Alberta Wetland Classification System

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Abbreviations

ACIMS	Alberta Conservation Information Management System
AWCS	Alberta Wetland Classification System
AWI	Alberta Wetland Inventory
CWCS	Canadian Wetland Classification System
ITIS	International Taxonomic Information System
TDS	Total dissolved solids
µS/cm	microsiemens per centimetre

Glossary

acidic – refers to soil or water with a pH of less than 7. Soil or water is slightly acidic if it has a pH of 5.5 to 6.5, moderately acidic if the pH is 4.5 to 5.5, and acidic if the pH is less than 4.5

aerobic – pertaining to the presence of oxygen

alkaline wetland – a wetland that has a high alkalinity

alkalinity – the capacity of an aqueous solution to neutralize an acid

anthropogenic disturbance – a change in environmental conditions caused by human activity

bog – a peatland fed by ombrogenous waters originating from precipitation with low concentrations of dissolved minerals

brown moss – a group of true mosses of several genera (e.g., *Scorpidium, Drepanocladus, Calliergon, Campylium, Hypnum, Tomentypnum*) that are often abundant and can comprise a high proportion of the ground cover in some fens

brackish – water with moderate to high concentrations of dissolved salts and other dissolved solids; electrical conductivity ranges from 5,000 µS/cm to 15,000 µS/cm

bryophyte – includes mosses, liverworts and hornworts

canopy – refers to the leaves and branches in the uppermost layer (stratum) of a wooded or shrubby ecosystem

conductivity – the ability of a substance to conduct electricity, measured in microsiemens per centimeter (µS/cm) at 25°C (i.e. specific conductance). Measurements can be converted into total dissolved solids (TDS) and vice versa using available published tables

coniferous – refers to cone-bearing trees with needle-like leaves; in Alberta wetlands, coniferous trees include black spruce (*Picea mariana*), white spruce (*Picea glauca*) or tamarack (*Larix laricina*)

deciduous – a tree that sheds its leaves annually. In Alberta wetlands, deciduous trees include Alaska birch (*Betula neoalaskana*), white birch (*Betula papyrifera*) and several cottonwood and poplar species, including balsam poplar (*Populus balsamifera*), plains cottonwood (*Populus deltoides*) and narrow-leaf cottonwood (*Populus angustifolia*)

deep wetland plant zone – a wetland plant zone in marshes and shallow open waters containing robust, emergent graminoids that are tolerant of prolonged inundation and deeper water levels than species in other vegetation zones (*see shallow wetland plant zone and wet meadow plant zone*)

delta – a depositional landform found at the mouth of a river where a river flows into another waterbody

emergent vegetation – pertains to robust, erect graminoids such as cattails, rushes, sedges and grasses that can tolerate variable and sometimes prolonged flooding

ephemeral waterbody – terrain affected by the water table near, at or above the ground surface for a short period of days, but not long enough to promote the formation of water altered soils within 30 cm of the ground surface or a dominance of water tolerant vegetation

extreme-rich fen – a fen with a high number of indicator species and a pH of greater than 7.0. Typically is a true moss-dominated alkaline wetland

feathermoss – a group of large, regularly branched mosses with stalks that often resemble feathers. Examples are stair-step moss (*Hylocomium splendens*), Schreber's moss (*Pleurozium schreberi*) and knight's-plume moss (*Ptilium crista-castrensis*)

fen – a minerogenous peatland with surface or subsurface water flow that range from moderately-acidic to basic

fibrisol (fibric adj.) – a type of organic soil with relatively undecomposed (i.e. a Von Post <5) material with a minimum depth of 60 cm

flark – wet depressions between peat ridges (strings) in patterned fens; always oriented perpendicular to the direction of water flow

forb – a non-graminoid, non-woody vascular plant that is usually broad-leaved

freshwater – water with very low concentrations of dissolved salts and other dissolved solids; electrical conductivity is less than 500 µS/cm

graminoid – a vegetative form comprising erect, rooted and herbaceous grass-like plants, including grasses, sedges, rushes, arrow-grasses and cattails

gleying – blue-grey or greenish soil that results from the reduction of iron and manganese between compounds caused by prolonged saturation under anaerobic conditions

gleysolic soil – soil developed from prolonged soil saturation and characterized by a blue-grey or greenish colour or prominent reddish to brownish mottles (spots or streaks of oxidized ferric iron)

ground cover – all components of the land surface, including low vascular plants (less than 30 cm tall), bryophytes, lichens, organic debris (e.g. leaves, wood, peat), exposed surface material (e.g. rock, soil), aquatic plants and water

groundwater – subsurface water moving in soil and underlying strata

groundwater discharge – pertaining to wetlands that receive water from groundwater flow

herb (herbaceous adj.) – a vascular plant with no persistent woody stems above the ground, including pteridophytes (e.g. ferns, horsetails), graminoids and forbs

humisol – a type of organic soil with advanced decomposition of organic materials (i.e. a Von Post of greater than 6); most of these materials are humified and have few recognizable fibers

hummock – a small mound that is usually composed of peat moss or clumps of graminoids

hydric – soil that is saturated long enough during the growing season to develop anaerobic conditions in the rooting zone

hydroperiod – the length of time the water table is at or above the ground surface in a wetland

hydrophyte (hydrophytic adj.) – a plant species that preferentially grows in wet areas under continuous or periodic anaerobic conditions

indicator species – an organism that reflects a characteristic of the environment and whose presence may be used to help indicate wetland class and type

intermittent – pertaining to periodic saturation of the ground surface and soil

lentic – an ecosystem associated with standing water

lichen – a group of complex organisms in which a fungus and an alga grow together in a mutually beneficial (i.e. symbiotic) relationship

liverwort – a plant species of the class Hepaticae in the division Bryophyta; species' usually have small, leafy stems or less commonly, a flat, tongue- to ribbon-like body without leaves (i.e. a thallus)

lotic – an ecosystem associated with flowing water

marl – a soft, unconsolidated deposit consisting of calcium carbonate or magnesium carbonate, and often indicated by the accumulation of shells

marsh – a mineral wetland with water levels near, at or above the ground surface for variable periods during the year, and which supports graminoid vegetation in the deepest portion of the wetland in the majority of years

mesisol – a type of organic soil with moderately decomposed organic material (i.e. Von Post of 5 to 7) that does not meet the requirements of either a fibric or a humic soil

mineral soil – soil consisting predominantly of mineral matter. Mineral soils contain less than 17% organic carbon by weight, except for an organic surface layer that may be up to 40 cm thick. Mineral soils have a Von Post decomposition rating of greater than 5

mineral wetland – a wetland characterized by mineral soils and/or organic soils that have either no accumulation of peat or a peat layer of less than 40 cm deep

minerogenous – refers to wetlands that receive water from precipitation as well as groundwater and/or surface water that has accumulated minerals from soil and/or bedrock

mixedwood – a wooded wetland consisting of a mix of coniferous and deciduous tree species

moderate-rich fen – a fen with a moderate number of indicator species and a pH between 5.5 and 7.0.

moderately brackish water – water with moderate concentrations of dissolved salts and other dissolved solids; electrical conductivity ranges from 2,000 µS/cm to 5,000 µS/cm

moss – bryophytes of the class Musci, in the division Bryophyta, that have small, leafy stems with inconspicuous sex organs that produce sporophytes

mottles – spots or blotches of different colours or shades of colour interspersed throughout the soil; often appear reddish to brownish in wet, iron-rich soils that are only occasionally exposed to oxygen. Mottles are characteristic of Gleysolic soils and when present in the rooting zone of plants (i.e., within 30 cm of the ground surface) are characteristic of mineral wetlands

ombrogenous – refers to wetlands that receive surface water originating solely from precipitation

open water zone – an expanse of open, mostly unshaded water in marshes and shallow open waters that typically supports submersed or floating vegetation

organic soil – soil developed mainly from organic deposits, containing at least 17% organic carbon by weight (roughly equivalent to at least 30% organic matter); organic soils are usually saturated for most of the year, unless they are artificially drained

patterned fen – a fen with alternating ridges of peat (strings) and shallow pools (flarks) that form sinuous or netted patterns and are oriented perpendicular to the direction of water flow

peat – ground composed of partially decomposed plant material (i.e. a Von Post of ≤ 5) that accumulates in some wetlands under saturated conditions; peat accumulation differentiates peatlands from mineral wetlands

peatland – a wetland with more than 40 cm of accumulated peat; includes bogs and fens and some swamps

permafrost – perennially frozen ground (including rock or soil) that remains at or below 0˚C for more than a year

permanent – describes the hydroperiod of a shallow open water wetland that contains stable water levels above the surface year-round even in persistent drought conditions

poor fen – a fen with a low number of indicator species and a pH of 5.5 or less

pteridophyte – a vascular plant with roots, stems and leaves and which reproduces by spores (no flowers or fruits); examples include ferns and horsetails

recharge – a process by which surface water enters the groundwater table via infiltration through soils and bedrock

rooting zone – the sub-surface depth that the roots of herbaceous plants extend past, corresponding to approximately 30 to 40 cm

saline water – water with very high concentrations of dissolved salts and other dissolved solids; electrical conductivity is greater than 45,000 µS/cm

saltflat – an intermittently flooded mineral wetland where salts are concentrated by evaporation during dry periods and may appear as whitish crystals

seasonal – describes the hydroperiod of a mineral wetland that is typically flooded for most of the growing season but has little to no surface water remaining by the end of summer

semi-permanent – describes the hydroperiod of a mineral wetland that is typically flooded year-round, except in years when drought conditions persist

shallow open water – a mineral wetland with water levels near, at or above the ground surface for variable periods during the year, which is less than two metres deep at midsummer and that contains an open water zone in the deepest wetland zone covering greater than 25% of the total area in the majority of years

shallow wetland plant zone – a wetland plant zone found in some marshes and shallow water wetlands that is dominated by narrow-leaved graminoids, such as sedges and grasses, that typically tolerate periodic inundation and prolonged root saturation

shrubby – a wetland form made up of woody, multi-stemmed plants of any height, and/or single-stemmed trees that are no taller than three metres in height

slightly brackish – water with low concentrations of dissolved salts and other dissolved solids; electrical conductivity ranges between 500 µS/cm and 2,000 µS/cm

string – ridges of peat that alternate between wetter flarks, elevated above the surface water and oriented perpendicular to the direction of water flow in patterned fens

submersed and floating aquatic plants – plants that occupy the open water zone of wetlands up to a maximum depth of two metres. Species rooted in the substrate may have submersed or floating leaves; other species are free-floating in the water column without anchorage to the substrate

sub-saline water – water with high concentrations of dissolved salts and other dissolved solids; electrical conductivity ranges between 15,000 µS/cm and 45,000 µS/cm

swamp – a mineral wetland with water levels near, at or above the ground surface for variable periods during the year which contains either more than 25% tree cover of a variety of species or more than 25% shrub cover

temporary – describes the hydroperiod of a mineral wetland that is typically flooded every year for a short period of time after snowmelt or a heavy rainfall, but otherwise lacks surface water; temporary wetlands are affected by the water table for long enough to promote formation of water altered soils within 30 cm of ground surface and a dominance of water tolerant vegetation during parts of the growing season

tilled – the process of digging, stirring or overturning soil for agricultural purposes

tree – a woody, single stemmed plant that is three metres or greater in height

understory – a lower layer of plants in a vertically stratified wetland; usually refers to shrubs below a canopy of trees, but can also apply to graminoids and forbs below a canopy of shrubs

vascular plants – plants with lignified tissues (i.e. xylem and phloem) used for conducting water and nutrients through the plant

Von Post decomposition scale – a field test to determine the degree of organic matter decomposition in the ground layer on a scale of 1 (undecomposed) to 10 (completely decomposed)

water altered soils – refers to visual evidence of anaerobic conditions and wet soil processes, including the accumulation of peat and the formation of mottles, gleying and other wet soil features

water table – the water level below which the ground is saturated

water tolerant vegetation – refers to plant species that are tolerant of wet areas under continuous or periodic anaerobic conditions, but that are not necessarily hydrophytic (*see hydrophyte*)

wetland – land that is saturated with water long enough to promote formation of water altered soils, growth of water tolerant vegetation, and various kinds of biological activity that are adapted to wet environments

wet meadow plant zone – a wetland plant zone found in some marshes and shallow water wetlands that is dominated by graminoids tolerant of periodically saturated soils and short periods of shallow inundation

wooded – a wetland form that contains more than 25% tree cover

woody – refers to shrubby and wooded cover forms

1. INTRODUCTION

Wetlands are land saturated with water long enough to promote formation of water altered soils, growth of water tolerant vegetation, and various kinds of biological activity that are adapted to a wet environment (Alberta Wetland Policy 2013). Wetlands are highly diverse, productive ecosystems that provide a host of ecological functions and values important to Albertans.

Approximately twenty percent of Alberta's surface area is covered by wetlands, ninety percent of which are peatlands. Wetlands provide many ecological values to Albertans: They can mitigate the effects of floods and droughts by storing and slowly releasing water; improve water quality by attenuating nutrients and contaminants; recharge groundwater tables; store and sequester carbon; and support a rich array of biodiversity. In Alberta alone, wetlands support more than 600 species of plants, some of which are provincially listed as rare, threatened, or endangered. Wetlands provide critical habitat for migratory and breeding waterbirds in Alberta, as well as several species at risk, including the northern leopard frog, piping plover, trumpeter swan, whooping crane and woodland caribou.

Humans also depend on Alberta's wetlands for a wide variety of activities and resources. They are used for recreational pursuits such as bird watching and hunting, and have increasingly become a focal point for the ecotourism industry. Wetlands play an important role in environmental and wildlife conservation programs in Alberta, as well as in the agricultural, peat and forestry sectors. Wetlands hold great value to First Nations and Métis communities' culture, tradition and knowledge. A large portion of land in Alberta used by First Nations and Métis contains wetlands.

1.1 Existing Wetland Classification Systems and Inventories in Alberta

Wetland classification in Alberta has previously relied on at least four different classification systems. The Canadian Wetland Classification System (CWCS, National Wetlands Working Group 1997), which was developed to support wetland classification at a national scale, has been used extensively in the central and northern parts of the province where peatlands are more prevalent. The Stewart and Kantrud System (Stewart and Kantrud 1971) has been widely used in southern Alberta to classify prairie pothole wetlands. The Cowardin Wetland Classification System (Cowardin *et al*. 1979) and ecosite guides for Alberta (Beckingham 1996; Beckingham and Archibald 1996) have also been applied to classify wetlands for varying purposes in Alberta.

Several wetland inventories also exist in Alberta. The Ducks Unlimited Boreal Plains Ecozone Classification (Smith et al. 1997) and the Alberta Wetland Inventory (AWI, Halsey et al. 2003) have been used extensively in the Boreal Region while the Grassland Vegetation Inventory includes the identification of lentic ecosystems in southern Alberta. The Alberta Merged Wetland Inventory is the first provincial wetland inventory of its kind in Alberta. For a comparison of the Alberta Wetland Classification System (AWCS) with other classification systems and inventories used in the province, see Appendix A.

Despite the wealth of available, existing classification systems and inventories, no current system consistently characterizes wetlands based on a similar suite of criteria that includes Alberta's

provincial flora and ranges of environmental, geological and climatic characteristics found in Alberta. To reconcile these differences, the Alberta Wetland Classification System (AWCS) has been developed for use and application across the province.

1.2 Alberta Wetland Classification System Objectives

The AWCS incorporates and merges information from existing wetland classification systems to provide a holistic classification system for the province. The AWCS is tailored specifically for wetlands in Alberta, providing suites of key indicators that in conjunction will help to classify different wetlands, particularly in the field. Overall, the intent of the AWCS is to achieve a standardized provincial wetland classification system that:

- Provides a consistent system for classifying wetlands across the entire province
- Promotes a consistent understanding of wetlands
- Applies classification keys that relate to provincial wetland characteristics associated with hydrologic, biogeochemical and biotic processes
- Is compatible with existing wetland classification systems and inventories
- Is aligned with legislation and policies that may affect wetlands, such as the Water Act, Public Lands Act and Alberta Wetland Policy
- Can be applied to Canadian geographic information system (GIS) databases and inventories

1.3 Overview of the Alberta Wetland Classification System

The same five broad classes of wetlands that exist in the CWCS are also recognized in the Alberta Wetland Classification System. These classes are bogs, fens, marshes, shallow open waters, and swamps.

In the AWCS, wetland classes are divided into forms based on vegetation structure. This subdivision can be used to align wetland classification with the Ducks Unlimited (Smith et al. 1997) and AWI (Halsey et al. 2003) inventories as well as the Field ecosite guides to Alberta (Beckingham 1996; Beckingham and Archibald 1996). It also recognizes the importance that vegetation structure has on wetland processes and biodiversity. Whereas some wetland classes have a unique wetland form (e.g. marshes are graminoid wetlands), others may have multiple wetland forms (e.g. fens may have graminoid, shrubby or wooded forms).

Wetland forms are further subdivided into types based on biological, hydrologic or chemical attributes. Stewart and Kantrud (1971) classes are captured at this level. Identifying a wetland to its type may be important for conserving or restoring specific wetland types and their associated organisms and communities. For a summary of AWCS classes, forms and types, see Table 1.

Table 1. Wetland classes, forms and types in the Alberta Wetland Classification System. Wetland classification codes for mapping uses are in brackets.

CLASS	FORM	Types		
		Salinity	Water permanence[1]	Acidity-alkalinity
Bog [B]	Wooded, coniferous [Wc] Shrubby [S] Graminoid [G]	Freshwater [f]	--	Acidic [a]
Fen [F]	Wooded, coniferous [Wc] Shrubby [S] Graminoid [G]	Freshwater [f]	--	Poor [p]
		Freshwater [f]	--	Moderate-rich [mr]
		Freshwater [f] to slightly brackish [sb]	--	Extreme-rich [er]
Marsh [M]	Graminoid [G]	Freshwater [f] to slightly brackish [sb]	Temporary [II]	--
		Freshwater [f] to moderately brackish [mb]	Seasonal [III]	--
		Freshwater [f] to brackish [b]	Semi-permanent [IV]	--
Shallow Open Water [W]	Submersed and/or floating aquatic vegetation [A] or bare [B]	Freshwater [f] to moderately brackish [mb]	Seasonal [III]	--
		Freshwater [f] to sub-saline [ss]	Semi-permanent [IV]	--
		Slightly brackish [sb] to sub-saline [ss]	Permanent [V]	--
	[A]	Saline [s]	Intermittent [VI]	--
Swamp [S]	Wooded, coniferous [Wc] Wooded, mixedwood [Wm] Wooded, deciduous [Wd] Shrubby [S]	Freshwater [f] to slightly brackish [sb][2]	Temporary [II][2]	--
		freshwater (f) to slightly brackish [sb][2]	Seasonal [III][2]	--
		moderately brackish [mb) to sub-saline [ss][2]	Seasonal [III][2]	--

[1] Roman numerals are equivalent to wetland classes by Stewart and Kantrud (1971)

[2] Swamp types are not applicable to wooded swamps due to a lack of available information

1.4 Wetland Factors, Processes and Characteristics

Regional factors that affect wetland processes and characteristics include climate, landscape situation, and surface and subsurface hydrogeology (Naticonal Wetlands Working Group 1997, Vitt et al. 1996, ESRD 2014). These factors influence the following processes:

- Hydrologic processes, such as the capacity of a wetland to receive, store, moderate and release surface water and groundwater in a watershed
- Biogeochemical processes, such as acid–base reactions, ion exchange and oxidation–reduction reactions, decomposition, nutrient cycling and carbon sequestration
- Biotic processes, such as biological productivity and competition

Wetland characteristics that reflect these processes are used to identify wetland classes, forms and types. These characteristics include:

- Peat accumulation (Section 1.4.1)
- Water regime (Section 1.4.2)
- Chemical gradients (Section 1.4.3)
- Soil characteristics (Section 1.4.4)
- Vegetation structure (Section 1.4.5)

The AWCS provides classification keys to distinguish wetlands from non-wetlands and key out wetlands found in Alberta to their class, form and type. Careful consideration and weighting of multiple characteristics will lead to a conclusion that is repeatable and consistent, in spite of challenges where wetlands exhibit intermediary characteristics between classes, such as intermediate states between marshes and fens. Additional characteristics of a wetland may help determine how best to classify it.

It is important to understand how both natural and anthropogenic disturbances in wetlands may influence classification. Wetlands that have been disturbed either by natural (e.g. beaver influence, fire and climate) or anthropogenic causes may lead to departures in wetland characteristics from previous conditions (see Naiman et al. 1994 for example). Examples of permanent disturbances that may cause a change in classification include tilling, partial infilling or drainage, storm water input, loss of groundwater inflow or peatland drainage. Poor plant health, abnormal species, or a combination of atypical characteristics may indicate that a wetland has undergone a recent disturbance. It is important to also take long-term climatic factors into careful consideration when classifying wetlands (ESRD in press; Johnson et al. 2004). For instance, marshes and shallow open water wetlands exhibit naturally fluctuating water levels that can shift plant community structure and composition (Miller and Zedler 2003, ESRD in press).

1.4.1 Peat Accumulation

Wetlands are divided into two broad groups: **peatlands** and **mineral wetlands**. For the purposes of this classification system, bogs and fens are considered to be peatlands and all other wetland classes (i.e. swamps, marshes and shallow open waters) are considered to be mineral wetlands. However, peatland swamps have also been observed in Alberta (Locky *et al*. 2005). The presence and depth of peat are diagnostic characteristics that differentiate peatlands from mineral wetlands. Peat can be composed of a wide range of unconsolidated or partially decomposed organic materials, including bryophytes, herbaceous vascular plants and woody debris (Mitch and Gosselink 2007). For a wetland to be considered a peatland, the organic soil that has accumulated must be almost entirely organic matter *and* be undecomposed to moderately-decomposed. Mineral wetlands have less than 40 cm of accumulated peat, whereas peatlands tend to have 40 cm of accumulated peat or more. It is important to note that mineral

wetlands can also include organic soils with a Von Post ranking of greater than 5 in the upper 40 cm of soil.

Von Post Decomposition Scale

A coarse test can be done in the field to differentiate peatlands from mineral wetlands by measuring the Von Post degree of decomposition; for a wetland to be classified as a peatland, it must have a Von Post rating of 5 or less. The Von Post decomposition scale is a field test that estimates the degree of organic matter decomposition (see Appendix B). Although mineral wetlands can accumulate organic matter in excess of 40 cm, it is typically more decomposed than peat and will likely have a Von Post decomposition rating of 6 or greater.

1.4.2 Water Regime

Peatlands

The major factor that differentiates bogs and fens is their water source. Bogs are ombrogenous, meaning that they receive water exclusively from precipitation. Fens, in contrast, are minerogenous because they receive water from a variety of sources, thereby accumulating minerals as the water comes in contact with surface and subsurface soils and bedrock (National Wetlands Working Group 1997).

Peatlands in Alberta tend to have relatively stable water tables (Vitt et al. 1993). In most fens, the water table may be at or near the surface; in bogs, the water table tends to be well below the surface (National Wetlands Working Group 1997). Despite variability in the depth to the water table, all peatlands typically have permanently saturated soil, which promotes anaerobic conditions and reduces the rate of decomposition. Permafrost peatlands can be exceptions, as the development of perennial ice can result in a surface which is often raised above the water table by up to one meter (Vitt et al. 1994).

Mineral Wetlands

Mineral wetlands have naturally fluctuating water levels (National Wetlands Working Group 1997, Stewart and Kantrud 1972). They may receive water inputs from a variety of sources, including surface water, groundwater and precipitation. Some closed or isolated basins are fed almost exclusively by precipitation and surface runoff, whereas other wetlands may exhibit complex groundwater-surface water interactions and have connections to other wetlands, lakes, streams, or ponds (National Wetlands Working Group 1997). Marshes, Shallow Open Waters and Swamps make up the classes of mineral wetlands found in Alberta.

Mineral wetlands have water tables near, at or above the surface for variable periods during the year. They may be permanently flooded, flooded repeatedly, or infrequently flooded for short periods of time. Water level fluctuations increase aerobic decomposition rates, and influence water chemistry, nutrient availability, and plant community structure and composition.

1.4.3 Chemical Gradients

Biogeochemical processes in wetlands are complex and highly variable. Chemical gradients of surface waters that are used in the AWCS to characterize wetlands include acidity-alkalinity and salinity.

Acidity-Alkalinity

Acidity is an important wetland characteristic, particularly in peat-accumulating wetlands that have a relatively high cation-exchange capacity. Unlike mineral wetlands, where cation exchange is dominated by metals, cation exchange in peatlands results in the production of hydrogen ions that can generate acidity (Mitch and Gosselink 2007). In some fens that receive groundwater rich in carbonates, hydrogen ion production is buffered and these ecosystems can be relatively basic. In contrast, bogs receive water from precipitation, which is low in minerals, and consequently have less alkalinity and an acidified environment.

Salinity

Salinity is also an important characteristic that influences a wetland's plant community structure and composition (Stewart and Kantrud 1972, Purdy et al. 2005). Plant species in most peatlands have a low tolerance for elevated salinity (Vitt et al. 1993); healthy peatlands thus have relatively low salinity levels. In contrast, some mineral wetlands contain unique species and communities that are adapted to elevated salinity (Stewart and Kantrud 1972). Electrical conductivity of surface water (when it is present) can be used to estimate the salinity type of mineral wetlands based on the ranges listed in Table 2.

Table 2. Salinity types and corresponding conductivity ranges (adapted from Stewart and Kantrud, 1971)

Wetland type	Conductivity (µS/cm)
freshwater	less than 500
slightly brackish	500 to 2,000
moderately brackish	2,000 to 5,000
brackish	5,000 to 15,000
sub-saline	15,000 to 45,000
saline	greater than 45,000

1.4.4 Soil Characteristics

Wetlands are characterized by the presence of water altered or hydric soils that develop from wet soil processes. The rooting zone of most plants occurs in the uppermost 30 to 40 cm of the soil profile, making it important for wetland classification. Soil characteristics develop over the long term, are generally stable, and are particularly important for identifying wetlands from non-wetlands and delineating their ecological boundaries (See the Alberta Wetland Identification and Delineation Guide for more information on this subject).

The accumulation of organic matter is also a key diagnostic attribute of wetlands. Thick deposits of organic matter are typical of some wetlands and are represented by the presence of organic soils such as Fibrisols, Mesisols and Humisols (Soil Classification Working Group 1998). In peatlands where mean annual temperatures and the insulating properties of peat are sufficient to maintain the soil profile below zero degrees Celsius for more than a year, permafrost will develop (Vitt et al. 1994), such as in Organic Cryosol soils. As stated before, wetlands that have accumulated organic matter may be peatlands or mineral wetlands, depending on whether the organic matter is peat or not.

Wet soil processes, such as the development of gleying and mottling, are important characteristics of mineral wetlands. When mineral soils are saturated for a prolonged period of time, oxygen is depleted and metals, such as iron and in some cases, manganese are reduced. In contrast, these metals are oxidized when soils are exposed to oxygen. Soil redox processes lead to colour changes in the soil profile. In soils with prolonged periods of saturation, soil profiles often have a blue-grey colour resulting from iron reduction that is commonly referred to a gleying (Soil Classification Working Group 1998). Reduced iron is mobile and can concentrate in specific areas of the soil profile. When water levels recede and expose the soil, it may become re-oxidized and produce red or brown mottles (Soil Classification Working Group 1998). The presence of gleying and mottling in the rooting zone is diagnostic of mineral wetlands and its location in the soil profile can help to characterize wetland type. Gleying is an indicator of relatively long periods of soil saturation, whereas mottling indicates fluctuating water levels and alternating reduced and oxidized states. Gleying and mottling are typical in Gleysolic soils. Under certain conditions, wetland mineral soils might lack evidence of gleying and mottling. Main causes for wetland soils that lack gleying and mottling include:

- moderate to strong alkalinity inhibiting metal reduction
- active deposition of sediments (e.g. deposition in floodplains)
- presence of restrictive soil layers limiting the saturation depth
- colour of parent material (e.g. black soils)
- recent wetland restoration or construction
- agricultural disturbances such as tilling or pugging by cattle
- Although the presence of gleying and mottling indicates the presence of saturated soils, the absence of these indicators does not necessarily confirm that the area is not a wetland.

1.4.5 Vegetation Structure

Characteristics of vegetation structure and composition differ among wetland classes, forms and types. Vegetation structure is captured in wetland form, and is based on the tallest strata present in a wetland, or by the form occupying the deepest portion or central zone of the basin (in marshes and shallow open waters). Vegetated strata in the AWCS include wooded (tree species greater than three metres tall), shrubby (woody species no taller than three metres), graminoid, aquatic and bare cover. A modifier for wooded forms is also used that recognizes differences in the relative cover of coniferous and deciduous species (i.e. wooded–coniferous, –mixedwood or –deciduous). Vegetation structure often reflects hydrological processes, with taller vegetation

strata generally inhabiting areas with decreasing water levels. For example, trees in swamps tend to be taller than the same species in fens and bogs that experience more waterlogging.

Diversity is also correlated with vegetation structure, and is generally higher in wetlands with more complex structure (i.e. those with multiple strata) than those with a simple structure (i.e. those with a single stratum). For example, wooded fens with several strata tend to be more diverse than graminoid fens (Vitt et al. 2003). Wildlife occupancy and use in wetlands also relates to vegetation structure because different strata provide food and shelter for different species.

Most plants in wetlands have adaptations that allow them to grow in soil that is saturated or flooded. Generally, the rooting zone of water tolerant plants extends below the water table, although soil properties may allow for capillary action to bring moisture to the surface. Not all species present in wetlands are unique to wet environments (Mitch and Gosselink 2007). Some upland plant species are tolerant of wet conditions even though they do not favour them (Boutin and Keddy 1993). Hydrophytes are plants that preferentially grow in wet areas.

Plant species indicators can often be used as a proxy for important environmental gradients such as water levels and hydroperiod, pH, acidity, salinity and nutrient availability. Vegetation is an easily observed, aboveground feature that can be used as a key characteristic in wetland classification (some vegetation can be detected by imagery). However, it is the overall species community structure and composition, and not the presence of a single or a few species, which should be used to assist in the classification of a wetland.

Peatlands

Peatlands are characterized by a well-established ground cover of bryophytes that thrive in conditions where the water table is relatively stable, and the water is fresh and slow-moving (Bayley and Mewhort 2004, Vitt et al. 1993). Stable water levels and slow-moving water flow also help to develop anaerobic conditions that lower decomposition rates. As peat accumulates under these conditions, nutrients are stored in a non-available form, causing nutrient deficiencies in peatlands and promoting establishment of plant species adapted to these extreme conditions (Mitch and Gosselink 2007).

Mineral Wetlands

Vegetation species in marshes and shallow open waters self-organize into plant community zones according to a moisture gradient that extends from the center of the basin outward. Submersed and/or floating aquatic plants occupy the deepest portion of the basin in shallow open water wetlands that have an open water zone of up to a depth of two metres. Rushes, cattails, and other graminoids are tolerant of prolonged flooding and inhabit a deep wetland plant zone typically present in semi-permanently and permanently flooded wetlands. A shallow wetland zone often surrounds the deep wetland zone, inhabited by narrow-leaved graminoids adapted to seasonally flooded conditions; this zone is typically present in seasonally to permanently saturated wetlands. Beyond this, a wet meadow zone contains water tolerant graminoids and forbs that are adapted to periodically flooded or saturated conditions present in temporary wetlands or along the margins of other wetland types. Wetland class, form and type in marshes and shallow open waters can be determined by its plant community structure (Table 3).

Table 3. Plant community zones for marshes and shallow open waters.

Wetland type	Hydroperiod	Plant community zone[1]
Temporary (II)	surface water is present for a short period of time after snowmelt or a heavy rainfall	wet meadow
Seasonal (III)	surface water is present throughout the majority of the growing season, but is typically dry by the end of summer	shallow wetland
Semi-permanent (IV)	surface water is present for most or all of the year, except in periods of drought	deep wetland
Permanent (V)	surface water is present throughout the year	open water
Intermittent (VI)	alternates between saline open water and exposed bottom	alkaline

[1] The plant community zone reflects the plant community found in the deepest portion of a wetland covering more than 25% of the total area in the majority of years and can be used as an indicator of wetland type. Roman numerals are equivalent to wetland class by Stewart and Kantrud (1971)

Despite its advantages, using vegetation as an indicator of wetland class in mineral wetlands has some drawbacks. Climatic cycles that influence water level fluctuations are typically accompanied by changes in vegetation (van der Valk 2005, Weller 1994). These water level fluctuations facilitate decomposition and productivity, elemental cycling and biogeochemical reactions, and in turn provide growing conditions and habitat for a much greater diversity and variability of species than would be found under stable water conditions. Basing wetland classification on a single visit, or on information collected from a single year or time of year, provides only a single climatic snapshot of a wetland, which fails to reflect its dynamic processes. When in doubt, soil characteristics, such as the presence of peat or water altered soils are the most stable characteristic of wetland-related processes.

1.5 Wetland Distribution

Wetlands are located in numerous landscape positions and settings, including on floodplains, springs, river islands, and glacial channels. They may occur in basins or depressions that are isolated from surface connections to other water bodies, or they may be adjacent to rivers, lakes, ponds, other wetlands and other water bodies. Climatic and landscape factors determine whether conditions are suitable for a wetland to form and be sustained. These factors can include precipitation, temperature, topography, landscape position, geology, and water inputs and interactions (Vitt et al. 1996, ESRD in press).

In Alberta, bogs, fens and swamps are the most common wetland classes in northern Alberta and cover vast expanses of the Boreal Region (Vitt et al. 1996). Further south, mineral wetlands such as marshes and shallow open waters (Vitt et al. 1996) become more common than peatlands as the province transitions into the central Parkland and Grassland Natural Regions. Mineral wetlands are mainly found in landscape positions where water levels fluctuate, such as adjacent to rivers and open waterbodies, in knob and kettle basins, shallow prairie pothole depressions, or in areas where salinity restricts the establishment of many freshwater herbaceous species and bryophytes. In southern

Alberta, wetlands are driven heavily by seasonal and multi-year climate cycles; there, temporary and seasonal wetlands are more abundant than more permanent wetlands commonly found in the Parkland Region.

1.6 Taxonomy

The scientific names for all vascular plants and bryophytes in this report follow the Integrated Taxonomic Information System (ITIS 2014). Common names follow those widely used in Alberta (ACIMS 2013). For a preliminary list of Alberta wetland plants, including the wetland classes in which these species typically occur, see Appendix C.

2. KEY TO THE WETLAND CLASSES AND FORMS OF ALBERTA

The following key presents sets of contrasting features under each number, only one of which should apply to a given location. Each choice leads to another set of features until eventually ending at a wetland form. Once wetland class and form have been determined, proceed to the appropriate key to classify the site to its type. Sections 3 to 6 also provides more detailed descriptions of typical characteristics of wetland classes, including commonly found plant species. As with other wetland keys that have been developed (e.g., National Wetlands Working Group 1997, Smith *et al*. 2007), this key does not include truly aquatic ecosystems. Note that form is the lowest level that bogs are classified to in Alberta. Wooded swamps are also not classified to type, due to a lack of available information on them for Alberta.

It is important to note that a site may contain more than one broad wetland class. Some common examples of this are marshes surrounded by a shrubby swamp fringe, and fens that support bog islands. In these cases, all wetland classes should be classified and/or mapped provided that they are large enough to meet a suitable mapping scale. Multiple characteristics and attributes need to be carefully considered before determining the class of a wetland, and best professional judgment may be required to overrule the key, particularly in wetlands that have undergone a hydrologic disturbance. For instance, a partially drained fen that no longer has 40 cm of peat accumulation, but that retains other fen characteristics should still be classified as a fen.

Classification Key to Wetland Classes and Forms

1.

1a. Terrain is not affected by the water table near, at or above the ground surface for more than a short period of days after spring snowmelt or a heavy rainfall, or is affected by deepwater habitat with water levels that are greater than two metres deep at midsummer **2**

1b. Terrain affected by the water table near, at or above the ground surface, and which is saturated long enough to promote water altered soils, growth of water tolerant vegetation, and other biological activities adapted to a wet environment. If surface water is present, it is less than two metres deep at midsummer **3**

2. Non-Wetland

2a. No evidence of water tolerant vegetation, water altered soils or surface water, or, if surface water is present, it is deepwater habitat with water levels that are greater than two metres deep at midsummer. ..... **Upland or Aquatic**

2b. Evidence of water altered soils may be found deeper than 30 cm below the ground surface or may not be present at all. Surface water is present in most years, but only for a brief period of days after snowmelt or a heavy rainfall. Although some water tolerant vegetation may be present, they are not dominant and are intermixed with a majority of upland species ..... **Ephemeral water body**

3. Wetland

3a. Wetland typically characterized by the accumulation of at least 40 cm of peat. Organic matter has a Von Post decomposition of 5 or less **4**

3b. Wetland typically characterized by the accumulation of less than 40 cm of peat. Organic matter has a Von Post decomposition of 6 or greater. Water table is near, at or above the ground surface for variable periods during the year in the majority of years **7**

4. Peatland

4a. Peatland is ombrogenous, containing water that is fresh (< 100 µS/cm) and acidic (pH < 4.5, typically). The site is elevated above the water table, which is usually found more than 40 cm below the surface. A dense ground cover of bryophyte species is typically present, which may include sphagnum mosses, feather mosses and lichens. Trees, when present, are typically restricted to black spruce. ..... **5 (Bog)**

4b. Peatland is minerogenous, and pH ranges from acidic to basic (typically > 4.5). Water contains more dissolved minerals than would occur from precipitation alone. A dense ground cover of bryophyte species is typically present, which may include sphagnum and brown mosses ..... **6 (Fen)**

5. Bog forms

5a. Contains more than 25% tree cover mainly by confers ..... **Wooded Bog [Section 3.1]**

5b. Contains more than 25% shrub cover, and tree cover is 25% or less ..... **Shrubby Bog [Section 3.2]**

5c. Contains more than 25% ground cover, tree cover is 25% or less, and shrub cover is 25% or less (rarely occurs in Alberta) ..... Open Bog

6. Fen forms

6a. Contains more than 25% tree cover mainly by conifers..... **Wooded Fen [Section 4.1]**

6b. Contains more than 25% shrub cover, and tree cover is 25% or less ..... **Shrubby Fen [Section 4.2]**

6c. Contains more than 25% ground cover, tree cover is 25% or less, and shrub cover is 25% or less ..... **Graminoid Fen [Section 4.3]**

7. Mineral Wetland

7a. Mineral wetland with water table near, at or above the ground surface in most years. Shrub cover is less than 25% of the total area..... **8**

7b. Typically a mineral wetland, although may be a peatland, with water table near, at or above the ground surface in most years. Woody plant cover comprises more than 25% of the total area ..... **9 (Swamp)**

8. Marsh and Shallow Open Water forms

8a. Dominated by graminoid forms in the deepest wetland zone covering more than 25% of the total area in the majority of years ..... **Marsh [Section 5.1]**

8b. Dominated by aquatic forms inhabiting an open water zone covering more than 25% of the total area in the majority of years ..... **Shallow Open Water [Section 5.2]**

9. Swamp forms

9a. Contains more than 25% tree cover, of which 75% or more is made up of coniferous species ..... **Coniferous Wooded Swamp [Section 6.1]**

9b. Contains more than 25% tree cover, which includes a mix of coniferous and deciduous species, where neither individually exceeds 75% of the total tree cover..... **Mixedwood Wooded Swamp [Section 6.2]**

9c. Contains more than 25% tree cover, of which 75% or more is made up of deciduous species ..... **Deciduous Wooded Swamp [Section 6.3]**

9d. Contains more than 25% shrub cover, and tree cover is 25% or less ..... **Shrubby Swamp [Section 6.4]**

Classification Key to Fen Types

1. Freshwater fen with an electrical conductivity of less than 100 µS/cm and a pH of less than 5.5 ..... **Poor Fen**

2. Freshwater fen with an electrical conductivity between 100 and 250 µS/cm and a pH between 5.5 and 7.0 ..... **Moderate-Rich Fen**

3. Freshwater to slightly brackish fen with an electrical conductivity typically between 250 µS/cm and 2,000 µS/cm and a pH of greater than 7.0 ..... **Extreme-Rich Fen**

Classification Key to Marsh and Shallow Open Water Types

1.

1a. Surface water periodically present every year for a short period of time after snowmelt or a heavy rainfall, but otherwise lacks surface water **2**

1b. Surface water present for most of the growing season, but has little or no surface water remaining by the end of summer **3**

1c. Surface water present year-round in the majority of years unless drought conditions persist **4**

1d. Surface water present year-round even in drought conditions **5**

2. **Temporary wetland**

2a. Periodically flooded with **freshwater** ..... **Temporary-Freshwater Marsh**

2b. Periodically flooded with **slightly brackish** water ..... **Temporary-Slightly Brackish Marsh**

2c. Periodically flooded with **saline** water ..... **Intermittent-Saline Shallow Open Water**

3. **Seasonal wetland**

3a. Seasonally flooded with **freshwater** ..... **Seasonal-Freshwater Marsh** ***or*** **Shallow Open Water**

3b. Seasonally flooded with **slightly brackish** water.. **Seasonal-Slightly Brackish Marsh** ***or*** **Shallow Open Water**

3c. Seasonally flooded with **moderately brackish** water ..... **Seasonal-Moderately Brackish Marsh** ***or*** **Shallow Open Water**

4. **Semi-permanent wetland**

4a. Semi-permanently flooded with **freshwater**... **Semi-Permanent-Freshwater Marsh** ***or*** **Shallow Open Water**

4b. Semi-permanently flooded with **slightly brackish** water ..... **Semi-Permanent-Slightly Brackish Marsh** ***or*** **Shallow Open Water**

4c. Semi-permanently flooded with **moderately brackish** water ..... **Semi-Permanent-Moderately Brackish Marsh** ***or*** **Shallow Open Water**

4d. Semi-permanently flooded with **brackish** water ..... **Semi-Permanent-Brackish Marsh** **or** **Shallow Open Water**

4e. Semi-permanently flooded with **sub-saline** water..... **Semi-Permanent-Sub-Saline Shallow Open Water**

5. **Permanent wetland**

5a. Permanently flooded with **slightly brackish** water even during drought conditions..... **Permanent-Slightly Brackish Shallow Open Water**

5b. Permanently flooded with **moderately brackish** water even during drought conditions ..... **Permanent-Moderately Brackish Shallow Open Water**

5c. Permanently flooded with **brackish** water even during drought conditions ..... **Permanent-Brackish Shallow Open Water**

5d. Permanently flooded with **sub-saline** water even during drought conditions ..... **Permanent-Sub-Saline Shallow Open Water**

Classification Key for Shrubby Swamp Types

1. Typically flooded with **freshwater** to **slightly brackish** water for a short period of time after snowmelt or a heavy rainfall but otherwise lacks surface water.....**Temporary-Freshwater to Slightly Brackish-Shrubby Swamp**

2. Typically flooded with **freshwater** to **slightly brackish** water for the majority of the growing season, but has little or no surface water remaining by the end of summer..... **Seasonal-Freshwater to Slightly Brackish-Shrubby Swamp**

3. Typically flooded with **moderately brackish** to **sub-saline water** for the majority of the growing season, but has little or no surface water remaining by the end of summer ..... **Seasonal-Moderately Brackish to Sub-Saline-Shrubby Swamp**

3. BOGS

The ground surface of bogs is composed of peat and is isolated from surface water and groundwater influences due to either landscape position (i.e. closed depressions with no sources of water inflow) or more commonly, by elevation (i.e. the ground surface is typically 40 cm or more above the water table). Elevation of the ground surface can result from the accumulation of peat or the formation of permafrost. As a result, bogs are ombrogenous systems fed exclusively by precipitation.

Bogs are permanent wetlands, as moisture levels are effectively maintained by the capillary action of sphagnum mosses. Although nutrients are imported into wetlands mainly through the input of surface water, primary production and decomposition generally determine the nutrient availability in wetlands (Mitch and Gosselink 2007). In bogs, primary production exceeds decomposition, storing nutrients in the peat and limiting the availability of nitrogen, phosphorous and other important minerals that many plants require (Mitch and Gosselink, 2007).

In northern Alberta, permafrost can form in peatlands where both low temperature and peat insulation results in ground temperatures that remain below freezing. Bogs in Alberta have been described by Belland and Vitt (1995) and have typically been subdivided into wooded and shrubby forms. Open bogs that are dominated by graminoids are known to occur in the province (see *Smith et al*. 2007), but are uncommon.

3.1 Wooded Bogs

Wooded bogs have more than 25% tree cover by coniferous species, predominantly black spruce (Picea mariana). These trees tend to be small and stunted, rarely reaching heights greater than ten metres. Common Labrador tea (Rhododendron groenlandicum) is the predominant understory shrub, often interspersed with bog cranberry (Vaccinium vitis-idaea), cloudberry (Rubus chamaemorus) and small bog cranberry (Vaccinium oxycoccos). Taller ericaceous shrubs such as bog rosemary (Andromeda polifolia), leatherleaf (Chamaedaphne calyculata) and northern laurel (Kalmia polifolia) are also common. Sheathed cottongrass (Eriophorum vaginatum) is the most prevalent graminoid species in wooded bogs.

In wooded bogs where the water table is closer to the surface, thick mats of sphagnum mosses (Sphagnum spp.) blanket the ground, including midway peat moss (Sphagnum magellanicum), poor-fen sphagnum (Sphagnum angustifolium) and rusty peat moss (Sphagnum fuscum). These species are often interspersed with round-leaved sundew (Drosera rotundifolia), scattered sedges (Carex spp.) and other bryophytes, including liverworts such as Mylia anomala and slender haircap moss (Polytrichum strictum).

In wooded bogs where the water table is further from the ground surface, dicranum mosses (Dicranum spp.), lichens, Schreber's moss (Pleurozium schreberi) and stair-step moss (Hylocomium splendens) are commonly present.

3.2 Shrubby Bogs

Shrubby bogs have more than 25% shrub cover and tree cover is 25% or less. Most shrubs are less than one metre tall. Shrub and ground cover species are similar to species found in wooded bogs. Sheathed cottongrass (Eriophorum vaginatum) is the most prevalent graminoid, and sphagnum mosses (Sphagnum spp.), including midway peat moss (Sphagnum magellanicum) and poor-fen sphagnum (Sphagnum angustifolium) often dominate the ground surface. Other common species that are often present in lower abundances include slender haircap moss (Polytrichum strictum) and tufted moss (Aulacomnium palustre).

3.3 Bog Types

Bogs are not subdivided into types. All bogs are acidic, typically having a pH of less than 4.5. As bogs are exclusively fed by precipitation, they are all freshwater wetlands; plants that live in bogs are adapted to extreme conditions with low available nutrients and high acidity, but they cannot tolerate elevated salinity.

4. FENS

Fens are minerogenous peatlands, meaning they receive water from a variety of sources that accumulates dissolved minerals and increases the alkalinity of the environment. Fens are permanently saturated wetlands that typically have a pH of greater than 4.5; although in specific landscapes, which include glaciofluvial deposits on northern uplands with local groundwater flow, pH can be as low as 3.5. Fens have fresh to slightly brackish water and like bogs, are low in salinity and available nutrients. For a review of the chemical and vegetation characteristics of fens in Alberta, see Vitt and Chee (1990).

Fen vegetation is typically dominated by sedges (*Carex* spp.) and dense mats of bryophyte species. When present, shrubs are one to two metres tall. Many vascular plants commonly found in fens are not typically found in bogs. Some of these species include bog muhly (*Muhlenbergia glomerata*), buck-bean (*Menyanthes trifoliata*), hairy-fruit sedge (*Carex lasiocarpa*), mud sedge (*Carex limosa*), tall white bog orchid (*Platanthera dilatata*), tamarack (*Larix laricina*), sticky false asphodel (*Tofieldia glutinosa*) and willows (*Salix* spp.). Note that use of the word 'bog' in common species names can be misleading.

4.1 Wooded Fens

Wooded fens have more than 25% tree cover by coniferous species. Black spruce (Picea mariana) and tamarack (Larix laricina) dominate the treed stratum of wooded fens; black spruce is more prevalent in poor fens, whereas tamarack is more common in extreme-rich fens. Water tables in wooded fens are typically less than 20 cm below the ground surface. Shrub birches (Betula spp.) and willows (Salix spp.) are common understory shrubs. Below this, Labrador tea (Rhododendron groenlandicum), thick mats of brown and sphagnum mosses, intermixed with some graminoid and forb species occupy the ground layer.

4.2 Shrubby Fens

Shrubby fens have more than 25% shrub cover and 25% or less tree cover. The water table in shrubby fens is typically within ten centimeters of the ground surface. Common species in shrubby fens include bog birch (Betula glandulosa), dwarf birch (Betula pumila) and a variety of willows (Salix spp.), such as bog willow (Salix pedicellaris) and hoary willow (Salix candida). Shrubs usually reach one to two metres in height, and are taller than the ericaceous shrubs that dominate bogs. Shrubs such as common Labrador tea (Rhododendron groenlandicum) and leatherleaf (Chamaedaphne calyculata) can also be present. Thick mats of brown and sphagnum mosses often cover the ground, interspersed with a variety of graminoids and forbs.

4.3 Graminoid Fens

Graminoid fens are dominated by ground cover, and have both 25% or less tree cover and 25% or less shrubby cover. Water levels in graminoid fens are typically at or near to the ground surface. Brown and sphagnum mosses cover the ground and are intermixed with sedges and forbs.

4.4 Fen Types

Because of the variety of water sources and landscape positions that fens occur in, water chemistry and vegetation in fens can be quite variable. Fens are grouped into poor, moderate-rich and extreme-rich types based on an acidity-alkalinity gradient and a corresponding set of indicator species (Vitt and Chee, 1990).

Poor fens have a low pH and little to no alkalinity, whereas moderate-rich and extreme-rich fens have increasing alkalinity. The acidity-alkalinity gradient does not correlate with a nutrient gradient, as poor fens, moderate-rich fens and extreme-rich fens all have low amounts of available nutrients.

Poor and moderate-rich fens are freshwater peatlands, whereas extreme-rich fens have slightly brackish water. Freshwater–poor fens tend to occur in headwaters like Alberta's northern highlands, where surface water inputs are more influential and groundwater flow paths are shallow (e.g., Stony Mountain, Birch Mountains and Caribou Mountains). Freshwater–poor fens also occur in areas of the province where bedrock and surficial deposits are acidic (i.e., Canadian Shield Region), or along the margin of large bogs that influence surface water chemistry. Moderate-rich fens and extreme-rich fens have a greater amount of groundwater discharge and are more typical at lower landscape positions or in association with coarse-grained surficial deposits (e.g., glaciofluvial and aeolian). Greater amounts of groundwater discharge result in higher alkalinity, which buffers acidity, particularly in extreme-rich fens.

Groundwater is an important component of extreme-rich fens. In some cases, extreme-rich fens can be indicators of geologic features such as springs, and are often associated with the deposition of marl. In northeastern Alberta, extreme-rich fens are typically found on glaciofluvial deposits at the base of uplands where regional groundwater flow paths discharge near or at the surface. The constant supply of groundwater throughout the growing season maintains water levels at the surface for the entire growing season. In spring, snowmelt can move as sheet flow on the frozen surface of these fens and deposit organic debris. This leads to the development of patterned fens that have distinctive patterns of drier ridges called strings and wetter pools known as flarks. The three fen forms (i.e., wooded, shrubby and graminoid) can all exist as poor, moderate-rich and extreme-rich types.

Poor Fen

Characteristics of a Poor Fen may include:

- Electrical conductivity of less than 100 µS/cm
- pH of less than 5.5
- Ground cover with graminoid species such as sheathed cottongrass (Eriophorum vaginatum), hairy fruit sedge (Carex lasiocarpa) and prostrate sedge (Carex chordorrhiza), and forbs such as bog muhly (Muhlenbergia glomerata) and three-leaved Solomon's-seal (Maianthemum trifolium). Additional species that can occur in low abundances include cloudberry (Rubus chamaemorus) and Scheuchzeria palustris.
- Bryophyte cover is typically dominated by various species of sphagnum mosses, including pendant branch peat moss (Sphagnum jensenii), poor-fen sphagnum (Sphagnum angustifolium), Sphagnum fallax and Sphagnum majus and shore-growing

peat moss (Sphagnum riparium). Other ground cover species which are frequently present in low abundances include brown mosses, such as *Warnstorfia exannulata*, and many liverworts.

Moderate–Rich Fen

Characteristics of a Moderate-Rich Fen may include:

- Electrical conductivity between 100 to 250 µS/cm
- pH between 5.5 and 7.0
- Herbaceous ground cover that includes sedge species found in poor fens, as well as three-seeded sedge (Carex trisperma), two-stamened sedge (Carex diandra) and water sedge (Carex aquatilis). Typical forbs include buck-bean (Menyanthes trifoliata), marsh cinquefoil (Comarum palustre), pitcher plant (Sarracenia purpurea), three-leaved Solomon's-seal (Maianthemum trifolium) and water arum (Calla palustris). Species such as seaside arrowgrass (Triglochin maritima) and tufted clubrush (Trichophorum cespitosum) can also be present in low abundance. Flat-leaved bladderwort (Utricularia intermedia) is sometimes present in pools but is more common in extreme-rich fens.
- Bryophyte ground cover is typically dominated by brown mosses, including aduncus brown moss (Drepanocladus aduncus), golden moss (Tomentypnum nitens), hamatocaulis mosses (Hamatocaulis lapponicus and Hamatocaulis vernicosus) and limprichtia brown moss (Limprichtia revolvens). Sphagnum mosses can be present and in some cases dominate bryophyte cover. Typical sphagnum moss species include warnstorfia peat moss (Sphagnum warnstorfii). Other species that are frequently present but occur in low abundances include Bryum pseudotriquetrum and tufted moss (Aulacomnium palustre).

Extreme–Rich Fen

Characteristics of an Extreme-Rich Fen may include:

- Electrical conductivity between 250 µS/cm and 2,000 µS/cm
- pH of greater than 7.0
- Herbaceous ground cover that includes graminoids and forbs such as mud sedge (Carex limosa), buckbean (Menyanthes trifoliata), marsh cinquefoil (Comarum palustre), pitcher plant (Sarracenia purpurea), seaside arrowgrass (Triglochin maritima), tufted clubrush (Trichophorum cespitosum) and water arum (Calla palustris). Flat-leaved bladderwort (Utricularia intermedia) is often present in pools. In slightly brackish fens where sodium is an important part of the water chemistry, sedges like C. aquatilis, C. atherodes and C. utriculata are common and associated with a reduction in bryophyte cover.
- Bryophyte cover is typically dominated by brown mosses, including giant calliergon moss (Calliergon giganteum), golden moss (Tomentypnum nitens), hamatocaulis mosses (Hamatocaulis lapponicus and Hamatocaulis vernicosus), limprichtia brown moss (Limprichtia revolvens), scorpidium moss (Scorpidium scorpioides), three-angled thread-moss (Meesia triquetra) and yellow starry fen moss (Campylium stellatum).

5. MARSHES AND SHALLOW OPEN WATERS

Marshes and shallow open waters are mineral wetlands characterized by mineral soil (which can include non-peat accumulating organic soil), fluctuating water levels, and a wide range of chemical gradients. Some marshes and shallow open waters may be isolated from surface water connections (e.g. some prairie potholes), while others may have a variety of water sources that exhibit complex groundwater-surface water interactions. Examples of marshes and shallow open waters with hydrologic connections include recharge, discharge and flow-through wetlands, and wetlands bordering lotic (e.g. streams) and lentic (e.g. lakes) water bodies.

Although nutrient levels vary widely in marshes and shallow open waters, many in Alberta are naturally eutrophic, which means their water has high nutrient concentrations. In mineral wetlands, decomposition typically exceeds primary production, and nutrients are released back into the ecosystem for use. Mineral wetlands typically have higher amounts of available nutrients than peatlands (Smith et al 2007).

Wetland class is defined by the plant community or form occupying the deepest portion of the basin covering greater than 25% of the total area in the majority of years; graminoid cover occupies marshes in the deepest portion of the basin, while shallow open waters have aquatic forms. Marshes and shallow open waters may exhibit temporal shifts in plant composition and abundance. Wetland class should be determined by the dominant vegetation in the deepest wetland zone *in the majority of years*.

5.1 Marsh Forms

Marshes only have one form – graminoid. They are mineral wetlands with water levels near, at or above the ground surface for variable periods during the growing season. They can be identified by the dominance of water tolerant graminoids in the deepest wetland zone covering more than 25% of the total area in the majority of years. Marshes contain less than 25% shrub cover, but may have willows and other woody species scattered in and around the wetland margin. In marshes with more than 25% shrub species around the margin, the site may be classified into two classes (i.e. marsh and swamp) if the both areas are large enough to map and delineate.

Marshes are found in a wide range of landscape positions, but are most common in the Grassland and Parkland Regions of Alberta. In these regions, they usually fill isolated shallow depressions or shallow drainage ways. They often occur in farmland, rangeland, and natural grassland landscapes. In the Boreal Region, they are less common and usually found along watercourses and waterbodies where water levels tend to fluctuate. They are also found in areas where salinity limits the growth of bryophytes and other salt-intolerant plants.

5.2 Shallow Open Water Forms

Shallow open waters typically have an open water zone supporting floating and/or submersed aquatic vegetation in the deepest wetland zone covering more than 25% of the total area in the majority of years; however, wetlands with sparse vegetation (e.g. salt flats) also exist. Shallow open waters are less than two metres deep at midsummer; depth measurements may be required to differentiate them

from adjacent lakes, ponds and other bodies of water. Graminoid communities similar to those in marshes often surround the open water zone in shallow open water wetlands.

Many shallow open waters have no inlets or outlets, and thus receive water from rain, overland surface flow and/or groundwater discharge. Other shallow open water systems may have a widened channel with continual inflow and outflow via surface streams. Like marshes, shallow open waters are most commonly found in the Grassland and Parkland Regions of Alberta.

5.3 Marsh and Shallow Open Water Types

Marshes and shallow open waters are subdivided into type based on their water level permanence and/or vegetation zones as well as salinity. Salinity levels can be influenced by saline groundwater and other factors such as evapoconcentration. Marshes and shallow open waters in Alberta vary widely in salinity.

Water level permanence is influenced by climatic factors such as precipitation and evapotranspiration, and is variable across these wetlands in Alberta. Marsh and shallow open water types are classified by the typical length of time surface water is present in the wetland, and the corresponding dominant vegetation species and community that occupy the deepest wetland zone covering more than 25% of the total area in the majority of years.

Although a seasonal hydroperiod in prairie wetlands typically exhibits a rise in water levels in spring after snowmelt or a heavy rainfall and then a decline over the growing season, inter-annual variation in climatic factors will lead to variability in plant species structure and composition. Persistent aridity may lead to exposed bare soils (Drawdown Bare Soil Phase in Stewart & Kantrud 1971) followed by the establishment of annuals and upland vegetation (Natural Drawdown Emergent Phase). During extensive periods of drought, temporary and seasonal wetlands may be dry year-round and will sometimes be tilled and seeded for agricultural purposes. When wetlands re-flood, plant communities will re-establish (Emergent Phase) until water levels surpass the species' tolerance limits, at which time they will die back and be replaced by aquatic species (Open Water Phase). Examination and comparison of historical aerial photography captured in different years and seasons with varying climate conditions can help improve the accuracy of wetland classification of these wetland types.

5.3.1 Temporary Marshes

Temporary–Freshwater Marsh

Characteristics of a Temporary-Freshwater Marsh may include:

- Conductivity of surface water (when present) of less than 500 µS/cm
- Evidence of soil redox features (e.g. mottles and gleying) within 20 cm of the ground surface;
- No evidence of organic soil development
- A wet meadow plant zone in the deepest part of the basin; typical species include bluejoint (Calamagrostis canadensis), fowl bluegrass (Poa palustris), graceful sedge (Carex praegracilis), northern reed grass (Calamagrostis stricta ssp.inexpansa),

Sartwell's sedge (Carex sartwelli), small bedstraw (Galium trifidum), tufted hairgrass (Deschampsia cespitosa), western dock (Rumex occidentalis), marsh skullcap (Scutellaria galericulata) and wild mint (Mentha arvensis)
- When a wetland has been tilled for agricultural use or has been otherwise disturbed, a variety of invasive species may be present

Temporary–Slightly Brackish Marsh

Characteristics of a Temporary-Slightly Brackish Marsh may include:

- Conductivity of surface water (when present) between 500 µS/cm and 2,000 µS/cm
- Evidence of soil redox features (e.g. mottles and gleying) within 20 cm of the ground surface
- No evidence of organic soil development
- A wet meadow plant zone in the deepest part of the basin; typical species include bluejoint (Calamagrostis canadensis), fowl bluegrass (Poa palustris), foxtail barley (Hordeum jubatum), tufted hairgrass (Deschampsia cespitosa), western dock (Rumex occidentalis), wild mint (Mentha arvensis) and wire rush (Juncus balticus)
- When a wetland has been tilled for agricultural use or has been otherwise disturbed, a variety of invasive species may be present, including quackgrass (Elymus repens)

5.3.2 Seasonal Marshes

Seasonal–Freshwater Marsh

Characteristics of a Seasonal-Freshwater Marsh may include:

- Conductivity of surface water (when present) of less than 500 µS/cm
- Evidence of soil redox features (e.g. mottles and gleying) within 10 cm of the ground surface
- Organic soils with a Von Post decomposition of 6 or greater
- A shallow wetland plant zone in the deepest part of the basin; typical species include awned sedge (Carex atherodes), common tall mannagrass (Glyceria grandis), common waterparsnip (Sium suave), reed canary grass (Phalaris arundinacea), short-awned foxtail (Alopecurus aequalis), sloughgrass (Beckmannia syzigachne), small bottle sedge (Carex utriculata) and water sedge (Carex aquatilis)
- When a wetland has been tilled for agricultural use, typical species include needle spikerush (Eleocharis acicularis)
- A wet meadow plant zone containing similar species as in temporary-freshwater marshes

Seasonal–Slightly Brackish Marsh

Characteristics of a Seasonal-Slightly Brackish Marsh may include:

- Conductivity of surface water (when present) between 500 µS/cm and 2,000 µS/cm
- Evidence of soil redox features (e.g. mottles and gleying) within 10 cm of the ground surface
- Organic soils with a Von Post decomposition of 6 or greater

- A shallow wetland plant zone in the deepest part of the basin; typical species include awned sedge (Carex atherodes), common waterparsnip (Sium suave), needle spikerush (Eleocharis acicularis), short-awned foxtail (Alopecuris aequalis), reed canary grass (Phalaris arundinacea), sloughgrass (Beckmannia syzigachne), small bottle sedge (Carex utriculata), spangletop (Scolochloa festucacea), water hemlock (Cicuta maculata), water sedge (Carex aquatilis) and water smartweed (Persicaria amphibia, terrestrial form)
- When the wetland has been tilled for agricultural use, typical species include needle spikerush (Eleocharis acicularis)
- A wet meadow plant zone containing similar species as in temporary-slightly brackish marshes

Seasonal–Moderately Brackish Marsh

Characteristics of a Seasonal-Moderately Brackish Marsh may include:

- Conductivity of surface water (when present) between 2,000 µS/cm and 5,000 µS/cm
- Evidence of soil redox features (e.g. mottles and gleying) within 10 cm of the ground surface
- Organic soils with a Von Post decomposition of 6 or greater
- A shallow wetland plant zone in the deepest part of the basin; typical species include needle spikerush (Eleocharis acicularis), Nuttall's salt-meadow grass (Puccinellia nuttalliana), short-awned foxtail (Alopecuris aequalis), sloughgrass (Beckmannia syzigachne) and spangletop (Scolochloa festucacea)
- When the wetland has been tilled for agricultural use, typical species include quackgrass (Elymus repens) and red goosefoot (Chenopodium rubrum)
- Moderately brackish, wet meadow species are often present along the margin; typical species include foxtail barley (Hordeum jubatum), reed canary grass (Phalaris arundinacea), prairie cord grass (Spartina pectinata) and wire rush (Juncus balticus)

5.3.3 Seasonal Shallow Open Waters

Seasonal–Freshwater Shallow Open Water

Characteristics of a Seasonal-Freshwater Shallow Open Water wetland may include:

- Conductivity of surface water (when present) of less than 500 µS/cm
- Evidence of soil redox features (e.g. mottles and gleying) within 10 cm of the ground surface
- A submersed and/or floating aquatic plant zone in the deepest part of the basin; typical species include common bladderwort (Utricularia vulgaris) and various-leaved pondweed (Potamogeton gramineus)
- A wet meadow plant zone can be present around the open water margin; species typically present include bluejoint (Calamagrostis canadensis), fowl bluegrass (Poa palustris), graceful sedge (Carex praegracilis), northern reed grass (Calamagrostis stricta ssp.inexpansa), Sartwell's sedge (Carex sartwelli), small bedstraw (Galium trifidum), tufted hairgrass (Deschampsia cespitosa), western dock (Rumex

occidentalis), marsh skullcap (Scutellaria galericulata) and wild mint (Mentha arvensis)

Seasonal–Slightly Brackish Shallow Open Water

Characteristics of a Seasonal-Slightly Brackish Shallow Open Water wetland may include:

- Conductivity of surface water (when present) between 500 µS/cm and 2,000 µS/cm
- Evidence of soil redox features (e.g. mottles and gleying) within 10 cm of the ground surface
- A submersed and/or floating aquatic plant zone in the deepest part of the basin; typical species include common bladderwort (Utricularia vulgaris), large-leaved white water crowfoot (Ranunculus aquatilis var. diffusa), needle spikerush (Eleocharis acicularis submersed form), small-leaf pondweed (Potamogeton pusillus), water smartweed (Persicaria amphibia aquatic form) and brown moss species of Drepanocladus spp.
- A wet meadow plant zone can be present around the open water margin; typical species include bluejoint (Calamagrostis canadensis), fowl bluegrass (Poa palustris), foxtail barley (Hordeum jubatum), tufted hairgrass (Deschampsia cespitosa), western dock (Rumex occidentalis), wild mint (Mentha arvensis) and wire rush (Juncus balticus)

Seasonal–Moderately Brackish Shallow Open Water

Characteristics of a Seasonal-Moderately Brackish Shallow Open Water wetland may include:

- Conductivity of surface water (when present) between 2,000 µS/cm and 5,000 µS/cm
- Evidence of soil redox features (e.g. mottles and gleying) within 10 cm of the ground surface
- A submersed and/or floating aquatic plant zone in the deepest part of the basin; typical species include algae (Chara spp.), common bladderwort (Utricularia vulgaris), large-leaved white water crowfoot (Ranunculus aquatilis var. diffusa) and brown moss species (Drepanocladus spp.)
- Wet meadow species that are associated with moderately-brackish conditions are often present along the margin; typical species include foxtail barley (Hordeum jubatum), reed canary grass (Phalaris arundinacea), prairie cord grass (Spartina pectinata) and wire rush (Juncus balticus)

5.3.4 Semi-Permanent Marshes

Semi-Permanent–Freshwater Marsh

Characteristics of a Semi-Permanent-Freshwater Marsh may include:

- Conductivity of surface water (when present) of less than 500 µS/cm
- Evidence of soil redox features (i.e. mottles and gleying) at the ground surface
- Organic soils with a Von Post decomposition of 6 or greater
- A deep wetland plant zone in the deepest part of the basin; typical species include common bladderwort (Utricularia vulgaris), common cattail (Typha latifolia),

crystalwort (Riccia flutians), common duckweed (Lemna minor), marsh marigold (Caltha palustris) and purple-fringed heartwort (Ricciocarpos natans)
- Shallow wetland and wet meadow zones containing similar species as in other freshwater marshes

Semi-Permanent–Slightly Brackish Marsh

Characteristics of a Semi-Permanent-Slightly Brackish Marsh may include:

- Conductivity of surface water (when present) between 500 µS/cm and 2,000 µS/cm
- Evidence of soil redox features (e.g. mottles and gleying) at the ground surface
- Organic soils with a Von Post decomposition of 6 or greater
- A deep wetland plant zone in the deepest part of the basin; species typically present include great bulrush (Schoenoplectus acutus var. acutus), three-square rush (Schoenoplectus pungens var. pungens) and water smartweed (Persicaria amphibia, aquatic form)
- Shallow wetland and wet meadow zones containing similar species as in other slightly brackish marshes

Semi-Permanent–Moderately Brackish Marsh

Characteristics of a Semi-Permanent-Moderately Brackish Marsh may include:

- Conductivity of surface water (when present) between 2,000 µS/cm and 5,000 µS/cm
- Evidence of soil redox features (e.g. mottles and gleying) at the ground surface
- Organic soils with a Von Post decomposition of 6 or greater
- A deep wetland plant zone in the deepest part of the basin; typical species include great bulrush (Schoenoplectus acutus var. acutus), ivy-leaved duckweed (Lemna trisulca) and three-square rush (Schoenoplectus pungens var. pungens)
- Shallow wetland and wet meadow zones containing similar species as in seasonal, moderately brackish marshes

Semi-Permanent–Brackish Marsh

Characteristics of a Semi-Permanent-Brackish Marsh may include:

- Conductivity of surface water (when present) between 5,000 µS/cm and 15,000 µS/cm
- Evidence of soil redox features (e.g. mottles and gleying) at the ground surface
- Organic soils with a Von Post decomposition of 6 or greater
- A deep wetland plant zone in the deepest part of the basin; species typically present include great bulrush (Schoenoplectus acutus var. acutus) and three square rush (Schoenoplectus pungens var. pungens)
- Shallow wetland and wet meadow species that are associated with brackish conditions are often present along the margin; typical species include creeping spike-rush (Eleocharis palustris), Nuttall's salt-meadow grass (Puccinellia nuttalliana), samphire (Salicornia rubra) and three-square rush (Schoenoplectus pungens var. pungens)

5.3.5 Semi-Permanent Shallow Open Waters

Semi-Permanent–Freshwater Shallow Open Water

Characteristics of a Semi-Permanent-Freshwater Shallow Open Water wetland may include:

- Conductivity of surface water (when present) less than 500 µS/cm
- Evidence of soil redox features (e.g. mottles and gleying) at the ground surface
- A submersed and/or floating aquatic plant zone in the deepest part of the basin; typical species include clasping-leaf pondweed (Potamogeton richardsonii), common bladderwort (Utricularia vulgafis), hornwort (Ceratophyllum demersum), large-leaved white water crowfoot (Ranunculus aquatilis var. diffusa), small-leaf pondweed (Potamogeton pusillus) and spike water-milfoil (Myriophyllum sibiricum)
- Shallow wetland and wet meadow zone containing similar species as in other freshwater shallow open waters and marshes

Semi-Permanent–Slightly Brackish Shallow Open Water

Characteristics of a Semi-Permanent-Slightly Brackish Shallow Open Water wetland may include:

- Conductivity of surface water (when present) between 500 µS/cm and 2,000 µS/cm
- Evidence of redox features (i.e. mottles and gleying) at the ground surface
- A submersed and/or floating aquatic plant zone in the deepest part of the basin; typical species include clasping-leaf pondweed (Potamogeton richardsonii), common bladderwort (Utricularia vulgaris), hornwort (Ceratophyllum demersum), large-leaved white water crowfoot (Ranunculus aquatilis var. diffusa), small-leaf pondweed (Potamogeton pusillus) and spike water-milfoil (Myriophyllum sibiricum)
- Shallow wetland and wet meadow zone containing similar species as in other slightly brackish shallow open waters and marshes

Semi-Permanent–Moderately Brackish Shallow Open Water

Characteristics of a Semi-Permanent-Moderately Brackish Shallow Open Water wetland may include:

- Conductivity of surface water (when present) between 2,000 µS/cm and 5,000 µS/cm
- Evidence of soil redox features (e.g. mottles and gleying) at the ground surface
- A submersed and/or floating aquatic plant zone in the deepest part of the basin; typical species include algae (Chara spp.), horned pondweed (Zannichellia palustris), large-leaved white water crowfoot (Ranunculus aquatilis var. diffusa), sago pondweed (Stuckenia pectinata) and water-milfoil (Myriophyllum sibiricum)
- Shallow wetland and wet meadow zones containing similar species as in other moderately brackish shallow open waters and marshes

Semi-Permanent–Brackish Shallow Open Water

Characteristics of a Semi-Permanent-Brackish Shallow Open Water wetland may include:

- Conductivity of surface water (when present) between 5,000 µS/cm and 15,000 µS/cm

- Evidence of soil redox features (e.g. mottles and gleying) at the ground surface
- A submersed and/or floating aquatic plant zone in the deepest part of the basin; typical species include algae (Chara spp.) and horned pondweed (Zannichellia palustris)
- Shallow wetland and wet meadow species that are associated with moderately brackish conditions are often present along the margin; typical species include foxtail barley (Hordeum jubatum), reed canary grass (Phalaris arundinacea), prairie cord grass (Spartina pectinata) and wire rush (Juncus balticus)

Semi-Permanent–Sub-Saline Shallow Open Water

Characteristics of a Semi-Permanent-Sub-Saline Shallow Open Water wetland may include:

- Conductivity of surface water (when present) between 15,000 µS/cm and 45,000 µS/cm
- Evidence of redox features (e.g. mottles and gleying) at the ground surface
- A submersed and/or floating aquatic plant zone in the deepest part of the basin; typical species include algae (Chara spp.), horned pondweed (Zannichellia palustris), sago pondweed (Stuckenia pectinata) and widgeon-grass (Ruppia cirrhosa)
- Shallow wetland and wet meadow species that are associated with sub-saline conditions are often present along the margin; typical species include alkali cordgrass (Spartina gracilis), common seablite (Suaeda calceoliformis), foxtail barley (Hordeum jubatum), Nuttall's salt-meadow grass (Puccinellia nuttalliana), salt grass (Distichlis spicata ssp. stricta), samphire (Salicornia rubra), seaside arrow-grass (Tryglochin maritima) and scratch grass (Muhlenbergia asperifolia)

5.3.6 Permanent Shallow Open Waters

Permanent–Slightly Brackish Shallow Open Water

Characteristics of a Permanent-Slightly Brackish Shallow Open Water wetland may include:

- Conductivity of surface water (when present) between 500 µS/cm and 2,000 µS/cm
- A submersed and/or floating aquatic plant zone in the deepest part of the basin that is almost exclusively widgeon-grass (Ruppia cirrhosa)
- Shallow wetland and wet meadow zones containing similar species as in other slightly brackish shallow open waters and marshes

Permanent–Moderately Brackish Shallow Open Water

Characteristics of a Permanent-Moderately Brackish Shallow Open Water wetland may include:

- Conductivity of surface water (when present) between 2,000 µS/cm and 5,000 µS/cm
- A submersed and/or floating aquatic plant zone in the deepest part of the basin that is almost exclusively widgeon-grass (Ruppia cirrhosa)
- Shallow wetland and wet meadow zones containing similar species as in other moderately brackish shallow open waters and marshes

Permanent–Brackish Shallow Open Water

Characteristics of a Permanent-Brackish Shallow Open Water wetland may include:

- Conductivity of surface water (when present) between 5,000 µS/cm and 15,000 µS/cm
- A submersed and/or floating aquatic plant zone in the deepest part of the basin that is almost exclusively large-sheath pondweed (Stuckenia vaginata), and widgeon-grass (Ruppia cirrhosa)
- Shallow wetland and wet meadow zones containing similar species as in other brackish shallow open waters and marshes

Permanent–Sub-Saline Shallow Open Water

Characteristics of a Permanent-Sub-Saline Shallow Open Water wetland may include:

- Conductivity of surface water (when present) between 15,000 µS/cm and 45,000 µS/cm
- A lack of submersed and/or floating aquatic vegetation, i.e., bare ground or open water
- Shallow wetland and wet meadow zones containing similar species as in other sub-saline shallow open waters

5.3.7 Intermittent Shallow Open Waters

Intermittent shallow open waters are alkaline wetlands subject to periodic flooding that are typically found in southern Alberta. Intermittent–saline–shallow open waters are characterized by saline water that is periodically present. When this wetland type is not flooded, glistening white alkali saltflats are exposed that are primarily composed of sodium and magnesium chlorides and sulphates.

Intermittent–Saline Shallow Open Water

Characteristics of an Intermittent-Saline Shallow Open Water wetland may include:

- Conductivity of surface water (when present) greater than 45,000 µS/cm
- Presence of a submersed alkaline wetland plant zone in the deepest part of the basin that is almost exclusively widgeon-grass (Ruppia cirrhosa)

6. SWAMPS

Depending on the moisture regime and hydrology, swamps may or may not accumulate peat, although they are generally considered to be mineral wetlands and are placed under mineral wetlands in the classification key. Water in swamps is nutrient-rich, and water levels fluctuate throughout the year. Many swamps along rivers are flooded annually. Although flooding can occur for extended periods, water levels typically decline during the growing season, and surficial water either disappears or only persists in depressions. Groundwater, however, remains close to the surface, within the tree and shrub rooting zone. The ground surface in swamps is often very hummocky, with deep, water-filled depressions alternating with elevated mounds on which trees and shrubs tend to grow.

Swamps can develop in a variety of environments, including the margins of other wetlands, river floodplains and deltas and alluvial fans. Swamps often form a transition zone between wetlands and surrounding uplands and can occur across broad, level plains in the Boreal Region or in the bottom of river valleys.

Swamps are defined as mineral wetlands that have at least 25% woody cover. Swamp forms are subdivided based on the presence or absence of trees (wooded or shrubby) as well as by the stand type (i.e., coniferous, mixedwood and deciduous).

6.1 Wooded Coniferous Swamps

Wooded coniferous swamps have more than 25% tree cover, of which 75% or more is comprised by coniferous species. Coniferous swamps are typically made up of black spruce (Picea mariana) and occasionally tamarack (Larix laricina). White spruce (Picea glauca) is occasionally present.

Trees often reach heights greater than ten metres in closed canopy stands. The understory of coniferous wooded swamps supports a variety of shrubs, including alders (Alnus spp.), bog birch (Betula glandulosa), common Labrador tea (Rhododendron groenlandicum) and dwarf birch (Betula pumila). The ground surface is hummocky, with pools of standing water accumulating around the base of trees. Ground cover includes bunchberry (Cornus canadensis), dewberry (Rubus pubescens), long-leaved chickweed (Stellaria longifolia), northern starflower (Trientalis borealis) and small bedstraw (Galium trifidum). Scattered bryophytes can be found, but are more common in open stands. Feathermosses may also be present.

6.2 Wooded Mixedwood Swamps

Wooded mixedwood swamps have canopies with at least 25% tree cover that can include a mix of coniferous and deciduous species, of which neither individually exceeds 75% of the total proportion. Alaska birch (Betula neoalaskana), balsam poplar (Populus balsamifera) and black spruce (Picea mariana) are typical species, while white spruce (Picea glauca) and tamarack (Larix laricina) are occasionally present. Shrubs are typically more than two metres high and include species of alder (Alnus spp.), beaked willow (Salix bebbiana), common Labrador tea (Rhododendron groenlandicum), skunk currant (Ribes glandulosum), pussy willow (Salix discolour) and wild red currant (Ribes triste). As with coniferous swamps, the ground surface is hummocky. Ground cover

species include the same species that are found in coniferous wooded swamps, as well as arrow-leaved coltsfoot (Petasites frigidus var. sagittatus) and horsetails (Equisetum spp.). Scattered bryophytes can be found and typically include species such as Amblystegium serpens, Climacium dendroides, Jamesoniella autumnalis, Lophocolea heterophylla and Plagiomnium ellipticum.

6.3 Wooded Deciduous Swamps

Wooded deciduous swamps have canopies with at least 25% tree cover, of which 75% or more is comprised of deciduous species. Alaska birch (Betula neoalaskana), balsam poplar (Populus balsamifera) and white birch (Betula papyrifera) are commonly present, while black spruce (Picea mariana), white spruce (Picea glauca) and tamarack (Larix laricina) are less common. Deciduous wooded swamps are often associated with alluvial fans found along the base of many of Alberta's northern highlands where nutrient input is comparably high for the boreal forest. In the river valleys of southern Alberta, common species include balsam poplar (Populus balsamifera), plains cottonwood (Populus deltoids) and narrow-leaf cottonwood (Populus angustifolia).

Shrub species in deciduous wooded swamps are similar to mixedwood swamps, although they are typically more robust and often include Manitoba maple (Acer negundo) and red-osier dogwood (Cornus sericea). Ground cover is diverse and includes species present in other wooded swamps as well as common marsh marigold (Caltha palustris), gold saxifrage (Chrysosplenium spp.), kidney-leaved violet (Viola renifolia), marsh violet (Viola palustris), sedges (Carex spp.), touch-me-nots (Impatiens spp.) and wood ferns (Dryopteris spp.).

6.4 Shrubby Swamps

Shrubby swamps have more than 25% shrubby cover and a canopy with 25% or less tree cover. These wetlands are often present along the margin of marshes and shallow open water wetlands or along rivers and deltaic floodplains.

Shrubby swamps are usually underlain by mineral soils with relatively little peat accumulation and typically have mottles and gleying present within the rooting zone. The vegetation is dominated by tall shrubs greater than two metres, composed of alder (Alnus spp.), red-osier dogwood (Cornus sericea) and willows (Salix spp.). Grasses and sedges are an important component of the understory, and species presence depends on water permanence and salinity. Bryophytes may be present but typically do not develop thick mats as they do in shrubby fens.

6.5 Swamp Types

Only shrubby swamps are classified to type due to a lack of information for wooded swamps. Shrubby swamp types are subdivided according to hydroperiod and salinity, which in turn influences the plant species present.

Temporary–Freshwater to Slightly Brackish–Shrubby Swamp

Characteristics of a Temporary-Freshwater to Slightly Brackish-Shrubby Swamp may include:

- Conductivity of surface water (when present) ranges from less than 40 µS/cm to 2,000 µS/cm
- Evidence of soil redox features (e.g. mottles and gleying) within 20 cm of the ground surface
- Shrubs such as alder (Alnus spp.) and willow (Salix spp.) intermixed with a wet meadow plant zone that typically includes bluejoint (Calamagrostis canadensis), common nettle (Urtica dioica), creeping thistle (Cirsium arvense), fowl bluegrass (Poa palustris), sedges (Carex spp.), slender wheatgrass (Elymus trachycaulus) and small bedstraw (Galium trifidum)

Seasonal–Freshwater to Slightly Brackish–Shrubby Swamp

Characteristics of a Seasonal-Freshwater to Slightly Brackish-Shrubby Swamp may include:

- Conductivity of surface water (when present) ranges from less than 40 µS/cm to 2,000 µS/cm
- Evidence of soil redox features (i.e., mottles and gleying) within 10 cm of the ground surface
- Shrubs such as alder (*Alnus* spp.), red osier dogwood (*Cornus serecea*) and willow (*Salix* spp.) intermixed with a seasonal wetland plant zone that typically includes awned sedge (*Carex atherodes*), bluejoint (*Calamagrostis canadensis*), common tall manna grass (*Glyceria grandis*), common waterparsnip (*Sium suave*), reed canary grass (*Phalaris arundinacea*), short-awned foxtail (*Alopecurus aequalis*) and sloughgrass (*Beckmannia syzigachne*)

Seasonal–Moderately Brackish to Sub-Saline-Shrubby Swamp

Characteristics of a Seasonal-Moderately Brackish to Sub-Saline-Shrubby Swamp include:

- Conductivity of surface water (when present) between 2,000 µS/cm and 5,000 µS/cm
- Evidence of soil redox features (i.e. mottles and gleying) within 10 cm of the ground surface
- Willow (Salix spp.) shrubs intermixed with a seasonal wetland plant zone that typically includes alpine hedysarum (Hedysarum alpinum), meadow sedge (Carex praticola), slender wheatgrass (Elymus trachycaulus), sloughgrass (Beckmannia syzigachne) and spangletop (Scolochloa festucacea)

7. LITERATURE CITED

Alberta Conservation Information Management System (ACIMS). 2015. Retrieved March 2014 from the Alberta Environment and Sustainable Resource Development, Edmonton, AB. Available at: http://www.albertaparks.ca/albertaparksca/management-land-use/alberta-conservation-information-management-system-%28acims%29.aspx.

Alberta Environment and Sustainable Resource Development (ESRD). In press. Guidelines for Wetland Establishment on Reclaimed Oil Sands Leases (3rd Edition). Prepared for the Wetlands and Aquatics Subgroup of the Reclamation Working Group of the Cumulative Environmental Management Association, Fort McMurray, AB.

Bayley, S. E. and R. L. Mewhort. 2004. Plant community structure and functional differences between marshes and fens in the southern boreal region of Alberta, Canada. Wetlands 24: 277-294.

Beckingham, J. D., I. G. W. Corns and J. H. Archibald. 1996. Field Guide to Ecosites of West-Central Alberta. Vancouver, BC, UBC Press.

Beckingham, J. D. and J. H. Archibald. 1996. Field Guide to Ecosites of Northern Alberta. Vancouver, BC, UBC Press.

Belland, R. and D. H. Vitt. 1995. Bryophyte vegetation patterns along environmental gradients in continental bogs. Ecoscience 2: 395-407.

Cowardin, L. M., V. Carter, F. C. Golet and E. T. LaRoe. 1979. Classification of Wetlands and Deepwater Habitats of the United States. U. S. Department of the Interior, Fish and Wildlife Service, Washington, DC, Jamestown, ND: Northern Prairie Wildlife Research Center. Available at: http://www.npwrc.usgs.gov/resource/wetlands/classwet/ (Version 04DEC1998). Accessed March 2014.

Government of Alberta (GOA). 2013. Alberta Wetland Policy. Available at: http://www.waterforlife.alberta.ca/documents/Alberta_Wetland_Policy.pdf. Accessed March 2014.

Halsey, L. A., D. H. Vitt, D. Beilman, S. Crow, S. Mehelcic and R. Wells. 2003. Alberta Wetland Inventory Standards Version 2.*0.* Resource Data Division, Alberta Sustainable Resource Development.

Integrated Taxonomic Information System (ITIS). 2014. Retrieved March 2014 from the Integrated Taxonomic Information System on-line database. Available at: http://www.itis.gov.

Johnson, W. C., S. E. Boettcher, K. A. Poiani and G. Guntenspergen. 2004. Influence of weather extremes on the water levels of glaciated prairie wetlands. Wetlands 24: 385-398.

Locky, D. A., S. E. Bayley and D. H. Vitt. 2005. The vegetational ecology of black spruce swamps, fens and bogs in southern boreal Manitoba, Canada. Wetlands 25: 564-582.

Miller, R. C. and J. B. Zedler. 2003. Responses of native and invasive wetland plants to hydroperiod and water depth. Plant Ecology 167: 57-69.

Mitsch, W. J. and J. G. Gosselink. 2007. Wetlands (4th Edition). John Wiley & Sons, Inc., Hoboken, NJ.

National Wetlands Working Group. 1997. The Canadian Wetland Classification System (2nd Edition). Wetlands Research Centre, University of Wateroo, Waterloo, ON.

Naiman, R. J., G. Pinay, C. A. Johnston, and J. Pastor. 1994. Beaver influences on the long-term biogeochemical characteristics of boreal forest drainage networks. Ecology 75: 905-921.

Purdy, B.G., S.E. Macdonald, and V.J. Lieffers. 2005. Naturally saline boreal communities as models for reclamation of saline oil sand tailings. Restoration Ecology 13: 667-677.

Smith, K. B., C. E. Smith, S.F. Forest and A. J. Richard. 2007. A Field Guide to the Wetlands of the Boreal Plains Ecozone of Canada. Ducks Unlimited Canada, Western Boreal Office, Edmonton, AB.

Soil Classification Working Group. 1998. The Canadian System of Soil Classification (3rd Edition). Agriculture and Agri-Food Canada, Publ. 1646 (Revised), Ottawa, ON.

Stewart, R. E. and H. A. Kantrud. 1971. Classification of Natural Ponds and Lakes in the Glaciated Prairie Region. Resource Publication 92, Bureau of Sport Fisheries and Wildlife, U.S. Fish and Wildlife Service, Washington, DC.

Stewart, R. E. and H. A. Kantrud. 1972. Vegetation of Prairie Potholes, North Dakota, in Relation to Quality of Water and Other Enviromental Factors. Geological Survey Professional Paper 585-D. Bureau of Sport Fisheries and Wildlife, U. S. Fish and Wildlife Service, U. S. Gelogical Survey, Washington, DC.

van der Valk, A. G. 2005. Water level fluctuations in North American prairie wetlands. Hydrobiologia 539: 171-188.

Vitt, D. H., L. A. Halsey, J. Bray and A. Kinser. 2003. Patterns of bryophyte richness in a complex boreal landscape: identifying key habitats at McClelland Lake wetland. The Bryologist 106(3): 372-382.

Vitt, D. H., L. A. Halsey, M. N. Thormann and T. Martin. 1996. Overview of the Peatland Resources in the Natural Regions and Subregions of Alberta. Prepared for the Alberta Peat Task Force. Includes 1:250,000 digital peatland files for the province. Edmonton, AB.

Vitt, D. H., L. A. Halsey and S. C. Zoltai. 1994. The bog landforms of continental western Canada in relation to climate and permafrost patterns. Arctic and Alpine Research 26: 1–13.

Vitt, D. H., G. Van Wirdum, S. Zoltai and L. A. Halsey. 1993. Habitat requirements of Scorpidium scorpiodes and fen development in continental Canada. The Bryologist 96: 106–111.

Vitt, D. H. and W. Chee. 1990. The relationships of vegetation to surface water chemistry and peat chemistry in fens of Alberta, Canada. Vegetatio 89: 87-106.

Weller, M. W. 1994. Freshwater Marshes: Ecology and Wildlife Management (3rd Edition). University of Minnesota Press, Minneapolis, MN.

Appendix A. Comparison of the AWCS to other Wetland Classification Systems and Inventories

Table A-1. Comparison of the AWCS to other classification systems and inventories used in Alberta. This table was adapted from Smith *et al.* (2007).

AB Wetland Classification Class and Form	Cowardin et. al. 1979	National Wetlands Working Group 1998	Smith *et al*. 2007	Steward & Kantrud, 1971	Halsey et. al., 2003
Wooded Bog	Palustrine, Forested or Scrub-shrub, Needleleaf Evergreen	Bogs (20 Forms and Subforms)	Treed Bog	Not described	Bog, Forested/ Treed
Shrubby Bog	Palustrine, Scrub/ Shrub, Broad-leaved Evergreen; Needle-leaved Evergreen	Bogs (20 Forms and Subforms)	Shrubby Bog	Not described	Bog Open-Shrub
Wooded Fen	Palustrine, Forested or Scrub-shrub, Needle-leaved Deciduous, Needle-leaved Evergreen	Fens (19 Forms and Subforms)	Treed Rich Fen, Treed Poor Fen	Not described	Fen, Forested/ Treed
Shrubby Fen	Palustrine, Scrub-shrub, Needle-leaved Deciduous/ Evergreen or Broad-leaved Deciduous (Shrub) or Moss	Fens (19 Forms and Subforms)	Shrubby Rich Fen, Shrubby Poor Fen	Not described	Fen, Open-Shrub
Graminoid Fen	Palustrine, Emergent/ Persistent, Moss/Lichen	Fens (19 Forms and Subforms)	Graminoid Rich Fen, Graminoid Poor Fen	Class VII	Fen, Open-Graminoid
Graminoid Marsh	Palustrine, Emergent or Persistent or Non-persistent	Marshes (26 Forms and Subforms)	Emergent Marsh	Class II to IV; emergent or drawdown phase	Marsh, Open-Graminoid
Submersed/Floating Shallow Open Water	Palustrine, Emergent or Persistent or Non-persistent	Shallow Open Water (29 forms and Subforms)	Shallow Open Water	Class III to VI; open water or bare phase	Shallow Open Water - Open

AB Wetland Classification Class and Form	**Cowardin et. al. 1979**	**National Wetlands Working Group 1998**	**Smith *et al*. 2007**	**Steward & Kantrud, 1971**	**Halsey et. al., 2003**
Coniferous Wooded Swamp	Palustrine, Forested, Needle-leaved Evergreen; Palustrine, Forested, Needle-leaved Deciduous	Swamps (26 Forms and Subforms)	Conifer Swamp, Tamarack Swamp	Not described	Swamp, Forested/ Treed
Mixedwood Wooded Swamp	Palustrine, Forested, Needle-leaved Evergreen, Broad-leaved Deciduous	Swamps (26 Forms and Subforms)	Mixedwood Swamp	Not described	Swamp, Forested/ Treed
Deciduous Wooded Swamp	Palustrine, Forested, Broad-leaved Deciduous	Swamps (26 Forms and Subforms)	Deciduous Swamp	Not described	Swamp, Forested/ Treed
Shrubby Swamp	Palustrine, Scrub-shrub, Broad-leaved Deciduous	Swamps (26 Forms and Subforms)	Shrub Swamp	Not described	Swamp, Open-Shrub

Table A-2. Comparison of the AWCS to *Field Guide to Ecosites of Northern Alberta*. The following table was adapted from Halsey *et al*. (2003). It is anticipated future versions of this document will be updated to reflect refined ecosite data in the EcoSys database (ESRD 2015).

AB Wetland Classification Class and Form	Beckingham and Archibald 1996			
	Boreal Mixedwood	**Boreal Highlands**	**Subarctic**	**Canadian Shield**
Wooded Bog	Ecosite phase g1 (Labrador tea-subhygric Sb-Pj) -10% of plots ≥80 cm organics Ecosite phase h1 (Labrador tea/horsetail Sw-Sb) -20% of plots ≥40 cm organics -Lack of Larix laricina within the recognized plant community is more suggestive of bog vegetation Ecosite phase i1 (Treed bog)	Ecosite phase h1 and h2 (Treed bog) Ecosite phase i1 (Treed poor fen) -Lack of Larix laricina within the recognized plant community is more suggestive of bog vegetation	Ecosite phase e1 (Labrador tea-hygric Sb-Pl) -50% of plots ≥80 cm organics Ecosite phase f1 (Treed bog)	Ecosite phase f1 (Treed bog)
Shrubby Bog	Ecosite phase i2 (Shrubby bog)	Ecosite phase h2 (Shrubby bog)	Ecosite phase f2 (Shrubby bog)	Ecosite phase f2 (Shrubby bog)
Wooded Fen	Ecosite phase j1 (Treed poor fen) Ecosite phase k1 | (Treed rich fen)	Ecosite phase i1 (Treed poor fen) *-Lack of Larix laricina within the recognized plant community is more suggestive of bog vegetation* Ecosite phase j1 (Treed rich fen)	Ecosite phase i1 (Treed poor fen) *-60% of plots < 40 cm organics* Ecosite phase h1 (Treed rich fen)	Ecosite phase j1 (Treed poor fen) Ecosite phase k1 (Treed rich fen)
Shrubby Fen	Ecosite phase j2 (Shrubby poor fen) *-30% of plots <40 cm organics* Ecosite phase k2 (Shrubby rich fen) *-50% of plots <40 cm organics*	Ecosite phase i2 (Shrubby poor fen) Ecosite phase j2 (Shrubby rich fen) *-Presence of Picea glauca tree layer not typical*	Ecosite phase g2 (Shrubby poor fen) Ecosite phase h2 (Shrubby rich fen) *-100% of plots <40 cm organics*	Ecosite phase g2 (Shrubby poor fen) *-100% of plots <40 cm organics* Ecosite phase h2 (Shrubby rich fen) *-bryophytes not identified as part of plant community*

AB Wetland Classification Class and Form	Beckingham and Archibald 1996			
	Boreal Mixedwood	**Boreal Highlands**	**Subarctic**	**Canadian Shield**
Graminoid Fen	Ecosite phase k3 (Graminoid rich fen) *-40% of plots <40 cm organics*	Ecosite phase h3 (Graminoid rich fen) *-40% of plots <40 cm organics*	Ecosite phase h3 (Graminoid rich fen) *-40% of plots <40 cm organics*	Ecosite phase h3 (Graminoid rich fen) *-40% of plots <40 cm organics*
Graminoid Marsh	Ecosite phase k3 (Graminoid rich fen) *-40% of plots have <40 cm organics* Ecosite phase l1 (Marsh)	Ecosite phase h3 (Graminoid rich fen) *-40% of plots <40 cm organics*	Ecosite phase h3 (Graminoid rich fen) *-40% of plots <40 cm organics*	Ecosite phase h3 (Graminoid rich fen) *-40% of plots <40 cm organics*
Submersed/Floating Shallow Open Water	Not recognized	Not recognized	Not recognized	Not recognized
Coniferous Wooded Swamp	Ecosite phase g1 (Labrador tea-subhygric Sb-Pj) -10% of plots have ≥80 cm organics Ecosite phase h1 (Labrador tea/horsetail Sw-Sb) -20% of plots have ≥40 cm organics -Lack of Larix laricina within the recognized plant community is more suggestive of bog vegetation Ecosite phase f3 (White spruce (Sw)/ /horsetail)	Ecosite phase f1 (Horsetail Sw) -	Ecosite phase d3 (Horsetail Sw)	Not recognized
Mixedwood Wooded Swamp	Ecosite Phase f2 (Balsam poplar (Pb)–white spruce (Sw) /Horsetail)	Ecosite phase g1 (Labrador tea-hygric Sb-Pj)	Ecosite phase e1 (Labrador tea-hygric Sb-Pl) *-50% of plots have ≥80 cm organics* Ecosite phase d2 (Horsetail Aw-Sw)	Ecosite phase e2 (Willow/horsetail Aw-Sw-Sb
Deciduous Wooded Swamp	Ecosite phase f1 (Horsetail Pb-Aw)	Not recognized	Ecosite phase d1 (Horsetail Pb-Bw)	Ecosite phase e1 (Willow/horsetail Aw-Bw-Pb)
Shrubby Swamp	Ecosite phase j2 (Shrubby poor fen) *-30% of plots <40 cm organics* Ecosite phase k2 (Shrubby rich fen) *-50% of plots <40 cm organics*	Not recognized	Ecosite phase h2 (Shrubby rich fen) *-100% of plots have <40 cm organics*	Ecosite phase g2 (Shrubby poor fen) *-100% of plots <40 cm organics* Ecosite phase h2 (Shrubby rich fen)

Appendix B. Von Post Decomposition Scale

The Von Post decomposition scale is a field test for determining the degree of organic matter decomposition. The test is completed by taking a handful of organic matter between 30 and 40 cm from the ground surface (note the ground surface could be below the water surface) and squeezing it. The extent of decomposition is determined by the nature of the liquid that is squeezed from the organic matter, how much organic matter remains in the hand after the organic matter has been squeezed, and the nature of the plant matter. A Von Post result of 5 or less indicates peat. The following table was adapted from the Soil Classification Working Group (1998).

Degree of Decomposition	Nature of Squeezed Liquid	Properties of Organic Mater Extruded	Nature of Plant Matter	Description
1	Clear, colourless	None	Plant structure unaltered	Undecomposed
2	Almost clear, yellow-brown	None	Plant structure distinct, almost unaltered	Almost undecomposed
3	Slightly turbid, brown	None	Plant structure distinct, most remains easily identifiable	Very weakly decomposed
4	Strongly turbid, brown	None	Plant structure distinct, most remains identifiable	Weakly decomposed
5	Strongly turbid, contains little organic material in suspension	Very little	Plant structure clear but indistinct and difficult to identify	Moderately decomposed
6	Muddy, much organic material in suspension	One third	Plant structure indistinct, with most undefinable	Well decomposed
7	Strongly muddy	One half	Plant structure indistinct	Strongly decomposed
8	Thick mud, little free water	Two thirds	Plant structure very indistinct with only resistant material such as roots identifiable	Very strongly decomposed
9	No free water	Nearly all	Plant structure almost unrecognizable	Almost completely decomposed
10	No free water	All	Plant structure not recognizable, amorphous	Completely decomposed

Appendix C. Preliminary Provincial List of Plant Species Found in Wetlands

Below is a compiled list of provincial plant species found in wetlands and the wetland class or classes in which they typically occur. This list does not identify whether or not a species is hydrophytic, water tolerant or an upland species, and does not include a sophisticated wetland indicator status system that implies obligate and facultative species. It is anticipated that future versions of the Alberta Wetland Classification System will enhance and refine this species list. The preliminary list was derived from the following sources:

Jacques Whitford-AXYS. 2007. An Analysis of Existing Information of Peatland Vegetation in the Regional Municipality of Wood Buffalo. Prepared for the Wetlands and Aquatics Subgroup, Reclamation Working Group, Cumulative Environmental Management Association. Fort McMurray, AB.

Forrest, A. 2010. Created Stormwater Wetlands as Wetland Compensation and a Floristic Quality Approach to Wetland Condition Assessment in Central Alberta. M.Sc. thesis, Department of Biological Sciences, University of Alberta, Edmonton, AB.

Purdy, B.G., S.E. Macdonald, and V.J. Lieffers. 2005. Naturally saline boreal communities as models for reclamation of saline oil sand tailings. Restoration Ecology 13: 667-677.

Stewart, R. E. and H. A. Kantrud. 1971. Classification of Natural Ponds and Lakes in the Glaciated Prairie Region. Resource Publication 92, Bureau of Sport Fisheries and Wildlife, U.S. Fish and Wildlife Service, Washington, DC.

Vitt, D. H., L. A. Halsey, M. N. Thormann and T. Martin. 1996. Overview of the Peatland Resources in the Natural Regions and Subregions of Alberta. Prepared for the Alberta Peat Task Force. Includes 1:250,000 digital peatland files for the province. Edmonton, AB.

Wilson, M.J., A. Forrest and S.E. Bayley. 2013. Floristic quality assessment for marshes in Alberta's northern prairie and boreal regions. Aquatic Ecosystem Health and Management 16: 288–299.

Wong, A., C. Greenway and S.E. Bayley. 2008. An Analysis of Existing Information on Wetland Vegetation in Oil Sands Region – Marshes. Prepared for the Wetlands and Aquatics Subgroup of the Reclamation Working Group of the Cumulative Environmental Management Association, Fort McMurray, AB.

The scientific names for species referenced in this report follow the *Integrated Taxonomic Information System* (ITIS 2014). Common names follow those widely used in Alberta (ACIMS 2013). NOTES:[1] B = bog, F = fen; M = marsh; W = shallow open water; and S = swamp.

Scientific Name –ITIS (2014)	Common Name ACMIS (2013)	Wetland Classes
TREES		
Betula neoalaskana Sarg.	Alaska birch	S
Betula papyrifera Marsh.	white birch	S
Larix laricina (Du Roi) K. Koch	tamarack	F, S
Picea mariana (Mill.) BSP.	black spruce	B, F, S
Populus angustifolia James	narrow-leaf cottonwood	S
Populus balsamifera L.	balsam poplar	S
Populus deltoides Bartr. *ex* Marsh.	plains cottonwood	S
SHRUBS		
Alnus incana ssp. *tenuifolia* (Nutt.) Breitung	river alder	S
Alnus viridis (Vill.) Lam. & DC.	green alder	S
Andromeda polifolia L.	bog rosemary	B, F, S
Betula glandulosa Michx.	bog birch	F
Betula occidentalis Hook.	water birch	F, S
Betula pumila L.	dwarf birch	B, F, S
Chamaedaphne calyculata (L.) Moench	leatherleaf	B, F
Cornus sericea L.	red-osier dogwood	S
Elaeagnus commutata Bernh. *ex* Rydb.	silverberry	S
Empetrum nigrum L.	crowberry	B, F
Gaultheria hispidula (L.) Muhl. *ex* Bigelow	creeping snowberry	B, F, S
Kalmia microphylla (Hook.) Heller	mountain laurel	B, F
Kalmia polifolia Wang.	northern laurel	B, F, S
Linnaea borealis L.	twinflower	B, F, S
Lonicera caerulea L.	fly honeysuckle	B, F, S
Lonicera dioica L.	twining honeysuckle	S
Lonicera involucrata (Richardson) Banks	bracted honeysuckle	F, S
Lycopodium annotinum L.	stiff club-moss	B, F, S
Myrica gale L.	sweet gale	F, S
Prunus virginiana L.	choke cherry	S
Rhamnus alnifolia L'Her.	alder-leaved buckthorn	F, S
Rhododendron groenlandicum Oeder	common Labrador tea	B, F, S
Rhododendron tomentosum Harmaja	northern Labrador tea	B
Ribes americanum P. Mill.	wild black currant	S
Ribes glandulosum Grauer	skunk currant	S
Ribes hudsonianum Richards.	northern black currant	F, S
Ribes lacustre (Pers.) Poir.	bristly black currant	F, S
Ribes triste Pall.	wild red currant	F, S
Rubus idaeus L.	wild red raspberry	B, F, S
Salix arbusculoides Andersson	shrubby willow	F, S
Salix bebbiana Sarg.	beaked willow	F, S
Salix candida Flüggé *ex* Willd.	hoary willow	F, S
Salix discolour Muhl.	pussy willow	F, S
Salix exigua Nutt.	sandbar willow	F, S
Salix glauca L.	smooth willow	F, S
Salix lucida Muhl.	shiny willow	F, S

Scientific Name –ITIS (2014)	Common Name ACMIS (2013)	Wetland Classes
Salix maccalliana Rowlee	velvet-fruited willow	F, S
Salix pedicellaris Pursh	bog willow	F, S
Salix petiolaris J.E. Sm.	basket willow	F
Salix planifolia Pursh	flat-leaved willow	F, S
Salix pyrifolia Andersson	balsam willow	F, S
Salix scouleriana Barratt *ex* Hook.	Scouler willow	F, S
Salix serissima (Bailey) Fernald	autumn willow	F
Sambucus racemosa L.	red elderberry	S
Sarcobatus vermiculatus (Hook.) Torr.	greasewood	M
Spiraea alba Du Roi	narrow-leaved meadowsweet	F, S
Vaccinium oxycoccos L.	small bog cranberry	B, F, S
Vaccinium vitis-idaea L.	bog cranberry	B, F, M, S
Viburnum edule (Michx.) Raf.	low-bush cranberry	S
Viburnum opulus var. americanum Aiton	high bush-cranberry	F, S
FORBS AND PTERIDOPHYTES		
Achillea millefolium L.	common yarrow	M, S
Actaea rubra (Ait.) Willd.	red and white baneberry	S
Adoxa moschatellina L.	moschatel	S
Agrimonia striata Michx.	agrimony	M
Agoseris glauca (Pursh) Raf.	yellow false dandelion	M
Alisma gramineum Lej.	narrow-leaved water-plantain	M
Alisma plantago-aquatica L.	broad-leaved water-plantain	M
Alisma triviale Pursh	broad-leaved water-plantain	M
Allium schoenoprasum L.	wild chives	M
Almutaster pauciflorus (Nutt.) A. & D. Löve	few-flower aster	M, W
Amaranthus retroflexus L.	red-root pigweed	M
Ambrosia psilostachya DC	perennial ragweed	M
Androsace occidentalis Pursh.	western fairy candelabra	M
Anemone canadensis L.	Canada anemone	M, S
Anemone quinquefolia L.	wood anemone	S
Apocynum cannabinum L.	Indian hemp	M
Aralia nudicaulis L.	wild sarsaparilla	F, S
Arnica chamissonis Less.	leafy arnica	F, M, W
Artemisia biennis Willd.	biennial sagewort	M
Artemisia ludoviciana Nutt.	prairie sagewort	M
Astragalus alpinus L.	alpine milk vetch	M
Astragalus americanus (Hook.) Jones	American milk vetch	M, S
Astragalus canadensis L.	Canadian milk vetch	M
Atriplex argentea Nutt.	silver saltbrush	M, W
Atriplex micrantha Mey.	saltbush	M
Atriplex powellii S. Wats.	Powell's saltbush	M
Atriplex prostrata Bouchér *ex* DC.	prostrate saltbush	M
Atriplex subspicata (Nutt.) Rydb.	spearscale saltbush	M, W
Atriplex truncata (Torr. *ex* S. Wats.) A. Gray	saltbush	M, W
Bacopa rotundifolia (Michx.) Wettst.	water hyssop	M

Scientific Name –ITIS (2014)	Common Name ACMIS (2013)	Wetland Classes
Barbarea orthoceras Ledeb.	American winter cress	M
Bidens cernua L.	nodding beggarticks	M, F, S
Bidens frondosa L.	common beggarticks	M
Bistorta vivipara (L.) Delarbre	alpine bistort	M
Brasenia schreberi J.F. Gmel.	watershield	F, M, W
Calla palustris L.	water arum	F, M, S
Callitriche hermaphroditica L.	northern water-starwort	M, W
Callitriche palustris L.	vernal water-starwort	F, M
Caltha natans Pall. *ex* Georgi	floating marsh-marigold	F, M, W
Caltha palustris L.	marsh marigold	F, M, S
Canadanthus modestus (Lindl.) Nesom	large northern aster	F, M
Capsella bursa-pastoris (L.) Medik.	shepherd's purse	M
Cardamine pensylvanica Muhl. *ex* Willd.	bittercress	M, S
Cardamine pratensis L.	meadow bitter cress	M
Castilleja raupii Pennell	purple paintbrush	M
Cerastium arvense L.	field mouse-ear chickweed	M
Chamerion angustifolium ssp. *angustifolium* (L.) Holub	common fireweed	F, M, S
Chamerion latifolium (L.) Holub	broad-leaved fireweed	M, F
Chenopodium album L.	lamb's quarters	M
Chenopodium capitatum Aschers	strawberry blite	M
Chenopodium rubrum L.	red goosefoot	M
Chenopodium glaucum var. *salinum* (Standl.) B. Boivin	oak-leaved goosefoot	F, M. S
Chrysosplenium iowense Rybd.	golden saxifrage	F, M
Chrysosplenium tetrandrum (Lund) Th. Fr.	green saxifrage	F, M
Cicuta bulbifera L.	bulb-bearing water-hemlock	F, M, S
Cicuta maculata L.	water-hemlock	F, M, S
Cicuta virosa L.	narrow-leaved water-hemlock	M
Cinna latifolia (Trevir. *ex*. Gopp) Griseb	drooping wood-reed	M
Circaea alpina L.	small enchanter's nightshade	S
Cirsium arvense (L.) Scop.	creeping thistle	M, S
Coeloglossum viride (L.) Hartm.	bracted bog orchid	M
Comarum palustre L.	marsh cinquefoil	B, F, M, S
Conium maculatum L.	poison hemlock	M
Corallorhiza trifida Chat	pale coralroot	F, S
Conyza canadensis (L.) Cronquist	horseweed	M
Coptis trifolia (L.) Salisb.	goldthread	M, S
Corydalis aurea Willd.	golden corydalis	M
Cornus canadensis L.	bunchberry	S
Crepis runcinata (James) Torr. & Gray.	scapose hawk's-beard	M
Crepis tectorum L.	annual hawk's-beard	M
Cyclachaena xanthifolia (Nutt.) Fresen	false ragweed	F, M, W
Cypripedium acaule Ait.	stemless lady's-slipper	B, S
Cypripedium parviflorum Salisb.	yellow lady's-slipper	M
Delphinium glaucum Wats.	tall larkspur	M, S
Descurainia sophia (L.) Webb *ex* Prantl	flixweed	M

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Dracocephalum parviflorum Nutt.	American dragonhead	M
Drosera anglica Huds.	great sundew	B, F
Drosera linearis Goldie	slender-leaved sundew	B, F, S
Drosera rotundifolia L.	round-leaved sundew	B, F, S
Dryopteris carthusiana (Vill.) Fuchs	narrow spinulose shield fern	S
Dryopteris cristata (L.) Gray	crested shield fern	S
Elatine triandra Schkuhr.	waterwort	M
Ellisia nyctelea (L.) L.	waterpod	M
Elodea bifoliata St. John	two-leaved waterweed	F, M
Elodea canadensis Mitchx.	Canada waterweed	M, W
Epilobium ciliatum Raf.	northern willowherb	B, F, M, S
Epilobium leptophyllum Raf.	narrow-leaved willowherb	B, F, M, S
Epilobium palustre L	marsh willowherb	F, M, S
Epilobium campestre (Jeps.) Hoch & Wagner	smooth boisduvalia	F, M. W
Equisetum arvense L.	common horsetail	B, F, M, S
Equisetum fluviatile L.	swamp horsetail	B, F, M, S
Equisetum hyemale L.	common scouring-rush	M
Equisetum laevigatum A. Braun.	smooth scouring-rush	M
Equisetum palustre L.	marsh horsetail	B, F, M, S
Equisetum pratense Ehrh.	meadow horsetail	F, M, S
Equisetum scirpoides Michx.	dwarf scouring-rush	B, F, M, S
Equisetum sylvaticum L.	woodland horsetail	B, M, S
Equisetum variegatum Schleich. *ex* Weber & Mohr	variegated horsetail	M, S
Eriogonum androsaceum Benth.	cushion umbrella-plant	F
Erigeron acris L.	northern daisyfleabane	M
Erigeron elatus (Hook.) Greene	tall fleabane	M
Erigeron lonchophyllus Hook.	fleabane	M
Erigeron philadelphicus L.	Philadelphia fleabane	M, S
Erysimum cheiranthoides L.	wormseed mustard	M
Eutrochium maculatum (L.) Lamont	spotted Joe-pye weed	S, M
Eurybia sibirica (L.) Nesom	Arctic aster	M
Euthamia graminifolia (L.) Nutt.	flat-topped goldenrod	M
Fallopia convolvulus (L.) Löve	wild buckwheat	F, M, W
Fragaria vesca L.	woodland strawberry	M
Fragaria virginiana Duchesne	wild strawberry	M
Galearis rotundifolia (Banks *ex* Pursh) Bateman	round-leaved orchid	F, S
Galeopsis tetrahit L.	hemp-nettle	F, M
Galium boreale L.	Labrador bedstraw	B, S
Galium labradoricum (Wiegand) Wiegand	northern bog bedstraw	B, F, M, S
Galium trifidum L.	small bedstraw	B, F, M, S
Galium triflorum Michx.	sweet-scented bedstraw	F, M, S
Gentianopsis detonsa (Rottb.) Ma	northern fringed gentian	M
Geocaulon lividum (Richards.) Fern.	northern bastard toadflax	B, F, S
Geum aleppicum Jacq.	yellow avens	F, M, S
Geum macrophyllum Willd.	large-leaved yellow avens	F, M, S

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Geum rivale L.	purple avens	M, S
Glycyrrhiza lepidota (Nutt.) Pursh	wild licorice	M
Gnaphalium palustre Nutt.	marsh cudweed	M
Goodyera repens (L.) Brown. *ex* Ait.	lesser rattlesnake plantain	S
Gratiola neglecta Torr.	clammy hedge-hyssop	M
Gymnocarpium dryopteris (L.) Newm	oak fern	S
Hedysarum alpinum L.	alpine hedysarum	S
Helenium autumnale L.	sneezeweed	M
Helianthus maximilianii Schrad.	narrow-leaved sunflower	M
Helianthus nuttallii Torr. & Gray	common tall sunflower	M
Heliotropium curassavicum L.	spatulate-leaved heliotrope	M
Heracleum sphondylium ssp*. montanum* (Schleich.) Briq.	cow parsnip	S, M
Hieracium umbellatum L.	narrow-leaved hawkweed	M
Hippuris vulgaris L.	common maretail	F, M
Hypericum majus (Gray) Britt.	large Canada St. John's-wort	M
Impatiens capensis Meerb.	spotted touch-me-not	M, S
Impatiens noli-tangere L.	western jewelweed	M, S
Iris missouriensis Nutt.	western blue flag	M
Isoetes bolanderi Engelm.	Bolander's quillwort	M
Isoetes echinospora Durieu	northern quillwort	M, W
Iva axillaris Pursh	povertyweed	M
Kochia scoparia (L.) Schrad.	summer-cypress	M
Lactuca biennis (Moench.) Fern.	tall blue lettuce	S
Lactuca serriola L.	prickly lettuce	M
Lathyrus ochroleucus Hook.	cream-coloured vetchling	S
Lemna minor L.	common duckweed	M
Lemna trisulca L.	ivy-leaved duckweed	M
Lepidium densiflorum Schrad.	common pepper-grass	M
Lilium philadelphicum L.	western wood lily	M
Limosella aquatica L.	mudwort	M
Linaria vulgaris Mill.	common toadflax	M
Lobelia dortmanna L.	water lobelia	M
Lobelia kalmii L.	Kalm's lobelia	M
Lomatogonium rotatum (L.) Fries. *ex* Fern.	marsh felwort	M
Lotus corniculatus L.	bird's-foot trefoil	M
Lycopodium annotinum L.	stiff club-moss	S
Lycopus americanus Muhl. *ex* Bart.	American water-horehound	F, M, W
Lycopus asper Greene	western water-horehound	M
Lycopus uniflorus Michx.	northern water-horehound	B, M, S
Lysimachia hybrida Michx.	lance-leaved yellow loosestrife	M
Lysimachia lanceolata Walt.	lance-leaved loosestrife	M
Lysimachia maritima (L.) Galasso, Banfi & Soldano	sea milkwort	F, M
Lysimachia thyrsiflora L.	tufted loosestrife	B, F, M, S
Lythrum salicaria L.	purple loosestrife	F, M
Maianthemum canadense Desf.	wild lily-of-the-valley	S
Maianthemum stellatum (L.) Link	star-flowered Solomon's-seal	M, S

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Maianthemum trifolium (L.) Sloboda	three-leaved Solomon's-seal	B, F, M, S
Marsilea vestita Hook. & Grev.	hairy pepperwort	M, W
Matricaria discoidea DC	pineappleweed	M
Matteuccia struthiopteris (L.) Tod.	ostrich fern	M, S
Melilotus officinalis (L.) Lam	yellow sweet-clover	M
Mentha arvensis L.	wild mint	M, S
Mentha spicata L.	spearmint	M
Menyanthes trifoliata L.	buck-bean	F, S
Mertensia paniculata (Ait.) Don	tall lungwort	S
Mitella nuda L.	bishop's-cap	B, F, M, S
Moehringia lateriflora (L.) Fenzl.	blunt-leaved sandwort	S
Moneses uniflora (L.) Gray	one-flowered wintergreen	B, S
Monolepis nuttalliana (Schult.) Greene	spear-leaved goosefoot	F, M, W
Mulgedium oblongifolium (Nutt.) Reveal	blue lettuce	M
Muhlenbergia richardsonis (Trin.) Rydb.	mat muhly	M
Myriophyllum sibiricum Kom.	spike water-milfoil	M, W
Myriophyllum verticillatum L.	water-milfoil	F, M, W
Najas flexilis (Willd.) Rostk. & Schmidt	slender naiad	M
Nasturtium officinale Brown	water cress	M
Neottia cordata (L.) Rich.	heart-leaved twayblade	S
Nuphar lutea (L.) Sm.	yellow pond-lily	F, M
Nymphaea tetragona Georgi	white water-lily	F, M
Orthilia secunda (L.) House	one-sided wintergreen	B, F, S
Osmorhiza longistylis (Torr.) DC.	smooth sweet cicely	S
Packera pauciflora (Pursh) A. & D. Löve	few-flowered ragwort	S
Packera paupercula (Michx.) Á. & D. Löve	balsam groundsel	S
Parnassia palustris L.	northern grass-of-Parnassus	B, F, M, S
Pedicularis groenlandica Retz.	elephant's-head	F, M
Pedicularis labradorica Wirsing	Labrador lousewort	B
Pedicularis macrodonta Richardson	muskeg lousewort	B, F, M
Pedicularis parviflora Smith *ex* Rees.	swamp lousewort	B, F, M
Penstemon procerus Dougl. *ex* Graham	slender blue beardtongue	F
Persicaria amphibia (L.) Gray	water smartweed	M, S
Persicaria lapathifolia (L.) Gray	pale persicaria	F, M, W
Petasites frigidus var *frigidus* (L.) Fr.	sweet coltsfoot	F, M
Petasites frigidus var. *palmatus* (Aiton) Cronquist	palmate-leaved coltsfoot	F, M, S
Petasites frigidus var. *sagittatus* (Banks *ex* Pursh) Gray	arrow-leaved coltsfoot	F, M, S
Petasites frigidus var *x vitifolius* (Greene) Chern	vine-leaved coltsfoot	M
Physostegia parviflora Nutt *ex.* Gray	false dragonhead	M
Pinguicula villosa L.	small butterwort	F, B
Plagiobothrys scouleri (Hook.&Arn.) Johnst.	Scouler's allocarya	M
Plantago eriopoda Torr.	saline plantain	M
Plantago maritima L.	sea-side plantain	F, M
Platanthera dilatata (Pursh) Lindl.	tall white bog orchid	B, F
Platanthera dilatata var. *dilatata* (Pursh) Lindl. *ex* L.C. Beck	tall white bog orchid	S
Platanthera hyperborea (L.) Lindl.	northern green bog orchid	F, M, S

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Platanthera obtusata ssp. *obtusata* (Banks *ex* Pursh) Lindl.	blunt-leaved bog orchid	F, S
Platanthera orbiculata (Pursh) Lindl.	round-leaved bog orchid	F, S
Polemonium acutiflorum Willd. *ex.* Roem & Schult.	tall Jacob's-ladder	M
Polygala paucifolia Willd.	fringed milkwort	S
Polygonum achoreum S.F. Blake	striate knotweed	F, M
Polygonum erectum L.	striate knotweed	M
Polygonum ramosissimum Michx.	bushy knotweed	M
Potamogeton foliosus Raf.	leafy pondweed	F, M, W
Potamogeton friesii Rupr.	Fries' pondweed	F, M, W
Potamogeton gramineus L.	various-leaved pondweed	M, W
Potamogeton natans L.	floating-leaf pondweed	F, M, W
Potamogeton praelongus Wulf.	white-stem pondweed	F, M, W
Potamogeton pusillus L.	small-leaf pondweed	W
Potamogeton richardsonii (Benn.) Rydb.	clasping-leaf pondweed	M
Potamogeton zosteriformis Fernald	flat-stemmed pondweed	F, M, W
Potentilla anserina (L.) Rydb.	silverweed	F, M
Potentilla gracilis Douglas *ex.* Hook.	graceful cinquefoil	M
Potentilla norvegica L.	rough cinquefoil	F, M, S
Potentilla rivalis Nutt.	brook cinquefoil	M
Primula incana Jones	mealy primrose	M
Primula pauciflora var. *pauciflora* (Greene) Mast & Reveal	pretty shooting star	B, M, S
Pyrola minor L.	lesser wintergreen	F, S
Ranunculus abortivus L.	small-flowered buttercup	M, S
Ranunculus acris L.	tall buttercup	M
Ranunculus aquatilis var. *diffusus* With.	large-leaved white water crowfoot	M, W
Ranunculus cymbalaria Pursh	seaside buttercup	M
Ranunculus flammula L.	creeping spearwort	F, M, W
Ranunculus gmelinii De Candolle	yellow water crowfoot	B, F, M, S
Ranunculus lapponicus L.	Lapland buttercup	M, S
Ranunculus macounii Britt.	Macoun's buttercup	F, M
Ranunculus pensylvanicus L. f.	bristly buttercup	F, M, W
Ranunculus sceleratus L.	celery-leaved buttercup	M
Rorippa palustris (L.) Besser	marsh yellow cress	B, F, M, W
Rubus arcticus L.	dwarf-raspberry	B, F, M, S
Rubus chamaemorus L.	cloudberry	B, F, S
Rubus pubescens Raf.	dewberry	B, F, M, S
Rumex britannica L.	water dock	M, S
Rumex crispus L.	curled dock	M, S
Rumex maritimus L.	golden dock	F, M, W
Rumex triangulivalvis (Danser) Rech. f.	narrow-leaved field dock	M
Ruppia cirrhosa (Petagna) Grande	widgeon-grass	M, W
Sagittaria cuneata Sheld.	arum-leaved arrowhead	M
Sagittaria latifolia Willd.	broad-leaved arrowhead	M
Salicornia rubra A. Nels.	samphire	M
Solidago gigantea Aiton	late goldenrod	M

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Salsola kali L.	Russian-thistle	M
Sanicula marilandica L.	snakeroot	S
Sarracenia purpurea L.	pitcher-plant	B, F, S
Scheuchzeria palustris L.	scheuchzeria	B, F
Scutellaria galericulata L.	marsh skullcap	F, M, S
Senecio congestus (R. Br.) DC	marsh ragwort	M
Senecio eremophilus Richardson	cut-leaved ragwort	M
Sinapis arvensis L.	wild mustard	M
Sisyrinchium montanum Greene	common blue-eyed grass	F, M, W
Sium suave Walter	common waterparsnip	F, M
Solidago canadensis L.	Canada goldenrod	M, S
Sonchus arvensis L.	perennial sow-thistle	M, S
Sonchus asper (L.) Hill	prickly annual sow-thistle	M
Spergularia salina J. & K. Presl	salt-marsh sand spurry	B, F, M
Spiranthes romanzoffiana Cham.	hooded ladies'-tresses	B, F, M, S
Stachys palustris L.	marsh hedge-nettle	M
Stellaria calycantha (Ledeb.) Bong.	northern stitchwort	F, M, S, W
Stellaria crassifolia Ehrh.	fleshy stitchwort	F, M
Stellaria longifolia Muhl. *ex* Willd.	long-leaved chickweed	F, M, S
Stellaria longipes Goldie	long-stalked chickweed	M
Streptopus lanceolatus var. *roseus* (Michx.) Reveal	rose mandarin	S
Stuckenia filiformis (Pers.) Börner	thread-leaved pondweed	M
Stuckenia pectinata (L.) Börner	sago pondweed	M, W
Stuckenia vaginata (Turcz.) Holub	large-sheath pondweed	W
Suaeda calceoliformis (Hook.) Moq.	western seablite	M
Suckleya suckleyana (Torr.) Rydb.	poison suckleya	F, M, W
Symphyotrichum boreale (Torr. & Gray) A. & D. Löve	marsh aster	F, M, W
Symphyotrichum ciliatum (Ledeb.) Nesom	rayless aster	M
Symphyotrichum ciliolatum (Lindl.) A. & D. Löve	Lindley's aster	M, S
Symphyotrichum ericoides (L.) Nesom	tufted white prairie aster	M
Symphyotrichum lanceolatum (Willd.) Nesom	western willow aster	M
Symphyotrichum puniceum (L.) Á. & D. Löve	purple-stemmed aster	F, M, S, W
Symphyotrichum puniceum var. *puniceum* (L.) Á. & D. Löve	purple-stemmed aster	M, S
Tanacetum vulgare L.	common tansy	M
Taraxacum officinale Weber *ex* Wiggers	common dandelion	M, S
Taraxacum erythospermum Andrz.	red-seeded dandelion	M
Thalictrum dasycarpum Fisch. & Ave-Lall.	tall meadow rue	S
Thalictrum venulosum Trel.	veiny meadow rue	S
Thlaspi arvense L.	stinkweed	M
Triantha glutinosa (Michx.) Baker	sticky false asphodel	M, F, S
Trientalis borealis Raf.	northern starflower	S, M
Trientalis europaea L.	Arctic starflower	F, S
Trifolium hybridum L.	alsike clover	M
Trifolium repens L.	white clover	M
Triglochin maritima L.	seaside arrow-grass	F, M

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Triglochin palustris L.	slender arrow-grass	F, S, M
Urtica dioica L.	common nettle	F, S, M
Urtica urens L.	small nettle	M
Utricularia cornuta Michx.	horned bladderwort	M, W
Utricularia intermedia Hayne	flat-leaved bladderwort	F, M, S, W
Utricularia minor L.	small bladderwort	F, M, S, W
Utricularia vulgaris L.	common bladderwort	F, M, W
Valeriana dioica L.	northern valerian	F, M, W
Veronica americana Schwein. *ex* Benth.	American brooklime	M
Veronica anagallis-aquatica L.	speedwell	F, M
Veronica peregrina L.	hairy speedwell	M
Veronica scutellata L.	marsh speedwell	F, M. W
Vicia americana Muhl. *ex* Willd.	wild vetch	F, M, S
Viola sororia var. *affinis* (Leconte) McKinney	bog violet	B, F, M
Viola macloskeyi Lloyd	MacIoskeyi's violet	M
Viola palustris L.	marsh violet	M, S
Viola renifolia Gray	kidney-leaved violet	F, S
Wolffia borealis (Engelm *ex.* Hegelm) Landolt & Wild.	northern ducksmeal	M, W
Wolffia columbiana Karst	watermeal	M, W
Xanthium strumarium L.	cocklebur	W
Zannichellia palustris L.	horned pondweed	M, W
Zizia aptera (A. Gray) Fernald	heart-leaved Alexanders	M
GRAMINOIDS		
Acorus americanus (Raf.) Raf.	sweet flag	M
Agrostis scabra Willd.	rough hair grass	F, M, S
Agrostis stolonifera L.	redtop	M, S
Alopecurus aequalis Sobol.	short-awned foxtail	M
Alopecurus pratensis L.	meadow foxtail	M, S
Amphiscirpus nevadensis (S. Watson) Oteng-Yeb.	Nevada bulrush	M
Beckmannia syzigachne (Steud.) Fernald	sloughgrass	M
Bolboschoenus maritimus ssp. *paludosus* (Nelson)Koyama	prairie bulrush	M
Bromus ciliatus L.	fringed brome	F, M, S
Bromus inermis Leyss.	smooth brome	M
Calamagrostis canadensis (Michx.) Beauv.	bluejoint	F, M, S
Calamagrostis stricta ssp.*inexpansa* (Gray) Greene	northern reed grass	F, M, S
Carex aquatilis Wahlenb.	water sedge	F, M, S
Carex atherodes Spreng.	awned sedge	F, M
Carex aurea Nutt.	golden sedge	B, F, M, S
Carex bebbii Olney *ex* Fernald	Bebb's sedge	F, M, S
Carex brevior (Dewery) Mack *ex* Lunell	slender-beaked sedge	B, F, M
Carex brunnescens (Pers.) Poir.	brownish sedge	B, F, M, S
Carex buxbaumii Wahlenb.	brown sedge	F, M
Carex canescens L.	hoary sedge	B, F, M, S
Carex capillaris L.	hairlike sedge	B, F, M, S
Carex chordorrhiza Ehrh. *ex* L. f.	prostrate sedge	B, F, M, S

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Carex crawfordii Fernald	Crawford's sedge	M
Carex diandra Schrank	two-stamened sedge	F, M, S
Carex disperma Dewey	soft-leaf sedge	B, F, S
Carex deweyana Schwein	Dewey's sedge	S
Carex gynocrates Wormsk. *ex* Drej	northern bog sedge	B, F, M, S
Carex heleonastes L. f.	Hudson Bay sedge	B, F, M, S
Carex interior Bailey	inland sedge	F, M, S
Carex lacustris Willd.	lakeshore sedge	F, M, S
Carex lasiocarpa Ehrh.	hairy-fruited sedge	B, F, M, S
Carex leptalea Wahlenb.	bristle-stalked sedge	B, F, S
Carex limosa L.	mud sedge	F, M, S
Carex livida (Wahlenb.) Willd.	livid sedge	B, M, F
Carex loliacea L.	rye-grass sedge	M
Carex magellanica ssp. *irrigua* (Wahlenb.) Hultén	bog sedge	B, F, M
Carex oligosperma Michx.	few-fruited sedge	B, M, F
Carex pauciflora Lightf.	few-flowered sedge	B, F, M, S
Carex pellita Muhl. *ex* Willd.	woolly sedge	M
Carex praegracilis Boott	graceful sedge	F, M
Carex prairea Dewey *ex* Wood	prairie sedge	F, M, S
Carex praticola Rydb.	meadow sedge	M, S
Carex pseudocyperus L.	cyperus-like sedge	B, F
Carex retrorsa Schwein.	turned sedge	F, M
Carex rostrata Stokes	beaked sedge	F, S
Carex sartwellii Dewey	Sartwell sedge	M
Carex saxatilis L.	rocky-ground sedge	M
Carex stipata Muhl. *ex* Willd.	awl-fruited sedge	M, S
Carex sychnocephala Carey	long-beaked sedge	M
Carex tenera Dewey	broad-fruited sedge	B, F, M, S
Carex tenuiflora Wahlenb.	thin-flowered sedge	B, M, S
Carex torreyi Tuck	Torrey's sedge	M
Carex trisperma Dewey	three-seeded sedge	B, F, M, S
Carex utriculata Boott	small bottle sedge	B, F, M
Carex vaginata Tausch	sheathed sedge	B, F, M, S
Carex viridula Michx.	green sedge	M
Carex vulpinoidea Michx.	fox sedge	M
Catabrosa aquatica (L.) Beauv.	brook grass	M
Cinna latifolia (Trev. *ex* Goepp.) Griseb.	drooping wood-reed	S
Deschampsia cespitosa (L.) Beauv.	tufted hairgrass	B, F, M
Dichanthelium acuminatum (Sw.) Gould & Clark	hot-springs millet	M
Distichlis spicata ssp. *stricta* (Torr.) Beetle	Inland saltgrass	M
Eleocharis acicularis (L.) Roemer & Schult.	needle spikerush	M
Eleocharis engelmannii Steud.	Engelmann's spike-rush	M
Eleocharis palustris (L.) Roemer & Schult.	creeping spike-rush	M
Eleocharis quinqueflora (Hartmann) Schwarz.	few-flowered spike-rush	M
Eleocharis tenuis (Willd.) Schulz	slender spike-rush	F

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Elymus canadensis L.	Canada wild rye	M
Elymus repens (L.) Gould	quackgrass	M
Elymus trachycaulus (Link) Gound *ex* Shinners	slender wheatgrass	M
Eriophorum angustifolium Honck.	narrowleaf cottongrass	B, F, M, S
Eriophorum brachyantherum Trautv. & Mey	close-sheathed cotton grass	M
Eriophorum chamissonis Mey.	russet cotton grass	B, F, M, S
Eriophorum gracile Koch	slender cottongrass	F, M, S
Eriophorum scheuchzeri Hoppe	one-spike cottongrass	B, F, M, S
Eriophorum vaginatum L.	sheathed cottongrass	B, F, S
Glyceria borealis (Nash) Batch.	northern manna grass	M
Glyceria grandis S. Wats.	common tall mannagrass	M
Glyceria pulchella (Nash) Schum.	graceful manna grass	M
Glyceria striata (Lam.) Hitchc.	fowl manna grass	F, M, S
Hordeum jubatum L.	foxtail barley	M
Juncus alpinoarticulatus Chaix	alpine rush	M
Juncus balticus Willd.	wire rush	M
Juncus brevicaudatus (Engelm) Fernald.	short-tailed rush	M
Juncus bufonius L.	toad rush	M
Juncus longistylis Torr.	long-styled rush	M
Juncus nodosus L.	knotted rush	M
Juncus tenuis Willd.	slender rush	M
Juncus torreyi Coville	Torrey's rush	M
Juncus vaseyi Engelm.	big-head rush	M
Muhlenbergia asperifolia (Nees & Meyen *ex* Trin.) Parodi	scratch grass	M
Muhlenbergia glomerata (Willd.) Trin.	bog muhly	B, F, M, S
Panicum capillare L.	witch grass	M
Phalaris arundinacea L.	reed canary grass	M
Phalaris canariensis L.	canary grass	M
Phleum pratense L.	timothy	M
Phragmites australis (Cav.) Trin. *ex* Steud.	reed	M, S
Poa palustris L.	fowl bluegrass	F, M, S
Poa pratensis L.	Kentucky bluegrass	M
Puccinellia distans (Jacq.) Parl.	slender salt-meadow grass	M
Puccinellia nuttalliana (Schult.) Hitchc.	Nuttall's salt-meadow grass	M
Rhynchospora capillacea Torr.	slender beak-rush	M
Schizachne purpurascens (Torr.) Swallen	purple oat grass	S
Schoenoplectus acutus var. *acutus* (Muhl. *ex* Bigelow)	great bulrush	M
Schoenoplectus heterochaetus (Chase) Soják	slender bulrush	M
Schoenoplectus pungens var. *pungens* (Vahl) Palla	three-square rush	M
Schoeoplectus tabernaemontani (Gmel.) Palla	common great bulrush	M
Scirpus cyperinus (L.) Kunth	wool-grass	M
Scirpus microcarpus J. & K. Presl	small-fruited bulrush	M
Scolochloa festucacea (Willd.) Link	spangletop	M
Sparganium angustifolium Michx.	narrow-leaved bur-reed	F, M, W
Sparganium eurycarpum Engelm. *ex* Gray	giant bur-reed	M

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Sparganium natans L.	slender bur-reed	M
Spartina gracilis Trin.	alkali cordgrass	M
Spartina pectinata Line	prairie cord grass	M
Trichophorum alpinum (L.) Pers.	Hudson Bay bulrush	F, M
Trichophorum aespitosum (L.) Hartm.	tufted bulrush	B, F, M
Trichophorum clintonii (Gray) Sm.	Clinton's bulrush	M
Typha latifolia L.	common cattail	F, M
Zizania palustris L.	wild rice	M, W
BRYOPHYTES		
Aulacomnium palustre (Hedw.) Schwaegr.	tufted moss	B, F, S
Amblystegium serpens (Hedw.) Schimp. In B.S.G.	moss	F, S
Anomodon minor (Hedw.) Furnr.	moss	F
Brachythecium campestre (Mull.) Schimp. in B.S.G.	moss	B, F
Brachythecium mildeanum (Schimp.) Schimp. *ex* Milde	moss	F
Brachythecium turgidum (Hartm.) Kindb.	moss	B, F, S
Bryum pseudotriquetrum (Hedw.) Gaertn. *et al*.	moss	B, F, S
Calliergon cordifolium (Hedw.) Kindb.	moss	F
Calliergon trifarium (Web. & Mohr.) Kindb.	moss	F
Calliergon giganteum (Schimp.) Kindb.	giant calliergon moss	F
Calliergon richardsonii (Mitt.) Kindb. in Warnst.	brown moss	F, S
Calliergon stramineum (Brid.) Kindb.	brown moss	F, S
Calliergon trifarium (Web. & Mohr.) Kindb.	moss	F
Calliergonella cuspidata (Hedw.) Loeske	moss	F
Campylium chrysophyllum (Brid.) Lange	moss	F, S
Campylium polygamum (Schimp. in B.S.G.) Jens.	moss	F
Campylium stellatum (Hedw.) C. Jens.	yellow starry fen moss	F
Ceratodon purpureus (Hedw.) Brid.	purple horn-toothed moss	F, S
Cinclidium stygium Sw. in Schrad.	moss	B, F, S
Climacium dendroides (Hedw.) Web. & Mohr	moss	F, S
Dicranum fragilifolium Lindb.	cushion moss	B, F
Distichium capillaceum (Hedw.) Bruch.& Schimp. in B.S.G.	moss	S
Distichium inclinatum (Hedw.) Bruch.& Schimp. in B.S.G.	inclined-fruited didymodon	F, S
Drepanocladus aduncus (Hedw.) Warnst.	aduncus brown moss	F, M, S
Eurhynchium pulchellum (Hedw.) Jen.	moss	B
Hamatocaulis lapponicus (Norrl.) Hedenäs	hamatocaulis moss	F
Drepanocladus sendtneri (Schimp.) Warnst.	brown moss	F
Hamatocaulis vernicosus (Mitt.) Hedenäs	hamatocaulis brown moss	F
Helodium blandowii (Web. & Mohr.) Warnst.	Blandow's feathermoss	B, F, S
Hylocomium splendens (Hedw) Schimp *in* BSG	stair-step moss	B, F, S
Hypnum lindbergii Mitt.	moss	B, F
Hypnum pallescens (Hedw.) Beauv.	moss	B, F, S
Hypnum pratense (Rabenh) Koch *ex* Spruce	moss	F, S
Isopterygium pulchellum (Hedw.) Jaeg.	moss	B, S
Leptobryum pyriforme (Hedw.) Wils.	moss	B, F, S
Leptodictyum riparium (Hedw.) Warnst.	streamside leptodictyum moss	F, S

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Limprichtia revolvens (Sw.) Loeske	limprichtia brown moss	F
Meesia triquetra (Richt.) Ångstr.	three-angled thread-moss	F, S
Meesia uliginosa Hedw.	moss	F, S
Myurella julacea (Schwaegr.) Schimp. in B.S.G.	moss	F, S
Oncophorus wahlenbergii Brid.	mountain curved-back moss	F, S
Orthotrichum speciosum Nees in Sturm	moss	F, S
Paludella squarrosa (Hedw.) Brid.	moss	F
Plagiomnium cuspidatum (Hedw.) Kop.	moss	F, S
Plagiomnium ellipticum (Brid.) Kop.	moss	B, F, S
Plagiomnium medium (Bruch & Schimp. in B.S.G.) Kop.	moss	B, F, S
Pleurozium schreberi (Brid.) Mitt.	Schreber's moss	B, F, S
Pohlia nutans (Hedw.) Lindb.	copper wire moss	B, F, S
Polytrichum commune Hedw.	common hair-cap	B, F, S
Polytrichum strictum Brid.	slender haircap-moss	B, F, S
Pseudobryum cinclidioides (Hub.) Kop.	moss	B, F, S
Ptilium crista-castrensis (Hedw.) De Not.	knight's plume moss	B, F, S
Pylaisiella polyantha (Hedw.) Grout	moss	F, S
Rhytidiadelphus triquetrus (Hedw.) Warnst.	red-stemmed pipecleaner moss	F, S
Rhizomnium gracile Kop.	fringed bog moss	F, S
Rhizomnium pseudopunctatum (Brusch & Shimp) Kop.	moss	B, F, S
Sanionia uncinata var. *uncinata* (Hedw.) Loeske	hook moss	F
Scorpidium scorpioides (Hedw.) Limpr.	scorpidium moss	F
Scorpidium turgescens (Jens.) Loeske	moss	F
Sphagnum angustifolium (Jens. *ex* Russ) Jens.*in*Tolf	poor-fen sphagnum; peat moss	B, F, S
Sphagnum balticum (Russ.) Jens.	balticum peat moss	B, F
Sphagnum capillifolium (Ehrh.) Hedw.	acute-leaved peat moss	B, F, S
Sphagnum centrale Jens in Arnell & Jens	peat moss	B, F
Sphagnum contortum Shultz	twisted bog moss	B, F
Sphagnum fallax (Klinggr.) Klinggr.	peat moss	B, F
Sphagnum fimbriatum Wils. in Wils. & Hook. f. in Hook.	shore-growing peat moss	B, F
Sphagnum fuscum (Schimp.) Klinggr.	rusty peat moss	B, F, S
Sphagnum girgensohnii Russ.	Girgensohn's moss	B, F, S
Sphagnum jensenii Lindb.	pendant branch peat moss	B, F
Sphagnum lindbergii Shimp. in Lindb.	Lindberg's bog moss	B, F
Sphagnum majus (Russ.) C. Jens.	peat moss	F
Sphagnum magellanicum Brid.	midway peat moss	B, F
Sphagnum obtusum Warnst.	blunt-leaved peat moss	B, F
Sphagnum riparium Ångstr.	shore-growing peat moss	F
Sphagnum russowii Warnst.	wide-tongued peat moss	F
Sphagnum squarrosum Crome	squarrose peat moss	F, S
Sphagnum subsecundum Nees in Sturm	twisted bog moss	B, F
Sphagnum teres (Schimp.) Ångström in Hartm.	thin-leaved peat moss	F
Sphagnum warnstorfii Russ.	Warnstorf's sphagnum	F, S
Splachnum ampullaceum Hedw.	flagon-fruited splachnum	B
Splachnum rubrum Hedw.	red collar moss	B

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Splachnum sphaericum Hedw.	globe-fruited splachnum	B
Splachnum vasculosum Hedw.	large-fruited splachnum	B
Tetraphis pellucida Hedw.	moss	B, F, S
Tetraplodon angustatus (Hedw.) Bruch&Schimp *in* BSG	narrow-leaved splachnum	B, F, S
Thuidium recognitum (Hedw.) Lindb.	moss	B, F, S
Tomentypnum falcifolium (Ren. *ex* Nichols) Tuom *in* Ahti&Fagers.	golden moss	B, F
Tomentypnum nitens (Hedw.) Loeske	golden moss	F
Rhytidiadelphus triquetrus (Hedw.) Warnst.	red-stemmed pipecleaner moss	F, S
Warnstorfia exannulata (Schimp *in* B.S.G.)Loeske	Brown moss	B, F, S
Warnstorfia fluitans (Hedw.) Loeske	warnstorfia peat moss	B, F, S
Warnstorfiia tundrae (Arnell) Loeske	moos	F
LIVERWORTS		
Aneura pinguis (L.) Dumort	liverwort	F, S
Blepharostoma trichophyllum (L.) Dum.	liverwort	F, S
Calypogeia sphagnicola (H. Arnell & Perss.) Warnst & Loeske	liverwort	F, S
Cephalozia connivens (Dicks.) Lindb.	liverwort	B, F, S
Cephalozia lunulifolia (Dum.) Dum.	liverwort	F
Cephalozia pleniceps (Aust.) Lindb.	liverwort	F
Geocalyx graveolens (Schrad.) Nees	liverwort	F, S
Jamesoniella autumnalis (Decandolle) Steph.	liverwort	B, F, S
Lepidozia reptans (L.) Dum.	liverwort	B, F, S
Lophocolea heterophylla (Schrad.) Dum.	liverwort	F, S
Lophocolea minor Nees	liverwort	F
Lophozia grandiretis (Lindb.) Schiffn.	liverwort	B
Lophozia guttulata (Lindb. et Arnell) Evans	liverwort	B, F
Lophozia rutheana (Limpre.) Mull. Frib	liverwort	B, F
Lophozia ventricosa (Dicks.) Dum.	liverwort	B, F
Marchantia polymorpha L.	green tongue liverwort	B, F, M, S
Moerckia hibernica (Hook.) Gottsche	liverwort	B, F
Mylia anomala (Hook.) S. Gray	liverwort	B, F, S
Pellia endiviifolia (Dicks.) Dumort.	liverwort	S
Plagiochila asplenioides (L.) Dum.	liverwort	B, F, S
Plagiochila porelloides (Torrey *ex* Nees) Lindenb.	liverwort	F
Porella platyphylla (L.) Pfeiff	liverwort	S, B
Ptilidium ciliare (Li.) Nees	liverwort	B, F, S
Ptilidium pulcherrimum (Web.) Hampe	liverwort	B, F, S
Radula complanata (L.) Dum.	liverwort	F, M, S
Riccia fluitans L.	crystalwort	M, W
Riccardia multifida (L.) Gray	liverwort	S
Ricciocarpos natans (L.) Corda	purple-fringed heartwort	F, M, W
Scapania paludosa (Mull.) Mull.	liverwort	B