TERRESTRIAL ECOSYSTEM MAPPING
CHAPMAN LANDSCAPE UNIT

Prepared For:

Sunshine Coast Timber Supply Area Licensee Group
Ian Robertson, R.P.F., FIA Coordinator
c/o International Forest Products Ltd.
311-1180 Ironwood St.
Campbell River, BC V9W 5P7

Prepared By:

Timberline Natural Resource Group
401-958 West 8th Ave
Vancouver, BC V5Z 1E5

March 31, 2008

Timberline
Natural Resource Group

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Natural Resource Group

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c/o International Forest Products Ltd.
311-1180 Ironwood St.
Campbell River, BC
V9W-5P7

Attention: Ian Robertson, RPF, FIA Coordinator

Reference: **Terrestrial Ecosystem Mapping within the Sunshine Coast TSA: Chapman Landscape Unit**

Dear Ian,

Please find enclosed the final project deliverables for the Chapman LU TEM project:

Non-Spatial Attribute Databases

1. TEM project database - (tem_4677*_mta.csv)
2. TEM polygon database - (tem_4677_ecp.csv)
3. Venus 5.0 (ground inspection) database - (tem_4677_eci.mdb)
4. Excel (visual inspection) database – (tem_4677_eci.xls)

Reports and Legends

5. Map legend – (tem_4677_ml.pdf)
6. Expanded (vegetation) legend – (tem_4677_el.pdf)
7. Final Report - (tem_4677_rpt.pdf)

ARC/INFO Spatial Databases

8. TEM polygon information - (tem_4677_ecp.e00)
9. TEM field plot data - (tem_4677_eci.e00)

Other Deliverables (available upon request)

- Typed air photos (with numbered ecosystem polygons and labeled BGC lines)
- Original field forms

* *Business Area Project ID (BAPID, supplied from the Ministry of Environment)*

Please contact me if you have any further questions or comments on the submitted deliverables.

Sincerely,

Scott Hawker, B.Sc., R.P.Bio.
Project Manager

Timberline Natural Resource Group Ltd.

ACKNOWLEDGEMENTS

Terrestrial ecosystem mapping of the Chapman Landscape Unit could not have been successfully completed without the efforts of many people.

This project was funded through the Forest Investment Account (FIA) and was coordinated by the participating Sunshine Coast TSA Licensee Group members. Ian Robertson, R.P.F., of Forsite Consultants Ltd., acted as the FIA Administrator on behalf of the Sunshine Coast TSA Licensee Group.

Ecological data collection was completed by the following Timberline staff: Scott Hawker, R.P.Bio. (Project Manager), Randy Moody, R.P.Bio. and Kara Aleksich, R.P.F.

Digital photo control was completed by Andrew Neale of Andrew Neale Digital Mapping (Victoria, BC). Data capture (via monorestitution) was completed by Eros Pavan, R.P.F., of Timberline. Nick Zukanovic and Eros Pavan of Timberline provided their GIS expertise throughout the project.

Helen Reid, R.P.Bio., provided an independent third party quality assurance check of the final classification, with emphasis on the quality and consistency of mapping between the mappers and on the correct use of site modifiers.

EXECUTIVE SUMMARY

The Chapman Landscape Unit (LU) is situated on the Sunshine Coast, spanning from Gibsons at it's eastern edge, into Sechelt and northwards to the mouth of the Salmon Inlet on the west-facing slopes above Sechelt Inlet. This landscape unit encompasses approximately 34,000 hectares.

In order to catalogue the ecological resources of the Chapman LU, the Sunshine Coast Timber Supply Area Licensee Group commissioned a terrestrial ecosystem mapping (TEM) project within this LU. The purpose of the project was to complete a TEM of the landscape unit for use in future timber supply reviews and other resource management activities. A total of **1,258** terrestrial ecosystem polygons were mapped within this landscape unit.

Mapping was completed according to the *Standards for Terrestrial Ecosystem Mapping in British Columbia* (RIC 1998), although the project followed a non-standard approach, as outlined in this document. As per standard TEM projects, the ecosystem mapping was based on the three level ecosystem classification framework, which includes ecoregion units, biogeoclimatic units and ecosystem units. Following prior discussions between the mapping contractor (Timberline), the Sunshine Coast TSA Licensee Group and Ministry of Environment staff in a previous fiscal year, several modifications were made to the 1998 TEM standards. The following approved variances (from a standard TEM project) applied to this project:

- Terrain attributes were not mapped,
- Structural stage attributes were not mapped,
- The sampling intensity targets applied largely to the productive forest land base (i.e. parkland ecosystems largely photo interpreted, where applicable),
- Ecosystem (FS882) field forms were not completed in the field,
- The Coastal Mountain-heather Alpine (CMA) zone was neither mapped nor classified, and
- The expanded legend did not provide a detailed listing of vegetation species by structural stage.

The following five biogeoclimatic units were mapped in the project area:

- CWHxm1 – Coastal Western Hemlock very dry maritime subzone
- CWHdm – Coastal Western Hemlock dry maritime subzone
- CWHvm1 – Coastal Western Hemlock submontane very wet maritime variant
- CWHvm2 – Coastal Western Hemlock montane very wet maritime variant
- MHmm1 – Mountain Hemlock windward moist maritime variant

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

1 INTRODUCTION

1.1 Project Background

The Chapman Landscape Unit (LU) boasts a wide variety of forest, cultural, wildlife, water and recreation resources. Stakeholders must balance their resource needs with the community, ecological and cultural requirements. One component in creating a balance between the many requirements is to catalogue the terrestrial ecosystems within the land base through the terrestrial ecosystem mapping (TEM) process.

As defined in the current TEM standards (RIC 1998), terrestrial ecosystem mapping is the stratification of a landscape into discrete map units, according to a combination of ecological features, primarily climate, physiography, surficial material, bedrock geology, soil and vegetation.

Together, the ecological features result in distinctive and repeatable site conditions and climax vegetation communities (site series) across the landscape. Each site series depicts a specified range of vegetation species and site productivity that can be found in a particular location. Ecosystem polygons are essentially lines that demarcate the site series or site series complexes.

TEM data forms a planning framework for a wide range of land or ecosystem-based management applications including:

- base-case analysis in timber supply reviews (TSR),
- ecosystem distribution and sensitivity analysis,
- long-term ecological monitoring,
- habitat supply modeling and assessment,
- rare ecosystem, plant or animal mapping or modeling,
- forest development, silviculture, site productivity (SIBEC) planning,
- riparian, biodiversity planning,
- wildfire risk analysis, and
- other operational and strategic planning initiatives.

The Sunshine Coast TSA Licensee Group commissioned this project with funding from the Forest Investment Account (FIA). This project contained several variances from the TEM standards (RIC 1998), as the focus was largely directed at the forested land base. Note that, as a Vegetation Resources Inventory (VRI) project is being completed concurrently within the Sunshine Coast TSA, structural stage attributes were not a deliverable for this project.

1.2 Objectives

The objectives of this mapping project within the Chapman Landscape Unit were to:

1. delineate the terrestrial ecosystems;
2. gather field data to better describe the site series;
3. field sample forested landscapes to Survey Intensity Level 4;
4. assess biogeoclimatic lines and provide new elevation rules, if necessary;
5. provide a seamless map of terrestrial ecosystems (with localized biogeoclimatic information); and to
6. provide deliverables for submission into the Ministry of Environment's Ecological Reports Catalogue (EcoCAT).

1.3 Study Area

1.3.1 Location

At nearly 22,000 hectares, the Chapman Landscape Unit is situated within the Sunshine Coast Forest District, spanning from Gibsons at the eastern edge, westward through the community of Sechelt and northward from Sechelt to the mouth of Salmon Inlet along the eastern slopes of Sechelt Inlet. This landscape unit covers portions of the following five 1:20,000 scale BCGS mapsheets:

- 092G042, 092G043
- 092G052, 092G053
- 092G062

The Chapman LU lies within the traditional territory of the Sechelt First Nation.

As described in the Chapman Landscape Unit Plan (Gordon and Waghorn 2002), the close proximity to the communities along the Sunshine Coast has a major effect on the relative values and presents a challenge to developing management strategies. There is a lot of private land within, and adjacent to, the landscape unit and consequently, there are a wide variety of interests in, and pressures upon, the land base. Most of the private land occurs along the southern shores of the landscape unit. The many forms of ownership and tenure within this landscape unit include private lands, Crown forest, Indian Reserve, Municipality, Provincial forest, woodlot, forest and timber license, Small Business Forest Enterprise Program area, provincial parks, heritage forest, community watershed, recreation reserve UREPs and timber salvage areas. The Chapman Landscape Unit Plan summarizes the geographic area, discusses the biodiversity management goals and strategies and addresses mitigation of the timber supply impacts.

Figure 1 presents an overview map of the Sunshine Coast Forest District (Sunshine Coast Timber Supply Area). Situated in the southeast corner of the TSA, the Chapman LU boundary is illustrated in Figure 2 (the pale green areas are included in the TSA).

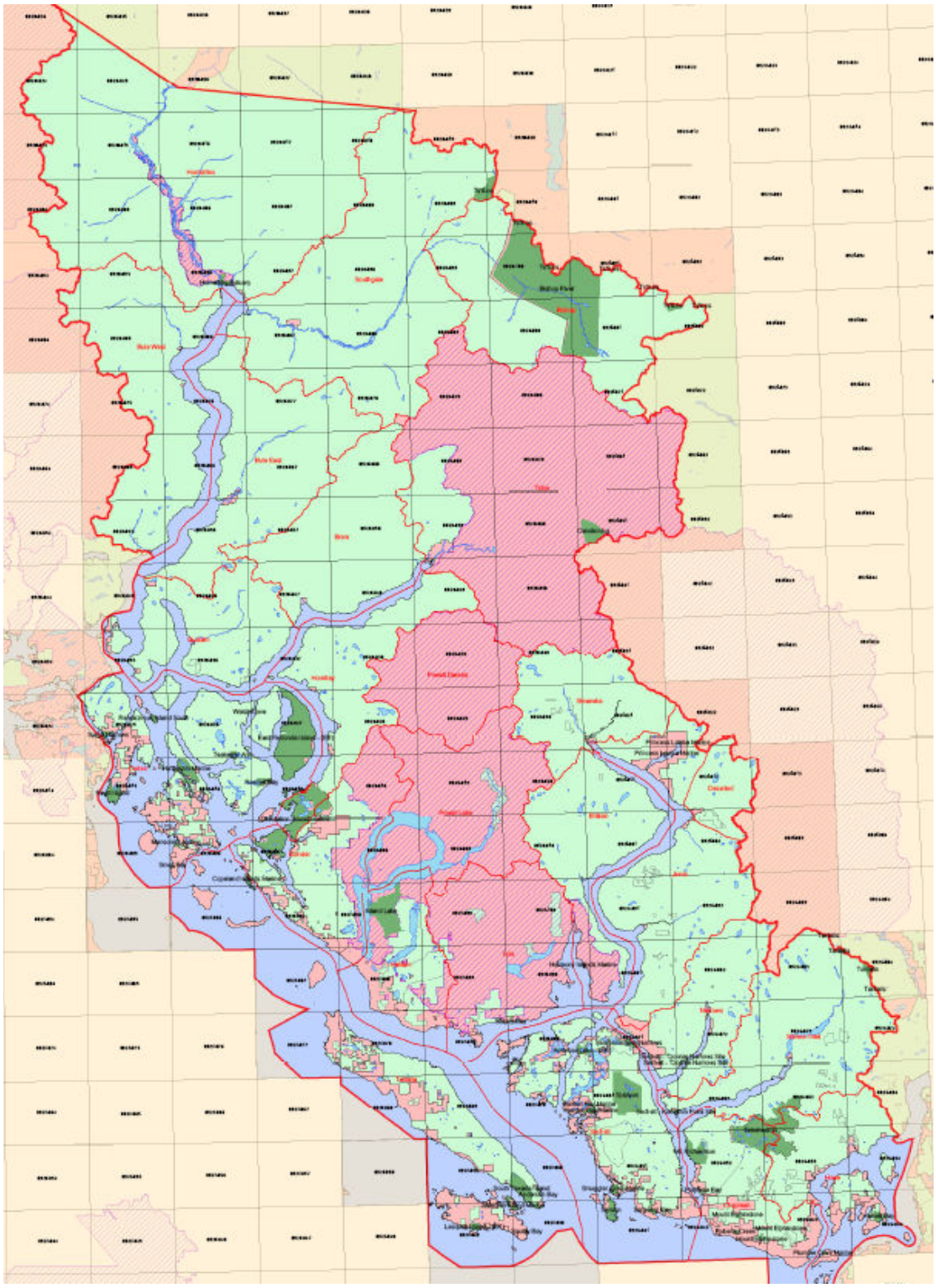

Figure 1. Sunshine Coast Timber Supply Area

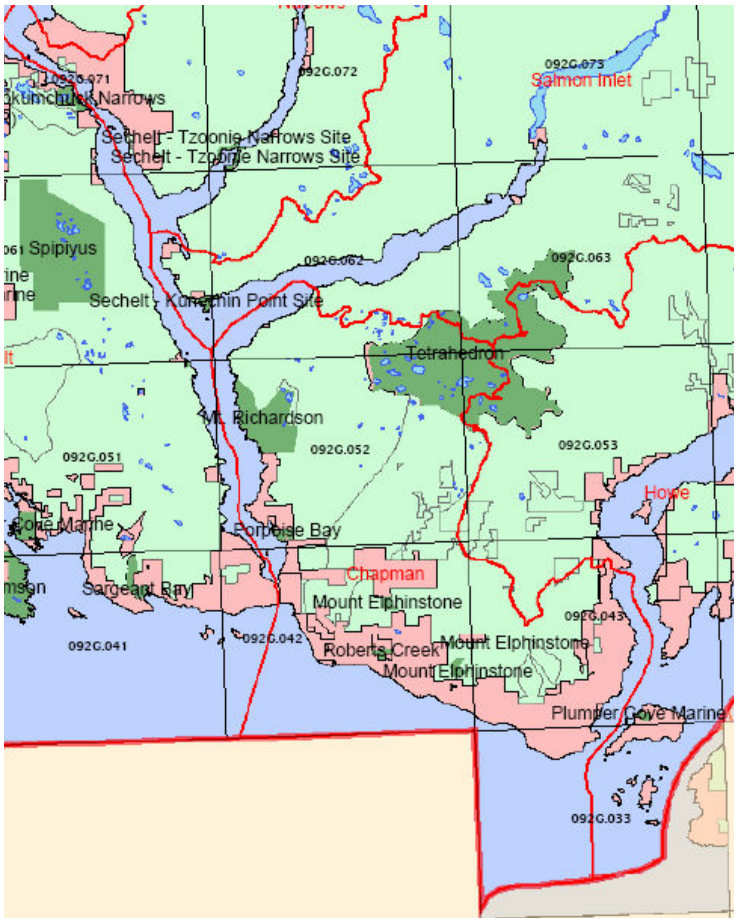

Figure 2. Chapman LU boundary overview

1.3.1.1 Biophysical Classification

There are two related systems for describing landscapes in British Columbia. The Ecoregion Classification System is a hierarchical system that provides a broad view of geographical relationships (Demarchi 1996). The Biogeoclimatic (BGC) Ecosystem Classification System provides another hierarchical classification method from the landscape to the site level (Pojar *et al*. 1987). The BGC subzones, which are a hierarchical unit within this system, are unique to each ecosection.

The Chapman Landscape Unit is situated within two ecoregions, the Lower Mainland and the Pacific Ranges Ecoregions (Figure 3 and Figure 4).

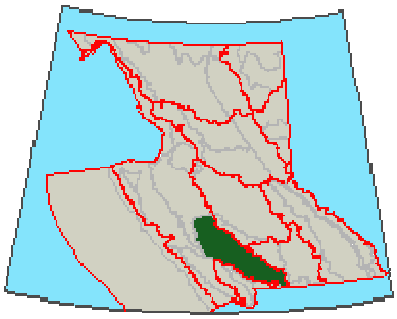

Figure 3. Pacific Ranges Ecoregion

As per Demarchi (1996), the Pacific Ranges Ecoregion includes the southern-most mountain range of the Coast Mountains in British Columbia. It includes the coastal islands, channels and fjords east of Queen Charlotte Sound; otherwise it lies east of the Georgia Depression Ecoprovince. The mountains are characteristically high and rugged throughout this ecoregion.

The Pacific Ranges Ecoregion consists of four Ecosections. One of these, the Southern Pacific Ranges (SPR) Ecosection, is mapped within the Chapman LU.

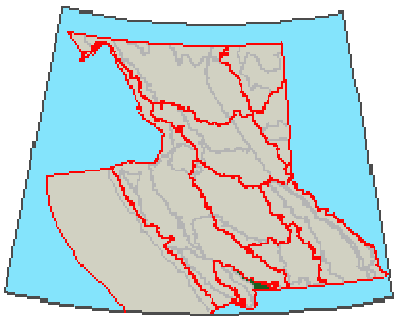

Figure 4. Lower Mainland Ecoregion

As per Demarchi (1996), the Lower Mainland Ecoregion represents an area of reduced rainfall (although the precipitation increases towards the Coast Mountains). As the rainshadow effect is most prominent towards the Fraser River delta and surrounding lowlands, this landscape unit is likely to receive more precipitation than typical.

The Lower Mainland Ecoregion consists of two Ecosections. One of these, the Georgia Lowland (GEL) Ecosection, is mapped within the Chapman LU.

The BGC subzones mapped within each of the ecosections in the Chapman LU are described in Table 1 and Table 2. The elevation ranges and descriptions are adapted from Green and Klinka's (1994) A Field Guide for Site Identification and Interpretation for the

Vancouver Forest Region: Land Management Handbook Number 28. Further descriptions and notes on the distribution of each unit, including the elevations at which each biogeoclimatic unit has been mapped for this project, are included in Section 3.

Table 1. Field Guide descriptions of the BGC units within the Chapman LU (SPR Ecosection)

Ecosection	BGC Unit	Name	Elevation Range (m)	Climate
Southern Pacific Ranges	CWHdm	Dry Maritime Coastal Western Hemlock Subzone	0 – 650 m	warm, relatively dry summers and moist, mild winters with little snowfall
	CWHvm1	Submontane Very Wet Maritime Coastal Western Hemlock Variant	0 – 650 m	wet, humid climate with cool summers and mild winters; relatively little snow
	CWHvm2	Montane Very Wet Maritime Coastal Western Hemlock Variant	650 – 1000 m	wet, humid climate with cool, short summers and cool winters; heavier snow than vm1
	MHmm1	Windward Moist Maritime Mountain Hemlock Variant	Lower: (800 - 1100 m); Upper: (1000 - 1350 m)	long, wet, cold winters with high snowfall and short, cool , moist summers

Table 2. Field Guide descriptions of the BGC units within the Chapman LU (GEL Ecosection)

Ecosection	BGC Unit	Name	Elevation Range (m)	Climate
Georgia Lowland	CWHxm1	Eastern Very Dry Maritime Coastal Western Hemlock Variant	0 – 650 m	warm, dry summers and moist, mild winters with relatively little snowfall
	CWHdm	Dry Maritime Coastal Western Hemlock Subzone	0 – 650 m	warm, relatively dry summers and moist, mild winters with little snowfall

1.3.2 Climate

The Chapman Landscape Unit experiences a range of precipitation, with the lowest elevation biogeoclimatic unit (CWHxm1) receiving less annual precipitation than the higher elevation units (CWHvm1, CWHvm2 and MHmm1), which receive significant annual precipitation, much of it in the form of rain and snow during the winter months. The following five BGC subzones are mapped within the landscape unit: CWHxm1, CWHdm, CWHvm1, CWHvm2 and MHmm1.

1.3.3 Hydrology

The watercourses within the Chapman Landscape Unit drain into either Sechelt Inlet or into the Strait of Georgia. Some of the larger watercourses within this landscape unit include Roberts Creek, Chapman Creek, and Gray Creek. There are numerous smaller tributary creeks, including Langdale, Gibsons, Chaster, Gough, Wilson, Burnett and Angus Creeks.

1.3.4 Topography and Soils

There is a range of topographic relief within the Chapman Landscape unit, from the prominent Mount Elphinstone in the southeast corner to the long, continuous slopes above Roberts Creek (Figure 5: photo from: http://www.randeesh.com/photos-group-30.html). Most of the area mapped as MHmm1 is comprised of subdued, undulating terrain with an abundance of small wet openings. Mount Steele, the highest peak in the study area, is located within Tetrahedron Provincial Park. The Chapman Creek valley, near the middle of the planning unit, is a steep-sided valley with its source (Chapman Lake) also within Tetrahedron Provincial Park.

Podzols, characterized by red-brown B horizons dominated by accumulations of aluminum, iron and humified organic material, typically develop on coarse to medium-textured, acidic parent materials. They are widespread on both glacial till and colluvium throughout the study area. Gleysols, typical of local wetter areas, are characterized by mottled grey colours due to prolonged saturation of the soils or fluctuating water levels throughout the year.

Figure 5. Uniform slopes above Roberts Creek

1.3.5 Parks

There are several provincial parks within the Chapman Landscape Unit including Mount Elphinstone, Tetrahedron, Mount Richardson and Roberts Creek Provincial Parks.

Mount Elphinstone Provincial Park, which occupies approximately 140 hectares in the southeast corner of the landscape unit, occurs as three separate parcels on the southwestern slopes of Mount Elphinstone. This park protects the area's abundance of forest mushrooms and contains a variety of hiking and mountain biking trails.

The 6,000 hectare Tetrahedron Provincial Park includes the headwaters of Chapman and Gray Creeks, important sources of drinking water for the local communities below, and therefore, there are a number of special use restrictions in place for this park. Recreation opportunities include hiking, cross-country skiing and over-night use of the cabins.

Mount Richardson Provincial Park, near the north end of the landscape unit, is a remote park accessible by four-wheel drive and boat. There are a number of rustic campsites and hiking trails with access to Richardson Lake.

Roberts Creek Provincial Park is a small park which includes a day use and family campground. It is located just west of Flume Road.

2 METHODOLOGY: ECOSYSTEM MAPPING

A full summary of the hierarchical framework of ecosystem mapping used in BC is described in Appendix 1.

Under a previous contract funded through the Forest Investment Account (FIA) by the Sunshine Coast TSA Licensee Group, Timberline Natural Resource Group (Timberline) completed the following TEM phases within the Chapman Landscape Unit:

- Air photo acquisition and preparation (2003-2005 colour; ~1:17,000 scale),
- Digital data acquisition and preparation,
- Ecosystem delineation (TEM delineation) below the CMA zone (where applicable),
- Placement of preliminary Biogeoclimatic (BGC) lines onto the aerial photos,
- Third party Quality-Assurance (QA) of the preliminary delineation, and
- Field sampling plan preparation.

The following phases were completed for this project:

- Digital line capture (monorestitution) of the ecosystem polygons and preliminary BGC lines,
- Field data collection,
- Data entry (VENUS 5.0 and MS Excel),
- Edits to ecosystem polygons and refinement of the preliminary BGC lines following field sampling, as required,
- Ecosystem classification (polygon attribution),
- Third party Quality-Assurance of the final classification and mapping,
- Preparation of final digital (GIS) data, and
- Final reporting and data preparation.

The following MOE-approved variances from a standard TEM project applied to this project:

- Pre-stratification of terrain polygons was not completed (not a standard 'terrain-based' approach).

- The field program consisted of a combination of ground inspections and visual inspections in a targeted ratio of 70% visual inspections and 30% ground inspections at a sampling density within the productive forested landbase of one plot per 100 hectares.

- Detailed *FS882* (ecosystem) plots were not completed in the field.

- Structural stage attributes were not catalogued as these attributes were being concurrently described as part of the accompanying VRI.

- The ecosystems within the CMA, Coastal Mountain-heather Alpine, zone were neither mapped nor classified.

- The expanded legend did not provide a detailed vegetation list within each structural stage.

2.1 Polygon Delineation: non-standard approach

Although this project did not follow a standard approach to delineating (bio)terrain polygons (as the client did not wish to collect comprehensive terrain information), it should be noted that the process to delineate the ecosystem polygons followed the same basic principles that are followed in the delineation of standard TEM bioterrain polygons (i.e. an initial stratification of the landscape according to the physical conditions that influence ecosystem development and expression).

The ecosystem polygons were delineated within the Chapman LU to capture the differences within the following criteria:

- surficial material types and texture (affecting soil drainage),
- surface expression (landform and thickness),
- slope position and gradient,
- topography,
- TEM aspect class (cool and warm), and
- geomorphologic process (i.e. gullying, avalanching, meandering river etc).

2.2 Field Planning

A preliminary sampling plan was developed prior to the commencement of field work. This plan identified the biogeoclimatic units and potential ecosystem units expected in the area and a working legend of expected map units was developed. In devising a preliminary plan, aerial photographs and overview maps were examined to identify accessible areas for potential field sampling. The potential sampling sites were selected to provide a cross section of the biogeoclimatic units and topographic relief present within the landscape unit.

2.3 Field Sampling

The targeted plot production was largely based upon the productive forest land base. In the digital netdown process (to estimate a productive forest land base), a final productive land base was estimated at approximately 21,000 ha. Although ecosystem delineation and classification were completed for the MHmmp1 (parkland) variant, field sampling was largely focused on the productive forested land base within the CWH and MH BGC zones.

Field sampling (Figure 6) in the Chapman LU was completed over several days between June and August of 2007. Each two-person crew consisted of an experienced ecologist and an assistant (VRI forester) familiar with the coastal vegetation species and site interpretation.

Figure 6. Field sampling within the Chapman LU

The sampling areas were accessed using the extensive road networks within the landscape unit. Most of the roads were in fairly good to very good condition which allowed for easy access to most of the land base. The Gray Creek and B&K Mainline Roads were used to access the northwest and central portions of the landscape unit. In the eastern portion, the Ouillet Creek Mainline Road was in fair condition along the lower slopes above the highway. In the Mountain Hemlock subzone, limited sampling was completed to the west of Tetrahedron Park and along the Dakota Ridge area. Poor road conditions limited access to this zone in the remainder of the landscape unit.

A total of **205** field plots were completed within the Chapman LU study area, consisting of **36** ground inspections and **169** visual inspections (including **73** aerial observations and **96** 'ground-based' visual assessments). The location of all field plots and air calls were marked and recorded on the air photos or maps at the time of field sampling. Wherever possible, Global Positioning System (GPS) point locations were also recorded in the field. Where satellite coverage was insufficient for an accurate measurement, the field plot locations were marked directly onto air photos. Crews ensured, wherever possible, that the chosen sampling locations expressed homogeneous site, soil and vegetation characteristics. The Field Manual for Describing Terrestrial Ecosystems (Ministry of Forests and BC Environment 1998) provided a detailed methodology for data collection at the ground inspections locations. Standard TEM ground inspection forms (GIF) were used for the ground inspections and for some of the visual inspections. Other visual inspections and air calls were recorded as hand-written notes on field note paper.

2.4 Data Entry and Analysis

The ground inspection data was entered into the Ministry of Environment's VENUS 5.0 software and the visual inspections were entered into a MS Excel spreadsheet. Both of the databases are submitted with this project.

Upon completion of the field program, each of the project ecologists reviewed the field forms in the office for completeness and accuracy and to ensure that all plot locations were accurately transferred into the GIS spatial database.

2.5 Ecosystem Mapping

Following completion of the field sampling and subsequent review of the field data, the ecosystem polygons were digitized (via monorestitution). The polygons were assigned a unique number and plotted onto a base map that included contour lines and Terrain Resources Information Mapping (TRIM) hydrology features in preparation for ecosystem classification.

Each of the ecosystems were classified and entered into an MS Excel TEM ecosystem 'polygon' database. The ecosystem unit labels were recorded by a project ecologist through manual examination of the air photos using a combination of a Sokkisha MS-27 mirror stereoscope, with 3X binocular attachment for enhanced resolution. The core data entered in the ecosystem database for each polygon includes:

- BCGS Mapsheet Number;
- Polygon number (ECP_Tag);
- Data source (Photo Interpreted, Ground Inspection, or Visual Inspection);
- Flight line (project specific) and photo number;
- Ecosection code;
- Biogeoclimatic zone, subzone, and variant;
- Ecosystem labels [decile, site series, modifier(s) and structural stage: recorded up to three times per polygon];
- User-defined field: Other "point-feature" habitat elements that are <20% of the polygon area (i.e. RO, TA, OW etc. that may be of importance for future habitat analysis);
- Polygon area (hectares); and
- Comments: additional information on the polygon, including some point wildlife and/or habitat observations.

Each of the ecosystem polygons have been classified as either a single ecosystem unit (simple label) or as a complex unit, with either two or three (maximum) ecosystem units per polygon. Each polygon includes a site series number (and TEM alpha map code) and has been described with up to three site modifier(s) where the conditions differ from the assumed conditions described in the provincial database for each site series. For the

complexed units, only the ecosystems estimated to cover approximately 20% of the total polygon area have been recorded.

Draft ecosystem maps were created in ARC/INFO format by combining the base map coverage, polygon digital files and the ecosystem databases.

2.6 Expanded Vegetation Legend

A modified expanded vegetation legend was developed in MS Word and is attached as Appendix 2. Whereas a standard legend has a detailed list of vegetation species for all potential structural stages, this legend does not differentiate between structural stages. The legend provides the following information for each mapped ecosystem unit (site series):

- a description of the typical situation in which the unit has been mapped,
- the assumed modifiers and typical soil moisture regime,
- the provincial, approved, site series (2-letter) map code,
- all mapped modifiers,
- the dominant vegetation species, by layer (tree, shrub, herb and moss layers),
- the associated vegetation species by layer (tree, shrub, herb and moss), and a
- list of the field plots established within each of the units.

For the units not confirmed with field plots, the typical situations and vegetation lists were derived from a combination of the provincial TEM map code database and the current Land Management Handbook for the Vancouver Forest Region: LMH28 (Green and Klinka 1994).

3 RESULTS: MAPPED BGC UNITS AND ECOSYSTEMS

A summary of the ecosystem units mapped in the project area is provided below. A full description of the plant associations within each ecosystem mapped in each of the BGC units is provided on separate tables found in Appendix 2.

3.1 Biogeoclimatic Units

Table 3 summarizes the number of polygons mapped within each of the BGC units within the Chapman Landscape Unit. Across the landscape unit, the average TEM polygon size is **16.9 hectares**, slightly greater than the 'typical' TEM polygon size range of 12 to 15 hectares.

Table 3. Summary of mapped polygons by BGC unit

BGC Unit	Name	# Polys	Area (Ha)
CWHxm1	Very dry maritime Coastal Western Hemlock variant	108	1875.5
CWHdm	Dry maritime Coastal Western Hemlock subzone	377	7006.5
CWHvm1	Submontane very wet maritime Coastal Western Hemlock variant	72	914.4
CWHvm2	Montane very wet maritime Coastal Western Hemlock variant	358	5908.3
MHmm1	Windward moist maritime Mountain Hemlock variant	343	5585.1

Following are descriptions of each of the biogeoclimatic (BGC) units mapped within the Chapman Landscape Unit.

3.1.1 CWHxm1

The very dry maritime Coastal Western Hemlock variant has been mapped at the lowest elevations within the landscape unit. Throughout most of its range, it has been mapped from sea level to approximately 300 metres elevation, below the CWHdm variant. This variant extends up Sechelt Inlet as far as Nine Mile Point, just North of Mount Richardson Provincial Park, beyond which CWHdm is mapped to the shoreline.

With 108 TEM polygons mapped within the CWHxm1 variant, the average polygon size is **17.4 hectares**. Table 4 summarizes the site series that have been mapped within the CWHxm1 variant. Where applicable, any map units that have been borrowed from other BGC units (as listed in the user-defined deliverable), have been noted within the table.

Table 4. Vegetated site series mapped within CWHxm1

Site Series	Map Code	Site Series Name
01	HK	HwFd – Kindbergia
02	DC	FdPl – Cladina
03	DS	FdHw – Salal
04	DF	Fd – Sword fern
05	RS	Cw – Sword fern
07	RF	Cw – Foamflower
12	RC	CwSs – Skunk cabbage

3.1.2 CWHdm

The dry maritime Coastal Western Hemlock subzone has been mapped above the CWHxm1 variant throughout the majority of the Chapman LU, with the exception of the portion north of Nine Mile Point, where it has been mapped to the shoreline. Throughout the landscape unit, it has been mapped to approximately 700 metres, below the CWHvm2 variant. Within the Gray and Chapman Creek valleys, the CWHdm subzone is replaced by the CWHvm1 variant.

With 377 TEM polygons mapped within the CWHdm subzone, the average polygon size is **18.6** hectares. Table 5 summarizes the site series that have been mapped within the CWHdm subzone. Where applicable, any map units that have been borrowed from other BGC units (as listed in the user-defined deliverable), have been noted within the table.

Table 5. Vegetated site series mapped within CWHdm

Site Series	Map Code	Site Series Name
01	HM	Hw – Flat moss
02	DC	FdPl – Cladina
03	DS	FdHw – Salal
05	RS	Cw – Sword fern
06	HD	HwCw – Deer fern
07	RF	Cw – Foamflower
09	CD	Act – Red-osier dogwood
12	RC	CwSs – Skunk cabbage

3.1.3 CWHvm1

The submontane very wet maritime Coastal Western Hemlock variant occurs adjacent to the CWHdm subzone within the Gray and Chapman Creek valleys (replaces the CWHdm subzone in valleys subject to a slightly cooler and wetter climate). As per the CWHdm subzone, the CWHvm1 variant has been mapped to approximately 700 metres elevation, below the CWHvm2 unit.

With 72 TEM polygons mapped within the CWHvm1 variant, the average polygon size is **12.7 hectares**. Table 6 summarizes the site series that have been mapped within the CWHvm1 variant. Where applicable, any map units that have been borrowed from other BGC units (as listed in the user-defined deliverable), have been noted within the table.

Table 6. Vegetated site series mapped within CWHvm1

Site Series	Map Code	Site Series Name
01	AB	HwBa – Blueberry
02	LC	HwPl – Cladina
03	HS	HwCw – Salal
05	AF	BaCw – Foamflower
06	HD	HwBa – Deer fern
07	AS	BaCw – Salmonberry
14	RC	CwSs – Skunk cabbage
00	TS	Tufted clubrush – Sphagnum bog

3.1.4 CWHvm2

The montane very wet maritime Coastal Western Hemlock variant has been mapped above the CWHdm subzone throughout the majority of the Chapman LU, with the exception of the Chapman and Gray Creek valleys, where it has been mapped above the CWHvm1 variant. This variant has typically been mapped between 700 metres and 1000 metres (as low as 900m in a couple of gentle areas), above which the MHmm1 variant has been mapped.

With 358 TEM polygons mapped within the CWHvm2 variant, the average polygon size is **16.5 hectares** Table 7 summarizes the site series that have been mapped within the CWHvm2 variant. Where applicable, any map units that have been borrowed from other BGC units (as listed in the user-defined deliverable), have been noted within the table.

Table 7. Vegetated site series mapped within CWHvm2

Site Series	Map Code	Site Series Name
01	AB	HwBa – Blueberry
02	LC	HwPl – Cladina
03	HS	HwCw - Salal
05	AF	BaCw – Foamflower
06	HD	HwBa – Deer fern
07	AS	BaCw – Salmonberry
09	YG	CwYc - Goldthread
11	RC	CwSs – Skunk cabbage
00	FS	Carex fen
00	SA	Sitka alder – Salmonberry avalanche chute

3.1.5 MHmm1

The Mountain Hemlock windward moist maritime variant occurs above the CWHvm2 variant. It has been typically mapped to 1500 metres on warm aspects and to 1400 metres on cool aspects.

With 343 TEM polygons mapped within the MHmm1 variant, the average polygon size is **16.3 hectares**. Table 8 summarizes the site series that have been mapped within the MHmm1 variant. Where applicable, any map units that have been borrowed from other BGC units (as listed in the user-defined deliverable), have been noted within the table.

Table 8. Vegetated site series mapped within MHmm1

Site Series	Map Code	Site Series Name
01	MB	HmBa – Blueberry
02	MM	HmBa – Mountain heather
04	AB	HmBa - Bramble
05	MT	BaHm - Twistedstalk
06	MD	HmYc – Deer cabbage
07	YH	YcHm - Hellebore
08	YS	HmYc - Sphagnum
09	YC	YcHm – Skunk cabbage
00	HM	Heather Meadow
00	MH	Hm – Mountain heather parkland / heath
00	TS	Non-forested wetland
00	YB	HmYc – Blueberry – Mountain heather

3.1.6 Non-vegetated units

The following non-vegetated units (Table 9) have been mapped within the Chapman Landscape Unit:

Table 9. Non-vegetated units mapped within the Chapman LU

Site Series	Map Code	Site Series Name
00	ES	Exposed soil
00	GC	Golf course
00	GP	Gravel pit
00	RI	River
00	RO	Rock
00	RZ	Road surface
00	TA	Talus
00	UR	Urban / suburban

4 QUALITY CONTROL

4.1 Internal Quality Control

Internal quality control was undertaken through all phases of this project. This included internal reviews of preliminary ecosystem delineation, review of preliminary BGC boundaries, especially in placement of parkland and alpine boundaries, and a final review of all field forms for logic and completeness of data.

The final deliverables were subject to a quality control process before final submission of the deliverables. In this process, Timberline's project manager:

1. deleted all small 'sliver polygons' (typically < 1ha);
2. checked the spatial and non-spatial data to ensure a 1:1 link of the polygon data;
3. reviewed the database to ensure all deciles of complex map units add to 100%;
4. reviewed the database to ensure the correct application of site modifiers (for the assumed and mapped modifiers);
5. reviewed the database to ensure that the provincial standard TEM codes have been applied to the ecosystems;
6. reviewed the database to ensure that no duplicate or blank fields remain for any of the polygons;
7. visually assessed the final dataset to ensure that every polygon within a specific BGC unit has been mapped appropriately (for example, to ensure there are no CWHvm1 labels within the MHmm1 BGC variant); and
8. completed a final review of the Venus and Excel databases for overall completeness.

4.2 External Quality Control

An independent assessment of mapping quality was completed by Helen Reid, R.P.Bio. Her QA report has been submitted to the Sunshine Coast Licensee Group.

5 REFERENCES

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APPENDIX 1: ECOSYSTEM UNIT MAPPING - BACKGROUND

Ecosystem mapping is based on the three level ecosystem classification framework defined by BC's Resource Inventory Committee (RIC 1998). This framework consists of ecoregion units, biogeoclimatic units and ecosystem units. Ecosystem unit labels consist of three components: site series, site modifier(s) and a structural stage. Site series are defined within the existing Ministry of Forests and Range (MoFR) biogeoclimatic ecological classification system.

Non-forested ecosystem units (i.e. avalanche units, parkland forest, heathland, and wetlands) may also be encountered that are presently not included in the MoFR site series classification. Definitions and codes for these units may be selected from the Ministry of Environment Provincial Site Series Code list.

Ecoregion

The ecoregion classification system is used to stratify BC's terrestrial and marine ecosystems into discrete geographical units. This system describes areas of similar climate, physiography, oceanography, hydrology, vegetation and wildlife potential (Demarchi 1993). Ecosection boundaries are delineated on 1:2,000,000 and 1:50,000 terrestrial ecosystem maps. There are five levels of classification. The two highest levels, Ecodomains and Ecodivisions, place BC in a global context. The three lowest levels, Ecoprovinces, Ecoregions and Ecosections, relate segments of the province to one another.

Biogeoclimatic Subzones

Within each ecoregion unit, biogeoclimatic (BGC) units are used to identify zonal climates and ecosystems. A zonal site is one that best represents the regional climate of an area. Subzones are subsets of zones and consist of unique sequences of geographically related ecosystems (Meidinger and Pojar 1991). Figure 1 below depicts the ecosection and biogeoclimatic unit labels as they appear on typical ecosystem maps (RIC 1998).

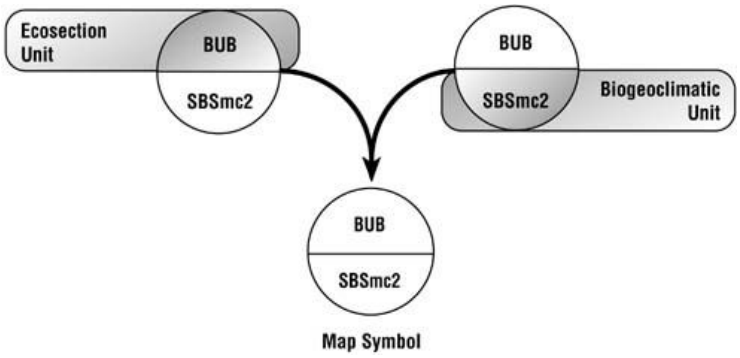

Figure 1. Symbols for Ecosection and Biogeoclimatic Units

Biogeoclimatic Variants

The BGC variants are a subdivision of a subzone. Because each subzone has considerable variability, variants are used to further reflect differences in climate. These climatic variations give rise to changes in vegetation, soil and ecosystem productivity (Meidinger and Pojar 1991). Figure 2 below (RIC 1998) illustrates the symbols used for biogeoclimatic units.

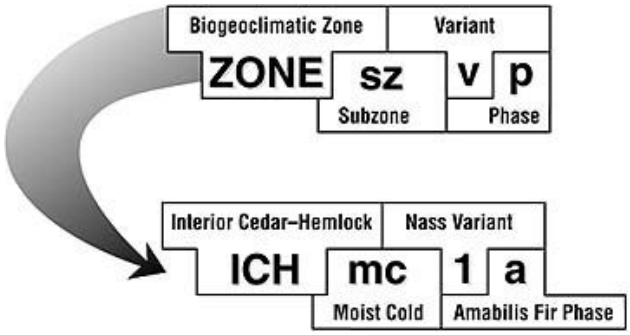

Figure 2. Symbols for biogeoclimatic units

Ecosystem Units

Ecosystem units incorporate the site series of biogeoclimatic classification in addition to physical attributes and structural stages. Generally, site series are relatively homogenous with regard to soils, surficial materials, topographic position, topoclimate and trends of secondary succession. Ecosystem units are typically composed of three components: site series, site modifiers, and structural stage. Ecosystem units have also been developed for non-forested ecosystems presently not included in the MoFR's site series classification system.

Site Series

Site series are the first component of an ecosystem unit. Site series have been developed to describe variation at the site level within the BGC units (RIC 1995, 1998). The site series describe all land areas capable of supporting a specific climax plant association and reflecting a specified range of soil moisture and nutrient regimes within a subzone or variant (RIC 1995, 1998). A two-letter symbol (map code) is assigned to each site series and each map code is unique to each BGC subzone and variant.

Site Modifiers

Site modifiers are used to refine each site series into more specific ecosystem units based upon distinguishing site, soil and terrain characteristics. Typical (or assumed) environmental conditions (modifiers) have been defined for each site series within the MoFR's BGC classification system (RIC 1998). Site modifiers are used to describe sites that differ from the typical conditions.

Table 1 below lists the mapped site modifiers, as defined by the BC Resource Inventory Committee (1998). Within the CWH and MH zones, aspect modifiers apply to slopes greater than 35%.

Table 1. Site Modifiers

Code	Criteria
Topography	
a	active floodplain[1] – the site series occurs on an active fluvial floodplain (level or very gently sloping surface bordering a river that has been formed by river erosion and deposition), where evidence of active sedimentation and deposition is present.
g	gullying[1] occurring – the site series occurs within a gully, indicating a certain amount of variation from the typical, or the site series has gullying throughout the area being delineated.
h	hummocky[1] terrain (optional modifier) – the site series occurs on hummocky terrain, suggesting a certain amount of variability. Commonly, hummocky conditions are indicated by the terrain surface expression but occasionally they occur in a situation not described by terrain features.
j	gentle slope – the site series occurs on gently sloping topography (less than 25% in the interior, less than 35% in the CWH, CDF, and MH zones).
k	cool aspect – the site series occurs on cool, northerly or easterly aspects (285°–135°), on moderately steep slopes (25%–100% slope in the interior and 35%–100% slope in the CWH, CDF and MH zones).
n	fan[1] – the site series occurs on a fluvial fan (most common), or on a colluvial fan or cone.
q	very steep cool aspect – the site series occurs on very steep slopes (greater than 100% slope) with cool, northerly or easterly aspects (285°–135°).
r	ridge[1](optional modifier) – the site series occurs throughout an area of ridged terrain, or it occurs on a ridge crest.
t	terrace[1] – the site series occurs on a fluvial or glaciofluvial terrace, lacustrine terrace, or rock cut terrace.
w	warm aspect – the site series occurs on warm, southerly or westerly aspects (135°–285°), on moderately steep slopes (25%–100% slope in the interior and 35%–100% slope in the CWH, CDF and MH zones).
z	very steep warm aspect – the site series occurs on very steep slopes (greater than 100%) on warm, southerly or westerly aspects (135°–285°).
Soil	
c	coarse-textured soils[2] – the site series occurs on soils with a coarse texture, including sand and loamy sand; and also sandy loam, loam, and sandy clay loam with greater than 70% **coarse fragment volume**.
s	shallow soils – the site series occurs where soils are considered to be shallow to bedrock (20–100 cm).
v	very shallow soils – the site series occurs where soils are considered to be very shallow to bedrock (less than 20 cm).

[1] Howes and Kenk 1997
[2] Soil textures have been grouped specifically for the purposes of ecosystem mapping.
[3] Canada Soils Survey Committee, 1987

APPENDIX 2: EXPANDED LEGEND – CHAPMAN LU