



Pierce County

Department of Planning and Land Services Development Engineering Section

PROJECT NAME: _____ DATE: _____

APPLICATION NO.: _____ PCDE NO.: _____

**LANDSLIDE HAZARD AREA (LHA)
GEOLOGICAL ASSESSMENT
REPORT REVIEW CHECKLIST
ORDINANCE 2004-57s
TITLE 18E**

DEFINITION: Assessment report (active LHA exists within 300 feet of the proposed project or when a geotechnical professional indicates that mitigation measures are necessary).

RETURN ALL REVIEW MARK-UPS AND CHECKLIST WITH RESUBMITTAL. Items 1 through 73 are the minimum requirements to be addressed by the geotechnical engineer per section.

Circled items need to be addressed. Checked items are OK. A determination cannot yet be made on items left blank. Address these items. If you believe a particular blank item does not apply, state this explicitly.

Landslide Hazard Geotechnical Report

1. ____ The geotechnical report signed, sealed, and dated by the geotechnical profession, and the format pre-approved by the Department.
2. ____ The first page of the document clearly identifies the submittal as a "Landslide Hazard Geotechnical Report."
3. ____ The dates when the geological assessment was performed. The date when the geotechnical report was prepared.
4. ____ The parcel number(s) of the site.
5. ____ Site address if one has been assigned by the County.
6. ____ A detailed description of the project (including the proposed land use) and a description of the area to be developed.

7. ____ A description of the surface and subsurface geology, hydrology, soils, and vegetation of the site and a list of the landslide hazard area indicators, as set forth in Section 18E.80.020 A., that were found on or near the site.
8. ____ A summary of the results, conclusions, and recommendations resulting from the geological assessment of the landslide hazards on or near the site. This summary shall address all of the information required in Section 18E.80.030 B.
9. ____ An accurate site plan drawn at a scale of 1" = 20', 1" = 30', 1" = 50' (or other scale deemed appropriate by the Department) is required.
10. ____ The site plan shall include site plan information based on a field survey by a licensed surveyor necessary.
11. ____ The limits/location of the active landslide hazard area(s) set forth in Section 18E.80.020 C.1. Delineation of the active landslide hazard area limits shall differentiate between areas of historic landslide activity and adjacent unstable areas.
12. ____ The limits/location of the required landslide hazard buffer based upon the requirements set forth in Section 18E.80.050 A.
13. ____ The limits/location of any potential landslide hazard areas that have been designated as stable areas in accordance with Section 18E.80.020 C.2.c.
14. ____ The location of any existing and proposed structures, utilities, on-site septic systems, wells, and stormwater management facilities.
15. ____ The full geographical limits of the proposed project area (area to be developed).
16. ____ Location and unique identifier of geotechnical borings, CPT soundings, or other surveys or explorations used to characterize subsurface conditions.
17. ____ Extent of cross-section(s) used to evaluate the three-dimensional subsurface geologic and groundwater conditions at the site.
18. ____ Extent of cross-section(s) used in the evaluation of slope instability.
19. ____ Existing topography on the site presented in two-foot contours.
20. ____ Property lines for the site.
21. ____ North arrow and plan scale.

22. _____ Subsurface data collection method utilized:
- ? Soil borings
 - ? Geophysical survey
 - ? Test pits
 - ? Other (identify) _____
-
-

Borings

23. _____ A boring data graphic log includes vertical scale such that 5 feet of drilled depth is scaled to range of 1" to 2" (1:60- or 1:30-scale), and shall include vertical columns that record depth in 1 foot increments, SPT value or equivalent value, and incremental blow counts, a graphic pattern representation of the soil type encountered during drilling, and sample descriptions and other comments regarding drilling.
24. _____ A header on the first page that includes a unique identifier for the boring, the times and dates of the start and completion of drilling, the manufacturer and model of the drilling rig, the company name of the drilling contractor, the name(s) of the site geologist(s) or engineer(s) overseeing the drilling activities, the details of the method used to advance the borehole (e.g., 4" i.d. hollow-stem auger), and the type of drilling fluid used to stabilize the borehole.
25. _____ An indication that the SPT was completed in accordance with applicable ASTM standards or other appropriate driven sample collection methods, which are specified, completed in general accordance with applicable ASTM standards.
26. _____ A description of the sampler, hammer weight, drop height, the type of hammer used to drive the sampler performing the SPT, number of turns of rope if a cathead is used to raise the hammer, condition of rope (i.e., new, used, frayed, oily, etc.), and the depth of static groundwater measured immediately prior to abandonment of the boring and the time and date of this measurement.
27. _____ All subsequent pages of the graphic log have the unique identifier for the boring, the times and dates of the start and completion of drilling, and the number of the page and the total number of pages comprising the log.
28. _____ Each SPT value or equivalent value reported in the appropriate column showing the blow counts recorded at each 6" interval, and the sum of the blow counts between penetration distances of 6" to 18," unless refusal conditions (50 or more blows with less than 6" of sampler penetration) are met anywhere in this interval. At refusal, the blow count shall be recorded as the number of blows with the corresponding sampler penetration, in inches.
29. _____ SPT tests or other sample collection methods shall be performed every 5 feet during drilling, at a minimum.

Soil Boring/Log Descriptions

30. ____ Soil sample descriptions include the total length of the recovered sample, the soil color, odor, the density or consistency (loose to very dense, very soft to very stiff), degree of water saturation (dry, moist, wet, saturated), and dilatancy.
31. ____ Granular (sand and gravel) soils, the description shall include a physical description of the soil sample, including size distribution (poorly or well graded), angularity, composition, amount and plasticity of the fines fraction.
32. ____ Fine soils (silt and clay), the description shall include a qualitative estimate of the proportion of the silt and clay size particles (e.g., silty clay, clay with some silt, etc.), plasticity, and amount and type of organic material.
33. ____ Sample description includes a description of any bedding, laminations, slickensides, or other textural or deposition features, including contact between dissimilar soil types.
34. ____ Sample description includes a field classification of the soil sample using the Unified Soil Classification System where the classification is expressed in lower case letters (e.g., sp, ml, etc.).
35. ____ Sample classification expressed in upper case letters (e.g., SP, ML, etc.) where subsequent laboratory testing has been performed.
36. ____ Column of the graphic log includes any other information relevant to the subsurface investigation, such as loss of drilling fluid, heaving, churning of the drill in gravelly soils, etc.

Sounding Data

37. ____ CPT sounding data reported as a graphic log.
38. ____ A sounding data graphic log includes vertical scale such that 5 feet of penetrated depth is scaled to range of 1" to 2" (1:60- or 1:30-scale), and shall include vertical columns that record depth in 1 foot increments.
39. ____ A sounding data graphic log includes header on the first page that includes a unique identifier for the boring, the times and dates of the start and completion of the CPT sounding, the manufacturer and model of the CPT system, the company name of the CPT service contractor, the name(s) of the site geologist(s) or engineer(s) overseeing the CPT sounding, and any comments regarding the conduct of the testing, reaction of the CPT system during sounding, etc.
40. ____ All subsequent pages of the graphic log shall have the unique identifier for the boring, the times and dates of the start and completion of drilling, and the number of the page and the total number of pages comprising the log.

41. ____ A sounding data graphic log includes displays, at a minimum, a continuous depth plot of the uncorrected tip resistance, the friction (sleeve) resistance, the friction ratio, and the measured pore pressure with an overlay of the calculated hydrostatic pore pressure. These curves shall be plotted to show the full variation of the measured quantities within the depth range of the sounding, and each curve shall have a visible scale with the minimum and maximum ranges labeled.
42. ____ A sounding data graphic log includes all CPT data recorded for each sounding provided in either electronic or hardcopy format. Electronic data will be presented in an ASCII text file format.
43. ____ Geotechnical borings or CPT soundings advanced to a depth sufficient to characterize geologic conditions the existing or potential landslide mass.
44. ____ Other methods used for subsurface characterization assigned a unique identifier, and the basic data presented in appropriate graphical and/or tabular format.
45. ____ The three-dimensional subsurface conditions at the site presented using one or more cross-sections showing location and depth penetration of geotechnical borings, CPT soundings, or other subsurface characterization methods, interpretation of the geometry of major soil units, and projected location of the static groundwater surface determined from the subsurface exploration.
46. ____ The cross-sections presented at a scale of 1" = 20', 1" = 30', and 1" = 50' (or other scale deemed appropriate by the Department).
47. ____ Each cross-section has a legend with a description of the various major soil units.
48. ____ **Soil strength and index properties** (i.e., unit weight, cohesion, etc.) shall be provided for each soil unit interpreted from the subsurface characterization of the site, and presented in tabular format.

Justification for the presented values of these soil parameters shall be based on one or more of the following approaches:

49. ____ Back analysis based on pre-landslide stability conditions.
50. ____ Laboratory measurement of strength or other index properties made on soil samples.
51. ____ Correlation of soil strength index properties to other geotechnical indices (e.g., SPT blow counts, etc.), where the correlation relations are documented (e.g., published literatures, in-house empirical data set, etc.).
52. ____ Soil strength and indices based on generic values must provide a clear justification for their use.
53. ____ A detailed description of any prior grading activity, soil instability, or slope failure.

54. _____ **Assessments and conclusions** regarding slope stability for both the existing and developed conditions shall be presented and documented.

These assessments and conclusions shall include:

55. _____ Evaluation of the potential types of landslide failure mechanisms (e.g., debris flow, rotational slump, translational slip, etc.) that may affect the site.
56. _____ Quantitative stability evaluation of slope conditions of the various failure mechanisms using state-of-the-practice modeling techniques.
57. _____ Limiting equilibrium methods of analysis state the stability conditions as a factor of safety.
58. _____ Most unstable failure geometry(ies) presented in the form of a cross-section(s), with the least stable failure geometry for each failure mechanism clearly indicated.
59. _____ Stability evaluation considers dynamic earthquake loading, and utilizing a minimum horizontal acceleration as established by the current version of the Washington State Building Code.
60. _____ An analysis of slope regression rate shall be presented in those cases where stability is impacted or influenced by erosional processes (e.g., wave cutting, stream meandering, etc.) acting on the toe of the slope.
61. _____ **Mitigation recommendations** using engineered measures to protect the proposed structure(s) and any adjacent structures, infrastructure, adjacent wetlands, or critical fish and wildlife habitat from damage or destruction as a result of proposed construction activities shall be designed by a professional engineer.

The Geotechnical Report shall contain:

62. _____ Design plans and associated design calculations for engineered structures or drainage systems (e.g., structural foundation requirements, retaining wall design, etc.) provided.
63. _____ Recommendations and requirements pertaining to the handling of surface and subsurface runoff in the developed condition provided.
64. _____ Identification of necessary geotechnical inspections to assure conformance with the report mitigation and recommendations provided.
65. _____ Proposed angles of cut and fill slopes, site grading requirements, final site topography (shown as 2' contours), and the location of any proposed structures, on-site septic systems, wells, and stormwater management features or facilities associated with the development detailed within the body of the report and shown on a site map at the same scale as that required in Section A-7 provided.
66. _____ Soil compaction criteria and compaction inspection requirements provided.

- 67. ____ An analysis that indicates how the proposal meets the standards outlined in Section 18E.80.040 provided.
- 68. ____ Structural foundation requirements and estimated foundation settlement provided if structures are proposed.
- 69. ____ Lateral earth pressures provided.
- 70. ____ Suitability of onsite soil for use as fill provided.
- 71. ____ Mitigation measures for building construction on each lot for short plats, large lots, or formal plats such that additional geotechnical professional involvement is minimized during building construction provided.
- 72. ____ Construction sequencing recommendations provided when an applicant intends to convert an active landslide hazard area to a stable area, concurrently with the construction of the proposed development (reference section 18E.80.020.C.2).
- 73. ____ The Geotechnical Report shall contain a paragraph that states the following specific language:

"The services described in this report were prepared under the responsible charge of (Individual's Name). (Individual's Name) meets the qualifications contained in Title 18E, Section 18E.80.030 to prepare a landslide hazard geological assessment. (Individual's Name) understands the requirements of the current Landslide Hazard Area Chapter 18E.80 and the definitions of the applicable terms contained within Chapter 18.25. Individuals under the responsible charge of (Individual's Name) have performed a landslide hazard geological assessment, conducted a field investigation, and researched historic records on or near the above referenced site. In my opinion, the scope of services completed for this project is adequate to meet the requirements of the Department.