spread species. Thus, the rating criteria for this function depend on the frequency of occurrence of various uncommon bird species in a given wetland, and whether or not the wetland contains the types of habitat with which these species are typically associated.

3.8.1.9 EROSION SENSITIVITY

Erosion sensitivity refers to a wetland's capacity to stabilize soils and sediments as a function of its vegetative cover, slope and soil type, and probable groundwater situation. While erosion is a natural process, this function refers to the potential for accelerated erosion resulting from human activity in or adjacent to wetlands.

3.8.1.10 ECOLOGICAL REPLACEMENT COST

Ecological replacement cost refers to the cost of restoring or recreating the ecological characteristics of a given wetland, should it be developed or disturbed. Older (i.e., later successional) plant communities such as forested wetlands and peat bogs are usually more difficult to replace than younger (i.e., early successional) communities. Thus, these wetlands rank high in terms of ecological replacement costs, whereas ponds, emergent, and scrub-shrub wetlands are more easily recreated, and rate low for this function.

3.8.1.11 RECREATIONAL USE

Because Adamus (1987) evaluated the recreational use of wetlands through administration of a public survey, this function was not evaluated for EIS project area wetlands in the field. Recreational values of sites within and around the Airport are instead described in Section 3.2.5.

3.8.1.12 DOWNSLOPE BENEFICIARY SITES

This wetland function is based on the ecological services that wetlands provide to downslope or downstream sites in terms of reducing peak flows and thereby providing flood protection. Thus, wetlands that are geographically situated higher in the watershed are more likely to generate these cost-saving services and are assigned a higher rating for this function. Because the wetlands surrounding JNU are situated downslope of urban development they rate low for this function.

3.8.2 PROJECT AREA WETLAND RESOURCES

For ease of description, the overall project area was divided into seven wetland analysis areas:

- Jordan Creek
- Northeast Development Area
- Eastern Runway Safety Area (RSA)
- Otter Pond Area (south of the Float Pond Woodland)
- Float Pond Woodland

ATTACHMENT C

- Western Runway Safety Area (RSA)
- Northwest Development Area (Duck Creek)

Figure 3-25 shows the location of these analysis areas within the overall project area.

Wetland classification and boundary designations in the Northwest Development Area, the Float Pond Woodland, and the Northeast Development Area were determined based on standard Corps methods described in the Wetland Delineation Manual (Environmental Laboratory 1987). Wetlands in the Eastern RSA, Western RSA and Jordan Creek were mapped using infrared aerial photography, vegetation ground control points, and visual ground truthing.

Wetlands were assigned National Wetland Inventory (NWI) mapping codes based on the Cowardin classification system (Cowardin et al. 1979). Four wetland systems occur within or adjacent to the JNU property: palustrine, estuarine, lacustrine, and riverine. Each of these systems is divided into several subsystems that are further divided into classes. SWCA classified delineated wetlands within the study area to nine different wetland classes. These include the following:

PEM1 Palustrine emergent marsh wetlands with persistent vegetation structure throughout the year.

PSS1 Palustrine scrub-shrub wetlands with broad-leafed, deciduous, woody vegetation less than six meters (20 feet) tall. The species include true shrubs, young trees (saplings), and trees or shrubs that are small or stunted because of environmental conditions (e.g., shrubby willows, alder, dogwood, etc.).

PAB3 Palustrine aquatic bed wetlands with unconsolidated sandy bottoms. Aquatic bed wetlands have standing water year-round and support floating vascular plants.

PUB4 Palustrine organic unconsolidated bed wetlands. Species include *Sphagnum* mosses that form peat in peat bogs. Vascular plant species may be perched on the topmost layers of moss.

L1UBH Littoral lacustrine wetlands with an unconsolidated bed. Wetlands are clear of vegetation due to water depth. This wetland type is limited to the Float Plane Pond.

E1UB3 Subtidal estuarine wetlands with unconsolidated muddy bottoms. These wetlands were identified with aerial photography.

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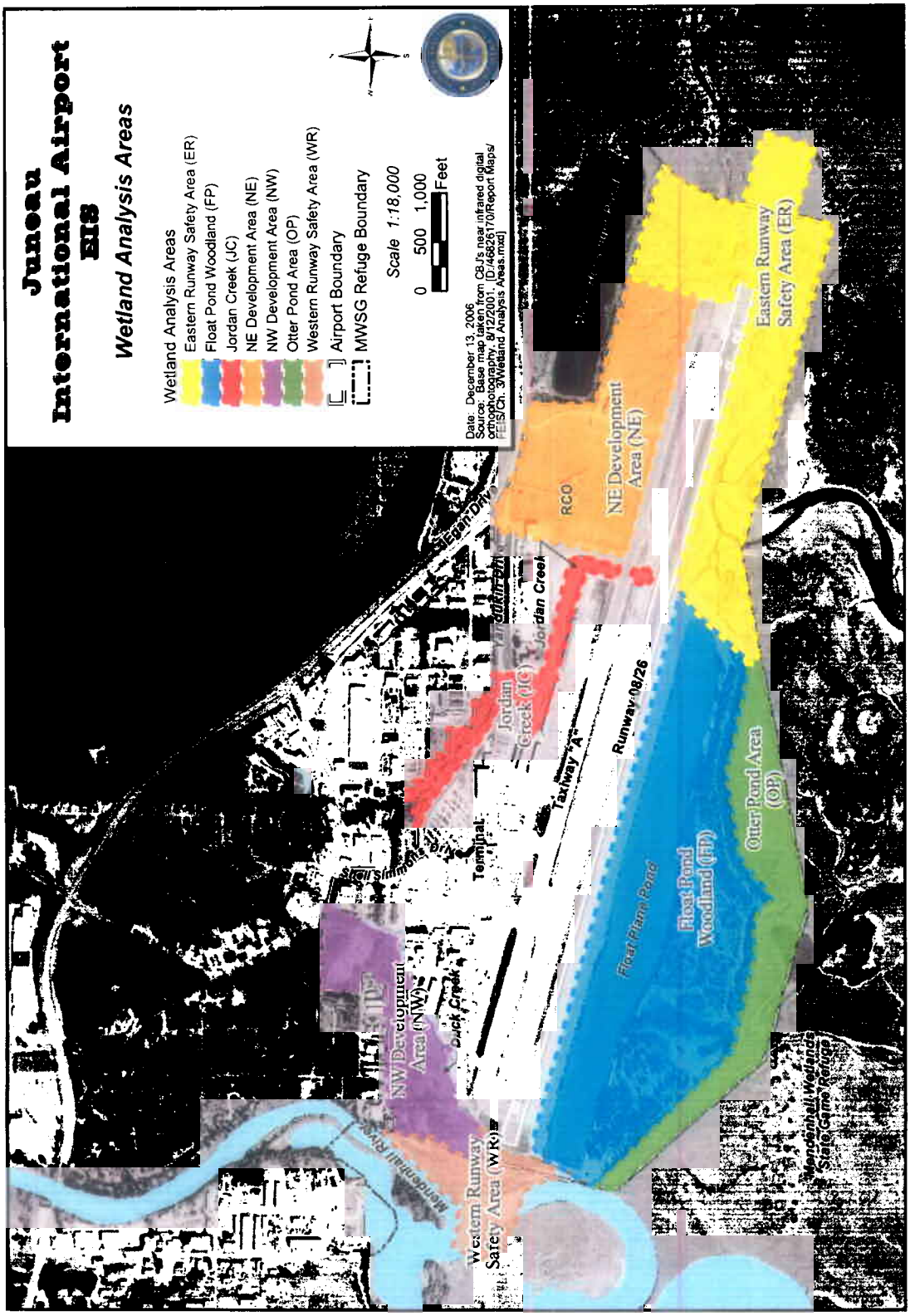

Figure 3-25. Wetland analysis areas.

E2EM1 Intertidal estuarine emergent wetlands with persistent vegetation structure (H/L) throughout the year. These wetlands were split into high marsh and low marsh since the fish habitat function is greater in the low marsh.

E2USN Intertidal estuarine wetlands with regularly flooded unconsolidated shores; these are typically unvegetated.

R3UB2 These are wetlands associated with streams characterized by a high gradient, fast water velocity, and flow throughout the year. The substrate consists of rock, cobbles, or gravel with occasional patches of sand. There is very little floodplain development

These wetland types were mapped across the project area, illustrated on Figures 3-26 through 3-29. Existing wetland condition, classification, and critical wetland functions were then described for each of the seven wetland analysis areas. Wetland functions and values were evaluated using the Adamus (1987) approach modified with input from the *Southeast Alaska Freshwater Wetland Assessment* (USACE 2000), and resource specialists from the cooperating agencies. The acreage and functional ratings for each of these wetlands is summarized in Tables 3-28 through 3-34. The alphanumeric wetland designations in Figures 3-26 through 3-29 correspond to the NWI code listed in Tables 3-31 through 3-37. For example, in Figure 3-23, the area of wetlands labeled "NE1" has been identified as wetlands type PEM1 (palustrine emergent marsh). Table 3-32 also shows this correlation along with the functional ratings of the wetlands found in area NE1. The other wetland areas have similar reference keys and summary tables.

3.8.2.1 JORDAN CREEK

The Jordan Creek area within the Airport boundary extends from the Aspen Hotel to the north side of the runway. The creek flows through culverts beneath Taxiway A and Runway 26 into the Dredge Channel and out to the Gastineau Channel. The Jordan Creek area within the Airport boundary encompasses 5.96 acres of wetlands (Table 3-31). This total includes wetlands located between Airport buildings and the taxiway (Figure 3-26).

Table 3-31. Jordan Creek Wetland Acreages and Functional Ratings

Wetland ID[1]		JC1	JC2	JC3	JC4	JC5
NWI Code		R3UB2	PEM1	PSS1	E2EM1 (H/L)	E2USN
Adamus Wetland ID		M5, M7	M5, M7	M5, M7	M5	M5
Acreage		0.4	0.8	1.8	0.3/1.8	0.8
Functional Ratings	Groundwater Recharge	L	L	L	L	L
	Groundwater Discharge & Lateral Flow	MH	MH	MH	MH	MH
	Surface Hydrologic Control	ML	H	ML	L	L
	Sediment/ Toxicant Retention	L	H	MH	MH	MH
	Nutrient Transform. & Export	H	M	M	M	H
	Riparian Support	H	MH	MH	H	MH
	Fish Habitat	VH	ML	ML	H/VH	VH
	Wildlife	H	L	H	H	H
	Regional Ecological Diversity	H	L	MH	H	H
	Erosion Sensitivity	ML	L	L	L	ML
	Ecological Replacement Cost	H	L	L	H	L
	Downstream Beneficiary Sites	L	L	L	L	L

[1] No sample points were taken for any wetland acreages.
Key to Functional Ratings: VH = Very High; H = High; MH = Moderate-High; M = Moderate; ML = Moderate-Low; L = Low.

3.8.2.2 Northeast Development Area

The Northeast Development Area extends off the northeastern side of the runway and encompasses 39.2 acres of wetlands (Figure 3-26). Three wetland classes were delineated in the this area, including: palustrine emergent marsh wetlands with persistent vegetation structure throughout the year (PEM1), intertidal estuarine emergent wetlands with persistent vegetation structure throughout the year (E2EM1), and intertidal unconsolidated shore estuarine wetlands (E2USN). Acreage of each wetland type is summarized in Table 3-32.

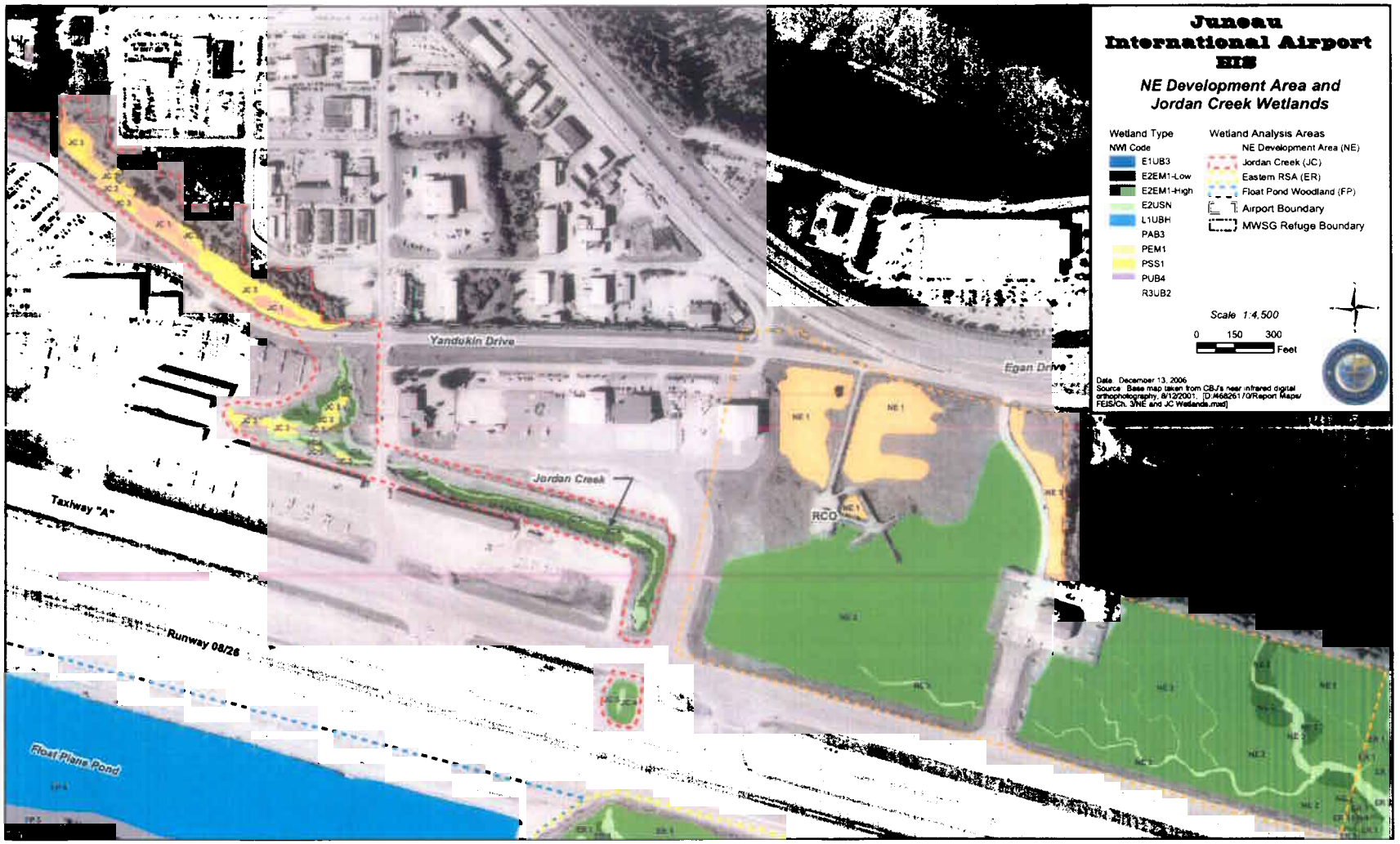

Figure 3-26. NE development area and Jordan Creek wetlands.

3.7.4 THREATENED AND ENDANGERED PLANTS

No federal or state listed threatened and endangered plants are known to occur in the project or landscape areas. There is the potential for several of the listed Alaska Natural Heritage Program rare plant species and Tongass National Forest sensitive plant species to occur based on these species having been documented in the Juneau area in the past and the similarity of their habitat requirements to that of the project area. However, the agencies have no record of their occurrence within the project or landscape areas and none were identified during field studies in support of the EIS. These species are listed in Table 3-30 along with their ranking within the state of Alaska. State ranking definitions are located in Appendix D.

Table 3-30. Alaska State Rare and USFS Sensitive Plant Species Potentially Occurring within the Project or Landscape Area

Common Name	Scientific Name	Global/State Rank
Western paper birch	*Betula papyrifera* var. *commutata*	G5T5/S2
Bebb's sedge	*Carex bebbii*	G5/S1
Goose-grass sedge	*Carex lenticularis* var. *dolia**	G5T3Q/S3
Black hawthorn	*Crataegus douglasii* var. *douglasii*	G5T4S1/S2
Alaskan pretty shooting-star	*Dodecatheon pulchellum* ssp. *alaskanum*	G5T2T4Q/S2
Northern wild-licorice	*Gallium kamtschaticum*	G5/S2
Broadlip listera	*Listera convallarioides*	G5/S1
Bog adder's mouth	*Malaxis paludosa*	G4/S2S3
Bigtooth lousewort	*Pedicularis macrodonta*	G4Q/S3
Choriso bog-orchid	*Platanthera chorisiana*	G3/S3
Western yellowcress	*Rorippa curvisiliqua*	G5/S1
Selkirk violet	*Viola selkirkii*	G5?/S3

[1] Alaska Natural Heritage Program Rare Species List (AKNHP 2002); Tongass National Forest Sensitive Species List.
[2] See Appendix B for ranking definitions.

3.8 WETLANDS

This section of the EIS describes wetland resources within the project area and its surroundings as delineated in the summer of 2001. Wetlands are among the most productive ecosystems on Earth and include bogs, freshwater marshes, prairie potholes, forested swamps, and saltwater estuaries. Wetlands provide critical nesting, rearing, feeding, and stop-over habitat for birds and other wildlife populations and are essential to estuary, river, and watershed health, trapping sediments and cleaning polluted waters, preventing floods, recharging groundwater aquifers, and protecting

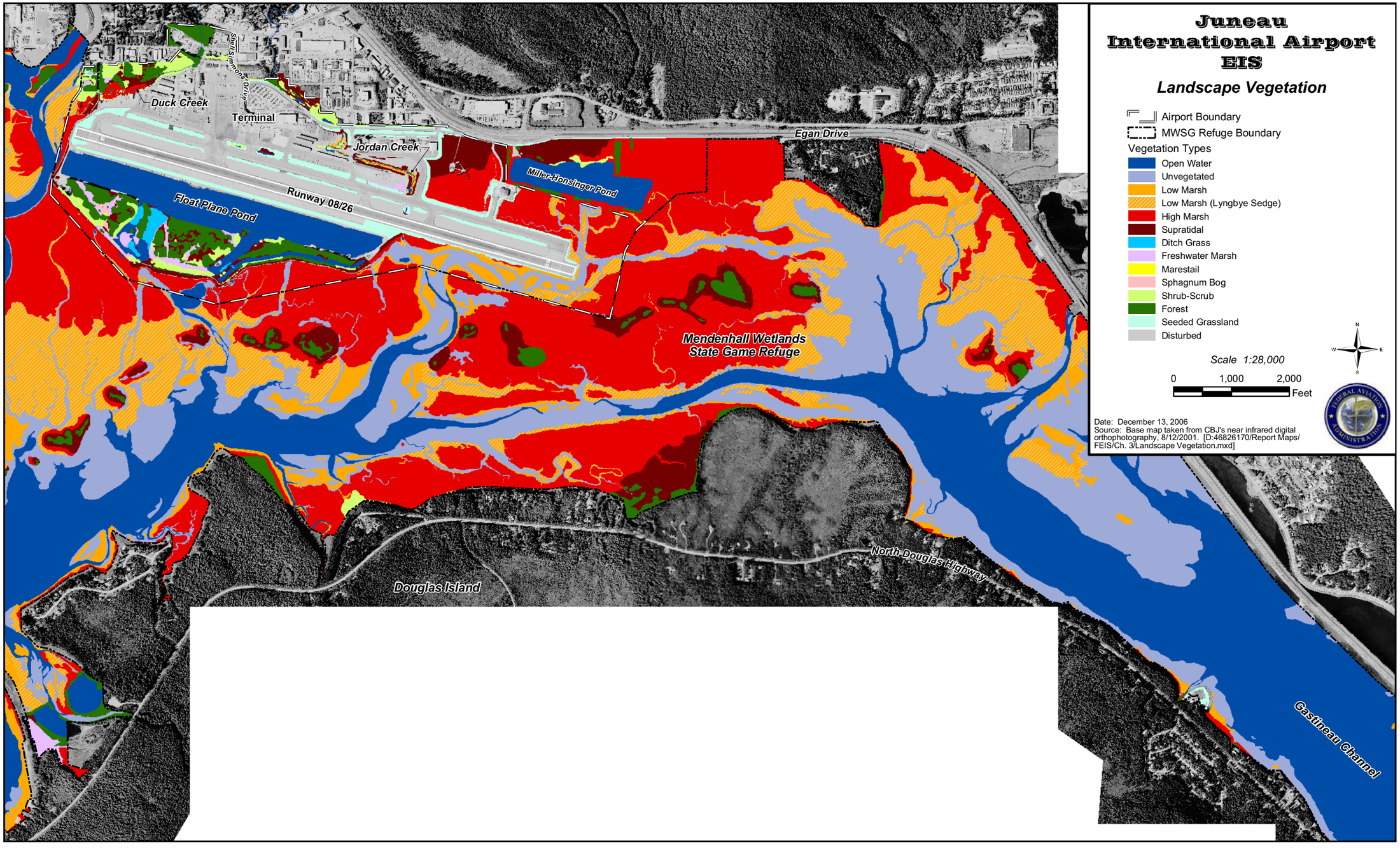

Figure 3-24. Landscape area vegetation.

shorelines. The following sections describe the regional and local physiography relevant to wetlands, the functions and values of wetlands in the area, and finally, a description of the specific wetland types present in the project area.

For the purpose of this analysis, wetland resources include both wetlands, as defined below, and perennial and seasonal streams. This is because wetlands and streams are often hydrologically interrelated, and because the Corps has jurisdiction under the Clean Water Act to regulate activities within waters of the U.S., which include wetlands. The actions and alternatives being considered for implementation at JNU thus have potential to affect resources that are regulated by law. The overall regulatory framework and permit requirements related to activities potentially affecting wetlands and waters of the U.S. was described earlier in Chapter 1 (see Section 1.6.2.1 and Table 1-8).

Under the Clean Water Act, wetlands are defined as:

> Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas [Environmental Laboratory 1987, p. 9]

Wetland boundaries in the Northwest Development Area, the Float Pond Woodland, and the Northeast Development Area were determined using the methodology described in the Corps' 1987 Wetland Delineation Manual (Environmental Laboratory 1987). Wetlands in the Eastern RSA, Western RSA and Jordan Creek were mapped using infrared aerial photography, vegetation ground control points, and visual ground truthing.

The delineation of wetlands for the JNU project area was conducted primarily in August and September of 2001. Follow-up work was conducted in July of 2002 during a Corps field review of the Airport wetland delineation. All waters of the U.S. contained in the JNU project area fall within Corps of Engineers regulatory jurisdiction. A wetland delineation report (SWCA 2002) has been prepared for the project and provides a detailed explanation on how wetlands were delineated and why the wetland boundaries presented in this document and others are correct. This study was reviewed by the Corps and made available for review to the other cooperating agencies including NMFS, ADF&G, and USFWS. The Corps provided comment on a first draft of the report. The second and final draft of the delineation report, revised to address comments by the Corps and others, is available for public review at the Juneau and Mendenhall public libraries.

3.8.1 WETLAND FUNCTIONS AND VALUES

As part of the delineation effort, wetland functions and values were evaluated within the EIS project area. They were assessed using a modified version of the Adamus wetland evaluation technique (WET) that was originally developed for the City and Borough of Juneau in 1987 (Adamus 1987). Based on agency input, the Adamus approach was adapted to better match the conditions of the EIS project area, particularly estuarine wetlands that were not the primary focus of the original Juneau WET. Adaptations were made in full collaboration with representatives of

the Corps, EPA, USFWS, NMFS, and ADF&G, based on accepted wetland evaluation techniques and professional judgment of the involved parties. The wetland functional assessment provides a means of evaluating potential impacts to wetlands and identifying mitigation measures that could be used to preserve, restore, or enhance wetland functions.

A detailed description of the various functions and values of wetlands in and around Juneau is provided in Adamus (1987) and, as they apply to this analysis, in the wetlands section of Technical Working Paper 4 – Biological Resources (SWCA 2002). This section provides a summary description of wetland functions and values as per Adamus (1987). A brief explanation of each function is accompanied by a description of its importance to other natural resources and/or human society. A quantitative functional rating system is presented that is to compare potential project impacts in Chapter 4. Appendix E includes a sample data sheet used to rate wetland function. The functional ratings for wetlands within the project area are provided in Section 3.8.2.

3.8.1.1 GROUNDWATER RECHARGE AND DISCHARGE

Groundwater recharge is the net downward flow of surface water into an underlying aquifer, a process important to water filtration and cleansing, and to re-supply aquifers. Recharge wetlands are often hydrologically linked with other wetlands such that their disturbance can have far-ranging, indirect impacts to other associated wetlands.

3.8.1.2 SURFACE HYDROLOGIC CONTROL

Surface hydrologic control refers to the capacity of wetlands to reduce the magnitude of peak flows and associated floods, delay the release of water to downslope/downstream areas following storms, sustain stream flows during dry seasons by producing a steady outflow, and reduce bank erosion and channel scour. Accordingly, the hydrologic control function is important in minimizing flood damage and maintaining proper drainage in developed areas, maintaining aquatic habitats and fisheries during periods of low surface flows, and maintaining the balance between freshwater and saltwater and their associated plant communities in estuarine zones.

3.8.1.3 SEDIMENT/TOXICANT RETENTION

Sediment and toxicant retention refers to the ability of wetlands to remove inorganic sediments from aqueous suspension and/or toxic metals and organic compounds from solution. This function is usually prevalent in flat, vegetated areas. The location of wetlands downstream of potential sediment and toxicant sources is also an indicator of their value for this function (USACE 2000; Adamus 1987). This function may benefit downstream water quality at the expense of habitat quality in wetlands where the sediment or toxicant is accumulating. Sediment retention has economic value in that it can help prevent or reduce the frequency of dredging to maintain navigable waterways in certain areas (Adamus 1987).

3.8.1.4 NUTRIENT TRANSFORMATION/EXPORT

This function refers to a wetland's capacity for transforming and/or exporting organic forms of nitrogen and phosphorous. In many environments, the removal or retention of these nutrients is important to maintaining water quality in downstream areas. Wetlands are also capable of transforming these nutrients into forms more available to aquatic and marine food webs. The value of the nutrient transformation/export function to other natural resources or the human environment therefore varies and can be a benefit under some conditions (e.g., reduced water treatment effort) and locations and a liability in others.

3.8.1.5 RIPARIAN SUPPORT

Wetlands, regardless of whether they themselves are important fish habitats, may have a critical influence on aquatic habitat quality in adjacent streams, downstream areas and estuaries. The riparian support function refers to the positive influence wetlands may have on regulating stream temperatures and exporting decaying plant material which provides nutrients to aquatic and estuarine habitats.

3.8.1.6 FISH HABITAT

The fish habitat function refers to the existing suitability of a wetland to produce any of the local salmonid and marine fishes, including coho, pink, chum, and sockeye salmon; cutthroat and steelhead trout; Dolly Varden char, eulachon, and herring. Juneau's salmon fisheries are a key component of the area's economy with respect to commercial and sport fisheries and tourism. Estuarine and riparian wetlands provide important breeding, rearing, and foraging habitat for fishes and their prey. For more detailed information on fisheries in and adjacent to the project area, refer to Section 3.9.

3.8.1.7 WILDLIFE

This function refers to the extent to which a given wetland supports wildlife species. Thus, wetlands that rate high for this function are those in which the most wildlife are likely to occur. Salt marsh is a key staging and foraging area for migratory birds, shorebirds, waterfowl, raptors, and passerines. Waterbird species are the number one indicator of high wildlife value. Gulls, corvids, and songbirds, although important, are not themselves indicators of high function for the purposes of this analysis. Resources used for wildlife function determination include Bird Use of the Mendenhall Wetlands in Juneau, Alaska (Cain et al. 1988), the Wildlife Hazard Assessment for the Juneau International Airport (USDA 2001) and field surveys conducted for this EIS (Carstensen and Armstrong 2002).

3.8.1.8 REGIONAL ECOLOGICAL DIVERSITY

In general, "regional ecological diversity" refers to the number of species (flora and fauna) native to a given region. With respect to function, wetlands that support rare species contribute more to regional ecological diversity than wetlands with a high number of relatively common or wide-

spread species. Thus, the rating criteria for this function depend on the frequency of occurrence of various uncommon bird species in a given wetland, and whether or not the wetland contains the types of habitat with which these species are typically associated.

3.8.1.9 EROSION SENSITIVITY

Erosion sensitivity refers to a wetland's capacity to stabilize soils and sediments as a function of its vegetative cover, slope and soil type, and probable groundwater situation. While erosion is a natural process, this function refers to the potential for accelerated erosion resulting from human activity in or adjacent to wetlands.

3.8.1.10 ECOLOGICAL REPLACEMENT COST

Ecological replacement cost refers to the cost of restoring or recreating the ecological characteristics of a given wetland, should it be developed or disturbed. Older (i.e., later successional) plant communities such as forested wetlands and peat bogs are usually more difficult to replace than younger (i.e., early successional) communities. Thus, these wetlands rank high in terms of ecological replacement costs, whereas ponds, emergent, and scrub-shrub wetlands are more easily recreated, and rate low for this function.

3.8.1.11 RECREATIONAL USE

Because Adamus (1987) evaluated the recreational use of wetlands through administration of a public survey, this function was not evaluated for EIS project area wetlands in the field. Recreational values of sites within and around the Airport are instead described in Section 3.2.5.

3.8.1.12 DOWNSLOPE BENEFICIARY SITES

This wetland function is based on the ecological services that wetlands provide to downslope or downstream sites in terms of reducing peak flows and thereby providing flood protection. Thus, wetlands that are geographically situated higher in the watershed are more likely to generate these cost-saving services and are assigned a higher rating for this function. Because the wetlands surrounding JNU are situated downslope of urban development they rate low for this function.

3.8.2 PROJECT AREA WETLAND RESOURCES

For ease of description, the overall project area was divided into seven wetland analysis areas:

- Jordan Creek
- Northeast Development Area
- Eastern Runway Safety Area (RSA)
- Otter Pond Area (south of the Float Pond Woodland)
- Float Pond Woodland

- Western Runway Safety Area (RSA)
- Northwest Development Area (Duck Creek)

Figure 3-25 shows the location of these analysis areas within the overall project area.

Wetland classification and boundary designations in the Northwest Development Area, the Float Pond Woodland, and the Northeast Development Area were determined based on standard Corps methods described in the Wetland Delineation Manual (Environmental Laboratory 1987). Wetlands in the Eastern RSA, Western RSA and Jordan Creek were mapped using infrared aerial photography, vegetation ground control points, and visual ground truthing.

Wetlands were assigned National Wetland Inventory (NWI) mapping codes based on the Cowardin classification system (Cowardin et al. 1979). Four wetland systems occur within or adjacent to the JNU property: palustrine, estuarine, lacustrine, and riverine. Each of these systems is divided into several subsystems that are further divided into classes. SWCA classified delineated wetlands within the study area to nine different wetland classes. These include the following:

PEM1 Palustrine emergent marsh wetlands with persistent vegetation structure throughout the year.

PSS1 Palustrine scrub-shrub wetlands with broad-leafed, deciduous, woody vegetation less than six meters (20 feet) tall. The species include true shrubs, young trees (saplings), and trees or shrubs that are small or stunted because of environmental conditions (e.g., shrubby willows, alder, dogwood, etc.).

PAB3 Palustrine aquatic bed wetlands with unconsolidated sandy bottoms. Aquatic bed wetlands have standing water year-round and support floating vascular plants.

PUB4 Palustrine organic unconsolidated bed wetlands. Species include *Sphagnum* mosses that form peat in peat bogs. Vascular plant species may be perched on the topmost layers of moss.

L1UBH Littoral lacustrine wetlands with an unconsolidated bed. Wetlands are clear of vegetation due to water depth. This wetland type is limited to the Float Plane Pond.

E1UB3 Subtidal estuarine wetlands with unconsolidated muddy bottoms. These wetlands were identified with aerial photography.

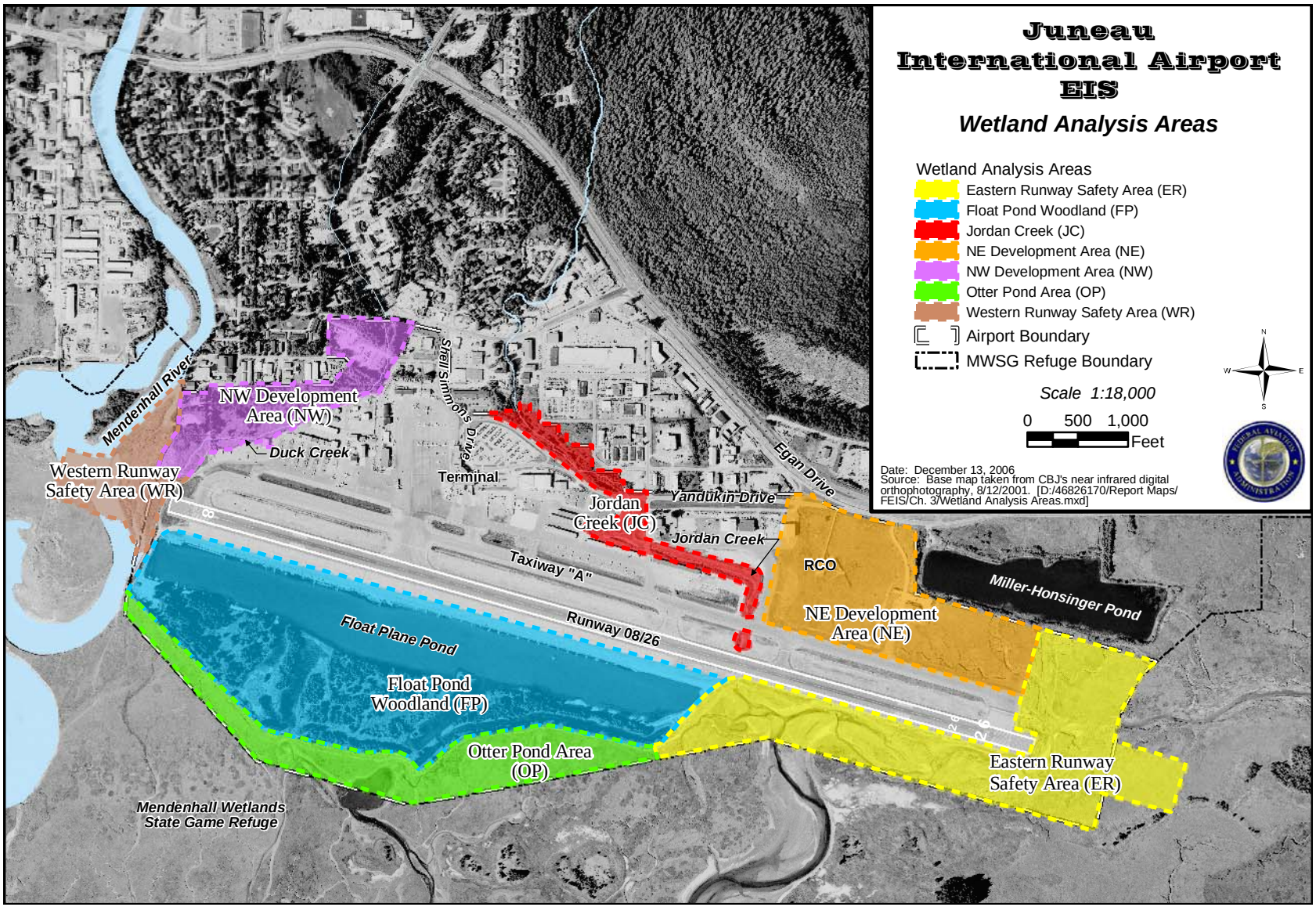

Figure 3-25. Wetland analysis areas.

E2EM1 Intertidal estuarine emergent wetlands with persistent vegetation structure (H/L) throughout the year. These wetlands were split into high marsh and low marsh since the fish habitat function is greater in the low marsh.

E2USN Intertidal estuarine wetlands with regularly flooded unconsolidated shores; these are typically unvegetated.

R3UB2 These are wetlands associated with streams characterized by a high gradient, fast water velocity, and flow throughout the year. The substrate consists of rock, cobbles, or gravel with occasional patches of sand. There is very little floodplain development

These wetland types were mapped across the project area, illustrated on Figures 3-26 through 3-29. Existing wetland condition, classification, and critical wetland functions were then described for each of the seven wetland analysis areas. Wetland functions and values were evaluated using the Adamus (1987) approach modified with input from the *Southeast Alaska Freshwater Wetland Assessment* (USACE 2000)**,** and resource specialists from the cooperating agencies. The acreage and functional ratings for each of these wetlands is summarized in Tables 3-28 through 3-34. The alphanumeric wetland designations in Figures 3-26 through 3-29 correspond to the NWI code listed in Tables 3-31 through 3-37. For example, in Figure 3-23, the area of wetlands labeled "NE1" has been identified as wetlands type PEM1 (palustrine emergent marsh). Table 3-32 also shows this correlation along with the functional ratings of the wetlands found in area NE1. The other wetland areas have similar reference keys and summary tables.

3.8.2.1 JORDAN CREEK

The Jordan Creek area within the Airport boundary extends from the Aspen Hotel to the north side of the runway. The creek flows through culverts beneath Taxiway A and Runway 26 into the Dredge Channel and out to the Gastineau Channel. The Jordan Creek area within the Airport boundary encompasses 5.96 acres of wetlands (Table 3-31). This total includes wetlands located between Airport buildings and the taxiway (Figure 3-26).

Table 3-31. Jordan Creek Wetland Acreages and Functional Ratings

Wetland ID[1]		JC1	JC2	JC3	JC4	JC5
NWI Code		R3UB2	PEM1	PSS1	E2EM1 (H/L)	E2USN
Adamus Wetland ID		M5, M7	M5, M7	M5, M7	M5	M5
Acreage		0.4	0.8	1.8	0.3/1.8	0.8
Functional Ratings	Groundwater Recharge	L	L	L	L	L
	Groundwater Discharge & Lateral Flow	MH	MH	MH	MH	MH
	Surface Hydrologic Control	ML	H	ML	L	L
	Sediment/ Toxicant Retention	L	H	MH	MH	MH
	Nutrient Transform. & Export	H	M	M	M	H
	Riparian Support	H	MH	MH	H	MH
	Fish Habitat	VH	ML	ML	H/VH	VH
	Wildlife	H	L	H	H	H
	Regional Ecological Diversity	H	L	MH	H	H
	Erosion Sensitivity	ML	L	L	L	ML
	Ecological Replacement Cost	H	L	L	H	L
	Downstream Beneficiary Sites	L	L	L	L	L

[1] No sample points were taken for any wetland acreages.
Key to Functional Ratings: VH = Very High; H = High; MH = Moderate-High; M = Moderate; ML = Moderate-Low; L = Low.

3.8.2.2 NORTHEAST DEVELOPMENT AREA

The Northeast Development Area extends off the northeastern side of the runway and encompasses 39.2 acres of wetlands (Figure 3-26). Three wetland classes were delineated in the this area, including: palustrine emergent marsh wetlands with persistent vegetation structure throughout the year (PEM1), intertidal estuarine emergent wetlands with persistent vegetation structure throughout the year (E2EM1), and intertidal unconsolidated shore estuarine wetlands (E2USN). Acreage of each wetland type is summarized in Table 3-32.

Figure 3-26. NE development area and Jordan Creek wetlands.

Table 3-32. Northeast Development Area Wetland Acreages and Functional Ratings

Wetland ID[1] (Sample Points)		NE1 (1, 2, 3, 4, 5, 6, 13, 14, 33)	NE2 (12, 19, 20, 21, 22, 23, 24, 25, 26, 27, 34, 35, 36)	NE3 (37)
NWI Code		PEM1	E2EM1(H/L)	E2USN
Adamus Wetland		ES15	ES15	ES11
Acreage		5.3	31.6/1.1	1.2
Functional Ratings	Groundwater Recharge	L	L	L
	Groundwater Discharge & Lateral Flow	L	MH	MH
	Surface Hydrologic Control	H	L	L
	Sediment/ Toxicant Retention	H	MH	MH
	Nutrient Transformation and Export	L	M	H
	Riparian Support	L	H	MH
	Fish Habitat	VL	H/VH	VH
	Wildlife	MH	H	H
	Regional Ecological Diversity	H	MH	H
	Erosion Sensitivity	L	L	ML
	Ecological Replacement Cost	L	H	H
	Downstream Beneficiary Sites	L	L	L

[1] No sample points were taken for any wetland acreages.
Key to Functional ratings: VH = Very High; H = High; MH = Moderate-High; M = Moderate; ML = Moderate-Low; L = Low

3.8.2.3 Eastern Runway Safety Area

The eastern RSA abuts the east side of the Northeast Development Area and contains similar wetland habitat (Figure 3-27). The eastern RSA encompasses 85.9 acres of undeveloped land and consists of a mosaic of intertidal vegetated and unvegetated estuarine wetlands. Wetland classes include intertidal estuarine emergent wetlands with persistent vegetation structure throughout the year (E2EM1) and unvegetated tidal sloughs comprising intertidal unconsolidated shore estuarine wetlands (E2USN). Acreages of each wetland type are summarized in Table 3-33.

Table 3-33. Eastern RSA Wetland Acreages and Functional Ratings

Wetland ID[1]		ER1	ER2
NWI Code		E2EM1 (H/L)	E2USN
Adamus Wetland		ES11, ES14	ES11, ES14
Acreage		38.8/21.2	25.9
Functional Ratings	Groundwater Recharge	L	L
	Groundwater Discharge & Lateral Flow	MH	MH
	Surface Hydrologic Control	L	L
	Sediment/Toxicant Retention	MH	MH
	Nutrient Transformation and Export	M	H
	Riparian Support	H	MH
	Fish Habitat	H/VH	VH
	Wildlife	VH	VH
	Regional Ecological Diversity	H	H
	Erosion Sensitivity	L	ML
	Ecological Replacement Cost	H	H
	Downstream Beneficiary Sites	L	L

[1] No sample points were taken for any wetland acreages.
Key to Functional ratings: VH = Very High; H = High; MH = Moderate-High; M = Moderate; ML = Moderate-Low; L = Low.

3.8.2.4 Otter Pond Area

The Otter Pond Area is directly connected to the Refuge and is separate from the Float Pond Woodland wetlands due to differences in hydrology imposed by the dike that surrounds the Float Plane Basin and woodland (Figure 3-28). The Otter Pond Area contains 41.30 acres of estuarine wetlands (Table 3-34). Wetland types represented in the Otter Pond Area include intertidal unconsolidated shore estuarine wetlands (E2USN), intertidal estuarine emergent wetlands (E2EM1), and subtidal estuarine wetlands with unconsolidated bottoms (E1UB3).

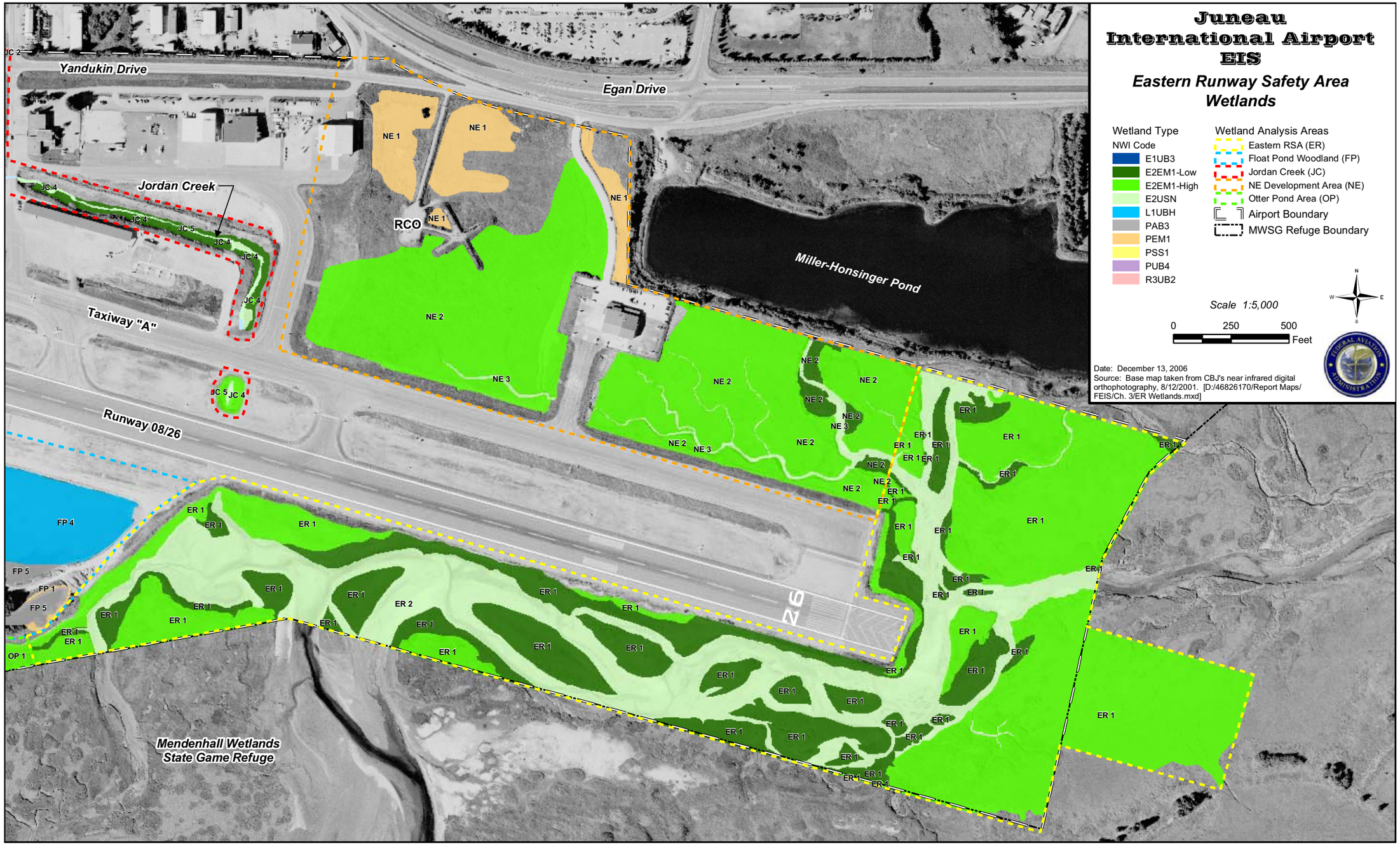

Figure 3-27. Eastern runway safety area wetlands.

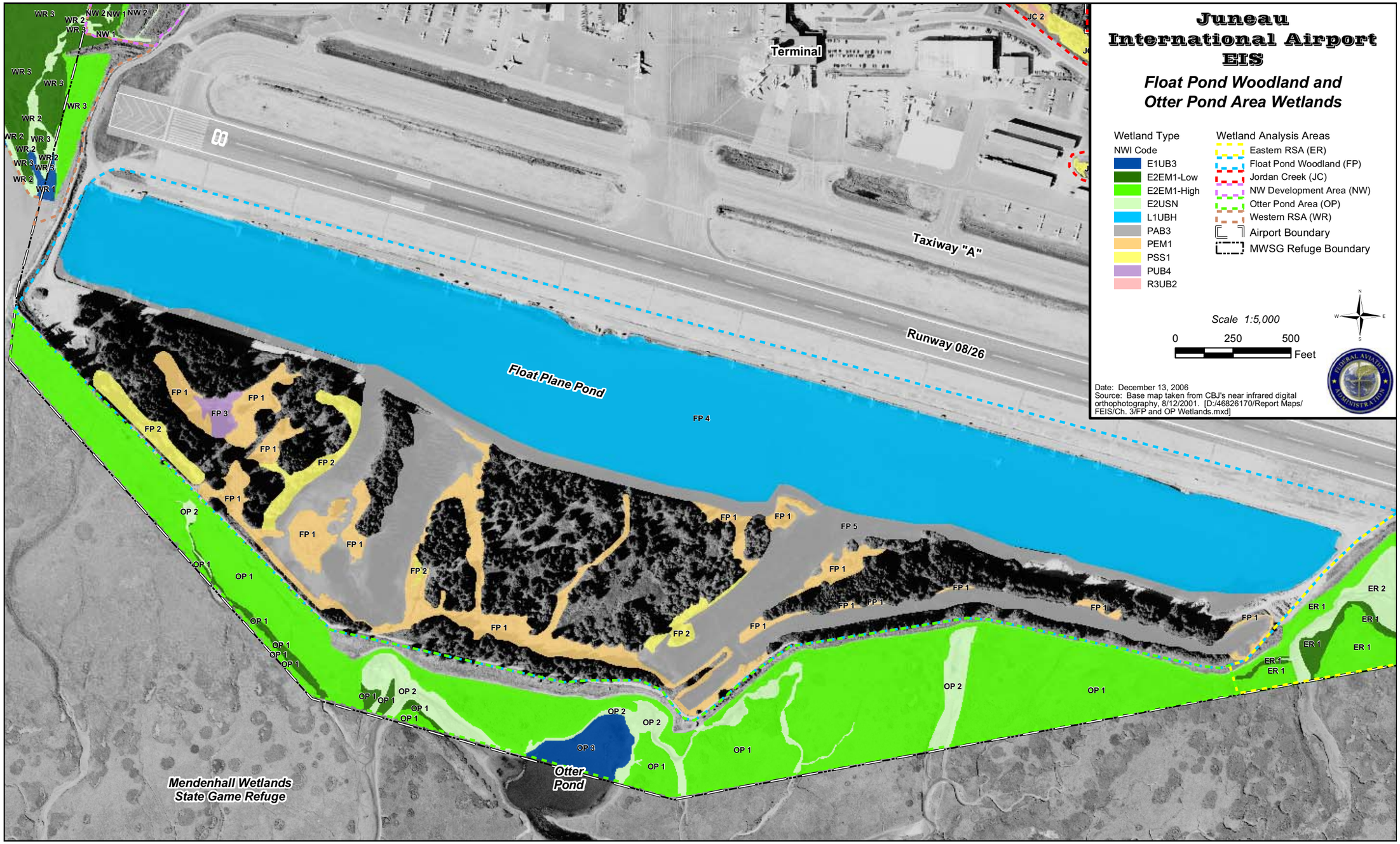

Figure 3-28. Float Plane Pond woodland and Otter Pond area wetlands.

Table 3-34. Otter Pond Area Wetland Acreages and Functional Ratings

Wetland ID[1]		OP1	OP2	OP3
NWI Code		E2EM1 (H/L)	E2USN	E1UB3
Adamus Wetland		M1B	M1B	M1B
Acreage		34.1/0.8	4.7	1.7
Functional Ratings	Groundwater Recharge	L	L	L
	Groundwater Discharge & Lateral Flow	MH	MH	MH
	Surface Hydrologic Control	L	L	L
	Sediment/ Toxicant Retention	MH	MH	MH
	Nutrient Transformation and Export	M	H	H
	Riparian Support	H	MH	MH
	Fish Habitat	H/VH	VH	VH
	Wildlife	VH	VH	VH
	Regional Ecological Diversity	H	H	H
	Erosion Sensitivity	L	ML	L
	Ecological Replacement Cost	H	H	L
	Downstream Beneficiary Sites	L	L	L

[1] No sample points were taken for any wetland acreages.
Key to Functional ratings: VH = Very High; H = High; MH = Moderate-High; M = Moderate; ML = Moderate-Low; L = Low

3.8.2.5 FLOAT POND WOODLAND

The Float Pond Woodland is comprised of a mosaic of Sitka spruce, Sitka alder, red alder, black cottonwood, and Barclay and Sitka willows interspersed with a variety of herbaceous communities. Many of these species occur predominantly in upland habitats. Upland habitat in the Float Pond Woodland was created by material dredged from the adjacent float plane impoundment. A popular recreation trail is located on the constructed dike that bounds the Float Pond Woodland to the south and separates it from the estuarine wetland system (Figure 3-25).

The Float Pond Woodland encompasses 97.4 acres of wetland. The Float Plane Pond comprises over 60% of this area, at 59.7 acres. Five of nine wetland classes described above are represented in this area. The acreage of each wetland type is summarized in Table 3-35.

Table 3-35. Float Pond Woodland Wetland Acreages and Functional Ratings

Wetland ID (Sample Points)		FP1 (62, 75, 77, 80, 82, 88, 91)	FP2 (64, 65, 71, 74, 78)	FP3 (67, 68)	FP4 (None)	FP5 (None)
NWI Code		PEM1	PSS1	PUB4	L1UBH	PAB3
Adamus Wetland ID		M1B/M1C	M1B	M1B	M1	M1B
Acreage		11.1	2.8	0.5	59.7	23.3
Functional Ratings	Groundwater Recharge	L	L	L	L	L
	Groundwater Discharge & Lateral Flow	L	L	L	L	L
	Surface Hydrologic Control	MH	MH	MH	H	MH
	Sediment/ Toxicant Retention	H	H	H	H	H
	Nutrient Transform. & Export	L	L	L	L	L
	Riparian Support	L	L	L	L	L
	Fish Habitat	VL	VL	VL	ML	ML
	Wildlife	H	ML	H	H	VH
	Regional Ecological Diversity	ML	MH	ML	MH	H
	Erosion Sensitivity	L	L	L	L	L
	Ecological Replacement Cost	L	L	M	L	L
	Downstream Beneficiary Sites	L	L	L	L	L

Key to Functional ratings: VH = Very High; H = High; MH = Moderate-High; M = Moderate; ML = Moderate-Low; L = Low; VL = Very Low

3.8.2.6 Western Runway Safety Area

The Western RSA includes the land off the west end of the runway and into the Mendenhall River (Figure 3-29). Indications of past human disturbance are evident throughout this area, such as the large rock dikes emplaced off the west end of the runway. These dikes protect the runway from the undercutting effects of the Mendenhall River and tidal action.

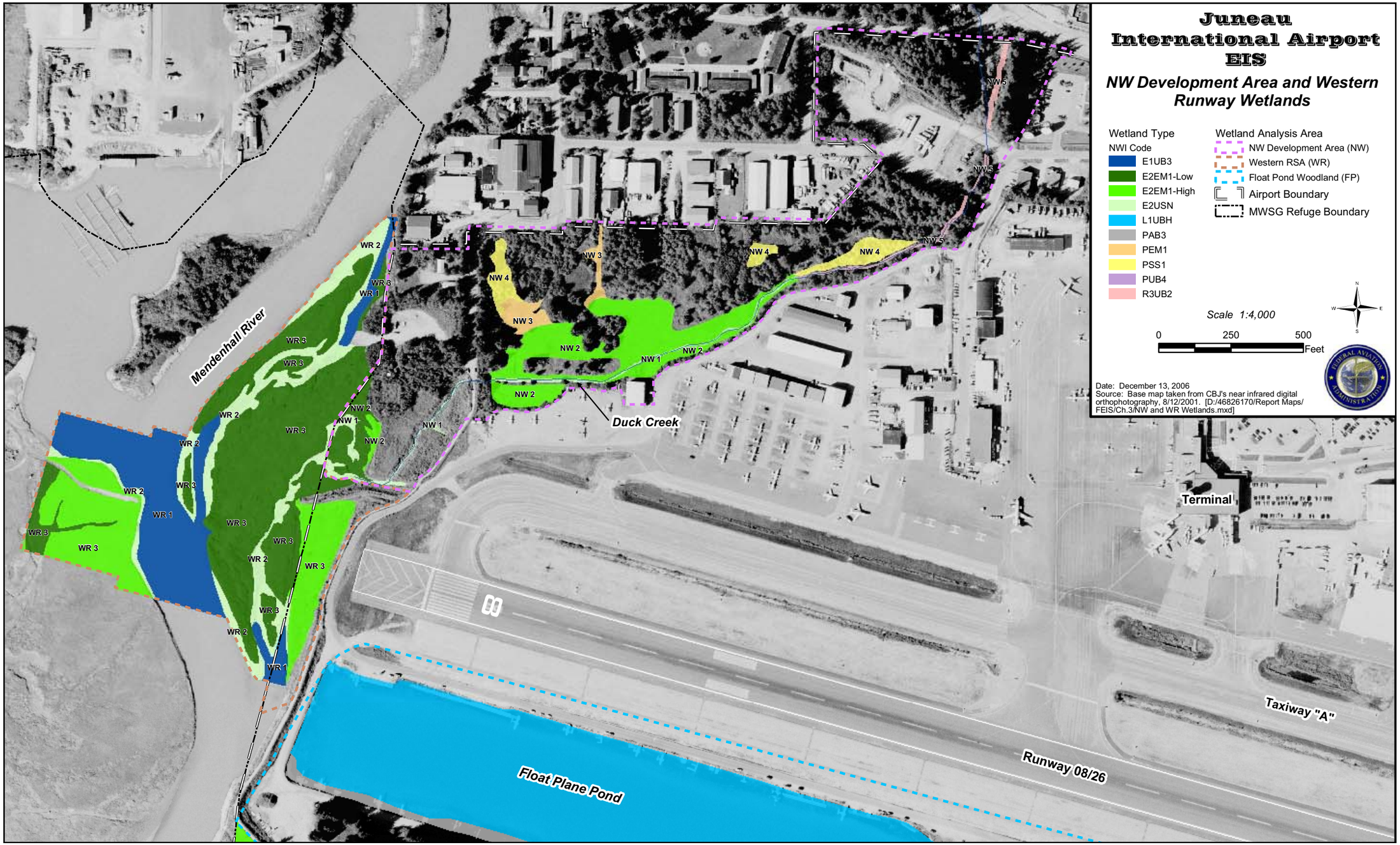

Figure 3-29. NW development area and Western Runway Safety area wetlands.

The Western RSA encompasses 19.6 acres of wetlands, represented by three of nine wetland classes. Wetland classes within this area include intertidal estuarine emergent wetlands with persistent vegetation structure throughout the year (E2EM1), intertidal unconsolidated shore estuarine wetlands (E2USN), and subtidal unconsolidated bottom estuarine wetlands (E1UB3) Acreage of each wetland type is summarized in Table 3-36.

Table 3-36. Western RSA Wetland Acreages and Functional Ratings

Wetland ID[1]		WR1	WR2	WR3
NWI Code		E1UB3	E2USN	E2EM1 (H/L)
Adamus Wetland		ES1	M51	M52
Acreage		4.5	2.8	3.8/8.5
Functional Ratings	Groundwater Recharge	L	L	L
	Groundwater Discharge & Lateral Flow	MH	MH	MH
	Surface Hydrologic Control	L	L	L
	Sediment/ Toxicant Retention	MH	MH	MH
	Nutrient Transformation and Export	H	H	H
	Riparian Support	MH	MH	H
	Fish Habitat	VH	VH	H/VH
	Wildlife	H	H	H
	Regional Ecological Diversity	H	H	H
	Erosion Sensitivity	MH	ML	L
	Ecological Replacement Cost	H	H	H
	Downstream Beneficiary Sites	L	L	L

[1] No sample points were taken for any wetland acreages.
Key to Functional ratings: VH = Very High; H = High; MH = Moderate-High; M = Moderate; ML = Moderate-Low; L = Low

3.8.2.7 NORTHWEST DEVELOPMENT AREA

The Northwest Development Area includes Duck Creek and the northwest portion of the Airport (Figure 3-29). Indications of past human disturbance are evident throughout the area. For example, Duck Creek has been channelized and diked by previous land development and management activities. The Northwest Development Area encompasses 6.1 acres of wetlands, with five of nine wetland classes delineated. Wetland classes within the area include palustrine emergent marsh wetlands with persistent vegetation structure throughout the year (PEM1), palustrine scrub-shrub wetlands with broad-leafed, deciduous, woody vegetation (PSS1), intertidal estuarine

emergent wetlands with persistent vegetation structure throughout the year (E2EM1), intertidal unconsolidated shore estuarine wetlands (E2USN), and lower riparian areas with unconsolidated sandy bottoms (Duck Creek - R3UB2). The acreage and function of each wetland type is summarized in Table 3-37.

Table 3-37. Northwest Development Area Wetland Acreages and Functional Ratings

Wetland ID (Sample Points)		**NW1** (None)	**NW2** (42, 47, 49, 53)	**NW3** (50)	**NW4** (39, 43, 44, 51)	**NW5** (38)
NWI Code		E2USN	E2EM1 (H/L)	PEM1	PSS1	R3UB2
Adamus Wetland ID		M51	M52	M52	M51, M52	M49
Acreage		0.5	3.2/0.7	0.5	0.9	0.3
Functional Ratings	Groundwater Recharge	L	L	L	L	L
	Groundwater Discharge & Lateral Flow	MH	MH	MH	MH	MH
	Surface Hydrologic Control	L	L	ML	H	ML
	Sediment/ Toxicant Retention	MH	MH	MH	H	L
	Nutrient Transform. & Export	H	H	M	L	H
	Riparian Support	MH	H	MH	L	H
	Fish Habitat	VH	VH	VL	VL	ML[1]
	Wildlife	ML	ML	L	ML	ML
	Regional Ecological Diversity	H	H	H	MH	H
	Erosion Sensitivity	ML	L	L	L	ML
	Ecological Replacement Cost	H	H	L	L	H
	Downstream Beneficiary Sites	L	L	L	L	L

Key to Functional ratings:
VH = Very High; H = High; MH = Moderate-High; M = Moderate; ML = Moderate-Low; L = Low; VL = Very Low
[1] The rating for Duck Creek's Fish Habitat reflects actual ecological conditions, not the future desired condition or its status as EFH

3.8.3 LANDSCAPE AREA WETLAND CONTEXT

The Mendenhall Valley and JNU are located on the outwash plain of the Mendenhall Glacier. The modern delta of the Mendenhall River extends to the Gastineau Channel. As a result, the majority of wetlands surrounding JNU and comprising the Refuge are estuarine wetlands influenced by both freshwater and marine tides. Non-estuarine, palustrine wetlands also occur in the area and are generally located upslope of estuarine wetlands in areas influenced by groundwater rather than streams or tides. Wetlands within the landscape area are mapped at a lower resolution than those within the project area. Just as for vegetation resources, the wetland landscape area includes JNU, the adjacent Miller-Honsinger property, and the Refuge.

Wetlands within the landscape area are described to the "subsystem" level of the NWI wetlands classification system whereas wetlands within the project area are described to the more specific "class" level (Cowardin et al. 1979). Eleven wetland subsystems were mapped within the landscape area. Marine and estuarine wetlands include subtidal marine wetlands with unconsolidated bottoms (M1UB), subtidal estuarine wetlands with unconsolidated bottoms (E1UB), intertidal estuarine unconsolidated shore wetlands (E2US), intertidal estuarine aquatic beds (E2AB), and intertidal estuarine emergent wetlands (E2EM, high and low). Lacustrine, palustrine, and riverine wetlands include littoral lacustrine wetlands with unconsolidated bottoms, and palustrine emergent wetlands (PEM1), palustrine shrub-scrub wetlands (PSS), bogs (PUB), palustrine aquatic beds, and stream channels (R3UB). The approximate acreage of these wetland subsystems is summarized in Table 3-38, and distribution of these wetlands at the landscape level can be viewed in Figure 3-30.

3.8.4 AFFECT OF UPLIFT ON AREA WETLANDS

The type and extent of wetlands within both the project and landscape areas are controlled by a number of factors, including isostatic rebound and tectonic uplift. As was described in Section 3.5.2.7, the ground surface is slowing being raised in the Mendenhall Valley and surrounding areas of Juneau at an estimated rate of 0.60 to 0.75 inches of uplift per year. This geologic phenomenon has the potential to reshape wetlands and change wetland types regionally and locally, in the vicinity of the Airport.

The uplift of land supporting estuarine wetlands will cause changes in tidal hydrology. It is likely that salts in uplifted marine sediments would gradually be leached out of the soil profile, producing a non-saline environment. Over time, it would be expected that estuarine wetland types would retreat towards the ocean, giving way to costal forb meadow on water-shedding (convex) surfaces and palustrine emergent wet meadows in depressional (concave) surfaces. The following transitions in wetland types are expected:

- estuarine tidal slough to estuarine emergent marsh
- estuarine emergent marsh to palustrine emergent marsh or costal forb meadow
- palustrine emergent marsh to costal forb meadow

Table 3-38. JNU Landscape Area Wetlands

Sub-system	Acreage (% of total)	Landscape Position	Main Functions
M1UB (marine)	463.2 (11.2%)	Deep water habitat of the eastern Gastineau Channel. Little mixing of fresh and salt water.	Not Rated (marine wetlands did not occur in the project area).
E1UB	1119.5(27.0%)	Associated w/ Gastineau Channel, Mendenhall R., and Jordan and Duck Creeks. Lowest landscape position.	Nutrient transformation and transport, riparian support, fish habitat, regional ecological diversity, disturbance sensitive wildlife habitat.
E2US	662.5 (16.0%)	Regularly flooded, unvegetated sloughs and shorelines of the Gastineau Channel and Fritz Cove in the MWSGR. Located above E1UB wetlands.	Nutrient transformation and transport, riparian support, fish habitat, regional ecological diversity, disturbance sensitive wildlife habitat.
E2AB	115.5 (2.8%)	Regularly flooded sloughs and shorelines of the Gastineau Channel and Fritz Cove in the MWSGR displaying semi-aquatic vegetation. Located above E1UB wetlands.	Nutrient transformation and transport, riparian support, fish habitat, regional ecological diversity, disturbance sensitive wildlife habitat.
E2EM (H/L)	950.9/681.8 (23.0/16.5%)	Located at the highest estuarine landscape position above E1UB, E2US, and E2AB.	Groundwater recharge and discharge, sediment and toxicant retention, nutrient transformation and transport, riparian support, fish habitat, disturbance sensitive wildlife habitat, regional ecological diversity.
L1UB	88.2 (2.1%)	The Miller-Honsinger Pond and float plane pond	Surface hydrologic control, sediment and toxicant retention, erosion sensitivity.
R3UB	0.7 (<0.1%)	Duck Creek and Jordan Creek above tidal influence.	Groundwater recharge and discharge, nutrient transformation and export, riparian support, fish habitat, regional ecological diversity.
PAB	23.3 (0.6%)	Palustrine aquatic bed wetlands confined to the sloughs south of the float plane impoundment.	Surface hydrologic control, sediment and toxicant retention, disturbance sensitive wildlife habitat, regional ecological diversity.
PSS	6.8 (0.2%)	Shrub-scrub palustrine wetlands in the float pond woodland and along Duck Creek.	Nutrient transformation and export, riparian support (except in the float pond woodland), regional ecological diversity.
PEM	28.2 (0.7%)	Palustrine emergent wetlands north of the Miller-Honsinger Pond and interspersed throughout the float pond woodland, the NEDA, and the NWDA.	Surface hydrologic control, nutrient transformation and export.
PUB	0.5 (<0.1%)	Palustrine unconsolidated bottom wetland (bog) located in the float pond woodland.	Surface hydrologic control, sediment and toxicant retention, disturbance sensitive wildlife habitat, regional ecological diversity. These wetlands would have a moderate ecological replacement cost.
Total Acres:	**4141.1**		

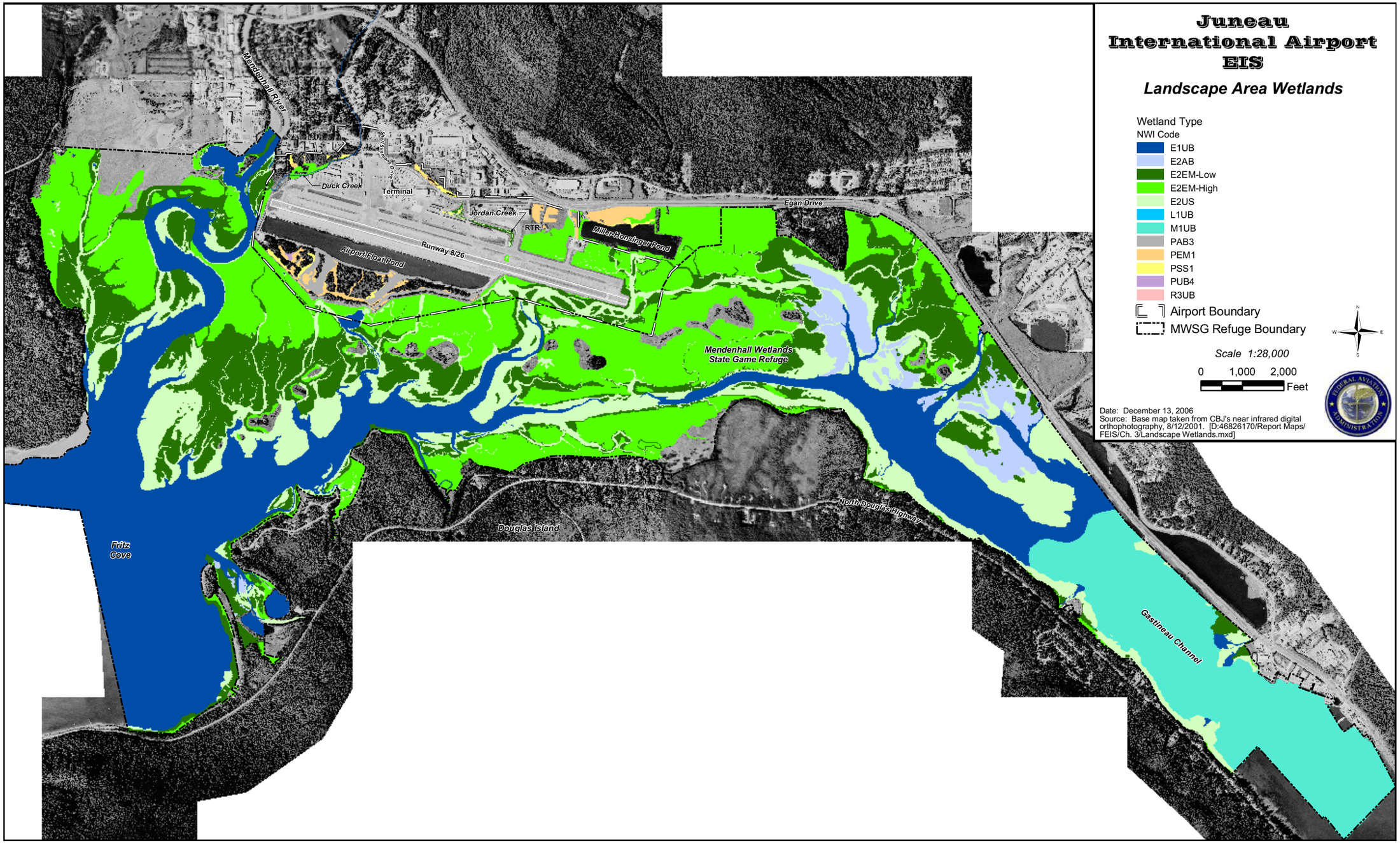

Figure 3-30. Landscape area wetlands.

These geologically rapid changes in hydrology and vegetation will obviously alter the habitat value for wildlife. Through time, regional uplift will inexorably affect the nature of undeveloped areas on and near the Airport and in the Refuge. The changes in habitat will affect the use and distribution of these areas by birds and other wildlife. These changes do not mean, however, that the ecological importance of these areas will lessen.

3.9 FISHERIES

Proposed actions at JNU could affect fish and aquatic organisms in three basic types of fish habitat: the tidal wetlands surrounding much of the Airport, freshwater streams and rivers bordering and flowing through JNU, and the Float Plane Basin. The streams include Duck Creek, Jordan Creek, and the Mendenhall River, while the tidal wetlands include slough and salt marsh habitats. The Float Plane Basin is a unique, man-made habitat recharged by brackish water at high tides, with a valve that inhibits outflow and fish movement. Tidal movements affect the distribution of fish daily and seasonally in all of these habitats.

Anadromous trout and salmon, which spawn in freshwater and spend at least part of their lifecycle feeding in saltwater, can be found at some season in all of these habitats. Table 3-39 identifies the aquatic habitats used by different species during different lifestages. These fish include the adult and juvenile lifestages of chinook salmon (*Oncorhynchus tshawytscha*), chum salmon (*O. keta*), coho salmon (*O. kisutch*), pink salmon (*O. gorbuscha*), and sockeye salmon (*O. nerka*); steelhead (*O. mykiss*); cutthroat trout (*O. clarki*); and Dolly Varden char (*Salvelinus malma*). Eulachon (*Thaleichthys pacificus*) are also anadromous, but their freshwater use is limited to the spawning and incubation portions of their lifecycle which occurs only in the lower reaches of streams and rivers. Also found in most of these aquatic habitats are adult and juvenile lifestages of species which tolerate both fresh and brackish water such as staghorn sculpin (*Leptocottus armatus*), coastrange sculpin (*Cottus aleuticus*), starry flounder (*Platichthys stellatus*), and three-spined stickleback (*Gasterosteus aculeatus*). Saltwater species such as capelin (*Mallotus villosus*) and Pacific herring (*Clupea palasi*) tend to move into and out of the project area with the tides.

These habitats have been affected by Airport, industrial, commercial, municipal, and residential development. Fish populations have been subjected to habitat degradation, exploitation (e.g., commercial, subsistence, and sport harvest), and hatchery production. The sport harvest from the Juneau area during 1990-2004 averaged 40,397 coho salmon and 13,120 chinook salmon (ADF&G 2006). Between 2003 and 2005, Douglas Island Pink and Chum, Inc. (DIPAC) released an average of approximately 35.5 million young salmon annually into Gastineau Channel. The releases have resulted in approximately 224,000 adult hatchery-bred salmon returning to Gastineau Channel, dwarfing the local production of wild salmon (Table 3-40). Juvenile hatchery fish may compete directly with wild fish in estuarine and open ocean waters, and adults that stray into area streams may compete with wild adults for mates and spawning habitats. Hatchery pink salmon adults have been observed in several streams north of the Mendenhall Wetlands, such as Auke and Waydelich creeks (Mortensen et al. 2002). It should be noted, however, that DIPAC stopped producing pink salmon in 2002.