Sensitive Ecosystems Inventory: Lake Country, 2005

Volume 2: Terrestrial Ecosystem, Terrain, Terrain Stability, and Surface Erosion Mapping, and Expanded Legend

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THE REAL ESTATE FOUNDATION OF BRITISH COLUMBIA

DISTRICT of LAKE COUNTRY

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We would like to thank the many landowners that gave us permission to access their lands for field sampling.

[1] The mission of the Real Estate Foundation is to support sustainable real estate and land use practices for the benefit of British Columbians.
[2] Iverson & MacKenzie Biological Consulting Ltd.
[3] District of Lake Country
[4] Polar Geoscience
[5] Ophiuchus Consulting
[6] Artemis Wildlife Consultants
[7] Baseline Geomatics Inc.

Introduction

This report presents detailed information on ecosystems in the Lake Country of the Central Okanagan. It is the second volume in a series of three volumes.

Volume 2, this report, provides detailed information on terrestrial ecosystem mapping (TEM) methods and gives descriptions of each of the ecosystems that occur within the sensitive ecosystems or other important ecosystems categories described in Volume 1. Appendix B of Volume 1 provides tables that can be used to cross-reference between sensitive and other important ecosystems units and terrestrial ecosystem map units in this report.

This report describes the natural setting of the study area and details methods, results and recommendations for bioterrain mapping and ecosystem mapping. It is intended for use by professionals that require more detailed ecological and terrain information. It is recommended for use by people interested in developing other interpretive map themes from the ecosystem or terrain mapping.

Volume 1[8] is intended for people and organizations that need information to help conserve and protect remaining sensitive and important ecosystems in the District of Lake Country and other similar areas. It is also intended to provide information and advice to landowners and developers on how to minimize and avoid possible degradation of sensitive ecosystems due to land use and development activities.

Volume 3[9] contains wildlife habitat mapping themes developed from the terrestrial ecosystem mapping (TEM) for the following ten species: Great Basin Spadefoot (*Spea intermontana*), Painted Turtle (*Chrysemys picta*), Western Rattlesnake (*Crotalus oreganus*), Gopher Snake (*Pituophis catenifer* ssp. *deserticola*), Western Screech-owl (*Otus kennicottii* ssp. *macfarlanei*), Long-billed Curlew (*Numenius americanus*), Yellow-breasted Chat (*Icteria virens*), Grasshopper Sparrow (*Ammodramus savannarum*), Swainson's Hawk (*Buteo swainsonii*), Spotted Bat (*Euderma maculatum*) and Badger (*Taxidea taxus jeffersonii*). All of these species are considered at risk in the province of B.C. and most are listed under the federal Species at Risk Act. These species provide a cross-section of threatened or endangered amphibians, reptiles, birds, and mammals that depend on a range of different ecosystems in the study area. There are many other threatened and endangered species that likely occur in the study area and are listed in each ecosystem chapter of Volume 1.

Wildlife habitat mapping portrays the potential importance of each ecosystem to specific animal species through a species-habitat model. The model assigns ratings to different ecosystem units from the TEM based on the needs of the species for particular life requisites. These ratings are displayed on the wildlife habitat maps. Volume 3 is intended for professionals who require more detailed information on wildlife habitat values in the study area than Volume 1 provides.

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[8] Iverson 2006

[9] Haney and Sarell 2006

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1 Study Area

The study area (Figure 1) lies within the central Okanagan Valley of south-central British Columbia. It is bounded by the boundaries of the District of Lake Country. It abuts the North Okanagan Regional District to the north, Okanagan Lake to the west, and the Central Okanagan Regional District and City of Kelowna in the south. The area covers 12,330 ha and includes private land, provincial parks, regional parks, and provincial crown land.

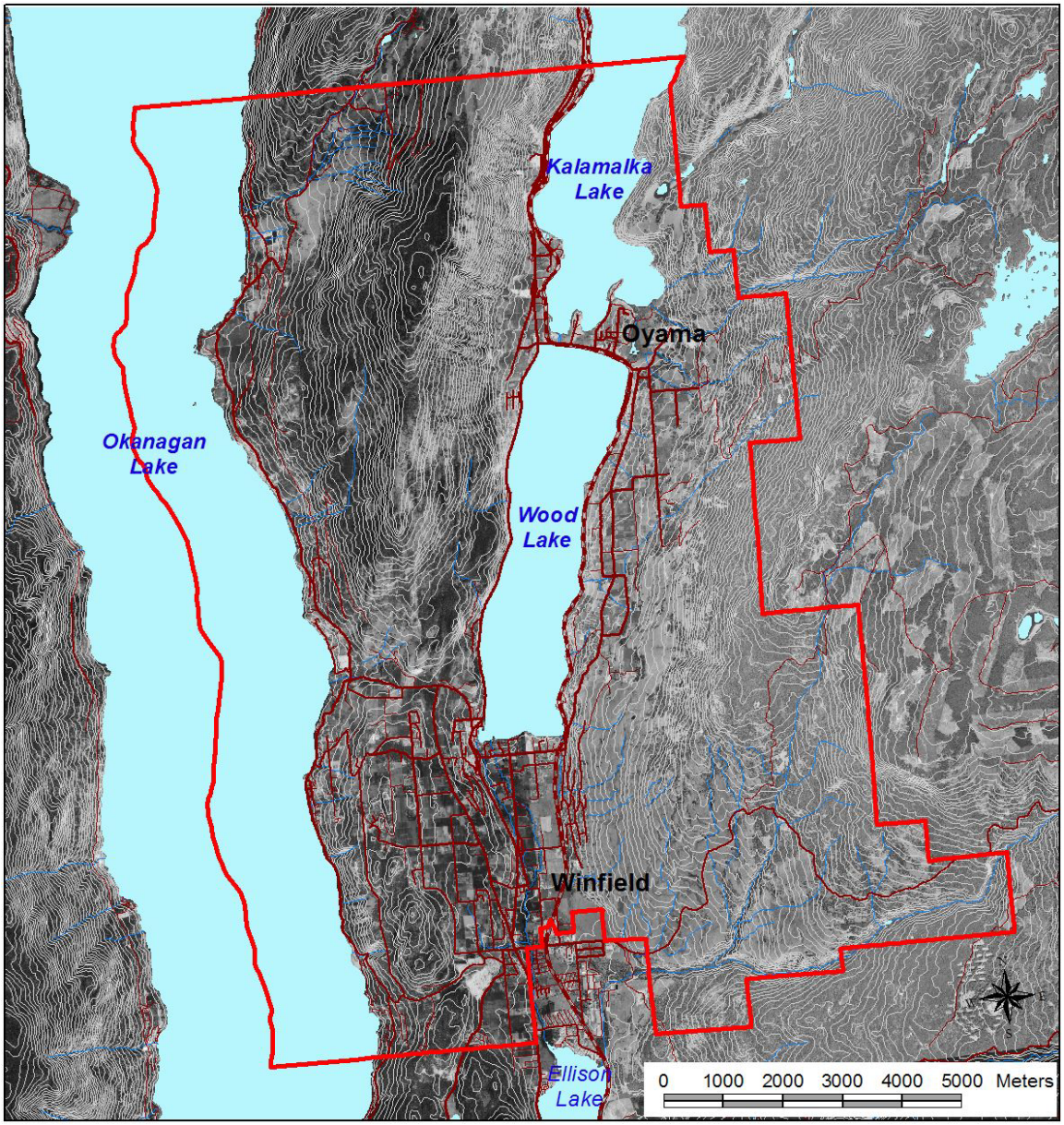

Figure 1. Map of study area. Study area boundary is shown in red.

1.1 Landscape Setting

The District of Lake Country includes the ridge between Okanagan Lake and the valley containing Kalamalka and Wood Lakes, Winfield, and the west-facing slopes above Winfield and Wood Lake. This area lies within the Thompson Plateau, a subdivision of the Interior Plateau Physiographic Region. The Thompson Plateau is characterized by a gentle, undulating upland surface, separated by large valleys.[10]

Bedrock Geology

A fault known as the Vernon Fault follows the valley bottom through Duck, Wood and Kalamalka Lakes. The bedrock geology of the study area[11] is quite different on either side of Vernon Fault. In general, the west side of the fault is underlain by younger intrusive rocks (Coryell Syenite (locally referred to as Oyama shale), the Okanagan Plutonic Suite, and Eocene – aged volcanic rock[11] (see Table 1).

Table 1. Bedrock Assemblages located on the west side of Vernon Fault.

Age	Bedrock Group or Suite	General Bedrock Type	Specific Rock Types	Location
Eocene	Andesitic Volcanic facies	Volcanic	Andesite	Two inclusions along NE edge of the study area
Paleocene	Coryell syenite	Intrusive	Syenite	Southern portion of the study area
	Coryell volcanic	Volcanic	Rhyolite porphyry and tuff	
Jurassic	Okanagan Plutonic Suite	Intrusive	Monzonite, quartz monzonite, diorite, quartz diorite, granodiortie and granite	Central portion of the study area
Permian	Harper Ranch Group (sedimentary and volcanic rocks)	Sedimentary and volcanic rocks partially metamorphosed	Siltstone, sandstone, argillite, conglomerate, breccia, phyllite, quartzite, limestone, tuff, andesite, minor marble, hornfels, skarn	Northern portion of the study area
	Harper Ranch Group (limestone)	Sedimentary	Limestone	

[10] Holland 1976
[11] Glombick et al. 2004

The east side of the fault is underlain by older metamorphic rocks (Chase Formation, Tsuius Schist, and Calc-silicate Gneiss) and younger intrusive rocks (Wood Lake Pluton and Cosens Bay Pluton) and capped by young sedimentary (Clark Creek Conglomerate) and volcanic rock (Thompson Plateau Basalt)[11].

Table 2. Bedrock Assemblages located on the east side of Vernon Fault.

Age	Bedrock Group or Suite	General Bedrock Type	Specific Rock Types	Location
Miocene	Thompson Plateau Basalt	Volcanic	Basalt	East-central portion of study area
Miocene	Clark Creek Conglomerate	Sedimentary	Conglomerate	East-central portion of study area
Cretaceous	Cosens Bay Pluton	Intrusive	Foliated biotite-granodiorite, granodiorite and granite	NE edge of study area
Jurassic	Wood Lake Pluton	Intrusive	Monzonite, quartz monzonite, diorite, quartz diorite, granodiortie and granite	Central portion of the study area
Devonian	Chase Formation	Metamorphic	Quartzite	Southern edge of study area
Paleo- and/or Mesoproterazoic	Tsuius Schist	Metamorphic	schist, gneiss, quartzite	East-central edge of study area
Paleo- and/or Mesoproterazoic	Calc-silicate Gneiss	Metamorphic	gneiss, marble, schist, amphilbolite	East-central edge of study area

Characteristics of bedrock such as mineral composition and structure determine the shape and texture of the weathered material that forms from it. These characteristics influence the shape and size of clasts and the matrix texture of soils that are created.

Intrusive bedrock and coarse-grained metamorphic rocks such as gneiss and quartzite tend to break down into sand and coarse silt. Thus, till and colluvium derived from these types of bedrock typically have a silty sand matrix. Well-jointed intrusive bedrock and coarse-grained metamorphic rocks break into large blocks and boulders.

Fine-grained metamorphic and sedimentary rocks such as schist weather to create a silty soil matrix. This bedrock typically fractures along foliation planes and jointing to create pebble-sized rubble and slabs. Finer sedimentary and metamorphic rock types that weather into silt create more erodible soil and are more susceptible to cut-slope slumping than rock types that weather to sand.

Non-siliceous volcanic bedrock typically breaks down into rubble and blocks, which weather into silt and clay. Silt and clay that weathers from volcanic bedrock and the finer sedimentary and metamorphic rock types create more erodible soil which is more susceptible to cut-slope slumping than rock types that weather to sand.

Landscape Evolution

The present physiography dates back two hundred million years ago (early Jurassic) when plate tectonics welded the former Pacific Ocean to the margin of the North American continent. This created ridges of metamorphic and plutonic bedrock orientated in a north-south direction. About 50 million years ago (early Tertiary), plate tectonics caused uplift of the area accompanied by extensive volcanism. A long period of relative stability followed, during which erosion and deposition formed a low-relief landscape with gentle slopes and low hills. During late Tertiary, the area was subject to uplift again, followed by a renewed period of down cutting, with the stream valleys deeply incising into the old erosion surface.

Both the upland surface and the steep-sided valleys were completely buried by ice during the Pleistocene glaciation. However, glaciers effected only relatively minor modifications to the older topography. Most of the surficial materials date from the last glaciation.

At the beginning of the last major glacial episode (Fraser Glaciation), ice accumulated in the high mountains and then gradually spread to valleys and lowlands. About 14,500 years ago, when the Cordilleran Ice Sheet was thickest and most extensive at the climax of Fraser Glaciation, ice flowed generally southward across the study area[12]. The rounded ridge tops suggest that the entire area was completely overridden by ice at this time, depositing till at the base of the ice sheet.

Deglaciation occurred between about 14,000 and 11,000 years ago. Deglaciation took place by downwasting so that the uplands emerged from beneath the ice while tongues of ice remained in the valley bottoms[13]. Stagnant ice in the valley bottoms impounded temporary glacial lakes in the Okanagan Valley (Glacial Lake Penticton). Downwasting ice often forms characteristic subglacial and ice-marginal landforms on gentle surfaces, such as, eskers, kames, and meltwater channels.

During post-glacial times, processes have re-worked some glacial sediments and weathered bedrock to redistribute them as colluvium (moved by gravity) and fluvial (moved by water) sediments. Some streams and rivers that have graded to the present day lake level have downcut into glacial deposits creating terraces, benches, and steep-sided scarps. Eolian sediments have been transported by wind and deposited on the gentler slopes on the eastern edge (lee side of the ridge) of the study area. Fine-grained sediments have accumulated in depressions due to slope wash.

Soils[14]

Soil forms the interface between surficial materials (parent materials) and the ecosystems they support. Ecosystems influence the formation of soils and soil affects what types of plants grow at a given site and the productivity of that site. Soil is defined as “naturally occurring, unconsolidated mineral or organic martial at least 10cm thick that occurs at the earth’s surface and is capable of supporting plant growth”[15]. The factors affecting soil formation include: parent material, climate, biota (including the vegetation, wildlife and organisms in the soil), topography (for example: slope, aspect, and slope morphology), and time. The following descriptions of the major soil groups present in the study area are derived from Wittneben (1986). Soil is not mapped in this project but

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[12] Fulton 1965
[13] Fulton 1969
[14] This section is adapted from Iverson et al. 2004
[15] Soil Classification Working Group 1998

has been included as part of the field data collected to describe the site and the ecosystems at detailed ecological plot locations.

Chernozemic soils (Brown and Darkbrown Chernozems) have developed in the semi-arid lower valley grassland and open forest communities. These are characterized by the formation of an organic rich (Ah) upper mineral horizon. The Ah horizon forms primarily from the accumulation of organic material from the fine roots of grasses and herbaceous plants.

Brunisolic soils occur throughout the study area. They are common under forested communities on moister and cooler aspects. These soils are present on moderately- to rapidly-drained surficial materials that are medium- to coarse-textured. These are soils that have poorly developed horizons. They were often found in a complex with other soil types including chernozems, luvisols, and gleysols.

Luvisolic soils are present on moderately- to rapidly-drained, clay-rich parent materials such as muddy glaciolacustrine deposits and finer textured tills. The movement of clay particles from the upper horizons to a lower horizon of accumulation (Bt) characterizes these soils. Luvisols underlied some of both forested and grassland communities in the Interior Douglas-fir and Ponderosa Pine Biogeoclimatic Zones.

Organic soils develop under wet conditions where decomposition rates are relatively slow and a net accumulation of organic material (peat) occurs. Most organic soils are poor- to very poorly-drained and are saturated for prolonged periods of time. Organic soils occurred under wetland communities in depressions.

Gleysolic soils develop under moist to wet conditions usually in depressions, toe slopes and on valley bottoms. They are mineral soils formed under periodic, or sustained, reducing conditions caused by saturation, and result in gleyed colours (grey, blue and green). Gleysolic soils are imperfectly to very poorly drained and occurred under moist forest and wetland communities.

Regosolic soils are under-developed soils that lack defined horizonation. Regosols were common on floodplains and talus slopes throughout study area. They develop on recent parent materials such as landslide and river deposits; recently exposed materials such as landslide scarps and eroded banks; or under conditions that suppress soil formation, for example, extremely dry conditions (very rapidly drained, coarse textured soils on southerly aspects). Regosols are often associated with non-vegetated or early successional plant communities.

Solonetzic soils occur on saline parent materials in semiarid to subhumid regions of the British Columbia interior. These soils occur in small non-vegetated or sparsely vegetated pockets in depressions and toe slope positions. These soils are often used as salt licks by wildlife and thus have high wildlife values. They occur in association with chernozemic soils and to a lesser degree with gleysolic and luvisolic soils. A small salt lick was observed in the grasslands in the southeast corner of the study area.

Climate

The study area is located within the northern portion of a dry climatic system resulting in warm, dry conditions[16]. The Coast and Cascade Mountains create a rain shadow effect in the interior of

[16] Demarchi 1996

British Columbia, reducing summer and winter precipitation. In summers, hot dry air moves in from the Great Basin to the south.

Within British Columbia, the climate of this region has resulted in semi-arid steppe vegetation with unique geological and landscape features; this has resulted in a diverse and unique assemblage of species in the Okanagan Valley.

Ecoregional and Biogeoclimatic Classification

The study area is located within the Southern Interior Ecoprovince, the northern extension of the Columbia Basin that extends south to Oregon[17]. Situated within the southernmost region of the Interior Plateau of British Columbia, the region lies west of the Columbia Mountains and east of the Coast and Cascade Mountains within the North Okanagan Basin Ecosection (NOB), a wide trench formed by parallel fault lines and further carved out by multiple glaciations, and the North Okanagan Highland Ecosection (NOH), a cool, moist, transitional mountain area, dominated by a rolling upland.

The Ministry of Forests biogeoclimatic ecosystem classification is a system of classifying vegetation based on climatic and topographic patterns[18]. Four biogeoclimatic variants are represented within the study area: the Okanagan Very Dry Hot Ponderosa Pine (PPxh1) and the Okanagan Very Dry Hot Interior Douglas-fir Variant (IDFxh1), Shuswap Moist Warm Interior Douglas-fir Variant (IDFmw1), and the Okanagan Dry Mild Montane Spruce Variant (MSdm1).

The **PPxh1** is the driest forested zone in British Columbia[19]. Occurring only at lower elevations in the southern valleys of British Columbia, it is at the northern extent of a much larger range that runs south through eastern Washington and Oregon. Cool winters with low snowfall and hot dry summers with growing-season moisture deficits result in a mosaic of open forests and grasslands.

The **IDFxh1** is the driest variant of the Interior Douglas-fir zone[19]; it has a long growing season with warm, dry summers, and summer drought. Winters are cool with low to moderate snowfall. Most portions of the IDFxh1 are dominated by mixed open forests of Douglas-fir and ponderosa pine; the study area also has extensive areas of grasslands.

The **IDFmw1** has a warm, dry climatic regime (but is moister than the IDFxh1) and a relatively long growing season with summer drought[19]. It occurs above the IDFxh1 on the east side of the study area. Mature forests are dominated by Douglas-fir with some western redcedar and western larch.

The **MSdm1** occurs at the highest elevations at the eastern edge of the study area. It is characterized by cold winters and moderately short, warm summers[19]. Mature forests are dominated by lodgepole pine with some hybrid white-spruce and subalpine fir; Douglas-fir occurs on warm aspect slopes.

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[17] The ecoregional classification system was developed and adapted by the Ministry of Environment, Lands & Parks, Wildlife Branch, to provide a systematic view of the small scale ecological relationships within British Columbia . See Demarchi 1996 for further information.

[18] The Biogeoclimatic Ecosystem Classification system was developed by the Ministry of Forests to provide a basis for natural resource management, particularly forest management and range management. See Pojar et al. 1987 for further information.

[19] Lloyd et al. 1990

1.2 Ecology and Disturbance Processes

Historically, frequent low-intensity surface fires maintained grasslands and open Douglas-fir and ponderosa pine forests. Fires were likely ignited by both lightning and First Nations peoples. First Nations people used fire to improve wildlife habitat, root crops (for example, mariposa lily and balsamroot) and likely to fireproof their villages[20]. Most native grassland plants are well adapted to fire through perennating buds or seeds just at or below the ground surface where fire temperatures are cooler[21]. Figure 2 shows a prescribed fire similar to many historical fires.

Figure 2. Understory fire similar to how most historical fires burned.

Frequent fire maintained forest understories dominated by bunchgrasses and shrubs and promoted nutrient cycling. Most grasses, forbs, shrubs and mature trees survived most fires, but small trees likely often died[22]. Historically, forests were mostly very open with grassy, shrubby understories. Moister sites were more productive and likely more closed and shrubby. Fires also contribute to nutrient cycling, releasing nutrients that are otherwise very slowly released through decay processes.

The exclusion of most fires (dating back to the time of intensive grazing in the late 1800's) has lead to striking changes in these ecosystems. Some areas that were formerly grasslands have been encroached upon by trees and are now dominated by trees. Tree densities are now much higher in forests (Figure 3). Dense forests with accumulated fuels have lead to declines in grass and shrub productivity, increasing susceptibility to insect and disease outbreaks, and a shift from frequent low-severity fires to larger, more intense crown fires[23] such as the Okanagan Mountain fire in the summer of 2003.

Figure 3. Ingrown stand resulting from fire exclusion. In this stand, no remnant veteran trees are visible in the picture and the area was very open historically.

Moisture is very limiting in these dry forest ecosystems and available moisture is critical for the survival of ponderosa pine seedlings. Ponderosa pine seedlings, with a deeper taproot, are better able to survive moisture depletion than Douglas-fir seedlings.

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[20] Turner 1994; Pokotylo and Froese 1983; Daubenmire 1968
[21] Daubenmire 1968
[22] Agee 1993
[23] Moore et al. 1999; Fule et al. 1997; Daigle 1996

Historically, the principal grazing animals were likely deer and elk[24]. Domestic cattle grazing began in the late 1800's and many of the grasslands in the study area have reduced cover of the more grazing-sensitive species such as bluebunch wheatgrass, Idaho fescue, and rough fescue and have more grazing resistant native grasses such as Columbian needlegrass, junegrass and Sandberg's bluegrass[25]. Some grasslands have been overtaken by knapweed, sulphur cinquefoil and introduced annual brome grasses such as cheatgrass. Some of the grasslands along central ridge in the west-central portion of the study area are in late seral condition with abundant bunchgrasses and diverse mixes of native forbs.

1.3 Human History

The semi-arid climate of the central Okanagan, with its hot summers and mild winters, has long attracted human habitation. Archaeological evidence indicates that humans have been present in the Okanagan valley for at least 6000 years. The valley provided water, wildlife for hunting, fish, roots, berries, herbs, and other foods and medicines for First Nations peoples[26].

Following the discovery of gold in British Columbia, ranchers from western Oregon came and settled in the dry interior valleys of B.C. Cattle were turned loose on the unfenced range and by the late 1870's most grasslands had deteriorated due to overgrazing[27].

Early forest harvesting was localised but became industrial and more widespread by the mid-1900's[28]. We observed that all accessible areas of the study area had been selectively harvested, leaving very few large, old trees.

[24] Tisdale 1947
[25] Dormaar et al.1989; McLean and Wikeen 1985; Daubenmire 1940
[26] Cannings and Durance 1998; Thomson 2000
[27] Mather 1996
[28] Cannings and Durance 1998

2 Methods and Limitations

This project has used the provincially recognised Terrestrial Ecosystem Mapping standard[29] to map terrain and ecosystems in the study area.

2.1 Terrestrial Ecosystem Mapping

Mapping at a scale of 1:20,000 and survey intensity level four was completed according to the methods in *Standard for Terrestrial Ecosystem Mapping in British Columbia*[30].

In addition to the required map attributes, the following map attributes were also recorded for each polygon:

- stand composition modifiers (e.g., coniferous, mixed or broadleaf stand),
- combined rating of quality and condition of the ecosystem (QUALCOND).

Preliminary Terrain Mapping

Terrain mapping is a method to categorize, describe and delineate characteristics of surficial materials (the loose materials on top of bedrock), landforms, and geomorphological processes (the active mechanism that continue to shape the landscape) within the natural landscape[31].

A terrain map is a map of surficial materials; it shows the surficial material type and thickness combined with surface expression or landform type (and geological processes if applicable). Each surficial material type is classified based on its genesis. It has its own characteristics of deposition and therefore physical properties such as texture and consolidation.

Terrain maps are the basis for many kinds of land use planning including terrain stability, ecosystem mapping, planning of urban roads and development, assessment of geological hazards, and aggregate mining. Terrain mapping with an ecological emphasis is called bioterrain mapping. Bioterrain mapping forms the basis of terrestrial ecosystem mapping (TEM) by delineating polygons with similar ecological conditions such as soil moisture, aspect, and vegetation characteristics.

Terrain mapping is based on air photo interpretation, which is then ground-truthed in the field. For this project, terrain mapping followed the standard British Columbia procedures for terrain classification[32], mapping methods[33], terrain stability mapping[34] (five-class system) and bioterrain mapping methods[35].

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[29] Resources Inventory Committee 1998
[30] Resources Inventory Committee 1998
[31] Ministry of Forests 1999
[32] Howes and Kenk 1997
[33] Resources Inventory Committee 1996
[34] Ministry of Forests 1999
[35] Resources Inventory Committee 1998

Project terrain mapping was more detailed than is typical as criteria for both bioterrain and terrain stability mapping were used during polygon delineation. Delineation was based on the following characteristics:

- terrain type;
- material depths;
- drainage;
- slope breaks;
- slope position;
- aspect: cool (from 285 to 135°) and warm (from135 to 285°);
- geomorphological processes;
- surface expression and slope morphology (e.g., concave or convex);
- terrain stability class;
- erosion potential class;
- vegetation changes;
- riparian zones and corridors; and
- any other ecologically significant areas such as cliffs, talus slopes, and ponds.

Preliminary terrain mapping was completed on colour aerial photographs at a scale of approximately 1: 15 000 (Table 3). Robert Maxwell, P.Ag. delineated the polygons and added terrain symbol and soil drainage class to each polygon. The linework was transferred to a digital map base by mono-restitution and the terrain labels were entered into the database.

At a later date, Polly Uunila, P.Geo. added slope gradient range (in percent), terrain stability class and soil erosion class to each polygon and entered the data the database. Appendix C: Terrain Legend provides a description of all materials and geological processes mapped. Figure 4 shows an example of a terrain polygon label.

Table 3. Mapsheets and aerial photographs used for mapping the study area.

TRIM Mapsheets	82L.003 82L.004 82L.013 82L.014
Flight Line and Air Photo Numbers	30BCC 94049: No. 96 – 102 30BCC 94052: No. 32 - 36 30BCC 94053: No. 60 – 66, 190 - 197 30BCC 94085: No. 32 – 40 30BCC 94089: No. 178 - 180 30BCC 94099: No. 73 - 78 30BCC 94152: No. 96 - 104

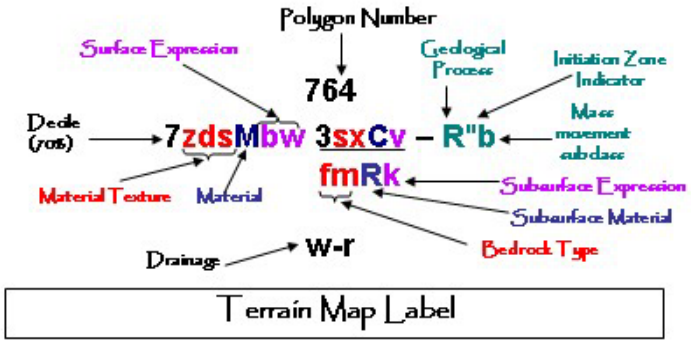

Figure 4. Sample terrain map label.

Field Sampling

A field-sampling plan was developed using aerial photographs and forest cover maps with the following objectives in mind:

- verify the presence, quality, and condition of sensitive ecosystems
- identify other ecosystems
- verify terrain labels
- verify ecosystems in at least 12% of the polygons
- gather detailed data for unclassified ecosystems

Landowners were contacted prior to fieldwork and many landowners granted us access to sample on their lands. Field sampling took place in June and July 2005. A team of three scientists conducted field sampling: a plant ecologist (Kristi Iverson, R.P.Bio.), a terrain and soil specialist (Polly Uunila, P.Geo.), and a wildlife habitat ecologist (Mike Sarell in June and Allison Haney in July).

Three types of sample plots were used to identify and assess ecosystems and terrain: detailed ecological plots (FS882), ground inspections, and visual inspections (Appendix A: Field Plot Forms). Field sampling procedures for detailed ecological plots and ground inspections are outlined in *Field Manual for Describing Terrestrial Ecosystems*[36]. We followed guidelines from the *Standard for Terrestrial Ecosystem Mapping* in British Columbia[37] for visual inspection data collection. Additionally, we collected the pertinent information from a site conservation evaluation form developed by the B.C. Conservation Data Centre to evaluate the quality and condition of all sensitive ecosystems.

Additional information regarding terrain stability and erosion potential was collected by Polly Uunila, P.Geo. including terrain stability and erosion potential classes, signs of instability or erosion, and any other pertinent information regarding stability and erosion potential classes. P. Uunila spent an extra day in the field to focus on refining the criteria for terrain stability and erosion potential.

The location of all detailed ecological plots, ground inspection plots, and visual inspections were either recorded by GPS or marked on project aerial photographs. Site locations were digitally captured and are shown on the terrestrial ecosystem map.

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[36] B.C. Ministry of Environment, Lands and Parks and B.C. Ministry of Forests 1998
[37] Resources Inventory Committee 1998

Forested and grassland ecosystems were identified using existing site series described in *A Field Guide for Site Identification and Interpretation for the Kamloops Forest Region*[38]. Non-forested units such as wetlands and rock outcrops and grassland seral associations were adopted from previous projects: the Bella Vista – Goose Lake Range SEI[39] and the Central Okanagan SEI[40]. These units were originally described based on field data and units were developed in conjunction with Dennis Lloyd, the Ministry of Forests and Range's Regional Ecologist in Kamloops.

Approximately 4% of the plots were detailed ecological plots (Table 4), 22% were ground inspections, and 74% were visual inspections. We checked a total of 11% of the polygons (TEM Survey Intensity 4, a total of 2553 polygons in 16,355 ha[41]). Detailed ecological field plots were used to sample representative sensitive ecosystems, unclassified ecosystems, and representative examples of each site series. Ground inspections were used to sample sensitive ecosystems and representative examples of site series. Visuals were primarily used to verify ecosystem units, structural stages, or terrain.

Table 4. Numbers and types of plots conducted at field sites.

FS882	Ground Inspections	Visuals	TOTAL
9	66	207	282

Final Terrain Mapping

Following fieldwork, revisions were made to the pre-typed polygon boundaries, terrain symbols and interpretative classes where necessary by Polly Uunila based on field observations and air photo interpretation. After the pre-typing was complete, the project objective changed to include interpretations for terrain stability and soil erosion in each polygon. Many of the polygons in the original terrain mapping contained areas of two or more terrain stability classes. In order to have polygons of internally uniform terrain stability class, several polygon boundaries were redrawn while maintaining an emphasis on important ecological elements such as surficial material, aspect and drainage. The database was updated to reflect any changes to polygon labels and the polygon boundaries were adjusted in the digital maps.

Expanded Legend Development

The expanded legend describes the terrain, soils, and vegetation of each ecosystem mapped in the study area. The vegetation and terrain descriptions in the expanded legend provided information for the wildlife biologists to develop wildlife habitat ratings (Volume 3; Haney and Sarell 2006).

The expanded legend also provides technical mapping information for each ecosystem unit: the map code, the ecosystem name, the site series number (if applicable), a listing of the assumed modifiers for each unit, and the modifier combinations that were mapped.

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[38] Lloyd et al. 1990

[39] Iverson and Shypitka 2003

[40] Iverson and Cadrin 2003

[41] Survey intensity level 4 has 60-100 hectares per inspection or 15-25% polygon inspection. Although we only checked 11% of polygons, the detailed mapping resulted in a large number of polygons and our hectares per insection was only 58 hectares (survey intensity level 3).

Site Series and Site Unit Mapping

Ecosystem units were mapped according to the *Standard for Terrestrial Ecosystem Mapping in British Columbia*[42]. Site series were identified according to Lloyd et al. (1990). Two-letter codes have been assigned to all site series in the master list available at: ftp://ftp.env.gov.bc.ca/dist/wis/tem/mapcodes_jan2003.xls[43]. For ecosystems not included in current site series classifications, new ecosystem units were previously approved by the Ministry of Forests' Regional Ecologist. Sparsely vegetated, non-vegetated and anthropogenic units follow the two-letter codes and descriptions in Table 3.1 of the *Standard for Terrestrial Ecosystem Mapping in British Columbia*[42].

Core polygon attributes collected for all polygons are shown below in Table 5. Site modifiers were also used to describe ecosystems. Up to two site modifiers may be present with each ecosystem unit. Site modifiers represent different site conditions than those of the typical situation, as defined in the master list, for each site series. Each site series has a set of assumed site modifiers under the typical situation. Where a site series is mapped in its typical situation, site modifiers are not included in the map label.

The site series code and site modifier(s) are followed by a structural stage designation, one through seven. Structural stage modifiers were used to subdivide shrub and herb structural stages. Stand composition modifiers indicate the dominant stand composition and were mapped for all forested ecosystems. Seral associations were mapped for grassland ecosystems.

Definitions and descriptions for all site modifiers, structural stage, structural stage modifier, and stand composition modifiers can be found in the *Standard for Terrestrial Ecosystem Mapping in British Columbia*[44].

Up to three ecosystems units were noted for each polygon. The percentage of each ecosystem unit present is indicated by deciles ranging from 1 to 10 (1=10%; 10=100%; Figure 5).

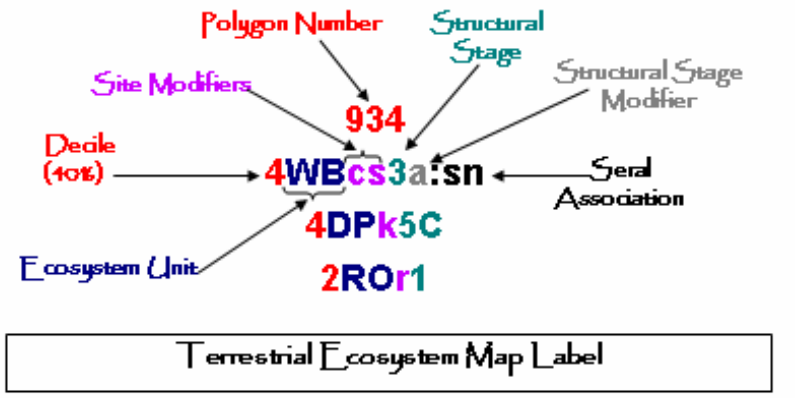

Figure 5. Example of a terrestrial ecosystem map label.

[42] Resources Inventory Committee 1998
[43] Resources Inventory Committee 2000a
[44] Resources Inventory Committee 1998

Table 5. Core attributes collected for all polygons.

Project- or Mapsheet-Specific Attributes - repeated for all polygons
Project name
Ecosystem mapper
Terrain mapper
Survey intensity level
Polygon-Specific Attributes - unique for each polygon
Record one of each of the following elements or classes per polygon:
Mapsheet number
Polygon number
Data source
Ecosection unit
Biogeoclimatic unit (zone and subzone; variant and phase required if present)
Geomorphological processes (when present)
Soil drainages
Record up to three ecosystem and/or terrain units per polygon:
Ecosystem attributes
• Decile
• Site series
• Site modifier(s)
• Structural stage
Terrain attributes
• Decile
• Terrain texture (optional but should be done where possible; record up to three for each component)
• Surficial material (record one for each component; could include a surficial subtype)
• Qualifiers (when present, record one for each component)
• Surface expression (record up to three for each component)

Data Management

Non-spatial information includes field plot data and polygon attribute data. Spatial data includes polygon linework and locations of field verification sites.

Field Plot Data

Data from field plots were entered into a digital database using Resources Inventory Committee standard software (VENUS Version 5). Both manual and electronic quality assurance were completed for the VENUS database. This database was used to sort data into ecosystem units, create the project vegetation species list, and develop the expanded legend. The range of environmental conditions, terrain units, and vegetation communities over which ecosystem units were distributed is described in the expanded legend (Appendix D: Expanded Legend).

Non-spatial Data

We captured the core set of polygon attributes required to meet the provincially accepted *Standard for Terrestrial Ecosystem Mapping (TEM) - Digital Data Capture in British Columbia*[45] (Table 5). Table 6 lists the optional attributes we also applied in this project. We also applied two "user-defined" polygon attributes for all occurrences of sensitive ecosystems: Quality/condition and viability. We ran quality assurance error checking routines to ensure the attribute databases were free of errors.

Table 6. List of Optional Attributes

Attribute
Structural stage modifiers
Stand Appearance
Seral Stage
Disturbance Class and Subclass

Spatial Digital Data

Ecosystems were represented visually on maps and the digital data required to produce this representation were maintained according to standards outlined in the TEM Digital Data Capture Standards[46]. The Terrain Resource Information Management (TRIM) was used as the mapping base. The linework mapped by the bioterrain and ecosystem specialists was captured through monorestitution. Monorestitution is the digital transfer of features by digitising directly from aerial photos using TRIM control points to georeference the data, and TRIM digital elevation models to correct for slope. The process allows for adjustments in polygon shape and size related to the third dimension. Standard quality assurance routines were applied to ensure accurate mapping.

2.2 Terrain stability

Terrain stability refers to the susceptibility of a given slope to gravitationally-induced mass movement. Rotational slumps, debris slides, debris flows, rock fall and rockslides are some examples of mass movement. Terrain stability mapping provides a polygon-based rating system that indicates the potential for instabilities to exist or develop as a result of anthropogenic slope modifications (e.g. tree harvesting, road building, etc). This rating is based on surficial material type and texture, slope gradient range, drainage, as well as the presence and type of geomorphological processes.

A terrain stability map can be used as a planning tool for urban development, road building, or forest development. These maps identify areas that need further assessment prior to development and as such ***should not be considered an on-site assessment, but a tool for flagging areas needing further assessment***. Terrain stability maps also help planners anticipate or avoid areas that may cause environmental damage[47].

[45] Resources Inventory Committee 2000b
[46] Resources Inventory Committee 2000b
[47] Ministry of Forests 1999

Terrain stability Criteria

Criteria used to assess terrain stability[48] are shown in Table 7. Definitions for terrain stability are shown in Table 8. Terrain stability is defined as the resistance of a slope to failure by landsliding[49] and the classes indicate the likelihood of instability resulting from development (i.e. tree removal and road building). Terrain stability ratings have a range of five classes for detailed terrain stability mapping from Class **I** (stable) to Class **V** (unstable).

Table 7. Guidelines for assessment of terrain stability classes.

Dominant texture	Typical surficial material	Terrain Stability Class				
		I	**II**	**III**	**IV**	**V**
fine s, z, zs, sz, c, m	LG, C1	<10 %	10-25 %	25-40 %	>40 %	all materials and landforms that are unstable, including rockfall; polygons with: -F"k, -F"m, -F"u, -R"s, -R"r, -R"d, -R"b
sm, dsm	LG, M	<15 %	15-30 %	30-55 %	>55 %	
dzs, zds, sg, a, x	M, F, FG, C	<20 %	20-40 %	40-60 %	>60 %	
resistant bedrock	R	<25 %	25-50 %	50-70 %	>70 %	

Numerical ranges in the table refer to the dominant range of slopes in percent. See Appendix C for definitions of texture and surficial material type.

Criteria are based chiefly on slope steepness, material type, texture, and the presence of geomorphological processes. The criteria were used as general guide with adjustments being made, as necessary, for specific conditions such as soil drainage and slope morphology. Each terrain polygon was rated individually in order to permit additional local factors to be taken into account when necessary. These additional local factors include:

- ***Slope smoothness/irregularity***: A slope morphology that includes irregular, near-surface bedrock may be rated as more stable than a similar slope with smooth underlying bedrock, because bedrock irregularities can reduce the likelihood of a landslide in surficial materials. The irregular bedrock acts to pin surficial materials in place, thus the potential for instability is less than on a slope of similar overall steepness but with a smoother profile.
- ***Drainage***: In general, wet slopes are more unstable than dry slopes. Wet slopes may be prone to slope failures through a reduction in normal stress due to high pore water pressure in the soil. Where imperfectly-drained areas are mapped on slopes with gradients that occur within the upper end of a slope steepness class range, the polygon may be rated one terrain stability class higher. Where rapidly drained areas are mapped on slopes with gradients that occur on the lower end of a slope steepness range, the polygon may be rated one stability class lower.
- ***Slope position***: In general, lower slopes and concavities are relatively wet because they receive moisture from a large area upslope; thus they may be classified as a terrain stability class higher than a similar slope that is located in a shedding slope position.

[48] 'Terrain stability' is sometimes also referred to as 'slope stability'

[49] Bates and Jackson 1984

- ***Landslide deposits***: Large rockslide deposits (geomorphological process" –Fm") that initiated in the Thompson Plateau basalt located along the eastern edge of the study area have been rated as terrain stability class IV. These areas have be rated potentially unstable because other rockslide deposits from Tertiary-aged basalt in the region are experiencing local areas of on-going creep. Thus, these slopes need to be assessed in greater detail prior to any development.

Each terrain stability class has defined management implications that are described below in Table 8.

Table 8. Definitions and management implications for terrain stability classes.[50]

Stability Class	Interpretation
I	• No significant stability problems exist.
II	• There is a low likelihood of landslides following disturbance or development. • Minor slumping is expected along road cuts and excavations.
III	• Stability problems can develop. • Follow BMP to reduce the likelihood of causing slope failure. • Minor slumping is expected along road cuts and excavations. There is a low likelihood of landslide initiation following disturbance or road construction. • On-site inspection required by geotechnical professionals.
IV	• Expected to contain areas with a moderate likelihood of landslide initiation following development, disturbance or road construction. • These areas should be avoided. Use caution when planning intensive land use above or below these areas. • On-site inspection required by geotechnical professionals
V	• Expected to contain areas with a high likelihood of landslide initiation. Signs of existing instability present. • Avoid these areas. Do not plan intensive land use above or below these areas. • On-site inspection required by geotechnical professionals

When using these ratings, it is essential to bear in mind that conditions are locally variable. The ratings (and information on the terrain map) indicate the mapper's impression of typical conditions for each terrain polygon, but locally steeper slopes, wetter soils, and emergence of water from seepage zones give rise to areas that are potentially more unstable and/or more erodible than their surroundings. Consequently, ***persons using these maps for development should recognize and take account of these local conditions***.

In some cases, a polygon may contain more than one stability class, or be able to fit into two stability classes. In these cases, the higher of the two stability classes was used for a conservative rating.

[50] Adapted from Ministry of Forests 1999

2.3 Erosion Potential

For this study, erosion refers to the particle by particle removal of material from bare soil by running water. Erosion potential refers to the susceptibility of a bare surface of the soil (that is without vegetation, humus, or other protective layers) to erosion by water. This interpretation is based on the *in situ* surficial materials stripped bare of its protective vegetation but does not include deposits of excavated materials

Fine sediment production from soil erosion is from exposure of bare soil to rain. Exposed soil occurs on roads, road cutslopes, ditches, construction sites, excavation sites, landslide scars, active gullying, excessive cattle use, or a fire in which the vegetation and humus is destroyed. Sediment generated by erosion is generally transported from a source area to a depositional area.

Soil erosion potential ratings are based on surficial material type and texture, surficial material thickness, slope, drainage, slope morphology (e.g., concave vs. convex), and upslope catchment area.

Erosion is a natural process, but it may be accelerated by human activity. Each polygon is assigned an erosion potential rating which gives the degree of soil erosion potential expected if the vegetation and humus is removed. Erosion potential mapping can be used as a planning tool to anticipate or avoid development in areas that may cause environmental damage.

Erosion Potential Criteria

Erosion potential is based on a five-class rating scheme ranging from very low (VL) where no problems of erosion are expected to very high (VH) where there already exists the natural movement of sediments into adjacent creeks (Table 10). Ratings were assigned to each polygon through aerial photographic interpretation.

Criteria for assessing erosion potential are based on, soil texture, material thickness and slope gradient (Table 9).

Table 9. Guidelines for assessment of surface erosion potential.

SURFICIAL MATERIAL CHARACTERISTICS		DOMINANT GRADIENT RANGE (%)			
		0 – 40%	30 – 60%	> 50%	>40%
Dominant texture Decreasing erodibility	Typical surficial material	smooth, irregular, benched, terraced slopes	moderate to moderately steep slopes	single gullies and scarps	dissected slopes (-V)
fine s, z, c, m	LG, E, C1	H	H, VH	VH	VH
coarse s, ds, gs, sdm, sdz	FG, C, M, F	M	H	H, VH	VH
dzs, zds	M	L	M	H	VH
sg, sd, sr, sx	F, FG, C, M	VL	L	M	H
x, a	C	VL	VL	L	L
resistant bedrock	R	VL	VL	VL	VL
organics (peat bogs)	O	VL	-	-	-

The criteria were used as general guide with adjustments being made, as necessary, for specific conditions such as slope position and geomorphic processes. Each terrain polygon was rated individually in order to permit additional local factors to be taken into account when necessary. These local factors included:

- ***Soil drainage:*** Polygons with imperfectly drained soils (seepage present) is rated one class higher.
- ***Slope position***: Lower slopes and concavities tend to be more erodible because they generally receive more moisture compared to a middle slope. As a result a polygon may be rated one class higher if it is a receiving site. In contrast, upper slopes are generally less erodible as they receive less water as compared to a middle slope and may be rated one class lower;
- ***Slope morphology***: An irregular slope is generally less erodible than a smooth slope. A polygon may be rated one class lower if a slope is irregular enough to inhibit some erosion potential; and
- ***Geomorphic Processes***: If a polygon contains an active geomorphic process that is deemed to increase the erosion, such as gullying or slope failure, the erosion potential class may be rated one class higher.

Each soil erosion potential class has defined management implications that are shown below in Table 10.

Table 10. Definitions and management implications of soil erosion potential classes.[51]

Class	Rating	Definition and Implications
VL	Very low	• Negligible or very minor soil erosion.
L	Low	• Expect minor erosion of fines in ditch lines and disturbed soils.
M	Moderate	• Expect moderate erosion when water is channelled onto exposed soils.
H	High	• Significant erosion problems can be created when water is channelled onto or over exposed soil on these sites.
VH	Very high	• Severe surface and gully erosion problems can be created when water is channelled onto or over exposed soils on these sites.

When using these ratings, it is essential to bear in mind that conditions are locally variable. The ratings indicate the mappers impression of typical conditions for each terrain polygon, but local pockets of eolian sediments (or other materials consisting of fine sand and coarse silt) steeper slopes, wetter soils, interception of shallow groundwater and emergence of water from seepage zones give rise to areas that are potentially more erodible than their surroundings.

2.4 Mapping Limitations

TEM & SEI Mapping Limitations

The SEI and TEM information is intended for use in alerting local and regional decision-makers of the presence of important ecosystems and ecological features. The SEI and TEM do not replace the need for on-site assessments of areas where land use changes are proposed or contemplated.

The accuracy of polygon boundaries is limited by the scale (1:15,000) and date (1994) of the aerial photographs on which the sites are delineated. Orthophotos from 2003 were used to update the mapping where urban development had occurred since the date of the aerial photographs. ***Data should not be enlarged beyond the scale of the photos as this may result in unacceptable distortion and faulty registration with other data sets.***

Given the continuing land-uses within the study area, including human settlement and agricultural development, attributes of some polygons may have changed since the date of the aerial photographs or field work. Wherever possible, polygons were updated to reflect changes noted at the time of field work.

One of the primary limitations of aerial photograph interpretations is the limited ability to see disturbances such as grazing and invasion of noxious weeds. The mapper applies information based on extrapolation from adjacent areas or current land use, and based on the tone and texture seen on the aerial photographs. Some grasslands may be incorrectly assigned to either ‘grasslands’ or ‘disturbed grasslands’.

[51] Adapted from Ministry of Forests 1999

There is limited ability to delineate polygons around small sensitive features or ecosystems. In most cases, these ecosystems are captured as a small component of a larger polygon dominated by another ecosystem. Many polygons are a complex of ecosystems and sensitive ecosystems may only occupy a portion of that polygon.

Field verification was limited by access. Not all private land owners granted permission to sample on their property. Finally, many important wildlife habitat features are difficult to capture in ecosystem maps unless they correlate well with certain ecosystems. It is likely that important habitat features such as snags, tree cavities, and coarse woody debris are present but are not included in SEI polygons.

Terrain Mapping Limitations

The accuracy of the terrain mapping and the reliability of the air photo interpretations are dependant on a number of factors. These factors are described below in Table 11.

Table 11. The factors affecting the reliability of terrain mapping.

Factors	Notes on this study
Skill and experience of the mapper	Pretyping was completed by Bob Maxwell, former Bioterrain Specialist for the Ministry of Environment and former resident of the Central Okanagan. Terrain stability and soil erosion and project completion by Polly Uunila, a resident of the North Okanagan, who has completed several terrain mapping projects locally and numerous projects throughout the province
Number of mappers	Two mappers
Continuity	Project started by one mapper and completed by another.
Quality control	Spot checked by Kristi Iverson
Vegetation cover	In general, the vast areas of grasslands and open forest allowed the mapper a good view of landform features while mapping.
Complexity of the landscape	Variable. The rock-controlled portion of the landscape is predictable and fairly straightforward. The thick valley fill on the lower slopes is more complex. Many of the smaller riparian corridors are not mapped.
Quality and scale of the airphotos	Colour photos. Appropriate photo scale for the scale of the final mapping. Generally of good quality, however many steep, west-facing slopes are shadowed and the air photos were 11 years old at the time of project completion.
Distribution of field checking	A majority of the study area is private land, and access to many properties was denied. Overall, the project team was able to check a representation of most ecosystems throughout the study area. Many steeper slopes were inaccessible.
Terrain Survey Intensity Level (TSIL)	TSIL D[52]/C[53] completed for project which is appropriate for mapping landforms and ecosystems, however a greater percentage of the checks on steeper slopes is ideal for Terrain Stability and Soil Erosion themes.
Interpretative criteria for Surface Erosion Potential and Slope Stability	Inadequate field data from this study but good data was available from comparable studies done in adjacent areas.

[52] TSIL D is defined as 1 - 20% of polygons inspected or 0 to 0.1 checks/ha
[53] TSIL C is defined as 20 - 50% of polygons inspected or 0.5 to 1.0 checks/ha

Factors	Notes on this study
Quality of the topographic base	Good.
Transfer of linework into digital format	Good. Checked during data entry.
Transfer of terrain symbols into digital format	The database is free of terrain coding errors. As every polygon was not checked against the original mapping on the airphotos, it is possible that data entry errors occurred. Spot-checking indicated that errors are not common.
Edit of final maps	No stand-alone bioterrain map was created so no final edit was done. The Soil Erosion Potential and Terrain Stability maps were spot checked against the original mapping on photos.

The terrain mapping was based on observations of land-surface conditions and current understanding of terrain and erosion. The following factors have not been taken into account by this study: subsurface conditions not detectable by air photo interpretation or field observations, events whose time of occurrence and severity cannot be predicted (e.g., storm events), management practices, and land-use.

Terrain Stability and Erosion Potential Mapping Limitations

The same limitations of terrain mapping also apply to terrain stability and erosion potential mapping. None of these previously listed limitations were found to be significant; however, terrain stability mapping and erosion potential mapping are also subject to additional limitations. These limitations include:

- ***Polygon based interpretations***: Both terrain stability and erosion potential classes have been assigned on a polygon basis. Even with small, fairly homogeneous polygons, these classes are not always continuous across the polygon. When assigning a terrain stability or erosion potential class, generally the most dominant class represented in the polygon is used. If there is a significant portion of a higher class in the polygon, then the higher class will be used for the most conservative rating. Sometimes within a polygon, a small portion of a higher class rating will be present, but deemed not significant enough in size to increase the rating. Many of the polygons from the pre-typing were refined after field checking to create as uniform polygons as possible at the scale of mapping.
- ***Field verification***: Terrain stability and erosion potential classes are assigned based on air photo interpretations and field verification. During field work, soil pits, root wads, and road cuts are used to interpret the subsurface conditions. No deeper subsurface investigations are carried out (i.e. test-pitting and drilling). Groundwater flow influences both terrain stability and erosion potential and can be adequately interpreted from the surface, but not as accurately as when subsurface investigations are carried out. Many of the areas mapped with higher classes of terrain stability are located on private land that denied access.
- ***Interpretations based on standard practices***: Interpretations are applied based on the use of standard forestry practices from the Forest Practices Code[54]. However, if inadequate culvert placing redirected drainage to an area that previously did not receive as much water, this area will be more susceptible to failure and erosion that it is rated. Extensive irrigation is another unnatural source of water that may increase erosion potential and the likelihood of a landslide.

[54] Ministry of Forests 1999

3 Results

3.1 Terrestrial Ecosystem Mapping

Table 12, Table 13, Table 14, and Table 15 below lists the ecosystems mapped in the study area fore each subzone, the area they covered, the percentage of the subzone, and the percentage of the study area landbase. Appendix B: Vegetation Species List provides a list of all plant species encountered during field sampling. Appendix D: Expanded Legend provides a complete description of each ecosystem.

Table 12. Ecosystem Units mapped, their area, and their percent of the study area in the IDFmw1.

IDFmw1				
Ecosystem Unit Code/ Number	Ecosystem Unit Name	Area (hectares)	% of IDFmw1	% of study area
CD /00	ActFd –Common Snowberry – Red-osier Dogwood Riparian	3.2	0.53	0.02
CT /00	Cattail Marsh	1.5	0.25	0.01
DF /01	Douglas-fir / Western redcedar – Falsebox – Prince's pine	276	45.6	1.69
DP /04	Douglas-fir – Pinegrass – Feathermoss	133	22.0	0.81
DS /02	Douglas-fir / Ponderosa pine – Snowberry – Bluebunch wheatgrass	4.7	0.78	0.03
ES /00	Exposed Soil	2.9	0.48	0.02
OW /00	Shallow Open Water	0.43	0.07	0.003
PP /03	Douglas-fir – Penstemon – Pinegrass	35.7	5.90	0.22
RD /06	Western redcedar – Devil's club – Foamflower	37.2	6.15	0.23
RR /05	Western redcedar / Douglas-fir - Dogwood	98.2	16.2	0.60
RZ /00	Road Surface	1.2	0.20	0.01
SO /00	Saskatoon – Mock orange Talus	1.0	0.17	0.01
TA /00	Talus	1.5	0.25	0.01
WB /00	Bluebunch wheatgrass – Balsamroot	7.8	1.29	0.05
WS /00	Willow – Sedge Wetland	0.43	0.07	0.003
TOTAL		**605**	**3.7**	**100**

Table 13. Ecosystem Units mapped, their area, and their percent of the study area in the IDFxh1.

IDFxh1				
Ecosystem Unit Code/ Number	Ecosystem Unit Name	Area (hectares)	% of IDFxh1	% of study area
AB /00	Nuttall's alkaligrass – Foxtail barley graminoid meadow	0.08	0.001	0.001
AS /98	At – Snowberry – Kentucky bluegrass	89.4	0.74	0.55
BM /00	Bulrush Marsh	3.21	0.03	0.02
BN /96	Kentucky bluegrass – Stiff needlegrass	17.4	0.14	0.11
BR /00	Baltic Rush Marsh-Meadow	2.97	0.02	0.02
CB /00	Cutbank	7.48	0.06	0.05
CD /00	ActFd –Common Snowberry – Red-osier Dogwood Riparian	19.0	0.16	0.12
CF /00	Cultivated Field	227	1.87	1.38
CL /00	Cliff	2.05	0.02	0.01
CO /00	Cultivated Orchard	464	3.82	2.84
CS /00	Common Spikerush Marsh	0.74	0.01	0.005
CT /00	Cattail Marsh	9.70	0.08	0.06
CW /00	Choke cherry – Bluebunch wheatgrass rocky bluff	1.59	0.01	0.01

IDFxh1				
Ecosystem Unit Code/ Number	Ecosystem Unit Name	Area (hectares)	% of IDFxh1	% of study area
DP /01	FdPy – Pinegrass	846	6.97	5.17
DS /07	FdPy – Snowberry – Spirea	784	6.46	4.79
DW /03	FdPy – Bluebunch wheatgrass – Pinegrass	1175	9.68	7.19
ES /00	Exposed Soil	8.05	0.07	0.05
FO /00	FdPy –Saskatoon – Mock orange	55.1	0.45	0.34
FW /91	Idaho fescue – Bluebunch wheatgrass	984	8.11	6.02
GP /00	Gravel Pit	17.4	0.14	0.11
LA /00	Lake	375	30.9	22.9
OW /00	Shallow Open Water	528	4.35	3.23
PB /02	FdPy – Bluebunch wheatgrass – Balsamroot	280	2.31	1.71
RF /97	Prairie Rose – Idaho fescue	207	1.70	1.26
RN /00	Railway	4.73	0.039	0.03
RO /00	Rock Outcrop	1.51	0.012	0.01
RW /00	Rural	308	2.54	1.88
RZ /00	Road Surface	92.3	0.76	0.56
SA/00	Antelope brush – Selaginella	37.2	0.31	0.23
SB /00	Selaginella – Bluebunch wheatgrass rock outcrop	21.3	0.18	0.13
SD /08	SxwFd – Douglas maple – Dogwood	78.8	0.65	0.48
SO /00	Saskatoon – Mock orange Talus	21.4	0.18	0.13
SP /04	FdPy – Snowbrush – Pinegrass	701	5.78	4.29
TA /00	Talus	8.57	0.07	0.05
UR /00	Urban/Suburban	74.9	0.62	0.46
WB /93	Bluebunch wheatgrass – Balsamroot	1300	10.7	7.95
WS /09	Willow – Sedge Wetland	5.17	0.04	0.03
TOTAL		**12136**	**100**	**74.2**

Table 14. Ecosystem Units mapped, their area, and their percent of the study area in the MSdm1.

MSdm1				
Ecosystem Unit Code/ Number	Ecosystem Unit Name	Area (hectares)	% of MSdm1	% of study area
PG /03	Lodgepole pine – Grouseberry – Cladonia	12.1	15.5	0.074
RO /00	Rock Outcrop	1.8	2.3	0.011
SF /01	Hybrid white spruce – Falsebox – Feathermoss	48.1	61.8	0.294
SG /06	Hybrid white spruce – Gooseberry	13.9	17.8	0.085
SH /07	Hybrid white spruce – Trapper's tea – Horsetail	0.8	1.1	0.005
TA /00	Talus	1.2	1.5	0.007
TOTAL		**77.8**	**100**	**0.48**

Table 15. Ecosystem Units mapped, their area, and their percent of the study area in the PPxh1.

PPxh1				
Ecosystem Unit Code/ Number	Ecosystem Unit Name	Area (hectares)	% of PPxh1	% of study area
AS /00	At – Snowberry – Kentucky bluegrass	2.5	0.07	0.02
CB /00	Cutbank	2.5	0.07	0.02
CD /00	ActFd –Common Snowberry – Red-osier Dogwood Riparian	45.9	1.30	0.28
CF /00	Cultivated Field	345.8	9.78	2.11
CL /00	Cliff	2.6	0.07	0.02
CO /00	Cultivated Orchard	670.1	18.95	4.10
CT /00	Cattail Marsh	2.0	0.06	0.01
CV /00	Cultivated Vineyard	4.7	0.13	0.03
CW /00	Choke cherry – Bluebunch wheatgrass rocky bluff	0.7	0.02	0.00
DM /08	Fd – Water birch - Douglas maple	40.0	1.13	0.24
DS /07	FdPy – Snowberry – Spirea	45.7	1.29	0.28
ES /00	Exposed Soil	3.3	0.09	0.02
FB /00	Rough fescue – Bluebunch wheatgrass	250.3	7.08	1.53
FO /00	FdPy –Saskatoon – Mock orange	3.3	0.09	0.02
GC /00	Golf Course	8.0	0.23	0.05
GP /00	Gravel Pit	33.8	0.96	0.21
OW /00	Shallow Open Water	2.3	0.07	0.01
PC /04	Py – Bluebunch wheatgrass – Cheatgrass	258.1	7.30	1.58
PF /05	Py – Bluebunch wheatgrass – Rough fescue	82.5	2.33	0.50
PT /02	Py – Red three-awn	132.8	3.76	0.81
PW /01	Py – Bluebunch wheatgrass – Idaho fescue	396.3	11.21	2.42
RO /00	Rock Outcrop	1.2	0.03	0.01
RW /00	Rural	447.6	12.66	2.74
RZ /00	Road Surface	49.7	1.41	0.30
SA/00	Antelope brush – Selaginella	13.1	0.37	0.08
SB /00	Selaginella – Bluebunch wheatgrass rock outcrop	9.5	0.27	0.06
SO /00	Saskatoon – Mock orange Talus	7.3	0.21	0.04
SP /06	FdPy – Snowberry – Pinegrass	61.5	1.74	0.38
SR /00	Snowberry – Rose – Kentucky Bluegrass	17.3	0.49	0.11
TA /00	Talus	3.5	0.10	0.02
UR /00	Urban/Suburban	343.7	9.72	2.10
WB /00	Bluebunch wheatgrass – Balsamroot	246.8	6.98	1.51
WS /00	Willow – Sedge Wetland	1.4	0.04	0.01
TOTAL		**3536**	**100**	**21.6**

3.2 Terrain, Terrain Stability, and Erosion Potential Results

In general, the landscape and surficial geology is quite variable and complex. A number of stability issues were identified during this project:

- slumps in glaciolacustrine sediments
- slumps in thick deposits of surficial materials in gully sidewalls
- slumps in bedrock
- tension cracks in bedrock
- rockfall
- debris flows
- debris slides
- debris flow fans

The following gives a brief and general description of the distribution of surficial geology, terrain stability, and erosion potential from the valley bottom adjacent to the lakes to the ridge tops.

- **Valley bottom**: Thin stretches of beach discontinuously lined the shores on the three major lakes (Okanagan, Kalamalka, and Wood Lakes) located in the study area. In Winfield, Vernon Creek has formed a large fan where the creek meets the valley bottom. The valley bottom between Duck and Wood Lakes consisted of a wide floodplain through which Winfield and Vernon Creeks flow northwards. Small fluvial fans were located at the mouths of the larger creeks and gullies throughout the area, for example on the west side and east side of Oyama.

  Stability issues in this area included the deposition zones of rapid and slow mass movements, such as debris flow fans, talus slopes and runout zone of slumps in glaciolacustrine sediments. The more erodible soils included fluvial silts and sands, lacustrine sands and glaciolacustrine sediments.

- **Lower slopes**: The lower slopes adjacent to the three major lakes and the Vernon/Winfield Creek floodplain consisted of deep valley fill (sloping benches dissected by gullies created by post-glacial streams and erosion). Areas of bedrock covered by little or no colluvium were scattered throughout these slopes. Located at the bottom of the valley fill were discontinuous outcrops of sediments pre-dating the most recent glaciation. These deposits were found at various locations, particularly in the Okanagan Centre area. For the most part, the surface of the benches consisted of thick deposits of glaciofluvial sediments, till, and glaciolacustrine sediments. Large deposits of glaciofluvial sediments were located at the mouths of the larger meltwater channels and gullies, for example, at the mouth of Cougar Canyon, in the Coral Beach and Commonage road area, on the west side and east side of Oyama, the vicinity of Pollard's Pond, along Okanagan Centre Road West in the south, and on either side of Vernon Creek upslope from its large fan. Thick till deposits were located in the Woodsdale area. Glaciolacustrine sediments deposited by Glacial Lake Penticton were found throughout much of the remainder of the lower slopes. Thin eolian sediments were found discontinuously on the surface on the east side of the study area.

  Stability issues in this area included rockfall, slumps in glaciolacustrine sediments, and debris

flow fans. The more erodible soils included fluvial and glaciofluvial silts and sands, eolian silts and sands, and glaciolacustrine sediments. Slopes containing gullies incised through thick surficial materials were areas of high potential for erosion.

- **Mid to lower slopes**: Immediately upslope of the sloping benches were areas of thick till deposits separated by areas of bedrock-controlled terrain with thin partial covers of till and colluvium/weathered bedrock. Several meltwater channels were located on these slopes, many of which were ice-marginal streams. There was a high concentration of these channels located in the grasslands upslope and to the east of Winfield. At the outlets of these channels, most of which flowed southwards, glaciofluvial sediments were deposited over a large area. There were eskers located here as well. Thin eolian sediments were found discontinuously on the surface on the east side of the study area.

  The canyon portions of Clark and Vernon Creeks comprised the largest amount of potentially unstable terrain (terrain stability classes IV and IV) and unstable (terrain stability class V) within the study area. Other areas of potentially unstable and unstable terrain included single gullies in the Okanagan Centre area, moderate to steeply sloping glaciolacustrine sediments, and areas of rockfall.

  The more erodible soils included fluvial and glaciofluvial silts and sands, and eolian silts and sands. Slopes containing gullies incised through thick surficial materials were areas of high potential for erosion.

- **Mid to upper slopes**: These slopes were typically moderately steep to steep, bedrock-controlled terrain. The bedrock was discontinuously covered by thin till and colluvium. Talus slopes flanked bedrock cliffs. There were large bedrock slump deposits located below Wrinkly Face Cliff and at the edge of the plateau above Woodsdale. There was a smaller bedrock slump at the top of Spinekopje. Vernon Creek has incised a deep canyon through a thick sequence of sediments; either side of the canyon consisted of gentler slopes. At about 1100m south of Vernon Creek, there was an area of glaciolacustrine sediments. These were likely deposited when stagnating ice in the main valley bottom dammed Vernon Creek, temporarily forming a lake. Thin eolian sediments were found discontinuously on the surface of the gentler slopes on the east side of the study area.

  The single gullies, the canyon sections of Clark and Vernon Creeks, and rockfall comprised the largest amount of potentially unstable terrain and unstable within this area. In general, open slopes between about 60 % and 70 %, and some dissected slopes between 50 % and 70 %, were assigned terrain stability class IV. Steeper bedrock-controlled slopes with a partial veneer cover were rated as terrain stability class IV. The bedrock slumps and tension cracks located in the Thompson Plateau basalt along the eastern edges of the study area in volcanic bedrock at the peak of Spinekopje were mapped as potentially unstable and unstable.

  For the most part, the headscarps were rated as terrain stability class V. Slumps tend to occur when bedrock has failed on a weak layer of weathered bedrock below the surface. Elsewhere in the Shuswap and the North Okanagan, this type of failure is common in Kamloops Group volcanics. Although initial failure was likely prior to 10,000 years ago, there can be reactivation and secondary movement of portions of the slide masses along weak, weathered layers at the base. Thus the slump deposits have been rated as terrain stability class IV. At those sites visited there were no recent indicators of creep.

The more erodible soils included fluvial and glaciofluvial silts and sands, eolian silts and sands, and glaciolacustrine sediments. Slopes containing gullies incised through thick surficial materials were areas of high potential for erosion.

3.3 Terrain Recommendations

Some project-specific recommendations include:

- The extent and stability of the bedrock slumps needs to be further investigated prior to any development on or below these landforms.
- Many of the smaller riparian corridors were not completely mapped. A project similar to Sensitive Habitat Inventory and Mapping (SHIM)[55] being carried out in other areas of the Okanagan can provide complete inventory of watercourses in the District of Lake Country.

The following recommendations are standard for avoidance of problems during development in areas that are prone to erosion or instability:

- Best Management Practices as outlined in the document *Best Management Practices for Erosion and Sediment Control-Upland Works*[56] should be followed. In and adjacent to riparian zones, it is particularly critical to avoid disturbances of erodable soils. Best Management Practices as outlined in *Best Management Practices for Erosion and Sediment Control-Instream Works*[57] should be followed as well as all legal requirements outlined in the *Fisheries Act* and the provincial *Water Act*.
- Conscientious drainage planning is essential during road construction. Local drainage patterns have slowly been created since deglaciation. This process took thousands of years to evolve, and is in a sensitive equilibrium with the volume of water discharge. All natural drainage patterns, even minor ephemeral channels should be maintained. This is also important upslope of steeper areas as redirected drainage will affect the steep slopes below. Natural drainage patterns should be maintained through comprehensive stormwater planning that maintains natural water flow patterns by using stormwater source control strategies that return 90% of the precipitation to their natural drainage pathways.
- Sloughing of cut banks along roads may develop due to emergence of shallow subsurface water. Design road patterns to minimize cut and fills, and armour ditches with rock or vegetation where erosion is likely to occur. Ditches should be inspected regularly and cleaned or otherwise maintained when necessary.
- Ensure that culvert size is adequate and that the discharge points are properly armoured if necessary to reduce local erosion. Seeding together with geotextiles and armouring with rock are effective for controlling erosion.
- Minimize areas of soil disturbance for each development site or phase construction so that site clearing is minimized at any given time.
- Grass seeding may be an effective means of reducing erosion potential on bare surfaces such as cut banks and other disturbed areas. These areas could be lined with material such as

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[55] See http://www.shim.bc.ca/methods/SHIM_Methods.html
[56] City of Kelowna 1998b
[57] City of Kelowna 1998a

weed-free straw to control erosion until grass becomes established. Grass seed used must be weed-free.

- Road construction should be avoided during wet weather and when the ground is wet due to snowmelt.
- Bare, compacted surfaces, even on gentle slopes, are particularly vulnerable to erosion by running water. Minimize disturbance of soils by having equipment use designated trails. Avoid leaving tracks aligned in the downhill direction that will channel runoff water and increase erosion. On steeper areas, these trails may require armouring to prevent surface erosion. Trails that are not part of the permanent road network should be scarified and rehabilitated and planted with native vegetation species adapted to the specific site.
- On steep slopes, construction should be minimized, but where unavoidable, all appropriate measures should be used to prevent soil and site degradation.
- Qualified registered professionals should evaluate the risk of a debris flow/torrent impacting development on the fan.
- Areas down slope of unstable glaciolacustrine scarps are also areas that could be impacted by landslide runout. Stability of glaciolacustrine scarps can be affected by over-irrigation, redirection of water (ditches and watercourses) onto the scarp, and addition of weight at the edge of the scarp (i.e., buildings, pools, trees, fill etc.). The force of the wind on tall trees and buildings can increase the forces that contribute to rotational slumps in thick glaciolacustrine materials.
- Glaciolacustrine materials are also susceptible to piping and collapse. It is recommended that qualified registered professionals investigate ground conditions in areas of thick glaciolacustrine material even in class **I** and **II** terrain.
- Where development is planned within or near polygons containing terrain stability classes **III, IV** and **V**, on-site inspections is required by a qualified registered professional, such as a Geotechnical Engineer, to determine more precisely the nature and extent of the unstable areas.
- Where development is planned within polygons containing soil erosion potential **M, H** and **VH**, on-site inspections is required by a qualified registered professional.
- Class **V** terrain is unstable and should be avoided.

The information and analyses contained in this report are based on observations of land-surface conditions and current understanding of slope processes. However, because terrain stability is strongly influenced by subsurface conditions that are not apparent from surface observations or air photo interpretation (e.g., subsurface hydrologic conditions, characteristics of subsurface materials), by events whose time of occurrence cannot be predicted (e.g., extreme storms, earthquakes), and by land management practices, the results and recommendations provided in the report cannot guarantee that no landslides will occur in areas affected by land clearing and development. Appropriate use of terrain information and implementation of recommendations will, however, reduce the risk of landslides and erosion.

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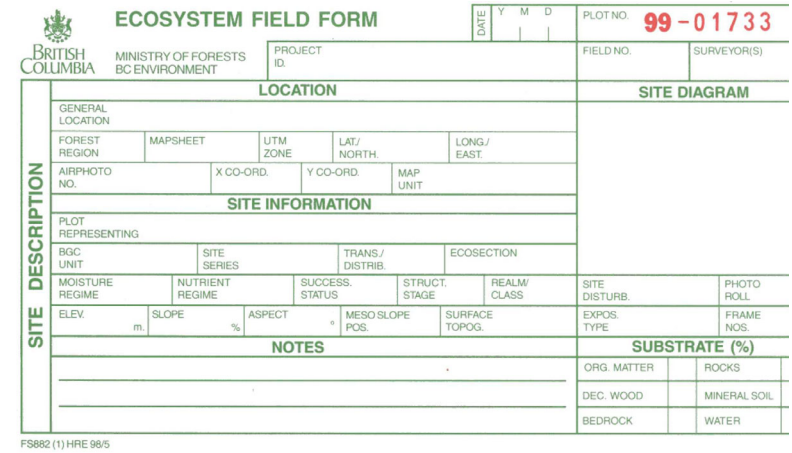
Appendix A: Field Plot Forms



ECOSYSTEM FIELD FORM

BRITISH COLUMBIA — MINISTRY OF FORESTS / BC ENVIRONMENT

DATE (Y M D) | PLOT NO. 99-01733 | PROJECT ID. | FIELD NO. | SURVEYOR(S)

SITE DESCRIPTION

LOCATION: GENERAL LOCATION; FOREST REGION; MAPSHEET; UTM ZONE; LAT./ NORTH.; LONG./ EAST.; AIRPHOTO NO.; X CO-ORD.; Y CO-ORD.; MAP UNIT

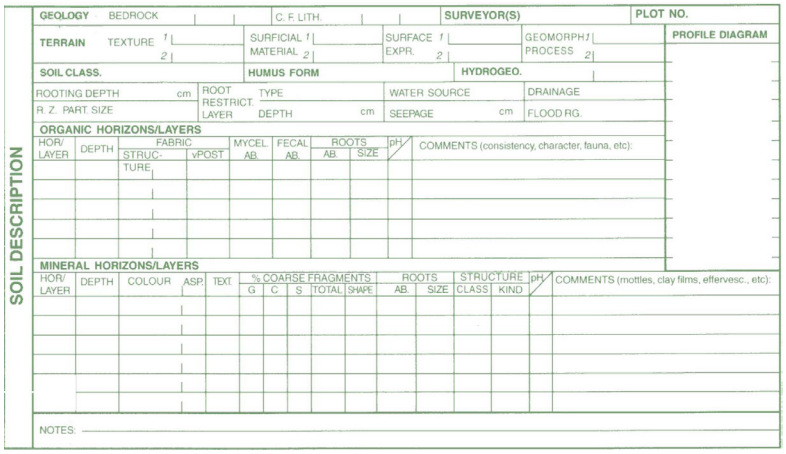
SITE INFORMATION: PLOT REPRESENTING; BGC UNIT; SITE SERIES; TRANS./ DISTRIB.; ECOSECTION; MOISTURE REGIME; NUTRIENT REGIME; SUCCESS. STATUS; STRUCT. STAGE; REALM/ CLASS; ELEV. m.; SLOPE %; ASPECT °; MESO SLOPE POS.; SURFACE TOPOG.

SITE DIAGRAM | SITE DISTURB. | PHOTO ROLL | EXPOS. TYPE | FRAME NOS.

NOTES

SUBSTRATE (%): ORG. MATTER; ROCKS; DEC. WOOD; MINERAL SOIL; BEDROCK; WATER

FS882 (1) HRE 98/5



SOIL DESCRIPTION

GEOLOGY: BEDROCK; C. F. LITH. | SURVEYOR(S) | PLOT NO.

TERRAIN: TEXTURE 1, 2; SURFICIAL MATERIAL 1, 2; SURFACE EXPR. 1, 2; GEOMORPH PROCESS 1, 2 | PROFILE DIAGRAM

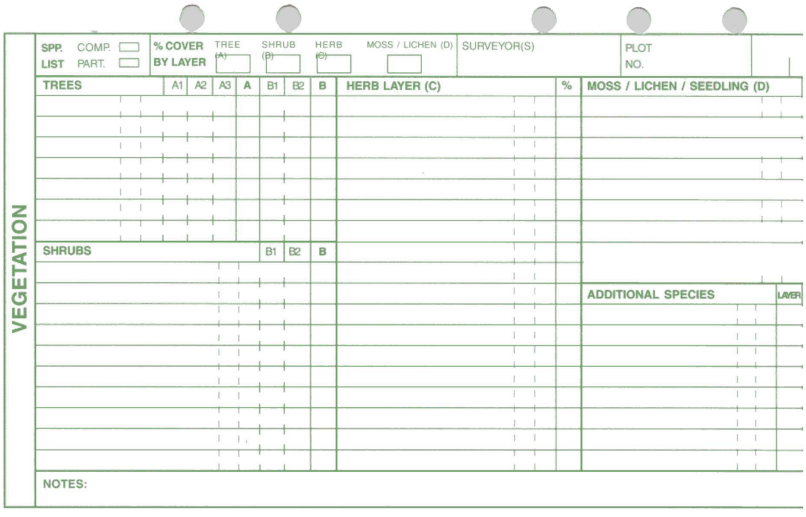
SOIL CLASS. | HUMUS FORM | HYDROGEO.

ROOTING DEPTH cm; R. Z. PART. SIZE; ROOT RESTRICT. LAYER; DEPTH cm; TYPE; WATER SOURCE; SEEPAGE cm; DRAINAGE; FLOOD FG.

ORGANIC HORIZONS/LAYERS: HOR/ LAYER; DEPTH; FABRIC: STRUCTURE, vPOST; MYCEL. AB.; FECAL AB.; ROOTS AB., SIZE; pH; COMMENTS (consistency, character, fauna, etc):

MINERAL HORIZONS/LAYERS: HOR/ LAYER; DEPTH; COLOUR; ASP.; TEXT.; % COARSE FRAGMENTS G, C, S, TOTAL, SHAPE; ROOTS AB., SIZE; STRUCTURE CLASS, KIND; pH; COMMENTS (mottles, clay films, effervesc., etc):

NOTES:



VEGETATION

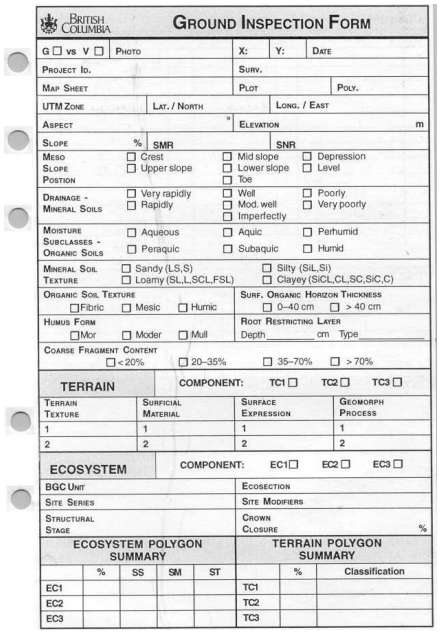
SPP. LIST: COMP., PART. | % COVER BY LAYER: TREE (A), SHRUB (B), HERB (C), MOSS / LICHEN (D) | SURVEYOR(S) | PLOT NO.

TREES: A1, A2, A3, A; B1, B2, B | HERB LAYER (C) | % | MOSS / LICHEN / SEEDLING (D)

SHRUBS: B1, B2, B

ADDITIONAL SPECIES | LAYER

NOTES:



BRITISH COLUMBIA

GROUND INSPECTION FORM

G ☐ vs V ☐	PHOTO	X:	Y:	DATE
PROJECT ID.		SURV.		
MAP SHEET		PLOT		POLY.
UTM ZONE	LAT. / NORTH	LONG. / EAST		
ASPECT °		ELEVATION m		
SLOPE %	SMR	SNR		

MESO SLOPE POSTION	☐ Crest	☐ Upper slope	☐ Mid slope	☐ Lower slope
	☐ Toe	☐ Depression	☐ Level	
DRAINAGE - MINERAL SOILS	☐ Very rapidly	☐ Rapidly	☐ Well	☐ Mod. well
	☐ Imperfectly	☐ Poorly	☐ Very poorly	
MOISTURE SUBCLASSES - ORGANIC SOILS	☐ Aqueous	☐ Aquic	☐ Perhumid	
	☐ Peraquic	☐ Subaquic	☐ Humid	
MINERAL SOIL TEXTURE	☐ Sandy (LS,S)	☐ Silty (SiL,Si)		
	☐ Loamy (SL,L,SCL,FSL)	☐ Clayey (SiCL,CL,SC,SiC,C)		

ORGANIC SOIL TEXTURE ☐ Fibric ☐ Mesic ☐ Humic	SURF. ORGANIC HORIZON THICKNESS ☐ 0–40 cm ☐ > 40 cm
HUMUS FORM ☐ Mor ☐ Moder ☐ Mull	ROOT RESTRICTING LAYER Depth_____ cm Type_____

COARSE FRAGMENT CONTENT ☐ < 20% ☐ 20–35% ☐ 35–70% ☐ > 70%

TERRAIN

COMPONENT: TC1 ☐ TC2 ☐ TC3 ☐

TERRAIN TEXTURE	SURFICIAL MATERIAL	SURFACE EXPRESSION	GEOMORPH PROCESS
1	1	1	1
2	2	2	2

ECOSYSTEM

COMPONENT: EC1 ☐ EC2 ☐ EC3 ☐

BGC UNIT	ECOSECTION
SITE SERIES	SITE MODIFIERS
STRUCTURAL STAGE	CROWN CLOSURE %

ECOSYSTEM POLYGON SUMMARY				
	%	SS	SM	ST
EC1				
EC2				
EC3				

TERRAIN POLYGON SUMMARY		
	%	Classification
TC1		
TC2		
TC3		

DOMINANT / INDICATOR PLANT SPECIES

TOTAL % A: B: C: D:

L.	SPECIES	%	L.	SPECIES	%	L.	SPECIES	%

COMPLETE ☐ PARTIAL ☐

Tree Mensuration

Spp.	DBH	Ht. Calculation to DBH						Ht. to DBH	Total HT	BH Age	Path Y/N
		Top	Bot	SD	SL	HD	HT				

NOTES (site diagram, exposure, gleying, etc.)

CONSERVATION EVALUATION & VISUAL INSPECTION FORM

PROJ. ID.	**SURV.**

POLY	**AIR PHOTO #**	**DATE**

ECOSYSTEM POLYGON SUMMARY						**TERRAIN POLYGON SUMMARY**		
	%	**SS**	**SM**	**ST**	**CC**		**%**	Classification
EC1						**TC1**		
EC2						**TC2**		
EC3						**TC3**		

PLOT #	**GR. PHOTO #.**	MAPSHEET
UTM ZONE	LAT./NORTH	LONG./EAST
ASPECT °	ELEVATION m	SLOPE %
MESO SLOPE	SOIL DRAINAGE	SOIL TEXTURE

ECOSYSTEM COMPONENT 1:	
TERRAIN COMPONENT 1	

DOMINANT / INDICATOR VEGETATION SPECIES

TOTAL	**A:**	**B:**	**C:**	**D:**

SPECIES	L	%	SPECIES	L	%	SPECIES	L	%

COMPLETE ❒ PARTIAL ❒

% Fragmentation (Plant Association)				
❑ UNFRAGMENTED (< 5% of polygon) ❑ PARTLY FRAGMENTED (5 - 25 % of polygon) ❑ HIGHLY FRAGMENTED (> 25% of polygon)				
SITE DISTURBANCE (e.g., L.c/F.l.b.b)				
ADJACENT LAND USE:				
KNOWN THREATS:				
OTHER FACTORS:				
EVALUATION SUMMARY:				
QUALITY	❑ EXCELLENT	❑ GOOD	❑ MARGINAL	❑ POOR
CONDITION	❑ EXCELLENT	❑ GOOD	❑ MARGINAL	❑ POOR
VIABILITY	❑ EXCELLENT	❑ GOOD	❑ MARGINAL	❑ POOR
DEFENSIBILITY	❑ EXCELLENT	❑ GOOD	❑ MARGINAL	❑ POOR
NOTES (site diagram, exposure, gleying, etc.)				

Appendix B: Vegetation Species List

Note: This is not a complete list of all plant species in the study area. It is a list of species that were encountered during field sampling and includes all species mentioned in this report.

*denotes introduced species. Please check the BC Conservation Data Centre web site for current provincial status of plant species (http://srmwww.gov.bc.ca/cdc/), and the COSEWIC web site (http://www.cosewic.gc.ca/) for national status of plant species. Although no rare plants were encountered during field sampling, the sampling methods did not include searches for rare plants and it is probable that many rare plants occur in the study area.

Common Name	Scientific Name
Alaska rein orchid	*Piperia unalascensis*
alfalfa*	*Medicago sativa*
alpine speedwell	*Veronica wormskjoldii*
alsike clover*	*Trifolium hybridum*
American speedwell	*Veronica beccabunga*
angelica	*Angelica* sp.
annual agoseris	*Agoseris heterophylla*
antelope-brush	*Purshia tridentata*
apple pelt	*Peltigera malacea*
arctic lupine	*Lupinus arcticus*
arrowleaf balsamroot	*Balsamorhiza sagittata*
aster	*Aster* sp.
awned haircap moss	*Polytrichum piliferum*
baldhip rose	*Rosa gymnocarpa*
balsam poplar	*Populus balsamifera*
Baltic rush	*Juncus balticus*
baneberry	*Actaea rubra*
Bebb's willow	*Salix bebbiana*
Bering chickweed	*Cerastium beeringianum*
birch-leaved spirea	*Spiraea betulifolia*
black elderberry	*Sambucus racemosa*
black gooseberry	*Ribes lacustre*
black huckleberry	*Vaccinium membranaceum*
black medic*	*Medicago lupulina*
bladderwort	*Utricularia* sp.
blue wildrye	*Elymus glaucus*
bluebunch wheatgrass	*Pseudoroegneria spicata*
bluejoint reedgrass	*Calamagrostis canadensis*
blunt-leaved sandwort	*Moehringia lateriflora*
brittle prickly-pear cactus	*Opuntia fragilis*
brown-eyed Susan	*Gaillardia aristata*
bull thistle*	*Cirsium vulgare*
bunchberry	*Cornus canadensis*
butterfly pelt	*Peltigera lepidophora*
California brome	*Bromus carinatus*

Common Name	Scientific Name
Canada thistle*	*Cirsium arvense*
Canada violet	*Viola canadensis*
cheatgrass*	*Bromus tectorum*
chocolate lily	*Fritillaria affinis*
choke cherry	*Prunus virginiana*
clad lichens	*Cladonia* sp.
cladonia lichen	*Cladonia gracilis*
clasping twistedstalk	*Streptopus amplexifolius*
claw-moss	*Hypnum* sp.
cleavers	*Galium aparine*
Columbia bower	*Clematis occidentalis*
Columbia brome	*Bromus vulgaris*
Columbia needlegrass	*Achnatherum nelsonii*
comandra	*Comandra umbellata*
common burdock*	*Arctium minus*
common cattail	*Typha latifolia*
common dandelion*	*Taraxacum officinale*
common duckweed	*Lemna minor*
common horsetail	*Equisetum arvense*
common hound's-tongue*	*Cynoglossum officinale*
common juniper	*Juniperus communis*
common mare's-tail	*Hippuris vulgaris*
common rabbit-brush	*Ericameria nauseosus*
common snowberry	*Symphoricarpos albus*
common spike-rush	*Eleocharis palustris*
common St. John's-wort*	*Hypericum perforatum*
common stork's-bill*	*Erodium cicutarium*
common timothy*	*Phleum pratense*
compact selaginella	*Selaginella densa*
corn gromwell*	*Lithospermum arvense*
cow-parsnip	*Heracleum maximum*
creamy peavine	*Lathyrus ochroleucus*
crested wheatgrass*	*Agropyron cristatum*
Dalmatian toadflax*	*Linaria genistifolia*
devil's club	*Oplopanax horridus*
diffuse fleabane	*Erigeron divergens*
diffuse knapweed*	*Centaurea diffusa*
dog pelt	*Peltigera canina*
Douglas' campion	*Silene douglasii*
Douglas maple	*Acer glabrum*
Douglas' water-hemlock	*Cicuta douglasii*
Douglas-fir	*Pseudotsuga menziesii*
early blue violet	*Viola adunca*
electrified cat's-tail moss	*Rhytidiadelphus triquetrus*
enchanter's-nightshade	*Circaea alpina*
European bittersweet*	*Solanum dulcamara*

Common Name	Scientific Name
false Solomon's-seal	*Maianthemum racemosum*
falsebox	*Paxistima myrsinites*
falseflax*	*Camelina sativa*
felt pelt	*Peltigera ponojensis*
felt pelt	*Peltigera rufescens*
fern-leaved desert-parsley	*Lomatium dissectum*
few-flowered shootingstar	*Dodecatheon pulchellum*
field filago*	*Filago arvensis*
field locoweed	*Oxytropis campestris*
field mint	*Mentha arvensis*
field pussytoes	*Antennaria neglecta*
fire-moss	*Ceratodon purpureus*
fireweed	*Epilobium angustifolium*
flixweed*	*Descurainia sophia*
floating-leaved pondweed	*Potamogeton natans*
foxtail barley	*Hordeum jubatum*
fragile fern	*Cystopteris fragilis*
freckle pelt	*Peltigera aphthosa*
glaucous bluegrass	*Poa glauca*
glow moss	*Aulacomnium palustre*
golden curl-moss	*Homalothecium aeneum*
golden-aster	*Heterotheca villosa*
great mullein*	*Verbascum thapsus*
greater bladderwort	*Utricularia macrorhiza*
green sorrel	*Rumex acetosa*
hairy vetch*	*Vicia villosa*
hard-stemmed bulrush	*Schoenoplectus acutus*
heart-leaved arnica	*Arnica cordifolia*
heron's-bill moss	*Dicranum sp.*
Himalayan blackberry	*Rubus discolor*
Holboell's rockcress	*Arabis holboellii*
Hooker's fairybells	*Prosartes hookeri*
hook-moss	*Drepanocladus sp.*
hybrid white spruce	*Picea engelmannii x glauca*
Idaho fescue	*Festuca idahoensis*
Japanese brome*	*Bromus japonicus*
junegrass	*Koeleria macrantha*
juniper haircap moss	*Polytrichum juniperinum*
Kentucky bluegrass*	*Poa pratensis*
kinnikinnick	*Arctostaphylos uva-ursi*
kneeling angelica	*Angelica genuflexa*
knotweed	*Polygonum douglasii*
lady fern	*Athyrium filix-femina*
large-fruited desert-parsley	*Lomatium macrocarpum*
large-leaved avens	*Geum macrophyllum*
lawn moss	*Brachythecium albicans*

Common Name	Scientific Name
leafy moss	*Mnium sp.*
leafy moss	*Plagiomnium sp.*
lemonweed	*Lithospermum ruderale*
lichen	*Fulgensia bracteata*
lichen	*Ochrolechia upsaliensis*
Lindley's aster	*Aster ciliolatus*
lipstick powderhorn	*Cladonia macilenta*
little buttercup	*Ranunculus uncinatus*
liverwort	*Riccia sp.*
lodgepole pine	*Pinus contorta*
Loesel's tumble-mustard*	*Sisymbrium loeselii*
long-leaved fleabane	*Erigeron corymbosus*
low pussytoes	*Antennaria dimorpha*
mannagrass	*Glyceria sp.*
marsh skullcap	*Scutellaria galericulata*
meadow birds-foot trefoil	*Lotus denticulatus*
meadow death-camas	*Zigadenus venenosus*
meadow saxifrage	*Saxifraga nidifica*
mealy pixie-cup	*Cladonia chlorophaea*
miner's funnel	*Cladonia cenotea*
miner's-lettuce	*Claytonia perfoliata*
mock-orange	*Philadelphus lewisii*
mountain alder	*Alnus incana*
mountain cliff fern	*Woodsia scopulina*
mountain lady's-slipper	*Cypripedium montanum*
mountain sweet-cicely	*Osmorhiza berteroi*
narrow-leaved collomia	*Collomia linearis*
needle-and-thread grass	*Hesperostipa comata*
Nootka rose	*Rosa nutkana*
northern bedstraw	*Galium boreale*
northern blackcurrant	*Ribes hudsonianum*
northern gentian	*Gentianella amarella*
northern mannagrass	*Glyceria borealis*
northern wormwood	*Artemisia campestris*
northwestern sedge	*Carex concinnoides*
Nuttall's pussytoes	*Antennaria parvifolia*
oak fern	*Gymnocarpium dryopteris*
oceanspray	*Holodiscus discolor*
one-leaved foamflower	*Tiarella trifoliata var. unifoliata*
one-sided wintergreen	*Orthilia secunda*
orange arnica	*Arnica fulgens*
orchard-grass*	*Dactylis glomerata*
Pacific willow	*Salix lucida*
pale alyssum*	*Alyssum alyssoides*
paper birch	*Betula papyrifera*
parsnip-flowered buckwheat	*Eriogonum heracleoides*

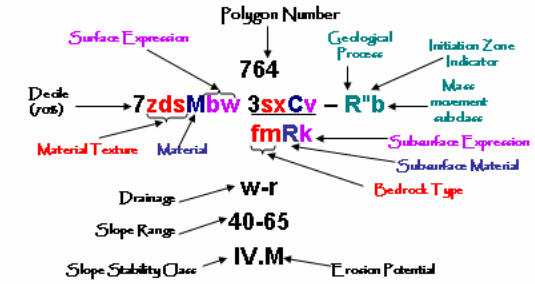
Common Name	Scientific Name
pasture sedge	*Carex petasata*
pathfinder	*Adenocaulon bicolor*
pearly everlasting	*Anaphalis margaritacea*
pebbled pixie-cup	*Cladonia pyxidata*
peg-leg soldiers	*Cladonia cariosa*
pelt lichens	*Peltigera sp.*
perennial sow-thistle*	*Sonchus arvensis*
Philadelphia fleabane	*Erigeron philadelphicus*
pinegrass	*Calamagrostis rubescens*
pink wintergreen	*Pyrola asarifolia*
plantain	*Plantago sp.*
poison ivy	*Toxicodendron rydbergii*
ponderosa pine	*Pinus ponderosa*
powdered trumpet	*Cladonia fimbriata*
prairie rose	*Rosa woodsii*
prairie sagewort	*Artemisia frigida*
prickly rose	*Rosa acicularis*
prince's pine	*Chimaphila umbellata*
purple sweet-cicely	*Osmorhiza purpurea*
purple-leaved willowherb	*Epilobium ciliatum*
quackgrass*	*Elymus repens*
queen's cup	*Clintonia uniflora*
ragged-moss	*Brachythecium sp.*
rattlesnake fern	*Botrychium virginianum*
rattlesnake-plantain	*Goodyera oblongifolia*
red raspberry	*Rubus idaeus*
red-osier dogwood	*Cornus stolonifera*
red-stemmed feathermoss	*Pleurozium schreberi*
reed canarygrass	*Phalaris arundinacea*
reed mannagrass	*Glyceria grandis*
Rocky Mountain juniper	*Juniperus scopulorum*
rose	*Rosa sp.*
Ross' sedge	*Carex rossii*
rough fescue	*Festuca campestris*
rough-fruited fairybells	*Prosartes trachycarpa*
rough-leaved ricegrass	*Oryzopsis asperifolia*
round-leaved alumroot	*Heuchera cylindrica*
sagebrush mariposa lily	*Calochortus macrocarpus*
salty-soil moss	*Pterygoneurum sp.*
Sandberg's bluegrass	*Poa secunda*
saskatoon	*Amelanchier alnifolia*
scarlet gilia	*Ipomopsis aggregata*
Scouler's hawkweed	*Hieracium scouleri*
scouring-rush	*Equisetum hyemale*
self-heal	*Prunella vulgaris*
sheep sorrel*	*Rumex acetosella*

Common Name	Scientific Name
shining starwort	*Stellaria nitens*
showy aster	*Aster conspicuus*
showy daisy	*Erigeron speciosus*
shrubby penstemon	*Penstemon fruticosus*
sidewalk moss	*Tortula ruralis*
silky lupine	*Lupinus sericeus*
silverleaf phacelia	*Phacelia hastata*
silver-moss	*Bryum argenteum*
silvery cinquefoil*	*Potentilla argentea*
Sitka columbine	*Aquilegia formosa*
six-weeks grass	*Vulpia octoflora*
skunk cabbage	*Lysichiton americanus*
slender hawksbeard	*Crepis atribarba*
small bedstraw	*Galium trifidum*
small-flowered blue-eyed Mary	*Collinsia parviflora*
small-flowered fringecup	*Lithophragma parviflorum*
small-flowered penstemon	*Penstemon procerus*
smooth brome*	*Bromus inermis*
smooth sumac	*Rhus glabra*
snowbrush	*Ceanothus velutinus*
soft brome*	*Bromus hordeaceus*
soft-leaved sedge	*Carex disperma*
soopolallie	*Shepherdia canadensis*
sow-thistle*	*Sonchus sp.*
spikelike goldenrod	*Solidago spathulata*
spotted knapweed*	*Centaurea biebersteinii*
spreading dogbane	*Apocynum androsaemifolium*
spring speedwell*	*Veronica verna*
star-flowered false Solomon's-seal	*Maianthemum stellatum*
step moss	*Hylocomium splendens*
sticky cinquefoil	*Potentilla glandulosa*
stinging nettle	*Urtica dioica*
stream violet	*Viola glabella*
sulphur cinquefoil*	*Potentilla recta*
swale desert-parsley	*Lomatium ambiguum*
sweet-scented bedstraw	*Galium triflorum*
tall annual willowherb	*Epilobium brachycarpum*
tall Oregon-grape	*Mahonia aquifolium*
tall tumble-mustard*	*Sisymbrium altissimum*
tarpaper lichens	*Collema sp.*
thatch soldiers	*Cladonia symphycarpia*
thimbleberry	*Rubus parviflorus*
Thompson's paintbrush	*Castilleja thompsonii*
thread-leaved fleabane	*Erigeron filifolius*
thread-leaved phacelia	*Phacelia linearis*
thread-moss	*Bryum sp.*

Common Name	Scientific Name
thyme-leaved sandwort	*Arenaria serpyllifolia*
timber milk-vetch	*Astragalus miser*
trembling aspen	*Populus tremuloides*
tufted thread-moss	*Bryum caespiticium*
twinflower	*Linnaea borealis*
umber pussytoes	*Antennaria umbrinella*
Utah honeysuckle	*Lonicera utahensis*
wall lettuce*	*Lactuca muralis*
water birch	*Betula occidentalis*
water smartweed	*Polygonum amphibium*
wavy-leaved thistle	*Cirsium undulatum*
western fescue	*Festuca occidentalis*
western groundsel	*Senecio integerrimus*
western larch	*Larix occidentalis*
western meadowrue	*Thalictrum occidentale*
western mountain-ash	*Sorbus scopulina*
western redcedar	*Thuja plicata*
western tansy mustard	*Descurainia pinnata*
Wheeler's bluegrass	*Poa wheeleri*
white clover*	*Trifolium repens*
white hawkweed	*Hieracium albiflorum*
white pussytoes	*Antennaria microphylla*
white sweet-clover*	*Melilotus alba*
white willow*	*Salix alba*
wild sarsaparilla	*Aralia nudicaulis*
wild strawberry	*Fragaria virginiana*
wood strawberry	*Fragaria vesca*
woolly sedge	*Carex lanuginosa*
worm-leaved stonecrop	*Sedum stenopetalum*
yarrow	*Achillea millefolium*
yellow monkey-flower	*Mimulus guttatus*
yellow pond-lily	*Nuphar lutea*
yellow salsify*	*Tragopogon dubius*
yellow sweet-clover*	*Melilotus officinalis*
yellow water-buttercup	*Ranunculus flabellaris*

Appendix C: Terrain Legend

Terrain Polygon Symbols



Note: one or more letters may be used to describe any characteristic other than surficial material, or letters may be omitted if information is lacking.

Composite Units: Two or three groups of letters are used to indicate that two or three kinds of terrain are present within a map unit.

e.g., 7Mv 3Rs indicates that the polygons contains approximately 70% "Mv" and 30%"Rs".
e.g., 6Mb 3Cv 1Rs indicates that the polygons contains approximately 60% "Mb" , 30%"Cv", and 10% “Rs”.

Stratigraphic Units: Groups of letters are arranged one above the other where one or more kinds of surficial material overlie a different material or bedrock: e.g., Mv indicates that "Mv" overlies "Rr".
Rr

Material	
Code	**Name**
A	Anthropogenic
C	Colluvium
C1	Slope wash
D	Weathered bedrock
E	Eolian
F	Fluvial materials
FA	"Active" fluvial materials
FG	Glaciofluvial materials
L	Lacustrine sediments
LG	Glaciolacustrine sediments
M	Till
O	Organic materials
R	Bedrock
U	Undifferentiated materials

Texture	
Code	**Name**
c	clay
z	silt
s	sand
p	pebbles
k	cobbles
b	boulders
a	blocks
d	mixed fragments
g	gravel
r	rubble
x	angular fragments
m	mud
y	shells
e	fibric
u	mesic
h	humic

Surface Expression	
Code	**Name**
a	moderate slope(s)
b	blanket (>1m thick)
c	cone
d	depression
f	fan
h	hummocky
j	gentle slope(s) (5-27%)
k	moderately steep slope (49-70%)
m	rolling topography
p	plain (0-5%)
r	ridges
s	steep slope(s) (>70%)
t	terrace(s)
u	undulating topography
v	veneer (≤1m thick)
w	mantle of variable thickness
x	thin veneer (10-25cm)

Detailed Descriptions of Surficial Materials

Anthropogenic Material (A)

Anthropogenic materials are deposits that are sufficiently reworked or redistributed by human activities that their original character is lost. Examples include gravel pits and fill used for roads and other construction.

Colluvium (C)

Colluvium accumulated during post-glacial times as a result of gravity-induced slope movement, for example, rock fall and soil creep. The physical characteristics of colluvium are closely related to its source and mode of accumulation. Four processes generally create colluvial deposits; (1) rockfall from bedrock bluffs, (2) soil creep in weathered bedrock, (3) mass movement processes in surficial materials (debris flows and debris slides), and (4) rockslides and rock slumps.

Rockfall from bedrock bluffs typically forms talus slopes (Ck). Talus is loosely packed rubble or blocks with little interstitial silt and sand near the surface, and is rapidly drained. Within the study area talus was scattered throughout flanking bedrock cliffs.

Colluvial veneers (Cv) and blankets (Cb) develop where weathered bedrock or surficial materials have been loosened and moved downslope by gravitational processes such as soil creep. It is loosely packed and usually rapidly drained. Colluvial veneers and very thin veneers were most common on upper, moderately steep and steep gradient slopes and as discontinous, very thin veneers on bedrock-controlled terrain in the watershed. The matrix texture of the colluvium reflects the bedrock or surficial materials it is derived from. Within the study area, colluvium typically had a silty sand texture and was rapidly drained.

Colluvial fans (Cf) and cones (Cc) form at the base of steep gullies due to deposition by debris flows (-Rd). These deposits are generally compact, and sorting may range from poorly sorted to well sorted. The deposit may or may not be matrix supported, and the matrix is usually sand. Colluvial cones and fans are common at the mouths of the large single gullies. Debris flow deposits (levees) were observed in the canyon sections of Vernon Creek and Clark Creek.

Deep-seated slumps in bedrock and surficial materials result in hummocky, irregular colluvial deposits (Chu). Rock slumps contain blocks and rubble with little or no interstitial silt and sand. Rotational slumps have developed in some portions of the plateau basalt cliffs due to failure along vertical joints and horizontal weak layers. A couple of large slumps are located in the basalt along the eastern edge of the study area. The extent of the deposits was difficult to map without more field checking. The large deposit located below Wrinkly Face Cliff occurred prior to the end of the last glaciation as the deposit and portions of the headscarp are covered by till. The peak of Spinekopje is a slump.

Slope Wash (C1)

Slope wash is a result of rainfall events in which non-channellized overland flow carries surface material from a steeper area to a gentler area down slope. The material is generally derived from eolian sediments. Slope wash generally does not travel far and comes to rest on gentler slopes of 0 to 15 %. In the study area, it was commonly found as a partial veneer overlying till, fluvial or lacustrine deposits. The typical texture was silty sand or sandy silt with generally less than 5 %

coarse fragments. It commonly included some imperfect drainage as it accumulates in receiving sites.

Weathered Bedrock (D)

Weathered bedrock has been modified *in situ* by mechanical and chemical weathering. In the study area, weathered bedrock was found as a discontinuous very thin veneer (Dx) overlying gently sloping or undulating bedrock outcrops. It typically contained a high proportion of angular coarse fragments with varying amounts of interstitial silty sand. It was non-cohesive and rapidly to very rapidly drained.

Eolian Sediments (E)

Eolian sediments were transported and deposited by wind. They typically occur as a thin cap (Ev) over other materials, but may locally thicken into a blanket or dunes. Eolian veneers were found on the gentler slopes on the eastern side (lee side) of the study area. These deposits typically consisted of silt and fine sand.

Fluvial Materials (F, F^A)

Fluvial materials were deposited in post-glacial time by streams. Fluvial materials consist of loosely packed, non-cohesive sands and silt with some gravel. In the study area, fluvial materials were present mainly as small portions of a polygon that include a stream. Fluvial materials were generally mapped as floodplains (Fp, F^Ap) or gentle fluvial areas (Fj) with imperfect to poor drainage. There was a large floodplain mapped in the valley bottom in Winfield across which flow Vernon and Winfield Creeks. Narrow floodplains were mapped along Clark and Vernon Creeks. Fluvial fans (Ff) were mapped at the mouths of larger creeks and gullies throughout the study area.

Glaciofluvial Materials (F^G)

Glaciofluvial materials were deposited by glacial meltwater streams at the end of the Fraser Glaciation. Sands and gravels accumulated along ice margins and on top of melting ice (FGu) and downstream of melting ice (FGf and FGp). In some areas, rivers were made and quickly abandoned depositing blankets of sands and gravels over top of till (FGb). In a few areas, postglacial streams have incised into outwash plains and fans transforming them into terraces (FGt) and creating erosional slopes (FGk). In general, glaciofluvial materials created well-drained and relatively dry sites due to the highly porous and permeable sands and gravels. The material is non-cohesive and therefore erodible, and will tend to ravel when exposed on steep slopes and road cuts. Glaciofluvial sands and gravels are potential sources of aggregate.

In the study area, glaciofluvial materials consisted of gravely sands with minor amounts of silt. These deposits ranged from well stratified to unstratified and well-sorted to moderately-sorted. Large deposits of glaciofluvial sediments were located at the mouths of the larger meltwater channels and gullies, for example, at the mouth of Cougar Canyon, in the Coral Beach and Commonage road area, on the west side and east side of Oyama, the vicinity of Pollard's Pond, along Okanagan Centre Road West in the south, and on either side of Vernon Creek upslope from its large fan. There were large glaciofluvial deposits and some eskers located on either side of the Vernon Creek canyon

Lacustrine (L)

Lacustrine materials were deposited from standing bodies of water. Fine sand, silt, or clay that have been suspended in the water settle to the lake bed creating sediments that are commonly stratified and fine textured. These sediments may be exposed when the lake is drained. In the study area, lacustrine materials occurred in shallow ponds that were periodically inundated (szLp and szLv). Sediments were also deposited at the margins lakes by wave action, such as on the beaches of Okanagan, Wood and Kalamalka Lakes. These materials generally consisted of sand and gravel.

Glaciolacustrine (L^G)

Glaciolacustrine materials were deposited from glacial or ice-dammed lakes that were present during and shortly after glaciation. Glaciolacustrine materials generally consist of well to moderately well stratified fine sand, silt, or clay with occasional lenses of till or glaciofluvial material.

Glaciolacustrine materials are generally only slowly permeable, and so the presence of even a thin layer of this material is sufficient to cause impeded drainage, perched water tables, and surface seepage. These conditions may promote instability in some situations. These fine-textured materials are also susceptible to surface erosion by running water.

In the study area, glaciolacustrine materials resulting from glacial Lake Penticton were found on the gentler slopes adjacent to Okanagan, Wood, and Kalamalka Lakes. At about 1100m, south of Vernon Creek, there was a large area covered by glaciolacustrine sediments. These were likely deposited when stagnating ice in the main valley bottom dammed Vernon Creek, temporarily forming a lake.

Till (M)

Till was deposited directly by glacier ice and was the most common surficial material within the study area. The deposits typically consist of poorly sorted silt, sand and gravels. In general, till on slopes is well drained and moderately-well drained, and imperfectly drained in depressions.

Thick till deposits were found in the Woodsdale area and on the upper edges of the sloping benches. On the mid to upper slopes, discontinuous veneers and blankets of till covered much of the gentle to moderately steep slopes. Patches of very thin veneers of till covered areas of undulating bedrock.

Throughout the study area, the typical till was a noncohesive, silty sandy basal till (terrain texture label "zds" or "dzs"). A finer textured basal till (terrain texture label "smd") was observed in some soil pits and road cuts and appeared to be associated with the presence of basalt in the local area. The matrix texture was chiefly silt and contains some sand and trace amounts of clay, the till contained a coarse fraction typically between 30 to 40 %. These soils were generally found on the upper slopes along the eastern edge of the study area.

Organics (O)

Organic materials form where decaying plant material accumulates in poorly or very poorly drained areas. In the study area, organic materials were uncommon, but may occur as veneers (Ov) or very thin veneers (Ox) in some of the wetlands.

Bedrock (R)

Bedrock was mapped where it outcrops at the surface. Polygons mapped with thin or very thin material (Cv, Dx, Mv, Mx), may also have a small proportion of bedrock outcrops. Bedrock outcrops were scattered throughout the study area.

Undifferentiated Material (U)

This material type is used to describe material that is too complex to be represented by the usual terrain symbols. Undifferentiated material is a layered sequence of surficial materials that have been exposed on an erosional slope. There is usually a sequence of three or more layers.

In the study area, undifferentiated material were mapped in the Okanagan Centre area (between Tyndall Road and Okanagan Centre Road West) and in the canyon portions of Vernon and Clark Creeks. The Okanagan Centre area consists of several tens of metres of complex sequences of surficial materials, much of which pre-date the most recent glaciation. Fulton [58] has identified several distinct layers of sand and gravel, till, and laminated silt layers. The canyons in Clark and Vernon Creeks consisted of various layers of till, glaciolacustrine and glaciofluvial sediments.

Geological Processes	
Code	**Name**
-E	Glacial meltwater channels
-F	Slow mass movement (failing, slumps)
-F"	Slow mass movement initiation zone
-Fk	tension cracks
-Fm	slump in bedrock
-Fu	Slump in surficial material
-H	Kettled
-L	Surface seepage
-R	Rapid mass movement (slides and falls)
-R"	Rapid mass movement initiation zone
-Rb	Rockfall
-Rd	Debris flow
-Rs	Debris slide
-Ru	Slump in surficial materials
-V	Gully Erosion

Drainage	
Code	**Name**
x	very rapidly drained
r	rapidly drained
w	well drained
m	moderately well drained
i	imperfectly drained
p	poorly drained
v	very poorly drained

Where two drainage classes are shown:

- if the symbols are separated by a comma, e.g., “w,i”, then no intermediate classes are present;
- if the symbols are separated by a dash, e.g., "w-i", then all intermediate classes are present.

Description of Geological Processes

Channeled by Meltwater (-E, -EV)

Meltwater channels form alongside, beneath, or in front of a glacier or ice sheet. Glacial meltwater channels are typically sinuous in plan, flat-floored, and steep-sided in cross-section. The floors of the meltwater channel may contain glaciofluvial sediments, indicative of the water flow that once took place here.

[58] Fulton 1975

Many meltwater channels were located within the study area and ranged from large to small and incised through bedrock to incised through surficial materials. The largest and most prominent meltwater channel in the study area was Cougar Canyon located near Oyama. There were several small meltwater channels incised in till in the grasslands above Woodsdale. Many more of these landforms were scattered throughout the study area.

Slow Mass Movement (-F, -F"k, -F"m, -F"u)

Slow mass movement refers to slope failures where movement occurs slowly or where the displaced material moves only a short distance downslope. The double prime symbol (") indicates the initiation zone of slow mass movement. Tension cracks are indicated by the subclass "k" (-Fk). Failures occurring in bedrock are indicated by the subclass "m" (e.g. –Fm). Failures occurring in thick surficial materials are indicated by the subclass 'u' (e.g. -Fu).

Tension cracks (-Fk) are open fissures commonly located near ridge tops. They indicate slow slope spreading, and may be the precursor to catastrophic slope failure. Tension cracks were mapped along the eastern edge of the study area near cliff faces in the Thompson Plateau basalt.

A slump in bedrock (-Fm) refers to a rotational slump where portions of the slide mass remains internally cohesive. Rotational slumps develop due to failure along vertical joints and horizontal weak layers. In the study area, slumps were present along bluffs in the Thompson Plateau basalt. There were smaller rotational slumps that have occurred since the last glaciation. These deposits were at a gentler slope than the angle of repose and the planimetric width of the deposits were much wider than the bluff they originated from. There were a couple of larger slumps (i.e., at the base of Wrinkly Face Cliff) located in the Thompson Plateau basalt on the eastern edge of the study area. A portion of the Wrinkly Face Cliff slide was observed in the field, but the large slide located further north was not. Evans (1983) has classifies these types of slides as a complex block movements. His interpretation is that movement has occurred along a plane of weak sediments (weak pyroclastic rocks, or tuffaceous or poorly lithified sediments) located at depth. It is assumed that the slide occurred prior to or during the Fraser Glaciation as the headscarp and deposit is largely covered by till. Secondary flow in portions of the slide mass is common in these types of large slide deposits, although no recent movement was observed in the field. The extents of these deposits were difficult to determine by air photo interpretation.

Slumps in surficial materials (-Fu) consist of deep-seated, rotational failures along a zone of weakness within thick deposits. Slumping in fine-grained sediments, such as, glaciolacustrine materials are common. There was a slump in glaciolacustrine sediments in the escarpment above Pixie Beach on Pixton Road. This polygon was designated as terrain stability class **V** and erosion potential **VH** (very high).

Kettled (-H)

Kettled topography consists of hummocky undulating terrain, which developed when blocks of glacial ice buried by or surrounded by glaciofluvial gravels and ablation till melted. Kettled kame deposits were mapped along the Commonage Road in the north edge of the study area and along Okanagan Centre Road West between Glenmore Road and Tyndall Road.

Surface Seepage (-L)

Seepage is mapped where relatively wet soils are widespread in a polygon. This commonly occurs where soils are on slowly permeable materials such as till, where thin surficial materials overlie bedrock, and on lower slopes where shallow subsurface water is received from a relatively large catchment area further upslope. They may also occur where groundwater is concentrated at the surface by a physical conduit such as a geological fault. In the study area, areas of abundant surface seepage were uncommon and generally spread throughout the study area. However, there was abundant seepage throughout the Wrinkly Face Cliff landslide deposit.

Rapid Mass Movement (-R, -R"b, -R"d, -R"s, -R"u)

Rapid mass movement refers to downslope movement by falling, rolling or sliding of debris derived from surficial material or bedrock. Where a double prime symbol (**"**) is used with a mass movement process (e.g., -R"s), slope failure has initiated within the polygon. Mass movement symbols without the double prime symbol (e.g., **-**Rb) indicate a polygon that contains the transport or deposition zone of rapid mass movement. Transportation zones are generally not recognized as areas where landslides initiate; they may contribute additional volume of transported material to a failure. Transport and deposition zones represent hazardous areas downslope of slides or rockfall.

Rockfall (-Rb, -R"b) occurs when either a single block or a mass of bedrock falls, bounces and rolls downslope. In the study area, rockfall from local outcrops created talus slopes, colluvial veneers and blankets. Polygons with rockfall were scattered throughout the study area in association with local bedrock outcrops or cliffs.

Debris flows (-Rd) initiate in steep gullies and debris slides (-Rd) initiate on steep hillsides. They occur when a mass of surficial material slides rapidly downslope often as a result of the loss of soil strength due to high pore water pressure. Debris slides (non-channelized movement of debris) and debris flows (channelized movement of debris) are initiated on steep slopes where material slides along a shear plane. The shear plane often coincides with the boundary between more permeable and less permeable material (e.g., between weathered and unweathered material or between surficial material and bedrock). Debris flows and debris slides are triggered by heavy rain, water from snow melt, or rain on snow events, and result from loss of soil strength due to high pore water pressure. During wet conditions, slides are also triggered by wind stress on trees, tree throw, impact of falling rocks from up slope, and vibrations due to earthquakes or human activity. In logged areas, debris slides that occur several years after logging can be due to the loss of soil strength that results from root decay. Diverted drainage from roads commonly triggers failure of sidecast material and may initiate landslides some distance downslope. A debris flow may move downslope for several hundred metres or more before it is arrested by gentler terrain or by de-watering, or it may enter a trunk stream. Debris flows are effective agents of erosion, commonly increasing the volume of material as it progresses downslope. Debris slides and debris flows are significant potential sources of stream sediment and a hazard to activities or structures (roads, culverts) located in runout zones.

In the study area, most of the debris slides and flows were mapped in the canyon portions of Clark and Vernon Creeks. In the large gullies incised through the thick sequence of surficial materials in the Okanagan Centre area (below Tyndall Road), there was no recent evidence of debris slides. The presence of colluvial fans and cones at the mouths of these gullies indicated post-glacial mass movement.

Gully Erosion (-V)

Gullies are small ravines with V-shaped cross sections that can form in either glacial drift or bedrock. Gully erosion is mapped in two kinds of terrain: (i) slopes with several parallel shallow gullies in drift materials (dissected slope) and (ii) single gullies where streams have exploited joints in bedrock or have cut down into thick drift. Gullied terrain is an indicator of either former or active erosion, and the symbol serves to identify material that is potentially subject to erosion or mass movement (e.g., Uk-V). Gully sideslopes and steep headwalls are common sites of slope failures and are classed as potential unstable (Class IV) where there is no evidence of instability and unstable (Class V) where there is evidence of instability. In the study area, gully erosion was mapped in polygons scattered throughout the study area.

Slope Range
Slopes are given in percentages as a range. For example, '20-45' indicates that the majority of the slopes in the polygon are between 20% and 45%.

Terrain stability Classes[59]	
Class	**Interpretation**
I	• No significant stability problems exist.
II	• There is a low likelihood of landslides following disturbance or development. • Minor slumping is expected along road cuts and excavations.
III	• Stability problems can develop. • Follow BMP to reduce the likelihood of causing slope failure. • Minor slumping is expected along road cuts and excavations. There is a low likelihood of landslide initiation following road construction. • On-site inspection required by geotechnical staff.
IV	• Expected to contain areas with a moderate likelihood of landslide initiation following development, disturbance or road construction. • These areas should be avoided. Use caution when planning intensive land use above or below these areas. • On-site inspection required by geotechnical staff
V	• Expected to contain areas with a high likelihood of landslide initiation. Signs of existing instability present. • Avoid these areas. Do not plan intensive land use above or below these areas. • On-site inspection required by geotechnical staff

Erosion Potential Classes[60]		
Class	**Rating**	**Management Implications**
VL	Very low	• Negligible or very minor soil erosion.
L	Low	• Expect minor erosion of fines in ditch lines and disturbed soils.
M	Moderate	• Expect moderate erosion when water is channelled down road surfaces or ditches and over exposed soils.
H	High	• Significant erosion problems can be created when water is channelled onto or over exposed soil on these sites.
VH	Very high	• Severe surface and gully erosion problems can be created when water is channelled onto or over exposed soils at these sites.

[59] Adapted from Ministry of Forests 1999
[60] Adapted from Ministry of Forests 1999

Appendix D: Expanded Legend

LAKE COUNTRY EXPANDED LEGEND – IDFmw1

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
CD	**Black Cottonwood –Common Snowberry – Red-osier Dogwood Riparian**	**IDFmw1**	**00**

Typic unit occurs on level or very gently sloping sites with deep, medium textured soils (d, j and m are assumed modifiers).

This forest ecosystem is rare but was found along major creeks including Vernon Creek. Forests are often mixed black cottonwood with some western redcedar. The understory is typically rich and shrubby, often dominated by mountain alder. Forbs are sparse to moderately abundant and include lady fern, common horsetail, and scattered other species.

List of mapped units:

CDn fan

SITE INFORMATION

Common Terrain Types:

- colluvial slopewash , lacustrine, and fluvial

Slope position:	lower and toe
Slope (%):	0-5
Aspect:	none
Soil Moisture Regime:	hygric
Soil Nutrient Regime:	rich

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
CD	Black cottonwood –Common Snowberry – Red-osier Dogwood Riparian	IDFmw1	00

	Structural Stage	3	4	5	6	7	
Trees	*Populus balsamifera* ssp. *trichocarpa*	**	***	***	***	***	black cottonwood
	Thuja plicata			*	**	**	western redcedar
Shrubs	*Alnus incana*	***	**	***	***	***	mountain alder
	Oplopanax horridus	*	**	***	***	***	devil's club
	Ribes lacustre	**	*	**	**	***	black gooseberry
	Cornus stolonifera	***	**	**	**	**	red-osier dogwood
Herbs	*Equisetum arvense*	**	*	*	*	**	common horsetail
	Athyrium filix-femina	**	*	**	***	***	lady fern
Mosses	*Plagiomnium* or *Mnium* spp.	**	*	**	**	**	leafy mosses
PLOTS						LCG003	

Highlighted species – indicate important forage plants for ungulates
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
CT	**Cattail Marsh**	**IDFmw1**	**00**

Typic unit occurs on level sites with deep, medium-textured soils (assumed modifiers are d, j, m).

This unit is equivalent to the *Cattail marsh* association in the provincial classification (MacKenzie and Shaw 2000).

This marsh wetland ecosystem occurs as a fringe on pond edges or in depressions, often adjacent to shallow open water (OW). This unit is rare in the study area. Water depths are typically up to 1 m in spring but draw down to the soil surface by late summer; soils remain saturated for most of the season. Some wetlands convert to cattail marshes when they are subject to nutrient loading. These sites are dominated by cattails with few other species. Soils are typically mineral, but may have a thin organic veneer on top.

List of mapped units:

CTp peaty materials, 40+cm of organic material overlaying mineral deposits

SITE INFORMATION

Common Terrain Types:

- thin organic veneer over lacustrine materials

Slope position:	depression
Slope (%):	0
Aspect:	none
Soil Moisture Regime:	subhydric
Soil Nutrient Regime:	rich

	Structural Stage	**2a**	
Herbs	*Typha latifolia*	****	common cattail
	Lemna minor	**	common duckweed
Mosses	*Bryum* sp.	**	thread moss
PLOTS		LCG028	

* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
DF	**Douglas-fir/Western Redcedar – Falsebox – Prince's pine**	**IDFmw1**	**01**

Typic unit occurs on gentle slopes with deep, medium textured soils (d, j and m are assumed modifiers).

This forest ecosystem is commonly associated with mesic gently sloping sites. Mature forests have an overstory dominated by western redcedar with a sparse understory.

List of mapped units:

DFc	coarse-textured soils (glaciofluvial)	DFf	fine-textured soils (glaciolacustrine)
DFk	cool aspect, slope >25%	DFks	cool aspect, slope >25%, shallow soils (50-100cm)
DFs	shallow soils (50-100cm)	DFw	warm aspect (often SE or NW), slope >25%

SITE INFORMATION

Common Terrain Types:

- deep morainal, glaciofluvial, and glaciolacustrine materials on level and gentle slopes
- moderate to steep cool aspect morainal and colluvial slopes

Slope position:	lower to middle
Slope (%):	0-30; steeper on cool aspects
Aspect:	all
Soil Moisture Regime:	mesic – submesic
Soil Nutrient Regime:	medium

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
DF	Douglas-fir/Western Redcedar – Falsebox – Prince's pine	IDFmw1	01

	Structural Stage	3	4	5	6	7	
Trees	*Thuja plicata*	***	***	***	****	****	western redcedar
	Pinus contorta	***	***	**	*		lodgepole pine
Shrubs	*Paxi myr*	**	*	**	***	***	
Grasses	*Calamagrostis rubescens*	**	*	**	**	**	pinegrass
Herbs	*Epilobium angustifolium*	****	*				fireweed
	Linnaea borealis	*	*	**	**	**	twinflower
	Clintonia uniflora	*	*	**	**	**	queen's cup
Mosses and Lichens	*Pleurozium shreberi*		*	**	***	***	red-stemmed feathermoss
	Brachythecium sp.	**	*	*	*	*	
	Peltigera spp.	*	*	**	**	**	pelt lichens
PLOTS		LCG0047 LCV054		LCG002			

Highlighted species – indicate important forage plants for ungulates
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
DP	**Douglas-fir – Pinegrass – Feathermoss**	**IDFmw1**	**04**

Typic unit occurs on gentle slopes with deep, medium textured soils (d, j and m are assumed modifiers).

This forest ecosystem is common on warm aspects. The overstory is dominated by Douglas-fir and the understory is dominated by pinegrass with showy aster, snowberry and other scattered shrubs and forbs.

List of mapped units:

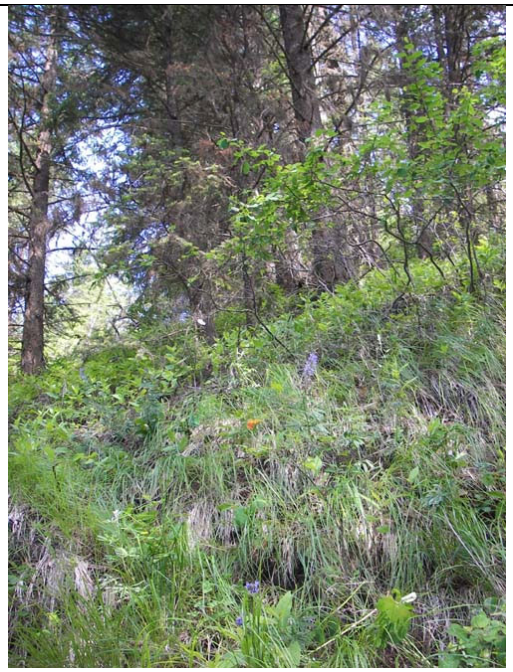
DPcw	coarse-textured soils (generally glaciofluvial); warm aspect, slope >25%	DPks	cool aspect (NNW or ESE), slope >25%, shallow soils (50-100cm)
DPs	shallow soils (50-100cm)	DPsw	shallow soils (50-100cm); warm aspect, slope >25%
DPw	warm aspect, slope >25%		

SITE INFORMATION

Common Terrain Types:

- deep morainal or glaciolacustrine materials on moderate to steep warm aspect slopes

Slope position:	middle and upper
Slope (%):	35 – 85
Aspect:	southeast to west
Soil Moisture Regime:	subxeric to submesic
Soil Nutrient Regime:	poor to medium



Site Unit Symbol	Site Unit Name	BGC	Site Series Number
DP	Douglas-fir – Pinegrass – Feathermoss	IDFmw1	04

	Structural Stage	3	4	5	6	7	
Trees	*Pseudotsuga menziesii* var. *glauca*	**	****	***	***	***	Douglas-fir
Shrubs	*Symphoricarpos albus*	****	*	**	**	**	common snowberry
	Spirea betulifolia	**	*	**	**	**	birch-leaved spirea
	Mahonia aquifolium	**	*	*	*	*	tall oregon-grape
Grasses	*Calamagrostis rubescens*	***	**	****	****	****	pinegrass
Herbs	*Aster conspicuus*	***	**	***	***	***	showy aster
	Lupinus sericeus	***	**	***	***	***	silky lupine
Mosses and Lichens	*Brachythecium albicans*	*	*	*	**	**	lawn moss
	Peltigera spp.	*		*	*	**	dog pelt
	Dicranum sp.	*	*	*	*	*	heron's bill moss
PLOTS				LCV089			

Highlighted species – indicate important forage plants for ungulates
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
DS	**Douglas-fir/Ponderosa pine – Snowberry – Bluebunch wheatgrass**	**IDFmw1**	**02**

Typic unit occurs on gentle slopes with deep, medium textured soils on ridges or crests (d, j, m and r are assumed modifiers).

This forest ecosystem occurs on very dry sites, often with some exposed bedrock.

List of mapped units:

DSv	very shallow soils (<20cm deep)	DSvw	very shallow soils (<20cm deep), warm aspect

SITE INFORMATION

Common Terrain Types:

- shallow till and colluvial slopes, rock

Slope position:	upper, crest
Slope (%):	0 – 60
Aspect:	none or warm
Soil Moisture Regime:	xeric
Soil Nutrient Regime:	poor to medium

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
DS	Douglas-fir/Ponderosa pine – Snowberry – Bluebunch wheatgrass	IDFmw1	02

	Structural Stage	3	4	5	6	7	
Trees	*Pseudotsuga menziesii* var. *glauca*	**	****	****	***	***	Douglas-fir
Shrubs	*Amelanchier alnifolia*	*	*	*	**	**	tall oregon-grape
Grasses	*Pseudoroegneria spicata*	**		*	*	**	bluebunch wheatgrass
Herbs	*Balsamorhiza sagittata*	**	**	***	***	***	arrow-leaved balsamroot
	Lupinus sericeus	***	**	***	***	***	silky lupine
	Achillea millefolium	**	*	**	**	**	yarrow

Highlighted species – indicate important forage plants for ungulates
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
ES	Exposed Soil	IDFmw1	N/A
These are areas of exposed soils and typically include recent disturbances such as soil erosion.			
List of mapped units:			
ESw warm aspect; slope >25%			

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
OW	Shallow Open Water	IDFmw1	N/A
These are areas of permanent open water that are less than 2m deep. There is less than 10% emergent vegetation but floating aquatics such as bladderwort are often present. Shallow open water commonly occurs in association with marsh ecosystems.			

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
PP	**Douglas-fir – Penstemon – Pinegrass**	**IDFmw1**	**03**

Typic unit occurs on significant warm slopes with deep, medium textured soils (d, m, and w are assumed modifiers).

This forest ecosystem is characterized by an open Douglas-fir canopy with a mixed pinegrass – shrub – forb understory.

List of mapped units:

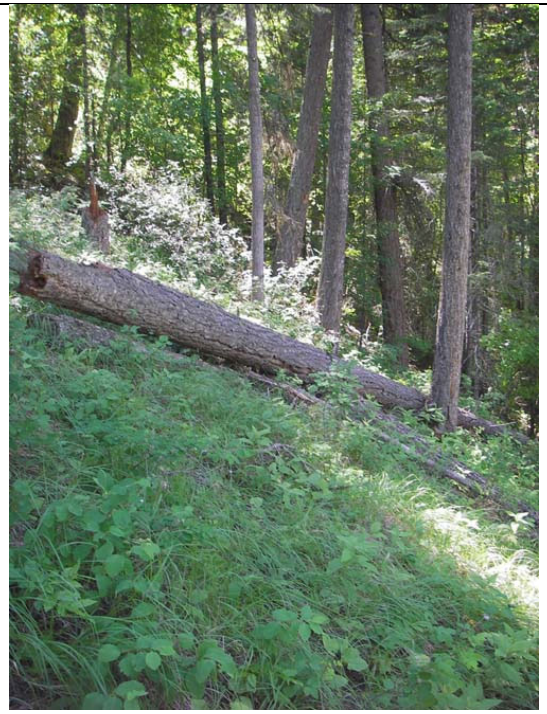
PPs shallow soils (50-100cm deep)

SITE INFORMATION

Common Terrain Types:

- moderate to steeply slope till and colluvium

Slope position:	middle and upper
Slope (%):	50-70
Aspect:	south – west
Soil Moisture Regime:	submesic – subxeric
Soil Nutrient Regime:	medium, poor



Site Unit Symbol	Site Unit Name	BGC	Site Series Number
PP	Douglas-fir – Penstemon – Pinegrass	IDFmw1	03

	Structural Stage	3	4	5	6	7	
Trees	*Pseudotsuga menziesii* var. *glauca*	**	**	****	***	***	Douglas-fir
	Pinus contorta	**	***	***	**	*	lodgepole pine
Shrubs	*Spirea betulifolia*	***	*	***	***	***	birch-leaved spirea
	Symphoricarpos albus	**	*	**	**	**	common snowberry
Grasses	*Calamagrostis rubescens*	***	**	****	****	****	pinegrass
Herbs	*Aster conspicuus*	***	**	***	***	***	showy aster
	Arnica cordifolia	***	**	***	***	***	heart-leaved arnica
Mosses and Lichens	*Brachythecium albicans*	*	*	*	**	**	lawn moss
	Peltigera spp.	*		*	*	**	dog pelt
	Dicranum sp.	*	*	*	*	*	heron's bill moss
PLOTS					LCG006		

Highlighted species – indicate important forage plants for ungulates
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
RD	**Western redcedar – Devil's club – Foamflower**	**IDFmw1**	**06**

Typic unit occurs on gentle toe slopes or depressions with seepage and deep, medium textured soils (d, j and m are assumed modifiers).

This forest ecosystem occurs on moist sites with seepage. Mature forests are dominated by western redcedar and hybrid white spruce with an understory characterized by Devil's club and rich forbs. Seral forest are often deciduous and are dominated by paper birch and trembling aspen.

List of mapped units:

RDg	gully	RDgw	gully, warm aspect, slope >25%
RDt	fluvial terrace; adjacent to creek		

SITE INFORMATION

Common Terrain Types:

- Fluvial and slopewash colluvial materials on gentle toe slopes

Slope position:	toe
Slope (%):	0 – 10
Aspect:	none
Soil Moisture Regime:	hygric (subhygric)
Soil Nutrient Regime:	rich

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
RD	Western redcedar – Devil's club – Foamflower	IDFmw1	06

	Structural Stage	3	4	5	6	7	
Trees	*Thuja plicata*	**	****	****	***	***	western redcedar
	Picea engelmannii x glauca	**	***	***	**	**	hybrid white spruce
	Betula papyrifera						paper birch
	Populus tremuloides						trembling aspen
Shrubs	*Oplopanax horridus*		*	**	***	***	Devil's club
	Symphoricarpos albus	***	*	**	**	**	common snowberry
	Cornus stolonifera	**	*	**	**	**	tall oregon-grape
Herbs	*Aralia nudicaulus*	**	*	*	*	**	wild sarsaparilla
	Equisetum arvense	**	*	*	*	*	common horsetail
Mosses	*Mnium* or *Plagiomnium* spp.			*	**	**	leafy mosses
	Brachythecium sp.	*	*	*	**	**	
PLOTS			LCG032		LCG005		

Highlighted species – indicate important forage plants for ungulates
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
RR	**Western redcedar/Douglas-fir – Dogwood**	**IDFmw1**	**05**

Typic unit occurs on gentle to level lower slopes, receiving sites with deep, medium textured soils (d, j and m are assumed modifiers).

This moist forest ecosystem is found on receiving sites and sometimes adjacent to small creeks. It has a rich understory characterized by abundant thimbleberry.

List of mapped units:

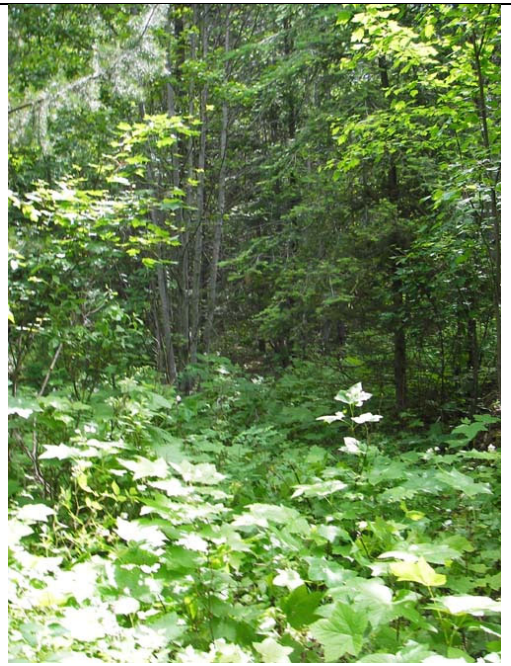
RRg	gully	RRgk	gully, cool aspect, slope >25%
RRgw	gully, warm aspect, slope >25%	RRw	warm aspect, slope >25%

SITE INFORMATION

Common Terrain Types:

- slopewash fluvial and till

Slope position:	toe (middle)
Slope (%):	0 – 20
Aspect:	none, all
Soil Moisture Regime:	subhygric (hygric)
Soil Nutrient Regime:	rich



Site Unit Symbol	Site Unit Name	BGC	Site Series Number
RR	Western redcedar/Douglas-fir – Dogwood	IDFmw1	05

	Structural Stage	3	4	5	6	7	
Trees	*Pseudotsuga menziesii* var. *glauca*	**	****	****	***	***	Douglas-fir
	Thuja plicata	**	***	***	**	**	Western redcedar
	Betula papyrifera	**	***	**	*	*	paper birch
Shrubs	*Rubus parviflorus*	****	***	****	*****	*****	thimbleberry
	Acer glabrum	**	*	**	**	**	Douglas maple
	Symphoricarpos albus	***	*	**	***	***	common snowberry
Herbs	*Osmorhiza berteroi*	**	*	**	**	**	mountain sweet-cicely
	Linnea borealis	**	*	**	**	**	twinflower
	Arnica cordifolia	***		**	**	**	heart-leaved arnica
Mosses	*Mnium* or *Plagiomnium* spp.	*	*	*	**	**	leafy mosses
	Brachythecium sp.	*	*	*	**	**	
PLOTS			LCG031	LCG009			

Highlighted species – indicate important forage plants for ungulates
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
RZ	Road Surface	IDFmw1	N/A
A gravel or paved road used for vehicular travel.			

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
SO	**Saskatoon – Mock orange Talus**	**IDFmw1**	**00**

Typic unit occurs on both warm and cool steep slopes with deep, coarse textured soils (blocky) (c and d are assumed modifiers).

This ecosystem is commonly associated with steep, blocky talus slopes with minimal soil in pockets between blocks. This is an uncommon unit in the study area. Scattered trees (Douglas-fir or aspen) and scattered shrubs (snowberry, saskatoon) grow in soil pockets between blocks. Often cliff ferns (a very characteristic species) and scattered grasses are found growing in soil pockets. Vegetation cover is generally higher on sites with smaller blocks and more soil. Cool aspects more commonly have trees on them. Sites that are dominated by shrubs will not necessarily develop into a forested structural stage.

List of mapped units:

SOw warm aspect; slope >25%

SITE INFORMATION	
Common Terrain Types: • rubbly colluvial slopes	
Slope position:	lower to upper
Slope (%):	60 – 70%
Aspect:	all
Soil Moisture Regime:	subxeric – xeric
Soil Nutrient Regime:	poor

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
SO	Saskatoon – Mock orange Talus	IDFmw1	00

	Structural Stage	3	4	5	6	7	
Trees	*Pseudotsuga menziesii* var. *glauca*	*	**	**	**	***	Douglas-fir
	Populus tremuloides	*	**	**	**	**	trembling aspen
Shrubs	*Amelanchier alnifolia*	**	**	**	**	**	saskatoon
	Symphoricarpos albus	**	**	**	**	**	common snowberry
	Prunus virginiana	*	*	*	*	*	choke cherry
Herbs	*Woodsia scopulorum*	*	*	*	*	*	cliff fem
	Calamagrostis rubescens	**	**	**	**	**	pinegrass
	Lomatium spp.	*	*	*	*	*	desert-parsely
PLOTS						9901758	

Highlighted species – indicate important forage plants for ungulates
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
WB	**Bluebunch wheatgrass – Balsamroot**	**IDFmw1**	**00**

Typic unit occurs on warm aspects with deep, medium-textured soils (assumed modifiers are d, m, and w)

This grassland ecosystem commonly occurs on moderately steep to steep warm slopes. Often surface soils are actively ravelling on steeper slopes. Bluebunch wheatgrass and balsamroot dominate these sites. Bunchgrasses are more widely spaced than on gentler slopes.

SITE INFORMATION	
Common Terrain Types: • morainal blankets and veneers and colluvial veneers	
Slope position:	middle, upper, crest
Slope (%):	25 – 65%
Aspect:	south, southwest, west
Soil Moisture Regime:	subxeric – submesic
Soil Nutrient Regime:	medium – poor

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
WB	Bluebunch wheatgrass – Balsamroot	IDFmw1	00

	Structural Stage Seral Association	2b WB	
Grasses	*Pseudoroegneria spicata*	****	bluebunch wheatgrass
	Koeleria macrantha	**	junegrass
Herbs	*Artemisia frigida*	**	pasture sage
	Balsamorhiza sagittata	***	arrowleaf balsamroot
	Lupinus sericeus	**	silky lupine
	Lithospermum ruderale	**	lemonweed
Mosses	*Cladonia* spp.	**	clad lichens
Lichens	*Tortula ruralis*	**	sidewalk moss
PLOTS		LCG027	

Highlighted species – indicate important forage plants for ungulates
Species – non-native species
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
WS	**Willow - Sedge**	**IDFmw1**	**00**

Typic unit occurs on level sites with deep, organic soils (d, j and p are assumed modifiers).

This is a generalized wetland ecosystem that has variable site conditions and plant composition.

SITE INFORMATION

Common Terrain Types:

- Organic

Slope position:	depression
Slope (%):	0
Aspect:	none
Soil Moisture Regime:	hygric - hydric
Soil Nutrient Regime:	medium - rich

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
WS	Willow – Sedge	IDFmw1	00

	Structural Stage	3	
Shrubs	*Alnus incana*	***	mountain alder
	Ribes hudsonianum	***	northern blackcurrant
Grasses	*Glyceria grandis*	***	reed mannagrass
Herbs	*Typha latifolia*	**	common cattail
	Ranunculus flabellaris	**	yellow water-buttercup
Mosses	*Drepanocladus spp.*	***	hook-moss
PLOTS		LCG029	

* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites
Comments: Very limited data; other sites are likely dominated by different species.

LAKE COUNTRY EXPANDED LEGEND – IDFxh1

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
AB	**Nuttall's alkaligrass – Foxtail barley graminoid meadow**	**IDFxh1**	**00**

Typic unit occurs on gentle slopes with deep, fine-textured soils (assumed modifiers are d, f, and j)

This meadow ecosystem commonly occurs at the fringes of alkaline ponds and lakes. These sites often have a white crust of salts on the soil surface. Vegetation is limited to species like Nuttall's alkaligrass, saltgrass, and foxtail barley that can tolerate alkaline conditions. This unit is rare in the study area.

SITE INFORMATION	
Common Terrain Types: • lacustrine and morainal blankets	
Slope position:	depression, lower, toe
Slope (%):	0 – 5
Aspect:	none
Soil Moisture Regime:	hygric
Soil Nutrient Regime:	rich – very rich

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
AB	Nuttall's alkaligrass – Foxtail barley graminoid meadow	IDFxh1	00

	Structural Stage	2b	
Grasses	*Puccinellia* sp.	***	alkaligrass
	Hordeum jubatum	***	foxtail barley
	Distichlis spicata	**	seashore saltgrass
Herbs	*Ranunculus cymbalaria*	**	shore buttercup
	Chenopodium spp.	*	lamb's quarters / goosefoot

Species – non-native species
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Notes: These are dynamic ecosystems and their location and vegetation composition can change over the years with changing water levels. Foxtail barley tends to increase on drier sites.

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
AS	**Trembling aspen – Snowberry – Kentucky bluegrass**	**IDFxh1**	**98**

Typic unit occurs on gentle slopes with deep, medium-textured soils (assumed modifiers are d, j, and m)

This forest ecosystem commonly occurs in large, broad depressions in grassland areas. These sites collect moisture from surrounding grassland areas. They have an overstory of trembling aspen and a shrubby understory dominated by snowberry and roses.

List of mapped units:

ASk	cool aspect; slope >25%	ASw	warm aspect; slope >25%
ASx	drier than typical	ASy	moister than typical

SITE INFORMATION

Common Terrain Types:

- morainal blankets, colluvial slopewash and sometimes glaciofluvial blankets

Slope position:	lower, toe, depression, mid
Slope (%):	0 – 10 (20)
Aspect:	none
Soil Moisture Regime:	subhygric
Soil Nutrient Regime:	rich

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
AS	Trembling aspen – Snowberry – Kentucky bluegrass	IDFxh1	98

	Structural Stage	3	4	5	6	7	
Trees	*Populus tremuloides*	*	***	***	***	***	trembling aspen
Shrubs	*Amelanchier alnifolia*	***	*	*	*	*	saskatoon
	Acer glabrum	**	**	**	**	**	Douglas maple
	Mahonia aquifolium	*	*	*	*	*	tall Oregon-grape
	Prunus virginiana	*	*	*	*	*	choke cherry
	Symphoricarpos albus	*****	****	*****	*****	*****	common snowberry
	Rosa spp.	**	**	**	**	**	roses
Grasses	*Poa pratensis*	**	*	**	**	**	Kentucky bluegrass
Herbs	*Osmorhiza berteroi*	*	*	*	**	**	mountain sweet-cicely
	Thalictrum occidentalis	**	*	*	*	*	western meadowrue
Mosses	*Brachythecium* sp.		*	*	*	*	ragged moss
PLOTS					LCG018 LCV081		

Highlighted species – indicate important forage plants for ungulates
Species – non-native species
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites
Wetter sites may have water birch, drier sites have more Oregon-grape and little or no Douglas maple.

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
BM	**Bulrush Marsh**	**IDFxh1**	**00**

Typic unit occurs on level sites with deep, fine-textured soils (assumed modifiers are d, f, and j).

This unit is equivalent to the *Great bulrush marsh* association in the provincial classification (MacKenzie and Shaw 2000).

This marsh wetland ecosystem commonly occurs on small ponds adjacent to shallow open water as a fringe along the shoreline. This unit is uncommon in the study area. It typcially occurs as a complex with shallow open water (OW). Water depths are up to 1.5 m but water levels draw down significantly in the summer. These sites are most commonly dominated by hard-stemmed bulrush, with some floating aquatic plants (duckweed, bladderwort and water smartweed). Vegetation species diversity is typically low on these sites. Soils are typically mineral, sometimes with a thin organic veneer.

SITE INFORMATION	
Common Terrain Types:	
• lacustrine veneer over morainal blanket	
Slope position:	depression
Slope (%):	0
Aspect:	none
Soil Moisture Regime:	subhydric - hydric
Soil Nutrient Regime:	rich

	Structural Stage	2b	
Rushes	*Schoenoplectus acutus*	***	hard-stemmed bulrush
Herbs	*Lemna minor*	**	common duckweed
	Utricularia macrorhiza	*	greater bladderwort

* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
BN	**Kentucky bluegrass – Stiff needlegrass**	**IDFxh1**	**96**

Typic unit occurs on gentle slopes with deep, medium-textured soils (assumed modifiers are d, j, and m)

This ecosystem commonly occurs in moisture-collecting swales and depressions in grasslands and grassland openings. These sites are generally quite small and are dominated by grasses with scattered forbs. All sites observed were disturbed and dominated by Kentucky bluegrass. This ecosystem is likely dominated by needlegrasses at climax but the presence of Kentucky bluegrass may prevent these ecosystems from returning to a climax state.

SITE INFORMATION	
Common Terrain Types: • thick morainal blankets	
Slope position:	toe, depression
Slope (%):	0 – 15
Aspect:	none
Soil Moisture Regime:	subhygric
Soil Nutrient Regime:	medium – rich

	Stuctural Stage	2b	
Grasses	*Poa pratensis*	****	Kentucky bluegrass
	Elymus repens	**	quackgrass
Herbs	*Taraxacum officinale*	**	dandelion

Species – non-native species
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Comments: no late seral or climax sites were observed so it is not known what climax vegetation is but may be dominated by Columbia needlegrass and forbs.

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
BR	**Baltic Rush Marsh-Meadow**	**IDFxh1**	**00**

Typic unit occurs on level sites with deep, fine-textured soils (assumed modifiers are d, f, and j).

This unit is equivalent to the *Baltic rush – Field sedge marsh* association in the provincial classification (MacKenzie and Shaw 2000).

This marsh-meadow wetland ecosystem occurs in areas where water draws down below the soil surface most summers (seasonal flooding). This unit is rare in the study area. These sites are dominated by baltic rush. Field sedge may also occur in slightly drier situations. Soils are typically mineral.

SITE INFORMATION

Common Terrain Types:

- lacustrine veneer over thick morainal or glaciofluvial materials

Slope position:	toe, depression, (lower)
Slope (%):	0
Aspect:	none
Soil Moisture Regime:	hygric
Soil Nutrient Regime:	rich

	Structural Stage	2b	
Rushes	*Juncus balticus*	***	baltic rush
Grasses	*Poa pratensis*	**	Kentucky bluegrass
	Elymus repens	***	quackgrass
PLOTS		LCV127	

* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Comments: We only observed disturbed sites.
It is unknown if these sites will recover climax vegetation (baltic rush, common silverweed, and field sedge).

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
CB	**Cutbank**	**IDFxh1**	**N/A**
Part of a road corridor which is created by excavation or erosion of the hillside.			

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
CD	**Black cottonwood/Douglas-fir –Common Snowberry – Red-osier Dogwood**	**IDFxh1**	**00**

Typic unit occurs on level or very gently sloping sites with deep, medium textured soils (d, j and m are assumed modifiers).

This forest ecosystem is rare but was found along larger creeks including Vernon Creek and along the edge of Okanagan Lake and Kalamalka Lake. Forests are often mixed black cottonwood with Douglas-fir, and paper birch. The understory is typically rich and shrubby, often dominated by Nootka rose, mock orange, snowberry and red-osier dogwood. Forbs are uncommon and scattered.

List of mapped units:

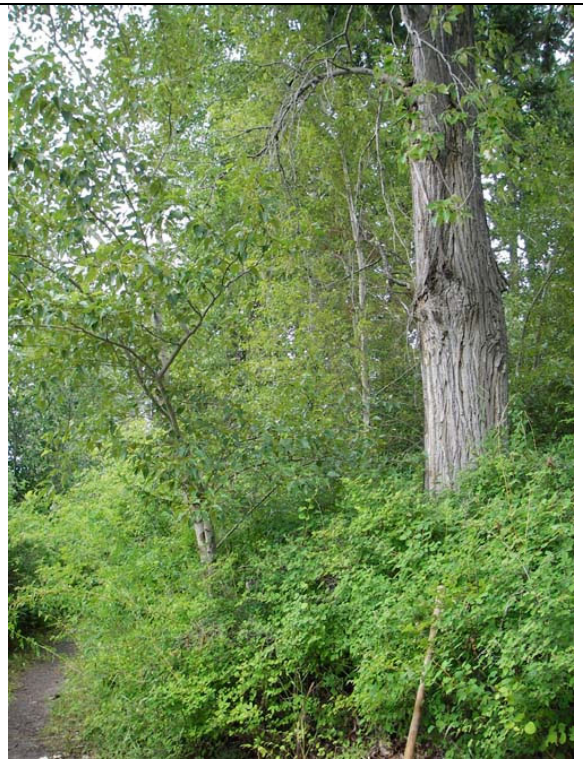
Cda active floodplain

SITE INFORMATION

Common Terrain Types:

- glaciofluvial and colluvial slopewash

Slope position:	lower and toe
Slope (%):	0-15
Aspect:	none
Soil Moisture Regime:	subhygric
Soil Nutrient Regime:	rich



Site Unit Symbol	Site Unit Name	BGC	Site Series Number
CD	Black cottonwood/Douglas-fir –Common Snowberry – Red-osier Dogwood	IDFxh1	00

	Structural Stage	3	4	5	6	7	
Trees	*Populus balsamifera* ssp. *trichocarpa*	**	***	***	***	***	black cottonwood
	Betula papyrifera		**	**	**	**	paper birch
	Pseudotsuga menziesii var. *glauca*			*	**	**	Douglas-fir
Shrubs	*Symphoricarpos albus*	*****	****	****	****	****	common snowberry
	Acer glabrum	***	**	***	***	***	mock orange
	Amelanchier alnifolia	**	**	**	**	**	saskatoon
	Rosa nutkana	***	*	**	**	***	Nootka rose
	Cornus stolonifera	***	**	**	**	**	red-osier dogwood
Grasses	*Elymus glaucus*	**	*	*	*	*	blue wildrye
	Poa pratensis	**	*	*	*	*	Kentucky bluegrass
Herbs	*Equisetum arvense*	**	*	*	*	**	common horsetail
Mosses	*Brachythecium* sp.				*	*	ragged moss
PLOTS					LCG019 LCG040		

Highlighted species – indicate important forage plants for ungulates
Species – non-native species
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
CF	**Cultivated Field**	**IDFxh1**	**N/A**
These are agricultural fields with tilled soils and planted crops or ground cover. Mapped units: CFcn – coarse-textured soils, fan; CFk – cool aspect, slope >25%			

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
CL	**Cliff**	**IDFxh1**	**N/A**
These are steep, vertical or overhanging rock faces. Typically there are scattered plants such as saskatoon and cliff ferns occurring in rock fractures or soil pockets. The non-standard modifier 'b' was used to indicate big cliffs large enough to support populations of spotted bats.			
List of mapped units:			
CLz	very steep warm aspect		

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
CO	**Cultivated Orchard**	**IDFxh1**	**N/A**
Agricultural areas for growing fruit trees.			

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
CS	**Common Spikerush Marsh**	**IDFxh1**	**00**

Typic unit occurs on level sites with deep, fine textured soils (assumed modifiers are d, f, and j).

This unit is equivalent to the *Common spike-rush marsh* association in the provincial classification (MacKenzie and Shaw 2000).

These marsh wetland ecosystems occur in standing water as a fringe around ponds, shallow open water and other marshes. This unit is rare in the study area. The water table often drops to the soil surface in late summer. These sites usually have shallower water than Bulrush marshes or Cattail marshes. Soils are typically mineral, but may have a thin organic veneer on top.

SITE INFORMATION	
Common Terrain Types: • lacustrine	
Slope position:	depression
Slope (%):	0
Aspect:	none
Soil Moisture Regime:	subhydric - hydric
Soil Nutrient Regime:	rich – very rich

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
CS	Common Spikerush Marsh	IDFxh1	00

	Structural Stage	2b	
Rushes	*Eleocharis palustris*	***	common spike-rush
Herbs	*Polygonum amphibium*	*	water smartweed
PLOTS		LCV102	

Highlighted species – indicate important forage plants for ungulates
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites
Comments: Vegetation may have more foxtail barley, oak-leaved goosefoot, and golden dock in drier years.

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
CT	**Cattail Marsh**	**IDFxh1**	**00**

Typic unit occurs on level sites with deep, medium-textured soils (assumed modifiers are d, j, m).

This unit is equivalent to the *Cattail marsh* association in the provincial classification (MacKenzie and Shaw 2000).

This marsh wetland ecosystem occurs as a fringe on pond edges or in depressions, often adjacent to shallow open water (OW). This unit is rare in the study area. Water depths are typically up to 1 m in spring but draw down to the soil surface by late summer; soils remain saturated for most of the season. Some wetlands convert to cattail marshes when they are subject to nutrient loading. These sites are dominated by cattails with few other species. Soils are typically mineral, but may have a thin organic veneer on top.

SITE INFORMATION

Common Terrain Types:

- thin organic veneer over lacustrine materials

Slope position:	depression
Slope (%):	0
Aspect:	none
Soil Moisture Regime:	subhydric
Soil Nutrient Regime:	rich

	Structural Stage	2a	
Herbs	*Typha latifolia*	****	common cattail
	Lemna minor	**	common duckweed
Mosses	*Bryum* sp.	**	thread moss

* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
CW	**Choke cherry – Bluebunch wheatgrass rocky bluff**	**IDFxh1**	**00**

Typic unit occurs on gentle slopes with very shallow soils (assumed modifiers are j and v)

This ecosystem commonly occurs on bedrock bluffs where the bedrock is quite fractured. This unit is uncommon in the study area. Exposed bedrock usually occupies 30-50% of the area. Shrubs are common, typically occurring in cracks in the rocks. Grasses, forbs, lichens and mosses occur in small soil pockets scattered in amongst the bedrock.

List of mapped units:

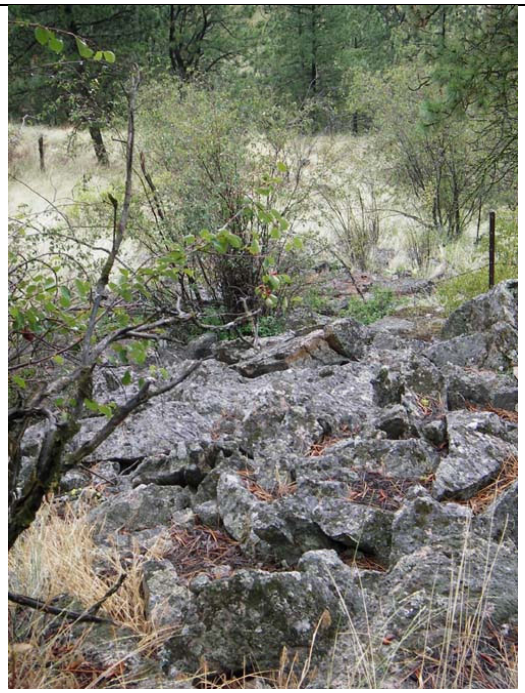
CWz very steep warm aspect; slope >100%

SITE INFORMATION

Common Terrain Types:

- rock and very thin colluvial and morainal veneers

Slope position:	crest, upper
Slope (%):	0 – 100+
Aspect:	all
Soil Moisture Regime:	very xeric – xeric
Soil Nutrient Regime:	very poor – poor



Site Unit Symbol	Site Unit Name	BGC	Site Series Number
CW	Choke cherry – Bluebunch wheatgrass rocky bluff	IDFxh1	00

	Structural Stage	3	
Shrubs	*Amelanchier alnifolia*	**	saskatoon
	Symphoricarpos albus	**	common snowberry
	Philadelphus lewisii	**	mock-orange
	Prunus virginiana	**	choke cherry
Grasses	*Pseudoroegneria spicata*	**	bluebunch wheatgrass
Herbs	*Woodsia scopulina*	*	mountain cliff fern
	Selaginella densa	*	compact selaginella
	Balsamorhiza sagittata	*	arrowleaf balsamroot
Mosses	*Tortula ruralis*	*	sidewalk moss
PLOTS		LCG033	

Highlighted species – indicate important forage plants for ungulates
Species – non-native species
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
DP	**Douglas-fir/Ponderosa pine – Pinegrass**	**IDFxh1**	**01**

Typic unit occurs on gentle slopes with deep, medium textured soils (d, j and m are assumed modifiers).

This forest ecosystem is commonly associated with mesic gently sloping sites. This is the most common forest unit in the study area. Forests are moderately closed with mixed Douglas-fir and ponderosa pine overstories, although historically they would have been quite open. The understory has abundant pinegrass with scattered snowberry, birch-leaved spirea, tall Oregon-grape, grasses, herbs and mosses. This unit is also common on cool aspects (DPk) where there is usually more of a moss layer. Mature (structural stage 6) and old (structural stage 7) forests are uncommon because most of the large trees historically present on these sites have been logged. Because of fire exclusion, most sites have become ingrown with higher densities of smaller stems. Grazing and ingrowth have together reduced the presence of bunchgrasses which were likely historically common.

List of mapped units:

DPc	coarse-textured soils (glaciofluvial)	DPck	coarse-textured soils (glaciofluvial), cool aspect, slope >25%
DPfs	fine-textured soils, shallow soils (generally 50-100cm)	DPgw	gully, warm aspect, slope >25%
DPk	cool apsect, slope <25%	DPks	cool aspect (usually NW to E), shallow soils (generally 50-100cm)
DPs	shallow soils (generally 50-100cm)	DPw	warm aspect (usually SE or NW), slope usually 25-35%

SITE INFORMATION

Common Terrain Types:

- deep morainal materials on gentle slopes
- moderate to steep cool aspect morainal and colluvial slopes (deep or variable thickness)

Slope position:	level, middle
Slope (%):	0-30; up to 70% on cool aspects
Aspect:	all
Soil Moisture Regime:	mesic – submesic
Soil Nutrient Regime:	medium (poor)

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
DP	Douglas-fir/Ponderosa pine – Pinegrass	IDFxh1	01

	Structural Stage	3	4	5	6	7	
Trees	*Pseudotsuga menziesii* var. *glauca*	**	****	****	***	***	Douglas-fir
	Pinus ponderosa	**	***	***	**	**	ponderosa pine
Shrubs	*Symphoricarpos albus*	****	*	**	**	**	common snowberry
	Spirea betulifolia	***	*	**	**	**	birch-leaved spirea
	Mahonia aquifolium	**	*	*	*	*	tall oregon-grape
Grasses	*Calamagrostis rubescens*	***		**	***	***	pinegrass
	Festuca idahoensis	**		*	*	*	Idaho fescue
	Festuca campestris			*	**	**	rough fescue
Herbs	*Amica cordifolia*	**	*	*	*	**	heart-leaved arnica
	Achillea millefolium	**	*	*	*	*	yarrow
	Fragaria virginiana	***		*	*	*	wild strawberry
Mosses and Lichens	*Rhytidiadelphus triquetrus*			*	**	**	electrified cat's tail moss
	Brachythecium albicans	*	*	*	**	**	lawn moss
	Peltigera canina	*		*	*	**	dog pelt
	Dicranum sp.	*	*	*	*	*	heron's bill moss
PLOTS		LCG001 LCG008			LCV100	LCG025	

Highlighted species – indicate important forage plants for ungulates

* incidental cover (less than 1% cover); used as indicator species

** 1-5% cover; occurs in 60% or more of sites

*** 6-25% cover; occurs in 60% or more of sites

**** 26-50% cover; occurs in 60% or more of sites

***** >50% cover; occurs in 60% or more of sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
DS	**Douglas-fir/Ponderosa pine – Snowberry – Spirea**	**IDFxh1**	**07**

Typic unit occurs on gentle slopes with deep, medium textured soils (d, j and m are assumed modifiers).

This forest ecosystem is commonly associated with gently sloping sites that are receiving some moisture. This is an uncommon forested ecosystem in the study area. These forests typically have moderately closed Douglas-fir overstories with very shrubby understories dominated by snowberry with some Oregon-grape, Douglas maple, and saskatoon. Often there is scattered Kentucky bluegrass with some heart-leaved arnica and other scattered forbs. There is a minimal moss layer with scattered patches of ragged mosses. Because these sites are moist, they may have had a longer fire-return interval than adjacent mesic and drier forests. These sites also tend to recover more quickly after disturbance (such as logging) because they are moister and more productive.

Although these sites are productive and vegetation recovers relatively quickly following disturbances such as logging, the moist soils on these sites are sensitive to disturbance and are difficult to find places for septic fields. Alterations in subsurface water flow present considerable risks to soil stability.

List of mapped units:

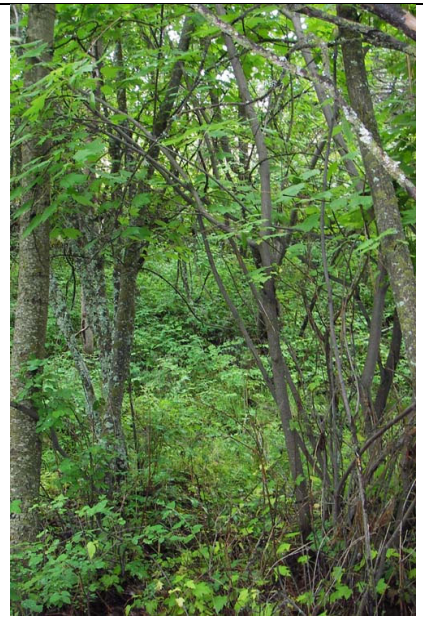
DSg	gully	DSgk	gully, cool aspect, slope >25%
DSgs	gully, shallow soils (generally 50-100cm)	DSgw	gully, warm aspect, slope >25%
DSk	cool aspect	DSks	cool aspect, shallow soil (50-100cm), slope >25%
DSs	shallow soils (generally 50-100cm)	DSsw	shallow soils (generally 50-100cm), warm aspect, slope >25%
DSw	warm aspect (usually SE or NW, sites with some compensating moisture)	DSy	moister than average

SITE INFORMATION

Common Terrain Types:

- gentle morainal slopes

Slope position:	lower and toe
Slope (%):	0-15% (up to 80% on cool aspects)
Aspect:	none, cool
Soil Moisture Regime:	subhygric
Soil Nutrient Regime:	rich



Site Unit Symbol	Site Unit Name	BGC	Site Series Number
DS	Douglas-fir/Ponderosa pine – Snowberry – Spirea	IDFxh1	07

	Structural Stage	3	4	5	6	7	
Trees	*Pseudotsuga menziesii* var. *glauca*	**	*****	****	****	***	Douglas-fir
	Populus tremuloides	**	*	**	*		trembling aspen
Shrubs	*Symphoricarpos albus*	*****	***	****	****	****	common snowberry
	Acer glabrum	***	**	**	***	***	Douglas maple
	Mahonia aquifolium	**		*	**	**	tall oregon-grape
	Paxistima myrsinites	**	**	**	**	**	falsebox
	Spirea betulifolia	***	*	**	**	**	birch-leaved spirea
Grasses	*Calamagrostis rubescens*	**		*	*	**	pinegrass
	Elymus glaucus	**		*	*	**	blue wildrye
	Poa pratensis	**	*	*	*	*	Kentucky bluegrass
Herbs	*Osmorhiza berteroi*	***	*	**	**	**	mountain sweet-cicely
Mosses	*Brachythecium* sp.			*	**	**	ragged moss
PLOTS				LCG057	LCG017 LCG043 LCG054		

Highlighted species – indicate important forage plants for ungulates
Species – non-native species
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites
Amount of trembling aspen varies from none to a significant part of the overstory (mixed); Douglas maple is often more abundant in mixed and deciduous overstories.

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
DW	**Douglas-fir/Ponderosa pine – Bluebunch wheatgrass - Pinegrass**	**IDFxh1**	**03**

Typic unit occurs on moderate to steep warm aspects with deep, medium textured soils (d, m and w are assumed modifiers).

This forest ecosystem is common on moderate to steep warm aspects (excluding southeast and west aspects which are usually /04 sites). This is an uncommon unit in the study area. It sometimes occurs on cooler aspects were soils are shallower and on ridges and crests where soils are not shallow enough to be the IDFxh1 /02 (PB). Mixed ponderosa pine – Douglas-fir forests are open and dominated by bunchgrasses, particularly bluebunch wheatgrass with scattered forbs (mostly balsamroot). Idaho fescue and sometimes rough fescue occur on sites that have not been heavily grazed. Mosses and lichens are scattered and uncommon. Ingrowth is commonly present, but drier conditions have helped keep most stands somewhat open.

List of mapped units:

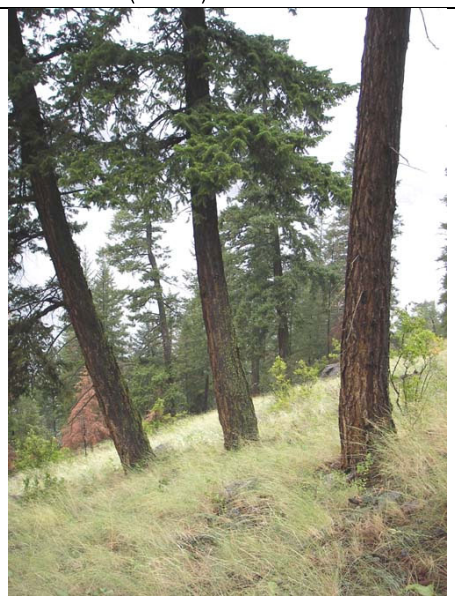
DWc	coarse-textured soils (usually glaciofluvial)	DWck	coarse-textured soils, cool aspect (generally ESE or NW), slope >25%
DWcs	coarse textured soils (glaciofluvial), shallow soils (20-100cm deep)	DWj	gentle slope (generally 20-25% slope, warm aspect or slight ridge or crest)
DWjs	gentle slope (generally 20-25% slope, warm aspect or slight ridge or crest), shallow soils	DWjv	gentle slope (often a slight crest), very shallow soils <20cm deep, exposed bedrock present
DWks	cool aspect (generally NW or ESE), shallow soils (<20cm)	DWkv	cool aspect (generally NW or ESE), very shallow soils (<20cm); exposed bedrock present
DWqs	very steep cool aspect (slope >100%, aspect usually ESE or NW), shallow soils (20-100cm deep)	DWrs	ridge, shallow soils (20-100cm)
DWs	shallow soils (20-100cm)	DWv	very shallow soils (<20cm)

SITE INFORMATION

Common Terrain Types:

- steep warm aspect thin to thick colluvial and morainal slopes
- glaciofluvial and occasionally on glaciolacustrine slopes

Slope position:	middle and upper
Slope (%):	(30) 35 – 60%
Aspect:	south, southwest, west (also cool aspects on very shallow soils)
Soil Moisture Regime:	subxeric (submesic)
Soil Nutrient Regime:	poor – medium



Site Unit Symbol	Site Unit Name	BGC	Site Series Number
DW	Douglas-fir/Ponderosa pine – Bluebunch wheatgrass - Pinegrass	IDFxh1	03

	Structural Stage	3	4	5	6	7	
Trees	*Pseudotsuga menziesii* var. *glauca*	**	***	***	***	***	Douglas-fir
	Pinus ponderosa	**	****	***	**	**	ponderosa pine
Shrubs	*Amelanchier alnifolia*	**	*	**	**	**	saskatoon
	Symphoricarpos albus	**	*	**	**	**	common snowberry
Grasses	*Pseudoroegneria spicata*	****	**	***	***	****	bluebunch wheatgrass
	Festuca campestris	**	*	**	**	**	rough fescue
	Koeleria macrantha	**	*	**	**	**	junegrass
	Bromus tectorum	*	*	*	*	*	cheatgrass
Herbs	*Balsamorhiza sagittata*	***	*	**	***	***	arrowleaf balsamroot
	Hieracium scouleri	*		*	*	*	Scouler's hawkweed
	Antennaria microphylla or *Antennaria parviflora* or *Antennaria umbrinella*	**	*	*	*	*	white pussytoes Nuttall's pussytoes umber pussytoes
Mosses and Lichens	*Cladonia* spp.	**	*	**	**	**	clad lichens
	Tortula ruralis	**	*	**	**	**	sidewalk moss
	Polytrichum piliferum	*		*	*	*	lawn moss
PLOTS				LCG021 LCG035 LCG059 LCV073 LCV115	LCG050 LCG064	9901759 9901764 LCG039	

Highlighted species – indicate important forage plants for ungulates
Species – non-native species
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
ES	Exposed Soil	IDFxh1	N/A
These are areas of exposed soils and typically include recent disturbances such as soil erosion.			
List of mapped units:			
ESk cool aspect		ESw warm aspect	

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
FO	**Douglas-fir / Ponderosa pine –Saskatoon – Mock orange**	**IDFxh1**	**00**

Typic unit occurs on steep slopes with deep, coarse-textured (rocky) soils (c, and d are assumed modifiers).

This forest ecosystem is commonly associated with steep colluvial sites with rocky soils. This is an uncommon unit in the study area. It occurs on both cool (FOk) and warm (FOw) aspects. The soil matrix is a mixture of both angular rocks and sandy, silty material. The overstory is generally open and dominated by Douglas-fir with scattered ponderosa pine. Understories are often quite shrubby with snowberry, saskatoon and mock orange. There is usually scattered bluebunch wheatgrass. Small rocks dominate a large portion of the soil surface.

List of mapped units:

FOj	gentle slope (20-25%)	FOk	cool aspect (>25%)
FOks	cool aspect (>25%), shallow soils (20-100cm deep)	FOsw	shallow soils (20-100cm deep), warm aspect (slope >25%)
FOw	warm aspect (slope >25%)		

SITE INFORMATION

Common Terrain Types:

- moderate and steep rocky colluvial slopes

Slope position:	lower to upper
Slope (%):	60-75%
Aspect:	all
Soil Moisture Regime:	submesic – subxeric
Soil Nutrient Regime:	medium, poor

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
FO	Douglas-fir / Ponderosa pine –Saskatoon – Mock orange	IDFxh1	00

	Structural Stage	3	4	5	6	7	
Trees	*Pseudotsuga menziesii* var. *glauca*	*	***	***	***	***	Douglas-fir
Shrubs	*Symphoricarpos albus*	*****	***	***	****	****	common snowberry
	Spirea betulifolia	***	*	*	**	**	birch-leaved spirea
	Philadelphus lewisii	**		*	**	**	mock-orange
	Prunus virginiana	***		*	**	**	choke cherry
	Amelanchier alnifolia	****	**	**	***	***	saskatoon
Grasses	*Pseudoroegneria spicata*	***	**	**	***	***	bluebunch wheatgrass
	Calamagrostis rubescens	***	**	**	***	***	pinegrass
Herbs	*Lomatium dissectum*	*	*	*	*	*	fern-leaved desert parsley
Mosses	*Tortula ruralis*	*		*	*	*	sidewalk moss
PLOTS				LCV114	LCG061		

Highlighted species – indicate important forage plants for ungulates
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
FW	**Idaho fescue – Bluebunch wheatgrass**	**IDFxh1**	**91**

Typic unit occurs on gentle slopes with deep, medium-textured soils (assumed modifiers are d, j, m)

This grassland ecosystem occurs on gentle warm aspects, levels sites, and cool aspects. A mixture of Idaho fescue and bluebunch wheatgrass with balsamroot and other herbs dominates late seral sites, but late seral sites are uncommon in the study area and no climax sites were observed. Soils are typically dark brown or black chernozems. Most of these sites are highly disturbed and some have a significant component of weeds. These are described below.

FW:cn *$Cheatgrass – Columbia needlegrass seral association*
This is an early seral association dominated by cheatgrass and other invasive annual bromes, weedy species, with scattered Columbia needlegrass and some native grassland forbs.

FW:fc *$Idaho fescue – Cheatgrass seral association*
This is a mid- to late-seral asoociation dominated by Idaho fescue with significant cover of invasive annual bromes, especially cheatgrass, and a variety of native grassland forbs.

FW:kc *$Knapweed – Cheatgrass seral association*
This is an early seral association dominated by knapweed, sulphur cinquefoil, and cheatgrass with few or no native bunchgrasses remaining on these sites.

FW:nc *$Columbia needlegrass – Cheatgrass seral association*
This is an early seral association dominated by Columbia needlegrass with significant cover of invasive annual bromes, especially cheatgrass, and a variety of native grassland forbs.

FW:wk $*Bluebunch wheatgrass – Knapweed seral association*
This is a mid- to late-seral seral association. On these sites there is still a reasonable component of bluebunch wheatgrass with knapweed, sulphur cinquefoil, or cheatgrass.

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
FW	**Idaho fescue – Bluebunch wheatgrass**	**IDFxh1**	**91**

List of mapped units:

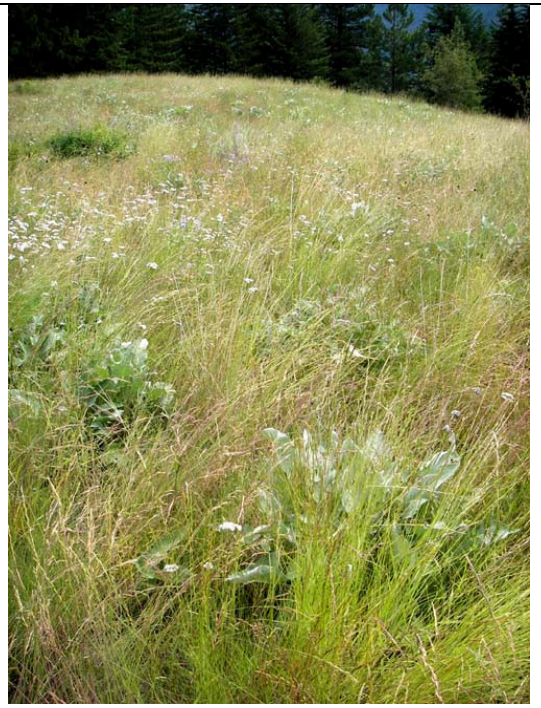
FWc	coarse-textured soils (generally glaciofluvial)	FWk	cool aspect (>25% slope)
FWks	cool aspect, shallow soils (20-100cm)	FWs	shallow soils (50-100cm)
FWw	warm aspect (generally SE or NW), slope >25%		

SITE INFORMATION

Common Terrain Types:

- morainal and glaciofluvial blankets, often with an aeolian veneer

Slope position:	lower to upper
Slope (%):	0-35% (up to 60% on cool aspects
Aspect:	all
Soil Moisture Regime:	mesic
Soil Nutrient Regime:	rich



Site Unit Symbol	Site Unit Name	BGC	Site Series Number
FW	Idaho fescue – Bluebunch wheatgrass	IDFxh1	91

	Structural Stage Seral Association	2b FW	2b FW:cn	2b FW:fc	2a FW:kc	2b FW:nc	2b FW:wk	
Shrubs	*Artemisia tridentata*							big sagebrush
Grasses	*Festuca idahoensis*	****		***				Idaho fescue
	Festuca campestris	**						rough fescue
	Pseudoroegneria spicata	***		*		*	***	bluebunch wheatgrass
	Koeleria macrantha	**		*		*		junegrass
	Achnatherum nelsonii		**	*	**	****	*	Columbian needlegrass
	Bromus tectorum or *Bromus japonicus*		****	***	****	***	***	cheatgrass or Japanese brome
Herbs	*Balsamorhiza sagittata*	***	*	**		**	**	arrowleaf balsamroot
	Lupinus sericeus	**	*	**	*	*	**	silky lupine
	Eriogonum heracleoides	**	**	**	*	*	*	parsnip-flowered buckwheat
	Lithospermum ruderale	*	*	*	*	*	*	lemonweed
	Calochortus macrocarpus	*						sagebrush mariposa lily
	Centaurea diffusa		*	*	***	**	**	diffuse knapweed
	Potentilla recta				***	*	*	sulphur cinquefoil
Mosses and Lichens	*Cladonia* spp.	**		*				clad lichens
	Tortula ruralis	**	*	*			*	sidewalk moss
	Peltigera rufescens or *Peltigera ponojensis*	**						felt pelt felt pelt
PLOTS		9901761 9901765 LCG042 LCG051		LCG056	LCV075 LCV098		LCG023 LCG055	

Highlighted species – indicate important forage plants for ungulates
Species – non-native species
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
GP	**Gravel Pit**	**IDFxh1**	**N/A**
These are areas of used for extraction of gravel and sand.			

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
LA	**Lake**	**IDFxh1**	**N/A**
These are areas of permanent open water that are greater than 2m deep and greater than 50ha.			

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
OW	**Shallow Open Water**	**IDFxh1**	**N/A**
These are areas of permanent open water that are less than 2m deep. There is less than 10% emergent vegetation but floating aquatics such as bladderwort are often present. Shallow open water commonly occurs in association with marsh ecosystems. **OWx** – drier than typical for a number of years – may only have water in spring and is dry by summer.			

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
PB	**Douglas-fir/Ponderosa pine – Bluebunch wheatgrass – Balsamroot**	**IDFxh1**	**02**

Typic unit occurs on warm aspects with medium-textured shallow soils (m, s and w are assumed modifiers).

This forest ecosystem is commonly associated with shallow or very shallow soils and bedrock outcrops (PB, PBrv, PBv). This unit is uncommon in the study area. Forests are very open with scattered large trees, often growing in bedrock fractures. The understory is variable depending on soil depth with more vegetation occurring on deeper soil pockets. Scattered shrubs and bunchgrasses (usually bluebunch wheatgrass) dominate the understory. A lichen and moss crust may be present on soil pockets on undisturbed sites.

List of mapped units:

PBcd	coarse-textured soils (sandy glaciofluvial), deep soils, surface soils ravelling	PBjv	gentle slope (usually low crest), very shallow soils (<20cm), exposed bedrock present
PBkv	cool aspect (usually NW or ESE), slope >25%, very shallow soils (<20cm), exposed bedrock present	PBrv	ridge, very shallow soils (<20cm), exposed bedrock present
PBv	very shallow soils (<20cm), exposed bedrock present	PBvz	very shallow soils (<20cm), exposed bedrock present, very steep warm aspect (slope >100%)

SITE INFORMATION

Common Terrain Types:

- Thin and very thin colluvial, morainal, and weathered bedrock materials over bedrock
- Occasionally occurs on steep sandy glaciofluvial slopes

Slope position:	upper and crest
Slope (%):	0-70%
Aspect:	none, south, southwest
Soil Moisture Regime:	very xeric – subxeric
Soil Nutrient Regime:	poor (very poor, medium)

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
PB	Douglas-fir/Ponderosa pine – Bluebunch wheatgrass – Balsamroot	IDFxh1	02

	Structural Stage	3	4	5	6	7	
Trees	*Pinus ponderosa*	**	****	***	***	***	ponderosa pine
	Pseudotsuga menziesii var. *glauca*	**	**	**	**	**	Douglas-fir
Shrubs	*Amelanchier alnifolia*	**	*	**	**	**	saskatoon
	Philadelphus lewisii	***	*	**	**	**	mock orange
	Mahonia aquifolium	*		*	*	*	tall oregon-grape
Grasses	*Pseudoroegneria spicata*	****	**	***	***	****	bluebunch wheatgrass
	Festuca campestris	**	*	**	**	**	rough fescue
	Bromus tectorum	*	*	*	*	*	cheatgrass
Herbs	*Balsamorhiza sagittata*	***	*	**	**	**	arrowleaf balsamroot
	Selaginella densa	*	*	*	*	*	compact selaginella
	Woodsia scopulina	*	*	*	*	*	mountain cliff fern
	Penstemon fruiticosa	*	*	*	*	*	shrubby penstemon
Mosses and Lichens	*Cladonia* spp.	**	**	**	**	**	clad lichens
	Tortula ruralis	**	**	**	**	**	sidewalk moss
	Polytrichum piliferum	**	**	**	**	***	awned haircap moss
PLOTS				LCG049	9901766 LCG034 LCV110		

Highlighted species – indicate important forage plants for ungulates
Species – non-native species
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
RF	**Prairie Rose – Idaho fescue**	**IDFxh1**	**97**

Typic unit occurs on gentle slopes with deep, medium-textured soils (assumed modifiers are d, j, and m)

This shrubland ecosystem commonly occurs in moisture collecting depressions, seepage slopes and swales in grassland areas. This unit sometimes occurs as patches on grassland slopes. These sites are dominated by shrubs, primarily snowberry and roses. Forbs and grasses are scattered in openings between shrubs. Soils are very rich black chernozems.

List of mapped units:

RFg	gully	RFk	cool aspect, slope >25%
RFs	shallow soils (usually 50-100cm)	RFsw	shallow soils (usually 50-100cm), warm aspect, slope >25%
RFw	warm aspect, slope >25%		

SITE INFORMATION

Common Terrain Types:

- morainal blankets

Slope position:	mid, toe, depression
Slope (%):	0-25
Aspect:	none, variable
Soil Moisture Regime:	subhygric
Soil Nutrient Regime:	rich

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
RF	Prairie Rose – Idaho fescue	IDFxh1	97

	Structural stage	3a or 3b	
Shrubs	*Symphoricarpos albus*	*****	common snowberry
	Rosa woodsii	***	prairie rose
	Rosa nutkana	***	Nootka rose
Grasses	*Poa pratensis*	**	Kentucky bluegrass
	Achnatherum nelsonii	**	Columbian needlegrass
PLOTS		LCV077	

Highlighted species – indicate important forage plants for ungulates
Species – non-native species
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
RN	**Railway Surface**	**IDFxh1**	**N/A**
A railway with fixed rails for single or multiple rail lines.			

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
RO	**Rock Outcrop**	**IDFxh1**	**N/A**
These are areas of exposed bedrock with less than 10% vegetation cover. On sites with fractured bedrock, some plants may be growing out of rock cracks.			
List of mapped units:			
ROr ridge		ROw warm aspect	

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
RW	**Rural**	**IDFxh1**	**N/A**
Rural areas of human settlement with scattered houses intermingled with native vegetation or cultivated areas.			

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
RZ	**Road Surface**	**IDFxh1**	**N/A**
A gravel or paved road used for vehicular travel.			

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
SA	**Antelope Brush - Selaginella**[61]	**IDFxh1**	**00**

Typic unit occurs on gentle slopes with shallow soils (assumed modifiers are j, m and s).

However, in the study area, this unit more commonly occurs on steep slopes on rock outcrops with small ledges and pockets of soil. The bedrock is generally fractured. This is an uncommon unit in the study area. In contrast with areas in the South Okanagan, there is no antelope brush on these sites. Scattered ponderosa pine trees and saskatoon bushes occur in rock fractures. Soil pockets on ledges are dominated by bluebunch wheatgrass with balsamroot, selaginella, and a well-developed microbiotic crust on soil pockets.

List of mapped units:

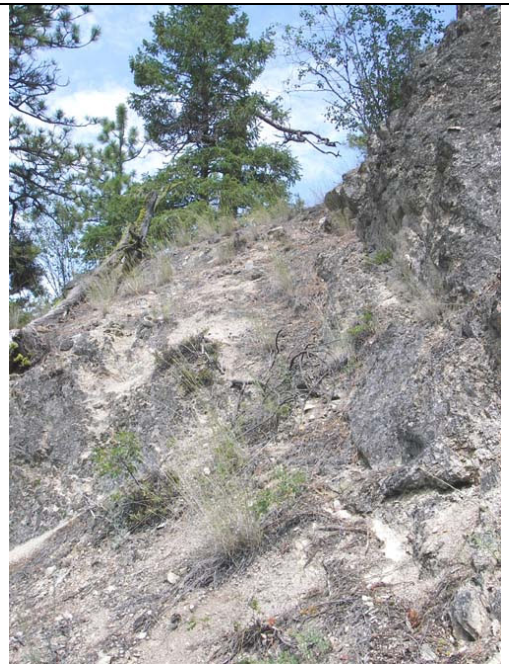
SAkv	cool aspect, very shallow soils	SAqv	very steep cool aspect (>100% slope), very shallow soils
SArv	ridge, very shallow soils	SAvw	very shallow soils, warm aspect
SAvz	very shallow soils, very steep warm aspect (>100% slope)		

SITE INFORMATION

Common Terrain Types:

- rock, very thin morainal and colluvial veneers

Slope position:	crest, upper
Slope (%):	0 – 70
Aspect:	variable
Soil Moisture Regime:	very xeric – xeric
Soil Nutrient Regime:	very poor – poor



[61] Although the plant association name includes antelope brush, antelope brush does not occur in the study area.

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
SA	Antelope Brush – Selaginella	IDFxh1	00

	Structural Stage	2b	3	4	5	6	7	
Trees	*Pseudotsuga menziesii* var. *glauca*		*	**	**	**	**	Douglas-fir
	Pinus ponderosa		*	***	***	***	***	ponderosa pine
Shrubs	*Amelanchier alnifolia*	**	**	**	**	**	**	saskatoon
	Spirea betulifolia	*	*	*	*	*	*	birch-leaved spirea
Grasses	*Pseudoroegneria spicata*	***	***	***	***	***	***	bluebunch wheatgrass
	Festuca campestris	*	*	*	*	*	*	rough fescue
Herbs	*Selaginella densa*	**	**	**	**	**	**	compact selaginella
	Penstemon fruticosa	*	*	*	*	*	*	shrubby penstemon
	Woodsia scopulina	*	*	*	*	*	*	mountain cliff fern
Mosses	*Cladonia* spp.	**	**	**	**	**	**	clad lichens
Lichens	*Polytrichum piliferum*	**	**	**	**	**	**	awned haircap moss
PLOTS		LCV127	LCG044			LCG065		

Highlighted species – indicate important forage plants for ungulates
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites
Comments: most sites do no progress through the structural stages. Some sites are more suitable for tree growth than others.

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
SB	**Selaginella – Bluebunch wheatgrass rock outcrop**	**IDFxh1**	**00**

Typic unit occurs on gentle slopes with very shallow soils (assumed modifiers are j and v)

This grassland ecosystem commonly occurs on bedrock outcrops. The bedrock is generally low relief and unfractured. This is an uncommon unit in the study area. Selaginella and rusty steppe moss with some grasses and forbs dominate these sites. This unit is commonly scattered as small sites in a grassland matrix.

SB:cg *Cheatgrass seral association*
This seral association is dominated by cheatgrass or sulphur cinquefoil with selaginella and rusty steppe moss.

List of mapped units:

SBk	cool aspect, slope >25%	SBr	ridge
SBw	warm aspect, slope >25%		

SITE INFORMATION

Common Terrain Types:

- rock, very thin morainal and colluvial veneers and weathered bedrock

Slope position:	crest, upper
Slope (%):	0 – 50
Aspect:	variable
Soil Moisture Regime:	xeric – very xeric
Soil Nutrient Regime:	poor

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
SB	Selaginella – Bluebunch wheatgrass rock outcrop	IDFxh1	00

	Structural Stage Seral stage	2a SB	2a SB:$cg	
Shrubs	*Amelanchier alnifolia*	*	*	saskatoon
Grasses	*Pseudoroegneria spicata*	**	*	bluebunch wheatgrass
	Poa secunda	**	**	Sandberg's bluegrass
	Bromus japonicus or tectorum	*	***	Japanese brome or cheatgrass
Herbs	*Selaginella densa*	***	***	compact selaginella
	Eriogonum heracleoides	*	*	parsnip-flowered buckwheat
	Potentilla recta		**	sulphur cinquefoil
	Centaurea diffusa		**	diffuse knapweed
Mosses and Lichens	*Cladonia* spp.	**	*	clad lichens
	Tortula ruralis	***	**	sidewalk moss
	Polytrichum piliferum	***	*	awned haircap moss
PLOTS				

Highlighted species – indicate important forage plants for ungulates
Species – non-native species
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
SD	**Hybrid white spruce/Douglas-fir – Douglas maple – Dogwood**	**IDFxh1**	**08**

Typic unit occurs on gentle slopes with deep, medium textured soils (d, j and m are assumed modifiers).

This forest ecosystem is commonly associated with gullies with intermittent or permanent streams or subsurface water flow. This is an uncommon unit in the study area. These are diverse, rich sites with mixed coniferous (Douglas-fir) and deciduous (paper birch and aspen) overstories. The understories are dominated by diverse mixture of shrubs. Forbs and mosses are scattered and uncommon on these sites. These moist sites likely had a longer fire return interval than adjacent upland areas.

Although these sites are productive and vegetation recovers relatively quickly following disturbances such as logging, the moist soils on these sites are sensitive to disturbance and septic fields would be difficult to locate on these sites. Alterations in subsurface water flow present considerable risks to soil stability.

List of mapped units:

SDa	active flood-plain, usually a few cottonwood trees present	SDcg	coarse-textured soils, gully
SDg	gullies, usually associated with permanent or intermittent creeks	SDgw	occurs in gullies on warm aspects
SDt	occurs on fluvial terrace, often a few cottonwood trees present		

SITE INFORMATION

Common Terrain Types:

- gentle morainal, fluvial, and slopewash sites

Slope position:	lower, toe
Slope (%):	0-15%
Aspect:	none
Soil Moisture Regime:	hygric
Soil Nutrient Regime:	rich (medium)

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
SD	Hybrid white spruce/Douglas-fir – Douglas maple – Dogwood	IDFxh1	08

	Structural Stage	3	4	5	6	7	
Trees	*Betula paperifera*	****	***	***	***	**	paper birch
	Pseudotsuga menziesii var. *glauca*	*	****	***	***	***	Douglas-fir
	Populus tremuloides	**	**	***	***	*	trembling aspen
Shrubs	*Symphoricarpos albus*	****	***	***	****	***	common snowberry
	Acer glabrum var. *douglasii*	****	**	***	***	***	Douglas maple
	Rosa nutkana	**	**	**	**	**	Nootka rose
	Cornus stolonifera	**	*	**	**	**	red-osier dogwood
	Betula occidentalis	***	*	**	**	**	water birch
Grasses	*Elymus glaucus*	**	*	*	*	*	blue wildrye
Herbs	*Osmorhiza berteroi*	**	*	*	**	**	mountain sweet-cicely
	Galium triflorum	*	*	*	*	*	sweet-scented bedstraw
	Maianthemum stellata	*	*	*	*	*	star-flowered false Solomon's-seal
Mosses	*Brachythecium* sp.	*	*	*	*	*	raggged-moss
	Mnium spp.	*	*	*	*	*	leafy moss
PLOTS		LCG058		LCG022 LCG063	LCG020		

Highlighted species – indicate important forage plants for ungulates
Species – non-native species
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
SO	**Saskatoon – Mock orange Talus**	**IDFxh1**	**00**

Typic unit occurs on both warm and cool steep slopes with deep, coarse textured soils (blocky) (c and d are assumed modifiers).

This ecosystem is commonly associated with steep, blocky talus slopes with minimal soil in pockets between blocks. This is an uncommon unit in the study area. Scattered trees (Douglas-fir, ponderosa pine or aspen) and scattered shrubs (mock orange, snowberry, saskatoon) grow in soil pockets between blocks. Often cliff ferns (a very characteristic species) and scattered grasses are found growing in soil pockets. Vegetation cover is generally higher on sites with smaller blocks and more soil. Cool aspects more commonly have trees on them. Sites that are dominated by shrubs will not necessarily develop into a forested structural stage. Historically, these sites would not have had enough fuel to burn.

List of mapped units:

SOk cool aspect

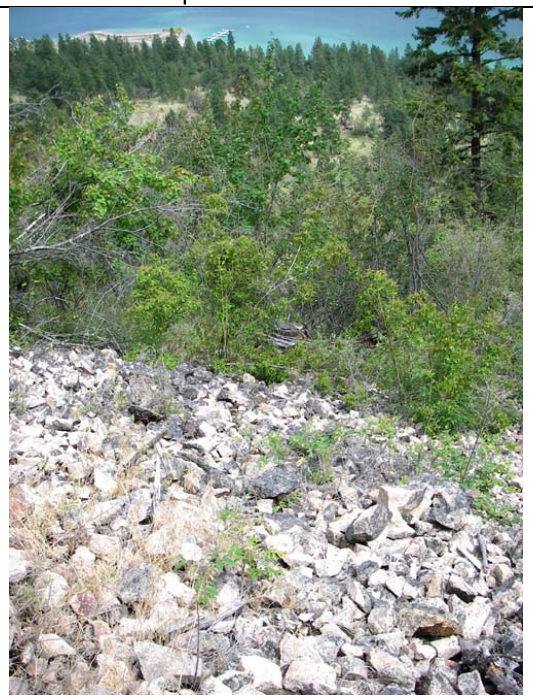
SOw warm aspect

SITE INFORMATION

Common Terrain Types:

- rubbly colluvial slopes

Slope position:	lower to upper
Slope (%):	60 – 70%
Aspect:	all
Soil Moisture Regime:	subxeric – xeric
Soil Nutrient Regime:	poor



Site Unit Symbol	Site Unit Name	BGC	Site Series Number
SO	Saskatoon – Mock orange Talus	IDFxh1	00

	Structural Stage	3	4	5	6	7	
Trees	*Pseudotsuga menziesii* var. *glauca*	*	**	**	**	***	Douglas-fir
	Pinus ponderosa	*	**	**	**	**	ponderosa pine
Shrubs	*Acer glabrum* var. *douglasii*	***	**	**	***	***	Douglas maple
	Philadelphus lewisii	**	**	**	**	**	mock-orange
	Amelanchier alnifolia	**	**	**	**	**	saskatoon
	Symphoricarpos albus	**	**	**	**	**	common snowberry
	Prunus virginiana	*	*	*	*	*	choke cherry
Herbs	*Woodsia scopulorum*	*	*	*	*	*	cliff fern
	Lomatium spp.	*	*	*	*	*	desert-parsely
PLOTS		LCG011 LCG045					

Highlighted species – indicate important forage plants for ungulates
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
SP	**Douglas-fir/Ponderosa pine – Snowbrush – Pinegrass**	**IDFxh1**	**04**

Typic unit occurs on gentle slopes with deep, medium textured soils (d, j and m are assumed modifiers).

This forest ecosystem is associated with moderate to steep slopes on neutral aspects (SPk; northwest and east-southeast). This is a common unit in the study area. It is also found on gently sloping sites with shallow soils (SPs). Occasionally it is found on warm aspects, but generally these are moderately sloping (25-35%) or on 'barely' warm aspects (west-northwest, southeast). The overstory is moderately closed, although historically frequent surface fires would have kept these stands very open and bunchgrasses such as rough fescue were more abundant. Understories are usually a mixture of bunchgrasses (bluebunch wheatgrass and rough fescue) and other grasses with scattered shrubs, forbs and mosses.

List of mapped units:

SPc	coarse-textured soils (usually glaciofluvial)	SPck	coarse-textured soils, cool aspect (usually ESE or NW), slope >25%
SPk	cool aspect (usually ESE or NW), slope >25%	SPks	cool aspect (usually ESE or NW), shallow soils
SPs	shallow soils (20-100cm deep)	SPsw	shallow soils (20-100cm deep), warm aspect (usually WNW or SE), slope 25-35%
SPw	warm aspect (usually SE or WNW)		

SITE INFORMATION

Common Terrain Types:

- thin or thick colluvial and morainal slopes and ridges

Slope position:	middle and upper
Slope (%):	25 – 50%
Aspect:	east-southeast, west-northwest
Soil Moisture Regime:	submesic
Soil Nutrient Regime:	poor – medium

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
SP	**Douglas-fir/Ponderosa pine – Snowbrush – Pinegrass**	**IDFxh1**	**04**

	Structural Stage	3	4	5	6	7	
Trees	*Pseudotsuga menziesii* var. *glauca*	**	***	***	***	***	Douglas-fir
	Pinus ponderosa	*	**	**	**	**	ponderosa pine
Shrubs	*Spirea betulifolia*	***	**	**	**	**	birch-leaved spirea
	Symphoricarpos albus	***	**	**	**	**	common snowberry
	Amelanchier alnifolia	**	*	**	**	**	saskatoon
Grasses	*Calamagrostis rubescens*	**	*	**	*	*	pinegrass
	Pseudoroegneria spicata	***	*	**	**	**	bluebunch wheatgrass
	Festuca campestris	***	*	***	****	****	rough fescue
	Koeleria macrantha	**	*	**	**	**	junegrass
Herbs	*Balsamorhiza sagittata*	**	*	*	**	**	arrowleaf balsamroot
	Lupinus sericeus	**	*	**	**	**	silky lupine
Mosses Lichens	*Cladonia* spp.	**	*	*	*	*	clad lichens
	Tortula ruralis	**	*	**	**	**	sidewalk moss
	Dicranum sp.	*	*	*	*	*	heron's-bill moss
PLOTS			LCG060		LCG026	LCG037	

Highlighted species – indicate important forage plants for ungulates
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
TA	**Talus**	**IDFxh1**	**N/A**
Steep colluvial deposits of angular rock fragments that result from rockfall. These sites have less than 10% vegetation cover.			
List of mapped units:			
TAw	warm aspect, slope usually 60-70%		

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
UR	**Urban/Suburban**	**IDFxh1**	**N/A**
Residential areas with concentrated houses and buildings that almost continuously cover the area. Urban areas are shown in the lower portion of the photo.			

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
WB	**Bluebunch wheatgrass – Balsamroot**	**IDFxh1**	**93**

Typic unit occurs on warm aspects with deep, medium-textured soils (assumed modifiers are d, m, and w)

This grassland ecosystem commonly occurs on moderately steep to steep warm slopes. Often surface soils are actively ravelling on steeper slopes. Bluebunch wheatgrass and balsamroot dominate these sites. Bunchgrasses are more widely spaced than on gentler slopes. Disturbed sites are mapped as seral associations as described below.

WB:kc *$Knapweed - Cheatgrass seral association*
These are early and very early seral sites. Although there are native forbs, there are few or no native bunchgrasses remaining on these sites. Invasive weeds including knapweed, cheatgrass and sulphur cinquefoil dominate these sites.

WB:wk $***Bluebunch wheatgrass – Knapweed seral association***
This is a mid- to late-seral seral association. On these sites there is still a reasonable component of bluebunch wheatgrass with knapweed, sulphur cinquefoil, or cheatgrass.

List of mapped units:

WBc	coarse-textured soils (generally glaciofluvial or rocky colluvial)	WBck	coarse-textured soils (generally glaciofluvial or rocky colluvial), cool aspect (generally ESE or NW), slope usually 60-70%
WBk	cool aspect (generally ESE or NW), slope usually 60-70%	WBks	cool aspect (generally ESE or NW), slope usually 60-70%, shallow soils (20-100cm deep)
WBr	ridge	WBs	shallow soils (20-100cm)

SITE INFORMATION

Common Terrain Types:

- morainal and glaciofluvial blankets and veneers and colluvial veneers

Slope position:	middle, upper, crest
Slope (%):	25 – 65%
Aspect:	south, southwest, west
Soil Moisture Regime:	subxeric – submesic
Soil Nutrient Regime:	medium – poor

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
WB	Bluebunch wheatgrass – Balsamroot	IDFxh1	93

	Structural Stage Seral Association	2b WB	2a WB:kc	2b WB:wk	
Shrubs	*Artemisia tridentata*				big sagebrush
Grasses	*Pseudoroegneria spicata*	***	*	**	bluebunch wheatgrass
	Koeleria macrantha	**		*	junegrass
	Bromus tectorum or *Bromus japonicus*	*	****	***	cheatgrass or Japanese brome
Herbs	*Artemisia frigida*	*		*	pasture sage
	Balsamorhiza sagittata	***	**	**	arrowleaf balsamroot
	Lupinus sericeus	**	*	**	silky lupine
	Eriogonum heracleoides	*	*	*	parsnip-flowered buckwheat
	Lithospermum ruderale	*	*	*	lemonweed
	Centaurea diffusa		****	**	diffuse knapweed
	Potentilla recta		***	**	sulphur cinquefoil
Mosses	*Cladonia* spp.	**		*	clad lichens
Lichens	*Tortula ruralis*	**		*	sidewalk moss
PLOTS		LCG007 LCG012 LCG024 LCG041 LCG062 LCG066 LCV113 LCV117	LCV076 LCV154	LCG036	

Highlighted species – indicate important forage plants for ungulates
Species – non-native species
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
WS	**Willow – Sedge Wetland**	**IDFxh1**	**09**

Typic unit occurs in depressions with deep, medium-textured soils (assumed modifiers are d, j, and m)

This unit is a generalized wetland unit equivalent to several swamp associations in the provincial classification (MacKenzie and Shaw 2000).

This swamp wetland ecosystem occurs at the edges of ponds and wetlands, forming a shrubby fringe on mineral soils. This is a very rare unit in the study area. It is dominated by willows, usually with sedges where it occurs at the edge of a wetland. O

SITE INFORMATION

Common Terrain Types:

- lacustrine veneer over morainal or glaciofluvial blanket

Slope position:	level, depression
Slope (%):	0
Aspect:	none
Soil Moisture Regime:	subhygric – hygric
Soil Nutrient Regime:	medium, rich

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
WS	Willow – Sedge Wetland	IDFxh1	09

	Structural Stage	3	
Shrubs	*Salix planifolia*	*****	tea-leaved willow
	Cornus stolonifera	***	red-osier dogwood
	Ribes hudsonianum	**	northern blackcurrant
Sedges	*Carex* spp.	**	sedges

Highlighted species – indicate important forage plants for ungulates
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Willow species likely vary from site to site.

LAKE COUNTRY EXPANDED LEGEND – MSdm1

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
PG	**Lodgepole pine – Grouseberry – Cladonia**	**MSdm1**	**03**

Typic unit occurs on gentle slopes with deep, medium textured soils (d, j and m are assumed modifiers).

This forest ecosystem is common on warm slopes with shallow soils.

List of mapped units:

PGs	shallow soils (generally 20-50cm)	PGsw	shallow soils (20-100cm); warm aspect; slope >25%

SITE INFORMATION

Common Terrain Types:

- shallow colluvial and morainal

Slope position:	middle, upper
Slope (%):	20-70%
Aspect:	usually warm
Soil Moisture Regime:	2-3
Soil Nutrient Regime:	poor, medium

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
PG	Lodgepole pine – Grouseberry – Cladonia	MSdm1	03

	Structural Stage	3	4	5	6	7	
Trees	*Pinus contorta*	**	*****	****	****	***	lodgepole pine
Herbs	*Arctostaphylos uva-ursi*	***	*	**	**	**	kinnikinnick
	Vaccinium scoparium	***	*	**	**	**	grouseberry
	Linnea borealis	*	**	**	**	**	twinflower
Lichens	*Cladonia* spp.	**	*	**	**	**	clad lichens

* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

RO	Rock Outcrop	MSdm1	N/A
These are areas of exposed bedrock with less than 10% vegetation cover. On sites with fractured bedrock, some plants may be growing out of rock cracks.			
List of mapped units:			
ROk	cool aspect	ROw	warm aspect

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
SF	**Hybrid white spruce – Falsebox – Feathermoss**	**MSdm1**	**01**

Typic unit occurs on gentle to moderate slopes with deep, medium textured soils (d, j and m are assumed modifiers).

This forest ecosystem occurs on zonal and near zonal sites.

List of mapped units:

SFk	cool aspect; slope >25%	SFs	shallow soils (generally 50-100cm)
SFw	warm aspect (generally SE or NW); slope >25%		

SITE INFORMATION

Common Terrain Types:

•

Slope position:	
Slope (%):	
Aspect:	
Soil Moisture Regime:	
Soil Nutrient Regime:	

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
SF	Hybrid white spruce – Falsebox – Feathermoss	MSdm1	01

	Structural Stage	3	4	5	6	7	
Trees	*Pinus contorta*	**	****	****	***	***	lodgepole pine
	Abies lasiocarpa			*	**	**	subalpine fir
	Picea engelmannii x glauca			*	**	**	hybrid white spruce
Shrubs	*Paxistima myrsinites*	***	*	**	**	**	falsebox
	Alnus viridis	****	*	**	**	**	Sitka alder
	Vaccinium membranaceum	***	*	**	**	**	black huckleberry
Grasses	*Calamagrostis rubescens*	***	*	**	**	**	pinegrass
Herbs	*Vaccinium scoparium*	***	*	**	**	**	grouseberry
	Epilobium angustifolium	****					fireweed
	Linnaea borealis	*	*	**	**	**	twinflower
	Cornus canadensis	***	**	**	**	**	bunchberry
Mosses	*Pleurozium schreberi*		*	**	***	***	red-stemmed feathermoss

Highlighted species – indicate important forage plants for ungulates
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
SG	**Hybrid white spruce – Gooseberry**	**MSdm1**	**06**
Typic unit occurs on gentle lower slope receiving sites with deep, medium textured soils (d, j and m are assumed modifiers).			
List of mapped units:			
SGgw gully, warm aspect, slope >25%			

SITE INFORMATION	
Common Terrain Types: • morainal	
Slope position:	lower, toe
Slope (%):	0 – 35%
Aspect:	none or warm
Soil Moisture Regime:	subhygric – hygric
Soil Nutrient Regime:	rich

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
SG	Hybrid white spruce – Gooseberry	MSdm1	06

	Structural Stage	3	4	5	6	7	
Trees	*Abies lasiocarpa*			*	**	**	subalpine fir
	Picea engelmannii x glauca	**	***	***	***	***	hybrid white spruce
Shrubs	*Ribes lacustre*	***	*	**	**	**	black gooseberry
Herbs	*Vaccinium scoparium*	***	*	**	**	**	grouseberry
	Cornus canadensis	***	**	**	**	**	bunchberry
	Actaea rubra	**	*	*	*	*	baneberry
Mosses	*Pleurozium schreberi*		*	**	**	**	red-stemmed feathermoss

* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
SH	**Hybrid white spruce – Trapper's tea – Horsetail**	**MSdm1**	**07**
Typic unit occurs on level sites with high water tables and deep, medium textured soils (d, j and m are assumed modifiers).			
List of mapped units:			
SHg gully			

SITE INFORMATION	
Common Terrain Types: • morainal	
Slope position:	toe, level, depression
Slope (%):	0 – 10%
Aspect:	none
Soil Moisture Regime:	hygric - subhydric
Soil Nutrient Regime:	rich

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
SH	Hybrid white spruce – Trapper's tea – Horsetail	MSdm1	07

	Structural Stage	3	4	5	6	7	
Trees	*Pinus contorta*	**	****	****	***	***	lodgepole pine
	Abies lasiocarpa			*	**	**	subalpine fir
	Picea engelmannii x glauca	*	**	**	***	***	hybrid white spruce
Shrubs	*Alnus viridis*	****	*	**	**	**	Sitka alder
	Ledum glandulosum	**	**	**	**	**	trapper's tea
	Ribes lacustre	***	*	**	**	**	black gooseberry
Herbs	*Vaccinium scoparium*	*	*	**	**	**	grouseberry
	Equisetum arvense	****	**	***	***	***	common horsetail
	Carex spp.	**	*	**	**	**	sedges
Mosses	*Mnium spp.*	**	**	***	***	***	leafy mosses
	Aulacomnium paluste	**	**	**	**	**	glow moss

* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

TA	Talus	MSdm1	N/A
Steep colluvial deposits of angular rock fragments that result from rockfall. These sites have less than 10% vegetation cover.			
List of mapped units:			
TAw	warm aspect, slope >25%		

LAKE COUNTRY EXPANDED LEGEND – PPxh1

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
AS	**Trembling aspen – Snowberry – Kentucky bluegrass**	**PPxh1**	**00**

Typic unit occurs on gentle slopes with deep, medium-textured soils (assumed modifiers are d, j, and m)

This ecosystem commonly occurs in large, broad depressions in grassland areas. These sites collect moisture from surrounding grassland areas. They have an overstory of trembling aspen and a shrubby understory dominated by snowberry and roses. This site unit was observed on the south-east side of the study area.

List of mapped units:

ASg	gully	ASk	cool aspect, slope >25%

SITE INFORMATION

Common Terrain Types:

- aeolian or slopewash veneer over morainal or glaciofluvial blankets

Slope position:	toe, depression
Slope (%):	0-15
Aspect:	none
Soil Moisture Regime:	subhygric
Soil Nutrient Regime:	rich

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
AS	Trembling aspen – Snowberry – Kentucky bluegrass	PPxh1	00

	Structural Stage	3	4	5	6	7	
Trees	*Populus tremuloides*	***	****	****	****	****	trembling aspen
Shrubs	*Symphoricarpos albus*	*****	****	****	****	****	common snowberry
	Rosa nutkana	***	**	**	**	**	Nootka rose
	Prunus virginiana	***	**	**	**	**	choke cherry
	Amelanchier alnifolia	**	*	*	*	*	saskatoon
	Mahonia aquifolium	**	*	*	*	*	tall Oregon-grape
Grasses	*Elymus glaucus*	*	*	*	*	*	blue wildrye
	Poa pratensis	*	*	*	*	*	Kentucky bluegrass
Herbs	*Cynoglossum officinale*	*	*	*	*	*	hound's tongue
	Arctium minus	*	*	*	*	*	burdock
	Maianthemum stellata	*	*	*	*	*	star-flowered false Solomon's-seal
Mosses	*Brachythecium* sp.	*	*	*	*	*	ragged moss

Highlighted species – indicate important forage plants for ungulates
Species – non-native species
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
CB	Cutbank	PPxh1	N/A
Edge of a road cut that is upslope or down slope of a road and was created by the excavation of a hillside.			

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
CD	**Ponderosa pine / Black cottonwood – Snowberry Riparian**	**PPxh1**	**00**

Typic unit occurs on gentle slopes with deep, medium textured soils (d, j and m are assumed modifiers).

This forest type is commonly associated with active floodplains and fluvial terraces with subsurface water. This unit is also found as a fringe along the Okanagan and Kalamalka Lake foreshore. Forests are often multi-layered with a mixture of black cottonwood, Douglas-fir, and Ponderosa pine. The understory is typically rich and shrubby, often dominated by snowberry and Douglas maple. Forbs (star-flowered false Solomon's seal), grasses (blue wildrye) and ragged mosses are uncommon and scattered.

List of mapped units:

CDa active floodplain

CDt fluvial terrace

SITE INFORMATION

Common Terrain Types:

- gentle and level fluvial sites and active floodplains
- lacustrine lake shores

Slope position:	level, lower and toe
Slope (%):	0-15%
Aspect:	none
Soil Moisture Regime:	subhygric – hygric
Soil Nutrient Regime:	rich

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
CD	Ponderosa pine / Black cottonwood – Snowberry Riparian	PPxh1	00

	Structural Stage	3	4	5	6	7	
Trees	*Populus balsamifera* ssp. *trichocarpa*	**	****	***	***	***	black cottonwood
	Betula papyrifera	*	**	**	**	**	paper birch
	Pinus ponderosa			*	**	**	ponderosa pine
	Pseudotsuga menziesii var. *glauca*			*	*	*	Douglas-fir
Shrubs	*Symphoricarpos albus*	*****	****	****	****	****	common snowberry
	Acer glabrum var. *douglasii*	****	***	***	***	***	Douglas maple
	Amelanchier alnifolia	***	**	**	**	**	saskatoon
	Mahonia aquifolium	***	**	**	**	**	tall oregon-grape
	Prunus virginiana	***	**	**	**	**	choke cherry
	Rosa nutkana	***	**	**	**	**	Nootka rose
	Cornus stolonifera	**	*	*	*	*	red-osier dogwood
Grasses	*Elymus glaucus*	**	*	*	*	*	blue wildrye
Mosses	*Brachythecium* sp.			*	*	*	ragged moss
PLOTS					LCV143		

Highlighted species – indicate important forage plants for ungulates
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Comments: some sites along the Okanagan Lake foreshore have low tree cover. Some pond fringes have higher Douglas-fir cover and may have tea-leaved willow and water birch as well on these sites.

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
CF	**Cultivated Field**	**PPxh1**	**N/A**
These are agricultural fields with tilled soils and planted crops or ground cover.			
List of mapped units:			
CFw	warm aspect, slope >25%		

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
CL	**Cliff**	**PPxh1**	**N/A**
These are steep, vertical or overhanging rock faces. Typically there are scattered plants such as cliff ferns occurring in pockets.			
List of mapped units:			
CLq	very steep (>100%) cool aspect	CLz	very steep (>100%) warm aspect

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
CO	**Cultivated Orchard**	**IDFxh1**	**N/A**
Agricultural areas for growing fruit trees.			

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
CT	**Cattail Marsh**	**PPxh1**	**00**

Typic unit occurs on level sites with deep, medium-textured soils (assumed modifiers are d, j, m)

This unit is equivalent to the *Cattail marsh* association in the provincial classification (MacKenzie and Shaw 2000)

This ecosystem commonly occurs as a fringe on ponds or in depressions, often adjacent to open water. Water depths are typically up to 1 m in spring but draw down to the soil surface by late summer; soils remain saturated for most of the season. Some wetlands convert to cattail marshes when they are subject to nutrient loading. These sites are dominated by cattails with few other species.

The photo below shows a cattail marsh in the spring before the new cattail leaves have grown above dead leaves from previous years' growth.

SITE INFORMATION	
Common Terrain Types: • lacustrine veneer over morainal or glaciofluvial blanket	
Slope position:	depression
Slope (%):	0
Aspect:	none
Soil Moisture Regime:	hygric - subhydric
Soil Nutrient Regime:	rich – very rich

	Structural Stage	2a	
Herbs	*Typha latifolia*	****	common cattail
	Lemna minor	**	common duckweed
PLOTS			

* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
CV	**Cultivated Vineyard**	**PPxh1**	**N/A**

Agricultural areas for growing grape vines.

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
CW	**Choke cherry – Bluebunch wheatgrass rocky bluff**	**PPxh1**	**00**

Typic unit occurs on gentle slopes with very shallow soils (assumed modifiers are j and v)

This ecosystem commonly occurs on bedrock bluffs where the bedrock is quite fractured. This unit is uncommon in the study area. Exposed bedrock usually occupies 30-50% of the area. Shrubs are common, typically occurring in cracks in the rocks. Grasses, forbs, lichens and mosses occur in small soil pockets scattered in amongst the bedrock.

List of mapped units:

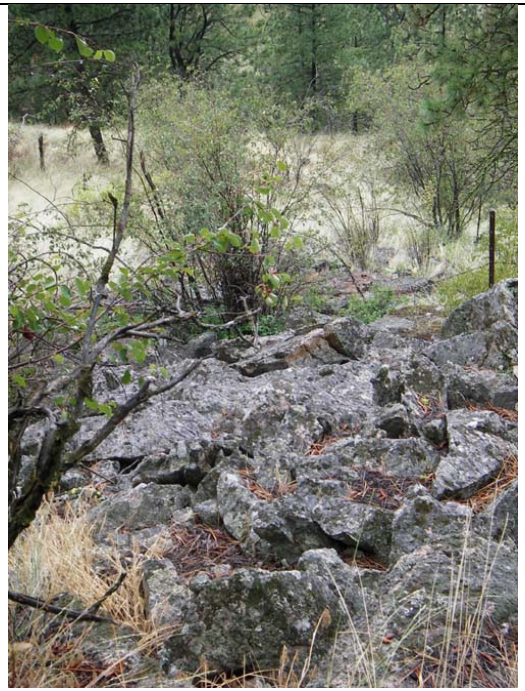
CWw warm aspect; slope >25%

SITE INFORMATION

Common Terrain Types:

- rock and very thin colluvial and morainal veneers

Slope position:	crest, upper
Slope (%):	0 – 100+
Aspect:	all
Soil Moisture Regime:	very xeric – xeric
Soil Nutrient Regime:	very poor – poor



Site Unit Symbol	Site Unit Name	BGC	Site Series Number
CW	Choke cherry – Bluebunch wheatgrass rocky bluff	PPxh1	00

	Structural Stage	3	
Shrubs	*Amelanchier alnifolia*	**	saskatoon
	Symphoricarpos albus	**	common snowberry
	Philadelphus lewisii	**	mock-orange
	Prunus virginiana	**	choke cherry
Grasses	*Pseudoroegneria spicata*	**	bluebunch wheatgrass
Herbs	*Woodsia scopulina*	*	mountain cliff fern
	Selaginella densa	*	compact selaginella
	Balsamorhiza sagittata	*	arrowleaf balsamroot
Mosses	*Tortula ruralis*	*	sidewalk moss

Highlighted species – indicate important forage plants for ungulates
Species – non-native species
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
DM	**Douglas-fir – Water birch - Douglas maple**	**PPxh1**	**08**

Typic unit occurs on gentle slopes with deep, medium textured soils (d, j and m are assumed modifiers).

This forest type is commonly associated with gullies with intermittent or permanent streams or subsurface water flow. These are diverse, rich sites with mixed coniferous (Douglas-fir) and deciduous (paper birch and aspen) overstories. The understories are dominated by diverse mixture of shrubs. Forbs are diverse but not abundant and mosses are scattered on these sites. These moist sites likely had a longer fire return interval than adjacent upland areas.

Although these sites are productive and vegetation recovers relatively quickly following disturbances such as logging, the moist soils on these sites are sensitive to disturbance and are difficult to find places for septic fields. Alterations in subsurface water flow present a considerable risk.

List of mapped units:

DMf	fine-textured soils	DMg	gullies, usually associated with permanent or intermittent creeks
DMgx	gully, drier than typic	DMt	fluvial terraces
DMw	warm aspect, slope >25%		

SITE INFORMATION

Common Terrain Types:

- gentle fluvial and morainal sites

Slope position:	toe (depression)
Slope (%):	0-15%
Aspect:	none
Soil Moisture Regime:	hygric
Soil Nutrient Regime:	rich

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
DM	Douglas-fir – Water birch - Douglas maple	PPxh1	08

	Structural Stage	3	4	5	6	7	
Trees	*Pseudotsuga menziesii* var. *glauca*	*	**	**	**	**	Douglas-fir
	Populus tremuloides	**	***	***	***	*	trembling aspen
	Betula paperifera	****	***	***	***	**	paper birch
Shrubs	*Symphoricarpos albus*	***	***	***	***	***	common snowberry
	Acer glabrum var. *douglasii*	****	***	***	***	***	Douglas maple
	Cornus stolonifera	**	**	**	**	**	red-osier dogwood
	Mahonia aquifolium	**	**	**	**	**	tall oregon-grape
	Philadelphus lewisii	**	**	**	**	**	mock-orange
	Rosa nutkana	**	*	*	*	*	Nootka rose
	Betula occidentalis	**	*	*	*	*	water birch
Grasses	*Elymus glaucus*	**	*	*	*	*	blue wildrye
Herbs	*Osmorhiza berteroi*	*	*	*	*	*	mountain sweet-cicely
	Galium triflorum	*	*	*	*	*	sweet-scented bedstraw
	Maianthemum stellatum	*	*	*	*	*	star-flowered false Solomon's-seal
Mosses	*Brachythecium* sp.	*	*	*	*	*	ragged moss
	Mnium sp.	*	*	*	*	*	leafy moss
PLOTS				LCG046	LCV136		

Highlighted species – indicate important forage plants for ungulates
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
DS	**Douglas-fir / Ponderosa pine – Snowberry – Spirea**	**PPxh1**	**07**

Typic unit occurs on gentle slopes with deep, medium textured soils (d, j and m are assumed modifiers).

This forest type is commonly associated with gently sloping sites that are receiving some moisture. It is also found on receiving sites where there is some sub-surface moisture. These forests are typically have moderately closed Douglas-fir overstories with very shrubby understories dominated by snowberry with some Oregon-grape, birch-leaved spirea, and saskatoon. Often there is scattered pinegrass or Kentucky bluegrass with some heart-leaved arnica and other scattered forbs. There is a minimal moss layer with patches of ragged mosses. Because these sites are moist, they likely had a longer fire-return interval than adjacent mesic and drier forests. These sites also tend to recover more quickly after disturbance (such as logging) because they are moister and more productive.

List of mapped units:

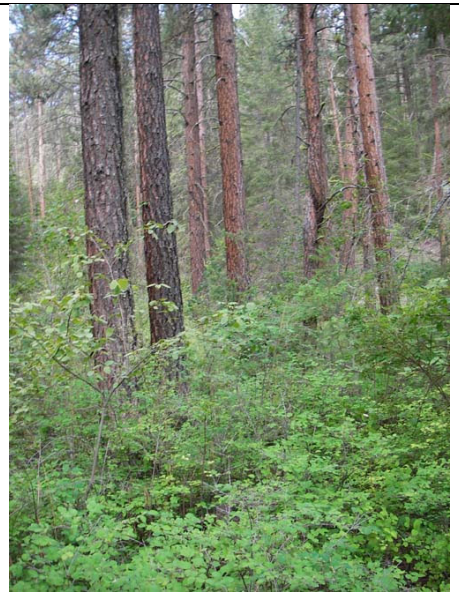
DSc	coarse-textured soils	DSf	fine textured soils (usually glaciolacustrine)
DSg	gullied (usually associated with intermittent streams)	DSgw	gully, warm aspect, slope >25%
DSk	cool aspect (slope >25%)	DSs	shallow soils (generally 50-100cm)

SITE INFORMATION

Common Terrain Types:

- gentle morainal and glaciofluvial slopes

Slope position:	lower, toe
Slope (%):	0-15% (and sometimes up to 60%)
Aspect:	none
Soil Moisture Regime:	subhygric
Soil Nutrient Regime:	rich



Site Unit Symbol	Site Unit Name	BGC	Site Series Number
DS	Douglas-fir / Ponderosa pine – Snowberry – Spirea	PPxh1	07

	Structural Stage	3	4	5	6	7	
Trees	*Pseudotsuga menziesii* var. *glauca*	**	**	***	****	***	Douglas-fir
	Populus tremuloides	**	***	***	**		trembling aspen
Shrubs	*Symphoricarpos albus*	****	***	***	***	***	common snowberry
	Amelanchier alnifolia	**	**	**	**	**	saskatoon
	Mahonia aquifolium	**	**	**	**	**	tall oregon-grape
	Spirea betulifolia	***	**	**	**	**	birch-leaved spirea
	Acer glabrum	**	*				Douglas maple
Grasses	*Elymus glaucus*	**	*	*	*	*	blue wildrye
Herbs	*Maianthemum racemosa*	*	*	*	*	*	false Solomon's-seal
	Maianthemum stellata	*	*	*	*	*	star-flowered false Solomon's-seal
	Osmorhiza berteroi	*	*	*	*	*	mountain sweet-cicely
	Prosartes trachycarpa	**	*	*	*	*	rough-fruited fairy bells
Mosses	*Rhytidiadelphus triquetrus*	*	**	**	**	**	electrified cat's-tail moss
	Brachythecium sp.	**	**	**	**	**	ragged moss

Highlighted species – indicate important forage plants for ungulates
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites

Comments: Douglas maple is more common on slightly moister sites; mixed and deciduous sites usually have a more diverse shrub layer; star-flowered false Solomon's seal, mountain sweet-cicely, and western meadowrue are often present on these mixed/pure deciduous sites as well

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
ES	Exposed Soil	PPxh1	N/A
These are areas of exposed soils and typically include recent disturbances such as soil erosion.			
List of mapped units:			
ESw	warm aspect		

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
FB	**Fescue – Bluebunch wheatgrass**	**PPxh1**	**00**

Typic unit occurs on gentle slopes with deep, medium-textured soils (assumed modifiers are d, j, m)

This ecosystem commonly occurs on gentle and level sites and cool aspects (when they are non-forested). A mixture of Idaho fescue and bluebunch wheatgrass with balsamroot and other herbs dominate late seral sites. Many sites have significant pocket gopher digging in them. Unfortunately, most of these sites are highly disturbed and have a significant component of weeds. Sites with more than 10% weeds are mapped as seral associations.

FB:cn *$Cheatgrass – Columbia needlegrass seral association*
This is an early seral association dominated by cheatgrass and other invasive annual bromes, weedy species, with scattered Columbia needlegrass and native grassland forbs.

FB:kc *$Knapweed – Cheatgrass seral association*
This is an early seral association dominated by knapweed, sulphur cinquefoil, and cheatgrass with few or no native bunchgrasses remaining on these sites.

FB:nc *$Columbia needlegrass – Cheatgrass seral association*
This is an early seral association dominated by Columbia needlegrass with significant cover of invasive annual bromes, especially cheatgrass, and native grassland forbs.

FB:wk $*Bluebunch wheatgrass – Knapweed seral association*
This is a mid- to late-seral seral association. On these sites there is still a reasonable component of bluebunch wheatgrass with knapweed, sulphur cinquefoil, or cheatgrass.

List of mapped units:

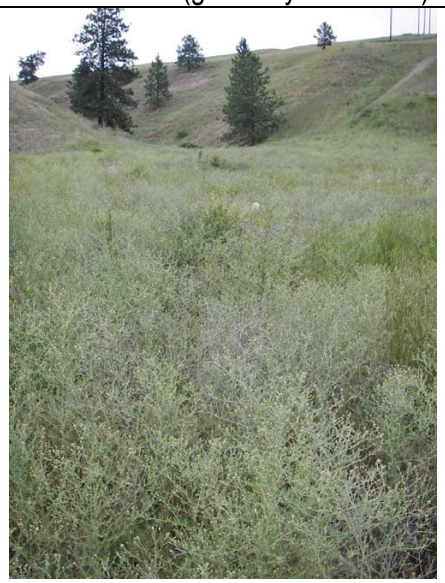
FBc	coarse-textured soils (glaciofluvial)	FBk	cool aspects, typically 25-35% slopes
FBks	cool aspects, shallow soils (generally 50-100cm)	FBs	shallow soils (generally 50-100cm)

SITE INFORMATION

Common Terrain Types:

- aeolian veneers overlying morainal or glaciofluvial blankets

Slope position:	Middle to upper
Slope (%):	0-35%
Aspect:	All
Soil Moisture Regime:	Submesic – mesic
Soil Nutrient Regime:	Medium – rich



Site Unit Symbol	Site Unit Name	BGC	Site Series Number
FB	Rough fescue – Bluebunch wheatgrass	PPxh1	00

	Structural Stage Seral Association	2 FB	2 FB:cn	2 FB:kc	2 FB:nc	2 FB:wk	
Shrubs	*Artemisia tridentata*						big sagebrush
Grasses	*Festuca idahoensis*	****					Idaho fescue
	Festuca campestris	**					rough fescue
	Pseudoroegneria spicata	***			*	***	bluebunch wheatgrass
	Koeleria macrantha	**			*		junegrass
	Achnatherum nelsonii		**	**	****	*	Columbian needlegrass
	Bromus tectorum or *Bromus japonicus*		****	****	***	***	cheatgrass or Japanese brome
Herbs	*Balsamorhiza sagittata*	***	*		**	**	arrowleaf balsamroot
	Lupinus sericeus	**	*	*	*	**	silky lupine
	Eriogonum heracleoides	**	**	*	*	*	parsnip-flowered buckwheat
	Lithospermum ruderale	*	*	*	*	*	lemonweed
	Calochortus macrocarpus	*					sagebrush mariposa lily
	Centaurea diffusa		*	***	**	**	diffuse knapweed
	Potentilla recta			***	*	*	sulphur cinquefoil
Mosses and Lichens	*Cladonia* spp.	**					clad lichens
	Tortula ruralis	**	*			*	sidewalk moss
	Peltigera rufescens or *Peltigera ponojensis*	**					felt pelt felt pelt
PLOTS				LCV062		LCV063 LCV066	

Highlighted species – indicate important forage plants for ungulates
Species – non-native species
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
FO	**Douglas-fir / Ponderosa pine –Saskatoon – Mock orange**	**PPxh1**	**00**

Typic unit occurs on steep slopes with deep, coarse-textured (rocky) soils (c, and d are assumed modifiers).

This forest ecosystem is commonly associated with steep colluvial sites with rocky soils. This is an uncommon unit in the study area. It occurs on both cool (FOk) and warm (FOw) aspects. The soil matrix is a mixture of both angular rocks and sandy, silty material. The overstory is generally open and dominated by Douglas-fir and ponderosa pine. Understories are often quite shrubby with snowberry, saskatoon and mock orange. There is usually scattered bluebunch wheatgrass. Small rocks dominate a large portion of the soil surface.

List of mapped units:

FOk cool aspect (>25%)

FOw warm aspect (slope >25%)

SITE INFORMATION

Common Terrain Types:

- moderate and steep rocky colluvial slopes

Slope position:	lower to upper
Slope (%):	60-75%
Aspect:	all
Soil Moisture Regime:	submesic – subxeric
Soil Nutrient Regime:	medium, poor

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
FO	Douglas-fir / Ponderosa pine –Saskatoon – Mock orange	PPxh1	00

	Structural Stage	3	4	5	6	7	
Trees	*Pseudotsuga menziesii* var. *glauca*	*	***	***	***	***	Douglas-fir
	Pinus ponderosa	*	**	**	**	**	ponderosa pine
Shrubs	*Symphoricarpos albus*	*****	***	***	****	****	common snowberry
	Spirea betulifolia	***	*	*	**	**	birch-leaved spirea
	Philadelphus lewisii	**		*	**	**	mock-orange
	Prunus virginiana	***		*	**	**	choke cherry
	Amelanchier alnifolia	****	**	**	***	***	saskatoon
Grasses	*Pseudoroegneria spicata*	***	**	**	***	***	bluebunch wheatgrass
	Calamagrostis rubescens	***	**	**	***	***	pinegrass
Herbs	*Lomatium dissectum*	*	*	*	*	*	fern-leaved desert parsley
Mosses	*Tortula ruralis*	*		*	*	*	sidewalk moss

Highlighted species – indicate important forage plants for ungulates
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
GC	**Golf Course**	**PPxh1**	**N/A**
Areas set aside for playing golf including grass-covered areas, and patches of trees or shrubs.			

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
GP	**Gravel Pit**	**PPxh1**	**N/A**
An area of exposed soil formed through the removal of sand and gravel			

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
OW	**Shallow Open Water**	**PPxh1**	**N/A**
These are areas of permanent open water that are less than 2m deep. There is less than 10% emergent vegetation but floating aquatics such as bladderwort may be present. **OWx** – drier than typical, may only have water in spring and is usually dry during summer.			

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
PC	**Ponderosa pine – Bluebunch wheatgrass – Cheatgrass**	**PPxh1**	**04**

Typic unit occurs on gentle slopes with deep, medium textured soils (d, j, and m are assumed modifiers).

This forest type is most common on moderate to steep warm aspects. It sometimes occurs on cooler aspects where soils are shallow. Occasionally found on ridges and crests where soils are not shallow enough to be the PPxh1 /02 (PT). Forests are open and dominated by bunchgrasses, particularly bluebunch wheatgrass with scattered forbs. Mosses and lichens are scattered and uncommon.

List of mapped units:

PCc	coarse-textured soils	PCcr	coarse-textured soils, ridge or crest
PCcs	coarse-textured soils, shallow soils (20-100cm deep)	PCcw	coarse-textured soils, warm aspect (25-50% slopes)
PCks	cool aspect (35-60% slopes, typically southeast), shallow soils	PCr	ridge, crest
PCsw	shallow soils, warm aspect (25-50% slopes)	PCw	warm aspect (25-50% slopes)

SITE INFORMATION

Common Terrain Types:

- colluvial and morainal blankets and veneers
- moderate to steep glaciofluvial slopes

Slope position:	middle and upper
Slope (%):	(30) 40 – 60%
Aspect:	south, southwest, west (also southeast on glaciofluvial slopes and shallow soils)
Soil Moisture Regime:	subxeric – submesic
Soil Nutrient Regime:	medium - poor

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
PC	Ponderosa pine – Bluebunch wheatgrass - Cheatgrass	PPxh1	04

	Structural Stage	3	4	5	6	7	
Trees	*Pinus ponderosa*	**	****	***	***	***	ponderosa pine
Shrubs	*Amelanchier alnifolia*	***	**	**	**	**	saskatoon
	Ceanothus velutinus	***					snowbrush
Grasses	*Pseudoroegneria spicata*	***	***	***	***	****	bluebunch wheatgrass
	Festuca campestris	*	*	**	**	**	rough fescue
Herbs	*Balsamorhiza sagittata*	**	**	**	**	**	arrowleaf balsamroot
	Antennaria spp.	**	*	*	*	*	pussytoes
	Achillea millefolium	**	*	*	*	*	yarrow
Mosses and Lichens	*Cladonia* spp.	**	**	**	**	**	clad lichens
	Tortula ruralis	**	**	**	**	**	sidewalk moss
	Brachythecium sp.	*	*	*	*	*	ragged moss
PLOTS		LCV121	LCV120		9901757		

Highlighted species – indicate important forage plants for ungulates
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites
Snowbrush may only occur on sites that have been burned.

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
PF	**Ponderosa pine – Bluebunch wheatgrass – Rough fescue**	**PPxh1**	**05**

Typic unit occurs on gentle slopes with deep, medium textured soils (d, j and m are assumed modifiers).

This forest type is commonly associated with moderate to steep slopes on cool aspects. It is also found on gently sloping sites with shallow soils. Occasionally it is found on warm aspects, but generally these are moderately sloping (25-35%) or on 'neutral' aspects (northwest, southeast). The overstory is moderately closed, although historically frequent surface fires would have kept these stands very open. Understories are usually a mixture of bluebunch wheatgrass, rough fescue, and pinegrass with scattered shrubs, forbs and mosses.

List of mapped units:

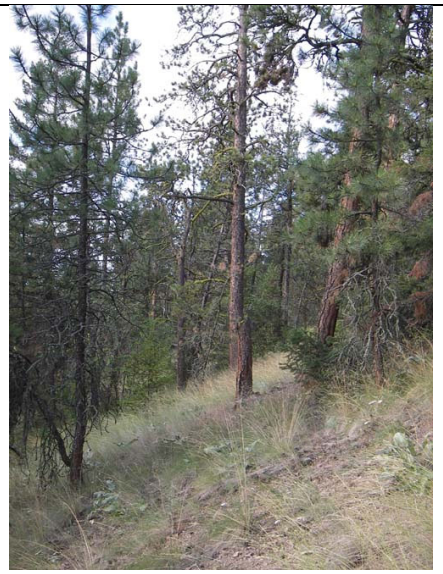
PFc	coarse-textured soils	PFck	coarse-textured soils, cool aspect (30-70% slopes)
PFfk	fine-textured soils (glaciolacustrine), cool aspect, slopes >25%	PFk	cool aspect (30-70% slopes)
PFks	cool aspect (30-70% slopes), shallow soils (50-100cm deep)		

SITE INFORMATION

Common Terrain Types:

- colluvial and morainal blankets and veneers
- moderate to steep glaciofluvial slopes

Slope position:	middle and upper
Slope (%):	30 – 75%
Aspect:	(northwest) north, northwest, east
Soil Moisture Regime:	mesic - submesic
Soil Nutrient Regime:	medium - poor



Site Unit Symbol	Site Unit Name	BGC	Site Series Number
PF	Ponderosa pine – Bluebunch wheatgrass – Rough fescue	PPxh1	05

	Structural Stage	3	4	5	6	7	
Trees	*Pseudotsuga menziesii* var. *glauca*	**	***	***	***	***	Douglas-fir
	Pinus ponderosa	**	***	***	***	***	ponderosa pine
Shrubs	*Amelanchier alnifolia*	***	**	**	**	**	saskatoon
	Symphoricarpos albus	***	**	**	**	**	common snowberry
Grasses	*Festuca campestris*	**	**	***	***	***	rough fescue
	Pseudoroegneria spicata	**	*	**	**	**	bluebunch wheatgrass
	Koeleria macrantha	*	*	*	*	*	junegrass
Herbs	*Balsamorhiza sagittata*	**	*	**	**	**	arrowleaf balsamroot
	Achillea millefolium	**	*	*	*	*	yarrow
	Antennaria spp.	**	*	*	*	*	pussytoes
	Hieracium scouleri	*	*	*	*	*	Scouler's hawkweed
Mosses and Lichens	*Cladonia* spp.	**	*	*	**	**	clad lichens
	Tortula ruralis	*	*	*	**	**	rusty steppe moss
	Polytrichum juniperinum	*	*	*	*	*	juniper haircap moss

Highlighted species – indicate important forage plants for ungulates
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
PT	**Ponderosa pine – Red three-awn**	**PPxh1**	**02**

Typic unit occurs on warm aspects with deep, coarse-textured soils (c, d, and w are assumed modifiers).

This forest type most commonly occurs on moderate to steep warm aspects, with shallow or very shallow soils (PTs, PTv). It is also commonly found on moderate to steep slopes of all aspects and ridge crests where the soils are extremely shallow. Forests are very open with scattered large trees, often growing in bedrock fractures. The understory is variable depending on soil depth with more vegetation occurring on deeper soil pockets. Scattered shrubs and bunchgrasses (bluebunch wheatgrass and rough fescue) dominate the understory. A lichen and moss crust may be present on undisturbed sites. This ecosystem also occurs on steep glaciofluvial slopes with raveling, sandy surface soils (PT). Trees and other vegetation is usually widely spaced and scattered on these slopes.

List of mapped units:

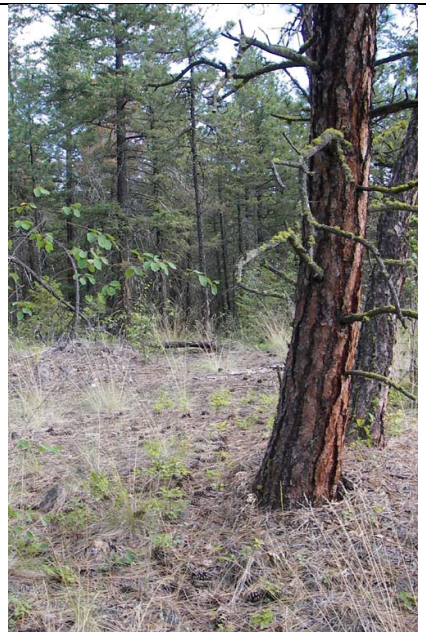
PTjv	gentle slopes, very shallow soils, exposed bedrock present	PTkv	cool aspect, very shallow soils, exposed bedrock present
PTrv	ridge, very shallow soils, exposed bedrock present	PTs	shallow soils
PTv	very shallow soils, exposed bedrock present		

SITE INFORMATION

Common Terrain Types:

- Thin and very thin colluvial, morainal and glaciofluvial veneers over bedrock
- Steep glaciofluvial slopes

Slope position:	upper and crest (and middle slopes on steep glaciofluvial sites)
Slope (%):	0-70%
Aspect:	None (crest), south, southwest
Soil Moisture Regime:	Very xeric to subxeric
Soil Nutrient Regime:	poor (very poor, medium)



Site Unit Symbol	Site Unit Name	BGC	Site Series Number
PT	Ponderosa pine – Red three-awn	PPxh1	02

	Structural Stage	3	4	5	6	7	
Trees	*Pinus ponderosa*	**	***	***	***	***	ponderosa pine
	Pseudotsuga menziesii var. *glauca*			*	**	**	Douglas-fir
Shrubs	*Amelanchier alnifolia*	**	**	**	**	**	saskatoon
	Symphoricarpos albus	**	*	*	*	*	common snowberry
Grasses and Sedges	*Pseudoroegneria spicata*	***	***	***	***	***	bluebunch wheatgrass
	Bromus japonicus or tectorum	*	*	*	*	*	Japanese brome or cheatgrass
	Festuca campestris	*	*	*	*	*	rough fescue
Herbs	*Selaginella densa*	***	**	**	**	**	compact selaginella
	Balsamorhiza sagittata	**	**	**	**	**	arrowleaf balsamroot
	Penstemon fruiticosa	**	**	**	**	**	shrubby penstemon
Mosses Lichens	*Cladonia* spp.	**	**	**	**	**	clad lichens
	Tortula ruralis	**	**	**	**	**	sidewalk moss
PLOTS				LCV133			

Highlighted species – indicate important forage plants for ungulates
Species – non-native species
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Comments: cover of Japanese brome or cheatgrass will usually increase with disturbance, spreading dogbane is often present on steep glaciofluvial sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
PW	**Ponderosa pine – Bluebunch wheatgrass – Idaho fescue**	**PPxh1**	**01**

Typic unit occurs on gentle slopes with deep, medium-textured soils (d, j, and m are assumed modifiers).

This forest type is commonly associated with gently sloping glaciofluvial and morainal deposits. The overstory is generally open and dominated by ponderosa pine. Historically these sites would have been kept extremely open by frequent low-severity surface fires. Saskatoon, bluebunch wheatgrass, rough fescue and arrow-leaved balsamroot are most common in the understory. This ecosystem type been altered extensively by ingrowth of small trees into formerly open forests and loss to urban and agricultural development in the study area.

List of mapped units:

PWc	coarse-textured soils (typically glaciofluvial materials)	PWcw	coarse-textured soils, warm aspect (25-35% slopes, most often mid-lower slopes)
PWf	fine-textured soils (glaciolacustrine)	PWk	cool aspect, usually NW or ESE, slope 25-35%
PWks	cool aspect (25-35% slopes, usually mid-upper slopes), shallow soils (generally 50-100cm deep)	PWs	shallow soils (50-100cm deep)
PWw	warm aspect (usually WNW or SE, 25-35% slopes)		

SITE INFORMATION

Common Terrain Types:

- Gently sloping glaciofluvial and morainal slopes and terraces

Slope position:	Level, mid to upper
Slope (%):	0-15 (25)%
Aspect:	none
Soil Moisture Regime:	submesic – mesic
Soil Nutrient Regime:	poor – medium

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
PW	Ponderosa pine – Bluebunch wheatgrass – Idaho fescue	PPxh1	01

	Structural Stage	3	4	5	6	7	
Trees	*Pinus ponderosa*		**	***	**	**	ponderosa pine
Shrubs	*Amelanchier alnifolia*	**	**	*	*	*	saskatoon
	Rosa acicularis	**	*	*	*	*	prickly rose
	Ceanothus sanguineus or *velutinus*	***	**				redstem ceanothus or snowbrush
Grasses	*Festuca campestris*	***	**	***	***	***	Rough fescue
	Pseudoroegneria spicata	**	*	**	**	**	bluebunch wheatgrass
	Bromus tectorum	*	*	*	*	*	cheatgrass
Herbs	*Balsamorhiza sagittata*	***	**	**	**	**	arrow-leaved balsamroot
	Antennaria spp.	**	**	**	**	**	pussytoes
	Achillea millefolium	*	*	*	*	*	yarrow
	Hieracium scouleri	*	*	*	*	*	Scouler's hawkweed
Mosses	*Brachythecium* sp.	*	*	*	*	*	ragged moss
	Cladonia spp.	*		*	**	**	clad lichens
	Tortula ruralis	*	*	*	**	**	sidewalk moss
PLOTS				9901762 LCG015 LCG047			

Highlighted species – indicate important forage plants for ungulates
Species – non-native species
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
RO	**Rock Outcrop**	**PPxh1**	**N/A**
These are areas of exposed bedrock with less than 10% vegetation cover. On sites with fractured bedrock, some plants may be growing out of rock cracks. Generally rock outcrops on the east side of the study area had more fractures than those on the west side of the study area.			
List of mapped units:			
ROk cool aspect		ROr ridge	

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
RW	**Rural**	**PPxh1**	**N/A**
Rural areas of human settlement with scattered houses intermingled with native vegetation or cultivated areas.			

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
RZ	**Road Surface**	**PPxh1**	**N/A**
A gravel or paved road used for vehicular travel.			

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
SA	**Antelope Brush - Selaginella**[62]	**PPxh1**	**00**

Typic unit occurs on gentle slopes with shallow soils (assumed modifiers are j, m and s).

However, in the study area, this unit more commonly occurs on steep slopes on rock outcrops with small ledges and pockets of soil. The bedrock is generally fractured. This is an uncommon unit in the study area. In contrast with areas in the South Okanagan, there is no antelope brush on these sites. Scattered ponderosa pine trees and saskatoon bushes occur in rock fractures. Soil pockets on ledges are dominated by bluebunch wheatgrass with balsamroot, selaginella, and a well-developed microbiotic crust.

List of mapped units:

SAkv	cool aspect, very shallow soils	SAqv	very steep cool aspect (>100% slope), very shallow soils
SArv	ridge, very shallow soils	SAv	very shallow soils
SAvw	very shallow soils, warm aspect	SAvz	very shallow soils, very steep warm aspect (>100% slope)

SITE INFORMATION

Common Terrain Types:

- rock, very thin morainal, weathered bedrock and colluvial veneers

Slope position:	crest, upper
Slope (%):	40 – 70
Aspect:	variable
Soil Moisture Regime:	very xeric – xeric
Soil Nutrient Regime:	very poor – poor

[62] Although the plant association name includes antelope brush, antelope brush does not occur in the study area.

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
SA	Antelope Brush – Selaginella	PPxh1	00

	Structural Stage	2b	3	4	5	6	7	
Trees	*Pseudotsuga menziesii* var. *glauca*		*	**	**	**	**	Douglas-fir
	Pinus ponderosa		*	***	***	***	***	ponderosa pine
Shrubs	*Amelanchier alnifolia*	**	**	**	**	**	**	saskatoon
	Spirea betulifolia	*	*	*	*	*	*	birch-leaved spirea
Grasses	*Pseudoroegneria spicata*	***	***	***	***	***	***	bluebunch wheatgrass
Herbs	*Selaginella densa*	**	**	**	**	**	**	compact selaginella
	Penstemon fruticosa	*	*	*	*	*	*	shrubby penstemon
	Woodsia scopulina	*	*	*	*	*	*	mountain cliff fern
Mosses	*Cladonia* spp.	**	**	**	**	**	**	clad lichens
Lichens	*Polytrichum piliferum*	**	**	**	**	**	**	awned haircap moss
PLOTS		LCG014						

Highlighted species – indicate important forage plants for ungulates
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites
Comments: most sites do no progress through the structural stages. Rather some sites are more suitable for tree growth than others.

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
SB	**Selaginella – Bluebunch wheatgrass rock outcrop**	**PPxh1**	**00**

Typic unit occurs on gentle slopes with very shallow soils (assumed modifiers are j and v)

This ecosystem commonly occurs on bedrock outcrops with low relief, generally unfractured bedrock. Selaginella and rusty steppe moss with some grasses and forbs dominate these sites. Shrubs are sometimes present but are quite uncommon due to the lack of fractures in the bedrock.

SB:cg *Cheatgrass seral association*
This seral association is dominated by cheatgrass.

List of mapped units:

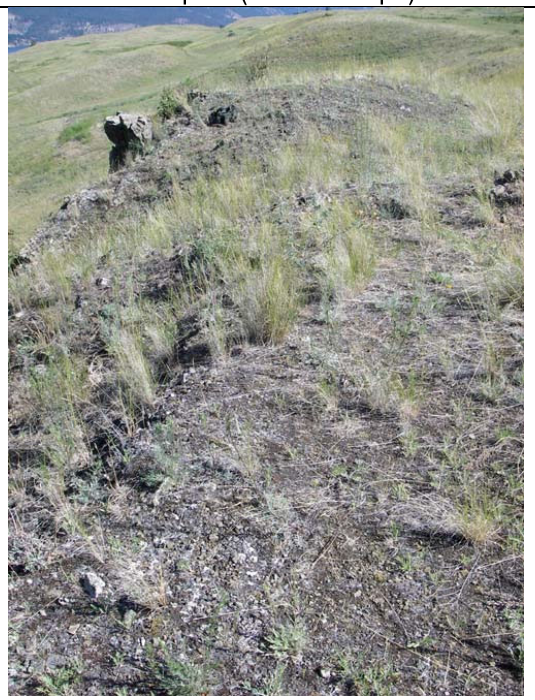
SBr	ridge	SBw	warm aspect (25-70% slope)

SITE INFORMATION

Common Terrain Types:

- Very thin morainal, glaciofluvial, weathered bedrock and colluvial veneers

Slope position:	crest
Slope (%):	0-20
Aspect:	all
Soil Moisture Regime:	very xeric
Soil Nutrient Regime:	poor, medium



Site Unit Symbol	Site Unit Name	BGC	Site Series Number
SB	Selaginella – Bluebunch wheatgrass rock outcrop	PPxh1	00

	Structural Stage Seral stage	2a SB	2a SB:cg	
Trees	*Pinus ponderosa*	*	*	ponderosa pine
Shrubs	*Amelanchier alnifolia*	*	*	saskatoon
Grasses	*Pseudoroegneria spicata*	**	*	bluebunch wheatgrass
	Bromus japonicus or tectorum	*	***	Japanese brome or cheatgrass
	Poa secunda	*	*	Sandberg's bluegrass
Herbs	*Selaginella densa*	***	***	compact selaginella
	Eriogonum heracleoides	**	*	parsnip-flowered buckwheat
	Achillea millefolium	*	*	yarrow
Mosses and Lichens	*Cladonia* spp.	**	*	clad lichens
	Tortula ruralis	**	*	sidewalk moss
	Peltigera rufescens or *Peltigera ponojensis*	*		felt pelt
PLOTS		LCG013 LCG053 LCV065		

Highlighted species – indicate important forage plants for ungulates
Species – non-native species
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
SO	**Saskatoon – Mock orange Talus**	**PPxh1**	**00**

Typic unit occurs on both warm and cool steep slopes with deep, coarse textured soils (blocky soils; c, and d are assumed modifiers).

This forest type is commonly associated with steep, blocky talus slopes with minimal soil in pockets between blocks. Scattered trees (Douglas-fir, ponderosa pine and/or aspen) and scattered shrubs (mock orange, snowberry, ocean spray) grow in soil pockets between blocks. Often cliff ferns (a very characteristic species) and scattered grasses are found growing in soil pockets. Vegetation cover is generally higher on sites with smaller blocks and more soil development, typically a mixture of both angular rocks and sandy, silty material. Cool aspects more commonly have trees on them. Sites that are dominated by shrubs will not necessarily succeed into a forested structural stage. Historically, these sites would not have enough fuel to burn. Thus they would be have been a seed source for some dry refugia species that are fire intolerant such as Rocky Mountain juniper.

List of mapped units:

SOk	cool aspect	SOw	warm aspect

SITE INFORMATION	
Common Terrain Types: • rubbly colluvium	
Slope position:	Lower to upper
Slope (%):	60-75%
Aspect:	All
Soil Moisture Regime:	subxeric to very xeric
Soil Nutrient Regime:	poor to medium

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
SO	Saskatoon – Mock orange Talus	PPxh1	00

	Structural Stage	3	4	5	6	7	
Trees	*Pseudotsuga menziesii* var. *glauca*	*	**	**	**	**	Douglas-fir
	Pinus ponderosa	*	**	**	**	**	ponderosa pine
	Populus tremuloides		**	**	**	**	trembling aspen
Shrubs	*Philadelphus lewisii*	***	**	**	**	**	mock-orange
	Amelanchier alnifolia	**	**	**	**	**	saskatoon
	Acer glabrum var. *douglasii*	**	**	**	**	**	Douglas maple
	Symphoricarpos albus	**	**	**	**	**	common snowberry
	Prunus virginiana	**	*	**	**	**	choke cherry
Grasses	*Pseudoroegneria spicata*	*	*	*	*	*	bluebunch wheatgrass
Herbs	*Woodsia* sp.	*	*	*	*	*	cliff fern
PLOTS		LCV071					

Highlighted species – indicate important forage plants for ungulates
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
SP	**Douglas-fir / Ponderosa pine – Snowberry - Pinegrass**	**PPxh1**	**06**

Typic unit occurs on gentle slopes with deep, medium textured soils (d, j and m are assumed modifiers).

This forest type is commonly associated with gentle lower slopes and moderate to steep cool aspects that are receiving some subsurface moisture. Common on the lower slopes of gullies, adjacent to the wetter /08 (DM) unit mapped along the creeks and streams. Forests are moderately closed with mixed Douglas-fir and ponderosa pine overstories, although historically they would have been quite open, as fire would have been a frequent disturbance. The understory is dominated by snowberry and pinegrass. Mosses are prominent in the moss and lichen layer, especially on the cool aspects. Forbs are more abundant on the open sites that have been less subject to ingrowth (or have been thinned). This ecosystem also occurs on gentle glaciofluvial slopes or terraces where ponderosa pine is often more abundant than Douglas-fir but understories are very similar. Mature (structural stage 6) and old (structural stage 7) forests are uncommon because most of the large trees historically present on these sites have been logged. Because of fire exclusion, most sites have become ingrown with higher densities of smaller stems.

List of mapped units:

SPk	cool aspect	SPks	cool aspect, shallow soils (generally 50-100cm)
SPs	shallow soils	SPw	warm aspect (lower slopes, often south, southeast)

SITE INFORMATION

Common Terrain Types:

- gentle morainal and glaciofluvial slopes
- moderate to steep morainal and glaciofluvial slopes
- glaciofluvial terraces

Slope position:	lower or toe
Slope (%):	0-30%; up to 70% on cool aspects
Aspect:	All
Soil Moisture Regime:	Mesic – subhygric
Soil Nutrient Regime:	Medium – rich

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
SP	Douglas-fir / Ponderosa pine – Snowberry - Pinegrass	PPxh1	06

	Structural Stage	3	4	5	6	7	
Trees	*Pseudotsuga menziesii* var. *glauca*	*	****	***	***	***	Douglas-fir
	Pinus ponderosa	*	**	**	**	**	ponderosa pine
Shrubs	*Symphoricarpos albus*	***	***	***	***	***	common snowberry
	Mahonia aquifolium	**	**	**	**	**	tall oregon-grape
	Spirea betulifolia	**	**	**	**	**	birch-leaved spirea
	Amelanchier alnifolia	**	*	*	*	*	saskatoon
	Ceanothus sanguineus or *velutinus*	****					redstem ceanothus or snowbrush
Grasses	*Calamagrostis rubescens*	***	***	****	****	****	pinegrass
	Festuca campestris	***	**	**	**	**	rough fescue
	Elymus glaucus	**	*	*	*	*	blue wildrye
Herbs	*Amica cordifolia*	***	**	**	**	**	heart-leaved arnica
	Aster conspicuus	**	*	*	*	*	showy aster
Mosses	*Brachythecium* sp.	**	*	*	*	*	ragged moss
PLOTS				LCV074	LCV132		

Highlighted species – indicate important forage plants for ungulates
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites
Comments: Fireweed seems to be common only after burning (as opposed to logging)

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
SR	**Snowberry – Rose – Kentucky Bluegrass**	**PPxh1**	**00**

Typic unit occurs on gentle slopes with deep, medium textured soils (d, j and m are assumed modifiers).

Typically moist shrub dominated depressions in grassland mosaics (equivalent to the IDFxh1 RF /97 unit). Sites are dominated by snowberry and Nootka rose, with some Kentucky bluegrass in openings between the shrubs. These depressions are typically much smaller and shallower than those sites with trembling aspen.

List of mapped units:

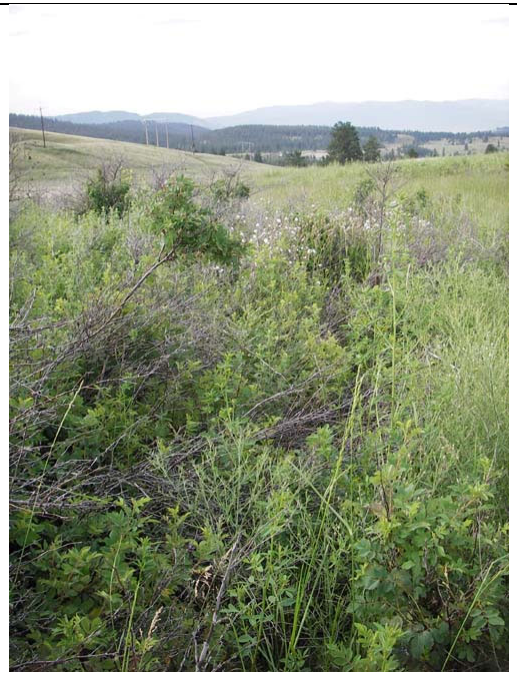
SRw warm aspect

SITE INFORMATION

Common Terrain Types:

- gentle and level fluvial sites

Slope position:	level, lower and toe
Slope (%):	0-15%
Aspect:	none
Soil Moisture Regime:	subhygric
Soil Nutrient Regime:	rich



Site Unit Symbol	Site Unit Name	BGC	Site Series Number
SR	Snowberry – Rose - Kentucky bluegrass	PPxh1	00

	Structural Stage	3	
Shrubs	*Symphoricarpos albus*	*****	common snowberry
	Amelanchier alnifolia	**	saskatoon
	Rosa nutkana or *gymnorcarpa* or *acicularis*	****	roses
Grasses	*Poa pratensis*	**	Kentucky bluegrass
PLOTS		LCV064	

Highlighted species – indicate important forage plants for ungulates
Species – non-native species
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
TA	**Talus**	**PPxh1**	**N/A**
Steep colluvial deposits of angular rock fragments that result from rockfall. These sites have less than 10% vegetation cover.			
List of mapped units:			
TAk cool aspect		TAw warm aspect	

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
UR	**Urban/Suburban**	**PPxh1**	**N/A**
Residential areas with concentrated houses and buildings that almost continuously cover the area.			

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
WB	**Bluebunch wheatgrass – Balsamroot**	**PPxh1**	**00**

Typic unit occurs on warm aspects with deep, medium-textured soils (assumed modifiers are d, w, and m)

This ecosystem commonly occurs on moderately steep to steep warm slopes. Often surface soils are actively raveling. Bluebunch wheatgrass and balsamroot dominate these sites. Bunchgrasses are more widely spaced than on more gentle slopes. Many of these sites have been disturbed by grazing and have been invaded by weeds (see seral association descriptions below).

WB:kc ***$Knapweed - Cheatgrass seral association***
These are early and very early seral sites. Although there are native forbs, there are few or no native bunchgrasses remaining on these sites. Invasive weeds including knapweed, cheatgrass and sulphur cinquefoil dominate these sites.
WB:wk $***Bluebunch wheatgrass – Knapweed seral association***
This is a mid- to late-seral seral association. On these sites there is still a reasonable component of bluebunch wheatgrass with knapweed, sulphur cinquefoil, or cheatgrass.

List of mapped units:

WBc	coarse-textured soils	WBcs	coarse-textured, shallow soils
WBk	cool aspect (usually NW or ESE)	WBrs	ridge, shallow soils
WBs	shallow soils		

SITE INFORMATION

Common Terrain Types:

- morainal and glaciofluvial blankets and veneers

Slope position:	middle, upper
Slope (%):	30-65%
Aspect:	south, southwest, west
Soil Moisture Regime:	subxeric
Soil Nutrient Regime:	medium – poor

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
WB	Bluebunch wheatgrass – Balsamroot	PPxh1	00

	Structural Stage Seral Association	2 WB	2 WB:kc	2 WB:wk	
Grasses and Sedges	*Pseudoroegneria spicata*	****	*	**	bluebunch wheatgrass
	Bromus tectorum or *Bromus japonicus*	*	****	***	cheatgrass or Japanese brome
	Koeleria macrantha	*	*	*	junegrass
	Poa secunda	*	*	**	Sandberg's bluegrass
Herbs	*Balsamorhiza sagittata*	**	*	*	arrowleaf balsamroot
	Lupinus sericeus	**	*	**	silky lupine
	Artemisia frigida	*	*	*	pasture sage
	Eriogonum heracleoides	*	*	*	parsnip-flowered buckwheat
	Lithospermum ruderale	*	*	*	lemonweed
	Centaurea diffusa	*	***	**	diffuse knapweed
	Potentilla recta		***	**	sulphur cinquefoil
Mosses Lichens	*Cladonia* spp.	**			clad lichens
	Tortula ruralis	**		*	sidewalk moss
PLOTS		LCG010		LCG016	

Highlighted species – indicate important forage plants for ungulates
Species – non-native species
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
WS	**Willow – Sedge Wetland**	**PPxh1**	**00**

Typic unit occurs in depressions with deep, medium-textured soils (assumed modifiers are d, j, and m)

This unit is a generalized wetland unit equivalent to several swamp associations in the provincial classification (MacKenzie and Shaw 2000).

This swamp wetland ecosystem occurs at the edges of ponds and wetlands, forming a shrubby fringe on mineral soils. This is a very rare unit in the study area. It is dominated by willows, usually with sedges where it occurs at the edge of a wetland.

SITE INFORMATION

Common Terrain Types:

- lacustrine veneer over morainal or glaciofluvial blanket

Slope position:	level, depression
Slope (%):	0
Aspect:	none
Soil Moisture Regime:	subhygric – hygric
Soil Nutrient Regime:	medium, rich

Site Unit Symbol	Site Unit Name	BGC	Site Series Number
WS	Willow – Sedge Wetland	PPxh1	00

	Structural Stage	3	
Shrubs	*Salix planifolia*	*****	tea-leaved willow
	Cornus stolonifera	***	red-osier dogwood
	Ribes hudsonianum	**	northern blackcurrant
Sedges	*Carex* spp.	**	sedges

Highlighted species – indicate important forage plants for ungulates
* incidental cover (less than 1% cover); used as indicator species
** 1-5% cover; occurs in 60% or more of sites
*** 6-25% cover; occurs in 60% or more of sites
**** 26-50% cover; occurs in 60% or more of sites
***** >50% cover; occurs in 60% or more of sites

Willow species likely vary from site to site.