Terrestrial Ecosystem and Wildlife Habitat Mapping for the Columbia National Wildlife Area

B.A. Blackwell
& Associates Ltd.

TERRESTRIAL ECOSYSTEM AND WILDLIFE HABITAT MAPPING FOR THE COLUMBIA NATIONAL WILDLIFE AREA

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LIST OF ACRONYMS

Acronym	Description
ArcGIS	ESRI's Geographic Information System version (v10.5)
ArcMap	ESRI GIS mapping program
BAB	BA Blackwell & Associates Ltd.
BC	British Columbia
BEC	Biogeoclimatic Ecosystem Classification
CWS	Canadian Wildlife Service
GIS	Geographic Information System
ha	Hectares
IDF	Interior Douglas-fir biogeoclimatic zone
m	Metres
NWA	National Wildlife Area
PurVIEW	ArcGIS Desktop extension, 3D photo stereo-viewing software
RIC	Resources Inventory Committee
RISC	Resources Inventory Standards Committee
SEI	Sensitive Ecosystem Inventory
SIL	Survey Intensity Level
TEM	Terrestrial Ecosystem Mapping
TEIS	Terrestrial Ecosystem Information System

1. Introduction

In 2019, BA Blackwell & Associates (BAB) and Ecologic Consulting (Ecologic) were retained by the Canadian Wildlife Service (CWS) to complete preliminary Terrestrial Ecosystem Mapping (TEM) and wildlife habitat rating matrices for the Qualicum, Widgeon, Vaseux-Bighorn, and Columbia National Wildlife Areas (NWA; Andrew and Leigh-Spencer 2020).

In August of 2020, BAB and Ecologic completed fieldwork in the Qualicum, Widgeon, and Columbia NWAs and finalized the preliminary TEM and wildlife habitat capability and suitability ratings. This report describes the approach, methods, and results of the fieldwork, TEM, and wildlife habitat mapping for the Columbia NWA.

1.1 Objectives

The main objectives of the project were to:

- complete fieldwork at a survey intensity level (SIL) 3 at a scale of 1:5,000;
- finalize TEM linework at a scale of 1:5,000 (or as limited by available imagery resolution);
- attribute TEM polygons; and
- finalize habitat capability and suitability ratings.

2. Project Team

The project was conducted for Erin Roberts (Protected Areas, Pacific Region, Canadian Wildlife Service Environment and Climate Change Canada / Government of Canada).

The ecosystem mapping was conducted by Ben Andrew and was reviewed by Bob Green (BAB). Habitat capability and suitability mapping was completed by Sally Leigh-Spencer of Ecologic.

3. Project Deliverables

The Project deliverables include:

1. Field data collecting during the field work in a FGDB format.
2. A final TEM geodatabase (standard TEIS [Terrestrial Ecosystem Information System] file geodatabase (FGDB) format as per current provincial standard templates provided in the 2020 Contractor Package).
3. Wildlife habitat capability and suitability ratings for each site unit identified in the TEM for the focal species for selected seasons/life requisites (.xlsx format).
4. A report describing the methods, fieldwork, TEM results, and wildlife habitat capability and suitability ratings.

4. Study Area

The study area for the Columbia NWA was provided by the CWS (Table 1; Figure 1) and includes four NWA units that are adjacent to the Columbia River: Brisco, Harrogate, Spillimacheen, and Wilmer (Table 1).

The Brisco, Harrogate, and Spillimacheen units are within the Columbia Dry Cool Interior Douglas-fir Variant (IDFdk5), which occurs in the bottom of the Columbia Valley in the Rocky Mountain Trench. The climate is characterized by cool winters and hot summers with mild springs and warm temperatures in the fall (MacKillop et al. 2018). Upland sites experience common droughts during the summer and moisture deficits on mesic and drier sites, with subhygric sites also experiencing deficits during dry years (MacKillop et al. 2018). Cold air drainage and cold snaps in the winter are contrasted by heat waves in the summer. Both are influential factors on the vegetation communities in the IDFdk5 (MacKillop et al. 2018).

The Wilmer unit is within the Very Dry Cool Interior Douglas-fir Subzone (IDFxk), which occurs south of the IDFdk5 in the bottom of the Columbia Valley in the Rocky Mountain Trench. The climate is relatively dry all year with cool winters, warm springs and falls, and hot summers (MacKillop et al. 2018). Droughts and moisture deficits are common on upland mesic and drier sites, with subhygric sites also experiencing deficits during dry years (MacKillop et al. 2018). Cold air drainage and cold snaps in the winter are contrasted by heat waves in the summer, both of which influence vegetation communities in the IDFxk (MacKillop et al. 2018).

Table 1. NWA Study Areas.

NWA	BGC Unit	Unit	Area (ha)
Columbia	IDFdk5	Brisco	158
		Harrogate	185
		Spillimacheen	203
	IDFxk	Wilmer	460
Total			1,005

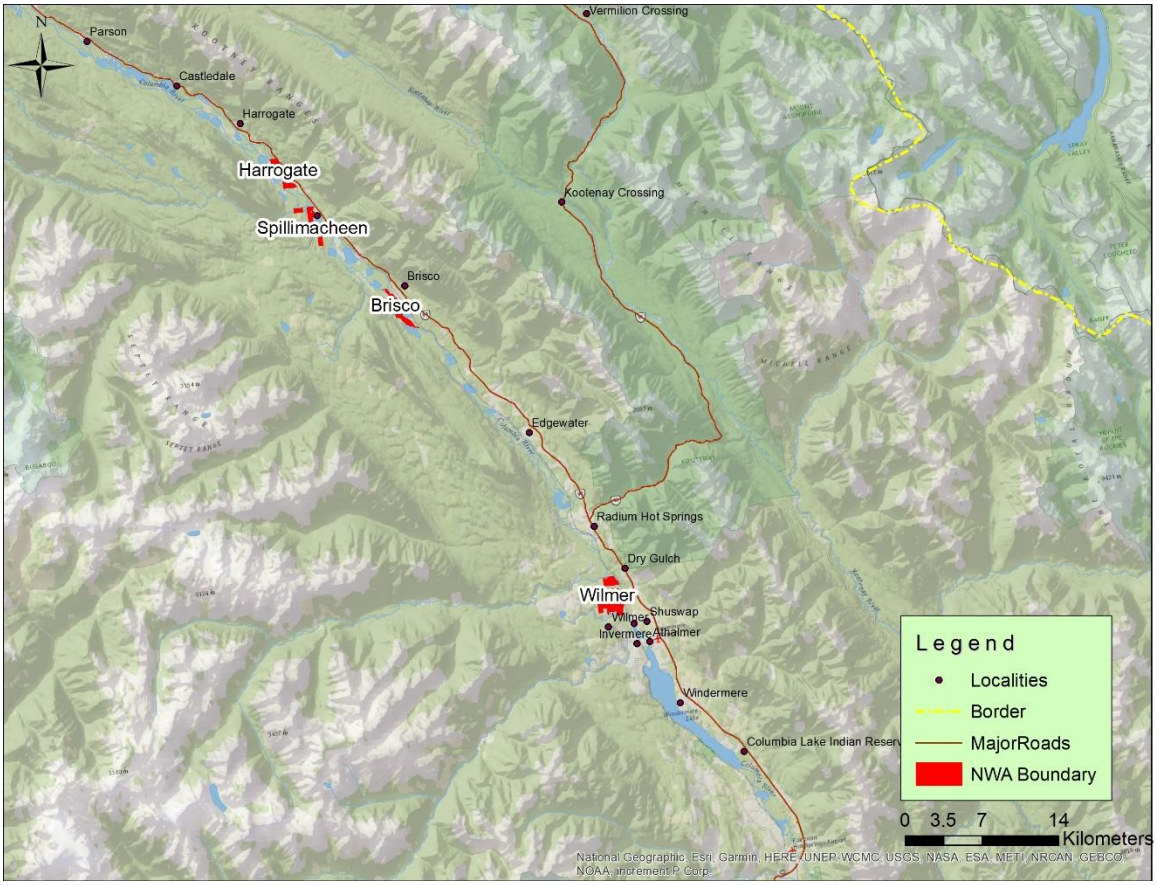

Figure 1. National Wildlife Area.

As much of the NWA is located on floodplains and in wetland units, the fluctuating water levels of the Columbia River are an important influence on vegetation communities. The seasonal fluctuations result in dramatic flooding of large areas with water containing suspended fine sediments. As floodwaters recede, and dry hot summer conditions prevail, areas previously inundated with shallow water shrink, exposing vegetated marshes and shallow water wetlands. This annual cycle of flooding and receding waters results in 'dynamic' hydrodynamics and the deposition of fine sediments that contribute to the rich nutrient conditions of the floodplains. The hydrodynamic regime and sediment deposition, as well as the regional climate, are important influences on the unique vegetation communities that occur in the Columbia NWA.

5. Methods

The following sections describe the methods used to complete the fieldwork, TEM, and wildlife habitat capability and suitability for the Columbia NWA.

5.1 Standards

5.1.1 TEM Standards

TEM was completed in accordance with provincial standards (RISC 1998), and submitted in accordance with "Terrestrial Ecosystem Information Digital Data Submission Standard -

Draft for Field Testing Database and GIS Data Standards" (RISC 2010) and using the 2020 Contractor Package. Terrestrial ecosystems and wetlands were classified and coded to site series or site association level using the relevant land management handbooks.

The TEM fieldwork, polygon delineation, attributing, and preparation of spatial data used the following provincial guides and standards including:

- A Field Guide to Ecosystem Classification and Identification for Southeast British Columbia (MacKillop et al. 2018);
- Wetlands of British Columbia: A Guide to Identification. Land Management Handbook 52 (MacKenzie and Moran 2004);
- Field Manual for Describing Terrestrial Ecosystems 2nd Edition (BC MOF & BC MOE. 2015);
- Terrestrial Ecosystem Information Digital Data Submission Standard (RISC 2015); and
- Standard for Terrestrial Ecosystem Mapping in British Columbia (RIC 1998).

5.1.2 Wildlife Standards

Wildlife Habitat Ratings (WHR) were applied to individual TEM polygons based on the rating criteria described in the British Columbia Wildlife Habitat Rating Standards (RIC 1999). Wildlife habitat mapping identifies areas in a landscape that provide life requisites for a particular wildlife species. The scale of wildlife habitat mapping varies based on available input data, knowledge of wildlife-habitat relationships, and project objectives.

Ecosystem mapping is the framework for applying habitat ratings. In B.C. wildlife habitat mapping commonly uses TEM data, with a focus on polygon attributes such as site modifiers and structural stage codes to inform WHR habitat suitability and capability ratings.

5.2 Field Sampling

Field sampling was designed to meet SIL 3 with the goal of distributing field-verified photo signatures strategically across the entire NWA area to facilitate photo interpretation. This is a key step of the mapping process, as it provides a measure of accuracy for the final ecosystem map product. Survey inspection density was targeted at 40 to 50% of total polygon numbers, equivalent to SIL 3 level TEM (RIC 1998). As preliminary mapping often included polygons outside the NWA boundary, based on natural ecological boundaries, the calculation to identify the number of field plot required was based on polygons clipped to the NWA boundary. This reduced fieldwork requirements while still meeting the desired SIL level within the NWA.

A sampling plan was prepared prior to fieldwork with pre-located field plots selected using the orthophotos and preliminary TEM polygons. Plot selection was prioritized based on accessibility, and then by potential ecological and habitat attributes of interest. Areas that were more difficult to interpret using imagery were selected for field sampling, when possible.

To maximize efficiency during sampling, an "opportunistic" sampling strategy was employed where additional inspection locations were identified while fieldwork was

underway, with the intent of collecting data on representative ecosystems throughout the study area. Due to access constraints, some pre-located field plots were not sampled.

A digital navigation system was used to control the sampling program. This featured a Samsung Tablet with integrated GPS/GIS program (ESRI Collector) with orthophoto imagery. Supplemental GIS layers included the NWA boundaries, preliminary TEM polygons, and basemap data for positional reference.

Ground inspection data and plot locations were collected using Samsung tablets with ESRI Collector and customised digital forms.

Fieldwork was conducted by Ben Andrew and Sally Leigh Spencer from August 12th to 18th, 2020. As most sites were not accessible by car (except the uplands in the Wilmer unit), the four units were accessed using a canoe. Prior to field sampling, an access plan was developed based on the available imagery; however, due to relatively low water levels, some areas that appeared accessible on the imagery were not accessible.

5.2.1 Field Form Types

5.2.1.1 TEM Field Forms

TEM field inspections were recorded on the Samsung tablets as one of four types:

- terrestrial ecosystem ground inspections (based on the FS 1333 Site Visit Form);
- terrestrial ecosystems visual inspections ;
- wetlands ground inspections; and
- wetland visual inspections.

The wetland form was based on a draft version of wetland form prepared by Ministry of Environment and Climate Change Strategy (MoECCS) that has not been released yet. Ground inspections were used to gather key ecological properties at the field plots, including site characteristics, ecosystem types, vegetation community composition, and soil and terrain features. Visual inspections included minimum plot data required to classify the site, such as BGC unit, site unit, structural stage, terrain type, soil drainage class, or other significant features. Wetland inspections collected similar site and vegetation community information but with a focus on characteristics specific to wetlands such as hydrodynamic index, water colour, Von Post scale, and hydrogeomorphic system and subsystem.

5.2.1.2 Wildlife Field Forms

The provincial Wildlife Habitat Assessment (WHA) form (FS882 (5)) was used to record the data required to assess habitat for its value to the focus species of the different NWAs and to record evidence of use of species using the habitats (Appendix 6). The form and field procedures are outlined in the Field Manual for Describing Terrestrial Ecosystems 2nd Edition (BC MOF & BC MOE 2010). The wildlife habitat assessment field locations were recorded on a Samsung tablet with an integrated GPS/GIS program (ESRI Collector) that had the preliminary TEM polygons and NWA boundaries outlined on a basemap for positional reference.

5.3 Terrestrial Ecosystem Mapping

5.3.1 Imagery

As recent 3D stereo imagery was not available for most of the NWAs, 2D orthophotos were used to delineate TEM polygons. Most of the NWAs occur on flat terrain, so the use of 2D imagery in delineating ecosystem boundaries was not a significant limitation for most units. There is topographic relief along the western edge of the Wilmer unit in the Columbia NWA. Google Earth was used to help identify topographic breaks in this unit. Table 2 lists the type, resolution and sources for the imagery used. Section 5.3.4 provides further discussion on limitations related to imagery.

Table 2. Imagery type, resolution, and source.

NWA	Type/Resolution	Imagery Source
Columbia	2D-Orthophoto/1 m	ESRI, Digital Globe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN; Google Earth.

5.3.2 TEM Polygon Delineation

During attributing, polygons were reviewed and updated based on fieldwork and field data. The updates were completed directly in an ArcMap geodatabase environment using available imagery (Section 5.3.1). Polygons were delineated using stable bioterrain features as well as structural stages visible on the imagery. Vegetation Resource Inventory (VRI; MFLNRORD 2019) data were used to help identify structural stage boundaries.

TEM is a method of dividing the landscape into polygons based on site characteristics and how these are reflected by ecological communities. Characteristics used during TEM polygon delineation include:

- soil moisture;
- soil nutrient regime;
- surficial material;
- vegetation communities;
- slope classes;
- topographic breaks;
- mesoslope position;
- aspect: cool (from 285° to 135°) and warm (from 135 to 285°) for slopes steeper than 35%;
- surface expression and slope morphology (e.g., concave or convex and slope length);
- floodplains;
- riparian ecosystems; and
- any other ecologically significant areas such as gullies, ravines, scarps, cliffs, talus slopes, and bodies of water (i.e., ponds).

Polygons were review for topological errors using ESRI tools and the tools supplied in the contractor package, provided with the TEIS data templates (MoECCS 2020). The final polygons were created using the most recent TEIS data template.

5.3.3 Attributing

The TEIS polygon attribute database was populated with TEM attributes based on interpretation of the imagery assisted by field observation data. Up to three components (indicated below as 1-3) were described within a polygon. Appendix 2 contains a database dictionary describing the codes for each attribute. Attributes include:

- Project Type;
- Project Map Scale;
- Project Identification (NWA_unit);
- Mapsheet Number;
- Polygon Number;
- Ecosection Label;
- Biogeoclimatic Unit Label;
- Decile of Ecosystem Component 1-3;
- Site Series Number of Ecosystem Component 1-3;
- Realm of Ecosystem Component 1-3;
- Group of Ecosystem Component 1-3;
- Class of Ecosystem Component 1-3;
- Site Series Map Code of Ecosystem Component 1-3;
- Site Modifiers 1 of Ecosystem Component 1-3;
- Site Modifiers 2 of Ecosystem Component 1-3;
- Structural Stage of Ecosystem Component 1-3;
- Stand Composition Modifier of Ecosystem Component 1-3; and
- Tree Crown Closure of Ecosystem Component 1-3.

5.3.4 Limitations

There were several limitation related to the fieldwork and mapping. During fieldwork, low water tables made accessing some areas impossible. Due to the timing of the fieldwork, willow species in the wetlands and floodplains and grass species in the upland areas lacked inflorescences, making identification of some species more difficult. The other constraint on mapping was related to the imagery. The raster size for most of the orthophotos was 1.2 m, which made differentiation of the various marsh and swamp communities difficult. The other constraint associated with imagery is related to the annual fluctuation in water levels. Wetland marshes and open water wetlands will vary considerably depending on what time of year imagery is taken.

5.3.5 Quality Assurance

Quality assurance of digital data was conducted using the 2020 contractor package tools as well as an internal review by a senior mapper.

5.4 Wildlife Habitat Capability and Suitability Mapping

The *BC Wildlife Habitat Rating Standards* (RIC 1999) is a provincial standard for rating wildlife habitat by applying habitat capability and suitability ratings to terrestrial ecosystem mapping. Ratings indicate the value of a habitat to support a particular wildlife species for

a specified habitat use compared to the best habitat in the province (Bonner and Demarchi 2000). A habitat rating is the value assigned to a habitat for its potential to support a particular species of wildlife. There are suitability and capability ratings. Suitability is defined as the ability of the habitat in its current condition to provide the life requisites of a species. Capability is defined as the ability of the habitat, under optimal natural conditions to provide life requisites of a species irrespective of its current habitat conditions (Bonner and Demarchi 2000).

Initially, a Conservation Data Centre (CDC) search was completed for each species to determine the provincial and federal conservation status and the relevant reports available. A summary of this information for each of the focus species for the Columbia NWA can be found in Appendix 4. CWS provided the final list of focal species.

Secondly, the life stage or stages and the function of the habitats critical for the survival for each of the focal species within the Columbia NWA were determined through a thorough literature review of each of the species. Detailed provincial species accounts for some of the species were made available through contacting several provincial biologists. Once the most critical life functions and seasons of use were listed for each species, the biophysical features and their attributes were researched and documented. This provided a condensed species account of the critical life requisites for each species. From each of the condensed species accounts, a preliminary ratings table was prepared for each species in each of the NWA, rating the TEM site series as to the capability of these habitats to provide the critical attributes to support the life requisites. A 4-class scheme was used for each of the species, as there was only an intermediate knowledge of habitat use. The scheme used high (H), moderate (M), low (L), and nil (N) ratings for defined seasons and life requisites (Table 3).

Table 3: Provincial Habitat Capability and Suitability Rating Scheme (RIC 1999).

% Provincial Best	Intermediate Knowledge of Habitat Use (4-Class)	
	Rating	Code
100 - 76%	High	H
75 - 26%	Moderate	M
25-1%	Low	L
0%	Nil	N

The WHA form and the associated attribute codes can be found in Appendix 6. The form was used during field inspections along with the ecologist conducting the ecosystem field inspections. Site units were recorded in consultation with the ecologist and all the relevant wildlife habitat data was documented on the form. Evidence of use was documented within the plot and in the ecosystem represented by the plot. The plot type was assessed for the value of the pre-determined life requisite and season for each species for that ecosystem type represented and then considered for the plot in context to the adjacent habitats. An overall suitability ratings value was then assigned to that ecosystem type for each of the focus species. Photos were taken of each plot and any notes on the habitat or species was recorded within the note section.

Capability ratings were then assigned to each site unit based on the climax successional stage that site unit type could reach. This would only be relevant to the tree-dominated sites

and therefore no wetland sites would vary from the suitability rating given based on the field assessment.

6. Results

This section describes the field sampling efforts, attributing and polygon refinement conducted after fieldwork, and presents summaries of the TEM and wildlife habitat ratings. Appendices 1 to 8 provide supporting information:

- Appendix 1: Columbia National Wildlife Area Site Unit Descriptions;
- Appendix 2: Terrestrial Ecosystem Mapping Database Dictionary;
- Appendix 3: Vegetation Summary Tables;
- Appendix 4: Wildlife Species Conservation Status;
- Appendix 4: Wildlife Species Conservation Status;
- Appendix 5: Wildlife Species Accounts;
- Appendix 6: Wildlife Habitat Assessment Form;
- Appendix 7: Columbia Wildlife Habitat Suitability and Capability Ratings Tables; and
- Appendix 8: Species References.

6.1 Field Sampling

In total, 181 (45% of the total polygon count[1]) inspections were completed for the planned inspection ratio of greater than 40% of the polygons to meet SIL 3 (Figure 5; Table 4). Table 4 summarizes the distribution of inspections and statistics for the mapped areas. The planned target number of inspections was 160 and the total actual number of plots is 181. The inspection numbers were based upon the preliminary TEM polygon counts. During attributing, the preliminary polygons were revised based on field data, and the total number of polygons in the NWA increased by 20%; however, inspection density still exceeded the target.

The average number of ground inspections is 34% of all plots and exceeded the 25% target (BC MOF & BC MOE. 2015). Vegetation species data collected during field surveys is summarized in Appendix 3.

Table 4. Survey inspection types and statistics for TEM field sampling.

NWA Unit	Final Polygon Count	TEM Ground	Wetland Ground	TEM Visual	Wetland Visual	Total Plots	Target Plot Number	Ground Plots (%)
Brisco	51		15		9	24	20	63%
Harrogate	84		11		27	38	34	29%
Spillimacheen	118	1	17	1	40	59	47	31%
Wilmer	148	11	6	14	29	60	59	28%
Total	401*	12	49	15	105	181	160	34%

**The polygon count represents polygons clipped to the NWA boundary.*

[1] The total polygon count is based on TEM clipped to the NWA boundary.

In total, 84 site units were assessed and ranked for their value for the 13 focal wildlife species within the Columbia NWA (Table 5). Five plots were conducted within non or sparsely vegetated sites that included flood fringe, beach, exposed soils, ponds and rivers; 25 field inspections were conducted within four low bench and two medium bench floodplains types; 19 field inspections were conducted within three forest type in the IDFdk5 and seven forest types and two grassland types in the IDFxk and 35 wildlife field inspections were conducted in wetland sites. The locations of the wildlife field inspection plots are shown on Figures 2, 3, 4, and 5.

Table 5. Locations and statistics for Wildlife Habitat Rating field sampling.

NWA Unit	Plot Location				Total Wildlife Plots
	Non- or Sparsely Vegetated Sites	Floodplain	Terrestrial	Wetland	
Columbia	5	25	19	35	84

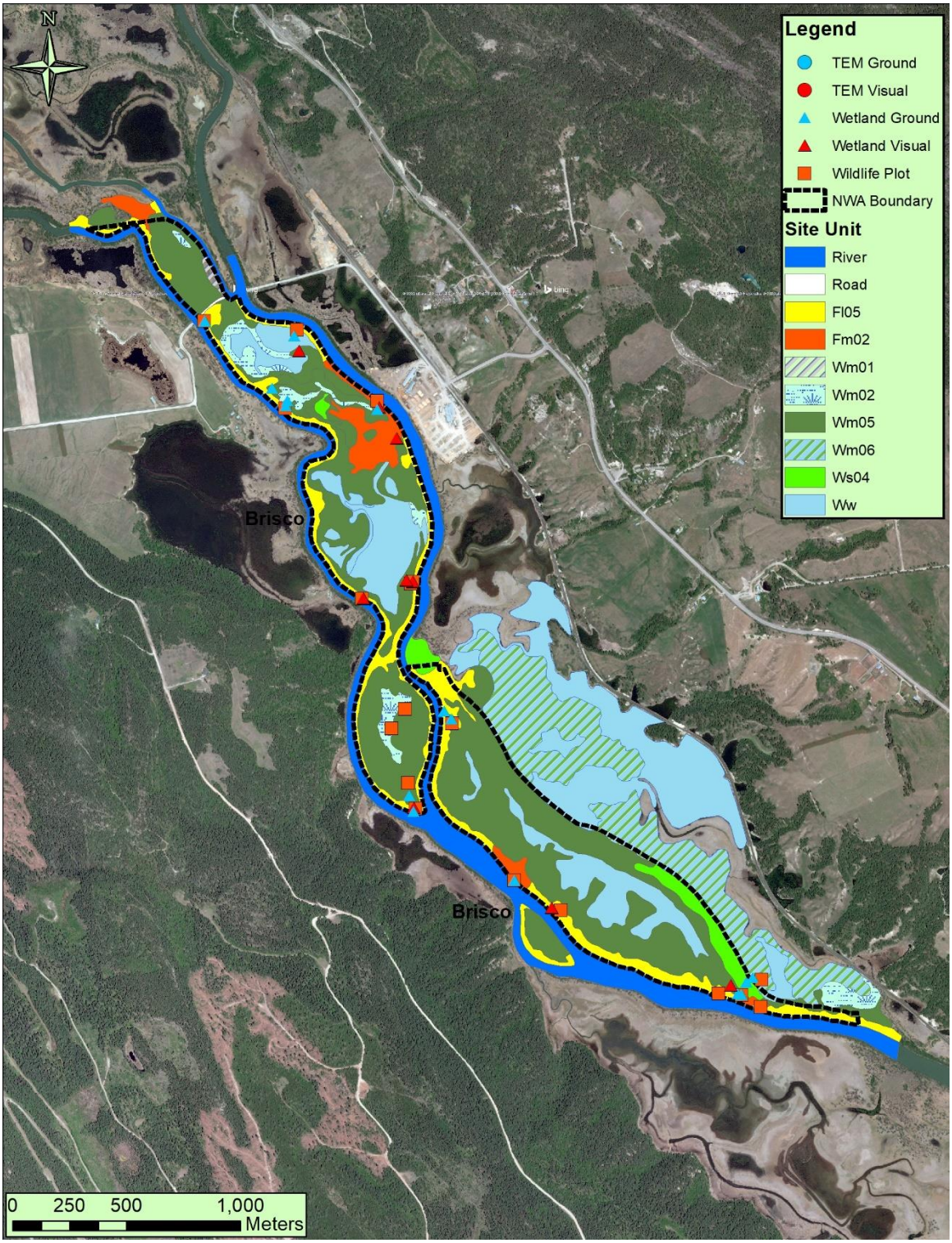

Figure 2. Field Survey Locations and TEM Site Units for Brisco in the Columbia NWA (See Table 9 and Appendix 1 for site unit descriptions).

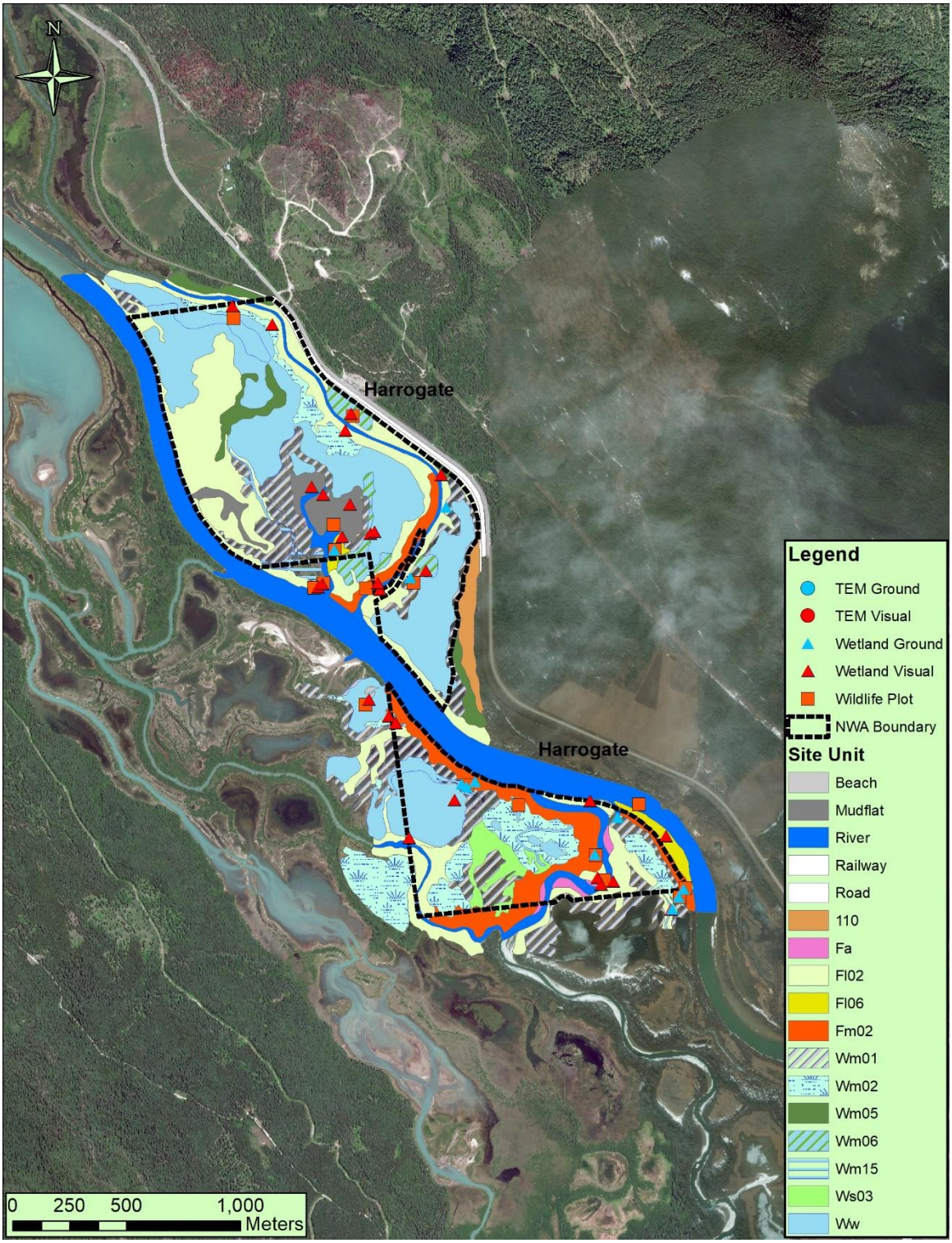

Figure 3. Field Survey Locations and TEM Site Units for Harrogate in the Columbia NWA (See Table 9 and Appendix 1 for site unit descriptions).

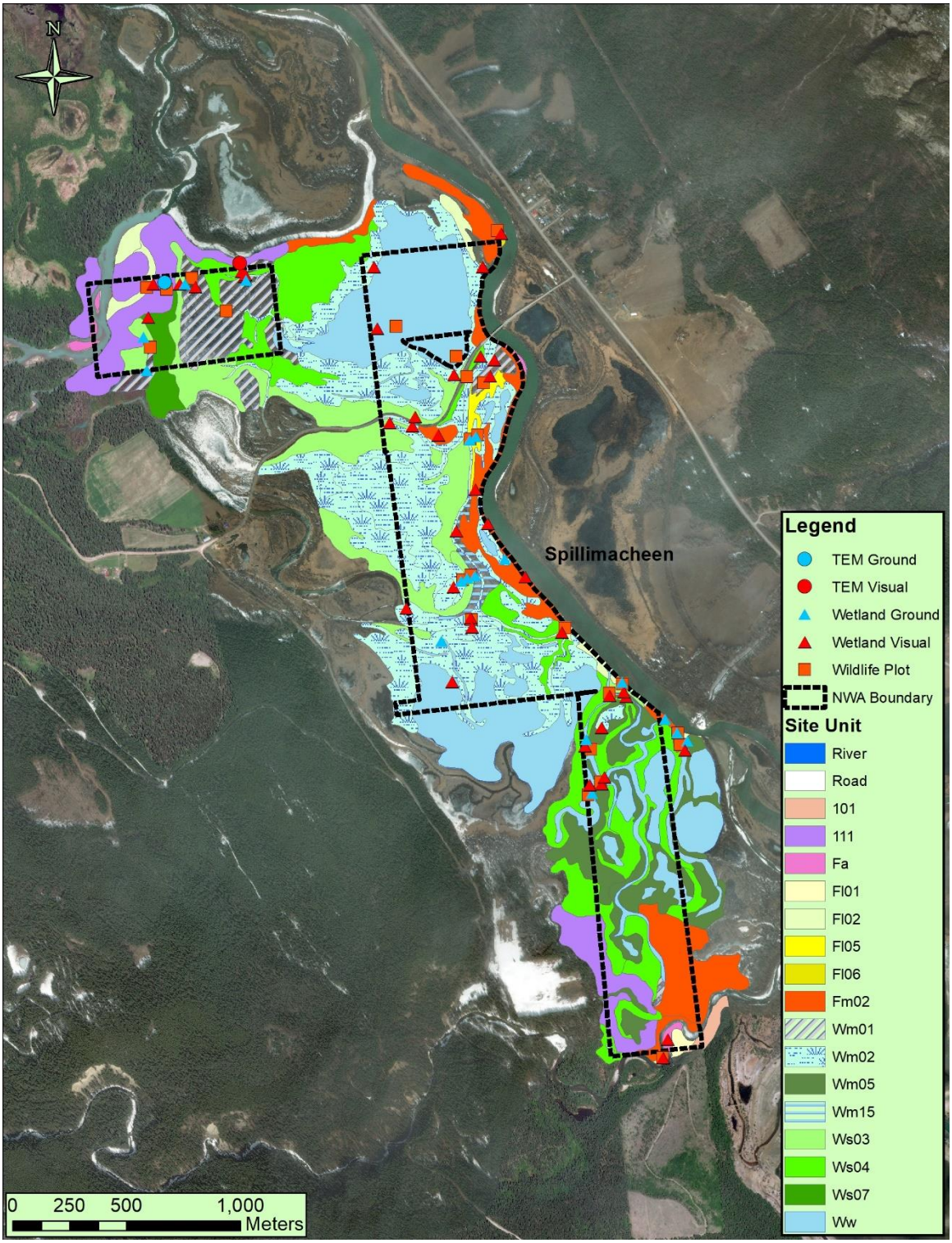

Figure 4. Field Survey Locations and TEM Site Units for Spillimacheen in the Columbia NWA (See Table 9 and Appendix 1 for site unit descriptions).

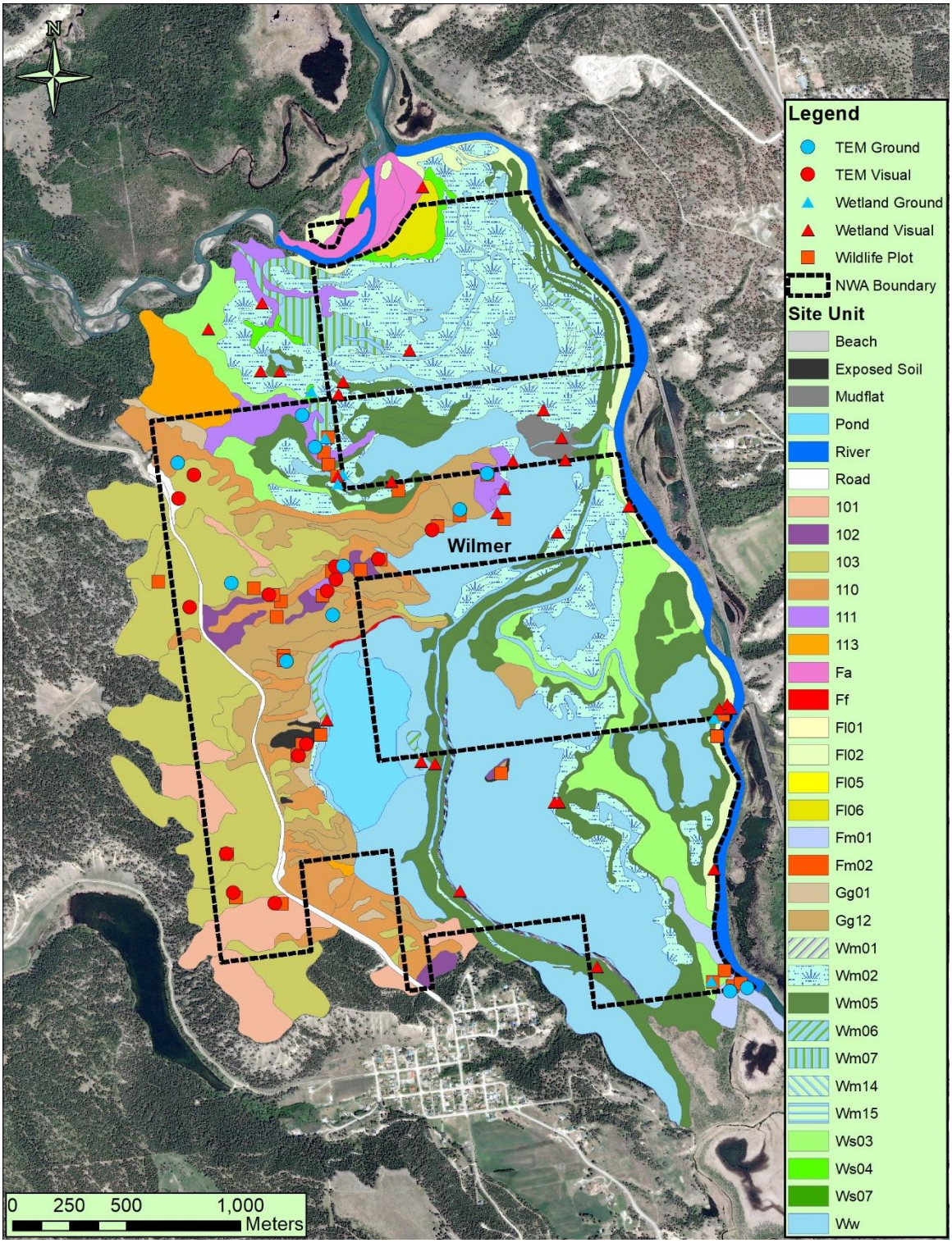

Figure 5. Field Survey Locations and TEM Site Units for Wilmer in the Columbia NWA (See Table 10 and Appendix 1 for site unit descriptions).

6.2 TEM Polygon Refinement

The total mapped area is 1,118 ha which is larger than the total NWA area (1,005 ha). The difference is because the TEM polygons were delineated irrespective of the NWA boundary. This was done so that the TEM would reflect ecological features not administrative boundaries. However, in some cases where natural TEM polygon boundaries extended far past the NWA boundaries, the polygons were cut off. All summaries provided in this report are based on the complete mapping, not the area located within the NWA.

The mean polygon mean area (ha) mapped is 3.8 ha (Table 6), and the polygon density for all units is 260 polygons/1000 ha. Polygon density provides a means for comparing mapping between different projects. For example, the polygon density of mid-scale TEM is generally between 50-60 polygons per 1000 ha. The greater polygon density in the NWA mapping reflects the 1:5,000 scale of the mapping and delineation of site units that might be grouped together in mid-scale mapping.

Table 6. Comparison of polygon area statistics.

NWA Unit	Mapped area (ha)	Mean polygon area (ha)	No. of polygons	Polygon density (polys/1000 ha)
Brisco	295.3	3.1	95	322
Harrogate	299.0	2.9	132	441
Spillimacheen	389.4	5.4	55	141
Wilmer	827.9	4.4	189	228
Total	1,811.6	3.8	471	260

During attributing of the TEM polygons, the polygon linework was further refined based upon observations made during fieldwork and with the aid of the field data. The final TEM database includes 20% more polygons than the preliminary database (Table 7; Andrew and Leigh-Spencer 2020) for the Columbia NWA.

Table 7. The increase in polygon numbers due to linework refinements between Phase 1 TEM and the final TEM.

NWA Unit	Original Polygon Count	Final Polygon Count	Increase	Increase (%)
Spillimacheen	122	132	10	8%
Brisco	37	55	18	49%
Harrogate	82	95	13	16%
Wilmer	152	189	37	24%
Total	393	471	78	20%

6.3 Biogeoclimatic Units

The Columbia NWA spans two BGC units including the IDFxk and IDFdk5 (Table 8).

Table 8. Biogeoclimatic Units that the Columbia NWA occurs within.

NWA	Unit	BGC Unit	BCG Unit Name
Columbia	Brisco	IDFdk5	Columbia Dry Cool Interior Douglas-fir Variant
	Harrogate	IDFdk5	Columbia Dry Cool Interior Douglas-fir Variant
	Spillimacheen	IDFdk5	Columbia Dry Cool Interior Douglas-fir Variant
	Wilmer	IDFxk	Very Dry Cool Interior Douglas-fir Subzone

6.4 TEM Site Units

The following sections provides background on the classification system, discusses issues particular to the NWA, and provides a summary of the site units mapped in the NWA.

6.4.1 Terminology

Three terms are used describe classification units in the Biogeoclimatic Ecosystem Classification (BEC) system: site series, site association, and site unit. The site series and site association units are categories within the site level of the BEC system that describe site potential on areas that are homogenous and have similar ecological properties as determined by the soils, climate, and mature vegetation communities.

Site series represent distinct sites and vegetation communities within a BGC unit, whereas site associations may occur over multiple BGC units. Site Associations and Site series have been developed for terrestrial (upland) ecosystems, although Site series are generally used for upland areas. Site associations are generally used for wetland ecosystems.

Site unit is a broader generic term that encompasses both site series and site association and includes other codes used to describe sites mapped in the TEM but not recognized in the BEC system. It has been used in table headings to reduce the need to separate out site series, site associations, and more general codes (e.g., RP=roads, RN=railways, GP=gravel pits) into separate tables.

In the TEM database, site series and site association (formally recognized ecosystems in the provincial classification) are attribute in the SS_1 to SS_3 columns. Site units not formally classified in the BEC system are noted with a numeric site series code of 00 in the SS_1 to SS_3 columns. Alphanumeric mapcodes for site units not formally recognized with numeric codes (e.g., RP for roads) were assigned to the SiteMC_S1 to SiteMC_S3 columns, following conventions used in the provincial mapping codes list.

6.4.2 Site Unit Classification – Columbia NWA

Identification of the site series and site associations in terrestrial, wetland, and floodplain ecosystems is often based on the presence of key plant species. Site series for terrestrial ecosystems, and the associated vegetation communities, are unique to each BGC unit and accurately determining site series in the field, based on these descriptions, is relatively reliable. For wetlands, this is also true for many site associations, particularly marshes, such as the Swamp horsetail – Beaked sedge (Wm02) or Cattail (Wm05), which have fairly

consistent species assemblages and match those described in the Land Management Handbook 71 (LMH; MacKillop et al. 2018).

The floodplains and the swamps vegetation communities in the Columbia River wetlands often differ from the communities described in LMH 71. This may be in part because of the relatively unique climate of the Columbia Valley. The climatic conditions result in summers that are dry and hot and winters that are cold which affects the vegetation communities found in the NWA (personal communication D. MacKillop November 6, 2020; MacKillop et al. 2018). The wetlands and floodplains are also unique in regards to their spatial extent and the annual flooding that occurs throughout the wetland complexes. This creates vegetation communities that may differ from those described by LMH 71.

For example, the Fl05 low bench floodplain units and the Ws03 and Ws04 units all experience annual flooding. These sites all contained Drummonds' willow (*Salix drummondiana*), Bebb's willow (*Salix bebbiana*), mountain alder (*Alnus incana*), and bluejoint reedgrass (*Calamagrostis canadensis*), making differentiation of these site associations difficult. Separating the floodplains and wetlands was done primarily based on the proximity to rivers and how dynamic the erosional and depositional forces were. Low bench floodplains were mapped in areas where flooding was active, erosional forces resulted in removal of litter from the soil surface, and deposition of sediment was observed. Swamps were mapped in areas setback from the main erosional forces of the river; however, these areas still experience flooding, erosion, and sedimentation, albeit with lower hydrodynamics.

During fieldwork, evidence of recent sediment deposition in the swamps was observed, associated with annual flooding events. The swamps were located on slightly elevated areas often surrounded by wetland marshes. The swamps, however, unlike the higher gradient flooding in the floodplain units, are less exposed to water flow and erosion. Sediment deposition likely occurs as silt laden water pools in these backwater areas. When the floodwaters recede, and evaporation occurs during the dry and hot summers, the previously suspended sediments are left on the ground surface. Based on lack of active erosional forces, and the more passive process of sedimentation, these were mapped as swamps, not active fluvial floodplains. They likely represent an intermediate class of floodplain /wetland due to the unique conditions in the Columbia Valley.

To help with the interpretation of the mapping, descriptions of all of the site units mapped in the NWA are provided in Appendix 1. Many of these descriptions have been adapted from LMH 71 (MacKillop et al. 2018); however, photos and additional comments are provided for site units that vary from the descriptions provided in LMH 71.

6.4.3 Site Unit Summary – IDFdk5

Table 9 provides a synopsis of all site units that occur within the IDFdk5 in the Columbia NWA units and Figure 2 to Figure 4 show their distribution. In the IDFdk5 (Brisco, Harrogate, and Spillimacheen), the most common site unit is Open Water (Ww; 20%). The size of the Ww fluctuates greatly during the year. During annual spring flooding, much of the Columbia NWA is inundated and marshes such as the Swamp horsetail – Beaked sedge (Wm02) and Beaked sedge – Water sedge (Wm01) are covered by standing water. As a result, interpretation of the total area of units, such as the Wm02, that experience flooding will be influenced by the season that the imagery was taken in.

The Wm02 (17%) is the next most frequently mapped unit. As noted, the size of this area will fluctuate annually due to flooding. Rivers (RI), while not within the NWA, account for 12% of the total mapped area. The Mountain alder – Red-osier dogwood – Lady fern (Fl02; 9%) occur adjacent to the Columbia River. The Wm01 (8%) are often adjacent to Ww sites.

Table 9. Columbia TEM Site Unit area summary for Brisco, Harrogate, and Spillimacheen in the IDFdk5.

Site Unit	Unit Name	Typical Structural Stages	Brisco (ha)	Brisco (%)	Harrogate (ha)	Harrogate %)	Spillimacheen (ha)	Spillimacheen (%)	Total (ha)	Total (%)
101	FdPl – Pinegrass – Feathermoss	6					1.36	<1%	1.4	<1%
110	Sxw(Fd) – Dogwood – Bunchberry	6			4.1	1%			4.1	1%
111	Sxw – Dogwood – Horsetail	6					27.1	7%	27.1	4%
BE	Beach	1a			0.2	<1%			0.2	<1%
Fa	Active Flood Channel Flood	1a			1.3	<1%	1.5	<1%	2.8	<1%
Fl01	Mountain alder – Common horsetail	3b					0.9	<1%	0.9	<1%
Fl02	Mountain alder – Red-osier dogwood – Lady fern	3b			56.8	19%	5.1	1%	61.9	9%
Fl05	Drummond's willow – Bluejoint reedgrass	3b	26.8	9%			2.5	1%	2.5	<1%
Fl06	Sandbar willow	3b			8.6	3%	0.2	<1%	8.8	1%
Fm02	Cottonwood – Spruce – Dogwood	6	8.2	3%	14.4	5%	29	7%	43.4	6%
MU	Mudflat	1a			7.3	2%			7.3	1%
RI	River	null	46.5	16%	53.7	18%	26.3	7%	80	12%
RN	Railway	null			1.9	1%			1.9	<1%
RP	Road	null	0.2		2.6	1%	1.2	<1%	3.9	1%
Wm01	Beaked sedge – Water sedge	2b	1.9	1%	31.2	10%	22	6%	53.3	8%
Wm02	Swamp horsetail – Beaked sedge	2a	12.5	4%	28.3	9%	89.9	23%	118.2	17%
Wm05	Cattail	2b	88.3	30%	6.7	2%	29.6	8%	36.4	5%
Wm06	Great bulrush	2b	33.9	11%	5.9	2%			5.9	1%
Wm15	Bluejoint – Beaked sedge	2b			2.2	1%	2.5	1%	4.7	1%
Ws03	Bebb's willow – Bluejoint	3b			5.2	2%	32.7	8%	37.9	6%
Ws04	Drummond's willow – Beaked sedge	3b	4.9	2%			42.6	11%	42.6	6%
Ws07	Spruce - Common horsetail - Leafy moss	6					5.1	1%	5.1	1%
Ww	Open Water (<5m depth)	2c	72.1	24%	68.6	23%	69.8	18%	138.4	20%
Total			295.3	100%	299.0	100%	389.4	100%	688.7	100%

The Cottonwood – Spruce – Dogwood (Fm02) mid-bench floodplain, Drummond's willow – Beaked sedge (Ws04), and Bebb's willow – Bluejoint (Ws03) are each 6% of the total NWA area. Cattail (Wm05) and Sxw – Dogwood – Horsetail (111) are 5% and 4% of the area respectively. The remaining site units are each 1% or less of the total mapped area in the NWA.

6.4.4 Site Unit Summary – IDFxk

The most common site unit in Wilmer is the Ww (25%). The Wm02 (14%) is the next most common unit, followed by the Wm05 (11%; Table 10; Figure 5).

The Wilmer unit contained the most upland area of all the units in the Columbia NWA. Much of the soils in the area are dry and the Fd – Rocky Mountain juniper – Kinnikinnick (103; 10%) is the predominant upland ecosystem, followed by the Fd – Rocky Mountain juniper – Pinegrass (101; 6%) ecosystem which represents more mesic soil moisture conditions. Bebb's willow – Bluejoint (Ws03; 5%) occurs on slightly elevated topography above the Wm05 marshes. The Fd – Rocky Mountain juniper – Kinnikinnick (110; 4%) ecosystems occur on cool aspect slopes dominated by Douglas-fir (*Pseudotsuga menziesii*) and feathermosses. The At – Prairie rose – Pinegrass (111; 2%) was mapped on slightly elevated areas adjacent to several marshes with trembling aspen (*Populus tremuloides*) stands.

Two grassland units were mapped, the Rough fescue – Yarrow – Junegrass (Gg12; 5%) and the Bluebunch wheatgrass – Prairie sagewort – Junegrass (Gg01; 1%). In the Wilmer NWA, the dominant grass species is needle-and-thread grass (*Hesperostipa comata*) with lesser amounts of rough fescue (*Festuca campestris*), therefore these sites are more representative of the Gg12$2.4 seral site association (MacKillop et al. 2018). Similarly, the Gg01 was dominated by needle-and-thread grass with lesser amounts of rough fescue and minor amounts of bluebunch wheatgrass (*Pseudoroegneria spicata*). This unit is best described by the Gg01$2.2 seral site association. The TEIS database does not currently allow for the use of these codes and only indicates the sites are Gg12 and Gg01.

One area occurs in the Wilmer unit that was mapped as a Pond (3%), and the waters of this area were relatively deep and quite clear compared to the Ww sites that had aquatic vegetation at or close to the surface of the water. Rivers (RI) are 3% of the area mapped. The Fl02 (2%) was mapped along the banks of the Columbia River. The rest of the mapped site units each account for 1% of the total area mapped in the Wilmer unit.

One relatively unique unit was mapped as Baltic rush (Wm07; 1%). The Wm07 site unit is uncommon and occurs on saline sites where there is early-season inundation followed by a gradual water table drop to below the surface. The vegetation is dominated by Baltic rush (*Juncus balticus*; MacKillop et al. 2018). While the NWA site had common Baltic rush, spike rush (*Eleocharis palustris*), and *Carex* species, it was not in a saline environment. Wm07 site unit was chosen based on presence of Baltic rush but does not fit the saline environment of the Wm07.

Table 10. Columbia TEM Site Unit area summary for Wilmer in the IDFxk.

Site Unit	Unit Name	Typical Structural Stages	Wilmer (ha)	Total (%)
101	Fd – Rocky Mountain juniper – Pinegrass	6	47.6	6%
102	Fd – Rocky Mountain juniper – Bluebunch wheatgrass	6	8.5	1%
103	Fd – Rocky Mountain juniper – Kinnikinnick	6	81.4	10%
110	Fd – Feathermoss – Step moss	6	30.1	4%
111	At – Prairie rose – Pinegrass	6	17	2%
112	SxwFd – Dogwood – Sarsaparilla	6	4.2	1%
113	Sxw – Dogwood – Horsetail	6	9	1%
ES	Exposed Soil	1a	4.4	1%
Fa	Active Flood Channel Flood	1a	8.6	1%
Ff	Flood fringe	3b	0.4	<1%
Fl02	Mountain alder – Red-osier dogwood – Lady fern	3b	15.4	2%
Fl06	Sandbar willow	3b	6.8	1%
Fm01	Cottonwood – Snowberry – Rose	6	6	1%
Gg01	Bluebunch wheatgrass – Prairie sagewort – Junegrass	2b	8.8	1%
Gg12	Rough fescue – Yarrow – Junegrass	2b	41.4	5%
MU	Mudflat	1a	3.3	<1%
PD	Ponds greater than 2m in depth	null	22.3	3%
RI	River	null	24.8	3%
RP	Road	null	9	1%
Wm02	Swamp horsetail – Beaked sedge	2a	116.7	14%
Wm05	Cattail	2b	89.4	11%
Wm06	Great bulrush	2b	3.6	<1%
Wm07	Baltic rush	2b	9.7	1%
Wm14	American common reed	2b	2.7	<1%
Ws03	Bebb's willow – Bluejoint	3b	43.3	5%
Ws04	Drummond's willow – Beaked sedge	3b	8.9	1%
Ww	Open Water (< 2m depth)	2c	204.6	25%
Total			827.9	100%

6.5 Sensitive Ecosystem Inventory

Sensitive Ecosystems Inventory (SEI) are used to represent rare or sensitive to disturbance. SEI inventories are a simplification of the information provided in TEM and are useful for higher level planning and communication with stakeholders and other groups.

Using the TEM data attributes for site units, structural stages, and stand composition modifiers, an SEI was developed for the NWA. Table 11 and Table 12 provide descriptions of the SEI classes and summarizes the areas within each class. The provincial TEIS database provides domains with defined SEI classes and subclasses, where possible, these

were used to classify each polygon in the NWA. Several additional classes and subclasses were created and domains were added to the TEIS database.

The most common subclasses in the Columbia NWA are Wetland marshes (32%), followed by Wetland shallow water (23%), and the Riparian river subclass (Figure 6 to Figure 9). Eight percent of the area mapped is Non-sensitive, and the majority of this are the young forests in the Wilmer unit. The Riparian low bench floodplain class and mid-bench floodplain are 7% of the mapped area respectively, and are located primarily on the banks of the Columbia River and its tributaries that bisect the NWA. Mature coniferous forests (4%) occur primarily in the Wilmer unit as does the Grasslands (3%) class.

The remaining SEI classes are each 1% of the mapped area and include: Broadleaf woodland trembling aspen copse, Freshwater pond, Mature forest mixed, Riparian beach, Riparian flood fringe, Riparian mudflat, Sparsely vegetated steep slope, deep soils (the lacustrine exposed soils that support swallow nesting), and the Woodland coniferous subclasses.

Table 11. SEI classes, subclasses and descriptions.

Class	Class code	Subclass	Subclass code	Description
Mature forest	MF			Mature forest structural stage
		coniferous	co	Conifer dominated (> 75% of stand composition)
		mixed	mx	Mixed conifer and broadleaf stand composition (< 75% conifer and < 75% broadleaf)
Woodland	WD			Dry site, open stands with 50% or less tree cover
		coniferous	co	Conifer dominated stands (> 75%)
Broadleaf Woodlands	BW			Dry site, open stands with 50% or less tree cover (> 75% broadleaf)
		broadleaf	ac	Broadleaf woodland trembling aspen copse
Riparian	RI			Ecosystems influenced by rivers, creeks, or lakes
		beach	be	Beach on river banks or on lake shorelines
		fringe	ff	Narrow band near ponds or lake shorelines, or streams with no floodplain
		high bench	fh	High bench floodplain
		medium bench	fm	Midbench floodplain
		low bench	fl	Low bench floodplain
		mudflat	mu	Freshwater tidal mudflat
		river	ri	River and streams including gravel bars
Wetland	WN			Wetlands
		fen	fn	Sedge fens
		marsh	ms	Graminoid or forb-dominated marshes
		swamp	sp	Tree or shrub dominated swamps
		shallow water	sw	Shallow water (<2 to 5 m deep) wetlands
Grassland	GR			Native grassland ecosystems
		grassland	gr	Native grassland ecosystems
Freshwater	FW			Lakes or ponds
		ponds	pd	Natural or semi-natural open water greater than 2 to 5 m deep

Class	Class code	Subclass	Subclass code	Description
Sparsely vegetated	SV			Areas with 5 – 10% vascular vegetation (may be greater in patches); often with mosses, liverwort and lichen cover
		steeply sloping, deep soil	st	Sites with steeply sloping exposed soil suitable for cliff nesting birds
Non-Sensitive	NS		NS	Non SEI ecosystems (e.g. young forests, roads, or gravel pits)

Table 12. Sensitive Ecosystem Inventory classes and areas.

Class: subclass	Description	Brisco (ha)	Brisco (%)	Harrogate (ha)	Harrogate (%)	Spillimacheen (ha)	Spillimacheen (%)	Wilmer (ha)	Wilmer (%)	Total (ha)	Total (%)
NS	Non-sensitive	0.1	<1%	4.5	2%	1.3	<1%	130.4	16%	136.3	8%
BW:ac	Broadleaf woodland trembling aspen copse							15.7	2%	15.7	1%
FW:pd	Freshwater pond							22.3	3%	22.3	1%
GR:gr	Grasslands							50.2	6%	50.2	3%
MF:co	Mature forest coniferous					28.5	7%	37.7	5%	66.2	4%
MF:mx	Mature forest mixed			4.1	1%			9.4	1%	13.5	1%
RI:be	Riparian beach			0.2	<1%					0.2	<1%
RI:ff	Riparian flood fringe							0.4	<1%	0.4	<1%
RI:fl	Riparian low bench floodplain	26.9	9%	65.4	22%	8.7	2%	22.2	3%	123.2	7%
RI:fm	Riparian mid-bench floodplain	8.2	3%	14.4	5%	29	7%	6	1%	57.6	3%
RI:mu	Riparian mudflat			7.3	2%			3.3	<1%	10.6	1%
RI:ri	Riparian river	46.5	16%	55	18%	27.8	7%	33.4	4%	162.7	9%
SV:st	Sparsely vegetated steep slope, deep soils							4.4	1%	4.4	<1%
WD:co	Woodland coniferous							13.5	2%	13.5	1%
WN:ms	Wetland marsh	136.6	46%	74.3	25%	144	37%	222.2	27%	577.1	32%
WN:sp	Wetland swamp	4.9	2%	5.2	2%	80.4	21%	52.2	6%	142.7	8%
WN:sw	Wetland shallow water	72.1	24%	68.6	23%	69.7	18%	204.6	25%	415	23%
Total		295.3	100%	299	100%	389.4	100%	827.9	100%	1811.6	100%

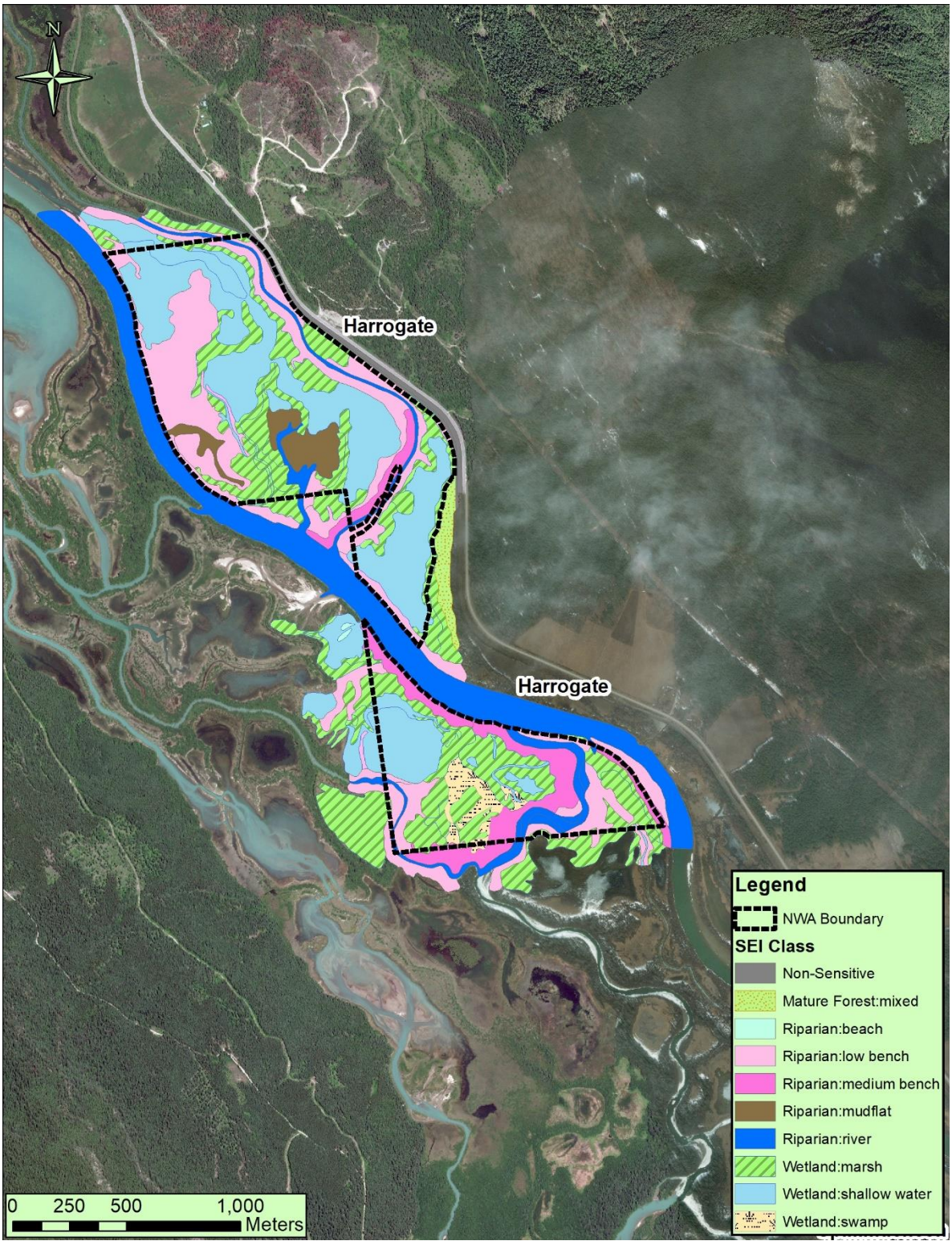

Figure 6. Harrogate SEI classes.

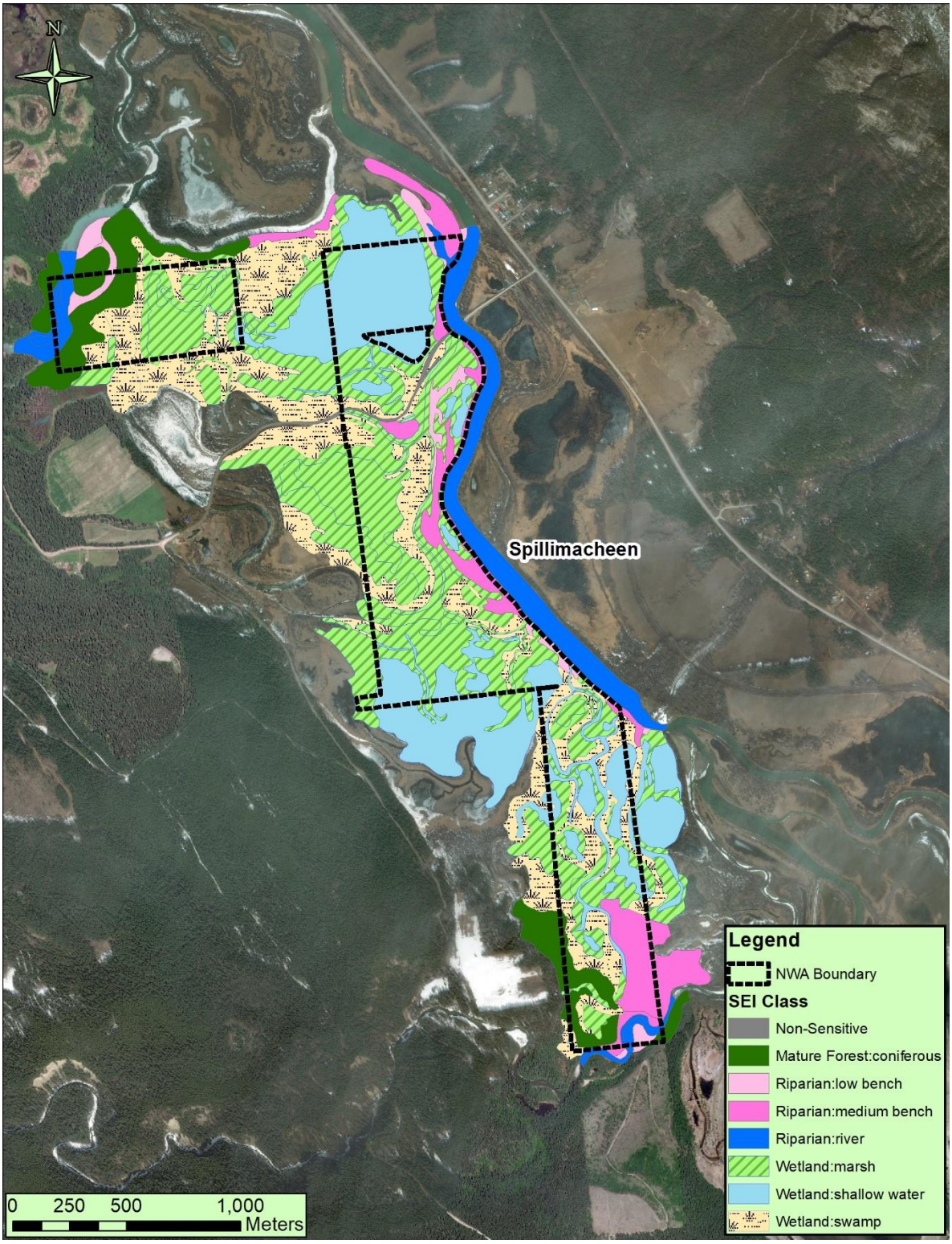

Figure 7. Spillimacheen SEI classes.

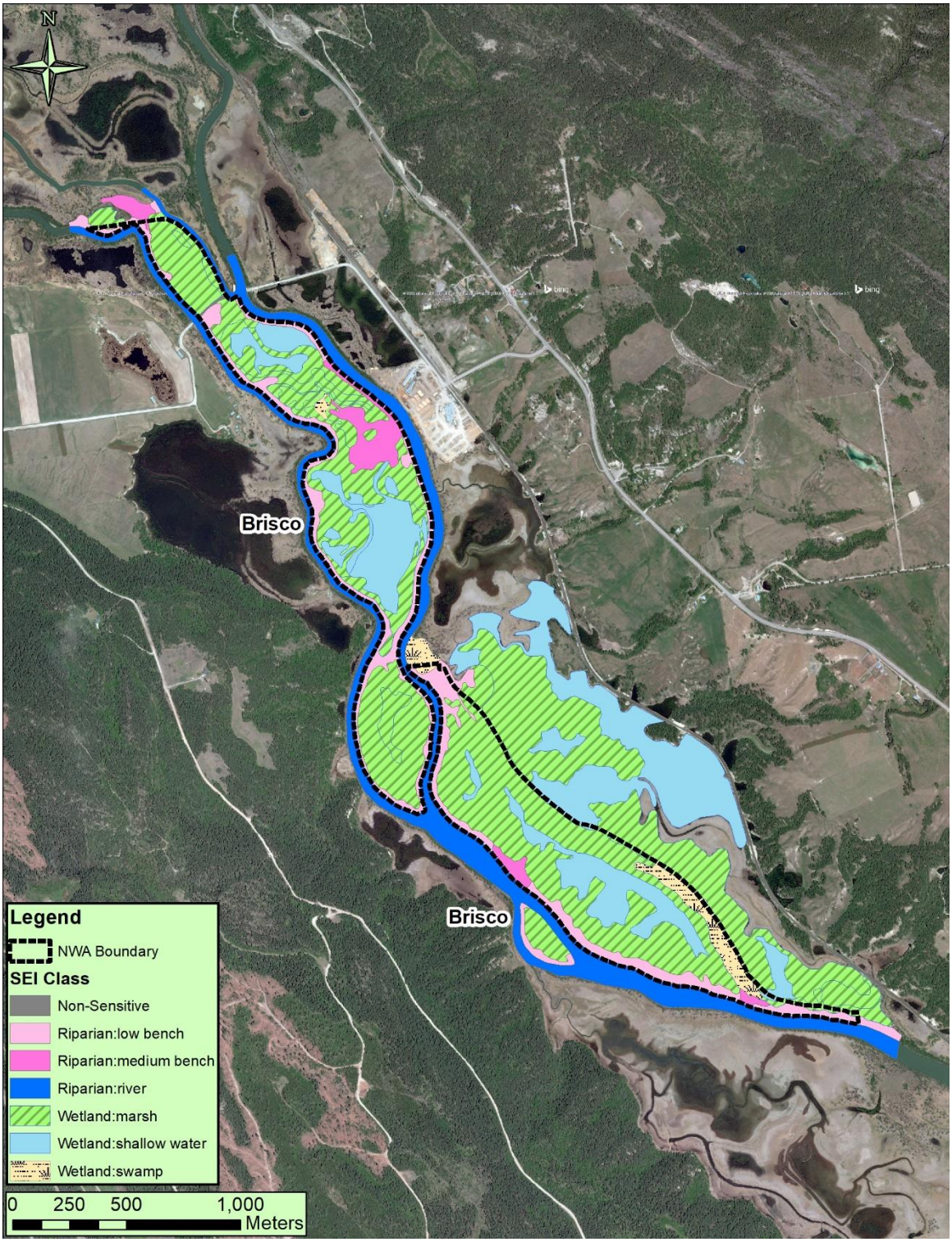

Figure 8. Brisco SEI classes.

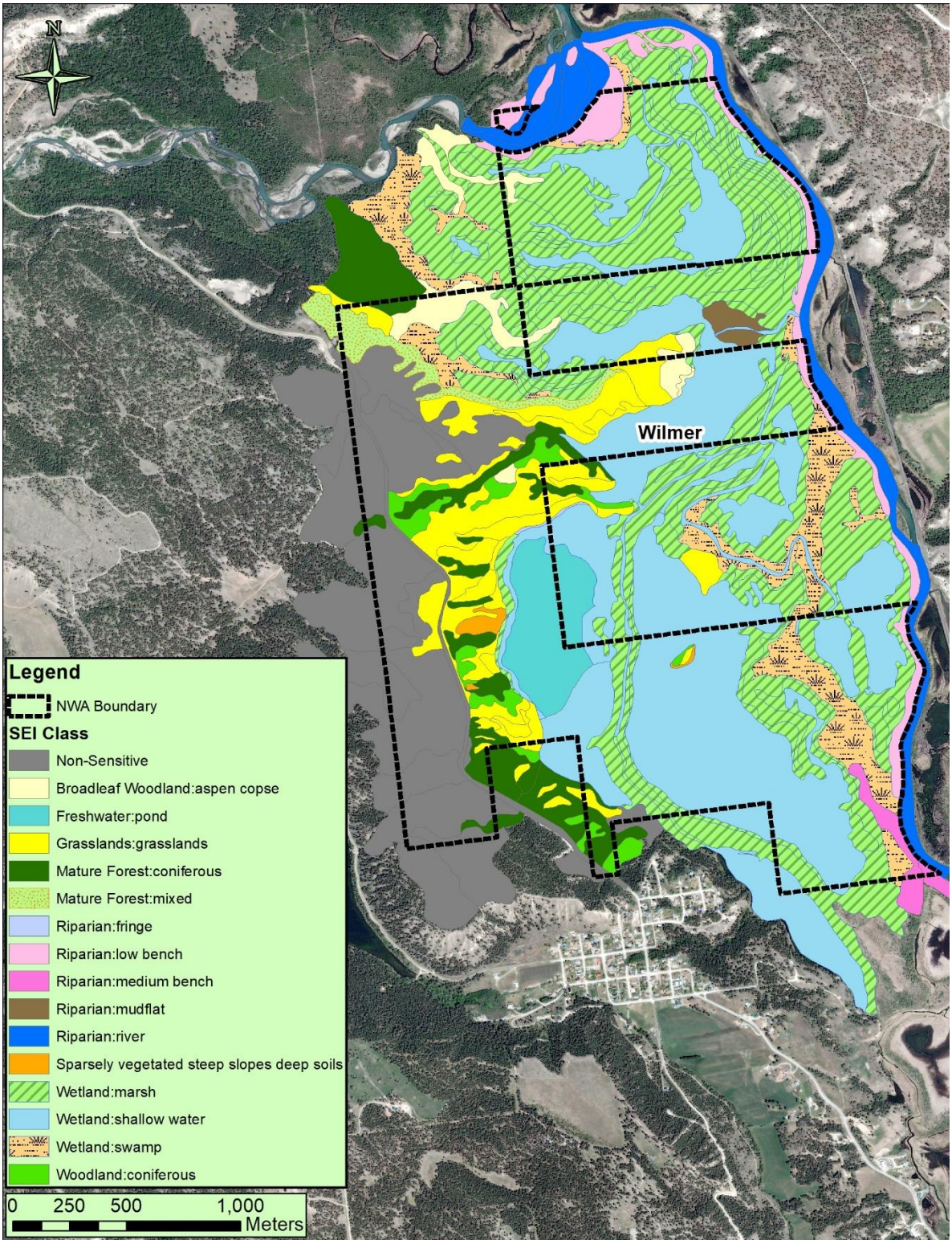

Figure 9. Wilmer SEI classes.

6.6 Structural Stage and other Tree Cover Attributes

The stand composition, structural stage, and crown closure are dynamic features of forested ecosystems. As these characteristics are relevant to identifying red- or blue-listed forested ecosystems, and are important attributes for wildlife habitat modeling, they were included in the attribute database and categorized using the provincially recognized classes (BC MOF & BC MOE 2010; Table 13; Table 14).

Stand composition modifiers were used to identify if the forested stands were primarily coniferous (>75% coniferous), broadleaf (>75% broadleaf), or mixed (MOF & BC MOE 2010). The upland sites in the Wilmer unit account for most of the forested area in the NWA, and the majority of these support coniferous stands of Douglas-fir (*Pseudotsuga menziesii)*. Coniferous dominated stands occur on 69% of the forested area in the NWA (Table 13). Broadleaf dominated forests (20% of the forested area) occurred primarily on mid-bench floodplain units with black cottonwood (*Populus trichocarpa*) stands. Mixed stands occur in all of the units on upland ecosystems (11%).

Structural stage definitions and relative abundance within each NWA unit are shown in Table 14 and Figure 10 to Figure 13. The most abundant class is 2c (23%) which represents shallow waters with aquatic vegetation. Graminoid structural stages (21%) are also common due to the prevalence of marshes and the upland grasslands in the Wilmer unit. Much of the forb-dominated stage (2a; 14%) is due to the prevalence of Wm02 marshes with swamp horsetail (*Equisetum fluviatile*). These communities are a mix of graminoids and forbs, however they were classified as 2a because swamp horsetail is the defining species for this site unit. Tall shrub (3b) communities, associated with the low bench floodplains and swamps, account for 14% of all structural stages. Ten percent of structural stages were classified as Null (non-vegetated areas such as rivers, ponds, roads, etc.). Mature (6) and young forests (5) comprise 9% and 7% of structural stages, respectively. Sparse (1a), low shrub (3a), and pole/sapling (4) make up the remaining 3% of structural stages.

Table 13. Stand composition modifiers and abundance in the TEM.

	Broadleaf		Coniferous		Mixed		
Unit	Area	%	Area	%	Area	%	Total
Brisco	8.2	100%					8.2
Harrogate	14.4	78%			4.1	22%	18.5
Spillimacheen	16.3	26%	28.4	46%	17.0	28%	61.8
Wilmer	19.8	10%	170.6	85%	9.4	5%	199.8
Total Area (ha)	58.8	20%	199.0	69%	30.5	11%	288.4

Table 14. Structural stage descriptions and area summaries.

Code	Description	Wilmer	Brisco	Harrogate	Spillimacheen	Total Area	Percent
		Area (ha)					
Null	Non-vegetated (Water, roads etc.).	54.1	46.7	56.3	27.5	184.6	10%
1a	Sparse/bryoid <10% vegetation cover.	16.9		10.6	1.5	29.0	2%
2a	Forb-dominated: Forb/Graminoid dominated communities; <10% tree cover, < 20% shrub cover and (>½ of the total herb cover) by non-graminoid herbs, including ferns.	116.7	12.5	28.3	89.9	247.4	14%
2b	Graminoid-dominated: Herbaceous communities dominated (>½ of the total herb cover) by grasses, sedges, reeds, and rushes.	156.9	124.0	43.9	54.1	378.9	21%
2c	Aquatic: Herbaceous communities dominated (>½ of the total herb cover) by floating or submerged aquatic plants; does not include sedges growing in marshes with standing water (which are classed as 2b).	204.6	72.1	68.6	69.8	415.1	23%
3a	Low shrub: shrub communities dominated by shrubby vegetation 0 to 2 m tall; natural regeneration may be abundant; tree cover < 10%.	8.8		0.5	0.2	9.5	1%
3b	Tall shrub; shrub communities dominated by shrubby vegetation 2 to 10 m tall; natural regeneration may be abundant; tree cover < 10%.	69.9	31.6	72.3	84.6	258.4	14%
4	Pole/Sapling: trees > 10 m tall have overtopped shrub and herb layer; dense stands usually less than 40 years since disturbance.	2.8				2.8	<1%
5	Young Forest: self-thinning evident with canopy layers developed; more open than Pole/Sapling; usually 40-80 years.	119.7				119.7	7%
6	Mature Forest: main canopy trees mature; well-developed understory often with advance regeneration; usually 80 to 250 years of age. Includes all forested bogs and poor productivity forested sites.	77.5	8.4	18.5	61.8	166.2	9%
7	Old Forest - old structurally complex stands with snags and CWD; time since disturbance generally greater than 250 years.						
	Total Area (ha)	827.9	295.3	299.0	389.4	1,811.6	

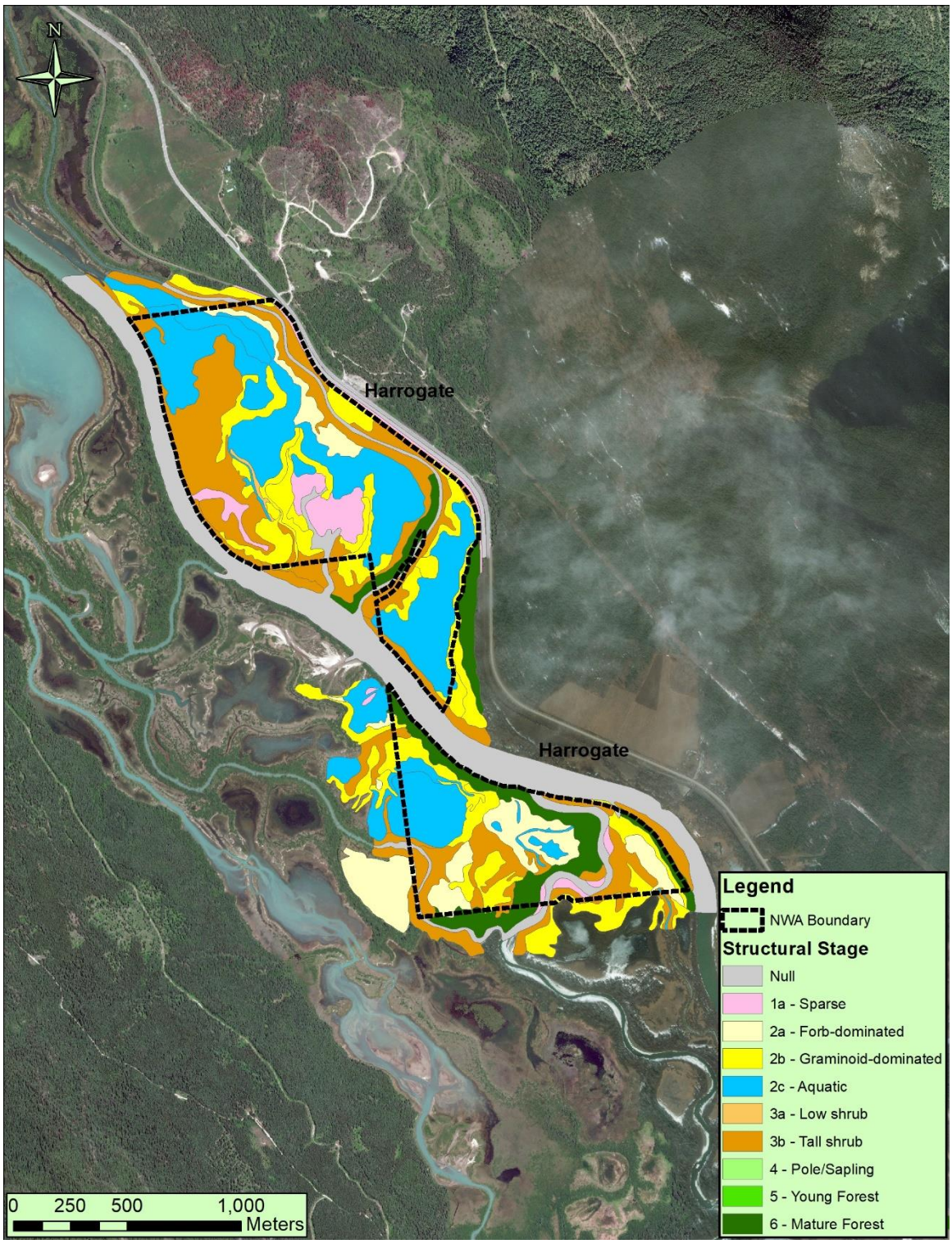

Figure 10. Harrogate Structural Stages.

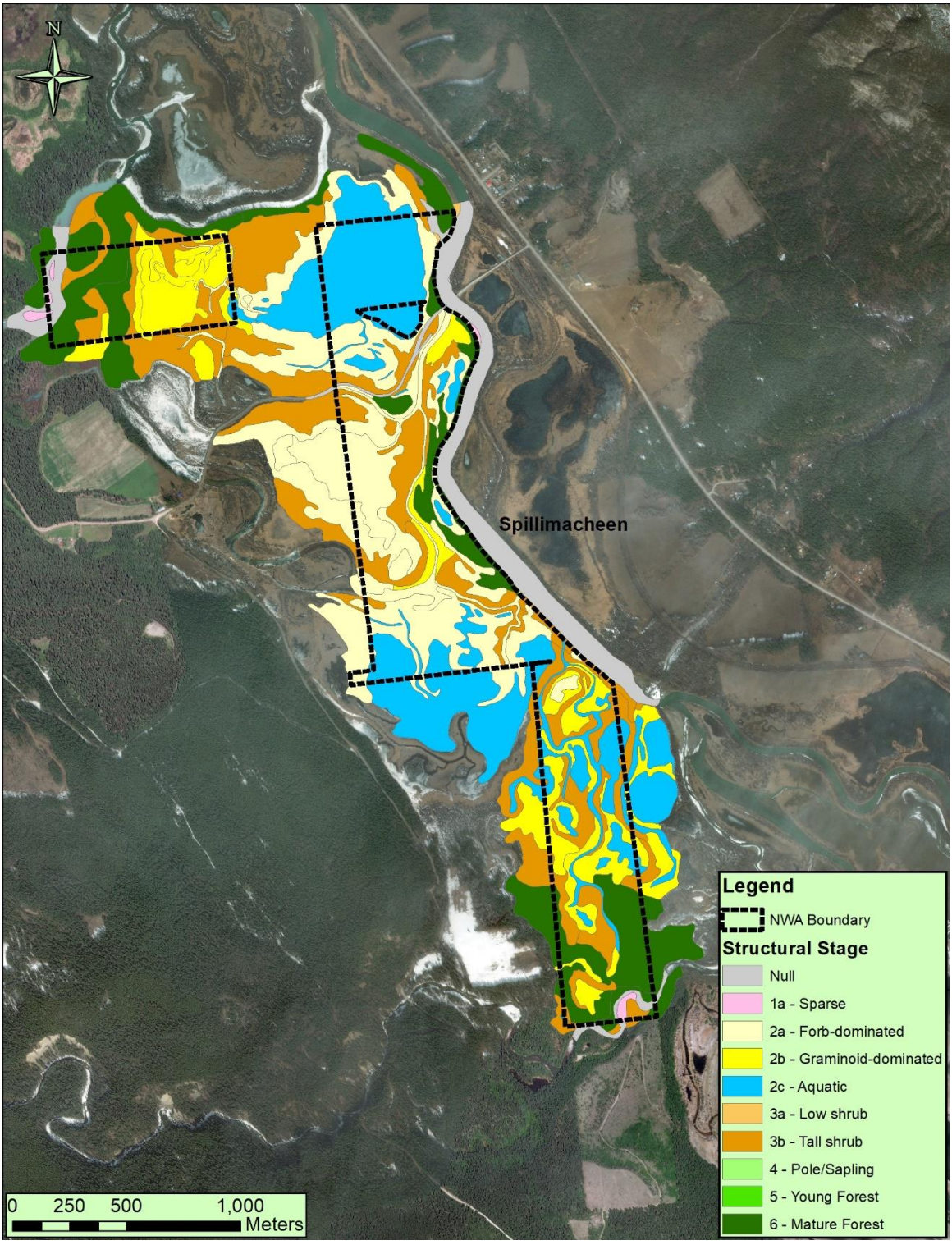

Figure 11. Spillimacheen Structural Stages.

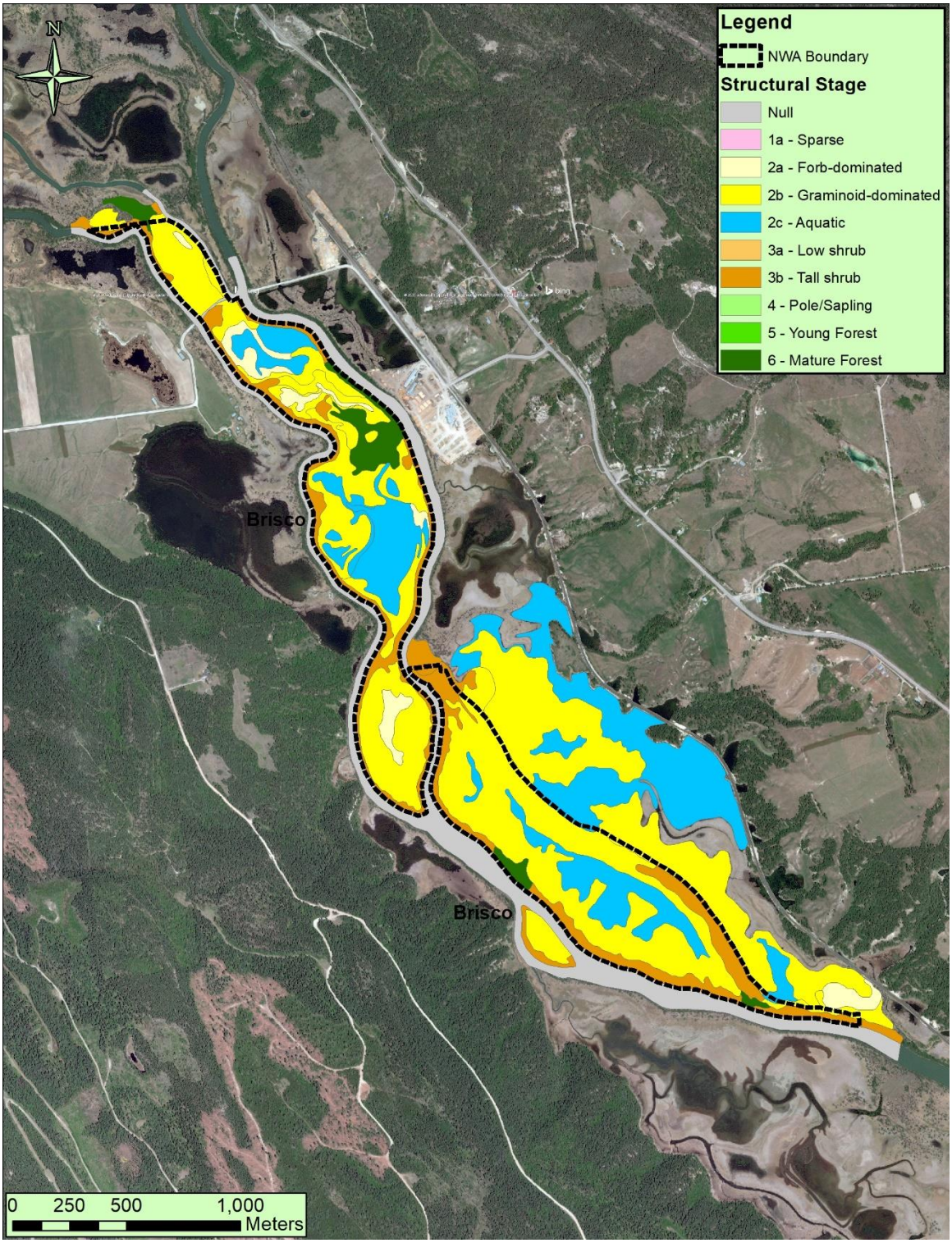

Figure 12. Brisco Structural Stages.

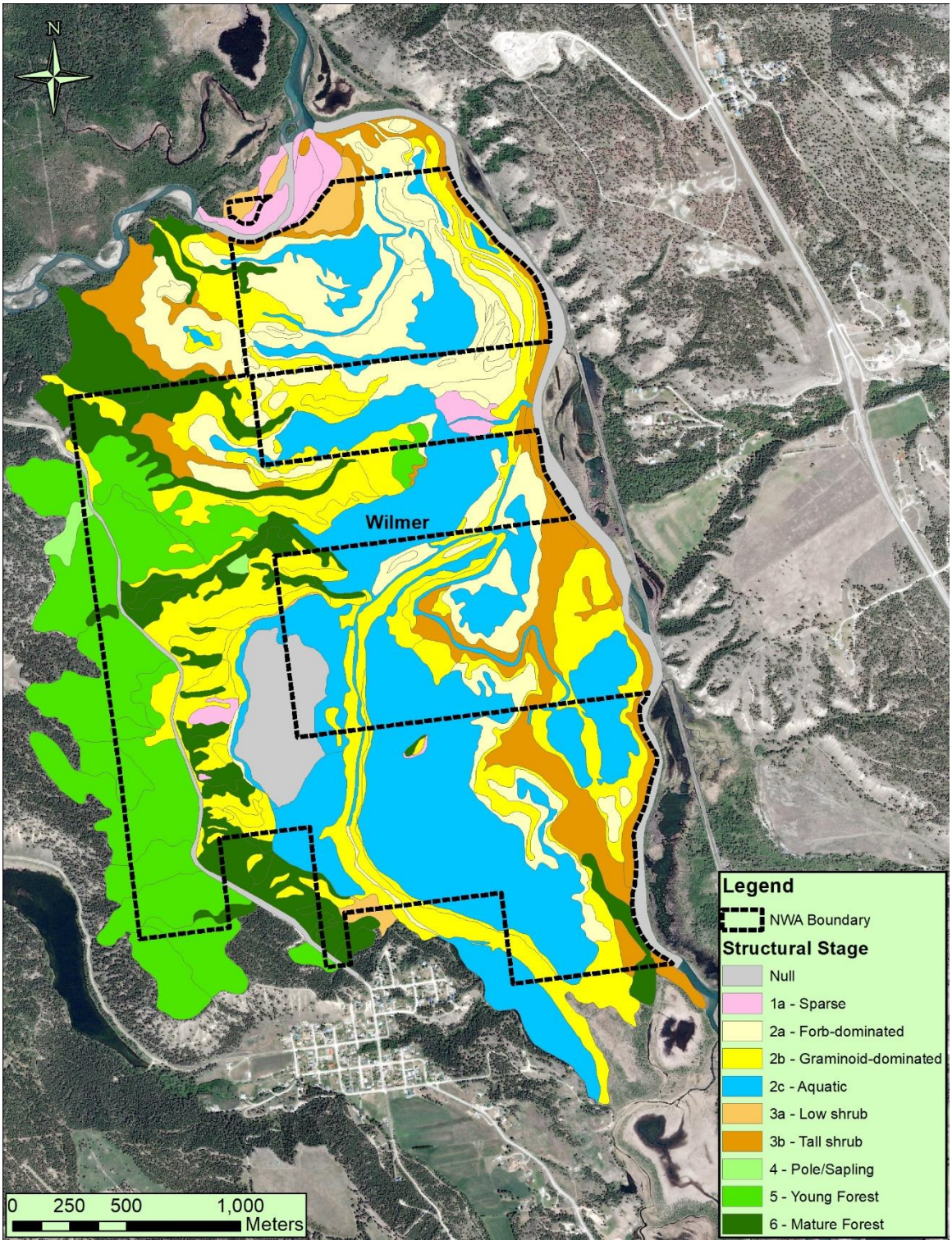

Figure 13. Wilmer Structural Stages.

6.7 Wildlife Habitat Suitability Ratings

Within the Columbia NWA, there are 13 species for which the TEM habitat types delineated by TEM polygons has been ranked for its capability and suitability for providing habitat attributes for the life requisite described within the species account as critical for that species. In total, there are 4 mammals, 5 birds, 3 amphibians and 1 reptile (Table 15).

Condensed species accounts have been prepared for each of the 13 focal species in the Columbia NWA. The species accounts list the critical life stages, the functions of the habitats, the biophysical features and attributes required to meet the seasonal habitat needs.

Table 16 provides a sample of the condensed species account. The complete species accounts for the 13 species within the Columbia NWA can be found in Appendix 5. The last column of the species account listed the reference(s) used for each these species and can be found in Appendix 8.

Habitat suitability ratings have been assigned to each of the TEM site series based on the ability of the attributes potentially present within these ecosystems to provide the functions required for the survival of the specific species.

Table 15. Focal species within the Columbia NWA.

Common Name	Scientific Name	Name Code
Birds		
Sandhill Crane	*Grus canadensis*	B-SACR
Common Nighthawk	*Chordeiles minor*	B-CONI
Great Blue Heron	*Ardea herodias ssp. herodias*	B-GBHE
Lewis's Woodpecker	*Melanerpes lewis*	B-LEWO
Olive-sided Flycatcher	*Contopus cooperi*	B-OSFL
Mammals		
North American River Otter	*Lontra canadensis*	M-LOCA
American Badger	*Taxidea taxus*	M-TATA
American Black Bear	*Ursus americanus*	M-URAM
American Beaver	*Castor canadensis*	M-CACA
Amphibians		
Western Toad	*Anaxyrus boreas*	A -ANBO
Northern Leopard Frog	*Rana pipiens*	A-RAPI
Columbia Spotted Frog	*Rana luteiventris*	A-RALU
Reptiles		
Western Painted Turtle	*Chrysemys picta*	R-CHPI

The critical life requisite based on the species accounts used for rating the suitability of the ecosystem types for the 5 bird species, the 3 amphibian species and the 1 reptile species was *Reproducing Eggs* (RE) for the *Growing Season* (G). The sites were given an overall rating based on the site in context with the surrounding ecosystem types. *Reproducing Eggs* is described as habitat used for building a nest, laying eggs, incubation, hatching, and

feeding non-mobile young. For the Western Toad the other life requisite used along with RE was *Migrating Seasonally* (MS).

The life requisite considered critical for mammals was *Denning* (DE) for the American Badger, American Beaver and River Otter for *All Seasons* (Aa), while the life requisite Living (LI) was considered also for these 3 species and for the American Black Bear for the *Growing Season* (G). *Denning* is described as habitat used for sleeping or hiding in a cavity, cave, or burrow; does not include hibernating nor reproducing-birthing.

The wildlife habitat suitability ratings are provided in an excel table format and show a rating of High (H), Moderate (M), Low (L), or Nil (N) or a combination of ratings based on the value of that ranked habitat in context with the adjoining habitat. Therefore, the habitat rating provided for a specific ecosystem type should not be considered a generic rating for that species for all similar ecosystem types.

In general, the swamp, marsh and water dominated wetlands provide the highest suitable/capable habitat types for the American Beaver, the Northern River Otter, the Western Toad, the Northern Leopard Frog, the Columbian Spotted Frog, the Sand Hill Crane and the Great Blue Heron. There are suitable egg laying habitats within these sites and an abundance of submerged vegetation, fish, amphibians and small mammals that provide forage for these species. Wetland ecosystems with adjacent potential nest trees ranked highest for the Great Blue Heron. Beach and low bench and some mid bench floodplains ranked highest for the Western Painted turtle providing suitable egg laying substrate and basking sites for adults. Most of the wetlands and floodplain ecosystems showed sign of Black Bear use. These sites have an abundance of forage species preferred by bears during the growing season.

The highest suitable/capable habitats for the American Badger were the drier forest and forest grassland ecosystems with deeper soils for burrow construction within the IDFxk. These sites also indicated use by Snowshoe Hare and Columbian Ground Squirrels. Many of the forest or floodplain ecosystems within both the IDFdk5 and the IDFxk with larger Douglas-fir or cottonwood trees or snags rated highly suitable/capable as Lewis's Woodpecker potential nesting site. Many of the older trees and snags have potential nest cavities.

The Common Nighthawk breeds in open and partially open habitats, bogs, and rocky or sandy natural habitats, as well as disturbed areas. Many of the forested ecosystem with natural openings or the floodplain ecosystems ranked moderate to high as suitable nesting habitat.

The wildlife habitat capability ratings are provided in an excel table format also and were assigned to each site unit based on the climax successional stage of the specific ecosystem unit. A capability rating was only relevant to the tree dominated sites and therefore no wetland sites vary from the suitability rating given based on the field assessment.

The wildlife habitat suitability and capability ratings table are provided in Appendix 7.

Species observed during the field assessments either as a visual sighting, a call, tracks or remains such as bones or pellets/scat were recorded. Tables 17, 18, and 19 provide a summary of the sightings, the ecosystem type they were recorded in and the number of the species observed.

Table 16. Sample of the Condensed Species Accounts

Species	Scientific Name	Critical Life Stage	Function	Biophysical Feature	Attributes	Reference #
Mammals						
American Badger	*Taxidea taxus*	All Life Stages - Living	Thermal, security, food, reproducing	Grasslands, open forests where there is an abundance of prey. Soils suitable for earthen dens.	Badger activity is at low elevations in dry regions (BG, PP, IDF) within native or non-native grasslands, open forests of Douglas-fir or ponderosa pine, and disturbed sites such as roadsides and fields. Maternal dens differ from those used for diurnal resting in that they are more structurally complex with larger soil mounds at the entrance. Staple food of badgers is usually earthworms which generally make up around 80% of their diet. They can eat several hundred worms each night; omnivorous - eat slugs, insects, fruit nuts, seeds and acorns along with crops like wheat and sweetcorn. Badgers are known to eat small mammals including mice, rats, rabbits, frogs, toads and hedgehogs and may take advantage of animal carcasses and carrion they come across.	1
American Beaver	*Castor canadensis* Kuhl	All Life Stages - Living	Thermal, security, food, reproducing	Wetlands, streams	Prefer low gradient streams (which they modify), ponds, and small mud-bottomed lakes with dammable outlets; the ponds they create for lodges have to be deep enough to not freeze in the winter. Can build a lodge in a backwater channels of a mainstream or in the bank of a river that floods continuously.	15
American Black Bear	*Ursus americanus* Pallas	Living - Growing	Foraging (spring, summer, fall), security habitat, thermal cover	Riparian areas including wetlands, avalanche tracks, subalpine meadows, berry producing sites; thermal cover - mature and old growth trees; security cover - trees with dbh >40cm	Forage in moist, rich wetlands with grasses, sedges, skunk cabbage in the spring, summer and fall diet is herbaceous and higher amounts of berries in late summer and fall. Diet is supplemented by fawns in the spring and salmon in the fall.	14

Table 17: Mammals species, the site unit and the sign observed in the Columbia NWA during the field assessment

Common Name	Scientific Name	Site Unit	Sign Observed	# of Species Observed
Mammals				
American Beaver	*Castor canadensis l*	Wm02, Fl05, Wm05, Fm02, Fl02, Wm01, Ww, Ws03	tracks, trail, lodge, tree, shrub cuts	
American Black Bear	*Ursus americanus*	Fl05, Fm02, Fa, Wm01, Wm02, IDFdk5 (111), Fm01, Ws03, Fm01	tracks, pad trail, scat, bed, visual	1
American Badger	*Taxidea taxus*	IDFxk (110), IDFxk (102), IDFxk (103)	burrows, tracks	
Cougar	*Puma concolor*	Fl02	tracks	
Coyote	*Canis latrans*	Fl05, Wm02, Mu, Gg12, IDFxk (110)	tracks, scat	1
Grizzly Bear	*Ursus arctos*	Fl02	tracks, pad trail, roar, grunts	
Columbian Ground Squirrel	*Urocitellus columbianus*	Gg12, IDFxk (102), IDFxk (103)	borrows	
Canada Lynx	*Lynx canadensis*	IDFxk (102)	tracks	
American Mink	*Neovisn vison*	Wm02, Fl05, Wm01, Fm02	tracks	
Muskrat	*Ondatra zibethicus*	Ww	lodge	
North American River Otter	*Lontra canadensis*	Wm02, Wm01	tracks	
Elk	*Cervus elaphus*	IDFxk(102)	pellets	
Snowshoe Hare	*Lepus americanus*	Gg12, IDFxk (110)	pellets	
White-tailed Deer	*Odoicoleus virginianus*	Fl05, Wm02, Fa, Mu, Fl02, IDFdk5 (111), Ww, Fm02, Fm01, Ws03, Fm01, Wm07, IDFxk (111), Gg12, IDFxk(102)	tracks, trail, visual, beds	2
Wolf	*Canis lupus*	IDFxk (102)	tracks, scat	
Red Squirrel	*Tamiasciurus hudsonicus*	IDFdk5 (111), IDFxk (111), IDFxk (110), IDFxk(102)	visual, middens	1

Table 18: Amphibian, Reptile and Fish species, the site unit and the sign observed in the Columbia NWA during the field assessment

Common Name	Scientific Name	Site Unit	Sign	Number
Amphibians, Reptiles, Fish				
Columbia Spotted Frog	*Rana luteiventris*	Fm02	visual	1
Pacific Tree Frog	*Hyla regilla*	Wm02	call	1
Common Garter Snake	*Thamnophis sirtalis*	Ws04	visual	1
unidentified fish fry		Wm02	visual	100+

Table 19: Bird species, the site unit and the sign observed in the Columbia NWA during the field assessment

Common Name	Scientific Name	Site Unit	Sign	Number
Birds				
American Crow	*Corvus brachyrhynchos*	Fl02	visual	1, 5
American Avocet	*Recurvirostra americana*	Fm01	visual	1
American Kestrel	*Falco sparverius*	IDFxk(102)	visual	1
American Robin	*Turdus migratorius*	Fl02	visual	2
American Wigeon	*Mareca americana*	Ww	visual	10+
Bald Eagle	*Haliaeetus leucocephalus*	Wm02, Ww, Fm02, Wm05, Fl02	visual, nest	2, 2, 1
Bank Swallow	*Riparia riparia*	Ws04, Fm01, Es	nest cavity visuals	30+
Barn Swallow	*Hirundo rustica*	Fl02	under bridge over floodplain	2
Belted Kingfisher	*Xenotriccus callizonus*	Fl05, Wm02, Fm02, Fa, Ww, Ws04, Fl02, IDFxk (110)	visual	4, 1, 3, 1
Black-capped Chickadee	*Poecile atricapillus*	Fm02, Ws03, Ws04, Fm01, Wm05, Fl02, IDFxk (111)	visual	2, 3
Black-billed Magpie	*Pica hudsonia*	IDFxk (111)		4
Blue-winged Teal	*Spatula discors*	Wm02, Ww, Ws04	visual	4, 8, 10
Canada Goose	*Branta canadensis*	Wm02, Mu, Ww, Fm02	tracks, visual	3, 5
Chestnut-backed Chickadee	*Poecile rufescens*	Fl05	visual	2
Cinnamon Teal	*Spatula cyanoptera*	Wm02, Ww	visual	55+, 1
Common Loon	*Gavia immer*	Fl05,	call, visual	2
Common Sandpiper	*Actitis hypoleucos*	Fm02, Wm01	visual	4
Common Snipe	*Gallinago gallinago*	Wm02	visual	12+
Dunlin	*Calidris alpina*			
Eastern Kingbird	*Tyrannus tyrannus*	Fl05, Ww, Wm05, Fm01, Fl02	visual	3, 2, 1, 2, 2
Gadwall	Mareca strepera	Fm02	visual	2
Golden-crowned Kinglets	*KI Regulus satrapa*	Fl05,	call, visual	6+
Great Blue Heron	*Ardea herodias ssp. herodias*	Fm02, Wm02, Fl05, Wm05, Ww, IFFxk (111)	carcass, feathers,	2, 2, 4, 2
Hooded Merganser	*Lophodytes cucullatus*	Ww	visual	2
Killdeer	*Charadrius vociferus*	IDFxk (111)	visual	1
Least Grebe	*Tachybaptus dominicus*	Ws03	visual	2
Lesser Scaup	*Aythya affinis*	Fl05	visual	20+
Lewis Woodpecker	*Melanerpes lewis*	IDFxk (111), IDFxk (110)	visual, call	1
Long-billed Dowitcher	*Limnodromus scolopaceus*	Wm02	visual	3
Mallard	*Anas platyrhynchos*	Wm01, Ww	visual	, 120+, 22, 3
Merlin	*Falco columbarius*	Ww	visual	1
Norther Flicker	*Colaptes auratus*	Fm01, IDFxk (111), IDFxk (110)	visual, call	1

Common Name	Scientific Name	Site Unit	Sign	Number
Birds				
Olive-sided Flycatcher	*Contopus cooperi*	Fl05, Fm02, Ws04	visual	1, 1, 1
Osprey	*Pandion haliaetus*	Fl05, Fm02, Ww	visual	1, 1, 1
Peregrine Falcon	*Falco peregrinus*	Wm02, Wm05	visual	1, 1
Pileated Woodpecker	*Dryocopus pileatus*	IDFxk (101)	visual	1
Pine Siskins	*Spinus pinus*	Wm01, IDFxk (110)	visual	many
Red-breasted Nuthatch	*Sitta canadensis*	IDFxk (110), IDFxk (103)	call	
Red-breasted Sapsucker	*Sphyrapicus ruber*	Ws03, IDFxk(102)	visual, call	1
Red-winged Blackbird	*Agelaius phoeniceus*	Ww	visual, call	30+
Rufous Hummingbird	*Selasphorus rufus*	Wm02	visual	1
Rusty Blackbird	Euphagus carolinus	Ws03	visual	2
Sandhill Crane	*Grus canadensis*	Fa, Mu, Fl05, Ws03, Wm02, Ww	visual, adults and juveniles	1, 5, 2, 6, 4, 5
Semipalmated Plover	*Charadrius semipalmatus*	Fl05,	visual, tracks	10+
Franklin's Gull	*Leucophaeus pipixcan*	Ww	visual	1
unidentified sparrow	*Passerellidae (gen, sp*	Fl02	visual	1
Tree Swallow	*Tachycineta bicolor*	Fl05	visual	2
Trumpeter Swan	*Cygnus buccinator*	Fl05, Fm02, Wm02, Ww	visual	6, 2, 2, 6 (5 signets)
unidentified Warbler	*Parulidae (gen, sp)*	Fl05	visual	1
Western Grebe	*Aechmophorus occidental*	Wm02	visual (male)	1, 3
Wood Duck	*Aix sponsa*	Ww (IDFxk(110)	on water adjacent to forest	1
Yellow-headed Blackbird	*Xanthocephalus xanthoce*	Ww	visual	1
unidentified hawk sp?	*Accipitridae (gen, sp)*	Wm02	visual	1

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Appendix 1: Columbia National Wildlife Area Site Unit Descriptions

IDFxk - Terrestrial Realm Site Units

IDFxk Terrestrial Realm Site Units[2]

Site Unit	Name	Description	
101	Fd – Rocky Mountain juniper – Pinegrass	The 101 site unit occurs on mid slopes of neutral aspects and on level or gentle areas with deep, medium-textured soils. It can also occur on lower or gentle (< 15%) slopes on warm aspects. Multi-storeyed Douglas-fir (*Pseudotsuga menziesii*) stands occur, and rarely include other tree species. Birch-leaved spirea (*Spiraea lucida)*, common and Rocky Mountain juniper (*Juniperus scopulorum*), roses (*Rosa* spp), and soopolallie (*Shepherdia canadensis*) comprise the moderately well-developed shrub layer. Pinegrass (*Calamagrostis rubescens*) is usually dominant, with minor bluebunch wheatgrass (*Pseudoroegneria spicata*) and showy aster (*Eurybia conspicua*). Low cover of many dryland species is common, including common harebell (*Campanula rotundifolia*), cut-leaved anemone (*Anemone multifidi*), spike like goldenrod (*Solidago glutinosa*), pussytoes (*Antennaria* spp.), yarrow (*Achillea* spp.), nodding onion (*Allium cernuum)*, lemonweed (*Lithosperma ruderale*), and yellow penstemon (*Penstemon confertus*). Moss cover is typically low.	

[2] Descriptions for these site units are adapted from "A Field Guide to Ecosystem Classification and Identification for Southeast British Columbia" (MacKillop et al. 2018). The descriptions have been shortened to include the most relevant information. When required, text has been inserted below these descriptions to provide additional characterization relevant to the NWA.

102	Fd – Rocky Mountain juniper – Bluebunch wheatgrass	The 102 site unit occurs on steep, warm aspects, typically with coarse or shallow soils. They are also common on warm, dry crests, and where exposed bedrock or talus is present. Stands are typically open-canopied Douglas-fir with abundant bluebunch wheatgrass and common rabbit-brush (*Ericameria nauseosa*) along with Rocky Mountain juniper and junegrass (*Koeleria macrantha*). Low cover of pussytoes, nodding onion, Holbell's rockcress (*Boechera retrofracta*), prairie sagewort (*Artemisia frigida*), and golden-aster (*Heterotheca villosa*) is often present.	
103	Fd – Rocky Mountain juniper – Kinnikinnick	103 site unit typically occurs on gentle to moderate slopes with warm aspects and medium- to coarse-textured soils. They also occur on cool or neutral aspects on upper slopes that are moisture-shedding and/or have coarse- to very coarse-textured soils. The Douglas-fir dominated canopy generally has abundant bluebunch wheatgrass and/or kinnikinnick (*Arctostaphylos uva-ursi*), and rough fescue (*Festuca campestris*) may be present. Several dryland species commonly occur with low cover, including cut-leaved anemone, brown-eyed Susan (*Gaillardia aristata*), spike like goldenrod, pussytoes, nodding onion, yarrow, Saskatoon (*Amelanchier alnifolia*) and Rocky Mountain juniper.	

110	Fd – Feathermoss – Step moss	The 110 site unit occurs on moderately steep to steep sites (usually > 50%) on cool-aspect slopes. Stands are characterized by closed canopies of Douglas-fir with a well-developed moss layer. Abundant step moss (*Hylocomium splendens*) and red-stemmed feathermoss (*Pleurozium schreberi*) are distinctive in this site series.	

111	At – Prairie rose – Pinegrass	The 111 site unit occurs on lower slopes, toe slopes, and in gullies on moist sites with seasonal seepage and moisture at depth. At is dominant in the canopy, usually with minor cover of interior spruce (*Picea engelmannii* x *glauca*), and occasionally with Lodgepole pine (*Pinus contorta*) or Paper birch (*Betula papyrifera*) in the overstorey and/or understorey. Snowberry (*Symphoricarpos* spp.), saskatoon, and roses are abundant in the understorey. Pinegrass is typically present along with blue wildrye and/or Kentucky bluegrass (*Poa pratensis*). This site mapped in the Wilmer unit is somewhat unusual. It occurs upslope from a Wm05 cattail marsh and adjacent to a Wm07 site with Baltic rush. The soils are a silty clay with gleying noted in deeper horizons. The vegetation is a complex of dry and wet indicators, possibly indicating a seasonal pattern of inundation during flood events and drying during summer droughts.	
112	SxwFd – Dogwood – Sarsaparilla	The 112 site unit occurs on lower and toe slopes or level sites where seepage is prolonged and typically within 70 cm of the soil surface. Interior spruce is dominant in the generally open overstory, and frequently occurs with Paper birch and Douglas-fir. Snowberry and roses are moderately abundant in the understorey, often with red-osier dogwood. Abundant wild sarsaparilla (*Aralia nudicaulis*) is distinctive in this site series. Very minor cover (< 3%) of horsetails (*Equisetum* spp.), sedges (*Carex* spp.), or other moist indicator species is common.	No photo available
113	Sxw – Dogwood – Horsetail	The 113 site unit is uncommon in the IDFxk. It occurs on level sites, in depressions, and on gently sloping toe slopes where the water table is within the top 30 cm of the soil profile. Open-canopied interior spruce stands often have minor cover of trembling aspen (*Populus tremuloides;* At) or	No photo available

		black cottonwood (*Populus trichocarpa*; Act). Horsetails are abundant in the understorey, sometimes with sedges and usually with various species associated with wet sites. Mountain alder (*Alnus incana*), red-osier dogwood (*Cornus stolonifera*), and roses are often present in the shrub layer.	
Gg01$2.2	Bluebunch wheatgrass – Prairie sagewort – Junegrass	The Gg01 site unit is the most common and widespread grassland at lower elevations in the Rocky Mountain Trench. It typically occurs where surface soils are unstable and prone to erosion, and It is most common on steep (> 45%), warm-aspect slopes with loamy soil textures and moderate to high coarse fragment content. The Gg01 occurs in both grassland-dominated areas and as pocket grasslands in forested areas. Vegetation is dominated by widely spaced bluebunch wheatgrass with low cover of junegrass, prairie sagewort, and scattered forbs with low cover. Most sites in the Wilmer NWA are located on warm slopes and have abundant needle-and-thread grass (Hesperostipa comata) and some rough fescue with lesser amounts of bluebunch wheatgrass. The TEIS database does not currently allow for the use of these seral ecosystem codes and only indicates the sites are Gg01.	

Gg12$2.4	Antelope-brush – Snowberry – Bluebunch wheatgrass	In the East Kootenay, the Gg12 site unit typically occurs on level and gently sloping sites in the IDFxk, IDFdm2, IDFdk5, and occasionally in the MSdw. Late seral vegetation is dominated by abundant rough fescue with spreading needlegrass (*Achnatherum richardsonii*), junegrass, and diverse scattered forbs such as pussytoes, yarrow, nodding onion, and yellow penstemon (*Penstemon confertus*); kinnikinnick is sometimes present and can be abundant. In the Wilmer NWA, the dominant grass species is needle-and-thread grass with lesser amounts of rough fescue, therefore these sites were mapped as Gg12$2.4 to indicate this. The TEIS database does not currently allow for the use of these seral ecosystem codes and only indicates the sites are Gg12.	

IDFdk5 - Terrestrial Realm Site Units

IDFdk5 – Terrestrial Realm Site Units[3]			
101	FdPl – Pinegrass – Feathermoss	The 101 site unit occurs on mid slopes of neutral to cool aspects with moderate-textured soils and, occasionally, on lower or gentle (< 15%) slopes on warm aspects. Douglas-fir forms closed forest canopies, often with minor amounts of lodgepole pine. The shrub layer is generally well-developed with moderate to high cover of snowberry, rose, saskatoon, soopolallie, and birch-leaved spirea. Pinegrass is abundant with moderate amounts of showy aster and low cover of twinflower (*Linnaea borealis;* and/or rattlesnake plantain - *Goodyera oblongifolia)*. 101 sites also have minor cover of heart-leaved arnica (*Arnica cordifolia*) and/or prince's pine (*Chimaphilla umbellata*). The moss layer generally includes abundant step moss and red-stemmed feathermoss with minor cover of pelt lichens (*Peltigera* spp.).	No photo available
110	Sxw(Douglas-fir) – Dogwood – Bunchberry	The 110 site unit typically occurs on gentle (< 15%) lower and toe slopes or level sites with seepage, often at depth. They also occur in moderately steep and steeper gullies or lower slopes with seepage. Mixed interior spruce, Douglas-fir, trembling aspen, and paper birch comprise the tree layer, with mixed red-osier dogwood, snowberry, and prickly rose (*Rosa acicularis*) dominant in the well-developed shrub layer. Understorey herb cover and composition varies, with bunchberry (*Cornus canadensis*), wild sarsaparilla, rough-leaved ricegrass (*Oryzopsis asperifolia*), and/or twinflower most common and abundant. Minor amounts of pinegrass (< 5%) are often present.	No photo available

[3] Descriptions for these site units are adapted from "A Field Guide to Ecosystem Classification and Identification for Southeast British Columbia" (MacKillop et al. 2018). The descriptions have been shortened to include the most relevant information. When required, text has been inserted below these descriptions to provide additional characterization relevant to the NWA.

111	Sxw – Dogwood – Horsetail	The 111 site unit occurs on level sites, depressions, and gently sloping toe slopes where the water table is within the top 30 cm of the soil profile. Sites are usually associated with riparian areas where groundwater and/or surface flow create temporarily saturated soils each year. Horsetail is generally a dominant species on this site.	

IDFdk5 and IDFxk - Floodplain Site Units

IDFdk5 and IDFxk Floodplain Site Units[4]			
Fl01	Mountain alder – Common horsetail	The Fl01 site unit occurs on low bench floodplains on gravel or sand bars adjacent to relatively high-gradient creeks and streams that can have a "flashy" flood regime. Mountain alder and horsetails are the dominant species, and often occur with bluejoint reedgrass (*Calamagrostis canadensis*), oak fern (*Gymnocarpium dryopteris*), lady fern (*Athyrium felix-femina*), and western meadowrue (*Thalictrum occidentale*). The two mapped occurrences are adjacent to Bugaboo Creek, which has a higher gradient than the Columbia River. No ground plots were located in these areas due to grizzly bear activity.	No photo available

[4] Descriptions for these site units are adapted from "A Field Guide to Ecosystem Classification and Identification for Southeast British Columbia" (MacKillop et al. 2018). The descriptions have been shortened to include the most relevant information. When required, text has been inserted below these descriptions to provide additional characterization relevant to the NWA.

Fl02	Mountain alder – Red-osier dogwood – Lady fern	Fl02 site unit occurs on low bench floodplain sites adjacent to low-gradient floodplains and in creek gullies where flooding is of moderate duration. Mountain alder, red-osier dogwood, and black twinberry usually occur with lady fern and common horsetail. These sites are mapped adjacent to the Columbia River on sites that show evidence of active flooding observable by the strandlines on the riverbanks (top photos), scouring of organic material on the surface of the soil, and the recent deposition of sediments as floodwaters receded (bottom photos). Soils are fine textured silts. Vegetation is dominated by mountain alder and red-osier dogwood. Horsetail is often present as are minor amounts of willow species and bluejoint reedgrass. Lady fern is absent on most sites. The Fl02 is not noted to occur in the IDF; however, the wetlands in the Columbia River Valley were not extensively sampled during fieldwork for LMH 71. The IDFdk5 does occur below the ICHmk5 and MSdk, BGC units that the Fl02 is noted to occur in. Based on the prevalence of mountain alder and red-osier dogwood and low-gradient flooding associated with the Columbia River, and fine textured soils, the Fl02 best represents these sites. Differentiating these units from the Fl05 units using the orthophotos imagery is difficult, and it is likely some units have been mapped as Fl05 or conversely Fl05 have been mapped as Fl02.	 

Fl05	Drummond's willow – Bluejoint reedgrass	The Fl05 site unit occurs on low bench floodplain along small, low-gradient streams from the upper IDF to the lower ESSF in the East Kootenay. These sites flood deeply during freshet but may be significantly elevated above the mid-season water table. Drummond's willow (*Salix drummondiana*) is most abundant, but other shrubs such as black twinberry (*Lonicera involucrata*) commonly occur. Bluejoint reedgrass is abundant in the understorey, often with lower cover of horsetails. Similar to the Fl02, the Fl05 sites are mapped adjacent to the Columbia River on sites that show evidence of active flooding observable by the strandlines on the riverbanks, scouring of the organic material on the surface of the soil, and the recent deposition of sediments as floodwaters receded. Soils are fine textured and dominated by silt. These sites are often slightly more elevated than the Fl02 and perhaps experience less prolonged flooding. The vegetation community has abundant willow species, including Bebb's (*Salix bebbiana*) and Drummond's willow. These sites also often have a high cover of mountain alder and red-osier dogwood as well as bluejoint reedgrass and common horsetail. Differentiating these units from the Fl02 units using the orthophotos imagery is difficult, and it is likely some units have been mapped as Fl02 or conversely Fl02 have been mapped as Fl05.	

Fl06	Sandbar willow	Sandbar willow site unit occurs on low bench floodplain sites with sandy lateral gravel and sand bars and on islands along very large river systems where spring flooding is prolonged and strong currents are common. Sandbar willow (*Salix exigua/interior*) is the dominant species on this site. The sandbar willow sites in the NWA are very distinctive and occur on low bench floodplains that show active flooding and erosion associated with strong currents.	
Fm01	Cottonwood – Snowberry – Rose	The Fm01 site unit is the most common cottonwood floodplain ecosystem in southeast British Columbia. It occurs at low elevations, in warm climates with dry summers, characteristic of the IDF and dry ICH, and on warmer sites in the MS and the moist ICH. It is most common on sandy–gravelly flats in riparian zones adjacent to streams, rivers, and lakes. Black cottonwood is always present and significant in the overstorey, along with lesser amounts of paper birch, and aspen. Shrub diversity is typically high, with snowberry and red-osier dogwood consistently present and often abundant. Nootka rose (*Rosa nutkana*), baldhip rose (*R. gymnocarpa*), Oregon grape (*Berberis* spp.), mountain alder, saskatoon, black hawthorn (*Crataegus douglasii*), choke cherry (*Prunus virginiana*), and beaked hazelnut (*Corylus cornuta*) are often present. Understorey herbs are also diverse and have variable cover, with minor amounts of horsetails (mostly common [*Equisetum arvense*]), scouring-rush (*E. hyemale*), wild sarsaparilla (*Aralia nudicaulis*), sedges (*Carex* spp.), and blue wildrye (*Elymus glaucus*). Weedy plant species such as	

		dandelion (*Taraxacum* spp.), vetch (*Vicia* spp.), and buttercups (*Ranunculus* spp.) are often present on disturbed sites, and Kentucky bluegrass (*Poa pratensis*) is common on sites grazed by cattle. The forested sites mapped in the NWA are representative of the Fm01 and have an overstory of black cottonwood. The other mapped site is a tall shrub community that has possibly been more recently flooded and represents an earlier seral stage of the Fm01.	
Fm02	Cottonwood – Spruce – Dogwood	The Fm02 site unit occurs on mid-bench floodplains in cool, low- to mid-elevation climates, primarily in the MS and IDF, and on cooler sites in the ICH. Fm02 stands occur on sandy or gravelly fluvial materials adjacent to streams and rivers that have short spring flood events followed by continual sub irrigation. Black cottonwood is dominant in the overstorey. Red-osier dogwood is dominant in the shrub layer and frequently occurs with mountain alder, black gooseberry (*Ribes lacustre)*, and/or highbush-cranberry (*Viburnum edule*). Willows and snowberry are also sometimes common. Horsetails, sweet-cicely (*Osmorhiza* spp.), and pink wintergreen (*Pyrola asarifolia*) are usually present, often with minor cover of bluejoint reedgrass, false Solomon's-seal (*Maianthemum racemosum*), oak fern, and/or blue wildrye. The Fm02 sites mapped in the NWA are located primarily along the banks of the Columbia River where black cottonwood has established with minor amounts of paper birch. The understory is dominated by mountain alder and red-osier dogwood but has a diverse vegetation community with shrubs including rose species, willows, choke cherry (*Prunus virginiana*), highbush-cranberry, and snowberry. The herb layer contains bluejoint reedgrass, baneberry (*Actaea rubra*), and horsetail species. It should be noted that the mid-bench floodplains were differentiated from the low bench floodplains based on the presence of black cottonwood. During fieldwork, beaver	

	activity was noted in most places and it is possible that some mid-bench floodplains may be in a disclimax condition due to the beavers and were mapped as low bench floodplains.	

IDFdk5 and IDFxk - Wetland Site Units

IDFdk5 and IDFxk Wetland Site Units[5]

Wm01	Beaked sedge – Water sedge	The Wm01 site unit is the most common marsh ecosystem across British Columbia. It occurs on seasonally flooded sites with some late-season drawdown, typically near ponds, along lake margins, on floodplains with slow-moving floodwater, and in flooded basins. It is dominated by an abundance of beaked sedge (*Carex utriculata*) and/or water sedge (*Carex aquatilis*).	

[5] Descriptions for these site units are adapted from "A Field Guide to Ecosystem Classification and Identification for Southeast British Columbia" (MacKillop et al. 2018). The descriptions have been shortened to include the most relevant information. When required, text has been inserted below these descriptions to provide additional characterization relevant to the NWA.

Wm02	Swamp horsetail – Beaked sedge	The Wm02 site unit typically occurs in depressions, in protected bays of larger lakes, and along slow-moving streams and river channels. High cover of swamp horsetail (*Equisetum fluviatile*) characterizes the Wm02, but beaked sedge may also be present with substantial cover. The Wm02 in the NWA has highly variable species composition but horsetail was always present and generally dominant with varying amounts and species of sedges.	
Wm05	Cattail	Wm05 site unit occurs in depressions and along lakeshores and pond edges, and is easily recognized by an abundance of common cattail (*Typha latifolia*).	

Wm06	Great bulrush	The Wm06 site unit occurs along lake margins and in depressions in areas with warm and dry summers. Floodwaters can be up to 1.5 m deep in spring, but sites dry up significantly into the growing season. The vegetation community is characterized by hard-stemmed bulrush (*Schoenoplectus tabernaemontani*) and/or soft-stemmed bulrush (*Schoenoplectus acutus*).	
Wm07	Baltic rush	The Wm07 site unit is uncommon and occurs on saline sites where there is early-season inundation followed by a gradual water table drop to below the surface. The vegetation is dominated by Baltic rush (*Juncus balticus*). These sites are limited to the Wilmer NWA and did not occur in a saline environment but bordered a poor 111 site unit in the IDFxk. Wm07 site unit was chosen based on presence of Baltic rush but does not fit the other characteristics of the Wm07 (e.g. saline environment). The depth of the humus was only 4 cm, the depth to seepage was 20 cm, and the soil was a silty clay. Species included Baltic rush, spike rush (*Eleocharis palustris*), and carex species.	

Wm14	American common reed	Wm14 site unit marshes are uncommon in the IDF in the Rocky Mountain Trench. Sites are dominated by American common reed (*Phragmites* spp.), a rhizomatous grass that grows up to 3 m tall on mineral soils in shallow water of lakes, ponds, and slow-moving streams. American common reed is identified in two plots in Brisco and potentially one plot in Wilmer, but accessing the Wilmer site was not possible. One polygon is mapped in Wilmer that is dominated by manna grass (Glyceria maxima; photo on the bottom). This is identified in the Poly_Com column in the TEIS database. Due to the limitations of the orthophotos, differentiating these sites from Ws05 sites units was reliant on field inspection data only. It is not clear if the species of American common reed found in the NWA is native or introduced.	 

Wm15	Bluejoint – Beaked sedge	Wm15 sites occur across low- to mid-elevation biogeoclimatic units on level areas, in shallow depressions, and along pond and lake margins. They have high cover of bluejoint reedgrass and usually low cover of beaked sedge and/ or water sedge. Additional herbs may be found with minor cover. Soils are seasonally flooded and frequently have a well-decomposed, thin organic layer. The Wm15 mapped in the Harrogate unit is floristically different from the vegetation community described in LMH 71. It is dominated by bluejoint reedgrass but also contains horsetail and sandbar willow. The site in Harrogate experiences annual flooding, and the Wm15 is the most floristically similar unit.	
Ws03	Bebb's willow – Bluejoint	The Ws03 site unit is uncommon in the IDF and MS, and occasionally occurs in the ICH and at lower elevations in the ESSF. It is most common along lake or pond margins, seasonal creeks, and fluvial terraces, and in depressions. Bebb's willow dominates the shrub layer, often with black twinberry. Mountain alder and red-osier dogwood may be present. Scattered interior spruce trees can occur. Bluejoint reedgrass and/or beaked sedge have high cover in the herb layer; horsetails and a diversity of forbs frequently occur. Interpretation of these site units depended on the presence of field inspection data. These communities are often intermixed with Ws03 with complexes of Bebb's willow, Drummond's willow, and Pacific willow (*Salix lasiandra*) within a polygon. Due to the limitations of interpreting species based on orthophotos, some sites may be complexes or Ws03 and Ws04. The Ws03 and Ws04 site units should be viewed as one unit given the limitations. They were mapped	

as separate units based on the abundance willow species in adjacent field inspections.

The Fl05 low bench floodplain units and the Ws03 and Ws04 units also experience flooding. During fieldwork, evidence of recent sediment deposition in the swamps was observed, reflecting annual flooding events. The swamp units were mapped setback from the main river channel behind the low bench floodplains. They were located on slightly elevated areas often surrounded by wetland marshes. Sedimentation was also noted in many of the marshes. However, unlike the higher gradient flooding in the floodplain units, it is likely that these areas are not exposed to water flow and erosion. Sediment deposition likely occurs when the floodwaters recede and evaporation occurs during the dry and hot summers, the previously suspended sediments are left on the ground surface. Based on lack of active erosional forces and the more passive process of sedimentation, these were mapped as swamps, not active fluvial floodplains. They likely represent an intermediate class of floodplain /wetland due to the unique conditions in the Columbia Valley.

Ws04	Drummond's willow – Beaked sedge	Ws04 site unit swamps are uncommon at low to mid elevations in the East Kootenay. They occur where water is stagnant, usually in depressions or adjacent to low-gradient streams. Drummond's willow dominates the shrub layer, although other willows may be present. The herb layer is typically dominated by beaked sedge and/or water sedge. Bluejoint reedgrass may occur. Interpretation of these site units depended on the presence of field inspection data. These communities were often intermixed with Ws03 with complexes of Bebb's willow, Drummond's willow, and pacific willow within a polygon. Due to the limitations of interpreting species based on orthophotos, some sites may be complexes of Ws03 and Ws04. The Ws03 and Ws04 site units should be viewed as one unit given the limitations. They were mapped as separate units based on the abundance willow species in adjacent field inspections.	

Ws07	Spruce - Common horsetail - Leafy moss	The Ws07 site unit is uncommon on gentle or level sites, lower or toe slopes, and margins of non-forested fens. Interior spruce is dominant in the overstory, with interior spruce and some subalpine fir (*Abies lasiocarpa)* in the understorey. Mountain alder, red-osier dogwood, and black twinberry are often present with low to moderate cover. Horsetails are always present and abundant with a diversity of other wetland and upland species, including bluejoint reedgrass, bunchberry, mitreworts (*Mitella* spp.), and twinflower. The site mapped in the NWA has common windthrow, which resulted in an altered tall shrub plant community with scattered interior spruce and paper birch. Shrub and herb species include roses, lady fern, horsetail, bunchberry, red-osier dogwood, bluejoint reedgrass, mountain alder, and carex species.	

Ww	Open Water	Permanently flooded; still or slow-moving water (0.5-5 m). Dominated by floating and submerged plants; frequently pond lilies (*Nuphar lutea*).	

IDFdk5 and IDFxk - Non- or Sparsely Vegetated Site Units

IDFxk and IDFdk5 - Non- or Sparsely Vegetated Site Units[6]

BE Beach

Beaches occur where fluvial deposition of coarse textured material, primarily sands, has occurred along active channels or on active fluvial fans where rivers converge.

The sands provide more rapid drainage and annual flooding prevents the establishment of vegetation. Sandbar willow often occurs sporadically on these sites in the NWA.

[6] Terrestrial Ecosystem Information (TEI): Coding Updates for Non-Vegetated, Sparsely Vegetated, and Anthropogenic Units - Version 1.0 (MoECCS 2020).

ES	Exposed Soil	Exposed soil was mapped where erodible soils were exposed on steep slopes. In the NWA, these were not mapped as hoodoos because they lack the typical spire form created by soft erodible material capped by harder less eroded material. These areas provide valuable nesting habitat for cliff swallows (*Petrochelidon pyrrhonota*).	
Fa	Active Flood Channel Flood	Active channel ecosystems occur on sites that are annually flooded and often scoured for prolonged periods. Sites are exposed and are usually immediately adjacent to the river channel at lower water levels and under water at high water levels. On unstable substrates, such as gravel bars and islands, Fa ecosystems are usually dominated by opportunistic annuals or perennial herb species with extensive root systems that are able to re-sprout after the aboveground structures have been removed by flooding and scouring.	

Ff	Flood Fringe	Flood fringe ecosystems occur on sites that are subirrigated but rarely flooded. These include slope draws and gullies in areas with dry, hot climates (typically BG, PP, and dry IDF) and sites adjacent to lakes and ponds that are above the high water mark. Flood fringe ecosystems were not generally mappable because of their limited spatial extent (a few metres in width) and limitations of the orthophotos. The photo also shows exposed soils, eroded on steep slopes.	
MU	Mudflat	Mudflat sediment	

PD	Pond	A small naturally occurring static body of water, less than 10 ha in size and at least 2 m deep in some portion. Not large enough to be classified as a lake but typically larger/ deeper than shallow water wetlands and are non-vegetated.	
RI	River	River	

RN	Railway	Tracks and related clearing for railways.
RP	Road	An area cleared and compacted for the purposes of vehicular travel.

Appendix 2: Terrestrial Ecosystem Mapping Database Dictionary

Data Fields[7]

TEIS field	Description
PROJ_ID	Project Identification
PROJPOLYID	Project Polygon Identifier; a unique polygon identifier for linking attribute data to spatial data (formerly ECP_TAG)
MAPSH_NBR	TRIM mapsheet number
POLY_NBR	Polygon number
SMPL_TYPE	Data source
ECO_SEC	Ecosection
BGC_ZONE	Biogeoclimatic zone
BGC_SUBZON	Biogeoclimatic subzone
BGC_VRT	Biogeoclimatic variant
BGC_PHASE	Biogeoclimatic phase
SDEC_1	1st ecosystem component - % decile composition of the polygon
REALM_1	1st ecosystem component - Realm
GROUP_1	1st ecosystem component - Group
CLASS_1	1st ecosystem component - Class
SITE_S1	1st ecosystem component – site series number from MOF field guide for site ID
SITEMC_S1	1st ecosystem component – site series mapcode
SITE_M1a	1st ecosystem component – 1st site modifier
SITE_M1b	1st ecosystem component – 2nd site modifier
STRCT_S1	1st ecosystem component – structural stage
STAND_A1	1st ecosystem component – stand composition modifier
TREE_C1	1st ecosystem component – % tree crown closure

Field Description

Project Identification

Code	Description
C_Bri	Columbia – Brisco
C_Har	Columbia – Harrogate
C_Spi	Columbia – Spillimacheen
C_Wil	Columbia – Wilmer

[7] Only relevant fields from the first decile of the full TEIS Master Long Table shown.

Data Source

Code	Description
G	Ground inspection
P	Photo interpretation
V	Visual inspection

Ecosection

Code	Description
UCV	Upper Columbia Valley

Biogeoclimatic Unit (Zone/Subzone/Variant)

Code	Description
IDFxk	Very Dry Cool Interior Douglas-fir Subzone
IDFdk5	Columbia Dry Cool Interior Douglas-fir Variant

Realm

Code	Description
W	Wetland
E	Estuary
I	Intertidal
O	Freshwater
T	Terrestrial

Group

Code	Description
B	Beach
E	Estuarine
F	Flood
G	Grassland
M	Mineral wetland
P	Peatland
R	Rock
S	Shrub
W	Wetland
X	Disclimax

Class

Code	Description
a	anthropogenic
b	bog (with W; beach with B)
d	meadow with E
f	fen

Code	Description
g	grassland
h	herb, high-bench floodplain with F
k	krummholz
l	low-bench floodplain
m	meadow with A, marsh with E, mid-bench floodplain with F
o	outcrop
r	rock
s	swamp
t	tidal
w	open water

Anthropogenic and other non-forested units

Site series	Mapcode	Name	Comments
00	BE	Beach	
00	BU	Buildings, parking, etc.	
00	CF	Cultivated fields	
00	ES	Exposed soil	
00	Et	Estuarine tidal flat class	
00	GP	Gravel pit	
00	HR	Hedgerow	
00	LA	Lake	
00	MU	Mudflat	
00	OC	Ocean	
00	OF	Old field	
00	OW	Shallow open water	
00	PD	Pond	
00	RI	River	
00	RN	Railway	
00	RP	Road surface	
00	RR	Rural	human developments scattered and intermingled with forest, range, farm land etc.
00	UR	Urban	

Site Modifiers

Code	Name	Comments
c	coarse-textured soil	sites with S or LS textures, or SL, L, or SCL textures with > 70% coarse fragments
d	deep soil	sites on soils > 100 cm deep
g	gullied	sites with frequent gullies
h	hummocky	sites on hummocky terrain
j	gentle slope	sites on slopes < 35%

Code	Name	Comments
k	cool aspect	sites on slopes 35%-100% with aspect 285^0-135^0
n	fan	sites on active fluvial fan
p	peaty	sites on deep organics or peaty surface over mineral soil
q	very steep cool aspect	sites on slopes > 100% with aspect 285^0-135^0
s	shallow	sites with predominantly shallow (<1 m) soils
t	terrace	sites on fluvial, glaciofluvial or lacustrine terrace
v	very shallow	sites on very shallow soils (<20 cm deep)
w	warm aspect	sites on slopes 35%-100% with aspect 135^0-285^0
z	very steep warm aspect	sites on slopes > 100% with aspect 135^0-285^0

Structural Stage

Code	Description
Null	Non-vegetated (Water, exposed soil, roads etc.).
1a	Sparse/bryoid <10% vegetation cover.
2a	Forb/Graminoid dominated communities; <10% tree cover, < 20% shrub cover and (>½ of the total herb cover) by non-graminoid herbs, including ferns.
2b	Herbaceous communities dominated (>½ of the total herb cover) by grasses, sedges, reeds, and rushes.
2c	Herbaceous communities dominated (>½ of the total herb cover) by floating or submerged aquatic plants; does not include sedges growing in marshes with standing water (which are classed as 2b).
3a	Low shrub communities dominated by shrubby vegetation 0 to 2 m tall; natural regeneration may be abundant; tree cover < 10%.
3b	Tall shrub communities dominated by shrubby vegetation 2 to 10 m tall; natural regeneration may be abundant; tree cover < 10%.
4	Pole/Sapling - trees > 10 m tall have overtopped shrub and herb layer; dense stands usually less than 40 years since disturbance; includes stagnated older stands.
5	Young Forest - self-thinning evident with canopy layers developed; more open than Pole/Sapling; usually 40-80 years.
6	Mature Forest - main canopy trees mature; well-developed understory often with advance regeneration; usually 80 to 250 years of age. Includes all forested bogs and poor productivity forested sites.
7	Old Forest - old structurally complex stands with snags and CWD; time since disturbance generally greater than 250 years.

Stand Composition Modifier

Tree Code	*Description*	Area (ha)
B	broadleaf	
C	coniferous	
M	mixed (coniferous/broadleaf mix	

Appendix 3: Vegetation Summary Tables

Summary statistics for species within site units includes Presence Class and Mean % Cover, with species grouped by Layer. *Sphagnum spp., Cladina spp, Cladonia spp., and Picea spp*. are lumped under their Genus. Only data from ground plots are shown in the summary tables.

Layer	Description
A	Tree layer
B	Shrub layer
C	Herb layer
D	Moss and lichen layer

Presence Class	% frequency
I	1-20% of plots
II	21-40% of plots
III	41-60% of plots
IV	61-80% of plots
V	81-100% of plots

IDFdk5 – Vegetation Summary

Strata	Species	111	Fl02	Fl05	Fl06	Fm02	Wm01	Wm02	Wm05	Wm15	Ws03
	n	1	2	3	1	7	8	11	5	1	2
A	*Betula papyrifera*	V - 12%				I - 12%					
A	*Cornus stolonifera*										III - 7%
A	*Picea sp.*	V - 55%									
A	*Populus balsamifera ssp. trichocarpa*			II - 7%		IV - 25%					
B	*Alnus incana*		V - 60%	IV - 41%		V - 39%					
B	*Betula papyrifera*		III - 7%	IV - 7%		I - 12%					III - 7%
B	*Cornus stolonifera*		III - 45%	V - 12%		V - 35%					
B	*Lonicera involucrata*					I - 7%					
B	*Picea sp.*	V - 12%									
B	*Populus balsamifera ssp. trichocarpa*			II - 12%		I - 7%					III - 7%
B	*Prunella vulgaris*		III - 1%								
B	*Prunus virginiana*					I - 22%					
B	*Ribes lacustre*	V - 1%									
B	*Rosa acicularis*		III - 7%	V - 9%		IV - 14%					III - 3%
B	*Rosa nutkana*					I - 3%					

Strata	Species	111	Fl02	Fl05	Fl06	Fm02	Wm01	Wm02	Wm05	Wm15	Ws03
	n	1	2	3	1	7	8	11	5	1	2
B	*Rubus idaeus*					II - 12%					
B	*Salix bebbiana*			II - 45%	V - 45%	I - 7%					V - 41%
B	*Salix drummondiana*			IV - 17%		II - 9%					
B	*Salix exigua*			II - 3%	V - 17%	I - 7%					
B	*Salix lucida ssp. lasiandra*			II - 12%	V - 12%	I - 7%	II - 7%				III - 12%
B	*Salix planifolia*			II - 7%							
B	*Salix sitchensis*		III - 3%								
B	*Salix sp.*		III - 7%								
B	*Spiraea betulifolia*			II - 7%							
B	*Symphoricarpos albus*					I - 3%					
B	*Viburnum edule*	V - 1%		IV - 5%		I - 3%					
C	*Actaea rubra*					II - 7%					
C	*Athyrium filix-femina*					II - 2%					
C	*Calamagrostis canadensis*		III - 7%	V - 39%	V - 7%	III - 25%	II - 3%	I - 7%		V - 95%	III - 75%
C	*Carex aquatilis*		III - 1%	II - 12%	V - 65%	I - 3%	V - 68%	IV - 32%		V - 7%	III - 7%
C	*Carex sp.*						II - 17%	I - 22%			III - 7%
C	*Carex viridula*					I - 7%					
C	*Elymus glaucus*			II - 12%		I - 3%					
C	*Equisetum arvense*			IV - 5%		III - 27%					
C	*Equisetum fluviatile*		III - 1%				IV - 7%	V - 73%			III - 1%
C	*Equisetum sylvaticum*					II - 29%					
C	*Equisetum variegatum*	V - 45%									
C	*Galium triflorum*	V - 1%									
C	*Geum macrophyllum*					I - 3%					
C	*Grasses*		III - 7%			I - 12%					
C	*Heracleum maximum*					I - 3%					
C	*Juncus effusus*						I - 7%				
C	*Maianthemum racemosum*	V - 7%	III - 3%	II - 3%							
C	*Mitella nuda*	V - 7%									

Strata	Species	111	Fl02	Fl05	Fl06	Fm02	Wm01	Wm02	Wm05	Wm15	Ws03
	n	1	2	3	1	7	8	11	5	1	2
C	*Pyrola asarifolia*		III - 3%								
C	*Streptopus lanceolatus*			II - 3%							
C	*Typha latifolia*						I - 7%	II - 1%	V - 91%		
D	*Dicranum sp.*					I - 3%					
D	*Hylocomium splendens*	V - 3%									
D	*Pleurozium schreberi*	V - 7%									
	Total species: 46	10	13	18	5	27	7	5	1	2	10

IDFxk – Vegetation Summary

Strata	Species	103	110	111	Fm01	Gg01	Gg12	Gg15	Wm02	Wm05	Wm07	Ws03	Ws04
	n	1	2	3	2	1	1	1	2	1	1	1	1
A	*Populus balsamifera ssp. balsamifera*				III - 65%								
A	*Populus tremuloides*			V - 35%									
A	*Pseudotsuga menziesii*	V - 35%	V - 60%										
B	*Arctostaphylos uva-ursi*	V - 12%											
B	*Artemisia frigida*	V - 3%				V - 7%	V - 7%						
B	*Betula occidentalis*			IV - 22%	V - 31%								
B	*Cornus stolonifera*				III - 12%							V - 7%	
B	*Elaeagnus commutata*				III - 17%								
B	*Juniperus communis*	V - 12%											

Strata	Species	103	110	111	Fm01	Gg01	Gg12	Gg15	Wm02	Wm05	Wm07	Ws03	Ws04
	n	1	2	3	2	1	1	1	2	1	1	1	1
B	*Juniperus scopulorum*	V - 22%	V - 7%	II - 1%		V - 7%	V - 7%						
B	*Populus balsamifera ssp. balsamifera*			IV - 3%	III - 7%								
B	*Populus tremuloides*			II - 17%									
B	*Pseudotsuga menziesii*						V - 3%						
B	*Rosa acicularis*	V - 3%	III - 1%	IV - 17%	III - 17%								
B	*Rosa nutkana*			II - 12%									
B	*Salix bebbiana*				III - 12%							V - 17%	V - 65%
B	*Salix drummondiana*											V - 12%	
B	*Salix exigua*				III - 1%								
B	*Salix sp.*											V - 7%	
B	*Spiraea betulifolia*		V - 4%										
B	*Symphoricarpos albus*				III - 7%								
C	*Achillea millefolium*	V - 3%	III - 0%										
C	*Anaphalis margaritacea*				III - 7%								
C	*Antennaria sp.*	V - 3%	III - 0%			V - 3%	V - 7%	V - 22%					
C	*Arctostaphylos uva-ursi*		III - 3%										
C	*Aster sp.*		III - 7%										
C	*Calamagrostis canadensis*			IV - 7%								V - 35%	

Strata	Species	103	110	111	Fm01	Gg01	Gg12	Gg15	Wm02	Wm05	Wm07	Ws03	Ws04
	n	1	2	3	2	1	1	1	2	1	1	1	1
C	*Calamagrostis rubescens*	V - 12%	III - 3%										
C	*Carex aquatilis*			IV - 7%								V - 35%	
C	*Carex sp.*										V - 55%		
C	*Equisetum arvense*			IV - 3%	V - 6%								
C	*Equisetum fluviatile*								V - 80%			V - 55%	V - 45%
C	*Equisetum hyemale*			II - 1%									
C	*Festuca sp.*					V - 3%							
C	*Grasses*				III - 1%								
C	*Maianthemum stellatum*				III - 3%								
C	*Solidago canadensis*		III - 1%										
C	*Typha latifolia*								III - 7%	V - 100%		V - 7%	
C	*Vicia americana*			II - 3%									
D	*Hylocomium splendens*		III - 12%										
D	*Ptilium crista-castrensis*		V - 90%										
	Total species: 37	9	12	11	12	4	4	1	2	1	1	8	2

Appendix 4: Wildlife Species Conservation Status

Conservation Status – Birds

Common Name	Scientific Name	CDC Status	COSEWIC	Species at Risk (SARA)	COSEWIC Status Report	Provincial Identified Wildlife Species Account	Notes
Birds							
Sandhill Crane	*Grus canadensis*	yellow-listed	NAR (1979)			yes	Typical breeding habitats include isolated bogs, marshes, swamps and meadows, and other secluded shallow freshwater wetlands generally >1 ha in size surrounded by forest cover. Emergent vegetation such as sedges (Carex spp.), Cattail (Typha latifolia), bulrush (Scirpus spp.), Hardhack (Spiraea douglasii), willows (Salix spp.), and Labrador Tea (Ledum groenlandicum) are important for nesting and brood rearing (Robinson and Robinson 1976, Runyan 1978, Littlefield 1995a). Nesting wetlands are usually secluded, free from disturbance, and surrounded by forest. In coastal areas, brackish estuaries are used for rearing broods
Common Nighthawk	*Chordeiles minor*	yellow-listed	SC 2018	1-T 2010	https://wildlife-species.canada.ca/species-risk-registry/virtual_sara/files/cosewic/srCommonNighthawk2018e.pdf		Variety of habitats; nest on gravel sites within forest openings, burns, field
Great Blue Heron	*Ardea herodias ssp. herodias*	blue-listed		no		yes	A. herodias herodias, in the interior of the province, is primarily migratory, although the extent of southward movement is unknown. Groups of A. herodias herodias are known to overwinter along ice-free watercourses of southern British Columbia (Machmer 2002), but some birds migrate as far south as Mexico and South America (Campbell et al. 1990; Butler 1992).
Lewis's Woodpecker	*Melanerpes lewis*	blue-listed	T 2010	1-T (2012)	yes		numerous recorded sightings Stump Creek and area; A few birds winter in the south Okanagan with the centre of abundance from Vaseux Lake to Summerland. In winter it appears to be restricted to residential areas and orchards; Lewis's Woodpeckers nest in living and dead deciduous and coniferous trees in British Columbia with ponderosa pine (47% of 215 nests) and black cottonwood (33%) the most common nest trees reported (Campbell et al. 1990
Olive-sided Flycatcher	*Contopus cooperi*	blue-listed	SC (2018)	1-T (2010)	https://wildlife-species.canada.ca/species-risk-registry/virtual_sara/files/cosewic/srOlive-sidedFlycatcher2018e.pdf	No	most often associated with edges of coniferous or mixed forests with tall trees or snags for perching, alongside open areas, or in burned forest with standing trees and snags. In natural conditions, these habitats may include open to semi open mature forest stands, as well as mature stands with edges near wet areas (such as rivers, muskeg, bogs or swamps), burned forest, openings created by insect outbreaks, barrens, or other gaps. The species also uses forest stands adjacent to human-created openings (such as clearcuts, thinned stands, and prescribed burns). There is some limited evidence that birds nesting in and near harvested habitats experience lower breeding success than those nesting adjacent to natural (e.g., burned) openings. In the Rocky Mountains and westward, Olive-sided Flycatcher occurs in sparsely vegetated forests from sea level to 2250 m in proximity to wetland edge, whereas farther east, it is most frequently found near wetland areas or in recent burns.

Conservation Status – Mammals

Common Name	Scientific Name	CDC Status	COSEWIC	Species at Risk (SARA)	COSEWIC Status Report	Provincial Identified Wildlife Species Account	Notes
Mammals							
North American River Otter	*Lontra canadensis*(Schreber)	yellow-listed					http://a100.gov.bc.ca/pub/eirs/finishDownloadDocument.do?subdocumentId=7732
American Badger	*Taxidea taxus*	Red-listed	E (2012)	1-E (2018)		yes	There are 498 sightings of badgers (mostly collected between 1995 and 2012) represented by the polygon, including 51 In British Columbia most badger activity is at low elevations in dry regions (BG, PP, IDF) within native or non-native grasslands, open forests of Douglas-fir or ponderosa pine, and disturbed sites such as roadsides and agricultural fields. However, badgers have also been documented using cutblocks, burns, early-seral forests of several species composition, other open sites in the ICH, MS, ESSF biogeoclimatic zones and parts of the SBPS and SBS and occasionally the AT (Apps et al. 2002; Weir and Hoodicoff 2002). observations of family groups (Weir and Davis 2012). Badgers consistently occur throughout the EO with concentrations in grassland/agricultural interface zones in the Vernon, Lumby, Mission Creek, Osoyoos, Anarchist Mountain/Rock Creek, and Grand Forks areas. Badgers also consistently occur in disturbed mid-elevation forests with suitable soils in the Aberdeen Plateau, Upper Kettle River, Beaverdell, and Venner Meadows areas. Badgers in the area have large home ranges (15-50 km²; Weir et al. 2003).
American Black Bear	*Ursus americanus* Pallas	yellow-listed				*http://a100.gov.l*	Black bears inhabit forests and nearby openings, including forested wetlands. When inactive, they occupy dens under fallen trees, ground-level or above-ground tree cavities or hollow logs, underground cave-like sites, or the ground surface in dense cover.
American Beaver	*Castor canadensis* Kuhl	yellow-listed				*https://animaldiv*	Breeding (i.e., copulation) occurs January-March in the middle part of the range, mainly February-March in cold northern areas; Gestation is thought to be 105-107 days, though also reported as about 128 days. Parturition occurs in April, May, or June. Dispersal occurs over land and via waterways (Leege 1968). Apparently the young may remain in the family group longer than two years in high quality habitats and/or in habitats that are saturated with beavers; Beaver ponds are a shifting mosaic of habitats, dependent on pond age and size, successional state, substrate, hydrology, and nutrients. In boreal regions, there is a complex pattern of ecosystem development that involves the formation of marshes, seasonally flooded meadows, and forested wetlands, which appear to persist in a somewhat stable condition for centuries (Naiman et al. 1988). Food shortage probably is the major factor affecting colony longevity. They prefer low gradient streams (which they modify), ponds, and small mud-bottomed lakes with dammable outlets . they require water that is deep enough such that it does not freeze to the bottom and allows the accumulation of a substantial food pile beneath the ice. Beavers are associated with deciduous tree and shrub communities. In many situations beavers modify existing stream courses or other bodies of water and make them more suitable for their own use (see section below on dam building). They may occupy deep sections of streams and existing lakes or ponds without constructing a dam.

Conservation Status – Amphibians

Common Name	Scientific Name	CDC Status	COSEWIC	Species at Risk (SARA)	COSEWIC Status Report	Provincial Identified Wildlife Species Account	Notes
Amphibians							
Western Toad	*Anaxyrus boreas*	yellow-listed	SC (2012)	1-SC (2018)	yes		Western Toads use a wide variety of aquatic and upland habitats. They breed in a variety of wetlands including shallow, sandy margins of lakes, ponds, streams, river deltas, river backwaters, river estuaries, and geothermal springs. Following breeding, adults may remain to forage in the marshy or riparian edges of breeding sites, or they may disperse several kilometres to foraging areas in other wetlands, riparian areas along streams, or upland sites. Western Toads hibernate underground, often in spaces created or modified by small mammals.
Northern Leopard Frog	*Rana pipiens*	Red-listed	E (2009)	1-E (2003)	file:///C:/Users/sls/Documents/BA%20Blackwell/Focal%20Species/Widgeon%20Valley/species%20Reports/EC_rs_northern_leopard_frog_rocky_e_final.pdf	Y http://www	Northern Leopard Frogs generally occur in and around wet meadows, shallow permanent or semi-permanent ponds, riparian areas with abundant vegetation for cover, mud and sand shorelines that provide basking sites, slow moving streams with shallow marshy borders, extensive marshes, moist meadows and adjacent upland areas with extensive grass or shrub cover. Clean, unpolluted water is important for amphibians, and agricultural chemicals, pesticides, and surfactants are known to reduce the suitability of habitat. Northern Leopard Frogs require habitat for each of four distinct activities: 1) breeding and early development, 2) foraging, 3) overwintering, and 4) migrating between seasonal habitats. The habitat attributes required for each of the four distinct activities overlap biophysically, geospatially, seasonally, and across life history stages. The Critical habitat is identified to meet the Northern Leopard Frog's needs for survival and recovery during all life history stages, at three locations in British Columbia: 1. Creston Valley 2. Upper Kootenay floodplain (referred to in the provincial recovery strategy as Bummer's Flats) 3. Columbia Marshes; The Rocky Mountain population is the only population of Northern Leopard Frog that occurs in British Columbia; 2010: tadpoles and then froglets observed in the summer (P. Ohanjanian, pers. comm. 2010). 2008: 24 young-of-year (YOY) wild Northern Leopard Frogs were observed and 6 males were heard calling at Bummer's Flats (North and South). 2007: 38+ wild YOY Northern Leopard Frogs were observed at Bummer's Flats (both sites combined). Three farmed males were observed; adult males were also heard calling from the North site (Ohanjanian and Houston 2008). 2006: In total at the North and South Bummer's Flats locations 19 Northern Leopard Frogs were observed (1 YOY, 10 farmed juveniles, 6 wild juveniles and two juveniles, unknown if captive raised or wild) (Ohanjanian and Houston 2008). 2005: At Bummer's Flats (North and South combined) 45 Northern Leopard Frogs were observed: 33 YOY (9 farmed, 20 wild, 4 unknown origin); 9 juveniles (6 farmed, 3 wild); and 3 adults (2 farmed, 1 wild) (Ohanjanian and Houston 2008). 2004: A total of 24 farmed YOY Northern Leopard Frogs were observed at Bummer's Flats (combined North and South locations) (Ohanjanian and Houston 2008). 2003: 11 farmed YOY Northern Leopard Frogs were captured and observed at Bummer's Flats (Ohanjanian and Houston 2008). In 2003 18974 metamorphs and 493 tadpoles were reintroduced at Bummer's Flats. In 2004, 1064 metamorphism were released and in 2005, 591 metamorphism were released (Ohanjanian and Houston 2008).
Columbia Spotted Frog	*Rana luteiventris* Thompsor	yellow-listed	NAR (2000)				http://www.env.gov.bc.ca/wld/documents/columbia.pdf; Rarely found far from water, Columbia Spotted Frogs make their homes in or near permanent lakes, ponds, slow-moving streams and marshes in a wide variety of wetlands, forest types, grassland, sage brushland and even alpine tundra between 950-2000 metres above sea level. Water bodies deep enough that they do not freeze on the bottom are required for over-wintering of adults, juveniles and possibly larvae. Shallow wetlands are preferred for other seasonal activities. Columbia Spotted Frogs prefer thick algae and abundant aquatic vegetation for cover and like to hide in rushes, sedge and grass.

Conservation Status - Reptiles

Common Name	Scientific Name	CDC Status	COSEWIC	Species at Risk (SARA)	COSEWIC Status Report	Provincial Identified Wildlife Species Account	Notes
Reptiles							
Western Painted Turtle	*Chrysemys picta*	blue-listed	SC (2016)	1-SC (2007)	yes; https://www.registrelep-sararegistry.gc.ca/virtual_sara/files/cosewic/sr_Western%20Painted%20Turtle_2016_e.pdf		Aquatic habitat includes wetlands, small lakes, or slow-moving streams with mud bottoms and aquatic vegetation. This habitat is required by the species for foraging, daily movement, and mating. The water in the wetland must be relatively warm, at least 1 m deep for overwintering and proximal to suitable terrestrial nesting sites. Basking sites, such as logs, emergent rocks or exposed, protected shoreline habitat, are also required by Painted Turtles for survival (thermoregulation, metabolic processes, etc.). Terrestrial habitat is required for nesting adult females, egg/hatchling development, and migration (to and from nesting sites, and between wetlands). Females leave their aquatic habitat in May–July and may travel overland as far as 200 m where a nest is excavated in well-drained soil at a sunny, sparsely vegetated location dependent on specialized wetland/terrestrial habitat matrix. Western Painted Turtles have been reported from the northern end of Vaseux Lake from 1922-2015 (Hobbs 2013; Canadian Museum of Nature online database, accessed December 15, 2015; SPI database - incidental sightings, accessed January 2017). They have also been seen at the two lagoons at the southern end of Vaseux Lake (Sarell and Alcock 2004; SPI database - incidental sightings, accessed January 2017), ponds along the Kettle Valley Railway Trail (Dyer 2011; Haney and Sarell 2015), at the pond at the south end of Skaha Lake (Dyer 2004c) and a pond along Highway 97 between Kaleden and Okanagan Falls (Noble and Spendlow 2006).

Appendix 5: Wildlife Species Accounts

Species Accounts – Mammals

Species	Scientific Name	Critical Life Stage	Function	Biophysical Feature	Attributes	Reference #
Mammals						
American Badger	*Taxidea taxus*	All Life Stages - Living	Thermal, security, food, reproducing	Grasslands, open forests where there is an abundance of prey. Soils suitable for earthen dens.	Badger activity is at low elevations in dry regions (BG, PP, IDF) within native or non-native grasslands, open forests of Douglas-fir or ponderosa pine, and disturbed sites such as roadsides and fields. Maternal dens differ from those used for diurnal resting in that they are more structurally complex with larger soil mounds at the entrance. Staple food of badgers is usually earthworms which generally make up around 80% of their diet. They can eat several hundred worms each night; omnivorous - eat slugs, insects, fruit nuts, seeds and acorns along with crops like wheat and sweetcorn. Badgers are known to eat small mammals including mice, rats, rabbits, frogs, toads and hedgehogs and may take advantage of animal carcasses and carrion they come across.	1
American Beaver	*Castor canadensis* Kuhl	All Life Stages - Living	Thermal, security, food, reproducing	Wetlands, streams	Prefer low gradient streams (which they modify), ponds, and small mud-bottomed lakes with dammable outlets; the ponds they create for lodges have to be deep enough to not freeze in the winter. Can build a lodge in a backwater channels of a mainstream or in the bank of a river that floods continuously.	15
American Black Bear	*Ursus americanus* Pallas	Living - Growing	Foraging (spring, summer, fall), security habitat, thermal cover	Riparian areas including wetlands, avalanche tracks, subalpine meadows, berry producing sites; thermal cover - mature and old growth trees; security cover - trees with dbh >40cm	Forage in moist, rich wetlands with grasses, sedges, skunk cabbage in the spring, summer and fall diet is herbaceous and higher amounts of berries in late summer and fall. Diet is supplemented by fawns in the spring and salmon in the fall.	14
River Otter	*Lontra canadensis(* Schreber)	All Life Stages - Living	Denning, breeding, foraging	rivers, wetlands, CWD, caves	Found in a variety of aquatic habitats, including marine habitats and freshwater wetlands; primarily a fish-eater, though it will also feed on bird, mammals, occasionally amphibians and invertebrates. When inactive and when rearing young occupies hollow logs, caves, space under roots, logs, or overhangs, abandoned beaver lodges, dense thickets near water, or burrows of other animal.	32

Species Accounts – Birds

Species	Scientific Name	Critical Life Stage	Function	Biophysical Feature	Attributes	Reference #
Birds						
Common Nighthawk	*Chordeiles minor*	Reproduction - Growing	Breeding, foraging	Deciduous and conifer forests, grasslands, sagebrush, vegetated rock	Breeds in a range of open and partially open habitats, including forest openings and post-fire habitats, prairies, bogs, and rocky or sandy natural habitats, as well as disturbed areas. It is also found in settled areas that meet its habitat needs, those with open areas for foraging and bare or short-cropped surfaces for nesting. The species' use of a wide range of habitats makes it difficult to estimate trends in habitat availability, except in urban habitats, where their main nesting sites – flat graveled roofs – are disappearing	61
Great Blue Heron, herodias subspecies	*Ardea herodias ssp. herodias*	Reproduction - Growing	Breeding, foraging	Agriculture, conifer and deciduous forests, riparian forests, lakes, ponds, rivers, wetlands	Central and southern interior of British Columbia with a relatively small population that is concentrated at scattered colonies in the Central Interior, Southern Interior, and Southern Interior Mountains. Distribution, both during breeding and wintering, are highly dependent on access to open water; found along or near lakes, rivers, streams, and other waterbodies. Nesting locations in the interior are typically along the edges of waterbodies, such as lakes, rivers, and other wetlands. Interior heron colonies have been in both coniferous and deciduous trees. During the winter herons occur where access to open water is available. Will forage in agricultural fields in the interior where available. Roosting locations are typically near foraging spots, and may be in trees (either coniferous or deciduous), along edges of waterbodies, or on gravel bars or other islets in rivers.	67, 68

Species Accounts – Birds

Species	Scientific Name	Critical Life Stage	Function	Biophysical Feature	Attributes	Reference #
Birds						
Lewis's Woodpecker	*Melanerpes lewis*	Reproduction - Growing	Breeding, foraging	Ponderosa Pine or Douglas-fir forests, open grasslands, with fire-maintained features. mature to old riparian cottonwood stands typically adjacent to grassland, agricultural field, shrub-steppe, or open woodland habitats; and relatively recently burned (<30 years) Ponderosa Pine and Douglas-fir dominated forests with standing snags resulting from stand-destroying fires.	Semi-colonial nester that breeds in low elevation habitats of the southern interior of BC; In BC, the Lewis's Woodpecker occupies three general habitat types: 1) dry open Ponderosa Pine (Pinus ponderosa) or Douglas-fir (Pseudotsuga menziesii) forests or open grassland with scattered trees, 2) mature to old riparian cottonwood (Populus spp.) stands typically adjacent to open habitats, and 3) relatively recently burned (<30 years) Ponderosa Pine and Douglas-fir dominated forests with standing snags. Lewis's Woodpeckers are birds of open forest, riparian woodland or grassland with scattered trees .	76
Olive-sided Flycatcher	*Contopus cooperi*	Reproduction - Growing	Breeding, foraging	Conifer forests	Breed in various forest and woodland habitats: taiga, subalpine coniferous forest, mixed coniferous-deciduous forest, burned-over forest, spruce or tamarack bogs and other forested wetlands, and along the forested edges of lakes, ponds, and streams. Most nesting sites contain dead standing trees, which are used as singing and feeding perches. Nests are placed most often in conifers, on horizontal limbs 2-15 meters from the ground. During the winter, this species occurs in a variety of forest, woodland, and open situations with scattered trees, especially where tall dead snags are present. Winters in South America.	85
Sandhill Crane	*Grus canadensis*	Reproduction - Growing	Breeding, foraging	wetlands, bogs, marshes, swamps, meadows, estuaries	Nests may contain eggs mid-May. Both sexes, in turn, incubate usually 2 eggs 28-30 days. Young are tended by both parents, begin flying at about 2 months, remain with parents until following year. Usually only one chick survives to fledging. Breeding habitat includes wetlands, bogs, marshes, swamps, meadows and estuaries. The breeding habitat requires a nest site (ground or over water), a roost site (ground), a foraging area, and isolation; while the precise amount of visual buffer provided by vegetation is unknown, its presence is undoubtedly of high importance. Sandhill Cranes, unlike most British Columbian wetland-associated birds, frequently use coniferous forests as escape cover, and possibly when resting and feeding with young . Although Sandhill Cranes are commonly reported to have high site fidelity, preliminary observations in BC suggest that site fidelity strength is not as strong among birds breeding here in comparison to other regions of their breeding range.	94

Species Accounts – Amphibians

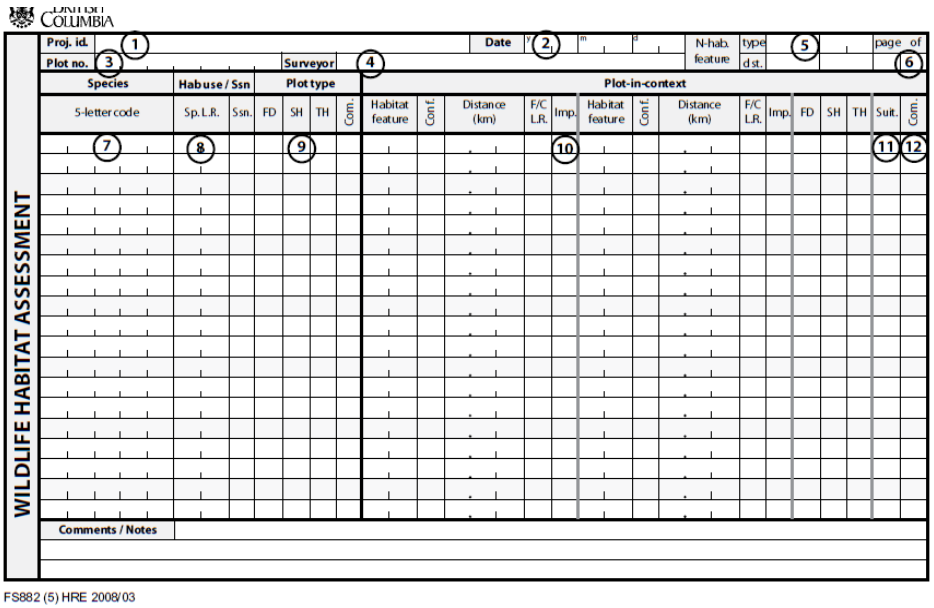
Species	Scientific Name	Critical Life Stage	Function	Biophysical Feature	Attributes	Reference #
Amphibians						
Columbia Spotted Frog	*Rana luteiventris* Thompson	Reproduction/Living - All Seasons	Overwintering, foraging, breeding, migrating	lakes, open water, riparian, wetlands, riparian forests	Breeds in February in shallow water in ponds or other quiet waters; Metamorphosis occurs by fall or tadpoles may overwinter and metamorphose the following spring. Highly aquatic; rarely found far from permanent quiet water; usually occurs at the grassy/sedge margins of streams, lakes, ponds, springs, and marshes. May disperse into forest, grassland, and brushland during wet weather, and may traverse uplands to reach wintering sites. Uses stream-side small mammal burrows as shelter. Overwintering sites include undercut stream banks and spring heads or deep lakes.	36, 37
Northern Leopard Frog	*Rana pipiens*	Reproduction/Living - All Seasons	Breeding and early development, foraging and possibly overwintering	Wetlands, moist meadows	Naturally eutrophic wetlands with sparsely vegetated Typha spp. Marshes, persisted during tadpole development. Overwintering waterbodies that do not freeze.	41, 42
Western Toad	*Anaxyrus boreas*	Reproduction/Living - All Seasons	Overwintering, foraging, breeding, migrating	wetlands, lakes, ponds, riparian, riparian forests.	Use a wide variety of aquatic and upland habitats. They breed in a variety of wetlands including shallow, sandy margins of lakes, ponds, streams, river deltas, river backwaters, river estuaries, and geothermal springs. Following breeding, adults may remain to forage in the marshy or riparian edges of breeding sites, or they may disperse several kilometres to foraging areas in other wetlands, riparian areas along streams, or upland sites. Western Toads hibernate underground, often in spaces created or modified by small mammals.	13

Species Accounts – Reptiles

Species	Scientific Name	Critical Life Stage	Function	Biophysical Feature	Attributes	Reference #
Reptiles/Turtle						
Western Painted Turtle	*Chrysemys picta*	Reproduction/Living - All Seasons	Overwintering; mating, egg laying, foraging basking	Riparian and adjacent upland habitats	Slow-moving or stagnant freshwater waterbodies with emergent vegetation, floating vegetation, vegetative mats and logs. Open terrestrial habitat types, with exposed soil and little to no vegetation; riparian edges or banks, natural islands, rocky bluffs, canopy gaps in forested habitats with flat or gently sloping ground (no pooling water) substrates: sand, gravel, or silt; low organic content (SEE CRITICAL HABITAT MAP LOCATIONS)	8

Appendix 6: Wildlife Habitat Assessment Form

Page 1



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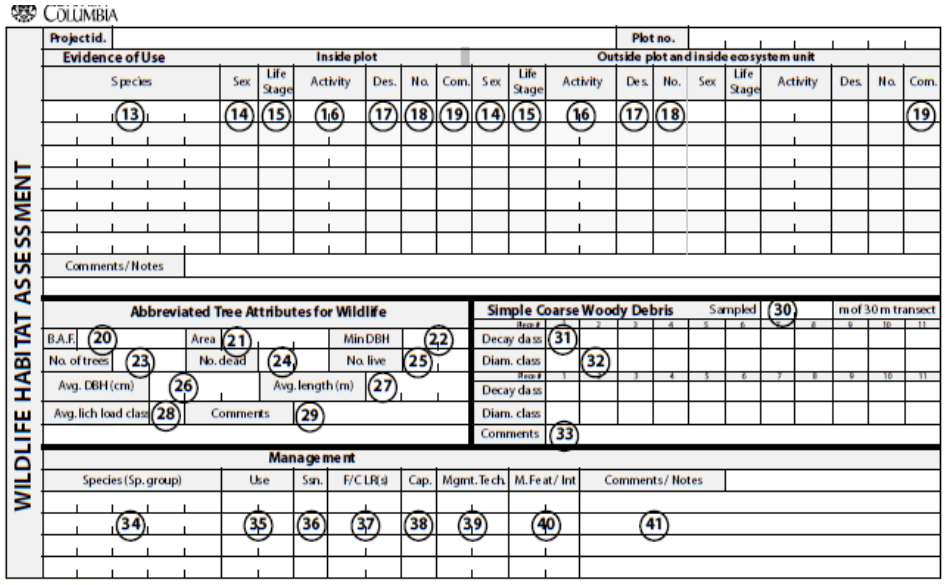

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WHA • 4

1	Project ID	
2	Date	Enter the two-digit codes for year, month, and day.
3	Plot Number	Record the plot number from the top of the Site Description Form.
4	Surveyor(s)	Enter the first initial and last name and of each person involved in completing this form.
5	Non-habitat Features	Enter up to two types of human activity or other non-habitat feature (N-hab. feat.) near the plot that may affect usage by wildlife. A non-habitat feature is a feature of the environment that influences the amount of use of the plot by wildlife. A non-habitat feature can be distinguished from a habitat feature because non-habitat fea-tures do not affect habitat attributes (i.e., something measurable to describe habitat) and therefore do not affect suitability.
5	Distance:	Enter a code (1–5) indicating the approximate distance (dst.) from the plot to the nearest sites of prolonged human activity or other non-habitat features which may affect wildlife.
6	Page ___ of ___	
7	Species	Indicate the species for which the habitat is being assessed. Use the five-letter codes from Cannings and Harcombe (1990), plus additional codes given in Appendix 5.1.
8	Habitat Use/Specified Life Requisite (SpLR)	For each habitat use (Hab use) to be assessed, use one row on the form. Specify the life requisite (SpLR) for which the habitat will be used with a two-letter code
	Season:	If required, indicate the season (Ssn.) for which the habitat is being assessed. Use codes listed in Table 5.4. Consult B.C. Wildlife Rating Standards (Resources Inven-tory Committee: Wildlife Interpretations Subcommittee 1998) for recommended season coding system for each species.
9	Plot-Type Assessment	Assess the food, security habitat and thermal habitat provided by the plot type for the species, use and season being considered. For these assessments, disregard plot size and shape, and position relative to other habitats. Instead, imagine that the plot type covers a sufficiently large area to maximize its value for the species, use and season being considered. These data will be used to establish suitability ratings for the ecosystem unit represented by the plot. For assessments of relative quality and suitability use codes in Table 5.5.
		For species where it is known that thermal habitat plays a significant role in overall suitability, but for which thermal qualities of the plot type cannot be assessed separately from the security qualities, do not attempt to enter a rating in the TH column—only use the SH column to enter a rating.
	FD	Food: For species that require food (FD) for the use and season being considered, rate the ability of the plot type to fulfill food requirements.
	SH	Security habitat: For species that require security habitat (SH) for the use and season being consid-ered, rate the ability of the plot type to fulfill security requirements.
	TH	Thermal habitat:For species that require thermal habitat (TH) for the use and season being consid-ered, rate the ability of the plot type to fulfill thermal requirements.
	COM	Comments:To provide additional information about the plot-type assessment, or to clarify an entry made on this line, enter a numeric code (Com.). Enter the same code in the Comments/Notes section of the form, followed by the pertinent information.
10	Plot-in-context Assessment	Given the location of the plot, assess the quality and accessibility of food, security and thermal habitat for the species, use, and season being considered. This assess-ment includes the adjacent habitat features that are accessible to the species, for the specified use and season. The data will be used to develop a suitability rating for the specific plot in the area. For assessments of quality and suitability use coding from Table 5.5.
	Habitat feature	A habitat feature is a feature of the environment that influences the amount of use of the plot by providing food, security or thermal habitat and thereby affects suitability (e.g., a nearby agricultural field may provide food and influence plot usage). Enter up to two habitat features (Table 5.6) that may affect suitability of the plot.
	Conf.	Confidence: Use the codes in Table 5.7 to identify a level of confidence (Conf.) in the assessment of habitat features (i.e., how confident you are that the habitat feature affects the spe-cies, use, and season being considered). Base this on your knowledge of the species' habitat requirements and on your knowledge of the quality and quantity of habitat present in the habitat feature.
	Distance (km)	Indicate, in kilometres, the distance from plot centre to the habitat feature.
	F/C LR.	Food/Cover life requisite: Identify the food/cover life requisite (F/C L.R.) (Table 5.8) that the described habitat feature provides. If the habitat feature provides more than one life requisite, then use a combination of codes (e.g., FS indicates that both food and security are provided by the habitat feature).
	Imp.	Impact: Assess the impact (Imp.) of the habitat feature using codes from Table 5.9. Given the presence of the habitat feature, the impact is a measurement of the increase or decrease in the quality and accessibility of the food/cover life requisite(s) relative to to quality and accessibility if the plot type extended indefinitely.
	Habitat feature	
	Conf.	
	Distance (km)	
	F/C LR.	
	Imp.	
	FD	Food: Considering the context of the plot, for species that require food (FD) for the use and season being considered, rate the overall quality and accessibility of food. Use coding from Table 5.5.
	SH	Security habitat: Considering the context of the plot, for species that require security habitat (SH) for the use and season being considered, rate the overall quality and accessibility of security habitat. Use coding from Table 5.5.
	TH	Thermal habitat: Considering the context of the plot, for species that require thermal habitat (TH) for the use and season being considered, rate the overall quality and accessibility of thermal habitat. Use coding from Table 5.5.
11	Suit.	Suitability: Assign a suitability rating (Suit.), using the codes in Table 5.5, for the plot-in-context, for the species, use, and season being considered. Base the suitability on the ratings entered in the food (FD), security habitat (SH), and thermal habitat (TH) columns. Theoretically, the suitability rating should be an average or weighted aver-age of the three food/cover life requisite ratings.
12	Com	Comments:To provide additional information about the plot-type assessment, or to clarify an entry made on this line, enter a numeric code (Com.). Enter the same code in the Comments/Notes section of the form, followed by the pertinent information.

17	Descriptor	Enter a coded descriptor (Des) that indicates whether the animal was observed or heard in the plot or ecosystem unit, or gives the probable age or season of the sign (Table 5.12).
18	Number	Record the number (No.) of animals present or the number of sign elements. Codes for relative abundance can be used for sign elements instead of numbers (i.e., H
		[high], M [moderate], L [low], or T [trace]).
19	Comments	To provide additional information about the evidence of use, or to clarify an entry on this line on the form, enter a numeric code (Com). Enter the same code in the Comments/Notes section of the form, followed by the pertinent information.
14	Sex	M, F, U
15	Life Stage	
16	Activity	
17	Descriptor	Enter a coded descriptor (Des) that indicates whether the animal was observed or heard in the plot or ecosystem unit, or gives the probable age or season of the sign (Table 5.12).
18	Number	Record the number (No.) of animals present or the number of sign elements. Codes for relative abundance can be used for sign elements instead of numbers (i.e., H
		[high], M [moderate], L [low], or T [trace]).
19	Comments	To provide additional information about the evidence of use, or to clarify an entry on this line on the form, enter a numeric code (Com). Enter the same code in the Comments/Notes section of the form, followed by the pertinent information.
20-41	NOT COMPLETING THIS PORTION OF THE FORM	

Non-Habitat Feature Codes

Code	Type
AI	Airport (e.g., noise from airplanes and human presence)
FA	Farming
FE	Fence
GD	Garbage dump
LO	Logging activity
MI	Mining activity
OT	Other (specify under "Comments")
RF	Road traffic, four lanes
RO	Road traffic, one lane
	Railroad (e.g., noise from trains and human presence)
RN	Road traffic, two lanes
RR	Rural (e.g., pressure from human activity)
UR	Urban/suburban (city, town, village) (e.g., pressure from human activity)

Distance Codes

Code	Distance
1	0-100m
2	100-250m
3	250-1,000m
4	1-5km
5	>5km

Life Requisite Codes

Code	Specified Life Requisite	Description
AP	Avoiding Pests	Habitat used for avoiding pests; e.g., caribou use snow fields to avoid insects in sum-
CO	Courting	Habitat used for courting; involves enticing a conspecific of the opposite sex into copulation, courtship feeding, and defense of mates
DE	Denning/roosting	Habitat used for sleeping or hiding in a cavity, cave, or burrow; does not include hibernating nor reproducing-birthing
FS	Feeding - salmon	Habitat used for feeding on fish during a salmonid run
HI	Hibernating	Habitat used for hibernating
LI	living	Habitat used for activities other than; denning, birthing, courting etc.
MD	Migrating daily	Habitat used for regular, daily travelling, including travelling away from or towards a communal habitat; e.g., habitat used by a bat for daily flights to and from a roosting site
MS	Migrating Seasonally	Habitat used for regular, annual travelling; e.g., habitat used by elk for spring and fall migrations, or habitat used for travelling away from or towards a communal habitat such as a hibernaculum
RB	Reproducing - birthing	Habitat used specifically for giving birth to live young; e.g., caribou use specialized habitat for birthing but beaver do not;
RE	Reproduction - eggs	habitat used by amphibians, birds, and reptiles for hatching of eggs is recorded as habitat used for reproduction by eggs Habitat used for building a nest,
SG	Staging	Habitat used for staging during spring or fall migrations

Season Codes

Code	Season
Aa	All seasons
G	Growing
W	Winter
P	Spring
S	Summer
F	Fall
WE	Early Winter
WL	Later Winter
PE	Early Spring
PL	Later Spring

Life requisite codes

Code	Food/Cover Life Requisite	Description
F	Food/Cover Life Requisite	Provides habitat used for consuming food items, including searching for and consuming food simultaneously such as is done by grazers, browsers, flying insectivores, ducks, and other species with similar feeding habits; includes habitat used for searching for, pursuing and killing prey
S	Security	Provides habitat used for protection or hiding from predators
T	Thermal	Provides habitat used for protection from heat, cold, or precipitation

Codes for descriptors of wildlife evidence of use

Code	Meaning
S	The animal was seen
H	The animal was heard
F	Fresh sign (<1 week old)
Y	Sign is <1 year old but >1 week old
O	Old (>1 year old)
U	Undetermined (age of sign is unknown)
W	Sign is from the winter season
G	Sign is from the growing season

Columbia Species Codes

Species		Code
Sandhill Crane	*Grus canadensis*	B-SACR
Common Nighthawk	*Chordeiles minor*	B-CONI
Great Blue Heron	*Ardea herodias ssp. herodias*	B-GBHE
Lewis's Woodpecker	*Melanerpes lewis*	B-LEWO
Olive-sided Flycatcher	*Contopus cooperi*	B-OSFL
River Otter	*Lontra canadensis(* Schreber)	M-LOCA
American Badger	*Taxidea taxus*	M-TATA
American Black Bear	*Ursus americanus* Pallas	M-URAM
American Beaver	*Castor canadensis* Kuhl	M-CACA
Western Toad	*Anaxyrus boreas*	A-ANBO
Northern Leopard Frog	*Rana pipiens*	A-RAPI
Columbia Spotted Frog	*Rana luteiventris* Thompson	A-RALU
Western Painted Turtle	*Chrysemys picta*	R-CHPI

Life Requisite Codes

Code	Activity	Description
AL	ALERT	Activity with the purpose of detecting predators; e.g., guard or sentry duty or a heads-up rigid stance
AN	ANTLER	A cast, solid, annually deciduous horn of a cervid
AP	avoiding pests	Avoiding pests; e.g., seeing caribou standing on snow fields during summer when insects are abundant
BA	basking	Behaviour for the purpose of gathering warmth; e.g., a marmot or snake lying on warm rocks, or marmot hair and soiling stains on flat rocks
BE	bedding	Bedding, sleeping, or resting above ground, including bedding for the purpose of cud chewing, and roosting and resting of birds
BP	body	Incidental portions of an animal's body which are parts left behind, but do not indicate the ani mal is dead; e.g., feathers, hairs, and shed skins; shed antlers are recorded as
BU	building	Building a nest, bed, burrow, den, lodge, or other dwelling
CA	casting	Discharging bodily waste from the mouth; e.g., an owl or snake casting pellets
CO	courtship	Behaviour for the purpose of enticing a conspe cific of the opposite sex into copulation, including copulation, courtship feeding, and defense of mates
CR	carcass	A carcass, or portions of a carcass, that indicates the animal is dead
DE	denning	Sleeping or hiding in a cavity, cave, or burrow; does not include hibernating; if the same den is used for hibernating and general denning, record as hibernating
DI	disturbed	Behaviour for the purpose of avoiding the observer; use only if the activity before distur bance is not known
DR	drinking	Drinking
EX	excreting	Discharging waste through the anus
FD	feeding	Consuming food items, including feeding by animals that search for food and eat simultane- ously; e.g., grazers, browsers, flying insectivores, and filter feeders; does not include hunting
FL	fleeing	Hurried movement to avoid conspecifics or other animals; does not include fleeing to avoid the observer
FS	feeding salmon	Feeding on salmonids, during a salmonid run
GR	grooming	Behaviour for the purpose of arranging and protecting the fur, feathers, skin, etc., including scratching and rubbing of antler velvet
HI	hibernating	If the same den is used for hibernating and general denning, record as hibernating
HU	hunting	Searching for, pursuing, and killing prey
IN	incubation	Incubating, protecting, or laying eggs
LI	living	Activity could not be specified due to ignorance or the activity was too diverse
MD	migrating daily	Travelling that is a regular daily activity, including travelling to or away from a communal habitat; e.g., a bat on its daily flight to or from a roosting site
MS	migrating seasonally	Travelling that is a regular annual activity; e.g., an elk or a Sandhill Crane on its migration route, or a snake travelling away from a communal habitat such as a
RB	reproducing birthing	Giving birth to live young; preparing a birthing reproduction site, such as a den
RE	reproducing eggs	Laying eggs (amphibians, reptiles and birds), building a nest, and feeding non-mobile young
RR	rearing	Adults feeding neonates and juveniles
SH	secrity habitat	Using habitat for protection or hiding from predators
ST	security and or thermal	Using habitat for its security and/or thermal values; used when differentiating between the two values is difficult or impossible
TE	territoriality	Behaviour for the purpose of marking or defending a territory; e.g., singing, drumming, winnowing, howling, antler rubbing, wallowing, or scraping the ground
TF	travelling/flying	Used when the purpose of flying is not known; if known, use a more specific description such as hunting
TH	themal habitat	Using habitat for protection from heat, cold, or precipitation
TP	travelling on a path	Walking on a trail that is embedded in the ground due to animals walking the same route for many years
TR	travelling	Travelling by a method other than flying, swimming, and walking usually used for animals that do not normally fly, swim, or walk; includes seeing an isolated track; does not include running if the purpose for running is known
TS	Travelling/swimming	used when the spesific purpose of swimming is not known; if known use a more specific description such as fleeing
TW	travelling/walking	used when the perpose of walking is not knownknown; if known, use a more specific description such as migrating; does not include travelling on a path (see "TP")
UR	urinating	

Appendix 7: Columbia NWA - Wildlife Habitat Suitability and Capability Ratings Tables

Columbia NWA Habitat Suitability Ratings Table

Common Name	Scientific Name	Name Code	Anthropogenic feature		Non- or Sparsley Vegetated Sites							Floodplain						Terrestrial IDFdk5			Terrestrial IDFxk									Wetland									
			Road (RP)	Railway (RN)	Active Flood Channel (Fa)	Flood fringe (Ff)	Beach (BE)	Mudflat (MU)	Exposed Soil (ES)	Ponds > 2m in depth (PD)	River (RI)	Mountain alder – Common horsetail (Fl01)	Mountain alder– Red-osier dogwood – Ladyfern (Fl02)	Drummond's willow – Bluejoint reedgrass (Fl05)	Sandbar willow (Fl06)	Cottonwood – Snowberry – Rose (Fm01)	Cottonwood – Spruce – Dogwood (Fm02)	FdPl – Pinegrass – Feathermoss (101)	Sxw(Fd) – Dogwood – Bunchberry (110)	Sxw – Dogwood – Horsetail (111)	Fd – Rocky Mountain juniper – Pinegrass (101)	Fd – Rocky Mountain juniper – Bluebunch wheatgrass (102)	Fd – Rocky Mountain juniper – Kinnikinnick (103)	Fd – Feathermoss – Step moss (110)	At – Prairie rose – Pinegrass (111)	SxwFd – Dogwood – Sarsaparilla (112)	Sxw – Dogwood – Horsetail (113)	Bluebunch wheatgrass – Prairie sagewort – Junegrass (Gg01)	Rough fescue – Yarrow – Junegrass (Gg12)	Beaked sedge – Water sedge (Wm01)	Swamp horsetail – Beaked sedge (Wm02)	Cattail (Wm05)	Great bulrush (Wm06)	Baltic rush (Wm07)	American common reed (Wm14)	Bluejoint – Beaked sedge (Wm15)	Bebb's willow – Bluejoint (Ws03)	Drummond's willow – Beaked sedge (Ws04)	Spruce - Common horsetail - Leafy moss (Ws07)	Open water <2m in depth (Ww)
Plot Number					21		24	26, 63	72				12, 27, 39, 49, 61	1, 3, 4, 8, 10, 11, 17, 28, 33	25	56, 57, 59	7, 23, 20, 19, 15, 29, 52			40,	83	79	82, 84, 85	70, 71, 73, 76, 78, 81	65, 67, 77				68b, 74, 75, 80	22, 30, 43	2,6, 18, 34, 36, 37, 51, 53	5,9, 13, 14, 45, 46, 50, 60, 64	31,	66			35, 41, 42, 58	48, 54		17, 32, 38, 44, 55, 62, 68a
Birds																																					
Sandhill Crane	*Grus canadensis*	B-SACR	N	N	L	L	M	L	N-L	L	L	L	L	L	M	L	L	L	L	L	L	L	N	N	L	N	H	M	H	H	M	H	H	M	M	L	H
Common Nighthawk	*Chordeiles minor*	B-CONI	L	L	N	L	M	N	L-M	N	N	L	L	L	M	M	L	M	L	L	H	H	H	H	M	M	L	H	H	N	N	N	N	N	L	N	N	N
Great Blue Heron	*Ardea herodias ssp. herodias*	B-GBHE	N	N	M	M	M	L	N	M	L	M	L	M	M	L	H	M	L	M	L	L	L	L	L	L	L	N	N	M	M	M	L	L	M	M	M	L	M
Lewis's Woodpecker	*Melanerpes lewis*	B-LEWO	N	N	N	L	N	N	N	N	N	L	N	L	N	M	L/M	H	H	H	H	H	H	H	M	H	H	L	M	N	L	N	N	N	N	N	N	L	N
Olive-sided Flycatcher	*Contopus cooperi*	B-OSFL	N	N	N	L	N	N	N	N	N	L	L	M	N	M	M	H	H	M	H	H	H	H	H	H	L	L	N	L	M	N	N	N	L	L	L	L	N
Mammals																																					
North American River Otter	*Lontra canadensis* (Schreber)	M-LOCA	N	N	H	H	L	N	N	H	H	M	M	M	L	M	H	L	L	L	L	L	L	L	L	N	N	M	M	L-M	L	L	L	L	M	H	M	M-H
American Badger	*Taxidea taxus*	M-TATA	N	N	L	L	N	N	L-M	N	N	L	L	N	N	N	N	M	L	L	H	M	H	M	L-M	L	N	H	M	N	N	N	N	N	N	N	N	N	N
American Black Bear	*Ursus americanus* Pallas	M-URAM	N	N	M	M	N	N	N	L	L	M	L	L	L	M	M	M	M	H	L	L	L-M	M	L	M	M	L	L	M	M	L	L	L	M	M	M	M	L-M
American Beaver	*Castor canadensis* Kuhl	M-CACA	N	N	H	H	L	L	N	H	M	M	H	H	M	M	H	L	L	H	L	L	N	L	L	L	M	L	N	N	M	H	H	M	M	H	H	H	H
Amphibians																																					
Western Toad	*Anaxyrus boreas*	A -ANBO	N	N	L	L	L	L	N	M	M	L	L	L	L	L	M	N	N	L	N	N	N	N	N	N	N	N	N	M	M	M	L	L	M	M	L	M	L	M-H
Northern Leopard Frog	*Rana pipiens*	A-RAPI	N	N	N	N	N	N	N	M	L	N	N	L	N	N	L	N	N	N	N	N	N	N	N	N	N	N	N	H	H	H	M	H	H	H	L	L	L	H
Columbia Spotted Frog	*Rana luteiventris* Thompson	A-RALU	N	N	N	M	N	N	N	M	L	L	N	L	N	N	L	N	N	L	N	N	N	N	N	N	N	N	N	H	H	M	L	L-M	M	M	M	L	L	H
Reptiles																																					
Western Painted Turtle	*Chrysemys picta*	R-CHPI	N	N	M	H	H	M	L-M	M	L	M	M	M	H	L	M	N	N	N	N	N	N	N	N	N	N	N	N	L	H	L	L	L	L	M	L	L	L	M-H

Columbia NWA Habitat Capability Ratings Table

Floodplain				Terrestrial IDFdk5					Terrestrial IDFxk									Wetland										
Mountain alder – Common horsetail (Fl01)	Mountain alder– Red-osier dogwood – Ladyfern (Fl02)	Drummond's willow – Bluejoint reedgrass (Fl05)	Sandbar willow (Fl06)	Cottonwood – Snowberry – Rose (Fm01)	Cottonwood – Spruce – Dogwood (Fm02)	FdPl – Pinegrass – Feathermoss (101)	Sxw(Fd) – Dogwood – Bunchberry (110)	Sxw – Dogwood – Horsetail (111)	Fd – Rocky Mountain juniper – Pinegrass (101)	Fd – Rocky Mountain juniper – Bluebunch wheatgrass (102)	Fd – Rocky Mountain juniper – Kinnikinnick (103)	Fd – Feathermoss – Step moss (110)	At-Prairie rose-Pinegrass (111)	SxwFd-Dogwood-Sarsaparilla (112)	Sxw – Dogwood – Horsetail (113)	Bluebunch wheatgrass – Prairie sagewort – Junegrass (Gg01)	Rough fescue – Yarrow – Junegrass (Gg12)	Beaked sedge – Water sedge (Wm01)	Swamp horsetail – Beaked sedge (Wm02)	Cattail (Wm05)	Great bulrush (Wm06)	Baltic rush (Wm07)	American common reed (Wm14)	Bluejoint – Beaked sedge (Wm15)	Bebb's willow – Bluejoint (Ws03)	Drummond's willow – Beaked sedge (Ws04)	Spruce - Common horsetail - Leafy moss (Ws07)	Open water <2m in depth (Ww)
L	L	L	M	L	L	L	L	L	L	L	N	N	N	L	L	L	N	H	M	H	H	M	H	H	M	M	L	H
L	L	L	M	M	M	M	L	L	H	H	H	H	M	M	L	H	H	N	N	N	N	N	N	N	L	N	N	N
M	L	M	M	L	H	M	L	M	L	L	L	L	L	L	L	N	N	M	M	M	L	L	M	M	M	M	L	M
L	N	L	N	H	H	H	H	H	H	H	H	H	M	H	H	L	M	N	L	N	N	N	N	N	N	N	L	N
L	L	M	N	H	H	H	H	M	H	H	H	H	H	H	H	L	L	L	M	N	N	N	N	L	L	L	L	N
M	M	M	L	M	H	L	L	L	L	L	L	L	L	L	L	N	N	M	M	L-M	L	L	L	L	M	H	M	M-H
L	L	N	N	N	N	M	L	L	H	M	H	M	L-M	L	N	H	M	N	N	N	N	N	N	N	N	N	N	N
M	L	L	L	M	M	M	M	H	M	M	L	M	L	M	M	L	L	M	M	L	L	L	L	M	M	M	M	L-M
M	H	H	M	M	H	L	L	H	L	L	N	L	L	L	L	N	N	M	H	H	M	M	H	H	H	M	H	H
L	L	L	L	L	M	N	N	L	N	N	N	N	N	N	N	N	N	M	M	M	L	L	M	M	L	M	L	M-H
N	N	L	N	N	L	N	N	N	N	N	N	N	N	N	N	N	N	H	H	H	M	H	H	H	L	L	L	H
L	N	L	N	N	L	N	N	L	N	N	N	N	N	N	N	N	N	H	H	M	L	L-M	M	M	M	L	L	H
M	M	M	H	L	M	N	N	N	N	N	N	N	N	N	N	N	N	L	H	L	L	L	L	M	L	L	L	M-H

Appendix 8: Species References

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