GUIDELINES FOR
GEOTECHNICAL
ENGINEERING SERVICES FOR BUILDING PROJECTS

ASSOCIATION OF
PROFESSIONAL ENGINEERS AND GEOSCIENTISTS
OF BRITISH COLUMBIA

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200 - 4010 Regent Street, Burnaby, B.C. V5C 6N2

Telephone: (604) 430-8035 Toll Free (BC) 1-888-430-8035 Fax: (604) 430-8085
E-Mail: apeginfo@apeg.bc.ca Internet: www.apeg.bc.ca

TABLE OF CONTENTS

GUIDELINES FOR

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1.0 INTRODUCTION

1.1 PURPOSE OF GUIDELINES

The "Guidelines for Geotechnical Engineering Services for Building Projects" has been prepared by a Task Force of the *Association* of Professional Engineers and Geoscientists of the Province of British Columbia (the "*Association*") and has been adopted by the Council of the *Association*.

The Guidelines set out the scope of professional practice which *Members* should meet and follow in providing professional engineering services. The *Association* and its Council are committed to improve the quality of the services *Members* provide to *Clients* and the public; these Guidelines have been published for that purpose.

It is anticipated that variations in the application of these Guidelines may be required. A *Member* must always exercise professional judgment in providing services. It is not intended that the Guidelines be used as a legal document or for altering contracts between *Members* and *Clients*. However, *Members* may use the Guidelines to assist in establishing the terms of their contracts with their *Clients*.

No variation, however, that detracts from the overall purpose of the Guidelines should be made. The Guidelines are intended to establish standards of practice which *Members* should meet to fulfil the *Member's* professional obligations, especially in regard to the primary duty to protect the safety, health and welfare of the public. The Council of the *Association* intends that failure to meet the intent of these Guidelines may give rise to disciplinary proceedings.

The *Association* supports the proposition that *Members* should receive fair and adequate compensation for services rendered and that this principle applies to the services provided to comply with these Guidelines. In no event will low fees be justification for services which do not meet the standards set out in these Guidelines. *Members* may wish to discuss these Guidelines with their *Clients* when receiving instructions for assignments and reaching agreements regarding compensation.

1.2 SCOPE OF GUIDELINES

These Guidelines apply to the practice of geotechnical engineering for buildings governed by Part 4 of the British Columbia Building Code or the National Building Code.

Where included in the scope of services, these Guidelines also apply to geotechnical services provided for buildings governed by the City of Vancouver Building By-Law and those geotechnical engineering services necessary to meet the requirements of the Workers Compensation Act of British Columbia.

These Guidelines also encompass the commitments which municipalities may require from *Members* as set out in the *Letters of Assurance* of the British Columbia Building Code and the City of Vancouver Building Bylaw.

These Guidelines outline the professional services which should generally be provided by the *Geotechnical Engineer of Record (GER)* or, where applicable, the *Specialty Geotechnical Engineer(s)*, for a project carried out under the requirements of those portions of the Codes and regulatory requirements set out above.

These Guidelines specify tasks which should be performed by the *Geotechnical Engineer of Record (GER)* to achieve designs which are in the best interest of the project and the public and which are properly coordinated with the work of other design and construction team participants. These Guidelines should assist in maintaining the integrity of the overall and detailed designs. The *Geotechnical Engineer of Record (GER)* often works in conjunction with the *Structural Engineer of Record (SER)* and/or other design team members or contractors on certain projects; these Guidelines should assist in the delineation of responsibilities among these parties.

1.3 QUALIFICATION

Notwithstanding the purpose and scope of the Guidelines in sections 1 through 4, the decision of the *Geotechnical Engineer of Record (GER)* not to follow one or more of these Guidelines does not mean that the *Geotechnical Engineer of Record (GER)* is legally negligent or unprofessional in the performance of professional services. Such a judgment or decision would depend upon a detailed analysis of all facts and circumstances to determine if other *Geotechnical Engineers* in similar circumstances would have conducted themselves similarly.

1.4 ACKNOWLEDGEMENT

This edition of the Guidelines for Geotechnical Engineering Services for Building Projects has been prepared by a volunteer Task Force of the *Association*. Significant portions of the text are derived from the *National Practice Guideline for the Geotechnical Engineer of Record (GER)* prepared by the ASFE (Associated Soils and Foundation Engineers, now called Professional Firms Practising in the Geosciences) and the *Guidelines for Structural Engineering Services for Building Projects* (by the *Association*). The Task Force wishes to acknowledge the assistance of ASFE as well as the review comments and suggestions received from practising *Geotechnical Engineers*.

2.0 DEFINITIONS

Agreement for Geotechnical Services

Agreement for Geotechnical Services, whether formal or implied, is the contract between the *Client* and *the Member(s*) or incorporated Geotechnical Engineering company.

Association:

The *Association* of Professional Engineers and Geoscientists of the Province of British Columbia.

Client:

The party who engages the *Geotechnical Engineer of Record (GER)* to provide professional geotechnical engineering services.

Coordinating Registered Professional:

Often referred to as the "Prime Consultant", the *Coordinating Registered Professional* is the individual who is registered as a *Member* in good standing of the *Association* or the Architectural Institute of British Columbia, and who has the responsibility to coordinate the design and *Field Reviews* of the various design professionals (such as electrical, structural, mechanical, geotechnical, architectural) for the project.

Field Reviews:

Field Reviews shall mean such reviews of the work by the *Member* at the project site as considered necessary, in the professional discretion of the *Member*, to ascertain that the work substantially conforms in all material respects to the plans and supporting documents prepared by the *Member*.

The *Field Reviews* by the *Geotechnical Engineer* are intended to ascertain whether that the subsurface conditions at the site are consistent with those considered in the design and, in the event that unanticipated subsurface conditions are encountered, to provide recommendations and *Field Reviews* of suitable measures to achieve the design objectives.

Geotechnical Engineer:

A *Member*, registered by the *Association* as a Professional Engineer who specializes in the art and science of quantifying the response of the ground to changes resulting from construction.

Geotechnical Engineer of Record (GER):

The *Geotechnical Engineer of Record (GER)* is the *Member* having responsibility for the geotechnical aspects of the design and associated *Field Reviews* for the *Support of the Building* or structure for which the project was undertaken, including issuance of *Letters of Assurance* for those items of direct responsibility.

In addition to the geotechnical aspects of the *Building Support*, the *Geotechnical Engineer of Record (GER)* may also, if included within the agreed scope of service, be responsible for the geotechnical aspects of ancillary facilities or temporary conditions. Alternatively, such ancillary or temporary facilities may be the responsibility of another Speciality *Geotechnical Engineer*.

Letters of Assurance:

Standard Forms of the British Columbia Building Code and the City of Vancouver Building Bylaw informing authorities having jurisdiction which aspects of a project design and *Field Reviews* are the responsibility of a particular registered professional, for the purposes of this Guideline, the *Geotechnical Engineer of Record (GER)* or *Specialty Geotechnical Engineer(s)*.

Member:

A *Member* in good standing of the *Association.*

Owner:

The party who owns the building.

Primary Structural System:

The combination of elements which support the building's self weight and the applicable live load based on occupancy, use of the spaces, and environmental loads such as wind, snow, and seismic forces.

Review:

Review is a highly variable term. Terms of reference, scope and limitations of a *Review* must be clearly defined for these to be clearly understood by the *Client* and the *Geotechnical Engineer*. Types of *Review* could include concept review, detailed design review, *Field Reviews*, etc.

Specialty Geotechnical Engineer:

A *Specialty Geotechnical Engineer* is a *Member* engaged for the project to provide the design of special elements of subsurface work. The Specialty Geotechnical Engineer

must be experienced and qualified to perform the design contemplated. Designs prepared by the *Specialty Geotechnical Engineer* should bear the designer's professional seal. Examples of *Specialty Geotechnical Engineers* include engineers who provide design services for excavation support systems, retaining structures, foundations, slurry walls, and other subsurface-related construction. The *Speciality Geotechnical Engineer* shall provide *Letters of Assurance* and carry out *Field Reviews* of those items of direct responsibility.

Support of the Building / Building Support:

That combination of soil, rock and groundwater, either natural or processed, which react to the imposed loadings of the *Primary Structural System* of the building as well as the ground's self weight.

***Structural Engineer of Record (SER)*:**

The *Member* with general responsibility for the structural integrity of the *Primary Structural System*.

SPECIAL NOTE: Definitions for use with *Letters of Assurance* are provided in Appendix A.

3.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

3.1 COMMON FORMS OF PROJECT ORGANIZATION

Project organizations vary according to the needs of the project and the parties. The *Geotechnical Engineer of Record (GER)* is usually engaged by the *Owner*, but may be engaged by the *Owner's Coordinating Registered Professional*, the *Structural Engineer of Record (SER)*, a design/build contractor, or other entity responsible for the delivery of part or all of the project.

3.2 RESPONSIBILITIES OF ORGANIZATION PARTICIPANTS

3.2.1 *Owner*

3.2.1.1 In order that the design and construction of the project may be carried out in a manner that meets appropriate standards of public safety and the requirements of applicable building regulations, the *Owner*:

(a) must retain or cause to be retained qualified professionals with responsibility for the design of all aspects of the project, including a *Coordinating Registered Professional* or "Prime Consultant";

(b) should cooperate with the *Coordinating Registered Professional* so that an adequate written description of the project is developed;

(c) should cooperate with or direct the *Coordinating Registered Professional* or other appropriate and mutually acceptable party to cooperate with the *Geotechnical Engineer of Record (GER)* in setting out a written description of the scope of the *Geotechnical Engineer of Record (GER)'s* services as described in paragraph 3.2.4;

(d) should, before the commencement of the *Geotechnical Engineer of Record (GER)'s* services, complete or cause to be completed a written agreement with the *Geotechnical Engineer of Record (GER)* (directly with the *Owner* or with the *Coordinating Registered Professional* or with another appropriate and mutually acceptable party) confirming the scope of services and associated compensation;

(e) should cooperate with the *Coordinating Registered Professional* and the *Geotechnical Engineer of Record (GER)* to establish a mutually agreed realistic schedule for the provision of the *Geotechnical Engineer of Record (GER)'s* services;

(f) should authorize in writing any additional services that may be required beyond the scope of the *Geotechnical Engineer of Record (GER)'s* agreement or original scope of services;

(g) should ensure that all required approvals, licenses and permits from the authorities having jurisdiction are obtained;

(h) should provide the *Geotechnical Engineer of Record (GER)* with the right of entry onto the project site for exploration purposes.

(i) should recognize that, since no design team nor its design is perfect, some errors or omissions may occur. In addition, the *Owner* should recognize that subsurface conditions may vary from those conditions anticipated. Accordingly, a reasonable contingency should be included in the *Owner's* budget. The *Owner* should not proceed with the contemplated project without adequate financing;

(j) should recognize that drawings, specifications and other documents prepared by the *Geotechnical Engineer of Record (GER)* are for the project and that such documents shall not be used or copied for other projects without the agreement of the *Geotechnical Engineer of Record (GER)* and without advice from a qualified design professional;

(k) should recognize that, because code interpretation by the authority having jurisdiction may differ from the *Geotechnical Engineer of Record (GER)*, changes may be required;

(l) should disclose fully and promptly any and all information that may affect the *Geotechnical Engineer of Record (GER)'s* performance, scheduling, design, or payment for services, including but not limited to any existing geotechnical reports or data, any situations that may require special testing or equipment, and all known potential environmentally sensitive or hazardous site conditions;

(m) should keep the *Geotechnical Engineer of Record (GER)* informed or cause the *Coordinating Registered Professional* or "Prime Consultant" to keep the *Geotechnical Engineer of Record (GER)* informed of construction progress and advise the *Geotechnical Engineer of Record (GER)* when foundation and earthwork elements of the project are ready for *Field Reviews*;

(n) should, if *Specialty Geotechnical Engineers* are selected or used, establish or shall cause to be established a clear delineation of the responsibilities of the *Geotechnical Engineer of Record (GER)* and *Specialty Geotechnical Engineer* including the provision for concept review by the *Geotechnical Engineer of Record (GER)* of the impact of specialty work on the *primary structural system* or project;

(o) should provide for a *Field Review* program as recommended by the *Geotechnical Engineer of Record (GER)* and, as may be required by *Association* Bylaws, the British Columbia Building Code, other relevant authorities and/or the project specifications;

(p) should , if the initial *Geotechnical Engineer of Record (GER)* is changed and another *Member* or geotechnical engineering company is retained to carry out analyses and design and/or provide *Field Reviews* for some or all of the project, assure or cause to be assured that the *Member* providing the latest design and/or *Field Reviews* accepts full responsibility for the geotechnical aspects of the project including issuance of *Letters of Assurance*. The *Owner* should recognize that a change in the *Geotechnical Engineer of Record (GER)* may require additional time and investigation to permit the new *Geotechnical Engineer of Record (GER)* to satisfy himself/herself of the adequacy of the design and the status of the previous work prior to issuance of *Letters of Assurance*.

3.2.1.2 If the *Owner* fails or refuses to carry out the obligations as set out in paragraph 3.2.1.1., the *Geotechnical Engineer of Record (GER)* should:

(a) consider giving written notice to the *Owner*, advising the *Owner* of the *Geotechnical Engineer of Record (GER)'s* recommendations;

(b) consider whether the *Geotechnical Engineer of Record (GER)* can continue with the project;

because in any event the *Geotechnical Engineer of Record (GER)* is obligated to comply with the intent of these guidelines.

3.2.2 *Coordinating Registered Professional*

To enable the *Geotechnical Engineer of Record (GER)* to perform his/her duties properly, the *Coordinating Registered Professional* should:

3.2.2.1 interpret and define the needs of the *Owner* and, in doing so, should define the *Owner's* intended functions and needs. The *Coordinating Registered Professional* should identify or cause to be identified by other participants of the design team any special design criteria such as loads, settlement tolerances, seismic resistance, and other performance requirements or additional geotechnical services not normally part of the scope of such projects, and should advise the *Geotechnical Engineer of Record (GER)* accordingly;

3.2.2.2 outline the scope of assignment to each design professional (including to the *Geotechnical Engineer of Record (GER)* and *Specialty Geotechnical Engineer*, if any) for design, preparation of contract documents, review of work during construction, and contract administration;

3.2.2.3 provide timely information in sufficient detail as required to permit the *Geotechnical Engineer of Record (GER)* to adequately perform his/her duties;

3.2.2.4 should recognize that, because code interpretation by the authority having jurisdiction may differ from the *Geotechnical Engineer of Record (GER)*, changes may be required;

3.2.2.5 should disclose fully and promptly any and all information that may affect the *Geotechnical Engineer of Record (GER)'s* performance, scheduling, design, or payment for services, including but not limited to any existing geotechnical reports or data, any situations that may require special testing or equipment, and all known potential environmentally sensitive or hazardous site conditions;

3.2.2.6 coordinate and review the designs, drawings, and other contract documents produced by all the participants of the design team;

3.2.2.7 coordinate communication of information between the *Owner*, the contractor, and the design professionals including the *Geotechnical Engineer of Record (GER)* so that the work proceeds in a manner which complies with applicable codes and regulations and meets the *Owner's* needs.

3.2.3 *Structural Engineer of Record (SER)*

The *Structural Engineer of Record (SER)* is responsible for the structural integrity of the primary structural system of a building project. The *Structural Engineer of Record (SER)* should:

3.2.3.1 identify any special structural design criteria such as loads, settlement tolerances, seismic resistance or other performance requirements and advise the *Geotechnical Engineer of Record (GER)* accordingly;

3.2.3.2 provide timely information in sufficient detail as required to permit the duties of the *Geotechnical Engineer of Record (GER)* to be adequately performed;

3.2.3.3 be responsible for the structural aspects of design, while the *Geotechnical Engineer of Record (GER)* is responsible for the geotechnical aspects of the design for *Support of the Building*.

3.2.4 *Geotechnical Engineer of Record (GER)*

The *Geotechnical Engineer of Record (GER)* is responsible for the geotechnical aspects of the design and the associated *Field Reviews* for the *Support of the Building.* If included in the Scope of Services, recommendations may also be provided for other aspects of a building project or other types of projects requiring geotechnical expertise, including considerations such as land stability beyond that considered for the building project itself, earthworks, pavement structures and criteria for design of permanent or temporary earth retention systems.

3.2.4.1 The *Geotechnical Engineer of Record (GER)* together with the *Owner* or *Coordinating Registered Professional* is responsible for setting out a written description of the scope of the *Geotechnical Engineer of Record (GER)'s* services sufficient to enable and permit the *Geotechnical Engineer of Record (GER)* to meet the design and *Field Review*s requirements of these Guidelines and applicable building regulations. This should include a clear delineation of responsibilities between the *Geotechnical Engineer of Record (GER)* and the *Specialty Geotechnical Engineer*, if any;

3.2.4.2 In the preparation of recommendations and designs, the *Geotechnical Engineer of Record (GER)* shall be entitled to rely upon project information and special structural design criteria such as loads, settlement tolerances, seismic resistance or other performance requirements provided by the *Owner* and other design professionals including the *Coordinating Registered Professional* and the *Structural Engineer of Record (SER)*. Errors or changes in this information during or following geotechnical investigations or design analyses may require additional investigations and/or changes to the design;

3.2.4.3 The *Geotechnical Engineer of Record (GER)* is normally responsible for the planning and execution of the exploration program needed to characterize the site's subsurface conditions relevant to the *Support of the Building.* Unless otherwise established in the scope of services, the *Geotechnical Engineer of Record (GER)* shall be entitled to rely upon the completeness and accuracy of the topographic or boundary survey data and other information such as the locations of underground structures and utilities supplied by the *Owner* or other members of the design team for the suitable layout of test holes or other exploration methods;

3.2.4.4 The *Geotechnical Engineer of Record (GER)* shall normally be responsible for the selection and testing of samples of soil or rock to develop physical characteristics or properties necessary for preparation of geotechnical recommendations and designs, such as strength and compressibility. The *Geotechnical Engineer of Record (GER)* is entitled to rely on the *Owner* or *Coordinating Registered Professional* to notify the *Geotechnical Engineer of Record (GER)* of situations that may require special testing or special equipment;

3.2.4.5 Observations of geotechnical aspects of construction should be performed under the direction of the Geotechnical Engineer of Record *(GER)* because the *Geotechnical Engineer of Record (GER)* is best qualified to recognize and deal with situations that require the *Geotechnical Engineer of Record (GER)'s* professional judgment and interpretation. The *Geotechnical Engineer of Record (GER)'s* observation of construction, interpretation of conditions, and formulation of recommendations or directions should be performed in close communication with the *Coordinating Registered Professional*, *Structural Engineer of Record (SER)* or other appropriate members of the design team to help evaluate the impact on the planned project;

3.2.4.6 The *Geotechnical Engineer of Record (GER)'s* responsibilities during construction usually include conducting *Field Reviews* of geotechnical aspects of construction being installed by the contractor engaged by the *Owner*. The *Geotechnical Engineer of Record (GER)* is primarily responsible for evaluating whether the

geotechnical aspects of construction are performed in general accordance with the geotechnical aspects of project plans and specifications, and the geotechnical design recommendations prepared by the *Geotechnical Engineer of Record (GER)*. The presence or observations of the *Geotechnical Engineer of Record (GER)* during construction shall not relieve the contractor of his responsibilities to construct the project in accordance with the contract documents and good practice, nor shall it relieve the contractor of his responsibilities for construction methods, techniques, sequences, procedures, safety precautions, and programs necessary for the safe and suitable completion of the project;

3.2.4.7 The *Geotechnical Engineer of Record (GER)* should provide ongoing observations, testing, advice, and recommendations to facilitate the successful completion of the geotechnically related aspects of the *Building Support*. The *Geotechnical Engineer of Record (GER)* typically relies on others such as the *Owner*, the *Coordinating Registered Professional*, or the contractor to notify him or her of the progress of construction and when the foundation and earthwork elements of the project are ready for *Field Reviews*. During construction, the *Geotechnical Engineer of Record (GER)* should be notified promptly by the *Coordinating Registered Professional* or other appropriate entity to permit *Field Reviews* and evaluation to identify whether subsurface conditions are as anticipated from the subsurface exploration and whether to modify recommendations if subsurface conditions are materially different;

3.2.4.8 Unless otherwise agreed within the scope of services, the *Geotechnical Engineer of Record (GER)* is responsible solely for the geotechnical aspects of the design of the *Building Support* shown on the structural drawings prepared by the *Structural Engineer of Record (SER)*. For this purpose, the *Geotechnical Engineer of Record (GER)* is responsible for review of the geotechnical aspects of these elements, as identified to the *Geotechnical Engineer of Record (GER)* and as shown on the drawings and specifications provided to the *Geotechnical Engineer of Record (GER)*;

3.2.4.9 The *Geotechnical Engineer of Record (GER)* signs the Assurance of Professional Design and Commitment for *Field Review*s regarding the geotechnical aspects of the design for the *Building Support* and the supporting documents which the *Geotechnical Engineer of Record (GER)* prepares, and not for those aspects of the design and supporting documents prepared by the *Specialty Geotechnical Engineer*. When required by the authority having jurisdiction, the *Geotechnical Engineer of Record (GER)* in cooperation with the *Structural Engineer of Record (SER)* and *Coordinating Registered Professional* will assist in the preparation and submission of record drawings or documents of the project;

3.2.4.10 The *Geotechnical Engineer of Record (GER)* shall be responsible for the concept review of the geotechnical effect of that construction designed by one or more *Specialty Geotechnical Engineers*, on the *Building Support* shown on the drawings prepared by the *Structural Engineer of Record (SER)*. If included in the agreed scope of services, the *Geotechnical Engineer of Record (GER)* may also be responsible for concept review of the design for temporary work for the project which is designed by a *Specialty Geotechnical Engineer*. As part of concept review, the *Geotechnical Engineer of Record (GER)* should;

(a) perform concept reviews of the *Specialty Geotechnical Engineer's* designs to advise relative to the feasibility of the particular planned construction and assess the impact of or the risks associated with this aspect of construction on the *Building Support*. Such concept reviews may be made to assist the *Owner* and *Coordinating Registered Professional* or *Structural Engineer of Record (SER)* in determining the suitability of a particular construction and the associated risks; and

(b) perform concept review of the *Specialty Geotechnical Engineer's Field Review* program to monitor the special construction during installation and during later phases of the project.

3.2.4.11 If the initial *Geotechnical Engineer of Record (GER)* is changed and another *Member* or geotechnical engineering company is retained to carry out analyses and design and/or provide *Field Reviews* for some or all of the project, the *Member* providing the latest design and/or *Field Reviews* shall carry out such reviews, investigations, and analyses as required to accept full responsibility for the geotechnical aspects of the project, including issuance of *Letters of Assurance*.

3.2.5 *Specialty Geotechnical Engineers*

3.2.5.1 The Specialty Geotechnical Engineer is usually engaged by the *Owner*, but may be engaged by the *Geotechnical Engineer of Record (GER)*, the *Owner's Coordinating Registered Professional*, the *Structural Engineer of Record (SER)*, a design/build contractor, or other entity responsible for the delivery of the project. For those items for which the *Specialty Geotechnical Engineer* is engaged, the *Specialty Geotechnical Engineer* shall be responsible for all aspects of investigation, design, submission of Letters of Assurance, and *Field Reviews* similar to that set out for the *Geotechnical Engineer of Record (GER)* in Section 3.2.4.

3.2.5.2 In all cases where the design or constructed works for which the *Specialty Geotechnical Engineer* is responsible will or may have geotechnical effects on the *Building Support*, as designed by the *Geotechnical Engineer of Record (GER)*, the *Specialty Geotechnical Engineer* shall provide to the *Geotechnical Engineer of Record (GER)* all relevant information on the loadings, deflections, and other performance criteria to permit the *Geotechnical Engineer of Record (GER)* to carry out a concept review of the impact of the specialty work on the *Building Support*. Concept review by the *Geotechnical Engineer of Record (GER)* is intended to achieve the objectives and requirements as set out in Section 3.2.4. While such information may not include the specific means or methods of analyses and design of the specialty work, the *Specialty Geotechnical Engineer* shall identify those conditions or characteristics which may differ materially from conventional design methods and from the critical or limiting design assumptions belonging to these conventional methods.

3.2.5.3 Concept review by the *Geotechnical Engineer of Record (GER)* of designs by *Specialty Geotechnical Engineers* is provided for the *Owner's* benefit only to assess risks associated with proceeding with such specialty work. Despite such reviews or

observations, the *Geotechnical Engineer of Record (GER)* has no responsibility for the designs prepared by the *Specialty Geotechnical Engineer* or for the *Field Reviews* of the construction of the specialty work.

3.2.6 General Contractor

3.2.6.1 The general contractor has a contract with the *Owner*. This contract usually provides that the general contractor is responsible for the labour, materials, and equipment for the work and that the general contractor is responsible for the construction methods, techniques, sequences, procedures, safety precautions, and programs associated with the construction work, all as set out in the contract documents.

3.2.6.2 The general contractor is responsible for coordinating the work of the sub-contractors and for checking the sub-contractor's work prior to *Field Review*s by the *Geotechnical Engineer of Record (GER)*.

3.2.6.3 The general contractor is responsible for providing reasonable notice to the *Owner* or *Coordinating Registered Professional* when components are ready for *Field Reviews* by the *Geotechnical Engineer of Record (GER)*.

3.2.6.4 The general contractor is also responsible to notify the *Owner* or *Coordinating Registered Professional* in a timely manner if he/she believes that there are material differences in the subsurface conditions which may have a detrimental effect on the project or the safety of the public.

3.2.7 Design/Build Contractor

3.2.7.1 The design/build contractor assumes total design and construction responsibilities for a project, including all professional services, labour, materials, and equipment to produce completed construction in accordance with an agreed contract with the *Owner*.

3.2.7.2 In addition to the normal responsibilities of a contractor, the design/build contractor will take on many of the responsibilities of the *Owner*, as identified in section 3.2.1, and may take on the responsibilities of the *Coordinating Registered Professional* [section 3.2.2] as well as the responsibilities of the *Structural Engineer of Record (SER)* [section 3.2.3]. These responsibilities shall include retaining and providing coordination among the *Geotechnical Engineer of Record (GER)*, any *Specialty Geotechnical Engineers*, and other participants of the design/build team.

3.3 SELECTION OF CONSULTANTS

The recommended procedures for selecting a consultant are as described in the "Fee Guidelines for Engineering Services" booklet published by the *Association* of Professional Engineers and Geoscientists of British Columbia and the Consulting Engineers of British Columbia.

4.0 GUIDELINES FOR PROFESSIONAL PRACTICE

The services which a *Geotechnical Engineer of Record (GER)* should consider as part of good practice are outlined below. This outline may assist in explaining the services of the *Geotechnical Engineer of Record (GER)* to a *Client*; it is not intended to be exhaustive and should not be interpreted to detract in any way from the previous provisions of these Guidelines and what might be considered appropriate in the professional judgment of the *Geotechnical Engineer of Record (GER)* for the circumstances of a particular project.

4.1 BASIC GEOTECHNICAL ENGINEERING SERVICES

The typical components of the basic services, as summarized below, are generally organized according to the sequential stages of a particular project. The nature of these services required for a particular project for *Building Support* will vary with the project characteristics including foundation location, depth, structural loading conditions, site geology, and site development. Although each stage of the basic services generally contains those items which pertain most typically to the progress of work for that construction stage, often because of the requirements of a specific project, some of the basic services' activities may be performed out of the normal sequence or in different stages than indicated below. Services that may be required for a typical project are:

4.1.1 Development of a suitable scope of services for the project after consultation with the *Client* and other design professionals on the details of the project and the needs of the various parties.

Depending on the judgement of the *Geotechnical Engineer of Record (GER)*, this scope of services may include a site visit, a review of available subsurface and construction information in the vicinity of the site as this information might relate to the proposed development.

4.1.2 Subsurface exploration to assist in characterizing subsurface conditions at the project site, including appropriate classification of soil and rock materials, groundwater levels, and other subsurface conditions that could affect the project.

Depending on the complexity of the development and/or subsurface conditions at the site, the subsurface exploration might be carried out in more than one phase.

4.1.3 Physical testing of samples recovered to assist in development of soil/rock parameters for design recommendations.

4.1.4 Liaison with other participants of the design team to identify foundation loading conditions and viable geotechnical related options.

4.1.5 Preparation of a geotechnical report providing recommendations addressing the geotechnical aspects of the *Building Support.*

These recommendations would normally include the geotechnical aspects of the foundation design, earth or groundwater pressures on walls below grade, floor slab support, earthwork, and subdrainage, as well as seismic design considerations. Estimates of probable foundation movement or differential movement are often provided.

Recommendations may be appropriate for matters such as stability of slopes, utility support, storm water facilities, temporary support and construction and long term dewatering among other subsurface related matters, but these are not commonly part of the basic services.

4.1.6 Following the owners decision to proceed with the project, the *Geotechnical Engineer of Record (GER)* should be engaged to provide:

4.1.6.1 Consulting services during development of design drawings and specifications to assist other members of the design team in a proper interpretation of the geotechnical recommendations and *Review* of the project contract documents before tendering for compatibility with the geotechnical design recommendations;

4.1.6.2 *Field Reviews* including construction observation and testing to allow the *Geotechnical Engineer of Record (GER)* to form a professional opinion about the geotechnical aspects of the work undertaken by the contractor. Such observation and testing will also be as considered necessary by the *Geotechnical Engineer of Record (GER)* to complete the *Letters of Assurance* to the appropriate municipal authority.

The *Geotechnical Engineer of Record (GER)* does not have control of and thus is not responsible for: construction means, methods, techniques or procedures; safety precautions and programs in connection with the construction work; the acts or omissions of the contractor, the sub-contractors, or any of the contractor's or sub-contractors' agents or employees or any other persons performing any of the construction work. In addition, the *Geotechnical Engineer of Record (GER)* is not responsible for the failure by the contractor or sub-contractors to carry out the construction work in accordance with the contract documents.

Construction observation or *Field Reviews* by the *Geotechnical Engineer of Record (GER)* does not relieve the contractor of responsibility for construction of the project, controlling progress, providing safe working conditions, and correcting any deviations from project requirements.

The *Geotechnical Engineer of Record (GER)* should issue timely reports to inform the appropriate parties of geotechnically related construction observations, defective work, and/or unanticipated conditions requiring interpretations and directions.

Construction observation by the *Geotechnical Engineer of Record (GER)* does not include the duties of inspection and/or monitoring of excavation required by the Industrial Health and Safety Regulations of the Workers Compensation Board of B.C. unless this is specifically included as an additional service.

4.1.7 *Specialty Geotechnical Engineer* drawings, if any, are prepared for construction of special elements of subsurface work of a project. These drawings normally should comply with the contract documents, recommendations contained in the geotechnical reports, and sound engineering and construction practices. The *Geotechnical Engineer of Record (GER)'s* review of *Specialty Geotechnical Engineer's* drawings shall be for general conformance with the contract documents and intent of the geotechnical recommendations. This *Review* is not for the purpose of determining adequacy of elements and correctness of dimensions or quantities for which the *Specialty Geotechnical Engineer* is responsible. The *Review* shall not constitute approval of the contractor's safety measures in or near the work site or methods of construction.

4.2 ADDITIONAL GEOTECHNICAL ENGINEERING SERVICES

Services beyond those outlined under Basic Services are frequently required. These services are generally not considered part of the basic geotechnical services. These services may be provided by the *Geotechnical Engineer of Record (GER)* under terms mutually agreed upon by the client and the *Geotechnical Engineer of Record (GER)*.

4.2.1 Special Services

Special services are those which ordinarily cannot be foreseen when the scope of services is first developed or are not normally included as basic services. The following is a partial listing of special services:

4.2.1.1 Site selection services, including air photo interpretation, geophysical investigations, geological studies, and site planning;

4.2.1.2 Environmental site assessments, environmental testing to evaluate the possible presence of hazardous or toxic materials in soils or groundwater or design of mitigative measures;

4.2.1.3 Installation and monitoring of groundwater observation piezometers or slope inclinometers;

4.2.1.4 Attending construction progress meetings;

4.2.1.5 Performance of special laboratory or insitu tests to assist in characterization of subsurface soil and rock parameters;

4.2.1.6 Excavation support and underpinning evaluation and designs;

4.2.1.7 Test installations of foundation and earthwork;

4.2.1.8 Testing for freeze thaw, wetting, and drying of soil and/or rock materials;

4.2.1.9 Soil dynamics testing for seismic risk and liquefaction potential evaluation;

4.2.1.10 Slope stability analysis;

4.2.1.11 Preconstruction investigations and surveys of existing structures;

4.2.1.12 Corrosion studies including corrosion potential testing;

4.2.1.13 Estimates or reviews of quantities and construction costs;

4.2.1.14 Storm water infiltration studies;

4.2.1.15 On-site sewage disposal system studies;

4.2.1.16 Routine monitoring of excavations required by the Industrial Health and Safety Regulations of the Worker's Compensation Board of B.C.;

4.2.1.17 Construction dewatering studies, including impact of construction dewatering on surrounding properties and structures;

4.2.1.18 Quality control testing including *Review* (inspection) and testing of engineered fill and backfill;

4.2.1.19 Preparation or review of contract documents;

4.2.1.20 Design and monitoring of ground modification/improvement;

4.2.1.21 Blasting review, control and/or monitoring;

4.2.1.22 Permanent dewatering or subdrainage studies and design including assessment of expected flows, filtration or control requirements, and impact on neighbouring properties;

4.2.1.23 Studies to help identify areas considered sensitive to disturbance or destruction of marine or terrestrial habitat in accordance with appropriate municipal, provincial, and federal regulations.

4.2.2 Extraordinary Additional Services

Extraordinary additional services are those that may be required due to unforeseen changes in the work during design and/or construction phases, or as may be requested by the *Owner* or the *Coordinating Registered Professional*. A partial listing of extraordinary additional services is:

4.2.2.1 Additional services due to changes in the scope, design, location or magnitude of the project as described and agreed to under the basic service agreement;

4.2.2.2 Services required because of cost overruns that are outside of the control of the *Geotechnical Engineer of Record (GER);*

4.2.2.3 Services required that are beyond or inconsistent with original instructions given by the *Client* or *Owner*, as a result of changes in codes, laws or regulations, or change orders;

4.2.2.4 Services required as a result of errors, omissions, or poor workmanship by the contractor, sub-contractors or by other professionals on the project;

4.2.2.5 Extra services due to extended schedule of design and/or construction;

4.2.2.6 Services involved with regulatory meetings, public hearings or legal proceeding concerning the project;

4.2.2.7 Services as an expert witness or fact witness in project related disputes;

4.2.2.8 Services resulting from man-made disasters, fires, or acts of God;

4.2.2.9 *Review* and/or design of substitute systems;

4.2.2.10 Overtime work requested by the *Client, Owner*, or *Coordinating Registered Professional*.

LETTERS OF ASSURANCE DEFINITIONS

Reference : B.C. Building Code documents Schedules B-1, B-2 and C.

As of the proclamation of the 1992 Edition of the British Columbia Building Code, letters of assurance have been introduced to delineate areas of professional responsibility for design and *Field Reviews* for conformance with Building Code requirements or good engineering practice.

Definitions or descriptions of each of the various areas set out in Schedules B-1, B-2 and C which relate to current geotechnical engineering practices are presented below.

In general, the integration of geotechnical engineering within the Building Code framework is relatively recent. Geotechnical designs have traditionally been based on engineering design rather than for compliance with various aspects of Building Code requirements. Given this change, all *Geotechnical Engineers* should review the Building Code requirements as they relate to their practice.

Environmental aspects related to investigation, testing, handling, and disposal of contaminated soil and ground water are not included and do not form part of the geotechnical items or responsibilities as set out in Schedules B-1 and B-2.

Where Building Code requirements as stated are at variance with normal practice (as for retaining wall construction inspection requirements or movement tolerances for excavations), it should be noted that clause 4.2.4 of the Building Code provides that generally accepted design or established local practice can also satisfy Code requirements.

SCHEDULE B-1

Field Reviews

Field Reviews shall mean such reviews of the work by the *Member* at the project site as considered necessary, in the professional discretion of the *Member*, to ascertain whether the work substantially conforms in all material respects to the plans and supporting documents prepared by the *Member*.

The *Field Reviews* by the *Geotechnical Engineer* are intended to ascertain whether the subsurface conditions at the site are consistent with those considered in the design and, in the event that unanticipated subsurface conditions are encountered, to provide recommendations and *Field Reviews* of suitable measures to achieve the design objectives.

Schedule B-2 GEOTECHNICAL - Temporary

Temporary - works which are designed for the purpose and duration of the construction of the building only. This period is normally less than 2 years and may be as short as several hours. Where temporary systems are in place longer than the period assumed in the design, the design should be reviewed and remedial work may be required.

7.1 **Excavation** - the design and *Field Reviews* of the geotechnical aspects of the removal of ground for the purpose of constructing a building. The scope of this item is normally limited to the responsibility for stability of cut slopes. The scope does not include any aspect of the contractor's responsibilities for construction methods, techniques, sequences, procedures, safety precautions, or the operation of equipment on, to, or from the site; nor does this scope include the responsibility for the layout of the location of the excavated cuts.

7.2 **Shoring** - the design and *Field Reviews* of geotechnical, soil reinforcing and structural works for supporting the excavation cuts. This normally includes both geotechnical and structural aspects.

7.3 **Underpinning** - the design and *Field Reviews* of geotechnical, soil reinforcing, and structural works for supporting existing building foundations adjacent to the excavation cuts. This normally includes both geotechnical and structural aspects.

7.4 **Temporary Construction Dewatering** - the design and *Field Reviews* of the installation of well and pumping systems to maintain the stability of the excavation by control of groundwater levels or flow. This normally is related to the pumping and drainage of groundwater, but does not include: diversion and pumping as required to maintain the excavation free of surface run-off; precipitation; minor bank seepage; control or treatment of sediment discharge; measures to prevent deposit of sediment or soil on/in adjacent properties, streets, or services.

Schedule B-2 GEOTECHNICAL - Permanent

Permanent - these are works designed for the life of the structure. This life is normally assumed to be approximately 50 years. Temporary construction aspects necessary to build the permanent works are not included in this section.

8.1 **Bearing Capacity of Soil** - the design and *Field Reviews*, of allowable bearing of the ground for the *Support of the Building* using shallow foundations. Included are: consideration of factors such as subsurface conditions, live load, wind, seismic, frost, long term settlement, etc. affecting the building. Not included are: the structural design of the foundation member; the layout of the location of the foundation members; the supervision and operation of personnel and machinery used for installing the foundation members.

8.2 **Geotechnical Aspects of Deep Foundations** - the design and *Field Reviews* of the geotechnical aspects of deep foundations (piles, caissons, etc.) for *Support of the Building.* Included are: factors such as subsurface conditions, live load, wind, seismic, long-term settlement, etc. affecting the building. Not included are the structural design of the deep foundation member (pile, caisson, etc.); the detailed layout of the location of the deep foundation members; the supervision and operation of personnel and machinery used for installing the deep foundation members.

8.3 **Compaction of Engineered Fill** - the design and *Field Reviews* of fills placed for *Support of the Building* foundations. It is recommended that compacted fills supporting building slabs on grade be included.

8.4 **Structural Considerations of Soil, including Slope Stability and Seismic Loading** - the design and *Field Reviews* of the stability of slopes supporting or loading against the building and the design of the geotechnical aspects of the interaction between the ground and building.

8.5 **Backfill** - the design and *Field Reviews* of backfill placed against and affecting the building walls and/or performance. Included is consideration of loadings on the building wall and of support for adjacent properties. Normally not included is fill which does not impinge on the performance of the building or adjacent property, e.g. fill under on-site sidewalks and driveways, landscaping fill or fill for the bedding of services.

8.6 **Permanent Dewatering** - the design and *Field Reviews* of the geotechnical aspects of the installation of well and drainage systems to maintain the groundwater at design levels and pressures. This normally is related to the pumping, drainage, and/or cut-off of groundwater. Not included are: pumping; normal perimeter and under slab drains or plumbing to maintain the building free of surface run-off; ground seepage; precipitation; the design of the moisture or waterproofing membranes for the building walls or slab.

8.7 **Permanent Underpinning** - the design and *Field Reviews* of the permanent geotechnical, soil reinforcing, and structural works to support existing building foundations adjacent to the new building. Normally included are both geotechnical and structural aspects.

6.0 BIBLIOGRAPHY

"Letters of Assurance", British Columbia Building Code and the City of Vancouver Building Bylaw

"National Practice Guideline for the Geotechnical Engineer of Record", ASFE (Associated Soils and Foundation Engineers, now called Professional Firms Practising in the Geosciences)

"Guidelines for Structural Engineering Services for Building Projects", Association of Professional Engineers and Geoscientists of British Columbia

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ASSOCIATION OF
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