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BURNCO AGGREGATE PROJECT

Vegetation Baseline Report

Submitted to:
BURNCO Rock Products Ltd
BC Aggregate
1A - 2670 Emerson Street
Abbotsford, BC
V2T 3J6

REPORT



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Executive Summary

BURNCO Rock Products Ltd. (BURNCO) is proposing development of the BURNCO Aggregate Project (the Proposed Project) which is situated in the McNab Creek Valley on the northwest shore of Howe Sound, British Columbia (BC), approximately 22 Kilometers (km) southwest of Squamish and 35 km northwest of Vancouver.

Desktop review of existing information and field studies were carried out to describe and quantify baseline vegetation resources that occur within the terrestrial Local Study Area (LSA) and Regional Study Area (RSA). These studies were conducted to provide background and survey data to facilitate completion of an environmental assessment under the *BC Environmental Assessment Act* (BCEAA) and the *Canadian Environmental Assessment Act* (CEAA).

Vegetation field studies included data collection in support of Terrestrial Ecosystem Mapping (TEM), rare plant surveying, and ecosystems at-risk surveying.

The terrestrial RSA is 30,034 ha in size, comprising the McNab Creek watershed and 14 adjacent watersheds that empty into Howe Sound. TEM previously completed by Timberline Natural Resources Group Ltd. was used to quantify vegetation resources in the RSA. The RSA spans three biogeoclimatic zones, dominated by the Coastal Western Hemlock (CWH) zone that occurs at sea level to mid-elevations. The CWH zone transitions to the Mountain Hemlock (MH) zone, which in turn transitions to the Coastal Mountain-heather Alpine (CMA) zone above, as climatic conditions become increasingly harsh. Mature and old growth forests account for 31.2% of the RSA, while shrub-dominated, sapling forest, and young forest structural stages account for 43.9%. Unvegetated or sparsely vegetated areas represent approximately one quarter (16.2%) of the RSA, which include alpine areas, avalanche debris tracks, as well as developed/disturbed land. The remaining 8.7% of the RSA does not have TEM data; these are composed of four small areas of unclassified land located north of the Proposed Project Area along the shore of Howe Sound.

The terrestrial LSA is 569 ha in size, comprising the Proposed Project Area, as well as a buffer. Upland forests occupy the majority of the LSA, while wetlands occupy just 1.5%. Much of the LSA has previously been disturbed by logging, resulting in a broad range of structural stages throughout the area. There is no old growth forest within the LSA; mature forests account for 20.0%, occurring mainly on the east side of McNab Creek, and as elevation increases from the valley bottom on either side of the LSA. The majority of the LSA is in various stages of regeneration following logging; this includes areas dominated by low/tall shrubs, sapling forests, and young forests between 40 and 80 years old.

Desktop review of existing information indicated 11 listed vascular plant species with the potential to occur within the LSA. Rare plant surveying failed to identify any listed plant species in the LSA.

Desktop review of existing information indicated 13 listed ecosystems with the potential to occur within the LSA. Of these ecosystems, seven are suspected to occur within the LSA, occupying 35.8% of the LSA. These suspected listed ecosystems were not formally evaluated as element occurrences due to the disturbed nature of the LSA resulting from logging. A review of BC Ministry of Environment (MOE) Sensitive Ecosystem Mapping studies indicated that no sensitive ecosystems have been mapped within the LSA.



The *BC Weed Control Act* requires all land occupants to specify and implement measures that prevent the introduction or spread of species listed as noxious under the *Weed Control Regulation*. A search of the BC Invasive Alien Plant Program (IAPP) on-line mapping program indicated that no noxious species have been historically documented as occurring within the LSA or RSA (IAPP 2014). However, seven non-native plant species were identified in the Proposed Project Area during the baseline field surveys.



Study Limitations

This baseline report was prepared for the exclusive use of BURNCO Rock Products Ltd. (BURNCO), its assignees and representatives, and is intended to provide a description of vegetation resources that occur within the LSA and RSA and may be affected by the Proposed Project. Furthermore, this report provides background and survey data to facilitate completion of an environmental assessment under the *BC Environmental Assessment Act* and the *Canadian Environmental Assessment Act*.

In developing this Vegetation Baseline Report, Golder Associates Ltd. (Golder) has relied in good faith on information provided by BURNCO, provincial databases, and available literature. We accept no responsibility for any deficiency or inaccuracy contained in this report as a result of our reliance on the aforementioned information.

The findings and conclusions documented in this report have been prepared for the specific application to this Proposed Project, and have been developed in a manner consistent with that level of care normally exercised by environmental professionals currently practicing under similar conditions in British Columbia. Golder makes no warranty, expressed or implied, and assumes no liability with respect to use of the information contained in this report for the Proposed Project Area, or at any other site, other than for its intended purpose.

Any use which a third party makes of this baseline report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Golder accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions undertaken based on this baseline report.



List of Abbreviations

| | |
|---------|---|
| ANPC | Alberta Native Plant Council |
| BC | British Columbia |
| BCEAA | British Columbia Environmental Assessment Act |
| BEC | Biogeoclimatic Ecosystem Classification |
| BC CDC | BC Conservation Data Centre |
| °C | Degrees Celsius |
| CEAA | Canadian Environmental Assessment Act |
| COSEWIC | Committee on the Status of Endangered Wildlife in Canada |
| cm | Centimeter(s) |
| CMA | Coastal Mountain-heather Alpine zone |
| CWH | Coastal Western Hemlock zone |
| GPS | Global Positioning System |
| LRDW | Land and Resource Data Warehouse |
| Ha | Hectare(s) |
| km | Kilometer(s) |
| LSA | Local Study Area |
| m | Meter(s) |
| masl | Meters above sea level |
| MH | Mountain Hemlock zone |
| MFLNRO | Ministry of Forests, Lands and Natural Resource Operations |
| MOA | Ministry of Agriculture |
| MOE | Ministry of Environment |
| MFLNRO | Ministry of Forests, Lands, and Natural Resource Operations |
| RISC | Resources Information Standards Committee |
| RSA | Regional Study Area |
| SAR | Species at risk |
| SARA | Species At Risk Act |
| TEM | Terrestrial Ecosystem Mapping |
| SEI | Sensitive Ecosystem Inventory |
| SPR | South Pacific Ranges ecosection |
| VRI | Vegetation Resource Inventory |



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1.0 INTRODUCTION

1.1 Overview

BURNCO Rock Products Ltd (BURNCO) is proposing development of the BURNCO Aggregate Project (the Proposed Project), which is situated in the McNab Creek Valley on the northwest shore of Howe Sound, British Columbia (BC), approximately 22 Kilometers (km) southwest of Squamish and 35 km northwest of Vancouver (Figure 1). The Proposed Project is located on a fan of the valley's glaciofluvial delta, in the lowlands (20 meters above sea level [masl]) west of the McNab Creek mainstem, and between Mount Wrottesley and Mount Varley (peaks SE2, S2, SE4 and S5).

The Proposed Project Area covers approximately 60 ha in size, which was cleared in 2002 to 2004. The delta fan consists of deposits of sand and gravel intended to be mined and that provide a production volume of 1 to 1.6 million tonnes per annum (mtpa). Mined material will be barged from the Proposed Project Area to BURNCO-owned facilities located in the Greater Vancouver area.

The major Proposed Project features related to terrestrial vegetation include the following:

- A sand and gravel pit which will be developed eastward from an existing logging road extending from the dock facility. The pit will be allowed to naturally fill with water and a floating clamshell dredge with a crusher, and floating conveyor system will be used to move material to a processing plant;
- A processing plant with at least seven aggregate stockpiles;
- A marine loading facility with capacity to accommodate up to 6,000 deadweight tonnage barges;
- Electrical substation;
- Sewage and stormwater treatment facilities;
- Small craft dock (existing) and boat launch; and
- Outbuildings such as site office, workers lunch/dry room, first aid facilities, caretaker's cabin, and heavy equipment maintenance shop (existing).

The Proposed Project Area is currently accessible by boat, float plane or helicopter. A network of logging roads exist north of the Proposed Project Area, many of which were decommissioned in 2008/2009 by Canfor Ltd. Road upgrades beyond the Proposed Project Area are not considered part of the current Proposed Project. Crews and equipment will be moved to the Proposed Project Area by boat or barge. Additional information about the Proposed Project is provided in Part A: Section 2.0 of the Environmental Assessment Certificate Application.

This report provides information on vegetation resources in the Local Study Area (LSA) collected in 2009 to 2012, as well as data compiled from previous surveys and background information sources.



1.2 Purpose

The purpose of this technical report is to describe and quantify baseline vegetation resources that occur within the LSA and Regional Study Area (RSA) established for the vegetation environmental assessment of the Proposed Project. Furthermore, this report provides background and survey data to facilitate completion of an environmental assessment under the *BC Environmental Assessment Act* (BCEAA) and *Canadian Environmental Assessment Act* (CEAA).

Vegetation resources were investigated and described through a combination of desktop review of existing information, field surveys, and development of GIS terrestrial ecosystem mapping products.

Ecosystem mapping of the Proposed Project Area followed the provincial Biogeoclimatic Ecosystem Classification system (BEC), which allows for a standardized approach to ecosystem classification and mapping, and facilitates interpretations for wildlife habitat rankings and assessment of species and ecosystems at risk (RIC 1998; 1999). Such field data and interpretive mapping form an essential part of baseline inventories for land use planning and development.

Specific objectives of the study include the following:

- Define ecosystem units on the basis of field studies;
- Characterize ecosystem units by soil, terrain, vegetation composition, and structural stage;
- Map ecosystem units identified within the study area using field data, topographical data, and colour digital imagery;
- Analyze the resultant terrestrial ecosystem map to identify ecosystem abundance, heterogeneity, and distribution on the landscape;
- Identify, map, and quantify plant species and ecosystem at risk within the study area; and
- Report on the findings of the field studies, data analysis, and subsequent mapping.



2.0 ENVIRONMENTAL SETTING

2.1 Regional Study Area

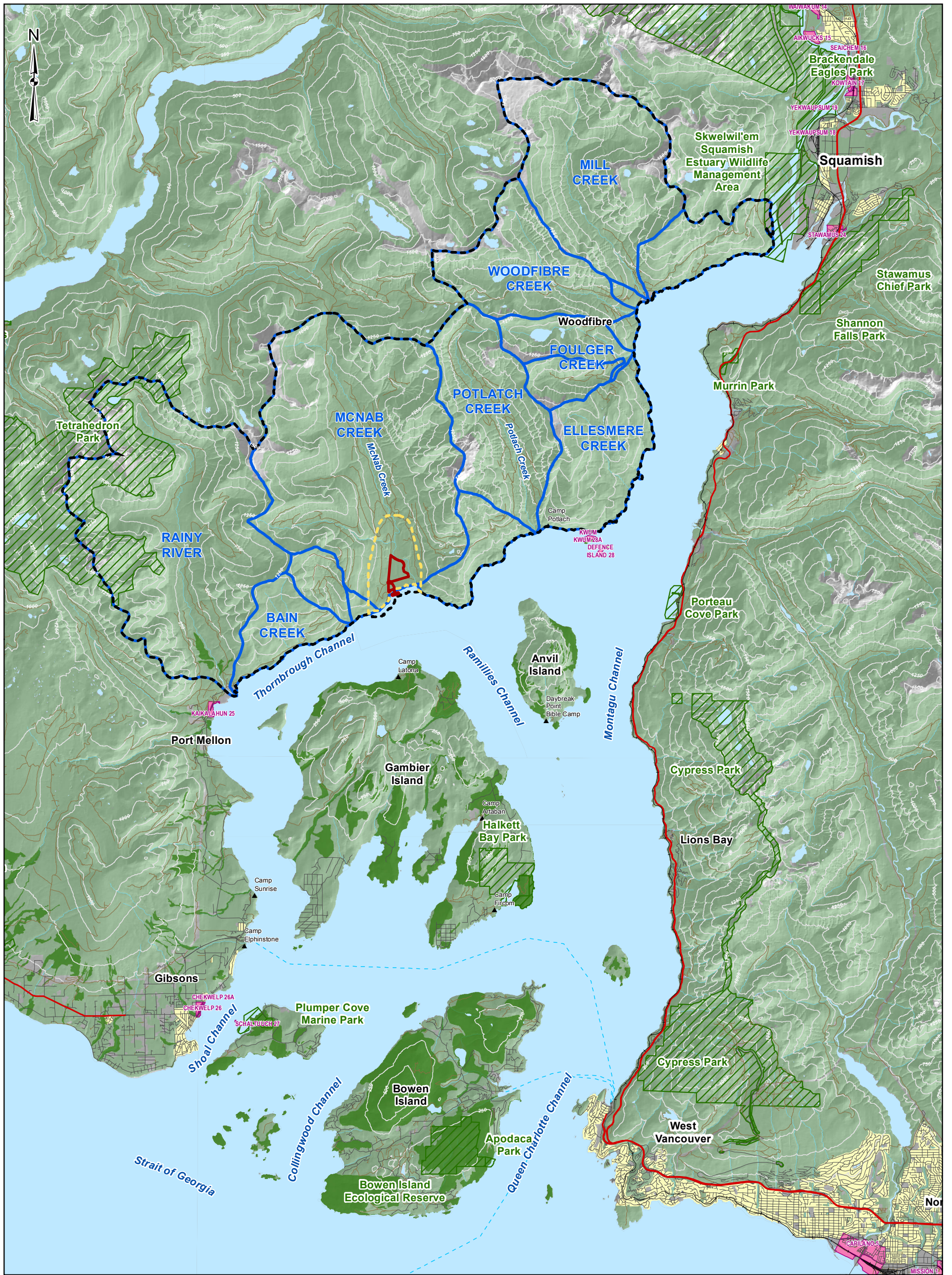
The terrestrial RSA is 30,034 ha in size, comprising the McNab Creek watershed and 14 adjacent watersheds that empty into Howe Sound (Figure 1). The RSA is bounded by Thornbrough Channel of Howe Sound to the south, the Rainy River watershed to the southwest, the Mill Creek watershed to the northeast, and mountain ranges to the north. The RSA was selected and defined based on the following:

- Topographical breaks and watersheds that provide natural landscape barriers;
- Environmental features present in the LSA being represented within the RSA to facilitate comparisons of habitat types; and
- An area large enough to encompass home ranges of large fauna, such as grizzly bear (*Ursus arctos*), to coincide with wildlife studies.

This broader study area is used (1) to provide a regional context for the distribution of terrestrial and wetland ecosystems, and (2) to assist in the assessment of environmental effects – especially in support of regional wildlife habitat assessments. The terrestrial RSA is a common study area for vegetation and wildlife because of the interrelationships between these disciplines.

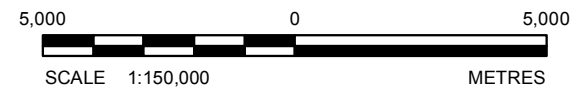
2.2 Local Study Area

The terrestrial LSA is largely defined by a buffer surrounding the Proposed Project Area, and is 569 ha in size (Figure 2). The primary purpose of the buffer is to provide baseline characterization of the surrounding area in order to properly consider the effects of the Proposed Project to wildlife and vegetation (e.g., indirect effects such as sensory disturbances and dust/nutrient deposition) for the environmental assessment. The terrestrial LSA is a common study area for vegetation and wildlife because of the interrelationships between these disciplines.



- LEGEND**
- Regional Study Area (RSA)
 - Local Study Area (LSA)
 - Project Area
 - Watershed in RSA
 - Park / Protected Area
 - Sensitive Environmental Area
 - Vegetation
 - Residential Area
 - Indian Reserve
 - Waterbody
 - Highway
 - Road
 - Resource Road
 - Railway
 - Watercourse
 - Ferry
 - Contour (250m)
 - ▲ Camp

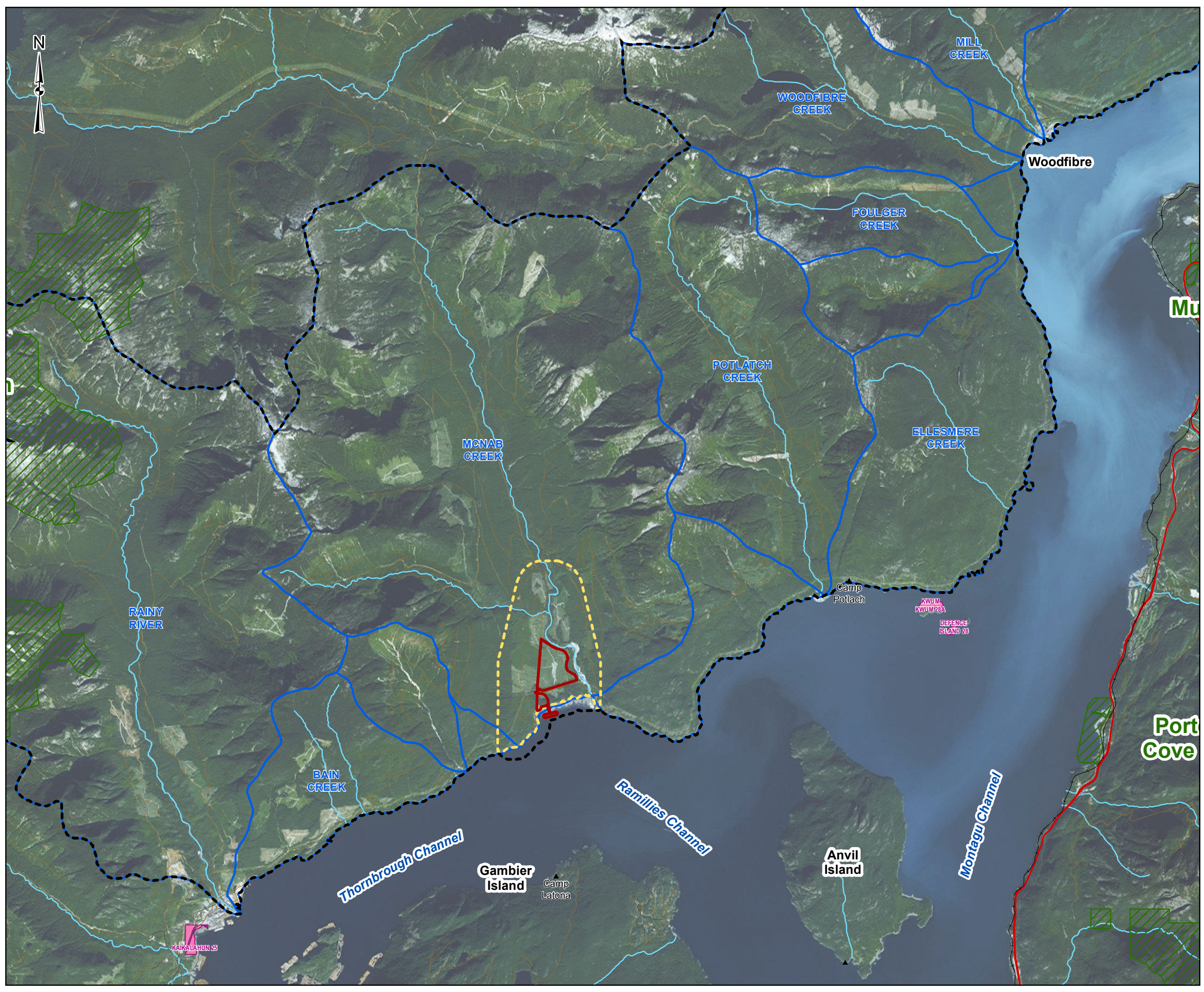
REFERENCE
 Parks/protected areas and sensitive areas from the Province of British Columbia. Elevation and Indian reserves from Geobase. Base data from CanVec. Projection: UTM Zone 10 Datum: NAD 83



| | | | | |
|---|-----|-----------------|----------------|--------|
| PROJECT | | | | |
| BURNCO ROCK PRODUCTS LTD. BURNCO AGGREGATE PROJECT, HOWE SOUND, B.C. | | | | |
| TITLE | | | | |
| TERRESTRIAL REGIONAL STUDY AREA | | | | |
| PROJECT NO. 11-1422-0046 | | PHASE No. | | |
| DESIGN | MD | 02 Nov. 2012 | SCALE AS SHOWN | REV. 0 |
| GIS | DL | 17 Mar. 2016 | | |
| CHECK | VBS | 17 Mar. 2016 | | |
| REVIEW | VBS | 17 Mar. 2016 | | |
| Golder Associates | | FIGURE 1 | | |

Path: X:\Project Data\BC\McNab\Figures\WxD\Vegetation\Baseline\BURNCO_VEGETATION_Figure_01_Terrestrial_Regional_Study_Area.mxd

Path: X:\Project Data\BC\McNab\Figures\MXD\Vegetation\Baseline\BURNCO_VEGETATION_Figure_02_Terrestrial_Local_Study_Area.mxd

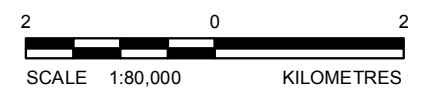


LEGEND

- Project Area
- Local Study Area (LSA)
- Regional Study Area (RSA)
- Watershed
- Park / Protected Area
- Indian Reserve
- Highway
- Road
- Resource Road
- Railway
- Watercourse
- ▲ Camp

REFERENCE

Parks/protected areas and sensitive areas from the Province of British Columbia. Elevation and indian reservers from Geobase. Base data from CanVec. Imagery Copyright © 20120912 Esri and its licensors. Source: DigitalGlobe. Used under license, all rights reserved. Projection: UTM Zone 10 Datum: NAD 83



| | | | |
|---------|-------------|---|----------------|
| PROJECT | | BURNCO ROCK PRODUCTS LTD. BURNCO AGGREGATE PROJECT, HOWE SOUND, B.C. | |
| TITLE | | TERRESTRIAL LOCAL STUDY AREA | |
| | PROJECT NO. | 11-1422-0046 | PHASE No. |
| | DESIGN | MD 2 Nov. 2012 | SCALE AS SHOWN |
| | GIS | DL 17 Mar. 2016 | REV. 0 |
| | CHECK | VBS 17 Mar. 2016 | FIGURE 2 |
| | REVIEW | VBS 17 Mar. 2016 | |



3.0 METHODOLOGY

3.1 Review of Existing Information

Prior to initiation of the field program, a desktop review of existing information pertaining to vegetation resources was conducted. Sources used to compile available vegetation-related data and information were:

- A Field Guide to Site Identification and Interpretation for the Vancouver Forest Region (Green and Klinka 1994);
- Ecosystems of British Columbia (Meidinger and Pojar 1991);
- Wetlands of British Columbia: A Guide to Identification (Mackenzie and Moran 2004);
- Rare Native Vascular Plants of BC (Douglas et al. 2002);
- BC Government iMap web-based mapping service;
- Provincial Biogeoclimatic Subzone/Variant Mapping (BC MFLNRO 2014);
- Provincial Site Series and Map Code List. MS Access Database Updated March, 2006 (BC MOE 2006);
- British Columbia Vegetation Resource Inventory, (BC MFLNRO 2012);
- BC Conservation Data Centre Species and Ecosystems Explorer (BC CDC 2016);
- BC MOE Sensitive Ecosystems Inventory of the Sunshine Coast and Adjacent Islands (BC MOE 2005);
- Species at Risk Public Registry (Government of Canada 2016); and
- Committee on the Status of Endangered Wildlife in Canada Status Reports (Environment Canada 2016).

3.2 Terrestrial Ecosystem Mapping

Vegetation resources within the LSA and RSA are described in accordance with the provincial BEC system. The BEC system groups together ecosystems into categories of a hierarchical classification system. For the purposes of BEC, an ecosystem is defined as a particular plant community and its associated topography, soil, and climate (Green and Klinka 1994). Geographic areas influenced by similar climatic conditions are classified into “biogeoclimatic units”, defined by stable “late-seral” or “near-climax” vegetation communities found on zonal sites (Pojar et al. 1987).

Zonal sites represent the vegetation community that is felt to best typify the influence of the regional climatic regime (Meidinger and Pojar 1991). Zonal sites are typically on soils with medium textures, have medium moisture and nutrient regimes, and occur in topography that is not extreme in terms of slope, aspect or landscape position. Within each biogeoclimatic region, a recurring pattern of vegetation exists that reflects the variation in site factors associated with soils and topography. Sites with similar vegetation potential also have similar environmental properties; most typically moisture and nutrient conditions. Therefore, biogeoclimatic units are further divided into site series, which are groups of ecosystems that, regardless of vegetation, have equivalent edaphic properties, making the sites capable of producing the same mature or climax plant communities (Meidinger and Pojar 1991).



Zonal vegetation and site series relevant to the Proposed Project study areas are discussed in greater detail in Section 4.0 of this report.

Terrestrial ecosystem mapping (TEM) is a process of delineating distinct ecological units in the landscape (i.e., BEC site series) according to characteristics defined by climate, physiography, geology, surficial materials, soils, and vegetation (i.e., species composition, canopy composition, structural stage and stand age). TEM was conducted following the methods set out in the *Standards for Terrestrial Ecosystem Mapping in British Columbia* (RIC 1998). The primary purpose of TEM is outlined by Resources Information Standards Committee (RIC 1998) as follows:

- Provides a means of integrating abiotic and biotic ecosystem components onto one map to portray landscape diversity;
- Provides a biological and ecological framework for land management;
- Provides a basis for rating resource values and indicating sensitivities in the landscape; and
- Provides a historic record of ecological site conditions that can be used as a basis for monitoring ecosystem responses to management.

Historical TEM studies were conducted for the RSA in 2007 and 2008 (Timberline 2007, 2008); the associated reports were located, and the data were used in spatial analysis of vegetation resources within the RSA. A TEM program was conducted to inventory vegetation resources in the LSA.

3.2.1 Field Program

The main objectives of the terrestrial field program were to:

- Collect sufficient data to effectively prepare and ground truth terrestrial ecosystem maps for the LSA;
- Characterize the vegetation and ecosystems in the LSA; and
- Search for plant species and ecological communities at risk (i.e., listed communities).

To meet these objectives, field surveys collected information on soils, presence and abundance of plant species, stand characteristics, site series classification, and listed plant species and ecological communities.

Due to the relatively small size of the LSA, a Level 1 Survey Intensity Level (i.e., 75 to 100% of vegetation polygons inspected) was chosen as per the guidelines set out in RIC (1998), with a resultant minimum survey effort of 2 full plots, 15 ground inspections, and 83 visual plots to meet sampling intensity requirements. A sampling plan of priority, and potential sites to conduct field inspections, were developed using Google Earth digital imagery and NTS maps, which were brought into the field to guide the field program.



Field surveys were conducted in the LSA by a 2-person field crew over a series of 8 field trips to account for different seasons and flowering periods. Three levels of plot data collection were used in describing ecosystems: full plot, ground inspection, and visual observation plot (BC MFLNRO and BC MOE 2010). A total of 125 plots were completed during field surveys, meeting the minimum number and types of plots required under Level 1 Survey Intensity (Table 1 and Figure 5).

Table 1: Summary of Plot Data Collection

| Field Date | Full Plot | Ground Inspection | Visual |
|------------------|-----------|--------------------|------------|
| 13-May-10 | - | 3 | 5 |
| 25-May-10 | - | 3 | 7 |
| 11-May-12 | - | 4 | 8 |
| 28-Jun-12 | - | 4 | 9 |
| 29-Jun-12 | 1 | 2 | 11 |
| 21-Aug-12 | 1 | 5 | 15 |
| 22-Aug-12 | - | 6 | 23 |
| 24-Aug-12 | 1 | 5 | 12 |
| Sub-Total | 3 | 32 | 90 |
| | | Grand Total | 125 |

Field procedures and methods used to describe ecosystems during field surveys followed BC Ministry of Forests and Range (MFLNRO) and BC Ministry of Environment (MOE) (2010). Ministry of Forests FS882 ecosystem field forms were used to record environmental site characteristics. Formal plot boundaries were not used; however, a comprehensive species list was generated by walking around an approximated 20 m x 20 m area. All plot position coordinates were determined using global positioning system (GPS) with an expected accuracy of approximately 4 m. Notes describing the plot, in context and variability within the polygon, were recorded. Photographs were taken at each plot. To characterize soils, shallow pits were dug to a minimum 40 cm or to the 'C' layer.

All vascular plant species, and most bryophyte and lichen species, were identified for full and ground inspection plots. Vegetation percent cover and distribution estimates were recorded. Vascular plant identification followed Hitchcock and Cronquist (1973). Bryophyte and lichen identification followed Vitt et al. (1988).

Following the completion of the field program, field data were entered into an MS ACCESS database using VPro '07 software, an ecological data entry and management tool (BC MFLNRO 2016) and checked for quality assurance. GPS data associated with plot locations were prepared for use in a geographic information system (GIS) environment (ArcGIS® 9.3).



3.2.2 Regional Study Area

Vegetation resources in the RSA were classified through two separate TEM studies completed by Timberline Natural Resource Group (Timberline) in 2007 and 2008 (Timberline 2007, 2008). Objectives of those TEM studies were to:

- Delineate terrestrial ecosystems within the landscape unit;
- Collect ground data to confirm and better describe the mapped site series;
- Localize BEC lines to the map scale; and
- Prepare study deliverables for submission to the BC MOE.

The Timberline TEM field programs consisted of a combination of ground inspections (30%) and visual plots (70%) at a targeted sampling intensity of approximately one plot per 100 ha of study area, equating to Survey Intensity Level 4 (RIC 1998).

Within these studies, the following variances from RIC (1998) standards were made (Timberline 2007, 2008):

- Structural stage attributes were not mapped, as they were being provided in a concurrent Vegetation Resource Inventory (VRI) program;
- The sampling intensity targets applied to productive forest land base, as the TEM was completed for use in future timber supply reviews;
- The Coastal Mountain-heather Alpine (CMA) zone was neither mapped nor classified; and
- Private lands were excluded from the mapped areas.

Shapefiles and associated spatial attribute tables for TEM were collected from the BC MOE Ecological Catalogue (EcoCat), merged, and clipped to the RSA boundary to create an ecosystem map with seamless coverage inside the RSA. A spatial analysis of ecosystems was conducted based on the distribution of BEC units and site series within the RSA.

Mapped Attributes

Deciles - The proportion of different ecological units in a given polygon was indicated by the use of a decile (a number between 1 and 10). Up to three ecosystem units can be designated in a polygon, the deciles of which must add up to 10.

Ecosystem Units - Each identified ecosystem was assigned a two-letter symbol. Ecosystem units that correspond to forested ecosystems or site series of the Coastal Western Hemlock Submontane Very Wet Maritime (CWHvm1) have been assigned a code in the provincial site series coding list.

Site Modifiers - Site modifiers have been used to further describe ecosystem units under conditions that are considered atypical of the site series definition, based on topography, moisture, or soils. Site modifiers used in the RSA TEM are defined in Table 2 (RIC 1998).



Table 2: Site Modifier Definitions

| Symbol | Criteria |
|--------|--|
| a | Active fluvial floodplain where evidence of active sedimentation and deposition is present. |
| c | Coarse textured soils, including sand and loamy-sand. |
| d | Deep soils (>100 cm to bedrock). |
| g | Gullying occurring. |
| h | Hummocky terrain (optional modifier) - hummocky conditions are indicated by the terrain surface expression. |
| j | Gentle slope (<35% in the CWH and Mountain Hemlock (MH) zones). |
| k | Cool aspect - northerly or easterly aspects (285° to 135°) on moderately steep slopes (35% to 100% slope in the CWH and MH zones). |
| m | Medium textured soils, including silt and silt loam. |
| r | Ridge (optional modifier) - occurs throughout ridge terrain or on a ridge crest. |
| s | Shallow soils (20 to 100 cm to bedrock). |
| w | Warm aspect - southerly or westerly aspects (135° to 285°) on moderately steep slopes (35% to 100% slope in the CWH and MH zones). |

Structural Stage – Structural stage was not included in the Timberline (2007, 2008) TEM studies. To supplement these data, VRI data were collected from BC Land and Resource Data Warehouse (LRDW) (BC MFLNRO 2012) for use in structural stage analysis of the RSA. The VRI data range in age, and were last updated in 2001; consequently, the VRI data required updating to reflect forestry and development activities that had occurred in the RSA since that time. The VRI dataset was updated to reflect forestry activity by overlaying the BC Forest Tenure Cutblock dataset (FTA 4.0) available from the LRDW in a GIS environment. As well, VRI polygon stand height, and stand age classifications were updated where discrepancies were observed. Cutblocks that were apparent in Google Earth© imagery, but not reflected in the FTA 4.0 dataset, were hand-digitized and their attributes were also updated accordingly.

3.2.3 Local Study Area

TEM was conducted within the LSA at a scale of 1:5,000, with a minimum polygon size of 0.125 ha (25 m in width). Data collected during field surveys were used as the foundation for interpreting ecological units. Colour, ortho-rectified imagery obtained in 2008 was loaded into ArcGIS® 9.3 software for interpretation.

Mapped Attributes

Deciles - The proportion of different ecological units in a given polygon was indicated by the use of a decile (a number between 1 and 10). Up to three ecosystem units can be designated in a polygon, the deciles of which must add up to 10.

Ecosystem Units - Each identified ecosystem was assigned a two-letter symbol. Ecosystem units that correspond to forested ecosystems or site series of the CWHvm1 have been assigned a code in the provincial site series coding list.





Site Modifiers - Site modifiers have been used to further describe ecosystem units under conditions that are considered atypical of the site series definition, based on topography, moisture, or soils. Site modifiers used in the LSA TEM are consistent with those used in the RSA TEM listed in Table 2.

Structural Stage - The structural stage component of the label consists of a numeric character from 1 to 7. The structural stage describes the existing dominant stand appearance of physiognomy of the ecosystem unit. One of these seven structural stage categories describing the current development stage is assigned to each ecosystem unit (Table 3).

Table 3: Structural Stage Definitions

| Symbol | Structural Stage | Age Criteria and Description |
|--------|-------------------------|---|
| 0 | No vegetation structure | No vegetation present; typically applied to aquatic and anthropogenic ecosystems. |
| 1 | Sparse/Bryoid | An initial stage of primary and secondary succession; total shrub and herb cover is <20%. |
| 1a | Sparse | <10% vegetation cover. |
| 1b | Bryoid | Bryophyte and lichen-dominated. |
| 2 | Herb | Early successional stages, and disclimax or climax sites, dominated by herbaceous vegetation (tree cover <10%, shrub cover ≤ 20%, herb cover >20% or ≥ 33% of total cover) (less than 20 years for normal forest succession). |
| 2a | Forb-dominated | Herbaceous communities dominated (>1/2 of total herb cover) by non-graminoid herbs, including ferns. |
| 2b | Graminoid-dominated | Herbaceous communities dominated (>1/2 of total herb cover by graminoids, e.g., grasses, sedges, reeds, and rushes). |
| 3 | Shrub/herb | Early successional stages, and communities dominated by shrub vegetation <5 m in height (tree cover <10%, shrub cover >20% or ≥ 33% of total cover). Used for communities that will be forested at climax (<20 years for normal forest succession). |
| 3a | Low shrub | Disclimax or climax communities dominated by shrub cover <2 m in height. |
| 3b | Tall shrub | Disclimax or climax communities dominated by shrub cover 2 to 10 m in height. |
| 4 | Pole/sapling succession | Trees >10 m tall; typically densely stocked (up to 80% crown closure); younger stands are more vigorous. Self-thinning and vertical structure are not yet evident in the canopy. Time since disturbance is usually <40 years. |
| 5 | Young forest | Self-thinning is usually evident and the forest canopy has begun differentiation into distinct layers (dominant, main canopy, and overtopped). Tree ages typically range from 40 to 80 years. |
| 6 | Mature forest | Trees established after the last disturbances have matured; a second cycle of shade tolerant trees may have become established; understory becomes well-developed as the canopy opens up. Tree ages typically range from 80 to 250 years. |
| 7 | Old-growth forest | Old, structurally complex stands composed mainly of shade-tolerant and regenerating tree species; snags and coarse wood debris in all stages typical. Tree ages typically >250 years. |

Structural stage modifiers are used to further describe the vertical structure of forested stands, indicating whether they are single storied (s), two-storied (t), multi-storied (m), irregular (i), or shelter-wood (h). Stand composition modifiers describe shrub and forest canopies as coniferous (C), broad-leaved (B), or mixed-wood (M).



3.3 Plants and Ecosystems at Risk

3.3.1 Review of Existing Information

The Government of British Columbia has adopted an approach to maintaining the province's rich biodiversity, referred to as the Conservation Framework (BC MOE 2009). This framework has three goals for conservation of species and ecosystems:

- Contribute to global efforts for species and ecosystem conservation;
- Prevent species and ecosystems from becoming at risk; and
- Maintain the diversity of native species and ecosystems.

To assist with these goals, species are ranked according to global and provincial risk status ranks determined by NatureServe (globally) and the BC Conservation Data Centre (CDC) (provincially) (BC CDC 2016). The methods used to rank species globally and provincially have been established by NatureServe (Faber-Langendoen et al. 2009). At a provincial level, scores are assigned to each species or ecosystem based on various criteria and categorized into one of several lists designated as red, blue, yellow, extinct, exotic, accidental, and unknown or no status (BC CDC 2016).

- Red-listed – includes any ecological community, and indigenous species and subspecies that is extirpated, endangered, or threatened in British Columbia. Extirpated elements no longer exist in the wild in British Columbia, but do occur elsewhere. Endangered elements are facing imminent extirpation or extinction. Threatened elements are likely to become endangered if limiting factors are not reversed.
- Blue-listed – includes any ecological community, and indigenous species and subspecies considered to be of special concern (formerly vulnerable) in British Columbia because of characteristics that make them particularly sensitive to human activities or natural events.
- Yellow-listed – any indigenous species or subspecies (taxa) which is not at risk in British Columbia.
- Exotic – any species that have been moved beyond their natural range as a result of human activity. Exotic species are also referred to as alien species, foreign species, introduced species, non-indigenous species and non-native species.
- Accidental – any species occurring infrequently and unpredictably, outside their usual range.
- Unknown – any species where there is extreme uncertainty about their status or uncertainty regarding whether they are native, introduced or accidental.

In addition to their conservation status, CDC provides information on known locations of species and ecological communities at risk. Potential rare, threatened and endangered species and plant communities (ecosystems) of the LSA were searched through two Ministry web applications to access the CDC database. Although the database is not a comprehensive listing of all known or suspected occurrences, it does provide baseline information from which to conduct on-site surveys.



The BC Species and Ecosystem Explorer application was used to generate provincial lists of species and ecosystems at risk currently documented and ranked by the CDC (BC CDC 2016). A search was conducted for listed plants and plant communities within the CWHvm1 of the Sunshine Coast Forest District.

Prior to initiating the field program, drawings and descriptions of plant characteristics, phenology and habitat were reviewed and compiled from various taxonomic references for listed species with potential to occur in the LSA.

In addition to ecological communities at risk, BC MOE Sensitive Ecosystems Inventory (SEI) studies were also consulted to see if SEI data were available for the RSA. SEI is used to identify remnants of rare and fragile terrestrial ecosystems and to encourage land-use decisions that will ensure the continued integrity of these ecosystems (BC MOE 2012). Ecosystem types identified include Old Forest, Woodland, Herbaceous, Riparian, Wetland, and Cliff (BC MOE 2012).

3.3.2 Field Program

Field surveys for plant species and communities at risk were carried out in conjunction with the TEM fieldwork. Systematic meandering surveys were carried out while traversing the site between TEM field plots as well as in the general vicinity of the plots. As no BC provincial standard for rare plant surveying currently exists, methods generally followed those laid out by Penny and Klinkenberg (2012) and the Alberta Native Plant Council (ANPC 2012). Since the fieldwork spanned eight separate trips over multiple years and different seasons, good coverage was considered to be achieved to account for varying phenology of plant species at risk with the potential to occur in the LSA.

Populations of plant species at risk located during field surveys were photographed, and if possible, a specimen was collected and preserved for verification. Plant specimens were verified by BC CDC botanists Jenifer Penny and Marta Donovan.



4.0 RESULTS

4.1 Terrestrial Ecosystem Mapping

4.1.1 Regional Study Area

The RSA is located in the Southern Pacific Ranges (SPR) ecosection under the provincial BEC system (Demarchi 2011). Demarchi (2011) provided the following description of the SPR ecosection:

“The SPR ecosection is composed of rugged granitic mountains that rise abruptly out of the Fraser Valley and Sunshine Coast... There are several fjords in the northern portion that drain into the Salish Sea, such as: Indian Arm, Howe Sound and Jervis Inlet... This ecosection is greatly influenced by westerly Pacific storms bringing heavy rain and snow from late fall to winter; summers can be dry and warm with occasional rainy periods... Except in the several parks, intensive clearcut logging, with its attendant roads has occurred on all the valleys and lower slopes.”

4.1.1.1 Ecosystem Units

The RSA spans three biogeoclimatic zones, dominated by the Coastal Western Hemlock (CWH) zone, which occurs at sea level to mid-elevations (Green and Klinka 1994). The CWH zone transitions to the Mountain Hemlock (MH) zone, which in turn transitions to the Coastal Mountain-heather Alpine (CMA) zone above as climatic conditions become increasingly harsh (Meidinger and Pojar 1991). Table 4 displays the distribution of biogeoclimatic units within the RSA as delineated by Timberline (2007, 2008).

Table 4: Distribution of Biogeoclimatic Units in the Regional Study Area

| Unit | Name | Area (ha) | Proportion of RSA (%) ¹ |
|--------------|--|-----------------|------------------------------------|
| CWHdm | Coastal Western Hemlock Dry Maritime Variant | 4,174.9 | 13.9 |
| CWHvm1 | Coastal Western Hemlock Submontane Very Wet Maritime Variant | 6,457.6 | 21.5 |
| CWHvm2 | Coastal Western Hemlock Montane Very Wet Maritime Variant | 8,411.8 | 28.0 |
| MHmm1 | Mountain Hemlock Windward Moist Maritime Variant | 7,198.0 | 24.0 |
| MHmmp1 | Mountain Hemlock Windward Moist Maritime Parkland Variant | 1,190.9 | 4.0 |
| N/A | Unclassified/private land | 2,601.0 | 8.7 |
| Total | | 30,034.4 | 100 |

NOTE: Timberline (2007; 2008) did not delineate CMA from MH zones; therefore CMA is included in MH total areas.

Coastal Western Hemlock (CWH) Zone

The CWH zone covers the majority of the RSA (19,044 ha or 63%). The CWH is characterized by a cool mesothermal climate, with cool summers (although hot dry spells can be frequent) and mild winters. Mean annual temperature is about 8°C and ranges from 5.2°C to 10.5°C among the CWH subzones (Meidinger and Pojar 1991). The CWH is typically the rainiest biogeoclimatic zone in BC, with mean annual precipitation at 2,228 mm (for the zone as a whole), <15% of which falling as snow in the southern regions of the zone (Meidinger and Pojar 1991). Three CWH subzones are present in the RSA.

¹ Numbers are estimates and have been rounded to the nearest whole number



CWHdm

The CWH dry maritime variant (CWHdm) ranges from sea level to approximately 650 masl. The CWHdm has warm, relatively dry summers and moist, mild winters with relatively little snowfall (Green and Klinka 1994).

Zonal vegetation in the CWHdm is dominated by Douglas-fir (*Pseudotsuga menziesii* ssp. *menziesii*), western redcedar (*Thuja plicata*), and western hemlock (*Tsuga heterophylla*). Major understorey species include salal (*Gaultheria shallon*), red huckleberry (*Vaccinium parviflorum*), step moss (*Hylocomium splendens*), Oregon beaked-moss (*Kindbergia oregana*), lanky moss (*Rhytidiadelphus loreus*), and flat moss (*Plagiothecium undulatum*). Less common species include dull Oregon grape (*Mahonia nervosa*), vine maple (*Acer circinatum*), bracken fern (*Pteridium aquilinum*), and sword fern (*Polystichum munitum*) (Green and Klinka 1994).

Although the BC MOE BEC coverage shows the lower elevations of the RSA to fall into the CWHvm1 variant, Timberline (2008) mapped the southern reaches of the RSA along the shoreline of Howe Sound as CWHdm. These edits were largely based on field observations of Amabilis fir (*Abies grandis*), which was not evident in any of the plots within these areas (Timberline 2008). Timberline (2008) mapped a total of 17 vegetated, non-vegetated, and anthropogenic site series within the CWHdm variant (Table 5 and Figure 3).

Table 5: CWHdm Site Series Mapped within the Regional Study Area

| Mapcode | Site Series Number | Ecosystem Unit Name | Area (ha) | Proportion of RSA (%) |
|--------------|--------------------|---|----------------|-----------------------|
| HM | 01 | Western hemlock – Flat moss | 2,130.8 | 7.1 |
| DC | 02 | Douglas-fir – Lodgepole pine – Cladina | 132.4 | 0.4 |
| DS | 03 | Douglas-fir – Western Hemlock – Salal | 570.2 | 1.9 |
| DF | 04 | Douglas-fir – sword fern | 16.0 | 0.1 |
| RS | 05 | Western redcedar – sword fern | 900.6 | 3.0 |
| RF | 07 | Western redcedar – Foamflower | 264.3 | 0.9 |
| SS | 08 | Sitka spruce – Salmonberry | 1.5 | <0.1 |
| RC | 12 | Western redcedar – Sitka spruce – skunk cabbage | 10.5 | <0.1 |
| AV | 00 | Red alder – vine maple avalanche track | 12.7 | <0.1 |
| GB | 00 | Gravel bar | 1.1 | <0.1 |
| PD | 00 | Pond | 2.5 | <0.1 |
| RI | 00 | River | 16.5 | 0.1 |
| RO | 00 | Rock outcrop | 92.6 | 0.3 |
| SA | 00 | Sitka alder – Salmonberry avalanche chute | 2.8 | <0.1 |
| TA | 00 | Talus | 7.6 | <0.1 |
| ES | 00 | Exposed soil | 9.9 | <0.1 |
| RZ | 00 | Road | 2.9 | <0.1 |
| TOTAL | | | 4,174.9 | 13.9 |

Path: X:\Project Data\BC\Vegetation\Baseline\BURNCO_VEGETATION_Figure_03_Regional_Study_Area_Terrestrial_Ecosystem_Map.mxd

| | |
|------------------------------|--|
| Ecosession | |
| SPR | South Pacific Ranges |
| Biogeoclimatic Units | |
| CWHm1 | Coastal Western Hemlock Dry Maritime Variant |
| CWHm2 | Coastal Western Hemlock Submontane Very Wet Maritime Variant |
| MHm1 | Mountain Hemlock Windward Moist Maritime Variant |
| MHm2 | Mountain Hemlock Windward Moist Maritime Variant |
| CMA | Coastal Mountain-heather Alpine Zone |
| Ecosystem Unit Labels | |
| Biogeoclimatic Unit | |
| Ecosystem Code 2 | |
| Ecosystem Code 1 | |
| Site Modifier | |

| | | |
|-----------------------------------|---|--------------------|
| CWHm1 Site Series Mapcodes | | |
| Mapcode | Ecosystem Unit Name | Site Series Number |
| AA | Western hemlock - Fir moss | 01 |
| OC | Douglas fir - Lodgepole pine - Cladonia | 02 |
| DF | Douglas fir - Western hemlock - Salal | 04 |
| RF | Western redcedar - sword fern | 07 |
| SS | Sitka spruce - Salmonberry | 08 |
| RC | Western redcedar - Sitka spruce - skunk cabbage | 12 |
| AV | Red alder - vine maple - avalanche chute | 00 |
| CB | Gravel bar | 00 |
| PD | Pond | 00 |
| RI | River | 00 |
| RO | Rock outcrop | 00 |
| SA | Sitka alder - Salmonberry - avalanche chute | 00 |
| TA | Talus | 00 |
| ES | Exposed soil | 00 |
| RZ | Road | 00 |

| | | |
|-----------------------------------|--|--------------------|
| CWHm2 Site Series Mapcodes | | |
| Mapcode | Ecosystem Unit Name | Site Series Number |
| AB | Western hemlock - Anemone fr. - Blueberry | 01 |
| LC | Western hemlock - Lodgepole pine - Cladonia | 02 |
| NS | Western redcedar - Western hemlock - Salal | 04 |
| AF | Anemone fr. - Western redcedar - Fleasbane | 05 |
| HD | Western hemlock - Anemone fr. - Deer fern | 07 |
| AS | Anemone fr. - Western redcedar - Salmonberry | 08 |
| SS | Sitka spruce - Salmonberry | 09 |
| LD | Lodgepole pine - Sphagnum | 11 |
| RC | Western red cedar - Sitka spruce - skunk cabbage | 14 |
| AA | Anemone fr. - Alaskan blueberry | 00 |
| BT | Brashy talus | 00 |
| GB | Gravel bar | 00 |
| OT | Grassmeadow - avalanche track | 00 |
| SA | Sitka alder - Salmonberry - avalanche chute | 00 |
| RI | River | 00 |
| RO | Rock outcrop | 00 |
| TA | Talus | 00 |
| ES | Exposed soil | 00 |
| UNC | Unclassified | 00 |

| | | |
|----------------------------------|---|--------------------|
| MHm1 Site Series Mapcodes | | |
| Mapcode | Ecosystem Unit Name | Site Series Number |
| MB | Mountain hemlock - Anemone fr. - Blueberry | 01 |
| MO | Mountain hemlock - Anemone fr. - Mountain-heather | 02 |
| MO | Anemone fr. - Mountain hemlock - Oak fern | 03 |
| AB | Mountain hemlock - bramble | 04 |
| MT | Anemone fr. - Mountain hemlock - Treadloose | 05 |
| MD | Mountain hemlock - Yellow cedar - Deer cabbage | 06 |
| YH | Yellow cedar - Mountain hemlock - Hellebore | 07 |
| YC | Yellow cedar - Mountain hemlock - skunk cabbage | 08 |
| AA | Anemone fr. - Alaskan blueberry | 09 |
| AS | Alaskan blueberry - Sitka vaterian | 10 |
| BT | Brashy talus | 00 |
| SV | Blue-leaved huckleberry - Sitka vaterian | 00 |
| CB | Gravel bar | 00 |
| HA | Heather meadow | 00 |
| RR | Kiwakwack - Racomitrium rock | 00 |
| LA | Lake | 00 |
| MR | Mountain hemlock - Mountain-heather parklandheath | 00 |
| MR | Mountain-heather - Racomitrium scrub | 00 |
| PD | Pond | 00 |
| PS | Partridgefoot - Sedge meadow | 00 |
| RO | Rock outcrop | 00 |
| RU | Rubble | 00 |
| SA | Sitka alder - Salmonberry - avalanche chute | 00 |
| TA | Talus | 00 |
| TS | Tuffet outwash - Sphagnum bog | 00 |
| YB | heather | 00 |
| ES | Exposed soil | 00 |

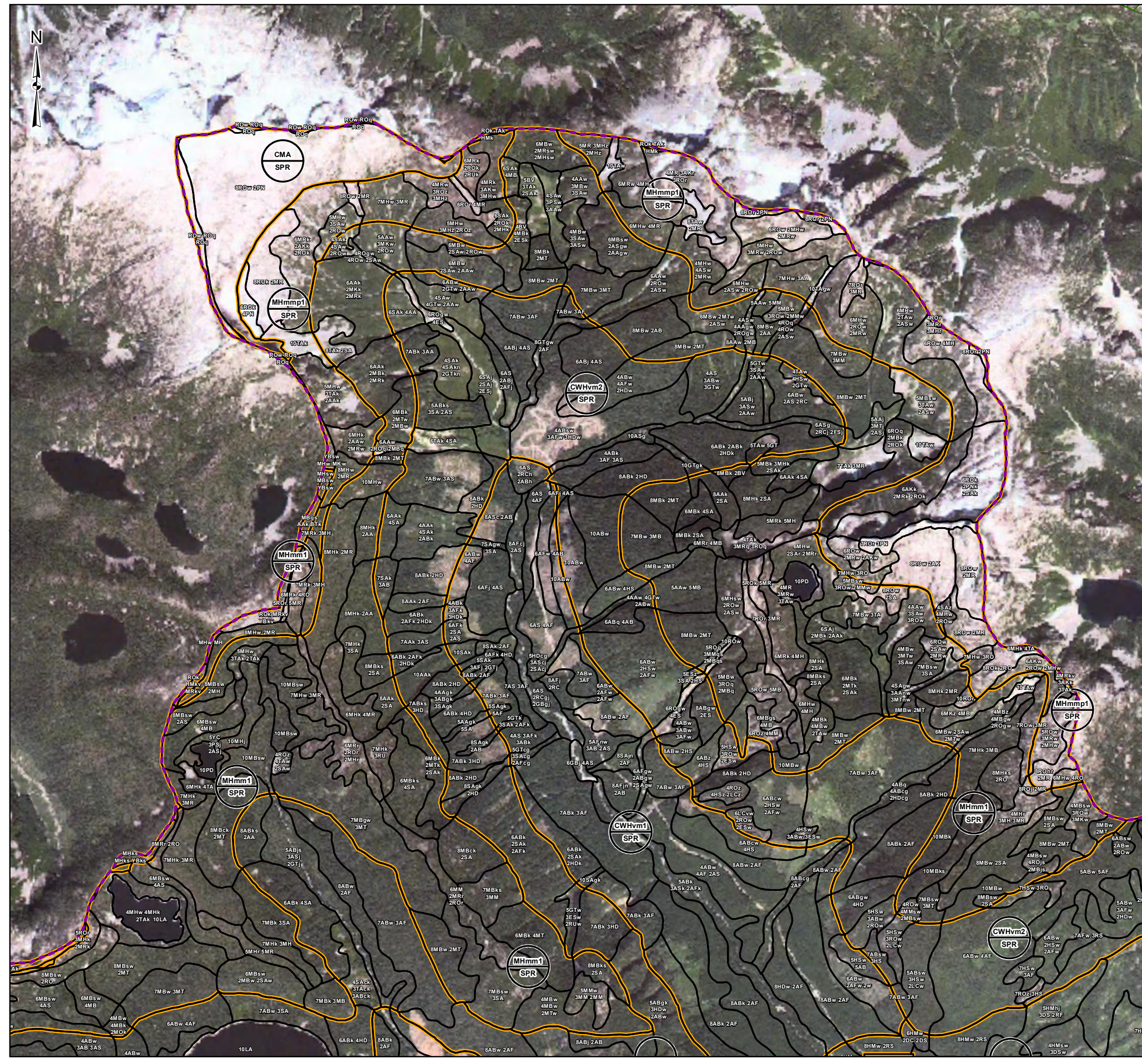
| | | |
|----------------------------------|---|--------------------|
| MHm2 Site Series Mapcodes | | |
| Mapcode | Ecosystem Unit Name | Site Series Number |
| AA | Anemone fr. - Alaskan blueberry | 01 |
| AK | Mountain hemlock - Yellow cedar - skunk cabbage | 02 |
| AV | Anemone fr. - Sitka vaterian | 03 |
| BT | Brashy talus | 00 |
| CB | Gravel bar | 00 |
| HA | Heather meadow | 00 |
| MR | Mountain hemlock - Mountain-heather parklandheath | 00 |
| MR | Mountain-heather - Racomitrium scrub | 00 |
| PD | Pond | 00 |
| UN | Unclassified mapcode | 00 |
| RO | Rock outcrop | 00 |
| RU | Rubble | 00 |
| SA | Sitka alder - Salmonberry - avalanche chute | 00 |
| TA | Talus | 00 |
| YB | heather | 00 |
| ES | Exposed soil | 00 |

| | | |
|----------------------------------|---|--------------------|
| MHm1 Site Series Mapcodes | | |
| Mapcode | Ecosystem Unit Name | Site Series Number |
| AA | Anemone fr. - Alaskan blueberry | 01 |
| AK | Mountain hemlock - Yellow cedar - skunk cabbage | 02 |
| AV | Anemone fr. - Sitka vaterian | 03 |
| BT | Brashy talus | 00 |
| CB | Gravel bar | 00 |
| HA | Heather meadow | 00 |
| MR | Mountain hemlock - Mountain-heather parklandheath | 00 |
| MR | Mountain-heather - Racomitrium scrub | 00 |
| PD | Pond | 00 |
| UN | Unclassified mapcode | 00 |
| RO | Rock outcrop | 00 |
| RU | Rubble | 00 |
| SA | Sitka alder - Salmonberry - avalanche chute | 00 |
| TA | Talus | 00 |
| YB | heather | 00 |
| ES | Exposed soil | 00 |

| | |
|-----------------------|--|
| Site Modifiers | |
| Symbol | Criteria |
| a | Active basal faultplain where evidence of active sedimentation and deposition is present |
| c | Coarse textured soils, including sand and loamy-sand |
| d | Deep soils (>100 cm to bedrock) |
| e | Gravelly occupying |
| h | Hummocky terrain (topographic modifier) - hummocky conditions are indicated by the terrain surface expression |
| j | Grass slope (<50% in the CWH zones) |
| k | Grass slope (>50% in the CWH zones) |
| m | Medium textured soils, including silty and silty loam |
| r | Ridge (topographic modifier) - occurs throughout ridge terrain or on a great escarpment |
| w | Warm aspect - southerly or westerly aspects (135° - 205°) on moderately steep slopes (25% - 100% slope in the CWH zones) |

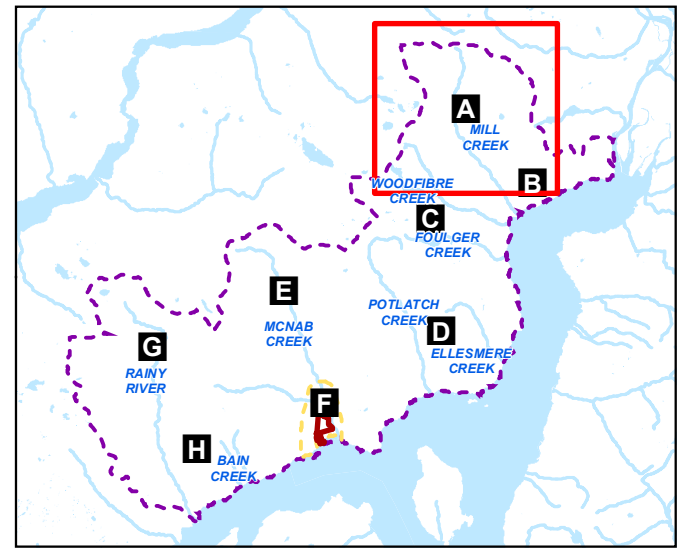
| | | |
|-------------------------|------------------|---|
| Structural Stage | | |
| Symbol | Structural Stage | Description |
| 1 | Pioneer | Ecotypic and lichen dominated communities |
| 2 | Herbaceous | Herbaceous communities |
| 3 | Forb | Forb cover |
| 2b | Grassmeadow | Dominated by grasses, sedges, and rushes |
| 3a | Low shrubs | Shrubs <2 m tall |
| 3b | Tall shrubs | Shrubs >2 m tall |
| 4 | Pole-slaying | Trees >10 m tall; stands typically 20-40 years old |
| 5 | Young Forest | Trees >10 m tall; stands typically 40-80 years old |
| 6 | Mature Forest | Trees >10 m tall; stands typically 80-200 years old |
| 7 | Old Forest | Trees >10 m tall; stands typically >200 years old |

| | | |
|------------------------------------|------------|--|
| Stand Composition Modifiers | | |
| Symbol | Stand Type | Description |
| C | Coniferous | >75% of total tree layer cover is coniferous |
| B | Broadleaf | >75% of total tree layer cover is broadleaf |
| M | Mixed | Neither coniferous or broadleaf account for >75% of total tree layer cover |



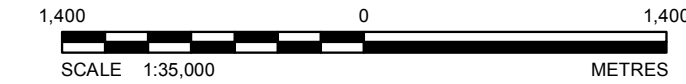
| | |
|---------------|---------------------------|
| LEGEND | |
| | Regional Study Area (RSA) |
| | Biogeoclimatic Unit |
| | Ecosystem Unit |
| | Park / Protected Area |

FIGURE AREA



REFERENCE

Parks and protected areas from the Province of British Columbia. Base data from CanVec. Imagery from BC WMS Layer: BC_S5L5_BC_2004_2006_BCALB_15M_PANB321_ENH. TEM from Timberline Natural Resource Group Ltd. (2007; 2008).
Projection: UTM Zone 10 Datum: NAD 83



PROJECT
BURNCO ROCK PRODUCTS LTD.
BURNCO AGGREGATE PROJECT, HOWE SOUND, B.C.

TITLE
REGIONAL STUDY AREA
TERRESTRIAL ECOSYSTEM MAP

| | | | |
|-------------|------------------|----------------|--------|
| PROJECT NO. | 11-1422-0046 | PHASE No. | |
| DESIGN | SH 21 Jan. 2013 | SCALE AS SHOWN | REV. 0 |
| GIS | DL 17 Mar. 2016 | | |
| CHECK | VBS 17 Mar. 2016 | | |
| REVIEW | VBS 17 Mar. 2016 | | |



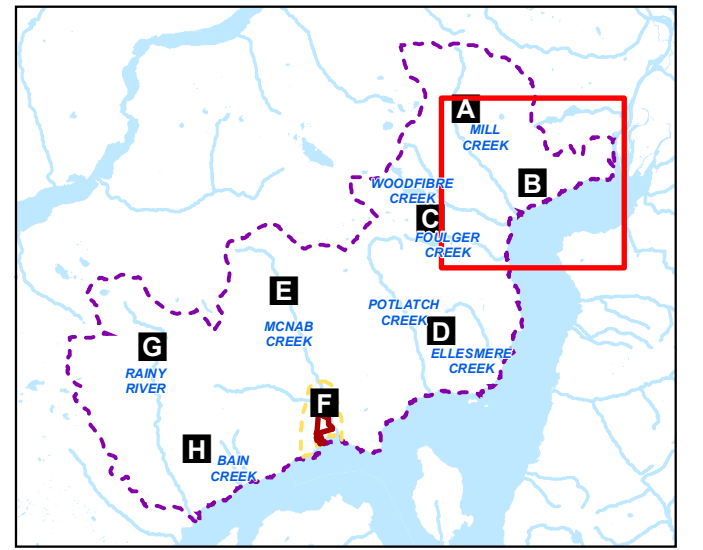
FIGURE 3 - A

| | | |
|---|---|--|
| Ecoecosection | | |
| SPR | South Pacific Ranges | |
| Biogeoclimatic Units | | |
| CWH1m | Coastal Western Hemlock Dry Maritime Variant | |
| CWH1m1 | Coastal Western Hemlock Submontane Very Wet Maritime Variant | |
| CWH1m2 | Coastal Western Hemlock Montane Very Wet Maritime Variant | |
| MH1m1 | Mountain Hemlock Windward Moist Maritime Variant | |
| MH1m2 | Mountain Hemlock Windward Moist Maritime Variant | |
| CMA | Coastal Mountain-heather Alpine Zone | |
| Ecoecosection and Biogeoclimatic Units Label | | |
| CWH1m1 | SPR | |
| 6AB | 4HDck | |
| CWH1m1 Site Series Mapcodes | | |
| Mapcode | Ecosystem Unit Name | Site Series Number |
| AA | Western hemlock - Fir moss | 01 |
| OC | Douglas fir - Lodgepole pine - Cladonia | 02 |
| LC | Western hemlock - Lodgepole pine - Cladonia | 03 |
| DF | Douglas fir - sword fern | 04 |
| RF | Western redcedar - sword fern | 05 |
| RF | Western redcedar - Feathermoss | 06 |
| SS | Sitka spruce - Salmonberry | 07 |
| RC | Western redcedar - Sitka spruce - skunk cabbage | 08 |
| AV | Red alder - vine maple - avalanche chute | 09 |
| CB | Great bar | 10 |
| PO | Pond | 11 |
| RO | Rock outcrop | 12 |
| SA | Sitka alder - Salmonberry - avalanche chute | 13 |
| TA | Talus | 14 |
| ES | Exposed soil | 15 |
| RZ | Road | 16 |
| CWH1m2 Site Series Mapcodes | | |
| Mapcode | Ecosystem Unit Name | Site Series Number |
| AB | Western hemlock - Anemone fr. - Blueberry | 01 |
| LC | Western hemlock - Lodgepole pine - Cladonia | 02 |
| NS | Western redcedar - Western hemlock - Sialia | 03 |
| AF | Anemone fr. - Western redcedar - Feathermoss | 04 |
| HD | Western hemlock - Anemone fr. - Deer fern | 05 |
| HO | Anemone fr. - Western redcedar - Salmonberry | 06 |
| SB | Sitka spruce - Salmonberry | 07 |
| RC | Lodgepole pine - Salmonberry | 08 |
| RC | Western redcedar - Sitka spruce - skunk cabbage | 09 |
| AA | Anemone fr. - Alaskan blueberry | 10 |
| BT | Brashy talus | 11 |
| OB | Great bar | 12 |
| OT | Grass/moss/avalanche track | 13 |
| SA | Sitka alder - Salmonberry - avalanche chute | 14 |
| RZ | Road | 15 |
| RO | Rock outcrop | 16 |
| TA | Talus | 17 |
| ES | Exposed soil | 18 |
| UNC | Unclassified | 19 |
| CWH1m2 Site Series Mapcodes | | |
| Mapcode | Ecosystem Unit Name | Site Series Number |
| AB | Western hemlock - Anemone fr. - Blueberry | 01 |
| AF | Western hemlock - Lodgepole pine - Cladonia | 02 |
| LC | Western hemlock - Lodgepole pine - Cladonia | 03 |
| NS | Western redcedar - Western hemlock - Sialia | 04 |
| RF | Western redcedar - Western hemlock - Feathermoss | 05 |
| HD | Western hemlock - Anemone fr. - Deer fern | 06 |
| HO | Anemone fr. - Western redcedar - Salmonberry | 07 |
| RC | Western redcedar - Sitka spruce - skunk cabbage | 08 |
| AA | Anemone fr. - Alaskan blueberry | 09 |
| BT | Brashy talus | 10 |
| OB | Great bar | 11 |
| OT | Grass/moss/avalanche track | 12 |
| SA | Sitka alder - Salmonberry - avalanche chute | 13 |
| OW | Shallow open water | 14 |
| PO | Pond | 15 |
| RO | Rock outcrop | 16 |
| RJ | Rubble | 17 |
| TA | Talus | 18 |
| ES | Exposed soil | 19 |
| MH1m1 Site Series Mapcodes | | |
| Mapcode | Ecosystem Unit Name | Site Series Number |
| MB | Mountain hemlock - Anemone fr. - Blueberry | 01 |
| MM | Mountain hemlock - Anemone fr. - Mountain-heather | 02 |
| MO | Anemone fr. - Mountain hemlock - Oak fern | 03 |
| AB | Mountain hemlock - bramble | 04 |
| MT | Anemone fr. - Mountain hemlock - Teasel | 05 |
| MD | Mountain hemlock - Yellow cedar - Deer cabbage | 06 |
| YH | Yellow cedar - Mountain hemlock - Hellebore | 07 |
| YC | Yellow cedar - Mountain hemlock - skunk cabbage | 08 |
| AA | Anemone fr. - Alaskan blueberry | 09 |
| AS | Alaskan blueberry - Sitka varian | 10 |
| BT | Brashy talus | 11 |
| BV | Blue-leaved huckleberry - Sitka varian | 12 |
| CA | Heather meadow | 13 |
| RR | Kivaknock - Racombium rock | 14 |
| LA | Lake | 15 |
| MH | Mountain hemlock - Mountain-heather parkinnohead | 16 |
| MR | Mountain-heather - Racombium scrub | 17 |
| PO | Pond | 18 |
| PS | Partingfoot - Sedge meadow | 19 |
| RO | Rock outcrop | 20 |
| RJ | Rubble | 21 |
| SA | Sitka alder - Salmonberry - avalanche chute | 22 |
| TA | Talus | 23 |
| ES | Exposed soil | 24 |
| MH1m2 Site Series Mapcodes | | |
| Mapcode | Ecosystem Unit Name | Site Series Number |
| AA | Anemone fr. - Alaskan blueberry | 01 |
| AK | Mountain hemlock - Yellow cedar - alpine krummholz | 02 |
| AS | Alaskan blueberry - Sitka varian | 03 |
| BT | Brashy talus | 04 |
| CL | Cir | 05 |
| HA | Heather meadow | 06 |
| MA | Mountain hemlock - Mountain-heather parkinnohead | 07 |
| MR | Mountain-heather - Racombium scrub | 08 |
| PO | Pond | 09 |
| PH | Upland meadow | 10 |
| RO | Rock outcrop | 11 |
| RJ | Rubble | 12 |
| SA | Sitka alder - Salmonberry - avalanche chute | 13 |
| TA | Talus | 14 |
| ES | Exposed soil | 15 |
| Site Modifiers | | |
| Symbol | Criteria | |
| a | Active basal floodplain where evidence of active sedimentation and deposition is present | |
| c | Coarse textured soils, including sand and loamy-sand | |
| d | Deep soils (>100 cm to bedrock) | |
| g | Gully occurring | |
| h | Hummocky terrain (optional modifier) - hummocky conditions are indicated by the terrain surface expression | |
| j | Gentle slope (<30% in the CWH zones) | |
| k | Coastal aspect (optional modifier) or westerly aspects (280° - 340°) on moderately steep slopes (25% - 100% slope in the CWH zones) | |
| m | Medium to steep slope (>30% to 100% slope in the CWH zones) | |
| r | Ridge (optional modifier) - occurs throughout ridge terrain or on a ridge crest | |
| s | Shallow soils (20-100 cm to bedrock) | |
| w | Warm aspect - southerly or westerly aspects (135° - 285°) on moderately steep slopes (25% - 100% slope in the CWH zones) | |
| Structural Stage | | |
| Symbol | Structural Stage | Description |
| 1 | Pioneer | Biogenic and lichen dominated communities |
| 2 | Herbaceous | Herbaceous communities |
| 3a | Forb | Dominated by forb cover |
| 3b | Grassland | Dominated by grasses, sedges, and rushes |
| 3c | Low Shrub | Shrubs <2 m tall |
| 3d | Tall Shrub | Shrubs >2 m tall |
| 4 | Pole-slaying | Trees >10 m tall; stands typically 20-40 years old |
| 5 | Young Forest | Trees >10 m tall; stands typically 40-80 years old |
| 6 | Mature Forest | Trees >10 m tall; stands typically 80-200 years old |
| 7 | Old Forest | Trees >10 m tall; stands typically >200 years old |
| Stand Composition Modifiers | | |
| Symbol | Stand Type | Description |
| C | Coniferous | >75% of total tree layer cover is coniferous |
| B | Broadleaf | >75% of total tree layer cover is broadleaf |
| M | Mixed | Neither coniferous or broadleaf account for >75% of total tree layer cover |



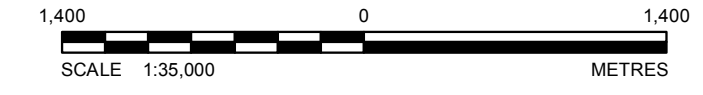
| | |
|---------------|---------------------------|
| LEGEND | |
| | Regional Study Area (RSA) |
| | Biogeoclimatic Unit |
| | Ecosystem Unit |
| | Park / Protected Area |
| | Road |

FIGURE AREA



REFERENCE

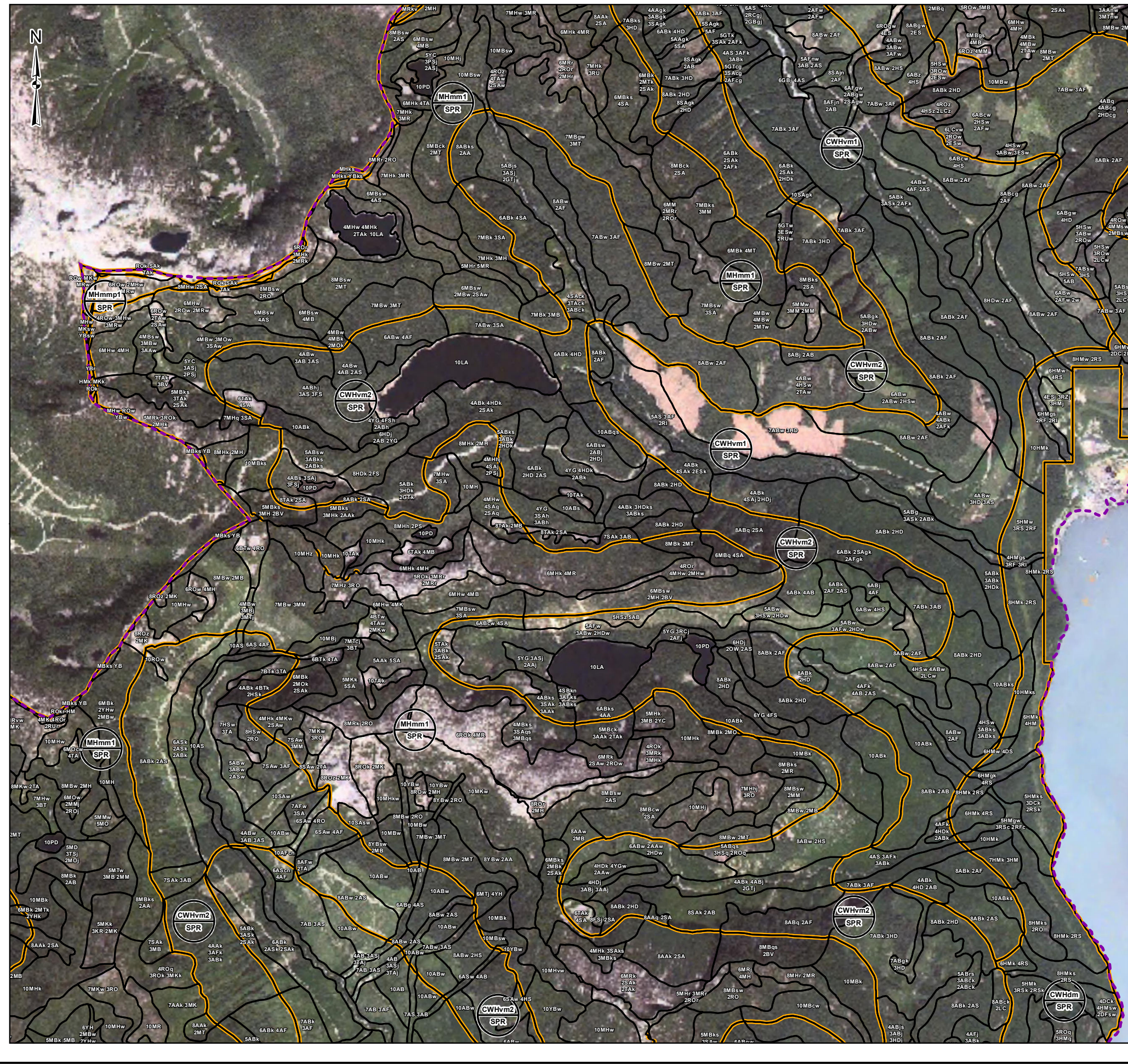
Parks and protected areas from the Province of British Columbia. Base data from CanVec. Imagery from BC WMS Layer: BC_S5L5_BC_2004_2006_BCALB_15M_PANB321_ENH. TEM from Timberline Natural Resource Group Ltd. (2007; 2008). Projection: UTM Zone 10 Datum: NAD 83



| | | | |
|--------------------------|-----|---|---------------------|
| PROJECT | | BURNCO ROCK PRODUCTS LTD. BURNCO AGGREGATE PROJECT, HOWE SOUND, B.C. | |
| TITLE | | REGIONAL STUDY AREA TERRESTRIAL ECOSYSTEM MAP | |
| PROJECT NO. 11-1422-0046 | | PHASE No. | |
| DESIGN | SH | 21 Jan. 2013 | SCALE AS SHOWN |
| GIS | DL | 17 Mar. 2016 | REV. 0 |
| CHECK | VBS | 17 Mar. 2016 | FIGURE 3 - B |
| REVIEW | VBS | 17 Mar. 2016 | |

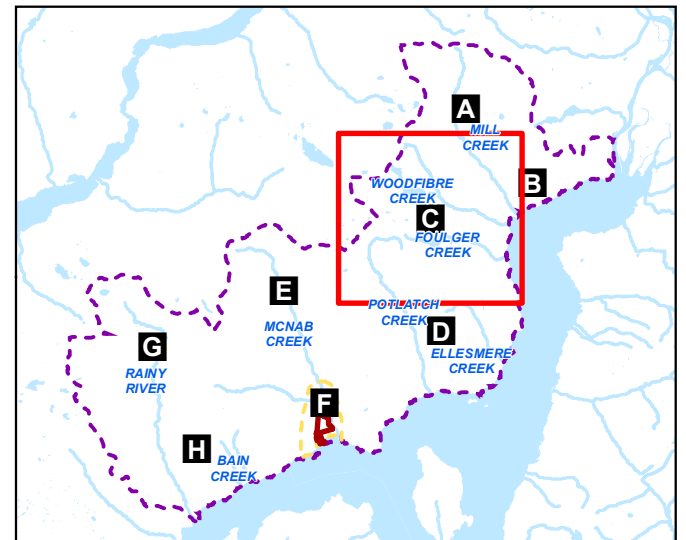


| | | |
|--|--|---|
| Ecosession | | |
| SPR | South Pacific Ranges | |
| Biogeoclimatic Units | | |
| CWH1m | Coastal Western Hemlock Dry Maritime Variant | |
| CWH1m1 | Coastal Western Hemlock Submontane Very Wet Maritime Variant | |
| CWH1m2 | Coastal Western Hemlock Maritime Very Wet Maritime Variant | |
| MH1m1 | Mountain Hemlock Windward Moist Maritime Variant | |
| MH1m2 | Mountain Hemlock Windward Moist Maritime Parkland Variant | |
| CMA | Coastal Mountain-heather Alpine Zone | |
| Ecosession and Biogeoclimatic Unit Labels | | |
| | | |
| CWH1m1 Site Series Mapcodes | | |
| Mapcode | Ecosystem Unit Name | Site Series Number |
| AA | Western hemlock - Fir moss | 01 |
| OC | Douglas fir - Lodgepole pine - Cladonia | 02 |
| DC | Douglas fir - Western hemlock - Salal | 03 |
| DF | Douglas fir - sword fern | 04 |
| RF | Western redcedar - sword fern | 05 |
| RF | Western redcedar - Forestfloor | 06 |
| SS | Sitka spruce - Salmonberry | 08 |
| RC | Western redcedar - Sitka spruce - skunk cabbage | 12 |
| AV | Red alder - vine maple avalanche track | 00 |
| CB | Gravel bar | 00 |
| PO | Pond | 00 |
| RI | River | 00 |
| RO | Rock outcrop | 00 |
| SA | Sitka alder - Salmonberry avalanche chute | 00 |
| TA | Talus | 00 |
| ES | Exposed soil | 00 |
| RZ | Road | 00 |
| CWH1m2 Site Series Mapcodes | | |
| Mapcode | Ecosystem Unit Name | Site Series Number |
| AB | Western hemlock - Anabelle fir - Blueberry | 01 |
| LC | Western hemlock - Lodgepole pine - Cladonia | 02 |
| HS | Western hemlock - Western redcedar - Salal | 03 |
| AF | Anabelle fir - Western redcedar - Forestfloor | 04 |
| HO | Western hemlock - Anabelle fir - Deer fern | 07 |
| AS | Anabelle fir - Western redcedar - Salmonberry | 08 |
| SB | Sitka spruce - Salmonberry | 12 |
| LD | Lodgepole pine - Sitka spruce | 14 |
| RC | Western red cedar - Sitka spruce - skunk cabbage | 14 |
| AA | Anabelle fir - Askan blueberry | 00 |
| BT | Brashy talus | 00 |
| OB | Gravel bar | 00 |
| OT | Grassmeadow avalanche track | 00 |
| SA | Sitka alder - Salmonberry avalanche chute | 00 |
| RI | River | 00 |
| RO | Rock outcrop | 00 |
| TA | Talus | 00 |
| ES | Exposed soil | 00 |
| UNC | Unclassified | 00 |
| CWH2m1 Site Series Mapcodes | | |
| Mapcode | Ecosystem Unit Name | Site Series Number |
| AB | Western hemlock - Anabelle fir - Blueberry | 01 |
| AF | Western hemlock - Lodgepole pine - Cladonia | 02 |
| LC | Western hemlock - Lodgepole pine - Cladonia | 02 |
| HS | Western hemlock - Western redcedar - Salal | 03 |
| RF | Western redcedar - Western hemlock - sword fern | 04 |
| HO | Western hemlock - Anabelle fir - Deer fern | 07 |
| AS | Anabelle fir - Western redcedar - Salmonberry | 08 |
| SB | Sitka spruce - Salmonberry | 12 |
| LD | Lodgepole pine - Sitka spruce | 14 |
| RC | Western red cedar - Sitka spruce - skunk cabbage | 14 |
| AA | Anabelle fir - Askan blueberry | 00 |
| BT | Brashy talus | 00 |
| OB | Gravel bar | 00 |
| OT | Grassmeadow avalanche track | 00 |
| SA | Sitka alder - Salmonberry avalanche chute | 00 |
| RI | River | 00 |
| RO | Rock outcrop | 00 |
| TA | Talus | 00 |
| ES | Exposed soil | 00 |
| UNC | Unclassified | 00 |
| MH1m1 Site Series Mapcodes | | |
| Mapcode | Ecosystem Unit Name | Site Series Number |
| MB | Mountain hemlock - Anabelle fir - Blueberry | 01 |
| MM | Mountain hemlock - Anabelle fir - Mountain-heather | 02 |
| MO | Anabelle fir - Mountain hemlock - Oak fern | 03 |
| AB | Mountain hemlock - bramble | 04 |
| MT | Anabelle fir - Mountain hemlock - Twistedstalk | 05 |
| MD | Mountain hemlock - Yellow cedar - Deer cabbage | 06 |
| MY | Yellow cedar - Mountain hemlock - Hellebore | 07 |
| YC | Yellow cedar - Mountain hemlock - skunk cabbage | 08 |
| AA | Anabelle fir - Askan blueberry | 00 |
| AS | Askan blueberry - Sitka spruce | 00 |
| BT | Brashy talus | 00 |
| SV | Blue-leaved huckleberry - Sitka spruce | 00 |
| CB | Chert | 00 |
| HM | Heather meadow | 00 |
| RR | Riverbank - Racomitrium rock | 00 |
| LA | Lake | 00 |
| MH | Mountain hemlock - Mountain-heather parklandsheath | 00 |
| MR | Mountain-heather - Racomitrium scrub | 00 |
| PO | Pond | 00 |
| PS | Partingfoot - Sedge meadow | 00 |
| RO | Rock outcrop | 00 |
| RU | Rubble | 00 |
| SA | Sitka alder - Salmonberry avalanche chute | 00 |
| TA | Talus | 00 |
| TS | Tufted clubmoss - Sphagnum bog | 00 |
| HE | Heather | 00 |
| ES | Exposed soil | 00 |
| MH1m2 Site Series Mapcodes | | |
| Mapcode | Ecosystem Unit Name | Site Series Number |
| AA | Anabelle fir - Askan blueberry | 01 |
| AK | Mountain hemlock - Yellow cedar alpine krummholz | 00 |
| AS | Anabelle blueberry - Sitka spruce | 00 |
| BT | Brashy talus | 00 |
| CL | Chert | 00 |
| HM | Heather meadow | 00 |
| MR | Mountain hemlock - Mountain-heather parklandsheath | 00 |
| MR | Mountain-heather - Racomitrium scrub | 00 |
| PO | Pond | 00 |
| UN | Unknown mapcode | 00 |
| RO | Rock outcrop | 00 |
| RU | Rubble | 00 |
| SA | Sitka alder - Salmonberry avalanche chute | 00 |
| TA | Talus | 00 |
| TS | Tufted clubmoss - Sphagnum bog | 00 |
| HE | Heather | 00 |
| ES | Exposed soil | 00 |
| Site Modifiers | | |
| Symbol | Criteria | |
| | Active basal faulting where evidence of active sedimentation and deposition is present | |
| | Coarse-textured soil, including sand and loamy-sand | |
| | Deep ash (>100 cm to bedrock) | |
| | Gulch occurrence | |
| | Hummocky terrain (optional modifier) - hummocky conditions are indicated by the terrain elevation expression | |
| | Gentle slope (<30% in the CWH zones) | |
| | Cool forest (optional modifier) - wetter forests (20% - 100% in the CWH zones) | |
| | Moderate forest (optional modifier) - occurs throughout ridge terrain on an edge crest | |
| | Ridge (optional modifier) - occurs throughout ridge terrain on an edge crest | |
| | Shallow slope (25% - 100% slope in the CWH zones) | |
| | Warm aspect - southerly or westerly aspects (130° - 200°) on moderately steep slopes (25% - 100% slope in the CWH zones) | |
| Structural Stage | | |
| Symbol | Structural Stage | Description |
| 1 | Pioneer | Biogenic and lichen dominated communities |
| 2 | Herbaceous | Herbaceous communities |
| 3 | Forb | Dominated by forb cover |
| 2b | Grassland | Dominated by grasses, sedges, and rushes |
| 3a | Low Shrub | Shrub <2 m tall |
| 3b | Tall Shrub | Shrub >2 m tall |
| 4 | Pole-slaying | Trees >10 m tall; stands typically 20-40 years old |
| 5 | Young Forest | Trees >10 m tall; stands typically 40-80 years old |
| 6 | Mature Forest | Trees >10 m tall; stands typically 80-200 years old |
| 7 | Old Forest | Trees >10 m tall; stands typically >200 years old |
| Stand Composition Modifiers | | |
| Symbol | Stand Type | Description |
| C | Coniferous | >75% of total tree layer cover is coniferous |
| B | Broadleaf | >75% of total tree layer cover is broadleaf |
| M | Mixed | Neither coniferous or broadleaf account for 75% of total tree layer cover |



| | |
|--|---------------------------|
| | Regional Study Area (RSA) |
| | Biogeoclimatic Unit |
| | Ecosystem Unit |

FIGURE AREA



REFERENCE

Parks and protected areas from the Province of British Columbia. Base data from CanVec. Imagery from BC WMS Layer: BC_S5L5_BC_2004_2006_BCALB_15M_PANB321_ENH. TEM from Timberline Natural Resource Group Ltd. (2007; 2008). Projection: UTM Zone 10 Datum: NAD 83



| | | | |
|--|--------------|---|---------------------|
| PROJECT | | BURNCO ROCK PRODUCTS LTD. BURNCO AGGREGATE PROJECT, HOWE SOUND, B.C. | |
| TITLE | | | |
| REGIONAL STUDY AREA TERRESTRIAL ECOSYSTEM MAP | | | |
| PROJECT NO. | 11-1422-0046 | PHASE No. | |
| DESIGN | SH | 21 Jan. 2013 | SCALE AS SHOWN |
| GIS | DL | 17 Mar. 2016 | REV. 0 |
| CHECK | VBS | 17 Mar. 2016 | FIGURE 3 - C |
| REVIEW | VBS | 17 Mar. 2016 | |



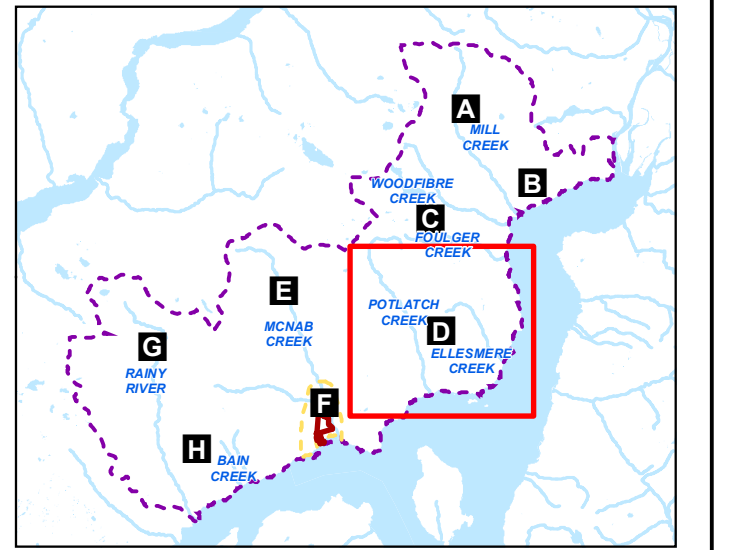
| | | |
|---|--|---|
| Ecoecosection | | |
| SPR | South Pacific Ranges | |
| Biogeoclimatic Units | | |
| CWHsm | Coastal Western Hemlock Dry Maritime Variant | |
| CWHm1 | Coastal Western Hemlock Submontane Very Wet Maritime Variant | |
| CWHm2 | Coastal Western Hemlock Montane Very Wet Maritime Variant | |
| MHsm1 | Mountain Hemlock Windward Moist Maritime Variant | |
| MHsm2 | Mountain Hemlock Windward Moist Maritime Variant | |
| CMA | Coastal Mountain-heather Alpine Zone | |
| Ecoecosection and Biogeoclimatic Units Label | | |
| CWHm1 | SPR | |
| CWHm2 | SPR | |
| MHsm1 | SPR | |
| MHsm2 | SPR | |
| CMA | SPR | |
| CWHm1 Site Series Mapcodes | | |
| Mapcode | Ecosystem Unit Name | Site Series Number |
| AA | Western hemlock - Fir forest | 01 |
| AC | Douglas fir - Lodgepole pine - Cladonia | 02 |
| AD | Douglas fir - Western hemlock - Salal | 03 |
| AE | Douglas fir - sword fern | 04 |
| AF | Western redcedar - sword fern | 05 |
| AG | Western redcedar - Feathermoss | 06 |
| AH | Sitka spruce - Salmonberry | 07 |
| AI | Western redcedar - Sitka spruce - skunk cabbage | 08 |
| AJ | Red alder - vine maple - avalanche chute | 09 |
| AK | Crested larch | 10 |
| AL | Pond | 11 |
| AM | Rock outcrop | 12 |
| AN | Sitka spruce - Salmonberry - avalanche chute | 13 |
| AO | Talus | 14 |
| AP | Exposed soil | 15 |
| AQ | Road | 16 |
| AR | Unclassified | 17 |
| CWHm2 Site Series Mapcodes | | |
| Mapcode | Ecosystem Unit Name | Site Series Number |
| AB | Western hemlock - Anemone fr. - Blueberry | 01 |
| AC | Western hemlock - Lodgepole pine - Cladonia | 02 |
| AD | Western hemlock - Western redcedar - Salal | 03 |
| AE | Western redcedar - Western hemlock - sword fern | 04 |
| AF | Western hemlock - Anemone fr. - Deer fern | 05 |
| AG | Sitka spruce - Salmonberry | 06 |
| AH | Lodgepole pine - Sphagnum | 07 |
| AI | Western red cedar - Sitka spruce - skunk cabbage | 08 |
| AJ | Anemone fr. - Alaska blueberry | 09 |
| AK | Mountain hemlock krummholz | 10 |
| AL | Tufted subshrub - Sphagnum bog | 11 |
| AM | Carex | 12 |
| AN | Sedge - Berberis fern | 13 |
| AO | Western hemlock - Fern | 14 |
| AP | Bushy talus | 15 |
| AQ | Grassmeadow/avalanche track | 16 |
| AR | Sitka spruce - Salmonberry - avalanche chute | 17 |
| AS | Lake | 18 |
| AT | Shallow open water | 19 |
| AU | River | 20 |
| AV | Rock outcrop | 21 |
| AW | Rubble | 22 |
| AX | Talus | 23 |
| AY | Exposed soil | 24 |
| AZ | Unclassified | 25 |
| MHsm1 Site Series Mapcodes | | |
| Mapcode | Ecosystem Unit Name | Site Series Number |
| MA | Mountain hemlock - Anemone fr. - Blueberry | 01 |
| MB | Mountain hemlock - Anemone fr. - Mountain-heather | 02 |
| MC | Mountain hemlock - Oak fern | 03 |
| MD | Mountain hemlock - bramble | 04 |
| ME | Anemone fr. - Mountain hemlock - Yellow cedar - Deer fern | 05 |
| MF | Yellow cedar - Mountain hemlock - Yellow cedar - skunk cabbage | 06 |
| MG | Yellow cedar - Mountain hemlock - skunk cabbage | 07 |
| MH | Anemone fr. - Alaska blueberry | 08 |
| MI | Alaskan blueberry - Sitka spruce | 09 |
| MJ | Bushy talus | 10 |
| MK | Blue-leaved huckleberry - Sitka spruce | 11 |
| ML | Heather meadow | 12 |
| MM | Kiwakumuck - Racombium rock | 13 |
| MN | Lake | 14 |
| MO | Mountain hemlock - Mountain-heather parklandheath | 15 |
| MP | Mountain-heather - Racombium scrub | 16 |
| MQ | Pond | 17 |
| MR | Particulate - Sedge meadow | 18 |
| MS | Rock outcrop | 19 |
| MT | Rubble | 20 |
| MU | Sitka spruce - Salmonberry - avalanche chute | 21 |
| MV | Talus | 22 |
| MW | Exposed soil | 23 |
| MX | Unclassified | 24 |
| MHsm2 Site Series Mapcodes | | |
| Mapcode | Ecosystem Unit Name | Site Series Number |
| MA | Anemone fr. - Alaskan blueberry | 01 |
| MB | Mountain hemlock - Yellow cedar - skunk cabbage | 02 |
| MC | Alaskan blueberry - Sitka spruce | 03 |
| MD | Carex | 04 |
| ME | Heather meadow | 05 |
| MF | Mountain hemlock - Mountain-heather parklandheath | 06 |
| MG | Mountain hemlock krummholz | 07 |
| MH | Mountain-heather - Racombium scrub | 08 |
| MI | Pond | 09 |
| MJ | Umbrella mapcode | 10 |
| MK | Rock outcrop | 11 |
| ML | Rubble | 12 |
| MM | Sitka spruce - Salmonberry - avalanche chute | 13 |
| MN | Talus | 14 |
| MO | Mountain hemlock - Yellow cedar - Blueberry - Mountain-heather | 15 |
| MP | Exposed soil | 16 |
| MQ | Unclassified | 17 |
| Site Modifiers | | |
| Symbol | Criteria | |
| a | Active basal faultline where evidence of active sedimentation and deposition is present | |
| b | Coarse textured soils, including sand and loamy sand | |
| c | Deep soils (>100 cm to bedrock) | |
| d | Grating occurrence | |
| e | Hummocky terrain (optimal modifier) - hummocky conditions are indicated by the basin (suboptimal modifier) - all wet and all | |
| f | Gentle slope (<30% in the CWH zones) | |
| g | Cool local microclimate (optimal modifier) - occurs on moderately steep slopes (20% - 100% slope in the CWH zone) | |
| h | Medium textured soils, including silty and silty loam | |
| i | Ridge (optimal modifier) - occurs throughout ridge terrain or on a great crest | |
| j | Shallow soils (20-100 cm to bedrock) | |
| k | Warm aspect - southerly or westerly aspects (135° - 205°) on moderately steep slopes (25% - 100% slope in the CWH zone) | |
| Structural Stage | | |
| Symbol | Structural Stage | Description |
| 1 | Pioneer | Biogenic and lichen dominated communities |
| 2 | Herbaceous | Herbaceous communities |
| 3 | Forb | Dominated by forb cover |
| 4 | Grassland | Dominated by grasses, sedges, and rushes |
| 5 | Low Shrub | Shrubs <2 m tall |
| 6 | Tall Shrub | Shrubs >2 m tall |
| 7 | Pole-slaying | Trees >10 m tall; stands typically 20-40 years old |
| 8 | Young Forest | Trees >10 m tall; stands typically 40-80 years old |
| 9 | Mature Forest | Trees >10 m tall; stands typically 80-200 years old |
| 10 | Old Forest | Trees >10 m tall; stands typically >200 years old |
| Stand Composition Modifiers | | |
| Symbol | Stand Type | Description |
| C | Coniferous | >75% of total tree layer cover is coniferous |
| B | Broadleaf | >75% of total tree layer cover is broadleafed |
| M | Mixed | Neither coniferous or broadleafed account for 75% of total tree layer cover |



LEGEND

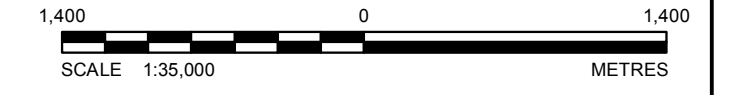
- Regional Study Area (RSA)
- Biogeoclimatic Unit
- Ecosystem Unit

FIGURE AREA



REFERENCE

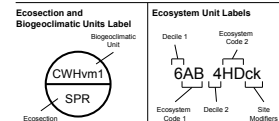
Parks and protected areas from the Province of British Columbia. Base data from CanVec. Imagery from BC WMS Layer: BC_S5L5_BC_2004_2006_BCALB_15M_PANB321_ENH. TEM from Timberline Natural Resource Group Ltd. (2007; 2008).
 Projection: UTM Zone 10 Datum: NAD 83



| | | | |
|--|------------------------|---|--|
| PROJECT | | BURNCO ROCK PRODUCTS LTD. BURNCO AGGREGATE PROJECT, HOWE SOUND, B.C. | |
| TITLE | | | |
| REGIONAL STUDY AREA TERRESTRIAL ECOSYSTEM MAP | | | |
| PROJECT NO. 11-1422-0046 | PHASE No. | | |
| DESIGN SH 21 Jan. 2013 | SCALE AS SHOWN | REV. 0 | |
| GIS DL 17 Mar. 2016 | CHECK VBS 17 Mar. 2016 | FIGURE 3 - D | |
| REVIEW VBS 17 Mar. 2016 | | | |



| | |
|-----------------------------|--|
| Ecosession | |
| SPR | South Pacific Ranges |
| Biogeoclimatic Units | |
| CWHm1 | Coastal Western Hemlock Dry Maritime Variant |
| CWHm2 | Coastal Western Hemlock Submontane Very Wet Maritime Variant |
| MHm1 | Mountain Hemlock Windward Moist Maritime Variant |
| MHm2 | Mountain Hemlock Windward Moist Maritime Variant |
| CMA | Coastal Mountain-heather Alpine Zone |



| CWHm1 Site Series Mapcodes | | |
|-----------------------------------|---|--------------------|
| Mapcode | Ecosystem Unit Name | Site Series Number |
| AA | Western hemlock - Fir forest | 01 |
| DC | Douglas fir - Lodgepole pine - Cladonia | 02 |
| DF | Douglas fir - Western hemlock - Salal | 04 |
| RF | Western redcedar - sword fern | 05 |
| RS | Western redcedar - Forest/flower | 07 |
| SS | Sitka spruce - Salmonberry | 08 |
| SC | Western redcedar - Sitka spruce - slunk cabbage | 12 |
| AV | Red alder - vine maple avianchute track | 00 |
| GB | Great bar | 00 |
| PD | Pond | 00 |
| RI | River | 00 |
| RO | Rock outcrop | 00 |
| SA | Sitka alder - salmonberry avianchute | 00 |
| TA | Talus | 00 |
| ES | Exposed soil | 00 |
| RZ | Road | 00 |

| CWHm2 Site Series Mapcodes | | |
|-----------------------------------|---|--------------------|
| Mapcode | Ecosystem Unit Name | Site Series Number |
| AB | Western hemlock - Anahills fir - Blueberry | 01 |
| LC | Western hemlock - Lodgepole pine - Cladonia | 02 |
| HS | Western hemlock - Western redcedar - Salal | 04 |
| HD | Western hemlock - Anahills fir - Deer fern | 06 |
| AS | Anahills fir - Western redcedar - Salmonberry | 07 |
| SB | Sitka spruce - Salmonberry | 08 |
| NC | Lodgepole pine - Sitka spruce - slunk cabbage | 12 |
| AA | Anahills fir - Alaskan blueberry | 14 |
| BT | Brashy talus | 00 |
| GB | Great bar | 00 |
| DT | Grass/straw avianchute track | 00 |
| SA | Sitka alder - salmonberry avianchute | 00 |
| RI | River | 00 |
| RO | Rock outcrop | 00 |
| TA | Talus | 00 |
| ES | Exposed soil | 00 |
| UNC | Unclassified | 00 |

| MHm1 Site Series Mapcodes | | |
|----------------------------------|--|--------------------|
| Mapcode | Ecosystem Unit Name | Site Series Number |
| MB | Mountain hemlock - Anahills fir - Blueberry | 01 |
| MM | Mountain hemlock - Anahills fir - Mountain heather | 02 |
| MO | Anahills fir - Mountain hemlock - Oak fern | 04 |
| MT | Mountain hemlock - bramble | 05 |
| MT | Anahills fir - Mountain hemlock - Teledstatik | 06 |
| MD | Mountain hemlock - Yellow cedar - Deer cabbage | 07 |
| MY | Yellow cedar - Mountain hemlock - Helleborus | 08 |
| YC | Yellow cedar - Mountain hemlock - slunk cabbage | 09 |
| AA | Anahills fir - Alaskan blueberry | 14 |
| AS | Alaskan blueberry - Sitka vaterian | 00 |
| BT | Brashy talus | 00 |
| SV | Blue-leaved huckleberry - Sitka vaterian | 00 |
| HM | Heather meadow | 00 |
| KR | Kwakwaka'wakw - Racombium rock | 00 |
| LA | Lake | 00 |
| MR | Mountain hemlock - Mountain-heather parklandsheath | 00 |
| MR | Mountain-heather - Racombium scrub | 00 |
| PD | Pond | 00 |
| PS | Participating - Sedge meadow | 00 |
| RO | Rock outcrop | 00 |
| RU | Rubble | 00 |
| SA | Sitka alder - salmonberry avianchute | 00 |
| TA | Talus | 00 |
| TS | Tuffel outwash - Sphagnum bog | 00 |
| VB | heather | 00 |
| ES | Exposed soil | 00 |

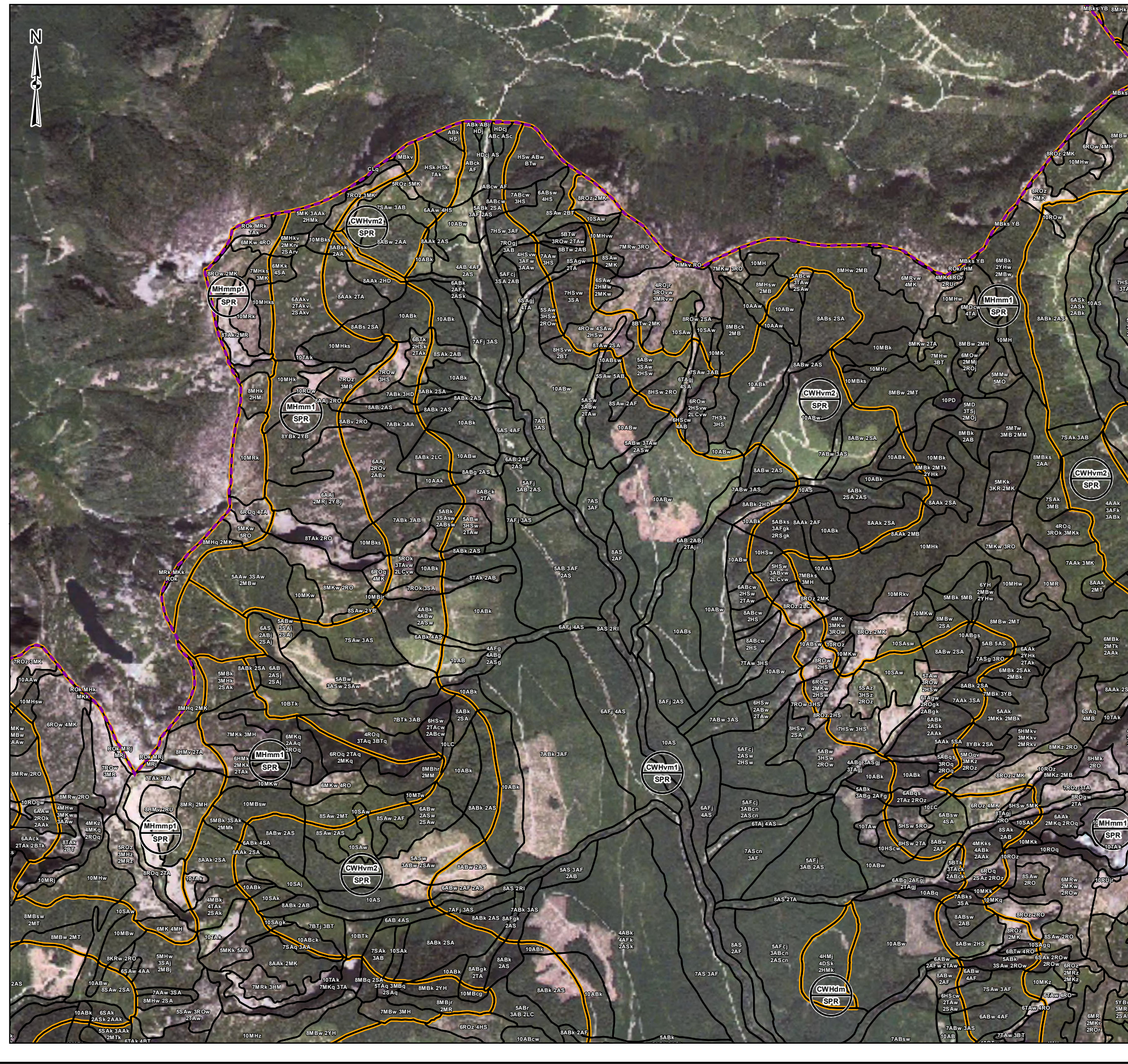
| MHm2 Site Series Mapcodes | | |
|----------------------------------|--|--------------------|
| Mapcode | Ecosystem Unit Name | Site Series Number |
| AA | Anahills fir - Alaskan blueberry | 14 |
| AK | Mountain hemlock - Yellow cedar - alpine krummholz | 00 |
| AS | Anahills fir - Sitka vaterian | 00 |
| BT | Brashy talus | 00 |
| CL | Cir | 00 |
| HM | Heather meadow | 00 |
| MR | Mountain hemlock - Mountain-heather parklandsheath | 00 |
| MR | Mountain-heather - Racombium scrub | 00 |
| PD | Pond | 00 |
| PS | Participating - Sedge meadow | 00 |
| RO | Rock outcrop | 00 |
| RU | Rubble | 00 |
| SA | Sitka alder - salmonberry avianchute | 00 |
| TA | Talus | 00 |
| TS | Tuffel outwash - Sphagnum bog | 00 |
| VB | heather | 00 |
| ES | Exposed soil | 00 |

| MHmmp1 Site Series Mapcodes | | |
|------------------------------------|--|--------------------|
| Mapcode | Ecosystem Unit Name | Site Series Number |
| AA | Anahills fir - Alaskan blueberry | 14 |
| AK | Mountain hemlock - Yellow cedar - alpine krummholz | 00 |
| AS | Anahills fir - Sitka vaterian | 00 |
| BT | Brashy talus | 00 |
| CL | Cir | 00 |
| HM | Heather meadow | 00 |
| MR | Mountain hemlock - Mountain-heather parklandsheath | 00 |
| MR | Mountain-heather - Racombium scrub | 00 |
| PD | Pond | 00 |
| PS | Participating - Sedge meadow | 00 |
| RO | Rock outcrop | 00 |
| RU | Rubble | 00 |
| SA | Sitka alder - salmonberry avianchute | 00 |
| TA | Talus | 00 |
| TS | Tuffel outwash - Sphagnum bog | 00 |
| VB | heather | 00 |
| ES | Exposed soil | 00 |

| Site Modifiers | |
|-----------------------|--|
| Symbol | Criteria |
| a | Active basal faultline where evidence of active sedimentation and deposition is present |
| c | Coarse textured soil, including sand and loamy sand |
| d | Deep soils (>100 cm to bedrock) |
| e | Quilting occurring |
| h | Humidity terrain (optimal modifier) - humidity conditions are indicated by the terrain surface expression |
| j | Gentle slope (<30% in the CWH zones) |
| k | Cool slope (30% - 100% slope in the CWH zones) |
| l | Medium to steep slope (>100% slope in the CWH zones) |
| m | Ridge (optimal modifier) - occurs throughout ridge terrain or on a ridge crest |
| n | Shallow soils (20-100 cm to bedrock) |
| o | Warm aspect - southerly or westerly aspects (130° - 280°) on moderately steep slopes (25% - 100% slope in the CWH zones) |

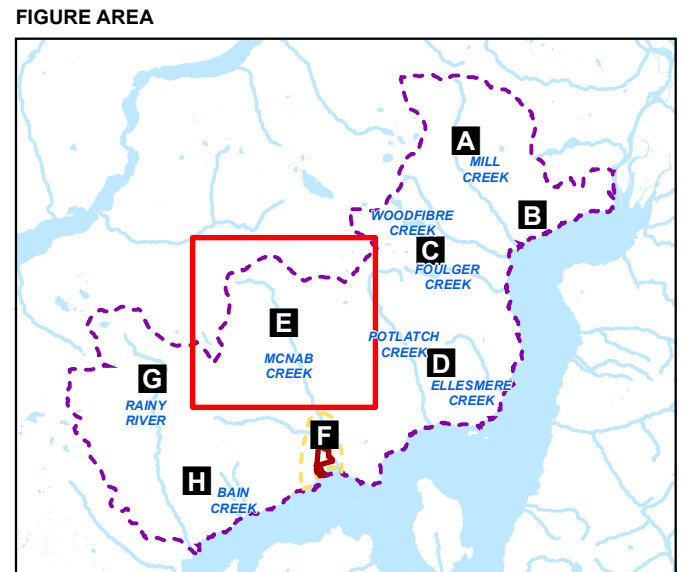
| Structural Stage | | |
|-------------------------|------------------|---|
| Symbol | Structural Stage | Description |
| 1 | Pioneer | Ecotypic and lichen dominated communities |
| 2 | Herbaceous | Herbaceous communities |
| 3 | Forb | Dominated by forb cover |
| 2b | Grassland | Dominated by grasses, sedges, and rushes |
| 3a | Low shrub | Shrubs <2 m tall |
| 3b | Tall shrub | Shrubs >2 m tall |
| 4 | Pole-slaying | Trees >10 m tall; stands typically 20-40 years old |
| 5 | Young Forest | Trees >10 m tall; stands typically 40-80 years old |
| 6 | Mature Forest | Trees >10 m tall; stands typically 80-200 years old |
| 7 | Old Forest | Trees >10 m tall; stands typically >200 years old |

| Stand Composition Modifiers | | |
|------------------------------------|------------|--|
| Symbol | Stand Type | Description |
| C | Coniferous | >75% of total tree layer cover is coniferous |
| B | Broadleaf | >75% of total tree layer cover is broadleaf |
| M | Mixed | Neither coniferous or broadleaf account for >75% of total tree layer cover |



LEGEND

- Regional Study Area (RSA)
- Biogeoclimatic Unit
- Ecosystem Unit



REFERENCE

Parks and protected areas from the Province of British Columbia. Base data from CanVec. Imagery from BC WMS Layer: BC_S5L5_BC_2004_2006_BCALB_15M_PANB321_ENH. TEM from Timberline Natural Resource Group Ltd. (2007; 2008).
 Projection: UTM Zone 10 Datum: NAD 83

1,400 0 1,400
 SCALE 1:35,000 METRES

PROJECT

BURNCO ROCK PRODUCTS LTD.
 BURNCO AGGREGATE PROJECT, HOWE SOUND, B.C.

TITLE

**REGIONAL STUDY AREA
 TERRESTRIAL ECOSYSTEM MAP**

| | | | |
|-------------|--------------|--------------|----------------|
| PROJECT No. | 11-1422-0046 | PHASE No. | |
| DESIGN | SH | 21 Jan. 2013 | SCALE AS SHOWN |
| GIS | DL | 17 Mar. 2016 | REV. 0 |
| CHECK | VBS | 17 Mar. 2016 | |
| REVIEW | VBS | 17 Mar. 2016 | |

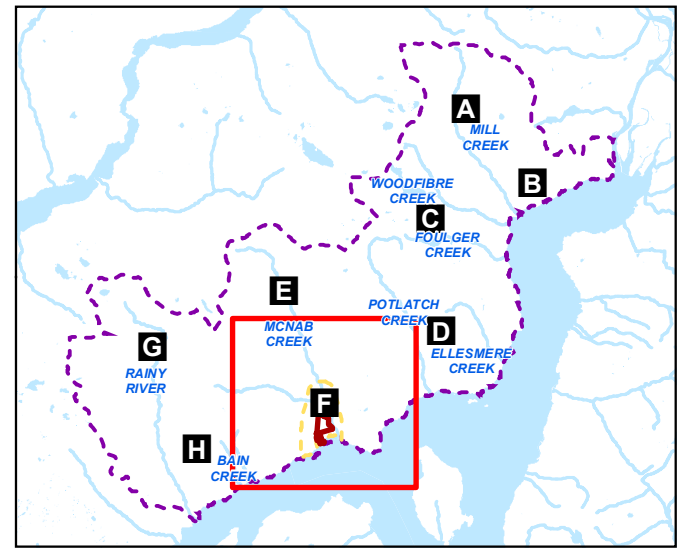
FIGURE 3 - E

| | | |
|------------------------------------|---|--|
| Ecosession | | |
| SPR | South Pacific Ranges | |
| Biogeoclimatic Units | | |
| CWH1m | Coastal Western Hemlock Dry Maritime Variant | |
| CWH1m1 | Coastal Western Hemlock Submontane Very Wet Maritime Variant | |
| CWH1m2 | Coastal Western Hemlock Maritime Very Wet Maritime Variant | |
| MH1m1 | Mountain Hemlock Windward Most Maritime Variant | |
| MH1m2 | Mountain Hemlock Windward Most Maritime Variant | |
| CMA | Coastal Mountain-heather Alpine Zone | |
| Ecosystem Unit Labels | | |
| | | |
| CWH1m1 Site Series Mapcodes | | |
| Mapcode | Ecosystem Unit Name | Site Series Number |
| AA | Western hemlock - Fir forest | 01 |
| OC | Douglas fir - Lodgepole pine - Cladonia | 02 |
| DC | Douglas fir - Western hemlock - Salal | 03 |
| DF | Douglas fir - sword fern | 04 |
| RF | Western redcedar - sword fern | 05 |
| NR | Western redcedar - Fraser fir | 06 |
| SS | Sitka spruce - Salmonberry | 07 |
| NC | Western redcedar - Sitka spruce - skunk cabbage | 08 |
| AV | Red alder - vine maple - avalanche chute | 09 |
| CR | Crest bar | 10 |
| PO | Pond | 11 |
| RI | River | 12 |
| RO | Rock outcrop | 13 |
| SA | Sitka spruce - Sitka spruce | 14 |
| TA | Talus | 15 |
| ES | Exposed soil | 16 |
| RZ | Road | 17 |
| CWH1m2 Site Series Mapcodes | | |
| Mapcode | Ecosystem Unit Name | Site Series Number |
| AB | Western hemlock - Anemone fr. - Blueberry | 01 |
| LC | Western hemlock - Lodgepole pine - Cladonia | 02 |
| NS | Western hemlock - Western redcedar - Salal | 03 |
| AF | Anemone fr. - Western redcedar - Fraser fir | 04 |
| HO | Western hemlock - Anemone fr. - Deer fern | 05 |
| AS | Anemone fr. - Western redcedar - Salmonberry | 06 |
| SB | Sitka spruce - Salmonberry | 07 |
| LD | Lodgepole pine - Salal | 08 |
| NC | Western redcedar - Sitka spruce - skunk cabbage | 09 |
| AA | Anemone fr. - Alaskan blueberry | 10 |
| BT | Brnhy talus | 11 |
| CB | Gravel bar | 12 |
| OT | Gravelly avalanche chutes | 13 |
| SA | Sitka spruce - Salmonberry - avalanche chutes | 14 |
| RI | River | 15 |
| RO | Rock outcrop | 16 |
| TA | Talus | 17 |
| ES | Exposed soil | 18 |
| UNC | Unclassified | 19 |
| CWH1m2 Site Series Mapcodes | | |
| Mapcode | Ecosystem Unit Name | Site Series Number |
| AB | Western hemlock - Anemone fr. - Blueberry | 01 |
| LC | Western hemlock - Lodgepole pine - Cladonia | 02 |
| NS | Western hemlock - Western redcedar - Salal | 03 |
| AF | Anemone fr. - Western redcedar - Fraser fir | 04 |
| HO | Western hemlock - Anemone fr. - Deer fern | 05 |
| AS | Anemone fr. - Western redcedar - Salmonberry | 06 |
| SB | Sitka spruce - Salmonberry | 07 |
| LD | Lodgepole pine - Salal | 08 |
| NC | Western redcedar - Sitka spruce - skunk cabbage | 09 |
| AA | Anemone fr. - Alaskan blueberry | 10 |
| BT | Brnhy talus | 11 |
| CB | Gravel bar | 12 |
| OT | Gravelly avalanche chutes | 13 |
| SA | Sitka spruce - Salmonberry - avalanche chutes | 14 |
| RI | River | 15 |
| RO | Rock outcrop | 16 |
| TA | Talus | 17 |
| ES | Exposed soil | 18 |
| UNC | Unclassified | 19 |
| MH1m1 Site Series Mapcodes | | |
| Mapcode | Ecosystem Unit Name | Site Series Number |
| MB | Mountain hemlock - Anemone fr. - Blueberry | 01 |
| MM | Mountain hemlock - Anemone fr. - Mountain-heather | 02 |
| MO | Anemone fr. - Mountain hemlock - Oak fern | 03 |
| AB | Mountain hemlock - bracken | 04 |
| MT | Anemone fr. - Mountain hemlock - Tradescantia | 05 |
| MD | Mountain hemlock - Yellow cedar - Deer cabbage | 06 |
| MY | Yellow cedar - Mountain hemlock - Hellebore | 07 |
| YC | Yellow cedar - Mountain hemlock - skunk cabbage | 08 |
| AA | Alaskan blueberry - Sitka spruce | 09 |
| AS | Alaskan blueberry - Sitka spruce | 10 |
| BT | Brnhy talus | 11 |
| BV | Blue-leaved huckleberry - Sitka spruce | 12 |
| CL | Cladonia | 13 |
| HA | Heather meadow | 14 |
| NR | Norway spruce - Alaskan blueberry | 15 |
| LA | Lake | 16 |
| MA | Mountain hemlock - Mountain-heather parklandheath | 17 |
| MR | Mountain-heather - Alaskan blueberry | 18 |
| PO | Pond | 19 |
| PS | Particulate - Sedge meadow | 20 |
| RI | River | 21 |
| RU | Rubus | 22 |
| SA | Sitka spruce - Salmonberry - avalanche chutes | 23 |
| TA | Talus | 24 |
| TS | Tufted subshrub - Sphagnum bog | 25 |
| VB | Vegetation | 26 |
| ES | Exposed soil | 27 |
| MH1m2 Site Series Mapcodes | | |
| Mapcode | Ecosystem Unit Name | Site Series Number |
| AA | Anemone fr. - Alaskan blueberry | 01 |
| AK | Mountain hemlock - Yellow cedar - Alaskan blueberry | 02 |
| AB | Mountain hemlock - Sitka spruce | 03 |
| BT | Brnhy talus | 04 |
| CL | Cladonia | 05 |
| HA | Heather meadow | 06 |
| MA | Mountain hemlock - Mountain-heather parklandheath | 07 |
| MR | Mountain-heather - Alaskan blueberry | 08 |
| PO | Pond | 09 |
| PS | Particulate - Sedge meadow | 10 |
| RI | River | 11 |
| RU | Rubus | 12 |
| SA | Sitka spruce - Salmonberry - avalanche chutes | 13 |
| TA | Talus | 14 |
| TS | Tufted subshrub - Sphagnum bog | 15 |
| VB | Vegetation | 16 |
| ES | Exposed soil | 17 |
| Site Modifiers | | |
| Symbol | Criteria | |
| a | Active basal faulting where evidence of active sedimentation and deposition is present | |
| b | Coarse textured soils, including sand and loamy sand | |
| c | Deep soils (>100 cm to bedrock) | |
| d | Gravelly occurring | |
| e | Hummocky terrain (optional modifier) - hummocky conditions are indicated by the basin surface exposure | |
| f | Gentle slope (<30% in the CWH zone) | |
| g | Cool slope (>30% in the CWH zone) | |
| h | Moderate slope (30% - 100% slope in the CWH zone) | |
| i | Steep slope (>100% slope in the CWH zone) | |
| j | Cold slope (>100% slope in the CWH zone) | |
| k | Medium textured soils, including all and all loam | |
| l | Ridge (optional modifier) - occurs throughout ridge terrain or on a ridge crest | |
| m | Shallow soils (0-100 cm to bedrock) | |
| n | Warm aspect - southerly or westerly aspects (135° - 205°) on moderately steep slopes (25% - 100% slope in the CWH zone) | |
| Structural Stage | | |
| Symbol | Structural Stage | Description |
| 1 | Pioneer | Bryophyte and lichen dominated communities |
| 2 | Herbaceous | Herbaceous communities |
| 3 | Forb | Forb dominated by forb cover |
| 2b | Grassland | Dominated by grasses, sedges, and rushes |
| 3a | Low Shrub | Shrubs <2 m tall |
| 3b | Tall Shrub | Shrubs >2 m tall |
| 4 | Pole-slaying | Trees >10 m tall; stands typically 20-40 years old |
| 5 | Young Forest | Trees >10 m tall; stands typically 40-60 years old |
| 6 | Mature Forest | Trees >10 m tall; stands typically 80-200 years old |
| 7 | Old Forest | Trees >10 m tall; stands typically >200 years old |
| Stand Composition Modifiers | | |
| Symbol | Stand Type | Description |
| C | Coniferous | >75% of total tree layer cover is coniferous |
| B | Broadleaf | >75% of total tree layer cover is broadleaf |
| M | Mixed | Neither coniferous or broadleaf account for >75% of total tree layer cover |



| | |
|--|---------------------------|
| | Project Area |
| | Local Study Area (LSA) |
| | Regional Study Area (RSA) |
| | Biogeoclimatic Unit |
| | Ecosystem Unit |

FIGURE AREA



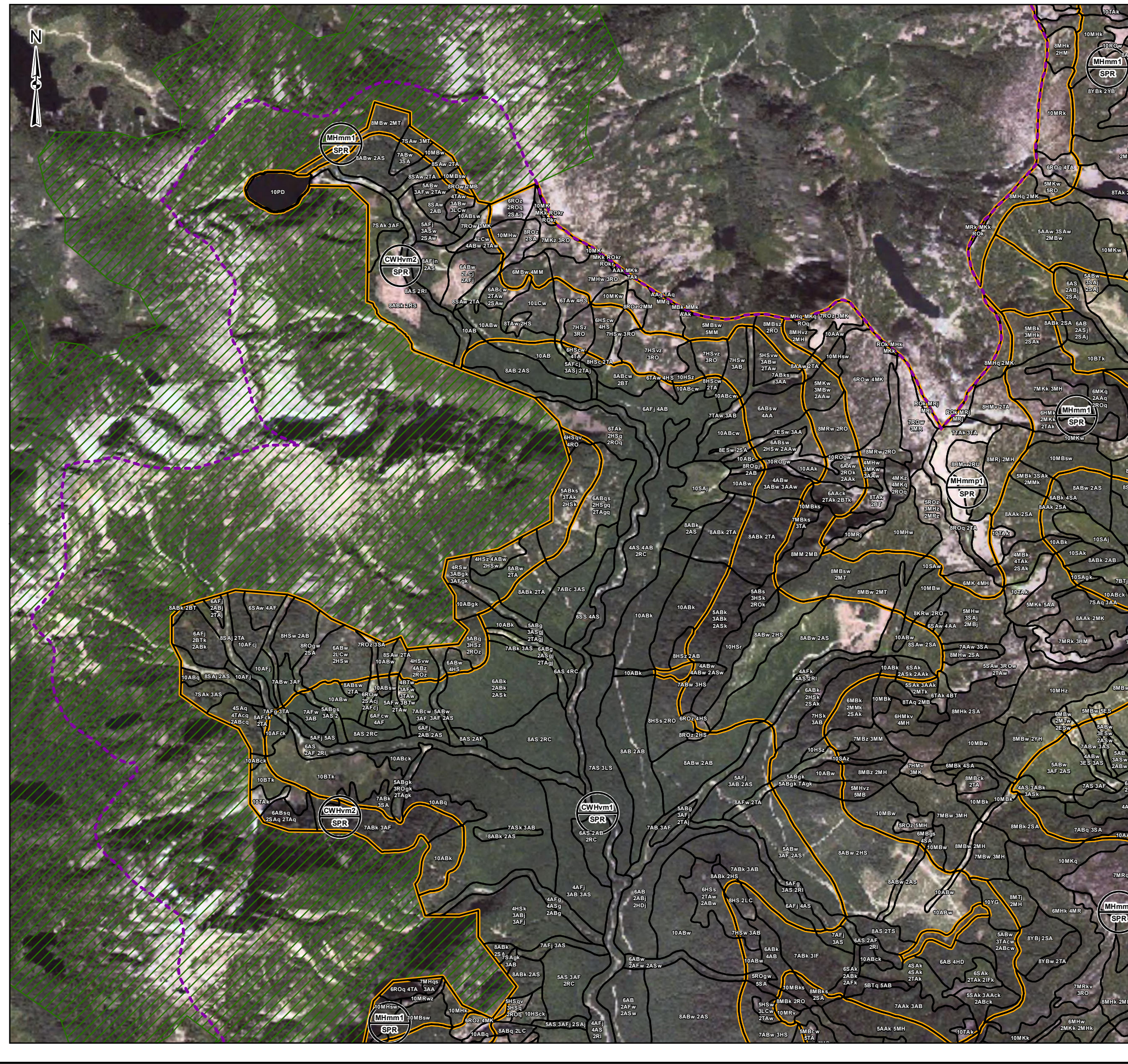
REFERENCE

Parks and protected areas from the Province of British Columbia. Base data from CanVec. Imagery from BC WMS Layer: BC_S5L5_BC_2004_2006_BCALB_15M_PANB321_ENH. TEM from Timberline Natural Resource Group Ltd. (2007; 2008). Projection: UTM Zone 10 Datum: NAD 83

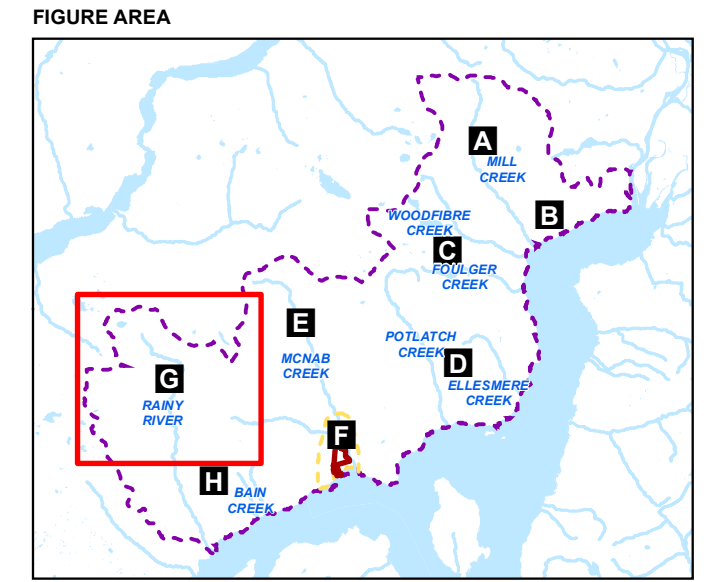


| | | | |
|--|------------------|---|--------|
| PROJECT | | BURNCO ROCK PRODUCTS LTD. BURNCO AGGREGATE PROJECT, HOWE SOUND, B.C. | |
| TITLE | | | |
| REGIONAL STUDY AREA TERRESTRIAL ECOSYSTEM MAP | | | |
| PROJECT NO. | 11-1422-0046 | PHASE No. | |
| DESIGN | SH 21 Jan. 2013 | SCALE AS SHOWN | REV. 0 |
| GIS | DL 17 Mar. 2016 | | |
| CHECK | VBS 17 Mar. 2016 | | |
| REVIEW | VBS 17 Mar. 2016 | | |
| | | FIGURE 3 - F | |

| | | |
|------------------------------------|---|--|
| Ecoecosection | | |
| SPR | South Pacific Ranges | |
| Biogeoclimatic Units | | |
| CWHm1 | Coastal Western Hemlock Dry Maritime Variant | |
| CWHm2 | Coastal Western Hemlock Submontane Very Wet Maritime Variant | |
| MHm1 | Mountain Hemlock Windward Moist Maritime Variant | |
| MHm2 | Mountain Hemlock Windward Moist Maritime Variant | |
| CMA | Coastal Mountain-heather Alpine Zone | |
| Ecosystem Unit Labels | | |
| | | |
| CWHm1 Site Series Mapcodes | | |
| Mapcode | Ecosystem Unit Name | Site Series Number |
| AW | Western hemlock - Fir moss | 01 |
| DC | Douglas fir - Lodgepole pine - Cladonia | 02 |
| DF | Douglas fir - Western hemlock - Salal | 04 |
| RF | Western redcedar - sword fern | 07 |
| SS | Sitka spruce - Salmonberry | 08 |
| RC | Western redcedar - Sitka spruce - skunk cabbage | 12 |
| AV | Red alder - vine maple avalanche chute | 00 |
| CB | Gravel bar | 00 |
| PO | Pond | 00 |
| RI | River | 00 |
| RO | Rock outcrop | 00 |
| SA | Sitka alder - Salmonberry avalanche chute | 00 |
| TA | Talus | 00 |
| ES | Exposed soil | 00 |
| RZ | Road | 00 |
| CWHm2 Site Series Mapcodes | | |
| Mapcode | Ecosystem Unit Name | Site Series Number |
| AB | Western hemlock - Anemone fr. - Blueberry | 01 |
| LC | Western hemlock - Lodgepole pine - Cladonia | 02 |
| NS | Western redcedar - Western hemlock - Salal | 04 |
| HD | Western hemlock - Anemone fr. - Deer fern | 07 |
| AS | Anemone fr. - Western redcedar - Salmonberry | 09 |
| SB | Sitka spruce - Salmonberry | 12 |
| NC | Lodgepole pine - Sitka spruce - skunk cabbage | 14 |
| AA | Anemone fr. - Alaskan blueberry | 00 |
| BT | Brnly talus | 00 |
| GB | Gravel bar | 00 |
| DT | Gravel bar - avalanche chute | 00 |
| SA | Sitka alder - Salmonberry avalanche chute | 00 |
| RI | River | 00 |
| RO | Rock outcrop | 00 |
| TA | Talus | 00 |
| ES | Exposed soil | 00 |
| UNC | Unclassified | 00 |
| MHm1 Site Series Mapcodes | | |
| Mapcode | Ecosystem Unit Name | Site Series Number |
| MB | Mountain hemlock - Anemone fr. - Blueberry | 01 |
| MM | Mountain hemlock - Anemone fr. - Mountain-heather | 02 |
| MO | Anemone fr. - Mountain hemlock - Oak fern | 03 |
| AB | Mountain hemlock - bracken | 04 |
| MT | Anemone fr. - Mountain hemlock - Teledickstar | 05 |
| MD | Mountain hemlock - Yellow cedar - Deer cabbage | 07 |
| MY | Yellow cedar - Mountain hemlock - Hellebore | 08 |
| YC | Yellow cedar - Mountain hemlock - Skunk cabbage | 09 |
| AA | Anemone fr. - Alaskan blueberry | 00 |
| AS | Alaskan blueberry - Sitka varian | 00 |
| BT | Brnly talus | 00 |
| SV | Blue-leaved huckleberry - Sitka varian | 00 |
| HA | Heather meadow | 00 |
| NR | Kiwakwack - Racomitrium rock | 00 |
| LA | Lake | 00 |
| MR | Mountain hemlock - Mountain-heather parklandheath | 00 |
| MR | Mountain-heather - Racomitrium scrub | 00 |
| PO | Pond | 00 |
| PS | Partridgefoot - Sedge meadow | 00 |
| RO | Rock outcrop | 00 |
| RU | Rubble | 00 |
| SA | Sitka alder - Salmonberry avalanche chute | 00 |
| TA | Talus | 00 |
| TS | Tuffet outwash - Sphagnum bog | 00 |
| YS | heather | 00 |
| ES | Exposed soil | 00 |
| MHm2 Site Series Mapcodes | | |
| Mapcode | Ecosystem Unit Name | Site Series Number |
| AA | Anemone fr. - Alaskan blueberry | 00 |
| AK | Mountain hemlock - Yellow cedar alpine krummholz | 00 |
| AS | Alaskan blueberry - Sitka varian | 00 |
| BT | Brnly talus | 00 |
| CL | Cliff | 00 |
| HA | Heather meadow | 00 |
| MR | Mountain hemlock - Mountain-heather parklandheath | 00 |
| MR | Mountain-heather - Racomitrium scrub | 00 |
| PO | Pond | 00 |
| UN | Unknown mapcode | 00 |
| RO | Rock outcrop | 00 |
| RU | Rubble | 00 |
| SA | Sitka alder - Salmonberry avalanche chute | 00 |
| TA | Talus | 00 |
| YS | heather | 00 |
| ES | Exposed soil | 00 |
| Site Modifiers | | |
| Symbol | Criteria | |
| a | Active fault footwall where evidence of active sedimentation and deposition is present | |
| c | Coarse textured soils, including sand and loamy sand | |
| d | Deep soils (>100 cm to bedrock) | |
| e | Gravelly soil | |
| h | Hummocky terrain (optional modifier) - hummocky conditions are indicated by the terrain (optional modifier) | |
| j | Gentle slope (<30% in the CWH zone) | |
| k | Cool slope (>30% in the CWH zone) | |
| m | Medium textured soils, including all soil and all soil | |
| r | Ridge (optional modifier) - occurs throughout ridge terrain or on a ridge crest | |
| s | Shallow soils (<50 cm to bedrock) | |
| w | Warm aspect - southerly or westerly aspects (135° - 285°) on moderately steep slopes (25% - 100% slope in the CWH zone) | |
| Structural Stage | | |
| Symbol | Structural Stage | Description |
| 1 | Pioneer | Biogenic and lichen dominated communities |
| 2 | Herbaceous | Herbaceous communities |
| 3 | Forb | Dominated by forb cover |
| 2b | Grassland | Dominated by grasses, sedges, and rushes |
| 4 | Low Shrub | Shrubs <2 m tall |
| 5 | Tall Shrub | Shrubs >2 m tall |
| 6 | Pole-slaying | Trees >10 m tall; stands typically 20-40 years old |
| 7 | Young Forest | Trees >10 m tall; stands typically 40-80 years old |
| 8 | Mature Forest | Trees >10 m tall; stands typically 80-200 years old |
| 9 | Old Forest | Trees >10 m tall; stands typically >200 years old |
| Stand Composition Modifiers | | |
| Symbol | Stand Type | Description |
| C | Coniferous | >75% of total tree layer cover is coniferous |
| B | Broadleaf | >75% of total tree layer cover is broadleaf |
| M | Mixed | Neither coniferous or broadleaf account for >75% of total tree layer cover |



| | |
|--|---------------------------|
| | Regional Study Area (RSA) |
| | Biogeoclimatic Unit |
| | Ecosystem Unit |
| | Park / Protected Area |



| | |
|--|---------|
| REFERENCE | |
| Parks and protected areas from the Province of British Columbia. Base data from CanVec. Imagery from BC WMS Layer: BC_S5L5_BC_2004_2006_BCALB_15M_PANB321_ENH. TEM from Timberline Natural Resource Group Ltd. (2007; 2008). | |
| Projection: UTM Zone 10 Datum: NAD 83 | |
| 1,400 | 0 1,400 |
| SCALE 1:35,000 METRES | |

| | | | |
|--|------------------|---|--------|
| PROJECT | | BURNCO ROCK PRODUCTS LTD. BURNCO AGGREGATE PROJECT, HOWE SOUND, B.C. | |
| TITLE | | | |
| REGIONAL STUDY AREA TERRESTRIAL ECOSYSTEM MAP | | | |
| PROJECT NO. | 11-1422-0046 | PHASE No. | |
| DESIGN | SH 21 Jan. 2013 | SCALE AS SHOWN | REV. 0 |
| GIS | DL 17 Mar. 2016 | FIGURE 3 - G | |
| CHECK | VBS 17 Mar. 2016 | | |
| REVIEW | VBS 17 Mar. 2016 | | |





CWHvm1

The CWH submontane very wet maritime variant (CWHvm1) ranges from sea level to approximately 650 masl. The CWHvm1 has a wet, humid climate with cool summer and mild winters featuring relatively little snow; consequently growing seasons are long (Green and Klinka 1994).

Zonal vegetation in the CWHvm1 is characterized by well stocked, productive stands of western hemlock, amabilis fir (*Abies amabilis*), and lesser amounts of western redcedar. Understorey vegetation on zonal sites features a well-developed shrub layer that is dominated by red huckleberry (*Vaccinium parviflorum*) and Alaskan blueberry (*Vaccinium alaskaense*). Herbs are typically sparse and include minor amounts of deer fern (*Blechnum spicant*), five-leaved bramble (*Rubus pedatus*), bunchberry (*Cornus canadensis*), and queen’s cup (*Clintonia uniflora*). Zonal sites also have a well-developed moss layer dominated by step moss (*Hylocomium splendens*) and lanky moss (*Rhytidiadelphus loreus*) (Green and Klinka 1994).

Timberline (2007, 2008) mapped a total of 19 vegetated, non-vegetated, and anthropogenic site series within the CWHvm1 variant (Table 6 and Figure 3). Approximately 251 ha of the RSA designated by Timberline (2007, 2008) as CWHvm1 were found to be unclassified.

Table 6: CWHvm1 Site Series Mapped within the Regional Study Area

| Mapcode | Site Series Number | Ecosystem Unit Name | Area (ha) | Proportion of RSA (%) |
|--------------|--------------------|---|----------------|-----------------------|
| AB | 01 | Western hemlock – Amabilis fir – Blueberry | 3,413.6 | 11.4 |
| LC | 02 | Western Hemlock – Lodgepole pine – Cladina | 2.6 | <0.1 |
| HS | 03 | Western hemlock – Western redcedar – Salal | 194.8 | 0.6 |
| AF | 05 | Amabilis fir – Western redcedar – Foamflower | 975.2 | 3.2 |
| HD | 06 | Western Hemlock – Amabilis fir – Deer fern | 115.8 | 0.4 |
| AS | 07 | Amabilis fir – Western redcedar – Salmonberry | 1,060.7 | 3.5 |
| SS | 09 | Sitka spruce – Salmonberry | 14.7 | <0.1 |
| LS | 13 | Lodgepole pine – <i>Sphagnum</i> | 11.3 | <0.1 |
| RC | 14 | Western redcedar – Sitka spruce – Skunk cabbage | 32.0 | 0.1 |
| AA | 00 | Amabilis fir – Alaskan blueberry | 4.8 | <0.1 |
| BT | 00 | Brushy talus | 42.3 | 0.1 |
| GB | 00 | Gravel bar | 6.0 | <0.1 |
| GT | 00 | Graminoid/herb avalanche track | 2.5 | <0.1 |
| SA | 00 | Sitka alder – Salmonberry avalanche chute | 103.4 | 0.3 |
| RI | 00 | River | 57.4 | 0.2 |
| RO | 00 | Rock outcrop | 54.3 | 0.2 |
| TA | 00 | Talus | 107.8 | 0.4 |
| ES | 00 | Exposed soil | 6.8 | <0.1 |
| UNC | 00 | Unclassified | 251.4 | 0.8 |
| Total | | | 6,457.6 | 21.5 |



CWHvm2

The CWH montane very wet maritime variant (CWHvm2) occurs above the CWHvm1, from approximately 650 to 1,000 masl. The CWHvm2 has a wet, humid climate with cool, short summers and cool winters featuring substantial snowfall. Compared to the submontane variant below it, the CWHvm2 has cooler temperatures, shorter growing seasons, and heavier snowfall, with snowpacks persisting throughout the winter (Green and Klinka 1994).

Zonal vegetation in the CWHvm2 is characterized by stands of western hemlock, amabilis fir, and to a lesser extent western redcedar, yellow cedar (*Chamaecyparis nootkatensis*) and mountain hemlock (*Tsuga mertensiana*). Major understorey species include Alaskan blueberry and five-leaved bramble, with a well-developed moss layer consisting of step moss, lanky moss, and pipecleaner moss (*Rhytidiadelphus robusta*) (Green and Klinka 1994).

Timberline (2007, 2008) mapped a total of 26 vegetated, non-vegetated, and anthropogenic site series within the CWHvm2 variant (Table 7 and Figure 3).

Table 7: CWHvm2 Site Series Mapped within the Regional Study Area

| Mapcode | Site Series Number | Ecosystem Unit Name | Area (ha) | Proportion of RSA (%) |
|--------------|--------------------|--|----------------|-----------------------|
| AB | 01 | Western hemlock – Amabilis fir – Blueberry | 4,545.3 | 15.1 |
| AF | 02 | Western Hemlock – Lodgepole pine – Cladina | 523.3 | 1.7 |
| LC | 02 | Western Hemlock – Lodgepole pine – Cladina | 126.6 | 0.4 |
| HS | 03 | Western hemlock – Western redcedar – Salal | 590.3 | 2.0 |
| RS | 04 | Western redcedar – Western hemlock – Sword fern | 15.7 | 0.1 |
| HD | 06 | Western Hemlock – Amabilis fir – Deer fern | 296.0 | 1.0 |
| AS | 07 | Amabilis fir – Western redcedar – Salmonberry | 494.0 | 1.6 |
| YG | 09 | Western redcedar – Yellow cedar – Goldthread | 41.5 | 0.1 |
| RC | 14 | Western red cedar – Sitka spruce – Skunk cabbage | 9.4 | <0.1 |
| AA | 00 | Amabilis fir – Alaskan blueberry | 260.3 | 0.9 |
| MK | 00 | Mountain hemlock krummholz | 23.0 | 0.1 |
| TS | 00 | Tufted clubrush – <i>Sphagnum</i> bog | 1.7 | <0.1 |
| FS | 00 | Sedge fen | 34.4 | 0.1 |
| SB | 00 | Sedge – Bentgrass fen | 1.0 | <0.1 |
| IF | 00 | Indian hellebore – Fern | 9.3 | <0.1 |
| BT | 00 | Brushy talus | 96.2 | 0.3 |
| GT | 00 | Graminoid/herb avalanche track | 54.4 | 0.2 |
| SA | 00 | Sitka alder – Salmonberry avalanche chute | 724.3 | 2.4 |
| LA | 00 | Lake | 89.2 | 0.3 |
| OW | 00 | Shallow open water | 1.1 | <0.1 |
| PD | 00 | Pond | 22.5 | 0.1 |
| RI | 00 | River | 7.9 | <0.1 |
| RO | 00 | Rock outcrop | 220.0 | 0.7 |
| RU | 00 | Rubble | 1.2 | <0.1 |
| TA | 00 | Talus | 194.6 | 0.6 |
| ES | 00 | Exposed soil | 28.4 | 0.1 |
| Total | | | 8,411.8 | 28.0 |



Mountain Hemlock (MH) Zone

The MH zone makes up the second largest portion of the RSA (8,309 ha or 28%). The MH zone is characterized by short, cool summers, and long, cold, wet winters, with heavy snow cover for several months (Meidinger and Pojar 1991). Mean annual temperature among the subzones varies from 0 to 5°C. Mean annual precipitation ranges from 1,700 to 5,000 mm, of which 20% to 70% is snow. The deep winter snowpack is slow to disappear, resulting in a short growing season (Meidinger and Pojar 1991). Two MH subzones are present in the RSA.

MHmm1

The MH windward moist montane variant (MHmm1) occurs from approximately 1,000 masl to between 1,100 and 1,350 masl. Zonal vegetation in the MHmm1 variant is characterized by stands of >50% hemlock cover, occurring as a mix of mountain hemlock and amabilis fir, and to a lesser extent, yellow cedar. Alaskan blueberry, oval-leaved blueberry (*Vaccinium ovalifolium*), and pipecleaner moss are prominent in the understorey (Green and Klinka 1994). Vegetation and stand characteristics are strongly influenced by local topography, which affects the timing and pattern of snowmelt (Green and Klinka 1994). Upper elevations grade into discontinuous forests of the parkland subzone (MHmmp1, discussed below).

Timberline (2007, 2008) mapped a total of 28 vegetated, non-vegetated, and anthropogenic site series within the MHmm1 variant (Table 8 and Figure 3).



BURNCO AGGREGATE PROJECT - VEGETATION BASELINE

Table 8: MHmm1 Site Series Mapped within the Regional Study Area

| Mapcode | Site Series Number | Ecosystem Unit Name | Area (ha) | Proportion of RSA (%) |
|--------------|--------------------|--|----------------|-----------------------|
| MB | 01 | Mountain hemlock – Amabilis fir – Blueberry | 2,310.9 | 7.7 |
| MM | 02 | Mountain hemlock – Amabilis fir – Mountain-heather | 117.7 | 0.4 |
| MO | 03 | Amabilis fir – Mountain hemlock – Oak fern | 23.3 | 0.1 |
| AB | 04 | Mountain hemlock – bramble | 5.2 | <0.1 |
| MT | 05 | Amabilis fir – Mountain hemlock – Twistedstalk | 208.5 | 0.7 |
| MD | 06 | Mountain hemlock – Yellow cedar – Deer cabbage | 14.9 | <0.1 |
| YH | 07 | Yellow cedar – Mountain hemlock – Hellebore | 22.4 | 0.1 |
| YC | 09 | Yellow cedar – Mountain hemlock – Skunk cabbage | 9.5 | <0.1 |
| AA | 00 | Amabilis fir – Alaskan blueberry | 402.5 | 1.3 |
| AS | 00 | Alaskan blueberry – Sitka valerian | 50.8 | 0.2 |
| BT | 00 | Brushy talus | 21.9 | 0.1 |
| BV | 00 | Birch – <i>Vaccinium</i> | 25.6 | 0.1 |
| CL | 00 | Cliff | 0.6 | <0.1 |
| HM | 00 | Heather meadow | 111.8 | 0.4 |
| KR | 00 | Kinnikinnick – <i>Racomitrium</i> rock | 6.9 | <0.1 |
| LA | 00 | Lake | 19.3 | 0.1 |
| MH | 00 | Mountain hemlock – Mountain-heather parkland/heath | 1,290.4 | 4.3 |
| MK | 00 | Mountain hemlock krummholz | 493.6 | 1.6 |
| MR | 00 | Mountain-heather – <i>Racomitrium</i> scrub | 498.7 | 1.7 |
| PD | 00 | Pond | 16.8 | 0.1 |
| PS | 00 | Partridgefoot – Sedge meadow | 11.7 | <0.1 |
| RO | 00 | Rock outcrop | 573.9 | 1.9 |
| RU | 00 | Rubble | 11.1 | <0.1 |
| SA | 00 | Sitka alder – Salmonberry avalanche chute | 504.4 | 1.7 |
| TA | 00 | Talus | 235.3 | 0.8 |
| TS | 00 | Tufted clubrush – <i>Sphagnum</i> bog | 6.8 | <0.1 |
| YB | 00 | Mountain hemlock – Yellow cedar – Blueberry – Mountain-heather | 200.9 | 0.7 |
| ES | 00 | Exposed soil | 2.8 | <0.1 |
| Total | | | 7,198.0 | 24.0 |



MHmmp1

The MH windward moist maritime parkland variant (MHmmp1) occupies the transition between the treeline and the true alpine CMA zone. The MHmmp1 is distinguished by discontinuous forest cover interspersed with subalpine heath, lush herb meadows, and subalpine bogs and fens (Meidinger and Pojar 1991). The MHmmp1 features a variety of alpine/subalpine plants, such as mountain-heathers (Cassiope spp.), that are absent from the forested subzones.

Timberline (2007, 2008) mapped a total of 16 vegetated, non-vegetated, and anthropogenic site series within the MHmmp1 variant (Table 9 and Figure 3).

Table 9: MHmmp1 Site Series Mapped within the Regional Study Area

Table with 5 columns: Mapcode, Site Series Number, Ecosystem Unit Name, Area (ha), and Proportion of RSA (%). It lists 16 site series and a total row.

Coastal Mountain-heather Alpine (CMA) Zone

The CMA zone occupies 79.5 ha (0.3%) of the RSA at elevations above approximately 1,350 masl. The CMA is characterized by a harsh, cold, windy climate with low growing season temperatures and a very short frost-free period (Meidinger and Pojar 1991). Mean annual temperatures remain below 0°C for 7 to 11 months of the year, and frost can occur at any time. Mean annual precipitation ranges from 700 to 3,000 mm, of which 70 to 80% falls as snow.



The CMA zone is treeless by definition; however, at lower elevations, krummholz (stunted) forms of subalpine fir (*Abies lasiocarpa*) and mountain hemlock exist in isolated and discontinuous stands. Zonal vegetation is dominated by shrubs, including willows (*Salix* spp.), and scrub birch (*Betula glandulosa*), herbs, bryophytes, and lichens (Meidinger and Pojar 1991).

Although the CMA zone is present within the RSA, Timberline (2007, 2008) neither mapped nor classified the CMA zone, as the focus of their reports was to classify forest resources within their specific study areas; therefore, the CMA zone was rather included in the MHmmp1 subzone for mapping purposes.

4.1.1.2 Structural Stages

Updating and analysing VRI data indicated a broad range of structural stages present in the RSA (Figure 4). Mature and old growth forests account for 45.9% of the RSA. Shrub, sapling forest, and young forest structural stages account for 30% of the RSA, which includes subalpine parkland, as well as areas subjected to natural and anthropogenic disturbance (e.g., logging) that are in a state of regeneration. Unvegetated or sparsely vegetated areas represent approximately a quarter (24.1%) of the RSA, which include alpine areas, as well as developed land such as buildings and roads.

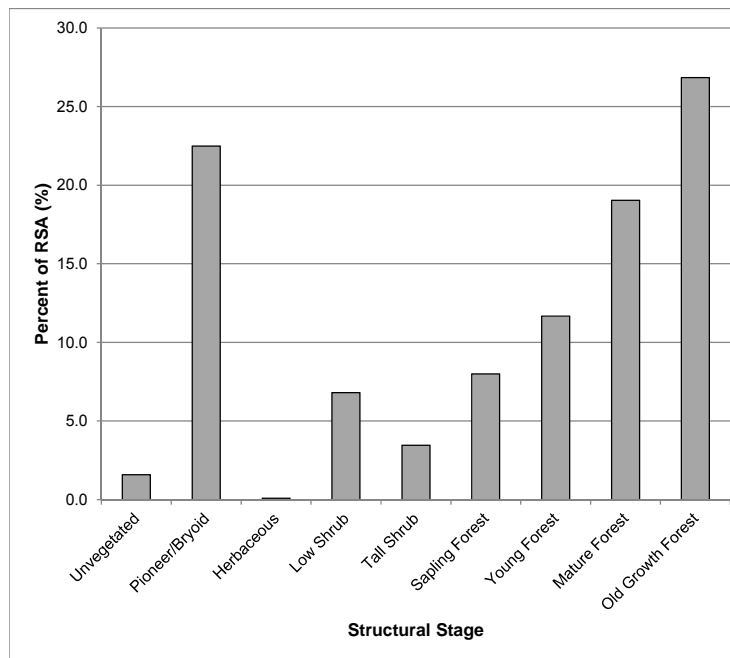


Figure 4: Distribution of Vegetation Structural Stages in the Regional Study Area



4.1.2 Local Study Area

The LSA falls exclusively within the CWHvm1 biogeoclimatic unit (Green and Klinka 1994). The Proposed Project Area is a mix of coastal forest in various structural forms resulting from logging activity occurring over the last 50 to 60 years. Mature riparian forests remain along McNab Creek and some of its tributaries, as well as mature foreshore coastal rainforest along the southern boundary of the LSA bordering Howe Sound.

4.1.2.1 Ecosystem Units

A total of 117 polygons were mapped within the 569 ha LSA at a scale of 1:5,000 (Figure 5). Upland forested ecosystem units occupy the majority of the LSA (82%), while wetland and riparian ecosystems occupy 6.4%. A total of 23 different ecosystem units were encountered in the LSA, four of which are anthropogenic in origin due to existing disturbances (Table 10). The properties of these ecosystem units as outlined by Green and Klinka (1994), Banner et al. (1993), and RIC (1998) are discussed in greater detail below.



BURNCO AGGREGATE PROJECT - VEGETATION BASELINE

Table 10: Distribution of Ecosystem Units in the Local Study Area

| Ecosystem Unit | Site Series | Ecosystem Unit Name | Area (ha) | Proportion of LSA (%) |
|---|-------------|---|--------------|-----------------------|
| Upland Forested Ecosystems | | | | |
| AB | 01 | Western hemlock – Amabilis fir – Blueberry | 212.9 | 37.4 |
| LC | 02 | Western Hemlock – Lodgepole pine – Cladina | 1.7 | 0.3 |
| HS | 03 | Western hemlock – Western redcedar – Salal | 73.5 | 12.9 |
| AF | 05 | Amabilis fir – Western redcedar – Foamflower | 61.4 | 10.8 |
| HD | 06 | Western Hemlock – Amabilis fir – Deer fern | 95.4 | 16.8 |
| AS | 07 | Amabilis fir – Western redcedar – Salmonberry | 21.5 | 3.8 |
| <i>Upland Forested Ecosystems Sub-total</i> | | | 466.4 | 82.0 |
| Wetland and Riparian Ecosystems | | | | |
| SP | 00 | Sitka spruce – Pacific crabapple | 4.4 | 0.8 |
| SS | 09 | Sitka spruce – Salmonberry (high fluvial bench) | 23.2 | 4.1 |
| CD | 10 | Black cottonwood – Red-osier dogwood (middle fluvial bench) | 4.7 | 0.8 |
| CW | 11/FI50 | Black cottonwood – Willow | 1.8 | 0.3 |
| RC | 14/Ws54 | Western redcedar – Sitka spruce- Skunk cabbage | 0.9 | 0.2 |
| GS | Ed02 | Tufted hairgrass – Douglas’ aster estuarine meadow | 1.3 | 0.2 |
| SC | 00 | Sedge – Skunk cabbage | 0.3 | <0.1 |
| <i>Wetland and Riparian Ecosystems Sub-total</i> | | | 36.6 | 6.4 |
| Sparsely Vegetated and Non-Vegetated Ecosystems | | | | |
| CB | 00 | Cut bank | 0.6 | 0.1 |
| GB | 00 | Gravel bar | 4.2 | 0.7 |
| MU | 00 | Mudflat sediment | 0.3 | <0.1 |
| RO | 00 | Rock outcrop | 5.7 | 1.0 |
| <i>Sparsely Vegetated/ Non-Vegetated Ecosystems Sub-total</i> | | | 10.8 | 1.9 |
| Aquatic and Marine Ecosystems | | | | |
| OC | 00 | Ocean | 1.5 | 0.3 |
| RI | 00 | River | 9.4 | 1.7 |
| <i>Aquatic and Marine Ecosystems Sub-total</i> | | | 10.9 | 1.9 |
| Anthropogenic Ecosystems | | | | |
| ES | 00 | Exposed soil | 3.0 | 0.5 |
| PL | 00 | Powerline | 12.2 | 2.1 |
| RU | 00 | Rural | 7.0 | 1.2 |
| RZ | 00 | Road | 22.6 | 4.0 |
| <i>Anthropogenic Ecosystems Sub-total</i> | | | 44.8 | 7.8 |
| Grand Total | | | 569.1 | 100.0 |

NOTE: Totals may not add up due to rounding.



Upland Forested Ecosystems

Western hemlock – Amabilis fir – Blueberry (AB; Site Series 01) is the most common ecosystem unit in the LSA, occurring over 37.4% of the LSA, and is the zonal site series for the CWHvm1 BEC subzone. These ecosystems are dry to mesic, and occur primarily at mid- to upper slope positions. Zonal forests are moderately stocked, and are dominated by western hemlock, amabilis fir, and western redcedar. Typical understorey vegetation includes a thick shrub layer of conifer regeneration, blueberry species, and a sparse layer of bunchberry, deer fern, and spiny wood fern (*Dryopteris expansa*). A carpet of feather and leafy mosses is typical.

Western Hemlock – Lodgepole pine – Cladina (LC; Site Series 02) is an uncommon ecosystem unit, occurring over only 0.3% of the LSA, located primarily in the southwest corner on outcrops overlooking Howe Sound. These ecosystems are found only on the driest bedrock outcrops with very thin soils. Forests are typically open and stunted mixtures of western hemlock, western redcedar and lodgepole pine (*Pinus contorta var. latifolia*). The shrub layer is dominated by salal; the herb layer is very sparse. The presence of rock moss and reindeer lichens differentiates this unit from all other sites series.

Western hemlock – Western redcedar – Salal (HS; Site Series 03) is a relatively common ecosystem unit, occurring over 12.9% of the LSA, located primarily in the southwest corner along the shore of Howe Sound, and east of McNab Creek where the slope begins to increase from the valley floor. These ecosystem units are dry, and found on bedrock outcrops with thin soils and rapid drainage. The western hemlock/ western redcedar forests are moderately stocked but stunted. Understorey species are similar to zonal forests but an abundance of salal, thin soils, and poor tree growth distinguish this sites series from the 01 (AB).

Amabilis fir – Western redcedar – Foamflower (AF; Site Series 05) occurs over 10.8% of the LSA, and is typically found on freely drained soils on mid- to lower slopes. Forests are dominated by highly productive western hemlock, amabilis fir, Sitka spruce (*Picea sitchensis*), and western redcedar. A diverse and lush fern layer is characteristic of this unit. A low cover of devil's club (*Oplopanax horridus*) distinguishes this unit from the 08 (AD).

Western Hemlock – Amabilis fir – Deer fern (HD; Site Series 06) is the second most common ecosystem unit, occurring over 16.8% of the LSA. This ecosystem occurs on mid- to lower slopes, often downslope of mesic forests. The species and understorey vegetation are similar to zonal forests, but western redcedar and deer fern are more abundant. Gleyed soils or wet organic veneers over rock are typical (indicating constant lateral seepage) and aid in differentiating this ecosystem from zonal sites. This ecosystem unit often occurs in a complex with wooded bogs with organic soils.

Amabilis fir – Western redcedar – Salmonberry (AS; Site Series 07) is a less common ecosystem unit, occurring over 3.8% of the LSA, found in isolated remnant stands throughout the LSA. These wet, nutrient rich ecosystems also occur on mid- to lower slopes, with forests dominated by productive western hemlock, amabilis fir, and western redcedar. The understorey typically consists of immature trees and salmonberry (*Rubus spectabilis*), often with a component of huckleberry.

Wetland and Riparian Ecosystems

Sitka spruce – Pacific Crabapple (SP; Site Series 00) is an uncommon unit, occupying 0.8% of the LSA, located along the shoreline of Howe Sound to the west of McNab Creek. These ecosystems units are treed mineral



swamps that occur in brackish channels and estuary edges with occasional tidal flooding, and are characterized by waterlogged, slightly saline soils.

Sitka spruce – salmonberry (SS; Site Series 09) occupies 4.1% of the LSA, occurring on elevated floodplain sites that experience seasonal water table fluctuations but not annual flooding. These are highly productive forests dominated by Sitka spruce and western hemlock. Salmonberry and devil's club dominate the understory. Ferns are common in the moderately developed herb layer; leafy mosses in the moss layer. This unit is differentiated from other floodplain ecosystems by the dominance of conifers in the tree layer.

Black cottonwood – Red-osier dogwood (CD; Site Series 10) is an uncommon ecosystem unit, occurring over 0.8% of the LSA adjacent to McNab Creek. These units are middle fluvial benches that experience periodic (annual) flooding and a prolonged elevated water table, which greatly inhibits conifer establishment. Forests are dominated by black cottonwood (*Populus trichocarpa* ssp. *trichocarpa*) and red alder (*Alnus rubra*). Thickets of salmonberry, red-osier dogwood (*Cornus stolonifera*), and stink currant (*Ribes bracteosum*) occupy the understory. Herb and moss layers are sparse. A lack of willow, greater forest stature, and higher bench height distinguish these units from the 11 (CW).

Black cottonwood – Willow (CW; Site Series 11/FI50) occupies 0.3% of the LSA adjacent to McNab Creek; these ecosystem units experience prolonged annual flooding and sediment erosion/deposition. This disturbance prevents successful conifer establishment and scours vegetation that is not suitably rooted. Sitka and Pacific willows (*Salix lasiandra*), black cottonwood, and sometimes red alder dominate and distinguish this unit. Herb and moss layers are very sparse.

Western redcedar – Sitka spruce- Skunk cabbage (RC; Site Series 14/Ws54) occupies just 0.2% of the LSA, and located just east of the existing workshop and primary access road. These ecosystem units are swamp wetlands occurring in low-lying areas on floodplains and receiving sites (downslope drainage) at toe slopes. The typically open canopy consists primarily of western redcedar and western hemlock. Salmonberry, blueberry, and salal typically dominate the shrub layer, with skunk cabbage present in damp hollows accompanied by a diversity of rich-site indicators.

Tufted hairgrass – Douglas' aster Estuarine Meadow (GS; Site Series Ed02) occurs over 0.2% of the LSA, occupying the marine foreshore of Howe Sound at the southern extent of the LSA. These are intertidal ecosystem units occur in the high marsh zone between the backshore shrub communities and the low marsh, usually in broad and extensive flats, where weakly brackish conditions dominate.

Sedge – Skunk cabbage (SC; Site Series 00) occurs over just 0.05% of the LSA as a small wetland just west of the main access road where beaver damming has resulted in an impoundment of water. These ecosystem units typically occur along valley bottoms on poorly drained sites with deep organic soils. Pockets of standing shallow water are often associated with this unit.

Aquatic and Marine Ecosystems

Aquatic and marine ecosystems include the portion of the LSA buffer that extends into Howe Sound (mapped as Ocean), and McNab Creek (mapped as River).



Anthropogenic Map Units

Anthropogenic ecosystems include the historical access road constructed for logging activities, existing buildings and dock facilities, and the powerline right-of-way that traverses the southern portion of the LSA. Several cottages on the eastern side of McNab Creek near its confluence with Howe Sound are also included in this category.



LEGEND

MCNAB CREEK TEM LEGEND

ECOSYSTEM MAPPING AND VASCULAR PLANT SPECIES AT RISK SURVEY

Ecosystem and Plant Species at Risk Survey Location ●

TEM Visual Check ●

BOUNDARIES

Project Area

Ecosystem Unit Boundaries

Biogeoclimatic Unit Boundaries

Ecosession

SPR South Pacific Ranges

Biogeoclimatic Units

CWHv1 Coastal Western Hemlock Submontane Very Wet Maritime Variant

Ecosystem Unit Labels

Decile 1 Structural Stage 1 Ecosystem Code 2 Structural Stage 2

6AB3a 4HDck7C

Ecosystem Code 1 Decile 2 Site Modifiers Stand Composition Modifier

CWHv1 Site Series Mapcodes

| Mapcode | Ecosystem Unit Name | Site Series Number |
|---------|--|--------------------|
| AB | Western hemlock – Amabilis fir – Blueberry | 01 |
| AF | Amabilis fir – Western redcedar – Foamflower | 05 |
| AS | Amabilis fir – Western redcedar – Salmonberry | 07 |
| HS | Western hemlock – Western redcedar – Salal | 03 |
| AD | Amabilis fir – Sitka spruce – Devil's club | 08 |
| CD | Black cottonwood – Red-osier dogwood | 10 |
| CW | Black cottonwood – Willow | 11/F150 |
| LC | Western Hemlock – Lodgepole pine – Cladina | 02 |
| HD | Western Hemlock – Amabilis fir – Deer fern | 06 |
| RC | Western red cedar – Sitka spruce- Skunk cabbage | 14/Ws54 |
| SP | Sitka spruce – Pacific crabapple | 00 |
| SS | Sitka spruce – Salmonberry | 09 |
| GS | Tufted hairgrass – Douglas' aster estuarine meadow | Ed02 |
| WS | Sitka willow – Sitka sedge | Ws06 |
| PL | Powerline | 00* |
| RI | River | 00 |
| RZ | Road | 00 |
| RU | Rural | 00 |
| RO | Rock outcrop | 00 |
| CB | Cut bank | 00 |
| ES | Exposed soil | 00 |
| GB | Gravel bar | 00 |
| MU | Mudflat sediment | 00 |
| OC | Ocean | 00* |

* = Non-standard unit

Site Modifiers

| Symbol | Criteria |
|--------|---|
| a | Active fluvial floodplain where evidence of active sedimentation and deposition is present |
| c | Coarse textured soils, including sand and loamy-sand |
| d | Deep soils (>100 cm to bedrock) |
| g | Gullying occurring |
| h | Hummocky terrain (optional modifier) – hummocky conditions are indicated by the terrain surface expression |
| j | Gentle slope (<35% in the CWH zone) |
| k | Cool aspect – northerly or easterly aspects (285° – 135°) on moderately steep slopes (35% – 100% slope in the CWH zone) |
| m | Medium textured soils, including silt and silt loam |
| r | Ridge (optional modifier) – occurs throughout ridge terrain or on a ridge crest |
| s | Shallow soils (20-100 cm to bedrock) |
| w | Warm aspect – southerly or westerly aspects (135° – 285°) on moderately steep slopes (35% – 100% slope in the CWH zone) |

Structural Stage

| Symbol | Structural Stage | Description |
|--------|------------------|---|
| 1 | Pioneer | Bryophyte and lichen dominated communities |
| 2 | Herbaceous | Herbaceous communities |
| 2a | Forb | Dominated by forb cover |
| 2b | Graminoid | Dominated by grasses, sedges, and rushes |
| 3a | Low Shrub | Shrubs <2 m tall |
| 3b | Tall Shrub | Shrubs >2 m tall |
| 4 | Pole/Sapling | Trees >10 m tall; stands typically 20-40 years old |
| 5 | Young Forest | Trees >10 m tall; stands typically 40-80 years old |
| 6 | Mature Forest | Trees >10 m tall; stands typically 80-250 years old |
| 7 | Old Forest | Trees >10 m tall; stands typically >250 years old |

Stand Composition Modifiers

| Symbol | Stand Type | Description |
|--------|------------|--|
| C | Coniferous | >75% of total tree layer cover is coniferous |
| B | Broadleaf | >75% of total tree layer cover is broadleaved |
| M | Mixed | Neither coniferous or broadleaf account for >75% of total tree layer cover |

REFERENCE

Image obtained from Google Earth, used under license. Imagery date: July 8, 2010. Google Earth image is not to scale. Watercourses from the Province of British Columbia and field data. Projection: UTM Zone 10 Datum: NAD 83

SCALE 1:5,000 METRES

PROJECT

BURNCO ROCK PRODUCTS LTD.
BURNCO AGGREGATE PROJECT, HOWE SOUND, B.C.

TITLE

LOCAL STUDY AREA
TERRESTRIAL ECOSYSTEM MAP

FIGURE 5

PROJECT No. 11-1422-0046 PHASE No.

| | | | | |
|--------|-----|--------------|----------------|--------|
| DESIGN | JB | 21 Nov. 2012 | SCALE AS SHOWN | REV. 0 |
| GIS | DL | 17 Mar. 2016 | | |
| CHECK | VBS | 17 Mar. 2016 | | |
| REVIEW | VBS | 17 Mar. 2016 | | |

Golder Associates

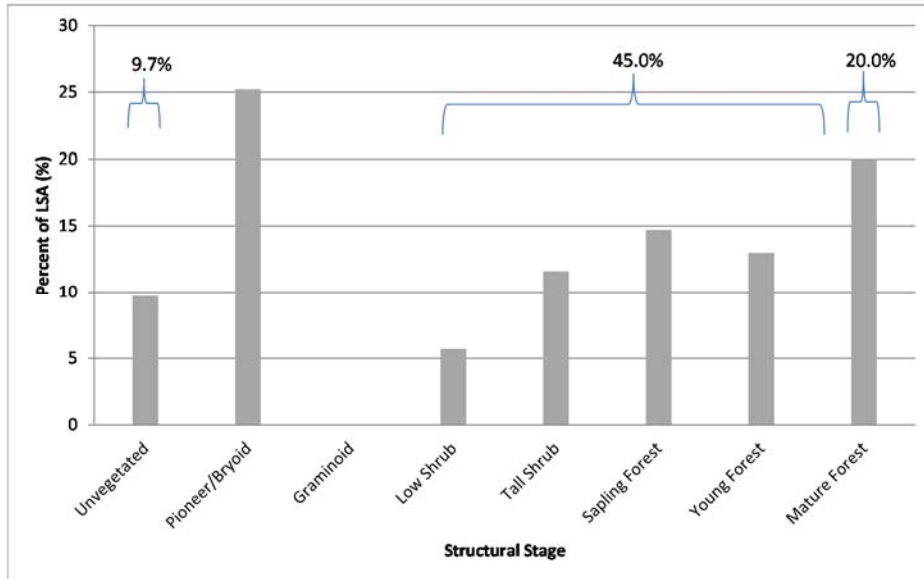


Figure 6: Distribution of Vegetation Structural Stages in the Local Study Area

4.2 Plants and Ecosystems at Risk

4.2.1 Plant Species at Risk

The review of existing information indicated that 11 listed vascular plants have the potential to occur in the LSA (Table 11).

Table 11: Listed Vascular Plants with Potential to Occur in the Local Study Area

| Scientific Name | English Name | BC List ^(a) | Provincial/Global Status ^(a,b) | COSEWIC Status ^(a,c) | SARA Rank ^(a,c) |
|---|----------------------------|------------------------|---|---------------------------------|----------------------------|
| <i>Allium amplexans</i> | slimleaf onion | Blue | S3/G4 | NA | NA |
| <i>Eleocharis kamtschatica</i> | Kamchatka spike-rush | Blue | S2S3/G4 | NA | NA |
| <i>Eleocharis parvula</i> | small spike-rush | Blue | S2S3/G5 | NA | NA |
| <i>Hypericum scouleri</i> ssp. <i>nortoniae</i> | western St. John's-wort | Blue | S2S3/G5T? | NA | NA |
| <i>Jaumea carnosa</i> | fleshy jaumea | Blue | S2S3/G4G5 | NA | NA |
| <i>Malaxis brachypoda</i> | white adder's-mouth orchid | Blue | S2S3/G4 | NA | NA |
| <i>Ophioglossum pusillum</i> | northern adder's-tongue | Blue | S2S3/G5 | NA | NA |
| <i>Polemonium elegans</i> | elegant Jacob's-ladder | Blue | S3?/G4 | NA | NA |
| <i>Rubus nivalis</i> | snow bramble | Blue | S3?/G4? | NA | NA |
| <i>Sanguisorba menziesii</i> | Menzies' burnet | Blue | S2S3/G3G4 | NA | NA |
| <i>Toxicodendron diversilobum</i> | poison oak | Blue | S3?/G5 | NA | NA |

(a) Source: BC CDC (2016). Search criteria: Forest District = DSC; Regional District = SCRD; BGC Zone = CWH.

Red = Extirpated, Endangered or Threatened; Blue = Vulnerable; Yellow = Not at Risk.

(b) S = Provincial; G = Global; 2 = Imperiled; 3 = Vulnerable; 4 = Apparently Secure; 5 = Secure; ? = Not Certain

(c) NA = Not Assessed



Rare plant surveys conducted within the LSA failed to locate any plant species at risk. It should be noted however that rare plant surveys can only confirm the presence of rare species, but can seldom rule out the existence of rare species in a survey area (ANPC 2012).

4.2.2 Sensitive Ecosystems and Ecosystems at Risk

Sensitive ecosystems include both ecosystems at risk and those ecosystems that are ecologically sensitive (RISC 2006). A review of BC MOE Sensitive Ecosystem Inventory (SEI) studies indicated that the closest study was the Sunshine Coast SEI, published in 2005, which focused on coastal lowlands from Howe Sound to Desolation Sound and the adjacent islands (BC MOE 2005). This study assessed lands just south of the RSA, including Gambier Island; however, no part of the RSA itself was assessed.

BC MOE (2005) defines sensitive ecosystems as “those ecosystems that are fragile and/or rare, or those ecosystems which are ecologically important because of the diversity of species they support”. Ecologically significant lands are disappearing throughout the lowlands surrounding the Strait of Georgia because intense development pressures fueled by population and economic growth have fragmented and degraded many terrestrial ecosystems (BC MOE 2005). As a result, a high proportion of these ecosystems are designated as ‘at risk’ in BC (BC MOE 2005).

A review of existing information on the BC CDC Species and Ecosystems Explorer indicated that 13 ecosystems at risk have the potential to occur within the LSA (Table 12). Of these listed ecosystems, seven are suspected to occur within the LSA, including 23.2 ha of the red-listed Sitka spruce – Salmonberry ecosystem (Figure 9). These ecosystems were not formally evaluated as Element Occurrences as per BC CDC conservation assessment procedure guidelines (BC MOE 2007) due to the disturbed nature of the LSA due to logging.



BURNCO AGGREGATE PROJECT - VEGETATION BASELINE

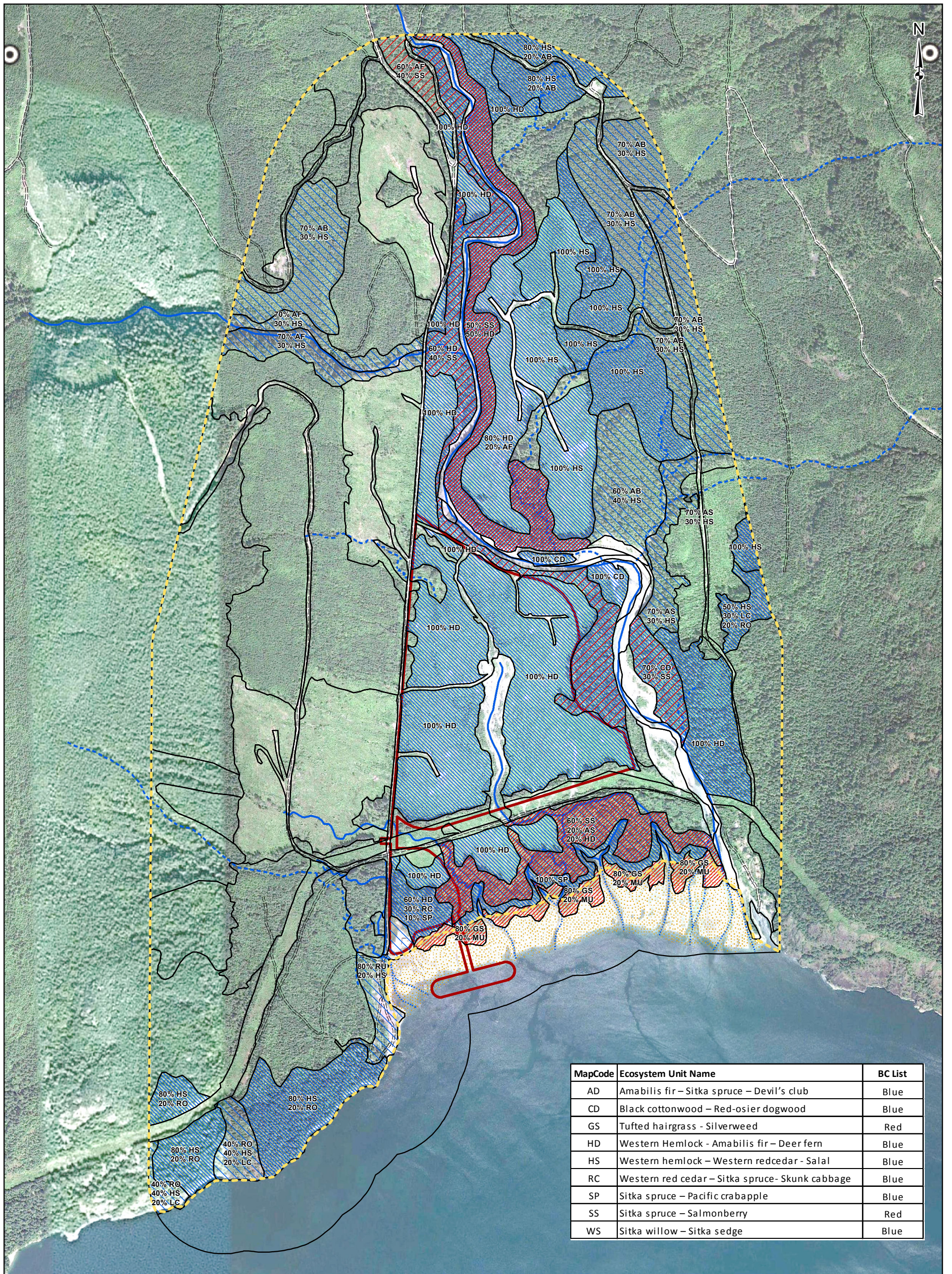
Table 12: Listed Ecosystems with Potential to Occur in the Local Study Area

| Mapcode/ Site Series ^(a) | Ecosystem Unit Name | BC List ^(b) | Prov./Global Status ^(b,c) | Area within LSA (ha) | Proportion of LSA (%) |
|--|--|---------------------------|---|-------------------------|--------------------------|
| Upland Forested Ecosystems | | | | | |
| HS/03 | Western hemlock – Western redcedar – Salal | Blue | S3/G3 | 73.5 | 12.9 |
| RS/04 | Western redcedar – western hemlock – sword fern | Blue | S3?/GNR | 0 | 0 |
| HD/06 | Western Hemlock – Amabilis fir – Deer fern | Blue | S3/GNR | 95.4 | 16.8 |
| AD/08 | Amabilis fir – Sitka spruce – Devil’s club | Blue | S3/GNR | 0 | 0 |
| Wetland and Riparian Ecosystems | | | | | |
| 00 | Dune wildrye – beach pea | Red | S1S2/GNR | 0 | 0 |
| GS/Ed02 | Tufted hairgrass – Douglas’ aster estuarine meadow | Red | S2/G3 | 1.3 | 0.2 |
| SP/00 | Sitka spruce – Pacific crabapple | Blue | S3/GNR | 4.4 | 0.8 |
| SS/09 | Sitka spruce – Salmonberry (high fluvial bench) | Red | S2/G3 | 23.2 | 4.1 |
| CD/10 | Black cottonwood – Red-osier dogwood (middle fluvial bench) | Blue | S3/GNR | 4.7 | 0.8 |
| RC/ 14/Ws54 | Western red cedar – Sitka spruce- Skunk cabbage swamp forest | Blue | S3?/GNR | 0.9 | 0.2 |
| NA/Wb50 | Labrador tea – western bog-laurel – Sphagnum | Blue | S3/G4 | 0 | 0 |
| NA/Wf51 | Sitka sedge – Sphagnum | Red | S2/G2 | 0 | 0 |
| NA/Ws06 | Sitka willow – Sitka sedge | Blue | S3/G3 | 0 | 0 |
| Total | | | | 203.4 | 35.8 |

(a) NA = No defined mapcode

(b) Source: BC CDC (2016). Red = Extirpated, Endangered or Threatened; Blue = Vulnerable.

(c) S = Provincial; G = Global; 1 = Critically Imperiled; 2 = Imperiled; 3 = Vulnerable; 4 = Apparently Secure; 5 = Secure; ? = Not Certain; NR = Not Ranked



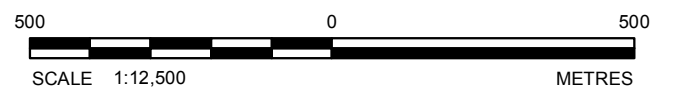
| MapCode | Ecosystem Unit Name | BC List |
|---------|---|---------|
| AD | Amabilis fir – Sitka spruce – Devil's club | Blue |
| CD | Black cottonwood – Red-osier dogwood | Blue |
| GS | Tufted hairgrass - Silverweed | Red |
| HD | Western Hemlock - Amabilis fir – Deer fern | Blue |
| HS | Western hemlock – Western redcedar - Salal | Blue |
| RC | Western red cedar – Sitka spruce- Skunk cabbage | Blue |
| SP | Sitka spruce – Pacific crabapple | Blue |
| SS | Sitka spruce – Salmonberry | Red |
| WS | Sitka willow – Sitka sedge | Blue |

LEGEND

- Local Study Area (LSA) - Wildlife and Vegetation
- Project Area
- Intertidal Zone
- Road (Existing)
- Permanent / Perennial Watercourse
- Intermittent Watercourse
- Intertidal Watercourse
- Ecosystem Unit
- 50-100% Red Listed
- Under 50% Red Listed
- 50-100% Blue Listed
- Under 50% Blue Listed

REFERENCE

Watercourses from the Province of British Columbia and field data. Base data from the Province of British Columbia. Base Imagery from Google Maps 20100807. Projection: UTM Zone 10 Datum: NAD 83



| | | | |
|--------------------------|-----|---|-----------------|
| PROJECT | | BURNCO ROCK PRODUCTS LTD. BURNCO AGGREGATE PROJECT, HOWE SOUND, B.C. | |
| TITLE | | ECOSYSTEMS AT RISK | |
| PROJECT NO. 11-1422-0046 | | PHASE No. | |
| DESIGN | SH | 02 Feb. 2013 | SCALE AS SHOWN |
| GIS | DL | 17 Mar. 2016 | REV. 0 |
| CHECK | VBS | 17 Mar. 2016 | FIGURE 7 |
| REVIEW | VBS | 17 Mar. 2016 | |





4.3 Invasive Plant Species

“Invasive species” is a general term, which can be refined to non-native², invasive,³ noxious weed⁴, and nuisance⁵ plant species (Cranston et al. 2002). The BC *Weed Control Act* requires all land occupants to specify and implement measures that prevent the introduction or spread of species listed as noxious under the *Weed Control Regulation*. Additionally, the BC Ministry of Agriculture provides a list of nuisance weed species that do not require control and thus are not regulated under the BC *Weed Control Regulation* (BC MOA 2016).

A search of the BC Invasive Alien Plant Program (IAPP) on-line mapping program indicated that no noxious species have been historically documented as occurring within the LSA or RSA (IAPP 2014).

Due to the disturbed nature of the Proposed Project Area, some invasive species establishment has occurred. The majority of non-native plant species observed were recorded around the existing buildings and infrastructure at the southwest corner of the Proposed Project Area. No formal invasive species inventory has been conducted at this stage; however, Table 13 provides a list of invasive plant species that were observed during the field program.

Table 13: Invasive Plant Species Observed in the Local Assessment Area

| Scientific Name | Common Name | BC Weed Act Status ^(a) |
|--------------------------|----------------------|-----------------------------------|
| <i>Buddleja davidii</i> | butterfly-bush | Nuisance |
| <i>Cytisus scoparius</i> | Scotch broom | Nuisance |
| <i>Mycelis muralis</i> | Wall lettuce | Non-native |
| <i>Plantago major</i> | common plantain | Nuisance |
| <i>Rubus armeniacus</i> | Himalayan blackberry | Nuisance |
| <i>Sonchus asper</i> | Prickly sow-thistle | NA |
| <i>Verbascum thapsus</i> | great mullein | Nuisance |

^(a) BC MOA (2016)

² A plant introduced by humans to a new place or habitat where it was not previously found.

³ A non-native plant capable of growing and spreading rapidly, causing economic or environmental damage, or harm to human health.

⁴ A plant that directly or indirectly injure or cause damage to agriculture, irrigation, navigation, natural resources, public health, or the environment; designated as noxious under the BC *Weed Control Act*.

⁵ A plant with a tendency to dominate plant communities, or is considered harmful to humans. They can be native or non-native.



5.0 CLOSURE

We trust that this report is sufficient for your immediate requirements. If you have any questions about the contents of this report, please do not hesitate to contact the undersigned at 604-296-4200.

GOLDER ASSOCIATES LTD.

Steven Henstra, M.Sc., R.P.Bio., P.Biol.
Vegetation Ecologist

Brock Simons, M.Sc., R.P.Bio., P.Biol.
Associate, Senior Wildlife Biologist

SWH/VBS/asd

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solutions@golder.com
www.golder.com

Golder Associates Ltd.
Suite 200 - 2920 Virtual Way
Vancouver, BC, V5M 0C4
Canada
T: +1 (604) 296 4200

