DRAFT

NATIONAL WETLANDS INVENTORY

NOTES TO USERS

YAKUTAT

INTRODUCTION

The U.S. Fish and Wildlife Service (FWS) has major responsibility for the protection and proper management of fish, wildlife and their habitats. The Fish and Wildlife Coordination Act authorizes the Secretary of the Interior "to make surveys and investigations of the wildlife of the public domain including lands and waters or interests therein acquired or controlled by any agency of the United States" (16 U.S.C. 669). This Act expands the concept of wildlife and wildlife resources to include not only animal life but also all types of "aquatic and land vegetation upon which wildlife is dependent." Within the last thirty years, a large amount of wetland modification has occurred. Increased emphasis on wetland preservation and management has been expressed through presidential executive orders and recent legislation. Amendments to the Clean Water Act of 1977 (33 U.S.C. 466) specify a major role for the National Wetlands Inventory (NWI) in the administration of that act.

The FWS has always recognized the importance of wetlands to waterfowl and other migratory birds. Consequently, the FWS has a direct interest in protecting wetlands, especially the breeding and overwintering wetlands. Wetlands, however, also provide a wealth of other values for the public including:

(1) Fish and shellfish protection.

(2) Furbearer and other wildlife production.

(3) Habitats for threatened or endangered plants and animals.

(4) Flood control through temporary storage of flood water.

(5) Water quality maintenance by removing silt load, filtering pollution and absorbing water-borne chemicals and nutrients.

(6) Erosion buffers to protect upland areas.

(7) Groundwater recharge and stream flow maintenance.

(8) Saltwater intrusion control.

(9) Coastal storm damage reduction.

(10) Open space for aesthetic appreciation and recreational activites.

Because of their public values, wetlands represent one of the Nation's most important natural resources.

NATIONAL WETLANDS INVENTORY PROGRAM

The National Wetlands Inventory (NWI) was initiated in 1975 and made operational in 1977. The primary goal of the NWI is to generate and disseminate scientific information on the characteristics, extent, and trends of the Nation's wetlands. The purpose of this information is to foster wise use of wetlands and to provide data for making responsible resource decisions.

Two types of information are produced through the NWI: detailed wetlands maps and status and trends reports. Detailed wetlands maps are produced for geographic areas of critical concern for impact assessments of site-specific projects. The maps may be utilized by local, state and federal agencies as well as by private industry and organizations for comprehensive resource management planning, environmental impact assessments, permit reviews, facility and corridor siting, oil spill contingency plans, natural resource inventories, wildlife surveys and other uses. Estimates of the current status and trends (i.e., losses and gains) of wetlands provide information for reviewing the effectiveness of existing programs and policies, for identifying national or regional land-use problems and allocation, and for general public awareness. A summary of the major objectives of the NWI project is as follows:

(1) Develop wetlands maps and a computer data base on the extent and type of wetlands.

(2) Reproduce and disseminate wetlands map products and reports.

(3) Develop reports on the utility of NWI maps for wetlands management decisions.

(4) Assist all potential users in evaluating the value of NWI products in meeting their needs.

(5) Development of wetlands status/trends reports.

(6) Develop and implement a capability for updating of inventory data to meet changing user needs.

(7) Continue development and implementation of the U.S. Fish and Wildlife Service's wetlands classification system.

(8) Correlate existing wetlands value information to the wetlands classification system.

(9) Provide expert technical assistance in the areas of wetland ecology, botany, soils, and hydrology.

User notes are also compiled for each completed 1:250,000 scale map area. These notes describe the general landform features and vegetation communities and serve to familiarize the user with the various mapping conventions.

DEVELOPMENT OF WETLANDS CLASSIFICATION SYSTEM

The FWS's wetlands classification system was developed by Cowardin, et al. and is titled Classification of Wetlands and Deepwater Habitats of the United States (FWS/OBS - 79/31). The purpose of the classification system is: (1) to describe ecological units having certain common natural attributes; (2) to arrange these units in a system that will facilitate resource management decisions; (3) to furnish units for inventory and mapping; and (4) to provide uniformity in wetland concepts and terminology throughout the U.S.

The classification system defines the limits of wetlands according to ecological characteristics and not according to administrative or regulatory programs. Three key attributes define the term "wetland:" (1) the presence of wetland plants (hydrophytes) or (2) the presence of wet soils (hydric soils) or (3) soil saturation or flooding. Wetlands are naturally extremely diverse and complex. The classification system presents a method for grouping ecologically similar wetlands.

The classification system is hierarchical with wetlands divided among five major systems at the broadest level: Marine, Estuarine, Riverine, Lacustrine and Palustrine. Each System is further subdivided by Subsystems which reflect hydrologic conditions, (e.g., subtidal vs. intertidal in the Marine and Estuarine Systems). Below subsystem is the Class level which describes the appearance of the wetland in terms of vegetation (e.g., Emergent, Aquatic Bed, Forested) or substrate where vegetation is inconspicuous or absent (e.g., Unconsolidated Shore, Rocky Shore, Streambed). Each Class is further subdivided into Subclasses. The classification system also includes modifiers to describe hydrology (water regime), water chemistry (pH, salinity and halinity) and special modifiers relating to man's activities (e.g., impounded, partly drained, farmed, artificial).

MAP PREPARATION

The FWS participates with other Federal and state agencies in the Alaska High-Altitude Photography Program. The NWI uses the 1:60,000 scale color-infrared photography that is obtained by this program. With this imagery the NWI is capable of detailed wetland mapping with a minimum mapping size of 2-5 acres. When the aerial photography is viewed through a stereoscope, the photointerpreter has the ability to see wetlands in three dimensions. The photointerpreter analyzes the vegetation, landforms, slope, and drainage patterns when identifying and classifying wetlands. This photo information is used in conjunction with ancillary data (e.g., soil surveys, topographic maps, etc.), and data obtained during field investigations.

The primary map product is a large-scale map (1:63,360) which shows the location, shape, and characteristics of wetlands and deep-water habitats on a U.S. Geological Survey (USGS) base map.

Introduction

Accuracy in determining wetland classifications on aerial photographs is achieved best by initially ground truthing the area. Field reconnaissance was possible over much of the area mapped. The mapping area consisted of 14 1:63,360 quadrangles in the Yakutat 1:250,000 map unit, covered by 138 photos. Photographic signatures were compared to the actual wetland's appearance in the field by observing vegetation, soil, topography, and tidal conditions. Field data was gathered using a helicopter to assure access to various types of wetlands.

Field members

Barbara Schuster (Biologist, Aerial Photographic Interpreter, Martel Laboratories, Inc.)
Marsha Martin (Geographer, Aerial Photographic Interpreter, Martel Laboratories, Inc.)
Jonathan Hall (Regional Coordinator, USFWS)
David Dall (Asst. Regional Coordinator, USFWS)
Les Vilchek (National Quality Control, USFWS)

Field Dates

August 2 - 6, 1986

Aerial Photography

Type: Color Infrared Transparencies
Scale: 1:60,000

Dates	% Cover
6/78	83%
8/78	7%
8/79	2%
9/81	8%

Collateral Data

USGS Quadrangles
Exploratory Soil Survey of Alaska, USCS
Flora of Alaska, Eric Hulten, 1968, Stanford University Press
Major Ecosystems of Alaska, Joint Federal-State Land Use Planning Commission for Alaska, 1973.
Description of the Ecoregions of the U.S. Bailey, Robert G. 1980, U.S. Department of Agriculture.

Physical Characteristics

The mapping area is located in the southeastern extension of Alaska just southeast of the Malaspina Glacier. Specifically, the area is from Yakutat Bay to south of the Grand Plateau Glacier and extending inland to the glaciated mountains at the Canada/U.S. border.

The St. Elias Mountains span most of the study area with peaks typically reaching 5000 ft. and 9000 ft. at their highest elevation in the work area. Russell Fiord is one of the larger bodies of water extending off at a 30° angle from Yakutat Bay. This was a controversial area at the time of field study due to the dynamic change in the Hubbard glacier north of Russell Fiord. The Hubbard glacier advanced at an unusually fast pace and crossed the mouth of the fiord, eventually blocking it entirely. This massive glacier was large enough to block the normal saltwater input from Yakutat Bay changing the ecosystem of the fiord by raising the water level, inundating the estuarine waters with a fresh water layer on top and trapping marine animals in this "lake." A major concern was possible future overflow flooding into low lying areas south of the fiord. This was only a temporary condition and all mapping is done to conditions at time of photography.

The mapping area can be divided into 3 ecosystems. Most of the area is covered by alpine tundra, glaciers, and ice fields. Snow is also abundant in this area on the photography. Vegetation here is sparse, low, heath shrubs if present at all. Soils also are not always able to accumulate on the rocky slopes and are thin. This tundra occurs above the treeline which is at 1000 to 1500 feet.

The second major ecosystem present here is the coastal sitka spruce and western hemlock forest which cover the hilly morraines and some of the coastal areas. Terraces of these forests also extend into the lowland marshes. Within this evergreen forest is also a scattering of mountain hemlock, lodgepole pine, western red cedar and Alaska cedar. Deciduous trees such as black cottonwood are common along rivers. Land surfaces can be steep rocky slopes, broad mountain drainages, or glacial morraines. Soils are free of permafrost. Morraine soils close to steep mountains and large glaciers consists of a typic cryorthent - typic crohemist association and a stony and gravelly till with large boulders on the surface. This soil association is well drained, shallow, coarse, and loamy near the timberline. On lower slopes and high morraines, the well drained soils are stoney and gravelly. Beach dunes and lowland terraces support sandy to silty soils. The poorly drained soils consist of mucky peats and are found in sloping valleys and depressions between hills.

The remaining portion of the study area is a wet tundra with little topographical relief and is found along the coast usually less than 100 feet above sea level. Standing water and shallow lakes are common. Dominant vegetation is sedge and cottongrass with many dwarf shrubs present. The major soils occupying outwash plains and alluvial fans of the coastal mountains and plains are a typic-cryaquent and typic-cryofluvent association. Some morraines and dunes can have these soils also. This association is poorly drained and consists of peat layers underlain by gravelly or sandy outwash interstratified with clay-like marine materials to great depths. Stabilized dunes of eolian sand border some of the beaches and parts of large flood plains. Frequent flooding from glaciers and high tides raises the water table, though normally it is near the surface.

The mean annual temperature is 39° and mean annual precipitation is approximately 133 inches. The driest month is June when most of the photography was taken. Rainfall increases through the summer until peaking in October with 20 inches during this month. At higher elevations precipitation is mainly snowfall and low summer temperatures, approximately 53°, allow ice to ramain throughout the seasons.

Commercial fishing is the principal occupation especially with native villages in this area. The Situk River flowing from Situk Lake near Russell Fiord to the Gulf is a popular spawning ground for salmon. Logging is also a major industry mainly northeast of Yakutat.

Biological Characteristics of Wetland Habitats

The following section describes the photographic signatures specific for each wetland type encountered in the field. A general description and/or community type, including dominant vegetation observed in the field, is provided for each code. When split-class designations are used the spatially dominant species type is listed first.

Marine System

This system includes the Gulf of Alaska and its beaches. Along the open coast from Phipps Penninsula to the far southeastern corner of the Yakutat 1:250,000, the shoreline is exposed to the full force of the wave action. Very little vegetation grows on these beaches of black sand.

Tidal Range

The mean diurnal tide range is 7.85 to 10.1 ft. and the mean tide level is 5.3 ft.

M1UBL Deep water and subtidal high salinity water near shoreline, including the Gulf of Alaska. This has the blue photographic signature of a nonvegetated deep water body. Wave action appears as small white brush strokes on the water. Vegetation is not visible beneath the water so is not mapped. However, kelp and clinging intertidal seaweeds can occur and were observed washed up on the beach.

M2USN Intertidal, regularly flooded, unvegetated beaches and flats. The shoreline immediately exposed to high energy waves was composed of black sand-sized particles. The photographic signature typically is a gray or bluish tone.

M2RSN Intertidal, regularly flooded, unvegetated areas of stones and larger rocks. This signature appears a very textured gray. Only one area was mapped with this classification: beach below the Grand Plateau Glacier.

M2USP Intertidal, irregularly flooded beaches and flats. Irregular flooding according to the classification system is a non-daily occurrance. This is seen on the photos as a rise in elevation from the regularly flooded areas and a slight change in tone of gray as one moves inland from the beach. Both zones of flooding are pulled out separately on the photo only when they are large enough. Normally, the transitional zone was observed in the field; however, much of the shoreline was lumped as M2USN to avoid mapping two thin polygons of M2USN and M2USP. This area was often littered with tidal debris such as large pieces of driftwood.

Estuarine System

The estuarine system is confined to bays, tidal marshes, fiords, and brackish river channels and exhibits a lower salinity than that found in the marine system. Estuarine coastlines are considered low energy since they are protected from the full force of wave action of the open ocean. In the Yakutat 1:250,000 this system includes Dry Bay, Dangerous River Tidal Bay, Disenchantment Bay, Yakutat Bay, Russell Fiord, and Nunatak Fiord. The breaks made between the marine and estuarine system are arbitrary and take into account wave action, freshwater input, and depth of water.

E1UBL Subtidal, low-energy, brackish open water including the permanently flooded portions of bays, fiords, and adjacent river channels. Also includes small brackish ponds which are inundated by high spring tides. This signature is deep blue. Vegetation is not present.

E1AB3L Subtidal, low energy, brackish water vegetated with rooted vascular aquatic beds. Typically this is found in lagoons and the dominant species found here is *Zostera marina*. Photographic signature is usually pinkish mixed in with the blue of the open water or especially with submerged eelgrass, may be only a darkening of the blue tone beneath the water.

E2AB1N Lower elevation areas of brackish flats and shorelines that are flooded regularly by tidal water and have algae as the dominant vegetation. The algae return on the photos gives off a bright orange tone. This is usually an indicator of *Fucus dyschensis*.

E2USN Intertidal, low energy, regularly exposed, unvegetated beaches and flats. Typically the substrate is silt or sand. The signature is gray or pale bluish when gravel or sand and greenish when mud is the substrate.

E2USP Irregularly flooded, unvegetated, low-energy, brackish beaches and flats. This also has a gray covertype that may differ slightly from E2USN and typically exhibits a slight rise in elevation. Often the prescence of a whiter tone on the mudflats indicated it is not as wet as the rest.

E2EM1N Lower elevation areas of brackish marshes that are flooded regularly by tidal water. Also includes complexes of low brackish marshes which are regularly flooded and high brackish marshes which are irregularly flooded (this complex represents an area where conditions pertinent to E2EM1N and E2EM1P exist in close proximity to one another, making it difficult to delineate). This area is vegetated with emergents that persist throughout the year. The E2EM1N marsh exists in areas exhibiting estuarine features, particularly at the heads of fiords and sheltered embayments.

Vegetation in this cover type includes Carex lyngbyaei, Elymus mollis, Deschampsia beringensis, Triglochin maritima and Puccinella sp. The signature that this very wet vegetation exhibits is a bright to deep orange color.

E2EM1/USN or E2US/EMIN Brackish marshes mixed with mud flats and/or tidal ponds (see descriptions for E2EMIN, E2EM1P, and E2USN wetland types). Typically found at the mouths of larger rivers, it is one of the most seaward vegetation types. The area is inundated daily; however, water drains off rapidly after flooding and the surface dries somewhat.

Dominant species include those described for the E2EM1N wetland type.

The photographic signature is also a mix of these two cover types depending on the amount of vegetation. The greenish tone is mixed with orange in patches.

E2EM1P Higher elevation areas of brackish marsh that are flooded irregularly by tidal water. Surface drainage is good in these areas. Vegetation is similar to that found in regularly flooded areas. Species found are Elymus spp., including Elymus mollis, Carex lyngbyaei, Puccinellia sp., and Triglochin maritima. Also observed was some Stellaria sp. The signature is the orange of estuarine emergents, but not as bright as the tone of those that are regularly flooded.

E2F05 Regularly flooded brackish areas vegetated with dead trees that presumably have become stressed out due to inundation of salt water. Their distinct signature is a whitish on light gray tone with spindly trees visable.

Lacustrine System

This system includes all lakes greater than 20 acres in size.

L1UBH Permanently flooded, open water areas of lakes. Generally, the water depth exceeds 2 meters. Vegetation (aquatic floating-leaved) is lacking or sparse (less than 30 percent aerial coverage). Photographic signature is deep blue.

L1UBV Permanently flooded, fresh water tidal lake with a water level that fluctuates when fresh water backs up into the lake during high tides. Signature appears deep blue.

L2USC Seasonally flooded mud and sand flats along lake shorelines. Typically devoid of vegetation. Signature is a darker shade of blue where the bottom is more evident due to water depth less than 6 meters.

L2USA Temporarily flooded mud and sand flats along lake shorelines. Typically devoid of vegetation. On photos this appears bluish but the bottom is most visible here.

L2USR Seasonally flooded tidal shoreline of lakes which are not brackish, but have water levels which fluctuate when fresh water backs up into the lake basin during high tides. On photos this gives the typical blue water signature.

L2AB4H Permanently flooded, floating-leaved aquatic vegetation growing in shallow water of lakes. Dominant plant is *Nuphar polysepalum*. (see description for the PAB4H wetland type). Vegetation appears pink on the blue water on photos.

Aquatic beds, mostly of yellow pond lily were commonly seen from the helicopter covering the lowland lakes.

L2EM2H Permanently flooded, littoral non-persistant emergent vegetation growing in lakes. These plants fall to the surface of the substrate or below the surface of the water at the end of the growing season. Field reconnaisance allowed us to document a lake southeast of Yakutat which was vegetated with *Arctophyla fulva*, *Hippurus vulgaris*, *Equisetum* sp., and *Carex* spp. It's signature was a mottled green, orange tone.

Riverine System

All rivers and stream channels upstream from the influence of ocean-derived salinity are included in the riverine system. Often there is a distinct break visible on the photography between the riverine and marine estuarine systems. This is due to the heavy concentration of glacier silt in the rivers draining these glaciers. Their pale blue signature contrasts the dark blue signature of the ocean-derived saline waters.

R1UBV Permanently flooded, tidal, open water channels of rivers and streams. These channels are subject to tidal flux, but are upstream from the influence of ocean-derived salinity. The signature is typical of unvegetated open water; shades of blue depending on concentration of glacier silt.

R1USR Seasonally flooded, tidal river flats and bars. These areas are not directly inundated by estuarine water but are flooded by fresh water which backs up into riverine channels during high tides. The bottom usually is visible on the photos giving a characteristic pale blue signature.

R2UBH Permanently flooded, open water channels of lower perennial rivers and streams. This is usually only found on low elevations. The signature is a light blue.

R3UBH Permanently flooded, open water channels of upper perennial rivers and streams.

Many of the rivers draining glaciers, lakes, and ponds of the upper elevations are steep and characterized by a bright white spotted signature typical of a fast moving river. In the field, the glacial silt was giving the rivers a very milky blue color as they leveled out. The Alsek River which extends up to Canada was extremely silty and the break where it meets the higher salinity waters at its mouth is quite distinct. This tone is a more aqua blue as compared to the deepwater navy blue.

R3USC Seasonally flooded river flats and bars. This type is extensive in major river channels. Typically unvegetated or sparsely vegetated by broad-leaved deciduous shrubs. Shrub cover is less than 30 percent of the flats area (see descriptions for the PSS1C and PSS1/USC wetland types). On the photo this appears as a gray or dark dull blue tone.

R3USA Temporarily flooded river flats and bars. Typically unvegetated or sparsely vegetated by broad-leaved deciduous shrubs. Shrub cover is less than 30 percent of the flats area (see description for the PSS1A wetland type). Similar signature to the seasonally flooded flats but more whitish.

R3US/UB
R3UB/US
R2UB/US
R2US/UB

Mixture of seasonally flooded river flats and bars and small open water channels. These codes are used when it is difficult to delineate the main water course because of the or numerous flats and bars which occur (Note the absence of a water regime for this code, which is a combination of R3USC and R3UBH or R2USC and R2UBH).

This is actually a very accurate classification for many braided glacier derived streams and rivers due to their changing courses. This was observed on two dates of photography with only three years between them. The river channel had changed considerably within its floodplain.

This signature is an obvious braid of blue and white.

R4SBC A complex of river flats, bars, and small open water pools of seasonally flooded intermittent streams. These streams do not carry water throughout the year, but do have a moving water flow for short to extended periods each year. Sparse to dense vegetative cover of broad-leaved deciduous shrubs may occur along the intermittent stream banks (see descriptions for the PSS1C wetland type). Signature is a faint linear with or without water visible.

Palustrine System

The palustrine system includes all wetlands dominated by trees, shrubs, persistent emergents, emergent moss, and lichens that are not influenced by ocean-derived salinity. Wetland types commonly referred to as bogs, muskegs, fens, marshes, and swamps are grouped in the palustrine system. Lakes and ponds less than 20 acres in size are also a part of the palustrine system.

Many of the palustrine areas especially the large wetlands in the Yakutat forelands are a mixture of many wetland communities that are too small and intertwined to be classified individually. The usefulness of the mapping is of prime consideration in the amount of complexity in photographic interpretation. Split classes are an accurate type of classification for most wetlands however are avoided if possible to minimize complexity. In the field *Salix* spp. and *Myrica gale* were often found in emergent meadows. Wet pockets of semipermanent water often dot the seasonal or saturated meadows. Photointerpretation allowed us to pull these features out only when the delineations would not overly complex the map.

The palustrine system is often influenced by beaver activity which is denoted by using the "b" modified on the appropriate label, i.e. PUBHb, PEM1Hb, and PF05Fb. The beaver indicators on the photography are a white dot in the pond, which is their lodge, a whitish, straight impoundment across one edge of the pond, which is the pile of dead trees or dead white trees nearby, which is evidence of their work. Often the dam raises the water level enough to kill off the pond's surrounding vegetation. The sitka spruce shows this stress by dying off and appears as the characteristic white tone.

Manmade influences on this system are noted by using the "x" modifier with the classification. Excavations can have an unconsolidated bottom which is exposed or flooded permanently, and can be vegetated.

PUBH Permanently flooded, small open water bodies (ponds). Vegetation is generally lacking within the open water area, but aquatic beds or persistent emergents may provide sparse cover less than 30 percent along the pond edge (see descriptions for PAB4H, PAB4/UBH, PEM1F, and PEM1H wetland types). This signature is also blue as for the lacustrine system's open water.

PUBF Semipermanently flooded, small open water bodies (ponds) where sparse vegetative cover may occur, but is generally less than 30 percent. Photographic signature is a shallow pond of a paler blue than that of PUBH.

PUSC Seasonally flooded, small basins that typically contain standing water only during the early part of the growing season. When surface water is absent, the exposed substrate will either remain unvegetated or will be colonized by herbaceous annuals. This shows up as a pale blue on the photography due to the shallow water level.

PUSA Temporarily flooded, small basins that typically contain standing water only briefly during the early part of the growing season. When surface water is absent, the exposed substrate will either remain unvegetated or will be colonized by herbaceous annuals. This blue-gray substrate is very evident on the photo and may or may not be covered with some water.

PAB3H Permanently flooded, rooted vascular aquatic plants growing in ponds. These small ponds are generally found in bogs of undrained hollows in the underlying bedrock surface. In the field the dominant vegetation observed was Nuphar polysepalum in the deeper bog ponds and forest ponds. Helicopter reconnaissance allowed us to note most of these bog ponds had some vegetation in them. The vegetation was identified as floating rooted vascular plants.

Eventually, many of these smaller ponds will be taken over by mat-forming (peat-producing) sedges (see descriptions for PEM1/AB3H, PEM1H, and PEM1F wetland types). Once these sedges become firmly established (PEM1C wetland) the buildup of peat is rapid (PEM1B wetland) and these areas are rapidly transformed to young bogs (early colonization of low shrub) which in turn are often colonized by tall shrubs (PSS1/EM1B wetland). The typical signature is an orange swirl or patch on the dark green water body. A mottling of green can also indicate vegetated ponds.

PAB3/UBH or PUB/AB3H Permanently flooded ponds supporting aquatic rooted vascular vegetation. This designation is used for complexes of PAB3H and PUBH when it is not practical to delineate the types separately. Vegetation for this type is described for the PAB3H wetland type. Signature is a mix of blue or green water with orange of aquatic bed.

PEM1H Permanently flooded, emergent freshwater marsh. These are marshes that exhibit standing water throughout the entire year in all years. The dominant vegetation we observed includes Menyanthes trifoliata, Hippuris vulgaris, Caltha palustris, and Cicuta douglasii.

Fringes of PEM1F and PEM1C wetland types may occur adjacent to the PEM1H wetland type, although they may not have been mapped due to minimum mapping size (approximately 3 acres).

On the photo, these marshes will often appear as a basin with mottled shades of green with distinct edges.

PEM1/UBH or PUB/EM1H — Typically a PEM1H (or PEM1F) wetland type mixed with areas of permanently flooded open water (see descriptions for the PEM1H and PEM1F wetland types). This type may occupy an area within the brackish water/freshwater ecotone. Vegetation may be very dense and composed primarily of sedges and those species described for the PEM1H wetland type. Its signature is a mixture of smooth green or blue with patches of mottling within.

PEM1/AB3H or PAB3/EM1H — Permanently flooded emergent marsh with aquatic bed. Both emergent and aquatic bed vegetation exceed 30 percent of the ponded area (see descriptions for the PEM1H and PAB3H wetland types).

This covertype is one of mottled greens with orange tone mixed in.

PEM1F — Semipermanently flooded emergent marshes. These marsh areas usually exhibit standing water throughout the growing season. This wetland type occurs in patterned bog pools and in depressions and pools not associated with patterned bogs, and along the periphery of ponds and lakes.

This signature is similar to the one of PEM1H, however less water depth is visible on the photo by a slightly lighter shade of dark green. Dominant vegetation observed in the field consisted of Eriophorum spp., Carex sitchensis and other sedges, and Caltha palustris.

Species included in the PEM1H wetland type may also be found in these semipermanently flooded areas.

The PEM1F wetland type generally contains small elevated areas of PEM1C and/or PSS1/EM1C wetland types (see these designated wetland types for a more complete listing of associated species).

PEM1C — Seasonally flooded, persistent emergent marsh. This emergent wetland type may occur on the floodplain of small streams and creeks and along pond margins. Standing water resulting from stream overflow is present early in the growing season. Species of primary importance along low-gradient streams may include Equisetum spp., Pedicularis macrodonta, Aster siberica, Sanguisorba sp., Potentilla palustris, Carex spp., and unidentified pteridophytes.

This covertype is also a major one associated with the wet tundra of the Yakutat forelands and other areas of little topographical relief. Within and around sedge/sphagnum bog pools may be found various species of Carex, Eriophorum, Eleocharis, Equisetum, Platinthera, Juncus, Solidago, and grasses. Potentilla palustris, Fauria

crista-galli, Ranunculus reptans, Gentiana douglasiana, Gium calthifolium, Rubus chameamorus, and Tofieldia glutinosia.

A dense mat of spagnum moss may underlie the herbaceous plants. Various shrubs such as Myrica gale, Salix spp., or Vaccinium spp. may also occur within this covertype.

Alpine meadows support lush growths of sedges and grasses as well as succulent forbs such as Fauria crista-galli.

Freshwater marshes develop from lakes, ponds, sloughs, or rivers and may persist as they are for some time, but many probably develop into bogs (PEM1B wetland type). Some marshes are invaded by shrubs and develop into deciduous shrublands (PSS1/EM1B wetland type), further succeeding to various forest types (PFO4B wetland type).

An increase in the prevalance of sedges is the primary characteristic that distinguishes this wetland type from the PEM1A wetland type.

The PEM1C wetland appears as a dark green area with indistinct edges on the photography when it is within other wetlands. As a depression in the upland forest it can appear as a gray-blue tone. On river floodplains it will appear a dirty dark gray tone due to the gravel substrate beneath showing up in the signature. It can less frequently appear as a very smooth orange tone when dominated by sedges.

PEM1/USC Seasonally flooded, persistent emergent marsh with areas of unvegetated flats. Emergent vegetation covers at least 30 percent of the area but does not exceed 70 percent (see descriptions for the PEM1C and PUSC wetland types).

PEM1B Saturated, emergent, bog-type marshes. These areas are generally saturated peat soils with a sphagnum mat covering the soil surface. This particular type of wetland contains the greatest variety and abundance of wetland plant species of any wetland category.

Several phases of h ~s occur in the process of development, beginning with the formation of a floating mat (moss and sedge) which evenutally covers the underlying water body. In time, peat accumulation will increase until the shallow pond beneath is completely filled with saturated peat. The bog will then take on a meadow-like appearance. At maturity, the bog will have progressed to a less wet phase, becoming thicket-like with abundant broad-leaved deciduous shrubs and ericaceous shrubs (see description for the PSS1/EM1B wetland type).

Plants documented in the field are Carex spp., Equisetum spp., Lathyrus sp., Iris spp., Sanquisorba stipulata, Polemonium acutiflorum, Artemisia arctica, Cornus canadensis, Aruncus sylvester, Fauria crista-galli, Plantago spp., Aconitum delphinifolium, Podecathon pulechellon, Tiarella trifolia Pedicularis macrodonta, Conioselinum chinense, Fritillaria camschatcensis, Cicuta Douglasii, Streptopus roseus, Veratrum viride, Eriophorum augustifolium, Potentilla palustris, and very frequently Drosera rotundifolia all within a Sphagnum mat.

As the bog progresses towards maturity, shrubs begin to invade the higher mounds within the bog complex. Such species as Rubus chamaemorous Rubus arcticus, Oxycoccus microcarpus, Empetrum nigrum, Vaccinium vitis-idaea, Vaccinium uliginosum, Andromeda polifolia, and various species of Salix (most notably S. commutata may commonly occur.

Saturated, emergent bogs occurring at higher elevations and on slopes have a similar flora; however, shrubs may appear at an earlier stage than that which occurs in similar bogs at lower elevations. These higher elevation saturated areas may not go through the floating mat stage of bog development. Slope muskegs are usually mixed communities of sedge and moss.

Bogs are dominated by either sedges or sphagnum, and this dominance is probably partially controlled by pH (affected by water supply, mineral concentration, etc.). Many of the peat profiles taken show sedge peat at the bottom and through much of the profile and often contain one or two layers of stumps of spruce or pine below the surface, presumably representing previously forested conditions during drier intervals.

The bog's signature is a smooth yellowish green or pale tan. Often it is dotted with stunted sitka spruce (less than 30%) which appear as brown specks. Wetter depressions are frequently within this covertype.

PEM1A Temporarily flooded, persistent emergent wetlands. Where it occurs, it is generally restricted to small depressions or on the floodplains of streams. Standing water is present for only brief periods during the growing season. Calamagrostis canadensis and Deschampsia beringensis are usually the dominant emergents. Associated species may include Hordeum sp., Lupinus nootkatensis, Aster junciformis, Parnassia spp. Fragaria virginiana, Aconitum delphinifolium, Ranunculus pennsylvannicus, Solidago sp., Heraclium lanatum, Achillea borealis, Rhynanthus spp., Galium triphidium, Dryapterus triacenata and Rumex fenestratus.

various shrubs including Salix barclayi, Alnus crispa, subsp. sinuata, Rubus chamemorous, Rubus spectabilis and several ericaceous shrubs may also occur (see description for the PSS1/EM1A and PSS1/EM1C wetland types). Small permanently flooded pools of standing water may remain throughout the growing season in these temporarily flooded areas. Small pools may contain Ranuncululus hyperboreus, Menyanthes trifoliata and Caltha palustris. For a more complete listing of plants able to withstand periods of freshwater inundation, see the description for the PEM1C wetland type.
This vegetation will give a grayish signature in depressions or bluish along rivers due to gravel substrate. It can sometimes appear as a very smooth beige tone.

PEM1/USA or PUS/EM1A — Temporarily flooded, persistent emergent wetland with open flat areas (see descriptions for the PEM1A and PUSA wetland types). The signature is a mixture of the pale blue-gray with the green tone.

PEM1T — Semipermanently flooded, tidal, persistent emergent marshes. This wetland type is similar to the PEM1F wetland type but occurs closer to the mouth of streams entering estuarine waters. See descriptions for the PEM1F and PEM1/UBF wetland types. The signature is similar in green tones.

PEM1R — Seasonally flooded, tidal, persistent emergent marshes. These marshes occur on terraces along the banks of freshwater tidal channels (R1UBV wetland type). This wetland type is similar to the PEM1C wetland type but occurs closer to the mouth of streams entering estuarine waters (see descriptions for the PEM1C and PSS1/EM1C wetland types. In the field we noted Triglochin spp. and Parnassia palustis occupied these river terraces. This appears as an orange tone or gray-blue.

PEM1S — Temporarily flooded, tidal, persistent emergent marsh. These areas are similar to the PEM1R wetland type but generally occur at a slightly higher elevation along freshwater tidal channels (see descriptions for the PEM1R and PEM1A wetland types).

Vegetation observed in the field on these river flats included Elymus sp., Chrysanthemum arctica, Plantago maritima, Deschampsia beringensis , Juncus arcticus, and Lathyrus meritimus. This signature is typically a pale greenish blue, or can also be a pale orange (smooth).

PSS1F — Semipermanently flooded wetland consisting of broad-leaved deciduous shrubs. This wetland type may occur along the edge of ponds where the water level has risen and fluctuates somewhat due to beaver activity. Dominant shrub vegetation consists primarily of Salix spp. and Myrica gale. This signature is the typical taller shrub texture with orange tone.

PSS1/UBH or PUB/SS1H — Permanently flooded scrub shrub wetland with open water bodies. Broad-leaved deciduous shrubs are predominantly Salix spp. and Alnus spp. This wetland type may occur in areas of extensive flooding by river or lake overflow or where beaver activity has altered the existing water level. On the photograph the shrubs are visible standing in the dark green water.

PSS1/EM1F or PEM1/SS1F — This designation is used primarily to indicate patterned bogs (string bogs and reticulate bogs). Patterned bogs are composed of bog ridges (strangs) and wet hollows (flarks). The string bog type has roughly parallel strangs separated by the wet flarks. The strangs are oriented perpendicular to water movement within the bog complex. The ridges in the reticulate bog type form a net-like pattern. Small ponds may exist and are irregularly sized, spaced, and shaped. Larger ponds, if any, may contain peat islands.

The ridges and islands in a patterned bog are dominated by broad-leaved deciduous shrubs. Important species include various species of Salix, Vaccinium uliginosum, Rubus spectabilis, Empetrum nigrum, and those species described for the PSS1B and PSS1C wetland types.

The flarks (ponds) are typically dominated by emergent vegetation and are characterized by a semipermanently flooded water regime. Sphagnum moss may form around flarks and on the bog strangs. Other shrub and emergent species which may be present include those described for the PSS1/EM1B and PEM1F wetland types.

In the field we observed this covertype as wide sloughs with the wetter low ground dominated by emergents with small islands of shrubs on the higher ground. These shrubs may be more seasonally flooded but due to the degree of complexity they are included as one wetland classification. This emergent signature is a dark green with the dull salmon colored shrubs mixed in.

PSS1C — Seasonally flooded dense shrub areas on river and stream floodplains consisting of willow and alder. Terrain may be hummocky with flooded depressions.

Alnus spp., Salix commutata and other species of willow are commonly mixed with Myrica gale , Vaccinium vitus-idae, V. uliginosum, and Betula nana.

Emergent vegetation, dominated by Calamagrostis canadensis, may be present in some areas. This wetland type often occurs on river bars that have become stable enough to support persistent woody vegetation. The alder and willow combined may exceed 75 percent cover in this type of wetland. Other common species occurring in the understory include those species described for the PEM1C wetland type.

The seasonally flooded shrubs give a rough orange return on the photographing.

PSS1/USC or PUS/SS1C — Seasonally flooded areas on river and stream floodplains consisting of a mix of shrubs and non-vegetated riverine flats. Shrub species are primarily Salix spp. and Alnus spp. The flats are typically composed of sand and gravel-sized particles, and are situated at a slightly lower elevation than the shrub area (see descriptions for the PSS1/USA, PSS1C, and PSS1A wetland types).

This signature is a mixture of the orange shrubs on the blue gravel substrate.

PSS1/EM1C or PEM1/SS1C — Seasonally flooded areas occurring on floodplains in stream and creek corridors. These wetlands are characterized by a mixture of broad-leaved deciduous shrubs and emergent vegetation. Surface water resulting from stream overflow is present during the early growing season. The substrate consists of an interspersion of raised mounds (hummocks) and lower basins and drainageways. Salix spp. and Alnus spp. dominate the hummock areas with emergent vegetation dominating the lower elevation areas. This is one of the most extensive shrub vegetation types. It occurs in some elongated depressions (flarks) between raised bog ridges (strangs), as a floating bog mat along large ponds, and in drained beaver meadows. It is a species-rich area and may include most of the species described for the PSS1C and PEM1C wetland types.

This type also occurs in seepage areas on flats at the base of bluffs along the coast where it forms a hummocky surface beneath alder. Rivulets and slow moving water occur between field observations showed this to be a series of seasonal emergent drainages braiding through the slightly higher elevated shrubs. These higher elevations usually are sprinkled with less than 30% coverage of stunted spruce. The signature is a vivid salmon tone with patches and strips of green.

PSS1/4C or PSS4/1C — Seasonally flooded areas adjacent to streams and small rivers that are a shrub complex dominated by Salix spp. and Alnus spp. Picea sitchensis also occur on somewhat higher terraces. This covertype is a textured orange tone with brown dots mixed throughout the wetland.

PSS1B — Saturated shrub bog with greater than 70 percent of the canopy consisting of broad-leaved deciduous shrubs. Emergent vegetation comprises less than 30 percent of the cover. Typical tall shrub vegetation may include alder and willow. Low mat-type shrub vegetation may include those species identified for saturated shrub/emergent wetlands (see description for the PSS1/EM1B wetland type). A dense mat of sphagnum moss may cover the soil

surface in some areas. Additional species may include scattered Empetrum nigrum, Rubus spectabilis, Vaccinium oxycoccus, Vaccinium vitis-idaea, Vaccinium ovalifolium, Vaccinium uliginosum, Oppopanax horridus, Viburnum edule, Myrica gale, Andromeda polifolia and those emergent species described for the PEM1B wetland type. Saturated shrub areas may also occur as hillside seeps. This may appear as an orange slightly textured tone or a mottled brownish orange on the photography.

PSS1/EM1B or PEM1/SS1B — Saturated shrub bog with a 30 percent or greater canopy coverage consisting of broad-leaved deciduous shrubs. The remaining portion of the vegetative cover consists of persistent emergents. This is one of the more common wetland types occurring in both basin areas and as hillside seeps. Common shrub species include stunted Picea sitchensis or Vaccinium uliginosum, Empetrum nigrum, Oxycoccus microcarpus, Vaccinium vitis-idaea, Betula nana, Andromeda polifolia, and various species of Salix.

Dominant emergent species include Carex spp., Eriophorum angustifolium, Drosera rotundifolia, Potentilla palustris, Sanguisorba stipulata, Cornus canadensis, Rubus chamaemorus, Veratrum sp., Sphagnum spp., as well as other species described for the PEM1B wetland type. The signature is a sandy beige with a mottling of pale peach.

PSS1/4B or PSS4/1B — Saturated deciduous shrub bog mixed with stunted Picea sitchensis (see descriptions for the PSS1B, PSS4/1B, PSS4/1B, PSS4B, and PSS1/EM1B wetland types). This signature has the characteristic brown dots of the stunted spruce with an understory of rough orange deciduous shrub tone.

PSS1A — Temporarily flooded dense shrub areas on river and stream floodplains consisting primarily of Salix spp., S. sitchensis, Viburnum edule, Rubus spectabilis, and Alnus crispa. This wetland type often occurs on river bars that have become stable enough to support persistent woody vegetation. Understory vegetation is generally sparse, but may contain Carex lyngbyaei, Calamagrostis canadensis, Equisetum arvense, Athyrium felix-femina, Deschampsia beringensis, and those species listed for the PEM1A wetland type. Peat development is usually lacking.

Photographically, this classification has an orange textured carpet when the shrubs are part of higher area of wet flatlands. The orange is less dense when these shrubs are on river floodplains and are mixed with the blue gravel substrate.

PSS4B — Saturated shrub bog. The Picea sitchensis or Picea mariana in these areas is shrub height (less than 6 meters) and generally exceeds 50 percent aerial coverage (see descriptions for the PSS4/1B, PSS1B, and PFO4B wetland types). This common signature is brown dots.

PSS4/EM1B or PEM1/SS4B — Saturated shrub bog with an emergent vegetative layer. The Picea sitchensis or Picea marina in these areas is shrub height (less than 6 meters). Emergent species are those described for the PEM1B wetland type (see also description for the PSS4/1B wetland type). The signature is also a mixture of those described for PEM1B and PSS4B.

PFO1A — Temporarily flooded deciduous forested wetland occurring on river floodplains. Populus trichocarpa is the dominant tree species. It may occur in relatively pure stands or in mixed stands with tree-size alder. Understory vegetation is usually lacking or sparse, consisting of various graminoid species (see description for the PEM1A wetland type for understory vegetation).

Other vegetation observed in the field included Populus balsamifera and Alnus sinuata. These trees have a distinct large crowned orange signature.

PFO1/SS1A or PSS1/FO1A — Temporarily flooded areas on river and stream floodplains consisting of a mix of broad-leaved deciduous forest and broad-leaved deciduous shrubs. Dominant tree species is Populus trichocarpa. Salix spp. and Alnus crispa are the dominant species in the shrub areas. The shrubs often occur in bands along the river channels and at a slightly lower elevation that the forested areas.

This community may also occupy exposed peaty, sandy soil around partially dewatered lakes. The present vegetation is primarily Alnus spp., Calamagrostis canadensis, Equisetum spp., and those species described for the PSS1A wetland type. The signature is a textured orange mix of tall trees and short shrubs.

PFO1/4A or PFO4/1A — Temporarily flooded, mixed forested wetland occurring on river floodplains. Populus trichocarpa is the dominant deciduous tree species and Picea sitchensis or Picea mariana are the dominant evergreens. (See descriptions for the PFO1A and PFO4A wetland types). See the signatures for these two wetland types also for the tones and patterns that make up the PFO1/4A signature.

PFO4/EM1C or PEM1/FO4C — A seasonally flooded open canopy forested wetland with an understory of persistent emergents. Shrub vegetation is sparse (less than 30 percent) to non-existent. See the description for PEM1C for the typical vegetation that will be mixed with the Picea sitchensis. The signature will be a mix of the PEM1C with brown trees.

PF04/SS1C or PSS1/F04C — Seasonally flooded areas adjacent to streams and small rivers that are a complex of Picea sitchensis or Picea mariana on higher terraces and deciduous shrubs on lower terraces. Salix spp. and Alnus spp. are the common shrub species (see description for the PSS1C wetland type). The signature is an orange textured mat with the brown trees.

PF04B — Saturated spruce bog. These areas are dominated by Picea sitchensis or Picea mariana greater than 6 meters in height. Stunted Tsuga heterophylla may also occur. This wetland type often occurs as a fringe (slightly elevated margin) bordering the upland edge of muskegs, or as "islands" within a patterned bog complex.

Dominant shrubby understory vegetation includes Alnus crispa, Empetrum nigrum, Equisetum spp., Rubus chamemorous. Betula nana, Picea mariana, Vaccinium vitis-idaea, and Vaccinium uliginosum, as well as others described for the PSS1B, PEM1B, and PSS1/EM1B wetland types. Herbaceous vegetation may include Cornus canadensis, Calamagrostis canadensis, Carex spp., and those species listed for the PEM1B wetland type. Sphagnum moss may provide a very dense ground cover.

This is a common wetland type with a distinct signature contrasting with the surrounding upland forest. The trees in the wetter substrate are shorter and have less crown density. They have a lighter grayish cast to them also than the drier forest. The signatures of the shrub or emergent understory are usually visible since the trees have such a sparse canopy.

PF04/EM1B or PEM1/F04B — Saturated, open conifer forest bog with an emergent ground layer. Emergent species for this wetland type are described for the PEM1B wetland type (see also description for the PF04B wetland type).

See also the description of signatures for these wetland types. Sometimes this covertype also appears as purplish trees over a pale mustard understory.

PF04/SS1B or PSS1/F04B — Same as PF04B wetland type, but Picea sitchensis or Picea mariana canopy cover is generally less than the PF04B wetland type. The understory scrub shrub vegetation in this wetland type exceeds 30 percent aerial coverage. Typical scrub shrub vegetation would include those dominant species described for the PSS1B wetland type. Peat is saturated year round and may exceed 1 meter in depth. See descriptions for the PF04B and PSS1B wetland types for vegetation and signatures.

PF04/SS4B or PSS4/F04B — Same as the PF04/SS1B wetland type with a greater understory of stunted Picea sitchensis or Picea mariana (occupying at least 30 percent of the understory cover). Dominant vegetation is similar to that described for the PF04B, PF04/SS1B, and PSS1B wetland types. The signature is typical of the stunted spruce.

PF04/1B or PF01/4B — Similar to the PF04B wetland type, but mixed with broad-leaved deciduous trees (greater than 6 meters in height). Picea sitchensis or P. mariana are the dominant evergreens. Understory vegetation is generally sparse. Soil conditions remain saturated throughout the year. Populus trichocarpa and Populus balsamifera are the dominant broad-leaved deciduous trees mixed with primarily sitka spruce or black spruce. See descriptions for the PF04B and PF01B vegetation and signatures.

Temporarily flooded areas with a closed canopy of needle-leaved evergreen trees generally occurring on river floodplains.

This covertype is sometimes a mix of the healthy and spindly crowns of spruce due to the infrequent inundation of water. Often an orange toned shrub understory is evident.

PF04/SS1A or PSS1/F04A — Temporarily flooded forests with an open canopy of sitka spruce and an understory of shrubs described in PSS1A wetland type. The signature is a rough orange mat with a mix of the brown dots. The trees may not be as spindly as those in pure spruce wetland since they actually may occupy slightly higher ground within the shrubs.

PF04/1A — Temporarily flooded mixed forested wetland occurring on river floodplains. Picea sitchensis or Picea mariana are the dominant evergreens mixed with Populus trichocarpa and/or Populus balsamifera (see descriptions for PF04A, PF01A, and PF01/4A wetland types).

PF05H — Permanently flooded dead tree swamp. Area is essentially an open water type wetland with scattered dead trees (either deciduous or evergreen) covering at least 30 percent of the open water area.

Beavers are typically a cause of this wetland community. The signature is a mix of a distinct white trees in blue water. Dead trees almost always appear white-gray.

PFO5/UBH Permanently flooded dead tree forested wetland with open water bodies. This situation may occur as a result of damming by beavers, a rise in pond water elevation, or by major (permanent) flooding of a stream or river channel (see description for the PFO5H wetland type).

PFO5F Semipermanently flooded dead tree swamp (see description for the PFO5H wetland type).

Waterways impounded by beaver activity may be surrounded by this type of wetland. As the dam raises the water level stressing the trees and they eventually die out. This signature is the same as that of PFO5H; however, the edges are less distinct.

PFO5/EM1F Semipermanently flooded dead tree swamp often created by beaver activity. Emergent vegetation is present below the dead trees. Emergent species are described for the PEM1F wetland type. Signatures are described for the PFO5F and PEM1F wetlands.

PFO5C Seasonally flooded dead tree forested wetland generally found surrounding ponds where the water level at one time was raised enough to kill off the trees. Little or no understory vegetation is present. The signature appears as typical dead trees without water beneath them.