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From: Planning & Development Services Department
District of Peachland

RE: **District of Peachland Hillside Development and Management Guidelines**

Date: February 19, 2009

Golder Associates Ltd. (Golder) was contracted by the Planning & Development Services Department (the Department) of the District of Peachland (DOP) to complete a hillside development study. Results of the study have been provided by Golder to the DOP during a series of meetings and during a presentation given during a planning discussion group hosted by DOP. The Department has reviewed the study and we are pleased with the innovative approach that was adopted. As a next step, it is our job is to take the information presented and to translate it into a planning approach for the management and regulation of hillsides. With that in mind, we suggest that there be a clearly defined approach to considering hillside development.

It is apparent that the greater the slope involved in land development, the greater are the issues and challenges facing a developer. Such issues include developing the site safely, engineering it appropriately and designing it in an acceptable manner from a planning perspective. Issues and challenges facing development in hillside areas include:

- Slope stability
- Cumulative effect of increasing development
- Impact of development on neighbouring properties
- Geotechnical hazards (e.g. rockfall and landslide hazard)
- Hydrogeological and groundwater related issues
- Potential costs and regulatory limitations on hazard mitigation
- Site grading and preparation which result in an unnatural looking hillside

It is important for development to comply with the DOP's Official Community Plan provisions which state, "that modification of the natural terrain is to be minimized" (p.-28) and "protect to the greatest extent possible the natural vegetation on the site" (p.-74).

It is the opinion of the Department that the District of Peachland should safeguard future hillside development by adhering to the following guidelines:

Slope Investigation

1. The existing approach for the management of hillside development needs to be more comprehensive and easier for the public and developers to understand. A wide area perspective is required where the entire hillside area (and not just individual lots) are looked at in the analysis process.
2. A Basic Investigation Review Process for Hillside Developments should be employed to provide a more reliable method to identify geotechnical hazards and to protect against damages and / or nuisance to persons and property. The degree of investigation intensity shall be determined by the District of Peachland based upon the methodology developed during the Golder study, which outlines 5 categories of investigation (G1 to G5).
3. Where the level of investigation warrants, a combined Hydrogeological and Geotechnical assessment completed by qualified professionals should be required.

Information Requirements for Slope Investigation

1. The estimated annual probability of occurrence should be clearly stated for each type and location of geotechnical hazard that may affect a proposed development site and the immediately adjacent properties. The annual probability of occurrence corresponding to “safe” or “developable” area should be clearly stated.
2. The proposed level and distribution of development in the proposed development area should be shown on base maps identifying lands that are “safe” or “developable” from a Geotechnical and hydro-geological perspective.
3. There is a possibility that on-site activities such as placement of fill or disposal of storm water to ground could lead to landslides that could affect areas outside of the study area. For this reason, on-site flow variations related to seasonal flow should be assessed for potential negative off-site effects.
4. Potential costs and regulatory limitations of hazard mitigation approaches should be discussed and evaluated as part of the report.

Monitoring

1. Larger or more complex developments should be required to monitor water levels at down gradient limits of the development until full build out. Monitoring of water levels should include both pre and post development water levels. The monitoring should include a review of retaining walls, water levels and indicators of slope stability.

2. Monitoring done by accredited professionals as part of standard Development Permit requirements should be coordinated so as to ensure there is no conflicting information between the applicable disciplines (ie, Geotechnical, Hydrogeological, Environmental, Engineering Design including drainage, Wildfire Protection).

Guidelines for Subdivision

1. A recommendation for defining steep slope is any land that has a slope angle of 20% or greater for a minimum horizontal distance of 10 metres. The definition will apply to all properties which are 0.5 hectares or greater in size, and where 10% or greater of the parent property contains slope of more than 20%.
2. Subdivision and site design should respond to the unique circumstances of each site, avoiding significant disruption of the natural terrain (tree cover and natural vegetation) as much as possible.
3. Development should be prohibited where the natural slope of the site is greater than 30%.
4. Preferred development on steeper sloped areas between 20% and 30% require a Development Permit. When calculating lot area for proposed single family subdivisions, such calculations should be exclusive of any slope greater than 30%.
5. In areas where the natural slope is greater than 20% (i.e. where a Development Permit is required) limitations should be placed on site grading and preparation such that the natural vegetation on the site should be retained to the maximum extent possible.”
6. Each parcel created by subdivision must have a buildable site with a building envelope on a subdivision grading plan. The building envelop should be located on land having a slope of less than 30%.
7. Subdivision development plans should provide contoured grading base mapping along with setbacks, driveways and building pads.
8. Natural open space development is more appropriate for environmentally or geotechnically sensitive parts of the hillside. Public dedication of these lands is preferred but other considerations might be a land trust or “no-build – no disturb covenants” required on these lands.
9. The following information shall be provided as part of the application process, associated with Geotechnical and Hydrogeological review:
 - General Site Survey
 - Land clearing and Tree Retention and Removal Plans should be required as part of the application process.

- Grading Plan (pre and post development conditions shown)
- Drainage Management Plan
- Erosion Control Plan
- Environmental Assessment
- Urban Wildfire Protection Plan

A Development Review matrix is established in Figure 1 to indicate the level of detail suggested for each application.

Subdivision and Development Services Bylaw and Related Issues

A new Bylaw needs to be completed by the District. Straight lines and rectilinear shapes do not compliment the natural terrain and they often result in greater modification of the hillside. The layout of roads and lots might best be done in a pattern offering a variety of sizes and configurations that compliment the topography and features of the site.

1. Grading – A grading plan should indicate the feasibility for roads and building envelope. The following should be considered:
 - Avoid grading or altering key topographic features (eg, knolls ridgelines, rock outcrops, cliffs, ravines, etc.)
 - Avoid manufactured appearance for graded slopes. Avoid sharp cuts and long or wide slopes with uniform grade.
 - Establish contours and gradients that resemble naturally occurring terrain. Round out slope transitions and blend transitions between lots or adjacent to undisturbed areas.
 - Refrain from grading large flat terraces on hillside sites in order to expand the developable area or to develop housing or other uses characteristic of flat or gently sloped sites.

2. Cut and Fill – Minimize the total amount of cut and/or fill and its environment and visual impact when designing and developing a site by:
 - Where the volume of cut exceeds the volume of fill material for a development being proposed, do not dispose of it on site in the form of unnecessary filling, berming or side-casting. Dispose of excess material at appropriate off-site locations.
 - Revegetate exposed slopes as quickly as possible to prevent erosion or slope stability.

3. Earthworks – An erosion plan is essential for development on hillsides and the following must be considered:

- Potentially hazardous or unstable areas of the site must be avoided.
 - No more trees or vegetation should be cleared than is necessary to install services for any given phase of development.
 - Do not create deep scars or expose large areas of highly visible sub-soil and material on the proposed development site.
 - Avoid side-casting of material along undeveloped road frontages.
 - Excavations and the placement of fill that result in terrain forms that are not characteristic of the natural topography should be avoided.
4. Retaining Walls - can be used to reduce disturbing the slope to provide useable construction sites. This should be the rational provided in the landscaping plans for a proposed development.
- Retaining walls should respect the natural character of the site and not be dominating or fortress-like.
 - Retaining wall height should be limited to a maximum of 3.0 metres for roads and 1.5 metres for other areas. Higher walls should only be considered for a marginal increment (+20%), where they are articulated, have a surface texture / pattern, or where sufficient landscaping is provided at its base.
 - Smaller stepped retaining walls and not a large uniform wall should be employed. The height and depth of the wall steps should be consistent with the natural terrain or with the slope above and below the walls. For stepped retaining wall systems, the intermediate terraces should be landscaped.
 - Where a retaining wall is part of the structural integrity of the building, it will be necessary to address the retaining wall through the building permit process.
5. Storm water Management is necessary for assessment, collection, conveyance and control of storm water that will mitigate potential impacts on and downstream of steep slopes. Drainage must be limited for new development according to the capacity and sensitivity of downstream watercourse systems, which is particularly pertinent to steep slope situations.
- Drainage planning must indicate how storm water runoff will be impacted by the development and how these impacts will be mitigated.
 - A Drainage Management Plan may be required for the entire site and downstream drainage areas. For steep slope situations, special attention must be paid to:
 - a) Hydrological conditions prior to and after development.
 - b) Protection of natural flow paths, volumes and storage resources.

- c) Impacts of trees, vegetation and other environmental features due to changes in drainage patterns.
 - d) Storm water and ground water quality prior to, during and after development.
 - e) Sediment and erosion control; and,
 - f) On and off-site impacts (eg, drainage from an upper lot to a lower lot).
6. Road Design and Development – Cut, fills and retaining walls associated with attempting to develop a flat land road standard may have a detrimental effect when applied to hillside development.
- Greater Flexibility Required - Flexible road layout patterns and road widths that compliment the hillside character should be pursued in harmony with an effort to compliment positive environmental management and visual quality objectives.
 - A road hierarchy should provide local roads connecting to collector roads and following the topography as much as possible.
 - Grid-like streets and major collector roads that do not adapt well to steep slopes must be avoided. Align roads to conform to natural topography. Gentle horizontal and vertical curves are preferable to straight line grid patterns that require significant earthmoving, or create exceptionally steep grades.
 - Local roads should be kept to minimum scale and be oriented to local resident / pedestrian use.
 - One-way roads may be utilized on a site specific basis where they reduce site disturbance significantly, where through traffic can continue to a conventional road connection and where pedestrian and traffic safety is maintained. [In these situations road widths could have a minimum of 6 metres and a minimum right of way of 9 metres – but these roads should not exceed 200 metres in length to the nearest cross road]
 - Where cul de sacs are contemplated, pedestrian connections linking the cul de sacs to other streets and open spaces should be incorporated.
 - Designs providing reduced cul de sac radii or hammerhead configurations may be considered where:
 - a) there is a lack of sufficient land for a cul de sac or very steep slopes which require excessive filling and cutting.
 - b) The road is less than 100 metres in length; or,
 - c) The road end accommodates the turning of service or emergency vehicles.

- Reduced road widths (i.e., 8.5 metres) should be considered on steep slopes where:
 - a) Slope disturbance is significantly reduced and/or special features or habitats are protected.
 - b) Parking requirements can be met on-site rather than on the road.
 - c) Public safety is maintained; and,
 - d) Access for maintenance and emergency vehicles is assured.
- Associated with road widths, right of way may be considered where grading for the full width will significantly impact topography or natural features.
- Strata development should be considered where access to a particular site by public or municipal vehicles is too challenging or difficult.
- Sidewalks should be considered for one side of the road only, where the pre-development cross slope on the road right of way exceeds 20% as long as pedestrian safety is not compromised by the exclusion of the second sidewalk (such as roads within 0.5 metres of a school).
- Curvilinear or meandering sidewalks should be considered where they eliminate long sustained grades and varying offsets between the road and the sidewalk may also be considered where it may save a significant feature or reduce grading requirements.
- Design speeds of less than 50 km/h should be considered on local roads or local connectors on steep slopes. This may allow roads to be more responsive to topographical conditions and significantly grading requirements and the need for cut and fill sections.
- Stopping distance at intersections should not be negatively affected. Lower grade access for future development on adjacent parcels should be encouraged.
- Individual driveways pose huge challenges on steep slopes including significant elevation difference, short travel distance, or tight corners; limited parking capability; limited visibility at the road; difficult access in winter conditions; and space for residential pick-up and delivery. Driveways should:
 - a) Have a grade of not more than 20%.
 - b) Where driveways exist having a grade of more than 20%, there should be 2 readily accessible off-road parking stalls on the property.
 - c) On downslope parcels, the driveway grade on the first 3.5 metres from the property line cannot be greater than 7%.

- d) Access by emergency vehicles should be taken into account when designing driveways.
- Common or Shared Driveways should be encouraged when:
 - a) Significant grading can be reduced.
 - b) The grade of the driveway is not greater than 14%.
 - c) There should be a limit to the number of development units sharing these driveways (current number is 3).
 - d) One guest parking space shall be provided per development for each development unit.
 - e) A “Reciprocal Access and Maintenance Agreement” is required between property owners.
 - f) There should be design provision for common garbage and recycling pick-up and postal delivery including provision for a service vehicle to pull over off the street.

Municipal Services

1. Aside from slope stability considerations, municipal services and utilities provided to steep slope developments should have the least environmental and visual impact, meet service requirements and minimize redundancy, capital costs and ongoing maintenance costs.
2. All new development proposals should provide an Engineering Design Brief. Associated with describing infrastructure requirements for new development, storm water / drainage requirements, road development and water and sanitary sewer designs need to be reviewed in conjunction with Geotechnical and Hydrogeological reviews.
3. All services and utilities are to be installed underground as part of Municipal requirements.
4. Where practical and where permitted, more than one service should be installed in a common trench to reduce the number of trench excavations and on the impact on the terrain.
5. Water service valves and meter boxes should be designed with flexible offsets to property lines to maintain ease of access and maintenance.
6. Water system pressure zone boundaries should be designed to ensure fire fighting pressures in the highest side of parcels.

Utilities

Any major infrastructure requirements such as new transmission lines, transformers, telephone switching facilities, primary gas mains or pumping stations should be identified and located early as part of the planning and design process.

1. Install power, telephone and cablevision in a common trench where practical and permitted. Installation of these services under sidewalks is encouraged where it can reduce the effective right of way required on a steep slope.
2. Another approach, if no sidewalks are provided, could be to install utilities on the upper side of a right of way to a deeper standard, allowing the slope to grade upward from the back of the curb within the road right of way. Utility service and transformer boxes which need to be at road grade would require suitable grading and retaining structures. *The net effect can significantly decrease earthworks volumes and grading required to install a road into the steep slope.*
3. Locate access to utility boxes, fire hydrants, and other services that require periodic inspection in areas where slopes do not exceed 15%. These should be clearly visible from the road.
4. Where possible, hydrants and access behind lots that back on forested areas should be provided where vegetation can be a potential hazard.

Building Design on Hillsides

1. Steep Slope Development Permit Areas should contain enhanced articulation to encourage form and character design in new developments which is compatible with the natural terrain including:
 - a) Housing Design – a building should be designed for the physical and visual context of the site and not simply the use of template house plans. Many designs assume flat sites and they are not appropriate for sloped sites. Custom house plans may cost more, but may save money in the long run in requiring less site manipulation.
 - b) Roof Form and Pitch – these should reflect the slope of the natural terrain, with roof pitches approximately the same or slightly less than the natural slope.
 - c) Decks and Terraces – Avoid long, continuous decks, especially when supported by cantilevered or supported by tall poles or columns. Limit the decks that are cantilevered and stepped decks or several smaller decks as opposed to one large one.
 - d) Garages – these can dominate the appearance of the house and detract from the character of the site. Detached garages can reduce the impact on slope. When attached, try setting the garages slightly back from the house. For multi-family dwellings, either put the parking under the building or for parking not under the

building, use arbours, trellises and landscaping to help screen the views of parking lots from the street or slope.

- e) Building Materials – use materials, colors and textures that reflect the natural setting and landscape of the hillside setting. Smooth, shiny, reflective surfaces or bright colors for building walls will clash with the slope.
- f) Landscaping – use natural species and/or species appropriate for steep terrain. Species which minimize water use, including xeriscape are encouraged.

Approving Officer and Subdivision Approval

1. The approving officer when reviewing hillside subdivisions shall utilize the aforementioned criteria in any decision rendered.

Mapping and Information Inventory

1. A GIS system has been compiled by Golder on behalf of the District of Peachland, documenting predevelopment or baseline conditions, including topography, soil and terrain information, as well as groundwater conditions. As new subsurface information is received, the database and the maps should be updated on a regular basis.
2. The GIS files should be used for other area-wide applications relating to water, such as quantification of irrigation return flow, water source protection and drought management.

District of Peachland - Summary of Application Review Process

Development Process	Required Assessment and Plans for Review							
	General Site Survey	Geotechnical Assessment	Environmental Assessment	Clearing, Tree Retention, or Removal Plan	Pre and Post Development Grading Plan	Drainage Management Plan	Erosion Control Plan	Urban Wildfire Protection Plan
1 OCP or ASP Amendment	Y	Y (general)	Y (general)	Y (general)	Y (general)	Y (general)	Y (general)	Y (general)
2 Zoning Amendment	Y	Y (detailed)	Y	Y (general)	Y (general)	Y (general)	Y (general)	Y (general)
3 Development Permit	Y	Y (detailed)	Y	Y (detailed)	Y (detailed)	Y (detailed)	Y (detailed)	Y (detailed)
4 Subdivision	Y	Y (detailed)	Y	Y (detailed)	Y (detailed)	Y (detailed)	Y (detailed)	Y (detailed)
5 Building Permit	Y	Y (site specific)	N	Y (site specific)	Y (site specific)	Y (site specific)	Y (site specific)	Y (detailed)

Notes:

- (1) Where a detailed report is required at earlier stages in the process, the same report can be used again to satisfy requirements at subsequent later stages of the process
- (2) Applicant is responsible for coordination of all analysis and reporting
- (3) Where site-specific detail indicated, the level of effort will be based on site conditions and/or unique circumstances of the application as agreed between the Applicant and the Building Inspector

Figure 1. Development Review Matrix.