Revised Targeted Critical Areas Geologic Hazard Evaluation

Energize Eastside Project
Bellevue, Washington

for
Puget Sound Energy

July 11, 2017

GeoEngineers
Earth Science + Technology

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File No. 0186-871-06

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INTRODUCTION

GeoEngineers, Inc. (GeoEngineers) is pleased to present the revised results for targeted critical areas evaluation of specific geologic hazards identified by Puget Sound Energy (PSE) for the Energize Eastside Project. Our services have been provided in general accordance with the proposal between GeoEngineers and PSE dated June 21, 2017. These services were authorized by Kelly Purnell with PSE on June 15, 2017, and formal authorization was received on June 26, 2017.

The project area is located along existing PSE rights-of-way and includes areas within the city of Bellevue. We previously provided a geologic hazard evaluation for various routes under consideration, including the route evaluated within this document, in a separate report submitted to PSE on December 19, 2014. The geologic hazards evaluation included in this report focuses on a desktop review for steep slope and landslide hazard areas (geologic hazard areas), as assigned by PSE, relative to proposed vegetation management activities, including tree-removal required for construction access and pole replacement. PSE has provided specific locations for evaluation and also provided a map developed by others which shows proposed pole replacement activities including proposed tree removal, vegetation management zones and access roads.

LOCAL REGULATIONS

GeoEngineers assessed local regulations in the Bellevue Land Use Code, Critical Areas Overlay District for Geologic Hazard Areas (20.25H.120) for the project areas identified by PSE that coincide with regulated geologic hazard areas.

General Geologic Hazard Area Buffers

The City of Bellevue Land Use Code, 20.25H.120, criteria for defining geologic hazards and geologic hazard buffers is described below.

- *Landslide Hazards: Areas of slopes of 15 percent of more with more than 10 feet of rise, which also displace areas of historic failures, including those areas designated as quaternary slumps, earthflows, mudflows, or landslides, areas that have shown movement during the past 13,500 years or that are underlain by landslide deposits, slopes that are parallel or subparallel to planes of weakness in subsurface materials, slopes exhibiting geomorphological features indicative of past failures such as hummocky ground and back-rotated benches on slopes, areas with seeps indicating a shallow ground water table on or adjacent to the slope face, or areas of potentially instability because of rapid stream incision, stream bank erosion, and undercutting by wave action.*

  According to the Bellevue Land Use Code, the established critical area buffer in geologic hazard critical areas for landslide hazards is 50 feet from the top of the slope.

- *Steep Slopes: Slope of 40 percent or more that have a rise of at least 10 feet and exceed 1,000 square feet in area.*

  According to the Bellevue Land Use Code, the established critical area buffer in general geologic hazard critical areas for steep slopes is 50 feet from the top of the slope.

EXISTING CONDITIONS

GeoEngineers reviewed a previous report, titled Geologic Hazards Evaluation and Preliminary Geotechnical Engineering Services report, submitted to PSE on December 2014, to assess existing conditions in the project area within City of Bellevue (GeoEngineers 2014). Existing geology in the identified areas mainly consists of glacial drift, recessional outwash, glacially consolidated till and advance outwash deposits, with the exception of a small areas of peat, fill, alluvium and Eocene age sedimentary rocks. Soil types anticipated in the project area include mainly silty gravel, silty sand and silt.

Steep slopes with slopes 40 percent or greater are observed locally within the project area, however the steep slope areas where selected tree removal is proposed are generally developed and include rockeries, landscaped residential slopes and managed right-of-way areas that are unlikely to be adversely impacted. Some undeveloped/natural areas of steep slopes along the project area include the Coal Creek drainage east and west locally along Coal Creek Parkway. These Coal Creek drainage areas also include localized mapped landslide hazards. We observed no active areas of slope movement or instability for project areas that include mapped steep slope areas or steep slope and landslide areas within the Coal Creek drainage area.

IMPACT ASSESSMENT

Tree Removal

There are two primary ways in which tree removal activities may impact slope stability on steep slopes or landslide hazard areas. After tree removal, root decay causes both the numbers of roots and the tensile strength of the remaining individual roots to decrease with time (Burroughs and Thomas 1977). Studies show that the period of minimum root strength is typically from 3 to 5 years after harvest (Ziemer 1981a; 1981b), but can extend up to 10 to 20 years depending on the tree species. For example, minimum root strength in evergreens is typically 10 years after harvest, alders have a minimum root strength of 5 to 10 years after harvest, and maples typically maintain full root strength after harvest (because they regrow from the existing stump). The reductions in root strength result in a net decrease in the cohesive strength of the near-surface soil mass.

Tree removal likely will modify surface and subsurface hydrology. Tree removal may increase soil moisture by reducing canopy interception and evapotranspiration. Ground-based yarding equipment can compact soil, which may alter hydrologic processes in certain soil types.

Elevated groundwater levels decreases the stability of slopes by reducing the shear strength of the soil and by adding additional weight. The probability of landsliding from increased groundwater levels depends on the magnitude of the increase and the existing stability of the slope. The magnitude of potential changes in groundwater levels from tree removal is highly variable and depends on several factors, including the tree size, silviculture, subsurface conditions and topography.

In general, tree removal will increase the impact on slope stability for steep slopes or landslide hazard areas. However, fewer impacts are expected in areas where tree removal is isolated to one or two trees and the steep slope or landslide hazard area is otherwise stable and well vegetated. Additionally, fewer impacts are expected at the toe of the slope, compared to tree removal within the body or at the top of the slope.

Much of the tree removal near/on steep slope areas north of I-90 are situated in the PSE parcel that will be developed for the Richards Creek Substation. GeoEngineers completed a geotechnical engineering report for this substation in a report dated September 23, 2016 and an addendum report dated April 4, 2017. The new substation will require some retaining walls along the south side of the parcel where existing steep slopes are mapped, and a soldier pile wall on the east side of the site. The soldier pile wall (and eastern limits of the new substation) will be located east of the existing eastern steep slope area. Thus, construction of the substation and soldier wall will result in removal of this small steep slope area and the hillside will be stabilized by the wall. As such, the proposed tree removal located within the steep slopes of the substation limits will not affect the stability of the hillside.

Access Construction

Temporary access routes will generally follow previously established access trails and routes, and in some cases, will cross existing developed landscape. Therefore, little cutting or filling will be required. Small amounts of quarry spalls might be necessary to stabilize portions of existing routes. Many of the existing routes are overgrown with vegetation and, thus, will need to be cleared. Standard erosion control best management practices (BMPs) should be followed during clearing and use of the temporary access routes. Following completion of construction activities, restoration BMPs such as mulching and/or placing jute matting, should be implemented.

Pole Installation

Where new poles are located in steep slope or landslide hazard areas, a temporary working bench might be necessary to install the pole. We anticipate that these benches might vary from about 10 feet by 10 feet to 30 feet by 30 feet in dimension. The same considerations discussed above for access routes also apply to benches needed for pole installation. We recommend that clearing activities be restricted to that necessary to auger the hole for the pole.

Recommendations for the design and construction of poles are presented in our Geotechnical Engineering Services report dated June 8, 2016. In general, most of the site soils along the proposed route consist of recessional deposits or glacially consolidated deposits, and in some limited locations, bedrock. These soils should provide adequate support for the new poles, and it is our opinion that once the pole is installed, the pole will not adversely impact slope stability since the pole should actually provide additional resisting force against slope failure, provided the pole is embedded to a sufficient depth.

Conclusions

Mapped steep slopes in Bellevue that include slopes 40 percent or greater are observed locally within the project area, however many of these areas are developed and include rockeries, landscaped residential or commercial development slopes and cut slopes associated with paved roadways and include the following:

- Two trees removed from just north of 132nd Avenue SE.
- Multiple trees removed and access just east of the intersection of Somerset Drive SE and 134th Place SE, north to Somerset Place SE.
- Multiple trees removed just east of the intersection of Somerset Drive SE and Somerset Boulevard SE.

- Multiple trees removed just east of 136th Place SE between SE 43rd Place and SE 43rd Street; and two trees between this area and the intersection of Somerset Drive SE and Somerset Boulevard SE.
- Two trees removed and access north of the intersection of SE 43rd St. and the PSE right-of-way.
- Multiple trees removed south of SE 42nd Street.
- Multiple trees removed between SE 37th Street and SE 36th Street.
- Access east of SE 32nd Street.
- Multiple trees removed in the Richards Creek Substation and Lakeside Substation area.
- Multiple trees removed and access south of SE 26th Street.

A localized natural area of steep slopes in the project area includes the Coal Creek drainage east and west locally along Coal Creek Parkway; this area also has localized mapped landslide hazards. The project area is within an existing right-of-way that is maintained for vegetation by PSE and includes a narrower right-of-way managed by a private petroleum pipeline company. The right-of-way for the buried petroleum pipeline includes areas with no trees and grass that is mowed regularly for vegetation management. We observed no indication of slope movement in the pipeline right-of-way that is included within the PSE right-of-way. The proposed removal of 11 selected trees in this area is consistent with the management activities of the existing pipeline right-of-way and is not anticipated to impact the mapped geologic hazard areas within the Coal Creek drainage, in our opinion, provided that no tracked or rubber-tired equipment is used to remove the trees.

Conceptual Impact Mitigation Strategy

Vegetation Management and Tree Removal

For vegetation management and tree removal in the City of Bellevue within the mapped geohazard areas outlined in the proposed PSE project segment, GeoEngineers suggests the following options for mitigating impacts after tree removal.

In general, to limit impacts on slope stability from vegetation management and tree removal within steep slope and landslide hazard areas, the sites should be accessed by foot to reduce equipment impacts. Hand cutting with chainsaws should be implemented to trim branches and remove trees. Stumps should remain in place, but can be cut to ground level. Branches, limbs, trunks and other tree debris should be chipped and scattered around the removal site within the right-of-way. Where chipping is not feasible, unchipped tree debris can be scattered.

In areas where tree removal is widely spaced within steep slope and landslide buffer areas, the trees should be cut, stumps left in place, and trimmed branches and trunks can be scattered within the right-of-way.

In areas where tree removal is clustered, erosion control BMPs, such as grass seeding, leaving stumps, scattering straw and/or replacement planting of native shrubs or small trees, should be implemented to reduce concentrated flows and minimize disturbance.

In areas where houses are located within 25 to 50 feet of vegetation management and tree removal, all tree debris should be removed from the owner’s property and communication with the property owner is suggested to identify possible reseeding, replacement tree or shrub, or landscaping options. If agreeable to the property owner, it is possible that the tree trunk can be cut and left below ground surface to maintain root strength (up to 5 to 10 years, depending on tree type), and a replacement tree or shrub may be planted near the trimmed trunk.

Reestablish Access Routes

Where vegetation clearing is required to reestablish the access on existing trails and access routes, BMPs should be implemented; these BMPs can include, but are not limited to: outsloping road surfaces, crowning road surfaces (where appropriate, such as at ridge tops and where roads climb gently inclined surfaces) and installing water bars or rolling dips at regularly spaced intervals to avoid concentrating surface water flow along the road surface. The spacing depends on the grade of the route, the soil type present, proximity to streams and the intended use of the road (e.g., temporary or permanent).

Most, if not all, access routes will be temporary and will be abandoned following construction of the transmission line. In the transmission corridor, no temporary access roads will cross any drainages situated in geologic hazard areas (i.e. Coal Creek).

It is the contractor's responsibility to complete construction work safely and in accordance with applicable local, state and federal laws. After access use is complete, where it is deemed necessary, limited regrading of the access route is recommended to avoid concentrating surface runoff along tracks, ruts or other potential flowpaths. Following completion of construction activities, the construction access routes will be graded to a stable free-draining configuration, treated with appropriate erosion control measures, such as mulching and/or placing jute matting and installation of water bars as needed to control runoff, and seeded. If jute mat is determined a necessary BMP, the jute mat should be anchored at the upslope and downslope ends and secured with staples per the manufacturer's recommendations.

Pole Installation

Where a bench is required to install a pole on a steep slope or landslide hazard area, the recommendations presented above for temporary access routes also apply for pole installation. Appropriate erosion control BMPs should be implemented during construction, and the disturbed area should be restored after pole installation by seeding or revegetating and covering the disturbed area with appropriate BMPs. Soil removed from the new pole excavations should be scattered into vegetation away from the any landscaped areas. Any areas of exposed soil must be seeded and mulched (or covered with hog fuel) to prevent transport of sediment down the steep slopes or into the seepage area during rain events. If the work area is wet or has standing water, driving mats should be used under all equipment and all soils should be removed from the site for off-site disposal.

For poles located in geologic hazards areas, the old poles should be cut off approximately 1 to 2 feet below the ground surface and the remaining portion of each pole left in place. If poles are installed on slopes steeper than 2H:1V (horizontal:vertical), they should be embedded at least 3 feet deeper than the typical design embedment.

CODE COMPLIANCE

20.25H.125 Performance standards – Landslide hazards and steep slopes

In addition to generally applicable performance standards set forth in LUC 20.25H.055 and 20.25H.065, development within a landslide hazard or steep slope critical area or the critical area buffers of such hazards shall incorporate the following additional performance standards in design of the development, as applicable. The requirement for long-term slope stability shall exclude designs that require regular and periodic maintenance to maintain their level of function.

A. Structures and improvements shall minimize alterations to the natural contour of the slope, and foundations shall be tiered where possible to conform to existing topography.

   Response to Code Requirement: No structures will be constructed as part of the proposed project. Site improvements (pole removal, pole replacement, access roads, and vegetation management) are not anticipated to adversely impact the natural contour of the slope. The proposed site activities that include vegetation management, tree removal, and temporary access roads (associated with the proposed pole replacement activities) will maintain overall existing site topography.

B. Structures and improvements shall be located to preserve the most critical portion of the site and its natural landforms and vegetation.

   Response to Code Requirement: No structures will be constructed as part of the proposed project. Site improvements include localized vegetation management, including tree removal, and use of existing access routes (associated with the proposed pole replacement activities). The proposed tree removal and surface disturbance will be limited to reduce potential impacts to natural landforms and vegetation.

C. The proposed development shall not result in greater risk or a need for increased buffers on neighboring properties.

   Response to Code Requirement: The proposed development includes vegetation management, including tree removal and use of existing access routes (associated with the proposed pole replacement activities) that will be followed by mitigation measures to reduce potential impacts to geologic hazards that include landslide and steep slope hazards. Mitigation measures include a variety of BMPs to reduce potential impacts to geologic hazards in the vicinity of neighboring properties. BMPs include plant replacement, scattering trimmed or removed tree debris, and chipping wood to reduce potential impacts to work areas as appropriate. Removal of vegetation by hand and/or using limited access machinery will reduce potential impacts to landslide and steep slope hazard areas. It is our opinion that the proposed project will not require additional buffers.

D. The use of retaining walls that allow the maintenance of existing natural slope area is preferred over graded artificial slopes where graded slopes would result in increased disturbance as compared to use of retaining wall.

   Response to Code Requirement: In the transmission corridor, no retaining walls or grading activities are proposed relative to the proposed vegetation management, tree removal and access route activities (associated with the proposed pole replacement activities). The development of soldier pile walls and retaining walls for the Richards Creek Substation is discussed in detail in the substation-specific geotechnical engineering report dated September 23, 2016, and in an addendum report dated April 4, 2017. The use of retaining walls for the new substation will reduce disturbance and grading of the existing natural slopes, which would be otherwise necessary without construction of the walls.

E. Development shall be designed to minimize impervious surfaces within the critical area and critical area buffer.

Response to Code Requirement: No new impervious surfaces are proposed relative to the proposed vegetation management, tree removal and access route activities (associated with the proposed pole replacement activities) within mapped critical area and mapped critical area buffers of the transmission corridor. Five narrow, and relatively small (low square footage), steep slopes are located on the future Richards Creek Substation property (comprising 8.46 acres), which is partially developed with an existing pole yard (existing hard surface/impervious surface of 1.58 acres). Only two mapped steep slopes are located within the limits of the new substation (one of which is mapped in the graded/compacted gravel pole yard). Based on the design of the future Richards Creek Substation, site development will be limited to that area necessary for the substation, leaving the surrounding vegetation and grade intact. As such, only one of the mapped steep slopes in the future Richards Creek Substation property will experience an increase in impervious surface.

F. Where change in grade outside the building footprint is necessary, the site retention system should be stepped and regrading should be designed to minimize topographic modification. On slopes in excess of 40 percent, grading for yard area may be disallowed where inconsistent with these criteria.

Response to Code Requirement: No change in grade is proposed relative to the proposed vegetation management, tree removal and access route activities (associated with the proposed pole replacement activities) within the transmission corridor. Within the new substation, grade transitions along the east side (up to 24 feet in height) will be supported with a soldier pile wall (cantilever and with tiebacks). Grade transitions along the west side (up to 6 feet in height) will be supported by fill slopes and a cast-in-place retaining wall.

G. Building foundation walls shall be utilized as retaining walls rather than rockeries or retaining structures built separately and away from the building wherever feasible. Freestanding retaining devices are only permitted when they cannot be designed as structural elements of the building foundation.

Response to Code Requirement: No building foundations are proposed relative to the proposed vegetation management and tree removal activities associated with the proposed pole replacement activities within the transmission corridor. However, for stability purposes, drilled pier foundations will be utilized on select poles in the corridor where appropriate. The new substation is not a building and, thus, does not have typical foundation walls; as such, soldier pile and retaining walls will be necessary to retain the required grade changes.

H. On slopes in excess of 40 percent, use of pole-type construction which conforms to the existing topography is required where feasible. If pole-type construction is not technically feasible, the structure must be tiered to conform to the existing topography and to minimize topographic modification.

Response to Code Requirement: No pole-type structures are proposed relative to the proposed vegetation management and tree removal activities. The new poles will meet the preferred construction type (which is pole-type construction). The new substation cannot be tiered and was situated east of the existing Olympic pipeline. This requires construction of a soldier pile wall east of the existing steep slope area. While this results in grading in the steep slope area, the area of disturbance is minimized by construction of a vertical wall.

I. On slopes in excess of 40 percent, piled deck support structures are required where technically feasible for parking or garages over fill-based construction types.

Response to Code Requirement: No structures requiring pile deck support are proposed relative to the proposed vegetation management and tree removal activities. The new poles will meet the preferred construction type (which is pole-type construction).

No parking or garage structures are planned for the new substation. Pile-supported deck structures are not feasible for a substation. The substation grades will require cutting into the steep slope on the east side, which will then be retained with a soldier pile wall.

J. Areas of new permanent disturbance and all areas of temporary disturbance shall be mitigated and/or restored pursuant to a mitigation and restoration plan meeting the requirements of LUC 20.25H.210. (Ord. 5680, 6-26-06, § 3).

Response to Code Requirement: Temporary disturbance for the proposed vegetation management and tree removal activities and access routes (associated with the proposed pole replacement activities) within the existing transmission corridor will be mitigated by scattering and/or chipping trimmed limbs and logs, replanting vegetation, and using limited access equipment or accessing only by foot as appropriate. For steep slope areas in the vicinity of the new substation that will be disturbed during construction, the disturbed areas should be restored by seeding/revegetating and covering the planted area with mulch or other appropriate BMPs.

LIMITATIONS

We have prepared this report for the exclusive use of PSE and their authorized agents for the Energize Eastside project located in Bellevue, Washington.

The purpose of our services was to review slope stability and landslide hazard impacts in relation to vegetation management and tree removal and temporary access routes (associated with the proposed pole replacement activities) in steep slope and landslide critical hazard areas along the transmission line corridor within the City of Bellevue. Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted practices in the field of geotechnical engineering in this area at the time this report was prepared. No warranty or other conditions, express or implied, should be understood.

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