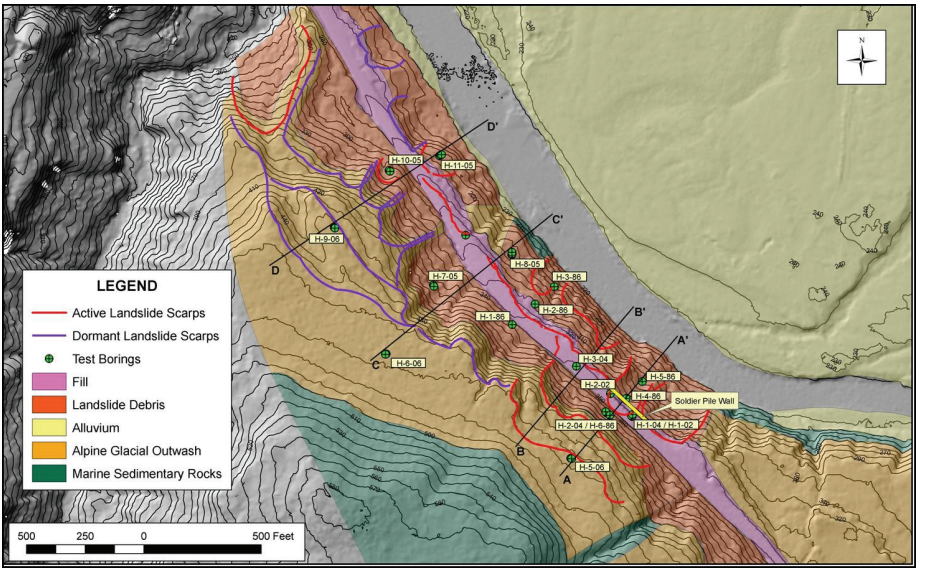
DEPARTMENT OF LICENSING

Guidelines for Preparing Engineering Geology Reports in Washington



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November 2006

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Acknowledgements:

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Guidelines for Preparing Engineering Geology Reports in Washington

I. Introduction

The Washington State Department of Licensing's (DOL) Geologist Licensing Board provides these guidelines for the following purposes:

1. to serve as a resource for consumers who engage the services of engineering geologists; and
2. to act as a reference for engineering geologists as they practice their profession.

These guidelines are intended to improve the quality and consistency of engineering geology reports in Washington.

The elements of the practice of engineering geology are outlined in Washington Administrative Code (WAC) 308.15.053. The elements define a process whereby geologic information and data are gathered, interpreted, synthesized, evaluated, analyzed, and then used for a specific application, at a scale and level of intensity appropriate for that application.

The following information is intended to provide guidance for the preparation and review of engineering geology and geotechnical reports prepared by engineering geologists in Washington. The actual scope of services for each engineering geology study will vary depending on the level of detail and accuracy needed for the intended application. Each report should include sufficient data and interpretation regarding geologic materials, structure, processes, and history to support conclusions and recommendations regarding the suitability of the site or area for the proposed activity, modification, or use.

The guidelines do not include systematic descriptions or all available techniques or topics, nor is it suggested that all techniques or topics be applied to every project. The guidelines are intended to be flexible and tailored to the specific project, based on the project complexity and scope of work. All elements of these guidelines should be considered during the preparation and review of reports prepared by engineering geologists.

This document contains elements from guidance publications for preparing engineering geology reports by the Guidelines Committee of the Utah Section of the Association of Engineering Geologists, the California Board for Geologists and Geophysicists, and the Oregon State Board of Geologist Examiners. These and other

references are presented in Section III.

The Geologist Licensing Board has prepared these guidelines in the spirit of service to the public and to assist public officials and professional engineering geologists to better understand the requirements of our state laws and codes. They are not intended to affect or limit the trade or business of individuals or firms that provide support services to the profession. If any portion of these guidelines is determined to conflict with or contradict Washington State law or rules, or those local ordinances governing these practices, Washington State law or rules or local ordinances will take precedence.

II. Report Content

A. General Information

Each report should include adequate background information to inform the reader of the reason for doing the project, who commissioned the work, the location of the site, the general site setting, the proposed land use, and the purpose and scope of the geologic investigation. The following items should be addressed:

1. Name of the party or entity that commissioned the report.
2. Location and size of area investigated, the proposed use of the site, and the reason the site is being evaluated (include specific regulatory references, as appropriate).
3. Purpose and scope of the report and geologic investigation, including specific tasks that were performed. A clear and complete description of the scope of the report is an essential component that enables readers and reviewers to understand the purpose of the geologic investigation as well as the methods employed.
4. Methodology used in the project, including dates specific tasks were completed, name(s) of geologist(s) and others who completed each task, and specific details about how data were actually gathered.
5. A description of prior work on the site or in the immediate area, including the nature and source of available subsurface information and geologic reports or maps. Suitable explanations of the available data should provide a technical reviewer with the means of evaluating the reliability of the data, if they are referenced in the report. Reference to cited works or field observations should be made to substantiate opinions and conclusions.

B. Site Characterization

The report should document the methods used to characterize the geology of the site and potential geologic and seismic processes that could impact the site and its suitability for the proposed use. This geologic evaluation should include a review and summary of pertinent existing geologic information and data, results of field assessment and exploration, and field and laboratory testing of rock, soil, and water to characterize the site conditions to the level of detail appropriate to meet the project objectives. The sources of existing information and data should be clearly documented using standard scientific bibliographic citations. Figures and maps based on existing sources should have the sources referenced on the graphic. The scope of field exploration and methods and laboratory procedures used should be described. Documentation and characterization of the site geology and geomorphic processes should include a written report with appropriate maps, figures, cross-sections, and appendices. Geologic features and data that were directly observed and measured should be clearly distinguished from existing information and inferences and interpretations. Laboratory test and geophysical survey results should be tabulated or summarized appropriately in the report and the test and survey reports appended.

1. Report Text

The following is a topical outline of site characteristics commonly described in the body of the report. In each case, references should be cited where applicable.

a. Topography, vegetation, and current land use, including the high and low elevations on the site, the total relief, slope inclination, form, and aspect, vegetation type and size, ground cover, and changes (both in vegetation and topography) due to past development or use. Where there is more than one slope, or there are a variety of different landforms on a project, the site should be subdivided into areas having similar characteristics, and each area should be described.

b. Regional and site geology, including a general description of relevant geologic history in the area. Descriptions should be written in a manner understandable to the client and the reviewer, and should include a review of previous geologic work conducted in the region and at the project location.

c. Site geology, soil and rock unit descriptions and classifications, including where the unit was encountered (including in explorations), and other pertinent information. Figures (geologic maps,

cross-sections and logs of explorations) should be referenced where applicable. References should be cited for the classification systems applied to the project.

d. Geologic processes, including surficial processes (slope movement, erosion and deposition, channel avulsion and migration, flooding, expansive and collapsible soils, and subsidence, etc.), coastal processes, seismic processes (including strong ground shaking, surface fault rupture, liquefaction, lateral spreading, and local tectonic deformation, tsunamis, seiches, etc.), and volcanic processes (ash-fall, pyroclastic flows, lahars, etc.), potentially affecting the site should be described. The process descriptions should be applied directly to specific locations in the project area, and should be related to the hazards that could be imposed as a result of the proposed development or use.

2. Illustrations

One or more of the following types of illustrations are typically included in a report:

- maps;
- annotated photographs;
- cross-sections;
- logs of explorations or geophysical testing; and
- actual results of laboratory test data.

The following paragraphs describe what are typically contained in the respective types of illustrations:

a. Vicinity Map
A vicinity map should include the specific project site in relation to known or familiar locations.

b. Engineering Geologic Maps and Cross-Sections
Engineering geologic maps of the area should be prepared at a scale that shows sufficient detail to adequately define the geologic conditions present, given the context of the proposed application. For most purposes, available published geologic maps are too general to provide a basis for understanding site-specific conditions, so a more site-specific geologic map may be needed. Depending on the nature of the project, the map may extend into adjacent areas to adequately define significant geologic conditions. Maps used for engineering geologic applications typically include site- or project-specific soil and rock units, landforms, drainage characteristics, and slope and other conditions related to development, such as existing cut and fill slopes, roads, proposed building footprints, etc.

Mapping should be done on a suitable planimetric or topographic base map or aerial photograph, at an appropriate scale with satisfactory horizontal and vertical control. Each map or photo should include the date and source of the base. Limitations of maps and remote sensing data (source and accuracy) should be clearly described.

Where detailed site-specific characteristics are important to the specific application, such as slope stability or foundation analysis, detailed cross-sections portraying actual ground measurements, slope breaks, contact and ground water relationships, and the locations of borings and other explorations should be included. Cross-sections should display both horizontal and vertical control, and should be drawn at a scale appropriate for site conditions and the specific application and should include the date of preparation and the name(s) of the person(s) who prepared the cross-section.

The engineering geologist should report the nature of bedrock and surficial materials, structural features and relationships, and the three-dimensional distribution of earth materials exposed and inferred within the area. A clear distinction should be made between observed and inferred features and relationships.

c. Logs of Subsurface Explorations
The scope and methods of subsurface explorations and geophysical surveys should be clearly summarized and include the following:

- type of exploratory and geophysical survey equipment and techniques used;
- operator and contractor's name(s);
- detailed information about sampling and testing techniques; and
- classification systems used.

The log of each exploration should describe the geologic materials encountered including the location, depth, top and bottom elevation, and a detailed description of drilling or excavation characteristics, individual samples and tests, water levels, changes in materials, and the details of installations of monitoring equipment for water levels, slope movement, or other expected changes.

Locations of explorations and surveys should be clearly and accurately shown on the site base map and cross-sections. When the exploration is not located immediately on the location of a

cross-section, the exploration location should be noted, and the data should be projected into the plane of the section where appropriate.

d. Laboratory and Field Test Results
Include documentation of laboratory and field-testing as an appendix. The laboratory and other subcontractors responsible for the field and laboratory testing, data processing, and data interpretation should be identified.

C. Assessment and Analysis

All engineering geologic information gathered for the project evaluation should be synthesized to allow an assessment of (1) the effect of the geologic conditions on the project and (2) the effect of the project on geologic processes (i.e., slope instability and erosion). This may take the form of geologic profiles, maps, sketches, and text to explain a logical train of thought for the conclusions and recommendations that will be presented in the following section. Report conclusions should not be made that cannot be supported by the geologic information and a logic that has not been established in this section of the report. For instance, interpreted geologic profiles should be commensurate with the subsurface information provided and relate to the proposed project.

Models, such as those for slope stability and erosion, may be used to support the analyses, but should not purport to convey legitimacy to situations where the collected information is insufficient. Assumptions of the model and the method of data collection should be stated. The analytical process being used should be described, along with the types of information needed, how it is processed, and the meaning and limitations of potential results. Assumptions such as ground water levels and seismic coefficients should be described, including the reasoning for their use. Variations should be described, where appropriate. The strength values or other data developed during synthesis should be listed. The results of the analyses for each assumption or variation should be described. Graphical or tabular results should be displayed.

D. Conclusions and Recommendations

This portion of the report documents the outcome of the study, based on the syntheses, assessments and evaluations, and analyses of geologic information, data, and interpretations used to characterize the project area or site. This section should describe the suitability of the site for the proposed development or use, and should

clearly state the likely effects of the proposed development or use on the geologic environment, as well as the likely effects of geologic processes on the proposed development or use.

Engineering geologic recommendations may cover one or more of the following topics, depending on the nature of the project:

- foundation strength characteristics of soil and rock;
- excavations and earthwork;
- slopes and slope stability;
- suitability of materials for use;
- surface and subsurface drainage;
- management of vegetation;
- temporary sediment control; and
- relevant regulatory issues.

This section should include recommendations regarding additional work needed to supplement the report, including, but not limited to, monitoring of geological conditions (ground water, slope movement, etc.), review of plans and specifications, and construction monitoring. Relative to the intended land use include a statement concerning the degree of confidence in and limitations of the data and conclusions.

E. Limitations

The limitations section should briefly restate the location, intended purpose, intended audience of the report, and what tasks were accomplished in meeting these ends. The limitations should include a statement regarding the limits of the intended use of the report, including scope and extent, and should restate any additional needs beyond the stated scope of work.

F. Signature and Stamp

All final reports or other documents must be signed and sealed/stamped by the engineering geologist who prepared and/or was in responsible charge of the engineering geology report (WAC 308-15-075).

G. Report References

Reference all pre-existing information used in the report using standard bibliographic citations. Include:

1. Literature, maps, and records cited and reviewed.
2. Aerial photographs or images interpreted, listing the type, scale, source, and index numbers etc.

3. Other sources of information, including well records, personal communications, or other data sources.

III. References

The following references are provided for use in preparing engineering geologic and geotechnical reports. In addition to the references listed, most county and city critical areas ordinances, as well as the Washington Forest Practices Rules (WAC 222) contain a section on reporting requirements.

California Department of Conservation. 1999. Guidelines For Engineering Geologic Reports For Timber Harvesting Plans. Division of Mines and Geology, Note 45.

California Department of Conservation. 2001. Guidelines For Preparing Geologic Reports For Regional-Scale Environmental and Resource Management Planning, Note 52. Division of Mines and Geology, 801 K Street, MS 14-34, Sacramento, CA 95814-3532.

California Geological Survey. 2004. Guidelines for Reviewing Geologic Reports. CGS Note 41.
http://www.consrv.ca.gov/cgs/information/publications/cgs_notes/note_41/index.htm

Oregon State Board of Geologist Examiners. 2005. Guidelines For Preparing Engineering Geologic Reports in Oregon. Oregon Board of Geologist Examiners, 707 13th Street SE, Suite 275, Salem, OR 97301.

Rogers, D.J. 2004. Standards For Geotechnical and Engineering Geology Reports. Karl F. Hasselman Chair in Geological Engineering, Department of Geological Engineering, University of Missouri-Rolla, 129 McNutt Hall, 1870 Miner Circle, Rolla, MO 65409-0230.
http://web.umr.edu/_rogersda/umrcourses/peer_review/standards.htm

Slosson, J.E. 1992. Guidelines For Preparing Engineering Geology Reports. Association of Engineering Geologists. pp. 2-12.

State of California-State and Consumer Services Agency, 1998. Guidelines for Engineering Geologic Reports. Board for Geologists and Geophysicists. 2535 Capitol Oaks Drive, Suite 300A, Sacramento, CA 95833-2926.

Utah Geological and Mineral Survey. 1986. Guidelines For Preparing Engineering Geologic Reports in Utah. 1594 W. North Temple, Ste. 3110, Salt Lake City, Utah 84116.

Washington State Department of Licensing. 2005. The Law Relating to Geologists. 18.220 RCW, 308-15 WAC, The Uniform Regulation of Business and Professions Act, 18.235. Geologist Licensing Board, PO Box 9045, Olympia, WA 98507-9045.
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