DRAFT

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MEMORANDUM

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TO:	Mark Johnson/ESA Adolfson; Dannon Traxler/Langabeer & Tull
FROM:	J. Gordon, PE
DATE:	February 12, 2009
FILE:	11911-001-02
SUBJECT:	Response to ESA Adolfson Memo dated December 23, 2008 Fairhaven Highlands Project Bellingham, WA

The purpose of this memorandum is to respond to ESA Adolfson's memorandum to GeoEngineers dated December 23, 2008, with the subject: Review of the "Earth Elements Technical Report" by GeoEngineers, Inc., for the Fairhaven Highlands Report. Our memorandum provides feedback following ESA Adolfson's bullet list for ease of discussion. The closed bullet is ESA Adolfson's questions, the open bullet is our response. Where we have provided information in our revised "Earth Elements Technical Report", we have so indicated.

AFFECTED ENVIRONMENT

- Figure: Geologic map.
  - We have provided a geologic map as Figure 4 in our revised technical report.
- Figure: Landslide hazard areas.
  - It is our understanding that the project is not subject to the current City of Bellingham Critical Areas Ordinance (CAO). However, we have shown those areas of the site that would be classified as landslide hazard areas under the CAO, which includes slopes greater than 40 percent. These areas are shown in Figure 3.
- Figure: Erosion hazard areas.
  - As described in the technical report, there is not significant evidence of erosion at the site in the undisturbed state because of the vegetation. Most of the site has slopes and most of the site soils are silty glacial soils. Therefore, most of the site soils have a high susceptibility to erosion when disturbed. This is not unusual and is addressed in the report, and conventional erosion control measures, BMPs, construction precautions are appropriate.

IMPACTS

Additional discussion has been added to the revised technical report regarding impacts from each alternative.

<u>Landslide Hazards:</u>

- Do any of the other alternatives propose roads in a landslide area or proposed 30-foot buffer?
  - Yes, these situations are discussed in the revised technical report.
- Can the shallow sloughs be characterized?
  - Section 3.1.2.5 describes what kind of shallow sloughs expected: 2 to 5 feet deep. There is no current evidence of a recent slough event (denuded vegetation). However, we have included the description of sloughs Golder observed previously.
- Would failures impact surrounding structures or properties?
  - No historical evidence of slides of this size and nature. Text added to the technical report.

- Can development occur without increasing risk of shallow sloughing?
    - The shallow slough risk is in the real steep area on the north side and the northeast side as described in the technical report. The two primary impacts that would increase the risk of sloughing include adding surface or groundwater to the slope, or construction on the slope where disturbance would occur or surcharge loading would occur. In the case of site development, all stormwater will be collected above these areas, so this could actually increase the slope stability. We have recommended a 30-foot setback from the steep slopes, which would also avoid construction disturbance and loading. The buildings have all been located outside of this setback with the exception of Alterative 1A through 1C. Occasional road sections are located within the setback. In the case where construction occurs within the setback area, other mitigation strategies are appropriate as discussed in the technical report.
- Are there long term risks to developing on "highly weatherable" sandstone?
    - Not at this site in our opinion. Highly erodable sandstone generally has a slower erosion rate than soils.
    - In the natural condition, steep exposures of poorly indurated sandstone are subject to erosion/retreat as a result of freeze-thaw actions. This site does not have significant bedrock exposures. Adversely bedded rock slopes "retreat" more quickly as a result of localized failures, such as along Chuckanut Drive and the Interstate 5 corridor north of Lake Samish. However, no evidence of adverse bedding or historical rock slide events was observed at this site.
    - No grading will occur along the rock slopes, with the possible exception of some excavations for structures or a retaining wall for a roadway. Some blasting could occur and expose bedrock. However, any bedrock exposures at this site after development would be flat to create a stable platform for construction and therefore not subject to erosion.

Blasting:

The report indicates that blasting can be accomplished "without significant adverse on-site or off-site impacts" (Section 3.1.3.5).

- How and where would blasting occur?
    - The only area envisioned to have blasting for all alternatives is the bedrock knoll in the north section of the site, with TP-6 located at the top.
- Does the blasting vary for alternatives?
    - Not significantly. The grading for each alternative requires lowering this knob for all alternatives. Some alternatives would require individual blasting for each building to achieve finished floor in that area.
- What is frequency and duration of blasting?
    - The design team does not dictate blasting means and methods. This is left up to the blasting contractor. However, as stated in the technical report, specific recommendations will be included in the design level geotechnical report once an alternative is selected.
    - We have been involved in several blasting projects within the City of Bellingham and City of Anacortes. Because of the high liability, the contractors and procedures are regulated by state and federal regulations. We have provided typical blasting considerations in our revised technical report in Section 3.1.3.5.
- How were soils determined not to be saturated in the summer months?
    - This is described now in the affected environment. The seasonally perched groundwater is only the upper few feet of the site soils. We completed explorations at the site in the summer and confirmed this to be the case at the site.
- Critical limit to the vibrations or lateral forces that would be considered dangerous on these slopes?
    - Vibration limits are stated in federal regulations. The limit of vibration is that which would damage sheetrock in a house, and is in Section 3.1.3.5. This is much lower than would be expected to damage the bedrock integrity at the site.

- Do any potential methods of blasting carry greater risk?
  - The method is drilling and blasting. The primary risk is a contractor not being careful and using charges that are too big. In years past without regulation, flyrock would go long distances from the blast site and the vibrations were more significant. Because of regulations and liability associated with blasting, the blasting contractors are much more professional and is much more carefully planned. The contractor will submit their blasting plan in advance of any drilling at the site.
- Would alternatives that involved blasting and regrading of the hilltops reduce the risk of slides by removing unstable and over-steepened slopes?
  - No. Assuming the blasting at the subject knob goes to approximately Elevation 230, it would not remove any of the slope material that is oversteepened.

Erosion Hazards:

- CAO uses 30% slopes for erosion, report says 15% in some other areas. What is the difference? A map appropriate?
  - The COB CAO uses 30% slopes for erosion. Many CAOs use the SCS maps. The SCS maps use 15% for some soils.
  - As we discussed earlier, much of this site has some slope to it and most of the soils will have a high susceptibility to disturbance because of the silt content of glacial soils. This is not really much different than most sloping sites in Puget Sound.
- Description of impacts of alternatives.
  - Generally speaking, the impact on erosion is directly proportionate to the amount of grading and land disturbance. We have provided some additional elaboration in the technical report text.
- 2005 Stormwater Manual
  - The stormwater report prepared by the civil engineer addresses this. Infiltration, dispersion, stormwater ponds, energy dissipators at discharge points are some of the techniques being used. Stormwater conveyance pipes along slopes could be butt-welded HDPE pipes installed at the surface, which would avoid excavation. Some discussion of stormwater management procedures are in Section 3.1.3.2 of the technical report.
- Further clarify any distinctions or erosion potential with the alternatives.
  - Addition information in impacts section of report (Sections 3.1.3.1 and the Alternatives sections).
- Is there no risk of erosion, siltation and sedimentation to on- and off-site wetlands assuming the use of BMPs?
  - BMPs will be incorporated into any construction plans. During construction, the contractor would be subject to Ecology regulations which requires performance based testing of turbidity at all discharge points. So while it is impossible to say there is no risk of erosion, siltation and sedimentation during construction, proper construction practices and monitoring procedures will manage the risks to the standard of practice.
  - In the built out situation, the designs should include BMPs and standard engineering practices to manage the risks to the standard or practice. For example, the dispersion systems above the wetlands will go through a forested buffer before getting to the wetlands to (a) slow the water (b) obtain typical nourishment from the forest duff and (c) infiltrate to keep the typical perched groundwater condition that occurs naturally. Stormwater vaults and ponds are included for settling purposes, energy dissipators will be included at all discharge points.
- Construction of walls directly above slopes. What are potential erosion impacts, additional mitigation required?
  - The only on-site walls for roads envisioned in any of the alternatives are those that show roads in the northeast corner of the site. It would be necessary to create a flat bench in the bedrock to safely construct the wall or any other structure. Disturbance would be avoided

below the wall. During construction, temporary erosion control procedures would be used per the TESCP. After construction, surface water would be captured at the road. If any denuded slopes are exposed, erosion protection would be required in accordance with the geotechnical report, which might include rolled erosion control products (RECPs).

- What are potential impacts from overexcavation area north of Wetland HH?
  - The overexcavation that would be required for structures in this area would just be vertical excavations for foundations and not represent an erosion problem.
- Would stormwater ponds shown in slope areas of Alternatives 1A, 1B, and 1C increase potential erosion impacts?
  - Yes. These ponds would require construction of access roads and create significant disturbance for conveyance pipes, equipment to get to the pond locations, and construction of the ponds. Therefore, these ponds would not likely be built. These alternatives would be redesigned, likely to include stormwater vaults in the upland areas, possibly some other stormwater techniques as previously described, and then use above ground HDPE pipes along slopes where they are necessary.

Seismic Related Impacts:

- Describe the impacts of potential failures associated with seismic shaking.
  - The impact is discussed in Section 3.1.3.1 of the technical report. The failures would likely be limited to the thin overburden soils over the bedrock on the northern over-steepened slopes previously described. High risk time is during the winter when the overburden soils are saturated, and then seismic shaking further reduces the safety factor.
- Indicate whether any alternatives pose a greater risk of damage due to seismic failures, and explain any appropriate mitigation strategies.
  - This discussion is included in the revised Alternatives section of the report. With the exception of Alternatives 1A through 1C, infrastructure and buildings are behind a setback of 30 feet. Therefore, there is no greater risk. However, since 1A and 1C site plans were prepared in prior to performing geotechnical studies, these site plans have some buildings out into steep areas. Some mitigation will be required as discussed in the technical report (Section 3.1.5.1).

Climate Change:

The scientific data and modeling is insufficient at the present time to make rational or defensible predictions regarding climate change. There is some preliminary agreement that the weather will likely be more unpredictable and that storm intensities may be increasing. However, there is no basis for incorporating quantitative considerations into site planning at this time.

MITIGATION

Landslide Hazards:

- What are the potential engineering stabilization measures that will be utilized in high risk areas?
  - The preferred action is avoidance. Most of the alternatives have avoided even the setback area established for the high risk landslide areas, with the exceptions of isolated occurrences and Alternatives 1A through 1C. Further discussion for these alternatives are in Sections 3.1.5 and 3.1.6 in the revised technical report. Site specific engineering recommendations are appropriate during design and/or construction. The types of stabilization measures could include excavation deeper into the rock with horizontal benches, rock bolts and/or shotcrete.
- Where are the areas where setbacks are not adhered to and what mitigation measures will be necessary?
  - These are addressed in the discussion of the individual alternatives, for Alternative 1A through 1C (Section 3.1.5).

- Some isolated roads encroach into the setback area, which are still stable areas. Mitigation includes horizontal benches into dense glacial soils and bedrock, and possibly the use of retaining walls.

- What BMPs might be necessary for walls adjacent to steep slopes?
  - This has been addressed in the revised technical report (Section 3.1.3.1). It is expected that creating flat benches into competent rock to construct the walls will be adequate.
- What specific additional mitigation measures are necessary for Alternatives 1A through 1C?
  - This has been addressed more broadly in the revised technical report in Sections 3.1.5 and 3.1.6. Since this plan was prepared prior to geotechnical input, the building locations are not preferred. Absent avoidance, significant engineering study and mitigation strategies would be necessary. The mitigation measures likely include excavation into the bedrock, or drilling rock bolts into the bedrock to provide stabilized grade beams for building support.

Blasting:
The blasting considerations are further described in the "Impacts" section of this memorandum and in the technical report in Section 3.1.3.5. No specific mitigations are required for blasting, other than accomplishing the blasting in accordance with local, state and federal regulations, preparing a blasting plan, and then a monitoring program during blasting. In the revised technical report, we have stated that the blasting should occur in the late spring through early fall months (May through September) to avoid blasting during winter seasonally perched groundwater.

Erosion Hazards:
The site does have glacial soils that are highly susceptible to erosion during construction and afterward until stabilized. However, this is typical of many if not most sites in the Puget Sound Basin. It is our opinion that the site does not have extraordinarily sensitive areas such that additional mitigation measures above the minimum should be considered to minimize impacts. The current regulatory standards during construction are performance based with monitoring and punitive monetary fines when exceedences occur, which has been reasonably successful in controlling erosion and sedimentation.

Climate Change:
As previously discussed, there is insufficient scientific basis to provide any specific conclusions regarding impacts and mitigations. This site does not have extraordinarily sensitive areas that we expect would have significant potential impacts based on the current body of knowledge (like shorelines subject to sea level rise).

ALTERNATIVE ANALYSIS

- Impacts for Alternative 1A-1C must identify potential impacts as currently designed, regardless that we have stated that some redesign would likely be done. In particular, some buildings are located within the slope setback and steep slope area.
  - Further elaboration of impacts and potential mitigation strategies are included in Section 3.1.6.1 and 3.1.6.2 of the revised technical report.
  - Some roads might be close to steep slopes. As stated several times in the technical report, the impact can be mitigated by creating a flat bench into the bedrock or dense glacial soils, possibly using a retaining wall to limit fill downslope.
- Provide cut and fill estimates for all alternatives, or relative quantities.
  - The civil engineer has provided some quantity estimates as discussed in Section 3.1.3.4.
- What is the predicted worst scenario impact of the 24th Street corridor?
  - The potential impact of this off-site corridor is discussed in section 3.1.6.2 of the revised technical report.