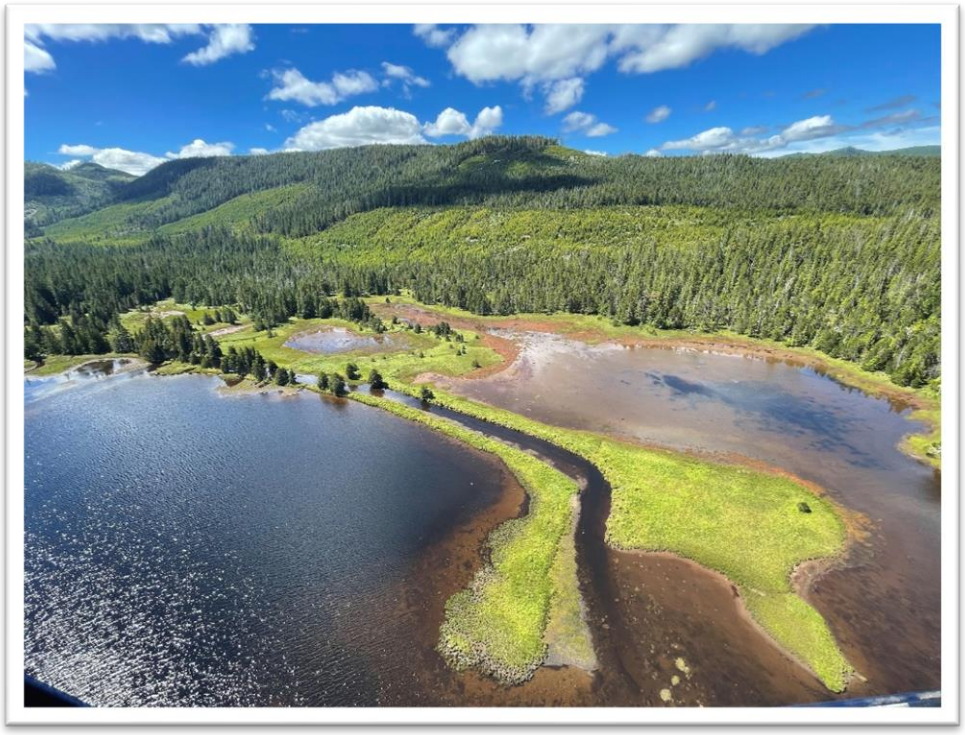
Cross-walking Biogeoclimatic Ecosystem Classification Wetland Data to the Canadian Wetland Classification System



B.A. Blackwell & Associates Ltd.

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LIST OF ACRONYMS

Acronym	Description
ArcGIS	ESRI's Geographic Information System version (v10.5)
ArcMap	ESRI GIS mapping program
Blackwell	B.A. Blackwell & Associates
BAPID	Business Area Project Identification Number
BEC	Biogeoclimatic Ecosystem Classification
BC	British Columbia
BGC	Biogeoclimatic
CNWI	Canadian National Wetland Inventory
CWCS	Canadian Wetland Classification System
CWS	Canadian Wildlife Service
ECCC	Environment and Climate Change Canada
EcoCat	EcoCat Ecological Reports Catalogue
EXC	Exceptions Mapping
gdb	File geodatabase (file type used by ESRI)
GIS	Geographic Information System
ha	Hectares
LiDAR	Light Detection and Ranging
LMH	Land Management Handbook
m	Metres
NCSF	Natural Climate Solutions Fund
NEM	Terrestrial Ecosystem Mapping without Bioterrain
NEMNSS	Terrestrial Ecosystem Mapping without Bioterrain and Structural Stage
NWWG	National Wetlands Working Group
RIC	Resources Inventory Committee
RISC	Resources Inventory Standards Committee
SEI	Sensitive Ecosystem Inventory
SIL	Survey Intensity Level
SIVI	Site Visit Form
STRCT	Structural stage
TEI	Terrestrial Ecosystem Information
TEIS	Terrestrial Ecosystems Information System
TEM	Terrestrial Ecosystem Mapping
TEMNSS	Terrestrial Ecosystem Mapping without Structural Stage
WET	Wetland Mapping
WLRS	Water, Land and Resource Stewardship

1. Introduction

BA Blackwell & Associates (BAB) was retained by the Ministry of Water, Land & Resource Stewardship (WLRS) to describe methods for cross-walking BC Terrestrial Ecosystem Information System (TEIS) ecological datasets that contain wetland data to the Canadian Wetland Classification System (CWCS; National Wetlands Working Group [NWWG] 1997) and the Version 12 (V12) schema described in the BC Canadian National Wetland Inventory (CNWI) - British Columbia Supplement (ECCC 2024).

2. Background

Under the new Natural Climate Solutions Fund (NCSF), Environment and Climate Change Canada (ECCC) is promoting the development of improved wetland mapping across Canada. The CNWI aims to identify and classify the location, extent and distribution of wetlands across Canada. Longer term, the CNWI will aim to monitor changes in the extent and quality of wetlands for climate change mitigation, and for impacts on water quality and biodiversity. The national database compilation will be made fully available to the public and supports Canada's Open Data initiative.

The Ministry of WLRS is providing assistance to the CWS to support the CNWI. Because WLRS is the provincial lead that supports and provides standards for ecological inventories in BC, they have the expertise to assist in the compilation of existing and new datasets into an authoritative, structured national database using the CWCS (NWWG 1997) and CNWI (V12; ECCC 2024).

Wetlands in BC are classified using *Wetlands of British Columbia: A Guide to Identification* (MacKenzie and Moran 2004) and regional land management guidebooks. The CWCS and CNWI use definitions that do not precisely align with the BC classification system. Therefore, the BC wetland class and attribute data must be reviewed and converted to the CWCS and CNWI schema (V12) to be incorporated in the CNWI.

The use of a common classification system (CWCS) and database schema is essential to this national database to ensure consistency of methods, analysis, and reporting cross-country. Partners will provide high quality field data and desktop delineated data to the CNWI, which ECCC will use to input into predictive mapping software. The predictive mapping software will produce a map product that will estimate the location, extent, and class of various wetland types across the country.

This document includes information from several other previous reports completed for ECCC and WLRS by BA Blackwell & Associates (Andrew 2023; Andrew 2024; BAB 2023).

2.1 Objectives

The primary purpose of the document is to consolidate and describe methods to cross-walk TEIS wetland data to the CNWI to ensure the consistency of wetland classification that is incorporated in the national inventory.

2.2 Project Team

The project was conducted for Cory McGregor (Provincial Terrain Information Specialist; Ministry of Water, Land & Resource Stewardship [WLRS]) by Ben Andrew, Senior Ecologist of B.A. Blackwell & Associates.

2.3 Qualifications for Cross-walking

Cross-walking should be conducted by individuals with experience in wetland classification and mapping, ecosystem mapping using the Biogeoclimatic Ecosystem Classification (BEC) systems, and familiarity with the CWCS (NWWG 1997), CNWI (ECCC 2024), and Canadian National Wetland Inventory Data Model (ECCC 2023). Individuals should have experience using Geographic Information Systems (GIS) software used for analysis of Terrestrial Ecosystems Information (TEI) data or the support of GIS specialists (ECCC 2024).

2.4 Wetland Classification References

The wetland classification systems and relevant supporting information that are useful in cross-walking are summarized below.

The Land Management Handbooks that describe the regional BEC classifications are not listed here but are available at Forest Science Program - Land Management Handbook Abstract Listing (gov.bc.ca).

Terrestrial Ecosystem Information Unit (TEI). 2024. Terrestrial Ecosystem Information (TEI): Ecosystem Mapping Code List. Version 3. Ministry of Water, Land and Resource Stewardship, Integrated Data and Analysis Services, Ecosystem Information Services. August, 2023.

MacKenzie, W. H. and J. R. Moran. 2004. Wetlands of British Columbia: A Guide to Identification. Land Management Handbook 52 (LMH 52). Ministry of Forests Research Program: Victoria, BC.transmission-nov-4-10-final.pdf.

MacKenzie, W.H. 2012. Biogeoclimatic ecosystem classification of non-forested ecosystems in British Columbia. Prov. B.C., Victoria, B.C. Tech. Rep. 068. www.for.gov.bc.ca/hfd/pubs/Docs/Tr/Tr068.htm.

Biogeoclimatic Ecosystem Classification Codes and Names BECdb Version 12. (BEC 12). 2021. https://www.for.gov.bc.ca/hre/becweb

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Environment and Climate Change Canada (ECCC). 2023. Canadian National Wetlands Inventory (CNWI) Database – User Manual – Version 1.0. Gatineau QC.

Environment and Climate Change Canada (ECCC). 2024. Canadian National Wetland Inventory – British Columbia Supplement (V12).

National Wetlands Working Group. 1997. The Canadian Wetland Classification System, Second Edition. Originally published 1988. Edited by B.G. Warner and C.D.A. Rubec.

3. Wetland Classification

An overview of the CNWI schema and attributes and an overview of the BEC system and key TEI long table attributes and differences between the two classification systems are discussed below.

3.1 Canadian National Wetland Inventory and Attributes – BC Supplement (V12)

As described in the Canadian National Wetland Inventory (CNWI) - British Columbia Supplement (V12): The CNWI is an initiative to compile, process, quality control, and publish best available wetland mapping and field validation data, with its metadata, into a comprehensive publicly available database. It also aims to acquire additional wetland data to fill high priority gaps in coverage, with an emphasis on peatlands and coastal wetlands (ECCC 2024).

CNWI classification schema has two key supporting documents the *Canadian Wetland Classification System* (NWWG 1997), and the *Canadian Wetland Inventory Data Model* (ECCC 2023). In recognition of the unique biophysical conditions and wetland types in BC, the ECCC produced a CNWI BC supplement (current version V12) to assist with new wetland mapping and cross-walking wetlands in BC to the CNWI. The CNWI BC supplement (ECCC 2024) provides a table with the attributes that are included in the point and polygon data for wetland mapping (Table 3-1). There are two CNWI file geodatabases (point and polygon databases) with attributes and domains specific to BC that can be obtained from ECCC upon request.

The CNWI classification schema has five wetland classes: bog, fen, swamp, marsh, and shallow open water (Figure 3-1; NWWG 1997; ECCC 2024). The classification also includes eight subclasses; however, these are not used in cross-walking in BC. It is mandatory that wetland class be attributed for wetland data to be included in the CNWI (ECCC 2024). When wetlands cannot be cross-walked from other data sources because of differences in classifications, they can be classified as Peatland, Mixed, and Unclassified (ECCC 2024). These are described in Table 3-3. It is important to note, CNWI only has one class of wetland assigned to each polygon and does not recognize multiple wetland classes at the polygon level, unlike BC TEI data which allows up to three ecosystem types to be included as deciles within a polygon. The methods of cross-walking many classes to one class are discussed further in this document.

Soil characteristics are important in defining wetland class (ECCC 2024). Wetland classes in the CWCS are classified according to soil depth into organic wetlands (peatlands) with greater than 40 cm organic soils depths (excluding Folisols) or mineral wetlands (NWWG 1997). Further subdivision occurs based on water source for peatlands, (ombrogenous or minerogenous hydrologic systems) and surface cover type for non-peatlands (Figure 3-1).

The CNWI classification schema includes attributes that provided additional descriptive information for wetland points and polygons (Table 3-1). In the BC supplement, these attributes include Surface Cover System, Hydroperiod, Tidal, Salinity, Soil Type, Permafrost, Alpine/Subalpine, Nutrients, Woody, Vegetation , Canopy Cover, Woody Vegetation Height,

Woody Vegetation Type, Herbaceous Type, Bryophyte or Lichen Vegetation Type, and Impact (ECCC 2024).

Table 3-1. Definitions for each of the attributes used for wetland point and polygon classification in CNWI BC Supplement (V12; ECCC 2024)

CNWI Schema V12	Description
Source Title	Source title of the database
Source Organization	Name of the organization that completed the wetland mapping
Project Type	Indicates if the data was existing and cross-walked for newly collected for the CNWI in BC
Business Area Project ID	Project identifier assigned by the Ministry of Environment, Ecosystem Information Section
Project Polygon Identifier	Field to link the data back to the BC source dataset
TEIS Primary Key	Field to link the data back to the BC source dataset
Feature Date Created	Date the linework was created, i.e., the date that the polygon was mapped and created, and/or validated by imagery on desktop
Validation Type	Type of independent validation completed on a wetland polygon
Validation Date	Date that the field validation work was performed
Wetland or Non-wetland	Identify if the polygon or point is a wetland or non-wetland
CNWI BC Wetland Class	Wetland class
Source Wetland Class	Type / classification of wetland used if the source database
Surface Cover	Dominant surficial cover features based on the general physiognomy of the cover
Hydrological System	Description of wetland hydrology
Hydroperiod	Amount of time that water is held on the surface of the wetland in a typical year
Tidal	Indicates if wetland influenced by tides
Salinity	Indicates if wetland influenced by salinity
Soil Type	Broad categories of soil characteristics
Permafrost	Ground (soil and/or rock) that remains frozen throughout multiple years
Alpine/Subalpine	Identifying wetlands and ecosystems in alpine, or high elevation mountainous terrain
Nutrients	Broad categories of wetlands based on nutrient availability and pH characteristics
Woody Vegetation Canopy Cover (%)	Percent canopy coverage of woody vegetation (trees and shrubs)
Woody Vegetation Height (m)	Categorization of the height of woody vegetation
Woody Vegetation Type	Type of woody vegetation
Herbaceous Vegetation Type	Categorization of the type of vascular herbaceous vegetation
Bryophyte or Lichen Vegetation Type	Categorization of the type of bryophytes or lichen vegetation
Impact	Categorization of the type of impact
Hectare	Polygon area in hectares

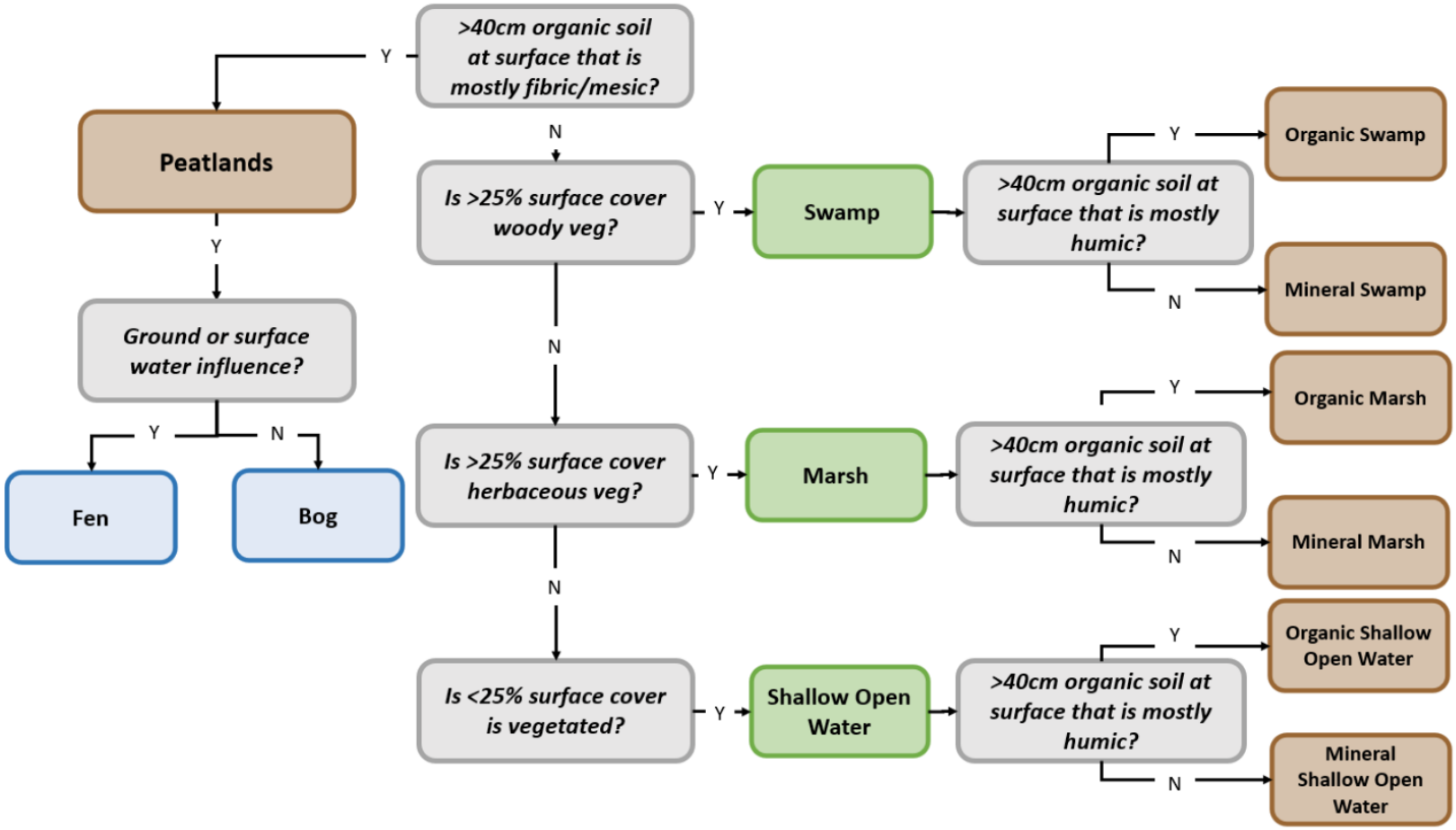


Figure 3-1. Wetland Classes for the Canadian National Wetland Inventory in British Columbia (from ECCC 2024).

3.2 Biogeoclimatic Ecosystem Classification System

The Biogeoclimatic Ecosystem Classification (BEC) system is a hierarchical classification that groups ecosystems into Biogeoclimatic zones, subzones, and variants based on regional climate, and further differentiates these at the stand-level into site series based on site, soil, and vegetation characteristics.

Ecosystem codes used in the BEC system for non-forested ecosystems were developed based on MacKenzie and Moran (2004) and MacKenzie (2012). The codes have four characters, the first two letters indicate the higher site levels of site realm/group and site class. The last two numbers identify site association. These codes do not change with biogeoclimatic unit, and they may apply within parts of or all of BC (Ryan et al., 2021).

As discussed above, the BEC includes the concept of broad units including site realm /group/ and class and which are further defined by the concept of site association and site series. Site association and site series include ecosystems that are physically and biologically similar that would have similar climax vegetation communities (MacKenzie 2012). The BC site class system is adapted from the CWCS, with regards to wetlands, and characterizes broad site potential (Mackenzie and Moran 2004). Both systems use similar class concepts for bogs, fens, swamps, marshes, and shallow open water. However, the site class concept used in BC requires that sites must align with the Site Association concept …*and the same restrictions apply: sites must be relatively homogeneous (rather than entire wetlands), mature, and undisturbed* (MacKenzie and Moran 2004). The alignment of site class and site association results in differences between the BEC system and the CNWI with regards to which class wetlands are assigned to. The differences in classification arise because BEC site associations are highly reliant on vegetation community composition and less determined by site conditions and soils, which are central to the CWCS (2023).

TEI long table attributes relevant to wetland mapping and cross-walking are summarized in Table 3-2, and the use of these attributes in cross-walking is summarized in Appendix 1.

Table 3-2. Key TEI Long Table Attributes Relevant to Wetland Cross-walking

Alias	Item Definition
TEIS Primary Key	a unique numeric identifier for detailed polygons that maintains the link between inventory polygons
Project Polygon Identifier	a unique enduring identifier within a project
Business Area Project ID	BAPID number assigned to a project is applied to all associated project components
Project Type	contains a 3-9 letter code indicating the specific type of mapping and attributes gathered for the project.
Project Map Scale	contains the scale the project was mapped at.
Biogeoclimatic Label	Biogeoclimatic unit in which the polygon occurs
Ecosystem Decile of Ecosystem Component 1 to 3	the proportion of the polygon covered by each ecosystem component 1-3
Realm of Ecosystem Component 1 to 3	highest level of BEC site classification, termed 'Site Realm' that delineates major biotic types
Group of Ecosystem Component 1 to 3	'Site Group' that designates a broad association of functionally similar ecosystems based on a dominant cluster of ecologically relevant environmental features
Class of Ecosystem Component 1 to 3	'Site Class' that describes ecosystems with similar underlying environmental attributes that support similar characteristic vegetation physiognomy and species adaptation guilds at climax
Site Series Number of Ecosystem Component 1 to 3	site series value for the ecosystem
Site Series Map Code of Ecosystem Component 1 to 3	mapping code for use with anthropogenic and natural non-vegetated units
Site Modifiers 1 of Ecosystem Component 1 to 3	site conditions of the site series in the landscape
Site Modifiers 2 of Ecosystem Component 1 to 3	site conditions of the site series in the landscape
Structural Stage of Ecosystem Component 1 to 3	structure of the vegetation cover at a point in time
Structural Stage Modifier of Ecosystem Component 1 to 3	stand composition, canopy structure and disturbance history
Stand Composition Modifier of Ecosystem Component 1 to 3	forest stands based on coniferous, broadleaf and mixed stand composition
Tree Crown Closure of Ecosystem Component 1 to 3	percent of ground area covered by the vertically projected crowns of the tree cover
Shrub Crown Closure of Ecosystem Component 1 to 3	percent of ground area covered by the vertically projected crowns of the shrub cover.
Site Disturbance Class of Ecosystem Component 1 to 3	site disturbance class
Site Disturbance Class Label of Ecosystem Component 1 to 3	site disturbance label
Sensitive Ecosystem Label of Ecosystem Component 1 to 3	sensitive ecosystem label for SEI
Condition of Ecosystem Component 1 to 3	condition of the sensitive ecosystem in SEI

3.3 Classification Differences between BEC and CNWI

The CWCS and BEC system wetland classification use the central five classes of wetlands: bog, fen, swamp, marsh, and shallow open water (TEI 2024; CNWI 2024). BC also includes additional ecosystems in other Realms, Groups, and Classes. These include the Estuarine Group (Meadow and Marsh Classes), Flood Group (High, Mid, and Low Bench Floodplains), Alpine wetlands within the Wetland Realm and Alpine Class, and Transitional ecosystems including the Shrub-carr Group and Alkaline meadow in the Grassland Group and Alkali meadow class. The CNWI includes some additional classes to address situations where wetland class cannot be accurately assigned and to identify non-wetland ecosystems; these include Mixed, Non-wetland, and Unclassified (Table 3-3).

The two classification systems use different primary characteristics to assign wetlands to the five main wetland classes. BC relies more on the concept of climax vegetation community composition to define wetland class (MacKenzie and Moran 2004), while the CWCS and CNWI use soil characteristics to define wetland class (ECCC 2024).

As a result, while the wetland class names are the same, the definitions for each wetland class used by the Province and the CWCS and CNWI differ. As a result, cross-walking wetland field inspection data and mapping from ecosystem mapping projects in BC is more complex than simply assigning federal wetland class based on provincial classes or site associations (Figure 3-2).

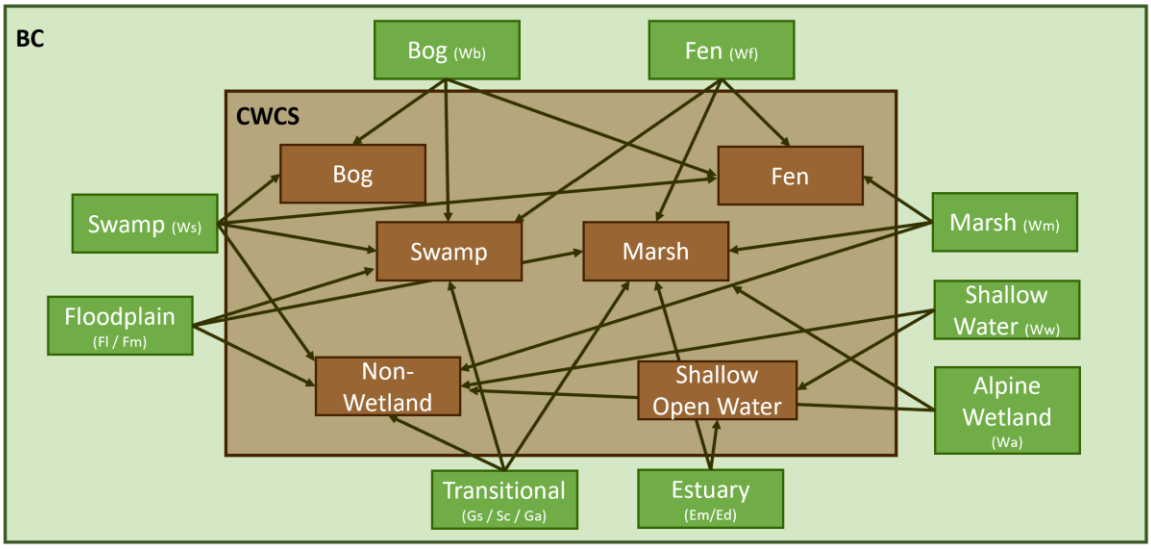


Figure 3-2. Wetland class cross-walk possibilities from the BC wetland classification system (vegetation composition classification lens) to the CWCS (soil classification lens) (Diagram from ECCC 2024; Canadian National Wetland Inventory - British Columbia Supplement V12).

Table 3-3 provides a comparison between the BC site class descriptions provided in *Wetlands of British Columbia: A Guide to Identification. Land Management Handbook 52* (MacKenzie and Moran 2004) and the CWCS descriptions provided in *Canadian National Wetland Inventory* –

British Columbia Supplement (V12) (ECCC 2024). Some of the differences that result in alternative cross-walking results are described below.

Bogs in the BEC system have characteristics that result in wetland class overlap between bogs, poor fens, and poor swamps (Ryan et al. 2021). As a result, some bog site associations in BC may be better classified as fens or swamps according to the CWCS. The principal difference, as described by the CWCS, is that *Bogs are characterized by being ombrogenous (typically receive water inputs from precipitation, fog, snow melt only)…* while *Fens are minerogenous (receiving water inputs from precipitation, surface water, runoff and groundwater).*

Wetlands of British Columbia (Mackenzie and Moran 2004) indicates that: *The traditional definition of bog describes peatland ecosystems that are ombrotrophic (i.e., isolated from groundwater). However, many peatland ecosystems in British Columbia with bog-like vegetation and abundant Sphagnum experience some groundwater contact, especially in microtopographic hollows. This guide includes these ecosystems (variously referred to as poor fens or poor swamps) in the bog wetland class.*

The inclusion of poor fens or swamps in the classification of bogs in BC means that CWCS definition of bogs and the provincial bog site associations are not always in agreement, and some site associations may be better aligned with the federal definitions for fens and swamps. Cross-walking needs to consider the differences in the definitions used by the BEC and CWCS classification systems to ensure wetlands are cross-walked as accurately as possible.

An additional difference between the two classification systems occurs as the CNWI allows only one wetland class per polygon, whereas the TEI long table may have up to three different site units within a polygon (RIC 2023). The TEI table uses deciles to identify how much of the polygon area is associated with each site unit. This can make it difficult to cross-walk data from TEI data to CNWI data, particularly when site units are a combination of upland and wetland ecosystems.

Table 3-3. Comparison of Wetland Classes between BEC and CNWI (ECCC 2024 – V12).

BC Site Class Description (LMH 52[1])	CNWI Class Description (V12)	Differences
Wetland Bog (Wb) Bogs are shrubby or treed, nutrient-poor peatlands with distinctive communities of ericaceous shrubs and hummock-forming *Sphagnum* species adapted to highly acid and oxygen-poor soil conditions. Bogs develop in basins where peat accumulation has raised the wetland surface above groundwater flow, or, less commonly,	Wetland typically with >40cm surficial organic horizon where bryophytes (typically *Sphagnum* moss) dominate ground cover often co-occurring with lichens and ericaceous shrubs and trees (often black spruce trees). Bogs ombrogenous (typically receive water inputs from precipitation, fog, snow melt only) with the water table at or slightly below the surface for all	Slight difference with respect to water inputs (groundwater inputs specifically acknowledged in BC classification). pH values for Bogs in LMH52 are described as less than 5.5 vs 4-4.8 (ECCC 2024). Subsequent descriptions in LMH 52 indicate that bogs may include ecosystems that

[1] Descriptions from MacKenzie and Moran 2004 except for Alpine Wetlands (MacKenzie 2012)

BC Site Class Description (LMH 52[1])	CNWI Class Description (V12)	Differences
where groundwater is very low in dissolved nutrients (e.g., flows from granitic parent material).	or most of the year. The land surface is raised or level with the surrounding terrain. Water is low in dissolved minerals and generally acidic (ranging from pH 4.0-4.8). In BC, for bogs, the dominant organic soil texture in the top 40 cm is typically fibric organics (Von Post 1-4).	experience groundwater contact and are referred to as transitional to poor fens or poor swamps. CNWI attributes used to characterize wetlands as fens include CNWI BC Wetland Class and Soil Type. CNWI allows for bogs with less than 40 cm organic soils over bedrock (some coastal bogs) by using Soil Type attributes (ECCC 2024).
Wetland Fen (Wf) Fens are peatlands where groundwater inflow maintains relatively high mineral content within the rooting zone. These sites are characterized by non-ericaceous shrubs, sedges, grasses, reeds, and brown mosses. Fens develop in basins, lake margins, river floodplains, and seepage slopes, where the watertable is usually at or just below the peat surface for most of the growing season.	Wetland typically with >40cm surficial organic horizon where bryophytes and/or graminoids dominate ground cover. Fens are minerogenous (receiving water inputs from precipitation, surface water, runoff, and groundwater). Water flows through fens can create different fen surface characteristics (e.g., patterning, and open water pooling). Fen surface cover can be water, herbaceous, bryophyte, shrubby, or treed. Nutrient rich fens have a pH generally >5.5; poor fens have a pH <5.5. In BC, fen's dominant organic soil texture in the top 40 cm is typically fibric/mesic organics (Von Post 1-6).	The most significant difference is that CNWI includes treed ecosystems which are not included in BC fen vegetation communities. Forested fens with surface or groundwater inputs are included as bogs in the BC classification compared to fens in the CNWI. Tree cover is less than 10% for all fens in LMH 52. CNWI attributes used to characterize fens include CNWI BC Wetland Class and Soil Type (ECCC 2024).
Wetland Marsh (Wm) A marsh is a shallowly flooded mineral wetland dominated by emergent grass-like vegetation. A fluctuating watertable is typical in marshes, with early-season high watertables dropping through the growing season. Exposure of the substrate in late season or during dry years is common. The substrate is usually mineral but may have a well-decomposed organic veneer derived primarily from marsh emergents. Nutrient availability is high (eutrophic to hyper-eutrophic) due to circumneutral pH, water movement.	Wetland dominated by herbaceous vegetation (i.e., graminoids, forbs; and less commonly algae) covering >25% of the surface area. Shrubs and trees canopy cover <25% of the surface area. Vegetation can occur randomly across a marsh or can be arranged in distinct zones of parallel or concentric patterns in response to gradients of water depths, frequency of drawdowns, water chemistry or disturbance. Periodic or persistent surface water may occur with water levels that can fluctuate seasonally and annually. In BC, organic marshes' dominant organic soil texture in the top 40 cm is typically humic organics (Von Post 7-	Tree cover may be up to 25% in CNWI compared to no tree cover in LMH 52. Marsh classification is similar between the two systems except BC includes marshes as Estuarine Marsh. CNWI attributes used to characterize estuarine marshes include Hydrologic System, Tidal, and Salinity (ECCC 2024).

BC Site Class Description (LMH 52[1])	CNWI Class Description (V12)	Differences
	10). In BC, marshes can also be found on mineral soil where there is <40cm surficial organic soil.	
Wetland Swamp (Ws) A swamp is a forested, treed, or tall-shrub, mineral wetland dominated by trees and broadleaf shrubs on sites with a flowing or fluctuating, semipermanent, near-surface watertable. Tall-shrub swamps are dense thickets, while forested swamps have large trees occurring on elevated microsites and lower cover of tall deciduous shrubs. Both types of swamps have abundant available nutrients from groundwater and often have surface standing water. Swamps may be underlain with peat, but this is well decomposed, woody, and dark.	Wetland with >25% woody vegetation canopy coverage on mineral soils (<40cm surficial organic horizon) or organic soils (>40cm surficial organic horizon). It includes coniferous, deciduous, mixed wood and shrub swamps. Periodic or persistent surface water may occur with water levels that can fluctuate seasonally and annually. In BC, organic swamps' dominant organic soil texture in the top 40 cm is typically humic organics (Von Post 7-10). In BC, swamps can also be found on mineral soil where there is <40cm surficial organic soil.	The definition of woody vegetation differs between the two classifications. Treed ecosystems in BC are those with greater than 10% tree canopy cover, which may result in differences in how wetlands are classified by the two systems (e.g. marsh or fen classes may be used on the CNWI for wetlands with 11 to 25% tree canopy cover). CNWI attributes used to characterize swamps include CNWI BC Wetland Class, Soil Type, and Woody Vegetation Canopy Cover (%; ECCC 2024).
Shallow-water Wetland (Ww) Aquatic wetlands are shallow waters dominated by rooted, submerged and floating aquatic plants. These communities are always associated with permanent still or slow-moving waterbodies such as shallow potholes or deeper ponds and lakes. Shallow-water sites are usually permanently flooded; rarely they may become exposed during extreme drought years. Shallow-water communities most commonly occur where standing water is less than 2 m deep in midsummer. Aquatic plants may root in mineral soils or in well-humified sedimentary peat. The term open water (OW) is used in legacy data and has been replaced by Ww.	Wetland area with standing, slow moving, or flowing water present for all or most of the year. Water depth can fluctuate seasonally but is typically less than 2 m during mid-summer. Aquatic vegetation (floating or submerged plants) and eelgrass may or may not dominate shallow water. Sediments may be exposed during a tidal cycle or low water conditions. Water and exposed sediment must cover >75% of the surface area; terrestrial vegetation (e.g., trees, shrubs, and herbs) and emergent herbaceous vegetation (e.g., cattails and bulrushes) must cover <25% of the surface area. A shallow open water wetland can be situated on deltas, floodplains, along rivers and streams, or along the margins and shores of lakes, oceans, and other open water bodies. In BC, organic shallow open waters' dominant organic soil texture in the top 40 cm is typically humic organics (Von Post 7-10). In BC, shallow open water can also be found on mineral	Similar descriptions. Some discrepancy as to whether non-vegetated shallow water wetlands are included in the BC class. CNWI includes tidal areas. CNWI accepts vegetation including herbaceous vegetation or shrubs and trees up to 25%. BC does not specifically acknowledge tidal shallow water wetlands. CNWI attributes used to characterize swamps include Wetland Class and Herbaceous Vegetation Type (ECCC 2024).

BC Site Class Description (LMH 52[1])	CNWI Class Description (V12)	Differences
	soil where there is <40cm surficial organic soil.	
Alpine Wetland (Wa) Wet, high-elevation, high-latitude ecosystems occur that do not clearly fit any of the wetland classes of the Canadian Wetland Classification System. These ecosystems occur on seeps and saturated flats that have site characteristics similar to lower-elevation swamps, but because of the constraints of cold climate, they support low-stature vegetation dominated by dwarf willows, forbs, and/or mosses. Sites may be underlain with mineral or very thin organic horizons; peat formation is limited because of low rates of accumulation. Permafrost may occur in some cases (MacKenzie 2012).	Identified using CNWI attribute Alpine / Subalpine.	Alpine wetlands are not well defined in either classification system and may cross-walk as fens, bogs, swamps, shallow open water, or marshes depending on soil characteristics (organic versus mineral) and / or vegetation community composition. CNWI attribute Alpine / Subalpine should be used to characterize this wetland class (ECCC 2024).
Alkaline meadow Transition Class (Ga) Alkaline meadows are grass-, rush-, or halophyte-dominated sites that occur on periodically saturated and occasionally inundated sites, where watertable decline is caused mainly by evaporation and where salts accumulate. These conditions occur only in dry climates. After a brief period of inundation, the watertable drops below the rooting zone during most of the growing season, resulting in a well-aerated rooting medium. These ecosystems are part of a Grassland Group of terrestrial ecosystems.	Included in Marsh Class. Identified using CNWI attribute Salinity.	The CNWI includes alkaline meadows in the marsh class. Similar ecosystems and species assemblages occur commonly in prairie ecosystems Chapter 5 - Wetlands of the Prairies (National Wetlands Working Group 1988). CNWI attribute Salinity should be used to characterize this wetland class (ECCC 2024).
Shrub-carr Transition Class (Sc) A shrub-carr is a shrub-dominated ecosystem that develops on frost prone sites with moist or very moist soils. These sites are seasonally saturated but rarely inundated (see flood ecosystems) and may have watertables perched at depth. Shrub-carrs frequently border wetlands or occur in frost-prone hollows in cold and dry climatic regions. A strongly	Not included in CNWI.	Shrub-carr ecosystems are considered transition to wetlands and typically occur in areas with cold and dry climates and on sites with cold-air drainage that precludes tree establishment. Typically, these are not considered wetlands though they may occur poorly to imperfectly drained soils. Barclay's willow – Water sedge

BC Site Class Description (LMH 52[1])	CNWI Class Description (V12)	Differences
mounded soil surface is typical, and shrubs of 1–2 m occur mainly on these elevated microsites. These ecosystems are part of a Shrubland Group of terrestrial ecosystems.		– Glow moss (Wf04) has similar structure and occurs on wetter soils and is a recognized wetland site association.
Low bench Flood Class (Fl) Low bench ecosystems occur on sites that are flooded for moderate periods (< 40 days) of the growing season, conditions that limit the canopy to tall shrubs, especially willows and alders. Annual erosion and deposition of sediment generally limit understorey and humus development.	Not included in CNWI. Identified using CNWI attribute Hydrologic System.	Floodplain classes are problematic to cross-walk. They have high variability and may or may not have wetland soil and or plant communities. Low, middle, and high bench floodplains may be freely drained with coarse textured soils with high coarse fragment content or fine textured soils with low coarse fragment content and wetland soil characteristics. Floodplains are not classified as wetlands in BC. CNWI attributes used to characterize floodplains include Hydrologic System and Salinity (ECCC 2024).
Middle bench Flood Class (Fm) Middle bench ecosystems occur on sites briefly flooded (10–25 days) during freshet, allowing tree growth but limiting tree species to only flood-tolerant broadleaf species such as black cottonwood and red alder.		
High bench Flood Class (Fh) High bench ecosystems occur where flooding rivers produce lengthy subsurface flow in the rooting zone but only periodic, brief inundation. Surface flooding may occur from as frequently as several times annually to only during extreme flood years. These periods of flooding are generally not restrictive of plant species; plant communities are similar to adjacent upland forests on seepage sites. High bench Site Series are described in BEC field guides and are not presented in this guide.		
Estuarine Ecosystems including Marsh Class (Em), An estuarine marsh is an intertidal ecosystem that is flooded diurnally and has simple communities dominated by salt-tolerant emergent graminoids and succulents. These marshes occur in the middle to upper tidal zones of estuaries where saltwater influences predominate.	Included in Marsh Class. Identified using CNWI attributes including Hydrologic System, Tidal, and Salinity.	Estuarine marsh class should be cross-walked to CNWI marsh class. CNWI attributes used to characterize estuarine marshes and meadows include Hydrologic, Tidal, and Salinity (ECCC 2024).

BC Site Class Description (LMH 52[1])	CNWI Class Description (V12)	Differences
Estuarine Meadow Class (Ed) Estuarine meadow Ecosystems of the high intertidal zone of estuaries, where tidal flooding occurs less frequently than daily and is tempered by freshwater mixing. Species composition is relatively diverse, typically with a mix of graminoids and forbs.	Included in Meadow Class. Identified using CNWI attributes including Hydrologic System, Tidal, and Salinity.	Estuarine meadow class should be cross-walked to CNWI marsh class. CNWI attributes used to characterize estuarine marshes and meadows include Hydrologic, Tidal, and Salinity (ECCC 2024).
Estuarine - Estuary - tidal flat (Et) Intertidal ecosystems of mudflats dominated by benthic/burrowing fauna and macroalgae.	Included in Shallow Open Water. Identified using CNWI attributes including Hydrologic System, Tidal, and Salinity.	Estuarine tidal flat class should be cross-walked to CNWI Shallow Open Water class. CNWI attributes used to characterize estuarine tidal flats include Hydrologic, Tidal, and Salinity (ECCC 2024).
Not included in BC Classification.	**Peatland** An area with (typically) >40 cm of accumulated organic matter with a surface dominated by bryophytes, graminoids, and/or brown mosses. Shrubs, trees, and open water pooling may be present. Note: only use peatland category when it is not possible to discern a bog vs a fen (e.g., when classified aerial imagery or from cross-walked data). In BC, the dominant organic soil texture in the top 40 cm is typically fibric/mesic organics (Von Post 1-6).	Used when bog or fen wetland class cannot be confidently assigned but organic soils are >40 cm (ECCC 2024).
Not included in BC Classification.	**Mixed** Adjoining wetlands classified as 'wetland complex' or individual wetland polygons reported with two or more wetland classes in source datasets.	Used when 2 or more wetland classes occur in a polygon and peatland cannot be assigned (ECCC 2024).
Not included in BC Classification.	**Non-wetland** An area that is not a wetland	Used for all non-wetland sites (ECCC 2024).
Not included in BC Classification.	**Unclassified** Unclassified wetland polygons included within a classified wetland dataset or classified wetland polygons in source datasets that cannot be	

BC Site Class Description (LMH 52[1])	CNWI Class Description (V12)	Differences
	cross walked to CNWI classes based on the currently available information.	

4. Evaluating BEC Mapping Projects for Cross-walking

An assessment of existing ecosystem mapping data should be completed to help reach the decision whether to cross-walk or update the data with new mapping. A qualified ecologist with experience in mapping should review the metadata and documentation such as project reports, field data, and the mapping data to assess the suitability of the existing for cross-walking. The decision to cross-walk existing mapping, update it, or replace it with new mapping requires a careful review of the existing mapping and an evaluation of the cost, effort, and benefit of new mapping.

The Terrestrial Ecosystem Information Digital Data Submission Standard: Database and GIS Data Standards (RISC 2023) provides guidance on the evaluation of existing TEI for use in other projects, such cross-walking to the CNWI. Table 4-1 provides examples of different levels of use of an existing TEI dataset and some of the considerations when evaluating the suitability of the data for other uses.

Table 4-1. Example Levels of Use and Evaluation Considerations for Existing Data (RISC 2023).

Level of Use	Evaluation Considerations
Use As Is (No Updates Required)	Existing data are appropriate for the project purpose and are to be used as-is, retaining the original mapping. If mapping is required outside of the existing mapping, new mapping will be edge-tied to existing mapping. Data limitations and assumptions relevant to the current project are documented.
Use After Updates (Updates Required)	Existing data are appropriate for the project purpose, but updates are necessary (incorporation of new BGC linework, new coding, new fields/attributes, etc.). If mapping is required outside of the existing mapping, new mapping will be edge-tied to existing mapping. Data updates, limitations, and assumptions relevant to the current project are documented.
Partial Use	A portion of the existing data is appropriate for the project purpose (specific fields/attributes, selected polygons etc.). If mapping is required outside of the existing mapping, new mapping will be edge-tied to existing mapping. Data updates, limitations, and assumptions relevant to the current project are documented.
Background Information Use	Existing data are reviewed and deemed not appropriate for incorporation into the project but are provided to project team as background resources. The review process and justification for not incorporating (did not meet the project requirements [e.g., mapping scale] but contains relevant data to inform the current project etc.) are documented.

Level of Use	Evaluation Considerations
Not For Use	Existing data are reviewed and deemed inappropriate for the project, either for incorporation or as background information. The review process and justification for not using (did not conform with project scope, outdated information etc.) are documented.

The following sections provide guidance on evaluating existing BC TEI products for cross-walking and include consideration of the point and polygon data, types of TEI mapping product, age of the TEI data, imagery used in the original mapping, mapping scale, and Survey Intensity Level (SIL). It is helpful to keep the five levels of use in Table 4-1 in mind when using these criteria to evaluation the utility of existing TEI data for cross-walking.

4.1 ECCC Source Inventory Selection Criteria

ECCC (2023) provides requirements for including wetland mapping in the CNWI geodatabase:

- Datasets include polygon features with wetland class/type attributes;
- Datasets include temporal information on polygon features and/or the source inventory (e.g., the creation date/year of the polygon feature, the inventory completion date/year);
- Datasets include information about the imagery and other data used for the delineation or classification of wetland polygons;
- Datasets include information about wetland classification system (including the description of wetland type/form/class used in the source data) used for delineation or classification of wetland features; and
- Datasets include a license to copy, modify, publish, translate, adapt, distribute or otherwise use the information in any medium, mode or format for any lawful purpose on the federal government's open science data portal.

Most BC TEI datasets meet these criteria; however, some older datasets may not provide enough information to accurately cross-walk wetland class/type attributes, which may exclude or limit their use for cross-walking. These datasets must be evaluated by a qualified ecologist to determine their suitability for cross-walking and their limitations should be detailed in project reporting.

Table 4-2. Key project characteristics used in evaluating TEI projects for cross-walking.

Project Characteristic	Description
Project Type	The project type is important in determining the utility of the data (Figure 4-1; Table 4-3). Project types include (in descending order of utility): WET, TEM, TEMNSS, NEM, SEI, EXC, PEM, BEM.
Completion Date	Older projects typically only mapped to wetland class not site association; Older projects are reflective of disturbance since mapping, which may require updating.
Survey Intensity Level	Projects with higher survey intensity (e.g. SIL 1) will typically have more detailed mapping. SIL (in descending order of survey intensity): 1, 2, 3, 4, 5, R.
Mapping Scale	Mapping scale is important for selecting data or determining appropriate end use of the mapping data (Figure 4-1). Larger scale mapping (e.g. 1:5,000 to 10,000) is preferred for use at Site and Local scale ranges and will have more detailed wetland delineation which will, in part, determine the final accuracy and use of the mapping. However, smaller scale mapping (e.g., 1:20,000) is common and can provide information for use at a regional scale range. Smaller scale mapping (1:250,000 or greater) can be appropriate for use at a Landscape or Provincial scale ranges and uses.
Imagery Quality	Imagery resolution and colour versus black and white imagery should be considered. Lower resolution imagery reduces mapping spatial accuracy and limits interpretation of wetland characteristics and subsequent assignment of attributes. Black and white imagery limits the interpretation of wetland characterises and attributes as vegetation identification is more limited due to the difficulty in interpreting differences in shading compared to differences in vegetation colour available in colour imagery (Andrew 2024).
Imagery Date	Imagery age and the season in which the imagery was collected can affect the results of the original mapping. Mapping based on older imagery will not reflect recent natural and anthropogenic disturbances that may affect wetland extent. The season in which the imagery was collected will affect the interpretation of wetland extent and wetland class due to seasonal differences in water levels (Andrew 2024).
Image Type	The image type or format (e.g., digital aerial imagery, hard copy aerial imagery, orthophoto, satellite) will affect the spatial accuracy and accuracy of wetland classification.
Software used in Viewing Imagery During Mapping	Software used to view and map ecosystems can includes 3D stereo capable programs (Purview, Summit Evolution) and Geographic Information Systems (ESRI ArcMap, QGIS) that allow only 2D mapping. 3D mapping provides a significant increase in spatial accuracy and wetland identification, especially for wetlands that are defined by topographic features, and provides more information to characterize wetland attributes such as vegetation height compared to 2D viewing software.
LiDAR	Use of LiDAR can improve delineation of wetland extent and may be helpful during interpretation of some wetland classes (e.g., floodplains) but is generally not useful for wetland classification.
Project Documentation	Detailed project documentation and descriptions of ecosystems assists in cross-walking wetlands, particularly for older TEI projects where user defined mapcodes may have been used in the absence of wetland descriptions included in the LMHs.
Land Management Handbook (LMH)	The age of the LMH and the classification may affect wetland class cross-walking unless LMH 52 was used for classification. Newer LMH guidebooks provide improved wetland classifications that align with LMH 52.

4.2 Evaluating Different TEI Products

A variety of ecological mapping products exist in BC that may be suitable for cross-walking to the CNWI. All spatial layers that are available for viewing in iMapBC, and downloadable through the BC Data Catalogue, are derived products of the TEI data distribution package. It is recommended to download the Data Distribution Package for the region of interest. The distribution packages include a project boundaries layer, short table, long table, and domain tables. Please note, the public facing distribution package is only recent up until the last load date. For the most up to date projects, it is recommended to send a shapefile of the area of interest to TEI_mail@gov.bc.ca to ensure the most up to date resources. A TEI sheet describing the different access locations and tools can be found at: TEI_Info_Sheet.pdf.

Evaluating the suitability of TEI products for cross-walking depends on the type of TEI product, project methods, scale, and the end use of the cross-walked data. The types of TEI product and general limitations for cross-walking are summarized in Table 4-3.

Table 4-3. Types of ecosystem mapping in British Columbia (listed in descending order of utility).

Acronym	TEI Product	General Limitations for Wetland Mapping
WET	Wetland Mapping	Specific mapping for wetlands. Some inconsistency in mapping standards across the province. A good choice for wetland cross-walking. Typically conducted at a scale of 1:5,000 to 1:10,000.
TEM	Terrestrial Ecosystem Mapping	Includes bioterrain and structural stage. Suitable for wetland cross-walking but requires assessment. Typically conducted at a scale of 1:20,000 but may be 1:5,000 to 1:10,000.
TEMNSS	Terrestrial Ecosystem Mapping without Structural Stage	Includes bioterrain but not structural stage. Suitable for wetland cross-walking but requires assessment. Assigning CNWI Surface Cover is not possible as structural stage is not recorded. Typically conducted at a scale of 1:20,000 but may be 1:5,000 to 1:10,000.
NEM	Terrestrial Ecosystem Mapping without Bioterrain	No bioterrain but includes structural stage. Typically, 1:20,000 but may be larger scale. Suitable for wetland cross-walking but requires assessment. Typically conducted at a scale of 1:20,000 but may be 1:5,000 to 1:10,000.
NEMNSS	Terrestrial Ecosystem Mapping without Bioterrain or Structural Stage	No bioterrain or structural stage. Typically, 1:20,000 but may be larger scale. Assigning CNWI Surface Cover is not possible as structural stage is not recorded. Suitable for wetland cross-walking but requires assessment. Typically conducted at a scale of 1:20,000 but may be 1:5,000 to 1:10,000.
SEI	Sensitive Ecosystem Inventory	Rare and sensitive ecosystems mapping but simplified classification system (less information to cross-walk to CNWI). Typically conducted at a scale of 1:5,000 to 1:20,000.
EXC	Exceptions Mapping	Typically completed to support PEM by mapping ecosystems that are poorly mapped in PEM. Could provide a source for cross-walking wetland data. Requires thorough assessment. Typically conducted at a scale of 1:5,000 to 1:10,000 but may be smaller scale.
PEM	Predictive Ecosystem Mapping	Model generated raster, pixels or polygons – poor at capturing unusual and spatially limited ecosystems (e.g., wetlands). Typically conducted at a scale of 1:20,000 to 1:50,000.

Acronym	TEI Product	General Limitations for Wetland Mapping
BEM	Broad Ecosystem Mapping	Interpretative base map for landscape level planning such as timber supply areas, land and resource management plans, and regional wildlife plans. Not useful for cross-walking to wetland class and lacks spatial accuracy as scale is typically 1:250,000.

Figure 4-1. BC TEI Product Suitability for Cross-walking to the Canadian National Wetland Inventory

Examples of Product Uses (original intent of mapping)

- Management of ecosystem and wildlife habitat features, small-ranging species, uncommon and small-patch habitat
- Identify and display small and uncommon ecological features that are difficult to map across the entire region
- Critical Habitat designations
- Average polygon size is typically less than 6 hectares
- Often associated with a high survey intensity level (i.e., greater than 25% of polygons field verified – SIL 1 to 3)

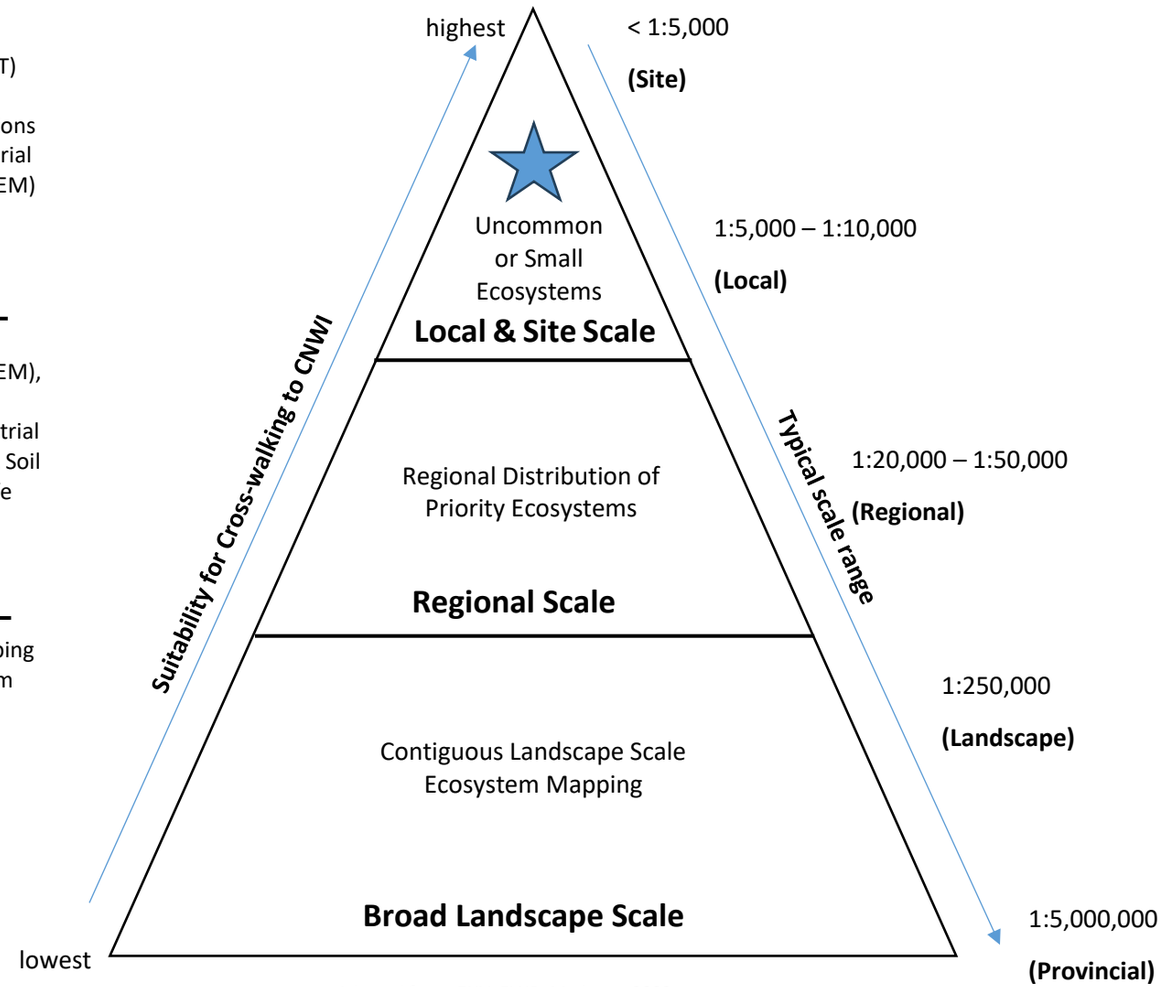
- Wetland Mapping (WET) Sensitive Ecosystem Inventory (SEI), Exceptions Mapping (EXC), Terrestrial Ecosystem Mapping (TEM)

- Map and model the distribution of regional priority ecosystems
- Informs specific valued components for cumulative effects
- Establish zoning and development permit areas for local government
- Medium size study area (e.g., Tree Farm License (TFL) area, landscape unit, community watershed, provincial parks and large conservation lands)

- Ecosystem Mapping (TEM), Predictive Ecosystem Mapping (PEM), Terrestrial Terrain Mapping (TER), Soil Mapping (SOIL), Wildlife Habitat Ratings (WHR)

- Management of wide-ranging species and matrix ecosystems
- Complete seamless TEI mapping database with up-to-date structural stage covering the entire region
- Map and model habitat characteristics such as ecosystem representation, patch size, edge habitat, fragmentation, connectivity, etc.
- Provide a spatial framework for predicting ecosystem change in response to climate change, land use, and other threats to wildlife
- Large study areas (e.g., Timber Supply Area (TSA), province-wide, Natural Resource Sector (NRS) regions)

- Broad Ecosystem Mapping (BEM), Broad Ecosystem Inventory (BEI), Broad Ecosystem Mapping Vegetation Resource Inventory (BEMVRI)



Adapted from: ENV, FLNR, Madrone. 2022. Strategic Plan for Kootenay Boundary Region: Ecosystem Mapping to Support Wildlife and Habitat Stewardship.

4.3 Date of Existing TEI Products

The date or age of existing TEI mapping may be a limiting factor and should be considered when evaluating the suitability of mapping for cross-walking. The consideration of wetlands in ecosystem mapping has changed over the previous decades. Greater consideration has been placed on mapping and classifying wetlands in products such as the CNWI, WET, and TEM. It is more likely that attributes required to cross-walk wetlands to the CNWI will be present in newer than older mapping. The determination of whether existing mapping is suitable to be cross-walked must be made on a case-by-case basis, preferably with an ecologist familiar with the mapping or the ecosystems and BGC units in the mapping.

Ephemeral attributes in the mapping, such as structural stage, may need to be updated, and older projects will not reflect more recent disturbances such as road construction or logging. Active riverine systems are also subject to frequent change as new channels establish and flooding alters the type and extent of adjacent ecosystems. Evaluation of the existing mapping accuracy should be conducted using newer imagery to assess if updates are required.

In cases where updates to existing TEI data are made, the TEI staff should be contacted (TEI_Mail@gov.bc.ca) to discuss the edits and allow for updates to existing data.

4.4 Imagery Date, Type, and Resolution

The age, type, and resolution of imagery used in the mapping is important to consider when assessing if existing wetland mapping is suitable for cross-walking, if the mapping can be updated, or if new mapping is a preferable option.

4.4.1 Imagery Date and Season

The age of imagery is an important consideration, particularly for active riverine systems subject to change. Recent imagery should be preferred with imagery greater than 10 years of age avoided if possible. Exceptions to this include areas where limited change to wetland extent and class is expected and anthropogenic and natural disturbances are less likely to have affected wetlands. Mapping that uses older imagery can be verified by comparing this to new online imagery such as Google Earth™, BING™, or ESRI Base Map data™ to determine if the older imagery accurately represents the current conditions. Where the age of imagery is difficult to determine, ERSI has a website that provides a digital archive of world imagery created over time that is useful for identifying imagery back to 2014 [World Imagery Wayback (arcgis.com)].

The time of year when imagery was captured may affect wetland mapping. Imagery date will reflect seasonal water levels, particularly for riverine systems or those that experience substantial annual changes in water level. These annual changes can alter the extent of open water and interpretation of the classes and extent of floodplains, swamps, fens, marshes, and shallow open water wetlands. In addition, interannual differences in timing and flooding extent occur based on annual differences in snowpack, rainfall, and temperature may affect mapping of wetland class and extent.

4.4.2 Imagery Types

3D Stereo Imagery – 3D stereo imagery is typically taken using low flying planes or drones (Airphotos), although some imagery may be available from satellites, it is generally of poor resolution. Stereo imagery is viewable using photogrammetry programs such as Purview or Softcopy. In aerial photography, the photo frames overlap each other by around 60%. When two overlapping photos are used, the two perspectives permit the mapper to view the imagery in 3D. The two overlapping images are known as a stereo pair. It allows the mapper to see the topographic relief and vegetation height and improves delineation of bioterrain features and interpretation of ecosystem attributes. It is the highest quality imagery and can dramatically improve mapping accuracy.

Orthophotos – Orthophotos are the least expensive and the most available imagery type. Orthophotos are typically collected using planes or drones and may be created using the same airphotos used in stereo imagery. Whereas overlapping images must be taken for stereo imagery, less overlap is required if only orthophotos will be created because overlapping perspective is not required.

The imagery used to create orthophotos must be georeferenced (aligned so it matches features on the earths surface to be spatially correct) and can be used to create orthomosaics (groups of airphotos that appear as one image).

Orthophotos are the source of publically available imagery such as Google Earth™, BING™, or ESRI Base Map data™. Because it is ubiquitous, more recent imagery is often available in this format. However, orthophotos are two dimensional and they do not provide the mapper with information to interpret topography and landscape position accurately. This is an impediment to accurately mapping ecosystems such as floodplains or incised features such as riparian ravines that commonly contain forested swamps. 2D imagery also limits the accurate mapping of structural stage based on vegetation height. Some of these limitations may be overcome using Light Detection and Ranging (LiDAR), which allows for the mapping of topographic features and can be used to determine vegetation height for structural stage mapping.

Drone Imagery – Drone imagery is collected using low flying drones and provides an excellent base on which to conduct wetland mapping. Drone imagery can be taken to create orthophotos or stereo imagery. Because of the low height at which the imagery is taken, the resolution of the imagery can allow for the identification of plant species and reliable wetland delineation and classification.

It does have similar limitations to orthophotos with respect to interpreting topography. However, drone imagery can also be collected as 3D stereo imagery and used in a photogrammetry program if the correct imagery is taken, and software is used to convert the imagery to matching stereo pairs. Drone imagery is suitable for relatively small areas where suitable airphoto imagery is not available. Acquiring imagery for large areas, is often not feasible because of the limited flying time and number of photos required compared to imagery taken with planes.

Satellite Imagery – Satellite imagery is taken from satellites and is typically of too coarse a resolution for the accurate delineation and interpretation of wetland extent and class. It may be a useful input for modelling or machine-based learning, however.

LiDAR – LiDAR is a typically collected from planes or helicopters. LiDAR is created using a laser to measure the distance to the ground and or vegetation surfaces. These light pulses are combined with other data recorded by the airborne system to create three-dimensional information about the ground (and vegetation) surfaces. LiDAR characteristics can be very useful in conjunction with stereo imagery, drone imagery, or orthophotos. It allows for the accurate delineation of topographic features, especially when mapping floodplain swamps and marshes. Depending on the data collected when the LiDAR was captured, it can also be used to identify vegetation height and structural stage.

4.5 Mapping Scale

Map scale is the area on the ground compared to the area represented on a map. Scale determines the detail that can be mapped and is determined, in part, by scale of the imagery used in mapping.

The scale of the mapping indicates the scale at which it may be used for (e.g., what level of detail the user should expect to be captured in the data). Inherent in the scale of mapping is that the mapping has used imagery of a suitable scale and resolution and that the mapping was done at the scale listed for the mapping product or at a larger scale. For example, 1:20,000 scale TEM is often mapped at scale larger than 1:10,000 because the mapper can ‘zoom’ in on the digital imagery and capture greater detail. In practice, this means that 1:20,000 mapping, especially for cross-walking, can be suitable for wetlands mapping recognizing there are limitations in spatial accuracy and attributes that come with smaller scale mapping. When feasible, larger scales of 1:10,000 or less are more appropriate for wetland specific mapping, especially in wetland complexes or areas where mapping will be used to guide restoration or land use planning.

Consideration of the end use of cross-walked data is important when evaluating the suitability of TEM projects for cross-walking. When the intended use of the data is for site level planning, such as public use planning, restoration, or active conservation management, detailed 1:5,000 to 1-10,000 wetland mapping is required (Table 4-5).

Coarser mapping should be considered when the primary goal of mapping is compilation of a wetland inventory where active management is not considered or landscape planning processes such as Land Resource Management Plans (LRMP).

Because wetland mapping is typically confined to limited areas (versus mapping a whole landscape), the use of the hectares / inspection metric is less useful for assessing survey intensity. For smaller areas, the polygon inspection rate may be more useful for determining the potential accuracy of mapping.

Minimum polygon size is determined when mapping scale is chosen (Table 4-4). Minimum polygon sizes are recommendations to guide mapping, however, actual minimum polygon sizes

may be less than recommended depending on project objectives and mapper preferences. Like mapping scale considerations, minimum polygon size should be evaluated during review of the TEI product to ensure that it meets the end use of the mapping (Table 4-4).

Table 4-4. Minimum Recommended Polygon Size.

Mapping Scale	Minimum Polygon Size (ha; RISC 2023)	Use of Mapping Data
1:5,000	0.5	Wetland restoration, management of ecosystem and wildlife habitat features, small-ranging species, uncommon and small-patch habitat, Critical Habitat designations.
1:10,000	1.0	Wildlife capability, map and model the distribution of local priority ecosystems, zoning and development permit areas for local government, habitat enhancement prescriptions, Critical Habitat designations.
1:20,000	2.0	Wildlife capability, map and model the distribution of regional priority ecosystems, zoning and development permit areas for local government, habitat enhancement prescriptions.
1:50,000	5.0	Wildlife capability; ecosystem representation; local resource planning; landscape management planning, cumulative effects assessment.

4.6 Survey Intensity Level

BC uses a six-class system for determining appropriate Survey Intensity Level (SIL) for ecosystem mapping (Table 4-5; RIC 1998). As the SIL increases in density, confidence in the accuracy of the mapping increases.

SIL 1 has the greatest density of plots; while expensive to complete, it provides the greatest confidence in the accuracy of the final mapping and is recommended for projects such as conservation covenants establishment and restoration planning. SIL 2 is generally recommended for projects that require a high degree of certainty in the mapping. SIL 3 and 4 are typically used for local and landscape level planning and for projects such as habitat suitability / capability mapping. SIL 5 and R (reconnaissance) are used for landscape level planning and are best completed by ecologists with extensive experience in the ecosystems being mapped (RIC 1998).

Cross-walked projects should be evaluated individually to assess their suitability for wetland mapping, keeping in mind that SIL for many TEM projects will be 4 or greater.

4.7 Terrestrial Ecosystem Information Field Inspection Point Data

It may be useful to cross-walk available wetland field inspection point data for TEI projects. TEI Field inspection data is useful for understanding the edaphic conditions and vegetation community composition for individual wetland site units to help build the cross-walk from the BEC system to CNWI classes. TEI Field inspection data may also be used to train machine-based programs in developing predictive ecosystem mapping and to validate machine-based products.

TEI Field inspection data may consist of Ecosystem Field Forms (FS882[2]), Site Visit Forms (SIVI; FS1333), Ecosystem Field Forms (FS882), or Visual Inspections. TEI plot data can be obtained from EcoCat[3] or can be requested from TEI/WLRS through TEI mail. BEC Master data can be obtained from the Ministry of Forests Research / Regional Ecologist. Contact information for BEC Program staff is available on the BEC Web site[4].

[2] Terrestrial ecosystem data standards and guidelines - Province of British Columbia

[3] EcoCat Ecological Reports Catalogue - Province of British Columbia

[4] BEC WEB

Table 4-5. Survey intensity levels for ecosystem mapping, mapping scales, and TEI field inspection density (adapted from RIC 1998)

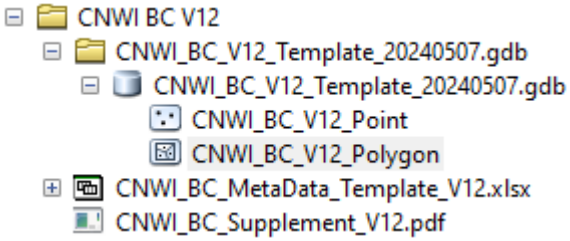
Survey Intensity Level	Percentage of Polygon Inspections	Ratio of Full Plots: Ground Insp.: Visual Checks[5]	Suggested Scales	Range of Study Area (ha)	Hectares per Inspection[6]				Use of Mapping Data
					1:5,000	1:10,000	1:20,000	1:50,000	
1	76-100	2:15:83	1:5,000-1:10,000	20-500	0.9-1.2	3.8-5	15-19	91-120	Wetland restoration, management of ecosystem and wildlife habitat features, small-ranging species, uncommon and small-patch habitat, Critical Habitat designations.
2	51-75	3:17:80	1:10,000-1:20,000	100-10,000	1.3-1.8	5.1-9	20-29	121-178	Wildlife capability, map and model the distribution of local priority ecosystems, zoning and development permit areas for local government, habitat enhancement prescriptions, Critical Habitat designations.
3	26-50	5:20:75	1:10,000-1:50,000	5,000-50,000	1.9-3.7	8-14	30-59	182-350	Wildlife capability, map and model the distribution of regional priority ecosystems, zoning and development permit areas for local government, habitat enhancement prescriptions.
4[7]	15-25	5:20:75	1:20,000-1:50,000	10,000-500,000	3.8-6.3	15-25	60-100	364-607	Wildlife capability; ecosystem representation; local resource planning; landscape management planning, cumulative effects assessment.
5[8]	5-14	5:20:75	1:20,000-1:50,000	10,000-1,000,000	6.4-17	26-76	101-302	650-1820	Wildlife capability; ecosystem representation; local resource planning; landscape management planning, cumulative effects assessment.
R[9,10]	0-4	0:25:75	1:20,000-1:50,000	50,000-1,000,000+	18-94+	77-370+	303-1500+	2275-9100+	LRMP, Regional planning; broad landscape management planning.

[5] Inspection ratios are guidelines; actual project ratio should be set by project ecologists responsible for administering project.
[6] Values are guidelines only and are based on an average polygon size of 9-16 ha.
[7] Survey intensity level recommended for most mapping. This provides a reasonable balance of cost and reliability.
[8] Survey intensity level recommended when Level 4 is too costly and lower reliability is acceptable.
[9] Survey intensity level recommended when Level 4 is too costly and lower reliability is acceptable.
[10] Level R (reconnaissance) ecosystem mapping should only be conducted by ecologists who have considerable field experience in the ecosystems of the study area.

5. Cross-walking Methods

The following sections describe the methods to cross-walk TEI BEC mapping products and TEI Field Inspection data to the CNWI. The process and methods used to cross-walk the date were developed during meetings with CWS and WLRS staff as part of initial cross-walking projects (Blackwell 2023; Madrone 2024). The process of cross-walking does not involve updates or alterations to the input TEI data.

Prior to beginning a cross-walking project, ECCC should be contacted[11] and the most recent templates acquired. The templates will include spatial data, metadata, and the most recent CNWI BC Supplement:



A comprehensive summary table is being developed to document existing cross-walking wetland site associations from BC TEI products to the CNWI to inform future cross-walking projects. This will be included in future version of the Terrestrial Ecosystem Information (TEI): Ecosystem Mapping Code List (TEI 2024). This list was compiled based on initial cross-walking completed in 2022 and 2023 (Blackwell 2023; Madrone 2024) and updates by WRLS staff. The cross-walked wetlands in this list are not authoritative and other wetland classes may be appropriate based on the characteristics of individual wetlands. The list of existing cross-walked wetlands includes the CNWI Wetland Class, Secondary CNWI Class (in cases where wetland has been cross-walked into more than one CWCS class), and relevant metadata.

A standardized Wetland Cross-walking Documentation Excel table was designed to record the wetland cross-walking completed for each project. This table must be completed and submitted for each cross-walking project (see Appendix 2 for example table). The intent of the cross-walk documentation summary table is to provide guidance for future cross-walking projects as the data will be used to update the Ecosystem Mapping Code List (TEI 2024). The attributes in the table include:

- Biogeoclimatic Label (BGC_LBL)
- Site Series (SITE_S)
- Site Series Name
- Realm (REALM)

[11] Contact information is available at Canadian National Wetlands Inventory - Canada.ca

- Group (GROUP)
- Class (CLASS)
- Source (LMH or Project name when project specific codes have been cross-walked)
- BAPID (BAPID number for the source wetland data)
- Primary CWCS Class (Most commonly assigned wetland class for a site unit)
- Secondary CWCS Class (Secondary wetland class if more than one assigned for a site unit)
- Comments

5.1 Cross-walking Polygon Data to the CNWI Schema

To cross-walk TEI data, it is important to review the project reports as well as identifying the relevant LMH that were used. Often codes used in field data are project specific and should be summarized in the project reports, particularly for older TEI projects.

The following sections outline the methods that can be used to cross-walking BEC polygon data to the CNWI. The products that are required to be delivered include:

1) Lookup Table;
2) Cross-walking Documentation Table (Appendix 2);
3) *BAPID_TEI_Long_Tbl_Cross.gdb* that contains the source Long Table data combined with the attributes cross-walked that are derived from the long-table;
4) Source *Operational_Data_XXXX.gdb*; and
5) *CNWI_BC_V12_Template_20240507.gdb* attributed according CNWI schema for polygon data.

Each BAPID that is cross-walked should be in a separate .gdb. The TEI Long Table and *CNWI_BC_V12_Template_20240507.gdb* files can be joined using the *Project Polygon Identifier* column which is a combination of BAPID and Polygon Number.

5.1.1 Terrestrial Ecosystem Information Long Tables

The input data for most cross-walking will be in the TEI Operational Data. The database structure used by ecosystem mapping projects, such as TEM, are provided by the Ministry of WLRS in their contractor package (WLRS 2023). The operational data is stored as a geodatabase file (.gdb) includes numerous tables as well point, polygon, line, and domain files (Figure 5-1).

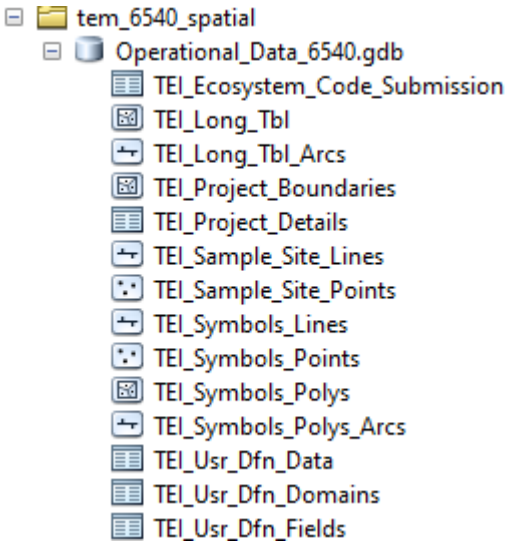


Figure 5-1. Example of TEI Operational Data files.

The main database used by ecosystem mapping projects is the TEI_Long_Tbl. The long table contains most of the data that can be used to cross-walk ecosystem mapping data to the CNWI. It is important to understand which fields have been attributed in the TEI_Long_Tbl when developing a cross-walk as these will determine what attributes in the CNWI can be filled in.

Appendix 1 provides an abbreviated data dictionary for the TEI long table that includes the fields most useful for cross-walking to the CNWI and includes some guidance on how these can be used to cross-walk the data (e.g., what TEI long table field can be used to populate a CNWI field).

The CNWI attributes that may be filled in using the TEI_Long_Table and those that are not always recorded and should be reviewed are detailed in Table 5-1.

The other files that may be of use include TEI_Project_Details, TEI_Sample_Site_Points, and TEI_Usr_Dfn_Fields. The TEI_Project_Details or Project Boundary files contains useful information for populating some of the CNWI schema 12 attributes (Table 5-1) as well as the required metadata file. The TEI_Sample_Site_Points contains the spatial data that the field data can be linked to. TEI_Usr_Dfn_Fields contain codes and descriptions of new fields or codes that may have been used in specific TEI products. Field data is supplied in non-spatial separate files.

Table 5-1. CNWI Schema V12 attributes that may be completed using TEI Project Details and TEI Long Tables.

	Information Source		
CNWI Schema V12	TEI_Project_Details	TEI_database	Comment
Source Title	Source title of the database	TEI Project Details: Project Name	
Source Org	Name of the organization that completed the wetland mapping	TEI Project Details; Consultant or Organization	

CNWI Schema V12	Information Source TEI_Project_Details	TEI_database	Comment
Business Area Project ID	Project identifier assigned by the Ministry of Environment, Ecosystem Information Section	TEI Long Table: BAPID	
Project Polygon Identifier	Field to link the data back to the BC source dataset	TEI Long Table: Project Polygon Identifier	
TEIS Primary ID	Field to link the data back to the BC source dataset	TEI Long Table: TEIS Primary Key	
Project Type	Indicates if the data was existing and cross-walked for newly collected for the CNWI in BC	TEI Long Table: Project Type	
Date Created	Date the linework was created, i.e., the date that the polygon was mapped and created, and/or validated by imagery on desktop	TEI Project Details: Project Completion Date	
Validation Method and Type	Type of independent validation completed on a wetland polygon	TEI Project Details: Field Check of Polygon Field Site Number or Plot Number	
Date Validate	Date that the field validation work was performed	TEI Project Details: Date Surveyed	
Wetland	Identify if the polygon or point is a wetland or non-wetland	TEI Long Table: Site Series Number of Ecosystem Component 1-3; Sensitive Ecosystem Label of Ecosystem Component 1-3. Site Series Map Code of Ecosystem Component 1-3	
CNWI BC Wetland Class	Wetland class	TEI Long Table: Site Series Number of Ecosystem Component 1-3; Sensitive Ecosystem Label of Ecosystem Component	Sometimes not reported: Sensitive Ecosystem Label

CNWI Schema V12	Information Source TEI_Project_Details	TEI_database	Comment
		1-3. Site Series Map Code of Ecosystem Component 1-3	
Source Wetland Class	Type / classification of wetland used if the source database		Project report
Surface Cover	Dominant surficial cover features based on the general physiognomy of the cover	TEI Long Table: Structural Stage of Ecosystem Component 1-3	Sometimes not reported
System	Description of wetland hydrology		Not reported
Hydroperiod	Amount of time that water is held on the surface of the wetland in a typical year		Not reported
Tidal	Indicates if wetland influenced by tides	TEI Long Table: Site Series Number of Ecosystem Component 1-3, and Realm of Ecosystem Component 1-3	Sometimes discernible using fundamental characteristic of a Site unit; Estuarine Realm can be used; Sensitive Ecosystem Label (e.g. Eel grass, tidal flats)
Salinity	Indicates if wetland influenced by salinity	TEI Long Table: Site Series Number of Ecosystem Component 1-3, and Realm of Ecosystem Component 1-3	Sometimes discernible using fundamental characteristic of a Site unit; Estuarine Realm can be used; Sensitive Ecosystem Label (e.g. Eel grass, tidal flats)
Soil Type	Broad categories of soil characteristics	TEI Long Table: Surficial Material of Terrain Component 1-3; Surface Expression 1 of Terrain Component 1-3; Surface Expression 2 of Terrain Component 1-3	Only in projects with Bioterrain mapping
Permafrost	Ground (soil and/or rock) that remains frozen throughout multiple years	TEI Long Table: Geomorphological Process and Subclass	Sometimes discernible using Permafrost Process 'X' code if active processes observable
Alpine/Subalpine	Identifying wetlands and ecosystems in alpine, or high	TEI Long Table; Biogeoclimatic Unit Label	

CNWI Schema V12	Information Source TEI_Project_Details	TEI_database	Comment
	elevation mountainous terrain		
Nutrients	Broad categories of wetlands based on nutrient availability and pH characteristics		Not reported
Woody Vegetation Canopy Cover	Percent canopy coverage of woody vegetation (trees and shrubs)	TEI Long Table: Tree Crown Closure of Ecosystem Component 1-3; Shrub Crown Closure of Ecosystem Component 1-3	Often not reported; doesn't align well because of differing heights used to categorize shrubs and trees
Woody Vegetation Height	Categorization of the height of woody vegetation		Not reported
Woody Vegetation Type	Type of woody vegetation	TEI Long Table: Stand Composition Modifier of Ecosystem Component 1-3	Often not reported
Herbaceous Type	Categorization of the type of vascular herbaceous vegetation		Not reported
Bryophyte or Lichen Vegetation Type	Categorization of the type of bryophytes or lichen vegetation		Not reported
Impact	Categorization of the type of impact	TEI Long Table: Site Disturbance Label of Ecosystem Component 1-3	Often not reported
Hectare	Polygon area in hectares	TEI Long Table: Shape_Area	Can be calculated
Shape_Length		TEI Long Table	
Shape_Area		TEI Long Table	

[1]*See Appendix 1 for the attributes in the TEI_Long_Table that may be used in cross-walking to the CNWI schema.*

5.1.2 Cross-walking TEM Polygon Attributes

To cross-walk the data, 'all possible combinations' tables should be prepared from the TEM datasets based on Biogeoclimatic unit, Site Series, Structural Stage, and Mapcode (for older projects). These 'all possible combinations' form the basis for lookup tables that are then used to cross-walk the BEC datasets to the CNWI (Table 5-2).

These lookup tables should be included as .xlsx files in the deliverables. Appendix 1 provides a database dictionary that outlines the basic structure of a TEI Long Table database used for ecosystem mapping projects like TEM. Appendix 1 shows which attributes in the TEI long table may be useful for cross-walking to the CNWI. A complete list of ecosystem site series codes for BC is provided by the TEI Unit (TEI 2024).

A lookup table (LookupTable_BAPID#.xlsx) should be created using the following attributes from the TEM data:

1. Biogeoclimatic Unit (BGC_VLD; BGC unit);
2. Mapcode (SITEMC_S1 to S3; older projects);
3. Site Series (SITE_S1 to S3); and
4. Structural stage (STRCT_S1 to S3).

General descriptions should assigned to each of the combinations in the lookup table (e.g., Forested Bog, Forested Site Series, Beach) to provide a simple way to check coding of the final federal wetland class. The next step is to assign the CNWI Wetland Class to each combination of BGC/Site Series (Mapcode) / Structural Stage (Table 5-2).

Where possible, Surface cover (in cases where structural stage is not recorded), System, and Tidal columns should be classified in the lookup table according to the current CNWI data dictionary schema for each site series based on inherent characteristics. For example, Em02 are tidal marshes with herbaceous plant communities, these occur in marine systems that have tidal influences and are typically associated with estuaries. Table 5-2 is an excerpt from an example lookup table and shows the classifications for various site series.

Prior to cross-walking the TEM data, a review should be conducted with the TEI group, Regional Ecologist, or ECCC of the final cross-walking decisions and discussion of problematic ecosystems that do not cross-walk easily from the BEC site series to federal wetland classes (discussed in Section 5.2.2).

Table 5-2. Excerpt from a cross-walk table lookup table.

BGC unit	Site series	Description	Wetland Class	Surface Cover	System	Tidal
CWHwh1	115	Goldthread	Swamp	Not Reported	Not Reported	Non-tidal
CWHwh1	116	Forested site series	Non-wetland	Not Reported	Not Reported	Non-tidal
CWHwh1	118	Forested swamp	Swamp	Not Reported	Not Reported	Non-tidal
CWHwh1	Bb02	Beach	Non-wetland	Not Reported	Marine	Tidal
CWHwh1	Br	Rocky Headland	Non-wetland	Not Reported	Marine	Tidal
CWHwh1	Em02	Marine Estuary Wetland	Marsh	Herbaceous	Marine	Tidal
CWHwh1	ES	Exposed Soil	Non-wetland	Exposed sediment	Not Reported	Non-tidal
CWHwh1	Et	Estuarine tidal flats	Shallow water	Exposed sediment	Estuarine	Tidal
CWHwh1	UR	Urban	Non-wetland	Anthropogenic	Not Reported	Non-tidal

BGC unit	Site series	Description	Wetland Class	Surface Cover	System	Tidal
CWHwh1	Vh	Avalanche herb	Non-wetland	Herbaceous	Not Reported	Non-tidal
CWHwh1	Wb51	Wetland bog	Bog	Not Reported	Palustrine	Non-tidal
CWHwh1	Wb511	Wetland bog	Bog	Shrub	Palustrine	Non-tidal
CWHwh1	Wb512	Wetland bog	Bog	Treed	Palustrine	Non-tidal

The remaining classes in the geodatabase from the CNWI schema can be attributed using a separate Rules table (Table 5-3). The Rules table is used to identify the source or value for each CNWI attribute. The source is typically identified as either the lookup table, TEI Long Table, or contains the value to be entered in the CNWI attribute. Specific values are included in cases where the values are either not reported (e.g., Impact) or have the same attributes for all polygons (Feature Date Created). For example, Validation Type in the CNWI schema should be coded using the SMPL_TYPE field in the TEM that identifies the type of data used to attribute the TEM polygon (e.g., Ground Inspection, Visual Inspection, or Air Photos interpretation).

TEM data has up to three site series that are accounted for as deciles (1 to 10) within a polygon. For example, a polygon with an area of 10 ha may have 70% of one site series (7 ha), 20% of a second site series (2 ha), and 10% of a third site series (1 ha). However, the CNWI schema allows for only one wetland class for each polygon. Because of this, cross-walking must consider how multiple site series in a polygon should be cross-walked to a single federal wetland class.

To address this issue, a set of interim TEM-derived attributes shown in Table 5-4 should be added to the TEI Long Table. This interim table should be named *BAPID_TEI_Long_Tbl_Cross* and must be included as a deliverable to document the process and results of how multi-decile polygons were classified.

Table 5-3. Example of a rules table used to assign attributes to the CNWI schema geodatabase that are not included in the lookup table.

CNWI Schema V12	Description	CNWI Schema V12	Description
Source Title	Area1_Cross-walk	**Hydroperiod**	Not reported
Source Organization	MOE	**Tidal**	Lookup Table
Project Type	Cross-walk	**Salinity**	Lookup Table
Business Area Project ID	9999	**Soil Type**	Not reported
Project Polygon Identifier	Source TEI_Long_Tbl: PROJPOLYID	**Permafrost**	Not reported
TEIS Primary Key	Source TEI_Long_Tbl: TEIS_ID	**Alpine/Subalpine**	Lookup Table
Feature Date Created	2020	**Nutrients**	Not reported
Validation Type	Source TEI_Long_Tbl: SMPL_TYPE	**Woody Vegetation Canopy Cover (%)**	Not reported
Validation Date	2019	**Woody Vegetation Height (m)**	Not reported

CNWI Schema V12	Description	CNWI Schema V12	Description
Wetland or Non-wetland	Lookup Table	**Woody Vegetation Type**	Not reported
CNWI BC Wetland Class	Lookup Table	**Herbaceous Vegetation Type**	Not reported
Source Wetland Class	LMH 52	**Bryophyte or Lichen Vegetation Type**	Not reported
Surface Cover	Lookup Table; Source TEI_Long_Tbl: STRCT_S1_S3	**Impact**	Not reported
Hydrological System	Lookup Table	**Hectare**	Calculated

Using the lookup table, the site series within a polygon (Site Series or Mapcodes 1 to 3) are cross-walked to the correct federal wetland class in the *BAPID_TEI_Long_Tbl_Cross, and assigned a percentage based on the corresponding ecosystem decile (SDEC_1 to 3)*. This may result in up to three federal wetland classes within a polygon. The deciles for any federal wetland class must add up to 80% or greater for the polygon to be considered wetland (e.g., 60% swamp and 20% marsh). If this condition is not met the polygon should be assigned “Non-wetland”. Where the deciles add to 80% or greater for a single federal wetland class (e.g., 80% swamp), that class should assigned to the polygon. Where the wetland deciles add to 80% or greater, but no single federal wetland class reaches 80% or greater, the polygon should be assigned “Mixed”. Table 5-4 shows an overview of the interim fields that should be added to the TEI GIS database to calculate wetland class and provides example classifications based on the deciles of each site unit. The 80% threshold was selected to ensure pure or nearly pure wetland polygons which may be used as an input for machine-based learning. When cross-walking structural stage for polygons identified as wetlands, (STRCT_S1 to S3), the Surface Cover should be assigned using structural stage for the dominant wetland class in the polygon.

The final steps of the cross-walking process are to export the CNWI attributes derived from the TEM data into the *CNWI_BC_V12_Template_20240507.gdb* and to assign the remaining attributes based on the rules table (Table 5-3).

Table 5-4. Example of *BAPID_TEI_Long_Tbl_Cross* showing the process and results of the final polygon wetland class using deciles in TEI.

Interim Wetland Attributes Derived from TEM Deciles													CNWI Attributes Derived from TEM				
SITE_S1 Class	SITE_S1 Percent	SITE_S2 Class	SITE_S2 Percent	SITE_S3 Class	SITE_S3 Percent	Non wetland Percent	Wetland Percent	Bog Percent	Fen Percent	Swamp Percent	Marsh Percent	Shallow Water Percent	Wetland Class	Surface Cover	System	Tidal	Validation Method and Type
Non-wetland	60	Non-wetland	30	Swamp	10	90	10	0	0	10	0	0	Non-wetland	Not reported	Not reported	Non-tidal	Air Photos
Non-wetland	80	Swamp	20		0	80	20	0	0	20	0	0	Non-wetland	Not reported	Not reported	Non-tidal	Air Visual Inspection
Bog	100		0		0	0	100	100	0	0	0	0	Bog	Not reported	Not reported	Non-tidal	Air Photos
Bog	80	Swamp	20		0	0	100	80	0	20	0	0	Bog	Not reported	Not reported	Non-tidal	Air Photos
Swamp	60	Non-wetland	20	Bog	20	20	80	20	0	60	0	0	Mixed	Not reported	Not reported	Non-tidal	Air Photos
Non-wetland	80	Non-wetland	20		0	100	0	0	0	0	0	0	Non-wetland	Not reported	Not reported	Non-tidal	Ground Inspection
Bog	70	Swamp	10	Bog	20	0	100	90	0	10	0	0	Bog	Not reported	Not reported	Non-tidal	Air Photos
Bog	40	Swamp	30	Non-wetland	30	0	100	100	0	0	0	0	Non-wetland	Not reported	Not reported	Non-tidal	Air Photos
Swamp	100		0		0	0	100	0	0	100	0	0	Swamp	Not reported	Not reported	Not reported	Air Photos
Fen	80	Non-wetland	20		0	20	80	0	80	0	0	0	Fen	Not reported	Not reported	Not reported	Air Visual Inspection

5.2 Cross-walking the Terrestrial Ecosystem Information Field Inspection Data to the CNWI Schema

BC TEI Field Inspection data is collected using Ecosystem Field Form (FS882), Site Visit Form (FS1333)[12], and visual inspections which vary considerably in the information captured. The Site Visit Form is the most used form for TEI mapping projects, and data is collected on site features, stand attributes, terrain, soil, and vegetation species and cover. The *Field Manual for Describing Terrestrial Ecosystems 2nd Edition* describes the attributes in the site visit form (BC MOF & BC MOE 2023). As there is no required format for visual inspections, these are not discussed as cross-walking must be completed on a case-by-case basis.

The following sections outline the methods that can be used to cross-walking TEI Field Inspection dataBEC point inspection data to the CNWI. The products that are required to be delivered include:

1) Lookup Table;
2) Cross-walking Documentation Table (Appendix 2);
3) *BAPID_TEI_Long_Tbl_Cross.gdb* that contains the source tem_XXXX_eci.mdb data and attributes cross-walked that are derived from the long-table;
4) Source *Operational_Data_XXXX.gdb*; and
5) *CNWI_BC_V12_Template_20240507.gdb* attributed according CNWI schema for point data.

5.2.1 Terrestrial Ecosystem Information Field Inspection Data

The CNWI attributes and the fields on the Ecosystem Field Form and Site Visit Form (Figure 5-3; Figure 5-4) that can be used in cross-walking TEI Field Inspection data to the CNWI are identified in Table 5-5. Many of the CNWI attributes cannot be cross-walked directly using data collected on the forms because of the differences in the definitions of the attributes and those used by the CNWI. The Attributes Cross-walk and Comment columns in Table 5-5 provide guidance on how easily field form attributes can be used cross-walked to the CNWI attributes. The following categories were used:

- Yes/No: Data can or cannot be used to cross-walk form data to the CNWI schema;
- Indirect: Data can be used but must interpreted to be correctly assigned to the CNWI schema (e.g., provincial cross-walk to CWCS wetland class);
- Partial: Data does not align exactly with the CNWI schema attributes, and some attributes will be missed;

[12] BEC WEB (gov.bc.ca)

- Difficult: This primarily refers to the complexity of cross-walking individual plant species percent cover to create summed totals that correlate with Woody Vegetation Type and Herbaceous Type attributes in the CNWI schema; and
- Not Recorded: Data is not collected on the Site Visit Form.

Table 5-5. Cross-walking attributes from the Site Visit Form (FS1333) / Ecosystem Field Form (FS882) to the CNWI schema attributes.

CNWI Attributes	FS1333 / FS882 Fields	Attributes Cross-walk	Comment
Wetland Class	15/19: Site Series	Indirect	Site series (associations) often includes wetland class according to BC classifications but must be cross-walked to CWCS because of classification differences
Surface cover	29/26: Structural Stage 15/19: Site Series	Partial	Structural stage substages and modifiers often not used. Does not cross-walk to some Surface cover classes (e.g. eelgrass). Site series with inherent structural characteristics can be used to derive some Surface cover classes (e.g., Em01 is always herbaceous)
System	15/19: Site Series	Partial	Inherent characteristics of some site series can be used to cross-walk to System (e.g., estuarine site units like Widgeon grass - Em01)
Tidal	15/19: Site Series	Partial	Inherent characteristics of some site series can be used to cross-walk to Tidal (e.g., estuarine site units like Em01 are always tidal)
Salinity	Not Recorded	No	Not recorded; Inherent characteristics of some site series can be used to attribute salinity (e.g. alkaline site units such as alkaline meadows or estuarine site units)
Soil	34/7: Humus Form; 35: Humus Thickness /16: Horizon Layer /17: Horizon Depth	Yes	Can be included cross-walked but requires detailed review of the horizon information on the FS882 form
Nutrients	17/24: Soil Nutrient Regime (SNR)	Indirect	Current definition of nutrients is not well aligned with BC characterization of soil nutrient regime
Wood_Veg_Cover	45/2: % Cover by Layer	No	Wood_Veg_Cover is total cover of woody vegetation. BC divides these into species cover and cover by A tree layers and B shrub layers. A and B layers are not additive (e.g., summation will overestimate total Woody Vegetation Cover)
Wood_Veg_Height	45/2: Percent Cover by Layer	Partial	Woody Vegetation Height is summarized as 0-2 m (B2), 2-10 m (B1). Height of A layer trees is not recorded except in mensuration data which is not commonly collected except on the FS882 form and would be time consuming to cross-walk
Wood_Veg_Type	48/7: Dominant/Indicator Plant Species; 50/8: Percent Cover	Difficult	Could be summarized using tree species and percent cover but this would be a very time-consuming task

CNWI Attributes	FS1333 / FS882 Fields	Attributes Cross-walk	Comment
Herbaceous_Type	48/7: Dominant/Indicator Plant Species; 50/8: Percent Cover	Difficult	Could be summarized using herbaceous species and percent cover but this would be a very time-consuming task
Impact	34/25: Site Disturbance	Partial	Could be used

15/19 indicates field 15 on the FS1333 form and field 19 on the FS882 form.

The input data for some cross-walking may be in the tem_XXXX_eci.mdb and the spatial data for TEI Field Inspection data may be in the TEI_Sample_Site_Point file in the TEI Operational Data. To use the field data, the Vpro64Data_Evn must be joined with the TEI sample points based on the ECI_TAG field.

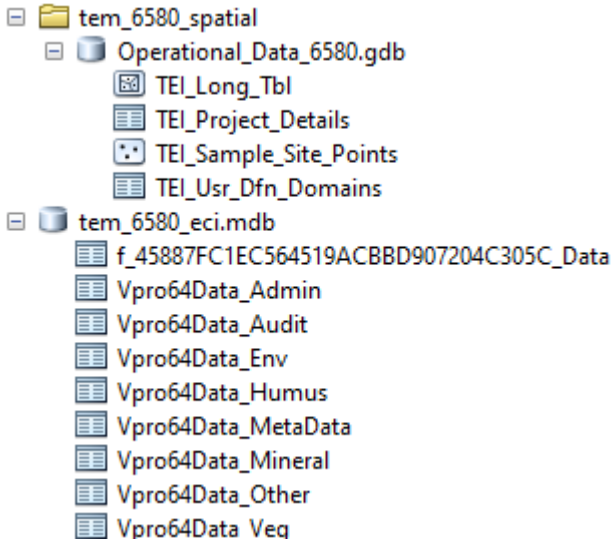
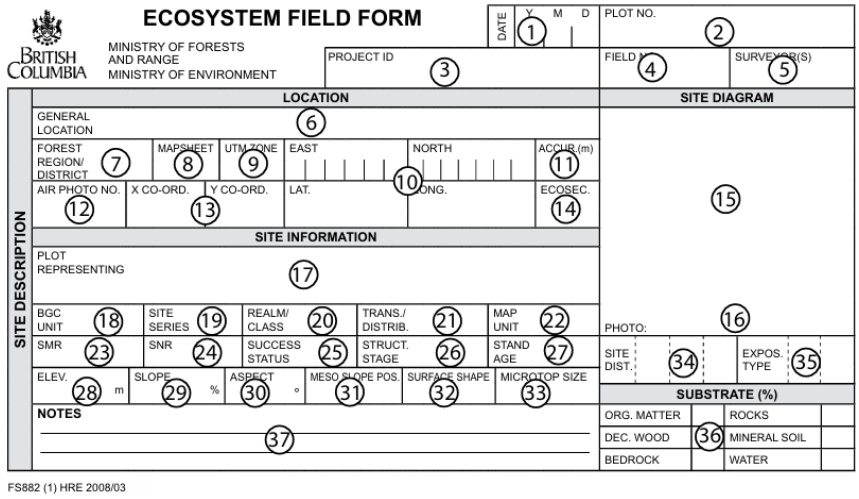
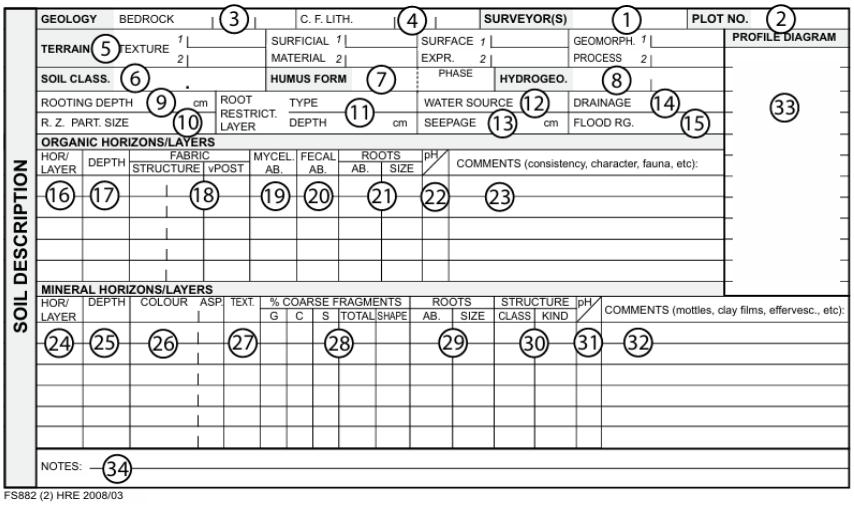


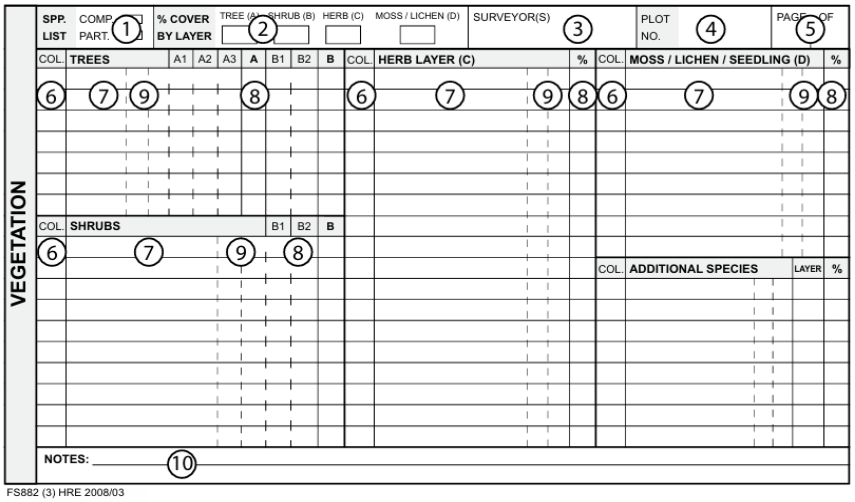
Figure 5-2. Example of TEI Operational Data files related to point features.



FS882 (1) HRE 2008/03



FS882 (2) HRE 2008/03



FS882 (3) HRE 2008/03

Figure 5-3. Ecosystem Field Form FS882

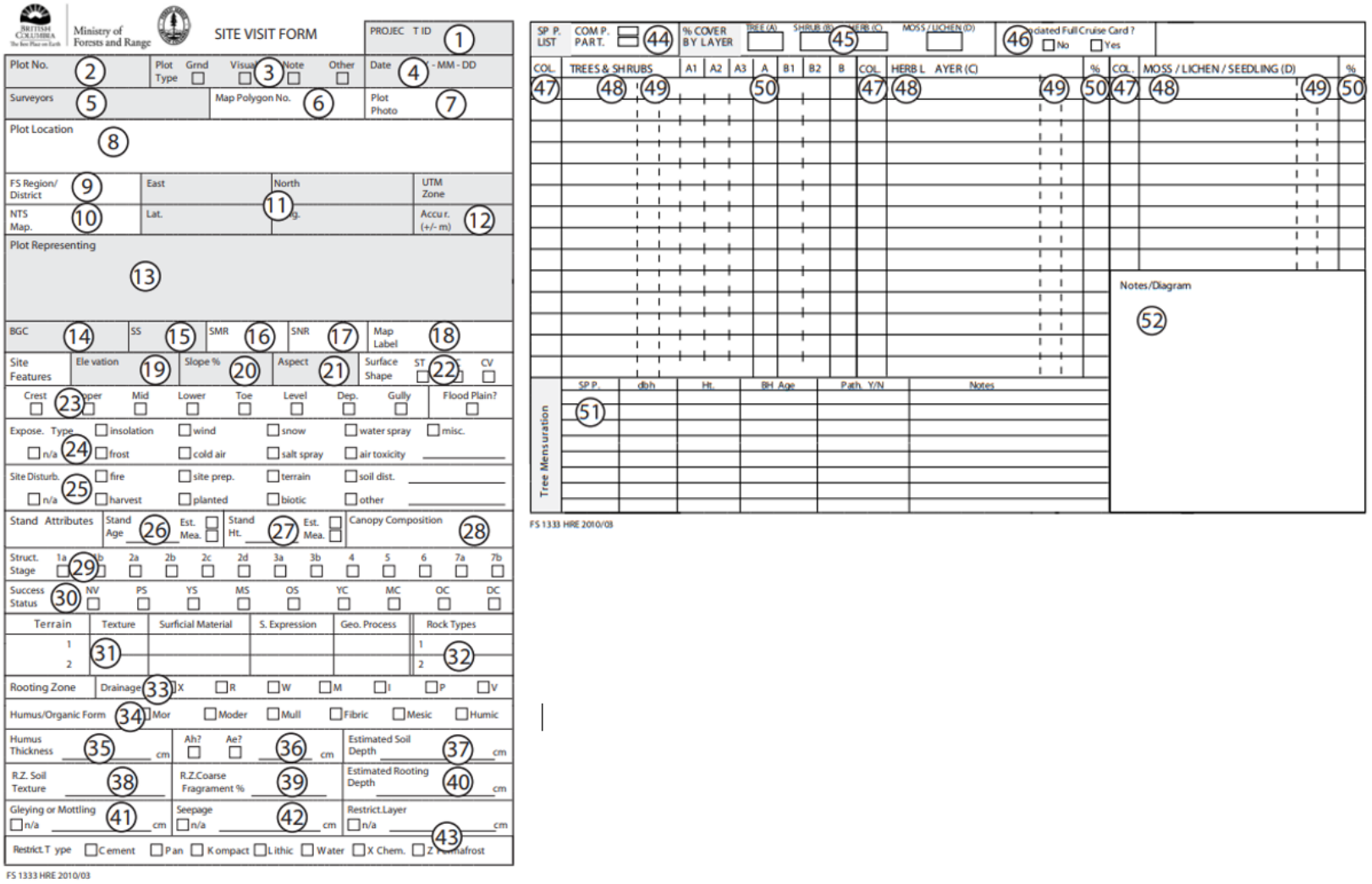


Figure 5-4. Site Visit Form FS1333.

5.2.2 Cross-walking TEI Field Inspection Point Data

To cross-walk TEI Field Inspection data, it is important to review the project reports as well as identifying the relevant LMH that were used. Often codes used in field data are project specific and should be summarized in the project reports, particularly for older TEI projects.

To cross-walk the data, the same process used for polygons is employed. 'All possible combinations' tables should be prepared from the TEI Field Inspection data point datasets based on Biogeoclimatic unit (where relevant), site series / mapcode, and structural stage. These 'all possible combinations' should form the basis for a lookup table.

Descriptions should be assigned to each of the combinations in the lookup table (e.g., Sphagnum-dominated topogenous bog, Swamp wetland, Non-wetland) to provide a method to check coding of the final federal wetland class.

Where possible, System and Tidal columns should be included in the lookup table and classified according to the CNWI data dictionary Schema V12 (or most recent version) for each site series based on inherent characteristics. Table 5-6 is an example from a lookup table and shows the classifications for various site series and mapcodes.

Table 5-6. Example from a cross-walk lookup table.

BGC unit	Site series	Structural Stage	Description	Wetland Class	Surface cover	System	Tidal
All	Em03	HB	Estuarine Marsh	Marsh	Herbaceous	Not reported	Tidal
All	Wf	MF	Fen wetland	Fen	Treed	Not reported	Non-tidal
All	Wm	HB	Marsh wetland	Marsh	Herbaceous	Not reported	Non-tidal
All	Wm	SH	Marsh wetland	Marsh	Shrub	Not reported	Non-tidal
All	Ws	Null	Swamp wetland	Swamp	Not reported	Undetermined	Non-tidal
All	Ws	SH	Swamp wetland	Swamp	Shrub	Undetermined	Non-tidal
All	Ws	MF	Swamp wetland	Swamp	Treed	Undetermined	Non-tidal
CWHvh1	11	OF	CwYc - Goldthread	Swamp	Treed	Undetermined	Non-tidal
CWHvh1	13	OF	Forested site series	Swamp	Treed	Undetermined	Non-tidal
CWHvh2	11	SH	Forested site series	Swamp	Shrub	Undetermined	Non-tidal
CWHvh2	11	YF	Forested site series	Swamp	Treed	Undetermined	Non-tidal

Because the TEI Field Inspection point data requires BGC unit and site series to identify unique site series, the table is too long to show in the report body but is included in Appendix 1

The remaining classes in the CNWI schema should be attributed using a separate Rules table as these are either not reported (e.g. Impact), are assigned the same attributes for each inspection point (e.g., Validation Method and Type), or are attributed using data specific to each field inspection (e.g., Horizon Layer and Depth). Table 5-3 shows and example of a Rules table for polygon data. While the inspection data typically includes tree and shrub cover (A_Layer and B_Layer) which are similar to Wood_Veg_Cover used in the CNWI schema, the differences in the definitions mean that the A and B layer totals would need to be added, which would over-estimate percent cover.

Using the lookup table, TEI Field Inspection data with wetlands should be selected. This selection should be further filtered to select plots in which the primary Site Series recorded was a wetland. ArcGIS scripts should be used to cross-walk the data and complete the CNWI schema (V12 or most recent version) using the template geodatabase format provided by ECCC.

The same standardized Wetland Cross-walking Documentation Excel table used for the polygon data, must be used to record the wetland cross-walking completed for point data. This table must be completed and submitted for each cross-walking project (see Appendix 2 for example table).

6. Meta Data

Meta data is required for cross-walked point or polygon data (Table 6-1). The meta data is recorded in Excel format (CNWI_BC_MetaData_Template_V12). ECCC should be contacted to ensure that the latest version of the template should be used.

Table 6-1. Definitions for Meta-data required for Cross-walked Point and Polygon Data (V12; ECCC 2024).

Column Name	Required or Optional	Description
SRCE_TITLE	Required	Title provided for the source dataset. Should include the property / place name and if the project is a new mapping project or cross-walk project. Generally, it is advised to have different properties / areas, indicated on different rows.
SRCE_ORG	Required	Name of the organization that provided the source dataset.
SOURCE_OBJ	Required	Description of why the inventory was undertaken, e.g. update of an existing wetland inventory, part of a general land-cover inventory, required under policy or legislation.
PARTNERS	Required	Partnering organizations.
PROJECTION	Required	Projection of geodatabase. All BC CNWIC datasets should be in NAD 1983 BC Environment Albers.
COPYRIGHT	Required	Organization holding copyright to the source data.
PERMISSIONS	Required	Restrictions on use and distribution of data. If no restrictions state "open".
PROJECT_TYPE	Required	Indicate if the dataset is a point or polygon-based dataset

COMPLETION_ DATE	Required	The date (or year) the organization completed the wetland work (or end of the project period)
SOURCE_ METHODOLOGY	Required	Document fully the methodology / approaches used for delineation or creation of wetland polygons: e.g., ground inventory, high-resolution air photo interpretation, high-resolution satellite imagery, radiometric and ortho-metric correction of images, details on machine learning algorithms, object-based segmentation rules, etc. other. This should include references or links to specification, classification, or methods documents.
HECTARE	Required	State the total project area in hectares (ha)
HECTARE_ WETANDS	Required	State the total area of wetland polygons in hectares (ha)
IMAGE_TYPE	Required	Type of remote sensing data used in the source dataset (e.g., Landsat, Sentinel-2, RADAR, HR Satellite Imagery, Aerial Photos, other)
IMAGE_DATE	Required	The date (month/year) of remote sensing data acquisition (provide time-stamp for multi-temporal data)
IMAGE_ RESOLUTION	Required	Pixel/cell size of remote sensing data used for delineation or classification (can be multiple values if multiple sources are used)
MINIMUM MAPPING UNIT (MMU)	Required	Minimum mapping unit (in hectares), which is the size of the smallest wetland feature delineated. If a dataset has more than one MMU due to multiple approaches, these must be described.
SCALE	Required	Map scale is a ratio of the distance on a map to the actual distance of the ground. Report the scale used for wetland polygon delineation or classification
COLLECTION_ DATE	Required	Time-stamp that the organization gathered and processed the wetlands information (in case of merged dataset comprising multiple sources – use the project time period of merged product)
VALIDATION_DATE	Required, if validation was performed	The date (or year) of validation or verification work performed. Verification is defined as the process of verifying the presence of wetland feature/polygon. N/A if no validation performed.
VALIDATION_TYPE	Required, if validation was performed	Validation / verification/ type refers to the type of methodology (ground-based, air-based, image-based, mixed, and other) used for verification of the presence of wetland feature/polygon. N/A if no validation performed.
CLASSIFICATION_ACC	Required	Overall wetland classification accuracy (e.g. confusion matrix for class and attributes, sample sizes). List the accuracies for core outputs, i.e. accuracy for distinguishing between upland and wetland, wetland accuracy at the class level, classification accuracy for descriptive attributes of surface cover, etc.

POSITIONAL_ACC	Optional	Positional accuracy refers to a measurement of the variance of wetland feature and its true position. Include any disclaimers of wetland delineation accuracy, i.e. ± m, or general statements about the interpreted accuracy of a wetland boundary line.
CONFIDENCE	Optional	It indicates confidence level, confidence interval or confidence score assigned to a wetland feature/polygon (depending on methodological approaches used for the delineation or classification). Record: Low, Medium, or High
SOURCE_CLASS_ SYS	Required, if classification system other than CNWI used	Classification schema used for delineation or classification of wetlands. In the case of merged/processed dataset comprising multiple source datasets – use the wetland classification system applied in the merged product). If other than CNWI classification system was used, please, provide the document or the link to the document.
SOURCE_CODE	Required, if classification system other than CNWI used	Description of source codes used to describe wetland class and attributes of source classification system (e.g., name of report including codes, hyperlink)
CROSSWALK_ORG	Required, if dataset was cross-walked from other classification system	Name of the organization/office performed schema cross-walk into the Canadian National Wetland Schema if cross-walk is completed
CROSSWALK_DATE	Required, if dataset was cross-walked from other classification system	The date (or year) that the wetland source classification schema cross-walk to the Canadian National Wetland Schema is completed

7. Quality Control

Quality control (QC) should include a review of the final cross-walked polygon data using aerial imagery or orthophotos to confirm that the cross-walking results are appropriate. A minimum of 10% of the polygons should be visually reviewed to confirm that the cross-walked wetland attributes are reasonable. If errors or inconsistencies are noted during this review, consider increasing the proportion of polygons that are reviewed and updating the cross-walk look-up tables if the possible. In cases where the cross-walking has been conducted by the person who originally completed the field work and mapping or are familiar with the dataset and errors in cross-walked attributes are not observed during initial QC, the proportion polygons that undergo QC may be reduced.

In some cases extensive QC may not be feasible or appropriate. For example, large databases may contain too many polygons to conduct a review of the final data. This should be indicated in final reporting.

Often mapping will have been completed using higher quality imagery, such as 3D aerial imagery, than what is available to conduct QC. In these cases, using poorer available imagery would not improve cross-walking results or provide a reliable assessment of wetland class compared to the original interpretation.

8. Final Products

Final products delivered as part of a cross-walking project should meet the standards outlined in the ECCC (2023) manual: *Canadian Nationals Wetlands Inventory (CNWI) Database - User Manual – Version 1.0*. Where discrepancies exist between the most recent BC Supplement and the user manual, the BC supplement should be followed. The final deliverables should in include:

- *CNWI_BC_MetaData_Template_V12*: Meta Data according to the CNWI meta data standards (ECCC 2023; ECCC 2024)
- Original source TEI spatial data
- Cross-walking Documentation Table (see Appendix 2);
- Lookup Table;
- *BAPID_TEI_Long_Tbl_Cross.gdb* that contains the source Long Table data and attributes cross-walked that are derived from the long-table;
- *CNWI_BC_V12_Template_20240507.gdb* (currently the most recent version); and
- Report that summarizes original data sources, cross-walking methods, results, and QC.

For final delivery, the spatial data must adhere to the following specifications:

- Format: ESRI File Geodatabase (gdb) version 10.0 or higher;
- Coordinate system: BC Environment Albers Projection;
- Single part polygons; and
- Topologically correct (i.e., no null geometry, slivers, or gaps).

In cases where updates to existing TEI data are made, the TEI staff should be contacted (TEI_Mail@gov.bc.ca) to discuss the edits and allow for updates to existing data.

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Appendix 1: Key TEI Long Table Attributes to be Considered in Cross-walking

Field Name	Alias	Item Definition	Instructions/ Comments	Examples	CNWI Cross-walk Use
TEIS_ID	TEIS Primary Key	contains a unique numeric identifier for detailed polygons that maintains the link between inventory polygons (i.e., TEI_Long_Tbl feature class) and related features (i.e., Domain Errors table). At the project level, within Provincial datasets, this value is not enduring.	Long integer attribute (Non-soils) that is automatically generated every time the Set TEIS_ID script is run. within Provincial datasets. Recommend data submitters populate with OBJECT_ID values for data submission to ensure an initial unique value submitted with minimal effort.	1, 1234567, 99392	Polygon identification should be retained in CNWI schema output
PROJPOLYID	Project Polygon Identifier	contains a unique enduring identifier within a project, that when combined with the BAPID creates a unique identifier within the Province and maintains the link between standard detailed attribute polygons and	Combination of the BAPID and POLY_NBR fields	1234_867	Link between original TEM and CNWI Cross-walked data. Should be included in CNWI schema output for BC cross-walk products

Field Name	Alias	Item Definition	Instructions/ Comments	Examples	CNWI Cross-walk Use
		user-defined data tables.			
BAPID	Business Area Project ID	contains a unique numeric project identifier. The BAPID number assigned to a project is applied to all associated project components (e.g., spatial data, tables, reports, photographs, etc.) and maintains the link between components and project metadata.	Contact TEI_mail@gov.bc.ca for project BAPID request information	1234	Reference number for project reports and information on EcoCat; Use in combination with PROJ_NAME to populate CNWI attribute: Source Title
PROJ_TYPE	Project Type	contains a 3-9 letter code indicating the specific type of mapping and attributes gathered for the project.	Contains a 3-9 letter code indicating the specific type of mapping and attributes gathered for the project.	TEM, PEM, SEI, TIM, TSM, TBT, TEMSEI, TEMNSS, PRETEM	Identify project utility for cross-walking
PROJ_SCALE	Project Map Scale	contains the scale the project was mapped at.	Should reflect the overall mapping scale that the product is intended for use at. Some products may map select features at more refined scales than the overall mapping scale. This information should be	10000, 20000, 50000, and 100000	Use in metadata

Field Name	Alias	Item Definition	Instructions/ Comments	Examples	CNWI Cross-walk Use
			captured in project reports and other metadata sources as applicable.		
BGC_LBL	Biogeoclimatic Label	contains a string of numeric and character codes indicating the Biogeoclimatic unit in which the polygon occurs. This field is a concatenation of zone, subzone, variant and phase codes, separated by spaces. Derived from BEC Map (Version 12) .		BWBS wk 1	Required to link site units and mapcodes (ecosystem classification types) to classification descriptions in Land Management Handbooks
SDEC_1_3	Ecosystem Decile of Ecosystem Component 1 to 3	contains a number from 4-10 indicating the proportion of the polygon covered by ecosystem component 1.	e.g., a decile of 10=100%of polygon, 8=80% of polygon, 2=20% of polygon	10	Used to calculate area of each ecosystem within polygons that contain more than one decile
REALM_1_3	Realm of Ecosystem Component 1 to 3	contains the letter code representing the highest level of BEC site classification, termed 'Site Realm' that delineates	Refer to the Ecosystem Mapping Codes List for current standard codes and MacKenzie 2012 – TR068.	E, M, O, T, W	Provide additional data to characterize site characteristics of Site_S1_S3 and SiteMC_S1_3. Also indicate provincial wetland class. Care should be taken not to use these in cross-walking.

Field Name	Alias	Item Definition	Instructions/ Comments	Examples	CNWI Cross-walk Use
		major biotic types that reflect gross differences in water abundance, quality, and source.			
GROUP_1_3	Group of Ecosystem Component 1 to 3	contains the letter code representing the BEC site classification, termed 'Site Group' that designates a broad association of functionally similar ecosystems based on a dominant cluster of ecologically relevant environmental features.	Refer to the Ecosystem Mapping Codes List for current standard codes and MacKenzie 2012 – TR068.	A, B, E, F, G, H	Provide additional data to characterize site characteristics of Site_S1_S3 and SiteMC_S1_3. Also indicate provincial wetland class. Care should be taken not to use these in cross-walking.
CLASS_1_3	Class of Ecosystem Component 1 to 3	contains the letter code representing the BEC site classification, termed 'Site Class' that describes ecosystems with similar underlying environmental attributes that support similar characteristic vegetation physiognomy and species	Refer to the Ecosystem Mapping Codes List for current standard codes and MacKenzie 2012 – TR068.	a, b, c, d, f, g	Provide additional data to characterize site characteristics of Site_S1_S3 and SiteMC_S1_3. Also indicate provincial wetland class. Care should be taken not to use these in cross-walking.

Field Name	Alias	Item Definition	Instructions/ Comments	Examples	CNWI Cross-walk Use
		adaptation guilds at climax.			
SITE_S1_3	Site Series Number of Ecosystem Component 1 to 3	contains a numeric, alpha-numeric or letter-based site series code derived from BEC and representing the site series value for the ecosystem.	Refer to the Ecosystem Mapping Codes List for current standard codes.	01, 12, Ws01, Ro	Site unit codes used for cross-walking (See TEIS BC Ecosystem Code List - TEI 2024); Populate CNWI attributes: Wetland; Wetland Class
SITEMC_S1_3	Site Series Map Code of Ecosystem Component 1 to 3	contains a letter-based TEI ecosystem mapping code for use with anthropogenic and natural non-vegetated units	Refer to the Ecosystem Mapping Codes List for current standard codes.	CF, LA, RI	Site mapcodes used for cross-walking (See TEIS BC Ecosystem Code List - TEI 2024); Populate CNWI attributes: Wetland; Wetland Class
SITE_M1A_3	Site Modifiers 1 of Ecosystem Component 1 to 3	contains the first of up to 2 letter codes describing the site conditions of the site series in the landscape.	Up to two site modifiers can be used per site series, describing variations in topography, moisture, soil and soil characteristics. Coding must follow Table 3.2 in the Standard for Terrestrial Ecosystem Mapping in British Columbia, (RIC, 1998). If more than one modifier is applied, they should be listed in alphabetical order.	j, w, v, s	Provide additional data to characterize site characteristics of Site_S1_S3 and SiteMC_S1_3

Field Name	Alias	Item Definition	Instructions/ Comments	Examples	CNWI Cross-walk Use
SITE_M1B_3	Site Modifiers 2 of Ecosystem Component 1 to 3	contains the second of up to 2 letter codes describing the site conditions of the site series in the landscape.	Up to two site modifiers can be used per site series, describing variations in topography, moisture, soil and soil characteristics. Coding must follow Table 3.2 in the Standard for Terrestrial Ecosystem Mapping in British Columbia, (RIC, 1998). If more than one modifier is applied, they should be listed in alphabetical order.	j, w, v, s	Provide additional data to characterize site characteristics of Site_S1_S3 and SiteMC_S1_3
STRCT_S1_3	Structural Stage of Ecosystem Component 1 to 3	contains a code representing the structure of the vegetation cover at a point in time.	Coding must follow the Field Manual for Describing Terrestrial Ecosystems (LMH 25).	3a, 5, 7b	Populate CNWI attribute: Surface cover; Herbaceous Type
STRCT_M1_3	Structural Stage Modifier of Ecosystem Component 1 to 3	contains a single value letter-code modifier for stand composition, canopy structure and disturbance history which can differentiate forest stands based on relative development of overstory, intermediate and suppressed crown classes.	Coding must follow the Field Manual for Describing Terrestrial Ecosystems (LMH 25). Can only be applied to structural stages 3-7 by definition. If more than one value is appropriate include the predominant modifier here with others provided in the Polygon Comments is deemed necessary.	t, o. k	Populate CNWI attribute: Surface cover; Herbaceous Type

Field Name	Alias	Item Definition	Instructions/ Comments	Examples	CNWI Cross-walk Use
STAND_A1_3	Stand Composition Modifier of Ecosystem Component 1 to 3	contains a single value letter-code modifier that differentiates forest stands based on coniferous, broadleaf and mixed stand composition.	Coding must follow the Field Manual for Describing Terrestrial Ecosystems (LMH 25). Can only be applied to structural stages 3-7 by definition.	B, C, M	Populate CNWI attribute: Surface cover; Herbaceous Type
TREE_C1_3	Tree Crown Closure of Ecosystem Component 1 to 3	contains the percent of ground area covered by the vertically projected crowns of the tree cover.			Populate CNWI attribute: Surface cover; Herbaceous Type
SHRUB_C1_3	Shrub Crown Closure of Ecosystem Component 1 to 3	contains the percent of ground area covered by the vertically projected crowns of the shrub cover.	Shrub crown closure is usually estimated for shrub- or herb-dominated components, not for forest-dominated components. Shrub crown closure is useful for determining wildlife uses.		Populate CNWI attribute: Surface cover; Herbaceous Type
DIST_LBL1_3	Site Disturbance Label of Ecosystem Component 1	contains a string of character codes representing the site disturbance label for component 1. This field is a concatenatio n of Site Disturbance class codes, subclass and subsubclass codes,	Coding must follow the Field Manual for Describing Terrestrial Ecosystems (LMH 25).	A, B, F, L	May provide data to populate CNWI attribute: Impact

Field Name	Alias	Item Definition	Instructions/ Comments	Examples	CNWI Cross-walk Use
		separated by a period.			
SECL_LBL1_3	Sensitive Ecosystem Label of Ecosystem Component 1	contains a string of character codes representing the sensitive ecosystem label for SEI component 1. This field is a concatenation of Sensitive Ecosystem class codes and subclass codes.	Compiled from the Standard for Mapping Ecosystems at Risk in British Columbia: Version 1 (Ministry of Environment Ecosystems Branch 2006).	WN	Sensitive ecosystem classes (See Standard for Mapping Ecosystems) at Risk in British Columbia - RISC 2006); Populate CNWI attribute: Wetland; Wetland Class; Possibly Tidal and Salinity for some SEI classes
COND_1_3	Condition of Ecosystem Component 1 to 3	contains a single code indicating the condition of the sensitive ecosystem in SEI component 1. Condition is an integrated measure of the quality of biotic and abiotic factors, structures, and processes within the ecosystem and the degree to which they affect the continued existence of		E, G, M, P	May provide data to populate CNWI attribute: Impact

Field Name	Alias	Item Definition	Instructions/ Comments	Examples	CNWI Cross-walk Use
		the ecosystem.			
SURFM_1	Surficial Material of Terrain Component 1 to 3	contains a code identifying the geomorphic origin of the surficial material in the first stratum of terrain component 1.	Mandatory field.	M	May provide data to populate CNWI attribute: Soil
SURF_E1A_E1C	Surface Expression 1 of Terrain Component 1	contains a lowercase character representing the dominant surface expression for the first stratum of surficial material in terrain component 1 -3 (one of up to three codes).		b	May provide data to populate CNWI attribute: Soil
DRAIN_1	1st Soil Drainage Class of Polygon	contains a lowercase character representing the dominant soil drainage class the terrain polygon.	Soil drainage refers to the rapidity and extent of water removal from the soil in relation to additions; this refers to the annual moisture status of the soil, not just the permeability.	x, m, i	May provide data to populate CNWI attribute: Soil
SMPL_TYPE	Field Check of Polygon	contains a letter code indicating the level of field checking	Base the value on most detailed plot collected for the polygon if more than one plot per polygon (i.e.,	E, G, V, A	Populate CNWI attribute: Method field; Method desktop

Field Name	Alias	Item Definition	Instructions/ Comments	Examples	CNWI Cross-walk Use
		done on the current polygon.	E>G>V>A). The POLY_COM field can be used to store additional field plot names. Recommend identifying Ground plots from Aircalls in Plot Name and Comments field or using FCODE values to distinguish between plot types.		
FLDNUM	Field Site Number	contains the project specific field site number (up to seven characters using a unique number series)	Include the unique project specific field site number (up to seven characters using a unique number series for in the form of year + initials + 3-digit running number). Other formats such as initials+plot type+3-digit running number are also acceptable but should be defined in project metadata. Use a comma to separate more than one field site in one polygon. Use the Plot Number field to enter the unique plot number as printed on each FS882 card.	09WM001 , WME001	Link to field data
PLOTN_NO	Plot Number	contains a unique plot number as printed on each FS882 card	Use this field to enter the unique plot number as printed on each FS882 card. Use the Field Site Number field to record the project specific field site number.	14-5497	Link to field data

Appendix 2: Cross-walking Documentation – CNWI Cross-walk Summary Template Required for all Cross-walking Projects

Natural Resource Region (Forest Region in current TEI Codes List)	Biogeoclimatic Label (BGC_VLD)	Site Unit	Name	Realm (REALM)	Group (GROUP)	Class (CLASS)	Source	BAPID	Primary CWCS Class	Secondary CWCS Class
West Coast	*All*	31	Sphagnum-dominated topogenous bog	W	P	b	LMH 52	1234	Bog	
West Coast	*All*	32	Carex-dominated fen	W	P	f	LMH 52		Fen	
West Coast	*All*	33	Marsh	W	M	m	LMH 52		Marsh	
West Coast	*All*	34	Sphagnum-dominated slope/blanket bog	W	P	b	LMH 52		Bog	
West Coast	*All*	35	Estuarine marsh	E	E	m	LMH 52		Marsh	
West Coast	*All*	41	Willow dominated swamp	W	M	s	LMH 52		Swamp	
West Coast	*All*	42	Sweet gale-Carex swamp	W	M	s	LMH 52		Swamp	
West Coast	*All*	44	Shrub swamp	W	M	s	LMH 52		Swamp	
West Coast	*All*	45	Cw – Carex swamp	W	M	s	LMH 52		Swamp	