General Disclaimer

The use of trade, firm, or corporation names in this publication is for the information and convenience of the reader. Such use does not constitute an official endorsement or approval by the Government of British Columbia of any product or service to the exclusion of any others that may also be suitable. Contents of this report are presented as information only. Funding assistance does not imply endorsement of any statements or information contained herein by the Government of British Columbia. Uniform Resource Locators (URLs), addresses, and contact information contained in this document are current at the time of printing unless otherwise noted.

Disclaimer of Liability

With respect to documents available from this server, neither the Government of British Columbia nor any of their employees, makes any warranty, express or implied, including the warranties of merchantability and fitness for a particular purpose, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights.

WATERSHED ASSESSMENT (CWAP) FOR PRIEST LAKE, TEXADA ISLAND, BC

0801-00-81528

October, 2000

EBA Engineering Consultants Ltd.

WATERSHED ASSESSMENT (CWAP) FOR PRIEST LAKE, TEXADA ISLAND, BC

FINAL REPORT

Prepared by:

EBA ENGINEERING CONSULTANTS LTD.
Vancouver, B.C.

Submitted To:

MINISTRY OF FORESTS, SUNSHINE COAST FOREST DISTRICT
Powell River, B.C.

Project No. 0801-00-81528

October, 2000

Sun Life Plaza, Suite 550, 1100 Melville Street, Vancouver, British Columbia V6E 4A6
Tel: (604) 685-0275 - Fax: (604) 684-6241 Internet: vancouver@eba.ca - Web Site: http//www.eba.ca

EXECUTIVE SUMMARY

EBA Engineering Consultants Ltd. (EBA) were retained by the Ministry of Forests, Sunshine Coast Forest District (MOF) to conduct a Coastal Watershed Assessment Procedure (CWAP) for the Priest Lake watershed (1131 ha). The watersheds provide domestic water and fire protection to approximately 200 properties in the Van Anda Community on Texada Island, BC.

The purpose of the WAP is to assess the cumulative effects of past forest practices on the watershed and to provide recommendations for further development based on the results of the assessment. The CWAP follows guidelines of the *Coastal Watershed Assessment Procedure Guidebook*, Second Edition, April 1999.

Based on the results of the watershed assessment, the hydrological risks of future harvesting and road construction are concluded as follows:

- there have been relatively few, and minor terrain stability and erosion hazards associated with the past development.
- the potential for changes in peak flows attributed to the proposed logging activities is low. Priest Lake, and other lakes in the watershed, will likely attenuate hydrologic changes in the watershed. Approximately 54 ha (4.7%) of the Priest Lake watershed is proposed for harvesting within the next 5 years.
- there is a low potential for landslides, stream channel disturbance, or riparian impact as proposed blocks in the Priest Lake watershed are situated on relatively stable terrain and maintain a treed buffer to streams. One cutblock, proposed on the north side of Priest Lake, is situated on fine-textured soils with a high erosion potential. The bottom boundary of the cutblock lies no less than 60 m upslope of Priest Lake on slopes of approximately 30%. The potential for sedimentation to the lake is considered to be relatively low.
- Priest Lake, the only developed source of drinking water for the Van Anda community, is most susceptible to changes in water quality. Parameters of concern are fecal coliform bacteria, total organic carbon, nutrients, phosphorous, and temperature.

Because a large proportion (39%) of the watershed is privately owned, much development is not regulated by the Forest Practices Code. Because of this, much responsibility for ensuring a clean and safe water supply lies with local land owners and developers. Recommendations for mitigating the hazard of impacting water characteristics in the community watersheds are summarized as follows:

Forest Harvesting

- forest harvest activities should consider the effect of harvesting on beaver activity, which may introduce coliform bacteria and may disrupt surface water drainage. As

beaver find deciduous tree species more palatable, harvested sites should be planted immediately with conifer tree species immediately after harvesting to discourage the colonization of disturbed sites by alder (deciduous) tree species. Selective removal of alder in the riparian reserve zone may enhance riparian function along streams that have been previously logged but care must be taken to ensure that stream shading is not significantly decreased.

- because the lake water supply systems are sensitive to algae blooms, special precautions should be undertaken to minimize the introduction of nutrients to streams. For example, fertilization activities should be limited to a slow-release variety and buffers should be maintained along streams, wetlands, and lakes.
- Priest Lake is sensitive to changes in temperature. To minimize the potential for summer temperature increases, streamside vegetation should be maintained within a reserve zone along all perennial tributary streams. The reserve zone width should also be assessed for windthrow hazard.

Roads

- as noted by the terrain mapping report, with the presence of extensive limestone deposits on Texada Island, there is the potential for the existence and development of karst and cave features (sinkholes, caves and underground drainage) that may pose safety risks and other problems during forest development. Underground cavities and channels may transport sediment directly into creeks. It is recommended that, if any karst or cave features are identified during construction, the extent of any sinkholes and potential road building and safety concerns are assessed.
- Where development is planned on areas mapped as having a high surface erosion potential, a detailed field assessment should verify site specific soil characteristics and provide detailed recommendations for harvesting or road building. It is recommended that soil disturbance be minimized by using compatible harvesting methods.
- To reduce the risk of introducing sediment to streams, activities on soils with a high soil surface erosion potential should be restricted to the dry season and follow rainfall shut-down guidelines during storms.

Water quality monitoring, undertaken by the Van Anda Improvement District, should continue at sites established at the water intake. Sampled parameters should include phosphate, dissolved phosphorous, nitrate, nitrite, conductivity, turbidity, total organic carbon, coliform bacteria (total and fecal), and temperature.

It is also recommended that an emergency response plan be developed in the event of a disturbance that is detrimental to the water supply. Contact names and numbers should be supplied to all contractors working in the watershed.

TABLE OF CONTENTS

Page

FIGURES

TABLES

APPENDICES

1.0 INTRODUCTION

1.1 Project Background and Rationale for Watershed Assessment

EBA Engineering Consultants Ltd. (EBA) were retained by the Ministry of Forests, Sunshine Coast Forest District (MOF) to conduct a Coastal Watershed Assessment Procedure (CWAP) for Priest Lake. The study area includes the area upstream from the community water intake (1131 ha), and is shown in Figure 1.1. Authorization to carry out this work was provided by Mr. Brian Kukulies of MOF on May 19, 2000.

Under the Forest Practices Code (FPC OPR 14(2)) a watershed assessment is required before a forest development plan is submitted for a community watershed.

1.2 Project Objectives

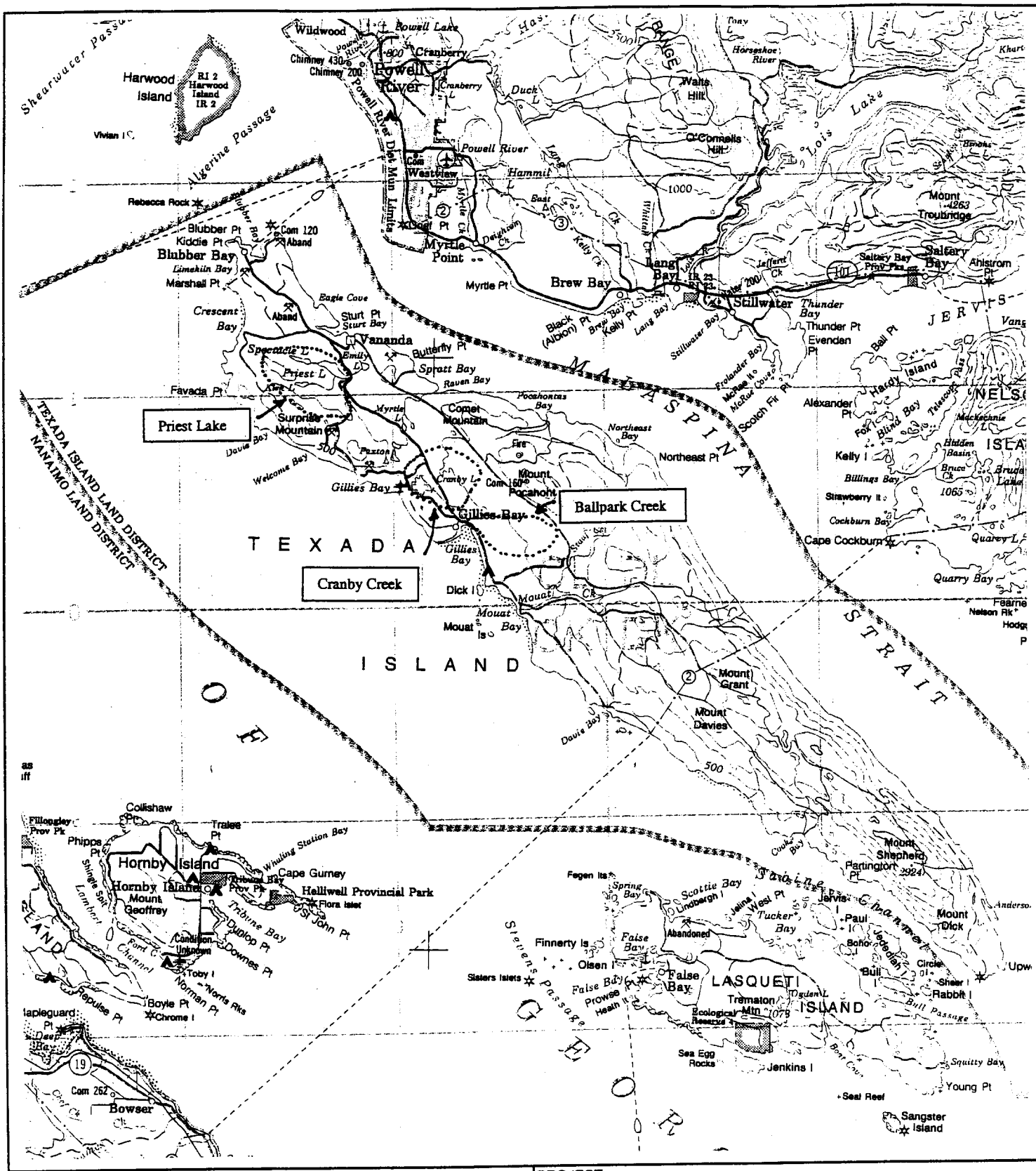
The purpose of the WAP is to assess the cumulative effects of past forest practices on the watershed and to provide recommendations for further development based on the results of the assessment. The specific objectives of the watershed assessment are to determine:

- the potential for changes in peak stream flows;
- the potential for accelerated landslide activity;
- the potential for accelerated surface erosion;
- channel bank erosion and changes to channel morphology as a result of logging the riparian vegetation;
- the potential for stream channel changes;
- the potential for changes in water quality; and,
- the interaction, and cumulative effect, of all of these processes, an evaluation of which indicates the sensitivity of the watershed to further forest development.

1.3 Water Supply Characteristics and Water Resource Concerns

The Van Anda Improvement District holds a water license on Priest Lake and is licensed to withdraw approximately 36.5 million gallons per year. A water license has been held on Priest Lake since 1947.

Currently Priest Lake is the only water source utilized by the Improvement District for domestic water and fire protection. The supply provides for approximately 200 properties, including 10 of a commercial/industrial nature. The single water intake on Priest Lake is enclosed in a well casing submerged approximately 12 feet, and situated approximately 12 feet off the lake bottom, at the east end of the lake (*WAC meeting notes, 2000).* Water is screened and treated with chlorine at the pump, is pumped to a storage tank, and is then gravity fed to users.



EBA Engineering Consultants Ltd.		PROJECT: Texada Island CWAPs	
CLIENT: **Ministry of Forests - Sunshine Coast FD**		TITLE: Location of the Study Area	
DATE: August, 2000	DWN.: JC	SCALE: 1:250,000	FILE NO.: 0801-00-81528	FIGURE 1.1

In addition to Priest Lake, there are water licenses on Kirk Lake. Residents outside the boundaries of the Improvement District frequently rely on groundwater sources such as springs, shallow, and deep wells for domestic water supply. One of the main areas on Texada Island where springs are licensed and developed for use is located south-east of Gillies Bay along School Road, in the Ballpark Creek watershed. Many of the wells, most of which are shallow (less than 15 m deep) and run dry in the summer low flow period.

An assessment and balance of water resources supply and demand on Texada Island was completed for a graduate thesis (Hay, 1985). In examining the water resource potential on Texada the research determined that, on an island-wide basis, water is abundant. Despite this, residents that rely on shallow wells, springs, or seasonal streams for water experience shortage during summer months. During the course of analysis it also became clear that land use threats to water quality exist.

Water quality parameters that are identified as a concern by the Van Anda Improvement District include:

- turbidity;
- temperature; and
- coliform bacteria.

Because the intake lies within a lake, nutrient levels are also a concern due to the risk of eutrophication.

1.4 Watershed Advisory Committee Consultation

A Watershed Advisory Committee (WAC), a group representing resource interests in the watershed, was assembled for the Priest Lake CWAP, and met on June 28, 2000 on Texada Island. Members included representatives of the Van Anda Improvement District, Ministry of Forests, Ministry of Environment, Lands and Parks, and a local logging contractor. The purpose of the meeting was to identify water resource issues and provide background information for the assessment.

A final WAC meeting was held on October 12, 2000 to discuss the results of a draft report. In a letter drafted by the Van Anda Improvement District, the following motions are summarized:

- no logging occur within the watershed at this time; and
- that the harvesting of a block adjacent to the north shoreline of Priest Lake, and a block at the head of Spectacle Lake not be logged at all for the foreseeable future.

A copy of the letter, dated October 19, 2000, is included in Appendix A of this report.

2.0 WATERSHED CHARACTERISTICS

2.1 General Physiography

The Priest Lake watershed (1131 ha) is located upslope from the community of Van Anda at the north end of Texada Island, which is situated off the Sunshine Coast near Powell River, BC (Figure 1.1). Priest Lake (Photo 1) flows north-east into Van Anda Creek, which flows into the Malaspina Strait. The small watershed has a low overall relief and is characterized by rolling topography. There are many small wetlands and lakes in the watershed, including Spectacle Lake and Kirk Lake.

2.2 Climate and Hydrology

The climate on Texada Island is characterized as warm and relatively dry in the summer and moist and mild in the winter with very little snow (Green and Klinka, 1994). Texada Island, specifically the northern half of the island, is generally drier than the mainland Sunshine Coast. Texada Island receives 957 mm of precipitation per year on average (as recorded at the Texada Island airstrip near Gillies Bay - Environment Canada Climate Stn. 1048140). While average annual precipitation recorded at the Powell River airport (Environment Canada Stn. 1046391) is 1233 mm. While some precipitation does fall as snow, the mild maritime climate, combined with basin size and physiography, prevent snow from remaining for long periods of time. Consequently, snow is unlikely to persist through the low flow period.

There are no streamflow measurement stations on Texada Island. Using the Rational Formula Method (Coulson, 1991), the peak flow runoff at the outlet of Priest Lake is estimated to be 19 m^3/s.

Two nearby stations were selected to characterize flows in the study area watersheds. Streamflows for Ogden Creek (WSC Stn. # 08HB047; 1.86 km^2), located on Lasqueti Island southeast of Texada Island, are compared to those of Lang Creek (WSC Stn. #08GB007; 128 km^2). The mean annual discharge of Odgen Creek is 0.025 m^3/s, or 0.013 m^3/s per km^2. The mean annual discharge of Lang Creek is 4.22 m^3/s, or 0.033 m^3/s per km^2. Based on this comparison, flows on Texada Island are approximately 2.5 times less than that experienced on the mainland. Using unit discharge estimates on Lasqueti Island, mean annual flow at the outlet of Priest Lake is estimated to be 0.147 m^3/s.

On Texada Island, the dominant hydrologic process is generated by rain and, less commonly, rain-on-snow. Low flow periods occur in the summer between May and October. Peak flow periods occur in the winter between November and January.

2.3 Geology, Geomorphology and Soils

Bedrock at the northern part of Texada Island is characteristically volcanic basalt and breccia (Webster and Ray, 1991) overlain by massive calcareous and dolomitic limestone at the very north part of the Island. There are a number of active limestone quarries that extract the pure limestone. Bedrock exposures may also include shale, siltstone, sandstone, conglomerate and coal. These are relatively weak friable and fissile rocks that break down into surficial material that has significant component of fines in the matrix.

The lower slopes of the study area are covered by accumulations of till, glaciofluvial, or glaciolacustrine material. Surficial materials are typically medium-textured pure sand (Quadra Sand) with very little silt and clay deposited as outwash deposits overlain with till and related glaciomarine drift. Depths range from less than 0.2 m to greater than 1 m.

Surficial material is generally covered with litter, fermentation, humus and pedalogic soil. The overlying organic layer is generally thin (< 6 cm) and easily disturbed or removed (Contour Geoscience Ltd., 2000).

There are extensive areas of low-lying ground between and adjacent to lakes in the study area. Some of these areas are poorly drained and swampy and are likely underlain with clayey and silty lake bottom material. There are also 'strings' of bogs and small lakes, that form, depending upon the depth of the present day water table.

2.4 Water Quality

The Van Anda Improvement District conducts water quality monitoring on a semi-regular basis at the water intake on Priest Lake. The most recent laboratory analytical results (06/05/00) indicate that all parameters sampled at the Priest Lake intake, except total coliforms and aluminum, meet Canadian (CCME, 1999) and British Columbia (MELP, 1998) drinking water standards. The results are included as Appendix B. Water quality parameters identified as a potential for concern are described as follows:

- *Temperature* – Forest cover provides shade to streams and harvesting streamside vegetation can increase peak summer stream temperatures. Temperature changes tend to be cumulative along the channel since thermal energy is not easily lost. Increased temperatures elevate the metabolic oxygen demand, which in conjunction with reduced oxygen solubility, impacts many species and can contribute to eutrophication in downstream reservoirs, or lakes.

  The water intake on Priest Lake is located in deeper water so it is likely a bit cooler than surface water. The provincial criterion for temperature is 15°C.

- *Nutrients (nitrogen and phosphorous)* – Logging, fire, and forest fertilization temporarily increase dissolved inorganic nitrogen (nitrate and ammonia) by

introducing organic material and sediment. Relative to the total amount of available nitrogen, these increases are generally small. Nitrogen concentrations may also increase as a result of inadequate human waste disposal, livestock, wildlife, and atmospheric fallout.

Primary production (i.e. plant growth) in lakes is limited by nutrients, namely phosphorous. Inputs of phosphorous are the prime contributing factors to eutrophication, which can change water chemistry, reduce dissolved oxygen levels, and decrease esthetic values. Research indicates that non-point sources of phosphorous include septic tanks, recreation, livestock and other animals, and soil erosion.

Most recent concentrations of nitrate and nitrite in Priest Lake is 0.19 mg-N/L and <0.006 mg-N/L, respectively. The provincial criterion for nitrate is 10 mg-N/L, and nitrite is 1 mg-N/L. Concentrations of total phosphorous and total dissolved phosphorous were not included in the water quality analysis. It is recommended that these parameters be included in subsequent samples.

- *Coliforms* – The presence of coliform bacteria may indicate contamination from human or animal waste. The total coliform group of microorganisms includes fecal coliforms and non-fecal coliforms, which are naturally present in soils and on vegetation. Fecal contamination of water may indicate the presence of harmful pathogenic organisms.

  Where there is disinfection, the provincial criterion for total coliform in drinking water is 10 (90^{th} percentile). Where there is partial treatment of the water supply, the criteria is 100. Coliform bacteria concentrations in Priest Lake are currently elevated (1790 CFU/100) and are a concern to water users. Concentrations of fecal coliform bacteria were not detected in the most recent water analysis. Potential sources of fecal bacteria contamination include: septic systems, wildlife (specifically, beaver or deer), and domestic animals.

- *Total Organic Carbon* - Total Organic Carbon (TOC) is a measure of dissolved and particulate organic carbon, which is comprised of humic substances and partly degraded plant and animal materials. Although there are currently no provincial drinking water criteria for TOC, the US EPA recently set 4 mg/L TOC as a limit to prevent the formation of trihalomethane, a harmful by-product of chlorination. The provincial criteria for trihalomethane in drinking water is 100 µg/L. These water quality parameters were not included in the most recent analysis, so it is unclear whether this is a concern for water users.

2.5 Fisheries and Wildlife Characteristics

2.5.1 Fisheries

Anadromous fish passage on Van Anda Creek is probably limited to the reaches downstream from Emily Lake. There are barriers to fish passage below Priest Lake, including the culvert beneath the Gillies Bay Road itself. There are resident fish in Priest Lake, which means that resident fish may populate all low gradient (i.e. less than 20% gradient) streams, and lakes, in the watershed.

A rare and unique species of stickleback, called the Vananda Limnetic Stickleback (*Gasterosteus* Sp 14 and Sp 15) has been recorded in Emily Lake, Priest Lake, and Spectacle Lake. Another species of stickleback has been recorded in Paxton Lake (Paxton Lake Limnetic Stickleback, *Gasterosteus* Sp 4 and Sp 5) located to the southwest of the Priest Lake watershed.

2.5.2 Wildlife

Wildlife characteristics on Texada Island are not well documented but the island is known to support a large population of black-tailed deer, as there are no natural predators to the deer (i.e. cougar or bear) on the island. There are raccoon and beaver, as well as freshwater turtle, garter snakes, frogs, and the alligator lizard. The Texada Island bird list shows approximately 200 resident or transient bird species. Species of interest include osprey, bald eagles, Great Blue heron, the Rufous Hummingbird, and Black Brant geese.

2.5.3 Significant Vegetation

The B.C. Conservation Data Center (CDC) maintains an inventory of known occurrences of rare species or natural plant communities. The CDC database represents information available at the time of the request and is updated or amended regularly. The CDC database lists a number of red- and blue-listed vascular plant species on Texada Island, although not necessarily within the watershed of interest for this study. These are summarized in Table 2.2 below and are shown in the map compiled by the CDC in Figure 2.1.

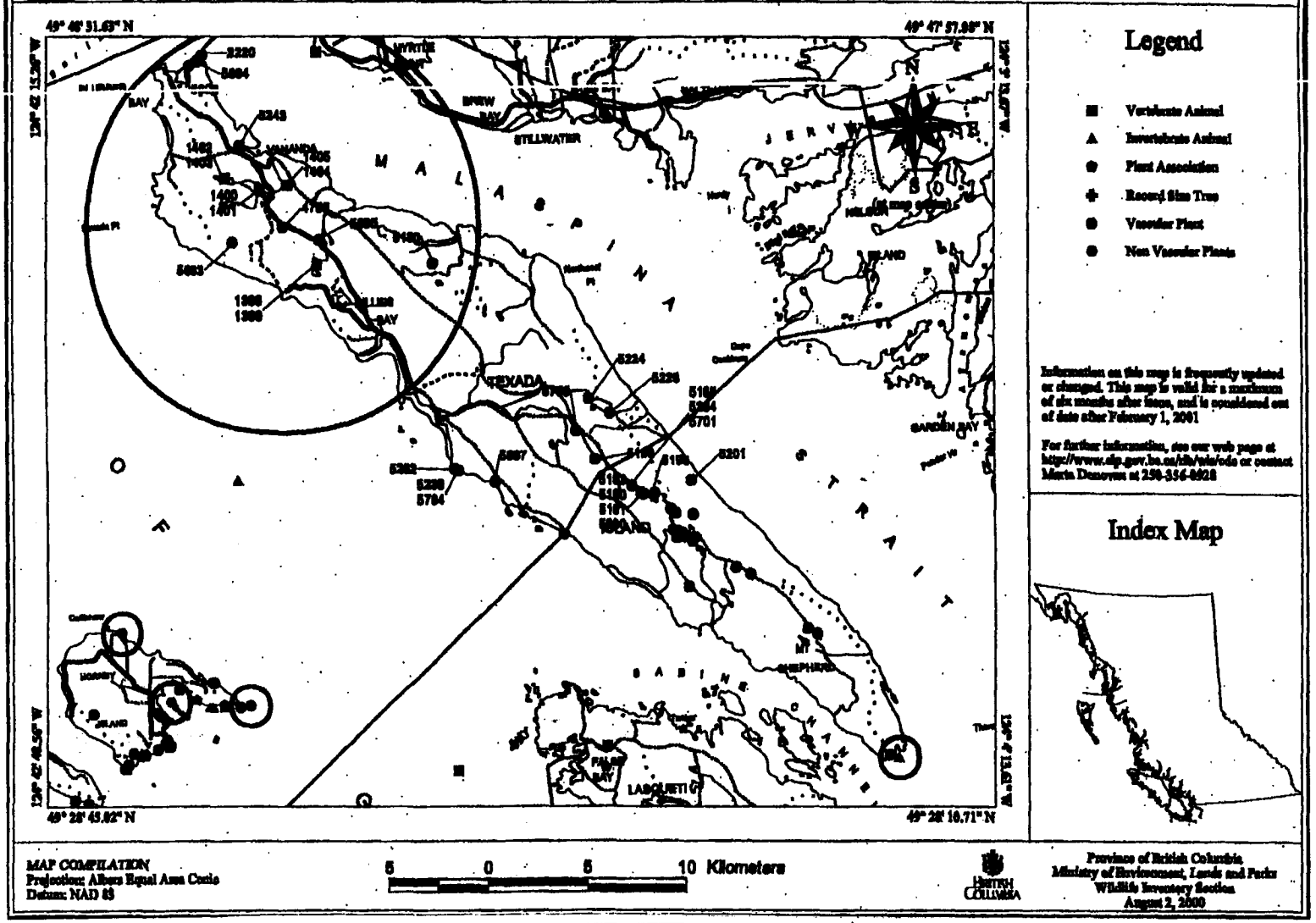
Table 2.2 List of Red- and Blue-Listed Plant Species Recorded on Texada Island

Vascular Plant Species	Provincial List Status[1]
Macoun's Groundsel (*Senecio macounii*)	Blue-listed
chaffweed (*Anagallis minima*)	Blue-listed
least moonwort (*Botrychium simplex*)	Blue-listed
green-sheathed sedge (*Carex feta*)	Blue-listed
western St. John's wort (*Hypericum scouleri nortoniae*)	Blue-listed
fleshy jaumea (*Jaumea carnosa*)	Blue-listed
one-leaved malaxis (*Malaxis brachypoda*)	Blue-listed
northern adder's-tongue (*Ophioglossum pusillum*)	Red-listed
california sword-fern (*Polystichum californicum*)	Red-listed
poison oak (*Toxicodendron diversilobum*)	Blue-listed

Source: B.C. Conservation Data Centre (August, 2000)

[1] Provincial List Status: Red-listed includes any indigenous species or sub-species considered to be Extirpated, Endangered, or Threatened in B.C. Blue-listed includes any indigenous species or sub-species considered to be Vulnerable in B.C.

BC Conservation Data Centre - Rare Element Occurrences, Texada Island



EBA Engineering Consultants Ltd.			Project: Texada Island CWAPs
Client: Ministry of Forests			BC CDC - Rare Element Occurrences
DATE: August, 2000			FILE NO. 0801-00-81528 FIGURE 2.1

3.0 PAST AND PROPOSED FORESTRY ACTIVITIES

3.1 Past Forest Harvest Activities

Forestry activities have occurred on Texada Island since the late 1910s. Currently, there are four licenses to harvest Crown Land on Texada Island. These include:

- R.H. Barbour Co. Ltd. (License No. A20487)
- Charles Klein Logging Co. Ltd. (License No. A20489)
- Hagman and Sons Logging Ltd. (License No. A20494)
- Van Anda Logging Co. Ltd. (License No. A20507)

On private land, land clearing and forest harvesting is largely unregulated. Much of the private land being logged is owned by Texada Island Forest Reserve Ltd. and managed by Charles Boulet, of Perdix Land Management Ltd.

3.3 Proposed Forest Harvest and Road Building

Five (5) cutblocks, comprising a total area of approximately 54 ha are proposed for harvest in the Priest Lake watershed over the next five years (average rate of harvest of 13.5 ha, or 1% of total watershed area per year). Approximately 2.9 km of forest road are proposed for construction and/or reconstruction. The proposed forest harvest and road building activities are shown on the accompanying watershed map.

4.0 CWAP METHODS

This CWAP follows guidelines of the *Coastal Watershed Assessment Procedure Guidebook*, Second Edition, April 1999. A more detailed description of assessment procedures is outlined below.

4.1 Sub-Basin Delineation

Community watershed boundaries are based on the height of land and are derived by the Ministry of Environment, Lands and Parks using 1:20,000 scale TRIM maps. Based on consultation with the WAC, the watershed boundary of Priest Lake was confirmed.

4.2 Peak Flow and Hydrologic Recovery Analysis

Based on recent research by Ziemer (1998), the greatest effect of logging on streamflow peaks is to increase the size of the smallest peaks (i.e. 1 in 2 to 5-yr events) during the driest antecedent conditions, with the effect declining as storm size and watershed wetness increases. The effect on major floods (i.e. peak flows) is apt to be minor compared to the influence of rainfall and basin storage. Discharge peaks in "smaller"

watersheds also tend to have greater post-logging response than "larger"watersheds (Jones and Grant,1996). As such, a 20% ECA in a small watershed may be considered to be a greater concern than a 20% ECA in a large watershed. This said, the effect on a small basin with a predominance of lakes and wetlands is likely much less.

Peak flows in the watershed is dominated by rain and, very occasionally, rain-on-snow processes. Members of the Van Anda Improvement District indicated no concern with respect to peak flows in the Priest Lake watershed. Due to the ability for lakes to attenuate the hydrologic effect of peak flows, peak flow effects are not likely to be of concern.

To determine the cumulative hydrologic effect of past forest harvest and road construction, an analysis of hydrologic recovery is conducted. In general, the hydrologic effect of harvested areas, which uses tree height as an indicator, is reduced as trees grow. This reduction is termed "hydrologic recovery".

Hydrologic recovery attributed to stand regeneration is expressed as the equivalent clearcut area (ECA) index. By current methods, ECA index values are related to tree height as shown in Table 4.1. Using the ECA index, harvested areas are "reduced" by that amount of recovery. For example, if the average canopy height in a 100 ha cutblock is 4 m the equivalent clearcut area is 75 ha (100 ha less 25% hydrologic recovery).

Table 4.1 – Equivalent Clearcut Area (ECA) Index

Stand Height (m)	ECA Index, or Hydrologic Recovery
0 to 3 m	0%
3 to 5 m	25%
5 to 7 m	50%
7 to 9 m	75%
9 m +	90%

Source: CWAP Guidebook (Interim Method), 1999

Stand heights, projected to 1999, are obtained from the forest inventory database. The database contains information for Crown Land but contains out of date stand heigth information for private land. Forest inventory information for private land was last updated in 1991. About 441 ha (39%) of the Priest Lake watershed is privately owned. With few exceptions, private lands are not extensively cleared and rural residential lots tend to be relatively small, with grassed yards. Where logging activities have occurred on private land, the harvested areas are predominantly selective, or partial cuts, and regenerated stands have a higher composition of deciduous tree species.

For the purpose of this study, it is assumed that 5% of all private land is currently cleared. This is a reasonable estimate based on a review of 1999 air photos. This estimate accounts for residential land clearing and historic partial (selective) forest harvesting.

Based on a qualitative comparison of 1988 and 1999 air photos, it appears that the percentage of cleared private land has increased on the north side of the watershed.

4.3 Sediment Source Survey, Stream Channel and Riparian Assessment

The purpose of a component-level analysis for the watershed assessment is to determine the significance of past forestry-related impacts and to determine the relative hazard related to future harvesting activities.

A reconnaissance-level sediment source survey, stream channel assessment, and riparian assessment were completed for the study watersheds. Each component was completed by the following methods:

- Information Review – For the sediment source survey, recently completed terrain and terrain stability mapping provides the key source of terrain information (Contour Geoscience Ltd., 2000).
- Air Photo Review - 1988 1:15,000 scale and 1999, 1:15,000 scale air photos were also reviewed. For the stream channel assessment, channel characteristics are summarized and evidence of past hydrologic or sedimentation disturbances are documented. Due to vegetative cover over the small stream channels the use of air photos to complete the channel stability assessment was restricted;
- Field Assessment – overview-level field assessment to confirm ratings, to supplement information where vegetation obscured ground and channel conditions, and determine the sensitivity to disturbance.

5.0 RESULTS

5.1 Peak Flow and Hydrologic Recovery Analysis Results

Equivalent clearcut area (ECA) was calculated for the Priest Lake watershed. The results indicate that 518 ha, or 46% of the watershed, has been logged and that the current ECA is 91 ha, or 8%. Of the total logged area, approximately 45% (41 ha) is attributed to logged areas that have reached the maximum 90% hydrologic recovery. Because of past logging, the watershed ECA will never be less than 41 ha, or 3.6%. A summary of forest harvest inventory data used to calculate ECAs is provided in Appendix C of this report.

Because land clearing and/or harvesting that occurs on private land is not regulated, or inventoried, in the same way as activities on Crown Land, these numbers likely underestimate the amount of logging that has occurred on private land. The ECA must, therefore, be recalculated assuming that a certain proportion of private land is cleared.

Approximately 441 (39%) of the Priest Lake watershed is privately owned. Assuming that 5% of private land is currently cleared and that the average stand height in these

clearings is less than 3 m (a conservative estimate), then a revised ECA is calculated to be 113 ha, or 10% (see Table 5.1).

Table 5.1 Current Equivalent Clearcut Area (ECA) Values

		Crown Land		Private Land	
Watershed	**Area (ha)**	**Total Area Logged**	**Equivalent Clearcut Area**	**Area (ha)**	**Revised ECA[1]**
Priest Lake	1131	518 ha, 46%	**91 ha, 8%**	441	**113 ha, 10%**

[1] – Revised ECA assumes that an additional 5% of private land is current logged

There are five small cutblocks proposed within the Priest Lake watershed over the next five years, representing a total area of approximately 54 ha, or 4.7% of the total watershed area. As previously logged stands recover, the net effect on ECA levels is to increase the overall ECA by 3% to 11%. As an alternate scenario, should the proposed logging not proceed, the watershed ECA would decrease as a result of natural recovery to 6.3%.

From a hydrologic perspective, the proposed logging is not likely to be a concern for the Priest Lake watershed. ECA levels are, overall, low (i.e. less than 15%) and are not significantly increased as a result of the proposed logging, which is estimated to proceed at a rate of no more than 5% of the watershed area in 5 years. This rate of harvest is consistent with guidelines outlined in the *Community Watershed Guidebook* (Forest Practices Code, 1996).

5.2 Sediment Source Survey and Landslide Hazard Assessment

Based on the terrain mapping and terrain stability assessment completed by Contour Geoscience Ltd. (2000), 5.9 ha (0.5% of watershed) are identified as potentially unstable (Class IV) terrain. There were no mappable landslides noted as the study area is strongly influenced by bedrock that is either at or very near the surface. There are steep bedrock pitches within some areas that exhibit some evidence of historic rockfall activity. The colluvial material associated with this activity is generally coarse rubble or blocks, materials that is not prone to erosion and has not been transported very far downslope.

Minor ravelling along road cuts constructed in glaciofluvial material and reworked morainal material was observed by Contour Geoscience Ltd. (2000).

Soil surface erosion, which refers to the detachment, entrainment and transport of mineral soil by running water, is accelerated after vegetation has been removed and mineral soil has been exposed. Factors that effect surface erosion potential are soil texture, soil moisture, soil structure, permeability, soil thickness, slope steepness, slope position, abundance of seepage and catchment area. The rate of erosion is also affected by the extent of compaction of the soil as well as the amount of cementation and alteration of

the soil. Slopes overlain with compact till are generally less erodible than slopes covered with loose glaciofluvial material that may be more prone to raveling.

The soils on Texada Island area are generally fine to medium textured as they are derived from fine to medium grained (sedimentary, limestone and volcanic) or medium to coarse grained (granitic and volcanic) bedrock sources. This, combined with biogeoclimatic factors, the drainage of the soils, or abundant seepage due to soils being moist throughout most of the year results in the soils being susceptible to surface erosion. Drainage is rapid over rock controlled slopes but is imperfect to very poor in depressions, and may be more erodible.

Contour Geoscience Ltd. (2000) mapped soil susceptibility to erosion. The results indicate that, in the Priest Lake watershed, there are 81.8 ha (7.2% of watershed) with a high surface erosion potential. Soils with high erosion potential are those on moderately steep to steep slopes (50-65%), overlain with finely textured materials. As observed by Contour Geoscience Ltd. (2000), there has been erosion of trails and harvested areas along moderately steep to steep slopes. Concentrating water flow in ditches, along roads and trails has increased erosion rates. Road cuts in wet, fine-grained material are inherently unstable as subsurface water flow is brought to the surface, increasing runoff. Seepage zones are subject to ongoing surface erosion and raveling. Road cuts through this type of terrain should be of a minimal length and height. This may be accomplished by avoiding the areas, but should access be required across these sites road grade steepening should reduce the disturbed area.

Two cutblocks are proposed on areas mapped as having a high soil surface erosion potential. The bottom boundary of the cutblock located on the north side of Priest Lake lies no less than 60 m upslope of Priest Lake on slopes of approximately 30%. No streams were encountered within the block during a reconnaissance field assessment and the potential for sediment delivery to Priest Lake is considered to be relatively low.

5.3 Channel Assessment Results

The Priest Lake watershed is relatively small and the associated stream channels are correspondingly small. The channels do not occupy distinguishable floodplains and the hydraulic energy available to mobilize sediment stored within the channel is limited to occasional storm-generated peak flow events.

A summary of stream channel characteristics is provided on a reach-by-reach basis for the watershed (see Table 5.2). Streams that flow into Priest Lake are generally narrow (less than approx. 2 m) and of a low gradient. The headwater reaches of Priest Lake flow from Spectacle Lake. One of the larger tributaries flows from Kirk Lake through elongated wetland areas. No indications of channel instability were noted. Flow into Van Anda Creek downstream from Priest Lake and Emily Lake is regulated by a small dam.

Table 5.2 Reach Characteristics for Priest Lake Tributaries

Reach No.	Length (m)	Approx. Width (m)	Avg. Gradient (%)	Channel Type	Hillslope-Channel Coupling	Riparian Vegetation Type & Stand Structure	Riparian Logging (y/n)	Role of Riparian Vegetation	Current Channel Stability Rating	Channel Sensitivity to Hydrologic Change**	Notes
Van Anda Creek											
1	1213	not visible	<2	not visible	Direct	Deciduous	yes, nearby road and private land development	provides stream cover and stability	not visible	Moderate to High	
2	Emily Lake	-	-	-	Direct	Deciduous	partial land clearing	lake side cover and shade	-	-	d/s water intake, reservior
3	1100	2	4	not visible	Direct	Mixed	no	provides long-term stability	S	Moderate	-
4	Priest Lake	-	-	-	Direct	Mixed	partial land clearing	lake side cover and shade	-	-	
5	330	not visible	6	not visible	Direct	Deciduous	no	provides cover and shade	S	Low	wetland characteristics
6	Spectacle Lake	-	-	-	Direct	Mixed	small areas cleared, pier	lake side cover and shade	-	-	
7	300 approx.	not visible	<1	RPg-w	Direct	Mixed	no	provides cover and shade	S	Low	
Kirk Creek											-
4-1	650	not visible	<1	not visible	Direct	Mixed	yes, historic partial cut	provides long-term stability and stream cover	not visible	Low	wetland characteristics
4.2	1200	not visible	3	not visible	Direct	Mixed	yes, historic	cover and shade	not visible	Low	wetland characteristics
4-3	Kirk Lake	-	-	-	Direct	Mixed	yes, partial	lake side cover and shade	-	-	

Note: Reach characteristics are based on 1999 air photos (approx. 1:15,000 scale) and are, therefore, approximate.

** Note - Sensitivitiy judgement based on field investigation and air photo assessment

Bankfull Width - the width of the water surface at bankfull stage which occurs just prior to flooding when the brim-full channel overflows with no banks exposed (Hogan, et al, 1996)

Channel Type - RPg - gravel, riffle-pool RPg-w - gravel, riffle-pool with functioning wood
RPc - cobble, riffle-pool

Hillslope-Channel Coupling - indicates the connectivity between the hillslopes and the channel. Coupling may be direct, indirect or none, depending on the width of the floodplain.

Using 1998 and 1999 1:15,000 scale air photos, the distribution and abundance of aquatic vegetation within and along the shorelines of Priest Lake were compared. The comparison indicates that the shoreline shape remained virtually unchanged over this period.

5.4 Riparian Assessment Results

The Forest Practices Code provides guidelines for riparian width based on stream class (i.e. stream channel width and fish presence). A riparian assessment evaluates the role of riparian vegetation in providing channel stability and structure and estimates how this has been affected by past riparian logging. Impacts related to the loss of vegetation in the riparian zone include a loss of streambank stability, sedimentation, and a diminished supply of large woody debris for fish and wildlife. Standards for riparian width do not specifically address the need to moderate stream temperatures along temperature-sensitive streams.

Approximately 1.7 km of stream in the Priest Lake watershed has been historically logged, representing 39% of the total length of stream (excluding lake shoreline). Based on limited field assessment the historic loss of riparian cover does not appear to have resulted in significant channel disturbance. The majority of this streamside disturbance has occurred along Kirk Creek as a result of historic land clearing, which appears to have been a selective (partial) removal of trees.

Proposed harvesting in the Priest Lake watershed is situated upslope from the stream and/or lake. A riparian reserve zone will be maintained along all perennial streams, wetlands, and lakes. Of particular concern is the cutblock adjacent to Reach 7 (upstream of Spectacle Lake). During detailed block engineering assessments, the riparian management zone must be planned to manage the reserve zone for windthrow.

6.0 SUMMARY OF RESULTS

6.1 Watershed Report Card

A Watershed Report Card is prepared for the Priest Lake watershed (Table 6.1). The report card summarizes some of the key measures of watershed condition and provides a summary assessment of hazard level for peak flow, sedimentation, channel impact, and riparian impact.

6.2 Conclusions

Based on the results of the watershed assessment, the hydrological risks of future harvesting and road construction are concluded as follows:

- there have been relatively few, and minor terrain stability and erosion hazards associated with the past development.
- the potential for changes in peak flows attributed to the proposed logging activities is low. Priest Lake, and other lakes in the watershed, will likely attenuate hydrologic changes in the watershed. Approximately 54 ha of the Priest Lake watershed is proposed for harvesting within the next 5 years.

Table 6.1 – Priest Lake Watershed Report Card

	Current Condition (2000)
Watershed Area (ha)	1131 ha
Equivalent Clearcut Area (%)	10%
Length of road and total road density (km, km/km^2)	22.6 km, 2.0 km/km^2
PEAK FLOW HAZARD	**LOW**
Total number of forestry-related landslides	0
Total number of landslides, point source of sediment that have directly impacted the stream	0
Length of High Hazard Road (km)	0
Area of Class IV terrain (ha, %)	5.9 ha (0.5%)
Area with high surface erosion potential (ha, %)	81.8 ha, 7.2%
SEDIMENTATION HAZARD	**LOW**
Length of mainstem stream with disturbed stream channel (km, %)	0
STREAM CHANNEL IMPACT HAZARD	**LOW**
Length of mainstem stream with impacted, non-functional riparian forest (km, %)	0
RIPARIAN IMPACT HAZARD	**LOW**

- there is a low potential for landslides, stream channel disturbance, or riparian impact as proposed blocks in the Priest Lake watershed are situated on relatively stable terrain. Two cutblocks are situated on fine-textured soils with a high soil surface erosion potential. Due to gentle to moderate slopes and a vegetated buffer, the potential for sediment delivery is considered to be relatively low but should be confirmed by a detailed assessment.
- Priest Lake, the only developed source of drinking water for the Van Anda community, is most susceptible to changes in water quality. Parameters of concern are fecal coliform bacteria, nutrients, and temperature.

Forest harvesting can take place in the Priest Lake watershed without degrading water resource characteristics. Priest Lake watershed is relied upon to provide a minimum quality and quantity of water that meets public need for consumption as well as fish species present in the system. Proposed harvesting must be sensitive to these values. To

minimize impacts, recommendations for hazard mitigation, provided below, must be followed as part of the Forest Development Plan approval process.

7.0 FOREST DEVELOPMENT PLAN RECOMMENDATIONS

7.1 Recommendations for Hazard Mitigation

Because a large proportion (39%) of the watershed is privately owned, much development is not regulated by the Forest Practices Code. Because of this, much responsibility for ensuring a clean and safe water supply lies with local land owners and developers. Recommendations for mitigating the hazard of impacting water characteristics in the community watersheds are summarized as follows:

Forest Harvesting

- forest harvest activities should consider the effect of harvesting on beaver activity, which may introduce coliform bacteria and may disrupt surface water drainage. As beaver find deciduous tree species more palatable, harvested sites should be planted immediately with conifer tree species immediately after harvesting to discourage the colonization of disturbed sites by alder (deciduous) tree species. Selective removal of alder in the riparian reserve zone may enhance riparian function along streams that have been previously logged but care must be taken to ensure that stream shading is not significantly decreased.
- because the lake water supply systems are sensitive to algae blooms, special precautions should be undertaken to minimize the introduction of nutrients to streams. For example, fertilization activities should be limited to a slow-release variety and buffers should be maintained along streams, wetlands, and lakes.
- Priest Lake is sensitive to changes in temperature. To minimize the potential for summer temperature increases, streamside vegetation should be maintained within a reserve zone along all perennial tributary streams. The riparian management zone must be planned to manage the reserve zone for windthrow.

Roads

- as noted by the terrain mapping report, with the presence of extensive limestone deposits on Texada Island, there is the potential for the existence and development of karst and cave features (sinkholes, caves and underground drainage) that may pose safety risks and other problems during forest development. Underground cavities and channels may transport sediment directly into creeks. It is recommended that, if any karst or cave features are identified during construction, the extent of any sinkholes and potential road building and safety concerns are assessed.
- Where development is planned on areas mapped as having a high surface erosion potential, detailed field assessment should verify site specific soil characteristics and provide detailed recommendations for harvesting or road building. It is

recommended that soil disturbance is minimized by using compatible harvesting methods.

- To reduce the risk of introducing sediment to streams activities should be restricted to the dry season and follow rainfall shut-down guidelines during storms.

Water quality monitoring, undertaken by the Van Anda Improvement District, should continue at sites established at the water intake. Sampled parameters should include phosphate, dissolved phosphorous, nitrate, nitrite, conductivity, turbidity, total organic carbon, coliform bacteria (total and fecal), and temperature.

It is also recommended that an emergency response plan be developed in the event of a disturbance that is detrimental to the water supply. Contact names and numbers should be supplied to all contractors working in the watershed.

7.2 Recommendations for CWAP Update

Under the Forest Practices Code it is recommended that if forest development activities proceed, the CWAP should be updated every three years. If no additional development occurs within the three-year period then it is recommended that the watershed assessment be updated only when it is again proposed. The update will provide a watershed status report and will provide an opportunity to re-evaluate the potential effects of proposed development activities.

8.0 CLOSURE

Services performed by EBA for this report have been conducted in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practising under similar conditions in the jurisdiction in which the services are provided. Professional judgement has been applied in developing the conclusions and/or recommendations provided in this report. No warranty or guarantee, express or implied, is made concerning the results, comments, recommendations, or any other portion of this report.

Respectfully submitted,

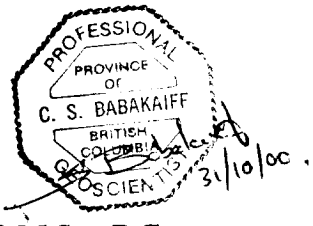
EBA ENGINEERING CONSULTANTS LTD.

Prepared by:

Jennifer Clarke

Jennifer Clarke, M.Sc., G.I.T.
Geomorphologist/Hydrologist

Reviewed by:



Scott Babakaiff, M.Sc., P.Geo.
Geomorphologist/Hydrologist

REFERENCES:

CCME. 1999. Canadian Water Quality Guidelines. Summary Table. Canadian Council for Ministers of the Environment. Ottawa, Ontario.

Contour Geoscience Ltd. 2000. Terrain Mapping and Terrain Stability Assessment. TSIL Level C. Report and Mapping. Prepared for the Ministry of Forests, Sunshine Coast Forest District. March, 2000. Comox, BC.

Coulson, C.H. (ed.) 1991. The Rational Formula Method, Extract from the Manual of Operational Hydrology in British Columbia (2nd Edition). Ministry of Environment, Water Management Division. Victoria, B.C.

Forest Practices Code. 1999. Coastal Watershed Assessment Procedures (CWAP). Ministry of Forests and Ministry of Environment, Lands and Parks. Victoria, BC.

Green, R.N. and Klinka, K. 1994. A Field Guide to Site Identification and Interpretation for the Vancouver Forest Region. Land Management Handbook #28, B.C. Ministry of Forests. Victoria, B.C.

Hay, Kathryn M. 1985. Planning for Water Resource Management in Rural Areas: A Case Study of Texada Island. M.A. Thesis (unpublished). University of British Columbia, School of Community and Regional Planning. Vancouver, BC.

Hogan, D.L., S.A. Bird, and D.J. Wilford. 1996. Channel Conditions and Prescriptions Assessment (Interim Methods) Watershed Restoration Technical Circular No. 7. July, 1996. Victoria, B.C.

Jones, J.A. and G.E. Grant. 1996. Peak Flow Responses to Clear-Cutting and Roads in Small and Large Basins, Western Cascades, Oregon. Water Resources Research. Vol. 32, No. 4, pp. 959-974.

MacDonald, L.H., A.W. Smart, and R.C. Wissmar. 1991. Monitoring Guidelines to Evaluate the Effects of Forestry Activities on Streams in the Pacific Northwest and Alaska. U.S. Environmental Protection Agency, Water Division. EPA/910/9-91-001. Seattle, Washington.

MELP. 1998. British Columbia Water Quality Guidelines (Criteria) 1998 Edition. BC Environment. Victoria, B.C.

Resources Inventory Committee. 1998. Guidelines for Interpreting Water Quality Data. Field Test Edition. Prepared by the Ministry of Environment, Lands and Parks, Water Quality Branch. Version 1.0. Victoria, B.C.

Webster, I.C.L. and Ray, G.E. 1991. Geology and Mineral Deposits of Northern Texada Island (92F/9, 10, and 15). Ministry of Energy, Mines and Petroleum Resources, Geological Fieldwork 1989, Paper 1990-1, pp. 257 – 265.

Ziemer, R.R. 1998. Proceedings of the Conference on Coastal Watersheds: The Caspar Creek Story. May 6, 1998. Ukiah, California. General Technical Report PSW GTR-168. Pacific Research Station, Forest Service, USDA. Albany, California.

\\VAN1\DATA\0801-FOR\PROJECTS\2000\00-81528\report\81528-PRIEST-FINAL.doc

VAN ANDA IMPROVEMENT DISTRICT

INCORPORATED 1942

SECRETARY TO THE BOARD:
EILEEN LAVERGREN (604) 486-7270

ASSESSMENT & AUDIT:
JOHN A COLLINS (604) 486-7331

BOX 115 - VAN ANDA
TEXADA ISLAND, BC
V0N 3K0

FAX: (604) 486-7331

October 19, 2000

To: All Committee Members
Coastal Watershed Assessment Procedure (CWAP) of Priest Lake

After reviewing all material presented during the assessment procedure, the Trustees of the Van Anda Improvement District have passed the following motions to become part of our public record:

1. That no logging occur within the watershed at this time – *majority vote.*

2. That the harvesting of a block adjacent to the north shoreline of Priest Lake, and a block at the head of Spectacle Lake not be logged at all for the foreseeable future – *unanimous vote.*

Members of the Board and other community members involved in the process are "not totally convinced" of the accuracy of the findings in the CWAP report. We feel the assessment and effects of past forest harvesting have been greatly underestimated and that the activities of the past 30 to 40 years has degraded the water quality to the point where remedial action (rehabilitation) must be taken, before there is any consideration of further harvesting. No matter what the Recovery Analysis in the report is based on, no one believes that the results could possibly indicate that only "46% of the watershed has been logged". Also, the map, included with the report, was very misleading as to the quality of present growth and recovery in the watershed. We also concluded that we can take no real pride in the overall condition of the forest land in our watershed owing mostly to past forestry practices.

It should be noted that Priest Lake is not just the only *developed* source of water for Van Anda, it is the only *viable* source for over a hundred years. Past mining activity has just about eliminated any hope of using deep wells as a future source of drinking water, as recommended, in the early 90s, by engineers with the Ministry of Health based in Nanaimo. They concluded that the lake was in a state of regression (turning to swamp) and if another source of water couldn't be found, we would probably have to intervene to slow what was called a somewhat natural process. We suspect that extensive Alder growth plays a partial role here.

We believe that past logging is connected to the gradual increase in the coliform count in the water since the 1960s (tests confirm) and the increase in turbidity. Sudden run-off into the lake, in the rainy season, has become an ever increasing problem, to the point where water quality is sometimes questionable. We also know that disinfection of the water under such conditions is difficult and not as effective as it should be. Combine this with the question of the ongoing Total Organic Carbon (TOC) debate and we see a huge challenge for the future. Just because our water meets the basic objectives of the Canadian and BC drinking water standards, doesn't mean there aren't huge concerns – we don't feel these concerns have been addressed strongly enough in the Report. Under forestry legislation we are led to believe that the water in a community watershed comes first and yet we feel that the process is putting the water second, after the harvesting.

cont'd

Addressing our opposition to the cutting block next to Priest Lake: With the risk of run-off, and considering our turbidity problem, it doesn't make any sense to take the chance of harvesting on slopes that are over 30 degrees in some places. Has no one observed the heavy rain run-off below the cleared gas-line right-of-way? Not only that, but it is the only parcel of land, or substantial buffer, on that side of the lake where there hasn't been some kind of development or disturbance (cleared land, multiple road ways, graveyard, open mining development). The other block at the head of Spectacle Lake is considered an important collection area for the watershed and shouldn't be disturbed.

The reason for the motion of not cutting in the watershed has been partially addressed in comments throughout this document, but the most basic logic is the very small size of the watershed. That being said, we can see the day where forestry activity might actually improve the quality of our water supply. Much of the extensive Alder growth, that is a result of past harvesting, could be gradually removed in small amounts and the areas replanted with more desirable species. We would emphasize that this activity should be considered long before there is any attempt to remove the very little that is left of marketable conifers. The excuse that "we don't do it this way anymore", should not exempt the Ministry of Forests from correcting past mistakes – especially in a community water shed.

The Report notes that current legislation does not control private land in the watershed. We feel that the Ministry of Forests does have a responsibility to consider the extent of private development when it is preparing plans for harvesting on public land. Their dual role certainly includes them as custodians of public lands and the condition of private land should dictate the limits of activity on public land.

The Improvement District has been encouraged to continue their water testing. We would like to point out that we only started to do limited testing ourselves when the Ministry of Health withdrew the service. Our tests do not supply enough information, or have the frequency, that would be required to measure the impact of further forestry activity. The Guidelines do mention a Water Testing Program that can be developed, but all mention has been left out of the report. We should not be paying for this. It would be a burden on our rate-payers to cover the extra costs, especially considering we are not the one who wants to log in the watershed.

We do regret that we have not had a more positive reaction to the Report. All the Trustees have expressed feelings that the process, for the most part, has been predetermined and it was an uphill battle to defend our water supply – which isn't that good to start with. Most of the people we have had input from, have spent many years dealing with our water supply and watershed issues, and have brought with them the inherent experience that is gained. The Trustees do have a responsibility to reflect the views of the majority of those who have elected them to office. We believe we have done that with this document and respectfully submit it for your review and consideration.

Approved for distribution: .....

Chairman: .....

District Secretary: .....

North Island Laboratories

2755 B Moray Avenue, Courtenay, B.C. V9N 8M9 Tel: (250) 338-7786 Fax: (250) 338-7553

Report To:

Aaron Service & Supplies
4703 Marine Drive
Powell River, B.C.

Lab Number: 14377
Date Reported: 13/06/00
Date Received: 05/06/00 16:20:00
Date Collected: 05/06/00 08:00:00

Collected by:
Source: Van Anda Water District
Sample point:

Water Analysis Results

Analysis	Result	Units	Method	Drinking Water Guidelines
14377-01 Priest Lake - intake				
Total Coliforms / Fecal Coliforms				
Total Coliforms	1790	CFU/100	MF	<10
Fecal Coliforms	< 1	CFU/100	MF	<1
14377-02 Priest Lake - Source				
Canadian Drinking Water Guidelines Package				
Color	15	CU		15
Conductivity	194	uS	Conductivity	
Total Dissolved Solids	127	mg/L	gravimetric	500
Hardness (CaCO3)	90.4	mg/L	calc	
pH	7.81	pH Units	pH meter	6.5-8.5
Turbidity	0.90	NTU's	Nephalometric	5
Alkalinity	71.7	mg/L		
Chloride	3.52	mg/L		250
Fluoride	0.05	mg/L		1.5
Sulfate	18.69	mg/L		500
Nitrate (N)	0.19	mg/L		10
Nitrite (N)	< 0.006	mg/L		1
T-Aluminum	0.210	mg/L	ICP	0.2
T-Arsenic	< 0.01	mg/L	HVAAS	0.025
T-Barium	0.0048	mg/L	ICP	1.0
T-Boron	0.027	mg/L	ICP	5.0
T-Cadmium	< 0.0006	mg/L	GFAAS	0.005
T-Calcium	33.0	mg/L	ICP	
T-Chromium	< 0.0009	mg/L	ICP	0.05
T-Copper	0.009	mg/L	ICP	1.0
T-Iron	0.028	mg/L	ICP	0.3

T-Lead	0.003	mg/L	GFAAS	0.01
T-Magnesium	1.95	mg/L	ICP	
T-Manganese	0.0060	mg/L	ICP	0.05
T-Mercury	< 0.0001	mg/L	HVAAS	0.001
T-Potassium	< 0.4	mg/L	ICP	
T-Selenium	< 0.004	mg/L	HVAAS	0.01
T-Sodium	3.0	mg/L	ICP	200
T-Uranium	< 0.06	ng/L	ICP-MS	0.1
T-Zinc	0.0357	mg/L	ICP	5

TABLE C1: LIST OF LOGGED AREAS AND CALCULATED ECAS IN THE PRIEST LAKE WATERSHED

Map Sheet No.	Polygon ID	Projected Ht. (1999)	Hydrologic Recovery (%)	Area (ha)	ECA (ha)	ECA (%)
092F077	40	18	90	11.0	1.10	0.10
092F078	388	0	0	23.0	23.04	2.04
092F077	56	0	0	2.7	2.74	0.24
092F078	144	0	0	0.5	0.49	0.04
092F078	389	29.4	90	0.3	0.03	0.00
092F077	31	0	0	0.3	0.27	0.02
092F078	382	16.6	90	52.7	5.27	0.47
092F078	381	17.8	90	20.4	2.04	0.18
092F078	353	29.7	90	27.4	2.74	0.24
092F078	418	30.4	90	18.5	1.85	0.16
092F078	366	26.1	90	43.5	4.35	0.38
092F078	378	14.4	90	28.0	2.80	0.25
092F078	415	14.4	90	78.0	7.80	0.69
092F078	164	7.6	75	5.5	1.37	0.12
092F078	165	26	90	10.9	1.09	0.10
092F078	167	21	90	5.1	0.51	0.05
092F078	367	26.1	90	3.2	0.32	0.03
092F078	377	9.1	90	5.4	0.54	0.05
092F078	374	12.7	90	11.1	1.11	0.10
092F078	168	11	90	3.8	0.38	0.03
092F078	363	26.6	90	5.3	0.53	0.05
092F078	61	15	90	11.5	1.15	0.10
092F078	416	8.8	75	18.1	4.52	0.40
092F078	419	8	75	27.1	6.77	0.60
092F078	420	8	75	14.6	3.64	0.32
092F078	341		90	38.2	3.82	0.34
092F078	65	5.5	50	0.1	0.03	0.00
092F078	63	13	90	16.0	1.60	0.14
092F078	65	5.5	50	0.4	0.19	0.02
092F078	340	17.2	90	5.2	0.52	0.05
092F078	486	7.5	75	6.4	1.60	0.14
092F078	487	13.5	90	13.4	1.34	0.12
092F078	488	0	0	2.6	2.60	0.23
092F078	489	7.5	75	7.0	1.75	0.15
092F078	492	0	0	1.3	1.30	0.11
TOTAL				**518.24 (45.8%)**	**91.18**	**8.06**

Photo 1 – Priest Lake, view from water intake (June, 2000)

Photo 2 – Priest Lake, view from proposed cutblock (Block 403).

Grassy area is cleared private land (July, 2000)

BRITISH COLUMBIA

File: ORCS 19600-55/TSL ALL

December 1, 2000

Eileen Lavergren,
Secretary of the Board
Van Anda Improvement District
Box 115 Van Anda
Texada Island, British Columbia
VON 3A0

Dear Eileen Lavergren:

Please find attached the Priest Lake Community Watershed Assessment Procedure final report. Also, thank you for your letter of October 19, 2000, outlining your review of the draft assessment report and your comments. I would like to comment on some of the issues that you raised in your letter and also inform you what further work we will be doing to assess the potential impact of proposed harvesting within the watershed. For your information I have also attached a colour map of the watershed showing the various age classes of the forest in different colours.

For this procedure, the standard used in determining whether an area has hydrologically recovered is tree height. As stated in the report, areas with trees less than three metres in height are considered to have no hydrological recovery. As the tree heights increase, the hydrological recovery increases and when the trees reach nine metres in height the hydrological recovery is 90%. Based on the assessment of the entire watershed, it was determined that five percent of the watershed could be harvested in five years without causing any hydrological problems.

Recognizing that we have no control over harvesting of private land within the watershed, harvesting on Crown land will be limited to five percent of the Crown land area (34.5 ha) over the next five years provided that this is within five percent of the total watershed area when combined with significant private land harvesting.

I have reviewed the forest cover information for the watershed and based on this approximately 23% of the area of the watershed has timber stands less than 40 years old. This includes Crown and private land.

In regards to the alder stands in the watershed, approximately 13.4% of the watershed is occupied by stands with a significant component of alder. The majority of this is on private land. The Ministry of Forests is undertaking a review of the existing condition of the forest cover on

Ministry of Forests

Sunshine Coast Forest District

Mailing Address:
7077 Duncan Street
Powell River, BC V8A 1W1

Tel: (604) 485-0700
Fax: (604) 485-0799

private land within the watershed to get a better understanding of the current condition of the entire watershed.

The slope measured in the Priest Lake block and referred to in the report is 30 % (17 degrees) not 30 degrees. The access into this block and the block itself will be field assessed to determine the surface soil erosion hazard. We will also complete a similar assessment of the proposed block west of Spectacle Lake.

I have examined the gas pipeline adjacent to the proposed Priest Lake block in November of this year looking for evidence of erosion. I did not note any evidence of erosion at that time along the pipeline right of way. I would be pleased to field review with you the area of concern regarding heavy rain runoff below the pipeline right-of-way.

The watershed report recommends that water testing be continued by the Van Anda Improvement District. The reference to watershed monitoring in the Community Watershed Assessment Procedures Guidebook is only if there are specific or cumulative upstream impacts. The report did not identify either circumstance.

The Sunshine Coast Forest District recognizes the importance of water quality in with respect to community watersheds. The Forest Practices Code contains extra provisions with respect to Community watersheds to ensure that water quality is given prime consideration when deciding if forestry activities can be performed within them without causing unacceptable risk to water quality. This includes the watershed assessment that has been done and the follow up field assessments noted above.

District staff extend an invitation for further onsite visits as further assessments are completed and, pending the results of the assessments, harvest systems are defined accordingly on the ground.

If you have any questions please contact me at (604) 485-0725.

Yours truly,

Brian Kukulies, R.P.F.
Tenures Forester
Sunshine Coast Forest District

Attachment(s): Community Watershed Assessment for Priest Lake
Colour Forest Cover Map

pc: Drew Brayshaw, Ministry of Environment, Lands and Parks, Water Management Branch
Rick Jones, Van Anda Logging Co, Ltd.