- ***Fill On-Airport Wetlands to Above High Tide Mark.*** The area considered for fill extends from the northern property boundary, west of Duck Creek, to the westernmost property boundary at the southernmost point adjacent to the Mendenhall River at low tide. Filled areas would be covered with riprap, or revegetated with species undesirable to most wildlife[18]. Inherent to this action would be relocation of Duck Creek to the north (see Section 2.5.2.4). The wetland fill could also be considered in conjunction with, or as a connected action to, construction of an additional RSA on the west approach.
- ***Selectively Fill and Regrade Wetlands on Airport West of Runway.*** This option would include the placement of some fill of wetlands on the west area of the Airport, but on a selective basis to reshape the existing landscape. Some areas would be dredged, to lower elevation, and others filled or graded. The intent of these actions would be to eliminate swales and depressions, create a free draining surface, and develop a more effective system for tidal drainage. Filled areas would be covered with fill and revegetated, and riprap placed on steeper slopes.
- ***No Action.*** This option would result in no changes to the wetlands west of the runway and emergency vehicle access road. As a result, an increase in the amount of wildlife hazing and harassment could be necessary.

2.5.3.3 Birds Attracted to Wetlands West of Airport Property on the Refuge

As mentioned in the above discussion, the extensive wetlands on and near Airport property attract a variety and abundance of birds. The wetlands just outside and west of the Airport are problematic, because of their proximity to the runway, and because they are alternately exposed and covered during the course of the day as tides fluctuate. Aircraft departing to the west and landing to the east pass over this intertidal wetland habitat at low elevations, increasing the risk of aircraft-bird collision. The area considered is part of the Refuge. All options for managing this hazard are included as components of the Wildlife Hazard Management alternatives; none are eliminated from detailed environmental analysis (see Section 2.9). The options include:

- ***Fill of Wetlands on Refuge West of JNU.*** Filling Refuge wetlands would reduce the potential for bird strikes to aircraft taking off to, or landing from, the west. This surface would be filled with material from the Float Plane Pond and covered in riprap, or possibly revegetated with plant species unattractive to wildlife of concern. This action could be taken in conjunction with the development of an additional RSA for Runway end 08.
- ***Selectively Fill Wetlands on Refuge West of JNU.*** This alternative would also involve fill of Refuge lands, but on a selective basis. Areas which pond rain water or tidal water would be filled using, to the extent possible, material borrowed from adjacent areas. This could involve dredging material from locations near the Mendenhall River edge and moving it into the low areas. Other, smaller channels may be created to facilitate tidal drainage. Fill would be imported from the Float Plane Pond as needed.

18. Vegetation species "undesirable" to most wildlife were not identified in the WHMP, and a study could be needed involving small plots of different species to monitor wildlife use.

- ***No Action.*** This option would result in no changes to the habitat west of Runway 08, off of Airport property.

2.5.3.4 Birds Feeding on Fish Staging at the Mouth of Duck Creek

The wildlife hazard assessment (USDA 2001) noted that anadromous fish have difficulty passing into or out of Duck Creek, particularly at low tides, because of several depressions along the mouth of the creek where it enters the Mendenhall River (CBJ 2001). According to USDA personnel, fish delayed in this area and carcasses stranded by low water levels attract large numbers of eagles, waterfowl, gulls, and herons, and the wildlife hazard assessment includes corvids as birds of concern. All options for managing this hazard are included as components of the Wildlife Hazard Management alternatives; none are eliminated from detailed environmental analysis (see Section 2.9). The options include:

- ***Relocate Mouth of Duck Creek Away From Runway.*** The mouth of Duck Creek would be relocated to the northern property boundary to shift the focus of bird activity upstream in the Mendenhall River. A new channel would be designed that would facilitate fish passage through the creek, and also flush fish carcasses out of the creek and into the river. Duck Creek relocation could also take place, in conjunction with other aviation facility development actions, as described in FW/RW-2.
- ***Relocate Limited Reach of Duck Creek.*** This option would involve relocation of only that portion of Duck Creek extending from Radcliffe Road (near the beginning of the Dike Trail) to the Mendenhall River. Duck Creek would be straightened somewhat so that it flows west to northwest, discharging at approximately the southwest corner of the former Gute property, as described in FW/RW-1.
- ***No Action.*** This option would result in no changes to the mouth or channel of Duck Creek.

The effects of Duck Creek relocation are evaluated in Chapter 4, but a decision on this action must also take into account other facility developments, including possible extension of the RSA and development of the northwest aviation area (FW/RW-1 and FW/RW-2).

2.5.3.5 Birds Attracted to Surface Water Conveyances on Airport

Many bird species are attracted to drainage areas around the Airport. Of particular concern at JNU are waterfowl and wading birds such as the great blue heron. Two separate incidents at JNU involving great blue heron ingestion into a B737-400 aircraft engine and subsequent engine shutdown illustrate the hazards presented by wading birds in the vicinity of the runways. Birds are attracted to water in these areas, as well as to forage for vertebrate and invertebrate food sources. Additionally, these areas are difficult to mow and could become choked with vegetation that succeeds into woody growth, providing perching sites. It is important for wildlife hazard abatement to maintain these drainage areas in a manner that minimizes the surface area of the water and allows for drainage as rapidly as practical. Four of the five options for managing hazards in this area are included as components of the Wildlife Hazard Management alternatives, and one is eliminated from detailed environmental analysis (see Section 2.9).

- ***Convert Drainage Ditches into Underground Drains.*** Drainages immediately adjacent to runways or taxiways would be reconstructed to direct water below the surface through surface drainage inlets, eliminating standing water that serves as an attractant to birds. The ditches would be covered in asphalt or artificial turf product.
- ***Regrade and Line Ditches with Artificial Turf.*** Existing surface water conveyances would be regraded to improve drainage, eliminating the ponding that attracts waterfowl and other birds and wildlife. These existing conveyances would be covered with a synthetic material that prohibits vegetation growth, thereby eliminating the grass that would provide cover for loafing and food sources.
- ***Regrade Ditches and Manage Vegetation.*** The ditches could be regraded to prevent ponding water, while maintaining a vegetative cover. However, the grass would be actively managed, as was described in an option for infield grass modifications. For example, vegetative cover could be allowed to grow for most of the season, reducing bird accessibility to worms and insects.
- ***Install Barrier/Grid Systems.*** Another method of wildlife management would be to install a wire barrier/grid system over the surface water drainages. This material would prevent birds from landing in the ponded water or feeding along the ditches. A concern associated with this option is that aircraft can become tangled in or damaged by a barrier or grid system. A barrier system could also impede the ability to use the ditches for snow deposition. Because of the concerns with aircraft damage, and location of the ditches within or adjacent to the RSA, this option is not prudent for application on the float plane ponds or stormwater ditches. (However, USDA has suggested it could have limited application over portions of Jordan Creek within the airfield, although no specific actions for Jordan Creek other than the small dam south of the runway were identified in the WHMP.)
- ***No Action.*** Under this option, no habitat modification would take place.

2.5.3.6 BIRDS ATTRACTED TO SWALES THAT COLLECT RAINWATER/RUNOFF

A variety of potentially hazardous bird species are periodically attracted to rainwater runoff ponding on paved areas, such as runways, taxiways, and aprons. The wildlife hazard assessment for JNU suggested that eagles, gulls, ravens, and crows will use these relatively small areas of ponded water for drinking and bathing (USDA 2001). Worms congregate in higher numbers here as well, thereby making the swales an attractive feeding location. All options for managing this hazard are included as components of the Wildlife Hazard Management alternatives; none are eliminated from detailed environmental analysis (see Section 2.9). The options include:

- Remove Swales and Areas along Pavement Edges that Collect Water, and Regrade and Pave. The lone habitat modification identified is to change the slope of these areas so water is not left standing. This would be accomplished through re-grading, preferably in conjunction with the option to eliminate infield vegetation. Regraded areas would be paved.
- No Action. Under this option, no habitat modification would take place.

2.5.3.7 WATERFOWL FEEDING ON FLOAT PLANE POND VEGETATION

Ducks and other waterfowl feed on aquatic vegetation growing in the Float Plane Pond, particularly the pond "fingers" not used for aviation. Waterfowl arriving at or leaving these areas present a hazard to aviation by crossing flight paths at low elevation. Three of the six options for managing this hazard are included as components of the Wildlife Hazard Management alternatives, and three are eliminated from detailed environmental analysis (see Section 2.9). All of the options other than the No Action for the Float Plane Pond that are carried forward would require continued maintenance, either to keep the repellents in place (screens, spheres, etc.) or to manage the new habitat (filling of pond fingers or removal of vegetation). Combinations of these actions could also be considered.

- ***Mechanically Remove Vegetation from Float Plane Pond.*** One option would be to remove the food source attracting birds by dredging vegetation from the bottom of the Float Plane Pond. Dredging would also temporarily remove mollusks, another food source of diving ducks, although sediment disturbance could result in rapid mollusk recolonization and possibly spread populations to other areas of the ponds. It is unclear whether deepening of the ponds (as would happen with dredging for fill material) would reduce or eliminate mollusk populations, although making the ponds substantially deeper may prevent ducks from feeding on bottom food sources. Dredging would probably be conducted in association with sediment removal for fill to be used in approved infrastructure projects, such as RSA construction. The near-shore slopes in the Float Plane Pond are covered with aquatic vegetation that attracts bird and also can entangle aircraft. Unfortunately slopes adjacent to the Pond can be steep and dredging may be difficult. Other means of vegetation removal could have to be used in these areas.
- ***Eliminate Vegetation Using Herbicides***. One option to prevent waterfowl from feeding in the Float Plane Pond would be to use herbicides to eliminate their primary food resource, aquatic vegetation. The significant concerns with herbicide use include potential impacts on other plant and wildlife species, degradation of water quality, and potential bioaccumulation of chemicals. The environmental uncertainties associated with herbicide use suggest it is not a prudent alternative for the Float Plane Pond. It is therefore dropped from further consideration and is not incorporated into any of the wildlife hazard alternatives.
- ***Use of Screens to Prevent Birds from Landing on Ponds***. An option that may prevent birds from landing on the float plane ponds is the use of a mesh or screen material. The mesh would not affect water chemistry (as sunlight and oxygen would not be impeded) but birds would not be able to land on the water. Unfortunately, the water could still provide a visual attractant to the birds, and upon landing they may become entangled. It is also possible that through time, waterfowl may learn to stay away from the screened areas. Screens could not be employed in areas of the float plane ponds where aircraft operate. They would also be very difficult to maintain, given the snow and ice that can build up at JNU, and to keep stabilized in wind. This alternative is not feasible for implementation on areas near an active runway. For these reasons screens were dropped from further consideration and are not incorporated into any of the wildlife hazard alternatives.

- ***Use of HDPE Spheres or Pillows to Reduce Plant Growth and Prevent Waterfowl Landing***. To deter waterfowl from landing, the ponds would be covered entirely with high density polyethylene (HDPE) spheres or pillows. The spheres have been extensively used and applied in other industries to keep waterfowl out of industrial ponds. The pillows are larger than the spheres. By partially filling the spheres or pillows they are much less susceptible to wind movement. Birds will not land on the spheres, and even if they land on the pillows they would not be able to access water underneath. These products would have the added benefit of limiting sunlight that reaches pond bottoms. This would in turn reduce growth of ditch grass and other aquatic vegetation preferred by waterfowl. Unfortunately, these products are not conducive to use in a climate such as JNUs, where the frequent freeze-thaw actions would quickly degrade the material. In addition, FAA and the Airport have concerns about the products being carried into the float plane runway. Because of the potential aviation hazards and concerns over how well the products would hold up in the Juneau climate, this option is eliminated from further consideration.
- ***Fill Float Plane Pond Fingers***. The fingers of the Float Plane Pond (i.e., the southern extensions of the pond) provide shelter and food for waterfowl and for a reportedly growing population of otter. These fingers do not support aircraft traffic, so there is little wildlife disturbance, except during hunting season. One option to reduce the waterfowl food source and habitat for otter is to fill in the ponds. This would greatly reduce the area attractiveness to otter and waterfowl, although it could attract other bird species, small mammals and deer.
- ***No Action***. As described for other hazards, no changes to the habitat would occur.

2.5.3.8 Birds Feeding on Fish at Mouth of Jordan Creek

During periods of time when fish are gathered at the mouth of Jordan Creek, several bird species are attracted to the area. A small dam and pool has developed at this discharge point due to the hydrologic changes caused by the culvert under the runway. Because of the location of the structure relative to the runway, this attraction poses a threat to safe aircraft operations. Although the alternatives for construction of a RSA on the south side of the runway would eliminate this problem, stand-alone wildlife hazard management options are considered here to avoid prejudicing one RSA alternative over another. Two of the four options for managing this hazard are included as components of the Wildlife Hazard Management alternatives, and two are eliminated from detailed environmental analysis (see Section 2.9). Options to abate this hazard include the following:

- ***Remove Dam at Mouth of Jordan Creek***. Removal of the dam at the mouth of Jordan Creek would eliminate the small pond where fish pool and birds congregate. This option could have to be repeated periodically because of the existing culvert configuration.
- ***Relocate Discharge Point***. Relocation of the Jordan Creek discharge farther from the runway would reduce the likelihood of foraging birds coming in contact with aircraft movements. This option could take place independently or in conjunction with construction of the lateral RSA. This action would entail installation of a new culvert system under the runway and RSA, or at least connection of additional culvert to the existing system. Because this action has little practical value without expansion of the RSA it is dropped from further evaluation.

- ***Install Wire Grids as Barriers***. Wire grids could be placed over the area of concern to prevent birds from feeding on schooling fish, precluding the need for relocation of the discharge point or removal of the dam. A grid system would be impossible to maintain, however, considering the extent of tidal fluctuations and ice development in this area. This option is considered not feasible and is dropped from further consideration.
- ***No Action***. Under this option, no habitat modification would take place.

2.5.3.9 WOODLAND HABITAT PROVIDING PERCH AND NEST SITES AND WILDLIFE COVER

The woodland habitat south of the Float Plane Pond supports a wide variety of bird and wildlife species. Most of the bird species are songbirds, and songbirds do not pose a great risk to aviation safety due to their relatively light mass and secretive behaviors that do not place them in conflict with aircraft flight patterns. However, northwestern crows, common ravens, great blue herons, and bald eagles have all been observed nesting, roosting, or loafing in this wooded area. These birds are of a size or are in numbers capable of damaging aircraft. Crows have established a rookery in one portion of the wooded area (although it may no longer be active) and eagles have frequently nested in the area. In addition, Sitka deer have been seen using this woodland and crossing active runways to forage or access other areas, and the river otters in the area have increased in number. The Airport has noticed that the shoreline provides habitat for a growing otter population, estimated by JNU staff to have grown from 2 to possibly 12 individuals in the past few years. Airport personnel also believe that the trees offer a cover to birds after they have been hazed from other Airport locations.

The WHMP does not offer a recommended habitat modification option for this area and instead calls for a series of information-gathering steps, including a study to determine 1) whether the woodland serves as a barrier to bird movement between JNU and the surrounding refuge, and 2) what, if any, management or habitat modification steps should be implemented. According to the WHMP, JNU will:

- Through the EIS, evaluate alternatives to address the wildlife hazard attractants associated with the woodland and assess resultant environmental impacts.
- Consult with the FWS with regard to JNU's options for habitat management and wildlife harassment in areas within close proximity to a bald eagle nest on JNU property.
- Request scientific information from the National Wildlife Research Center (NWRC) regarding whether trees around airports can "promote bird deterrence."
- Request of the FWS and NWRC a sample study protocol designed to test the premise that the woodland serves as a barrier to bird movement between JNU and the Refuge.

The Airport has completed some of these steps. Consultation with the NWRC indicates there is no information publicly available to suggest that the trees may serve as a barrier and promote bird deterrence (USDA 2003). JNU submitted a request to the FWS for additional literature review and a study protocol to test whether the woodland serves as a barrier to bird movement. However, FWS deferred to the NWRC findings (that there is no evidence of trees either deterring or encouraging bird use near airports) and decided not to conduct further literature reviews on the topic

(FWS 2003). In the interim, until or if FAA signs a record of decision for additional habitat modification, JNU will continue to harass hazardous wildlife found using the woodland, and monitor and document results of wildlife hazard management activities.

This EIS provides an evaluation of the impacts associated with the habitat management actions listed below. It is recognized that ongoing data collection by JNU and consultation with wildlife experts at FWS and the NWRC would provide information relevant to the assessment of these actions. As information becomes available for the EIS, it will be incorporated into the analysis, and factored into FAA's environmental review decisions stemming from this EIS. Four of the five options for managing this hazard are included as components of the Wildlife Hazard Management alternatives; one is eliminated from detailed environmental analysis (see Section 2.9). The options include:

- ***Cut and Remove*** All Trees in the Float Plane Pond Woodlands. All forested habitat (unless otherwise restricted by the Bald and Golden Eagle Protection Act) in the Float Plane Pond Woodlands on the south side of the Airport would be removed. The trees would be cut and removed from the area to eliminate their attraction to wildlife of particular hazard to aircraft, such as eagles, corvids, and deer. Downed vegetation would be properly disposed at the Airport Manager's/Contractor's discretion. JNU has decided not to propose cutting the entire woodland. As there is no proponent for this option and it is not considered necessary at this time to control the wildlife species of concern, it is dropped from further analysis.
- ***Selectively Thin Trees and Clear Understory***. Removal of some trees, to increase the spacing between trees (selective thinning), and removal of all brush and understory would reduce cover for large mammals and waterfowl. This effort would likely help to reduce attractiveness of the area to some problem species such as crows and ravens, and reduce potential for recolonization of historic crow rookeries in the woodlands.
- ***Remove Corvid Nests***. A more limited option would be to periodically remove corvid nests from the woodlands, either eliminating the rookeries or at least reducing the numbers of breeding birds
- ***Install Deer Fence***. Because the woodlands (if left in place) would continue to provide good forage and cover for deer or other large mammals, a fence could be installed along the north side of the dike from the existing fence on the west end to the existing fence on the east end. Gates for staff and emergency vehicle ingress/egress would need to be installed at select locations. It has been suggested that a fence installed around the entire Airport perimeter would help to keep large mammals out of the woodlands and off the runway and airfield. FAA concurs that it is desirable to fence the entire Airport; however, it is not feasible because of the highly variable intertidal conditions on some portions of the Airport boundary. A fence could not be installed that would stand up to the pressures and erosional forces caused by ice and debris movement during tidal changes.
- ***No Action***. No habitat modification would take place under the no action option.

2.5.3.10 USE OF AIRFIELD EQUIPMENT AS BIRD PERCHES

Bald eagles and other birds perch on a variety of airfield equipment, including the RCO antennae, wind anemometers, and Runway 08 MALSR. Some of this equipment, such as the MALSR, is directly in the flight path of incoming and outgoing aircraft. Past attempts to prevent eagle perching have not been fully successful, as the eagles have damaged the exclusion devices. The WHMP recommends installation of more and better bird exclusion devices on airfield equipment. A specific design has not been selected, but Airport staff plan to test various types prior to full implementation. The exclusion devices would be designed and used in a manner that minimizes risk of injury to the targeted species. The Airport staff would be responsible for placing the devices on airfield and near-airfield equipment.

Upon consideration of this specific wildlife hazard, it was determined that there is no habitat modification associated with exclusion devices as long as 1) they do not result in injury to eagles, and 2) there is no additional ground disturbance needed to access the equipment used as perches. As a consequence, this EIS does not include an evaluation of environmental impacts associated with this action.

2.5.3.11 WILDLIFE MANAGEMENT AND ACTIVE CONTROL TECHNIQUES

As noted in the introduction to Section 2.5, more effort directed at habitat modification to prevent wildlife use can reduce the amount of work needed to actively manage wildlife. The reverse is also true: the less effort directed at making habitat and Airport facilities unattractive to wildlife, the more day-to-day wildlife management will be needed. And, while habitat modifications can require high-capital expenditures, wildlife hazard management practices involving more staff and supplies may cost as much or more when considered in the long term. One advantage of active wildlife management is that there are typically fewer environmental impacts associated with habitat alteration or loss. Active wildlife management or wildlife control is essentially the use of a variety of tools to harass birds and wildlife away from an area. Generally, these tools are used interactively with habitat modifications and in escalating fashion to improve effectiveness and reduce habituation. Wildlife control activities would be an integral part of any action approved by FAA at JNU, but one of the alternatives listed in Section 2.5.5 and described in Section 2.9.3 relies heavily on day-to-day hazard management involving greater use of control methods.

2.5.4 EVALUATION OF RISKS AND BENEFITS

To weigh the potential benefits of implementing various management objectives, it is useful to view each in terms of operational risk. At this time, no standard methodology for calculating absolute wildlife strike risk has been proposed or approved for application at civil airports. Several risk models have been developed by the U.S. Air Force for assisting air crews in identifying seasonal hot spots of bird activity, and a few local risk models have been developed following several years of intensive data collection with radar and other remote-sensing technologies. While calculating the actual probability of a bird strike at JNU is not possible with available data, it is possible to establish a measure of the *relative* risk presented by the various bird species identified during the on-site surveys. The value of this risk assessment effort is that it provides another means to assess whether habitat modifications and hazard control technologies

are focusing on the species and habitats of most concern on or near the airfield. The challenge in preparing such a review is in the consideration of wildlife behavior, as databases on birdstrikes and species characteristics cannot accurately predict how wildlife will react at a specific airfield. The relative rankings prepared for this assessment combined with the habitat or risk zone maps for JNU are believed to be valuable tools in the assessment of alternatives. Most importantly, however, the observational data from the Airport (such as the USDA studies and surveys for the WHA, and additional work conducted for the EIS) form the basis for impact analysis and ultimately FAA's selection of alternatives to implement.

For the purpose of this analysis, operational risk is defined simply as a function of the probability of occurrence and the severity of outcome. Occurrence probability and outcome severity are derived from existing data sets from the USDA wildlife hazard assessment, the bird strike data for JNU, and the national bird strike data from the FAA. Other data that could have been used in this analysis, such as runway counts from regional airports or runway counts collected at JNU, were not available in the raw form needed for this model.[19]

USDA conducted 136 surveys for the wildlife hazard assessment. During each survey the species, species number, and flock sizes were noted. To estimate probability of occurrence for this risk assessment, the mean flock size was used. This weights the computation towards flocking species, which are generally of greater concern, due to the increased likelihood of a multiple strike. Also, this technique provides an estimate of how frequently flocking species were observed. Severity of outcome, or the possibility of a strike causing damage, is generally a function of the mass of the bird and the number of birds struck at any one time. Mean flock size was multiplied by mean weight in grams (Dunning 1994, BASH Team Data and records from the Smithsonian Institute). Where records showed that a species has sexual size dimorphism, the average mass of the larger sex was used. The resulting value is called Flock Risk.

Not all bird strikes cause significant damage. In fact, a high percentage of strikes, estimated at greater than 90%, result in little or no damage to the aircraft (FAA 2005a). To estimate the frequency of damage by species, the U.S. bird strike database was queried to determine how many strikes had been attributed to a given species, and then how often the strikes resulted in aircraft damage. Certain heavy-bodied species are known to damage aircraft more times than not, while some smaller species, such as swifts, are not known to have ever caused significant aircraft damage. Flock risk was multiplied by frequency of damage to arrive at a relative risk factor. These values were ranked and then normalized by dividing each by the maximum value to determine the relative relationship between each species. To make the values easier to read, each value was scaled (multiplied times 100), so that the species with the highest relative risk value was 100.

To account for species relatively common at JNU but rarely observed or struck across the nation, a penalty was assigned to species that had a reported strike history at JNU. This value was added rather than multiplied in an effort to not over-emphasize the local strike history because few bird

19. The Wildlife Hazard Assessment did provide some information, such as Figures 22 and 23, based on runway counts but without specific species correlation. The ranking of relative frequency of occurrence by species provided in the WHA could be used in the risk assessment but it would not enhance the qualitative value of the approach.

strikes have been officially reported at JNU over the past ten years. The penalty value was calculated by multiplying the number of reported strikes times the number of multiple strikes reported (with a default value of at least one if no multiples had been reported). This value was added to a damage value of 1, 5, or 10, which can be considered as low, moderate, and severe damage. Once the local penalties were added, the species were ranked by relative risk with the penalty added. Table 2-10 depicts the relative risk of the most commonly observed birds as documented in the wildlife hazard assessment for JNU.

The risk model developed for this analysis used the statistical robustness of the FAA bird strike database along with site-specific species observations and the local bird strike record. Because bird strikes are rare events relative to their nationwide distributions and densities, and reporting of bird strikes is not required, any empirical model will have anomalies. The process used for this EIS results in a simple ranking of species of concern based upon the frequency of observation and the damage they can cause.

It should be noted that this risk assessment methodology results in a few anomalies with regard to the relative risk posed by certain species. For instance, mallards are over three times more common in the JNU area than Canada geese but are ranked considerably lower due to their smaller mean flock size, lighter body mass, and lower proportion of damage to reported strikes in the national database. Conversely, the canvasback is relatively rare in the area but ranks as a riskier species than mallard due to the fact that the only reported strike for this species resulted in damage (100%) versus a 27% damage rate for mallards. The ranking for the American wigeon may be another anomaly. Although it is only common in the Juneau area during the spring and fall migratory periods, the wigeon is the species that ranks second in terms of wildlife risk to aircraft at JNU. Its high rank is due to 1) the large mean flock size resulting from a single observation of 233 individuals and 2) the fact that the three reported strikes with aircraft all resulted in damage. While the relatively small, short duration data set (136 surveys over one year) and the use of national strike statistics have resulted in some counterintuitive results, the ranking methodology uses an approach incorporating both local data and national strike statistics. This approach provides an objective means of understanding the relative risk posed by various bird species at JNU. Accordingly, this approach has been reviewed by an international group of bird-air-strike hazard specialists, all of whom generally agreed that it was an appropriate methodology for the purposes of this EIS, although each of the reviewers included comments and cautions about application of the method. Refer to Appendix B for a report on this review process.

In addition to the relative risk posed by various bird species, there are other important factors that should be considered when developing management strategies and assessing impacts and alternatives for JNU. One such factor is where on the Airport potentially hazardous species commonly occur, or where they are periodically attracted. Certain habitats, such as tidal sloughs, low marsh (particularly Lyngbye sedge-dominated areas), ditch grass, and open water are attractive to several high risk species. The areas of most concern are related to where aircraft are on the Airport and particularly where aircraft are in their most vulnerable phases of flight. Additionally, how potentially hazardous species move through the airspace relative to these aircraft movements also plays a role in developing and prioritizing management strategies. These bird movements are influenced by habitats and land uses well away from the Airport.

Table 2-10. Relative Risk Matrix for Bird Species found at JNU[1]

Species[2]	Abundance	Mean Flock Size	Weight	Risk Mean Flock Weight	Bird Counts (136 Surveys)	JNU Strikes Reported	JNU Strike Multiple	JNU Damage	U.S. Reported Strikes	U.S. Strikes Damage	U.S. % Damage	Flock Risk Norm/ Scale	Strike JNU Penalty	Risk w/ Relative Penalty
Canada Goose	621.00	16.00	3814.00	61024.00	4.57	1.00	1.00	5.00	286.00	153.00	0.53	100.00	6.00	100
American Widgeon	439.00	26.00	792.00	20592.00	3.23	0.00	0.00	0.00	3.00	3.00	1.00	63.08	0.00	60
Greater white-fronted Goose	4.00	4.00	2703.00	10812.00	0.03	0.00	0.00	0.00	1.00	1.00	1.00	33.12	0.00	31
Great Blue Heron	2.00	1.00	2576.00	2576.00	0.01	2.00	1.00	20.00	71.00	11.00	0.15	1.22	22.00	22
Northern Pintail	31.00	5.00	1035.00	5175.00	0.23	0.00	0.00	0.00	1.00	1.00	1.00	15.85	0.00	15
Lesser Scaup	110.00	6.00	850.00	5100.00	0.81	0.00	0.00	0.00	1.00	1.00	1.00	15.62	0.00	15
Canvasback	12.00	4.00	1248.00	4992.00	0.09	0.00	0.00	0.00	1.00	1.00	1.00	15.29	0.00	14
Mallard	2039.00	10.00	1082.00	10820.00	14.99	3.00	1.00	3.00	174.00	47.00	0.27	8.95	6.00	14
Green-winged Teal	322.00	11.00	364.00	4004.00	2.37	1.00	1.00	1.00	2.00	2.00	1.00	12.27	2.00	13
Mew Gull	493.00	5.00	432.00	2160.00	3.63	4.00	3.00	1.00	7.00	1.00	0.14	0.95	13.00	13
Common Merganser	23.00	2.00	1709.00	3418.00	0.17	0.00	0.00	0.00	1.00	1.00	1.00	10.47	0.00	10
Bald Eagle	134.00	1.00	5350.00	5350.00	0.99	2.00	1.00	1.00	23.00	8.00	0.35	5.70	3.00	8
Common Raven	319.00	2.00	1240.00	2480.00	2.35	1.00	1.00	1.00	6.00	1.00	0.17	1.27	2.00	3
Glaucous-winged Gull	185.00	2.00	1010.00	2020.00	1.36	0.00	0.00	0.00	9.00	4.00	0.44	2.75	0.00	3
Short-eared Owl	7.00	2.00	315.00	630.00	0.05	1.00	1.00	1.00	17.00	1.00	0.06	0.11	2.00	2
Western Sandpiper	269.00	24.00	23.00	552.00	1.98	1.00	1.00	1.00	1.00	0.00	0.00	0.00	2.00	2
Northwestern Crow	1100.00	6.00	415.00	2490.00	8.09	1.00	1.00	1.00	0.00	0.00	0.00	0.00	2.00	2
Tree Swallow	1.00	26.00	21.26	552.76	0.01	1.00	1.00	1.00	39.00	0.00	0.00	0.00	2.00	2
Semi Palmated Plover	0.00	0.00	56.00	0.00	0.00	1.00	1.00	1.00	4.00	0.00	0.00	0.00	2.00	2
Herring Gull	21.00	2.00	1226.00	2452.00	0.15	0.00	0.00	0.00	139.00	27.00	0.19	1.46	0.00	1
Ring-necked Duck	1.00	1.00	730.00	730.00	0.01	0.00	0.00	0.00	2.00	1.00	0.50	1.12	0.00	1

[1] Section 2.5.4 may be reviewed for an explanation of the factors used to determine relative risks to aviation at JNU posed by the species identified on this table. In summary, the estimate of biomass from surveys is based upon the mean flock size observed over the 136 observation periods multiplied by the average mass of the bird species. This value was then multiplied by the frequency of damage the species has had on aircraft over the past 10 years from the national bird strike database. The species with the maximum value from this computation was used to normalize all of the other computed values for the other species (all resulting values were divided by the maximum value of the highest rated species). These values were all multiplied by 100 to scale the values. A penalty was added to account for local reported bird strike history and to further weigh values towards those that have been struck at Juneau and have caused damage.

[2] Approximately 58 species were identified during the WHA. This table does not list the 37 species with the lowest relative risk factors.

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A risk zone map shown as Figure 2-21 was prepared to depict those areas on and around the Airport where movements of potentially hazardous bird species could result in a damaging strike. Areas marked A-1 include portions of the runway where aircraft rotate during takeoff (i.e., liftoff from the runway). This is the most critical phase of flight for a bird strike, since aircraft must at that point continue takeoff due to the lack of sufficient runway to safely stop. Additionally, aircraft departing the runway are in a high drag configuration, and lack altitude and airspeed that could otherwise provide time for a safe return to the Airport if sufficient damage is sustained. Hazardous bird species that pass through risk zone A-1 represent a serious bird strike risk. A-1 includes the entire active runway. The area marked A-2 includes the entire Float Plane Pond, which is also a runway, but ranks lower than the paved runway, because it does not service jet-powered aircraft. Unlike risk zone A-1, however, zone A-2 provides foraging habitat for diving ducks such as scaups and mergansers, which present some hazard to aircraft.

The areas marked B include areas adjacent to the active runways that have the potential to attract birds and wildlife, and would provide immediate access to areas A-1 and A-2. This area includes the habitat along the extended centerline of the runway for 5 miles, accounting for the angled approach and departure paths. Aircraft approaching the runway at a three-degree glide slope will be approximately 1,500 feet above ground level, at a distance of 5 miles from the runway end. Areas immediately adjacent to the runway, risk zone B are characterized by wildlife habitats including tidal sloughs, estuarine low marsh, Lyngbye sedge, and open water of the Mendenhall River, all of which provide habitat for high risk species such as geese and herons. Area B excludes industrial and commercially developed areas (except taxiways and ramps that do have a potential wildlife attraction).

Area C includes the remaining Airport property and habitats that are not immediately adjacent to runways but provide loafing, roosting, and feeding opportunities for various bird and wildlife species. For instance, the ditch grass habitat located in the fingers of the Float Plane Pond and the open water and Lyngbye sedge habitats along the lower portion of Jordan Creek (between Yandukin Drive and Taxiway A) both fall into risk zone C. While only a small portion of these habitats are immediately adjacent to aircraft movement areas, to the extent that hazardous species such as the great blue heron may travel between them by flying across the runway, habitats in zone C can still present considerable risks to aircraft.

Area D includes the remainder of habitat surrounding Airport property out to a range of 5 miles. The 5-mile radius is based on land-use concerns outlined in FAA Advisory Circular 150/5200-33 "*Hazardous Wildlife Attractants On or Near Airports.*" Area E includes habitats from 5 miles out to a distance of 10 miles.

Combining relative risk factors with the risk zone map and the location of habitats that tend to attract hazardous species provides a way to evaluate the potential impact of an action that would alter Airport habitat and to assess the relative value of a wildlife hazard reduction measure. While this process allows a means to rank these actions in terms of potential wildlife hazards, management strategies must also incorporate master planning objectives and costs associated with implementing wildlife control measures. Table 2-11 combines the bird risk values and airport risk zones for possible wildlife habitat modifications to assess potential impact on the wildlife hazard control program. This table adds the relative risk factors for the species anticipated to be affected by an

action and assigns a value of 1 to 10 for the risk zone where the action will occur. In this scheme, areas designated A-1 receive a value of 10; A-2 a value of 8; B a value of 7; C a value of 5; D a value of 3; and E a value of 2. These numbers are based upon the distance from the runway and the physical relationship to aircraft traffic patterns. It is possible that habitats at much greater distances from the runway influence bird movements across the Airport and create bird hazards that are of significant concern. However, since the Airport has little or no direct control of these areas, and these areas are not part of the proposed actions at the Airport, they are not included in this analysis.

2.5.5 WILDLIFE HAZARD MANAGEMENT PLAN (WHMP) ALTERNATIVES

Habitat modifications available to address each of the wildlife hazard assessment issues were identified in Section 2.5.3. Each option considered prudent and feasible, other than the No Action Alternative, has the potential to alleviate specific wildlife management concerns and achieve, at least in part, the hazard reduction objectives. The risk evaluation presented in Section 2.5.4 offers an acceptable method to assess the relative safety priority of the various locational and species objectives, as well as the potential benefits of each action and option. Using this information, the wildlife hazard management plan alternatives have been developed that address each of the hazard objectives. The alternatives are estimated to achieve varying degrees of hazard reduction based on the extent of habitat modification. It is reasonable to expect that wildlife control activities would increase with lesser habitat modification, so that JNU can effectively maintain risks to a level deemed acceptable. Therefore, one of the alternatives incorporates a greater degree of active wildlife hazard management using some of the control techniques identified in Section 2.5.1.2. The fourth alternative considered, the No Action, would continue the existing effort at wildlife hazard mitigation at JNU. Table 2-12 illustrates the individual components of each of the four alternatives.

- WH-1, Wildlife Hazard Management Plan Action – Most Habitat Modification.
- WH-2, Alternative 2 – Moderate Habitat Modification
- WH-3, Alternative 3 – Minor Habitat Modification and Adaptive Hazard Management Program
- WH-4, No Action – No Change in Habitat or Control Activities

These alternatives are evaluated for their environmental and social impacts in Chapter 4. The alternatives are not, however, mutually incompatible in that FAA may determine that the most appropriate means of achieving purpose and need would be to combine elements of the alternatives into a new wildlife hazard management plan.

Subsequent to preparation of the WHMP and in coordination with development of this EIS, Airport staff has continued to evaluate and refine the habitat modifications under consideration. The actions currently proposed by JNU that would alter wildlife habitat incorporate many elements from Alternative WH-1, but some actions have been dropped from JNU's proposal. Section 2.13 of this chapter describes the components of the above alternatives that are incorporated into the Airport's Proposed Action.

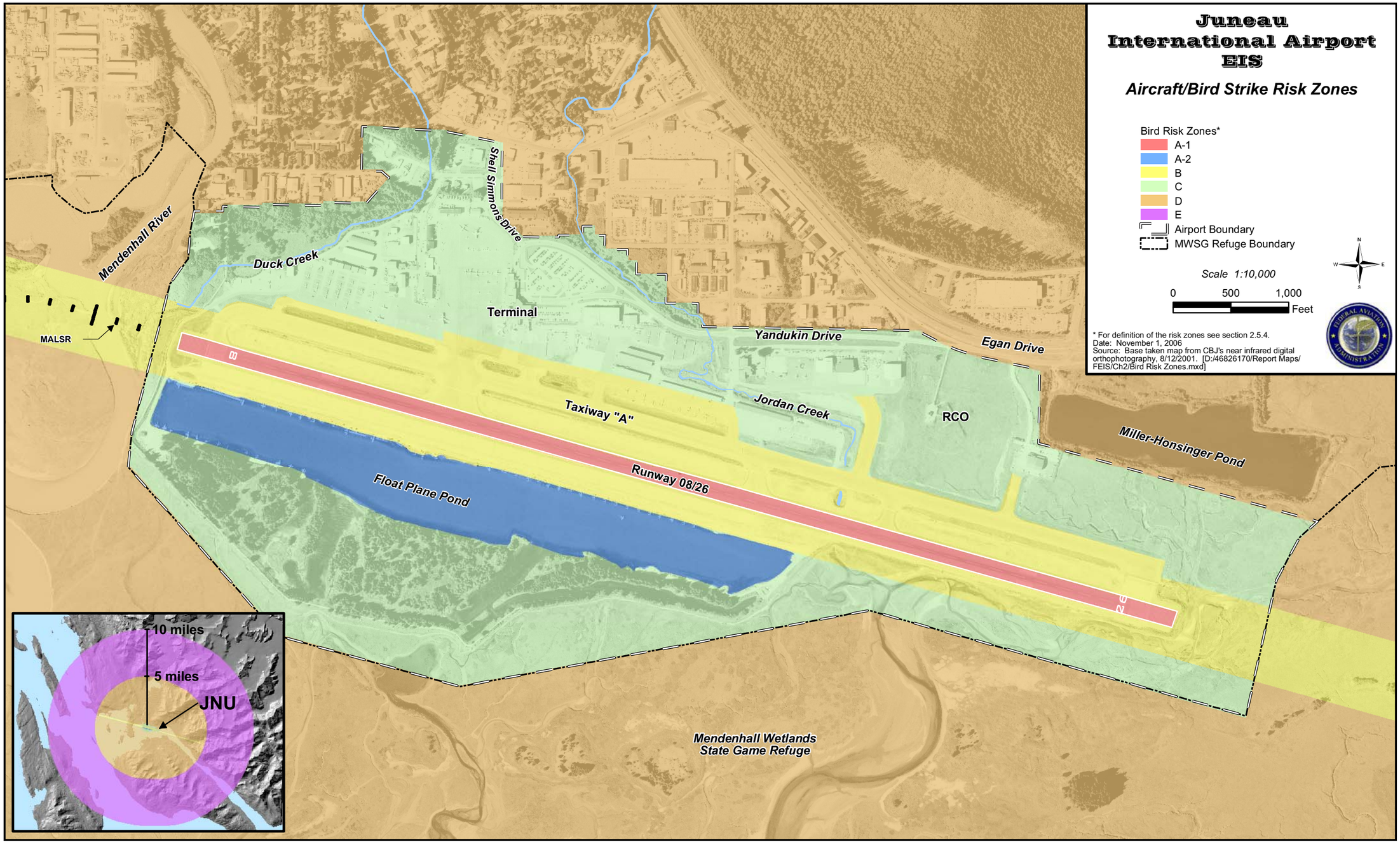

Figure 2-21. Aircraft/bird strike risk zone map.

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Table 2-11. Estimated Impacts of WHMP Actions and Alternatives on Wildlife Control*

WHMP Actions and Alternatives	Primary Species of Concern	Species Relative Risk[1]	Safety Zone[2]	Safety Zone Factor[3]	Risk Zone Value[4]	Safety Priority[5]	Degree of Improvement to Hazard Control
1. Birds Attracted to Vegetated Areas near Runways and Taxiways							
Eliminate infield turf by paving	Canada Goose/Gulls	113	B	7	791	A	Significant
Install artificial turf product	Canada Goose/Gulls	113	B	7	791	A	Significant
Alter mowing practices	Canada Goose/Gulls	113	B	7	791	A	Moderate
2. Birds Attracted to Wetlands on West Portion of Airport Property							
Fill target area to above high tide mark and level of NW Development Area, with gradual slope to Mendenhall River	Waterfowl/Herons/ shorebirds	184	B	7	1288	A	Moderate
Regrade area by selective dredging and filling to eliminate ponds, channels, create free draining surface	Waterfowl/Herons/ shorebirds	184	B	7	1288	A	Moderate
3. Birds Attracted to Wetlands West of Airport Property							
Fill target area to above high tide mark, with free draining slope to Mendenhall	Waterfowl/Herons/ shorebirds	184	B	7	1288	A	Moderate
Regrade area by selective dredging and filling to eliminate ponds and channels, create free draining surface	Waterfowl/Herons/ shorebirds	184	B	7	1288	A	Moderate
4. Birds Feeding on Fish at Mouth of Duck Creek							
Relocate Creek to north Airport property	Eagle/Gulls/Herons	43	B	7	301	A	Moderate
Relocate limited reach of Duck Creek from Radcliffe Road to Mendenhall River	Eagle/Gulls/Herons	43	B	7	301	A	Somewhat
5. Birds Attracted to Surface Water Conveyances							
Install underground drain pipes, fill ditches	Herons/Waterfowl	182	B	7	1274	A	Significant

Table 2-11. Estimated Impacts of WHMP Actions and Alternatives on Wildlife Control*, continued

WHMP Actions and Alternatives	Primary Species of Concern	Species Relative Risk[1]	Safety Zone[2]	Safety Zone Factor[3]	Risk Zone Value[4]	Safety Priority[5]	Degree of Improvement to Hazard Control
Regrade ditches and line with concrete or other synthetic material	Herons/Waterfowl	182	B	7	1274	A	Moderate
Regrade ditches to prevent standing water, manage vegetation	Herons/Waterfowl	182	B	7	1274	A	Moderate
6. Birds Attracted to Swales that Collect Rainwater							
Remove swales on pavement edges, regrade	Gulls	13	A-1	10	130	A	Significant
7. Ducks and Waterfowl Feeding on Float Plane Pond Vegetation							
Remove aquatic vegetation by dredging	Waterfowl	160	A-2	8	1280	B	Significant
Fill Float Plane Pond fingers	Waterfowl	160	A-2	8	1280	B	Significant
8. Birds Feeding on Fish at Mouth of Jordan Creek							
Remove Dam	Herons/Eagles	30	B	7	210	B	Moderate
9. Woodland Habitat Providing Perch and Nest Sites, and Wildlife Cover							
Selectively thin 1/3 trees, clear understory, install deer fence	Eagles/Crows/Deer	10	B	7	70	C	Moderate
Remove corvid nests and install deer fence	Eagles/Crows/Deer	10	B	7	70	C	Moderate

* Only includes actions associated with habitat modification. Control technique and other management activities are not included.

1 Species Relative Risk is calculated by summing the highest relative risk for all species in each group, as shown on Table 2-10. For example, the species relative risk value for Wh-1, Birds attracted to the infield, is 113 and generated by adding the score for Canada Goose (100) to the score for Mew Gull (13).

2 Safety Zone. See the locations on Figure 2-21 and scores based on proximity to aviation activity, discussed in Section 2.5.4.

3 Safety Zone Factor. Relative score based on Airport location, with 10 the highest value and 2 the lowest possible value.

4 Risk Zone Value. Species Relative Risk times Safety Zone Factor.

5 Safety Priority. This is a relative classification, with "A" representing the highest priority and "C" the lowest priority. The rankings correspond well to the habitat management categories and priorities identified in Section 4.1 of the Wildlife Hazard Management Plan, page 4-1.

Table 2-12. Habitat Modifications for Wildlife Hazard Management Alternatives

Wildlife Hazard Issue	Alternative WH-1[1] JNU's Proposed Action	Alternative WH-2[2] Moderate Habitat Modification	Alternative WH-3[3] Minor Habitat Modification & Adaptive Hazard Management	Alternative WH-4[4] No Action
a. Birds Attracted to Vegetated Areas near Runways and Taxiways	WH-1a Pave grassed infield areas	WH-2a Install synthetic ground cover in the infield	WH-3a Grade infield areas to prevent water from ponding; alter vegetation management practices to attract fewer wildlife; increase hazing	WH-4a Continue Existing Hazard Management Program
b. Birds Attracted to Wetlands on West Portion of Airport Property	WH-1b Fill on-Airport wetlands west of runway to above high tide, at level of Northwest Development Area	WH-2b Regrade on Airport areas by selective dredging and filling to eliminate ponds, channels, and swales that capture water	WH-3b Increased hazing of wildlife using control technologies	
c. Birds Attracted to Wetlands on Refuge West of Airport Property	WH-1c Fill of wetlands on Refuge west of JNU, creating free draining surface to Mendenhall	WH-2c Regrade area by selective dredging and filling west of JNU to eliminate ponds, channels, and swales that capture water	WH-3c Increased hazing of wildlife using control technologies	
d. Birds Feeding on Fish Staging at the Mouth of Duck Creek	WH-1d Relocate Duck Creek beginning at Airport Gate 'E' to the mouth, away from Alex Holden Way to north JNU boundary, discharge at former Gute property	WH-2d Relocate limited reach of Duck Creek, from Radcliffe Road, to create new channel trending west to Mendenhall River	WH-3d Increased hazing of wildlife using control technologies	
e. Birds Attracted to Surface Water Conveyances on JNU	WH-1e Convert drainage ditches into underground drains, install treatment	WH-2e Regrade and line ditches with concrete or other synthetic material, install treatment	WH-3e Regrade and manage vegetation, with increased hazing	

Table 2-12. Habitat Modifications for Wildlife Hazard Management Alternatives, continued

Wildlife Hazard Issue	Alternative WH-1[1] JNU's Proposed Action	Alternative WH-2[2] Moderate Habitat Modification	Alternative WH-3[3] Minor Habitat Modification & Adaptive Hazard Management	Alternative WH-4[4] No Action
f. Birds Attracted to Swales that Collect Rainwater	WH-1f Remove swales and areas along pavement edges that collect water, regrade to RSA	WH-2f Same as WH-1f	WH-3f Same as WH-1f	
g. Ducks and Waterfowl Feeding on Float Plane Pond Vegetation	WH-1g Mechanically remove vegetation from float plane pond and fingers using dredges or other means	WH-2g Fill In Float Plane Pond fingers to eliminate waterfowl habitat	WH-3g Increased hazing of wildlife, elimination of hunting program	
h. Birds Feeding on Fish at Mouth of Jordan Creek	WH-1h Remove dam at mouth of Jordan Creek	WH-2h Same as WH-1h	WH-3h Same as WH-1h	
i. Woodland Habitat Providing Perch and Nest Sites, and Wildlife Cover	WH-1i Selectively thin trees, clear understory, and install deer fence	WH-2I Periodically remove Corvid nests and install deer fence	WH-3i Increased hazing of wildlife using control technologies, adaptive management program as needed through Advisory Board consultation	

[1] Some increased labor effort and supplies would be needed for WH-1, but less than for other action alternatives. See Section 2.9.1.
[2] Increased labor effort and supplies would be needed for WH-2, more than WH-1 but less than for WH-3. See Section 2.9.2.
[3] Increased labor effort and supplies would be needed for WH-3, most of any action alternatives. See Section 2.9.3.
[4] No Action Alternative means no change from existing conditions for that specific habitat modification or hazard abatement action.

2.6 DESCRIPTION OF RSA ALTERNATIVES – DESIGN CONCEPT AND CONSTRUCTION

This section provides additional information concerning RSA alternatives carried forward for detailed environmental analysis. Common elements of the alternatives (such as general construction specifications, borrow sources, RSA surface and others) are described first. The following sub-sections offer specific details of any features unique to each alternative. A comparative summary of the environmental impacts associated with the RSA alternatives is provided in Section 2.6.10.

Conceptual estimates of life-cycle costs have been developed for each of the RSA alternatives. To the extent possible and practicable, the costs are based on unit rates incurred for other, similar projects on the Airport or in the Juneau area. Because the estimates use consistent cost factors they provide a means of comparing relative costs by alternative. A more detailed cost estimate would be developed in conjunction with the design plans for the selected alternative. Appendix A includes the cost tables for RSA alternatives and other actions considered in the EIS.

Subsequent to closure of the public comment period on the DEIS, and while this FEIS was being prepared, Alaska Airlines informed JNU of their concern with the Airport's newly developed Alternative RSA-5D (Alaska Airlines 2006b). The air carrier specifically noted that moving runway thresholds would require redesign of all required navigation performance (RNP RNAV) arrival and departure procedures, and could potentially increase visibility or decision altitude minimums and possibly bring new obstacles (such as trees, terrain, etc) into the approach or departure surfaces. Alaska Airlines also expressed concern that FAA approval of revised procedures could take 18 months or more to receive, with some possibility that revised procedures would not be approved. FAA recognized that while Alaska Airlines' letter was addressed specifically to just one alternative (RSA-5D), it would apply to any alternative that incorporates threshold displacement or relocation. To further evaluate the operational significance of threshold changes FAA retained the services of Naverus, Inc., a company that specializes in the design of performance-based navigation procedures, to evaluate the operational significance of specific threshold changes upon arrival procedures. The full text of the report is included with this FEIS as Appendix J. A summary of the results follows.

The RNP procedures employed by Alaska Airlines at JNU have increased access and operational reliability since their use began in the mid-1990s. They allow flight crews to fly down to a ceiling of 318 feet on approach to Runway 26 and 687 feet on approach to Runway 08 before needing to see the runway for landing (Naverus 2007). These altitudes are known as the runway "Decision Altitudes" as they are the altitude at which the pilot makes a decision to land based on visual acquisition of the runway environment, or to miss the approach because the runway is not visible.

FAA directed Naverus to consider the impacts on decision altitudes of a few possible runway displacement configurations, representing the maximum displacement of landing thresholds from the RSA alternatives evaluated in detail in this EIS. Naverus determined that the only potential changes to these procedures involve changes of 6 feet or less to the currently published decision altitudes. Naverus, working under the constraints and limitations identified in the full report, does

not consider the changes in decision altitude to be of positive or negative operational significance. Indeed, the greatest change in decision altitude (an increase of 7 feet) represents less than a 2% change from the existing operation. Naverus also reviewed the possible obstructions involved in approaches using the displaced thresholds, and found them to be the same obstructions limiting current approach procedures, including trees at different locations east of the Airport and trees and an antenna on Pedersen Hill, west of the Airport.

In summary, the displacement or relocation of thresholds considered in most alternatives should not significantly limit or improve Alaska Airlines RNP RNAV procedures. However, Naverus confirmed that *any* change in thresholds would necessitate a change in procedures that would require FAA approval. As taken from the Naverus report:

> The procedures currently in place (and those that would need to be designed to replace them) use specialized design rule sets that recognize the unique capabilities of the Alaska Airlines 737-400 and 737-NG fleet [which includes the 737-900]. Redesign and approval of the Juneau RNP procedures could represent a substantial risk to Alaska Airlines and to the community of Juneau from a direct cost standpoint, and an unknown time to benefit, based on the (FAA) approval process.

The concerns expressed by Alaska Airlines and defined in the above paragraph can be simplified as follows. If a runway threshold is moved, Alaska Airlines would have to re-design the applicable RNP procedures. These revised procedures would have to go through an FAA review and possibly revision before approval. There is some risk that re-designed procedures would not be approved. At a minimum, it is expected that the procedure re-design, review, and approval process would take many months, and possibly years to complete. Physical changes to the runway threshold locations prior to approval and implementation of revised RNP procedures could decrease operational reliability and access to Juneau, at least for an interim period.

Because any change in thresholds would require re-design of one or more RNP procedures, this EIS considers alternatives with no threshold modification, such as RSAs-1 and -6C, to have no operational risk; i.e., Alaska Airlines would continue to use existing approach and departure procedures.[20] The remaining alternatives are considered to have some operational risk, as described above, in that their implementation could be delayed or not approved.

One important note concerns final operational characteristics of the RSA alternatives. The locations described in this EIS of specific features, such as displaced or relocated thresholds, and departure and landing lengths, are estimates based on aerial photography, 2001 LIDAR, and existing Airport mapping. Prior to actual construction the appropriate areas for disturbance would be surveyed and tied to known reference locations. These new surveys will determine the final design distances and operational criteria to be shown on the revised Airport Layout Plan. The specific surveys would be used by Alaska Airlines if re-design of the RNP procedures is needed.

20. The landing points for RSA-6D would not change. Departure points allowing increased take-off roll are included in the alternative, but their use would not be required and it is unclear if Alaska Airlines would have to modify special departure procedures. Alaska Airlines has reviewed the RSA-6D alternative; see Section 2.2.2.7, RSA-6D description.

The footprint of the RSA alternative implemented would be adjusted to account for the new surveys, meet operational and safety criteria, and adapt to the engineering constraints presented by the Mendenhall River or other physical features.

2.6.1 RSA Design and Construction

2.6.1.1 Borrow Material

Fill for construction of the RSA and for other Airport development would be obtained by dredging from the Float Plane Pond fingers and possibly the main channel. This source would offer a number of benefits over an off-site location. First, the sediments in the Float Plane Pond are reportedly well-sized for construction of the RSA, reducing much of the effort required to crush and sort borrow from an off-site quarry. According to CBJ staff, the material underlying the Float Plane Pond meets all specifications for common and select borrow (Stone 2002b). During construction of the parallel taxiway extension in 2000, this material was found to require only minimal compaction and to be unsusceptible to frost, although some sorting of the material would be required for the subgrade layer below RSA surface or asphalt.

A second benefit to using the Float Plane Pond is the action would be compatible with wildlife hazard reduction goals to eliminate vegetation that attracts waterfowl, such as sego pond lily, as this vegetation would be removed during dredging. Another benefit is dredging would result in a deeper pond, reducing problems including aircraft grounding that can be caused by shallow water lanes.

The pond bottoms would be suction dredged and piped to the locations requiring fill, such as the footprints for added runway safety area, the SREF construction site, and northwest and northeast development areas where aviation facilities would be constructed. Fill material in these areas would be placed according to FAA construction methods and standards (FAA 1989b). A substantial benefit of this process is it would virtually eliminate many of the problems associated with haul trucks bringing in material from an off-site source: energy use, safety concerns and operational challenges associated with runway crossings, etc.

For example, haul trucks traveling from an off-site borrow source are not banned from any streets, but they would have to avoid congested intersections and residential streets, and temporary traffic signage would be installed. The Yandukin route to the Airport would likely be preferred, using the business area of Glacier Highway/Airport. However, there would be problems using this route as well, since trucks would have to cross the inbound traffic lane on Egan in one direction, and make a very tight turn in the other direction (S. Kito, personal communication with L. Snow). Whatever route used, the importation of fill material from off-Airport sources would raise social concerns, particularly over safety and noise.

Finally, there are no CBJ-owned quarries that could provide sufficient quantities of suitable fill material. It would therefore have to come from a private source, adding significant cost to the project. CBJ has estimated that dredging the pond would produce non-frost susceptible material for approximately $12.00 per cubic yard compared to a cost of at least $17.00 per cubic yard if the material is imported from off site (CBJ 2002b; Carson 2006a). As much as 603,125 cubic yards of

fill material could be needed, depending on the extent of new disturbance and where this disturbance would occur. This volume includes development of RSA on the sides and ends of the runway. Table 2-2 provides estimates of disturbance areas and fill volumes for each of the possible alternatives.

A layer of Class III, average-size 700-lb riprap could be used to stabilize the fill side slopes. This would somewhat reduce the amount of fill needed from the Float Plane Pond and eliminate the need for top soil and revegetation. Depending on the alternative selected, as much as 9,700 cubic yards of this class of riprap could be imported from an off-site borrow source. One haul truck can carry approximately 17 yards of riprap, so approximately 570 truck trips would be needed to supply the riprap.

2.6.1.2 DREDGING OPERATIONS

The following description of dredging operations is based on a draft safety plan prepared by CBJ for borrow removal (CBJ 2002b) and refinements to those plans being contemplated during preparation of the FEIS. Additional detail would be developed by the contractor selected for work and approved by appropriate agencies prior to commencement of work. The description is applicable not only to construction of the RSA but for other activities considered in this EIS that would require fill material, such as facilities development and some wildlife hazards management actions.

One large (16" diameter) or two smaller (10-12" diameter) suction dredges would be transported to the Float Plane Pond on flatbed trailer and then loaded one or two barges. Dredging operations would likely begin in the safest areas outside of the active float plane operational channels, such as the fingers or sloughs on the south side of the pond, and proceed toward the main Float Plane Pond and active water lane. All sloughs could be dredged, but construction in the operational area may be limited to areas of dense vegetative material and shallow zones that may interfere with aviation operations or aircraft parking.. Dredging in the operational area of the Float Plane Pond, if necessary, would normally be conducted at night unless seasonal conditions and fill quantities dictate a more expedited project. The Float Plane Pond would be lighted by orange buoys anchored approximately 100 feet north of the south bank of the pond; dredging would be allowed south of these buoys. The buoyed work area would be limited to a maximum of 350 linear feet along the south bank at any time, which would leave a minimum width of 350 feet for aircraft operations at the narrowest point. Buoys around the work area would be relocated as material is dredged to a depth of 30 feet. The work area may be revised, depending on the number of dredges operating in the pond, the depth of the pond, the usable material found in specific areas of the pond, etc. Final dimensions of the dredging area would be specified by the design firm and approved by FAA and CBJ prior to commencement of the work.

During a previous project, the dredging equipment had a maximum height of 60 feet above waterline during initial equipment set-up, with a maximum operational height for equipment of 30 to 60 feet. The maximum dredge depth of this equipment was 30 feet. The dredge is capable of working in an area 100 feet wide without moving the barge, and approximately 2 hours is needed to set up or dismantle the equipment for each relocation. If the barge is to be used in the sloughs during the day and on the main pond at night, equipment may have to be set up and taken down for longer

distance moves, thereby slowing production. Docks along the side of the operational area would not have to be moved, since this type of equipment can typically operate on an angle of up to 60 degrees from vertical. One local operator of such equipment estimates that he is able to produce approximately 220 cubic yards of material per operational hour. Equipment use and capability is dependent on the size and numbers of dredges operating.

For construction of RSA and other approved actions, material would be pumped from the barge and piped directly to the footprint of the new development. Depending on the volumes of material extracted from the pond and distance piped, a temporary pump booster station may be installed to maintain sufficient pressure to pump to locations such as the SREF. Prior to dredging, the footprint of the facility (such as the Runway 26 RSA) would be surveyed and staked, and a dike constructed on the outer perimeter. This dike would be used to define the extent of project fill, but also serve as a barrier protecting nearby wetlands and habitat from inadvertent sediment discharges. The diked area would allow dredged materials to dewater and settle, as preparation for compaction according to the construction specifications. Makeup water collecting from within the diked area would be pumped back to the Float Plane Pond to reduce off-site environmental impacts and maintain operational water levels for aviation.

It is reasonable to assume that the dredged material would be relatively clean, and free of contamination, since there is no history of hazardous waste storage or dumping in this area. Nevertheless, the dredging operations would be visually monitored on a continuous basis, and if material displays evidence of contamination (stained coloration, odors, debris, etc.) then a pre-approved testing program would be implemented that could include analysis for organic and/or inorganic contaminants.

All trucks, barges, and other equipment operating would be lighted with standard construction caution and/or obstruction lights, as needed for airfield operations. One or more Notice to Airmen would be issued on an as-needed basis to identify the project activity locations and areas of operation. Additional specifications and procedures would be developed prior to dredging and filling, and information would be disseminated to operators to explain any needed changes to lighting, departure or arrival procedures, work schedules, and so forth.

Material dredged from the Mendenhall River for some of the alternatives (RSA-5D, -6B, -6C and -6D) would be used for the infrastructure projects on Airport property, potentially including RSA construction, facilities development, or fill of wetlands between the Airport and the River for wildlife hazard control. The west bank dredging would take place prior to any removal of fill materials from the Float Plane Pond to ensure there are projects available for disposal/re-use of the river sediments and gravels.

2.6.1.3 RSA CONSTRUCTION

The runway at JNU has a slope from the centerline to the edges of the runway of approximately 1.0% to 1.5%, with a shoulder of slightly greater slope. This slope is to facilitate drainage from the runway. The lateral RSA would comply with FAA design criteria and grade from 1.5% to 3.0%. For the first 200 feet of the RSA at each runway end, the longitudinal grade would be between 0 and 3%. All RSA surfaces would slope away from the runway, and the maximum grade

to the end of the RSA would be 5%. Construction of the RSA would comply with FAA Advisory Circular 150/5370-10 and Federal Aviation Regulation Part 152 (FAA 1989b). Fill obtained from the Float Plane Pond would meet FAA's specifications and appropriate ASTM standards for size, density, and compaction (see FAA 1989b, 152-2).

Two different RSA/EMAS embankment configurations are used in this EIS. Figure 2-22 illustrates the relationship between the existing ground surface and new RSA and/or EMAS system east of the runway, for all of the alternatives, and west of the runway for Alternatives RSA-1, -5C, and -6A. The RSA and EMAS toe slope would be graded at 4:1 down to the ground level, on the east end, and to a 20-foot wide Float Plane Pond access road, fence, and then EVAR/Dike Trail on the west end. This slope would be covered in recycled asphalt mix or vegetated. The side slopes of the RSA ends and lateral RSA would be graded at 1:1 slope and covered in riprap or other rock. However, steeper slopes than 4:1 on the RSA ends or retaining wall systems on the lateral RSA could be used to reduce environmental impacts. These design modifications are incorporated to some extent in the remaining RSA alternatives, and discussed further in Section 2.11.

The remaining RSA alternatives would also use 4:1 embankments on the east runway end, but the embankment west of the runway would be steepened to minimize fill in the Mendenhall River. The embankment supporting the RSA or EMAS would be graded at 2:1 slope down to a new, 70-foot wide Float Plane Pond access road. This road would be substantially wider than that employed for other alternatives because towed aircraft would need more space to clear the steeper, up-hill embankment slope. The slope extending down to the EVAR/Dike Trail and beyond to the river would be even steeper, at a 1.5:1 grade.

CBJ has previously requested that any new RSA be surfaced with a 4-inch asphalt-treated base course. A benefit of a paved surface as opposed to a vegetated RSA is it would prevent birds from foraging, nesting, and sheltering. However, construction of paved surface would be much more expensive than other treatments, result in the loss of extensive surface water infiltration capacity, and require a more extensive storm-water capture and treatment system on the Airport. FAA made a preliminary determination that an asphalt surface for all RSAs at JNU is not necessary unless used for runway length, and may not be eligible for capital funding under the Airport Improvement Program.

Therefore, in most locations and for each alternative other than Alternative RSA-6D, it has been assumed the RSA surface would be vegetated with short grass, less than 6 inches high. The surface would meet grading requirements to avoid ponding of surface water, promote runoff, and allow some infiltration to the subsurface. This surface would require more intensive and active dispersal of birds to reduce risks of collision with aircraft. In conjunction with the actions to reduce wildlife hazards at the Airport, FAA and CBJ are also evaluating the efficacy of synthetic ground covers for the RSA. Section 2.9.2.1 provides more information on synthetic ground covers.

As with other construction activity on or near operational surfaces, a Notice to Airmen would be issued to identify the RSA construction locations and areas of operation.

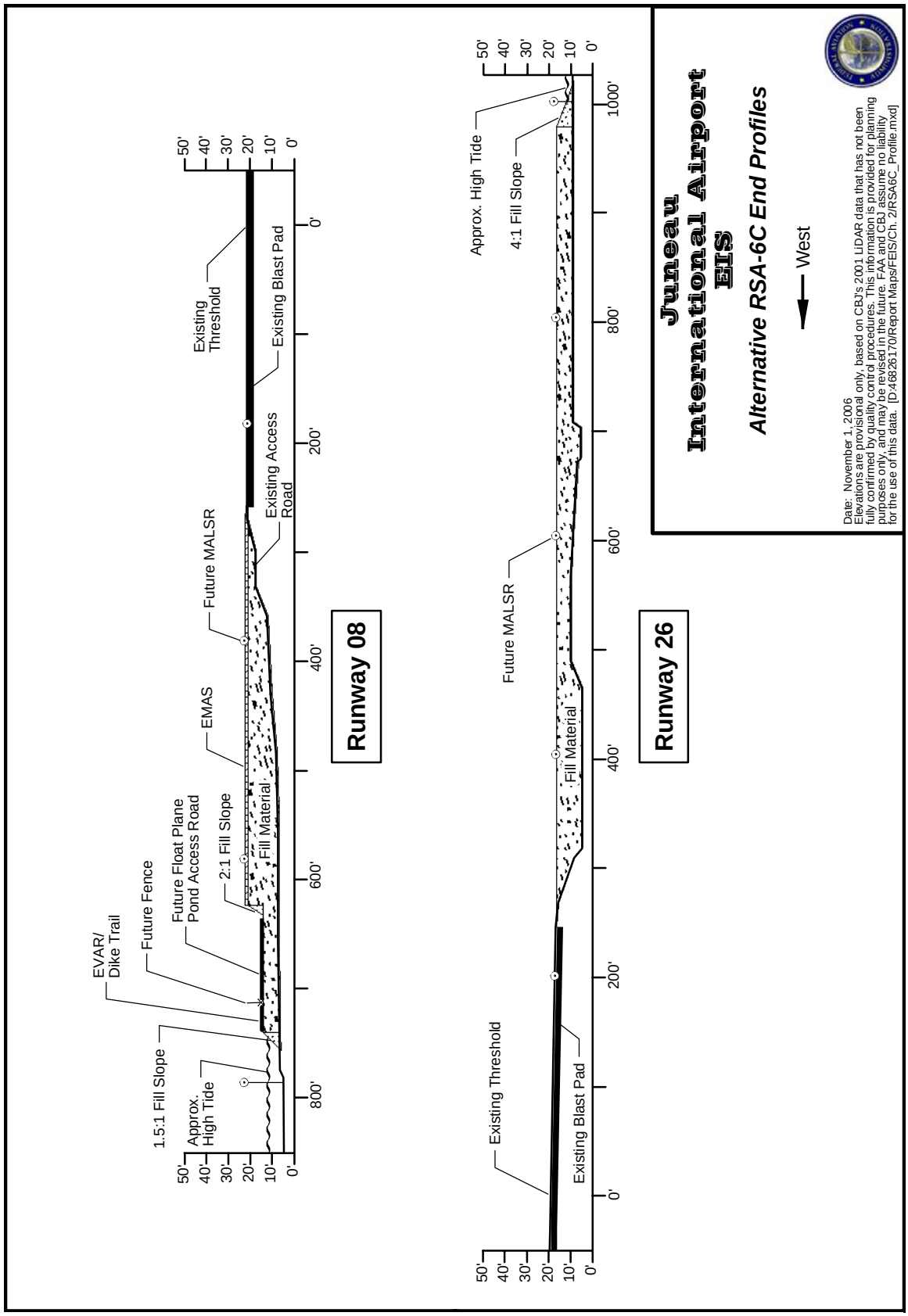

Figure 2-22. Profile of EMAS and RSA sections (based on Alternative RSA-6C configuration).

2.6.2 LATERAL RSA: FILL AND GRADE ALTERNATIVE

Only one alternative for development of lateral RSA along the southern portion of the east end of the runway was found to meet the purpose and need, and to be both prudent and feasible. Approximately 3,535 feet[21] on the south side of the runway (see Figures 2-1 through 2-16) would be cleared, filled, and graded to standards specified in FAA's Airport Design Advisory Circular 150/5300-13 (FAA 2002d). Fill would be imported to raise the grade to the appropriate elevation. It is estimated that, depending on the runway end RSA alternative chosen, anywhere from 11.6 to 13.8 acres would require fill on the south side of the runway, displacing farther south the estuarine tidal channels that currently recharge wetlands on the Refuge and in the northeast portion of the Airport.

A relatively small area of the RSA does not meet standards on the north portion of the runway where Jordan Creek enters a culvert to pass under the runway. The culvert would have to be extended north in this area to remain functional and permit new fill placement and RSA construction. In addition, the southern end of the culvert would be extended approximately 138 additional feet as fill for the lateral RSA is added to meet minimum standards. The net result of these corrections would be a culvert for Jordan Creek extending approximately 770 feet (since it would not just include the 500-foot wide RSA, but also extend under Taxiway A).

Each of the RSA alternatives would include extension of the Jordan Creek culvert through the lateral RSA north of the runway in a bottomless arch culvert pipe, constructed at a size and shape to match the capacity of the current culvert. Stormwater drainage systems would be modified to accommodate the new RSA and taxiway. One-way gate valves would be installed at the point the stormwater drains discharge into Jordan Creek to prevent back flow during extreme high tides. The Jordan Creek culvert system would be extended south of the runway through the new RSA using a bottomless arch span to connect with the existing corrugated metal pipe culvert.

The length of the culvert needed for Jordan Creek with expansion of the lateral RSA raises concerns about effects on aquatic life, particularly on the ability of salmon and other species to navigate upstream and downstream through the culvert. FAA has identified design modifications that could reduce impacts to Jordan Creek and aquatic habitat. These modifications are discussed in Section 2.11.

A 1:1 fill slope would be constructed for stabilization of the RSA on the south side, causing some additional displacement of the tidal channels and fill of low marsh wetlands. This represents a very steep side slope, but compared to standard 3:1 or even 4:1 slopes it would significantly reduce the RSA footprint and therefore reduce the amount of habitat lost to RSA development. The fill material would be covered with a layer of large, riprap anchor rock to help resist tidal channel erosion and prevent vegetative growth. As noted earlier, a vertical bulkhead could be constructed to support the lateral RSA and eliminate the need for a toe slope, reducing the overall affect on habitat. The feasibility of such a system, cost, and its benefits are discussed in Section 2.11.

21. Again, the amount would vary depending on changes to runway lengths.

To meet RSA standards, an area 1,000 feet by 500 feet at either end of the runway needs to be "capable, under dry conditions, of supporting snow removal equipment, aircraft rescue, and fire-fighting equipment, and the occasional passage of aircraft without structural damage to the aircraft" (FAA 1989a). The following describe some of the construction challenges and environmental considerations associated with the RSA alternatives.

2.6.3 RSA-1: Fill and Grade Existing RSA Deficiencies

Alternative RSA-1 represents the traditional means of achieving compliance with RSA standards. Approximately 60.4 acres of Airport and surrounding Refuge lands would be disturbed, including 37.2 acres for the RSA and embankment, 8.4 acres of Duck Creek relocation, and 14.8 acres for relocation of the sloughs and drainage channels east of the runway. This total assumes no net loss of Mendenhall River corridor after relocation. There would be no change to the parallel taxiway. An estimated 603,125 cubic yards of fill would be needed for this work, although construction of the eastern channels would generate about 46,249 cubic yards of available fill. This alternative is shown in Figure 2-23.

2.6.3.1 Operational Considerations for RSA-1

The departure and landing thresholds for both runways would remain in their existing locations. Therefore, no changes to the published "public-use" instrument approaches, Alaska Airline's existing "special use" RNAV approaches, or the Lemon and Fox turning procedures from Runway 08 would be necessary. There would be no need to modify Taxiway A for this alternative, nor would there be a need to modify the Runway 08 MALSR. This alternative represents no risk to existing aviation operations.

2.6.3.2 Environmental Considerations for RSA-1

The RSA at the Runway 08 end would be extended another 750 feet to the west. The supporting fill material, graded at a 4:1 slope, and access roads and Dike Trail/EVAR would extend the overall project footprint farther into the Refuge and into the Mendenhall River. Sheet piling or some other barrier system would be used while construction occurs to place and stabilize the fill material, and construct the roads and trail. To construct this alternative the Airport would have to acquire access to approximately 10.5 acres of the Refuge west of the Airport through purchase, land transfer, or lease/easement. RSA-1 would require relocation of the river around the end of the RSA, adding as much as 3,000 lineal feet to the river course. It would also require the relocation of the lowermost 500 feet of Duck Creek (already being considered for other development purposes and wildlife hazard management) and of the EVAR/Dike Trail and the Float Plane Pond access road.

Without modifying the Runway 26 threshold, it may be possible to construct the RSA on the east end entirely within the existing Airport boundary, but that would require use of gabion walls on the end or an overly steep embankment slope. The 4:1 slope incorporated into this design would encroach slightly, about 10 feet, into the Refuge east of the Airport but provide easier access for emergency response and also easy transition for the MALSR access road from some designs. While the RSA would not encroach into the Refuge, the East Runway Slough would be redirected

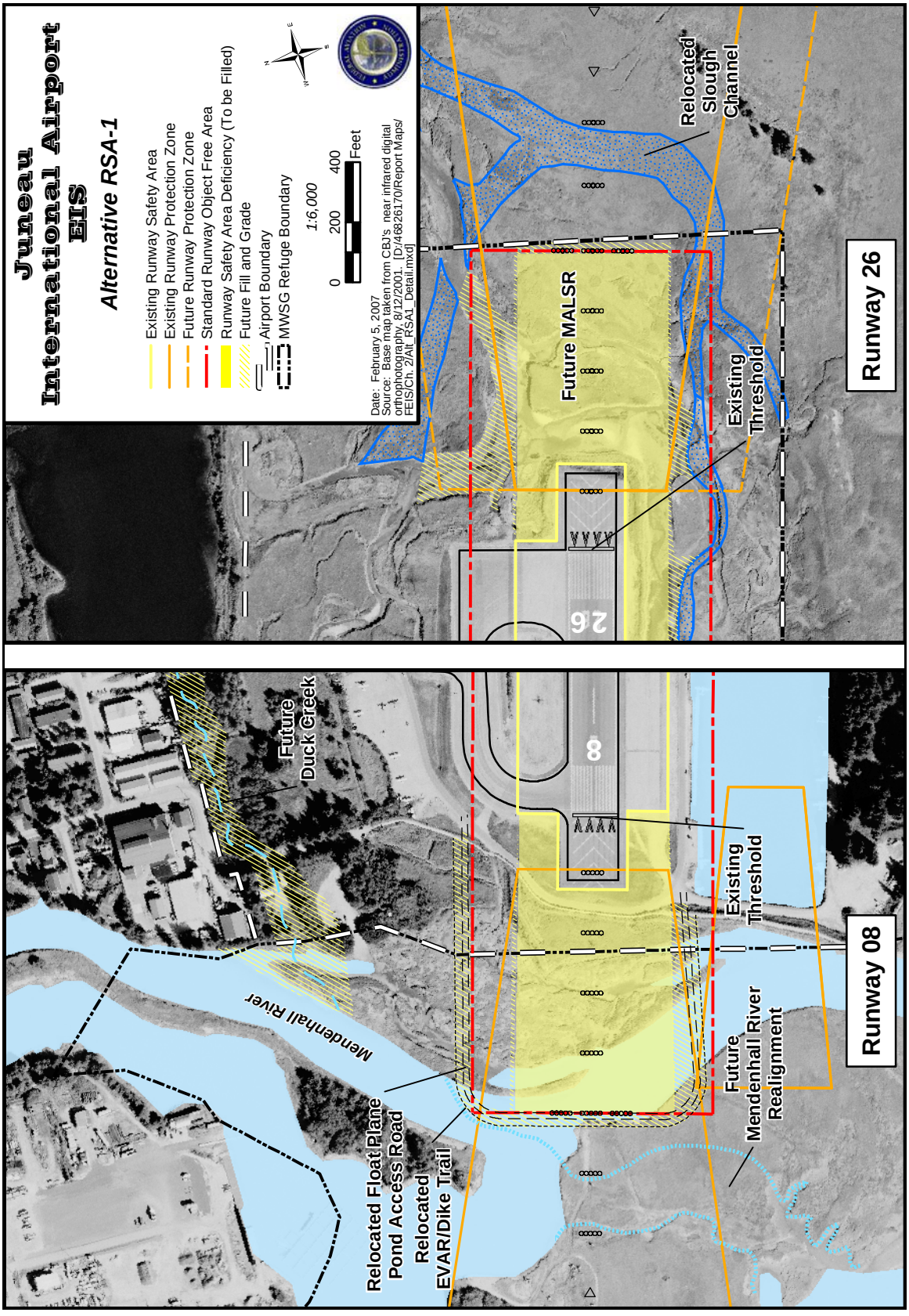

Figure 2-23. RSA-1 fill areas.

east of the RSA fill and toe slope. The new channel could be re-established by tidal flows within the Refuge, however, a constructed channel is incorporated into the design to ensure tidal exchange north and south of the runway is maintained. Without channel modifications, the hydrologic connection between the estuarine channels south of the runway and wetlands to the north, including the area south of Miller-Honsinger Pond, would be altered by this fill and by subsequent passive channel realignment. Alterations to the slough hydrology could negatively affect the emergent estuarine marsh that serves as essential fish habitat. Possible methods to minimize environmental impacts on this important habitat and preserve the hydrologic function of the area are discussed in Section 2.11.

Figure 2-48 in Section 2.11 illustrates a conceptual design for drainage channels east of the new RSA embankment for this alternative (and Alternatives RSA-5D and RSA-6C). Approximately 3,000 feet of new, 120-foot wide channel would be excavated northeast and east of the runway to an average depth of 5 feet below existing ground surface. Just east of the new RSA the single channel would be routed west for about 2,800 feet, and become increasingly less incised (i.e., a shallower channel) as it is connected to existing channels south of the runway.

A 500-foot wide, 3,535-foot long lateral RSA would be constructed south of the runway with a 1:1 toe slope anchored by riprap. The lateral RSA would be covered with a layer of topsoil and reseeded to establish vegetation that would inhibit erosion and reduce potential for foreign object debris (FOD) to get on the runway. Bottomless arch culvert extensions to Jordan Creek would be installed on the north and south sides of the runway.

2.6.3.3 COSTS FOR RSA-1

Appendix A includes estimated construction and life-cycle costs for runway safety area alternatives. Alternative RSA-1 would cost approximately $16.9 million to construct, at a present worth cost of $17.1 million over a 20-year life-cycle. The estimated cost to provide compensatory mitigation for the habitat lost and negatively affected by this alternative is $2.6 million.

2.6.4 RSA-5C: DISPLACE RUNWAY 08 THRESHOLD AND CONSTRUCT ADDITIONAL RSA

Alternative RSA-5C was developed to meet FAA standards for RSA, while preserving or enhancing runway operational capabilities. It combines relocation of the Runway 26 threshold with displacement of the Runway 08 threshold. The combination of these two actions would preserve all landing lengths and the departure length on Runway 26, and actually increase the accelerate stop distance for Runway 08. Approximately 60 acres of Airport and surrounding Refuge lands would be disturbed, including 39.3 acres for the RSA, parallel taxiway extension, and embankments, 8.4 acres of Duck Creek relocation, and 12.3 acres for relocation of the sloughs and drainage channels east of the runway. An estimated 595,204 cubic yards of fill would be needed for this work, although construction of the eastern channels would generate about 11,947 cubic yards of available fill. This alternative is shown in Figure 2-24.

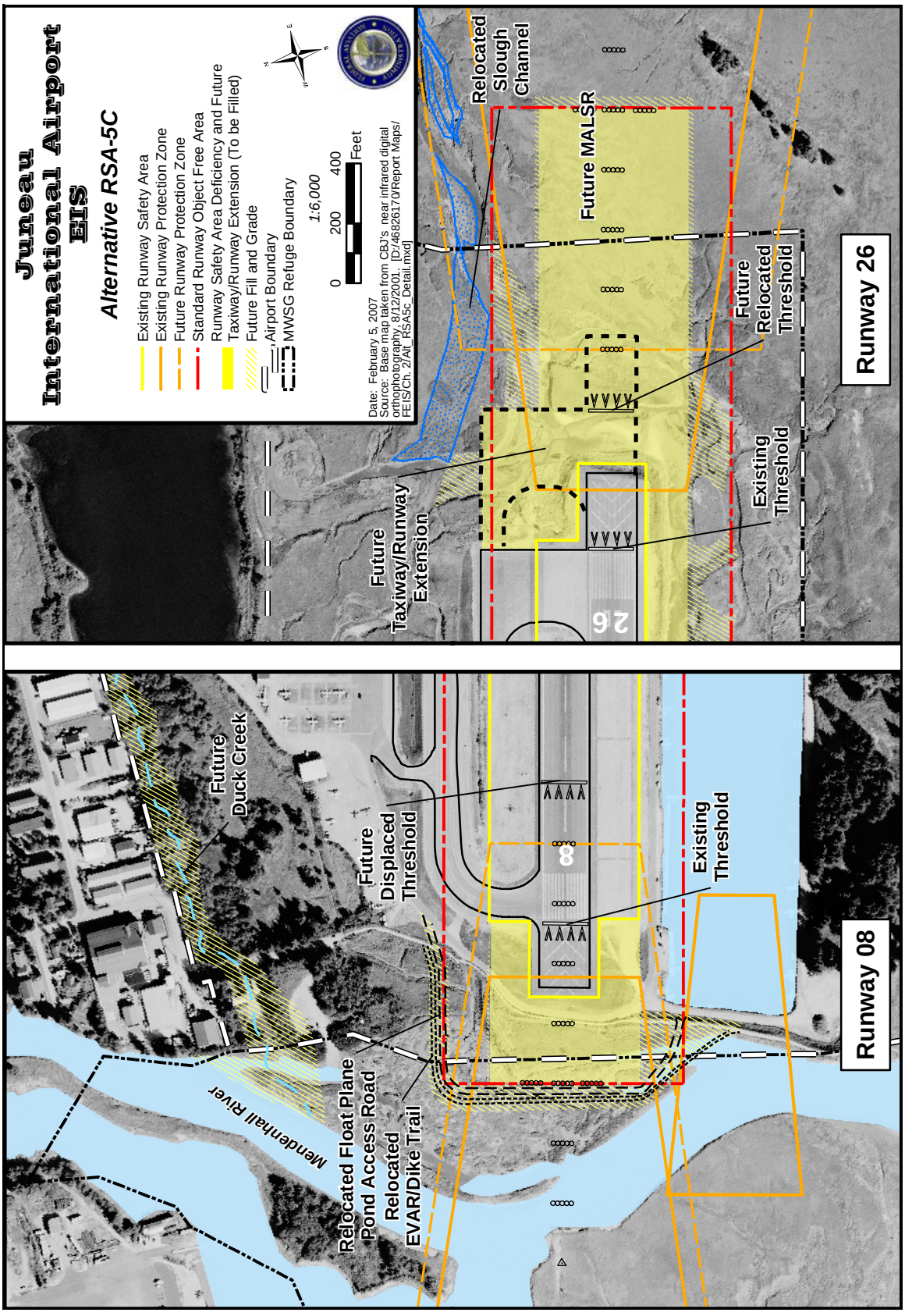

Figure 2-24. RSA-5C fill areas.

2.6.4.1 OPERATIONAL CONSIDERATIONS FOR RSA-5C

As with several other alternatives, RSA-5C would require minor revisions to the published "public-use" instrument approaches to Runway 08. Even though the Runway 08 departure point would remain unchanged, revisions to Alaska Airlines special departure procedures from Runway 08, such as the Lemon and Fox turning procedures, could still be required. This is because the special procedures rely on at least one waypoint during departure that is keyed to the Runway 26 threshold location. Runway departure length would actually increase by approximately 446 feet. This alternative would also necessitate revisions to Alaska Airlines' existing "special-use" RNP RNAV approach to both runways. The displacement of the Runway 08 landing threshold to the east, and resultant modification to the RNAV approach, would improve safety margins since the landing threshold would be located farther from the controlling obstructions at Pederson Hill. The entire Runway 08 MALSR would have to be shifted in accordance with the new west approach as the threshold change is not within +/- 20 feet of the 200-foot spacing increment specified in FAA Order 6850.2A.

The resulting change in approach to Runway 26 may be slightly more complicated than for other alternatives carried forward. Relocation of the Runway 26 threshold to the east could result in penetration of the approach airspace by obstructions along the Gastineau Channel. For example, the tall trees in Sunnypoint subdivision or southeast of the runway, on dredge islands within the Refuge, may constrain the approach procedures. One remedy would be to remove the trees or trim them to acceptable heights so they do not penetrate the approach airspace. However, before this alternative could be implemented a survey for possible obstructions would be completed to confirm if this is a problem and to what extent. If necessary, steps may be taken to remove the obstructions (in the case of trees, for example) or to revise approach procedures (in the case of terrain obstructions, for example).

According to the operational analysis done for this EIS, relocation of the Runway 26 threshold east would actually lower the RNP approach decision altitude by about six feet. As noted in the beginning of Section 2.6, the operational benefit of this change is negligible. More importantly, from the perspective of the major carrier serving JNU, operational risk would actually be increased because RNP procedures for both runways would have to be revised, possibly reducing flight reliability and access to Juneau for some period of time.

2.6.4.2 ENVIRONMENTAL CONSIDERATIONS FOR RSA-5C

To construct this alternative, JNU would place fill within the Refuge west of the Airport and shift the EVAR/Dike Trail into the Refuge. The projected elevation of the EVAR/Dike Trail would be 14 ft msl, although it may be necessary to raise the elevation another one to two feet to stay above the FEMA-mapped 100-year flood level and coastal high hazard zone. A new Airport perimeter fence would be located on the property line. Inside the perimeter fence on Airport property a new Float Plane Pond access road would be constructed to the west of the 4:1 fill slope supporting the RSA. This road would be 20 feet wide and located so that aircraft can be towed with enough of a safety margin so that the fence and aircraft do not affect navigable airspace[22]. East of the road, a 1000-foot RSA would be constructed and the displaced threshold for Runway 08 would be located at the end of the RSA. The brake-release point for aircraft departing on Runway 08 would

remain the same as currently exists at the west runway end. Although this alternative would encroach about 178 feet into the Refuge west of the Airport in order to relocate the EVAR/Dike Trail and to place supporting fill, it would not affect the actual course of the Mendenhall River, as would Alternative RSA-1.

The Runway 26 threshold would be relocated 446 feet, for a total of 8,902 feet of runway from the Runway 08 departure threshold, followed by the newly constructed 1,000-ft RSA. The lateral RSA would be constructed for the length of the runway, as described for Alternative RSA-1.

RSA-5C would extend approximately 490 feet into the Refuge east of the Airport. To construct this alternative the Airport would have to acquire access to approximately 9.8 acres of the Refuge through purchase, land transfer, or lease/easement. This area includes emergent marsh wetlands and sloughs linking the northeast portion of the Refuge with the tidal flows in the Gastineau Channel. Construction of the RSA would potentially separate the hydrologic connection between the estuarine wetlands south of the Miller-Honsinger Pond and Jordan Creek. It is possible that the tidal sloughs would be re-established at the east end of the RSA, and continue to function as corridors for fish movement and access to rearing habitat. However, it is less likely that function would be retained for this alternative (compared to the other RSA alternatives considered in this section) because of the greater eastward displacement. While tidal water may still replenish the wetlands south of the Pond, the flows would change from what is primarily a north-south connection to mostly an east-west connection. The net result from fill placement and displacement of flows is likely to be a reduced tidal exchange and more sedimentation of low marsh areas, with more rapid transition to high marsh habitat. In recognition of this possibility, JNU has suggested that a channel should be constructed to connect the Sunny Slough with the Miller-Honsinger wetlands, to ensure that tidal recharge and flushing is maintained north of the runway. This option was considered and evaluated with a number of other concepts to maintain hydrologic connection between the different wetlands and drainages. (A description of these concepts is included in Section 2.11.) Figure 2-49 in Section 2.11 illustrates a conceptual design for a new drainage channel north of the runway and RSA that would connect to the Sunny Sloughs. Approximately 600 feet of new, 120-foot wide channel would be excavated north and northeast of the runway to an average depth of 5 feet below existing ground surface. A small section of new channel would also be constructed south of the runway to ensure hydrologic connectivity with Jordan Creek and wetlands south of the new RSA.

2.6.4.3 Costs for RSA-5C

Appendix A includes estimated construction and life-cycle costs for runway safety area alternatives. Alternative RSA-5C would cost approximately $14.7 million to construct, at a present worth cost of $14.9 million over a 20-year life-cycle. The estimated cost to provide compensatory mitigation for the habitat lost and negatively affected by this alternative is $2.5 million.

22. A Twin Otter was selected as the design aircraft for the new road, since it represents the largest aircraft likely to be towed to the Float Plane Pond.

2.6.5 RSA-5D: Relocate Runway 26 Threshold and Construct Additional Runway and Safety Areas

Alternative RSA-5D was developed by JNU as a means of retaining full runway length while reducing fill footprint and environmental impacts, relative to Alternative RSA-5C. This alternative also involves relocation of the Runway 26 threshold, but it relies on the minimum RSA undershoot protection to lessen impacts to wetlands and the Refuge east of the Airport. Approximately 62.1 acres of Airport and surrounding Refuge lands would be disturbed, including 35.6 acres for the RSA, taxiway and embankment, 8.4 acres of Duck Creek relocation, 14.8 acres for relocation of the sloughs and drainage channels east of the runway, and 3.3 acres disturbance to the Mendenhall River. An estimated 511,677 cubic yards of fill would be needed for this work, although construction of the eastern channels and modifications to the west bank of the Mendenhall River would generate about 85,097 cubic yards of available fill. This alternative is shown in Figure 2-25.

2.6.5.1 Operational Considerations for RSA-5D

The Runway 08 public use instrument approaches and MALSR leading to the west end approach would be unaffected by this alternative, as the threshold would remain in its current location. As with Alternative RSA-5C, however, the special departure procedures used by Alaska Airlines on Runway 08 would need to be revised because of the change in the Runway 26 threshold, which serves as a check waypoint for the procedures. This alternative would also necessitate revisions to Alaska Airlines' existing RNP RNAV approach to Runway 26. The resulting change in approach to Runway 26 would be very similar to that described for RSA-5C. Relocation of the Runway 26 threshold to the east could result in penetration of the approach airspace by trees, representing obstructions because they penetrate an airspace surface, within the Refuge or in Sunnypoint subdivision. One remedy would be to remove the trees or trim them to acceptable heights so they do not penetrate the approach airspace. However, before this alternative could be implemented a survey for possible obstructions would be completed to confirm if this is a problem and to what extent. As with Alternative RSA-5C, the operational benefit incurred by an eastward shift of the Runway 26 threshold would be negligible. Operational risk would be increased somewhat because the RNP procedures for Runway 26 and special departure procedures for Runway 08 would have to be revised, possibly reducing flight reliability and access to Juneau for some period of time

2.6.5.2 Environmental Considerations for RSA-5D

The eastward change in Runway 26 threshold is similar to that for Alternative RSA-5C (400 feet compared to 446 feet), but the disturbance footprint for Alternative RSA-5D would be quite different. This is because the RSA embankment would only extend 600 feet from the Runway 26 threshold, ending at approximately the boundary between the Refuge and Airport, approximately 10 feet into the Refuge. The parallel taxiway would also be extended 400 feet to east. The lateral RSA would be constructed for the length of the runway, as described for Alternative RSA-1.

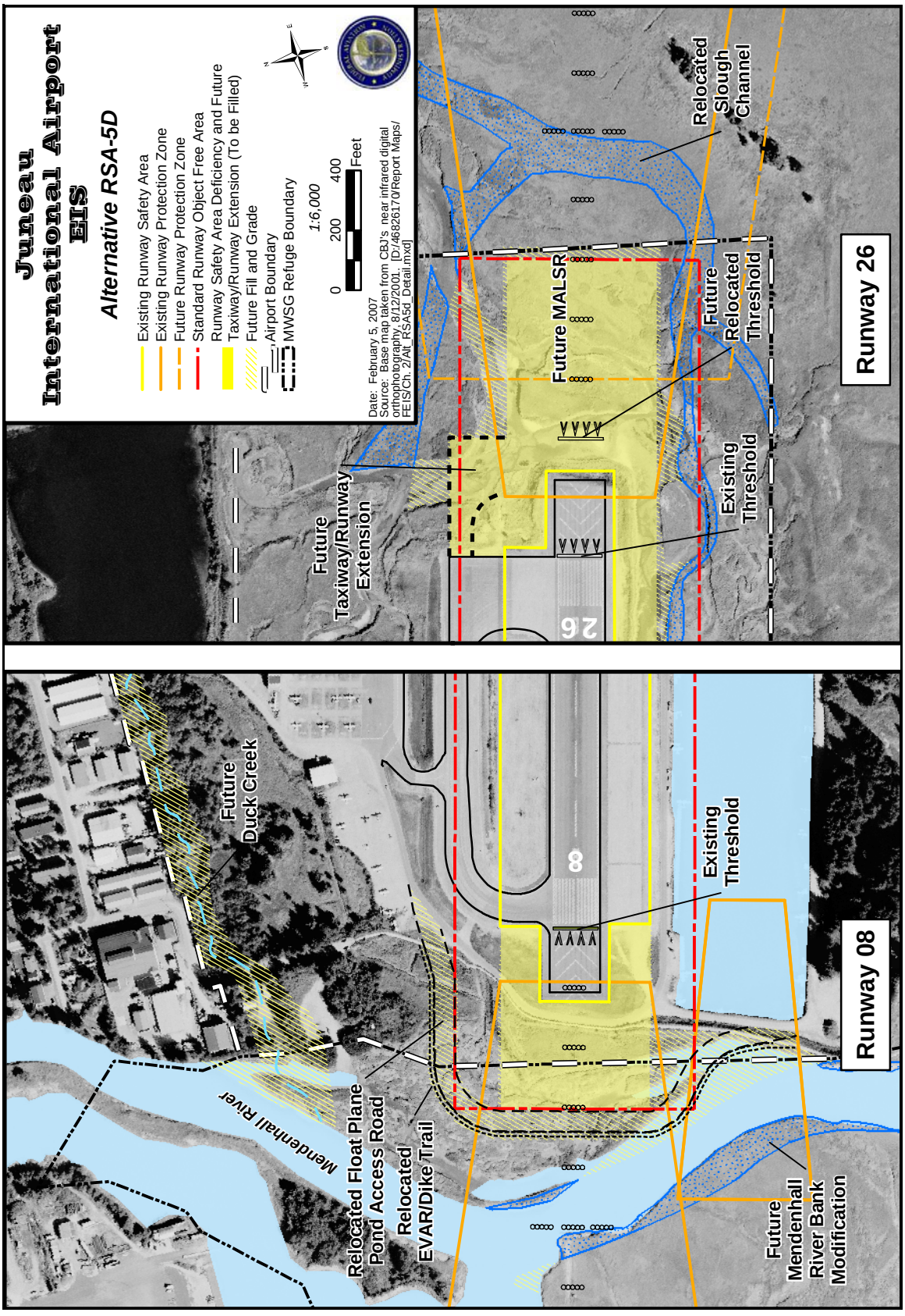

Figure 2-25. RSA-5D fill areas.

While the RSA would encroach slightly into the Refuge east of the Airport (as with Alternative RSA-1, about 10 feet), the East Runway Slough would be redirected east of the RSA fill and toe slope and through Refuge land. The hydrologic connection between the estuarine channels south of the runway and wetlands to the north, including the area south of Miller-Honsinger Pond, would be altered by this fill and by subsequent channel realignment. Alterations to the slough hydrology could negatively affect the emergent estuarine marsh that serves as essential fish habitat. To ensure that adequate hydrology for fish and habitat is maintained, a new channel would be constructed to pass tidal flows between the wetlands north and south of the runway, around the RSA embankment. The conceptual design for the new channels is as described in Section 2.6.3.2 for Alternative RSA-1, as shown on Figure 2-48 in Section 2.11. Further discussion of the analysis done to evaluate methods to preserve the hydrologic function of the area is included in Section 2.11.

A 500-foot wide, 3,942-foot long lateral RSA would be constructed south of the runway with a 1:1 toe slope anchored by riprap. The lateral RSA would be covered with a layer of topsoil and reseeded to establish vegetation that would inhibit erosion and reduce potential for foreign object debris (FOD) to get on the runway. Bottomless arch culvert extensions to Jordan Creek would be installed on the north and south sides of the runway.

This alternative was designed to minimize direct impacts to the Refuge east of the Airport and also to take advantage of other work west of the runway, specifically, fill of wetlands to reduce wildlife hazards (see WH-1b). As a result, however, the area disturbed to support new RSA and maintain float plane pond access and recreational access to the Refuge south of the Airport would extend into the east side of the Mendenhall River, directly west and southwest of the runway. During preparation of the FEIS the FAA's consulting team, in coordination with JNU's consulting engineers, used a hydraulic model to evaluate possible impacts to the river channel and flows caused by the addition of RSA fill. The model was applied considering different increments of fill volumes, using progressively steeper embankment slopes to reduce river impacts. More information concerning the model parameters and results is summarized in Chapter 3, Section 3.6. The entire report may be found in Appendix K.

The conceptual design resulting from the hydraulic modelling is incorporated into this alternative (as well as RSAs-6B, -6C, and -6D) and shown on Figure 2-25. The RSA west of the Runway 08 threshold would be extended an additional 350 feet. A 2:1 embankment slope would be used from the RSA surface down to the Float Plane Pond access road. This slope is steeper than would otherwise be preferred by FAA and JNU, as it would be desirable for the embankment slope to be constructed so as to allow emergency vehicle access. However, the increased slope would also reduce impacts to the Mendenhall River relative to a standard 4:1 design, such as is used in RSA-5C or RSA-1. The Airport fence would be relocated just outside the Float Plane Pond access road, and from there an even steeper slope of 1.5:1 would be constructed down to the new Dike Trail/EVAR. The Dike Trail/EVAR would be located on approximately the 14-foot msl contour. From there the slope would be relatively flat down to about 10 feet msl. Duck Creek would have to be relocated north due to the fill footprint and relocated facilities.

The west end embankment and facilities relocation would extend about 258 feet into the Refuge west of the Airport. Approximately 9 acres of Refuge would have to be, or leased by JNU for implementation of this alternative.

2.6.5.3 COSTS FOR RSA-5D

Appendix A includes estimated construction and life-cycle costs for runway safety area alternatives. Alternative RSA-5D would cost approximately $15 million to construct, at a present worth cost of $15.3 million over a 20-year life-cycle. The estimated cost to provide compensatory mitigation for the habitat lost and negatively affected by this alternative is $2.65 million.

2.6.6 RSA-5E: DISPLACE RUNWAY 08 THRESHOLD 120 FEET AND CONSTRUCT ADDITIONAL RSA

Alternative RSA-5E was developed in response to the concerns of FAA, CBJ and Cooperating Agencies that the placement of fill into the Mendenhall River (as would occur for some alternatives) may affect hydrologic functions such as channel size, extent of scouring, erosional and depositional areas, and even the water level elevation. This alternative is similar to Alternative RSA-5C, in that it combines relocation of the Runway 26 threshold with displacement of the Runway 08 threshold. Alternative RSA-5E would require no direct impact to the Mendenhall River channel, while preserving runway operational capabilities. It also would have the least direct disturbance to the Refuge of any non-EMAS alternative. The JNU Airport Board voted unanimously on February 14, 2007, to select Alternative RSA-5E as the new Proposed Action.

Approximately 58 acres of Airport and surrounding Refuge lands would be disturbed, including 35.3 acres for the RSA, parallel taxiway extension, and embankments, 8.4 acres of Duck Creek relocation, and 14.3 acres for relocation of the sloughs and drainage channels east of the runway. An estimated 484,365 cubic yards of fill would be needed for this work, although construction of the eastern channels would generate about 50,363 cubic yards of available fill. This alternative is shown in Figure 2-26.

2.6.6.1 OPERATIONAL CONSIDERATIONS FOR RSA-5E

Operational changes for aircraft departing from or landing at JNU would be very similar to those described for Alternative RSA-5C, including minor revisions to the published "public-use" instrument approaches to Runway 08 and revisions to Alaska Airlines special departure procedures from Runway 08, such as the Lemon and Fox turning procedures. Alternative RSA-5E would also necessitate revisions to Alaska Airlines' existing "special-use" RNP RNAV approach to both runways. The displacement of the Runway 08 landing threshold to the east, and resultant modification to the RNAV approach, would improve safety margins since the landing threshold would be located farther from the controlling obstructions at Pederson Hill. The lights comprising the Runway 08 MALSR would have to be shifted to match the eastward threshold displacement, as the change in landing position for Runway 08 would be greater than the MALSR light spacing tolerance specified in FAA Order 6850.2A.

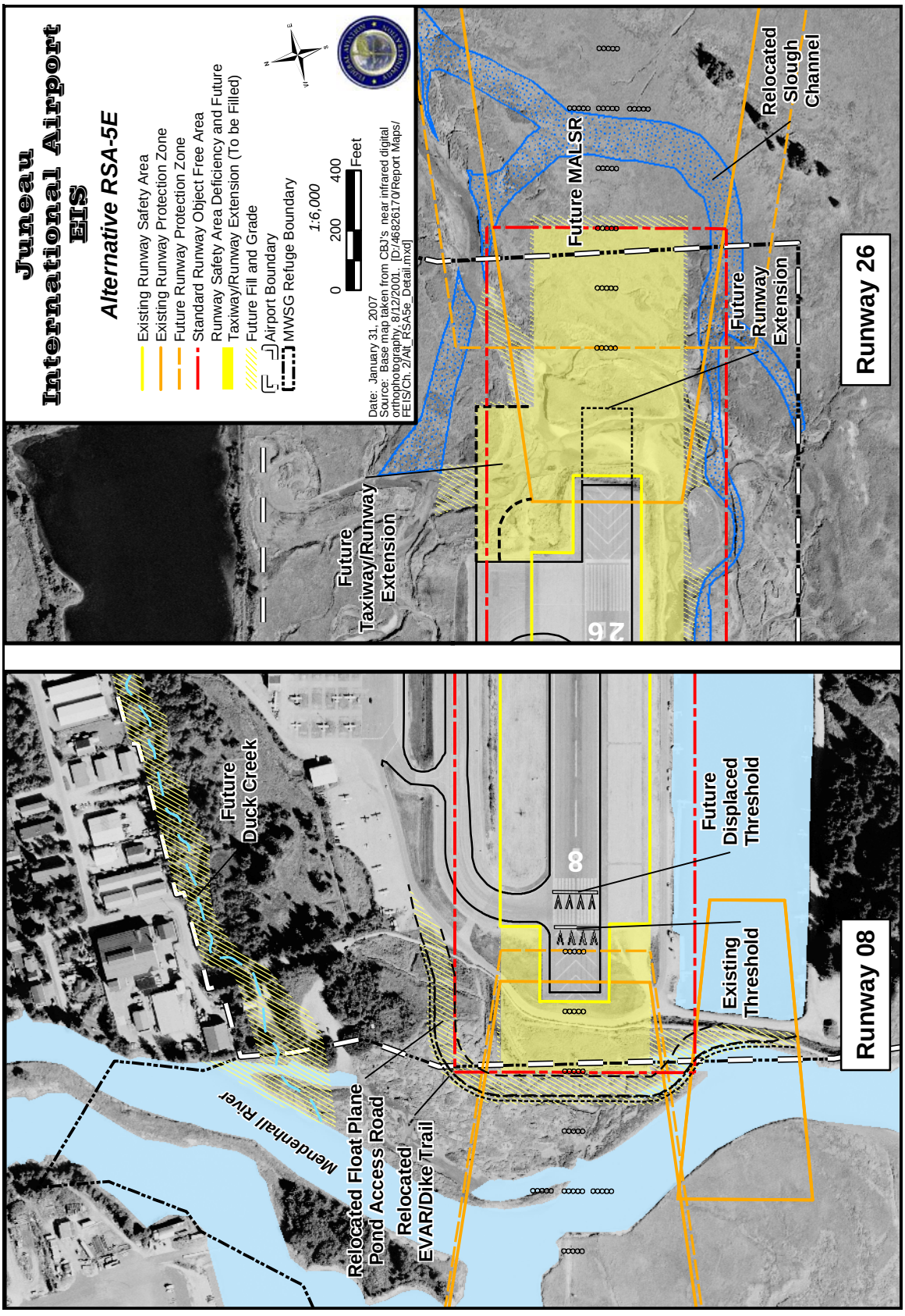

Figure 2-26. RSA-5E fill areas.

The resulting change in approach to Runway 26 may be slightly more complicated than for other alternatives carried forward. Relocation of the Runway 26 threshold to the east could result in penetration of the approach airspace by obstructions along the Gastineau Channel, as described for Alternative RSA-5C. Before this alternative could be implemented an updated survey for possible obstructions would be completed to confirm if this is a problem and to what extent. If necessary, steps may be taken to remove the obstructions (in the case of trees, for example) or to revise approach procedures (in the case of terrain obstructions, for example).

According to the operational analysis done for this EIS, relocation of the Runway 26 threshold east would actually lower the RNP approach decision altitude by six to seven six feet. As noted in the beginning of Section 2.6, the operational benefit of this change is negligible. More importantly, from the perspective of the major carrier serving JNU, operational risk would actually be increased because RNP procedures for both runways would have to be revised, possibly reducing flight reliability and access to Juneau for some period of time.

2.6.6.2 Environmental Considerations for RSA-5E

To construct this alternative, JNU would place fill within the Refuge west of the Airport and shift the EVAR/Dike Trail into the Refuge. The projected elevation of the EVAR/Dike Trail would be about 17 msl. The Airport perimeter would be extended eastward about 138 feet, with a new fence separating the Airport from the Refuge and EVAR/Dike Trail. Inside the perimeter fence on Airport property a new, 70-foot wide Float Plane Pond access road would be constructed to the west of the 2:1 fill slope supporting the RSA. East of the road, a 600-foot RSA would be constructed and the displaced threshold for Runway 08 would be located at the end of the RSA. The brake-release point for aircraft departing on Runway 08 would remain the same as currently exists at the west runway end. The Runway 26 threshold would be relocated 520 feet, followed by 600 additional feet of newly constructed RSA. The lateral RSA would be constructed for the length of the runway, as described for Alternative RSA-1.

RSA-5E would extend approximately 130 feet into the Refuge east of the Airport. To construct this alternative the Airport would have to acquire access to approximately 3.9 acres of the Refuge through purchase, land transfer, or lease/easement. This area includes emergent marsh wetlands and sloughs linking the northeast portion of the Refuge with the tidal flows in the Gastineau Channel and, as described for other alternatives such as RSA-5C, the safety area fill could disrupt or even separate the hydrologic connection between the estuarine wetlands south of the Miller-Honsinger Pond and Jordan Creek. To ensure maintenance of this important hydrologic and biologic corridor, a new channel would be constructed to pass tidal flows between the wetlands north and south of the runway, around the RSA embankment. The conceptual design for the new channels is similar to that described in Section 2.6.3.2 for Alternative RSA-1, as shown on Figure 2-51 in Section 2.11.

Approximately 1,700 feet of new, 120-foot wide channel would be excavated north and northeast of the runway to an average depth of 5 feet below existing ground surface. A small section of new channel would also be constructed south of the runway to ensure hydrologic connectivity with Jordan Creek and wetlands south of the new RSA.

2.6.6.3 COSTS FOR RSA-5E

Appendix A includes estimated construction and life-cycle costs for runway safety area alternatives. Alternative RSA-5E would cost approximately $13.2 million to construct, at a present worth cost of $13.4 million over a 20-year life-cycle. The estimated cost to provide compensatory mitigation for the habitat lost and negatively affected by this alternative is $2.2 million.

2.6.7 RSA-6A: EMAS WITH DECLARED DISTANCES AND RUNWAY 26 EXTENSION

Alternative RSA-6A would include the installation of EMAS at both runway ends. This configuration was developed to minimize environmental impacts west of the Airport while preserving or enhancing runway operational capabilities. It combines relocation and displacement of runway thresholds approximately 188 feet to the east. RSA-6A would preserve the existing landing distance and increase the departure lengths for both runways by 188 feet. There would be no need to modify Taxiway A for this alternative. Approximately 43.3 acres of Airport and surrounding Refuge lands would be disturbed, including 25 acres for the RSA and embankment, 8.4 acres of Duck Creek relocation, and 9.9 acres for relocation of the sloughs and drainage channels east of the runway. An estimated 317,412 cubic yards of fill would be needed for this work, although construction of the eastern channels would generate about 16,211 cubic yards of available fill. This alternative is shown in Figure 2-27.

2.6.7.1 OPERATIONAL CONSIDERATIONS FOR RSA-6A

As with other alternatives, RSA-6A would require minor revisions to the published "public-use" instrument approach and Alaska Airline's existing "special use" RNAV approach to Runway 08. These minor revisions may be considered to improve safety margins since the landing threshold would be displaced farther east from the controlling obstructions at Pederson Hill, but the operational analysis indicates that the pilot's decision altitude would actually increase (i.e., be higher) by about two feet. This change is negligible in terms of impact to operations. Nevertheless, operational risk would be increased slightly because the shift in Runway 08 arrival threshold would require Alaska Airlines to revise the RNP procedures and obtain FAA approval before implementation. Runway 08 departures, including the Lemon and Fox turning procedures, would be unaffected, and departure runway length would actually increase by approximately 188 feet for both runways. Because the Runway 26 landing threshold would remain unchanged there would be no impact to Alaska Airlines' existing "special-use" RNAV approach from the east. This alternative would necessitate only minor modification to the Runway 08 MALSR to convert some lights currently on stanchions to frangible supports within the RSA. The western-most light stanchion would be removed, but the remainder of the lights could remain at their existing sites.

2.6.7.2 ENVIRONMENTAL CONSIDERATIONS FOR RSA-6A

To construct this alternative, the slope supporting the EMAS, access roads and EVAR/Dike Trail would extend about 128 feet into the Refuge west of the Airport. The fill would be graded at a 4:1 slope and maintain sufficient height to keep the EVAR/Dike Trail, relocated from the Airport property to the Refuge, above high tide. A new Airport perimeter fence would be located on the property line. Inside the perimeter fence on Airport property a new Float Plane Pond access road

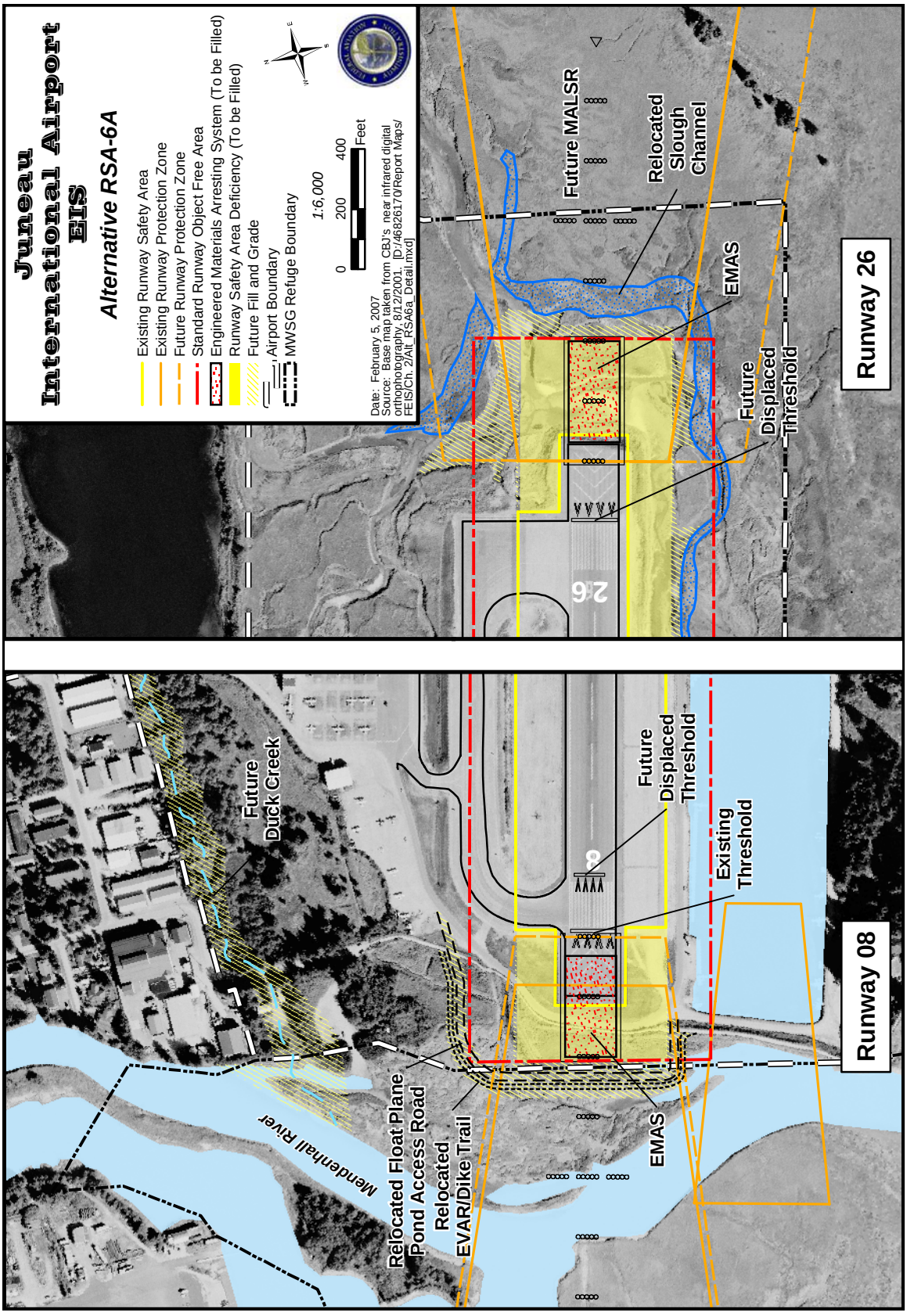

Figure 2-27. RSA-6A fill areas.

would be constructed. This road would be twenty feet wide and located so that aircraft can be towed on the road with an appropriate safety margin so that the fence and aircraft would not affect navigable airspace. The slope would climb to the west end of the EMAS. It would include approximately 337 feet of engineered blocks placed on a graded surface with a slight slope toward the east, as shown earlier on Figure 2-22. Approximately 263 feet of standard RSA would adjoin the EMAS, at the east end of which would be located the new Runway 08 landing threshold. This EMAS and RSA configuration would supply the required 600-foot undershoot protection (FAA 2004c). However, as with other alternatives involving displaced thresholds, the Runway 08 departure point can be located as much as 188 feet west of the landing threshold, since there only needs to be a separation of 75 feet from EMAS to the departure threshold.

Although this alternative would affect the Refuge west of the Airport in order to relocate the EVAR/Dike Trail and place supporting fill, it would not encroach on the course of the Mendenhall River. RSA-6A would extend approximately 125 feet west into the Refuge. To construct this alternative the Airport would have to acquire access to approximately 2.7 acres of the Refuge west of the Airport through purchase, land transfer, or lease/easement. Alternative RSA-6A would have the least affect on wetlands and habitat west of the runway of any of the alternatives.

There would be no direct impact on the Refuge east of the Airport, although the wetlands, sloughs, and overall hydrology of the area would be affected by construction of the Runway 26 EMAS. The hydrologic connection between the estuarine channels south of the runway and wetlands to the north, including the area south of Miller-Honsinger Pond, would be altered by this fill and subsequent channel realignment. Alterations to the slough hydrology could negatively affect the emergent estuarine marsh, but not to the extent caused by the greater disturbance areas incorporated in most other alternatives except for RSA-6B. To ensure that tidal exchange is maintained, a new channel would be constructed to connect tidal wetlands north and northeast of the runway with those to the south and Jordan Creek. Figure 2-50 in Section 2.11 illustrates a conceptual design for drainage channels east of the new RSA embankment for this alternative (and also similar to Alternatives RSA-6B and -6D). Approximately 1,385 feet of new, 100-foot wide channel would be excavated northeast and east of the runway to an average depth of 5 feet below existing ground surface. Just east of the new RSA the single channel would be routed west for about 2,800 feet, and become increasingly less incised (i.e., a shallower channel) as it is connected to existing channels south of the runway. Possible methods to minimize environmental impacts on this important habitat and preserve the hydrologic function of the area are discussed further in Section 2.11.

2.6.7.3 COSTS FOR RSA-6A

Appendix A includes estimated construction and life-cycle costs for runway safety area alternatives. Alternative RSA-6A would cost approximately $23.1 million to construct, at a present worth cost of $29.6 million over a 20-year life-cycle. The estimated cost to provide compensatory mitigation for the habitat lost and negatively affected by this alternative is $1.58 million.

2.6.8 RSA-6B: EMAS WITH DECLARED DISTANCES AND RUNWAY 08 EXTENSION

Alternative RSA-6B is essentially the mirror opposite of Alternative RSA-6A. It would also include the installation of EMAS at both runway ends, but in contrast to Alternative RSA-6A most of the disturbance would be shifted to the west. This configuration was developed to minimize environmental impacts east of the runway while preserving or enhancing runway operational capabilities. It combines relocation and displacement of runway thresholds approximately 188 feet to the west. RSA-6B would preserve the existing landing distance and increase the departure lengths for both runways by 188 feet. There would be no change to the parallel taxiway. Approximately 49.3 acres of Airport and surrounding Refuge lands would be disturbed, including 27.2 acres for the RSA and embankment, 8.4 acres of Duck Creek relocation, 10.4 acres for relocation of the sloughs and drainage channels east of the runway, and 3.3 acres disturbance to the Mendenhall River. An estimated 371,244 cubic yards of fill would be needed for this work, although construction of the eastern channels and fill from the modifications to the west bank of the Mendenhall River would generate about 55,059 cubic yards of available fill. This alternative is shown in Figure 2-28.

2.6.8.1 OPERATIONAL CONSIDERATIONS FOR RSA-6B

RSA-6B would require no changes to the published "public-use" instrument approach or Alaska Airline's existing "special use" RNAV approach to Runway 08. Runway 08 departures would begin about 188 feet west of the current threshold, offering a longer takeoff run that would have only minor, if any, positive affect on the Lemon and Fox turning procedures employed by Alaska Airlines. However, as with other alternatives, these special departure procedures employed by Alaska Airlines from Runway 08 would still require revision because of the change in Runway 26 landing threshold. The Runway 26 threshold would be displaced about 188 feet west of its current location. This change would have a negligible effect on Alaska Airlines' existing "special-use" RNAV approach from the east; but, again, the procedures would have to be revised. Changes in procedures introduce some operational risk, at a minimum for the period while they are in review for regulatory approval, with the worst-case scenario being that procedures would not be approved. Departures on Runway 26 would have the potential for a longer takeoff run, although the terrain obstructions west of the Airport may preclude any advantage to the extra length. This alternative would require no change to most of the Runway 08 MALSR locations, although the easternmost lights would be converted from stanchions to frangible supports within the new EMAS and safety area prior to the threshold.

2.6.8.2 ENVIRONMENTAL CONSIDERATIONS FOR RSA-6B

This alternative was designed to minimize fill on the east runway end and maximize the degree of west RSA disturbance with any actions taken to reduce wildlife hazards. However, after publication of the DEIS and during preparation of revisions, it was noted that the 4:1 RSA embankment slopes extending from the west runway end EMAS would encroach into the Mendenhall River. As a consequence, extensive hydraulic modelling was conducted using different embankment designs to minimize the impact of RSA fill on the river. The design incorporated into this alternative is exactly as described for Alternative RSA-5D. Duck Creek would be relocated to the north.

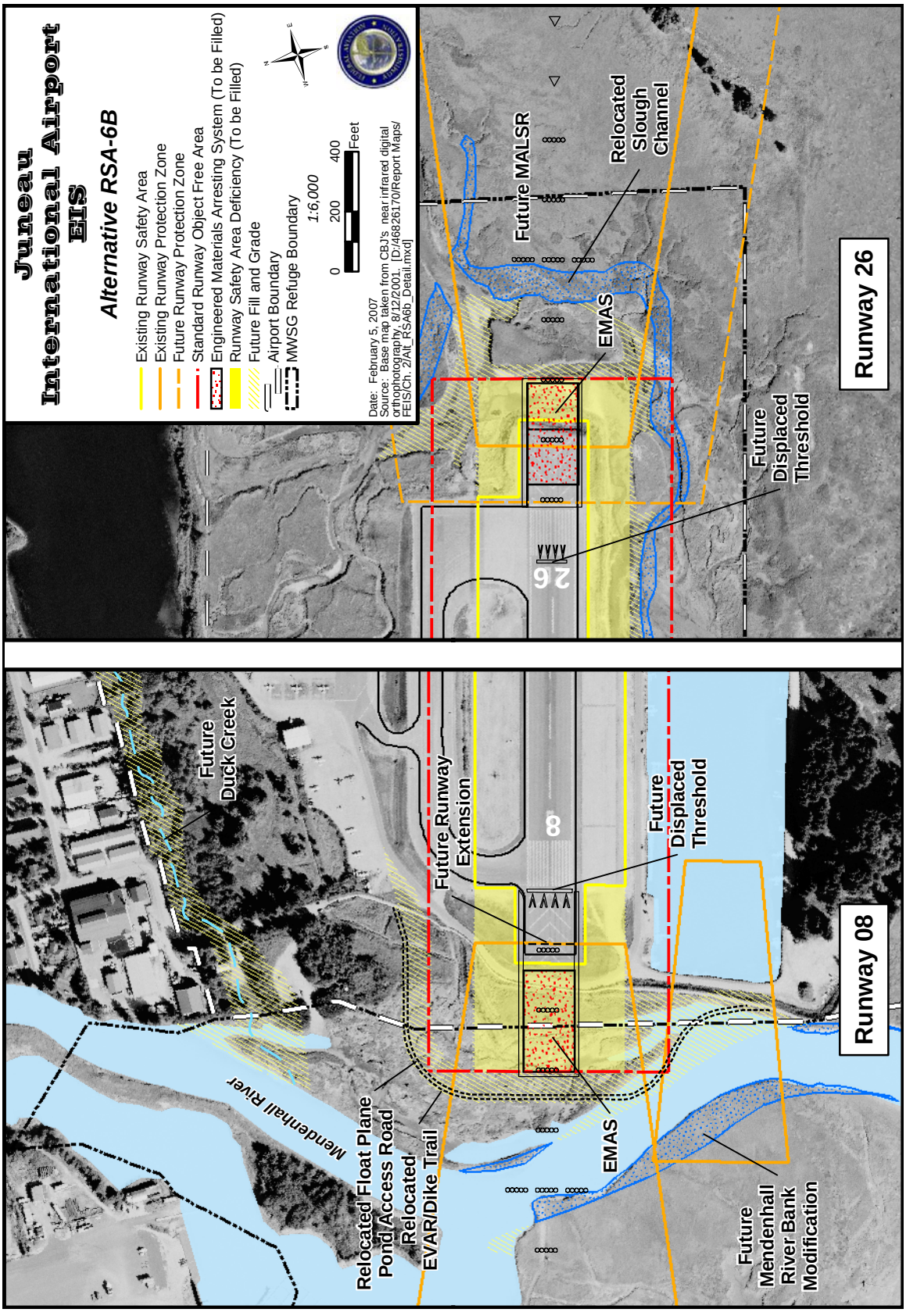

Figure 2-28. RSA-6B fill areas.

The RSA on Runway 08 end would consist of an EMAS approximately 337 feet long containing engineered blocks placed on a graded surface with a slight slope toward the east, as shown earlier on Figure 2-21. Adjoining the EMAS would be approximately 263 feet of standard RSA, at the east end of which would be located the Runway 08 landing threshold. This EMAS and RSA configuration would supply the required 600 foot undershoot protection (FAA 2004c). However, as with other alternatives involving displaced thresholds, the Runway 08 departure point can be located as much as 188 feet west of the landing threshold, since there only needs to be a separation of 75 feet from EMAS to the departure threshold.

On the east Runway 26 end, departures would begin at the existing threshold location but the landing threshold for approaches from the east would be displaced approximately 188 feet west of the existing threshold. This displacement would be necessary to provide a full 600 feet of undershoot protection for approaches from the east. An EMAS system about 337 feet long would be installed starting 75 feet east of the Runway 26 departure threshold. Installation of the EMAS would be as described for Runway 08, except that the system would slope down slightly to the west. As with all other alternatives, the RSA embankment on the east runway end would be graded at a 4:1 slope. The 3,360-foot long lateral RSA would be constructed for the length of the runway, as described for Alternative RSA-1.

To construct this alternative the Airport would have to acquire access to approximately 9 acres of the Refuge west of the Airport through purchase, land transfer, or lease/easement. In addition, fill would be placed within the Mendenhall River to achieve the full RSA embankment support and retain the EVAR/Dike Trail and other facilities. To help compensate for the reduced channel width created by fill on the east side of the river, some dredging would be conducted on the west bank, thereby maintaining for the most part existing channel capacity and velocities.

There would be no direct impact on the Refuge east of the Airport, although the wetlands, sloughs, and overall hydrology of the area may be indirectly affected by construction of the Runway 26 EMAS. A constructed channel similar to that shown in the Figure 2-50 conceptual design would be developed northeast, east, and south of the runway. This channel would ensure tidal exchange between habitat north and east of the runway is maintained to Jordan Creek and areas south of the runway. Because the disturbance footprint east of the runway is smaller than any of the other alternatives, RSA-6B should have the least impact to the hydrologic functions and habitat in this area of any of the alternatives.

2.6.8.3 COSTS FOR RSA-6B

Appendix A includes estimated construction and life-cycle costs for runway safety area alternatives. Alternative RSA-6B would cost approximately $25.8 million to construct, at a present worth cost of $32.2 million over a 20-year life-cycle. The estimated cost to provide compensatory mitigation for the habitat lost and negatively affected by this alternative is $1.9 million.

2.6.9 RSA-6C: COMBINED EMAS AND STANDARD RUNWAY SAFETY AREA

Alternative RSA-6C was designed to combine some positive features of both EMAS and standard RSA. It would include standard RSA on the east, Runway 26 end and installation of EMAS on the west, Runway 08 end. The overall effect would be to reduce installation and maintenance cost (relative to a double EMAS alternative) but also limit environmental and social impacts on the Refuge west of the Airport (relative to a standard RSA installation). In addition, the thresholds for both runways would remain unchanged. There would be no change to the parallel taxiway. Approximately 60.2 acres of Airport and surrounding Refuge lands would be disturbed, including 33.7 acres for the RSA and embankment, 8.4 acres of Duck Creek relocation, 14.8 acres for relocation of the sloughs and drainage channels east of the runway, and 3.3 acres disturbance to the Mendenhall River. An estimated 490,288 cubic yards of fill would be needed for this work, although construction of the eastern channels and fill from the modifications to the west bank of the Mendenhall River would generate about 85,097 cubic yards of available fill. This alternative is shown in Figure 2-29.

2.6.9.1 OPERATIONAL CONSIDERATIONS FOR RSA-6C

The departure and landing thresholds for both runways would remain in their existing locations. Therefore, no changes to the published "public-use" instrument approaches, Alaska Airline's existing "special use" RNAV approaches, or the Lemon and Fox turning departure procedures from Runway 08 would be necessary. There would be no need to modify Taxiway A for this alternative, nor would the Runway 08 MALSR require any changes. There would be no operational risk associated with this alternative.

2.6.9.2 ENVIRONMENTAL CONSIDERATIONS FOR RSA-6C

Installation of the EMAS would be as described for Alternative RSA-6B. The RSA embankment slope, location and size of Float Plane Pond access road, and Dike Trail/EVAR would be designed as described for Alternative RSA-5D (and applying to RSA-6B as well). These features are shown on Figure 2-29. Duck Creek would be relocated to the north.

To construct this alternative the Airport would have to acquire access to approximately 9 acres of the Refuge west of the Airport through purchase, land transfer, or lease/easement. In addition, fill would be placed within the Mendenhall River to achieve the full RSA embankment support and retain the EVAR/Dike Trail and other facilities. To help compensate for the reduced channel width created by fill on the east side of the river, some dredging would be conducted and some fill would be placed to create a small peninsula on the west bank, thereby maintaining for the most part existing channel capacity and velocities.

On the east Runway 26 end, departures and landings would also remain unchanged. A standard 1,000-foot RSA would be installed on the east runway end in the same configuration and using the same construction techniques as Alternative RSA-1, such that the area filled would be almost entirely on existing Airport property, but with a slight direct impact of about 0.01 acre on the Refuge (due to the RSA embankment extending approximately 10 feet into the Refuge). The hydrologic connection between the estuarine channels south of the runway and wetlands to the

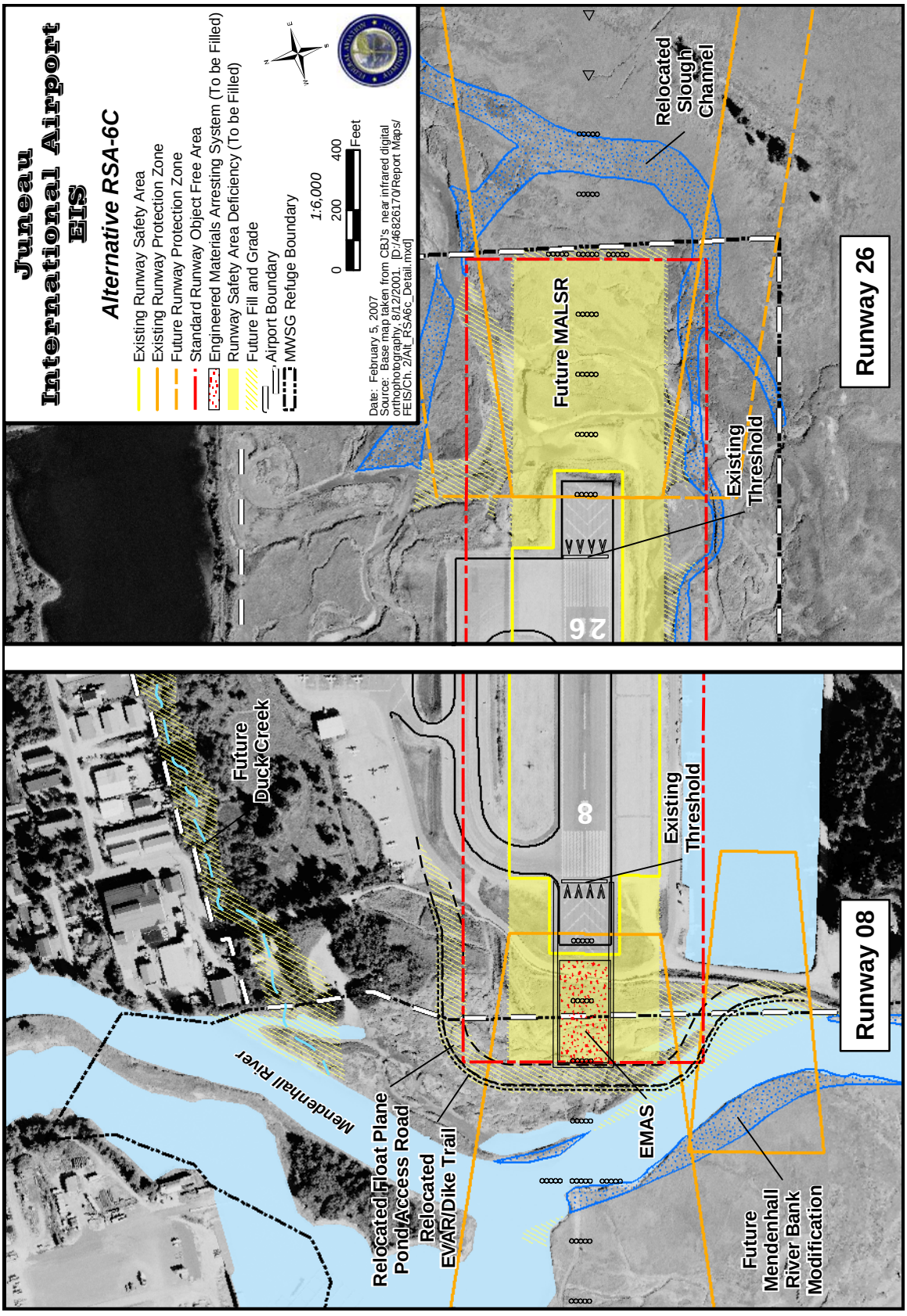

Figure 2-29. RSA-6C fill areas.

north, including the estuarine wetlands south of Miller-Honsinger Pond, would be altered by this fill, negatively affecting the emergent estuarine marsh that serves as essential fish habitat. As with RSA-1, the East Runway Slough would be shifted to the Refuge east of the Airport via a constructed channel around the east end of the fill pad to maintain functions of this important habitat. Possible methods to minimize environmental impacts on this important habitat and preserve the hydrologic function of the area are discussed in Section 2.11.

2.6.9.3 COSTS FOR RSA-6C

Appendix A includes estimated construction and life-cycle costs for runway safety area alternatives. Alternative RSA-6C would cost approximately $20.3 million to construct, at a present worth cost of $23.6 million over a 20-year life-cycle. The estimated cost to provide compensatory mitigation for the habitat lost and negatively affected by this alternative is $2.35 million.

2.6.10 RSA-6D: THRESHOLD DISPLACEMENT USING DECLARED DISTANCE CRITERIA WITH OPTION FOR EMAS

Alternative RSA-6D was developed by the FAA subsequent to the Draft EIS as a compromise alternative to address the concerns about EMAS expressed by JNU and CBJ. Specifically, FAA recognized that the EMAS Alternatives RSA-6A and -6B represented the least environmentally damaging alternatives, but also the most expensive (and, in the view of JNU and CBJ, an unproven safety technology for Juneau's environment). FAA designed Alternative RSA-6D with four objectives, while meeting FAA standards for safety area:

1. Keep the footprint of the new RSA (i.e., the amount of disturbance and environmental impact) as small as possible.
2. Use standard RSA construction for the runway ends (so as to minimize construction and maintenance costs) but build in flexibility for future use of EMAS.
3. Maintain landing thresholds, so as to eliminate operational risk of Alaska Airlines losing the use of some RNP procedures for an interim period or even permanently.
4. Maintain full runway capability to the extent possible.

The first three objectives are achieved by this alternative. Some departure characteristics for both runways would actually be increased, as illustrated on Table 2-3, however, the landing distance would be reduced by approximately 400 feet unless EMAS were later installed. Approximately 50.8 acres of Airport and surrounding Refuge lands would be disturbed, including 29.2 acres for the RSA and embankment, 8.4 acres of Duck Creek relocation, and 9.9 acres for relocation of the sloughs and drainage channels east of the runway, and 3.3 acres disturbance to the Mendenhall River. An estimated 401,842 cubic yards of fill would be needed for this work, although construction of the eastern channels and fill from the modifications to the west bank of the Mendenhall River would generate about 55,059 cubic yards of available fill. This alternative is shown in Figure 2-30.

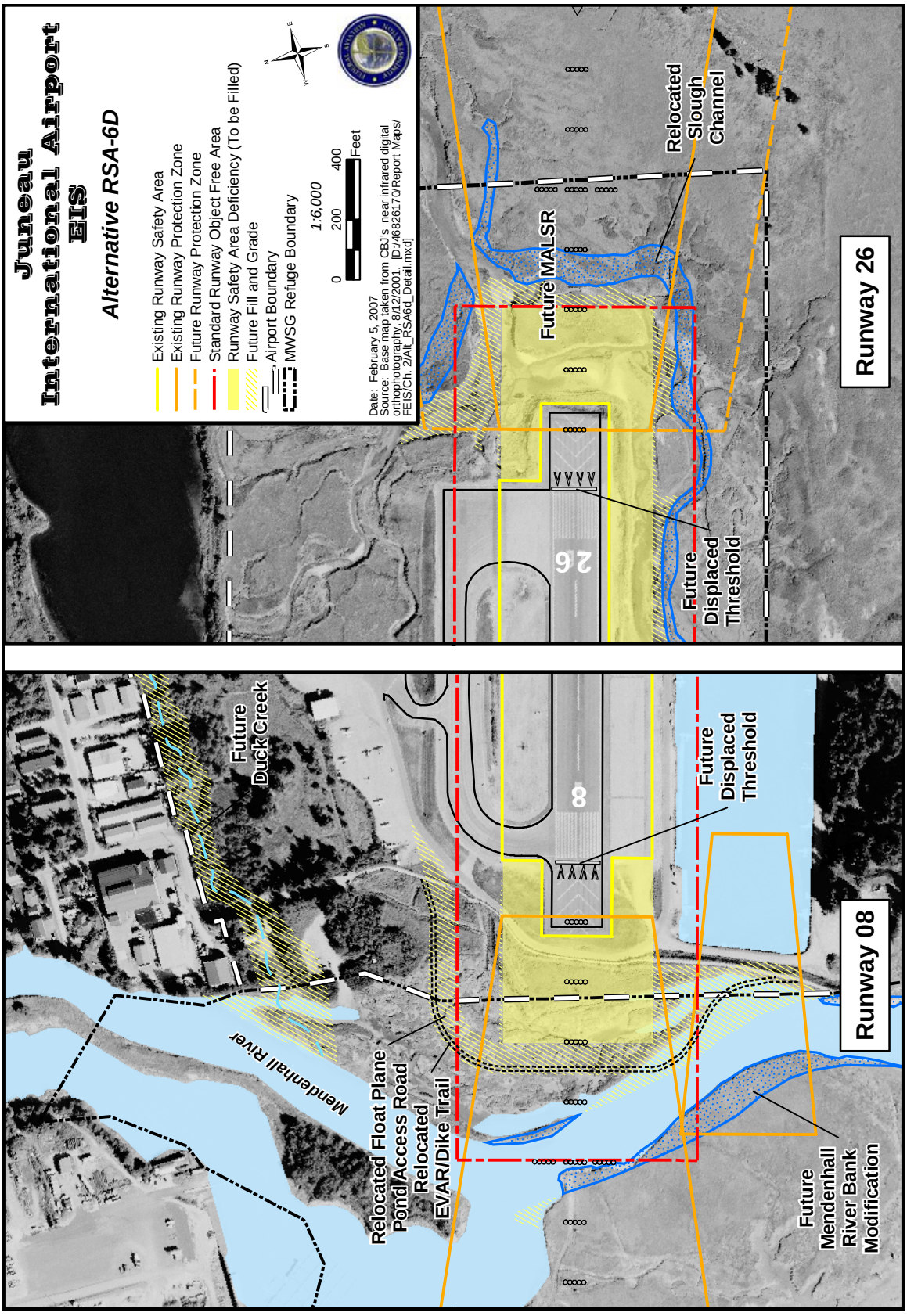

Figure 2-30. RSA-6D fill areas.

2.6.10.1 OPERATIONAL CONSIDERATIONS FOR RSA-6D

The departure points for takeoffs from both runways would be moved, approximately 400 feet west for Runway 08 and 600 feet east for Runway 26. However, these changes may not directly affect Alaska Airlines departure procedures because the landing thresholds for both runways would remain in their existing locations. The connecting taxiways would not be extended, so aircraft would need to backtaxi in order to gain the maximum available takeoff "pavement" from each runway. Because JNU's runways are relatively long, particularly compared to other Southeast airports, it could be expected that, for most operations, aircraft would not choose to backtaxi. This can be important to aircraft operations. A taxiway entrance at a location other than at or behind the departure threshold, could result in the need for some aircraft to backtaxi and turn 180 degrees before starting takeoff roll. Backtaxi operations mean more aircraft residence time on the runway, which could even slow down aircraft arrival activity during busy operations. Basic pilot training and operational policies, however, encourage the use of full runway length. Pilot preference for use of the full runway length to provide an increased margin of safety would, as stated previously, cause increased aircraft residence time and possibly slow Airport operations.

To ascertain whether these conditions would have a negative affect on commercial aviation operations, FAA consulted with Alaska Airlines about the thresholds changes. Alaska concluded that "if the existing runway entrance points were maintained, the need to back taxi will be low" (Alaska Airlines 2006a). However, later correspondence from Alaska Airlines clarified that the lack of a full-length taxiway could reduce the frequency of the operations and capacity of the airport by increasing the amount of time aircraft must spend on the runway because of backtaxiing (Alaska Airlines 2007a and 2007b).

A particular safety concern with backtaxi operations is the potential for increased runway incursions (more than one aircraft or ground vehicle on the runway at the same time resulting in loss of specified separation distances necessary to ensure safe aircraft and airport operations). Full length parallel taxiways segregate taxiing aircraft from other aircraft landing or taking off. In those cases where backtaxiing is necessary the potential for runway incursions is heightened. Backtaxi situations complicate air traffic control and detract considerably from airport efficiency during peak operating hours. For these reasons, FAA considers a full parallel taxiway to be a basic component of Airport infrastructure.

The ATCT tower at JNU has adopted a new policy, effective February 5, 2007 to decline to issue "position and hold" instructions. This policy, designed to reduce the possibility of runway incursions, may affect airfield efficiency and operational flexibility at JNU under current conditions, even with a full length parallel taxiway. FAA believes application of this policy without a full parallel taxiway would increase the time the runway was unavailable and delay use by other aircraft.

Because the landing thresholds would remain in their existing locations there would be no need for changes to the published "public-use" instrument approaches or Alaska Airline's existing "special use" RNAV approaches. There would be no need to change the Runway 08 MALSR configuration.

There would be little operational risk associated with this alternative, but under a combination of circumstances the shortened landing length could affect air carrier flights. On those relatively infrequent occasions when the runway was experiencing poor braking action and an Alaska Airlines aircraft were flying at or near maximum landing weights, the aircraft could be forced to divert to another airport. It is unlikely but not impossible that these two conditions, of poor runway braking action and maximum landing weight, would be experienced concurrently.

2.6.10.2 ENVIRONMENTAL CONSIDERATIONS FOR RSA-6D

The conceptual design for the west runway RSA would be almost the same as described for RSA-5D, except that the first 400 feet of RSA west of the Runway 08 landing threshold would be constructed to full pavement strength, allowing its use in departures to the east. Otherwise, the footprint of RSA and embankment slopes, and relocation of facilities such as the Float Plane Pond access road, fence, EVAR/Dike Trail, and Duck Creek would match that of Alternative RSA-5D. Approximately 9 acres of Refuge habitat would be affected by this construction and, as with other alternatives, some fill into the Mendenhall River would be needed despite attempts to minimize project footprints through the use of steep embankment slopes.

On the east Runway 26 end, an additional 311 feet of runway safety area would be constructed. All of this new RSA would be constructed to full pavement strength, allowing its use for departures to the west. The 289 feet of existing RSA would be converted to full pavement strength as well. The embankment supporting slopes would be graded at 4:1. The hydrologic connection between the estuarine channels south of the runway and wetlands to the north, including the estuarine wetlands south of Miller-Honsinger Pond, would be altered by this fill but not to the extent anticipated with other alternatives using standard RSAs on the east runway end. There would be no direct impact on the Refuge east of the Airport, although the wetlands, sloughs, and overall hydrology of the area may be indirectly affected by construction of the Runway 26 RSA. A consequence of the RSA development would be the need for a constructed channel similar to that shown in the Figure 2-50 conceptual design would be developed northeast, east, and south of the runway. This channel would ensure tidal exchange between habitat north and east of the runway is maintained to Jordan Creek and areas south of the runway. Possible methods to minimize environmental impacts on this important habitat and preserve the hydrologic function of the area are discussed in Section 2.11.

2.6.10.3 COSTS FOR RSA-6D

Appendix A includes estimated construction and life-cycle costs for runway safety area alternatives. Alternative RSA-6D would cost approximately $11.9 million to construct, at a present worth cost of $12.1 million over a 20-year life-cycle. The estimated cost to provide compensatory mitigation for the habitat lost and negatively affected by this alternative is $1.99 million.

2.6.11 RSA-8: NO ACTION ALTERNATIVE

In accordance with regulations implementing NEPA, the No Action Alternative is carried forward. In this alternative, there would be no improvements to the RSA to meet federal standards and no construction associated with this need.

2.6.12 Comparative Summary of Impacts: RSA

The seven RSA alternatives represent a range of options in terms of operational capability, designated land uses, and environmental impacts. Figure 2-31 highlights some of the important differences between these alternatives by illustrating disturbance footprints, landing and departure lengths for both runways, potential operational risk, extent of encroachment on the Refuge, and even displacement of the Mendenhall River.

Table 2-13 provides a summary comparison of the environmental impacts associated with RSA development. A full treatment of the resources listed on this table and the important criteria used to determine the extent and severity of environmental effects is found in Chapter 4 of this EIS.

2.7 Description of Navigational Alignment Alternatives – Design Concepts and Construction

Two alternatives for improved navigational alignment on Runway 26 are considered in the detailed analysis of environmental impacts. Section 2.7.1 provides a description of the MALSR and facilities needed to support the Runway 26 approach lighting system. Section 2.7.2 addresses the No Action Alternative.

2.7.1 NAV-2B: Installation of MALSR on Runway 26

The MALSR is a preferred lighting system for instrument approaches because it offers a more reliable transition from instrument navigation to visual navigation on approach. It also provides a visual guidance system that helps all pilots align with the runway during nighttime operations. The system includes both steady-burning and flashing lights, but it is not intended for constant use. The flasher system lights sequence toward the runway threshold and appear to the pilot as an arrow during the approach phase of the flight. The MALSR is activated by the Air Traffic Control Tower upon aircraft approach when the Tower is open and by the Automated Flight Service Station, initiated by pilot communication, when the Tower is closed at night.

In accordance with the guidance specified in FAA Order 6850.2A, Visual Guidance Lighting Systems, the light stations would be sited at 200-foot intervals, with a spacing tolerance of plus or minus 20 feet. Thus, there is some flexibility in placement to avoid features such as sloughs or drainage channels. For a new MALSR on Runway 26, the specific landing threshold would first be surveyed, and the locations for each MALSR light station would be sited at approximately 200-foot intervals beginning at the threshold and extending east.[23]

23. Some of the RSA alternatives would entail relocation or displacement of the Runway 08 landing threshold. Depending on the distance and interval, the threshold change could necessitate relocation of the Runway 08 approach MALSR. This effect of threshold movement is evaluated in the discussions for each RSA alternative.

The MALSR in use for the Runway 08 approach at JNU provides a good example of the system layout and manner in which the lights operate. FAA performs routine maintenance on the MALSR on monthly, quarterly, and semi-annual bases. FAA must be prepared, 24-hours a day, to respond quickly to problems that cause reduced capability in navigational aids. This need for emergency maintenance becomes even more important at night and during inclement weather. The maintenance schedule and emergency access requirements factor into the proposed MALSR design features.

Data is not readily available regarding the frequency of MALSR malfunction or failure. Ongoing maintenance is generally adequate to identify and prevent system-wide problems. The failure of individual fixtures does not compromise the entire MALSR system; however, aircraft approach minima are affected if too many steady lights or flashers have failed. FAA Orders establish criteria for how many individual fixture failures (e.g., light burned out) can exist before the entire system must be taken out of service. In the event that the number of fixture failures exceeded the FAA criteria, approach minima would be reduced until such time as the failures were repaired and the system was returned to service. In inclement weather or poor visibility conditions, this could result in delayed or re-routed flights into Juneau. Therefore, it is imperative that an access road be constructed for the MALSR to allow repairs as soon as tides and other environmental conditions allow.

2.7.1.1 MALSR DESIGN

The system consists of a series of lights mounted on standards that align with the runway centerline and extend a total of 2,400 feet from the runway threshold. There would be 14 light configurations, some mounted on standards within the RSA or RSA/EMAS along the centerline, and the remainder placed on towers extending from the end of the RSA. The lights would be positioned at 200-foot intervals, beginning at the Runway 26 landing threshold on the east end of the runway. If a standard RSA is constructed using a 1,000-foot undershoot embankment, the first 1,000 feet of MALSR would consist of five light configurations mounted either flush with the surface, or on low support towers. (Any lighting systems within the RSA must have break-away coupling within 3 inches of the surface.[24]) An additional two light towers would be placed on either side of the centerline at 1,000 feet east of the runway threshold; the width of these three towers from one end of a crossbar to the other would be about 70 feet. The next 1,400 feet of MALSR would include seven light configurations mounted on fiberglass towers. In total, there would be 14 light support towers except where the lights are flush mounted within the RSA, 63 bulbs, and 5 flashers. A small control building, about 10 feet by 14 feet by 10 feet, would also be installed on piles at approximately the midway point of the MALSR system. Figure 2-17 illustrated the MALSR layout with a standard RSA constructed from the existing Runway 26 threshold.

24. The MALSR design assumes development of a standard RSA extending 1,000 feet from the threshold. Any reduction in RSA would not alter the distance positioning of the lights, but each 200-foot reduction in RSA would result in replacement of one flush- or near-surface mounted light configuration with a tower.

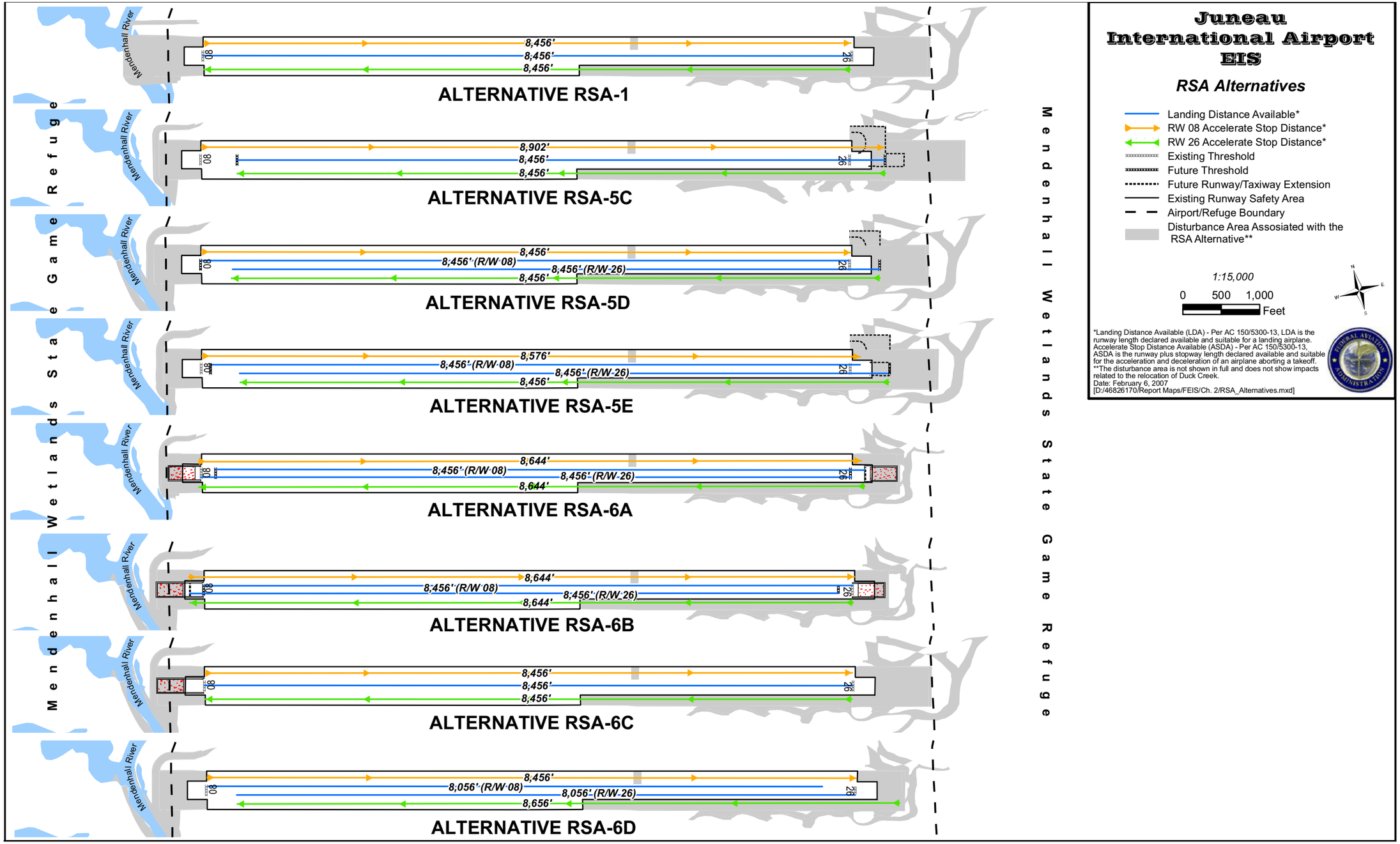

Figure 2-31. Comparison of RSA Alternatives.

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Table 2-13. Comparative Summary of Environmental Impacts: Runway Safety Area Alternatives[1]

Resource	RSA-1[2]	RSA-5C	RSA-5D	RSA-5E	RSA-6A	RSA-6B	RSA-6C	RSA-6D	RSA-8
Construction									
RSA Disturbance Area (not including relocation of Duck Creek channel)	37.2 acres	39.3 acres	35.6 acres	35.3 acres	25.0 acres	27.2 acres	33.7 acres	29.2 acres	None
Refuge Disturbance	9.8 acres	9.0 acres	8.1 acres	4.1 acres	1.9 acres	8.1 acres	8.1 acres	8.1 acres	None
Other Disturbance (River, East Runway Slough, Duck Creek; includes some Refuge overlap)	23.2 acres	20.7 acres	26.5 acres	22.7 acres	18.3 acres	22.1 acres	26.5 acres	21.6 acres	None
Fill Volume	603,125 yd^3	595,204 yd^3	511,677 yd^3	484,365 yd^3	317,412 yd^3	371,244 yd^3	490,288 yd^3	401,842 yd^3	None
Cost									
Construction	$16.9 million	$14.7 million	$15.0 million	$13.2 million	$23.1 million	$25.8 million	$20.3 million	$11.9 million	None
20-Year Life Cycle (includes Construction Cost)	$17.1 million	$14.9 million	$15.3 million	$13.4 million	$29.6 million	$32.2 million	$23.6 million	$12.1 million	None
Compensatory Mitigation	$2.6 million	$2.5 million	$2.65 million	$2.2 million	$1.58 million	$1.9 million	$2.35 million	$1.99 million	None
Total Cost (Life Cycle + Mitigation)	$19.7 million	$17.4 million	$17.9 million	$15.6 million	$31.2 million	$34.1 million	$25.95 million	$14.1 million	None
Noise									
1.5 DNL or Greater Noise Increase in 65 or Greater DNL Contour?	None	Yes, 7 points east of runway	Comparable to RSA-1 at Rwy 08 end and RSA-5C at Rwy 26 end	Comparable to RSA-6A at Rwy 08 end and RSA-5C at Rwy 26 end	Yes, one point east of runway	Yes, one point west of runway at existing dike trail	None	Yes, 6 points east of runway and 2 points west of runway	None
3.0 DNL or Greater Noise Increase in 60-65 DNL Contour?	None	None	None	None	None	None	None	None	None
Incompatible Noise?	No	No	No	No	No	No	No	No	No
65 DNL & greater area (square mile)	1.08	1.09	1.09	1.09	1.00	1.7	1.08	1.09	1.08
Human Environment and Compatible Land Use									
Noise Sensitive Areas	None	Increase not incompatible	Comparable to RSA-1 at Rwy 08 end and RSA-5C at Rwy 26 end	Comparable to RSA-6A at Rwy 08 end and RSA-5C at Rwy 26 end	None	Increase not incompatible	None	Increase not incompatible	No Change
Developed Recreation/ Dike Trail	Minor, negative	Minor, negative	Minor, negative	Minor, negative	Minor, negative	Minor, negative	Minor, negative	Minor, negative	No Change

Table 2-13. Comparative Summary of Environmental Impacts: Runway Safety Area Alternatives[1], continued

Resource	RSA-1[2]	RSA-5C	RSA-5D	RSA-5E	RSA-6A	RSA-6B	RSA-6C	RSA-6D	RSA-8
Dispersed Recreation (hunting, bird-watching, hiking, etc.)	Minor, negative	Minor, negative	Minor, negative	Minor, negative	Minor, negative	Minor, negative	Minor, negative	Minor, negative	No Change
Socioeconomics									
Short-term Business Income	$23,117,000	$20,187,000	$20,676,000	$18.178,000	$40,970,000	$43,631,000	$31,981,000	$16,398,000	$0
Short-term (construction) FTE Employment	148	129	132	117	263	279	204	105	$0
Short-term (construction) Payroll	$6,913,000	$6,008,000	$6,153,000	$5,410,000	$12,044,000	$12,985,000	$9,518,000	$4,880,000	$0
Short-term Sales Tax Revenues	$304,400	$264,600	$271,000	$238,800	$530,400	$571,900	$419,200	$214,900	$0
Long-term Economic Impacts	Minor, positive	Minor, positive	Minor, positive	Minor, positive	Minor, positive	Minor, positive	Minor, positive	Minor, positive	None
Long Term Revenue Impacts	None	None	None	None	None	None	None	None	None
Long-term Social Impacts	Minor, positive	Minor, positive	Minor, positive	Minor, positive	Minor, positive	Minor, positive	Minor, positive	Minor, positive	None
Air Quality									
Changes in Operating Emissions due to Action (year 2015)	None	Yes; insignificant increase of CO, VOC, NOx	Yes; comparable to RSA-5C	Yes; comparable to RSA-5C for the Rwy 26 end and RSA-6A for the Rwy 08 end	Yes; insignificant increase of CO, VOC	Yes; insignificant increase of CO, VOC	None	Yes; comparable to but slightly higher than RSA-5C	None
$PM_{10}/PM_{2.5}$ (tons/year) – Operating	1.5	1.5	Comparable to RSA-5C	Comparable to RSA-5C	1.5	1.5	1.5	Comparable to but slightly higher than RSA-5C	1.5
$PM_{10}/PM_{2.5}$ (tons/year) - Construction	0.7	1.0	Comparable to RSA-5C	Intermediate between RSA-5C and RSA-6A	0.8	0.8	0.5	Comparable to but slightly higher than RSA-5C	N/A
$PM_{10}/PM_{2.5}$ (tons/year) - Total	2.2	2.5	Comparable to RSA-5C	Intermediate between RSA-5C and RSA-6A	2.3	2.3	2.0	Comparable to but slightly higher than RSA-5C	1.5
Fugitive Dust (tons/year, peak year)	44.6	45.2	Comparable to RSA-5C	Comparable to RSA-5C	30.4	31.8	39.7	Comparable to but slightly higher than RSA-5C	0.0
Hazardous Materials and Solid Waste									
Presence of Buried Hazardous Waste or Soil Contamination	Low potential to encounter buried, hazardous wastes	Low potential to encounter buried, hazardous wastes	Low potential to encounter buried, hazardous wastes	Low potential to encounter buried, hazardous wastes	Low potential to encounter buried, hazardous wastes	Low potential to encounter buried, hazardous wastes	Low potential to encounter buried, hazardous wastes	Low potential to encounter buried, hazardous wastes	No potential to encounter hazardous waste

Table 2-13. Comparative Summary of Environmental Impacts: Runway Safety Area Alternatives[1], continued

Resource	RSA-1[2]	RSA-5C	RSA-5D	RSA-5E	RSA-6A	RSA-6B	RSA-6C	RSA-6D	RSA-8
Hazardous Materials Use/ Pollutant Generation	No increase in use of hazardous materials	Increase use of urea due to additional taxiway length	Increase use of urea due to additional taxiway length	Increase use of urea due to additional taxiway length	No increase in use of hazardous materials	No increase in use of hazardous materials	No increase in use of hazardous materials	Increase use of urea due to additional operational runway length	No change
Water Resources and Floodplains									
Floodplain Volume	Major, loss of floodplain	Moderate, loss of floodplain	Moderate, loss of floodplain	Moderate, loss of floodplain	Minor, loss of floodplain	Minor, loss of floodplain	Moderate, loss of floodplain	Moderate, loss of floodplain	None
Riparian/Channel Effects	Major, Mendenhall River, Duck Creek, & Miller-Honsinger Slough relocated	Major, Duck Creek & Miller-Honsinger Slough relocated	Major, Duck Creek & Miller-Honsinger Slough relocated, Mendenhall River channel modified	Moderate, Duck Creek & Miller-Honsinger Slough relocated	Moderate impacts, Duck Creek & Miller-Honsinger Slough relocated	Major impacts, Duck Creek & Miller-Honsinger Slough relocated, Mendenhall River channel modified	Major, Duck Creek & Miller-Honsinger Slough relocated, Mendenhall River channel modified	Major, Duck Creek & Miller-Honsinger Slough relocated, Mendenhall River channel modified	None
Tidal Prism Volume	Moderate loss, fills in Miller-Honsinger marsh and in lower Mendenhall River	Major loss, fill in Miller-Honsinger marsh	Moderate loss, fill in Miller-Honsinger marsh and in Mendenhall River	Moderate loss, fill in Miller-Honsinger marsh	Minor, fill in Miller-Honsinger marsh and the Mendenhall River	Minor, fill in Miller-Honsinger marsh and the Mendenhall River	Moderate loss, fills in Miller-Honsinger marsh and Mendenhall River	Moderate loss, fill in Miller-Honsinger marsh and Mendenhall River	None
Snow Storage	Low impact, less pervious surface than current	Low impact, less pervious surface than current	Low, less pervious surface than current	Low, less pervious surface than current	Negligible, less pervious surface than current	Negligible, less pervious surface than current	Low impact, less pervious surface than current	Low, less pervious surface than current	None
Surface Water Quantity	Moderate, less pervious surface than current conditions	Moderate, less pervious surface than current conditions	Moderate, less pervious surface than current conditions	Moderate, less pervious surface than current conditions	Minor, less pervious surface than current conditions	Minor, less pervious surface than current conditions	Moderate, less pervious surface than current conditions	Moderate, less pervious surface than current conditions	None
Surface Water Quality	Moderate, short-term degradation	Moderate, short-term degradation	Moderate, short-term degradation	Moderate, short-term degradation	Moderate, short-term degradation	Moderate, short-term degradation	Moderate, short-term degradation	Moderate, short-term degradation	None
Long-Term (post construction)	Low impact, increased runoff	Low impact, increased runoff	Low impact, increased runoff	Low impact, increased runoff	Low impact, increased runoff	Low impact, increased runoff	Low impact, increased runoff	Low impact, increased runoff	None
Short-Term (construction)	Moderate degradation	Moderate degradation	Moderate degradation	Moderate degradation	Moderate degradation	Moderate degradation	Moderate degradation	Moderate degradation	None
Groundwater Recharge	Moderate loss of recharge, due to reductions in surface infiltration capacity (less pervious surface)	Moderate loss of recharge, due to reductions in surface infiltration capacity (less pervious surface)	Moderate loss of recharge, due to reductions in surface infiltration capacity (less pervious surface)	Moderate loss of recharge, due to reductions in surface infiltration capacity (less pervious surface)	Minor loss in recharge, some reductions in surface infiltration capacity (EMAS impervious)	Minor loss in recharge, some reductions in surface infiltration capacity (EMAS impervious)	Moderate loss in recharge, due to reductions in surface infiltration capacity (less pervious surface)	Moderate loss of recharge, due to reductions in surface infiltration capacity (less pervious surface)	None
Vegetation									
Direct Impacts for RSA construction	35.7 acres	37.0 acres	37.2 acres	33.3 acres	23.5 acres	28.8 acres	35.4 acres	30.8 acres	None

Table 2-13. Comparative Summary of Environmental Impacts: Runway Safety Area Alternatives[1], continued

Resource	RSA-1[2]	RSA-5C	RSA-5D	RSA-5E	RSA-6A	RSA-6B	RSA-6C	RSA-6D	RSA-8
Acres impacted for reconstruction of tidal sloughs to minimize hydrologic impacts	14.8 acres	12.3 acres	14.8 acres	14.3 acres	9.9 acres	10.4 acres	14.8 acres	9.9 acres	None
Total acres of direct impacts	50.5 acres	49.3 acres	52.0 acres	47.6 acres	33.4 acres	39.2 acres	50.2 acres	40.7 acres	None
Indirect Impacts	Second greatest impact of all alternatives.	Greatest potential for weed introduction to Dredge Spoil Islands and other areas within Refuge east of runway	Most severe of all RSA alternatives, identical impact to RSA-5D, RSA-6C, and RSA-6D west of runway	Minor effect west of runway, moderate effect east of runway	Least severe of all RSA alternatives. Little effect on west end of runway, moderate effect on east end	Moderate effect on west end of runway, minor effect on east end & NE wetlands, identical impact to RSA-5D, RSA-6C, and RSA-6D west of runway	Third greatest impact of all alternatives, identical impact to RSA-5D, RSA-6B, and RSA-6D west of runway.	Moderate level of impact compared to other alternatives, identical impact to RSA-5D, RSA-6B, and RSA-6C west of runway.	None
Wetlands									
Modification of Wetlands (acres impacted for RSA construction)	28.7 acres estuarine wetlands filled	29.5 acres estuarine wetlands filled	29.4 acres of estuarine wetlands filled	25.5 acres of estuarine wetlands filled	16.6 acres estuarine wetlands filled	21.2 acres estuarine wetlands filled	27.8 acres estuarine wetlands filled	23.2 acres of estuarine wetlands filled	None
Acres impacted for reconstruction of tidal sloughs to minimize hydrologic impacts	14.8 acres	12.3 acres	14.8 acres	14.3 acres	9.9 acres	10.4 acres	14.8 acres	9.9 acres	None
Total acres impacted	43.5 acres	41.8 acres	44.2 acres	39.8 acres	26.5 acres	31.6 acres	42.6 acres	33.1 acres	None
Impact Significance and Basis for Conclusion	Yes. Hydrologic alterations would affect functions and values of the wetlands and EFH.	Yes. Hydrologic alterations would affect functions and values of the wetlands and EFH.	Yes. Hydrologic alterations would affect functions and values of the wetlands and EFH.	Yes. Hydrologic alterations would affect functions and values of the wetlands and EFH.	No. Relatively minor hydrologic changes would not substantially impair functions and values or EFH.	Yes. Hydrologic alterations would affect functions and values of the wetlands and EFH.	Yes. Hydrologic alterations would affect functions and values of the wetlands, and EFH.	Yes. Hydrologic alterations would affect functions and values of the wetlands and EFH.	No
Fisheries									
Essential Fish Habitat lost for construction of RSA	28.7 acres lost	29.5 acres lost	29.4 acres lost	25.5 acres lost	16.6 acres lost	21.2 acres lost	27.8 acres lost	23.2 acres lost	None
Acres impacted for reconstruction of tidal sloughs to minimize hydrologic impacts	14.8 acres	12.3 acres	14.8 acres	14.3 acres	9.9 acres	10.4 acres	14.8 acres	9.9 acres	None
Total acres impacted	43.5 acres	41.8 acres	44.2 acres	39.8 acres	26.5 acres	31.6 acres	42.6 acres	33.1 acres	None
Fish access to Jordan Creek	Inhibited (longer, darker culverts)	Inhibited (longer, darker culverts)	Inhibited (longer, darker culverts)	Inhibited (longer, darker culverts)	Inhibited (longer, darker culverts)	Inhibited (longer, darker culverts)	Inhibited (longer, darker culverts)	Inhibited (longer, darker culverts)	No change
Fish access to Duck Creek	Similar to existing (relocation of mouth)	Similar (relocation of mouth)	Similar (relocation of mouth)	Similar (relocation of mouth)	Similar (relocation of mouth)	Similar (relocation of mouth)	Similar (relocation of mouth)	Similar (relocation of mouth)	No change

Table 2-13. Comparative Summary of Environmental Impacts: Runway Safety Area Alternatives[1], continued

Resource	RSA-1[2]	RSA-5C	RSA-5D	RSA-5E	RSA-6A	RSA-6B	RSA-6C	RSA-6D	RSA-8
Overall construction impacts (e.g. disruption of fish movement and activity)	Moderate-severe, based on Mendenhall alterations	Moderate-severe, East Runway Slough and tidal channel changes, Mendenhall River modified	Moderate-severe, East Runway Slough and tidal channel changes, Mendenhall River modified	Moderate, East Runway Slough and tidal channel changes	Relatively minor, East Runway Slough and tidal channel changes	Moderate, least East Runway Slough and tidal channel change, Mendenhall River modified	Moderate, East Runway Slough and tidal channel changes, Mendenhall River modified	Moderate-severe, East Runway Slough and tidal channel changes, Mendenhall River modified	None
Overall indirect impacts	Most (Mendenhall R. changes, blockage of east sloughs, Duck Creek relocation)	Moderate-severe (permanent east slough alterations, probable loss of northeast sloughs, Duck Creek relocation)	Moderate-severe (Mendenhall River changes, Duck Creek relocation, relocation of East Runway Slough)	Moderate (Duck Creek relocation, relocation of East Runway Slough)	Minor (minor effect on East Runway Slough, Duck Creek relocation)	Moderate (least effect on East Runway Slough, Duck Creek Relocation, Mendenhall River changes)	Moderate-severe (blockage of East Runway Slough, Duck Creek relocation, Mendenhall River changes)	Moderate (minor effect on East Runway Slough, Duck Creek relocation, Mendenhall River changes)	None
Wildlife									
Overall Effect	2nd largest acreage of wildlife habitat affected, but greatest overall impact because of substantial modifications to the Mendenhall River. Moderate impact east of the runway	4th most acreage of wildlife habitat affected, but 2nd greatest overall impact because of major changes in hydrologic connections for tidal sloughs east of the runway	Most acreage of wildlife habitat affected, but 3rd greatest overall impact	5th most acreage of wildlife habitat affected and 5th most overall impact	Least acreage of wildlife habitat affected and least overall impact.	7th most acreage of wildlife habitat affected and 7th most overall impact	3rd most acreage of wildlife habitat affected, but less overall impact than RSA-5C because of substantial reduction in impact on hydrologic connections for tidal sloughs east of runway	6th most wildlife habitat affected and 6th most overall impact	None
General Habitat (direct impacts for RSA construction)	35.7 acres	37.0 acres	37.2 acres	33.3 acres	23.5 acres	28.8 acres	35.4 acres	30.8 acres	None
Acres impacted for reconstruction of tidal sloughs to minimize hydrologic impacts	14.8 acres	12.3 acres	14.8 acres	14.3 acres	9.9 acres	10.4 acres	14.8 acres	9.9 acres	None
Total acres impacted	50.5 acres	49.3 acres	52.0 acres	47.6 acres	33.4 acres	39.2 acres	50.2 acres	40.7 acres	None
Threatened and Endangered Species	RSA impacts to threatened or endangered species would be insignificant under all action alternatives. There would be no direct effects on sea lions and whales and the potential indirect effects to forage fish are not likely to adversely affect these species.								None
High Interest Species	23.7 acres (1.6%) of shorebird habitat lost from landscape area; 21.0 acres (0.9%) of Vancouver Canada Goose habitat lost from landscape area	23.9 acres (1.7%) of shorebird habitat lost from landscape area 1687 acres (0.7%) of Vancouver Canada Goose habitat lost from landscape area	24.3 acres (1.7%) of shorebird habitat lost from landscape area 19.4 acres (0.6%) of Vancouver Canada Goose habitat lost from landscape area	20.7 acres (1.4%) of shorebird habitat lost from landscape area 15.5 acres (0.6%) of Vancouver Canada Goose habitat lost from landscape area	18.9 acres (1.3%) of shorebird habitat lost from landscape area 14.2 acres (0.6%) of Vancouver Canada Goose habitat lost from landscape area	21.3 acres (1.5%) of shorebird habitat lost from landscape area 177 acres (0.7%) of Vancouver Canada Goose habitat lost from landscape area	23.1 acres (1.6%) of shorebird habitat lost from landscape area. 18.9 acres (0.8%) of Vancouver Canada Goose habitat lost from landscape area	22.0 acres (1.5%) of shorebird habitat lost from landscape area. 18.5 acres (0.8%) of Vancouver Canada Goose habitat lost from landscape area	None
	Impacts to high interest species would be insignificant under all action alternatives because construction of the RSA and associated facilities for all alternatives would not be expected to have substantive effects on the populations of these species.								None

Table 2-13. Comparative Summary of Environmental Impacts: Runway Safety Area Alternatives[1], continued

Resource	RSA-1[2]	RSA-5C	RSA-5D	RSA-5E	RSA-6A	RSA-6B	RSA-6C	RSA-6D	RSA-8
Sensitive Species	16.5 acres (1.3 %) of goshawk habitat lost from landscape area 50.53 acres (1.2%) of peregrine falcon habitat lost from landscape area	18.0 acres (1.4%) of goshawk habitat lost from landscape area 49.31 acres (1.1%) of peregrine falcon habitat lost from landscape area	18.7 acres (1.5%) of goshawk habitat lost from landscape area 52.0 acres (1.2%) of peregrine falcon habitat lost from landscape area	19.5 acres (1.5%) of goshawk habitat lost from landscape area 47.6 acres (1.1%) of peregrine falcon habitat lost from landscape area	7.7 acres (0.6%) of goshawk habitat lost from landscape area 33.4 acres (0.8%) of peregrine falcon habitat lost from landscape area	9.1 acres (0.7%) of goshawk habitat lost from landscape area 39.2 acres (0.9%) of peregrine falcon habitat lost from landscape area	18.3 acres (1.5%) of goshawk habitat lost from landscape area 50.2 acres (1.2%) of peregrine falcon habitat lost from landscape area	9.9 acres (0.8%) of goshawk habitat lost from landscape area 40.7 acres (0.9%) of peregrine falcon habitat lost from landscape area	None
	Impacts to sensitive species would be insignificant under all alternatives because construction of the RSA would not be expected to have substantive effects on the populations of these species.								None
Cultural Resources	No known impact to historic properties, low potential to encounter cultural resources	No known impact to historic properties, low potential to encounter cultural resources	No known impact to historic properties, low potential to encounter cultural resources	No known impact to historic properties, low potential to encounter cultural resources	No known impact to historic properties, low potential to encounter cultural resources	No known impact to historic properties, least potential to encounter cultural resources	No known impact to historic properties, low potential to encounter cultural resources	No known impact to historic properties, low potential to encounter cultural resources	No impacts to historic properties
Visual Resources	Major long-term visual degradation at Rwy 08 end from RSA development in Mendenhall River	Moderate to major negative changes in visual quality from Rwy 26 RSA expansion into the Refuge	Moderate long-term visual degradation at Rwy 08 end from RSA development in Mendenhall River, impacts at Rwy 08 end the same as for RSA-6B, RSA-6C, and RSA-6D	Moderate long-term visual impacts on both runway ends	Minor long-term changes in the visual character from EMAS at both runway ends	Moderate long-term changes in the visual character from Rwy 08 end EMAS, minor changes on Rwy 26 end, moderate long-term visual degradation at Rwy 08 end from RSA development in Mendenhall River, impacts at Rwy 08 end the same as for RSA-5D, RSA-6C, and RSA-6D	Impacts the same as RSA-1 for Rwy 26, moderate long-term visual degradation at Rwy 08 end from RSA development in Mendenhall River, impacts at Rwy 08 end the same as for RSA-5D, RSA-6B, and RSA-6D	Moderate long-term visual degradation at Rwy 08 end from RSA development in Mendenhall River, impacts at Rwy 08 end the same as for RSA-6B, RSA-6C, and RSA-6D	No changes in visual quality
DOT Section 4(f) Lands									
Direct Impact on Land	Acquire 9.85 acres of Refuge west and 0.01 acre east of Airport; relocation of Dike Trail to Refuge.	Acquire 3.2 acres of Refuge west and 5.8 acres east of Airport; relocation of Dike Trail.	Acquire 8.1 acres of Refuge west and 0.01 acre east of Airport; relocation of Dike Trail.	Acquire 2.7 acres of Refuge west and 1.4 acres east of Airport; relocation of Dike Trail.	Acquire 1.9 acres of Refuge west of Airport; relocation of Dike Trail.	Acquire 8.1 acres of Refuge west east of Airport; relocation of Dike Trail.	Acquire 8.1 acres of Refuge west and 0.01 acre east of Airport; relocation of Dike Trail.	Acquire 8.1 acres of Refuge west of Airport; relocation of Dike Trail.	None
Acres impacted for reconstruction of tidal sloughs to minimize hydrologic impacts	4.5 acres	2.1 acres	4.5 acres	5.0 acres	0.2 acres	0.2 acres	4.5 acres	0.2 acres	None
Total acres impacted	14.4 acres	11.1 acres	12.6 acres	9.1 acres	2.1 acres	8.3 acres	12.6 acres	8.3 acres	None

Table 2-13. Comparative Summary of Environmental Impacts: Runway Safety Area Alternatives[1], continued

Resource	RSA-1[2]	RSA-5C	RSA-5D	RSA-5E	RSA-6A	RSA-6B	RSA-6C	RSA-6D	RSA-8
Indirect Impacts	Greatest hydrologic and habitat impacts to Refuge west of Airport, minor impacts east of Airport with some impairment to beneficial uses of the Refuge.	Greatest hydrologic and habitat impacts to Refuge east of Airport with some impairment to beneficial uses of the Refuge.	Moderate hydrologic and habitat impacts to Refuge west of Airport, minor impacts east of Airport, minor impairment to beneficial uses of the Refuge.	Minor hydrologic and habitat impacts to Refuge west of Airport, moderate impacts east of Airport with minor impairment to beneficial uses of the Refuge.	Relatively minor hydrologic and habitat impacts to Refuge, least impairment to beneficial uses.	Moderate hydrologic and habitat impacts to Refuge west of Airport, minor impacts east of Airport, minor impairment to beneficial uses of the Refuge.	Moderate hydrologic and habitat impacts to Refuge west of Airport, minor impacts east of Airport, minor impairment to beneficial uses of the Refuge.	Moderate hydrologic and habitat impacts to Refuge west of Airport, minor impacts east of Airport, minor impairment to beneficial uses of the Refuge	No impact
Constructive Use Impact (Substantial Impairment)	No	No	No	No	No	No	No	No	No

[1] Each of the alternatives, except the no action RSA-8, includes development of full lateral runway safety area.
[2] Impacts from RSA-1 would be greater than those shown in this table due to substantial modification of the Mendenhall River channel that is not quantified in the EIS. Overall Impacts from RSA-1 would be greater than all other RSA alternatives.

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The light towers are made of fiberglass and stand from 5 feet to 20 feet in height, depending on aircraft approach path elevations. A 10-foot-wide crossbar mounted on top of the single fiberglass pole holds five medium-intensity light bulb fixtures. The entire assembly is fixed to a steel mounting stand and base plate. Another possible configuration would use two steel piles driven well below the surface supporting a platform located above the high tide line. The platform would support the base plate assembly including a junction box and fiberglass light pole, as shown on Figure 2-32.

A 12-foot-wide at-grade road along the lighting system is proposed to properly repair, maintain, and test the system. The road would allow maintenance crews vehicular access to the light towers but immediate access would not be available to most of the lights when tide levels are above approximately 11-foot msl. This minimal footprint road system would provide access for a ¾-ton utility vehicle. The vehicle is needed to carry replacement equipment, tools, and maintenance personnel. For example, the equipment needed to repair a light would consist of a replacement flasher unit weighing approximately 75 pounds, tools, and a ladder. Due to the importance of the approach lighting system in establishing approach minima, and its role in safe visual alignment with the runway, a maintenance road for the lighting system is considered an essential component of the development.

The road could be constructed through the existing sloughs that provide tidal water to the marshes and wetlands south of the Miller-Honsinger Pond. If a new RSA is constructed on the Runway 26 end, cutting off the existing sloughs and causing new channels to form east of the runway, a bridge or arch culvert span may be needed for the MALSR access road to reach lights east of the RSA.

Two vehicle and equipment turnarounds, approximately 18 ft by 30 ft, (including the road width), would be constructed. One of the turnarounds would be located at the eastern end of the system, and the other would be located in the middle of the access road. Small fiberglass posts may be used to mark the access road.

2.7.1.2 Access Road and MALSR Construction

The access road would be constructed of a geotextile "honeycomb" placed on geotextile fabric and recessed into the ground at least one foot. The honeycomb would be filled with granular aggregate, so that the top of the road would be approximately flush with the existing ground surface (see Figure 2-32). The road would allow vehicle passage at tides lower than the road surface, estimated to be no lower than 9 feet msl. Natural vegetation should take hold through the road honeycomb and help restore the alignment to a more natural function and appearance. Communications and power cables would be trenched and buried adjacent to the road along the centerline of the light towers. Culverts or other water diversion systems may have to be placed just upgradient of any light pads that are located in "drainages," as the separation distance between towers should be maintained at 200 feet if at all possible.

As was mentioned previously, construction of RSA or EMAS on the Runway 26 approach end would displace some sloughs that maintain a hydrologic connection the wetlands north of the runway and south of the Miller-Honsinger Pond. Section 2.11 in this EIS describes some options

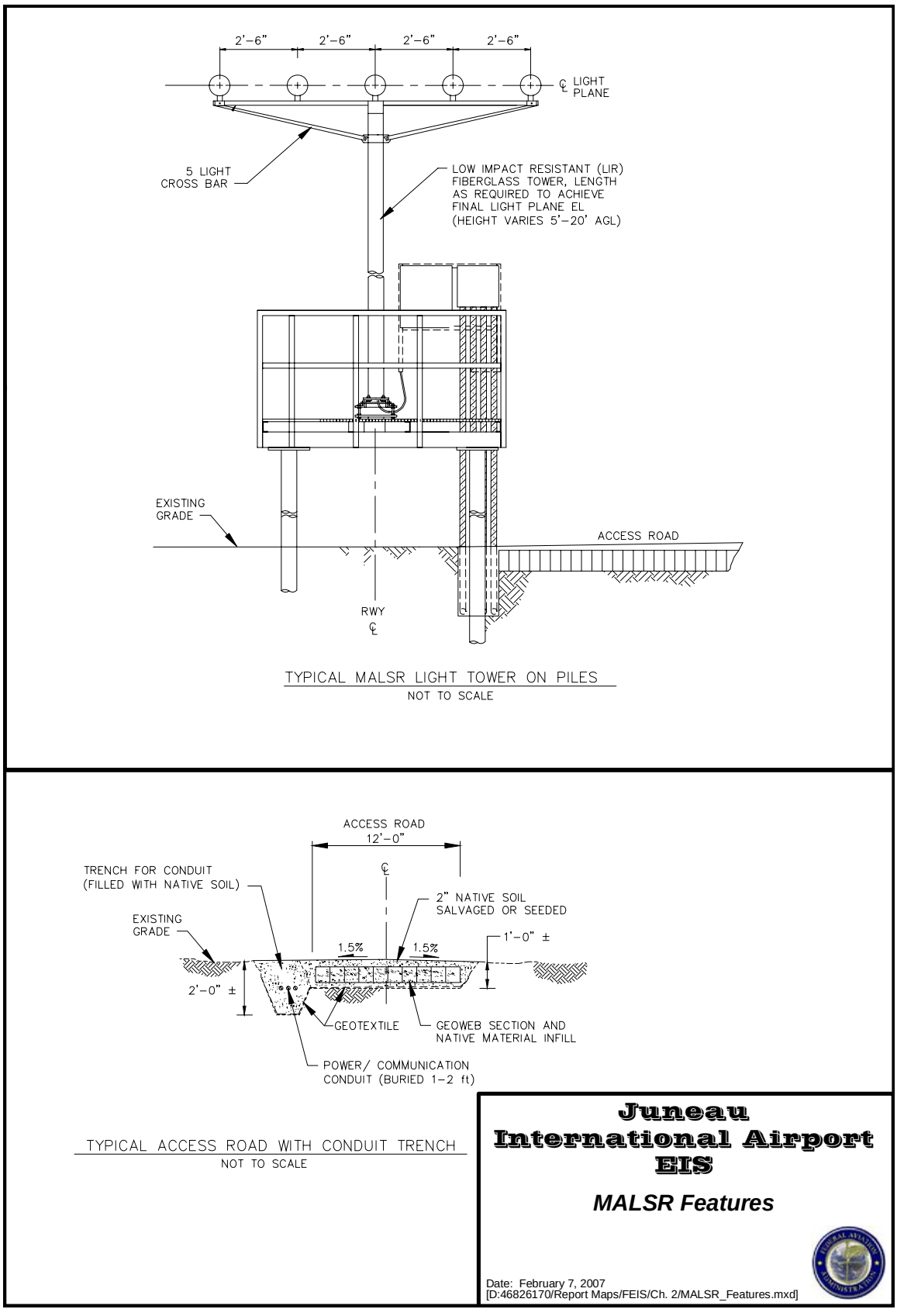

Figure 2-32. MALSR light tower and road/pad cross-section.

to maintain the existing hydrologic connection, including installation of culverts or concrete spans under the new RSA. However, if the sloughs are relocated east of the new RSA or EMAS, the access road would have to be elevated across the channels for about 150 feet. Three to four concrete spans would be needed to cross the sloughs, with an additional service road to access facilities. Section 2.11.5 provides more information on options for emergency and routine maintenance access to the MALSR.

Equipment used to construct the MALSR system and access road would probably include dump trucks to haul borrow material; a crane and pile driver to install the light towers; a bulldozer; a rubber tire loader; and a trencher or small backhoe for the power cables. The first three or four MALSR lights (the lights furthest east) would be subjected to storm surges, ice flows, and debris, and may require a pile foundation for protection. Silt fences and other sediment controls would be used to reduce construction-related sediment releases from entering adjacent habitat.

It is estimated that up to 1.4 acre of intertidal estuarine and estuarine emergent wetlands would be disturbed by this project, depending on the specific RSA configuration. Up to 1,000 cubic yards of fill material would be needed to construct the road, light maintenance pads, and vehicle turnarounds. This fill would be hauled in by truck from an off-site, permitted borrow source, or obtained from the Float Plane Pond dredging in association with construction of the RSA.

FAA has estimated the MALSR as described in this section would cost about $1.5 million using a design that would reduce environmental impacts (by routing the access road along higher ground, avoiding the largest sloughs, etc.). Approximately one-half to two-thirds of this cost would be incurred for materials purchase and installation, including wiring to the lights, control systems, pad construction, and so forth. Preliminary design suggests the MALSR access road would cost approximately $320,000, depending on length and route. This estimate is based on a 14-foot wide, 2,500-foot long road at $5 per foot, with one 40-foot wide slough crossing using four bottomless arch culverts, at additional cost of about $145,000. Alternatively, a one lane, 14-foot wide bridge could be constructed to span the slough in place of the arch culverts. The MALSR control building would cost approximately $40,000. However, the total cost is highly dependent on route and manner of structure used for channel crossings. Section 2.11.5 describes the feasibility of using other possible MALSR access methods, including a different route for the MALSR access road that would have less impact on fish habitat and estuarine wetlands.

2.7.2 NAV-3: No Action Alternative

As described previously, the No Action Alternative is carried forward. There would be no improvements to navigational systems and runway alignment, and no new construction or habitat disturbance.

2.7.3 Comparative Summary of Impacts: Navigational Alignment

Table 2-14 provides a summary comparison of the environmental impacts associated with installation of the MALSR. A full treatment of the resources listed on this table and the important criteria used to determine the extent and severity of environmental effects is found in Chapter 4 of this EIS.

2.8 Description of Airport Facilities Alternatives – Design Concept and Construction

The following sections describe features of the proposed Airport facilities, including snow removal equipment building, new parking and hangars for aircraft and tenants, and fuel farm access alternatives. Locations for the alternatives addressing these facilities were shown on Figures 2-18 and 2-19.

2.8.1 Snow Removal Equipment and Maintenance Facility (SREF)

Three alternatives for the snow removal equipment and maintenance building are carried forward for detailed analysis, including the No Action Alternative. The distinction between the two action alternatives is their location on the Airport. Alternative SREF-1B would place the new facility on undeveloped property at the west end of the Airport, just east of a relocated Duck Creek or north of the existing channel. Alternative SREF-3B1 would involve building the facility on partially disturbed property immediately south of Yandukin Drive at the east end of the Airport.

Section 2.8.1.1 provides a description of the SREF that is common to both alternatives. Any distinctions between the alternatives, such as the operational considerations, are described in Sections 2.8.1.2 and 2.8.1.3. Section 2.8.1.4 addresses the No Action Alternative. More detailed information concerning the SREF may be found in the Snow Removal Equipment Facility Conceptual Design Report, prepared by USKH, Inc. for CBJ in June 2004. The concept plan for this facility is shown on Figure 2-33.

2.8.1.1 SREF Design

The SREF would be designed to store snow removal equipment and provide work space for maintenance on Airport vehicles and equipment. At the time of preparation of the Master Plan, there were 20 pieces of snow removal equipment, including pickup trucks, snow plows with dump systems, graders, snow removal loaders, high-speed runway brooms, sand trucks, and snow blowers. A recently completed Conceptual Design Report for the SREF indicates there are as many as 36 pieces of snow removal equipment, although only 19 of those are "FAA-authorized," meaning they are deemed necessary by FAA to keep the Airport operational (USKH 2004). The minimum amount of snow removal equipment needed is based on the following, as taken from FAA Advisory Circulars 150/5200-30A, 150/5200-20, and 150/5220-18:

- snow clearance time limits for commercial service airports,

Table 2-14. Comparative Summary of Environmental Impacts: Navigational Alignment

Resource	NAV-2B: MALSR	NAV-3: No Action
Construction		
Disturbance Area	Up to 2.1acres, depending on RSA configuration, as follows: RSA-8, 2.1 acres; RSAs-1 and -6C, 1.3 acres; RSA-5C, 0.8 acres; RSAs-6A and -6D, 1.8 acres; RSA-6B, 1.9 acres; RSA-5E, 1.2 acres	None
Fill Volume	Approximately 1,000 yd^3	None
Cost		
Construction	$1.5 million	$0
Mitigation	$46,552	$0
Total Cost (Mitigation + Construction)	$1,546,552	$0
Noise		
Long-term Noise Changes due to Action (does not include short-term, construction related noise increases)	None	None
65 DNL & greater (square mile)	1.08	1.08
Human Environment and Compatible Land Use		
Noise Sensitive Areas	None	None
Developed Recreation/Dike Trail	None	None
Dispersed Recreation (hunting, bird-watching, hiking, etc.)	Minor, negative	None
Socioeconomics		
Short-term Business Income	$2,057,000	$0
Short-term (construction) FTE Employment	14	0

Table 2-14. Comparative Summary of Environmental Impacts: Navigational Alignment, continued

Resource	NAV-2B: MALSR	NAV-3: No Action
Short-term (construction) Payroll	$673,000	$0
Short-term Sales Tax Revenues	$27,900	$0
Long-term Economic Impacts	Unquantifiable, positive	None
Long Term Revenue Impacts	None	None
Long-term Social Impacts	Unquantifiable, positive	None
Air Quality		
Changes in Operating Emissions due to Action	None	None
PM_{10} (tons/year) - Operating	1.5	1.5
PM_{10} (tons/year) - Construction	0.4	N/A
PM_{10} (tons/year) - Total	1.9	1.5
Fugitive Dust (tons/year, peak year)	0.9	N/A
Hazardous Materials and Solid Waste		
Presence of Buried Hazardous Waste or Soil Contamination	Low potential to encounter buried, hazardous wastes	None
Hazardous Materials Use/Pollutant Generation	No Increase in use of hazardous materials	No change
Water Resources and Floodplains		
Floodplain Volume	Low, minor loss of floodplain	None
Riparian/Channel Effects	Minor impacts	None
Tidal Prism Volume	Low, minor loss of tidal prism	None
Snow Storage	None	None

Table 2-14. Comparative Summary of Environmental Impacts: Navigational Alignment, continued

Resource	NAV-2B: MALSR	NAV-3: No Action
Surface Water Quantity	Low, minor additional impervious surface	None
Surface Water Quality	Low, short-term degradation	None
Long-Term (post construction)	Low impact, increased runoff	None
Short-Term (construction)	Low impact due to construction degradation	None
Groundwater Recharge	Low, minor loss of recharge	None
Vegetation		
Direct Impacts	0.8 - 1.9 acres of vegetation impacted, depending on RSA alternative (RSA-1, -5C, and -6C would have the least impact, RSA-8 the greatest)	None
Wetlands		
Modification of Wetlands	Between 0.7 and 1.3 acres filled	None
Impact Significance and Basis for Conclusion	No significant impact on hydrology needed to maintain wetland functions and values, and no affect on sustainability of the natural systems that maintain habitat. The MALSR would not be inconsistent with the state wetland strategy because there is no prudent and feasible alternative that would satisfy the need for navigational alignment.	No
Fisheries		
EFH Lost	0.7 - 1.3 acres of EFH affected, depending on RSA alternative (RSA-1, -5C, and -6C would have the least impact, RSA-8 the greatest).	No loss
Access to Jordan Creek	No change	No change
Access to Duck Creek	No change	No change
Overall construction impacts (e.g. disruption of fish movement and activity)	None (work on low tides)	None

Table 2-14. Comparative Summary of Environmental Impacts: Navigational Alignment, continued

Resource	NAV-2B: MALSR	NAV-3: No Action
Overall indirect impacts	None	None
Wildlife		
Overall Habitat Effect	0.8 - 1.9 acres of primarily high marsh wildlife habitat impacted, depending on RSA (RSA-1, -5C,-5D, and -6C would have the least impact, RSA-8 the greatest)	None
Threatened and Endangered Species	Impacts to threatened endangered species would be insignificant. There would be no direct effects on sea lions and whales. Potential indirect effects to forage fish are not likely to adversely affect these species.	None
High Interest and Sensitive Species	Impacts to high interest and sensitive species would be insignificant because construction of the MALSR for all RSA alternatives would not be expected to have substantive effects on the populations of these species.	None
Cultural Resources	No known impacts to historic properties	No impacts to historic properties
Visual Resources	Moderate, negative long-term changes to existing visual quality in Refuge	No changes in visual quality
DOT Section 4(f) Lands		
Direct Impact on Land	Acquisition/use of up to 1.4 acres of Refuge (for Alt RSA-5D or RSA-8) or 1.2 acres for RSA-5E	None
Indirect Impacts	Minor changes in hydrology and habitat but no substantial impairment of beneficial uses.	None
Constructive Use Impact (Substantial Impairment)	No	No

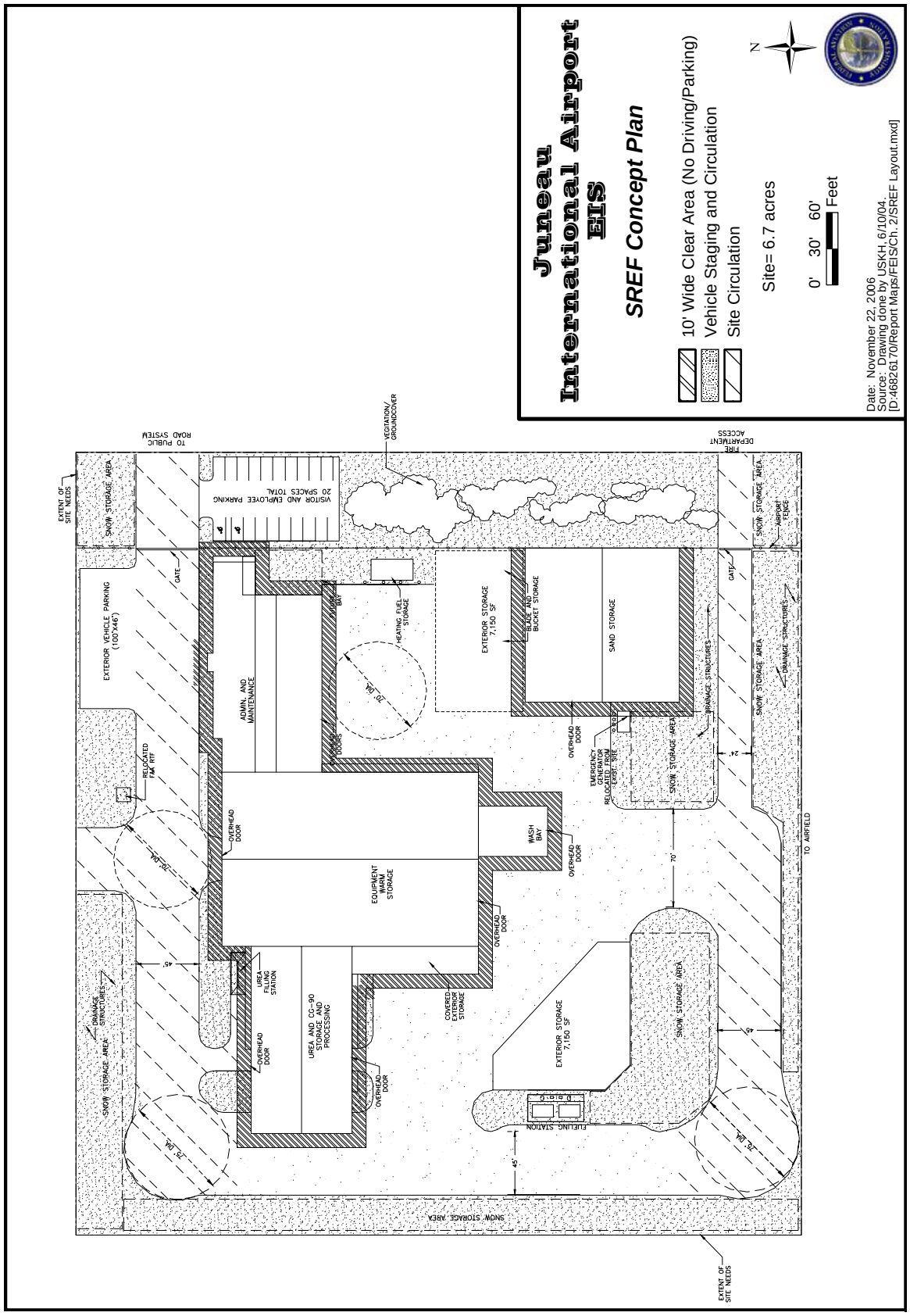

Figure 2-33. Snow removal equipment facility concept plan.

- the number of aircraft operations conducted at the Airport,
- the area of runway and other areas to be cleared,
- the facilities maintained on the Airport, and
- weather and snow conditions specific to the Airport.

The Airport Master Plan and Conceptual Design Report provides the detailed justification for a new SREF and sand shed, based on the types and numbers of equipment to be stored and space needed for maintenance, administration, mechanical/heating systems, and so forth. On this basis, CBJ determined the desired spatial requirements for the SREF, as listed in Table 2-15. Based on the amount of sand applied to the Airport in a typical year, with additional contingency space and projecting for future expansion of Airport apron, it was determined that a separate building for sand storage would need to have a footprint of approximately 12,100 ft^2.

Table 2-15. SREF Space Requirements

Activity	Area Needed (in ft^2)
Vehicle Storage	18,074
Vehicle Wash Bay	1,800
Bulk Urea Inventory and Processing	5,004
Bulk CG-90 Storage	3,384
Mechanics Bay and Paint Booth	1,600
Maintenance Bay	1,600
Grease and Lubrication Bay	1,600
Tool Room	96
Lube Storage and Distribution	220
Parts Inventory	288
Tire Repair and Storage	96
Electrical Shop	352
Sign Making and Carpentry	560
Toilet and Locker Rooms	448
Radio Repair and Inventory	20
Secure Storage	20
Break Room	280
Training Room	480
Administrative Offices	266
Boiler Room	180
HVAC Equipment	320

Table 2-15. SREF Space Requirements, continued

Activity	Area Needed (in ft^2)
System Room	48
Electrical Room	168
Communication Room	70
Generator Storage	160
Large Supply Storage	2,930
Janitors Storage	15
Main Entry Vestibule	36
Building Space (walls, structure, columns, etc.)	3,871
Total Area Needed	44,616 sq. ft

Source: Snow Removal Equipment Facility Conceptual Design Report, June 2004. Prepared by USKH, Inc. for CBJ

Figure 2-33 illustrates CBJ's design concept for the SREF. It includes a number of stalls for vehicle and equipment, a large storage area for chemicals such as urea and CG-90, administrative space, a wash bay, and other storage. The sand storage building would include space for blade and truck storage and an emergency generator. There would also be a refueling station for snow removal equipment and other Airport vehicles.

CBJ has estimated that 6.7 acres would be needed for the entire facility. Much of this area would be consumed by pavement needed for large equipment to maneuver, turn, and enter and exit the main building. Additional space has been added for snow storage and vehicle parking. The entire facility would be fenced.

USKH prepared a conceptual level cost estimate for the SREF. Approximately $15.6 million would be needed to prepare the site, construct the buildings, extend access to the main taxiway, pave and landscape (Stone 2004a). This figure is adjusted for inflation and projected construction in 2007. Project management, design, and other planning and implementation costs would raise the estimate to approximately $16 million.

2.8.1.2 SREF-1B: West End of Airport, East of Relocated Duck Creek

Figure 2-18 shows the approximate footprint of the 6.7-acre development area for SREF-1B in the northwest Airport area. The layout for the facility would be as shown in Figure 2-33.

Snow removal would probably start at the beginning of Runway 08 and extend east toward the end of the runway. This site could be more expensive to develop than others, including SREF-3B1 if constructed as a stand-alone facility without other airfield operations in the area. The 6.7-acre site development would extend from approximately the north Airport boundary to the existing apron. Relocation of Duck Creek, an action being considered for both wildlife hazard reduction

and apron development, would push the SREF development south approximately 150 feet. Approximately 45,000 cubic yards of fill would be imported from the Float Plane Pond to construct the parking area and SREF and sand shed.

A primary concern with this location, however, is the potential conflict with other airfield development. Snow clearing equipment would have to traverse through an area of hangars and aircraft parking in order to reach the highest priorities for snow removal: the active runway and taxiways.

2.8.1.3 SREF-3B1: SOUTH OF YANDUKIN DRIVE

Figure 2-18 shows the approximate footprint of the 6.7-acre development area for SREF-3B1 in the northeast Airport area. Snow removal from this location would probably begin at the Runway 26 threshold and extend west toward the runway end. The mostly cleared and leveled location in the Northeast Development Area of the Airport would help to minimize development costs, but reconfiguration of the Yandukin Drive intersection with the TEMSCO access road, and partial relocation of the access road, would add expense. A parking area for employees, vendors and buses could be located on the east side of the relocated TEMSCO access road. Approximately 40,000 cubic yards of fill would be required for site preparation.

There could be some operational concern associated with this location if the Northeast Development Area is fully developed, as new hangars and aircraft storage and parking would be present. However, there would be little conflict with TEMSCO, as much of the helicopter traffic is conducted during the time of year when snow removal is not required.

2.8.1.4 SREF-5: NO ACTION ALTERNATIVE

As described previously, the No Action Alternative is carried forward. There would be no improvements to the SREF or sand shed.

2.8.1.5 COMPARATIVE SUMMARY OF IMPACTS: SREF

Table 2-16 provides a summary comparison of the environmental impacts associated with construction of a new SREF and associated facilities. A full treatment of the resources listed on this table and the criteria used to determine the extent and severity of environmental effects is found in Chapter 4, Sections 4.2 and 4.5 of this EIS.

2.8.2 AVIATION FACILITIES

Section 1.3.3.3 described the existing demand for additional aviation facilities, and the projected needs through the year 2015 (i.e., the end of the 20-year planning period of the 1999 Master Plan, initiated using data from the year 1995). Conceptual layouts designed to meet these needs were prepared for aviation facilities in the northeast and Northwest Development Areas. These conceptual layouts were prepared in accordance with the FAA criteria specified in Advisory Circular 150/5300-13 Airport Design, Advisory Circular 150/5390-2B Heliport Design, and Federal Aviation Regulation (FAR) Part 77 Objects Affecting Navigable Airspace. The overall layout and placement of facilities was driven by the design standards presented in these documents and gen-

Table 2-16. Comparative Summary of Environmental Impacts: Snow Removal Equipment and Maintenance Facility

Resource	SREF-1B[1]	SREF-3B1[1]	SREF-5: No Action
Construction			
Disturbance Area	6.7 acres	6.7 acres	None
Fill Volume	45,000 yd^3	40,000 yd^3	None
Cost			
Construction	$15.6 million	$15.6 million	$0
Mitigation	$76,922	$133,561	$0
Total Cost (Construction + Mitigation)	$15,676,922	$15,733,561	$0
Noise			
Long-term Noise Changes due to SREF (does not include short-term, construction related noise increases)	None	None	None
65 DNL & greater (square mile)	1.08	1.08	1.08
Human Environment & Compatible Land Use			
Noise Sensitive Areas	None	None	None
Developed Recreation/Dike Trail	Minor, short-term, negative	Minor, short-term, negative	None
Dispersed Recreation (hunting, bird-watching, hiking, etc.)	None	None	None
Socioeconomics			
Short-term Business Income	$21,382,000	$21,382,000	$0
Short-term (construction) FTE Employment	169	169	0
Short-term (construction) Payroll	$8,176,000	$8,176,000	$0

Table 2-16. Comparative Summary of Environmental Impacts: Snow Removal Equipment and Maintenance Facility, continued

Resource	SREF-1B[1]	SREF-3B1[1]	SREF-5: No Action
Short-term Sales Tax Revenues	$289,700	$289,700	$0
Long-term Economic Impacts	Unquantifiable, positive	Unquantifiable, positive	None
Long Term Revenue Impacts	None	None	None
Long-term Social Impacts	None	None	None
Air Quality			
Changes in Operating Emissions due to SREF Operational Use	None	None	None
PM_{10} (tons/year) - Operating	1.5	1.5	1.5
PM_{10} (tons/year) - Construction	0.8	0.8	N/A
PM_{10} (tons/year) - Total	2.3	2.3	1.5
Fugitive Dust (tons/year, peak year)	2.7	2.7	N/A
Hazardous Materials and Solid Waste			
Presence of Buried Hazardous Waste or Soil Contamination	Least potential to encounter buried, hazardous wastes	Low potential to encounter buried, hazardous wastes	None
Hazardous Materials Use/Pollutant Generation	No increase in use or pollutant generation. Safer and more secure storage areas and drain systems	No increase in use or pollutant generation. Safer and more secure storage areas and drain systems	No change from existing conditions
Water Resources and Floodplains			
Floodplain Volume	Low, minor loss of floodplain	Low, minor loss of floodplain	None
Riparian/Channel Effects	None	None	None
Tidal Prism Volume	None	Low, minor loss of tidal prism	None
Snow Storage	None	None	None

Table 2-16. Comparative Summary of Environmental Impacts: Snow Removal Equipment and Maintenance Facility, continued

Resource	SREF-1B[1]	SREF-3B1[1]	SREF-5: No Action
Surface Water Quantity	Low, minor additional impervious surface	Low, minor additional impervious surface	None
Surface Water Quality	Low, short-term degradation	Low, short-term degradation	None
Long-Term (post construction)	Low impact, increased runoff	Low impact, increased runoff	None
Short-Term (construction)	Low impact, due to construction degradation	Low impact due to construction degradation	None
Groundwater Recharge	Low, minor loss of recharge	Low, minor loss of recharge	None
Vegetation			
Direct Impacts	Approximately 4 acres of native vegetation impacted including high marsh, supratidal, shrub-scrub, forest	Approximately 6 acres of native vegetation impacted including high marsh and supratidal communities	None
Indirect Impacts	Moderate: potential for introduction and spread of weed species in NW Airport area	Minor: Area surrounding proposed site is already infested with a variety of non-native, weedy plants	None
Wetlands			
Modification of Wetlands	1.5 acres estuarine and palustrine wetland filled in NW airport area	2.5 acres estuarine and palustrine wetland filled in NE airport area	None
Impact Significance and Basis for Conclusion	Insignificant. Minor direct impact. No substantial impact to hydrology, no affect on sustainability of natural systems that maintain habitat.	Insignificant. Minor direct impact. No substantial impact to hydrology, no affect on sustainability of natural systems that maintain habitat.	No
Fisheries			
Essential Fish Habitat Lost	1.7 acres. Impacts relatively minor based on small amount of EFH lost.	1.6 acres. Impacts relatively minor based on small amount of EFH lost.	No change
Access to Jordan Creek	No change	No change	No change
Access to Duck Creek	No change	No change	No change

Table 2-16. Comparative Summary of Environmental Impacts: Snow Removal Equipment and Maintenance Facility, continued

Resource	SREF-1B[1]	SREF-3B1[1]	SREF-5: No Action
Overall construction impacts (e.g. disruption of fish movement and activity)	None (work on low tide)	None	None
Overall indirect impacts	Moderately increased exposure to contaminants	Slightly increased exposure to contaminants	None
Wildlife			
General Wildlife Habitat	Approximately 4 acres of native habitat impacted including high marsh, supratidal, shrub-scrub, forest	Approximately 6 acres of native habitat impacted including high marsh and supratidal types	None
Threatened and Endangered Species	Impacts to threatened or endangered species would be insignificant. There would be no direct effects on sea lions and whales and the potential indirect effects to forage fish are not likely to adversely affect these species.		
High Interest Species	4 acres impact to potentially suitable habitat for bald eagles and other raptors, corvids, songbirds, black bear, and deer; 2.2 acres impact for river otter; 1.7 acres impact for rufous hummingbird.	6 acres impact to potentially suitable habitat for bald eagles and other raptors, corvids, songbirds, black bear, and deer; 5.3 acres impact to rufous hummingbird; 0.7 acres impact for swallows and Bonaparte's Gull.	No effect
	Impacts to high interest species insignificant for both alternatives. Populations of high interest species unlikely to be affected by minor habitat loss.		
Sensitive Species	4 acres impact to potentially suitable habitat for Queen Charlotte goshawk; 1.7 acres impact to peregrine falcon	6 acres impact to potentially suitable habitat for Queen Charlotte goshawk and peregrine falcon	No effect.
	Impacts to sensitive species insignificant for both alternatives. Populations of sensitive species unlikely to be affected by minor habitat loss.		

Table 2-16. Comparative Summary of Environmental Impacts: Snow Removal Equipment and Maintenance Facility, continued

Resource	SREF-1B[1]	SREF-3B1[1]	SREF-5: No Action
Cultural Resources	No known impacts to historic properties	No known impacts to historic properties	None
Visual Resources	Minor, negative changes in visual quality	Minor, negative changes in visual quality	No change in visual quality
DOT Section 4(f) Lands			
Direct Impact on Land	None	None	None
Indirect Impacts	None	None	None
Constructive Use Impact (Substantial Impairment)	No	No	None

[1] Assumes construction in northest development area after all relocation of Duck Creek but without development of aviation faciltites.
[2] Impacts consider preparation of 6.7 acre layout for SREF, sand shed, parking and turnarounds, and accessroads to apron. See Figure 2-33.

eralized city planning guidelines. These layouts are shown in Figures 2-34, 2-35, and 2-36. The following sections describe each of the development scenarios carried forward for detailed analysis.

2.8.2.1 NORTHEAST DEVELOPMENT AREA (ALTERNATIVES FW/RW-1 AND FW/RW–2)

Both of the alternatives for aviation facilities include the same general layout for the Northeast Development Area, illustrated in Figure 2-34. The objectives in this area are to accommodate expansion of commercial aviation facilities (including fixed-based operators and helicopter tour operators), large maintenance/storage hangars, and construction of a new SREF. (As was described in a previous section, the SREF could also be located in the Northwest Development Area, but for consistency and the sake of comparing alternatives for aviation facility development it is assumed to be placed in the Northeast Development Area.) Airside access, meaning access to the apron by aircraft, would be provided from Taxiway A, Taxiways E-1 and F-1, and a new taxiway between E-1 and F-1. Table 2-17 identifies the projected development needs and the numbers of facilities provided in the conceptual layout shown on Figure 2-34.

The Master Plan and CBJ have recommended development of a new tour helicopter facility within the southwest quadrant of this area, and adequate space has been allocated to accommodate the projected development requirements of one major tour operator.[25] ERA Aviation has committed to relocate 14 helicopters to a new location within the development, and this area would accommodate their operations. They will need a business facility approximately 5,000 ft^2 in size for maintenance, offices, visitor waiting, etc. In addition, the southeast portion of the site is currently leased for the future expansion of TEMSCO. The site could include the development of a final approach and takeoff area, with access parallel to Taxiway A.

There has been identified a future need to relocate the existing fixed-base operator located directly east of the passenger terminal complex. A suitable area for this operator is incorporated within the south-central portion of the site, and would include adequate space for large hangar development, tiedown apron, and taxilane access.

Alaska Flight Center will be expanding their flight instruction school, necessitating lease of a new large maintenance hangar, and facilities for aircraft rental. They have expressed to JNU that future growth may include up to seven new aircraft with a need for an equal number of tiedowns.

Another possible tenant for this area is Northern Air Cargo. This firm has informed JNU that their operations at Juneau and in Southeast are currently limited because they can provide only light maintenance, due to a lack of acceptable hangar space and parking areas. A larger hangar with sufficient parking area for cargo aircraft would allow them to conduct more efficient maintenance (since aircraft would not have to fly to Anchorage for this work) and expand their service network within Southeast.

25. The Aerospatiale Ecrueuil 350 (Astar) was used as the design helicopter for the layout of the facility.

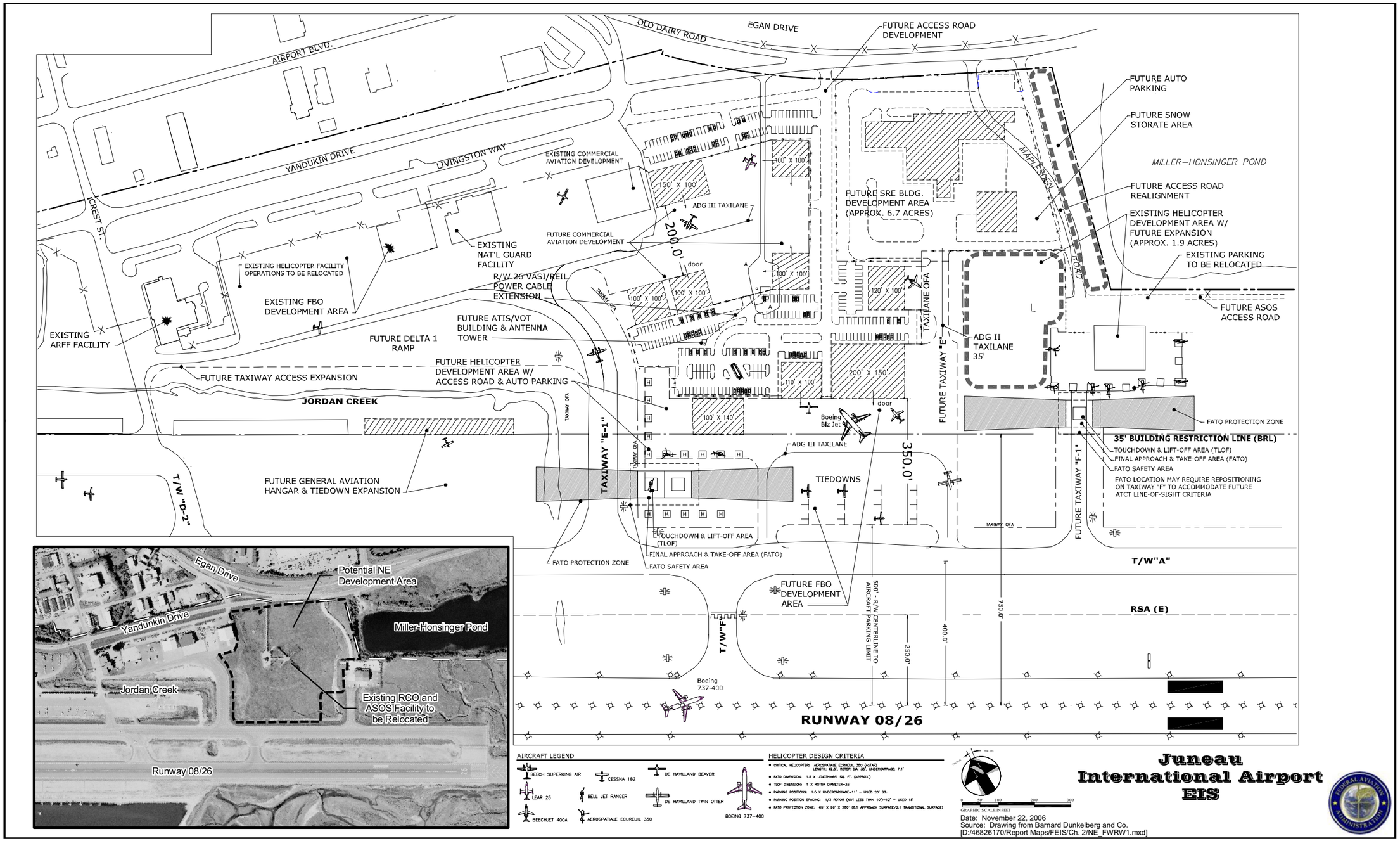

Figure 2-34. Alternative FW/RW-1 and FW/RW-2: Northeast aviation development area.

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Table 2-17. Northeast Development Area Facilities

Facility Type	Number Provided	Projected Need (see Table 1-2)
Based and Transient Tiedowns[1]	12[1]	23[1]
Large Hangars	7	7
Helicopter FBO	2	2
Helicopter Tiedown Spaces	15	14

[1]Insufficient space is allocated for tiedowns in either the NE or NW Development Areas. The number provided (12) should be combined with that shown in Tables 2-18 or 2-19 to determine relationship to the projected need of 23 combined based and transient tiedowns. Area for tiedowns can vary depending on the size and types of aircraft to be accommodated.

Each of the commercial aviation facilities specified to be incorporated in the Northeast Development Area would restrict or limit vehicular access onto the aircraft operating areas. Sufficient auto parking areas are to be incorporated into the various site-development plans. This conceptual layout for the Northeast Development Area would meet the projected needs for helicopter facilities and commercial operations identified in Table 1-2 of this EIS.

CBJ has proposed to develop the SREF on approximately 6.7 acres in the northeast corner of the Northeast Development Area. Airside access to and from the proposed SREF is to be provided by a new connector taxiway extending northward from Taxiway A, between taxiways E-1 and F-1.

Vehicles would reach the facilities via a new road extending southward from Yandukin Drive. This road would provide direct public access to the parking lots for the various commercial aviation companies. The parking lot proposed by JNU would be located just east of the access road and north of TEMSCO. Controlled access points would also be established at various locations, to permit authorized vehicles with direct access to the aircraft operating surfaces. Vehicles would enter the SREF by an existing roadway that extends southward from Yandukin Drive. As shown on Figure 2-34, this road would be realigned and straightened to capture additional property for the SREF.

The future buildout within the Northeast Development Area would necessitate relocation of the RCO, ASOS and other FAA equipment. Most of the equipment from these facilities would be relocated to the Engineer's Cut or to a site either just east of the TEMSCO parking lot or to the southeast of TEMSCO, north of the parallel taxiway. A few items, including the air traffic information service radio facility and the VHF omni-directional range test transmitter, would need to remain in close proximity to the runway. The layout in Figure 2-34 includes space for this equipment in the south portion of the Northeast Development area. Section 2.10 provides additional information on the impacts associated with the relocation of RCO equipment and the ASOS.

Approximately 24.8 acres would be disturbed by the proposed development in the northeast Airport area, including approximately 19.8 acres of wetlands[26]. Some of this has already been disturbed for facilities, including the RCO and the access road to TEMSCO. However, other portions of the area consist of estuarine wetland habitat. It is estimated that 133,500 cubic yards of fill

would be needed to raise the elevation above tidal influence, to approximately the level of the Delta One ramp, and provide a suitable support base for the facilities. The culvert providing a hydraulic connection between this area and the extreme east portion of the Airport would be removed or used as part of the storm-water drainage system. The fills proposed for the Northeast Development Area would displace existing marsh habitat and decrease the volume of tidal exchange, compared to current conditions.

2.8.2.2 FW/RW-1: FULL DEVELOPMENT OF NORTHEAST AND NORTHWEST DEVELOPMENT AREAS

This alternative includes development of the northeast and northwest Airport areas for aviation facilities. The conceptual design for the Northeast Development Area would be as described in Section 2.8.2.1. Objectives for development in the Northwest Development Area include the expansion of general aviation aircraft storage facilities such as executive hangars, T-hangars, and tiedown apron spaces, while maintaining the current Duck Creek channel alignment, although minor changes to the alignment could be accommodated if deemed necessary for other Airport needs. A new fuel farm access road or fuel distribution pipeline could be constructed in the Northwest Development Area. These actions are described in detail in other sections. The following provides an explanation of one potential layout for aviation facilities in the Northwest Development Area of the Airport.

Figure 2-35 illustrates a design concept for this alternative that would entail only partial relocation of the Duck Creek channel, at the west Airport end. The number of facilities offered by this alternative, compared to the facility requirement projections shown in Table 1-2 of the EIS, is as shown in the following Table 2-18:

The existing Duck Creek channel presents a barrier to the Airport expansion in the northwest, in that new facilities (including hangars, parking, and taxiways) cannot be easily integrated into the existing layout. Nevertheless, the design concept for this alternative generally meets the projected needs for aviation. Executive hangar and T-hangar development matches the expressed need. However, the layout provides about 25% more tiedown space, when added to the parking allotted for the Northeast Development Area shown in Figure 2-34, than is projected to be needed by the year 2015.

The Northwest Development Area would include a dual taxilane access bridge crossing Duck Creek[27]. FAA standards for this design require that the taxilanes be at least 35 feet wide, and that there be at least a 97-foot separation between the two taxilanes, as measured from centerline to

26. These numbers do not include the area set aside for a SREF, as shown on the Figure 2-28. Total disturbance including the SREF in the NE Development Area would be about 31.5 acres, requiring 173,680 cubic yards of fill .
27. The number of access taxiways that are required to adequately serve an aviation development area is dictated by the total number of aircraft that would be taxiing to and from the runway facility, and not the aircraft size. It should be noted that the future hangar development area would be initially served by just one bridge crossing during the early development timeframe.

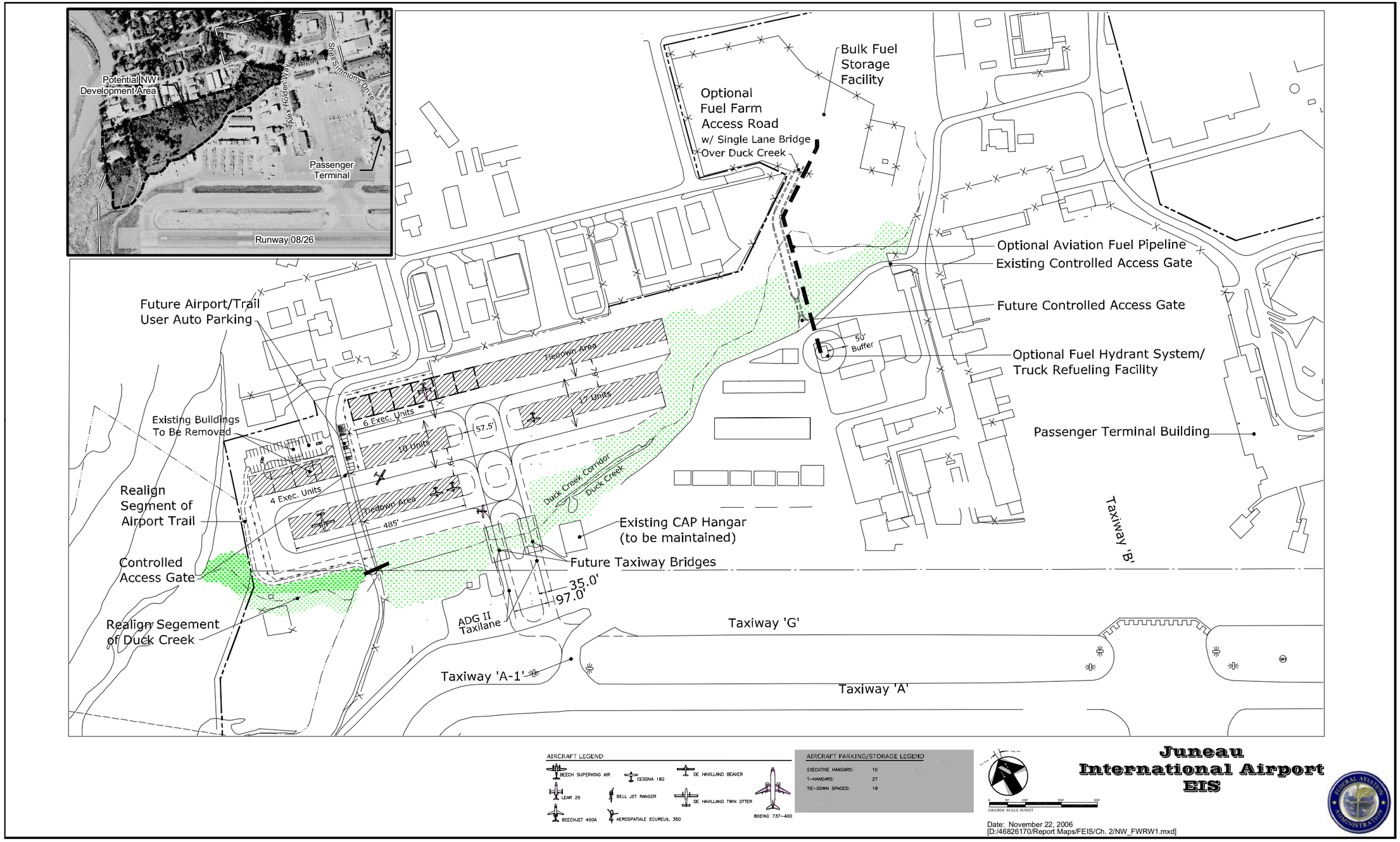

Figure 2-35. Alternative FW/RW-1: Northwest aviation development area.

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Table 2-18. Northwest Development Area Facilities, Alternative FW/RW-1

Facility Type	Number Provided	Projected Need (Table 1-2)
Executive/T-Hangers	37	36
Based and Transient Tiedowns[1]	17[1]	23[1]

[1]Insufficient space is allocated for tiedowns in either the NE or NW Development Areas. The number provided (17) should be combined with that shown in Table 2-17 (12) to determine relationship to the projected need of 23 combined based and transient tiedowns. Area for tiedowns can vary depending on the size and types of aircraft to be accommodated.

centerline (see AC 150/5300-13: Table 2-3). Hangars would offer either north- or south-facing doors, and tiedown areas would be oriented in an east-west configuration, with parked aircraft generally facing south.

Vehicle access to this area would be via both Radcliffe Road and the unnamed Airport access road. A segment of the EVAR/Dike Trail would be developed that links a new auto parking area with the existing trail via a new pedestrian footbridge crossing Duck Creek.

This design would include an approximately 50-foot development setback/buffer zone on either side of the Duck Creek centerline. The layout in Figure 2-35 includes realignment of a short segment of the creek west of the new development area. Starting at the Radcliffe Road/Dike Trail crossing, the creek would flow approximately due west and discharge into the backwater channel of the Mendenhall River. This action would remove the channel from beneath the extended Runway 08 approach surface, and reduce opportunities for bird species to feed on carcasses and juvenile fish in close proximity to landing and departing aircraft. Realignment of this creek section is not, however, necessary to implementation of the aviation facilities layout described in this alternative.

Approximately 17 acres would be disturbed by the proposed development in the Northwest Development Area, most of which is currently undeveloped. The habitat to be disturbed includes approximately 5.0 acres of wetlands. It is estimated that 67,240 cubic yards of fill would be needed to raise the elevation above tidal influence and provide a suitable support base for the facilities. Bottomless arch culverts or bottomless box culverts would be installed at the new fuel farm road crossing over Duck Creek, if approved, and they would also replace the existing culvert at Radcliffe Road.

2.8.2.3 FW/RW-2: Full Development of Northeast and Northwest Development Areas With Duck Creek Relocation

This alternative also includes development of the northeast and northwest Airport areas for aviation facilities, and the conceptual design for the Northeast Development Area would be as described in Section 2.8.2.1. Objectives for development in the Northwest Development Area are the same as for Alternative FW/RW-1, but this alternative would include relocation of most of lower Duck Creek, including that portion on the Airport and west of the Airport on the Refuge. As with the previous alternative, a new fuel farm access road or fuel distribution pipeline could be

constructed in the Northwest Development Area. These actions are described in detail in other sections. The following provides an explanation of the alternative layout for aviation facilities in the northwest portion of the Airport.

Figure 2-36 illustrates the design concept for this alternative. The number of facilities offered by this alternative, compared to the facility requirement projections shown in Table 1-2 of the EIS, is as shown in the following Table 2-19:

Table 2-19. Northwest Development Area Facilities, Alternative FW/RW-2

Facility Type	Number Provided	Projected Need (Table 1-2)
Executive/T-Hangers	38	36
Based and Transient Tiedowns[1]	11[1]	23[1]

[1] Insufficient space is allocated for tiedowns in either the NE or NW Development Areas. The number provided (11) should be combined with that shown in Table 2-17 (12) to determine relationship to the projected need of 23 combined based and transient tiedowns. Area for tiedowns can vary depending on the size and types of aircraft to be accommodated.

This alternative relocates the existing Duck Creek channel that currently presents a barrier to efficient Airport expansion in the Northwest Development Area. As can be seen from the facility projections, this action would open space to meet virtually all of the projected needs for executive hangars, T-hangars, and tiedowns. The Civil Air Patrol hangar would remain but future development could include replacement to orient a new building with the remainder of the airfield.

FAA standards for this layout require that the taxilanes be at least 35 feet wide, and include a 115-foot taxilane, object-free area width (see AC 150/5300-13: Table 4-1). Hangars would offer either north- or south-facing doors, and tiedown areas are to be oriented in a north-south configuration, with parked aircraft generally facing east.

This alternative proposes the realignment of Duck Creek on the Airport and Refuge, beginning near the intersection of Cessna Drive and the unnamed Airport road, and extending westerly along the northern Airport boundary to a new discharge point in the Mendenhall River. A 50-foot development setback/buffer zone would be established on either side of the Duck Creek centerline. The relocation of about 500 feet of Duck Creek would allow a more integrated design between new facilities and the existing Airport layout. The Airport security fence would be placed between the newly aligned Airport road and the creek, which would remain accessible to the public from the north. This action would remove the creek from beneath the extended Runway 08 approach surface, and reduce opportunities for bird species to feed on carcasses and juvenile fish in close proximity to landing and departing aircraft.

The proposed alignment has a buffer with a minimum of 31 feet on each bank, and an average width of 55 feet on the right bank and 81 feet on the left bank. There is a relatively wide portion of the corridor where Duck Creek enters Airport property to accommodate a change in channel

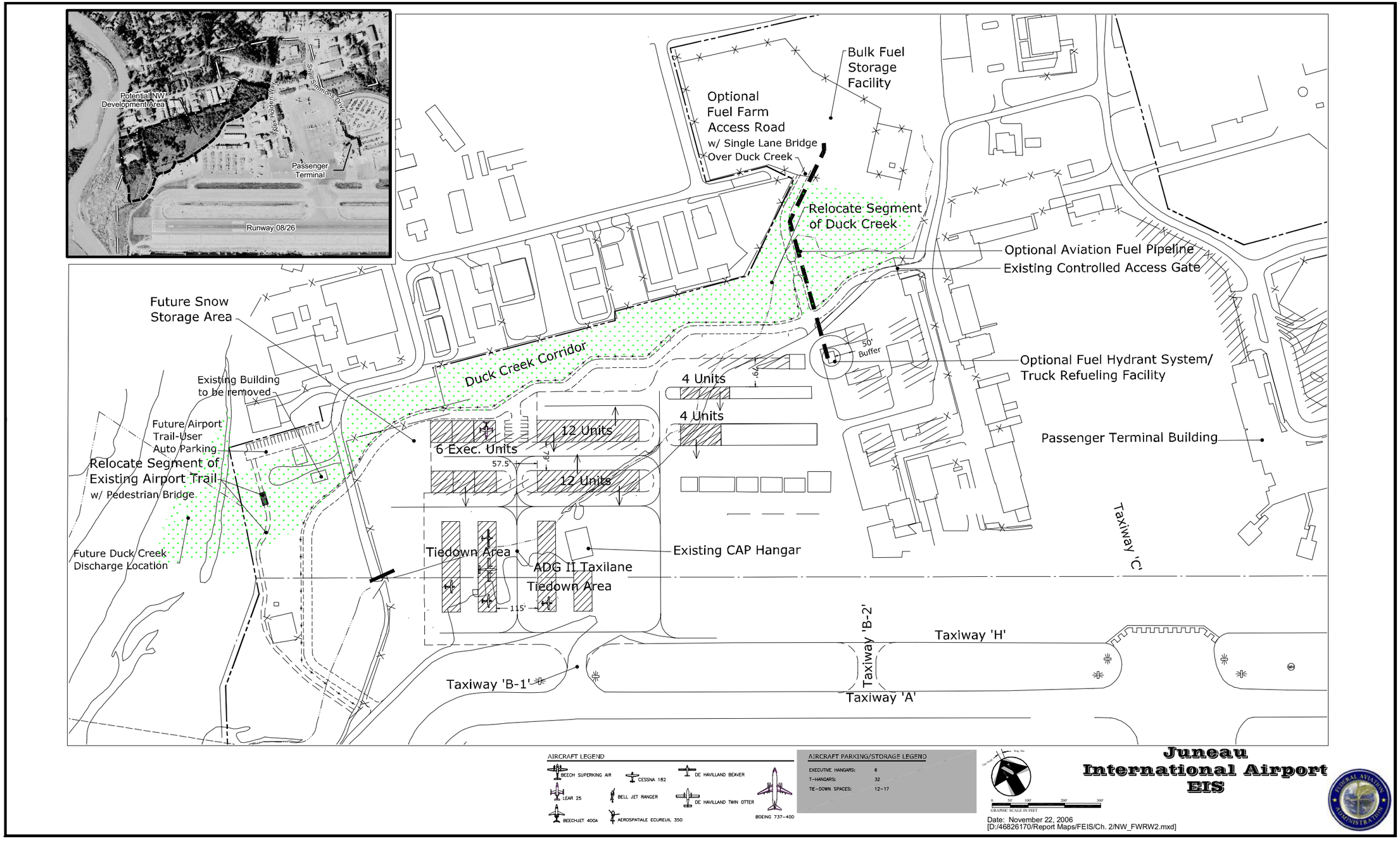

Figure 2-36. Alternative FW/RW-2: Northwest aviation development area with Duck Creek relocation.

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direction. The average corridor width (including creek channel and bank setbacks) of 151 feet is less than 10% greater than a Sponsor-developed corridor design offered to regulatory agencies some years ago.

Vehicles would reach the aviation facilities via realignment and extension of the unnamed Airport access road. The new roadway would be located on the south side of the realigned segment of Duck Creek and would connect with the existing Airport-controlled access road that extends around the west end of Runway 08. New auto parking areas would be developed as needed on the south side of the new roadway to serve airport users.

An auto parking facility would be developed at the new terminus of Radcliffe Road for recreationists using the Dike Trail. A portion of the Dike Trail would be relocated farther west, with access via a pedestrian footbridge crossing Duck Creek from the new parking area. Access to the Dike Trail would still be available, however, to emergency vehicles for travel to the south side of the Airport property.

As with the previous alternative, approximately 17 acres would be disturbed in the Northwest Development Area. However, the net gain in wetlands in the Northwest Development Area due to relocation of Duck Creek is estimated at 3.6 acres. The proposed development would be at elevation of about 19 feet msl; an estimated 87,000 cubic yards of fill would be needed to raise and level the surface to that elevation. A bottomless arch culvert or bottomless box culvert would be installed at the new fuel farm road crossing over Duck Creek, if approved, and a pedestrian footbridge would span the creek where the Dike Trail crosses, near the Airport's western boundary. The existing pipe culvert at Radcliffe Road would be removed. The area north and south of the new outlet of Duck Creek on the Mendenhall River would be graded and a berm would be placed along the northern edge of the grading to stabilize the new channel. Although this design should be sufficient to maintain the location and design of the new Duck Creek outlet, it may prove necessary to add additional armoring of the creek banks near the outlet. This could be accomplished with traditional riprap or bioengineering techniques.

The relocation of Duck Creek would benefit the Airport layout and would also provide an opportunity to improve certain stream characteristics and aquatic functions. The most valuable fish function of the lowermost portion of Duck Creek is as a migration corridor for anadromous and resident salmonids. Currently, this function is impaired due to low flows, periodic creek dewatering, and lack of habitat diversity. Conditions for migration would be improved, and conditions for other functions maintained, if a new channel were designed that meets the following design objectives:

- Reduces or prevents surface water loss to groundwater.
- Maintains approximately the same channel sinuosity.
- Provides a relatively gentle gradient (<1%) free of passage obstacles.
- Contains a natural substrate of silt, sand, and gravel.
- Includes margins of silt and sedges in the intertidal zone (low marsh habitat).

- Banks vegetated with native trees, shrubs, and groundcovers.
- Riparian buffers consistent with CBJ ordinance (see Specified Area Provisions, Chapter 49.70).
- Use of bottomless arch culvert at the new fuel farm access road, if installed, and a footbridge for pedestrian access over Duck Creek at the new trail crossing. The existing pipe culvert at Radcliffe Road would be removed.

While conditions for upstream and downstream fish migration would improve substantially, conditions would remain about the same for other life stages of fish. Because of its low gradient and transport capacity, the portion of Duck Creek on Airport property would remain a depositional reach. It is likely that, even with local erosion controls, fine sediments would embed the substrate as they have in the current channel. Consequently, the new channel would likely continue to have poor conditions for rearing and spawning salmonids. Margins of low-marsh habitat similar in size and elevation to those currently present would provide unchanged habitat conditions for forage fish rearing and spawning.

The improvements incorporated into this project for fish migration in this portion of Duck Creek are consistent with recent studies (cf. USFWS 2002). The primary objectives would be to reduce or prevent water loss, facilitate the upstream movement of adult and juvenile fish to rearing and spawning areas, and to speed the downstream movement of juveniles to summer rearing areas in the estuary. It is not the intent of this design to increase fish rearing or spawning in the lower portion of Duck Creek. A consequence of such improvements would be increased bird activity, which is contrary to the goal of reducing wildlife hazards to aviation. In general, the concepts for Duck Creek realignment presented in this alternative would address most of the major problems identified with this reach of the creek in the Duck Creek Watershed Management Plan.

In an effort to enhance fish migration opportunities a liner would be installed to prevent seepage into groundwater and retain surface water flows, the existing culvert under Radcliffe Road would be removed, and the channel slope would be increased from approximately 0.1% to approximately 0.2%. The proposed new channel has:

- an impermeable geotextile bed liner to prevent complete dewatering
- a length of approximately 2,450 feet versus the estimated 3,000 foot length of the current channel
- sinuosity of approximately the same as existing (1.2)
- estimated bankfull velocities under 4 feet per second
- natural substrate of silt, sand, and gravel
- margins of silt and sedges in the intertidal zone (low marsh habitat)
- banks vegetated with native trees, shrubs, and groundcovers
- stream corridor width averaging 151 feet to be consistent with CBJ ordinance

Other benefits from implementation of this alternative would be to remove the creek from beneath the extended Runway 08 approach surface, and reduce opportunities for bird species to feed on carcasses and juvenile fish in close proximity to landing and departing aircraft. This design could also be used as an action to reduce wildlife hazards, unconnected to aviation development, as described in Section 2.9.1.4.

Figures 2-37 through 2-42 illustrate the conceptual plans for Duck Creek relocation.

2.8.2.4 FW/RW-3: No Action Alternative

In accordance with regulations implementing NEPA, the No Action Alternative is carried forward for detailed analysis. The existing demand and projected future needs for additional aviation facilities would not be met under this alternative.

2.8.2.5 Comparative Summary of Impacts: Aviation Facilities

Table 2-20 provides a summary comparison of the environmental impacts associated with development of the aviation facilities. A full treatment of the resources listed on this table and the important criteria used to determine the extent and severity of environmental effects are found in Chapter 4, Sections 4.2 and 4.7 of this EIS.

2.8.3 Fuel Farm Access

Two development options to improve the distribution of aviation fuel on the Airport have been presented, and each has been depicted on the design illustrations for the Northwest Development Area (see Figures 2-35 and 2-36). The first alternative includes the construction of a new fuel farm access road directly linking the tank farm with the non-public access portion of Alex Holden Way and the aircraft operations area. This alternative would include a single-lane crossing of Duck Creek near Alex Holden Way. The second alternative would require installation of a set of aviation fuel pipelines extending southward from the tank farm, crossing under Duck Creek, and servicing a new hydrant refueling facility on the south side of Alex Holden Way. These two alternatives are described in the following sections.

2.8.3.1 FF-1: Develop New Access Road to Fuel Farm

JNU has proposed to build a new access road from the south edge of the tank farm, trending approximately southwest along the Airport property line, and turning south toward the Airport apron. A new intersection would be created at the junction with the unnamed Airport service road. The new road would also have to cross Duck Creek, either at a relocated location near the north Airport boundary, or at the existing channel near Alex Holden Way. The route of the proposed fuel farm access road is shown on Figures 2-19 and 2-35.

The road would consist of two lanes, each 12 feet wide, with an adjacent 2-foot shoulder on each side. Runoff from the road surface would be captured by drainage channels located adjacent to the shoulders. The drainage channels would be vegetated consistent with Best Management Practices identified in the Stormwater Pollution Control Plan (Carson Dorn 2001). Sediments, oils and

greases, etc. would receive passive treatment during the growing season from plant materials in the channel before discharging to Duck Creek. The road would be paved with asphalt and underlain by select graded gravels and a base of borrow material, meeting CBJ construction standards and suitable for the vehicle types and weights to be transported. A seal coat would not be placed on the surface, because of the road's proximity to Duck Creek. Figure 2-43 illustrates the road construction method.

A bottomless arch culvert or bottomless box culvert would be installed at the Duck Creek crossing. To reduce the culvert length, and therefore reduce impacts to the riparian corridor and aquatic life, the road width would be narrowed to a 16-foot, single-lane crossing for approximately 30 feet. The culvert diameter would be sized according to the width of stream channel crossed. The new road would extend approximately 565 feet from the fuel farm to Alex Holden Way..

This new road would include 535 feet of double-lane asphalt constructed to the applicable CBJ pavement standards. An additional 30 feet of single lane road would be constructed over a bottomless arch culvert. Additional expenses would be incurred for design, construction oversight, painting, signs, and some work to tie in the new road to the existing Airport access road. The total estimated cost for this alternative is $302,998. A bridge could be used in place of a bottomless arch culvert, and achieve some relatively minor reduction in fill and environmental impact. The bridge would raise the cost to about $374,364 based on a unit rate of $186 per square foot.

Approximately 0.23-acre would be disturbed, including some palustrine scrub-shrub wetlands. Approximately 2,000 cubic yards of fill would be required for road construction.

After publication of the DEIS a private vendor of fuel, Petro Marine, proposed to construct new fuel storage tanks at the existing fuel farm, increasing capacity at the facility by about 210,000 gallons. After reviewing the proposal in consideration of proposed Airport actions evaluated in this EIS, including construction of a fuel farm access road, the Corps of Engineers independently determined that the proposed fuel storage tanks would "…not appear to to interfere with our evaluation of practicable alternatives or mitigation opportunities (within the EIS)." (Corps 2006). FAA concurs with this determination. During initial review of the PetroMarine proposal the Corps identified a possible alternative access road to the fuel farm; upon further investigation, however, FAA and other reviewers determined that the alternative access road was not practicable due to its proximity to Duck Creek, which would require construction within the floodplain. JNU also identified problems with this route, such as the likely placement of snow (carrying sediments, salts, and other pollutants) removed from Alex Holden Way and the fuel farm route into Duck Creek.

FAA and the Corps agreed the proposed changes to the fuel farm storage capacity would be considered within the cumulative effects analysis of this EIS if the requested conditional use permit were approved by CBJ. On October 17, 2006 the Planning Commission of CBJ denied Petro Marine's application for a permit.

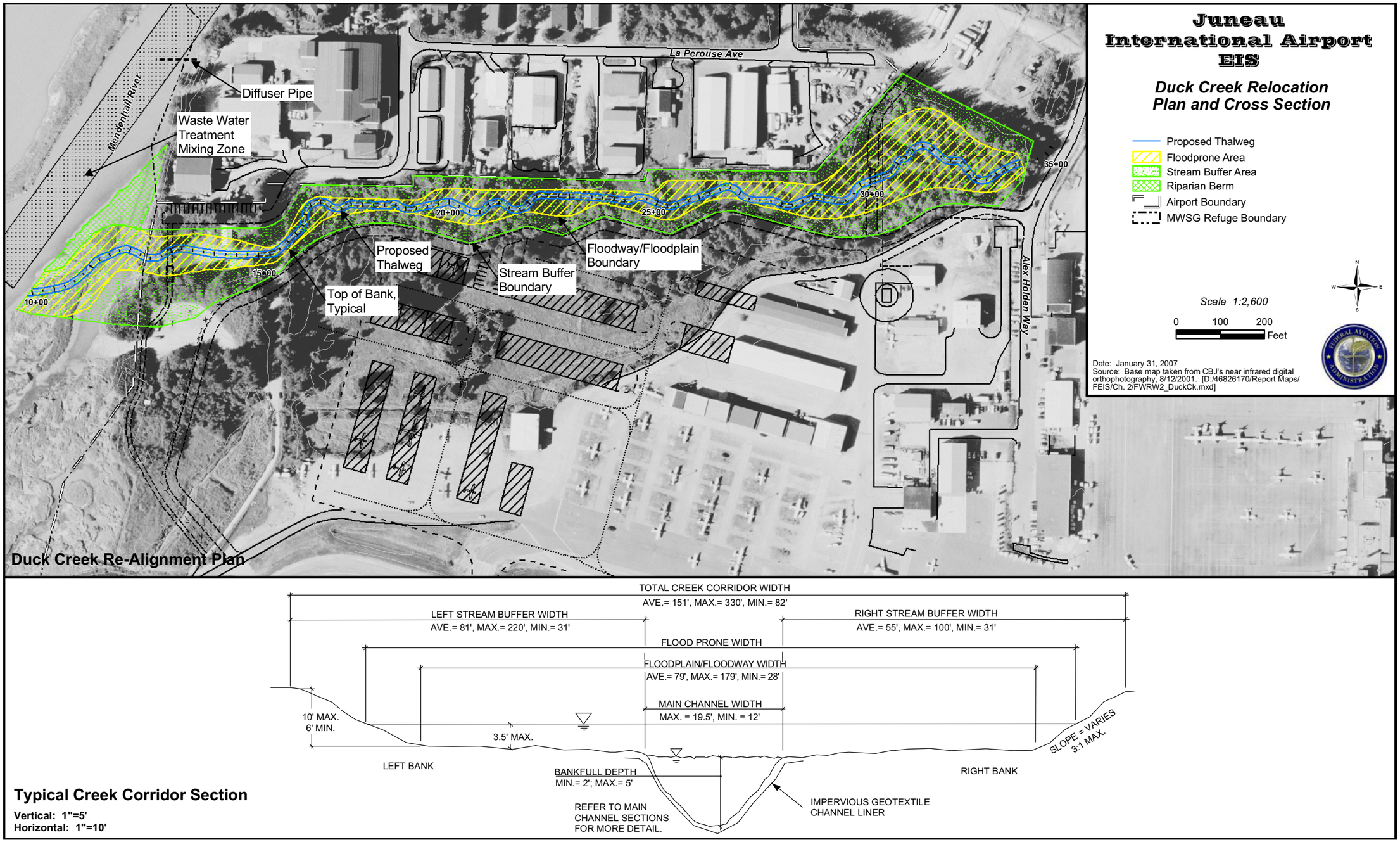

Figure 2-37. Alternative FW/RW-2: Duck Creek relocation plan and cross sections.

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Figure 2-38. Alternative FW/RW-2: Duck Creek relocation plan and creek profile: east half.

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