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BC Ministry of Environment
Environmental Assessment Office
PO Box 9426 STN PROV GOVT
Victoria, BC
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Attn: Mr. Derek Griffin, Acting Associate Deputy Minister and Project
Assessment Director, Sechelt Carbonate Project

and Ms. Karen Christie, Project Assessment Manager, Sechelt Carbonate
Project

Dear Mr. Griffin and Ms. Christie:

The purpose of this letter is to present our observations on karst resources in the Sechelt Carbonate Project Area (northern site) based on cursory August 1-2, 2007 site visits. These site visits were made at the request of two community groups, Friends of the Sechelt Peninsula and Save Our Sunshine Coast.

Recommendations are also made to help ensure the karst resources in the project area are properly considered and protected. It is our professional opinion that the nature of the karst in the project area justifies a dedicated evaluation. For some years now, karst evaluations have been undertaken prior to harvest operations on Crown forest lands in BC. They have also been requested by government for selected reviewable wind and hydroelectric energy projects on Vancouver Island.

Briefly, the site visits allowed us to confirm the presence of karst landscapes and discrete karst resource features within this particular project area. While a more definitive statement on significance must necessarily follow a karst inventory and assessment, there is little doubt in our minds that this karst site is a unique and unusual occurrence for the southern Mainland Coast. At a minimum, it appears to be an important element of biological and geological diversity for the region.

Karst is a three-dimensional soluble rock landscape hosting a distinctive mixed-media ecosystem. The surface and subsurface components of karst ecosystems are fragile, interconnected, and dependent upon the maintenance of a delicate balance between hydrology, climate, soils and vegetation. Biodiversity of karst ecosystems can be highly restrictive. The environmental linkages are covered extensively in BC government web sites and assorted publications. Beyond their natural attributes, karst ecosystems and specific karst resource features can have considerable historical, cultural, aesthetic, scientific and educational value. It is our experience that the surface and subsurface karst landscape elements on the BC coast may often hold particular spiritual, ceremonial and other cultural value to First Nations.

Determining the significance of karst features using the *Karst Inventory Standards and Vulnerability Assessment Procedures for British Columbia* (KISVAP) requires a qualitative evaluation of a number of criteria. These criteria include: dimensional characteristics; connectivity; hydrology; geological values; biological values; scientific and educational values; archaeological, cultural, and historical values; recreational and commercial values; rarity and abundance; and visual quality. Many of these criteria are interrelated and dependent on each other.

During our site visits we observed specific and discrete karst features in the project area including uncovered rundkarren, grikes, sinkholes, karst cavities (including suspected caves) and possible karst springs. We also observed that karst waters might be contributing to nearby wetland and small lake complexes through karst springs and other emergences. In one instance, an apparent spring discharge with a specific conductance of 171 microSiemens (August 2, 2007) runs over a recently built or upgraded road and towards one of the wetland areas.

The interpretation of carbonate geology and karstification in the project area is complicated by metamorphism and dolomitization processes, and juxtaposition of the carbonates with other rock types. The mixed geology contributes to the unique character of this karst occurrence, as does the relationship to the complexes of wetlands and small lakes, and remnants of old-growth forest that contain some very old cypress and hemlock trees.

Following the provincial protocol, the KISVAP vulnerability rating of the karst terrain within the project area appears to range from low and moderate, to high or possibly very high in some localized areas. The four-step KISVAP vulnerability assessment procedure is a systematic method for determining a vulnerability rating for a karst polygon using three major criteria: epikarst sensitivity, surface karst sensitivity, and subsurface karst potential. The procedure also allows for the integration of three modifying factors: fine-textured, erodible soils; karst

roughness; and unique or unusual karst flora/fauna sites. The examples of high or very high vulnerability karst terrain exhibit a slightly higher level of epikarst development, thinner soils, and a greater density of surface karst features.

Much of the project area appears to have been harvested for timber some decades ago. The antecedent harvesting impacts to the karst resources include infilling above natural rates of some of the sinkholes and small-scale negative relief features with coarse woody debris and other logging residue. No karst restoration or rehabilitation activities appear to have been undertaken following the historical timber harvesting. We observed unambiguous examples of adverse effects or impacts resulting from the mineral exploration activities to date, including roadbuilding, exhumation of karst surfaces through vegetation and regolith removal, physical destruction of karst surfaces, drilling and coring, and slash piling.

As much of the karst is without doubt in conflict with the mineral exploration activities and proposed quarrying, we are of the opinion that a thorough evaluation or study of the karst in the project area is required in order to adequately protect the karst resources. The inventory and assessment of karst in the project area is of considerable importance to sustainable management of karst as an environmentally sensitive resource. This precautionary karst evaluation should be conducted with due rigour, following the principles and procedures outlined in the KISVAP document including for the total karst catchment approach. The catchment approach to a karst evaluation is necessary to ensure a fuller understanding of the relationship between the karst recharge areas and the adjacent complex of wetlands and small lakes.

The potential effects and impacts of quarrying operations in the project area start with deforestation of the karst surface. Forest cover plays an essential role in the natural karst solution process. Its removal results in loss of biota, reduced evapotranspiration, soil degradation and erosion, sedimentation of fissures, conduits and other karst cavities, and water quality deterioration. These effects in turn can lead to an impoverished ecology and karst ecosystem degradation. The production phase of a quarry project can also involve rock and mineral removal, noise and vibration due to drilling or blasting, increased sediment discharge, and wastewater discharge. Quarry development can result in the destruction of karst landforms and associated elements of geodiversity, collapse and general ecosystem degradation. In addition, there are implications for downstream hydrology and aquatic communities.

Significant concerns were raised in our minds about the instances of karst damage already caused by the mineral exploration and past timber harvesting activities in the project area. A globally recognized principle of karst protection developed for

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the IUCN with input from Canada no less, holds that notwithstanding the nonrenewable nature of many karst features, good management demands that damaged features be restored as far as is practicable. Accordingly, we urge the restoration of the damaged and degraded karst landscapes in the project area to the extent practicable. This action will require careful planning and consultation with qualified karst specialists.

My qualifications for writing on this subject are well known to BC government agencies with a mandate to protect and manage karst resources on Crown land. My profession is inherently multidisciplinary, incorporating aspects of geology, hydrology, chemistry, ecology, biology, geography and speleology - among other fields of study. Understanding how these facets act together in surface and subsurface karst environments, and how varied land use activities can affect karst systems, processes and values, is my area of expertise. My experience includes more than 30 years of experience investigating and documenting impacts of industrial activities on karst resources in BC and abroad. In addition, I have carried out karst evaluations for reviewable projects in BC and overseen the cleaning up of mineral exploration sites in conflict with karst.

Carol Ramsey who is also a karst specialist accompanied me to the site. Ms. Ramsey has participated in numerous karst field assessment projects in BC and has considerable experience in applying the karst vulnerability assessment procedure as detailed in the *Karst Inventory Standards and Vulnerability Assessment Procedures for British Columbia* (KISVAP).

If I can clarify or amplify on any aspect of this letter, please do not hesitate to call me.

Yours truly,



Paul Griffiths

Selected photographs attached

Selected Photos - Sechelt Carbonate Project - Karst
to accompany August 7, 2007 letter



Image 6644 Uncovered rundkarren



Image 6523 Karst cavity



Image 6518 Complex of wetlands and small lakes



Image 6582 Roadbuilding



Image 6545 Exhumation of karst surfaces through vegetation and regolith removal



Image 6583 Physical destruction of karst surfaces



Image 6661 Drilling and coring



Image 6629 Slash piling