for Geotechnical Reports

### 5.1 Overview

The following section contains requirements common to all Geotechnical Reports submitted to the City of Calgary as part of Land Development Applications. Sections 6.0 to 8.0 contain guidelines specific to each type of Geotechnical Report.

### 5.2 Authorship

Geotechnical Evaluation Reports, Slope Stability Reports and Deep Fills Reports submitted to the City of Calgary must be authored by a qualified Geotechnical Engineering Consultant with a valid permit to practice. Hydrogeological Reports are to be authored by a qualified hydrogeologist or Geotechnical Engineering Consultant with appropriate experience in hydrogeology.

### 5.3 Report Limitations

The City accepts reports and relies on the professional engineering judgment of the Geotechnical Engineering Consultant and/or Hydrogeologist authoring the report. Reports accepted by the City, pursuant to City approval and paid for by a third-party applicant or surveyor, must name "The City of Calgary" as a party and addressee of the report. The report must also make clear that the "City of Calgary" can use and rely on the information in the report.

The first page of all Geotechnical Reports and/or Hydrogeological Reports submitted to the City must state the following:

*"This report has been prepared for the benefit of \_\_\_\_\_ (APPLICANT NAME) and their agents in support of their \_\_\_\_\_ (DEVELOPMENT PERMIT/SUBDIVISION/ETC.) application to the City of Calgary, which report becomes a public document upon submission.*

*The City of Calgary shall at all times be entitled to fully use and rely on this report, including all attachments, drawings, and schedules, for the specific purpose for which the report was prepared, in each case notwithstanding any provision, disclaimer, or waiver in the report that reliance is not permitted.*

*The City of Calgary shall be entitled to provide copies of the report to City Council, City of Calgary employees, and City of Calgary regulatory boards, each of whom shall also be similarly entitled to fully use and rely on the report in their official capacities for the specific purpose for which the report was prepared.*

*The City of Calgary is at all time entitled to provide copies of the report to Alberta Transportation, adjacent municipalities, and any other governmental authorities and regulatory bodies having jurisdiction. The City of Calgary may also contact the author or any other parties to the report to request further information respecting the report or to discuss the report further."*

In addition, the limitations set out in the report must not limit the City's reliance as required above.

If a previously approved Geotechnical Report and/or Hydrogeological Report are being re-submitted to the City as part of a new Land Development Application, the City must still be named as a party to and addressee of the report, with specific reference to the new Land Development Application. In such instances, a signed letter from the Geotechnical Engineering Consultant and/or Hydrogeologist who authored the report may be submitted along with the report indicating that the City may rely on the

information for the purposes of the new Land Development Application. A copy of a letter template is found in Appendix C.

#### **5.4 Verification of Dated Reports**

Geotechnical Reports submitted in support of a Land Development Application must:

- address the geotechnical requirements for the present (and anticipated future) subsurface conditions at the site to support the proposed development; and,
- be signed and sealed by a Geotechnical Engineering Consultant.

For Geotechnical Reports older than two years from the date of issuance, the City will require written confirmation from the Geotechnical Engineering Consultant indicating that the report adequately addresses the geotechnical requirements for the Land Development Application and is therefore suitable for submission to the City. The intent of this requirement is not to relieve the Geotechnical Engineering Consultant for the completeness or accuracy of the Geotechnical Report, rather to provide the City with assurance that the Geotechnical Engineering Consultant is in agreement with all the information presented within the report and that it adequately addresses the geotechnical issues of the site and proposed development, particularly for situations where the City will ultimately have ownership of a part of the project (e.g., new services and roadways in residential subdivisions) or where the public may be impacted by the development.

If the Geotechnical Engineering Consultant does not agree with all information presented in the Geotechnical Report being submitted, or does not consider the Geotechnical Report to adequately address the geotechnical issues of the site with respect to the proposed development, an addendum geotechnical report or new geotechnical report will be required by the City.

## 6.0 Geotechnical Evaluation Report

### 6.1 Overview

The Geotechnical Evaluation Report is an interpretative report that is completed by a qualified Geotechnical Engineering Consultant and is intended to evaluate the geotechnical conditions of the site and confirm that the land may be used safely for the intended use without undue risk of hazards.

The Geotechnical Evaluation Report may contain a Preliminary Slope Stability Evaluation and/or Preliminary Hydrogeological Evaluation and shall contain recommendations for any further studies and/or investigation that may be required at later stages of the proposed development to define lands Suitable for Development.

### 6.2 Geotechnical Evaluation Report Contents

The minimum contents of the Geotechnical Evaluation Report are as follows:

1. A description of the purpose, objectives and scope of the report.
2. A description of the study area (e.g., the extents of the study area, and/or legal description of the property, or description of the property relative to well-known geographic features).
3. A description of the terrain and/or topography.
4. A description of the proposed development and extents of proposed development.
5. A description of the evaluation approach methodology as determined by the Geotechnical Engineering Consultant, such as:
  - a. Factors considered in planning and executing the subsurface investigation program (e.g., program objectives, site constraints).
  - b. Test hole locations and depths, observation and sampling methods, laboratory testing, and instrumentation installations (e.g., piezometers, slope inclinometers).
  - c. Description of specific testing and/or other methods used to characterize the subsurface conditions (e.g., cone penetration testing, geophysical techniques, in situ testing, geotechnical/hydrogeological instrumentation, aerial photographs).
6. A summary of the Geotechnical Engineering Consultant findings and observations, which may include but is not limited to:
  - a. Existing Information Review
    - i. Available existing public information (e.g., published geological maps and reports, topographic maps, water well records, flood plain mapping).
    - ii. LiDAR imagery, aerial photographs (historical to present).
    - iii. Previous geological, geotechnical, and slope stability reports that address the study area and neighbouring areas.
  - b. Site Reconnaissance/Field Visit
    - i. Relevant observations such as: terrain or physical description, soil/rock exposures, signs of potential slope instability (e.g., cracking, slumping, scarps), groundwater discharge, overland flow, erosion, and vegetation communities.

- ii. Relevant observations from adjacent properties or similar slopes in the vicinity of study area that may or may not show signs of instability.
  - iii. Relevant photographs (show annotations on a plan indicating the location and direction of photographs).
- c. Subsurface Investigation Program
- i. Description of the subsurface conditions and general stratigraphy encountered during the site reconnaissance and/or subsurface investigation program supported by test hole records.
  - ii. Laboratory test results (e.g., Atterberg limits, water content, particle size distribution, corrosivity, strength and compressibility testing).
  - iii. Description of other observations (e.g., frost depth, sloughing).
7. A description of the interpreted geotechnical and hydrogeological site conditions and parameters based on field observations and/or testing, and laboratory testing (e.g., soil/rock conditions, groundwater conditions, depth of frost penetration, seismic potential, soil erodibility for all soil types).
  8. Any recommendations and discussion required with respect to the proposed Development (e.g., site grading, foundations, frost protection, retaining walls, slab-on-grade, construction procedures, concrete type, weeping tile requirements, pavement design, site drainage, testing and inspection to be carried out during construction).
  9. A description of any further studies, evaluation, and/or investigation that may be required at later stages of development.

### **6.2.1 Preliminary Slope Stability Evaluation**

Preliminary Slope Stability Evaluation is typically part of a preliminary geotechnical evaluation and is generally documented within the Geotechnical Evaluation Report. This evaluation is typically conducted using existing information and site reconnaissance (as defined in Section 6.2). For the City of Calgary, a Preliminary Slope Stability Evaluation is required where any existing or proposed slopes on or adjacent to the development site exceed 15%.

The evaluation should consider any factors that may affect the stability of the slope over a period of one life-cycle of development, the length of which shall be to the satisfaction of the City, or the estimated life expectancy of the structure, whichever is greater.

The objectives for the Preliminary Slope Stability Evaluation are:

1. To identify slopes on the subject or adjacent lands where existing or final design slopes exceed 15% (e.g., topographic analysis).
2. To identify past and/or potential current slope instability.
3. To identify topographically controlled surface water drainage features that may direct water towards potentially unstable slopes.
4. To identify groundwater discharge points on or near slopes.
5. To identify potential existing active erosion and future toe erosion caused by water flowing on the slope face and/or in close proximity to the slope toe.

6. To identify the need for additional geotechnical assessment (e.g., for subsequent stages of planning and development).
7. To identify the boundary of Stable Land or identify the need for additional geotechnical assessment.
8. To identify anticipated changed conditions that may negatively impact the stability of the slope (e.g., increase in groundwater, removal of vegetation, placement of fill, re-grading).

As part of the Preliminary Slope Stability Evaluation, a plan must be provided that classifies the terrain according to the following three categories:

- lands Suitable for Development;
- any lands requiring further investigation to evaluate whether lands are Suitable for Development; or,
- lands that are not Suitable for Development.

The plan should identify geotechnical and hydrogeological observations and findings where appropriate and provide sufficient information on the existing site features, terrain, and proposed development to support the classification.

### 6.2.2 Preliminary Hydrogeological Evaluation

A Preliminary Hydrogeological Evaluation is also typically part of a broader geotechnical evaluation and is generally documented within the Geotechnical Evaluation Report. This evaluation is typically conducted using existing information, site reconnaissance observations, and results of the subsurface investigation program.

For slope stability assessments, groundwater conditions (i.e., water levels) are often one of the greatest unknowns and most open to interpretation by the Geotechnical Engineering Consultant. Generally, there are three groundwater conditions that can be used in preliminary slope stability analysis with simple geology:

- **Full Hydrostatic Saturation** – assumes that the groundwater level is at ground surface (i.e., all of the soils are saturated) and that groundwater flows horizontally towards the slope (may be considered conservative and somewhat unrealistic, since water would be flowing out of and along the full slope face, a condition not generally observed).
- **Groundwater Flow Parallel to the Slope Face** – assumes full saturation, but there is discharge at the slope toe, which may be reasonable where surface water flow is observed at the slope toe.
- **Groundwater Level at Some Depth in the Slope** – assumes that the upper soil profile is in an unsaturated condition and the piezometric surface slopes down towards the slope toe.

The abovementioned groundwater conditions can occur on different portions of the same slope, and under seasonal conditions their locations on the slope can vary; therefore, adequate study should be carried out to understand the groundwater regime and fluctuations.

Ideally, piezometers are installed within boreholes to measure the groundwater levels at various locations above, below, and on the slope and these should be measured at various times in the year and under worst case conditions (e.g., when precipitation is generally highest). However, it is unlikely that the groundwater levels will be measured to be the highest that could occur and the timeframe required for on-going monitoring is likely not practical. Therefore, care needs to be taken by the Geotechnical

Engineering Consultant to use the highest groundwater level that could reasonably be expected to occur (i.e., anticipated “worst case” condition) using some judgement on how high the groundwater levels could become for preliminary analysis.

Consideration should also be given to influences of flooding of the slope, possible saturation of the slope due to discharge, the effects of irrigation, and the effects of adjacent stormwater management ponds and the like. Where new development is anticipated, consideration may be required for further hydrogeological study depending on the sensitivity of the slope to changes in the groundwater levels.

At a minimum, the Preliminary Hydrogeological Evaluation for the purposes of Preliminary Slope Stability Evaluation should identify that the groundwater levels have been established or assumed based on a rational “defensible” method that accounts for potential fluctuations and are modelled in an anticipated “worst case” condition.



## 7.0 Slope Stability Report

### 7.1 Overview

Slope Stability Reports are required to assess Stable Lands within the area under consideration in order to determine the boundary of Development. There are generally two means of slope assessment reporting accepted as part of Land Development Applications:

- the Preliminary Slope Stability Evaluation within the Geotechnical Evaluation Report, where, in the opinion of the Geotechnical Engineering Consultant, the site is deemed Suitable for Development and the City's Geotechnical Engineer is satisfied, based on the Geotechnical Engineering Consultant's opinion, that further assessment is not required; or,
- where a Slope Stability Report is required.

The following section provides requirements for the Slope Stability Report.

### 7.2 General

The general intent of a Slope Stability Report is to assess whether or not a slope is considered to be stable, and if not, to establish a Line of Stability beyond which structures and other facilities can be constructed.

Slope Stability Reports are required for all sites where existing or final grades exceed fifteen percent (15%) or where, in the opinion of the City's Geotechnical Engineer slope stability is considered to be a potential concern. In addition to natural slopes (e.g., river valley, ravines, gullies, coulees, and other sloping terrain), a slope assessment is typically required for fill slopes, cut slopes, constructed drainage features, constructed ponds (temporary and/or permanent water retention facilities), and retaining walls greater than 1.0 m in height.

Slope Stability Reports require site-specific geotechnical investigation and must consider pre- and post-development conditions. The Slope Stability Report should also outline operational rules and restrictions required for any portion of the lands to prevent unnecessary detrimental impacts to existing slopes and to maintain long-term stability of land deemed Suitable for Development.

In addition to the objectives of the Preliminary Slope Stability Evaluation, the Slope Stability Report should address the following:

1. Develop and establish a Line of Stability.
2. Provide development and operational criteria, rules and restrictions with the purpose of maintaining or enhancing the stability of the slope or slopes.

### 7.3 City of Calgary Criteria

Development proposed on or near slopes must adhere to the following City of Calgary criteria.

#### 7.3.1 Minimum Factor of Safety Requirements

All land proposed for Development must have a minimum FOS of 1.5 (1.0 for seismic loading) against slope failure. Lands with a FOS less than 1.5 (or less than 1.0 for seismic loading) are deemed to be

potentially unstable from a slope stability perspective and may be taken as Environmental Reserve at subdivision at the discretion of the Approving Authority pursuant to the Municipal Government Act.

In developing areas where property lines have not been set, the entire parcel proposed for development must have a minimum FOS of 1.5 (i.e., the property line must lie where the FOS is greater than or equal to 1.5) and must include additional setback provisions (e.g., erosion allowances, future construction access allowance) where appropriate.

In developed areas where property lines have already been registered, should a Slope Stability Report indicate that a portion of the parcel does not meet the FOS of 1.5, a Development and Geotechnical Covenant will be registered against the title of the property restricting Development to the area with a FOS greater or equal to 1.5.

It is recommended that pathways and other Parks maintained infrastructure located on public land (e.g., lighting, benches) meet the same minimum FOS requirement of 1.5 unless otherwise approved by the Director, Parks.

In instances where the FOS is less than 1.5, the slope may be modified, subject to the approval of the Approving Authority, to increase the FOS to a minimum of 1.5, thus increasing the area able to be developed.

### **7.3.2 Retaining Wall Considerations**

Proposed retaining wall drawing(s) shall show the FOS against failure (sliding, overturning, bearing and global stability). Retaining walls shall be designed and constructed following the provisions in the Alberta Building Code and guidelines provided in the City of Calgary Design Guidelines for Bridges and Structures (current edition) and the Canadian Foundation Engineering Manual. Individual retaining wall design will be reviewed by and subject to the acceptance of the Chief Structural Engineer, Roads.

Proposed retaining walls may require submission of additional development permit applications. As per Land Use Bylaw 1P2007, retaining walls greater than 1.0 m in height, measured from the lowest grade at any point adjacent to the retaining wall, require a development permit and shall be designed and certified by a qualified geotechnical and/or structural engineer as to their adequacy. Please consult the most recent version of the Land Use Bylaw to determine development permit requirements for retaining walls at the time of development. In addition to any drawings required at the development permit stage, the retaining wall drawing(s) shall be submitted concurrent with the Building Permit plan(s) for individual developments.

### **7.3.3 Drainage Considerations**

Unauthorized drainage onto adjacent land may impact the hydrogeological regime in an area and therefore the stability of slopes. All development plans and recommendations contained within a Slope Stability Report must abide with the City of Calgary Lot Grading Bylaw 32M2004 and Drainage Bylaw 37M2005, as amended or replaced.

### **7.3.4 Report Compliance and Verification**

It is the responsibility of the developer and/or builder to comply with all recommendations presented in the Geotechnical Report, such as drainage, fill and slope configuration.

The developer shall also retain the Geotechnical Engineering Consultant to review the final drawings and confirm that the setback limit and drainage layout are in accordance with the recommendations made in the Geotechnical Report.

The developer shall be required to retain the Geotechnical Engineering Consultant to review the as-built slopes and drainage systems, after completion of construction. The Geotechnical Engineering Consultant shall certify in writing that these comply with the recommendations made in the Geotechnical Report. This shall be submitted to the Development Engineering Generalist at the time of Construction Completion Certificate or Development Completion Permit inspection.

During and after construction, an adequate number of geotechnical inspections shall be conducted to satisfy the Geotechnical Engineering Consultant that construction is conducted in accordance with design recommendations. A record of certification shall be submitted to the Development Engineering Generalist at the time of Construction Completion Certificate or Development Completion Permit inspection.

#### **7.4 Slope Stability Report Contents**

The minimum contents of the Slope Stability Report are as follows:

1. A description of the purpose, objectives and scope of the Slope Stability Report.
2. A description of the study area, including the extent of the study area, a legal description of the property, if applicable, or a location map and/or a description of the property relative to well-known geographic features. The study area should be determined by the size of the parcel of land or the size of a specific site, as well as the stability and geological and geotechnical complexity of the terrain involved, and the type of Development.
3. A description of the proposed Development and the slope under review (existing and post-development conditions) including any modifications that may affect the slope stability.
4. A description of the terrain and/or topography.
5. A description of the evaluation approach methodology as determined by the Geotechnical Engineering Consultant, such as:
  - a. Factors considered in planning and executing the subsurface investigation program (e.g., program objectives, site constraints).
  - b. Test hole locations and depths, observation and sampling methods, laboratory testing, and instrumentation installations (e.g., piezometers, slope inclinometers).
  - c. Description of specific testing and/or other methods used to characterize the subsurface conditions (e.g., cone penetration testing, geophysical techniques, in situ testing, geotechnical/hydrogeological instrumentation, aerial photographs).
6. A summary of the Geotechnical Engineering Consultant findings and observations, which may include but not limited to:
  - a. Existing Information Review.
    - i. Available existing public information (e.g., published geological maps and reports, topographic maps, water well records, flood plain mapping).
    - ii. LiDAR imagery, aerial photographs (historical to present).

- iii. Previous geological, geotechnical, and slope stability reports that address the study area and neighbouring areas.
  - b. Site Reconnaissance/Field Visit
    - i. Relevant observations such as: terrain or physical description, soil/rock exposures, signs of potential slope instability (e.g., cracking, slumping, scarps), groundwater discharge, overland flow, erosion, and vegetation communities.
    - ii. Relevant observations from adjacent properties or similar slopes in the vicinity of study area that may or may not show signs of instability.
    - iii. Relevant photographs (show annotations on a plan indicating the location and direction of photographs).
  - c. Subsurface Investigation Program
    - i. Description of the subsurface conditions and general stratigraphy encountered during the site reconnaissance and/or subsurface investigation program supported by test hole records.
    - ii. Laboratory test results (e.g., Atterberg limits, water content, particle size distribution, corrosivity, strength and compressibility testing).
    - iii. Description of other observations (e.g., frost depth, sloughing, slickensided surfaces).
    - iv. Provide a description of the subsurface conditions and general stratigraphy encountered during the site reconnaissance and/or subsurface investigation program support by test hole records.
- 7. A description of geotechnical and hydrogeological site conditions and parameters based on field observations and testing, and laboratory testing (e.g., soil/rock conditions, groundwater conditions, seismic potential).
- 8. A description of the slope stability assessment, which may include but not limited to:
  - a. The slope stability analysis method (e.g., limit equilibrium) and analysis software (i.e., Slide, Slope/W, SV Slope, or acceptable equivalent).
  - b. The input parameters used in the slope stability analysis and basis for selection (e.g., in situ measurement, laboratory measurement, published information, relevant experience) including but not limited to: strength parameters, unit weight, and anticipated "worst case" piezometric conditions.
  - c. The location of stratigraphic cross-sections used for slope stability analysis shown in plan with an explanation on the basis for the selection of those cross-sections.
  - d. The slope stability results considering an appropriate range of slope failure mechanisms used to determine:
    - i. The minimum FOS for the slope, and associated location(s) of failure mechanism slip surface; and,
    - ii. The location at/beyond the crest or toe of the slope for which all slip surfaces have a FOS of 1.5 and greater.
- 9. A description of conditions anticipated over a period of one life-cycle of development, the length of which shall be to the satisfaction of the City, or the estimated life expectancy of the structure

(whichever is greater) that may negatively impact the stability of the slope and consequently change the Line of Stability, such as:

- a. Changes to slope geometry from either natural erosional processes (e.g., hydrologic, wind, temperature) or human activities.
  - b. Changes to groundwater and/or surface flow patterns from either natural changes in precipitation trends and runoff patterns, or human activities and urban development.
  - c. Changes in land use and/or changes resulting from resource development.
  - d. Natural processes such as earthquakes.
  - e. Natural processes such as wildfires and insect infestations on treed slopes.
10. A description of additional setback allowances (identified by the Geotechnical Engineering Consultant) to be included in the Line of Stability (e.g., to address anticipated changed conditions, future slope access).
11. Identification of the following on a detailed topographic plan for the proposed Development:
- a. Proposed and existing property lines.
  - b. Top of embankment or escarpment (crest of slope)
  - c. Bottom of embankment or escarpment (toe of slope).
  - d. Cross-section(s) selected for slope stability analysis.
  - e. Line of Stability at both the crest and toe of slope (if applicable).
  - f. Footprint of the proposed Development including building structure(s) (if known).
  - g. Location of proposed retaining walls (if known).
12. Indicate any conditions and restrictions associated with the Line of Stability, such as:
- a. Controlled overland surface water flow to prevent uncontrolled discharge of water proximate to the crest of the slope.
  - b. Possible restrictions regarding swimming pools and irrigations systems proximate to the Line of Stability.
  - c. Limitation on the installation of underground utilities and pipelines.
  - d. For man-made fill or cut slopes, and for portions of natural slopes for which loss of vegetation and erosion is a problem or potential problem, recommendations related to erosion control blankets and establishing a suitable, sustainable vegetation cover.
  - e. Where cut or fill slopes may impede or expose the existing surface water, or groundwater flow regime, drainage measures/restrictions to manage that water.
  - f. Erosion control measures where erosion of/near the toe of a slope is a potential problem.
  - g. Loading near the crest of the slope (e.g., fill placement, retaining walls, road embankments).
13. Provide the following statements within the report:
- a. "In the opinion of the Geotechnical Engineering Consultant, the proposed site is Suitable for Development with specific reference to the proposed Development."
  - b. "The stability analysis and the results shown in this report comply with all the requirements of the City of Calgary guidelines for slope stability."
- or,

"In the opinion of the Geotechnical Engineering Consultant, additional geotechnical investigation and/or analysis is required and would be beneficial prior to Development of the site."

## 8.0 Deep Fills Report

### 8.1 Overview

A Deep Fills Report is required for all development areas that will have fills of more than 2.0 m in compacted depth. The objectives for a Deep Fills Report are as follows:

1. To identify fill locations, fill type and variations in fill material and fill thickness;
2. If the local bedrock (generally comprising claystone, siltstone and sandstone that is expected to physical break down into smaller fragments over time) is to be incorporated into the fill, to identify conditions/limitations regarding its usage.
3. To identify fill compaction standards including minimum compacted density (as a percentage of Standard Proctor maximum dry density), soil moisture content (relative to the optimum moisture content), and fill lift thicknesses.
4. To identify the on-site materials to be stripped/removed (topsoil, organic soil, soft soil, and/or existing fill materials) and the underlying native soil stratigraphy onto which the deep fill will be placed.
5. To identify the suitability of stripped materials for re-use.
6. To compute the magnitudes and rates of settlement, for both the underlying native soil and the fill soil.
7. To determine lag time durations after completion of fill placement required prior to the start of buildings, roads and underground utilities construction.

### 8.2 City of Calgary Specific Criteria

Development proposed on Deep Fills must adhere to the following City of Calgary criteria:

1. As biodegradation of organic materials will result in the generation of methane, no material containing organics (for example: topsoil, pond bottom sediments, grasses, shrubs, pieces of trees, wood) should remain below the deep fill, or be included within (e.g., blending, layering, or trenches) the deep fill. 'B' Horizon soils maybe suitable for blending into the upper 2m of the deep fill except where a proposed building envelope is located. The mixing ratio and mixing process shall be reviewed by the Geotechnical Engineering Consultant. The Geotechnical Engineering Consultant shall keep quality control records during construction of deep fills that document the quantity (e.g. estimated percentage) of organics placed per lift and location of placement. The records shall be made available to the City of Calgary upon request  
Borrow Pits can be exempt from the above requirement until the City of Calgary and industry partners reach an understanding on addressing this issue. At such time, the Guidelines may be updated to reflect those discussions.  
The compaction standard for deep fills shall be a minimum 98% of Standard Proctor maximum dry density. Rock correction values must be provided.
2. Grading beneath proposed structures is to be a minimum of 5 horizontal to 1 vertical to reduce differential fill thickness, and associated future differential settlement.

3. Where drainage blankets or drainage galleries are proposed at the base of deep fills to control groundwater levels or seepage, the design must provide for a maintenance service life of the subsurface drainage feature.
4. Material such as topsoil, organic soils, very soft or wet soils, and deleterious materials (e.g., clay lumps, shale, large rocks, construction debris, objectionable material) are unacceptable for use in deep fills under building envelopes and utility right-of-ways.
5. Specifications for landscape fill can be found in the City of Calgary document titled *Development Guidelines and Standard Specifications: Landscape Construction* (current edition).

### 8.3 Report Compliance and Verification

During and after construction, geotechnical monitoring shall be conducted, to demonstrate that construction is in accordance with design recommendations. A record of certification shall be submitted to the Development Engineering Generalist at the time of Construction Completion Certificate or Development Completion Permit inspection.

The building grade plan for the Development shall identify all lots having deep fill.

### 8.4 Geotechnical Report for Deep Fills Contents

The minimum contents of the Deep Fills Report is as follows:

1. A description of the purpose, objectives and scope of the Deep Fills Report.
2. Cut/fill plans and proposed fill depths (thicknesses). Note: the interval between the ground elevation contours shall be no more than 0.5 m.
3. A description of the existing subsurface conditions (e.g., soil, rock, groundwater) at the proposed deep fill locations and include recommendations on any stripping/excavation that may be necessary prior to deep fill placement.
4. A description of the suitability of native materials for use as deep fill, or provide recommendation on imported materials for construction of deep fill.
5. A description of the evaluation approach methodology (methods used).
6. A description of any assumptions and soil parameters used for short- and long-term settlement analysis, if carried out.
7. A description of on-site locations that unsuitable material (e.g., topsoil, organic soils, very soft or wet soils, and deleterious materials (e.g., clay lumps, shale, large rocks, construction debris, objectionable material) may be placed.
8. Predictions of total and differential settlement which may occur under any single structure and/or utility upon completion of fill placement.
9. Recommended minimum (lag) time for aspects of proposed Development (shallow foundations, underground utilities), following completion of the deep fill.
10. Recommendations for monitoring of potential settlement, which may be required or beneficial, to confirm that the settlements are sufficient for the Development to proceed. Include who is responsible for the monitoring (The City of Calgary is not responsible for monitoring of settlement).



11. Recommendations for potential foundation options, including type of foundation, drainage system requirements, and utility trench connection requirements to accommodate the predicted differential settlement as applicable.
12. Design recommendations for the support of underground utilities and/or building structures placed in deep fill if the predicted remaining settlements are significant.
13. A description of the anticipated impact of the proposed deep fills on the hydrogeology (e.g., groundwater levels, springs) and hydrology (e.g., surface runoff, infiltration, ponds and streams).

## 9.0 Hydrogeological Reports

### 9.1 Overview

A Hydrogeological Report is required when groundwater is a known potential concern in an area, as identified by a Preliminary Geotechnical Evaluation. Generally, three aspects are to be considered:

- Current and future groundwater elevations with consideration to seasonal and long-term fluctuations that may affect the performance of foundations, drainage systems (for below-grade structures), frost heaving of surface structures, etc.
- Current and future groundwater elevations with consideration to seasonal and long-term fluctuations as input into the geotechnical designs for slope stability assessment and stabilization, earth embankments, and site grading (cuts and fills).
- Groundwater withdrawals required for construction and during life of development.

### 9.2 Hydrogeological Report Contents

The minimum contents of the Hydrogeological Report are as follows:

1. A description of the purpose, objectives and scope of the report.
2. A description of the study area (e.g., the extents of the study area, legal description of the property, description of the property relative to well-known geographic features).
3. A description of the regional setting (e.g., topography, physiogeography, surficial geology, bedrock geology, hydrogeology, vegetation).
4. A description of the proposed Development and extents of proposed development.
5. A description of the interaction between Development, or Development alternatives under consideration (existing and post-Development) and the groundwater system.
6. A description of the approach methodology, as determined by the Geotechnical Engineering Consultant or Hydrogeologist, such as:
  - a. The depth and areal extent of investigation with supporting rationale (e.g., with consideration to impacts outside the proposed development area).
  - b. Data collection methodology [e.g., description of field investigation, sources of data, nature of data used (published, unpublished and verbal), geophysical survey methods].
  - c. Analysis methodology (e.g., analytical or numerical models), if applicable.
7. A description of the findings and observations, which may include but not limited to:

- a. Hydro-stratigraphy (i.e., subdivision of strata into aquifers and aquitards).
  - b. Hydro-structural features (i.e., structures that do not have a stratigraphic control).
  - c. Areal extent and thicknesses of each unit.
  - d. Lithology and hydraulic properties for aquifer and aquitards.
  - e. Recharge and discharge areas, groundwater levels, flow directions, flow rates.
  - f. Fluctuations in water levels pertinent to the objectives (e.g., seasonal, multiple year).
  - g. Groundwater quality, if applicable.
  - h. Groundwater users, if applicable.
  - i. Surface water-groundwater interactions (e.g., locations and groundwater discharge rates).
  - j. Any special physical or chemical features present (e.g., structural features, instability, caverns/karst, expansive clays, water chemistry and quality, hot springs, fumaroles).
8. A description of any modelling or assessment, which may include but not limited to:
    - a. The analysis method and any software used.
    - b. The input parameters and basis for selection (e.g., in situ measurement, laboratory measurement, published information, relevant experience).
    - c. The location of stratigraphic cross-sections shown in plan with an explanation on the basis for the selection of those cross-sections.
    - d. The results.
  9. A description of the anticipated hydrogeologic conditions during and after Development, including but not limited to:
    - a. The affects the proposed Development is anticipated to have on local and regional groundwater regime, such as changes to groundwater levels and direction (e.g., increase or decrease in groundwater levels), changes in groundwater quality, changes in discharges to surface water bodies.
 

**Note:** For material impacts, discuss the magnitude of impacts and proposed mitigations. The assessment should consider how the proposed Development may affect the adjacent areas, especially existing residential areas. Groundwater impacts should be described as known or suspected (potential) risks affecting the study area and adjacent area(s). Quantified measures should be used to describe the risks of the impacts.
    - b. Anticipated water table fluctuations under current and future conditions that could impact slope stability, or proposed/existing underground development.
    - c. Any uncertainty in predictions.
    - d. A description of potential cumulative effects based on known future development in adjacent areas.
  10. A statement as to whether, in the opinion of the Geotechnical Engineering Consultant or Hydrogeologist, the proposed site is Suitable for Development with specific reference to the proposed Development.
  11. Any recommendations for additional reports and/or mitigation plan(s), which in the opinion of the Geotechnical Engineering Consultant or Hydrogeologist, are required and/or would be beneficial prior to Development of the site.

12. Any recommendations for additional work or monitoring (including the frequency of reporting monitoring data), if there is significant inherent uncertainty and if consequences of the uncertainty are material.

## Appendix A: Geotechnical Report Submission Checklist (Nov. 2016)

Report Title	
Author/Consultant	
Report Date	
Report Type	<input type="checkbox"/> Geotechnical Evaluation Report <input type="checkbox"/> Slope Stability Report <input type="checkbox"/> Deep Fills Report <input type="checkbox"/> Hydrogeological Report
Application Type	<input type="checkbox"/> Area Structure Plan (ASP) <input type="checkbox"/> Land Use/Outline Plan (LOC) <input type="checkbox"/> Tentative Plan (SB) <input type="checkbox"/> Development Permit (DP) <input type="checkbox"/> Stripping & Grading Permit (SG) <input type="checkbox"/> Other (DA, DL etc.); please specify
Application Number	
Does the first page of the report name the City as a party and addressee to the report by way of an exact duplication of the statement provided in Section 5.3 of the Geotechnical Report Guidelines?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Is this report a revision to an initial submission to address comments from the City?	<input type="checkbox"/> Yes <p style="text-align: center;"><i>(If yes please attach a sheet with initial City of Calgary comments)</i></p> <input type="checkbox"/> No
Has this report been previously submitted to the City of Calgary as part of a previous application?	<input type="checkbox"/> Yes <p>(If yes specify application number: _____, and provide letter from author of the report authorizing the City of Calgary to rely on the report, in accordance with the first page of the report, for the purposes of the current application.</p> <input type="checkbox"/> No <input type="checkbox"/> Unknown

<p>Does this report make reference to other Geotechnical Reports for background information or reference?</p>	<p><input type="checkbox"/> Yes</p> <p><i>(If yes, have these reports been previously been accepted by the City of Calgary?)</i></p> <p><input type="checkbox"/> Yes</p> <p><input type="checkbox"/> No or unknown (if no, submit copies of these reports with current application)</p> <p><input type="checkbox"/> No</p>
<p>Does the report indicate any further reports or investigations are required to support later stages of development?</p>	<p><input type="checkbox"/> Yes</p> <p><input type="checkbox"/> No</p>



OR

**AND WHEREAS** pursuant to the Developer's development permit number DP \_\_\_\_\_, the development authority approved the development of the Servient Lots subject to certain conditions of approval, including a condition requiring the Developer to register this Development and Geotechnical Covenant against title to the Servient Lots at the Land Titles Office.

**AND WHEREAS** Section 67 of the *Land Titles Act*, R.S.A. 2000 c. L-4, as amended provides that when an easement or an incorporeal right in or over land for which a certificate of title has been granted is created for the purpose of being annexed to or used and enjoyed together with other land for which a certificate of title has also been granted, the Registrar shall make a memorandum of the instrument creating the easement or incorporeal right on the existing certificates of title of the dominant and servient tenements respectively.

**AND WHEREAS** Section 68(1) of the *Land Titles Act* provides that an owner may grant to himself or herself an easement or restrictive covenant for the benefit of land that the owner owns and against land that the owner owns and the easement or restrictive covenant may be registered under the Act.

**AND WHEREAS** the City is the owner of streets, lanes and public reserves adjacent to the Servient Lots.

**FOR VALUABLE CONSIDERATION, THE SUFFICIENCY AND RECEIPT OF WHICH IS ACKNOWLEDGED BY THE DEVELOPER, THIS COVENANT WITNESSETH:**

1. THAT the Developer does agree for the Development and the Developer's successors-in-title to observe and be bound by the hereinafter mentioned covenants which shall be deemed to be and shall be covenants running with the land and shall be appurtenant to all of the Servient Lots or any portion or portions thereof for the benefit of each of the Servient Lots and the following adjacent lands, owned by The City, namely:

Street Name or MR Lot

(hereinafter referred to as the "Dominant Tenement")

2. The Servient Lots or any portion or portions thereof shall not be developed or redeveloped in any way other than in strict compliance with the **Slope Stability Report OR Hydrogeological Report OR Deep Fills Report** (the "Geotechnical Report") for the Servient Lots prepared by \_\_\_\_\_ and dated \_\_\_\_\_, a copy of which is attached hereto as Schedule "A", and with The City of Calgary Geotechnical Report Requirements then current at the time development occurs and any further geotechnical reports (the "Additional Reports") that may from time to time be submitted prior to development on behalf of the Developer by a professional geotechnical

2

engineering consultant (the "Consultant"), which is a member in good standing of the Association of Professional Engineers, Geologists, and Geophysicists of Alberta, and who is licensed to practice engineering in the Province of Alberta, all of which reports referred to above being subject to the acceptance by the Manager, Infrastructure Planning.

3. The Developer further specifically agrees for the Development and the Developer's successors-in-title that any development on the Servient Lots will comply with the Development Setback shown on the Development Setback Plan registered at the Alberta Land Titles Office as Plan \_\_\_\_\_. The Developer acknowledges and agrees, for itself and for its successors in title, that the Development Setback is based on the conditions described in the Geotechnical Report, and is subject to change, at the discretion of the development or subdivision authority, based on findings of Additional Reports provided to or required by the development or subdivision authority in connection with a future development.
4. The covenants set out herein are enforceable against the Developer or the Developer's successors-in-title; and by the owner or owners, or any of them, of the Dominant Tenement, or any portion thereof.
5. No action shall be maintainable against the Developer or the Developer's successors-in-title for damages for breach of the covenants contained in this Covenant unless the Developer is or was, or the Developer's successor-in-title is or was, the registered owner of the Servient Lots, or a portion thereof, at the time of the alleged breach of this Covenant. This paragraph shall constitute an absolute defence to any such action and may be pleaded as such.
6. If any provision of this Covenant, or the application thereof to any person or circumstance, shall to any extent be invalid or unenforceable, the remainder of this Covenant shall not be affected thereby and each remaining provision shall be valid and shall be enforceable to the extent permitted by law.

**IN WITNESS WHEREOF** the parties have executed this Development and Geotechnical Covenant this \_\_\_\_ day of \_\_\_\_\_, 20\_\_.

APPROVED AS TO CONTENT	INITIALS
Bus. Unit: Infrastructure Planning Name: _____	
APPROVED AS TO FORM BY LAW DEPARTMENT	INITIALS
Name: Cheryl Hamilton Law File: _____	

**DEVELOPER'S NAME**

Per: \_\_\_\_\_

(Corporate Seal)

Per: \_\_\_\_\_

(Corporate Seal)



THE CITY OF CALGARY

Per \_\_\_\_\_  
Manager

Per: \_\_\_\_\_  
City Clerk

## Appendix C: Report Reliance Letter Template

[To be placed on Consultant letterhead]

[DATE]

To: The City of Calgary

Dear Sir or Madame:

**Re: Letter Agreement re Approval to Rely on Geotechnical Reports;**  
**[TITLE OF REPORT]**

[Geotechnical Consultant] has been retained by [Developer/ Prime Consultant] (the “Parties”) to undertake certain geotechnical slope stability analysis and other investigations, testing and assessments and to prepare a geotechnical and slope stability assessment report as further described at Schedule “A” (the “Report”), in connection with the development project [project and application description], application number [Application number], in Calgary, Alberta (the “Project”).

The Report was required pursuant to application [Application number], and The City of Calgary has requested the Parties agreement that The City of Calgary may fully and unconditionally rely upon the Report.

In consideration of The City of Calgary accepting the application [Application number], from the Parties, which includes the Report, and for other good and valuable consideration, the receipt and sufficiency of which are hereby conclusively acknowledged, the Parties agree that The City of Calgary shall at all times be entitled to fully use and rely on this report, including all attachments, drawings, and schedules, for the specific purpose for which the report was prepared, in each case notwithstanding any provision, disclaimer, or waiver in the report that reliance is not permitted.

The City of Calgary shall be entitled to provide copies of the report to City Council, City of Calgary employees, and City of Calgary regulatory boards, each of whom shall also be similarly entitled to fully use and rely on the report in their official capacities for the specific purpose for which the report was prepared.

The City of Calgary is at all time entitled to provide copies of the report to Alberta Transportation, adjacent municipalities, and any other governmental authorities and regulatory bodies having jurisdiction. The City of Calgary may also contact the author or any other parties to the report to request further information respecting the report or to discuss the report further.”

**[GEOTECHNICAL CONSULTANT]**

Per: \_\_\_\_\_ c/s

Per: \_\_\_\_\_ c/s

**[DEVELOPER/ PRIME CONSULTANT]**

Per: \_\_\_\_\_ c/s

Per: \_\_\_\_\_ c/s

**[DEVELOPER/ PRIME CONSULTANT]**

Per: \_\_\_\_\_ c/s

Per: \_\_\_\_\_ c/s

## SCHEDULE "A"

### Description of Report

[GEOTECHNICAL CONSULTANT], "[TITLE OF REPORT]", dated [REPORT DATE OF ISSUANCE, submitted to [DEVELOPER/ PRIME CONSULTANT].