CHAPTER 5

CUMULATIVE IMPACTS

This chapter of the EIS describes the cumulative effects projected to occur in association with Airport development projects. In order to determine cumulative effects on the human environment, it is necessary to assess past and ongoing actions in the study area and to predict future actions that would be reasonably expected to occur.

5.1 INTRODUCTION TO CUMULATIVE IMPACTS

The basis for this analysis is the recognition that, while the impact of any individual action may be small, the cumulative impacts of many such actions on populations or resources can be considerable. The Council on Environmental Quality's (CEQ) regulations for implementing NEPA define cumulative effects as:

> The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions. (40 CFR §1508.7)

NEPA requires that cumulative effects be evaluated along with the direct and indirect effects of the actions and alternatives described in Chapter 4 of this EIS. As with direct and indirect effects, the No Action Alternative serves as the baseline against which cumulative effects are evaluated.

Cumulative effects analysis necessarily involves assumptions and uncertainties, as well as data sets that may be incomplete (CEQ 1997). For example, it is known with some certainty how many persons are currently employed at JNU and the economic effect of the Airport on the community and southeast Alaska. It is not possible to know how many people have been employed since the Airport was opened or how much economic stimulus the Airport has provided southeast Alaska in the past 50+ years, because records are not available and current models would not be applicable. Unknowns such as these are not uncommon in cumulative impacts analyses; often, impacts to a resource must be expressed in non-numerical terms or as relative changes. A data deficiency should not be used as a reason for not assessing cumulative effects to the extent possible.

In Chapter 4, levels of impact significance were determined for individual actions using various standards, calculations, and/or thresholds, most of them based on FAA guidance. For consistency's sake, it would be desirable to use these same impact significance criteria when considering cumulative effects, but the uncertainties concerning many past or future projects prevent application of the same analytical rigor.

Nevertheless, many local, state and federal standards or guidelines will apply to some of the resources, as do the requirements established in FAA's National Policy for assessing environmental impacts (see Appendix A of FAA Order 1050.1E, 2004a). The analyses contained in this chapter identify any such defined thresholds. Where numerical thresholds are not available or cannot be determined, impacts are typically quantified in relative terms of magnitude. Goals and objectives from land use management plans and other guiding programs may also be used to establish significance thresholds.

5.2 Past and Current Airport Projects to Consider

JNU was initially developed by the U.S. government to support military operations in Alaska. Since that time, the Airport has continued to grow and provide more operational capability and service to Juneau and Southeast Alaska. Key events in development of the Airport include construction of the paved runway in 1942; initial construction of the terminal in 1948, with subsequent expansions of the terminal; extension of the runway in 1961 to accommodate jet aircraft; and construction of the full-length parallel taxiway in 1989. Ongoing improvements for aviation support facilities, aircraft parking, and tenants have continued through the years. Table 5-1 documents the Airport-related projects which have been permitted by the U.S. Army Corps of Engineers (the Corps) since 1982. Other projects not requiring a Corps permit have also been undertaken. Many of the projects listed on Table 5-1 were subjected to FAA analysis of environmental impacts in order to obtain Airport Improvement Program funding, and/or approvals to Airport Layout Plans.

The nature and individual impact of these Airport projects is not relevant to the actions considered in this EIS, but the cumulative effects to the community and natural resources (as best they can be ascertained) are important. By the year 2002, Airport property had increased to approximately 662 acres of land, of which approximately 388 acres have been developed (i.e., paved or otherwise disturbed) and are used to support Airport facilities.

Apart from the specific proposed actions being considered in this EIS, the Airport has a number of other infrastructure and planning projects underway or in the design phase. Most of these projects are expected to have little or no measurable environmental consequences because of their limited scope and/or project location. Others, such as the Delta 1 Ramp Expansion, have received categorical exclusions from further NEPA analysis, but their scope and impact are still considered here in the cumulative effects analysis. Phase I of the Terminal Expansion Feasibility Study was completed and in August 2004, the Airport Board selected a consulting team to conduct Phase II, which should result in the publication of a recommended expansion alternative. It is too early to contemplate the extent of environmental impact that could be associated with such a project. Table 5-2 summarizes the Airport projects that were underway or being initiated at the same time this EIS was being developed, and also those Airport projects contemplated in the next five years.

Table 5-1. Projects at JNU Permitted by U.S. Army Corps of Engineers Through 2002

Effective Date & Permit No.	Location	Work Performed	Impacts and Comments
4/20/1982 M-810320	Jordan Creek by Crest Blvd and north of East Airport runway.	Jordan Creek realignment and pond construction.	Remove 750 cubic yards (cy) of material from existing lower end of Jordan Creek. Construct a temporary haul road for access.
6/3/1987 O-810320	East end of Juneau Airport runway.	Replace failed Jordan Creek culvert under east end of runway.	Temporary placement of 2,750 cy of fill on wetlands. Will be replaced at completion of the project.
12/23/1988 N-810320 R-810320 DD-810320	Northeast quadrant of Juneau Airport.	Extend parallel taxiway to East end of runway, and build access ramp for Temsco hanger. Modified for runway safety area improvements.	210,000 cy of fill in wetlands. Culverts for Jordan Creek placed under taxiway and at intersection with Crest Avenue. Modified (5/4/2000) to place 38,000 cy of embankment material in wetlands and waters between taxiway and runway for runway safety area improvements.
1/11/1989 T-810320	Northeast end of Airport runway.	Extend taxiway (100 ft. wide) by 150 ft. extend roadway (28 ft. wide) by 300 ft.	2,385 cy of organic, sand and gravel fill material (1,800 cy of organics, 500 cy of base/sub-base material, and 85 cy of asphalt). About .53 acres of wetlands impacted.
10/10/1999 S-810320	Across street from Airport parking lot, at Aspen Inn.	Construct a pedestrian interpretive trail along Jordan Creek, including 2 pedestrian bridges.	84,000 cy of sand and gravel fill, 1,500 cy of sub-base/ base material, 1,800 cy of concrete, and 150 cy (275 tons) of asphalt in about 6.7 acres of wetlands.
10/12/1989 Q-801320	Juneau Airport float plane pond.	Construct extension of access road (1,800 ft, east end and 600 ft. west end) to float pond, and a floatplane ramp.	7,750 cy of fill (clean sand or gravel and/or rock fill) into floatplane pond.
7/28/1994 W-810320	Airport Dike near float plane pond.	Fill and riprap placement on existing Airport perimeter dike to protect dike from erosion.	1,350 cy of clean gravel fill, topped with 650 cy of riprap fill on top of crushed-in-place old car bodies making up the Airport perimeter dike.

Table 5-1. Projects at JNU Permitted by U.S. Army Corps of Engineers Through 2002, continued

Effective Date & Permit No.	Location	Work Performed	Impacts and Comments
4/18/1995 X-810320 Z-810320	North of Airport runway.	Construct and pave a 22,500 sq. yds. area for commercial aviation apron expansion.	Place 33,500 cy of fill in 1.27 acres of wetlands, and cap with 22,500 sq. yds. of asphalt. Includes catch basins, oil/water separators and 1,500 ft. of culvert.
8/25/1995 Nationwide Permit	East and west ends of Airport runway.	Install power and signal cables for a wind sensor.	Minor discharges of material for backfill for bedding for utility lines.
8/16/1996 Y-810320 EE-810320	Float plane basin, southwest end of Airport runway.	Expand floatplane parking and improve emergency vehicle access.	Place 9,800 cy of clean sand/gravel, crushed rock and class I riprap fill over 2,500 ft. by 35 ft. (1.9 acre area) below high tide line. Also place 1,950 cy of earthen fill over 400 ft. by 60 ft. (0.4 acre) wetland area.
8/11/1999 AA-810320 CC-810320	Between Delta and Charlie taxiways on north side of Airport runway.	Creation of new tie down and hangar space.	Place 54,000 cy of clean sand and gravel and 3,000 cy of class I and 2 riprap within an 800 ft. by 300 ft. estuarine and emergent wetland area. Modified to add 20,000 cy of used asphalt as fill.
8/10/2000 BB-810320	Floatplane basin, southwest end of Airport runway.	Dredge of floatplane basin.	Dredge 147,000 cy of material from within floatplane basin.

Source: U.S. Army Corps of Engineers files, Juneau District Office. Compiled by Southeast Strategies. May 2002.
[1] Based on Airport planning data, for information purposes only. List includes estimated project initiation times for most actions evaluated in this EIS.
TSA = Transportation Security Act requirements.

Table 5-2. Summary of Recently Completed, Current, and Potential Future Airport Projects[1]

Year	Project Title	Notes
2002	Relocate ASOS	As needed for facility improvements, upgrades (deferred pending EIS decision)
	Conduct Environmental Impact Study	Underway
	Tree Removal & Replanting	Along Jordan Creek; project complete
	Addition to Existing Maintenance Facility	On west end of existing facility; project complete

Table 5-2. Summary of Recently Completed, Current, and Potential Future Airport Projects[1], continued

Year	Project Title	Notes
2002	Acquire equipment, including: SRE-Blower, SRE-Sand, ARFF Replacement, 1-Ton Chemical Truck, skidster, command vehicle, 3 snowbrooms	Acquired
	Rehabilitate Access Road (Cessna Dr./Alex Holden Way)	Within existing road footprint; project complete
	Terminal Expansion Feasibility Study Ph 1	Result of TSA requirements; Phase I complete
	Relocate Security Screening	TSA mandates; completed
2003	Terminal Screening Modification (Bathrooms)	TSA mandates; completed
	Parallel Taxiway Reconstruction	Within existing taxiway footprint; completed.
	Gate 2 Terminal Addition	On existing apron adjacent to terminal
	Terminal Building Modification for CTX Equipment	Inside terminal, Completed
	Airfield Water/Sewer-Main Field Ph. 1	Existing infrastructure upgrades; completed
2004	Terminal Expansion Feasibility Study/Design (Ph II)	Initial terminal expansion study to respond to TSA-required modifications. Began 9/2004, Scheduled to finish in 2005
	Fuel Farm: leasing of 1.5 acres for impounded and derelict cars	Completed
	Rehabilitate Airport Main Entrance Road	Completed
	Acquire Vacuum Truck and GripTester vehicle	Acquired
	Construct C1, W2, install LED Lights, Taxiway Re-designation	Pending EIS decision, In process of being completed
	Airfield Water/Sewer Main Ph. I	Existing infrastructure upgrades, Completed Winter 2005
	Rehabilitate main parallel Taxiway A	Completed
	Acquire Loader (Unit 20)	Acquired
2005	Northwest Airport Area Development	Pending EIS decision
	Snow Removal Equipment Building Ph. I	Pending EIS decision, Preliminary Study for size determination completed

Table 5-2. Summary of Recently Completed, Current, and Potential Future Airport Projects[1], continued

Year	Project Title	Notes
2005	RSA Mitigation & Construction	Pending EIS decision,
	Snow Removal Equipment Building Ph. II/Relocation RTR/ASOS	Pending EIS decision
	Security Upgrades/Equipment Ph. II	TSA mandates, Completed
	Construct Sand Storage & Chemical Storage Building	Pending EIS decision
	Acquire Security Vehicle (Unit 8)	Will apply for the grant in 2005
	Part 121 Ramp Reconstruction Phase 1	Will begin design work once the PFC application is accepted
	Delta-1 Ramp Expansion	Categorical exclusion granted. Design work is underway.
2006	Snow Removal Equipment Building Ph. II/Relocation RTR/ASOS	Pending EIS decision
2007	Purchase/acquisition of Land for Airport Expansion	Pending EIS decision. Purchase once PFC application accepted
	Master Plan Update	Pending EIS decision
	West GA Area Paving, Ph. I	Pending EIS decision and changes to NW Development Area
2008	New Air Carrier Ramp	In filled (uplands) area; categorical exclusion granted.
	Replace Maintenance Vehicles 2, 4, 5, 6, 9, 15	Equipment purchases
	Expand Airport Parking Facility	Determination based on Terminal Study
	Construct/Expand Airport Terminal	Determination based on Terminal Study
	Acquire SRE--20yd. Dump Truck (Unit 30)	
	Expand Airport Fuel Farm	Pending outcome of appeal of denial of project application.

5.3 Past and Current Area Projects to Consider

Chronological limits have to be placed on the cumulative effects analysis, since there may be no records to evaluate very old projects, and those potentially occurring too far in the future will have insufficient details for analysis and little assurance of being completed. Similarly, there need to be spatial boundaries for the cumulative effects analysis, although these can vary by resource. For the purposes of this analysis, all of the previous Airport infrastructure projects, regardless of when they occurred, have been grouped into one past development. This grouping allows the current Airport environment to be contrasted against conditions prior to approximately 1932. Similarly, projects within the past 70+ years that have urbanized and developed the Mendenhall watershed—that is, past projects in the general vicinity of the Airport—are grouped together (with a few notable exceptions, see below) so as to contrast the pre-development conditions against current conditions.

The notable exceptions include past and current projects from other developments in the area that are unique or particularly relevant to the impacts disclosed in Chapter 4. For example, construction and operation of a fish hatchery relatively near the Airport may have particular relevance to wildlife hazard management alternatives due to the attraction of some birds to fish processing waste. These types of projects warrant separate identification and, if possible, disclosure of effects.

Table 5-3 provides a list of the past and present area projects considered for cumulative effects and the resources affected by those projects.

5.4 Reasonably Foreseeable Future Actions to Consider

Some of the actions shown on Table 5-3 have not yet started but are in the planning or design phase. These projects have a reasonable expectation of occurring within the planning timeframe of Airport development (through the year 2015), based on information obtained from the Sponsor or agencies involved in the action. Some of these projects could affect natural resources or economic conditions, although the magnitude and significance of the impacts are difficult to ascertain at this stage due to the lack of project detail. A few projects to be undertaken in relatively close proximity to JNU have been sufficiently described, and cumulative effects in the context of these projects can be assessed with more confidence. These projects are described below.

5.4.1 Egan Drive Improvements

Alaska Department of Transportation and Public Facilities (ADOT) is in the planning stages for improvement of the Egan Drive intersection with Yandukin Drive, just north of the TEMSCO access road and Miller-Honsinger Pond. This project is part of a larger scope evaluation of several intersections and road improvement projects on Egan Drive, from Yandukin Drive to Industrial Boulevard west of the Mendenhall. One element of the ADOT proposed action that would affect

Table 5-3. Past, Present, and Reasonably Foreseeable Future Actions

Action and Location	Proponent	Timeline[1] and Date, if Known	Disciplines and Resources Affected (relative to Airport)	Notes
Juneau International Airport – construction and operation. Studies for future modifications, such as Terminal Expansion, underway.	City and Borough of Juneau	Past - Initial airfield use in 1930s, first paved runway 1942. Presently operating	Water, vegetation, fisheries, wildlife, socioeconomic, land use, visual, air	Approximately 388 acres have been disturbed, and approximately 660 acres designated within Airport property boundary.
Urbanization of Mendenhall Valley and development of area in vicinity of JNU, including subdivisions such as Mendenhaven, and roads such as Egan Drive	Various private and governmental	Past, Present, Future	All resources	Significant changes to water resources, vegetation, wildlife, visual resources, noise, and air quality. Development likely to continue in future.
Mendenhall Wastewater Treatment Plan – treats wastewater and discharges into Mendenhall River, upstream of Airport	CBJ	Presently operating	Water, fisheries, wildlife	Water quality mixing zone, potential attractant to aquatic life and birds
Macaulay Hatchery	Douglas Island Pink and Chum (DIPAC)	Presently operating	Fisheries, wildlife hazards	Large, artificial increase in number of juvenile salmon using EFH and some increase in number of adult salmon using EFH and creek access
Capstone Project – throughout Southeast Alaska	FAA	Present and Future	Aviation Safety	May increase air traffic as safety increases.
Airport Security Modifications – various projects to comply with Transportation Security Act	CBJ and Transportation Security Agency	Presently upgrading and Future TSA improvements	None	Some new facilities have been and will be added to terminal, but at this time no indication of expansion to previously undisturbed areas of Airport
Airport Terminal Expansion and Renovation	CBJ	Planning Study – 2004. Construction – 2005 or later	Socioeconomics	Renovation will improve efficiency at the terminal building.

Table 5-3. Past, Present, and Reasonably Foreseeable Future Actions, continued

Action and Location	Proponent	Timeline[1] and Date, if Known	Disciplines and Resources Affected (relative to Airport)	Notes
North Douglas Road Extension and West Douglas Development – Extend Douglas Island road to West Douglas Island, develop housing, deepwater harbor, marina	CBJ and Goldbelt, Inc.	Future	Air quality, water, wetlands, wildlife, fisheries, land use, vegetation	Development not proximal to Airport, but may be related to other proposals such as Douglas Island Connection
Douglas Island Connection – additional bridge crossing from mainland to Douglas Island, potentially in vicinity of Airport	CBJ and ADOT	Future	All resources	Additional disturbance of wetlands, wildlife habitat, fisheries. Location uncertain.
NOAA/NMFS Office Building and Laboratory – new facility to be located at Lena Loop	NOAA/NMFS	Future - 2004-2006	Socioeconomics	Increased economic activity through short-term construction
Kensington Gold Mine – Expansion of underground gold mine 45 miles north of Juneau	Coeur Alaska	Future - 2005 to 2016	Socioeconomics	Increased economic activity, mine development and operation
West Egan Drive – Various Egan intersections including Yandukin, Glacier Highway, Mendenhall Loop Road, Riverside Drive, and Vintage Blvd. Potential connecting of Old Glacier highway to Mendenhall Loop Road. Possible widening or moving of Egan between Riverside and Yandukin.	ADOT	Future – 2007 or later	Water, fisheries, socioeconomics (Airport access)	Potential impacts to Jordan Creek and Duck Creek with new or widened road crossings
Glacier Seafoods Fish Processing Plant – 8,000 sq. ft. facility at Auke Nu Cove, near state ferry terminal at Auke Nu Cove and Auke Bay intersection	Alaska Glacier Seafoods	In operation by 2005	Wildlife hazards	Fish processing and off-shore ("deep sea") disposal of fish waste
Commercial Heliport – new facility for primarily tourism-based scenic helicopter aviation	CBJ	Future	Noise, land use compatibility	Centralize helitour operators serving glaciers and other areas

Table 5-3. Past, Present, and Reasonably Foreseeable Future Actions, continued

Action and Location	Proponent	Timeline[1] and Date, if Known	Disciplines and Resources Affected (relative to Airport)	Notes
Implementation of Stage 4 Noise Standards	FAA	Future - 2005	Noise, land use compatibility	Would reduce noise levels for certain aircraft by lowering noise level standard
Upper Duck Creek watershed enhancements	DCAG; various agencies	Future	Water, fisheries	Proposed treatments on JNU reach will help ensure that increases in fish do not increase JNU wildlife hazards (see USFWS 2002)
Fast Ferry Service – various routes between Auke Bay and SE communities	ADOT	Future	Socioeconomics	Ferry service may result in some reduction to commuter airline demand at JNU
Juneau Access Improvements Project	ADOT	Future	All resources	51-mile long 2-lane highway along the Lynn Canal from Juneau to near the Katzehin River, Haines Borough
Mendhenhall Wastewater Treatment Plant Connection to North Douglas	CBJ	2005-2006	Wetlands, fisheries, wildlife habitat, vegetation	6-inch sewer pipe connection from North Douglas wastewater collector center to Mendenhall Treatment Plant.
Lemon Creek Dike and Access Ramp and Haul Road – construct an access ramp/haul road and dike to divert the flow of Lemon Creek around a proposed gravel mining operation	R. Horecny	Future – 2007 or later	Socioeconomics, wetlands	Increased economic activity, gravel pit development and operation; development not proximal to Airport but could impact regional wetlands

[1] Past = May vary by resource, but can extend as far back as Airport development, approximately 1940.
Present = Currently operating, or in construction or design, but already approved.
Future = Through the planning horizon for this EIS, 2015. Dates shown are estimates.

the Yandukin intersection is the development of a full-access interchange at Yandukin Drive and Egan Drive to the east of the current Fred Meyer access road (Lemon Spur Road) This action would improve access to JNU.

This same plan calls for changes to the Egan Drive and Glacier Highway intersection, which will preclude right turns from Egan Drive toward the Airport from the southbound lanes of traffic. Traffic southbound on Egan Drive will have to turn right at the Egan Drive and Mendenhall Loop intersection, or at the Egan Drive and Yandukin Drive intersection to access the Airport. This plan includes additional crossings of both Duck and Jordan Creeks. While the plan has been approved, funding for construction of these projects will not be available until 2007 at the earliest. Development of these highway improvements will be coordinated with the Airport planning process so that shifts in right-of-way or access can be incorporated into the design of facilities.

5.4.2 DOUGLAS ISLAND CROSSING

In 2003, an EIS was initiated to consider a new crossing to Douglas Island. Because of the proximity of the Airport and the Refuge to Douglas Island (i.e., the Gastineau Channel is relatively narrow in this area), it is likely that one or more possible locations for the crossing would be near the Airport. There would be obvious environmental concerns associated with a crossing in this vicinity, but it is reasonable to expect that the airfield operating environment would limit how close a crossing could be sited to the Airport. This project has reportedly been put on hold but may be reinitiated in the reasonably foreseeable future.

5.4.3 UPPER DUCK CREEK WATERSHED IMPROVEMENTS

The Duck Creek Advisory Group (DCAG) and the Mendenhall Watershed Partnership (MWP), in cooperation with CBJ, work on watershed projects throughout the Mendenhall Valley. The Duck Creek Watershed Management Plan, completed in July 1999, identified numerous projects to improve the watershed, including:

- Channel reconstruction,
- Culvert replacements,
- Storm-water marsh creation,
- Snow fencing, and
- Revegetation.

These projects are designed to control dissolved iron, restore stream flows, create wetlands, protect streambeds and remove sediment. Projects completed thus far include replacement of culverts in the reach between Egan Drive and Berners Avenue, and stream lining with riparian revegetation downstream of the Egan/Mendenhall Loop intersection. Additional culvert replacements and stream lining projects will continue as funding becomes available through NMFS, the Corps, and CBJ.

Preliminary data from hydrologic monitoring of Duck Creek by the USGS indicates that changing water table levels, possibly as a result of glacial rebound, stormwater and sewage piping, and other factors, may require a reassessment of project goals and objectives. The MWP will facilitate inter-agency and public meetings to re-evaluate project scope and priority.

5.4.4 HELIPORT

The CBJ completed a Tourism Management Plan that called for developing a satellite heliport within the Juneau Borough in an attempt to address noise pollution issues. Earlier studies identified the south end of Juneau's road system (Dupont) and the Montana Creek area, north of Juneau, as potential heliport sites. It is not clear what effect, if any, a new heliport would have on rotary wing operations at JNU, but it is likely that existing leases and projected increases through the year 2015 would continue to be based at the Airport.

The CBJ has entered into a cooperative agreement with the USFS and ADOT to undertake further study and possibly an EIS for the project. No schedule has been set for these studies. That the heliport project is still in a preliminary planning phase should not be taken as an indicator of whether it is reasonably foreseeable. The USFS assumed that a satellite heliport would be constructed and operative as part of their decision to increase the number of helicopter landings allowed on the Juneau Icefield in future years.

5.4.5 FAST FERRY OR IMPROVED FERRY SERVICE

The ADOT recently completed a Southeast Alaska Regional Transportation Plan (SATP) and a follow-up study - to examine possible access options for Sitka and ferry service options for the northern-most communities in Southeast Alaska - is currently underway. Some fast ferry service has been initiated for Southeast Alaska locations, including Juneau. If the fast ferry is convenient and proves to be less expensive than commercial airline travel, it is likely that many travelers will use the ferry in lieu of flying. A survey performed as part of the SATP indicated that improved ferry service (times of operation, convenience of docks, travel times, etc.) would result in more ferry use in the region. In addition, as fast ferry service and dayboat service are implemented throughout the region, they may well cut into air carrier markets. This could affect frequency and capacity of air service and may even reduce the number of carriers.

5.4.6 JUNEAU ACCESS IMPROVEMENTS PROJECT

The ADOT recently completed a Supplemental Environmental Impact Statement (SEIS) for Juneau Access Improvements. The purpose of this project, as stated on the ADOT website (at http://dot.alaska.gov/), is to improve surface transportation, provide travel flexibility, add capacity to meet demand, and provide greater travel opportunity while reducing travel time, state costs and user costs. The selected alternative includes 51 miles of two-lane highway from the end oft he Glacier Highway at Echo Cove in Juneau to a point two miles north of the Katzehin River in the Haines Borough, a ferry terminal at the north end of the highway, and new shuttle ferries from Haines and Skagway. Three major rivers and several smaller streams will be bridged as part of the project. The Supplemental Final EIS (SFEIS) was released to government agencies, organiza-

tions, and individuals on the project mailing list in mid-January, 2006. The Notice of Availability for the SFEIS was published in the Federal Register on February 10, 2006. The Federal Highway Administration (FHWA) issued the Record of Decision for the EIS in April 2006. The schedule d completion of the project depends on funding availability.

5.5 CUMULATIVE IMPACTS ANALYSIS

The alternatives described in Chapter 2 were evaluated in Chapter 4 for their potential impact to the human environment. Because these alternatives were developed to satisfy various, distinct purposes and needs, the evaluation of each alternative was typically conducted based on construction and operation effects. Impacts of individual alternatives were compared to existing conditions, conditions in the year 2015, and the other alternatives satisfying the same need. However, the Chapter 4 analyses did not consider whether the alternatives satisfying other needs would be implemented. In reality, it is possible that alternatives serving two or more of the different needs (RSA, aviation facilities, SREF, etc.) would be implemented, and the environmental analysis needs to consider the combined effects of these actions.

To address cumulative effects, it is therefore necessary to summarize the environmental effects associated with a comprehensive set of alternatives satisfying the different needs. Collectively, this group of alternatives is termed the "Proposed Actions Alternative". The Proposed Actions Alternative consists of the actions for each Need that are incorporated into the permit applications submitted by CBJ to the Corps and other agencies for regulatory approvals to implement the actions and are the FAA's preferred alternatives. In most cases, these actions also represent those with the most adverse environmental impacts, and they generally do not incorporate design features that could otherwise be used to reduce or minimize environmental impacts. The actions included in the Proposed Actions Alternative are RSA-5E, NAV-2B, FF-1, FW/RW-2, and SREF-3B1 (Figure 5-1).

JNU has proposed to implement a set of wildlife hazard management activities that represent a subset of the alternatives. Upon consideration of the benefits and drawbacks for each of the alternative wildlife hazard management activities, JNU has determined there is no longer a need to pave all grassed areas of the infield (WH-1a) or to convert surface water drainage ditches into underground drains (WH-1e). The following actions are proposed by JNU, and adopted by the FAA as the preferred WHMP alternative, to reduce the risks of wildlife strikes to aircraft and are incorporated into the cumulative effects analyses in this chapter:

- Filling the wetlands located near the mouth of Duck Creek on the Airport to above high-tide level and approximate level of Northwest Development Area (WH-1b)
- Selective regrading wetlands on the Refuge, west of Runway 08 and extending north past the mouth of Duck Creek, to create a free draining surface to the Mendenhall River (WH-2c).
- Relocating the mouth of Duck Creek close to the northern Airport boundary, from just south of the intersection of Cessna Drive and Alex Holden Way discharging to the Mendenhall River south of the location of the former Gute property and at the southern end of the wastewater treatment plant mixing zone (WH-1d).

- Alteration of vegetation management techniques and increased hazing in the infield areas (WH-3e).
- Removing swales and areas that pond water along the edges of the runway and parallel taxiway by filling, leveling, and regrading to the level of the RSA (WH-1f).
- Removing vegetation from the Float Plane Pond by dredging it to a depth of at least ten feet in all waters south of the Float Plane Pond and in the main portion of pond where vegetation exists. (Dredging to greater depths would be conducted as necessary to provide materials for new construction projects associated with the RSA, facilities, etc.) (WH-1g).
- Removing the dam at the mouth of Jordan Creek (WH-1h).
- Implementation of an adaptive hazard management approach to the Float Plane Pond woodlands. The Airport would monitor, evaluate and document hazards along with the effectiveness of wildlife hazard control techniques (such as those described in Section 2.5.1.2) to assess whether additional habitat modifications may be needed in the future (modification of WH-1i). The following habitat modifications would be implemented:
  - Installing a deer fence along the north side of the dike, from the existing fence on the west end to the existing fence on the east end, and
  - Periodic removal of corvid nests as needed to prevent re-establishment of the rookeries in the woodlands.

The scope of past, present, and reasonably foreseeable future actions for cumulative-effects consideration can vary by resource, just as the geographic study areas for the different resources described in Chapter 3 vary. In general, projects on or within the immediate area of the Airport property are included because they are within the potential impact zone of build actions, including development of the RSA, development of aviation facilities, etc. For example, cumulative impacts to water resources are limited to the Mendenhall Valley watershed. For resources outside of the immediate impact zone to be considered in the analysis, they would need to qualify as being under political or land use jurisdictions, as having unique characteristics, as being important in a local and regional setting, or as being in the area of potential effect.

The following sections briefly analyze the scope of cumulative effects for each resource. Table 5-4 identifies the estimated cumulative impacts for each of the resources considered in this EIS.

5.5.1 NOISE

Since the advent of widespread commercial jet operations in the 1960s, technological advances in engine design and noise suppression have substantially reduced noise levels. Reductions in aircraft noise are attributed to the establishment of Federal Aviation Regulation (FAR) Parts 36 and 91, which required first the phase-out of Stage 1 aircraft by 1985, and then the phase-out of, or huskkit modification to, Stage 2 aircraft over 75,000 pounds (including the B-737-200) by 2000. Alaska airports were exempted from some phase-out conditions, but most operations in the state meet Stage 3 restrictions for newer, quieter aircraft.

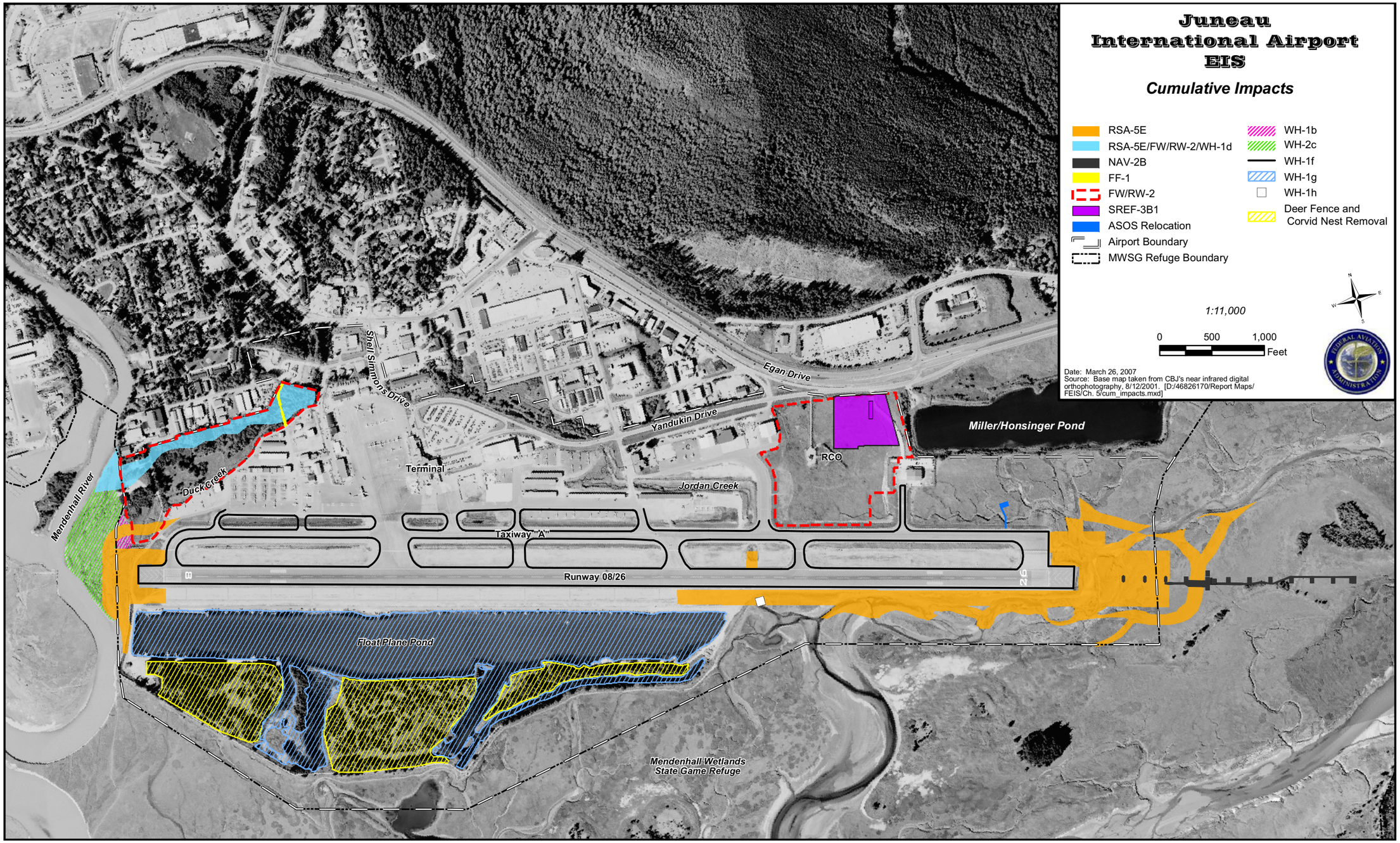

Figure 5-1. proposed actions.

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Table 5-4. Summary of Cumulative Effects

Past Actions	Present Actions	Proposed Actions Alternative[1]	Reasonably Foreseeable Future Actions	Cumulative Effect
Noise				
25% decrease in noise levels in past 10 years	Implementation of Part 150 standards further reduces aircraft noise, phased approach.	No measurable change in noise as a result of these actions.	Stage 4 noise standards will result in 20% additional decrease in noise level.	Aircraft noise levels continue to decrease despite projected increases in activity.
Human Environment and Compatible Land Use				
662 Acres established for Airport use, approximately 3,500 acres designated for residential, mixed use, industrial, and commercial development in the Mendenhall Valley.	Continued urbanization of Mendenhall Valley.	Permanent taking of Refuge land for RSA development, MALSR installation, and wildlife habitat modifications.	Fish processor locating near Airport; development of additional channel crossing to Douglas Island.	Minor land use shift to industrial and transportation. Potential conflict between fish processing plant and aviation safety mitigated by "deep sea" disposal of waste products.
Past urbanization of rural and recreational resources. Development of the Refuge and Dike Trail.	Continued urbanization of Mendenhall Valley and Airport area.	Installation of deer fence and some clearing. Degradation of local recreational experience (bird-watching, hiking, and possibly hunting).	Continued urbanization of Mendenhall Valley and Airport area.	Minor degradation of recreational experience in study area.
Socioeconomic				
Past development of safe aviation operations at JNU.	Ongoing development of Capstone, GIS, wind profiling and other aviation programs.	Extended runway safety areas, new navigational aids, improved ground operations.	Continued development of operational safety programs. Increasingly safe operations.	Air carriers, aviation operators, FAA and CBJ are constantly working to improve safe operations into JNU.
SE Alaska Transportation Plan. Development of improved ferry service in the region.	Sitka Shuttle recently began operations	No measurable impact on air carrier operations from RSA or other projects.	Future plans for fast ferries to ports with jet service may dampen demand for jet service.	Magnitude of effects on air carrier service difficult to determine but potentially substantial.
Development of Juneau road system near JNU. Urbanization of Airport area and Mendenhall Valley.	Continued urbanization of Mendenhall Valley and Airport area.	Possible increased noise near northwest corner apron development.	Increased noise and traffic from possible Egan Drive improvements and second Gastineau Channel crossing.	Long-term potential for easier access to Airport and airfield business from Egan Drive improvements.
Economic growth of Juneau area and the region.	Legislative move vote was recently defeated.	Improved flight safety at JNU, providing good environment for economic/business growth.	Kensington Mine develop-ment, NOAA/NMFS facility development, N. Douglas road extension, and general economic development.	Airport safety improvements provide beneficial impacts by providing a good environment for economic growth.
Air Quality				
Establishment of NAAQS and SIPs has resulted in a reduction in pollutant levels of criteria pollutants. Engine technology to reduce aircraft noise have increased ozone related pollutants	Continued reduction in on-road mobile and stationary source emissions and ongoing construction and maintenance emissions.	No significant impacts, construction-related emissions increase in the short-term.	Continued reduction in on-road emissions but increase in aviation emissions.	Reduction in total regional emissions, with the Airport likely representing a slightly increasing portion of emissions.
Hazardous Materials and Solid Wastes				
Development of the Airport and Mendenhall Valley has generated substantial quantities of household and industrial solid waste.	Solid waste generation continues to rise as household and industrial development continues to grow in the Valley.	Minor amounts of construction debris would be generated by the actions to construct RSA, a fuel farm road, and the other actions identified in Chapter 5.	Continued development in the Valley and near the Airport will generate construction debris.	Cumulative effects are not quantified, but expected to be insignificant based on capacity of local landfill, and types of development anticipated.

Table 5-4. Summary of Cumulative Effects, continued

Past Actions	Present Actions	Proposed Actions Alternative[1]	Reasonably Foreseeable Future Actions	Cumulative Effect
Hazardous materials use (household and industrial) has generated waste products requiring special handling and disposal, and inappropriate disposal (spills and leaks of petroleum compounds) has caused some environmental degradation.	Hazardous materials use is more carefully controlled but also more widespread.	Some potential exists to encounter subsurface petroleum-related contamination in the areas near the fuel farm and TEMSCO. No changes expected in the quantities of hazardous materials used or waste generated, except slight increase of urea application. Risk of fuel truck petroleum spills reduced.	Residential and industrial development will continue to generate increasing quantities of solid waste and potentially hazardous waste, and consume more hazardous materials.	
Water Resources and Floodplains				
Over 200 acres of existing impervious surface and 113 acres of open water that was previously wetlands at JNU.	Conversion of undeveloped areas to paving and buildings.	76% increase in impervious and less pervious surfaces (154 acres) at JNU as a result of the combined actions identified in Chapter 5.	Proposed Egan Drive improvements would add substantial impervious surface in the Jordan Creek basin.	Substantial increase in impervious surface in watershed.
Undetermined loss of floodplain and marshplain	No ongoing losses identified in immediate area of JNU but upgradient losses in watershed probably occurring.	Loss of 331 acre-feet of floodplain/tidal prism storage volume as a result of the combined actions identified in Chapter 5.	Proposed Egan Drive improvements would decrease floodplain volume in the Jordan Creek basin	Substantial loss of floodplain and tidal prism storage volume in watershed
Glycols and urea have been applied seasonally when freezing conditions present and drained to groundwater, with some biological and biochemical treatment, and to adjacent receiving water bodies with little or no treatment.	Glycols and urea are applied seasonally to aircraft, runway and taxiway surfaces and drain to receiving water bodies. No existing treatment beyond natural processes during infiltration.	Some additional urea may be used (relative to no action) for east runway end taxiway and runway maintenance. Increased impervious surface and reduced treatment would increase contaminant loads to receiving waters.	Technology may advance to use of less toxic de-icing/anti-icing materials, and treatment systems may be installed.	Cumulative effects on water quality unknown, but degradation has likely occurred.
Oil and grease, solvents intermittently added to adjacent receiving water bodies due to spills, leaks in the Mendenhall watershed.	Stormwater Pollution Prevention Plan is in place for the Airport to reduce contaminant loading.	Probably no additional impact from new development as improved treatment would be installed in stormwater capture system.	Some increased affect on Jordan Creek from proposed Egan Drive improvements.	Cumulative effects to water quality unknown, but some degradation likely has occurred.
Sediment added as a short-term impact during construction of buildings, roads and facilities in vicinity of JNU, primarily upgradient in watershed.	Sand applied for traction on roads during freezing conditions drains to receiving water bodies.	Probably less impact long-term due to wider buffer for Duck Creek, but some turbidity impact exceeding 10% over existing conditions during construction is possible.	Some increased short-term risk from future developments in watershed and long-term from winter maintenance of Egan Drive improvements.	Cumulative effects unknown but water quality degradation likely has occurred.
Vegetation				
Approximately 26 acres of forest were indirectly created by construction of the float plane pond. Removal of trees along Jordan Creek between Yandukin Drive and Crest Street reduced forest coverage by approximately 5 acres. Dredging of Gastineau Channel resulted in the loss of 49 acres of estuarine marsh and the creation of approximately 36 acres and 13 acres of supratidal and forest communities, respectively.	Continued urbanization of Mendenhall and Lemon Creek Valleys, the Egan Expressway Corridor, and Douglas Island are reducing the areal extent of forest and supratidal plant communities and degrading their quality through the introduction of weed species. Isostatic rebound, in conjunction with human modifications to tidal dynamics, continues to cause uplandification of marsh habitats with associated increases in extent of high marsh and supratidal communities at the expense of low marsh and unvegetated tidelands.	Implementation of the combined actions described in Chapter 5 would reduce estuarine marsh communities by approximately 45.3 acres. Supratidal and forest communities would be reduced by 34.4 acres and 6.0 acres, respectively. Natural incision of a new tidal channel around the east end of the runway (caused by development of east Runway end RSA) would convert high marsh to low marsh and unvegetated tidelands in this area.	Construction of a new crossing to Douglas Island and Egan Drive improvements may further diminish estuarine marsh habitat quantity and quality. Because location and project details are not available, estimates of vegetation loss cannot be forecast.	Past, present, and Airport actions would result in a cumulative net loss of approximately 862acres of estuarine marsh and a potential* net gain of 28 acres of forest and 1.9 acres of supratidal meadows in the landscape area and its immediate surroundings. (*The acreage of forest and supratidal meadows lost to urban development is unknown)

Table 5-4. Summary of Cumulative Effects, continued

Past Actions	Present Actions	Proposed Actions Alternative[1]	Reasonably Foreseeable Future Actions	Cumulative Effect
Wetlands				
Development of the Airport, Egan Expressway, and golf course, and the Gastineau Channel dredging activities have resulted in a loss of approximately 822 acres of estuarine wetlands from the landscape area and its immediate surroundings.	Isostatic rebound, in conjunction with human modifications to tidal dynamics, continues to cause uplandification of marsh habitats with associated increases in extent of supratidal and high marsh communities at the expense of low marsh. Carstensen (2002) estimates that, between 1979 and 2002, E2U and E2EM(L) wetlands have decreased in areal extent by 210 acres and 457 acres, respectively, in the landscape area and its immediate surroundings. During the same period, E2EM(H) increased by approximately 550 ac.	Implementation of actions identified in Chapter 5 would reduce estuarine high and low marsh by about 55.3 acres within the landscape area. Palustrine wetlands would be reduced by 22 acres within the landscape area (16 acres of which would be dredged). No net loss of riverine habitat would occur and lacustrine wetlands would not be affected. Active relocation of a tidal channel around the east end of the runway would minimize the conversion of high marsh to low marsh and unvegetated tidelands in this area.	Construction of a new crossing to Douglas Island would further diminish estuarine marsh acreage and function. Egan Drive Improvements would likely affect the Miller-Honsinger Pond and palustrine wetlands adjacent to the north Airport boundary. The Upper Duck Creek Watershed Improvements would result in a net gain of wetland functions and acreage.	Past, present, and reasonably foreseeable actions have resulted in net losses of approximately 869 acres of estuarine wetlands and 20 acres of palustrine wetlands from the landscape area and immediate surroundings. Shifts in the relative acreages of E2U, E2EM(L), and E2EM(H) wetlands continue to occur as described under present actions.
Fisheries				
Since 1948, development in and around the landscape area has reduced essential fish habitat (EFH) by approximately 822 acres.	New or expanded roads, buildings, and human activities continue to reduce EFH. Isostatic rebound is and will continue to diminish and degrade EFH through the gradual replacement of low marsh with high marsh and high marsh with supratidal habitats.	Implementation of the actions identified in Chapter 5 would reduce EFH by approximately 68 acres. Active relocation of a tidal channel around the east end of the runway would minimize the conversion of high marsh to low marsh and unvegetated tidelands in this area.	Construction of a new crossing to Douglas Island and Egan Drive improvements may further diminish EFH quantity and quality. Because location and project details are not available, estimates of EFH loss cannot be forecast.	Past, present, and reasonably foreseeable actions have resulted in net losses of approximately 869 acres of EFH from the landscape area and its immediate surroundings.
Development projects on and off-Airport have reduced fish access to Duck and Jordan Creeks during dry periods due to culverts, streambed disturbance, and channel dewatering	Some improvements to upper Duck Creek and Jordan Creek watersheds are designed to improve fish access and fish passage.	Benefits to Duck Creek through relocated, lined channel, and stream-simulation culverts. Lengthened culvert in Jordan Creek increases fish passage difficulty.	Some improvement to wintering habitat, fish passage, and fish access as a result of upper Duck Creek improvement projects	Improved fish access and fish passage in Duck Creek relative to existing conditions. Degraded fish passage conditions for Jordan Creek.
Risk of injury to fish has increased gradually with expansion of impervious surfaces and use of contaminants (e.g. fuel, septic systems, antifreeze, urea, etc.)	Occasional exposure mostly at road crossings over and drains into creeks; also de-icing, maintenance, and fuel deliveries at Airport.	Expansion of impervious surfaces and conversion of ditches to drains increases potential for injury to fish through increased contaminant loads.	Continued development of impervious surfaces, increased stormwater runoff and, indirectly, adverse impacts on fish through water quality degradation	Overall continued degradation of fishery conditions through increased stormwater runoff and water quality degradation
Wildlife				
Since 1948, development of the Airport, Egan Expressway, and golf course and the dredging of Gastineau Channel have resulted in a loss of approximately 822 acres of estuarine marsh habitat from the landscape area. This habitat loss has likely had substantial adverse effects on the Vancouver Canada goose and other waterfowl, as well as shorebirds.	Continued urbanization of Mendenhall and Lemon Creek Valleys, the Egan Corridor, and Douglas Island are reducing upland habitats (primarily forest and supratidal meadows) and reducing habitat connectivity between mainland coast and Douglas Island.	Implementation of the actions identified in Chapter 5 would reduce estuarine habitats by approximately 45.3 acres within the landscape area. Supratidal and forest habitats would be reduced by about 34.4 and 6.0 acres, respectively.	Construction of a new crossing to Douglas Island would further diminish estuarine marsh habitat quantity and quality. Construction of a new crossing to Douglas Island would further diminish supratidal and forest habitat quantity and quality.	Past, present, and Airport actions would result in a cumulative net loss of approximately 862acres of estuarine unvegetated and marsh habitats. High interest and sensitive species most adversely affected by these changes include the Vancouver Canada goose, swans, and shorebirds.

Table 5-4. Summary of Cumulative Effects, continued

Past Actions	Present Actions	Proposed Actions Alternative[1]	Reasonably Foreseeable Future Actions	Cumulative Effect
Construction of the float plane pond indirectly resulted in the creation of approximately 26 acres of forest habitat. Removal of trees along Jordan Creek between Yandukin Drive and Crest Street diminished forest habitat by approximately 5 acres. Dredging of Gastineau Channel resulted in the creation of approximately 36 acres of supratidal habitat and 13 acres of forest.	Continued "uplandification" of marsh habitats from isostatic rebound, and reductions in wildlife habitat value. Current levels of human activity (particularly those involving unleashed pets) in and around the Refuge continue to degrade wildlife habitat quality within the landscape area. Isostatic rebound continues to cause uplandification of marsh habitats and an associated shift in wildlife habitat values.			Past, present, and Airport actions would result in potential* net gain of 28 acres of forest and1.9 acres of supratidal habitat in the landscape area and its immediate surroundings. These habitat changes have potentially increased habitat for the bald eagle and rufous hummingbird as well as the Queen Charlotte goshawk, olive-sided flycatcher, and Townsend's warbler. (*The acreage of forest and supratidal meadows lost to urban development is unknown)
Cultural Resources				
Development of Airport facilities both during World War II and the post-war period have resulted in the loss of an unknown number of cultural resource sites. Known sites that were eliminated include a smokehouse operated by Native Alaskans and numerous World War II era military structures.	Development is subject to Section 106 review, thus cultural resources are identified and evaluated for eligibility to the National Register of Historic Places prior to any ground disturbance. No current activities in vicinity of Airport are known to have potential to affect cultural resources.	The actions described in Chapter 5 would have no affect on any known historic properties. Ground disturbance may uncover sites currently buried; a determination of potential Historic Register eligibility would be made.	Some future projects (NOAA lab, Channel crossing, Egan Drive intersections, etc.) may affect as yet unknown historic properties. Such properties would be identified through cultural resource investigations.	Past projects have resulted in the destruction of an unknown number of cultural resources. Proposed Airport development alternatives would not impact any known historic properties. Future projects may impact as yet undetermined numbers of cultural resources, but cumulative significance could not be determined until discovery and assessment.
Visual Resources				
Urbanization and development has altered natural character of Mendenhall Valley and Gastineau Channel area	Continued changes to color and form with new housing, roads, and industries	Degrades the natural character of some areas on Airport and surrounding landscapes, but consistent with previous development and land use objectives	New major projects such as Douglas Crossing, and Egan Drive intersection improvements would eliminate visual screens, and contrast with and degrade the natural viewsheds.	Substantial adverse changes to the original visual character of Refuge and area in the vicinity of the Airport.
DOT Section 4(f)				
Increased development-related pressure. Indirect environmental impacts on area 4(f) resources from noise, air and water pollution,, hydrologic changes, habitat degradation.	Continued increased development-related pressure. Indirect environmental impacts on area 4(f) resources continue, although aviation noise decreases.	Direct impact on 4(f) lands through use of Refuge land for RSA, Dike Trail relocation, wildlife hazard actions.	Continued increased development-related pressure, including Douglas Island Crossing, Egan Drive. Indirect environmental impacts on 4(f) land (noise, air and water pollution, habitat, recreation), including changes by isostatic rebound.	Increased development-related pressure. Taking of relatively small amount of DOT 4(f) land (Refuge). Indirect environmental impacts on area 4(f) resources (habitat, hydrologic changes, wetlands, water pollution)

[1] Includes RSA-5C, FW/RW-2, FF-1, NAV-2B, SREF-3B1, and most elements of WH-1, which are the FAA's preferred alternatives.

In 1987, so as to develop a balanced and cost-effective program for reducing existing aircraft noise exposure, CBJ completed the first Part 150 Noise Compatibility Planning Study for the Airport. The Part 150 plan was then updated by CBJ in 1999. Chapter 7 of the 1999 Noise Exposure Map report of the update compared the 1985 noise exposure map with the baseline conditions of 1996 (similar to the comparison provided in this document between year 2000 and predicted year 2015 noise contours). The 1999 update showed that the noise exposure contours had decreased substantially west of the Airport. For instance, the 1996 contour of the Part 150 update illustrates the 65 DNL contour as reaching the eastern portion of the Mendenhall Peninsula. In contrast, the 65 DNL contour associated with conditions about 10 years earlier is much larger, passing over the Mendenhall Peninsula and extending approximately 1.5 miles into Auke Bay.

The International Civil Aviation Organization, the group that identifies industry-wide source noise controls, has recently adopted a Chapter 4 (called Stage 4 in the U.S.) noise standard, which is expected to result in further reductions in aircraft noise exposure. Commencing January 1, 2006, the Stage 4 standard would apply to newly certificated aircraft and to Stage 3 aircraft for which re-certification is requested, including for aircraft that operate at JNU. As a result, it is expected that further reductions would be made in the individual noise profiles associated with aircraft that use JNU. The analysis in Chapter 4 of this EIS demonstrates that combined, long-term noise levels for the Maximum Build-out scenario would be lower than current noise levels.

The Proposed Actions alternative would cause increased levels of short-term noise on the Airport, directly related to construction activities associated with the various build alternatives. These short-term increases would decrease and stop as construction is completed. However, there would be no change in operational noise levels associated with concurrent implementation of the Proposed Action alternative beyond those identified for RSA-5E, in Section 4.3.1.

It is possible that as activity levels increase beyond the planning horizon of 2015 considered in this EIS, the noise from increased aircraft operations could offset the reduction in noise from improved aircraft technology, resulting in slight, incremental increases in aircraft noise over time. However, through the reasonably foreseeable future, future noise levels are expected to be lower than current (2000) conditions.

5.5.2 Human Environment and Compatible Land Use

This section describes compatibility of the Proposed Actions alternative with existing land uses and land use designations. Some reasonably foreseeable future actions could be incompatible with existing land uses, including aviation and recreation. Cumulative effects of the Proposed Actions alternative with past, present and reasonably foreseeable future actions are disclosed.

5.5.2.1 Compatible Land Uses

The analysis in Chapter 4 demonstrates that combined, long-term noise levels for the Proposed Actions alternative would be lower than current noise levels. Therefore, populations affected by aviation noise would decrease as the noise contours shrink through the foreseeable future. Noise levels at most noise-sensitive facilities, such as churches, schools, and recreation sites, would decline relative to the baseline (year 2000) conditions. As described in the Section 4.3.2 analysis,

Alternative RSA-5E would cause a greater than 1.5 DNL increase in noise on a small area of the Refuge just east of the expanded runway and RSA. However, this increase is still within acceptable noise contours established by FAA's land use compatibility guidelines for the Refuge.

It is doubtful that any of the projects identified in Table 5-3 would, when combined with aviation noise, result in noise levels incompatible with existing land uses and designations. The most likely project would be a new crossing to Douglas Island. Depending on its proximity to the Refuge, this project could result in long-term, vehicular noise levels well above those currently experienced on the Refuge. However, restrictions on obstructions to flight paths make it unlikely that a new Douglas Island crossing would be sufficiently close to the Airport to have significant noise impacts to local populations or at noise-sensitive sites.

Some of the actions considered for this EIS would encroach on the Refuge and cause a change in land use from rural reserve to industrial. Based on language incorporated in the statute designating the Refuge, it is anticipated that such land use changes would be accompanied by either a property transfer from the state of Alaska to CBJ or an easement for Airport/FAA land use. Table 5-5 illustrates the cumulative land use changes caused by the Proposed Actions alternative. The Proposed Actions alternative would constitute a loss of approximately 0.6% of the 4,000-acre Refuge.

Table 5-5. Land Use Changes: Refuge to Airport Use

Proposed Projects Alternative	Acres of Refuge Lost
RSA 5E: Runway Safety Area	9.9[1]
NAV-2B: Navigation (MALSR)	1.2
SREF-3B1: Snow Removal Equipment Facility	0.0
FF-1: Fuel Farm Road	0.0
FW/RW-2: Aviation Facilities	0.0
Proposed Wildlife Hazard Management Actions	10.2
Total Acres of Refuge Transferred	**21.3**

[1] Does not include 5.0 acres of impact on Refuge to reconstruct the tidal slough channel around the Runway 26 end to minimize hydrologic impacts.

Past land use impacts in the study area include development of the Airport (662 acres), and the urbanization of the Mendenhall Valley and Airport areas. As described in Section 3.2, there are a variety of land use and zoning plans and designations controlling where and how development proceeds. Cumulative impacts of all past, present, and foreseeable future actions, along with the Proposed Actions alternative, would result in the continued shift of land use in the Airport vicinity and Mendenhall Valley area from rural reserve to industrial, commercial, and residential. The location of a new Alaska Glacier Seafoods fish processing plant approximately 3-4 miles west of the Airport could cause land-use conflicts between a commercial entity and aviation operations, if fish processing and waste disposal attract birds that cause hazards to aviation. However, plant

plans submitted in support of permit applications and correspondence to FAA suggest that waste will be encapsulated and disposed at "deep sea" sites far from the Airport (Pusich 2002).

5.5.2.2 RECREATION

The Proposed Actions alternative would result in displacement of the Dike Trail, but this should not be a significant impact to recreational uses and Refuge access. There are some indirect, beneficial impacts associated with moving the Dike Trail, as there could be a reduction in conflict with Airport emergency access needs, and a new trail head and trail may provide more assurance of long-term access to the Refuge.

Past impacts to recreation in and around the study area include development of the Refuge and the use of the emergency vehicle access road (EVAR) as a recreational-use trail. Present and foreseeable future actions include the continued urbanization of the Mendenhall Valley and Airport vicinity, although development of the 4,000-acre Refuge has safeguarded many recreational resources in the area. The cumulative effects of past, present, and foreseeable actions would be degradation of the recreational experience in the vicinity of the Airport. These effects would have local significance but much less regional significance due to the numerous recreational opportunities in the Juneau area.

5.5.3 SOCIOECONOMIC IMPACTS

This section describes long-term and short-term socioeconomic impacts of the combined actions, as well as potential cumulative economic impacts on Juneau and the surrounding region. The following discussion describes short-term economic impacts, revenue impacts, impacts to air carriers, indirect economic impacts and social impacts. The baseline for cumulative effects analysis is present conditions at JNU and in southeast Alaska, as economic benefits from past infrastructure projects have been accrued and continue to be factored into the reasonably foreseeable future economic forecasts.

5.5.3.1 SHORT-TERM (CONSTRUCTION) ECONOMIC IMPACTS

Table 5-6 presents the combined short-term economic impacts from construction of the Maximum Build-out and Preferred alternatives. These numbers were generated using the estimated costs shown on Table 4-2 in Chapter 4 for runway safety, navigational aid, fuel farm access, development of aviation facilities, SREF, and wildlife hazard management actions. Construction costs were based on the estimates provided in Chapter 2 and outlined in Appendix A. These costs were entered into the IMPLAN econometric input/output model with Juneau-specific employment and expenditure data (IMPLAN 2000).

The Proposed Actions alternative would generate approximately $1.7 million in sales taxes for local government during construction, and have significant short-term economic benefits to Juneau, and by extension, to the Southeast Region.

If other large construction projects, such as development of the NOAA/NMFS office building and lab site or the North Douglas Road Extension, were to occur in Juneau at the same time as Airport

Table 5-6. Combined Economic Impacts of Construction (2005 Dollars)

Alternative	Business Income (Project Cost)	Indirect & Induced Bus. Income	Total Business Income	Direct FTE Jobs	Indirect & Induced FTE Jobs	Total FTE Jobs	Direct Payroll	Indirect & Induced Payroll	Total Payroll
Proposed Projects Alternative	$69,602,000	$34,231,000	$104,820,000	387	349	736	$21,204,000	$7,563,000	$28,767,000

Sources: *Juneau International Airport Master Plan Update*, USKH, Inc., 1999; USKH, Inc. 2004, CBJ Engineering Dept., CBJ Airport Staff, FAA, NOAA National Weather Service Staff, Estimations 2004, and the SWCA Project Team. Also, IMPLAN Pro 2000 input/output model, Minnesota IMPLAN Group.

Notes:

1. Project Cost, primarily federally funded, represents gross income to businesses.
2. Indirect impacts result when the contractors purchase goods and services from other producers in the local economy.
3. Induced impacts result when households receiving income from these projects increase local spending.
4. FTE is Full Time Equivalent, and represents one full time job for one year. Assumes each project takes one year to complete.
5. All costs and payrolls are in 2004 dollars. Some were adjusted from earlier dollar amounts using the Anchorage Consumer Price Index (CPI-U).
6. Proposed Projects Alternative includes RSA-5E, NAV-2B, SREF-3B1, FF-1, FW/RW-2, and most elements of WH-1.

development projects, short-term beneficial impacts could be even greater. Concurrent construction projects can create some economies of scale and allow more efficient use of equipment, manpower, and other resources. However, concurrent construction can also cause more social and community disruption in terms of noise, delays in public and private transportation, etc.

5.5.3.2 Revenue Impacts

Most of the economic benefits resulting from Airport projects would be short-term, generated during construction. However, as described in Section 4.7.3, the addition of new hangars and other aviation facilities would generate additional long-term revenue for the Airport. Most of this revenue would be in the form of hangar and apron leases and tiedown fees. Total revenues through the year 2015 from the proposed aviation facility development alternative, FW/RW-2, are estimated at $1,083,100. Other past or reasonably foreseeable future projects would have no influence on these economic benefits.

5.5.3.3 Economic Impacts to Air Carriers

None of the actions considered in this EIS would have measurable direct, adverse impacts on air carriers or other fixed base operations at the Airport. Development of the east end MALSR would clearly result in benefits to all traffic at JNU, and there could be positive economic gains. Other airfield improvements may also provide economic benefits due to the increased airfield operational efficiency, but these impacts are not measurable.

One reasonably foreseeable future action that could affect aviation economics is the development and improvement of fast ferry service between Juneau and other communities within the region. These ferry routes primarily connect communities without jet service, so jet air carriers will not feel these impacts. However, plans for fast ferry service between Juneau and Sitka, and possibly Petersburg, Wrangell and Ketchikan (all with jet service) could have a negative effect on air carrier revenues in the future.

Additional safety and security regulations imposed after September 11, 2001 as well as increased insurance rates and passenger fees, will continue to affect air carrier revenues for the foreseeable future.

5.5.3.4 Indirect Economic Impact

The Proposed Actions alternative would improve safety and efficiency. In general, improvements in safety and efficiency at JNU would improve the business climate and promote growth of the local and regional economy. Thus, Airport improvements would economically benefit businesses and projects within the Borough and the surrounding areas.

5.5.3.5 Social Impacts

Most of the social consequences resulting from the Proposed Actions alternative are described in other sections dealing with noise, human environment/land use, air, and visual resources (Sections 5.5.1, 5.5.2, 5.5.4, and 5.5.12, respectively). It is likely that positive social impacts would be

manifest as improved air carrier service, and more efficient and safer airfield operations under either Airport development scenario. The reasonably foreseeable, potential improvements to Egan Drive access near the Airport could reduce some traffic problems and improve ground access to the terminal and cargo facilities. In addition, terminal renovation and expansion planning is underway. Terminal additions and/or modifications would likely improve vehicular access and increase operational efficiency for all activities within the terminal. It is not clear what cumulative social effects would result, if any, from Airport development projects in conjunction with other area transportation projects such as a new Douglas Island crossing.

5.5.4 AIR QUALITY

Table 5-7 summarizes the air quality emission increases for the Proposed Actions alternative. As was noted in the earlier sections, no increased project-related airport operational emissions are expected to result from any of the alternatives except for a slight increase of CO, NOx, and VOC associated with increased taxiway length for Alternative RSA-5E. Otherwise, only construction-related emissions (exhaust and fugitive dust) are expected.

Table 5-7. Summary of Project-Related Combined Emissions: Air Quality

	Tons per year Construction Vehicle Exhaust					Fugitive Dust (tons)
	CO	NOx	VOC	SO2	PM_{10}/ $PM_{2.5}$	
Proposed Projects Alternative						
RSA-5E: Runway Safety Area	12.5	20.3	2.8	1.1	1.0	45.2
NAV-2B: MALSR	2.5	2.7	0.4	0.2	0.4	0.9
SREF-3B1: Snow Removal Equipment Facility	6.8	6.9	1.3	0.6	0.8	2.7
FF-1: Fuel Farm Road	6.8	8.5	1.3	0.7	0.4	2.7
FW/RW-2: Aviation Facilities	17.8	30.2	4.2	2.7	3.1	24.0
Proposed Wildlife Hazard Management Actions	9.4	22.6	2.8	2.0	1.9	66.8
Total Max Build-Out	**55.8**	**91.2**	**12.8**	**7.3**	**7.6**	**142.3**

Source: Synergy Consultants, Inc. October 2004. Table illustrates emissions that would be generated above the level associated with the No Action Alternative. RSA-5E is the only alternative contributing additional aircraft/ GSE operational emissions. For the remaining alternatives, construction-related emissions are the only quantifiable project-related emissions.

The Southeast Alaska Intrastate Air Quality Control Region is designated as non-attainment for PM_{10} and attainment for all other pollutants. However, as the southern boundary of the PM_{10} non-attainment area is described as the north boundary of the Airport, JNU is in attainment for all pollutants (Shepard 2001; Puckett 2004). Therefore, the requirements of the Clean Air Act for general conformity do not apply to the Airport, as the federal action would be occurring outside the non-attainment area.

Section 4.9.4 of Chapter 4 describes the Airport's proximity to the Juneau non-attainment area for PM_{10} and the relevance of the de minimis thresholds established by the Clean Air Act Amendments General Conformity regulation. For federal actions occurring in the Juneau non-attainment area, the de minimis threshold is 100 tons of PM_{10} per year. Table 5-7 demonstrates that the maximum construction-related exhaust emissions from all of the proposed projects (assuming they were conducted in the same year) would not exceed the threshold (7.6 tons in comparison to the threshold of 100 tons).

Consideration was also given to a possible need to demonstrate conformity for $PM_{2.5}$ (fine particles). In February 2004, the State of Alaska submitted a request to the U.S. EPA for all areas in the State to be designated as attainment for $PM_{2.5}$. In 2004 the U.S. EPA designated all of Alaska as attainment for these fine particulates.

Construction-related emissions at the Airport include fugitive dust. Assuming that all fugitive dust is PM_{10} and that construction of all wildlife hazard management actions occur concurrently, the maximum fugitive dust level for the Proposed Actions alternative is estimated at 142.3 tons. Of this maximum number, 66.8 tons would occur during implementation of wildlife hazard management activities. It is unknown how the projects under the Proposed Actions alternative would be implemented, but it is not possible they all would be under construction in one year. It is reasonable to assume that the projects selected for implementation would be completed within a 3 to 7 year timeframe and that annual fugitive dust emissions would be well below air quality thresholds.

In addition to the cumulative impacts associated with combining all of the proposed actions, consideration was given to the air quality implications of all past, present, and future actions. Air quality has clearly been adversely affected as a result of human activities and development. In the past 30 years, application of federal and state emissions regulations and technological improvements aimed at reducing affects on air quality have acted to counter emissions increases caused by population and development growth. Table 5-4 summarizes the cumulative trend in air quality up to the present and how Airport projects and other reasonably foreseeable future actions in the area would influence that trend.

5.5.5 Hazardous Materials and Solid Waste

Quantities of solid waste generated by the different actions evaluated in this EIS are expected to be minor. There is a low probability for asbestos-containing materials to be generated by these alternatives since the only demolition involves the existing RCO and ASOS buildings. The areas with a higher potential to contain subsurface hazardous wastes in the form of contaminated soils include the northwest Airport area, near the fuel farm, and the northeast Airport area just west of the TEMSCO facility. Subsurface work in these areas would most likely be limited, since fill is required to elevate both the fuel farm and new apron above existing ground surface.

Reasonably foreseeable future actions in the area would also contribute solid waste to the CBJ landfill, primarily in the form of construction debris. Cumulative effects are not expected to be significant, however, since the CBJ landfill has adequate capacity through the foreseeable future. The solid waste incinerator co-located with the landfill was shut down in 2004 because it did not

meet federal air quality standards. It is uncertain whether the incinerator will be upgraded and allowed to continue operations, which would extend the operating life of the landfill. However, according to the operator of the local solid waste disposal facility, even without the incinerator the landfill should have a life-span of approximately 35 years.[1]

By increasing the length on Runway 08 and extending primary and connecting taxiway, RSA-5E would increase the quantities of urea applied to runway at JNU. As described in various sections of Chapter 4, none of the other alternatives is predicted to result in changes to the types or quantities of hazardous materials used at the Airport. In fact, new facilities, particularly a new SREF, would likely result in improved use and control of hazardous materials because such facilities would have improved spaces designated for vehicle and equipment maintenance, painting operations, etc., as well as upgraded treatment and sewage systems. The Proposed Actions alternative would increase the amount of de-icing chemicals carried by storm-water to surface waters; these effects are described in more detail in Section 5.5.6, Water Resources and Floodplains.

The use and consumption of hazardous materials and generation of hazardous wastes is expected to continue to increase in the vicinity of JNU with continued development in the Mendenhall Valley. These increases would be associated primarily with increased vehicles and households and new industrial development. The cumulative effect of these increases is not known.

5.5.6 Water Resources and Floodplains

Water resources of the lower Mendenhall River, Jordan Creek, and Duck Creek have been affected by human development, particularly since the 1930s. Construction of the Airport, its expansion for the World War II effort, and subsequent upgrades have filled floodplains and wetlands, added substantial impervious surfaces, and altered stream alignments. Urbanization throughout the Mendenhall Valley has adversely affected these streams and the estuary. As indicated in Chapter 3, Duck Creek has been most heavily impacted by these widespread cumulative changes in the landscape. Jordan Creek and the Mendenhall River function at higher levels in part because they still retain important undeveloped floodplains and wetlands. The marshplain and channels of the estuary have also seen substantial impacts due to urbanization and transportation infrastructure improvements. Urbanization increases the number and frequency of peak flow events, which erode streams and adjacent water resources, and generally degrades water quality with point sources and non-point sources of pollution.

Table 5-8 shows the impervious surface developed as part of the Proposed Actions alternative. The creation of approximately 154 acres of impervious or less pervious surface represents a substantial increase of pavement or material with low infiltration capacity on the Airport (about 39%).

Table 5-9 shows the floodplain/tidal prism effects for the Proposed Actions alternative. The loss of an estimated 331 acre-feet of floodplain/tidal prism storage volume would be significant.

1. Personal communication between Mike Alison of Waste Management and Linda Snow, Southeast Strategies, 12/28/04.

Table 5-8. Combined Impervious and Less Pervious Surface Development

Proposed Projects Alternative	Acres
RSA-5E: Runway Safety Area	35.1
NAV-2B: Navigation (MALSR)	0.0
SREF-3B1: Snow Removal Equipment Facility	3.9
FF-1: Fuel Farm Road	0.3
FW/RW-2: Aviation Facilities	38.0
Proposed Wildlife Hazard Management Actions	77.0
Total New Impervious or Less Pervious Surface	**154.3**

[1] Includes impervious materials such as asphalt or concrete, and less pervious surfaces such as compacted fill for RSA.
Source: Vigil-Agrimis 2004

Table 5-9. Combined Floodplain/Tidal Prism Loss

Proposed Projects Alternative	Acre-Feet
RSA-5E: Runway Safety Area	334.2
NAV-2B: Navigation (MALSR)	0.0
SREF-3B1: Snow Removal Equipment Facility	0.0
FF-1: Fuel Farm Road	0.2
FW/RW-2: Aviation Facilities combined with Proposed Wildlife Hazard Management Actions[1]	+3.2
Total floodplain/tidal prism loss	**331.0**

[1]Proposed aviation facilities impacts to floodplain storage/tidal prism volume have been combined with the proposed wildlife hazard management actions to ensure Duck Creek relocation impacts (a part of each action) are counted only once.
Source: Vigil-Agrimis 2004

These tables illustrate the large increase of impervious surface and the corresponding, sizeable loss of floodplain/marshplain storage volume for the alternative. The increased storm-water runoff associated with the Proposed Actions alternatives has negative implications for water quality. Glycols and urea are applied seasonally during freezing weather. The cumulative impact from the use of these materials is unknown, but probably detrimental to water resources. The increase of storm-water, reduced treatment from infiltration, and lack of downstream treatment for these chemicals in the drainage system suggest that contaminant loads would increase to surface water. Oil-water separators incorporated into the new storm-water drainage systems would have little or no effect on deicing compounds, but they should provide other benefits by removing oil and grease that has been spilled or leaked onto Airport apron.

Water quality of area streams has been heavily influenced by human activities; Duck Creek has been particularly degraded. Although local zoning and development restrictions and state and federal regulations can help to reduce contaminant loads, the anticipated future growth of the area (with new roads, buildings, and industries) will increase pressure on water resources. Continued loss of flood storage is predicted as development continues within the floodplains of the Mendenhall watershed.

Table 5-3 identifies a number of projects and developments that have adversely affected water resources in the vicinity of JNU and some reasonably foreseeable future actions that could exacerbate existing problems. Table 5-4 summarizes the key water resources issues stemming from previous development, as well as potential cumulative effects on water resources resulting from new development at the Airport in conjunction with future projects in the area.

5.5.7 VEGETATION

Table 5-10 summarizes direct impacts to key, landscape area vegetation types for each action within the Proposed Actions alternative. Key vegetation types have been identified based on their relative rarity in southeast Alaska (estuarine low and high marsh), their species diversity (supratidal), or the habitat diversity they confer to a landscape otherwise dominated by intertidal wetlands (woodland). Combined impacts to key vegetation types from the Proposed Actions alternative would consist of the loss of about 86 acres (1.8% of the landscape area) of low marsh, high marsh, supratidal, and forest communities.

Table 5-10. Summary of Project-Related Combined Impacts: Vegetation

	Acreage of Direct Impact to Key Vegetation Types			
	Low Marsh	**High Marsh**	**Supratidal**	**Forest**
Proposed Projects Alternative				
RSA-5E: Runway Safety Area	9.0	18.8	0.7	0.0
NAV-2B: Navigation (MALSR)	0.0	0.7	0.2	0.0
SREF-3B1: Snow Removal Facility	0.0	0.7	5.3	0.0
FF-1: Fuel Farm Road	0.0	0.0	0.0	0.0
FW/RW-2: Aviation Facilities	0.3	5.9	28.2	5.8
Proposed Wildlife Hazard Actions	8.0	1.9	0.0	0.2
Total Impacts in Acres	**17.3**	**28.0**	**34.4**	**6.0**

Source: SWCA, Inc. 2004

Table 5-4 highlights the cumulative impacts affecting vegetation resources in the area. Past and ongoing development projects have eliminated estuarine marsh habitat in some areas and have converted estuarine habitat to woodland and supratidal habitat in other areas. The slow but seemingly constant process of isostatic rebound causes uplandification of marsh habitats and an associ-

ated reduction in wildlife habitat value. Past, present, and reasonably foreseeable actions would continue to reduce estuarine marsh, supratidal meadow, and woodland habitats in the landscape area.

5.5.8 WETLANDS

Cumulative impacts to wetlands were evaluated for the landscape area within the boundary illustrated in Figure 3-27 in Chapter 3. Nearly all of the lands immediately outside the Airport boundary are wetlands. Additionally, aerial photography from 1926 shows that approximately 95% of the 662 acres within the JNU boundary were wetlands prior to most of the human development in this area, with the only areas considered upland adjacent to Duck Creek as it entered the Airport area. Drainage patterns were evident throughout the rest of JNU in the 1926 aerial photo. Using this information, the baseline wetland area was determined to be approximately 4,545 acres (96% of the 4,715 acres within the landscape boundary).

Key wetland types were selected to summarize combined project effects. Estuarine wetlands were divided into different types since the functions of these wetlands are of great importance to southeast Alaska. Palustrine wetlands were grouped together, and only one type of riverine class was determined to occur in the project area. Lacustrine wetlands would not be affected by the alternatives. Table 5-11 summarizes effects of each activity within the Proposed Actions alternative on these wetland classes, and the combined effect implementation of the entire alternative.

Table 5-11. Summary of Project-Related Combined Impacts: Wetlands

	Acres of Direct Impact to Wetland Classes				
	High/Low Marsh	**Intertidal/ Subtidal Sloughs**	**Palustrine**	**Riverine**	**Total Acreage**
Proposed Projects Alternative					
RSA-5E: Runway Safety Area	18.5/8.9	11.9/0.5	0.0	0.0	-39.8
NAV-2B: Navigation (MALSR)	0.7/0.0	0.0/0.0	0.0	0.0	-0.7
SREF-3B1: Snow Removal Facility	1.6/0.0	0.0/0.0	0.9	0.0	-2.5
FF-1: Fuel Farm Road	0.0/0.0	0.0/0.0	<0.1	0.0	<0.1
FW/RW-2: Aviation Facilities	-16.4/+1.2	+0.2/0.0	6.3	0.0	-21.3
Proposed Wildlife Hazard Management Actions	2.3/8.1	2.5/0.6	16.1*	0.0	-29.6
Total Acres of Impact	**39.5/15.8**	**14.2/1.1**	**22.4**	**0.0**	**-93.0**

* Impacts associated primarily with dredging activities
Source: SWCA, Inc. 2004

5.5.8.1 ISOSTATIC REBOUND

Isostatic rebound has affected wetlands within the JNU boundary by altering the local hydrology. As the land rises in elevation, estimated at a rate of 0.6 inches/year, the depth to groundwater may increase. This uplift can cause an "uplandification" of some wetlands within the project and landscape areas. Additionally, a rise in land elevation and a subsequent lowering of relative sea level could substantially reduce tidal influence on coastal and riparian wetlands.

The palustrine wetlands are least affected by an increase in land elevation because they tend to occur with slowly permeable sediments (clays and silts). A drop in the water table may affect palustrine wetland hydrology by decreasing groundwater recharge, but precipitation would likely maintain the hydrologic supply to these wetlands. Increased isolation of palustrine wetlands could increase its wetland function as a sediment and toxicant retention feature (Adamus 1987). Estuarine wetlands, such as high and low marsh and intertidal sloughs, may experience more dramatic changes as a result of isostatic rebound. Additionally, salt-water infiltration into the tidal flats could be reduced or eliminated by localized uplift (Adamus 1987).

The establishment of a non-saline, groundwater table characteristic of freshwater, palustrine wetland systems could occur in high marsh. Over time, mixed upland coastal forbs and grasses characteristic of freshwater, palustrine wetlands would replace intertidal vegetation. If these wetlands become increasingly isolated, the function of sediment and toxicant retention could increase, and fish habitat would be diminished. Low marsh and intertidal sloughs would likely convert to high marsh. Inundation by tides would occur less frequently, resulting in a reduction in fish habitat quality and riparian support. Subtidal estuaries would convert to intertidal sloughs, but wetland function would not change appreciably in this scenario.

Changes in hydrology and vegetation due to isostatic rebound are ongoing in the landscape area. Carstensen (2002) found that high marsh increased by approximately 550 acres (in an area over coverage similar to the Landscape area of this EIS) over a 23-year period (1979-2002), but this increase was at the expense of low marsh habitat, which decreased by approximately 460 acres over the same period. These figures do not necessarily represent loss of wetland acreage; rather, they demonstrate dramatic spatial and temporal changes in wetland type over the landscape.

Additionally, Carstensen (2002) deduced that isostatic rebound could not be the sole force driving these changes. Carstensen theorizes that tidal processes may counter the effects of isostatic rebound to some extent. Tidal action may carve and grade estuarine slough channels, thereby maintaining adjacent low marsh habitat. It is likely that development (mainly in and around the Airport) and other human-constructed barriers (such as the dredge-spoil islands) have impeded tidal processes that maintain tidal channels and estuarine hydrology. These alterations have resulted in the conversion of low marsh to high marsh habitat.

5.5.8.2 PAST AIRPORT PROJECTS

The construction of JNU and its facilities permanently disturbed approximately 345 acres of wetlands from baseline conditions to present-day. Table 5-1 presents a summary of activities permitted by the U.S. Army Corps of Engineers since 1982. The bulk of these projects affected estuarine wetland types such as high marsh, low marsh, and intertidal sloughs. Wetland functions lost due to Airport construction and development include:

- Groundwater discharge and lateral flow
- Sediment and toxicant retention
- Riparian support
- Nutrient export (by intertidal sloughs)
- Fish habitat
- Wildlife habitat
- Regional ecological diversity

5.5.8.3 PAST AND CURRENT AREA PROJECTS TO CONSIDER

The construction of the golf course, west of the Mendenhall River, resulted in the loss of approximately 120 acres of high marsh habitat. Additionally, the golf course caused the high marsh boundary to shift to the south, thereby decreasing low marsh habitat west of the Mendenhall River.

The development of Miller-Honsinger Pond converted 28 acres of estuarine high marsh to lacustrine wetlands. Indirectly, this action contributed to loss of tidal influence near Egan Drive, resulting in the conversion of high marsh to palustrine wetlands. This action resulted in the loss of wetland functions such as ground water discharge and lateral flow, fish habitat, regional ecological diversity, and riparian support, and the gain of functions such as sediment and toxicant retention and surface hydrologic control.

Dredging of the Gastineau Channel to connect commercial boat traffic to Auke Bay occurred around 1959, causing a loss of 53 acres of estuarine wetlands and the formation of upland habitat. (Some of these dredge-spoil islands have developed stands of spruce.) Wetland functions lost are similar to those lost due to Airport development and construction. As mentioned earlier, the dredge-spoil islands likely have had an effect on tide dynamics that actively maintained intertidal sloughs and adjacent low marsh habitat. With the local reduction of tidal forces and continued isostatic rebound of the land surface, more rapid uplandification could occur at the landscape level.

5.5.8.4 REASONABLY FORESEEABLE FUTURE PROJECTS

Egan Drive improvements would likely affect lacustrine wetlands, such as the Miller-Honsinger Pond, and palustrine wetlands near the Fred Meyer department store and adjacent to the north Airport boundary. These plans have not been fully developed, and loss of wetland acreage cannot be determined at this time. However, wetland function such as sediment and toxicant retention and surface hydrologic control would be lost.

The Douglas Island crossing would be likely to permanently disturb high and low marsh habitat and subtidal and intertidal sloughs. This would result in the loss of wetland functions similar to those lost due to Airport development.

Though outside of the landscape area, the Upper Duck Creek Watershed Improvements would result in a net gain of wetland functions and acreage. Wetlands created would include palustrine wet meadow and shrub-scrub wetlands. Wetland functions gained from this project would include fish habitat, wildlife habitat, and riparian support.

Isostatic rebound will continue for the foreseeable future, causing a gradual change to features and values of the area and Refuge. This is not to say the changes would be negative in terms of habitat, wildlife use, or other important functions. However, the changes could represent degradation in the context of this cumulative effects analysis in that the existing habitat or wildlife use or other functions would be changed. This change is, of course, naturally occurring and would not represent a *human-initiated* impairment to habitat or a DOT Section 4(f) land.

5.5.9 FISHERIES

The Proposed Actions alternative would have the greatest long-term, adverse impact to fish, including the largest loss of essential fish habitat (EFH) (see Table 5-12). It would also result in the greatest indirect effects to fish due to increased surface water contamination and less infiltration to, and treatment by, groundwater. The Proposed Actions alternative would create an impediment to fish movement in Jordan Creek due to the unlighted connection of existing culverts. Fish passage in Duck Creek would be improved by relocation and lining of the channel. Short-term construction impacts related to these actions would be separated spatially and would not compound other construction impacts from the perspective of the fish resource.

The net accumulation of past and current development on and near the Airport, particularly along Duck and Jordan Creeks, has resulted in substantial loss of freshwater and estuarine EFH, reduction in fish habitat quality, increased risk of fish injury and death due to contamination, and impediments to fish movement. The natural process of isostatic rebound has also contributed to loss of estuarine EFH and has perhaps exacerbated fish access problems in lower Duck Creek. Alternatively, recent DIPAC operations include annual releases of millions of juvenile hatchery salmon that compete with wild salmon, at least during a few weeks annually, for limited estuarine rearing habitats. Hatchery adults may also compete with wild adults for holding space, spawning habitat, and mates – especially in small streams like Duck and Jordan creeks. (Because DIPAC fish originate from local stocks, their overall influence may be minor, but they remain products of

Table 5-12. Summary of Combined EFH Reduction

Proposed Projects Alternative	Acres EFH Lost
RSA 5D: Runway Safety Area	39.8
NAV-2B: Navigation (MALSR)	0.7
SREF-3B1: Snow Removal Equipment Facility	1.6
FF-1: Fuel Farm Road	0.0
FW/RW-2: Aviation Facilities	12.4
Proposed Wildlife Hazard Management Actions	13.5
Total Acres of EFH Lost	**68.0**

Source: SWCA, Inc. 2004

human rather than natural genetic selection.) Finally, although difficult to assess independent of natural variability, management and harvest may have contributed to reductions in abundance of some fish populations.

Present and foreseeable future actions that may cumulatively adversely affect the fish resource include continued fishery management and harvest, continued releases and returns of DIPAC hatchery fish, and most human development along the estuary and within the drainage basins of the Mendenhall River, Duck Creek, and Jordan Creek. One exception is that actions related to the upper Duck Creek watershed enhancements will tend to improve habitat quality and access for salmon within Duck Creek (Koski and Lorenz 1999). These improvements should increase the number of fish using Duck Creek, but may be offset or overshadowed by habitat and access losses related to other development in the basin. Actions proposed at the Airport are mostly consistent with the Duck Creek Watershed Management Plan, in that they tend to discourage salmon from lingering near the mouth of Duck Creek and encourage them to move through this reach more efficiently. While DIPAC has discontinued their pink salmon program as of 2002, releases of chum, coho, and chinook salmon into Gastineau Channel are likely to continue into the foreseeable future (Rick Focht, DIPAC, pers. comm. November 2002).

Overall, restoration efforts and application of improved management practices (e.g., stream-simulation culverts and stream buffers) would improve fish habitat and access into the streams. It is reasonable to assume that the Refuge will continue to protect estuarine EFH. However, increased development, combined with glacial uplift, will cause a long-term reduction in estuarine EFH and increase the risk of fish injury due to contaminants.

5.5.10 WILDLIFE

Table 5-10, shown in Section 5.5.7, summarizes direct impacts to key vegetation types for each activity within the Proposed Actions alternative. These vegetation types can also be considered key wildlife habitats for the same reasons, (i.e., based on their relative rarity in southeast Alaska [estuarine low and high marsh], their species diversity [supratidal], or the habitat diversity they

confer to a landscape otherwise dominated by intertidal wetlands [forest]). The Proposed Actions alternative would result in combined losses of 17.3 acres (2.6%) and 28.0 acres (2.9%) of low and high marsh from the landscape area, respectively.

Table 5-4 highlights the key projects adversely affecting wildlife habitat in the area. Past and ongoing development projects have eliminated high value habitat in some areas and converted high value habitat to lesser value habitat in other areas. Past, present, and reasonably foreseeable actions have reduced and will continue to reduce estuarine marsh, supratidal meadow, and woodland habitats from the landscape area. These effects are likely to have adverse consequences on high-interest species including Vancouver Canada geese, shorebirds, bald eagles, other raptors, and songbirds. It is unlikely that these habitat changes would result in substantive impacts to terrestrial mammals such as black bear and Sitka black-tailed deer.

To the extent that cumulative losses in estuarine marsh habitats adversely affect populations of forage fish, they may confer adverse, indirect effects on the threatened Steller sea lion and endangered humpback whale, which depend on these species for food. While such effects would be unlikely to have a substantive influence on sea lion and whale populations, they could cause shifts in the distribution and abundance of these species in the landscape area and surrounding coastal waters.

Alaska Glacier Seafoods has applied for permits to develop a commercial seafood processing and handling facility at the approximate intersection of Auk Nu Cove and Auke Bay, approximately 3-4 miles west of the Airport. This type of facility would generate fish waste that can attract large numbers of gulls and other birds, potentially creating a hazard to aircraft departing to or approaching JNU from the west. According to correspondence received from the Alaska Glacier Seafoods consulting engineers, fish waste would be ground up inside a processing building and loaded into sealed Fish Tote containers. The containers would be transported once per week via boat to a deep sea disposal area located approximately 1 mile off-shore from Portland Island or the west side of Douglas Island (M. Pusich 2002). This method of waste handling and disposal should reduce bird attraction to the facility and minimize cumulative hazards to aircraft.

5.5.11 Cultural Resources

Cultural resource sites have been affected by development projects in and around the Airport. Examination of historical photographs and aerial photographs as well as review of existing archival materials and informant interviews indicate that cultural resources from both the ethnographic and historical periods of the area were once located on the Airport. In particular, informant interviews indicate that a smokehouse operated by local Native Alaskan inhabitants was formerly located in the vicinity of Duck Creek. This facility was purportedly purchased and demolished by the federal government as part of the development of the Airport for military purposes during World War II.

Other historical resources, such as the World War II-era military facilities in the Duck Creek area, where portions of the Army Air Corps large encampment were located, have themselves been eliminated by subsequent development of the current fuel farm and by commercial and residential development off of Airport property. Military bunkers along the south boundary of the Airport

have been eliminated by the development of the dike and Float Plane Pond, and construction of new runways and taxiways during the 1960s and 1980s has eliminated most of the remaining segments of the original 1940s runway. Additional, on-site construction of new hangars and other buildings has resulted in the demolition of historical buildings on the Airport. Table 5-4 summarizes these known past impacts.

Other, undocumented disturbance to or loss of cultural resources on and near the Airport may have occurred. Much of the development work in the area occurred prior to the implementation of legislation mandating the assessment of potential impacts to cultural resources prior to site work. Therefore, it is believed that no cultural resource investigations have been carried out on the Airport prior to the investigations conducted in preparation of this EIS, and it is unknown whether cultural resources other than those identified above have been disturbed or destroyed. Given the nature of the depositional environment and known historical uses of the area by native inhabitants, the potential for such additional resources to have been impacted is high.

At present, no known historical properties (cultural resources that are eligible for the National Register of Historic Places) are located in any of the areas that may be disturbed by implementation of any of the Action alternatives in this EIS. It is possible that subsurface resources, those not available for visual identification and assessment during a standard pedestrian inventory, may be present within these proposed development areas. Archaeological monitoring during ground disturbance or subsurface archaeological testing prior to project-related ground disturbance could help mitigate any such inadvertent impacts.

Many of the areas that could be affected by those reasonably foreseeable future actions identified in Table 5-3 have neither been inspected for the presence of cultural resources in preparation for the foreseeable future actions, nor been inspected during previous studies. As such, it is impossible to know what impacts these undertakings may have on cultural resources, though the likelihood of cultural resources, particularly subsurface resources, being located within some areas such as Auke Bay, Auke Nu Cove, and along major drainages (such as the Mendenhall River and Duck Creek) is moderate to high. The cumulative effect of impacts to cultural resources cannot be estimated, but it is reasonable to assume that development in such locations will continue to cause irretrievable losses of historically or culturally important resources. The significance of such impacts could not be determined until discovery of such a site is made and the site is described and evaluated for historic eligibility.

5.5.12 VISUAL RESOURCES

The visual character of the area on and near JNU has undergone major change since development of the Airport. Continued changes to visual resources would result from other planned or foreseeable development on lands within JNU or on lands adjacent to or within the vicinity of JNU. Construction and operation of the projects in the Proposed Actions alternative would change the character of the landscape within the vicinity of JNU. It would also visually expose some new features to residents living south and east of the Airport, to travelers on Egan Drive, and to recreationists using the Dike Trail and Refuge. Regardless of the mitigation applied, the cumulative impact of the Proposed Actions alternative would be to degrade the visual quality of the landscape.

Past development in the Mendenhall River watershed and near the Airport has substantially altered the visual character of the area from its pre-development condition. The changes are evident at the local scale, where development has changed the visual landscape from a natural condition to one containing roads, buildings, vehicles and other signs of urbanization. These changes are less notable in the surrounding area, given the Airport's proximity to the Coastal Range, Gastineau Channel, and other natural features that remain relatively unblemished.

It is expected that the viewshed will continue to change in the foreseeable future as a result of new housing, roads, and industrial development. The proposed improvements to the Egan Drive and Yandukin intersection could result in the removal of trees from the north side of Miller-Honsinger Pond, which provide a visual screen for motorists and residents. The construction of an additional bridge crossing from the mainland to Douglas Island in the vicinity of JNU would have major effects on visual quality. The introduction of a bridge and roadway into a relatively natural setting would produce negative visual impacts for viewers from the Dike Trail and from residences with differing vantage points. In addition, industrial and residential development within the Mendenhall area continues to encroach upon the relatively natural setting of the landscape that surrounds JNU. The cumulative effect of this development would have negative effects on the visual setting of the landscape. Road and building construction would segment and isolate remaining natural areas within the development area boundaries, and the irretrievable loss of natural landscape would continue.

5.5.13 Department of Transportation Section 4(f) Lands

Two DOT Section 4(f) lands, the Refuge and Dike Trail, have been identified that would be affected by one or more of the various alternatives. Table 5-13 summaries the predicted impacts on DOT Section 4(f) lands resulting from the Proposed Actions alternative. No DOT Section 6(f) lands would be affected.

Table 5-13. Summary of DOT Section 4(f) Lands Impacts

Proposed Projects Alternative	Refuge		Dike Trail	
	Land Acquisition	Constructive Use	Land Acquisition	Constructive Use
RSA-5E: Runway Safety Area	Yes	No	Yes	No
NAV-2B: Navigation (MALSR)	Yes	No	No	No
SREF-3B1: Snow Removal Equipment Facility	No	No	No	No
FF-1: Fuel Farm Road	No	No	No	No
FW/RW-2: Aviation Facilities	No	No	Yes	No
Proposed Wildlife Hazard Management Actions	Yes	No	No	No

[1] Land Acquisition: Land purchase or easement use, direct disturbance of the DOT Section 4(f) land.
[2] Constructive Use = Occurs when the proximity of the project to the DOT Section 4(f) land substantially impairs the established or designated uses of the DOT Section 4(f) land (refers only to transportation projects).

Past actions are not relevant to a cumulative effects analysis of the two DOT Section 4(f) lands, as both the Refuge and the Dike Trail have remained relatively intact since their establishment. Reasonably foreseeable future actions are not anticipated to materially affect the Dike Trail. However, some area development and specific projects could affect the Refuge. A new crossing to Douglas Island would affect wetlands, vegetation, and potentially other features of the Refuge if a bridge were installed on the Refuge. A crossing adjacent or proximal to the Refuge could affect attributes such as visual quality, hunting, and recreation. New intersections or expanded road right-of-way emplacements for the Egan Drive improvements could have both direct and indirect impacts on the Refuge. These and other area developments could continue to erode the land base of the Refuge and cumulatively affect attributes important to its habitat and function.

Another potential impact to the Refuge is the slow accretion of tidal lands. It is unclear whether new tidal lands adjacent to the Refuge would become part of the Refuge or if private or federal entities would be entitled to these lands. Acquisition of accreted lands could help to compensate for other losses in the Refuge land base.

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