CHAPTER 2

PROPOSED ACTION AND ALTERNATIVES

This chapter of the EIS describes the proposed actions and alternatives for each of the needs identified in Chapter 1 for Juneau International Airport (JNU or the Airport). In accordance with the federal guidelines implementing NEPA, a range of reasonable alternatives have been identified that may accomplish the objectives of the proposed actions. This chapter first summarizes each of numerous possible alternatives and the rationale for retaining or eliminating each from further analysis. Those that did not meet the Purpose and Need, or that are not technically feasible or economically practical, were eliminated from detailed consideration in the EIS. For example, in the case of runway safety area (RSA) alternatives, there were many that could potentially achieve FAA standards. These alternatives were further screened and reduced to a reasonable number by considering factors such as impacts on aircraft departure and approach procedures, and the potential for degradation of aviation services. The result of this process is a full spectrum of alternatives meeting the stated Need for RSA that were retained for detailed analysis. Those alternatives still available after the screening process are then described in sufficient detail to allow an evaluation of impacts upon the human environment.

In summary, the process used by the federal agencies in making a decision about the actions (both the FAA and the Corps are expected to prepare Records of Decision) is:

- Identify the need for the projects and describe the purpose of the proposed actions.
- Identify possible alternatives and discuss reasons for elimination of any.
- Evaluate the impacts for a range of reasonable alternatives, including the No Action.
- Evaluate appropriate mitigation measures for any unavoidable, adverse impacts.

Sections in this chapter summarize the environmental impacts of the proposed actions and the alternatives in comparative form to provide a means of clearly differentiating the alternatives. A summary of environmental impacts is also provided.

Chapter 2 has been organized to present the following:

- Section 2.1 describes the rationale for developing alternatives to the proposed actions.
- Sections 2.2 through 2.5 summarize the various alternatives to the proposed actions, including those alternatives the FAA initially considered but later eliminated, and the justifications for their dismissal from further evaluations.
- Sections 2.6 through 2.9 provide more detailed descriptions of the alternatives carried forward for detailed environmental analysis and a comparative summary of the environmental impacts associated with each alternative.

- Section 2.10 describes connected actions that would have to be taken for development of aviation facilities in the Northeast Development Area of the Airport.
- Section 2.11 identifies additional design opportunities for alternatives that could reduce or minimize environmental impacts.
- Section 2.12 summarizes the proposed mitigation plan to compensate for environmental impacts caused by the actions contained in CBJ's application to the Corps for permits.
- Section 2.13 describes the FAA's preferred alternatives.

2.1 DEVELOPMENT OF ALTERNATIVES

Evaluation of alternatives to the Proposed Action is required by NEPA and by the Council on Environmental Quality (CEQ) (40 CFR §1502.14). The reason for this statutory mandate is that some aspects of the proposed actions may impact the environment in a manner that could be minimized or even eliminated by using an Alternative Action. Alternatives to the proposed action have been developed to:

1. meet project Purpose and Need;
2. respond to environmental, operational, and economic concerns raised by the public, agencies, business and other special interest groups during the scoping process, and
3. address potential environmental or engineering issues that have been identified during review of the proposed actions.

The concerns expressed during scoping that have influenced development of alternatives are included in Table 1-9.

NEPA mandates that all reasonable alternatives to the proposed actions must be examined. The CEQ has defined "reasonable" as those alternatives that are practical or feasible from a technical and economic standpoint. The screening criteria are similar to the test of "prudent and feasible" alternatives applied in Section 4(f) of the U.S. Department of Transportation Act, also known as DOT Section 303c.[1] Therefore, FAA evaluated the initial set of alternatives for each need to determine whether they:

- met the defined purpose and need for the project.
- were feasible from the engineering perspective, meaning, are they technically implementable and effective to meet the project needs.
- were practical from an economic perspective.
- were feasible and prudent.

1. Under Section 4(f), an alternative is feasible and prudent if it does not: 1) create any truly unique or unusual factors, 2) have costs of extraordinary magnitude, 3) result in community disruption of extraordinary magnitude, or 4) contain an accumulation of these factors.

The first two criteria are relatively easy to identify and establish for each alternative. However, the cost of a specific alternative, criterion three, is difficult to determine without conducting a more rigorous design analysis. In addition, some costs, such as those for compensatory mitigation, may not be apparent early in the analysis. For these reasons cost was never the only factor when eliminating an alternative from consideration, unless the cost was estimated to be many times higher than other feasible and prudent alternatives. Planning level cost estimates were prepared for this EIS using a variety of sources. These cost estimates were developed to provide a relative understanding of the expense potentially associated with each action and alternative, and are based on FAA guidance where available (such as FAA 2004(c)). FAA recognizes that other agencies may rely on different approaches to costing to meet their own regulatory requirements, such as the financial tests for practicability under the Clean Water Act. FAA believes the cost information provided in this FEIS should satisfy the needs of other federal and state agencies to make reasoned jurisdictional decisions. More importantly, the cost estimates allow comparison of costs between alternatives using consistent assumptions. Supporting detail for the cost estimates is provided in Appendix A.

Two specific scoping concerns are not being addressed by alternatives in this EIS. When evaluating airport development actions that are based on air travel demand, alternatives that involve using other modes of transportation (such as bus, rail, and shipping) are also typically considered, as are alternatives that rely on increased use of other area airports. This is commonly done because, in some instances, these options can lessen the need for an action. In the case of Juneau, no other mode of transportation exists within the area that satisfies the time-sensitive transportation needs of tourism, commercial passenger and freight transport, and general aviation. The primary limitations of other transportation modes are terrain and coastal location, since there is no road or rail access between Juneau and other communities[2]. Therefore, requiring potential air travelers to use an automobile, bus, or train instead is not a viable alternative. Air travelers and cargo might be shipped by ferry to other Alaskan towns; however, Alaskans have not found this means of transportation to always be an acceptable alternative to air transportation, and it certainly would not provide a satisfactory alternative to travel beyond southeast Alaska.

For different reasons, the use of another, existing airport or construction of a new airport does not satisfy the purpose and need for the actions being considered. The requirement to meet standards for a RSA at JNU is based on existing uses, regardless of whether or not another regional airport were developed. In order for JNU to continue to have commercial aviation services, the RSA must be upgraded to meet federal regulations. The FAA does not believe it would be prudent to consider an alternative for a new airport, as a replacement for or in addition to the existing airport, for a number of reasons including:

- The extreme cost to develop a new facility and decommission the existing Airport.
- The environmental impacts associated with development of a large, new facility in the vicinity of Juneau.

2. An environmental and feasibility study has been prepared considering impacts associated with a new road to connect Juneau with other Alaska communities. Approval and construction of an access road may influence airport activity, but it would not eliminate the need for the projects described herein as the projects are not dependent on levels of airport activity.

- Difficulty in finding other airport locations without significant operational impediments such as strong winds, terrain obstructions, and so forth.
- Cumulative social and environmental effects of two such facilities, recognizing that decommissioning of the existing JNU would not result in a return of the "natural" environmental conditions.
- Lack of a Sponsor for such an action. In other words, CBJ has not demonstrated a need for a new Airport nor has it requested that FAA further investigate the feasibility and justification for such a facility.

It is also important to recognize that in making these evaluations, FAA is responding to actions requested by the Airport Sponsor (the City and Borough of Juneau), to address safety standards and long-term aviation needs.[3] Therefore, the alternatives do not include alternative modes of transportation or construction of a new airport. The following sections summarize the various possible alternatives considered for each of the stated needs, and provide the rationale for eliminating some alternatives from detailed consideration.

2.2 RUNWAY SAFETY AREA (RSA)

Public Law 109-115, signed into law on November 30, 2005, requires that airports such as JNU comply with FAA RSA standards by the year 2015. Specifically, this law states:

> That not later than December 31, 2015, the owner or operator of an airport certificated under 49 U.S.C. 44706 shall improve the airport's runway safety areas to comply with the Federal Aviation Administration design standards required by 14 CFRR Part 139: *Provided further*, that the Federal Aviation Administration shall report to the Congress on the agency's progress toward improving the runway safety areas at 49 U.S.C. 44706 airports.

The FAA has determined that the existing RSA at JNU does not meet the standards in the FAA Advisory Circular 150/5300-13, Airport Design, but that it may be possible to achieve RSA compliance at JNU using traditional means. The FAA defines "traditional means" as "graded areas surrounding the runways." This preliminary determination has been based on the results of the Airport Master Plan (USKH 1999) and Final Environmental Assessment (USKH 2000) prepared by the CBJ. The FAA will use this EIS to make one of the following final determinations:

- The existing RSA does not meet standards, and it is possible to improve the RSA so that it will meet current standards.
- The existing RSA can be improved to enhance safety, but the RSA will still not meet the current standards.
- The existing RSA does not meet current standards, and it is not possible to improve the RSA.

3. CBJ owns and operates the Airport. References in this chapter to JNU refer to the Airport facility or Airport staff, while references to proposals and activities are made to the Sponsor, CBJ.

FAA guidance presents the following possible types of alternatives to consider when addressing RSAs that do not meet standards (FAA 1999):

- The first alternative to be considered is constructing traditional graded areas surrounding the runway. Where not practicable to obtain RSA through traditional means, the following should be considered.
- Relocation, shifting, or realignment of the runway (while maintaining runway length).
- Reduction in the runway length where existing runway length exceeds that which is required for the existing or projected design aircraft.
- A combination of runway relocation, shifting, and grading.
- Declared distances.
- Engineered Materials Arresting Systems (EMAS).
- Feasibility of increasing the size of the RSA by including additional land parcels, even if it will result in an RSA of an irregular size.

Each category of alternatives was initially considered for application to the safety area at JNU runways. In addition, and in accordance with NEPA, a "No Action Alternative" is also included in the range of alternatives. Alternatives designed to achieve standards using one or more of the above methods are identified in Section 2.2.2.

The focus of the above list is on safety areas at the ends of runways. As was noted in Section 1.4, and illustrated in Figure 1-3, JNU's lateral safety area also does not meet FAA standards: it is too narrow for approximately 3,500 feet of runway. For that reason, a number of alternatives were identified to address lateral safety area deficiencies. Because the lateral safety area alternatives can affect all of the end-of-runway alternatives, these are described first, in Section 2.2.1.

2.2.1 Alternatives to Achieve Lateral RSA Standards

Alternatives available to achieve compliance with the lateral length would likely affect the alternatives considered for the ends of the runway. Along with the No Action Alternative, four additional alternatives were considered to address deficiencies in lateral RSA. Each of these is described below.

2.2.1.1 Clear and Grade along Existing Runway Shoulders

Clearing, adding more fill material, and grading the existing shoulders of the runway would be required to address the RSA-deficiency along the south side of the eastern portion of the runway shoulder. As CBJ owns the land along the lateral potions of the runway, no other sub-options involving land acquisition are necessary. Fill could be imported from the Float Plane Pond to provide sufficient RSA. Preliminary estimates indicate that, using the existing runway configuration as a basis for the estimate, at least 12.0 acres of estuarine wetlands, including channels along

the southern portion of the runway and east of the Float Plane Pond, would require fill on the south side of the runway. North of the runway, the Jordan Creek culvert would have to be extended beyond the additional fill zone needed to achieve standard lateral RSA width.

Depending on the configuration resulting from RSA improvements to the runway ends, up to 13.8 acres could need to be filled and graded to develop the lateral RSA. The estimated cost to construct this alternative is $2.1 million, based on the size of the safety area deficiency and an average fill depth to 15 feet. This cost estimate is only for lateral safety area and does not include RSA deficiency at the runway ends.

2.2.1.2 Relocate or Realign the Runway and Taxiways

Theoretically, the primary runway at JNU could be relocated or realigned to achieve FAA standards for lateral RSA. Although only the eastern portion of the RSA is deficient in width, the entire runway would have to be relocated north by approximately 136 feet (to maintain optimal aircraft performance). This action, however, would have several consequential effects: relocating the adjacent parallel Taxiway A by 136 feet; relocating Taxiway H; and the encroachment on the terminal and landside facilities or relocation of these facilities north.

This alternative would result in inordinately negative effects when compared to other alternatives developed for achieving the purpose and need. Substantial costs would be incurred to re-position all facilities affected by the relocation of the runway. Because the Airport is bounded by industrial and residential neighborhoods and by public thoroughfares, extensive social and community disruption would occur. Based on the costs developed for other actions proposed at the Airport, including RSA construction, development of the Northwest and Northeast Development Areas, Duck Creek relocation, and other safety and operational improvements, this alternative is estimated to cost in excess of $100 million, an excessively high cost in comparison to the other lateral RSA alternatives.

Another notable concern associated with a shift of the runway to the north would be the impact to approach and departure procedures. The Lemon Creek special departure procedure from Runway 08 is critically situated with respect to terrain on the north. Moving the runway closer to this terrain could preclude use of this procedure (employed when east departures with a B737-200 aircraft are necessary but the wind coming down from the Coast Range along the Gastineau Channel creates turbulent conditions). The Fox departure, applicable to the B737-400 aircraft, could be similarly affected. Also, obstructions at both Sunny Point could encroach on the Runway 26 special use approach, and higher obstructions at Pederson Hill could affect departures from Runway 08. If so, the new obstructions could require modifications to the ceiling and/or visibility conditions, or even an increased climb gradient for departures. All of the current instrument minimums would also have to be amended.

For these reasons, this alternative is not reasonable or prudent and it is eliminated from detailed analysis.

2.2.1.3 RECONFIGURE RUNWAY-TAXIWAY SPACING

The current separation distance between the runway centerline and the primary, parallel Taxiway A centerline is 400 feet, in conformance with FAA standards. An option suggested by one of the cooperating agencies is to create a "non-standard" condition for the spacing between the runway and taxiway centerlines. A preliminary calculation of spatial requirements suggests that the runway could be shifted approximately 94 feet north, while still accommodating a B737-900 design dimension of 306 feet from runway to taxiway, without physical alteration of the taxiway. (A greater shift could occur if only the B737-400 were considered.) These shifts would be based on physical dimensions of the design aircraft, but not take into account FAA standards that include safety buffers for aircraft movement.

This option would reduce the overall effect on habitat from construction of lateral RSA by approximately 65% and save between 8 and 12 acres of estuarine wetlands. It is difficult to calculate the costs to implement such an action, primarily because the lower capital construction costs relative to other alternatives would likely be more than offset by lost revenue associated with new operational restrictions (see below). The estimated cost to construct this alternative would be on the order of $25 million, when only considering fill, site preparation and asphalt surfacing. There are, however, two major problems with this approach.

First, as with the runway relocation option described earlier, this approach could cause significant impacts to operational capability, since it would require the alteration and possibly loss of special-use departure procedures. Impacts could also include additional limitations on departures, and loss of Alaska Airline's special departure procedures from Runway 08. Other problems noted in Section 2.2.1.2 concerning obstructions in the approach paths are also possible. Second, the changes inherent in this alternative would constitute the creation of one new, non-standard condition (insufficient taxiway-runway separation) to resolve an old, non-standard condition (the lack of sufficient RSA). Such an action would be contrary to the objective of improving safety at the Airport. For these reasons, this alternative was deemed not reasonable or prudent and is eliminated from detailed analysis.

2.2.1.4 CONSTRUCT AN ELEVATED RSA SURFACE

The existing runway and RSA drop quickly down to estuarine tidal channels and wetlands on the south side, and construction of traditional RSA in this area would result in the loss of substantial habitat. A possible alternative to the traditional fill and grade method of developing RSA that would minimize environmental impacts would be to construct an elevated RSA surface on piers. The elevated pier structure would have to be designed to carry maximum aircraft loads, meet appropriate grading and surface standards, allow snow removal operations to be performed as determined necessary by the Airport, and accommodate fire fighting equipment positioning and other maintenance requirements. Supporting columns would have to be designed to withstand water erosion and ice scour, and the footings would have to be set well below the surface for structural stability.

The requirements and costs for a standard highway bridge structure were considered similar to this alternative, as the safety area would be loaded infrequently by large aircraft when they have veered off from normal runway operations (Morrison-Maierle 2002). The analysis was based on seismic demands for the Juneau area, with liquefaction potential comparable to standard highway bridge structure. The analysis determined that a standard highway bridge structure would have acceptable factors of safety for structures with spans greater than 130 feet in length. However, aircraft loading would produce greater beam shears and concrete deck demands, necessitating additional reinforcing steel at the beam ends and in the deck.

Alaska Department of Transportation and Public Facilities (ADOT&PF) recommended a per square foot cost of $175 for planning bridge structures in this area. With a minimum width of 136 feet (using a bulkhead retaining wall) and an estimated minimum overall length of 3,500 (it may have to be as much as 4,170 feet to tie in ends) the structure would cost in excess of $80 million, many times more than most other alternatives. For this reason, this alternative was found to not be prudent and eliminated from detailed analysis.

2.2.1.5 Engineered Materials Arresting System for Lateral RSA

At airport locations where other alternatives are not practicable, the FAA, working with industry, has approved the use of a system that will arrest the speed of an aircraft that overruns the ends of the runway. An Engineered Materials Arresting System (EMAS) consists of a number of pre-cast, cellular cement blocks installed at the end of the runway or available RSA. Although only approved for use on runway ends, at the time this EIS was being prepared consideration was given to the use of EMAS along the width of the Juneau runway as a possible means to minimize environmental impact to estuarine habitat south of the runway. (Additional discussion of EMAS technology, limitations, and uncertainties relative to use of EMAS at the ends of the runway is provided in Section 2.2.2.6 of this EIS).

EMAS was not designed for use as a substitute for cleared and graded areas along the lateral length of a runway. The system is designed for direct or close to direct, 90-degree entry by aircraft, not angled entry as would typically occur during veeroffs. It is possible the EMAS could actually require a greater lateral footprint than standard RSA to provide sufficient capture distance, negating any possible environmental benefit. Recent guidance has been developed by FAA to calculate the financial feasibility of EMAS installation and use (FAA Order 5200.9), but the possible cost of EMAS south of the JNU runway cannot be calculated using this guidance or other means, since there is no design standard to be applied.

Because EMAS has not been approved for use as an RSA substitute along runway sites, and there is no design standard to apply, the technology was deemed not prudent or feasible and eliminated from further consideration.

2.2.1.6 No Action Alternative

NEPA and its implementing regulations at 40 CFR 1502.14(d) require that a No Action Alternative be subjected to detailed environmental analysis in an EIS. The No Action Alternative applied to the lateral RSA means no construction (or fill) would take place, and no additional RSA on the

sides of the runways would be gained. Implementation of the No Action Alternative would essentially maintain existing conditions, in this case, a lateral RSA that is too narrow for more than 40% of the runway length. This alternative does not meet the Purpose and Need of achieving compliance with RSA standards, but it is carried forward for detailed analysis in accordance with federal regulation.

2.2.1.7 Summary of Lateral RSA Alternatives

The possible alternatives to create a standard lateral RSA were evaluated for technical feasibility, relative cost, ability of an alternative to meet the purpose and need, and other factors. Table 2-1 summarizes the results. Based upon this evaluation, the only prudent and feasible alternative for achieving RSA compliance along the lateral length of the runway is clearing, filling, and grading along the eastern portion of the east runway. In accordance with NEPA, the No Action is also considered further.

2.2.2 Alternatives to Achieve RSA Standards for Runway Ends

The following sections describe alternatives for achieving RSA compliance beyond the ends of the runway. These RSA alternatives have been arranged following the categories outlined in FAA Order 5200.8. Important considerations in the screening of RSA alternatives are how each alternative would affect runway characteristics, and how those changes could affect aviation operations at the Airport. Table 2-2 provides a summary of the runway threshold changes required for each alternative and the estimated area of disturbance and volume of fill needed to construct only the RSA and related facilities incorporated into the alternative. More refined estimates of disturbance areas and fill volumes, including all areas potentially affected by the RSA project, are presented in Section 2.6 for those alternatives selected for detailed environmental analysis. Table 2-3 shows the maximum takeoff and landing distances available after construction of each alternative. Note that when considering RSA compliance for the ends of the runway, as described in the following sections, all of the alternatives incorporate development of a RSA along the lateral portion of the runway as a component of the action.

This section of the FEIS includes some important differences from the DEIS, stemming in part from design refinements developed by FAA and CBJ, but also reflecting new RSA criteria for the design aircraft. Previously, the FAA's RSA criteria for aircraft such as the B-737-900 or -400, classified as Airplane Design Group III, incorporated a 1,000-foot safety area for both undershoots and overshoots. FAA still requires a 1,000-foot overshoot protection but the minimum undershoot protection has been reduced to 600 feet (FAA 2004b). This change has provided opportunities to modify some alternatives evaluated in the DEIS such that disturbance footprints and overall environmental impact can be reduced. The operational characteristics of alternatives developed during the DEIS are presented using full 1,000-ft undershoot and overshoot protection. Modifications of alternatives evaluated in the DEIS, based on the FAA's new RSA criteria, are included in this FEIS.

Three alternatives have been added to the FEIS, each representing a modification of alternatives evaluated in the DEIS. They include:

Table 2-1. Screening of Lateral Runway Safety Area Alternatives

Alternative	Feasible	Relative Cost[1]	Benefits	Drawbacks	Included or Eliminated?[2]
Clear, Grade, and Fill	Yes	Low ~$2.1 million	Achieves standard RSA Prudent and feasible	Fill up to 13.8 acres of wetland/habitat, including estuarine channels Extension of Jordan Creek culvert	Included
Relocate or Realign Runway and Taxiways	No	Extremely High ~$100 million	Achieves standard RSA Reduces direct impact to estuarine habitat and wetlands south of runway	Requires relocation of all airport facilities Fill 8-12 acres of wetland/habitat, including estuarine channels Potential impacts to aircraft operations Excessively high cost Not prudent or feasible	Eliminated
Reconfigure Runway Taxiway Spacing	Yes	Moderate-High ~$25 million	May achieve standard RSA (if separation distance maintained) Reduces direct impact to estuarine habitat and wetlands south of runway	Requires creation of non-standard airport operating environment, would not meet minimum runway-taxiway separation distance Potential impacts to aircraft operations. Not prudent	Eliminated
Elevated RSA Surface	Yes	Extremely High ~$80 million	Achieves standard RSA Reduces need for fill materials and impact on fill sources Minimizes impact on estuarine habitat and wetlands south of runway	Substantial engineering challenges to reduce effects from tidal erosion, ice scour Expected to cost substantially more than most other alternatives, Not prudent	Eliminated
Engineered Materials Arresting System (EMAS)	Yes	Unknown	Reduce impact on estuarine habitat and wetland south of runway	Does not provide lateral safety area protection, untested technology for this use Does not meet purpose and need as a substitute for lateral RSA Not prudent or feasible	Eliminated
No Action	Yes	None	No environmental impacts	Does not meet purpose and need	Included[3]

[1] Cost relative to other alternatives
[2] Included for detailed evaluation in the EIS or Eliminated from further consideration.
[3] Evaluation of the No Action Alternative is required by federal regulation.

Table 2-2. Threshold Changes and Disturbances Resulting from Possible RSA Alternative

Alternative	Relocate Thresholds[1] (feet)		Displace Thresholds[2] (feet)		Taxiway Modifications (feet)		Linear Disturbance for RSA & Rwy (feet)[4]		Lateral RSA Disturbance Area[5] (acres)	Total RSA Disturb-ance[5] (acres)	Volume Fill[5] (yd^3)
	Rwy 08	Rwy 26	Rwy 08	Rwy 26	Rwy 08	Rwy 26	Rwy 08	Rwy 26			
RSA-1 – Fill and Grade Existing RSA Deficiencies	No	No	No	No	None	None	750	711	12.2	37.2	570,762
RSA-1A – Elevated RSAs Applied to RSA-1	No	No	No	No	None	None	750	711	12.9[6]	37.1[6]	~200,000
RSA - 2A – Full RSA by Shifting Runway East	618	618	No	No	None	618	132	1329	15.7	37.7	507,375
RSA - 2B – Full RSA by Shifting Runway Further East	750	750	No	No	None	750	None	1461	16.5	37.4	648,882
RSA-2C – Full RSA by Shifting Runway West	400	400	No	No	400	None	1150	311	12.6	36.8	622,090
RSA-3 – Reduce Runway Length to Achieve RSA	870	711	No	No	870	711	None	None	10.2	15.4	226,250
RSA-5A – Displace Thresholds with Declared Distances[7]	No	No	870	711	None	None	None	None	10.2	15.4	226,250
RSA-5A(1) – Displace Thresholds w/Takeoff Procedure[7]	No	No	750	711	None	None	None	None	10.2	15.4	226,250
RSA-5A(2) – Displace Thresholds w/EMAS	No	No	450	411	None	None	None	None	10.9	17.7	279,250

Table 2-2. Threshold Changes and Disturbances Resulting from Possible RSA Alternative, continued

Alternative	Relocate Thresholds[1] (feet)		Displace Thresholds[2] (feet)		Taxiway Modifications (feet)		Linear Disturbance for RSA & Rwy (feet)[4]		Lateral RSA Disturbance Area[5] (acres)	Total RSA Disturb-ance[5] (acres)	Volume Fill[5] (yd^3)
	Rwy 08	Rwy 26	Rwy 08	Rwy 26	Rwy 08	Rwy 26	Rwy 08	Rwy 26			
RSA-5B – Displace 08 Threshold and Construct 26 RSA[7]	No	No	870	No	None	None	None	711	12.6	24.1	427,796
RSA-5C – Displace 08 Threshold, Construct 26 Rwy and RSA	No	446	446	No	None	446	304	1157	13.8	39.3	524,271
RSA-5D – Relocate 26 Threshold, Construct 26 Runway and RSAs	No	400	No	No	None	400	350	711	13.6	35.6	467,770
RSA-5E – Displace 08 Threshold, Relocate 26 Threshold, Construct 26 Runway and RSAs	No	520	120	No	None	520	230	831	14.0	35.3	454,778
RSA-6A – EMAS with Declared Distances/Rwy 26 Extension	No	No	188	188	None	None	162	311	12.2	25.0	286,584
RSA-6B – EMAS with Declared Distances/Rwy 08 Extension	No	No	188	188	None	None	350	123	11.6	27.2	326,505
RSA-6C – Combined EMAS and Standard Runway Safety Area	No	No	No	No	None	None	350	711	12.2	33.7	446,360

Table 2-2. Threshold Changes and Disturbances Resulting from Possible RSA Alternative, continued

Alternative	Relocate Thresholds[1] (feet)		Displace Thresholds[2] (feet)		Taxiway Modifications (feet)		Linear Disturbance for RSA & Rwy (feet)[4]		Lateral RSA Disturbance Area[5] (acres)	Total RSA Disturb-ance[5] (acres)	Volume Fill[5] (yd^3)
	Rwy 08	Rwy 26	Rwy 08	Rwy 26	Rwy 08	Rwy 26	Rwy 08	Rwy 26			
RSA-6D – Threshold Displacement using Declared Distance Criteria with Option for EMAS Installation	No	No	400	600	None	None	350	311	12.2	29.2	359,646
RSA-8 – No Action	No	No	No	No	None	None	None	None	None	None	None

[1] Per AC 150/5300-13, the portion of pavement behind a relocated threshold is not available for takeoff or landings, as can be the case with a displaced threshold (see next footnote). The arrival threshold and takeoff start point would "relocated" to the same position on both runways for alternatives 2A, 2B, 2C and 3, and for only Runway 26 for Alternatives RSA-5C, -5D, and -5E.

[2] Per AC 150/5300-13, the portion of pavement behind a displaced threshold may be available for takeoffs in either direction and landings from the opposite direction. Therefore, the arrival threshold would be "displaced" from the takeoff start point on both runways for Alternatives RSA-5A, -5A(1), and -5A(2), and for only Runway 08 for Alternatives RSA-5B, -5C, and -5E. Alternatives RSA-6A and -6B also incorporate displaced thresholds on both runways as well as runway extensions on one runway, allowed because of the EMAS equivalency to standard RSA.

[3] Refers to extension of taxiway or modification of taxiway entrance to runway.

[4] Linear Disturbance is measured from RSA/EMAS ends and do not include length for fill slopes or EMAS access pavement.

[5] Area and Volume calculations were generated from CBJ's 2001 LiDAR data, which is provisional and not up to their accuracy standards. Area and fill volume calculations include only disturbance associated with the RSA/EMAS development footprint, including embankments, taxiway, runway, & roads.

[6] An RSA constructed as a bridge-type structure would not have the same type of fill disturbance as other alternatives. Area of disturbance would be similar.

[7] Threshold displacements are based on 1,000-ft undershoot and overshoot criteria in place during preparation of the DEIS.

Table 2-3. Landing and Takeoff Distances for Possible RSA Alternatives (in feet)

Distance	RSA-1 RSA-7 RSA-8	RSA-2A 2B 2C	RSA-3	RSA-5A[2]	RSA-5A(1)[2]	RSA-5A(2)	RSA-5B[2]	RSA-5C	RSA-5D	RSA-5E	RSA-6A	RSA-6B	RSA-6C	RSA-6D
Runway 08 (east flow)														
Landing Length Available	8,456	8,456	6,875	6,875	6,995	8,006	7,586	8,456	8,456	8,456	8,456	8,456	8,456	8,056
Takeoff Run Available	8,456	8,456	6,875	8,456	8,456	8,456	8,456	8,902	8,856	8,976	8,644	8,644	8,456	9,456
Takeoff Length Available	8,456	8,456	6,875	8,456	8,456	8,456	8,456	8,902	8,856	8,976	8,644	8,644	8,456	9,456
Accelerate Stop Distance[1]	8,456	8,456	6,875	7,745	7,745	8,456	8,456	8,902	8,456	8,576	8,644	8,644	8,456	8,456
Runway 26 (west flow)														
Landing Length Available	8,456	8,456	6,875	6,875	6,995	8,045	7,586	8,456	8,456	8,456	8,456	8,456	8,456	8,056
Takeoff Run Available	8,456	8,456	6,875	8,456	8,456	8,456	8,456	8,902	8,856	8,976	8,644	8,644	8,456	9,456
Takeoff Length Available	8,456	8,456	6,875	8,456	8,456	8,456	8,456	8,902	8,856	8,976	8.644	8.644	8,456	9,456
Accelerate Stop Distance[1]	8,456	8,456	6,875	7,586	7,706	8,456	7,586	8,456	8,456	8,456	8,644	8,644	8,456	8,656

[1] Per FAA Advisory Circular 150/5300-13, Accelerate Stop Distance Available is the runway plus stopway length declared available and suitable for the acceleration and deceleration of an airplane aborting a takeoff. This value is used in the EIS for determining and comparing runway departure distances.

Source: Barnard Dunkelberg & Company, 2004; Alaska Airlines, 2002b; 2003; 2006a

[2] Landing distance available for this alternative is based on previous RSA criteria of 1,000-ft undershoot and overshoot protection. LDA would increase based on new criteria, but would still result in reductions from current runway conditions.

- RSA-5D, an alternative based on RSA-5C and developed by JNU to use areas west of the Airport to the maximum extent possible for runway safety area,
- RSA-5E, developed by FAA and CBJ in consultation with the Cooperating Agencies to avoid fill into the Mendenhall River resulting from some alternatives evaluated in the DEIS, such as RSAs-1, -6B and -6C, as well as RSA-5D, and
- RSA-6D, developed by FAA based on the DEIS Alternatives RSA-6A and -6B, that could be used with traditional safety areas or modified to incorporate EMAS and thereby increase runway length.

RSA-5C, the alternative evaluated in the DEIS as JNU's Proposed Action, has also been modified to reduce impacts east of the runway but with a larger disturbance footprint west of the Airport.

The JNU Airport Board voted unanimously on February 14, 2007 to designate Alternative RSA-5E as the new Proposed Action.

2.2.2.1 OPERATIONAL CONSIDERATIONS FOR RSA

Even without consideration of the unpredictable climate factors in southeast Alaska, such as wind, rain, icy runways, and limited visibility and low ceilings, the operating conditions at JNU are complex. A detailed evaluation and screening of RSA alternatives requires a solid understanding of how changing runway lengths and threshold locations can affect airport operations for the aviation user groups (e.g., commercial passenger airlines, cargo carriers, and general aviation operators) and the traveling public. For example, JNU is served by two public-use non-precision instrument approaches, both to Runway 08; two "special use" instrument approaches authorized for use by Alaska Airlines on Runway 08; and two RNAV "special" approaches for use by Alaska Airlines, one each on Runways 08 and 26. Alaska Airlines also has "special use" departure procedures including the Gastineau Channel departure and the Lemon and Fox departures, approved for takeoffs from Runway 08.

All of these procedures have been specifically approved for use at JNU and are based on the existing facility layout and use configuration. At a minimum, changes to the runway thresholds or declared lengths would necessitate revisions to those procedures and conceivably the loss of the procedures.

In addition, changes to the runway threshold locations or runway lengths could also result in the imposition of operational weight penalties on landings or takeoffs for the larger commercial jet aircraft. For example, Table 1-6 in Chapter 1 illustrated the runway takeoff length requirements for each use configuration of the specified aircraft types, based on both the estimated mission and maximum obstruction-limited weights. From the standpoint of aircraft departures, any reduction in available runway length must be evaluated in consideration of these two weights to quantify and assess potential weight penalties that may be incurred. In simple terms, an aircraft operating from JNU must carry less weight, as runway length decreases, to safely clear obstructions (such as mountains or even tall trees). Because the fuel requirements for a particular destination do not change significantly for a fully loaded flight, a decrease in allowable payload weight, resulting from a shortened runway, would come in the form of less cargo and/or fewer passengers. Addi-

tional criteria that must be factored in to the runway takeoff length requirement evaluation include runway utilization patterns, wind coverage (i.e., tailwind, headwind, and crosswind components), temperature, pavement conditions, and specific departure procedures (e.g., standard vs. improved climb).

With respect to aircraft landing operations, Table 1-7 in Chapter 1 illustrated the runway landing length requirements of the specified aircraft for both wet and dry pavement in consideration of the maximum landing weight configurations. In addition to this general planning data, which is derived from aircraft flight manuals, Boeing also provides advisory landing information to assess the impacts of reduced braking performance caused by "slippery" runway conditions. As can be noted from Table 1-7, approximately 2,250 feet of additional runway landing length, above that specified for wet pavement conditions (i.e., a total of 8,450 feet), would be required for the Boeing 737-400 aircraft in consideration of slippery runway conditions for the medium braking coefficient. Alaska Airlines has requested that this reduced braking performance be included in the assessment of required runway length for the RSA alternatives evaluation. Additional factors that must be considered in the required runway landing length evaluation include runway use patterns, wind coverage (i.e., tailwind, headwind, and crosswind components), and specific instrument approach procedures (i.e., both public and special use procedures).

Changing the runway threshold location can have the same effect as shortening the runway, because it can move the starting point of the takeoff closer to an obstruction. In this example, to safely perform the departure procedure, the aircraft would also have to carry less weight, possibly resulting in a payload reduction.

Determining how extensive and costly changes to approach and departure procedures would be for each of the alternatives is difficult. For example, maintenance of the Runway 08 departure threshold is likely critical to preserve the takeoff weight capabilities of Alaska Airline's existing Lemon and Fox departure procedures. Also, many of the RSA alternatives would require the modification of the existing Runway 08 MALSR to reconcile light positions with a new landing threshold. To weigh the operational impacts for the alternatives, the FAA considered whether or not each would affect the existing, specialized procedures and, to the extent possible, the relative magnitude of that effect. Table 2-4 summarizes these operational components and impacts.

2.2.2.2 RSA-1: Construct Traditional Graded Areas Surrounding the Runway

The first alternative to consider in every case of meeting RSA standards is through filling and grading the existing runway ends. The intent of this alternative would be to develop a traditional and standard 1000-ft RSA with no change in runways thresholds or operational procedures. As shown on Table 2-3, this alternative and options to the alternative would preserve the existing takeoff and landing distances for both runways.

This method requires ownership of the needed lands or an ability to acquire the lands. JNU would have to purchase or otherwise gain access to Refuge lands owned by the State of Alaska to achieve the RSA compliance in this manner. One alternative, to gain land access and constructed

Table 2-4. Summary of Operational Impacts for Possible RSA Alternatives

Alternative	Impact to Runway Safety Margin[1]	Require Revisions to Alaska Airlines Special Use RNAV Approaches[2]		Require Revisions to Rwy 08 Public Use Instrument Approaches	Impose Additional Weight Limitations on Departures[3]		Limit or Preclude Lemon & Fox Departures	Retain Landing Distance Available
		Rwy 08	Rwy 26		Rwy 08	Rwy 26		
RSA-1 – Fill and Grade Existing RSA Deficiencies	Major Increase	None	None	None	None	None	No	Yes
RSA-1A – Elevated RSAs Applied to RSA-1	Increase	No Change	No Change	No Change	None	None	No	Yes
RSA-2A – Full RSA by Shifting Runway East	Major Increase	Minor Change	Possible Change (new obstructions)	Minor Change	Moderate Change	None	Yes	Yes
RSA-2B – Full RSA by Shifting Runway Further East	Major Increase	Minor Change	Possible Change (new obstructions)	Minor Change	Moderate Change	None	Yes	Yes
RSA-2C – Full RSA by Shifting Runway West	Minor Increase	Significant Change (proximity to obstructions)	Minor Change	Potentially Significant (proximity to obstructions)	None (increase)	Minor Change	No	Yes
RSA-3 – Reduce Runway Length to Achieve RSA	Reduction	Minor Change	Minor Change	Minor Change	Significant Change	Minor	Yes	No
RSA-5A – Displace Thresholds with Declared Distances	Minor Reduction	Minor Change	Minor Change	Minor Change	Moderate Change[4]	Minor	No	No
RSA-5A(1) –Displace Thresholds w/ Takeoff Procedure	Minor Reduction	Minor Change	Minor Change	Minor Change	Moderate Change[4]	Minor Change	No	No
RSA-5A(2) – Displace Thresholds w/ EMAS	Minor Increase	Minor Change	Minor Change	Minor Change	Moderate Change	None	No	No
RSA-5B – Displace 08 Threshold and Construct 26 RSA	Major Increase	Minor Change	No Change	Minor Change	None	Minor Change	No	No
RSA-5C – Displace 08 Threshold, Construct 26 Rwy and RSA	Major Increase	Minor Change	Minor Change	Minor Change	None	None	No	Yes
RSA-5D - Relocate 26 Threshold, Construct 26 Rwy and RSAs	Moderate Increase	No Change	Minor Change	No Change	None	None	No	Yes
RSA-5E - Displace 08 Threshold, Construct 26 Rwy and RSAs	Moderate Increase	Minor Change	Minor Change	Minor Change	None	None	No	Yes
RSA-6A – EMAS with Declared Distances/Rwy 26 Extension	Moderate Increase	Minor Change	No Change	Minor Change	None	None	No	Yes
RSA-6B – EMAS with Declared Distances/Rwy 08 Extension	Moderate Increase	No Change	Minor Change	No Change	None	None	No	Yes
RSA-6C – Combined EMAS and Standard Runway Safety Area	Major Increase	No Change	No Change	No Change	None	None	No	Yes
RSA-6D **-** Threshold Displacement using Declared Distance Criteria w/Option for EMAS	Moderate Increase	No Change	No Change	No Change	None	None	No	No
RSA-8 – No Action	No Change	None	None	None	None	None	No	Yes

[1] Qualitative assessment based on factors including runway length, extent of RSA for undershoots and overshoots, and proximity to terrain obstructions. Alternatives incorporating full 1,000 undershoot protection would tend to have greater increase in safety margin than alternatives with 600-foot undershoot protection.
[2] Redesign of the RNP RNAV approach for Runway 08 could result in slightly higher or lower minima than the current procedure.
[3] Takeoff weight restrictions could be imposed by a shortened runway length or threshold shift that may reposition obstructions relative to the departure path.
[4] According to operational takeoff weight data provided by Alaska Airlines, a non-stop JNU to SEA flight would be weight restricted based on the estimated typical mission weight of the B737-400 aircraft.

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graded safety areas while maintaining existing thresholds locations, is considered prudent and feasible. An option to construct elevated RSA at the runway ends was also considered but eliminated as follows.

Fill and Grade Existing RSA Deficiencies. To meet RSA standards, the areas at either runway end that currently do not meet RSA standards, would be filled and graded (Figure 2-1). Over 700 additional feet of 500-ft wide RSA would be created at either runway end. On the east Runway 26 end, the RSA would extend out to approximately the Airport/Refuge boundary approximately 711 feet beyond the end of the existing RSA. On the west Runway 08 end, the RSA would require about 750 additional feet of fill plus the amount needed to relocate the Emergency Vehicle Access Road (EVAR) and Dike Trail, and boundary fence. This alternative would also require the following:

- Acquisition, transfer, or lease of approximately 9.8 acres of Refuge west of the Airport. An additional 4.5 acres of Refuge land east of the Airport would be disturbed for the construction of the East Runway Slough channel
- Approximately 603,125 cubic yards of fill for construction on about 37.2 acres of new disturbance (including the Refuge land, but not including disturbance area to the Mendenhall River).
- Relocation of the Mendenhall River around the end of the RSA, adding as much as 3,000 feet to the river's length.
- Relocation of Duck Creek (already being considered for other development purposes and wildlife hazard management).
- Relocation of both the EVAR/Dike Trail outside of a new Airport boundary and the Float Plane Pond access road to the west edge of the new Airport boundary.

Depending on the construction methods employed east of the Runway 26 threshold, it should be possible to build the required RSA within the existing eastern Airport boundary, with no property acquisition or encroachment necessary into the Refuge. The estimated cost to construct this alternative is $16.9 million.

This alternative would have obvious environmental consequences, particularly due to the extensive fill and grade required on both ends of the runways and relocation of the Mendenhall River. However, it could be constructed using relatively straightforward engineering techniques, and it would achieve compliance with RSA standards using the traditional methods of filling and grading. This alternative meets purpose and need, is both prudent and feasible, and is carried forward for detailed analysis.

Option RSA-1A: Elevated RSA Alternative. In response to scoping comments, consideration was also given to elevating the RSA on the west runway end via a pier-supported structure. The footprint or plan view of the structure would be similar to that shown in Figure 2-1, since there would be no change in thresholds or to existing runway or taxiway. The advantage of such a structure would be to eliminate the need for fill in the wetlands adjacent to the Mendenhall River, and to

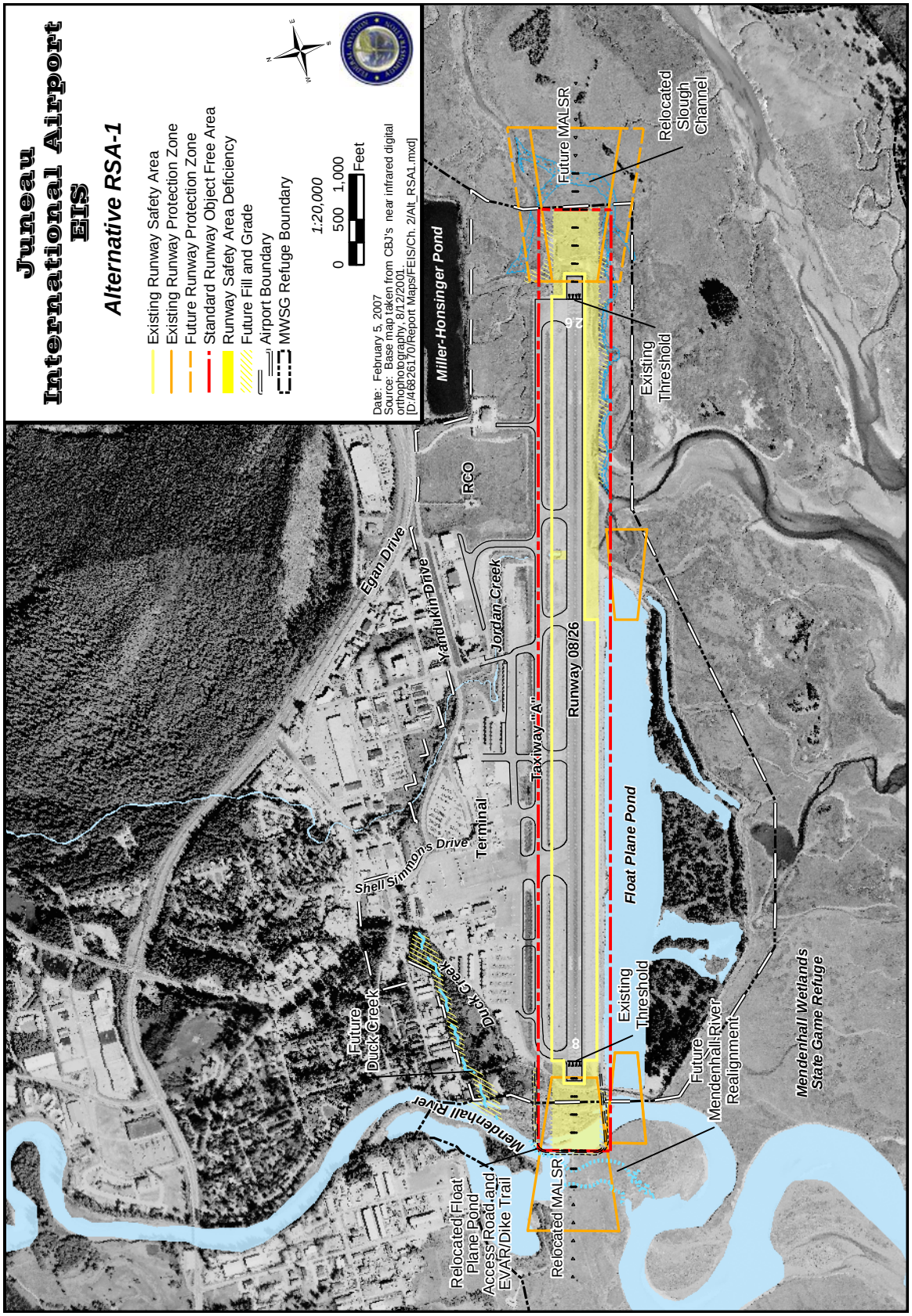

Figure 2-1. Fill and grade existing RSA deficiencies-Alternative RSA-1.

eliminate the rerouting of the river around the RSA. The EVAR/Dike Trail and Float Plane Pond access road would still have to be relocated. While constructing a facility with the necessary structural requirements might be technically feasible, the costs would be excessive.

The planning estimate of $175 per square foot for highway bridge structures in this area was applied. With a minimum length of approximately 700 feet and a width of 500 feet, this structure would cost in excess of $61 million. In addition, this cost estimate does not include the added structural support that could be required to withstand the force of landing aircraft. Because support piers would have to be installed in the river, significant ground preparation work and structural reinforcement would be required, potentially including diversions of the river or other means to prevent ice scour and erosion around the footings. Finally, it is less desirable to have a pier-structure at the ends of the RSA, since the consequences of an aircraft undershoot and collision with the RSA end would obviously be more severe than the impact with a graded slope typical of an RSA.

Because of the extremely high cost and cumulative design concerns, this option is not prudent and feasible, and is eliminated from detailed analysis.

2.2.2.3 RSA-2: Relocate, Shift, or Realign the Runway

This category of alternatives would alter the location of the runway or its thresholds to achieve RSA compliance, while maintaining the existing runway length. However, as was shown earlier, realignment or relocation of the entire runway to the north (or south, for that matter) is not a prudent or feasible alternative. Therefore, consideration was given to relocating the position of the runway thresholds to the east or west. The three alternatives described below would all preserve existing takeoff and departure lengths for both runways.

Alternative RSA-2A: Full RSA by Shifting the Runway East. This alternative was described in the 2000 Environmental Assessment as the preferred alternative of CBJ, the Airport owner and operator (USKH 2000). The Runway 08 threshold would be relocated approximately 618 feet to the east, fill would be placed at a 500-foot width almost to the Airport property boundary, and a 1000-foot long RSA would be constructed. The emergency vehicle access road (also serving as the Dike Trail) would be relocated farther west, adjacent to the Refuge. The MALSR lighting the west end approach would have to be relocated east the same distance, about 618 feet, because of the threshold shift to the east. The Runway 26 threshold would also be relocated east approximately 618 feet. Approximately 1,329 feet of new disturbance would be necessary for the threshold relocation, and runway and RSA construction on the east end. An additional 132 feet of disturbance would occur at the west runway end to complete the RSA. To enable aircraft to taxi to and from the new threshold, the parallel taxiway would be extended 618 feet to the east.

Approximately 507,375 cubic yards of fill would be needed to construct this alternative. It would disturb an estimated 37.7 acres, much of it wetlands and estuarine habitat. To implement this alternative JNU would have to acquire or gain access to use about 7.4 acres of state-owned Refuge property east of the Airport. The estimated cost to construct this alternative is $9.1 million.

As illustrated in Figure 2-2, Alternative RSA-2A would retain the current takeoff and landing distances. However, the operational capability of the Airport would be degraded due to the additional weight limitations imposed for some Runway 08 departures, including but possibly not limited to the Fox and Lemon special departure procedures.[4] The additional weight limitations would be necessary to enable departures from the new threshold to gain sufficient clearance over the terrain to the east. Furthermore, the existing turning departures from this runway (i.e., Lemon and Fox) would be further weight-restricted or lost entirely, due to the closer proximity of terrain obstructions. Other impacts would include revisions to special-use instrument approaches and revisions to public-use instrument approaches. The Runway 08 Gastineau Channel departure procedure would likely be unaffected by the easterly shift of the runway.

The impacts of this alternative on air service at JNU could be extensive. Alaska Airlines is dependent on these turning departure procedures during IFR conditions for the operation of the B-737-200 aircraft, and also for the B-737-400 aircraft if wind sensor readings preclude the use of the Gastineau Channel departure. Arrivals from the east could be affected by obstructions penetrating a lowered approach path resulting from an eastward shift of the Runway 26 landing threshold.

Due to the potentially severe degradation of operational procedures compared to other alternatives being considered, this alternative has been deemed not prudent or feasible, and is eliminated from detailed analysis. However, per a request by CBJ, aspects of this alternative have been modified for use in Alternative RSA-5C.[5] Refer to Section 2.2.2.6 for details of Alternative RSA-5C.

Alternative RSA-2B: Full RSA by Shifting the Runway Further East. During the preparation of the Final EA, resource agencies identified the detrimental effects of filling wetlands and habitat west of the runway. In response, an alternative was developed to minimize environmental impacts west of the Airport. This alternative is similar to RSA-2A, but the greater shift of thresholds to the east with RSA-2B would result in only minor changes to the EVAR/Dike Trail and no disturbance on the Refuge to the west. This alternative is illustrated in Figure 2-3.

The thresholds for both runways would be relocated approximately 750 feet to the east. This action would entail disturbance of approximately 1,461 feet on the east end of the runway for the threshold relocation and construction of the RSA. The Runway 08 MALSR leading to the west end approach would also have to be relocated east about 750 feet because of the threshold shift. To enable aircraft to taxi to and from the new threshold, parallel Taxiway A would also be extended approximately 750 feet east. The length of the runways would remain unchanged.

Approximately 648,882 cubic yards of fill would be needed to construct this alternative on 37.4 acres of new disturbance, including about 9 acres of Refuge land. The estimated construction cost of this alternative is $10 million.

4. Weight restrictions have the potential to require less passenger or cargo to be carried on a flight than might otherwise be accommodated. In this instance, the weight restrictions would affect primarily Alaska Airlines, but the exact number of departures that would be affected cannot be determined.
5. Letter from Allan Heese, Airport Manager to Ken Wallace, SWCA Project Manager, dated November 16, 2001.

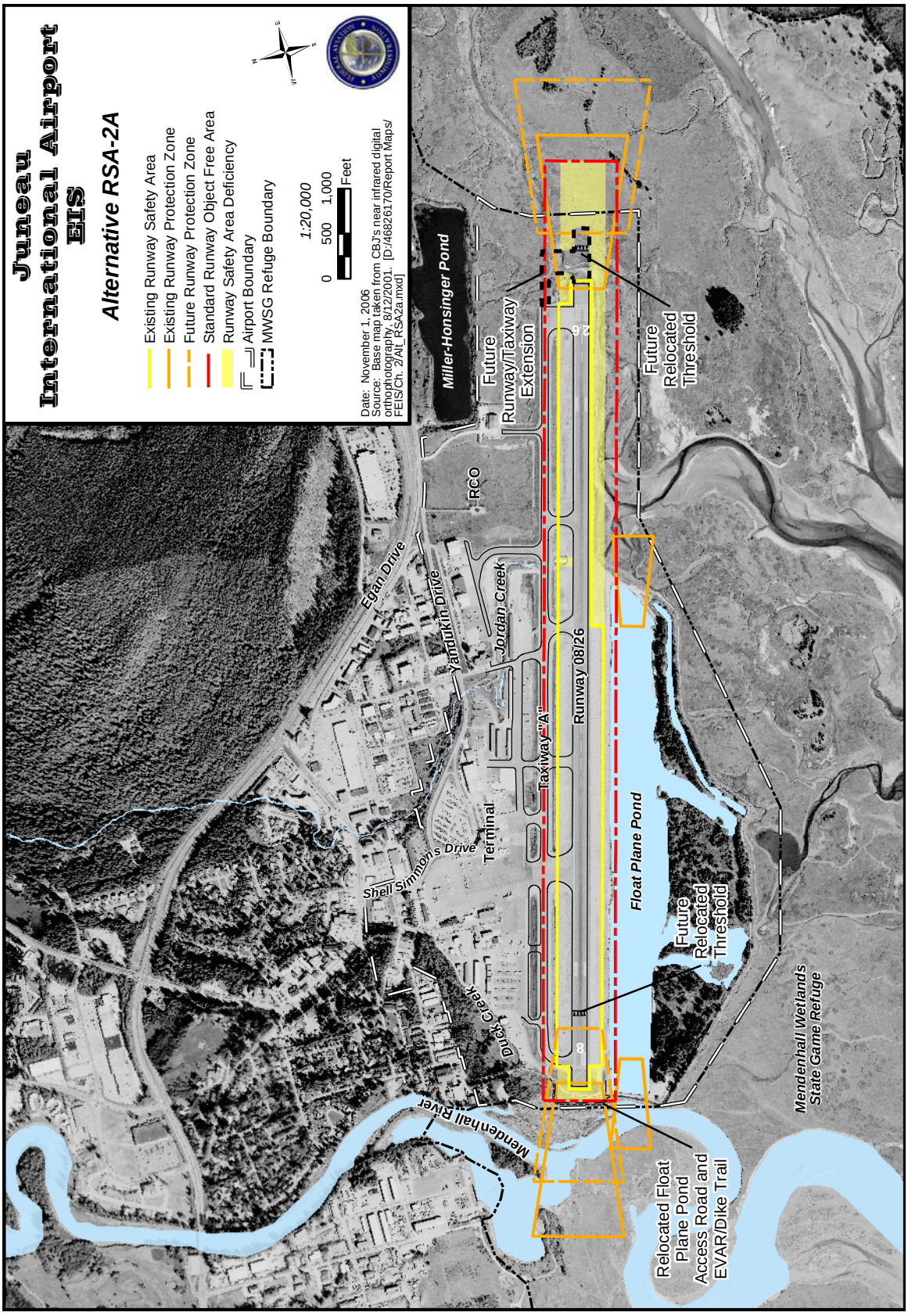

Figure 2-2. Full RSA by shifting runway east-Alternative RSA-2A.

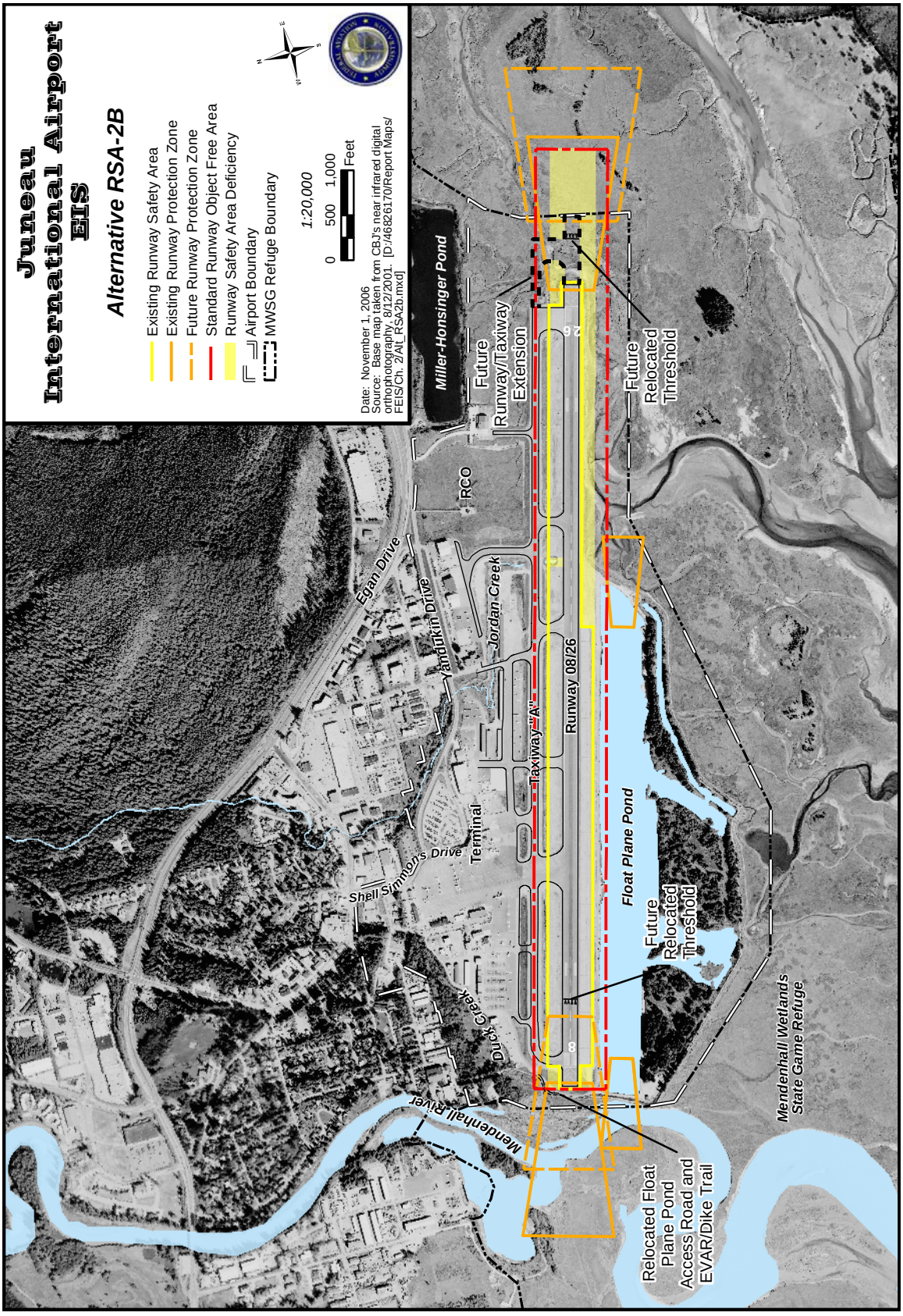

Figure 2-3. Full RSA by shifting runway further east-Alternative RSA-2B.

As with Alternative RSA-2A, but to a more severe degree, this alternative would affect the existing operating capability of the runway by reducing operating weights for Runway 08 departures and by possibly eliminating Alaska Airlines' ability to conduct the Lemon and Fox departures. These changes would lessen the air carrier's ability to predict and schedule air transportation services. Other effects to operational procedures would include revisions to special-use instrument approaches and revisions to the public-use instrument approaches.

Due to the severe degradation of operational procedures, this alternative has been deemed not prudent or feasible. It is eliminated from detailed analysis.

Alternative RSA-2C: Full RSA by Shifting the Runway West. This alternative was designed to reduce environmental impacts on the east runway end. The Runway 26 threshold would be relocated 400 feet west. Approximately 311 feet of new disturbance for a width of 500 feet would occur on the east runway end to create a standard, 1,000-foot long RSA. As a consequence, the Runway 08 threshold would also have to be extended approximately 400 feet, as would the Taxiway B connecting to the west runway end threshold. An additional 1,150 feet of disturbance would then be required on the west runway end to complete the runway and achieve a standard-length RSA. The Runway 08 MALSR lighting to the west end approach would also have to be relocated west about 400 feet because of the threshold shift. As illustrated in Figure 2-4 and shown on Table 2-3, takeoff and departure distances for both runways would remain unchanged.

This alternative would avoid land in the Refuge east of the Airport, but it would require acquisition, transfer, or use of Refuge lands on the west and a complete relocation of the Mendenhall River. As with other alternatives, the EVAR/Dike Trail and Float Plane Pond access road would have to be relocated around the end of the RSA. Approximately 622,090 cubic yards of fill would be needed to construct this alternative on 36.8 acres of new disturbance, including about 12 acres of Refuge property. The estimated construction cost is $14 million.

As with Alternatives RSA-2A and 2B, this alternative would result in a number of revisions to special-use approach procedures for both runways. The impact to the Runway 08 public-use instrument approach procedures is of particular concern because of the existing high minimums associated with the procedures, and the potential negative impacts associated with shifting the Runway 08 landing threshold closer to the obstructing terrain (referred to locally as Pederson Hill). Unlike the previous two alternatives there would probably be no negative impact on Runway 08 departures, but increased weight limitations would be imposed on Runway 26 departures.

Due to the impacts on operational procedures, implementation challenges to construct in the Mendenhall River, high cost, and potentially severe environmental impacts, this alternative is neither prudent nor feasible. Alternative RSA-2C is eliminated from further consideration.

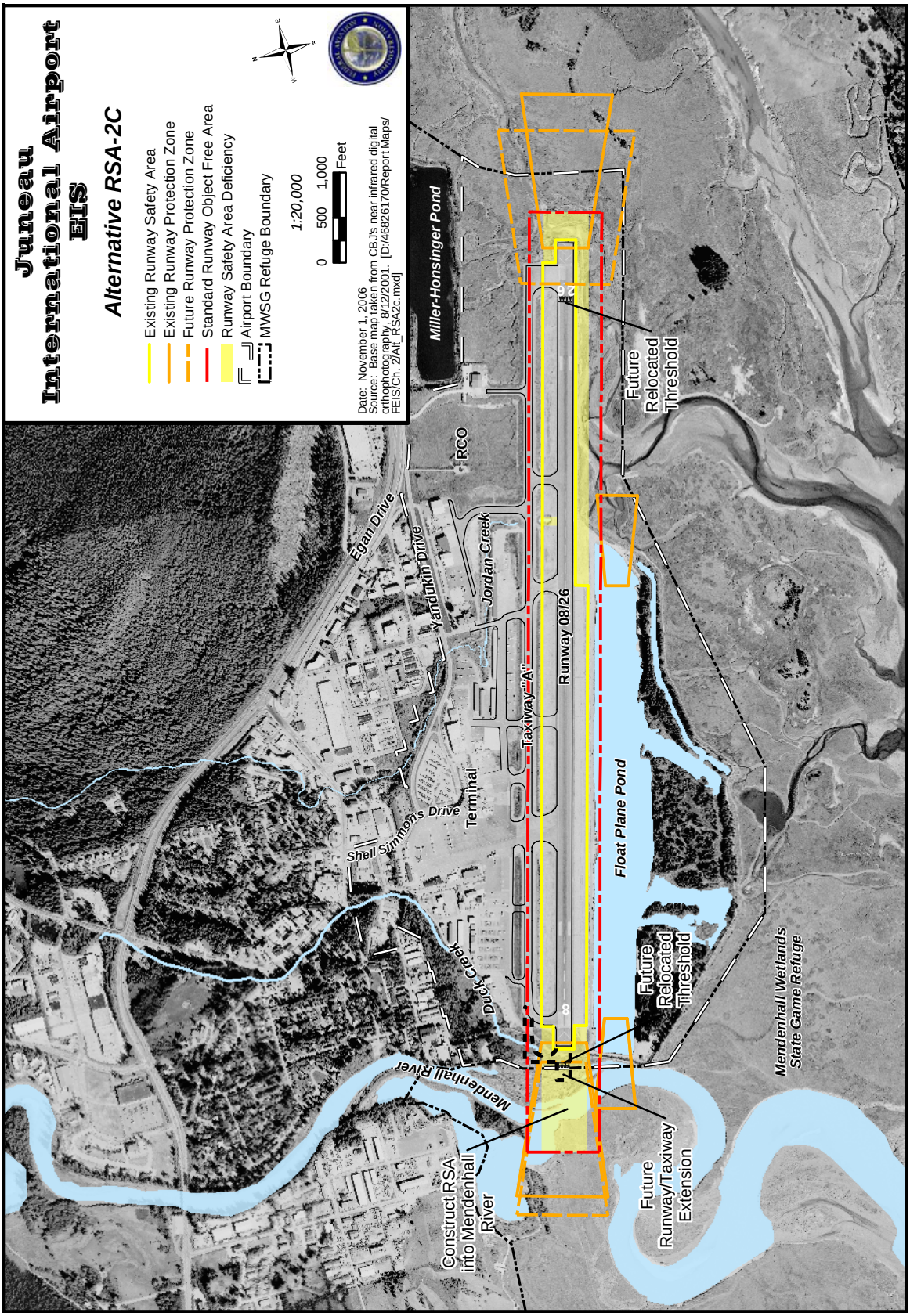

Figure 2-4. Full RSA by shifting runway west-Alternative RSA-2C.

2.2.2.4 RSA-3: Reduce Runway Length Where Existing Runway Length Exceeds That Required for the Existing or Projected Design Aircraft

Alternatives to achieve RSA compliance with the existing runway orientation were considered by relocating the thresholds for both ends of the runway the length by which they currently do not meet RSA standards. Without consideration of other factors, this would result in a relocation of the Runway 08 threshold by 750 feet to the east, and relocation of the Runway 26 threshold by approximately 711 feet to the west—the respective additional lengths to meet RSA standards on each runway. However, as shown on Figures 1-4 and 1-5 in Chapter 1, full extension of a 500-foot-wide, 1,000-foot-long RSA is not achievable without disturbing the EVAR/Dike Trail on the west end. To mitigate this effect the Runway 08 threshold relocation was increased by approximately 120 feet, for a total of 870 feet to avoid these resources. These changes would create a standard 1,000-foot long RSA at the ends of both runways. The connecting taxiways would also be adjusted to the new thresholds. The Runway 08 MALSR lighting the west end approach would also have to be relocated east about 750 feet because of the threshold shift. Figure 2-5 shows the effects of these changes on the runway configuration.

Approximately 226,250 cubic yards of fill would be needed to construct this alternative on 15.4 acres of new disturbance. The estimated construction cost is alternative is $4.5 million, associated primarily with construction of the lateral RSA and new taxiway connectors. No Refuge land would be affected by this alternative.

This alternative would reduce the takeoff and departure distances for both runways by a total of 1,581 feet. The remaining length of 6,875 feet exceeds the 5,900-foot dry pavement landing length requirement (according to the Aircraft Flight Manual) for any of the possible design aircraft listed on Table 1-7, but it may not provide sufficient landing distance under slippery conditions with tailwind. Additional, potentially severe weight restrictions would be imposed for all B737-400 and B737-200 departures from Runway 08. The Runway 08 relocation could eliminate Alaska Airline's ability to perform the Lemon and Fox turning procedures from Runway 08. These changes would lessen the air carrier's ability to predict and schedule air transportation services. Other effects to operational procedures would include revisions to special-use instrument approaches and revisions to the public-use instrument approaches.

This alternative effectively shortens both runways to achieve RSA compliance. Legislation passed by Congress in 2003 and signed into law precludes FAA from requiring an owner or operator of an airport in the State of Alaska to reduce the length of a runway or declare the length of a runway to be less than the actual pavement length for the purpose of complying with RSA standards[6]. CBJ has informed FAA that any RSA alternative incorporating a shortening of the runway through either pavement reduction or the use of declared distances in order to meet FAA

6. See Public Law Section 502 Runway Safety Standards, Vision 100—Century of Aviation Reauthorization Act, dated December 12, 2003.

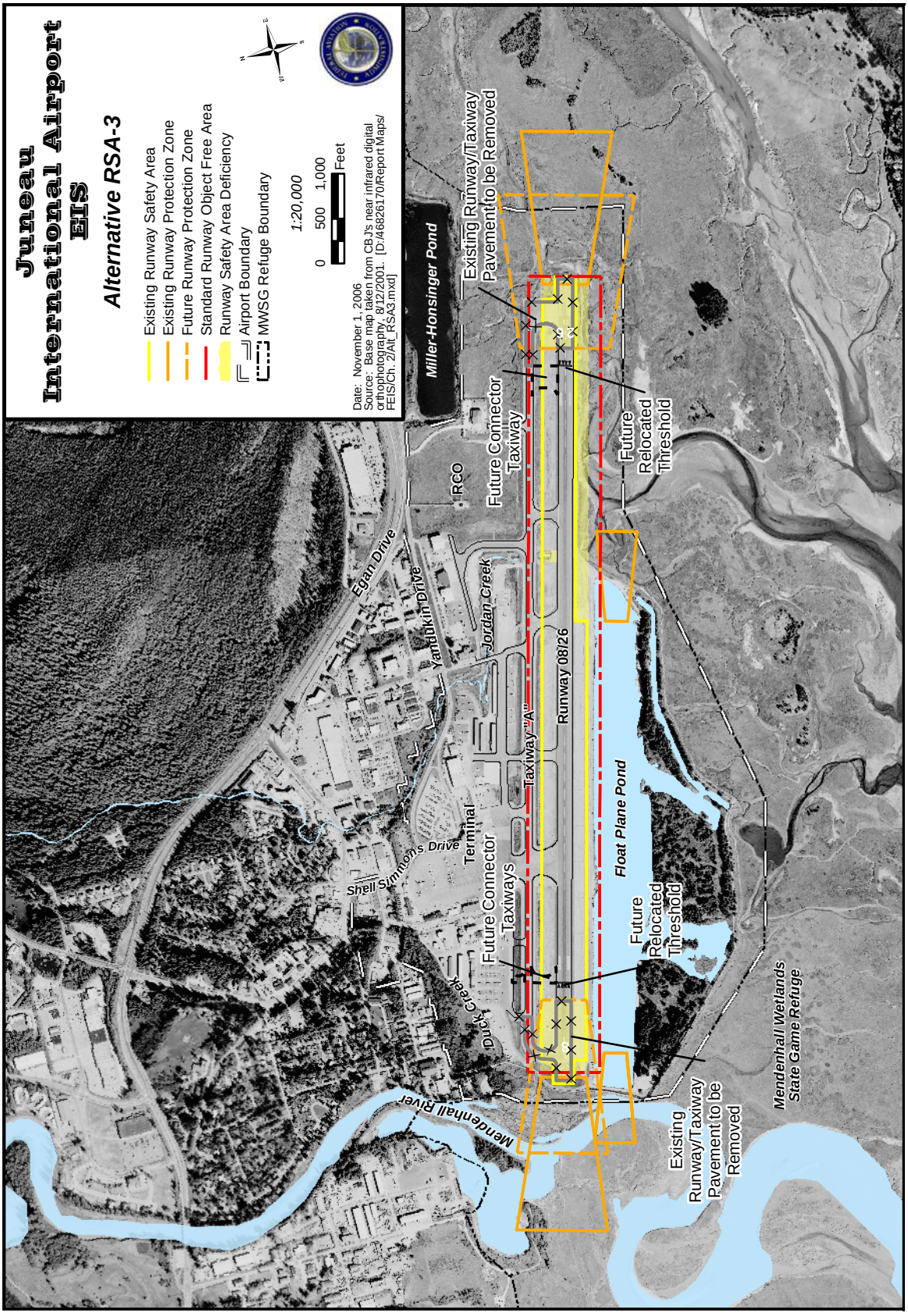

Figure 2-5. Reduction in runway length where existing runway length exceeds that which is required for the existing or proposed design aircraft-Alternative RSA-3.

standards for RSAs would be unacceptable[7]. For this reason RSA-3 and other runway-shortening alternatives described in following sections cannot be implemented by FAA and are eliminated from full consideration in the EIS.

2.2.2.5 RSA-4: COMBINATION OF RUNWAY RELOCATION, SHIFTING, AND GRADING

Options for combining runway location, shifting, and grading are included in the RSA-2 and RSA-3 alternatives, and indirectly through the following declared distance alternatives. As a result there are no separate RSA-4 alternatives discussed in the text or tables.

2.2.2.6 RSA-5: DECLARED DISTANCES

According to FAA guidance, the alternative of using declared distances to achieve compliance with specified airport design criteria "shall be limited to cases of existing constrained airports" in accordance with specified FAA design standards (FAA 1989a). Declared distances reflect the distance within a runway that has been declared useable for either landing or takeoff. A critical consideration of the use of declared distances is that the shortened runway lengths imposed by their application could potentially restrict or prohibit the operation of aircraft that use the Airport. For this set of alternatives, adjustments to runway layout that would achieve RSA, while maintaining adequate runway lengths through use of displaced thresholds[8] and declared distances, were considered.

RSA-5A: Displace Thresholds with Declared Distances. This alternative was considered because, similar to Alternative RSA-3, it would result in no wetland fill or habitat destruction on the ends of the runways. Alternative RSA-5A would alter the location of the runway thresholds, and achieve RSA compliance by implementing declared distances criteria. This would shorten all runway operating configurations with an approximate 870-foot threshold displacement on Runway 08, and an approximate 711-foot threshold displacement on Runway 26. This alternative would provide a landing length of 6,875 feet on both runways and an accelerate-stop takeoff length of 7,745 feet when departing Runway 08, or 7,586 feet when departing Runway 26. The Runway 08 MALSR lighting the west end approach would also have to be relocated east about 870 feet because of the threshold shift. This alternative is shown on Figure 2-6.

Approximately 226,250 cubic yards of fill would be needed to construct this alternative on 15.4 acres of new disturbance. The estimated construction cost for this alternative is $3.1 million, associated primarily with construction of the lateral RSA. No Refuge land would be affected by this alternative.

7. Letter from Joe Heueisen, Chair, JNU Board to Byron Huffman, Manager, FAA Airports Division, Alaska, dated November 20, 2003.
8. A displaced threshold refers to a landing threshold that is located further down the runway than the departure point (typically in this case departures have a greater length, while arrivals have a shorter length associated with the displacement). In contrast and as evaluated in the RSA-2 options, a relocated threshold incorporates co-located arrival and departure points on the runway, resulting in equal arrival and departure lengths.

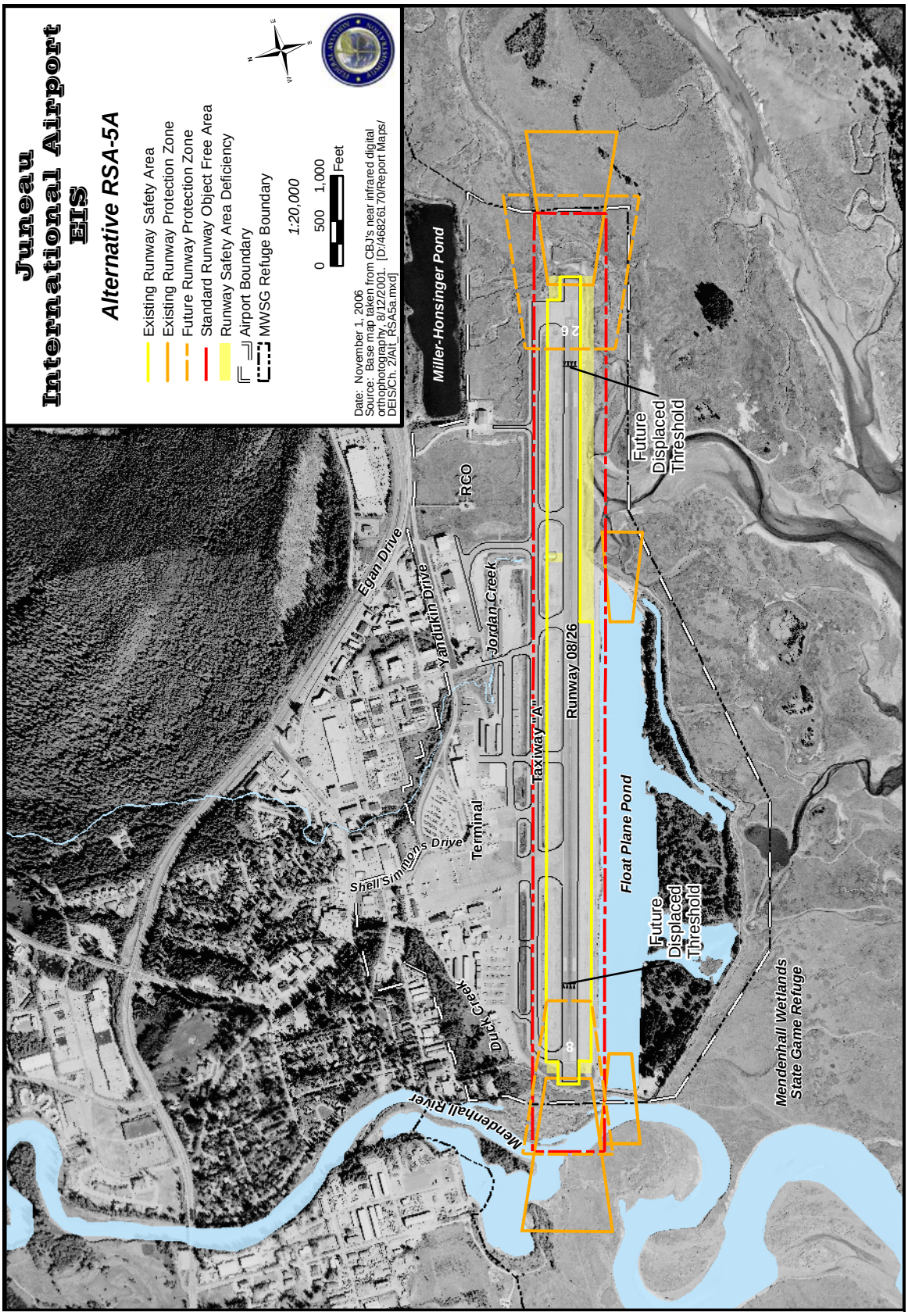

Figure 2-6. Displace thresholds with declared distances-Alternative RSA-5A.

The remaining length of 6,875 feet exceeds the 5,900-foot dry pavement landing length requirement (according to the Aircraft Flight Manual) for any of the possible design aircraft listed on Table 1-7, but it would not provide sufficient landing distance under slippery conditions with tailwind. This alternative would preserve the Lemon and Fox turning departure procedures from Runway 08, but additional weight restrictions would be imposed on departures from both runways. Other effects to operational procedures would include revisions to special-use instrument approaches and revisions to the public-use instrument approaches.

As was explained for RSA-3 alternatives, CBJ has notified FAA that it would not be acceptable for one or both runways to be shortened to achieve compliance with RSA standards. As a result, this alternative is deemed not prudent because it cannot be implemented by FAA. Alternative RSA-5A is eliminated from further consideration.

During the course of EIS development (and before passage of the applicable RSA/runway legislation) two alternatives based on threshold displacements were offered by some of the cooperating agencies. These alternatives are described below for information purposes and also to maintain consistency between this EIS and the environmental analysis to be conducted by the Corps as part of their permitting responsibilities under the Clean Water Act.

In advance of a detailed impact analysis or an application by CBJ for a permit to fill wetlands, the Corps has already determined that one of these options would constitute the least damaging practicable alternative[9]. Each of the options would have the same approach to construction of the lateral RSA, as follows:

- A lateral RSA would be constructed in the northwest and southwest corners of the runway using graded fill material. The existing emergency vehicle access road would be realigned; or, alternatively, the RSA would be constructed up to the access road and therefore not meet full FAA standards of 500-foot width.
- A lateral RSA would be constructed to FAA standards in the northeast and southeast corners of the runway using graded fill material.
- A RSA would be constructed at Jordan Creek on the north side of the runway, and the existing pipe culvert would be replaced with a bottomless arch culvert or bottomless box culvert.

Specific features of each alternative are described below.

RSA-5A1: Cooperating Agencies Alternative 1, Displace Thresholds. This alternative would eliminate the need for fill or habitat destruction on the ends of the runways by displacing thresholds and implementing declared distances criteria to achieve RSA standards. The Runway 08 landing threshold would be displaced 750 feet to the east, so that the end of the west RSA would be at its current location. For Runway 26 (the east end) the landing threshold would be displaced 711 feet to the west. This would shorten some of the runway operating configurations, as shown on Table 2-3 and illustrated in Figure 2-7. This alternative is very similar in approach to RSA-5A,

9. Letter from G. Justis, Chief, East Section of Corps Regulatory Branch to P. Sullivan, FAA Project Manager, dated June 12, 2002.

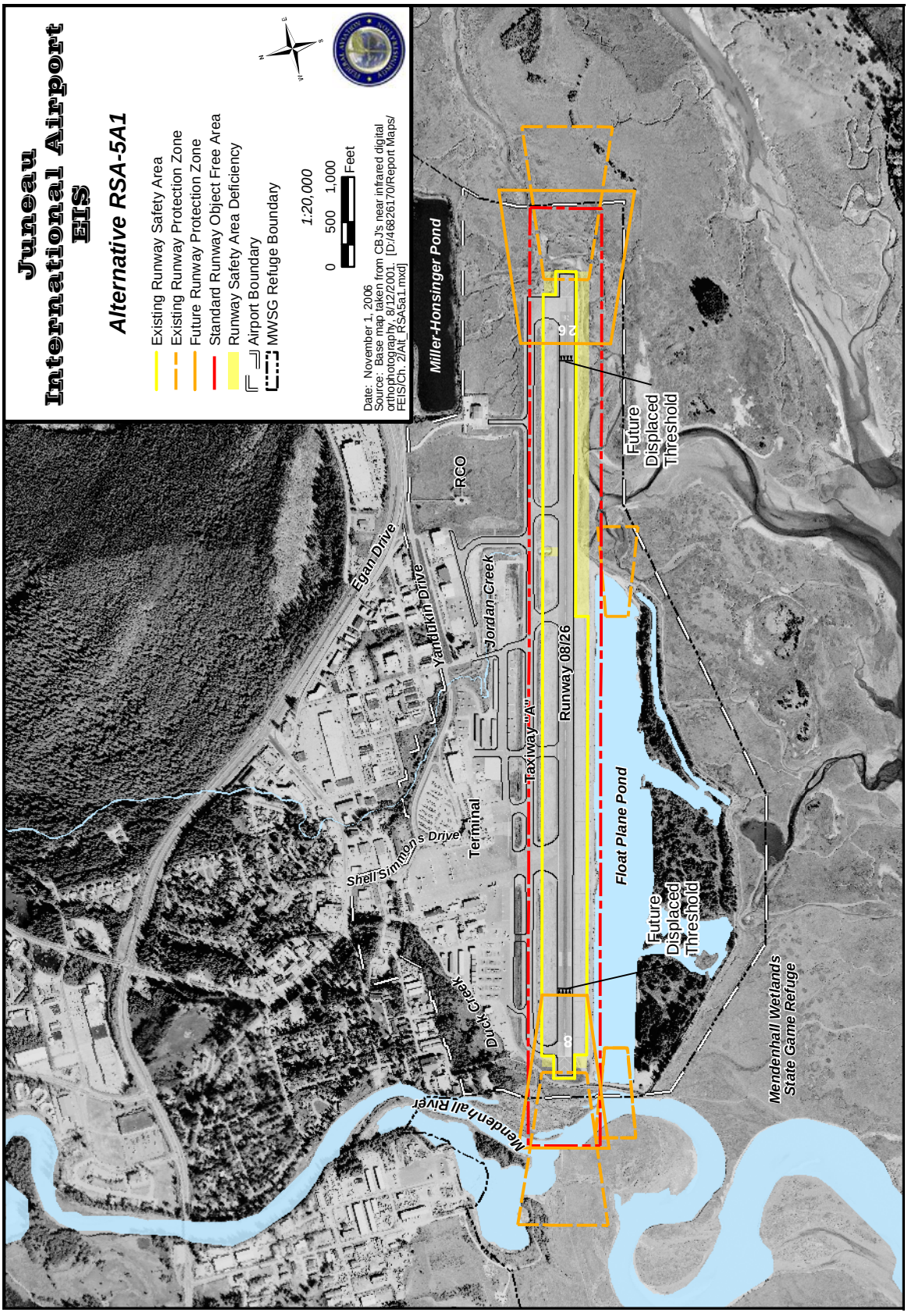

Figure 2-7. Cooperating Agencies Alternative 1, displaced thresholds-Alternative RSA-5A1.

although it retains approximately 120 additional feet of landing distance for both runways and an equal amount of additional accelerated-stop takeoff length on Runway 26. The Runway 08 MALSR leading to the west end approach would also have to be relocated east about 750 feet east because of the threshold shift. Slight relocation of the EVAR/Dike Trail would be required around the lateral RSA on the west end.

Approximately 226,250 cubic yards of fill would be needed to construct this alternative on 15.4 acres of new disturbance. The estimated construction cost for this alternative is $3.1 million, associated primarily with construction of the lateral RSA. No Refuge land would be affected by this alternative.

The Runway 08 departure capability would be affected by this alternative. The accelerate stop distance for Runway 08 would be reduced from 8,456 feet to approximately 7,745 feet, necessitating additional weight restrictions on payload. Because more than 65% of Alaska Airlines flights from JNU use Runway 08, the economic impact from reduced payloads could be substantial. The weight restrictions may also have social impacts since payload reductions would be incurred at the expense of passenger seats and/or cargo.

The remaining length of 6,995 feet exceeds the 5,900-foot landing length requirement (according to the Aircraft Flight Manual) for any of the possible design aircraft listed on Table 1-7, but it would not provide sufficient landing distance under slippery conditions with tailwind. This alternative would preserve the Lemon and Fox turning departure procedures from Runway 08, but additional weight restrictions would be imposed on departures from both runways. Other effects to operational procedures would include revisions to special-use instrument approaches and revisions to the public-use instrument approaches.

The Corps suggested that this alternative include a requirement that takeoff procedures be specified that would meet the resultant weight requirements, or "impose minor weight restrictions on certain aircraft under certain conditions." However, FAA and other agencies cannot incorporate such conditions into the alternatives.

As was explained for previous alternatives, CBJ has notified FAA that it would not be acceptable for one or both runways to be shortened to achieve compliance with RSA standards. As a result, this alternative is deemed not prudent because it cannot be implemented by FAA. Alternative RSA-5A1 is eliminated from further consideration.

RSA-5A2: Cooperating Agencies Alternative 2, Displace Thresholds with EMAS. This alternative would also eliminate the need for fill or habitat destruction on the ends of the runways, but it includes lesser threshold displacements and use of the EMAS technology to attempt to compensate for a shorter RSA. The Runway 08 threshold would be displaced 450 feet, and the west end of the RSA would remain at its current location to provide a 1,000-foot long RSA. The Runway 26 threshold would be displaced 411 feet to the west. The clear and graded area that would meet RSA standards at both runway ends would total 700 feet in length. To compensate for the 300-foot RSA deficiency on each runway, an EMAS cell would be added to both the west and east RSA ends. This alternative would shorten some of the runway operating configurations, but not to the extent of RSA-5A1 or RSA-5A2. The Runway 08 MALSR leading to the west end approach would also

have to be relocated east about 450 feet because of the threshold shift. The EVAR/Dike Trail would require slight re-routing, around the lateral RSA on the west end. This alternative is illustrated in Figure 2-8.

Approximately 279,250 cubic yards of fill would be needed to construct this alternative on 17.7 acres of new disturbance. The estimated construction cost for this alternative is $11.5 million, associated primarily with installation of the EMAS cells on each runway end and construction of the lateral RSA. No Refuge land would be affected by this alternative.

RSA-5A2 would provide a landing distance of 7,595 feet, well in excess of the 5,900-foot landing length requirement (according to the Aircraft Flight Manual) for any of the possible design aircraft listed on Table 1-7. This alternative would preserve the Lemon and Fox turning departure procedures from Runway 08, but additional weight restrictions would be imposed on departures from both runways, particularly with respect to Alaska's ability to use improved climb procedures. Other effects to operational procedures would include revisions to special-use instrument approaches and revisions to the public-use instrument approaches.

As was explained for previous alternatives, CBJ has notified FAA that it would not be acceptable for one or both runways to be shortened to achieve compliance with RSA standards. As a result, this alternative is deemed not prudent because it cannot be implemented by FAA. Alternative RSA-5A2 is eliminated from further consideration.

RSA-5B: Displace Runway 08 Threshold and Construct Runway 26 Safety Area. This alternative represents a combination of Alternatives RSA-5A and RSA-1, originally developed by FAA for this EIS as a means of maintaining the most critical runway operational characteristics while achieving standard RSA and minimizing environmental impacts. However, as with other alternatives described above, it must be eliminated from full consideration at JNU because it would shorten landing distance available on both runways and accelerate-stop distance on Runway 26. This alternative would not be acceptable to CBJ. It is described here for information purposes and consistency with the Corp's permitting process.

Alternative RSA-5B would avoid filling the highly valued estuarine wetland adjacent to the Mendenhall River and make it unnecessary to encroach on Refuge property. As with Alternative RSA-5A, the location of the Runway 08 landing threshold would be displaced 870 feet toward the east, which when combined with implementation of declared distances criteria would achieve compliance with RSA standards. There would be little disturbance on the west end (only that needed to complete the lateral safety area standard), and the EVAR/Dike Trail would be unaffected. The Runway 08 MALSR leading to the west end approach would also have to be relocated east about 870 feet because of the threshold shift.

No Refuge land would be needed to construct this alternative. As shown on Table 2-2, approximately 427,796 cubic yards of fill would be used on a disturbance area of about 24.1 acres. The estimate cost for this alternative, illustrated in Figure 2-9, is $6.1 million.

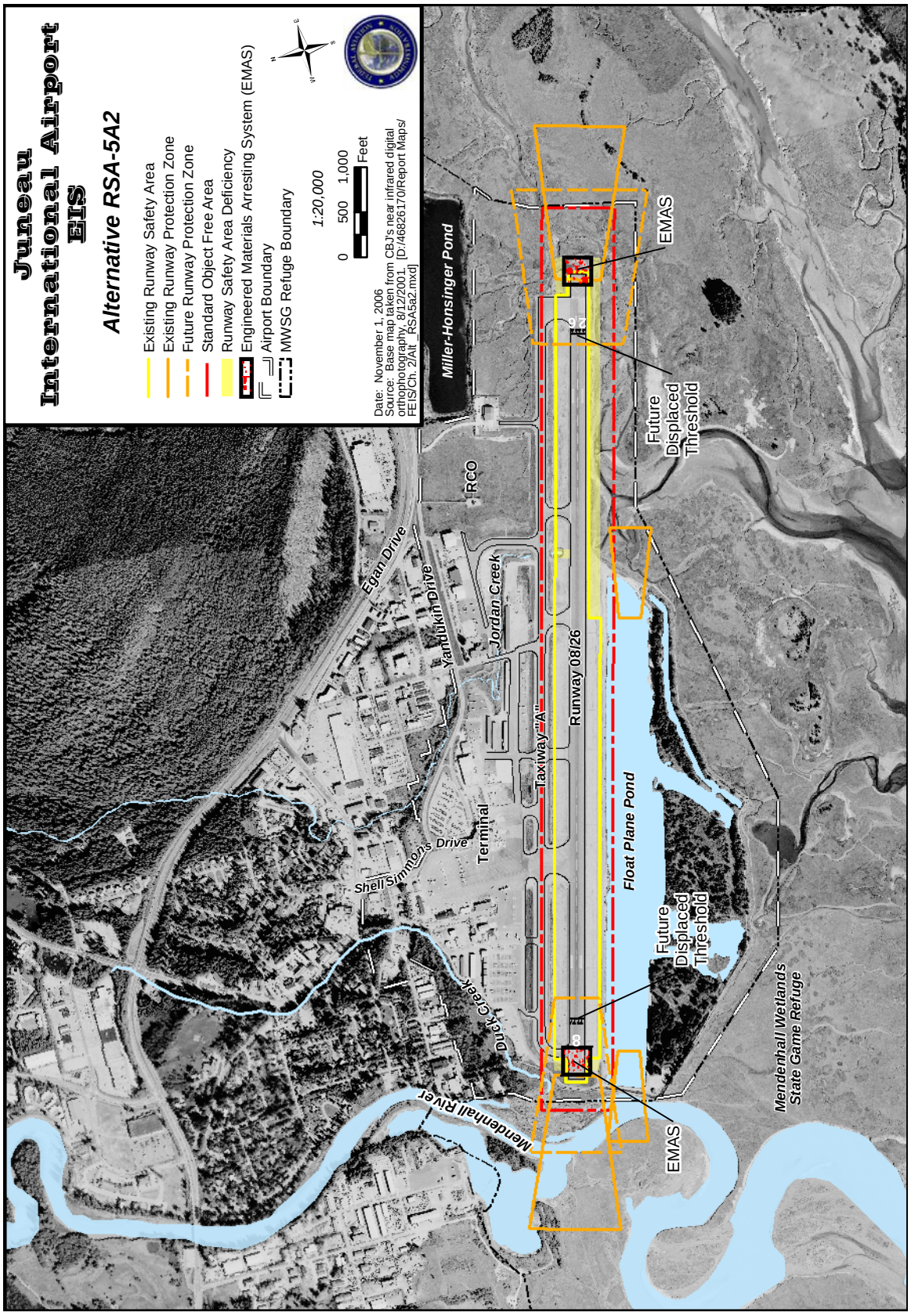

Figure 2-8. Cooperating Agencies Alternative 2, displaced thresholds with EMAS-Alternative RSA-5A2.

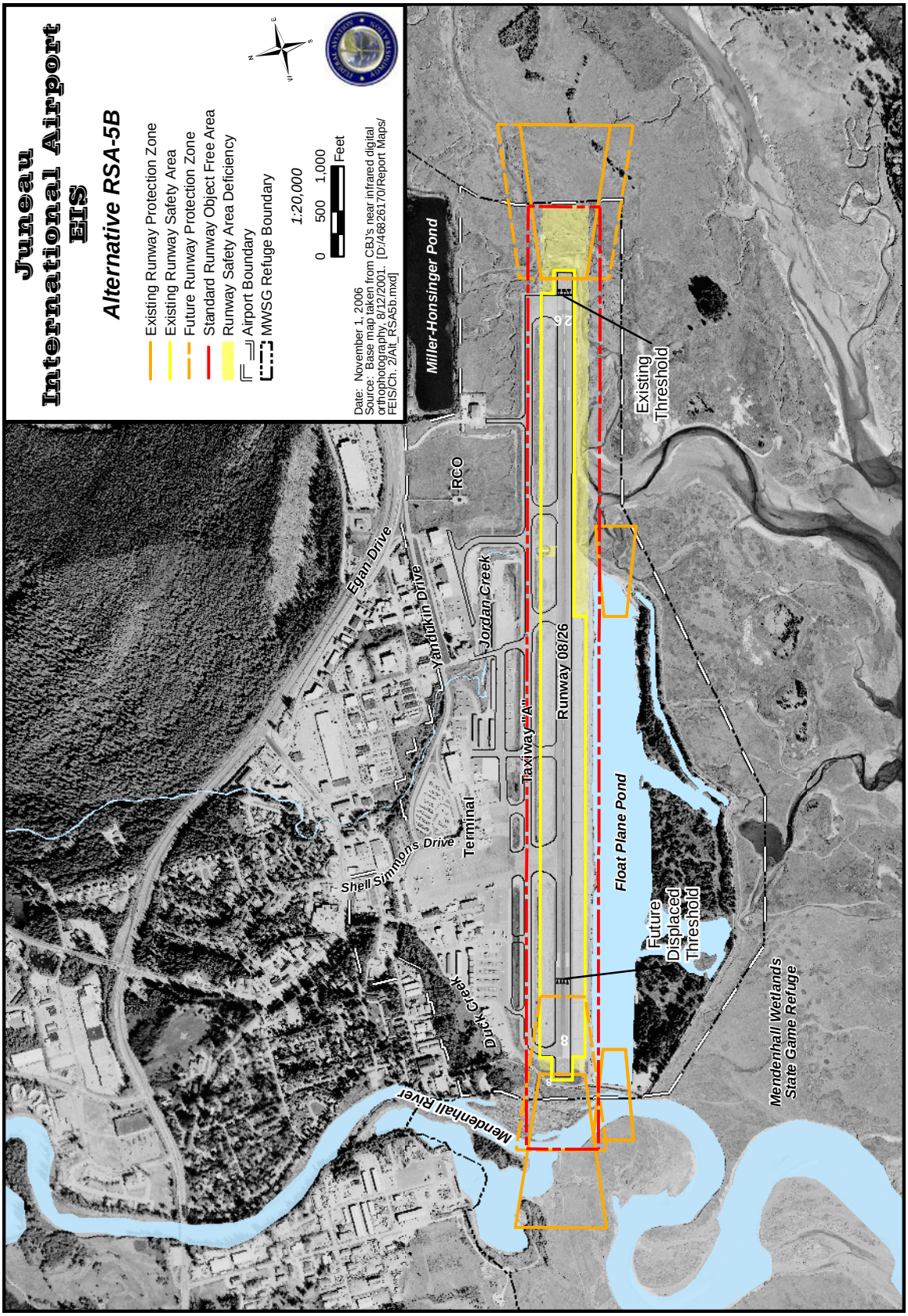

Figure 2-9. Displace Runway 08 threshold and construct Runway 26 safety area-Alternative RSA-5B.

As with Alternative RSA-1, approximately 711 feet of additional fill would be placed up to the Refuge boundary on the east end of the Airport property This would increase the RSA on the Runway 26 approach to the standard of 1,000 feet long by 500 feet wide. Landing distance available would be shortened on both runways to approximately 7,586 feet, which exceeds the 5,900-foot landing length requirement (according to the Aircraft Flight Manual) for any of the possible design aircraft listed on Table 1-7, and provides sufficient buffer for slippery runway and tailwind conditions. Runway 08 departures would remain unaffected, without additional weight restrictions, and the Lemon and Fox turning departure procedures would be preserved. Special-use approach procedures to Runway 26 would also remain unaffected. There could be a relatively small impact to Alaska Airline's ability to use the improved climb procedure on Runway 26, as a result of the decrease in available accelerated-stop distance. The decrease in accelerated stop distance could result in a minor payload reduction. Revisions to the Runway 08 special use instrument approaches would be required, as would revisions to the public-use instrument approaches.

The minor departure payload penalty incurred on Runway 26 can be addressed through the use of what is specified as "prior permission required pavement" (PPR). Essentially, Alaska Airlines or other carriers as needed could be permitted by the control tower to back-taxi to the end of the Runway 26 RSA pavement to begin their take-off roll. This need is estimated to be less than 10 times per year for Alaska Airlines based on historic operations. This alternative would require the development of full-strength runway pavement for the runway safety area, constituting a difference from other RSA that do not typically have the same structural and cover requirements as runway. An example of the PPR pavement has been approved by the FAA and is currently being designed for construction at King County International Airport (Boeing Field), and there are other examples of this application across the country.

During development of the EIS, Alaska Airlines noted that Alternative 5B would provide adequate landing length on both runways, since there would be additional runway length beyond that reported as technically required for wet pavement landings in the Aircraft Flight Manual (see, for example, Table 1-7 in Chapter 1). Representatives for Alaska Airlines pilots did concur that the landing length for Runway 26 would be acceptable because additional pavement would be preserved for unintended overruns (FAA 2002b). The additional pavement is a result of approximately 870 feet of RSA west of the displaced Runway 08 threshold maintained to preserve takeoff procedures. However, the pilots also expressed concern that the landing distance available for Runway 08 would provide insufficient safety margins for landings conducted under contaminated runway conditions and other challenges caused by difficult terrain, tailwinds, weather, and the offset approach path (FAA 2002b). A recommendation offered by pilots was to create a non-standard RSA that would apply only to the Runway 08 approach end, which would limit the safety area west of the displaced threshold by reducing the distance in which the threshold is displaced to the east.

FAA does not concur that the pilot's approach would be an acceptable solution, for two primary reasons. First, as described earlier in this chapter, FAA believes that it is practicable to construct a RSA that fully meets standards for length and width. The approach described above would not meet RSA standards. Second, while this action would create a greater overrun buffer for landings on Runway 08, the gain in safety would be offset by the reduction in safety buffer for undershoots for landings on Runway 08 and overruns for landings on Runway 26.

However, the FAA has made an adaptation to this alternative to address the Alaska Airlines pilots' concerns. The Runway 08 threshold would still be displaced by 870 feet, while the Runway 26 threshold would be maintained at its current location. The center 150-foot section of the RSA at the east end of the runway would be paved with 3 to 4 inches of runway asphalt. The net result of this design feature would be to ensure that approximately 7,586 feet of pavement, measured from the Runway 08 displaced threshold, would be available for landings, with an additional 1,000 feet of pavement being available in the event of an unintended runway overrun.

As was explained for Alternative RSA-3, CBJ has notified FAA that it would not be acceptable for one or both runways to be shortened to achieve compliance with RSA standards. As a result, and in accordance with the FAA's reauthorization act of 2003 (Vision 100 – Century of Aviation Reauthorization Act), this alternative is deemed not feasible because it cannot be implemented by FAA. Alternative RSA-5B is eliminated from further consideration.

RSA-5C: Displace Runway 08 Threshold and Construct Additional 26 Runway and Safety Area. This alternative, formerly JNU's proposed action, reflects a refinement of the Alternative RSA-5C preferred by CBJ at the time the Draft EIS was in development. Essentially, it represents a modification of Alternative RSA-2A, the Proposed Action in the 2000 Environmental Assessment, and additional threshold and footprint adjustment since publication of the DEIS. It has been designed to minimize impacts to Refuge land on the west runway end but take advantage of other work west of the runway (specifically, fill of wetlands to reduce wildlife hazards, see WH-1b) to reduce the overall footprint east of the runway. In this case, the location of the Runway 08 landing threshold would be displaced 446 feet to the east, and Runway 26 would be extended 446 feet to the east to preserve existing length. A standard 1,000-foot RSA would be constructed beyond the extension of Runway 26 and a partial RSA extension would be constructed to west end of the runway. These modifications in conjunction with the implementation of declared distances standards would meet standards for runway safety area.

The parallel taxiway would be extended 446 feet to the east to provide taxiway access to the extended runway. The Runway 08 MALSR leading to the west end approach would also have to be relocated east about 446 feet because of the threshold shift to the east, but the Runway 08 departure point would be maintained at its existing location. The EVAR/Dike Trail, Duck Creek, and Float Plane Pond access road would have to be relocated slightly to the west.

Approximately 1,157 feet of fill would be necessary on the east end of the runway for the threshold relocation and construction of the RSA, including a 4:1 fill slope, and 304 feet of new disturbance would be added to the west runway end to complete the RSA. Additional fill and disturbance would be required for about 96 more linear feet west of the RSA to accommodate relocation of the Float Plane Pond access road and Dike Trail/EVAR. To enable aircraft to taxi to and from the new Runway 26 threshold, the parallel taxiway would also be extended 446 feet east.

Approximately 9.0 acres of Refuge would have to be acquired, transferred, or leased to JNU for implementation of this alternative. An additional 2.1 acres of Refuge land east of the Airport would be disturbed for the construction of the East Runway Slough channel. As shown on Table

2-2, a total of about 39.3 acres would be disturbed and 595,204 cubic yards of fill needed to construct the RSA and associated facilities, at an estimated cost of $14.7 million. This alternative is illustrated in Figure 2-10.

As shown on Table 2-3, the combination of Runway 26 threshold relocation and Runway 08 threshold displacement would actually increase takeoff distance for Runway 08, and preserve the existing distances for other criteria, so no additional weight restrictions would be imposed. Revisions to the special-use instrument approaches for both runways would be required, as would revisions to the Runway 08 public-use instrument approaches. Modifications to some Runway 08 departure criteria may be needed due to the change in Runway 26 threshold (which serves as a waypoint for Runway 08 special departures).

This alternative meets the Purpose and Need, retains full runway length, and is both prudent and feasible. RSA-5C is carried forward for detailed analysis.

RSA-5D: Relocate Runway 26 Threshold and Construct Additional Runway and Safety Areas. This alternative was developed by JNU in response to FAA's attempts to identify a "compromise" alternative that would be satisfactory to the agency as well as the sponsor. RSA-5D is a modification to RSA-5C, which was previously identified as the Airport's proposed action in the DEIS. This alternative eliminates the threshold displacement incorporated into RSA-5C on the west runway end. RSA-5D also applies recent changes to FAA's requirements for runway safety area, relying on the minimum RSA undershoot protection (600 feet) to lessen impacts to wetlands and minimize encroachment into the Refuge east of the Airport.

Alternative RSA-5D retains the existing Runway 08 threshold but includes relocation of the Runway 26 threshold by 400 feet to the east. This alternative, shown on Figure 2-11, incorporates a 600-foot undershoot protection for approaches to both runways and through the use of declared distances criteria also includes 1,000-foot overrun protection. The Runway 26 changes and RSA additions east of the runway would extend to the Airport boundary with the Refuge. JNU has also proposed that the parallel taxiway be extended 400 feet east so that aircraft would be able to taxi directly to the new Runway 26 threshold. Approximately 750 feet of fill would be necessary on the east end of the runway for the threshold relocation and construction of the RSA, extending 711 feet, plus an additional 39 feet for the 4:1 fill slope to support the RSA embankment.

The RSA west of the Runway 08 threshold would be extended 350 feet. Additional fill and disturbance would be required for about 125 more linear feet west of the RSA to accommodate the steep RSA embankment slope, and relocation of the Airport perimeter fence, Float Plane Pond access road and Dike Trail/EVAR. A substantial portion of Duck Creek would have to be relocated north due to the fill footprint and relocated facilities.

This alternative was designed to avoid 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, relocate the Float Plane Pond access road, and maintain 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. To compensate for the possible hydrologic changes stemming from this work an approxi-

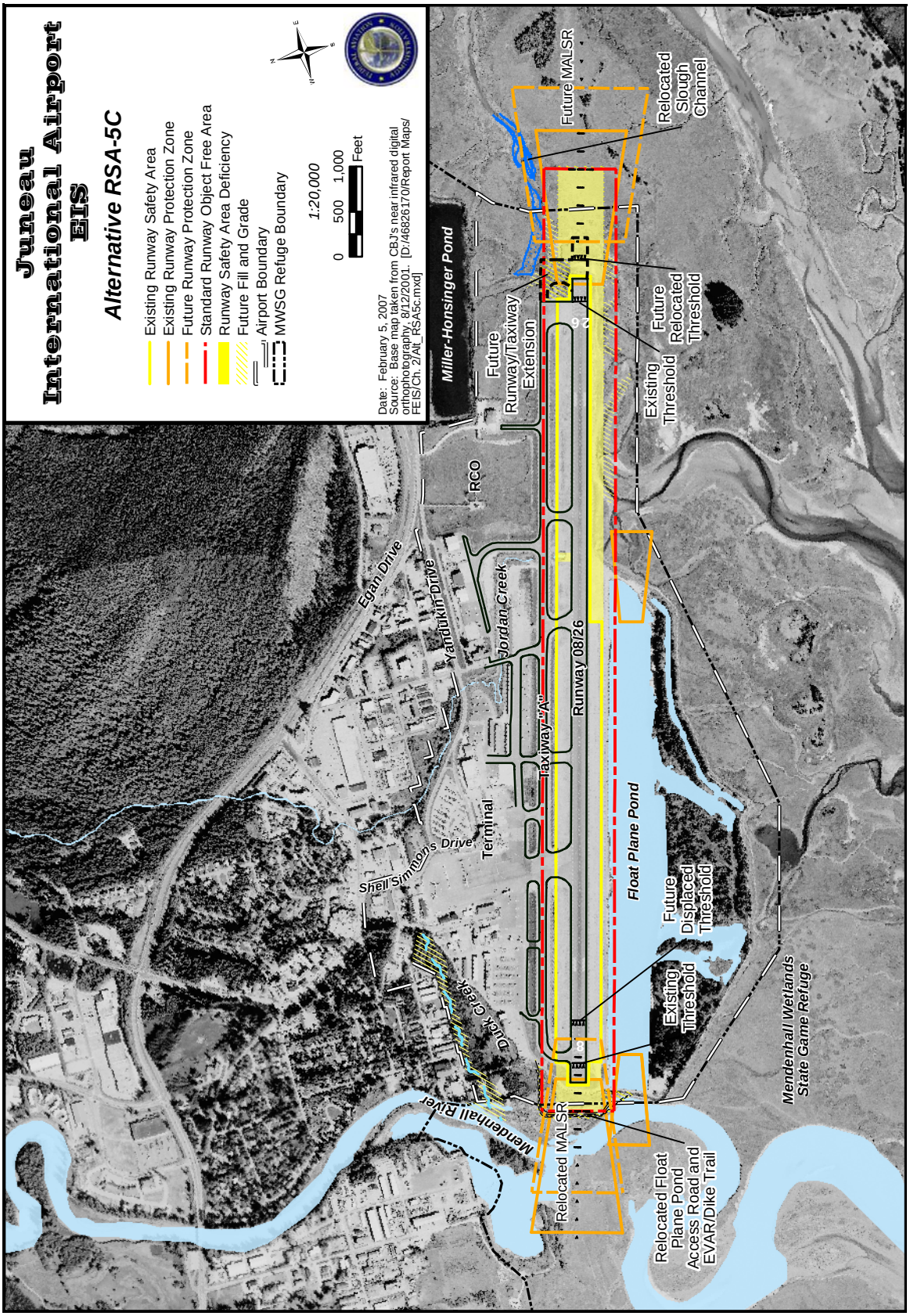

Figure 2-10. Displace Runway 08 threshold and construct additional Runway 26 and safety area-Alternative RSA-5C.

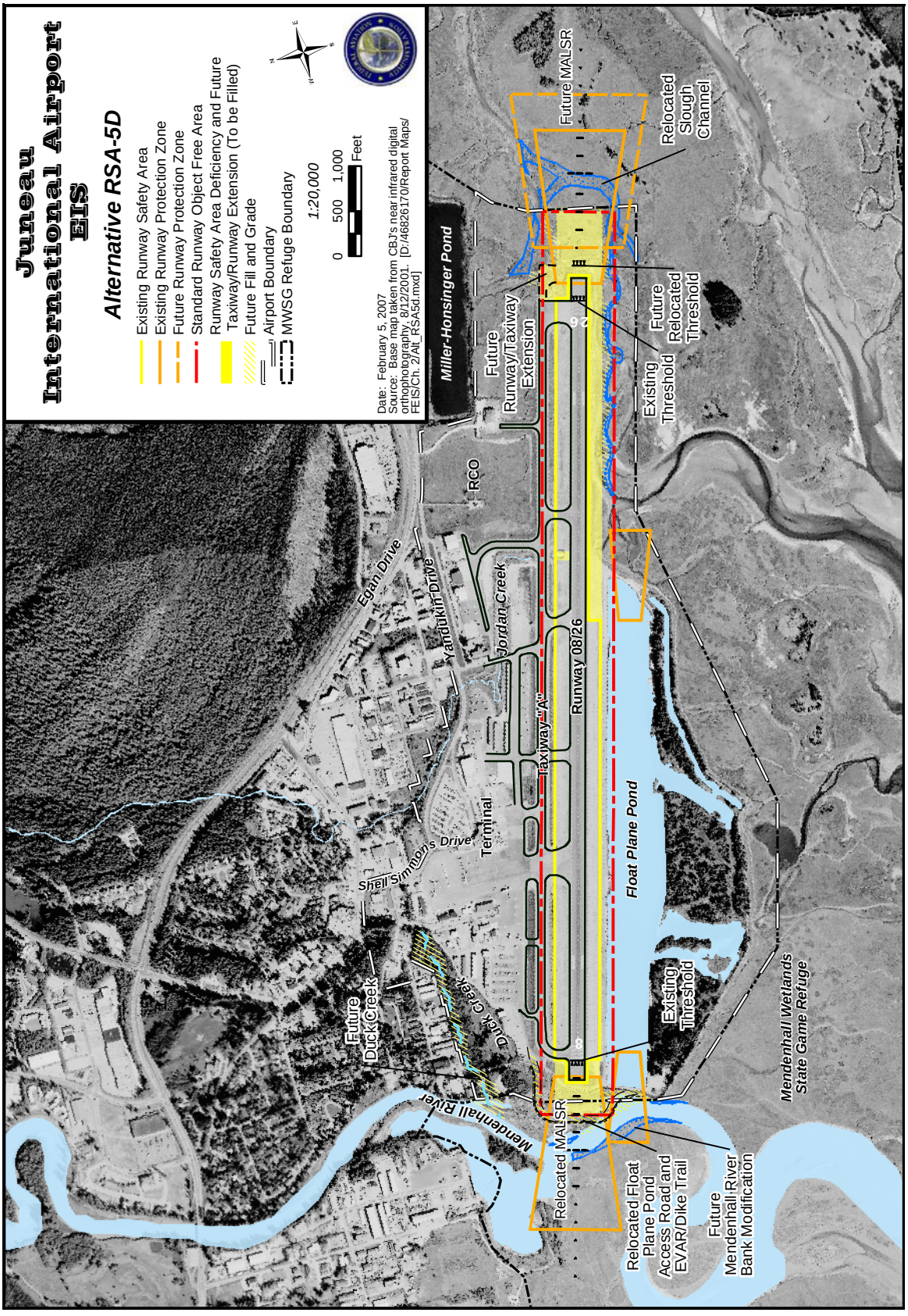

Figure 2-11. Relocate Runway 26 threshold and construct Runway 26 extension and RSAs-Alternative RSA-5D.

mately equal amount of dredging would be conducted on the west riverbank. More information concerning the analysis done to predict hydrologic changes, and design modifications to reduce impacts, is included in Sections 2.6.5.2 and 2.11. The Runway 08 MALSR leading to the west end approach would be unaffected since the threshold remains unchanged.

Approximately 8.1 acres of Refuge would have to be acquired, transferred, or leased to JNU for implementation of this alternative. An additional 4.5 acres of Refuge land east of the Airport would be disturbed for the construction of the East Runway Slough channel. A total of about 35.6 acres would be disturbed by the RSA and relocation of facilities, and 511,617 cubic yards of fill would be needed. The estimated construction cost is $15.1 million. This alternative is illustrated in Figure 2-11.

Relocation of the Runway 26 threshold allows the existing landing and takeoff distances to be retained for both runways. Revisions to the special-use instrument approaches for Runway 26 would be required, and modifications to some Runway 08 departure criteria may be needed due to the change in Runway 26 threshold (which serves as a waypoint for Runway 08 special departures).

This alternative meets the Purpose and Need, retains full runway length, and is both prudent and feasible. RSA-5D is carried forward for detailed analysis.

RSA-5E: Displace Runway 08 Threshold 120 Feet and Construct Additional 26 Runway and Safety Area. This alternative was developed by FAA and CBJ, in consultation with the Cooperating Agencies, in recognition that some alternatives included in the DEIS would encroach into the Mendenhall River west of the Airport. Specifically, the west RSA embankment for alternatives RSAs-1, -6B and -6C would all necessitate some fill in the Mendenhall River channel, potentially necessitating channel widening on the opposite bank to provide hydrologic compensation. Alternative RSA-5D, described in the previous section, also would encroach into the river. FAA, CBJ, and resources agencies have all expressed some concern over the predicted impacts to the Mendenhall from those alternatives and the uncertainties associated with the impact analysis, particularly hydraulic modelling.

Alternative RSA-5E therefore represents a modification of alternatives evaluated in the DEIS, combining the use of standard safety area construction with displaced and relocated thresholds to maintain full runway length. JNU has informed FAA that Alternative RSA-5E is the Airport's Proposed Action for the FEIS.

Alternative RSA-5E varies from other alternatives using standard safety area in the extent of change to the two runway thresholds. The location of the Runway 08 landing threshold would be displaced 120 feet east, although departures from that runway would begin at their current brake-release point. Runway 26 would be extended 520 feet to the east to preserve existing runway length. Each runway would have 600-foot undershoot protection and 1,000-foot RSA for overruns. These modifications in conjunction with the implementation of declared distances standards would meet standards for runway safety area.

The parallel taxiway would be extended 520 feet to the east to provide taxiway access to the extended runway. The lights comprising the Runway 08 MALSR would have to be shifted to match the eastward threshold displacement. The EVAR/Dike Trail and Float Plane Pond access road would have to be relocated to the west of the RSA embankment slope, and Duck Creek would be relocated north of the new RSA and away from other facilities.

Approximately 850 feet of fill would be necessary on the east end of the runway for the threshold relocation and construction of the RSA, including a 4:1 fill slope, and 230 feet of new disturbance would be added to the west runway end to complete the RSA. Additional fill and disturbance would be required for about 96 more linear feet west of the RSA to accommodate relocation of the Float Plane Pond access road and Dike Trail/EVAR. To enable aircraft to taxi to and from the new Runway 26 threshold, the parallel taxiway would also be extended 520 feet east.

Approximately 4.1 acres of Refuge would have to be acquired, transferred or leased to JNU for implementation of this alternative. An additional 5.0 acres of Refuge land east of the Airport would be disturbed for the construction of the East Runway Slough channel. As shown on Table 2-2, a total of about 35.3 acres would be disturbed and 484,365 cubic yards of fill needed to construct the RSA and associated facilities, at an estimated cost of $13.2 million. This alternative is illustrated in Figure 2-12.

As shown on Table 2-3, the combination of Runway 26 threshold relocation and Runway 08 threshold displacement would slightly increase takeoff distance for Runway 08, and preserve the existing distances for other criteria, so no additional weight restrictions would be imposed. Revisions to the special-use instrument approaches for both runways would be required, as would revisions to the Runway 08 public-use instrument approaches. Modifications to some Runway 08 departure criteria may be needed due to the change in Runway 26 threshold (which serves as a waypoint for Runway 08 special departures).

This alternative meets the Purpose and Need, retains full runway length, and is both prudent and feasible. RSA-5E, the FEIS Proposed Action, is carried forward for detailed analysis.

2.2.2.7 RSA-6: ENGINEERED MATERIALS ARRESTING SYSTEM (EMAS) TECHNOLOGY

The EMAS was developed by FAA and Engineered Arresting Systems Corporation specifically for airports where standard RSAs cannot feasibly be developed off the runway ends. EMAS consists of a number of pre-cast, cellular cement blocks installed beyond the end of the runway on available RSA. The specific standards for these blocks are based on the types of aircraft using the airport, but the overall design objective for JNU would be to arrest the design aircraft entering the system at 70 knots and prevent the aircraft from exiting the far end of EMAS. As an aircraft traverses the first row of "lead-in" blocks in the EMAS, they begin to crush. The interface between the aircraft tires and arresting material becomes resistant to the load, causing a deceleration or slowing down of the aircraft. This product has been installed in Minneapolis-St. Paul and Rochester, NY, and at least 14 other airports in the U.S[10].

10. According to ESCO website at http://www.esco.zodiac.com/index.cfm/navid-53. Reviewed 10/4/06.

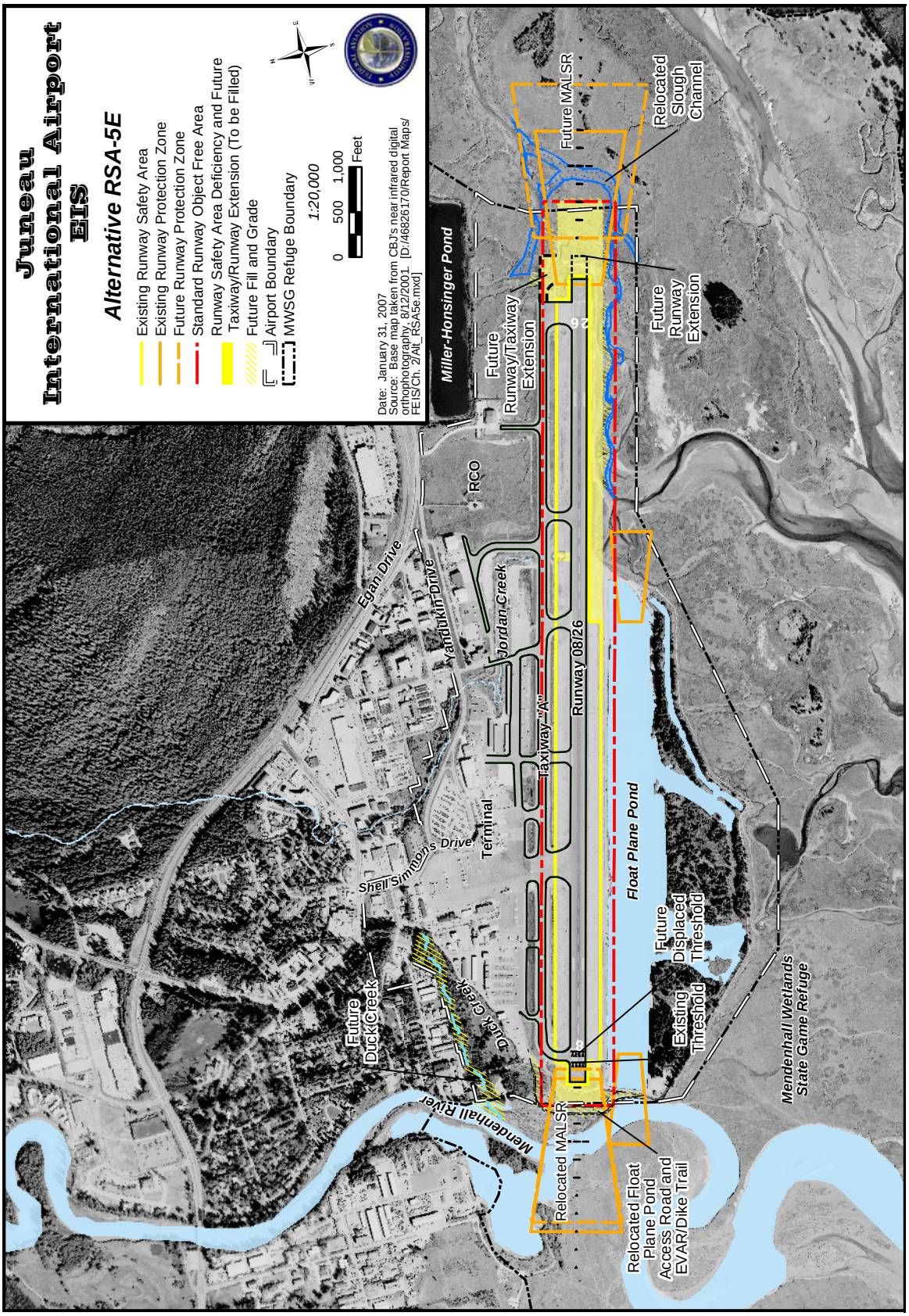

Figure 2-12. Displace Runway 08 Threshold 120 Feet and Construct Additional 26 Runway and Safety Area-Alternative RSA-5E.

EMAS has been credited with successfully arresting aircraft at a number of airports, the most recent event (at the time of FEIS preparation) occurring at the Greenville Downtown airport on July 25, 2006. A Dassault Falcon 900 business jet was landing on Runway 01 when it experienced a brake system malfunction and exited the runway surface. The aircraft entered the EMAS and was safely brought to a controlled stop within 100 feet of the threshold. There were no injuries among the 2-man crew and 3 passengers, and no significant damage to the aircraft was reported (Skycontrol 2006). The EMAS arrestor bed at Greenville was installed in the Runway 01 overrun area in 2003. This bed was also the first designed specifically for general aviation and small business jet protection.

Early installations of EMAS at civil airports included some problems with moisture seeping between the blocks or even into the blocks at damaged surfaces. However, the newest versions of the product have a water-resistant and jet blast resistant coating. The joints between the individual blocks are sealed with backer rods and caulking to prevent water from infiltrating the system and compromising the cellular cement. Apparently, this product has performed well, even at airports with high precipitation and extreme temperature variations. The Assistant Airport Director/Maintenance for Minneapolis-St Paul Airport (MSP) stated: "The two blocks noted are the first to be replaced here at MSP. And as miserable as the first seal-coating product performed, the durarock covers with jet blast resistant coating have been exactly the opposite. It has performed extremely well, especially when considering our weather and temperature extremes." (FAA 2005c). The manufacturer estimates the EMAS beds using this system will need to be re-coated every 3 to 5 years (FAA 2005b).

ESCO distributed an announcement in the fall of 2006 that a new, waterproof plastic "lid" will be used in place of the durarock covers for all future EMAS installations. According to ESCO, the benefit of the new system is that waterproof painting may never be required, reducing maintenance costs and increasing moisture protection (ESCO 2006). The lids will also, according to ESCO, reduce installation time since a fork lift can be used instead of the special clamper system previously required for durarock placement.

FAA has developed new guidance concerning EMAS and its potential application in lieu of standard runway safety area (FAA Order 5200.9). After years of testing and analysis, FAA has determined that EMAS can provide a level of safety generally equivalent to a standard RSA for overruns. However, for protection on runways with vertical guidance (such as instrument approach or visual guidance lighting), an EMAS system still needs an additional amount of RSA between the EMAS and the threshold so as to provide no less than 600 feet of undershoot protection.

One reason that EMAS has been considered for JNU is that it would reduce the extent of environmental disturbance on and off the Airport, compared to many of the RSA alternatives, while preserving existing runway length. Airport staff and others have expressed some uncertainties and concern, however, relative to the application of EMAS at JNU. The EMAS surface is sensitive to disturbance by equipment, and, in particular, can be damaged by maintenance equipment. Specialized snow removal equipment would be needed since the EMAS may at times (although not frequently) have to be cleared of snow and slush to prevent ice buildup. The manufacturer has stated that EMAS should not have a 1-inch or greater build up of ice to be effective.

The EMAS bed can support the weight and maneuvering of ARFF and emergency vehicles with some rutting. Potential tire rutting damage to additional blocks in an emergency response event is of no consequence, but maintenance vehicles like a ¾-ton utility vehicle should not be permitted to access the EMAS bed. Any tire rutting to the surface of the EMAS bed material could compromise the water resistant design features of the EMAS blocks. FAA Advisory Circular 150/5220-22A section 8i states that EMAS is not intended to support vehicular traffic for maintenance purposes. Snow removal on EMAS beds is typically conducted with a rubber track skid loader or blower so as not to puncture the surface coating.

Concerns have been raised about the possibility that EMAS blocks will deteriorate if moisture is allowed to infiltrate past the coating or through joints. CBJ and Airport staff have noted that EMAS has not been installed in an environment with climactic conditions similar to Juneau, with very high precipitation and resident humidity, and constant freeze/thaw cycles for many months of the year. Other airports using EMAS may have some similar conditions (for example, Minneapolis-St. Paul; Kennedy; Little Rock) but it is fair to say that conditions at Juneau represent a combination of high precipitation, constant humidity, and frequent freeze/thaw cycles that are not found at these other locations. A University of Alaska at Fairbanks study on specific aspects of EMAS materials did not provide useful information concerning the appropriateness of EMAS use in Alaska.

FAA has considered JNU's environmental conditions with respect to EMAS performance. A properly designed and installed EMAS system will limit the infiltration of moisture into the cellular cement blocks. The EMAS technology now employed at a number of airports includes sealants and resistant coatings to prevent water infiltration. In addition, there are numerous independent blocks in an EMAS system, such that even if one failed it would have no detrimental effect on other blocks. There is no evidence that moisture infiltration between block causes deterioration when EMAS blocks are properly installed. In fact, actual aircraft incidents involving EMAS suggest the technology continues to perform as designed even in the presence of water in the blocks (FAA 2005b).

An EMAS may also have a greater potential to arrest aircraft in wet, icy and/or slippery conditions than standard RSA. For example, the EMAS installation at JFK has recorded three aircraft saves (i.e., a B-747 and MD-11 cargo aircraft, and a SAAB 340 commuter aircraft) and is credited with saving both lives and preventing tens of millions of dollars in aircraft damage. In January of 2005 a B-747 overran the runway at JFK during a winter storm. The EMAS successfully arrested the aircraft, potentially preventing the B-747 from going into Thurston Bay given the slippery surface conditions. While the cost to repair the damaged blocks within the EMAS system was high, estimated at nearly $2 million, it is substantially lower than the cost to replace an aircraft entirely, a not unlikely scenario for that incident if the EMAS had not been in place and the aircraft had gone into the Bay (FAA 2005c).

This technology has been demonstrated for aircraft overruns, but a concern for most airports and particularly at JNU, based on accident history, is for aircraft that inadvertently touch down short of the landing threshold on the EMAS. It is important to understand that EMAS is not a runway surface and does not provide any operational benefit for short landings. Research, modeling, and actual undershoot events indicate that EMAS should not create a hazard to undershoot aircraft,

either. Extensive simulation testing of ESCO's material suggests that aircraft undershooting a runway and encountering EMAS at even a steep rate of decent should maintain enough lift to prevent landing gear penetration of the EMAS. The FAA has conducted computer simulation modeling to determine the EMAS's predicted performance during short landings. The result of this modeling indicates the EMAS surface will not create an unacceptable safety margin for undershoots. Actual experience at other airports provide further verification including an incident involving a short landing at Little Rock where the pilot was able to maneuver the aircraft onto the runway surface with good control (FAA 2005b). JNU does have more documented historic undershoots than overruns, but in response to those specific problems additional navigational technology was installed (such as the MALSR on Rwy 08) that have reduced the potential for aircraft to undershoot.

It should also be recognized that the standard RSA undershoot criteria for small general aviation aircraft ranges between 240 and 300 feet for ADG I & II aircraft in consideration of the Airport's existing public-use instrument approach visibility minimums. These dimensions are approximate to the 263-foot paved portion of the undershoot RSA that is described for the EMAS alternatives in following sections. FAA Order 5200.9 section 6a declares that EMAS provides an acceptable level of safety for undershoots. Additionally, Advisory Circular 150/5220-22A sections 8c and 8j require that EMAS be designed to take into consideration gear configuration and to "not cause control problems for aircraft undershoots which touch down in the EMAS bed."

JNU has expressed concern in comments to the DEIS and its draft permit application that a runway could be out of service for extended periods if an aircraft is arrested within an EMAS. This should not be the case. It took about 30 hours to clear the aircraft from the EMAS bed after the January 2005 incident at JFK described earlier in this section. The runway was back in service just over a day later. After an aircraft has been arrested within an EMAS system the damaged blocks must be replaced. At JNU, and at other airports currently with EMAS, such as JFK and MSP, seasonal conditions may prevent block replacement for many days or weeks, as installation is most desirable in dry, warm weather. Again, the evidence from incidents at JFK and other airports indicates the runway can still be in service even when some of the blocks are no longer usable. However, until blocks are replaced, an incomplete EMAS system would be in use for the runway.

The cost to replace or repair EMAS blocks damaged from an accident should not be part of an airport's annual O&M budget. The aircraft operator responsible for damage (normally an insurance company) would be expected to pay for blocks damaged by an overrun or other inadvertent entry into the EMAS bed, just as it would for an aircraft damaging other facilities on an airport (FAA 2005b; FAA 2005c). Nevertheless, as a consequence of higher installation costs for materials and routine maintenance costs such as application of sealant, the EMAS life-cycle costs are expected to be much greater than standard RSAs. Recent discussions with the manufacturer and bids for EMAS installation at the Cordova, Alaska airport provide more insight to the potential cost for JNU.

ESCO provided an estimated unit rate quote for the JNU installation of about $86/square foot (Quan 2006). With additional shipping costs to Alaska, the unit rate would be about $94/square foot. This value matches well with the unit rate bid that ESCO provided ADOT&PF for the

Cordova Airport project. The Cordova Airport is in the process of RSA design and construction, including the installation of a reduced-size EMAS (170 feet wide by 251 feet long, for 40-knot arresting speed). During discussions between ADOT&PF, the EMAS manufacturer, ESCO, prepared and submitted an installation bid of about $4 million including materials, for a unit rate of about $94/square foot. However, ADOT&PF was unable to approve direct contract with ESCO. As a result, ADOT&PF advertised the EMAS installation for third-party contractor bids and received estimates ranging from about $135/square foot to $150/square foot. There are a number of possible explanations as to why the contractor bids were about 50% higher than ESCO's, including contractor markup and assignment of risk involved with the first EMAS installation in Alaska.

Regardless, the higher bids are probably more relevant to this EIS because JNU has informed FAA that it would not be prudent for CBJ to purchase the EMAS directly from the manufacturer, and would require a contracted entity to purchase and install the system (Mello 2006b). Using a base unit rate of about $94/square foot, plus typical design, construction management, overhead, and contractor markup rates, it is likely the final unit rate for EMAS installation would approximate the lower end of the Cordova Airport bids. In summary, EMAS would undoubtedly provide environmental benefits relative to other alternatives by reducing impacts to wetlands and habitat, but at a substantially greater cost than traditional-type runway safety area embankments.

Three alternatives incorporating EMAS were identified in the DEIS that would retain full runway length and provide a level of aircraft overrun and undershoot protection equivalent to standard RSA. The following sections provide a brief description of Alternatives RSA-6A, -6B, and -6C. In addition, a fourth alternative was developed by the FAA after publication of the DEIS that could be modified to incorporate EMAS and increase runway lengths relative to existing JNU conditions. This alternative, incorporating threshold displacements and fill footprints from Alternatives RSA-6A and -6B, has been designated RSA-6D.

RSA-6A: EMAS Technology – EMAS with Declared Distances/Runway26 Extension. This EMAS alternative was designed to avoid direct disturbance to the Refuge east of the runway and minimize disturbance to the Refuge on the west runway end. The Runway 08 landing threshold would be displaced 188 feet east, but takeoffs would begin from the current departure threshold. The Runway 26 departure threshold would be located 188 feet east of its current location, while the 26 landing threshold would be at the current location. The net effect is that the new Runway 26 arrival threshold would be at the existing Runway 26 threshold. The existing landing distance would be maintained for both runways, while the takeoff distances would increase about 188 feet in both directions. The Runway 08 MALSR leading to the west end approach would also have to be relocated east about 188 feet because of the threshold shift.

The alternative would be designed in accordance with EMAS guidance FAA Order 5200.9. An EMAS bed approximately 337-ft long would provide overrun protection equivalent to standard RSA. The EMAS bed plus additional RSA between the threshold and the beginning of the EMAS would create a 600-foot undershoot margin, considered by FAA as an acceptable level of protection. On the east runway end, approximately 323 feet of new disturbance would be needed to build the additional RSA and EMAS. On the west, Runway 08 end the EMAS would extend to just beyond the current Airport/Refuge boundary by adding about 175 additional feet of RSA

embankment, for the EMAS, plus additional disturbance for fill slopes. The Float Plane Pond access road, security fence, and EVAR/Dike Trail would be relocated further west to provide adequate separation distance from the EMAS embankment. Additional fill would be added to maintain the road, EVAR/Dike Trail and fence at elevations above the design tide levels.

The Airport boundary would shift to the west as approximately 1.9 acre of Refuge land would be acquired, transferred, or leased to JNU. The security fence would mark the west Airport boundary. The Float Plane Pond access road would be relocated adjacent to the fence, but within the Airport boundary, while the Dike Trail would be sited just west of the fence. Duck Creek would be relocated to a discharge site in the Mendenhall River north of the runway. Relatively minor revisions would be needed for the west RNAV approach procedures. Approximately 0.2 acres of Refuge land east of the Airport would be disturbed for the construction of the East Runway Slough channel. Approximately 25 acres of disturbance would be caused for the RSA and embankment construction, including the 12.2 acres of lateral RSA. Approximately 317,412 cubic yards of fill would be needed for this work, at an estimated construction cost of $23.1 million. Figure 2-13 illustrates alternative RSA-6A.

This alternative meets the Purpose and Need, retains full runway length, and is considered feasible. Although it would cost more than alternatives relying on traditional runway safety area installation, Alternative RSA-6A would also have less environmental impact. This alternative was carried forward for detailed analysis in the Draft EIS. However, using updated costing information obtained following issuance of the Draft EIS, FAA has determined that Alternative RSA-6A is not prudent based on cost since this alternative is approximately 2.5 times the cost of traditional fill RSA alternatives and exceed FAA's $30 million financial feasibility threshold for runway safety area at JNU. FAA retained Alternative RSA-6A for analysis the Final EIS for the purpose of full disclosure of potential impacts and costing information.

RSA-6B: EMAS Technology – EMAS with Declared Distances/Runway 08 Extension. This EMAS alternative was designed to minimize disturbance to wetlands and habitat east of the Runway. However, the reduced footprint east of the runway would necessitate a greater disturbance area west of the runway. The Runway 26 landing threshold would be displaced 188 feet west, while takeoffs would begin from the current departure threshold. The Runway 08 departure threshold would be relocated 188 feet west of its current location, but the landing threshold would remain at the current location. The landing distance would be maintained for both runways, while the takeoff distances would increase about 188 feet in both directions. The Runway 08 MALSR would be unaffected by this alternative.

As with Alternative RSA-6A, this alternative would be designed in accordance with new EMAS guidance FAA Order 5200.9, using an EMAS bed approximately 337-foot long to result in acceptable overrun protection. Additional RSA development between the thresholds and the EMAS beds would create an acceptable 600-foot undershoot margin. On the east runway end, approximately 135 feet of additional disturbance would be needed to build the remaining RSA and EMAS. On the west, Runway 08 end, about 350 feet of new disturbance would be required for the new RSA and EMAS, but embankment construction and relocation of facilities would extend the disturbance footprint another 125 feet. The design of the west end embankment is the same as described for Alternative RSA-5D. As a consequence, fill would extend into the Refuge and the

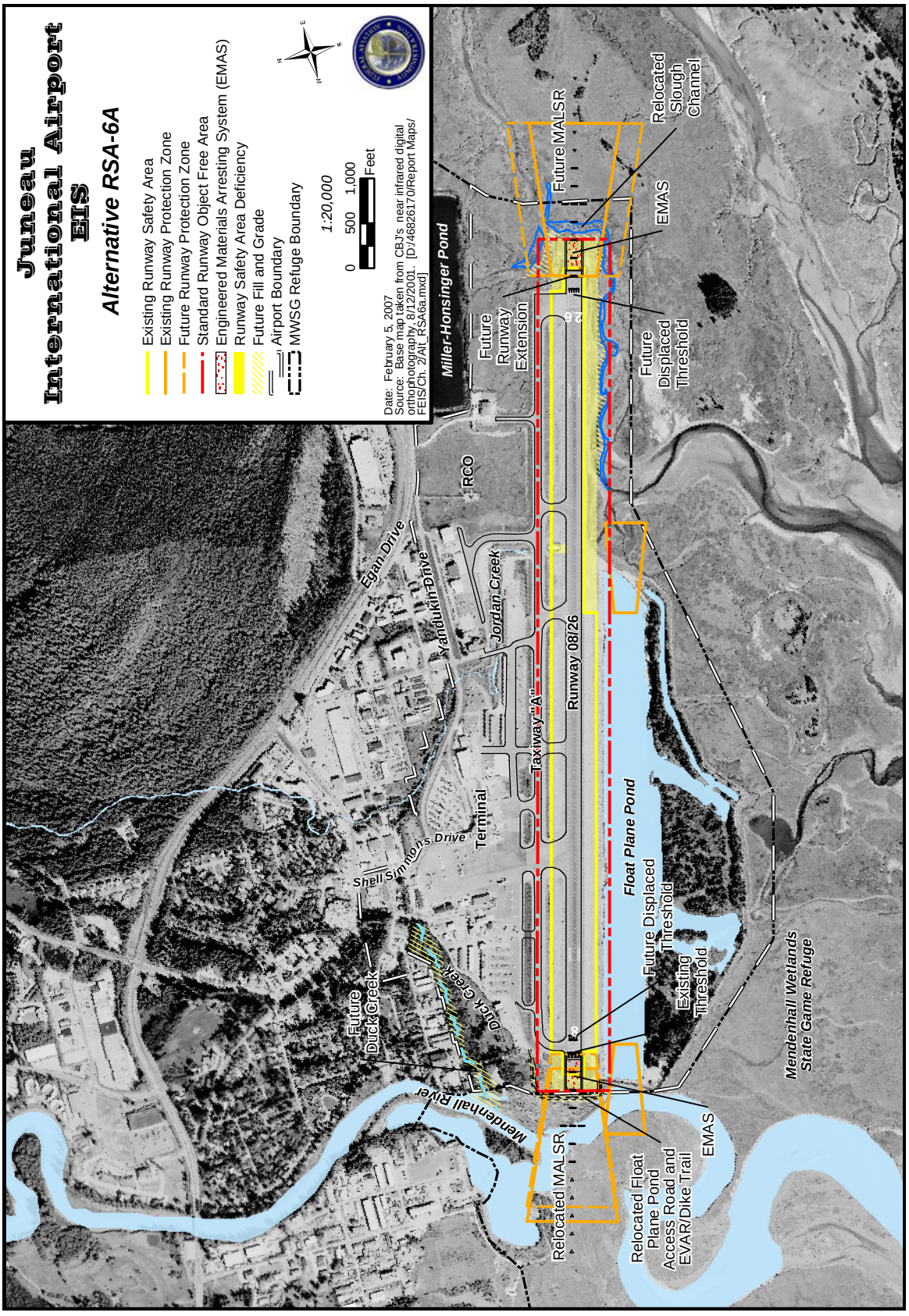

Figure 2-13. EMAS Technology-EMAS with declared distances/Runway 26 extension-Alternative RSA-6A.

east bank of the Mendenhall River and some material would be dredged from the west river bank to compensate for possible hydrologic changes. The Float Plane Pond access road, security fence, and EVAR/Dike Trail would be relocated further west to provide adequate separation distance from the EMAS embankment. Duck Creek would also be relocated to the north.

As with other alternatives, the Airport boundary would shift to the west as approximately 8.1 acres of Refuge land would be acquired, transferred, or leased to JNU. The security fence would mark the west Airport boundary. The Float Plane Pond access road would be relocated adjacent to the fence, but within the Airport boundary, while the Dike Trail would be sited just west of the fence. Duck Creek would be relocated to a discharge site in the Mendenhall River north of the runway. An additional 0.2 acres of Refuge land east of the Airport would be disturbed for the construction of the East Runway Slough channel. Approximately 27.2 acres of disturbance would be caused for the RSA and embankment construction, including the 11.6 acres of lateral RSA. Approximately 371,244 cubic yards of fill would be needed for this work, at an estimated construction cost of $25.8 million. Figure 2-14 illustrates Alternative RSA-6B.

This alternative meets the Purpose and Need, retains full runway length, and is considered feasible. Although it would cost substantially more than traditional RSA alternatives it would also have less environmental impact. This alternative would cost slightly more than Alternative RSA-6A, but the environmental impacts resulting from the two alternatives are different. RSA-6B was carried forward for detailed analysis in the Draft EIS. However, using updated costing information obtained following issuance of the Draft EIS, FAA has determined that Alternative RSA-6B is not prudent based on cost since this alternative is approximately 2.5 times the cost of traditional fill RSA alternatives and exceed FAA's $30 million financial feasibility threshold for runway safety area at JNU. FAA retained Alternative RSA-6B for analysis the Final EIS for the purpose of full disclosure of potential impacts and costing information.

RSA-6C: EMAS Technology – Combined EMAS and Runway Safety Area. This alternative was developed as a means of combining positive features of both standard (1,000-ft long) RSA and EMAS technology. An EMAS system would be installed on the Runway 08 end, and a standard safety area would be constructed at the Runway 26 end. This alternative would reduce construction and operation costs relative to other alternatives incorporating EMAS at both runway ends, and it would cause no displacement or relocation of runway thresholds. Therefore, no change would be required to landing or departure procedures, and the Runway 08 approach MALSR would be unaffected by this alternative.

As with previous alternatives using arresting systems, the Runway end 08 would be designed in accordance with FAA Order 5200.9, using an EMAS bed approximately 337-foot long to result in acceptable overrun protection. An additional 263-foot RSA between the thresholds and the EMAS beds would create a 600-foot undershoot margin. On the east runway end, approximately 711 feet of new disturbance would be needed to construct a full, 1000-foot long RSA, with an additional 39 feet of fill slope. On the west, Runway 08 end, 350 feet of EMAS and RSA plus fill slopes and relocation of existing facilities would extend the total disturbance footprint to 475 feet. The design of the west end embankment is the same as described for Alternatives RSA-5D and -6B. As a consequence, fill would extend into the east bank of the Mendenhall River and some material would be dredged from the west river bank to compensate for possible hydrologic

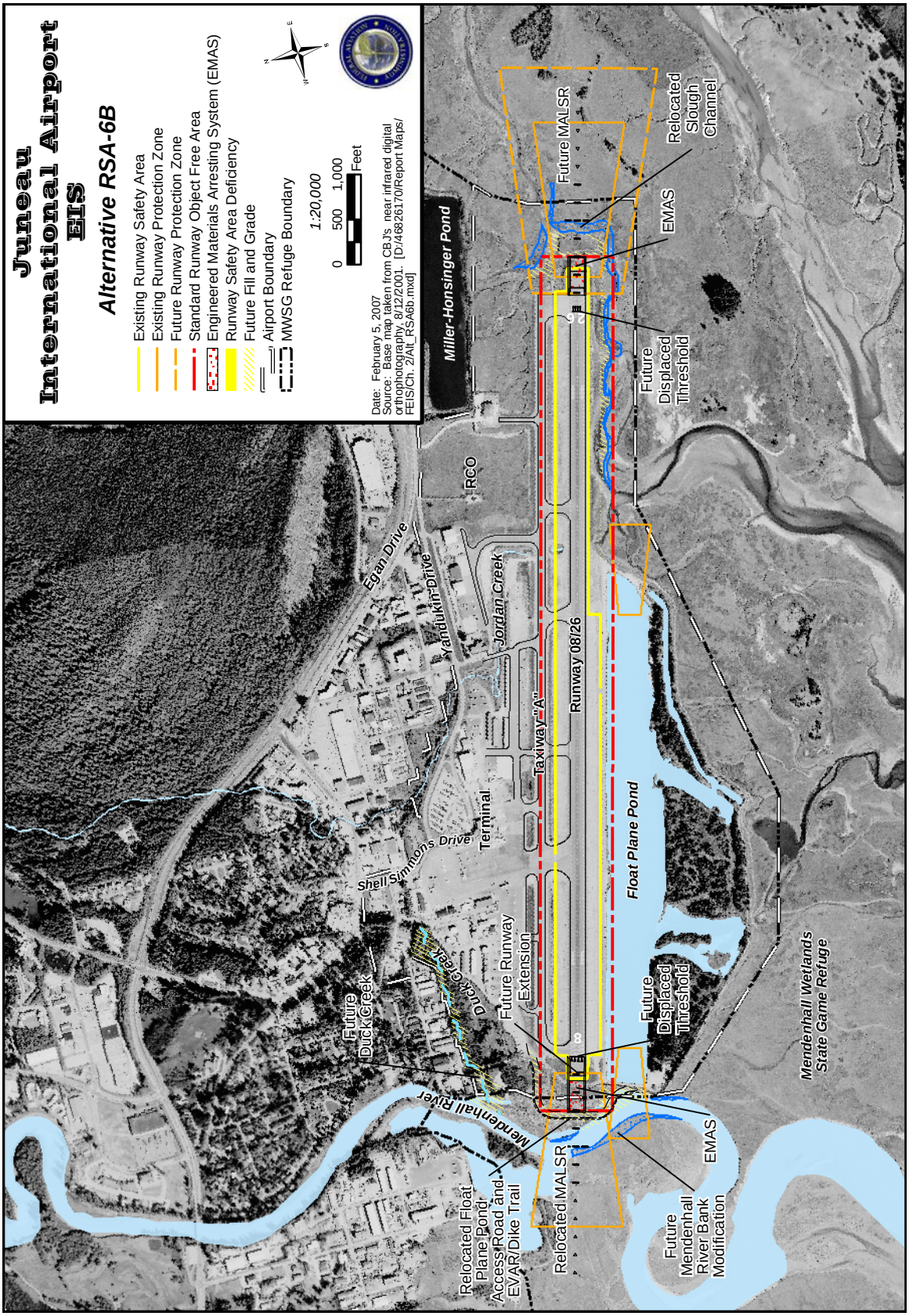

Figure 2-14. EMAS Technology-EMAS with declared distances/Runway 08 extension-Alternative RSA-6B.

changes. The Float Plane Pond access road, security fence, and EVAR/Dike Trail would be relocated further west to provide adequate separation distance from the EMAS embankment. Duck Creek would also be relocated to the north.

The Airport boundary would shift to the west as approximately 8.1 acres of Refuge land would be acquired, transferred, or leased to JNU. The security fence would mark the west Airport boundary. The Float Plane Pond access road would be relocated adjacent to the fence, but within the Airport boundary, while the Dike Trail would be sited just west of the fence. Duck Creek would be relocated to a discharge site in the Mendenhall River north of the runway.

An additional 4.5 acres of Refuge land east of the Airport would be disturbed for the construction of the East Runway Slough channel. Approximately 33.7 acres of disturbance would be caused for the RSA and embankment construction, including the 12.2 acres of lateral RSA. Approximately 490,288 cubic yards of fill would be needed for this work, at an estimated construction cost of $20.3 million. Figure 2-15 illustrates alternative RSA-6C.

This alternative meets the Purpose and Need, retains full runway length, and is both prudent and feasible. Although RSA-6C would cost more than alternatives using traditional RSA designs (such as RSA-1, RSA-5C or RSA-5D), it would also have less environmental impact since there would be no taxiway extension and a smaller disturbance footprint, due to the use of EMAS on the west runway end. This alternative would cost less than RSA-6A or -6B, since only one EMAS bed would be installed, but it would also have greater environmental impacts than dual EMAS alternatives because of the full safety area developed on the east runway end. RSA-6C is carried forward for detailed analysis.

RSA-6D: Threshold Displacement using Declared Distance Criteria with Option for EMAS. This alternative was developed by FAA after publication of the Draft EIS and in consideration of comments expressed by JNU, CBJ and others concerning EMAS alternatives. Alternative RSA-6D is a modification of EMAS Alternatives RSA-6A and -6B that could be implemented without the use of EMAS yet still have lower cost and less environmental impact than other traditional-RSA alternatives (such as RSA-1, RSA-5C or RSA-5D). RSA-6D has a greater amount of threshold displacement on each runway end than either RSA-6A or RSA-6B, but with roughly the same fill footprints as RSA-6B on the west end and RSA-6A on the east end. The alternative would provide JNU with a greater runway safety margin that meets standards, increased structural pavement, and as shown on Table 2-3, increased departure distances from Runway 26. The alternative would be designed to accommodate the future installation of EMAS at one or both runway ends with no additional disturbance. The operational drawback with this alternative is the landing distance available without EMAS would be reduced to 8,056 feet for each runway, about 400 feet less than existing conditions. With EMAS installed the landing distance for each runway would increase to approximately 8,644 feet.

The configuration of this alternative on the west runway end would be similar to that described for Alternatives RSA-5D, RSA-6B, and RSA-6C. The RSA west of the Runway 08 threshold would be extended 350 feet. Additional fill and disturbance would be required for about 125 more linear feet west of the RSA to accommodate the steepened RSA embankment slope (2:1 from the RSA down to the access road, and 1.5:1 from the access road to the trail), and relocation of the

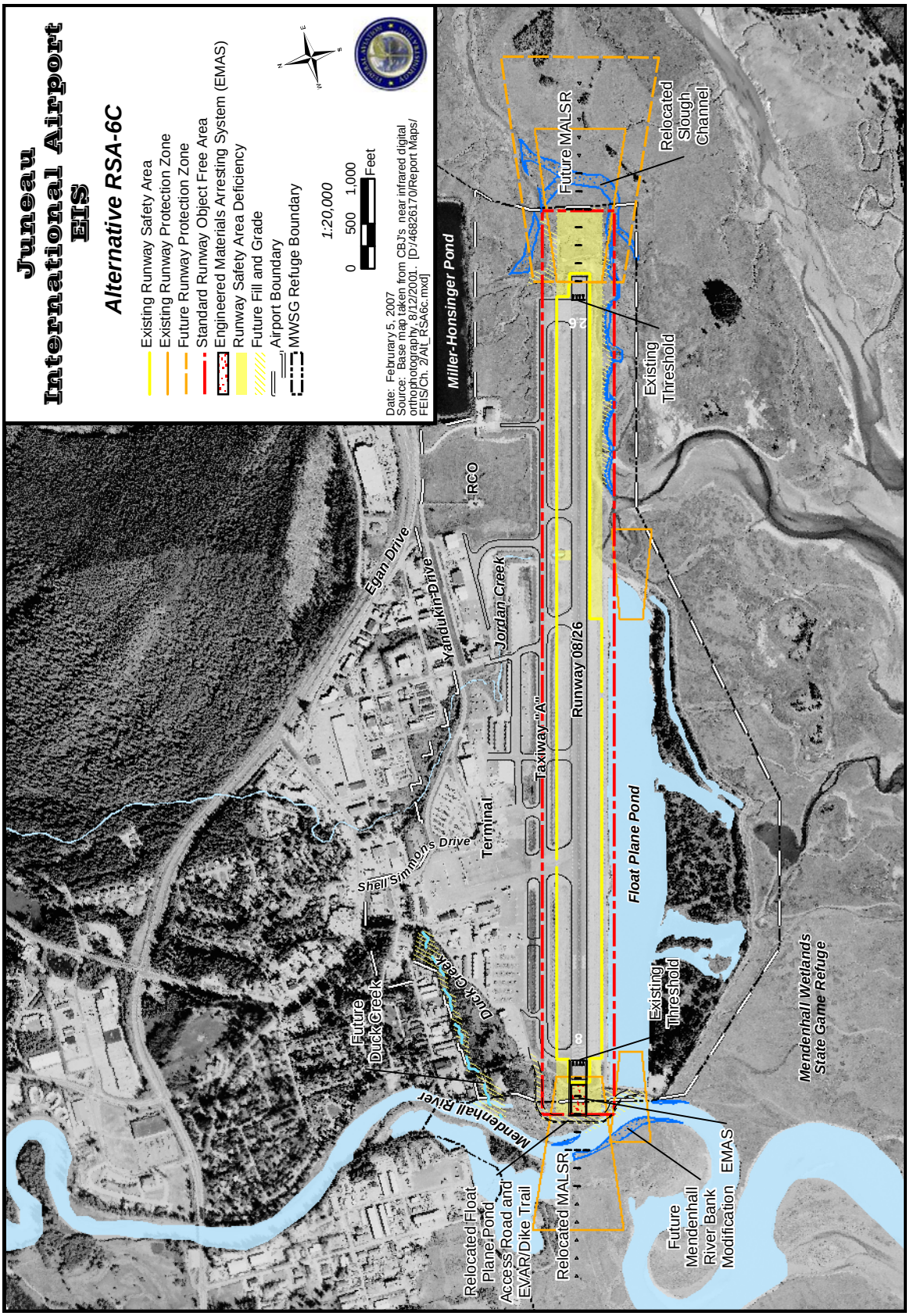

Figure 2-15. EMAS Technology-Combined EMAS and Runway Safety Area-Alternative RSA-6C.

Airport perimeter fence, Float Plane Pond access road, and Dike Trail/EVAR. A substantial portion of Duck Creek would have to be relocated north due to the fill footprint and relocated facilities.

A difference between this alternative and the west end configurations of those alternatives mentioned previously is that approximately 400 feet of RSA west of the Runway 08 threshold would be constructed to full pavement strength, meaning it would meet design standards for runway. This would ensure that aircraft departing to the east could have as much runway available for takeoffs as currently exists on Runway 08 at JNU.

RSA-6D 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, relocate the Float Plane Pond access road, and maintain 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. To compensate for the possible hydrologic changes stemming from this work an approximately equal amount of dredging would be conducted on the west riverbank. More information concerning the analysis done to predict hydrologic changes, and design modifications to reduce impacts, is included in Sections 2.6.5.2 and 2.11. The Runway 08 MALSR leading to the west end approach would be unaffected since the threshold remains unchanged.

An additional 311 feet of runway safety area would be added to the east runway approach, creating a 600-foot undershoot RSA prior to the Runway 26 threshold. The entire 600 feet of RSA would be constructed at full pavement strength so as to meet design standards for runway use. This would allow departures on Runway 26 to begin at the east end of the RSA and pavement. The RSA embankment slope would be graded at 4:1 down to the wetlands.

FAA conferred with Alaska Airlines concerning possible operational impacts created by the reduced landing distance. Alaska has noted in correspondence about other RSA alternatives that retention of the existing landing threshold locations (as with this alternative) is most important to their operations, as any change in thresholds could jeopardize continued use of required navigational procedures (for example, Alaska Airlines 2006b). Further, assuming that winter snow removal and ice control keeps braking action fair or better, as required by operations plans, and that existing runway entrance points are maintained, "the proposed modified RSA Alternative (6D) appears to be adequate for the majority of our operations" (Alaska Airlines 2006a). On those relatively infrequent occasions when the runway was experiencing poor braking action Alaska Airlines could be forced to divert an aircraft to another airport if flying under maximum landing weights. It is unlikely but not impossible that these two conditions, of poor runway braking action and maximum landing weight, would be experienced concurrently.

This alternative does not include extension of the parallel taxiway for departures from either runway. Instead, aircraft that want or need to use the entire available takeoff pavement would be required to enter the runway at either Taxiway B, for Runway 08, or Taxiway G, for Runway 26 and backtaxi to the end of the full-strength pavement, and turn 180 degrees to begin takeoff roll. Alaska Airlines informed FAA that "if the existing runway entrance points were maintained, the need to back taxi will be low." However, Alaska Airlines also pointed out that extending the

runway without also extending the taxiway to the threshold "... would increase our taxi times, and the time we are on the runway, possibly reducing the frequency of operations and the capacity of the airport" (Alaska Airlines 2006a). In short, the need to backtaxi would increase the potential for runway incursions.

FAA weighed the environmental benefits of requiring aircraft to backtaxi to obtain the full possible takeoff length for Runway 26 versus the safety and operational concerns associated with more runway residence time for aircraft. Full-length parallel taxiways segregate taxiing aircraft from aircraft landing and taking off. In those cases where backtaxiing is necessary, aircraft would be on the runway for longer periods of time, which further increases the possibility of runway incursions. 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. Implementation of this policy without a full parallel taxiway would increase the time the runway was unavailable and delay use by other aircraft. Additionally, basic pilot training, and operational policies encourage the use of full runway length. Pilot preference for use of the full runway length to provide an increased margin of safety would result in an increase in runway occupancy times. Therefore, while Alternative RSA-6D meets the Purpose and Need and is both feasible and prudent, FAA considers the lack of a full-length parallel taxiway to be a drawback of this alternative.

Approximately 8.1 acres of Refuge west of the Airport would have to be acquired, transferred, or leased to JNU. An additional 0.2 acres of Refuge land east of the Airport would be disturbed for the construction of the East Runway Slough channel. Approximately 29.2 acres of disturbance would be caused for the RSA and embankment construction, including the 12.2 acres of lateral RSA. Approximately 401,842 cubic yards of fill would be needed for this work, at an estimated construction cost of $11.9 million. Figure 2-16 illustrates alternative RSA-6D.

As noted earlier, this alternative as constructed without EMAS would actually reduce the landing distance available. Technically, this alternative does not meet the statutory requirements to retain full runway length if JNU would not agree to its implementation, even though coordination with Alaska Airlines suggests that the reduction would have only minimal effect on Alaska Airlines operations. However, this alternative was designed for possible future use with EMAS, and the runway configuration with arresting systems on both ends would restore the "lost" landing length. In addition, this alternative would have a lower construction cost than all other alternatives carried forward, and cause less environmental impact than most. For these reasons Alternative RSA-6D is carried forward for detailed consideration.

2.2.2.8 RSA-7: Feasibility of Increasing the Size of RSA by Including Additional Land Parcels, Even if it Results in an RSA of Irregular Size

A wide range of alternatives would be available to provide nonstandard RSAs, although there are none that would completely eliminate the impacts to wetlands and habitat, and still meet the purpose and need for RSA. As has been disclosed throughout this chapter, there are alternatives

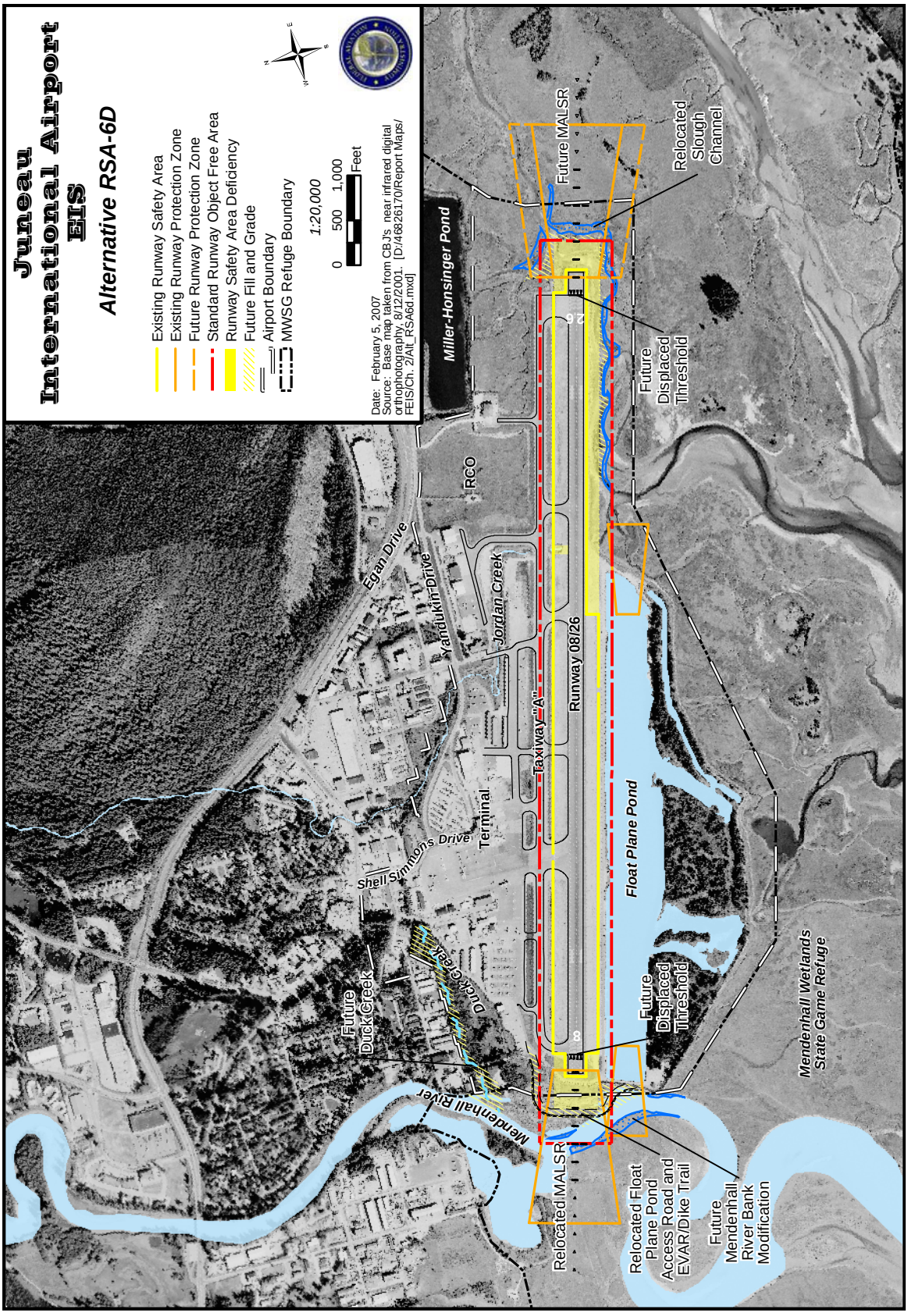

Figure 2-16. Constructed RSAs with option for EMAS-Alternative RSA-6D.

available to achieve standard RSAs at JNU. Unless FAA later determines that none of these alternatives are practicable, no alternative providing a less-than-standard RSA (except for the federally required No Action Alternative) will be considered. This EIS contains no analysis of non-standard RSAs.

2.2.2.9 RSA-8: NO ACTION ALTERNATIVE

CEQ regulations require the consideration of a No Action Alternative. While it is the FAA's belief that a No Action Alternative is not practicable, consideration is given to an alternative that essentially maintains existing conditions. In this case, the runway thresholds would be maintained in their present location and a runway length of 8,456 feet would be retained. This alternative would result in RSAs that are deficient by approximately 750 feet at each end and too narrow for more than 40% of the runway length if no action were taken to address the lateral RSA deficiencies.

2.2.2.10 SUMMARY OF RSA ALTERNATIVES

In accordance with the federal guidelines implementing NEPA, a range of reasonable alternatives were identified and described in sufficient detail to determine their ability to meet the purpose and need of achieving a standard RSA. Those meeting purpose and need, and that are also feasible and prudent, were given consideration for detailed evaluation in this EIS. Two alternatives, RSA-6A and RSA-6B, were considered both feasible and prudent at the time the Draft EIS was prepared but were subsequently determined by the FAA to not be prudent based on cost since these alternatives are approximately 2.5 times the cost of traditional fill RSA alternatives and exceed FAA's $30 million financial feasibility threshold for runway safety area at JNU. However, FAA retained Alternatives RSA-6A and RSA-6B for analysis the Final EIS for the purpose of full disclosure of potential impacts and costing information.

The range of alternatives was further narrowed by eliminating alternatives that have similar performance and operational impacts, but would not provide additional benefits. For example, RSA-2C would satisfy most of the critical performance and operational criteria, but it would also be one of the most expensive to construct, and result in much greater environmental impact to the Mendenhall River and Refuge, than other comparable alternatives such as RSA-1. Nevertheless, a full spectrum of alternatives was retained for detailed analysis.

Table 2-5 summarizes the considerations that were used to screen RSA alternatives. Some of the criteria are based on the predicted impacts to operational capability, as derived from Table 2-4. This table identified benefits and drawbacks of the RSA alternatives relative to airport operational capability and aviation procedures. Only two of the possible build alternatives (RSA-1 and RSA-6C) would have no impact on the required navigational procedures or special departure procedures used by Alaska Airlines. Any shift in a runway threshold, no matter how small, could have an impact, ranging from a relatively minor adjustment to published approach or departure procedures, to major limitations on departure procedures for certain aircraft.

Table 2-5. Screening of Possible Runway Safety Area Alternatives

Alternative	Meets RSA Standards	Feasible	Relative Cost to Construct[1]	Benefits	Drawbacks	Included or Eliminated?[2]
RSA-1 Fill and Grade Existing Deficiencies	Yes	Yes	High $16.9 million	Retains current runway lengths, threshold locations, and operational capability Preserves existing operational capability for all approaches and departures Would provide safety margin increase under challenging weather conditions and contaminated runway	Requires acquisition of or access to Refuge habitat Relocation of EVAR/Dike Trail, realignment of access roads Rerouting of Mendenhall River channel Relatively greater fill of wetlands/habitat Requires relocation of Duck Creek	Included
RSA-1A Elevated RSAs Applied to RSA-1	Yes	No	Highest $61 million	Retains current runway lengths, threshold locations, and operational capability Lessened environmental impact to Mendenhall River resources and adjacent habitat (relative to RSA-1) Would provide safety margin increase under challenging weather conditions and contaminated runway	Unproven engineering and catastrophic consequences of structural failure during undershoot, not feasible Exceedingly high costs, not prudent Requires acquisition of or access to Refuge habitat Relocation of EVAR/Dike Trail, realignment of access roads	Eliminated
RSA-2A Full RSA by Shifting Runway East	Yes	Yes	Low-Moderate $9.1 million	Retains current runway lengths No direct impacts to Refuge on west end No added Rwy 26 departure weight restrictions Would provide safety margin increase under challenging weather conditions and contaminated runway	Limits or precludes turning departures from primary departure runway[3] Results in additional weight restrictions to Rwy 08 Requires revisions to all RNP and public use approaches Relocation of EVAR/Dike Trail, realignment of access roads	Eliminated
RSA-2B Full RSA by Shifting Runway Further East	Yes	Yes	Moderate $10.0 million	Retains current runway lengths No direct impacts to Refuge on west end No impact on dike trail or access roads Would provide safety margin increase under challenging weather conditions and contaminated runway	Limits or precludes turning departures from primary departure runway[3] Results in additional weight restrictions to Rwy 08 Requires revisions to all RNP and public use approaches	Eliminated
RSA-2C Full RSA by Shifting Runway West	Yes	Uncertain	Moderate-High $14 million	Retains current runway lengths No direct impacts to Refuge on east end Retains full capability on primary departure runway, including turning procedures Retains Rwy 08 departure length with no additional weight restrictions Would provide safety margin increase under challenging weather conditions and contaminated runway	Results in additional weight restrictions to Rwy 26 Requires revisions to all RNP and public use approaches Requires acquisition of or access to Refuge habitat Requires complete re-routing of Mendenhall River, fill of wetlands and habitat Relocation of EVAR/Dike Trail, realignment of access roads High cost	Eliminated
RSA-3 Reduce Runway Length to Achieve RSA	Yes	Yes	Low $4.5 million	Eliminates need for fill and grade at runway ends Avoids acquisition of Refuge lands Minimizes environmental impacts Avoids all impact to EVAR, Dike Trail	Limits or precludes turning departures from primary departure runway Imposes relatively high additional weight restrictions on both runways, may preclude use of critical aircraft Requires revisions to all RNP and public use approaches Large reduction in landing lengths, both runways Would provide net safety margin decrease under challenging weather conditions and contaminated runway Does not meet statutory conditions to retain full runway length when developing RSA; not prudent	Eliminated

Table 2-5. Screening of Possible Runway Safety Area Alternatives, continued

Alternative	Meets RSA Standards	Feasible	Relative Cost to Construct[1]	Benefits	Drawbacks	Included or Eliminated?[2]
RSA-5A Displace Thresholds with Declared Distances	Yes	Yes	Low $3.1 million	Eliminates need for fill and grade at runway ends Avoids acquisition of Refuge lands Minimizes environmental impacts No impact to EVAR/Dike Trail Retains full capability on primary departure runway, including turning procedures	Imposes relatively moderate additional weight restrictions on both runways, may preclude use of critical aircraft Requires revisions to all RNP and public use approaches Large reduction in landing lengths, both runways Would provide net safety margin decrease under challenging weather conditions and contaminated runway Does not meet statutory conditions to retain full runway length when developing RSA; not prudent	Eliminated
RSA-5A1 Cooperating Agencies Alternative 1, Displace Thresholds	Yes	Yes	Low $3.1 million	Eliminates need for fill and grade at runway ends Avoids acquisition of Refuge lands Minimizes environmental impacts Retains full capability on primary departure runway, including turning procedures	Imposes relatively moderate additional weight restrictions on both runways Requires revisions to all RNP and public use approaches Large reduction in landing lengths, both runways Would provide net safety margin decrease under challenging weather conditions and contaminated runway Does not meet statutory conditions to retain full runway length when developing RSA; not prudent	Eliminated
RSA-5A2 Cooperating Agencies Alternative 2, Displace Thresholds with EMAS	No	Yes	Moderate $11.5 million	Eliminates need for fill and grade at runway ends Avoids acquisition of Refuge lands Minimizes environmental impacts Retains full capability on primary departure runway, including turning procedures	Imposes some additional weight restrictions on both runways Requires revisions to all RNP and public use approaches Some reduction in landing lengths, both runways Does not meet statutory conditions to retain full runway length when developing RSA; not prudent	Eliminated
RSA-5B Displace Rwy 08 Threshold and Construct Rwy 26 RSA	Yes	Yes	Low $6.1 million	Avoids acquisition of Refuge lands No impact to dike trail or access roads Retains full capability on primary departure runway, including turning procedures Retains Rwy 08 length with no additional weight restrictions Does not affect special use RNAV approach on Rwy 26 Would provide safety margin increase under challenging weather conditions and contaminated runway	Imposes relatively low additional weight restrictions on Rwy 26 Requires revisions to RNP and public use approaches on Rwy 08 Some reduction in landing lengths on both runways Does not meet statutory conditions to retain full runway length when developing RSA; not prudent	Eliminated
RSA-5C Displace 08 Threshold, Construct Additional 26 Runway and RSA	Yes	Yes	Moderate-High $14.7 million	Retains current runway lengths and operational capability Increased takeoff distance available on primary departure runway May increase payload capability for Rwy 26 Would provide safety margin increase under challenging weather conditions and contaminated runway	Requires acquisition of or access to Refuge land east of Airport Relatively greater fill of wetlands/habitat Requires revisions to all RNP and public use approaches, and special departure procedures Requires relocation of EVAR/Dike Trail and Duck Creek	Included

Table 2-5. Screening of Possible Runway Safety Area Alternatives, continued

Alternative	Meets RSA Standards	Feasible	Relative Cost to Construct[1]	Benefits	Drawbacks	Included or Eliminated?[2]
RSA-5D Relocate Runway 26 Threshold and Construct Additional Runway and Safety Areas	600-foot Undershoot, 1000-foot Overrun Protection	Yes	Moderate-High $15.1 million	Retains current runway lengths and operational capability May increase payload capability for Rwy 26, and/or slight reduction in decision altitude Would provide safety margin increase under challenging weather conditions and contaminated runway	Requires acquisition of or access to Refuge land west and east of Airport Relatively greater fill of wetlands/habitat Requires revisions to Rwy 26 RNP approaches and special departure procedures Requires relocation of EVAR/Dike Trail and Duck Creek Modifications to Mendenhall River channel	Included
RSA-5E:CBJ's Proposed Action Displace 08 Threshold 120 Feet, Construct Additional 26 Runway and RSA	600-foot Undershoot, 1000-foot Overrun Protection	Yes	Moderate-High $13.2 million	Retains current runway lengths and operational capability Increased takeoff distance available on primary departure runway May increase payload capability for Rwy 26 Would provide safety margin increase under challenging weather conditions and contaminated runway	Requires acquisition of or access to Refuge land west and east of Airport Relatively greater fill of wetlands/habitat Requires revisions to all RNP and public use approaches, and special departure procedures Requires relocation of EVAR/Dike Trail and Duck Creek	Included
RSA-6A EMAS with Declared Distances and Rwy 26 Extension	600-ft Undershoot, Equivalent Overrun using EMAS	Yes	Very High $23.1 million	Least impact to Refuge lands relative to other prudent alternatives Minimizes environmental impacts west of runway while meeting standards Would retain full capability on primary departure runway, including turning procedures Retains full runway lengths Would provide safety margin increase under challenging weather conditions and contaminated runway	Requires revisions to all Rwy 08 RNP and public use approaches Requires minor relocation of EVAR/Dike Trail Construction cost is high, and maintenance and replacement costs are high relative to standard RSAs; not prudent based on cost Requires acquisition of or access to Refuge habitat	Included
RSA-6B EMAS with Declared Distances/ and Rwy 08 Extension,	600-ft Undershoot, Equivalent Overrun using EMAS	Yes	Very High $25.8 million	Reduced environmental impacts to habitat east of runway while meeting standards Would retain full capability on primary departure runway, including turning procedures Retains full runway lengths Would provide safety margin increase under challenging weather conditions and contaminated runway	Requires revisions to Rwy 26 RNP approaches and special departure procedures Requires relocation of EVAR/Dike Trail and Duck Creek Construction cost is high, and maintenance and replacement costs are high relative to standard RSAs; not prudent based on cost Modifications to Mendenhall River channel	Included
RSA-6C Combined EMAS and RSA	600-ft Undershoot on Rwy 08, Equivalent Overrun using EMAS Full RSA on Rwy 26	Yes	High $20.3 million	Reduced environmental impacts to habitat relative to other standard RSA alternatives Would retain full capability on all runways, including retention of turning procedures on primary runway Retains full runway lengths No revisions to departure or arrival procedures required. Would provide safety margin increase under challenging weather conditions and contaminated runway	Requires relocation of EVAR/Dike Trail and Duck Creek Greater disturbance on east runway end and impacts to habitat, Refuge than other alternatives with two EMAS systems Construction cost is high, and maintenance and replacement costs are high relative to standard RSAs Modifications to Mendenhall River channel	Included

Table 2-5. Screening of Possible Runway Safety Area Alternatives, continued

Alternative	Meets RSA Standards	Feasible	Relative Cost to Construct[1]	Benefits	Drawbacks	Included or Eliminated?[2]
RSA-6D Threshold Displacement using Declared Distance Criteria with Option for EMAS	600-foot Undershoot, 1000-foot Overun Protection	Yes	Moderate $11.9 million	Reduced environmental impacts to habitat relative to other standard RSA alternatives No revisions to departure or arrival procedures required. Would provide safety margin increase under challenging weather conditions and contaminated runway Flexible design could incorporate EMAS for added safety margin and increased landing lengths for runways	Could impose minor additional weight restrictions on runways Small (<5%) reduction in landing lengths, both runways Does not meet statutory requirement to retain full runway length if Airport objects (however, accepted for analysis) Requires relocation of EVAR/Dike Trail and Duck Creek Modifications to Mendenhall River channel Minor revision to special departure turning procedures required	Included
RSA-8 No Action	No	Yes	None	Retains current runway lengths, threshold locations, and operational capability Preserves existing operational capability for all approaches and departures No environmental impacts	Does not achieve standard RSA on either runway end Does not meet purpose and need Does not increase or decrease current safety margin	Included[4]

[1] Costs relative to other RSA alternatives. Based on disturbance area and fill volume required, including development of lateral RSA, does not include compensatory mitigation or EMAS replacement costs. See Section 2.6 and Appendix A for detailed costs of alternatives carried through analysis.
[2] Included for detailed evaluation in the EIS or Eliminated from further consideration.
[3] Rwy 08 is the primary departure runway at JNU. An estimated 65% of all aircraft departing JNU use Rwy 08.
[4] Evaluation of the No Action Alternative is required by federal regulation.

In determining the possible significance of these impacts, FAA relied heavily on the operational history of the Airport, with respect to the critical aircraft (as described in Section 1.3.6), as well as review by Alaska Airlines and the operational analysis conducted by Naverus, Inc. (Appendix J). For example, approximately 65% of the operations at JNU (i.e., both landings and takeoffs) are conducted to the east, using Runway 08. It was therefore deemed necessary for each alternative carried forward to preserve the Lemon and Fox turning departure procedures or require only minor revisions, such as modification of Runway 26 waypoint, and if possible to result in minor, or no, additional weight restrictions on departures. Such weight restrictions have the potential to limit air service capacity at the Airport.

Two alternatives that preserve the Lemon and Fox departure procedures were eliminated from detailed analysis, for other reasons. The concept of RSAs constructed on piers structures at runway ends to reduce environmental impacts, as described for RSA-1A, is deemed impracticable because of the design challenges and extreme high cost, relative to other prudent and feasible alternatives. Design and construction of RSA-2C would incur severe engineering challenges presented by relocation of the Mendenhall River, very high construction costs relative to some other alternatives, and the most significant adverse environmental consequences. For these reasons, and because it would not offer operational benefits relative to the other alternatives, it was dropped from further consideration. To comply with recent federal legislation, some alternatives were dropped because they would shorten one or more runway operational lengths, even those that may have offered substantial environmental and/or cost advantages.

Late in 2006, after publication of the Draft EIS and while revisions were being completed to this Final EIS, Congress passed and the President signed Public Law 109-443 to the National Transportation Safety Bill. Portions of this law address the proposed runway safety area improvements at JNU, and provide explicit direction to FAA concerning which alternative is preferred for implementation. Specifically, P.L. 109-443 states that "…the Secretary of Transportation may only select as the preferred alternative the least expensive runway safety area alternative that meets the standards of the Federal Aviation Administration and that maintains the length of the runway as of the date of enactment of this Act." In determining the least expensive runway safety area alternative "…the Secretary shall consider, at a minimum, the initial development costs and life-cycle costs of the project."

Revisions to the FEIS included substantial review and update to many of the cost analyses (see Appendix A). Some alternatives incorporating EMAS were shown to have substantially greater construction and life-cycle costs than those alternatives using standard safety area construction. FAA considered eliminating the higher-cost EMAS alternatives from the full environmental analysis, since they clearly would not satisfy the statute's requirement to select the least expensive alternative. However, FAA also noted two other relevant factors. First, considerable effort had been expended responding to public and agency comments to develop alternatives that would reduce environmental impacts to the Refuge and nearby habitat. While the EMAS alternatives may be precluded from selection as the preferred alternative, FAA believes it is important to complete the administrative record documenting all efforts to reduce and minimize adverse environmental effect. Second, some agencies have suggested they would not be bound by a statute pertaining to the Department of Transportation when there are other, possibly contradictory statutes applicable. For example, the Clean Water Act requires the Corps of Engineers to select

the least environmentally damaging, practicable alternative with somewhat different direction from FAA's approach to project cost estimation. For these reasons, FAA has retained some EMAS alternatives for complete environmental analysis in the EIS.

Although agencies other than the FAA have suggested they would not be bound by a statute pertaining to the Department of Transportation (i.e., Public Law 109-443), FAA notes that because of this legislation, no other RSA alternative would be available to the Airport Sponsor since the Airport Sponsor cannot implement an alternative that FAA cannot approve. FAA not only provides funding for airport development but also must approve changes to the Airport Layout Plan (ALP) in order for the Sponsor to implement any projects that alter the ALP. P.L. 109-443 precludes the FAA approving an RSA alternative or associated changes to the ALP that is inconsistent with the mandates of the law. Therefore, the Airport Sponsor is limited to implementing the one alternative that FAA may select under P.L. 109-443.

The alternatives carried forward for thorough analysis of environmental consequences and described in greater detail in Section 2.6 are:

- RSA-1: Fill and Grade Existing Deficiencies
- RSA-5C: Displace Runway 08 Threshold and Construct Additional 26 Runway and Safety Area
- RSA-5D: Relocate Runway 26 Threshold and Construct Additional Runway and Safety Areas (CBJ's Proposed Action)
- RSA-5E: Displace Runway 08 Threshold 120 Feet and Construct Additional 26 Runway and Safety Area
- RSA-6A: EMAS Technology – EMAS with Declared Distances and Runway 26 Extension
- RSA-6B: EMAS Technology – EMAS with Declared Distances and Runway 08 Extension
- RSA-6C: EMAS Technology – Combined EMAS and Standard Runway Safety Area
- RSA-6D: Threshold Displacement using Declared Distance Criteria with Option for EMAS
- RSA-8: No Action

2.3 NAVIGATIONAL ALIGNMENT

Section 1.3.2 identified the navigational aids that assist with aircraft course guidance and approach alignment at JNU. The current public published approach during good and poor weather at JNU is from the west to Runway 08. Runway 08 is served by a medium-intensity approach lighting system with runway alignment indicator lights (MALSR), the most sophisticated approach lighting system available for that runway. Until recently, when the special procedures were established, no approaches occurred to Runway 26 during poor weather, due to existing terrain and vegetation in the vicinity of the Airport. However, Alaska Airlines now uses a RNAV approach to Runway 26 when visibility is as low as 1 mile and the ceiling is as low as 337 feet. The RNAV approach procedure to Runway 08 is also at a 1-mile visibility, with a higher ceiling of

724 feet. While the special approach procedures enable the pilot to gain electronic guidance to the runways during poor weather, the Runway 08 MALSR provides the pilot with an enhanced visual confirmation of the alignment required for landings from the west. The lead-in lights also provide visual guidance for all aircraft during nighttime approaches to Runway 08. Although the RNAV approach to Runway 26 allows lower minimums, there are no sophisticated approach lights to Runway 26 to provide the visual guidance during use of special approach procedures or at night.

There are two general types of navigational systems that could improve pilot alignment with the runway at night and during poor weather. Taken alone or in combination with other systems, there is a range of technologies within these two navigational systems types that would be available to meet the need for additional navigational alignment at JNU.

On-the-ground visual landing aids generally consist of enhanced lighting systems that assist the pilot with runway alignment on approach. They include the following:

- Approach lighting with sequential flashers (ALSF) consists of high-intensity lights that are required to support Category II and III precision approaches.[11] Lighting based on this technology extends 2,400 feet off the runway approach end.
- Medium intensity approach light system (MALS) consists of medium-intensity lights extending a distance of 1,400 feet from the runway end that enhance non-precision and nighttime visual approaches. This technology, without runway alignment indicator lights, does not facilitate precision approaches during poor weather and is therefore not considered as a stand-alone alternative.
- Medium intensity approach light system with runway alignment indicator lights (MALSR) consists of medium-intensity lights that extend 2,400 feet away from the approach end of the runway and support Category I precision approaches[12].
- Omni directional approach lighting system (ODALS) is installed on a runway with a non-precision approach or on a runway that is difficult to identify due to an excessive number of other lights in the area. This situation does not occur at JNU, and therefore this technology is not applicable.

In-the-cockpit navigational aids are procedures and technology available to the pilot to enable alignment of the aircraft on approach to a runway, but without use of additional lighting. These include:

- Microwave landing system (MLS) serves as an instrument and approach landing system that operates on microwave frequencies. While this technology was once state-of-the-art, it was surpassed by GPS technology and as a result is no longer being advocated by FAA for installation.

11. The weather designated capability of the landing system that provides acceptable guidance information to the pilot capable of supporting a landing minimum of 100 feet decision height and 1,200 feet runway visual range, the length down the runway visible to the pilot.
12. Supporting landing minima of 200 feet decision height and 1,800 feet runway visual range.

- Global positioning system (GPS) and/or flight management system (FMS) consist of instrumentation in the cockpit that uses satellite communication technology to ensure the precise position of the aircraft on approach or departure. This technology requires all aircraft using GPS/FMS procedures to be equipped with the appropriate technology and cockpit crews to be trained in its use. Alaska Airlines has so equipped all of their 737-400 series aircraft operating at JNU with such technology, and thus, has approval to use the RNAV approach procedures to Runways 08 and 26.

Based on this review of available and applicable technologies, the following possible alternatives were considered to meet the need for improved navigational alignment.

2.3.1 NAV-1: EQUIP AIRCRAFT WITH GPS/FMS TO ENABLE USE OF RNPS

While it may be desirable to have all aircraft equipped with state-of-the-art technology, the costs for such equipment, ranging from $15,000 to $50,000 depending on the aircraft type, is prohibitive. FAA does not have the authority to require operators to purchase and use GPS. Further, equipping each aircraft with such technology requires an equal commitment by the aircraft operator (including small, single engine private aircraft, as well as commercial operators and carriers) to train their cockpit crew. While use of the special approach procedures facilitates alignment with both runways, the full benefit of these procedures can only be gained on Runway 08 approach, because of the availability of the MALSR on that runway end. The need for enhanced visual alignment, particularly during nighttime operations, would not be met. For these reasons, and because its cost is substantially more than other alternatives and the ability of FAA or an Airport to enforce such a cost on private aviation is dubious, this alternative is considered not prudent and not feasible. It is eliminated from detailed environmental analysis

2.3.2 NAV-2: INSTALLATION OF APPROACH LIGHTING ON RUNWAY 26

Two specific, somewhat similar alternatives using on-the-ground navigational aids are available to enhance visual alignment at night and during poor weather conditions. These are described below.

2.3.2.1 NAV-2A APPROACH LIGHTING WITH SEQUENTIAL FLASHERS (ALSF)

An ALSF would improve operating conditions at JNU by enhancing pilot recognition and alignment on the runway during conditions of reduced visibility due to poor weather and at night. However, airports that have installed ALSF technology have done so in conjunction with criteria requirements to support Category II or III instrument approach capabilities. At JNU, surrounding terrain and existing vegetation are likely to preclude the implementation of Category II or III instrument approaches to either end of the runway; therefore, the full benefit of an ALSF would not be realized. In other words, the ALSF provides a greater degree of navigational performance than JNU can support. Relative to the MALSR system considered in Alternative NAV-2B, the ALSF also requires a greater construction and operational disturbance, and therefore entails greater environmental impact that does Alternative NAV-2B. The cost of an ALSF is approximately $2.5 million, including equipment and installation.

Because other alternatives considered for navigational alignment meet purpose and need more proportionately and less expensively, and because this alternative would result in a higher level of environmental impact relative to other alternatives, it is considered not prudent. Alternative NAV-2A is eliminated from detailed environmental analysis.

2.3.2.2 NAV-2B Medium Intensity Approach Light System with Runway Alignment Indicator Lights (MALSR)

A MALSR would improve operating parameters at JNU by enabling visual alignment with Runway 26 for all aircraft at night and during poor weather. The MALSR would provide a 1/4-mile lighting credit for the Runway 26 precision approach, allowing Alaska Airlines minimums to be reduced to 3/4 mile from the current 1-mile minimum. This would result in an estimated 17.5 additional hours of access per year that is otherwise precluded by weather conditions, thus reducing flight delays. The MALSR would also result in much easier alignment for all aircraft approaching JNU from the east at night. The cost of a MALSR is approximately $1.5 million, including equipment and installation (and construction of an access road for equipment operation and maintenance).

This alternative meets the purpose and need described for navigational alignment. Based on the estimated cost to install a MALSR on Runway 26, and the demonstrated ability of the technology to satisfy the need, it is considered both prudent and feasible. Alternative NAV-2B is carried forward for detailed environmental analysis.

2.3.3 NAV-3: No Action Alternative

This alternative would leave the current runway alignment systems unchanged. As a result, no operational improvements would be available or implemented to assist in nighttime approaches, or with poor weather and instrument approaches to Runway 26. As a result, the frequency of flight delays at JNU would continue unchanged. In accordance with CEQ regulations, this alternative is carried forward for detailed environmental analysis.

2.3.4 Summary of Navigational Alignment Alternatives

The possible alternatives to improve pilot alignment with the runway at night and during poor weather conditions were evaluated for technical feasibility, relative cost, environmental impact and ability to meet purpose and need. Table 2-6 summarizes the results of the initial screening. The use of ALSF technology would meet objectives, but at a higher cost and with greater construction-related environmental impact than other technology. Because the MALSR would provide a comparable level of service with lower cost and lesser environmental impacts, Alternative NAV-2A (the ALSF) was dropped from detailed evaluation. Alternative NAV-1, incorporating GPS/FMS technology, would not meet the need to improve runway alignment at night. This alternative is also not prudent or feasible, because of the high costs and inability to enforce system installation and crew training for all aircraft using JNU.

Table 2-6. Screening of Navigational Alignment Alternatives

Alternative	Feasible	Relative Cost[2]	Benefits	Drawbacks	Included or Eliminated?[1]
NAV-1 Equip aircraft with GPS/FMS to enable use of RNPs	No	Extremely high ~$7.5 million[3]	Provides the greatest precision for approach and departure procedures	Technology not in use by all users and would require training commitment High cost to equip all aircraft with systems Would require installation of additional lighting on Rwy 26 for visual guidance Not prudent or feasible, doesn't meet need	Eliminated
NAV-2A Installation of an ALSF for Runway 26	Yes	Moderate to High ~2.5 million	Provides the greatest degree of visual alignment Assists in pilot alignment during poor weather conditions Meets purpose and need	Full capabilities would not be achievable in JNU due to terrain and vegetation. High cost with no advantage over NAV-2B Impacts to wetland/habitat to install and service technology Encroach on Refuge east of Airport	Eliminated
NAV-2B Installation of a MALSR for Runway 26	Yes	Moderate ~1.5 million	Provides high degree of visual alignment Cost effective relative to ALSF Meets purpose and need Less visual disruption, and smaller environmental footprint than ALSF	Impacts to wetland/habitat to install and service technology Encroach on Refuge east of Airport	Included
NAV-3 No Action	Yes	None	No environmental impacts No encroachment on Refuge	Does not meet purpose and need to improve pilot alignment with runway at night and during poor weather conditions	Included[4]

[1] Included for detailed evaluation in the EIS or Eliminated from further consideration.
[2] Cost relative to other alternatives.
[3] Assumptions: $25,000/plane installation, 300 based planes at JNU (training costs not included)
[4] Evaluation of the No Action Alternative is required by federal regulation.

Of the FAA-sanctioned technologies available, installation of a MALSR is the only prudent and feasible alternative for achieving the stated need on Runway 26. Figure 2-17 illustrates a possible MALSR configuration off the Runway 26 end, starting at the existing landing threshold. This alternative and the No Action Alternative, NAV-3, are carried forward for detailed analysis.

2.4 AIRPORT FACILITIES DEVELOPMENT

Chapter 1, Section 1.4.3 described the current and reasonably foreseeable future needs for snow removal resources, aircraft parking and storage, and access to and from the fuel farm. The following sections identify possible alternatives to address each of those needs.

2.4.1 SNOW REMOVAL RESOURCE ALTERNATIVES

The following discussions of sites for a snow removal equipment and maintenance facility (SREF) assume the following:

- a consistent building footprint of 44,616 square feet (ft^2),
- a separate, 12,000-square-foot building for sand storage, and
- a total facility area of about 6.7 acres[13].

The cost of the facility would vary, depending on the site selected, grading requirements, parking requirements, access road construction, and other factors. However, based on estimates prepared by the Airport, the cost for development of a site and facility construction is expected to range from approximately $12.0 to $17.0 million. Figure 2-18 illustrates the possible locations for the SREF.

2.4.1.1 SREF-1: NORTHWEST END OF AIRPORT

Two alternatives were identified to address the SREF requirements in the area west of the main terminal (i.e., in the proposed Northwest Development Area): a site north of Duck Creek (SREF-1A), and a site available after the relocation of Duck Creek (SREF-1B). The alternatives are described below.

SREF-1A. Located at Radcliffe Road and the northern Airport boundary, this alternative includes the most westerly site of land available to develop a new SREF. A bridge would have to be constructed at Duck Creek for vehicle and equipment access. Adequate land is available in this area to develop the requisite facilities. However, this site would block the relocation of Duck Creek if needed to satisfy objectives for aviation facility development (see Section 2.4.2) and reduction of wildlife hazards (see Section 2.5).

13. For convenience, SREF is used when referring to the combined snow removal equipment and maintenance facility, and sand storage shed. Size estimates are based on conceptual design report for SREF developed by USKH for CBJ, 2004.

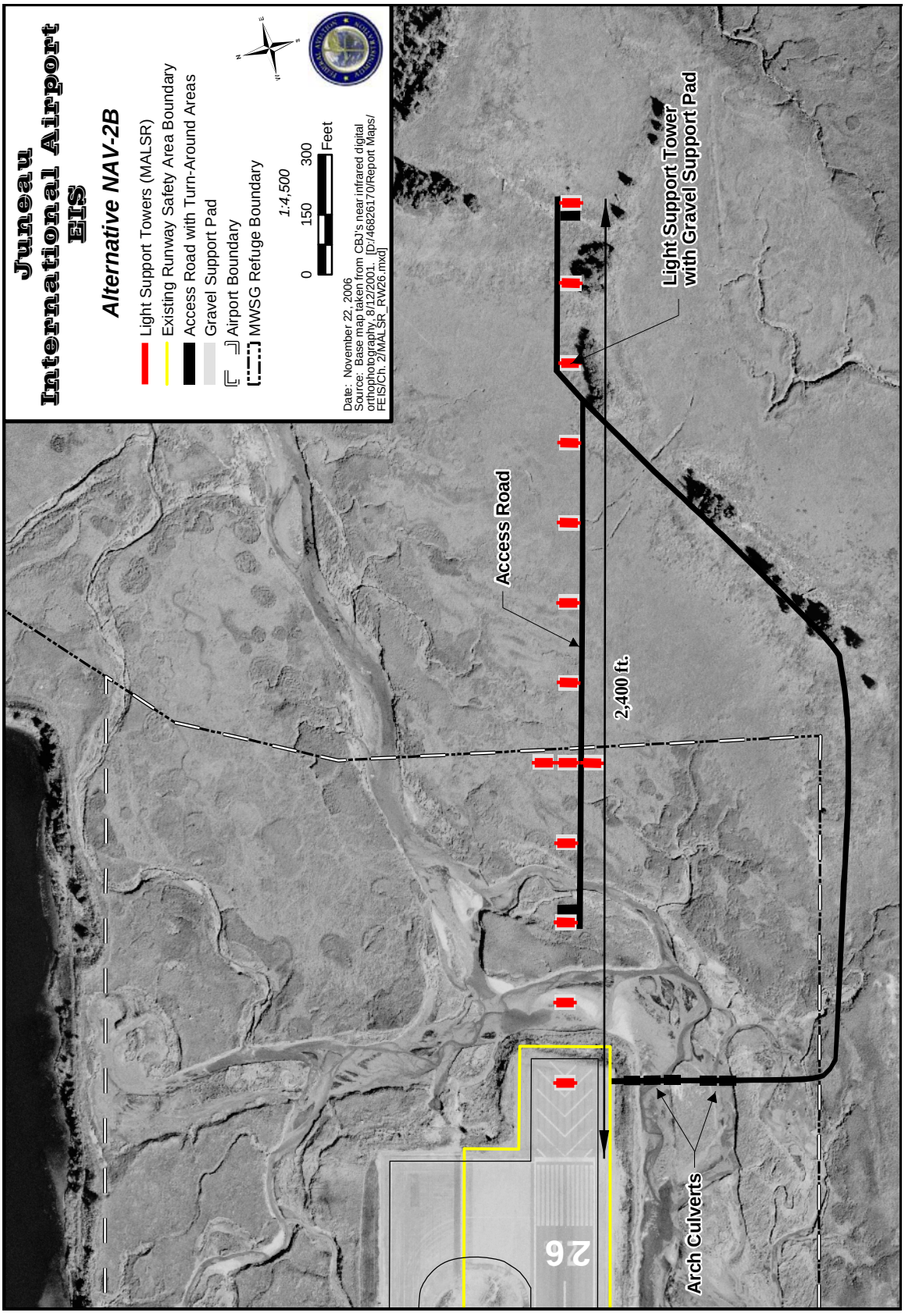

Figure 2-17. Installation of MALSR on Runway 26 (using RSA-8 as an example).

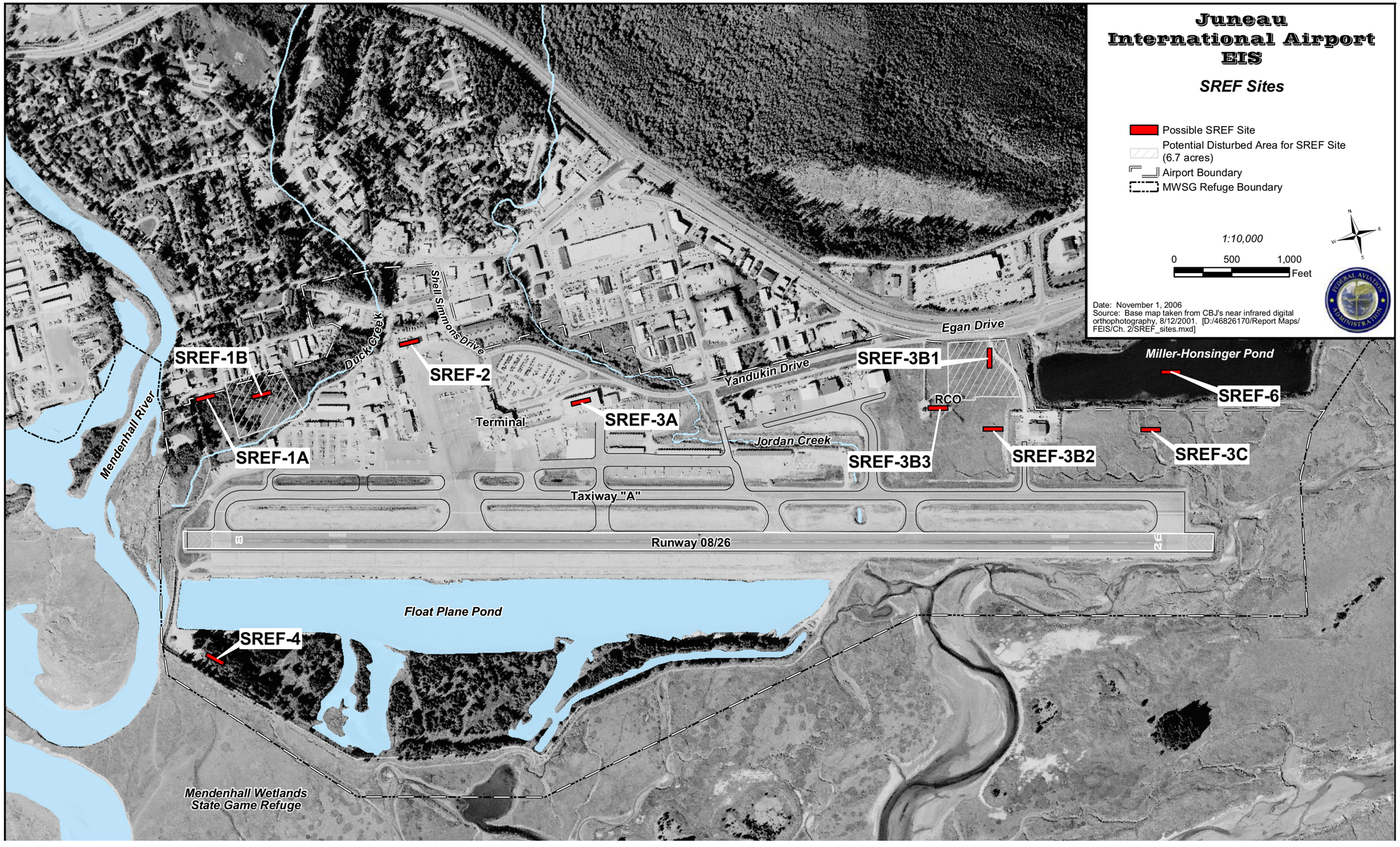

Figure 2-18. Alternative locations for SREF.

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As a consequence, SREF-1A is deemed not prudent because it would reduce the viability and operational efficiency of other aviation facilities. Therefore, this alternative is eliminated from detailed environmental analysis.

SREF-1B. To enable the relocation of Duck Creek, potentially needed for aviation facility development and/or to reduce wildlife hazards, a site on the east and south bank of the relocated creek was identified. This site is a few hundred feet east of the SREF-1A location, described above. Sufficient land exists to accommodate the facility. The estimated cost to develop this site could be greater than for other comparable areas, since a road may have to be cleared from the apron to the new building (if the SREF were approved without other airfield development in this area). Although locating the SREF here would allow development of other facilities in the immediate area, ironically, it would also somewhat limit that development as well. The site would have to be sufficiently distant from the north Airport boundary to allow relocation of the creek and accommodate the required stream setbacks. These buffers, combined with the parking and turnaround requirements for large snow removal equipment, would limit the number of hangars or other facilities constructed in the northwest Airport area.

Placing a SREF at this site would cause only minor operational or developmental complications. This alternative is otherwise deemed both prudent and feasible; therefore, it is carried forward for detailed environmental analysis.

2.4.1.2 SREF-2: EXISTING SREF AREA

Within this alternative, two primary sub-options were identified for development of the needed SREF at the existing facility site: expansion and renovation of the existing facility, or development of a new facility on the site of (or in the immediate vicinity of) the current SREF. However, a number of design and operational deficiencies are readily apparent:

1. The building conflicts with existing ramp and aircraft parking/storage due to heavy equipment travel on taxiways and proximity to parked or taxiing aircraft.
2. The existing SREF was originally constructed in the 1940's to house firefighting trucks. Because it was not designed as an SREF or maintenance facility, it lacks a number of needed elements, such as:
    a. A location for welding, painting, and major equipment repairs.
    b. An outside water access.
    c. A wash-down bay.
    d. A ventilation system to remove fumes, particularly ammonia vapors that build up throughout the shop during winter.
    e. An internal sprinkler system.
    f. Adequate lighting for maintenance activities.
    g. An area for chemical containment.

3. There is not enough space available for the SREF, including the sand storage building, without eliminating approximately 5 acres worth of apron and aircraft storage; therefore, expansion would conflict with other demonstrated Airport needs.

In addition, the presence of an SREF within the aircraft movement area used for commuter and air taxi operations presents a safety concern. Large, heavy snow removal vehicles are cumbersome and challenging to operate. A facility of this type is best located adjacent to a connecting taxiway so that travel through apron areas is minimized except for snow removal operations.

Because of the space limitations, and impact on other Airport facilities and operations, it is neither prudent nor feasible to build a new SREF at the existing site or expand and renovate the existing building. This alternative is eliminated from detailed environmental consideration.

2.4.1.3 SREF-3: EAST OF MAIN TERMINAL SITES

At JNU, the greatest amount of currently undeveloped land is located east of the main terminal. Five sites east of the main terminal were identified as possible locations for the SREF.

Location SREF-3A. The current sand shed is located east of the Main Terminal, south of Yandukin Drive next to Loken Aviation. Consideration was given to development of the SREF site at this site, particularly because the existing sand storage hangar is in poor condition and will need to be torn down in the near future: it is rusted, the steel supports are structurally deficient, the electrical system is failing, and the roof is falling in and leaks. However, this site has limited available, undeveloped land and construction of the SREF here would limit any possibility of future Main Terminal expansion to the east, require the acquisition and relocation of Loken Aviation, and place additional surface vehicle traffic in an already congested location. The estimated cost of this alternative is higher than for most alternatives because of the facility acquisition and relocation costs for Loken Aviation and other tenants.

This site is not feasible for SREF development because of the limited land availability. In addition, it is not prudent because of its constraint on other reasonably foreseeable Airport development (terminal expansion) and relocation of a tenant with a long-term lease. This alternative is eliminated from detailed environmental consideration.

Location SREF-3B. Three sites were identified south of Yandukin Drive, west of Maplesden Road as possible SREF sites:

- SREF-3B1, the first site, is located immediately south of Yandukin Drive. This site would not affect any planned Airport development. While minor operational conflicts could arise between snow vehicles and aircraft, the helicopters operating in this area are typically less active during winter when snow removal operations are conducted. Adequate spacing exists in this area for both large jet aircraft using the main terminal and for aircraft taxiing to and from the runway system. Conflicts between snow removal equipment and aircraft would be minimized by developing separate service roads from the taxiway system. Maplesden Way, the short access road to TEMSCO located on the Airport, would need to be re-routed. This alter-

native is the Proposed Action, selected by CBJ after considerable deliberation and evaluation during the Master Planning process. According to CBJ, this site provided the best compromise between Airport development, cost, environmental and other factors.

- SREF-3B2 is located south of the SREF-3B1 site in close proximity to Taxiway A and Taxiway F-1, and adjacent to the TEMSCO property. While access to the site from the airfield is better than SREF-3B1 or possibly from any other location, it would adversely affect expansion of the existing fixed based aviation operation and preclude development of a new access taxiway. For example, TEMSCO has already identified this location as the preferred lot for expansion of their operations if the area is approved for development. Because placing a SREF at this site would cause major developmental complications, this alternative is deemed not prudent; it is eliminated from detailed environmental analysis.
- SREF-3B3 would be located where the remote communications outlet (RCO), automated surface observation system (ASOS), and other FAA equipment are currently positioned, requiring their removal to another location. This site was suggested by the Corps in reviewing options for the SREF, on the grounds that it would be located on uplands, and not require as much wetland fill as other alternatives. The major disadvantage of this site is it would preclude efficient development of other facilities for a large portion of the northeast Airport area, due to the need for an access road to the SREF for employees and vendors delivering supplies, sand, chemicals, and equipment. An access to the main taxiway would also have to be constructed.

FAA recognizes the desire and need to prefer sites that would not impact wetlands and habitat. However, when taxiway access is taken into account, and considering that wetlands at this site cover an area equal to or greater than site SREF-3B1, this site's net impact to wetlands could be as much or more than for other alternatives, including SREF-3B1. Because SREF-3B3 has no known operational or developmental advantages over SREF-3B1 and, in fact, would result in conflicts with other Airport development needs and potentially a greater adverse environmental impact, it is eliminated from detailed environmental analysis.

Location SREF-3C. Another site was identified at the east end of the Airport. CBJ identified this site as having the greatest operational and long-term planning benefits. Because of its remote location, it would not compete with other users for access to the airfield. However, this location would require construction of new roads (to access the facility from on- and off-Airport, as well as the airfield). Also, the large distance between the site and much of the runway and taxiway system would degrade snow removal efficiency. This area is also within tidal habitat and estuarine wetlands. The Master Plan estimated this alternative would cost approximately 30% to 40% more than other sites. Finally, this location has been independently selected by the National Weather Service as the best site for an ASOS, if development in the Northeast Development Area necessitates relocation of this equipment.

This alternative is deemed not prudent because the distance between the site and much of the runway and taxiway system would degrade snow removal efficiency, and it would conflict with needed relocation of the ASOS. Furthermore, this site location within tidal habitat and estuarine wetlands would result in greater environmental impacts than for other alternatives, including SREF-3B1. For these reasons, this alternative is eliminated from detailed environmental analysis.

2.4.1.4 SREF-4: SOUTH OF RUNWAY SITE

The Master Plan also identified a site south of the runway and near the west end of the Airport. This site would provide good access to and from the runways, and it would not impede most other Airport development, although it could conflict with a future second runway as identified in the last Master Plan update. Because of its distance, and the need for snow removal equipment to cross the runway to access the substantial majority of the Airport, potential conflicts between aircraft operations and ground vehicles would increase and counter FAA's safety initiatives to reduce runway incursions. There could be delays as well in conducting snow removal activities (due to the need to coordinate crossings with aircraft on approach or departure from the Airport).

This alternative is deemed not prudent because of the potential operational and safety conflicts, and the resulting delays in snow removal response and reductions in snow removal efficiency. Alternative SREF-4 is eliminated from detailed consideration.

2.4.1.5 SREF-5: NO ACTION ALTERNATIVE

This alternative would require retaining the current SREF at its present site, in its present condition. Some snow removal equipment and maintenance operations would remain outside. Without the added space to accommodate existing and future equipment, CBJ would continue to experience increased maintenance costs and decreased life expectancy of the snow removal equipment. As a result, delays in responding to snow and ice conditions would continue and would likely increase in the future. Under this alternative, FAA's participation in future equipment acquisition may be jeopardized. Nonetheless, as required by NEPA, this alternative is carried forward for detailed environmental analysis.

2.4.1.6 SREF-6: MILLER-HONSINGER POND

The privately owned Miller-Honsinger Pond is located east of the Airport, and some agencies suggested that it should be considered for Airport use in developing the SREF and other facilities. An advantage of this alternative is that it would require filling the pond, which currently presents a potential aviation hazard due to bird movement across the runway from the Float Plane Pond. The numbers of waterfowl crossing the east runway end would likely decrease without the surface water attraction of the pond.

However, this alternative presents difficult operational constraints. The pond is remote from the rest of the existing Airport infrastructure and would require more time to access main facilities. This area is also outside of the established operational areas designated for Airport aviation.

A connecting taxiway would also have to be constructed to join Taxiway A. Previous discussions between the Airport and pond owners indicate it would be expensive to purchase, particularly since the gravel on site could increase the property value. The agencies originally suggested use of the pond on the grounds that it would make sense to reclaim a borrow pit, which was the pond's original use, as opposed to filling high-value wetlands and/or relocating Duck Creek. However, fill of the pond and development of a taxiway would also affect hydrology in the intertidal estuarine emergent wetlands to the south and it

is unlikely there would be any net environmental benefit when compared to other alternatives. Finally, the pond and surrounding property are zoned for Rural Reserve and a change in land-use designation would be required.

The alternative is not carried forward for detailed analysis, as a number of reasons render it not prudent. The remote location would cause snow removal response delays, degrading existing operational efficiency. The site would be expensive to purchase, and since there is suitable, available land for the SREF within Airport property it is not necessary to increase the Airport holdings. There would be no expected environmental benefit from this alternative, particularly because of the need to develop a new taxiway solely for snow removal equipment access to the Airport and runway.

2.4.1.7 SUMMARY OF SREF ALTERNATIVES

The possible alternatives for construction of a new SREF and maintenance facility were evaluated for technical feasibility, particularly in consideration of other needed Airport developments, relative cost, possible environment benefits or drawbacks, and ability to meet purpose and need. Other important considerations for this action include impacts on snow-removal response and capability, and whether a site would impede efficient development of other facilities. Table 2-7 summarizes the results of the initial screening.

Only two of the sites considered for the SREF are not feasible, either because of the presence of other Airport buildings within the needed development footprint, or a lack of development space without significant operational impacts on other Airport tenants and facilities. However, some alternatives were considered not prudent, typically because a number of factors including remote location and degradation of snow removal operations, and possible conflicts with aviation operations.

To reduce them to a reasonable range for detailed evaluation in the EIS, the FAA relied heavily on those sites that would have the least impact on existing or planned aviation developments, while still providing adequate access to the airfield with little potential for conflict with aircraft movements. As a result, two alternatives were selected for detailed evaluation of environmental impacts: SREF-1B, West End of Airport and East of a Relocated Duck Creek, and SREF-3B1, South of Yandukin Drive. Both of these sites are shown on Figure 2-18.

2.4.2 AVIATION FACILITIES

Sections 1.3.3.3, 1.4.3.3, and Table 1-2 illustrated the existing demands, projected future needs, and the net spatial and storage deficiencies for fixed wing and rotary wing aircraft. As is evident from the Chapter 1 discussion, future expansion of aviation facilities at JNU will be demand-driven throughout the specified planning period. FAA's long experience facilitating civil aviation and Airport service suggests that it is imperative to plan and develop the limited amount of available Airport property as efficiently as possible. Based on the airfield facility development objectives identified in Chapter 1 and the demonstrated existing aviation needs, combined with the forecast needs through the year 2015, a number of possible initial alternatives were developed. Areas for potential development are shown in Figure 2-19.

Initial efforts to develop alternatives distinguished between fixed wing facilities and rotary wing facilities, with the possibility of achieving complete separation of the two in accordance with desirable Airport layout principals. However, it was unclear how much space would be required to accommodate the existing and forecast aviation demand. It was later determined through the planning and forecast validation efforts that neither of the two main undeveloped lands on the Airport (known as the Northeast Development Area and Northwest Development Area) could provide sufficient space to accommodate forecast demand. The alternatives described in the following sections were those initially considered.

One other important function of the apron space needed to be factored into facility planning. During winter months large volumes of snow accumulate in "storage" areas. Because of the crowded airfield condition these storage locations are not permanent, but shift according to immediate Airport needs for parking and other uses. Environmental concerns have arisen when snow, with sediment and salts from deicing operations, has been stored adjacent to or even plowed into Jordan Creek and Duck Creek. It would be most desirable to designate snow storage locations, which could be developed with appropriate surface water capture, drainage, and if necessary treatment systems. It has been estimated by JNU that approximately 5% of the apron/facilities space should be dedicated to snow storage to preclude operational conflicts and environmental problems (Stone 2004a).

2.4.2.1 FW-1: NORTHWEST END OF AIRPORT

Land west of Alex Holden Way (which provides access to existing T-hangars) on the northwest side of the airfield could be used to provide additional executive and T-hangars and a tiedown ramp for Juneau-based aircraft. This area is west of the existing T-hangars, in the vicinity of the Civil Air Patrol and near Duck Creek.

To provide adequate land to develop the needed facilities, Duck Creek would require relocation to the northern and western perimeter of Airport property, and the Float Plane Pond access road would likely be realigned to improve airfield efficiency and safety. Approximately ¾ mile of Duck Creek would require location northward by as much as 600 feet from its present location. The Master Plan suggests that a natural buffer could be created as part of the Duck Creek relocation, and conversations with staff from CBJ and cooperating agencies confirm this would be required. All of the Juneau-based, fixed wing aircraft needs could be met in this location, but there would be no room for commercial operations or rotary aircraft. The buffer requirements for Duck Creek, space required for relocation of the emergency vehicle access road, and potential presence of a new SREF (SREF-1B) would constrain the development opportunity and design efficiency. This area would not accommodate all of the existing and forecast aviation demand. As a result, this alternative is not feasible and eliminated from detailed environmental consideration. However, the Northwest Development Area is incorporated into later alternatives that do meet the purpose and need for aviation facilities.

Table 2-7. Screening of Snow Removal Equipment and Maintenance Facility Alternatives

Alternative	Feasible	Relative Cost[1]	Benefits	Drawbacks	Included or Eliminated?[2]
SREF-1A Most Westerly Site	Yes	Moderate	No existing operational conflicts	Blocks Duck Creek relocation Requires bridging of Duck Creek Would impede development of new general aviation facilities and/or aircraft parking Impacts to habitat/wetlands	Eliminated
SREF-1B East Bank of Relocated Duck Creek	Yes	High	Would accommodate Duck Creek relocation	Would impede some development of new aviation facilities and/or aircraft parking Cost increase if Duck Creek relocation expense incorporated Impacts to habitat/wetlands	Included
SREF-2 Existing SREF and Maintenance Bldg	No	Moderate	Reduces environmental impacts by limiting proposed development on other Airport areas	Insufficient space available for new SREF and the necessary parking and turnarounds Would result in relocation of other tenants Existing building not adequate or suitable Not feasible or prudent, conflicts with other aviation facility needs	Eliminated
SREF-3A Current Sand Shed Site east of Main Terminal	No	Moderate	Reduces environmental impacts by limiting proposed development on other Airport areas Preserves options for future Airport development	Insufficient space available for all facilities without relocation of tenants May preclude future expansion of other facilities, including terminal Existing building not adequate or suitable Increased vehicular traffic in congested area Not feasible or prudent, conflicts with other aviation facility needs	Eliminated
SREF-3B1 South of Yandukin Drive, east of Main Terminal	Yes	Moderate	Would not impede current Airport needs or proposed future development Relatively easy access to runway	Extension and re-route of Livingston Way required Some, relatively minor conflicts between snow removal vehicles and aircraft Impacts to wetlands/habitat	Included
SREF-3B2 Adjacent to TEMSCO, east of Main Terminal	Yes	Moderate	Optimum access to airfield compared to other sites	Would impede proposed expansion of existing tenant's operations (TEMSCO) Impacts to wetlands/habitat	Eliminated
SREF-3B3 Existing RCO and ASOS Site	Yes	Moderate	May reduce impacts to high value wetlands/habitat Relatively easy access to runway	SREF placement in the middle of the Northeast Airport Area would prevent an efficient facility layout for hangars and fixed base/commercial operations. Some, relatively minor conflicts between snow vehicles and aircraft	Eliminated
SREF-3C Furthest East Site	Yes	Very High	Remote site ensures no conflict with aircraft or vehicular traffic Allows maximum development of northeast airport area	Remote location results in slower response to high priority airfield area New access road and taxiway required in undeveloped area Conflicts with optimal site for relocated ASOS Impacts to wetlands/habitat Indirect effects on Refuge	Eliminated

Table 2-7. Screening of Snow Removal Equipment and Maintenance Facility Alternatives, continued

Alternative	Feasible	Relative Cost[1]	Benefits	Drawbacks	Included or Eliminated?[2]
SREF-4 South of Runway	Yes	Moderate	Good access to and from runways (highest priorities for snow removal) Would not impede current Airport needs or proposed future development	Long distance from some airfield areas Potential safety concerns related to frequent crossing of runways Increased potential conflict between aircraft operations and snow removal activities contrary to FAA's safety initiative to reduce runway incursions Impacts to habitat/wetlands Other environmental impacts, re: trail users	Eliminated
SREF-5 No Action[3]	Yes	None	No environmental impacts No capital cost expenditures	Does not meet purpose and need Increased operating costs expected due to inefficient operations, increased equipment breakdown and repair, etc. Increased delays in snow removal capability and response	Included[3]
SREF-6 Miller-Honsinger Pond	Yes	Very High	Remote site ensures no conflict with aircraft or vehicular traffic Allows maximum development of northeast airport area	Remote location results in slower response to high priority airfield area New access road and taxiway required in undeveloped area Impacts to wetlands/habitat Private property, very expensive if available High cost and potentially impact to fill pond	Eliminated

[1] Cost relative to other alternatives. It is expected that the cost to construct a SREF could vary, depending on the alternative considered, from about $12 to $17 million. The difference would be due primarily to site development costs.
[2] *Included* for detailed evaluation in the EIS or *Eliminated* from further consideration.
[3] Evaluation of the No Action Alternative is required by federal regulation.

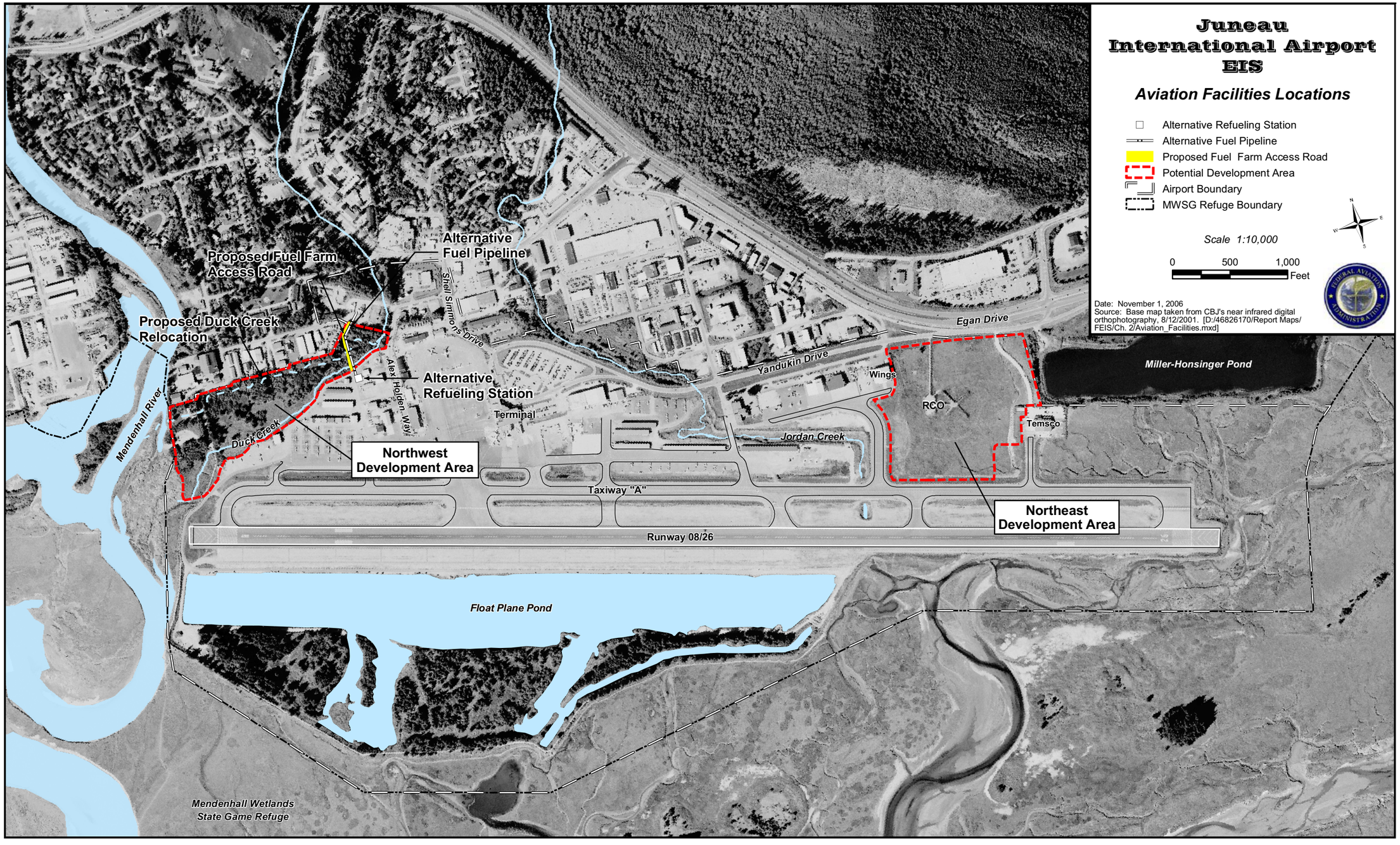

Figure 2-19. Alternative locations for aviation facilities.

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2.4.2.2 RW-1: NORTHEAST END OF AIRPORT

CBJ identified a specific, approximately 37-acre parcel of land as suitable for development of new aviation facilities, particularly fixed-based operators and commercial operations. This large parcel is south of Yandukin and Egan Drives, and immediately west of the Miller-Honsinger pond and TEMSCO. Currently, the RCO, ASOS and other FAA equipment are located here and most of their equipment would have to be relocated. Initial plans developed for the EIS suggest this area could accommodate most of the existing and future aviation demand, except for two constraints. First, the site is also suitable for a new SREF. CBJ has proposed that approximately 6.7 acres in the northeast portion of the parcel be used for this purpose. Second, about 4 acres along the southern portion of the parcel are within the building restriction zone, so they could only be used for aircraft tiedowns. Because of the space necessary for access roads and a new taxiway, the aerial limitations imposed by the building restriction zone, and the facility planning limitations to separate aircraft types, there would be insufficient space in this area to accommodate all of the existing and forecast aviation demand. As a result, and with or without construction of a new SREF in this area, this alternative is not feasible and is eliminated from detailed environmental consideration. However, the Northeast Development Area is incorporated into later alternatives that do meet the purpose and need for aviation facilities.

2.4.2.3 FW/RW-1: FULL DEVELOPMENT OF NORTHEAST AND NORTHWEST DEVELOPMENT AREAS WITHOUT DUCK CREEK RELOCATION

As was noted in the previous two alternatives, not all of the aviation facilities can be accommodated in a consolidated fashion in either the northeast or Northwest Development Areas. Therefore, consideration was given to development in both parcels, while meeting all of the planning/development objectives previously stated (e.g., separation of aircraft types, fixed base and commercial operations in one area, private aircraft in another, etc). Because a substantial portion of fixed wing aircraft uses occur on the west portion of the Airport, the Master Plan recommended that additional fixed wing aircraft parking for based aircraft occur on the northwest area along with new T-hangars and executive hangars. Fixed-based operators and other commercial tenants (such as TEMSCO, Wings, National Guard, Coastal, etc.) would, to the extent practicable, be concentrated in the Northeast Development Area. This alternative would require relocation of the EVAR/Dike Trail and trail parking access. Bridges would have to be constructed to cross Duck Creek in two locations for aircraft and vehicles to access and exit the area.

If selected, this alternative could accommodate either SREF alternative (i.e., sited in the Northeast or Northwest Development Areas). Most of Duck Creek would remain in its existing location. Although the stretch of Duck Creek from the EVAR/Dike Trail crossing (at Radcliffe Road) to the Mendenhall River could be relocated as a separate action related to wildlife hazard management, any minor changes to the Duck Creek alignment that might influence the implementation of this alternative would be related to wildlife hazard management. The SREF could be located into this design, but it would limit space for aviation facilities and disrupt efficient operational flow of aircraft by transecting apron connecting hangars to taxiways.

With minor developmental and/or operational complications, this alternative would meet the existing and forecasted demands for space and aviation facilities as well as meet the facility development objectives. Therefore, it is carried forward for detailed environmental analysis.

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

This alternative would also result in buildout of the Northeast and Northwest Development areas, and meet the planning objectives for existing and future demand and aircraft/facility separation. The planning concept applied to this alternative would be similar to that described in the previous section, with new, fixed wing aircraft parking in the Northwest Development Area along with new T-hangars and executive hangars. Transient aircraft parking, fixed-based operators and other commercial tenants would be concentrated in the Northeast Development Area.

If selected, this alternative could accommodate either SREF alternative (i.e., sited in the Northeast or Northwest Development Areas). However, placement of the SREF in the Northwest Development Area would be less efficient, since Duck Creek relocation would reduce available space in that area, and the SREF activity would also disrupt aircraft and vehicle traffic. This alternative would include relocation of Duck Creek to a more northerly discharge location into the Mendenhall River. The relocated creek would have to meet the CBJ ordinance for stream setbacks or receive a variance from the setback conditions. This alternative would also involve relocation of the EVAR/Dike Trail and parking for recreationists using the Dike Trail.

With minor developmental and/or operational complications, this alternative would meet the existing and forecasted demands for space and aviation facilities as well as meet the facility development objectives. Therefore, it is carried forward for detailed environmental analysis.

2.4.2.5 FW/RW-3: No Action Alternative

This alternative would not satisfy existing and future aviation needs. The likely result would be that aircraft operations would still increase and parking would become increasingly congested until JNU and FAA determined that unsafe conditions would arise. Additional effort would be expended by Airport staff and tenants to move aircraft as needed but it would become increasingly difficult to operate either safely or efficiently. It would also become impossible with further growth to meet Airport Design standards, established to provide adequate aircraft clearance from other aircraft and ground support equipment. The lack of new facilities would also prevent CBJ from gaining additional revenue at the Airport, such as those received from tie-down rentals and hangar/apron leases. In accordance with federal regulations implementing NEPA, the No Action Alternative is carried forward for detailed environmental analysis.

2.4.2.6 FW/RW-4: Miller-Honsinger Pond

The privately owned Miller-Honsinger Pond is located east of the Airport, and some cooperating agencies suggested that it should be considered for Airport use in facility development. The pond currently presents a potential aviation hazard due to bird movement across the runway between the Float Plane Pond and the Miller-Honsinger property, so removal and development of this

habitat would have the added advantage of reducing wildlife attractants. Another advantage is that it would have no direct impact on existing tenants, and relocation of other facilities (such as the ASOS and RCO) would not be required.

In order to use this property for Airport development, it would have to be filled, and it may be difficult to find sufficient, suitable material. (Indeed, this pond was developed as a materials source for local development projects.) This alternative presents difficult operational problems. The pond is remote from the rest of the existing infrastructure and from the basic services that most aircraft require on a frequent or periodic basis (like fueling, snow removal, mechanical/electrical checks and repairs). This alternative would require more taxi time to access main airport facilities. Another, connecting taxiway would have to be constructed south to join Taxiway A. This area is also outside of the established operational areas designed for the Airport, and new flight tracks for helicopter use could be required.

As described in Section 2.4.1.7, the Miller-Honsinger Pond would be expensive to purchase, particularly since the gravel on site increases (according to the owner) the property value. There would be no real environmental benefit to development of the Pond, compared with most alternatives considered, particularly because of the new taxiway and access roads needed. Finally, the pond and surrounding property are zoned for Rural Reserve and a change in land-use designation would be required.

The alternative is not carried forward for detailed analysis. Aside from the possible benefits to wildlife hazard reduction, the Miller-Honsinger Pond does not offer any advantage over other alternatives considered. The Pond is far from the rest of the Airport, new infrastructure would have to be developed including new access roads and taxiways, and large amounts of fill would be needed to render the site ready for development. Importantly, the Pond is not owned by CBJ and since the Airport currently has sufficient land available for development, there is no compelling need to expand the property boundaries to incorporate the Pond. This alternative is eliminated from detailed environmental consideration.

2.4.2.7 Summary of Aviation Facilities Alternatives

The possible locations for development of new aviation facilities were evaluated for technical feasibility, relative cost, relative environmental impacts, and ability to meet purpose and need. Other important considerations for this action include the ability to meet the airfield facility development objectives, defined in Section 1.4.3.3. Table 2-8 summarizes the results of the initial screening.

The aviation facility alternatives are limited, constrained primarily to the undeveloped Airport areas. It has been determined through the planning and forecast validation efforts that neither of the two main undeveloped lands on the Airport (i.e., the Northeast Development Area and Northwest Development Area) could provide sufficient space to accommodate forecast demand on their own. Only two alternatives, each making use of both large undeveloped areas remaining on the Airport grounds, would meet the existing and forecast demands for space and aviation facilities. These alternatives would also meet the facility development objectives. FW/RW-1 and FW/RW-2

are carried forward for detailed environmental analysis, as is the No Action Alternative, FW/RW-3. Other alternatives described in the preceding sections are eliminated from further consideration.

2.4.3 FUEL FARM ACCESS

The bulk fuel storage tanks (known collectively as the "Fuel Farm") at JNU are located on the northwest side of the Airport, west of Alex Holden Way and Duck Creek. Access to and from the fuel farm occurs on Airport property, but travel involves public-use thoroughfares, Cessna Drive and Alex Holden Way. Refueling trucks have to leave the controlled access gate on the Airport, travel on Alex Holden Way and Cessna Drive, and enter the Airport through a gate to the fuel farm for loading, and then make the return trip. CBJ has determined this process presents both a public safety concern and a security risk.

One safety risk is the single gate in and out of the fuel farm. A leak and fire at the farm could be extremely difficult and hazardous to battle, particularly because surface drainage slopes toward the single entrance.

Another risk is the maximum gross weight of the fuel trucks on public roads. The refueling trucks are privately owned and operated. Of the three companies that supply fuel to aircraft at JNU, Aero Services is the only one using the fuel farm to load their refueling trucks. The refueling trucks can weigh 15,000 pounds or more and carry up to 34,000 pounds of fuel[14]. This means the trucks, when loaded, exceed the maximum 38,000-pound weight limitation for two-axle vehicles on public thoroughfares and may be considered something of a public liability[15].

There are limited options to improve access for trucks, since it is not feasible to re-locate the fuel farm (due to space limitations on the Airport, and siting safety constraints for petroleum storage tanks). Few alternatives were available to address the needs associated with vehicles heavier than the allowable road capacity, Airport security and public safety concerns, and efficiency of refueling operations. Two alternatives, for a new fuel farm road and a fuel pipeline with service station, are shown on Figure 2-19.

2.4.3.1 FF-1: DEVELOP NEW ACCESS ROAD TO FUEL FARM

A new access road would be constructed to exit the south side of the fuel farm site. The route would parallel the Airport fence line, cross Duck Creek, and connect to the aircraft apron in the vicinity of Taxilane W-2. Using this route, the fuel farm could be reached without having to travel on public roads or exit from the secure Airport perimeter. The estimated cost to develop the new access road, described in more detail in Section 2.8.3, is $302,998.

14. Letter from Aero Services, Inc. to Mr. Allan Heese, June 3, 2002.
15. Per Juneau Code of Ordinances 72.08.040 and state law 17 AAC 25.009.

Table 2-8. Screening of Aviation Facility Development Alternatives

Alternative	Feasible	Relative Cost[1]	Benefits	Drawbacks	Included or Eliminated?[2]
FW-1 Northwest Area of Airport	Yes	Low	Currently undeveloped area, would require no relocation of tenants or other critical services Helps provide separation of aircraft (e.g., fixed wing vs. rotary wing) Accommodates existing demand and projected increases in locally based aircraft storage Much cost borne by new tenants for facility development	Would require bridging of Duck Creek for aircraft and vehicle movement Necessitates relocation of emergency access road. Potential siting of new SREF would limit available space for aviation facilities, limit airfield efficiency Some impacts to wetland/habitat Insufficient space available for all of the existing demand and forecast aviation needs; does not meet purpose and need	Eliminated
RW-1 Northeast Area of Airport	Yes	Low	Large, relatively undeveloped area, would require no relocation of tenants Helps provide separation of aircraft (e.g., fixed wing vs. rotary wing) Provides space for taxiway development and ready access to runway Accommodates growth of existing commercial operators and some new operations Much cost borne by new tenants for facility development	Potential siting of new SREF would limit available space for aviation facilities South portion of area within building restriction line, only suitable for tiedowns Some impacts to wetland/habitat Insufficient space available for all of the existing demand and forecast aviation needs; does not meet purpose and need Requires relocation of existing RCO & ASOS facilities	Eliminated
FW/RW-1 Full Development of Northeast and Northwest Areas	Yes	Moderate	Could accommodate SREF in either area Consolidates most aircraft (fixed and rotary) in separate portions of Airport Separates commercial from private facilities Minimizes re-development and dislocation of tenants, services in existing configurations Much cost borne by new tenants for facility development	Difficult to integrate layout with existing Airport configuration, as Duck Creek presents a barrier to facilities east and south Impacts wetlands/habitat Requires bridging or culverts to cross Duck Creek Requires relocation of dike trail and access roads Requires relocation of existing RCO and ASOS facilities	Included
FW/RW-2 Full Development with Duck Creek Relocation	Yes	Moderate	Could accommodate SREF in either area Consolidates most aircraft (fixed and rotary) in separate portions of Airport Separates commercial from private facilities Minimizes re-development and dislocation of tenants, services in existing configurations May benefit aquatic life by improving fish access to upstream habitat Much cost borne by new tenants for facility development	Some loss in development potential due to Duck Creek channel relocation and stream setbacks Impacts wetlands/habitat Requires relocation of dike trail and access roads Requires relocation of existing RCO and ASOS facilities	Included
FW/RW-3 No Action[3]	Yes	None	No environmental impacts No capital cost expenditures	Does not meet purpose and need to accommodate existing demand and forecast growth Continued congestion, increased hazards for aircraft and vehicle traffic	Included
FW/RW-4 Miller-Honsinger Pond	Uncertain	Highest (due to site purchase and development cost)	Reduce wildlife hazards by eliminating habitat for waterfowl Minimizes re-development and dislocation of tenants, services in existing configurations Reduces impacts to on-Airport wetlands and habitat Eliminates need to relocate RCO and ASOS	Large quantity of fill material would be required Remote location from the rest of the existing infrastructure and services reduces efficiency, increases environmental impacts Requires new connecting taxiway New helicopter flight tracks could be required Currently zoned for rural reserve, change in land-use designation would be required Potentially not feasible (acquisition uncertain) and not prudent (high cost of purchase and development)	Eliminated

[1] Cost relative to other alternatives. Alternatives FW-1 and RW-1 would have the least cost, because less apron area and fewer facilities (hangars, parking sites, etc) would be developed.
[2] *Included* for detailed evaluation in the EIS or *Eliminated* from further consideration.
[3] Evaluation of the No Action Alternative is required by federal regulation.

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There are a number of operational, safety and security benefits associated with a new road. The new location would save approximately 450 feet of total travel distance each direction. The new road would be within the Airport fence line, so public traffic would not be allowed. Also, the new road would reduce transport time for the refueling trucks, since there would be no security gates and a shorter travel distance to Taxilane W-2, leading on to the general aviation apron. An additional security and safety benefit would be incurred by reduction of travel through the existing Gate E, where tanker trucks require a delayed gate-closing system to ensure trucks clear the opening. There would be environmental concerns associated with this alternative, particularly development of another Duck Creek crossing, and removal of some upland and wetland habitat. However, there may also be an environmental benefit incurred by reduction in accident potential and reduced operations proximal to Duck Creek.

This alternative is both prudent and feasible, and it represents the Airport's Proposed Action. It is carried forward for detailed environmental consideration.

2.4.3.2 FF-2: INSTALL PIPELINES FROM FUEL FARM TO CENTRAL FUEL DISTRIBUTION PORT

An alternative identified by the cooperating agencies is to bury a fuel distribution pipeline extending from the fuel farm to a central refueling station on the Airport. The refueling station could be located just south of an unnamed Airport road and would be used by tanker trucks that service aircraft. This alternative was developed to reduce environmental impacts associated with construction of a new fuel farm road and another Duck Creek crossing. It would also increase operational efficiency by further reducing the travel distance for airfield refueling trucks. Two possible methods of pipeline installation would include "trench and fill" on top of the installed pipeline, or directionally drilling below the surface and creek. The estimated cost to develop a new fuel pipeline and refueling system, described in more detail in Section 2.8.3, is $721,726.

Trenching is a standard construction technique and generally involves short-term environmental impacts from equipment access and the trenching process. Special procedures and precautions would have to be established to trench through the Duck Creek bed. Directional drilling would be less invasive, could probably be accomplished from a rig located on the fuel farm, and would reduce the potential impacts to the creek, as drilling would go under the bed. However, this is an expensive method of pipeline installation and probably not cost-effective. Trenching also allows more direct control over any subsurface conditions of concern, such as buried metal or contaminated soils. This concern is not trivial as the fuel farm and this area of the Airport were used in the past for other industrial and military activities. Finally, long-term concerns associated with buried pipelines include undetected leaks resulting from breaks or poor joint seals. Contamination arising from these problems may not be detected immediately, or until substantial subsurface degradation has occurred.

The advantages of a pipeline system are similar to those for a new fuel farm access road: increased security and public safety, and more efficient operations because of reduced travel distance and time. A pipeline system would further reduce transport distance for the refueling trucks, as they would take on aviation gasoline (product known as "AvGas") or jet fuel at a new

service station located just south of the unnamed Airport road and adjacent to Taxilane W-2. However, development of a service station in this area would occupy space that may otherwise be dedicated to aircraft parking.

The potential for this alternative to reduce environmental impacts relative to other alternatives, such as a new road, is uncertain: it would reduce the amount of surface disturbance compared to Alternative FF-1, the access road alternative, but the potential for hazardous materials contamination to go undetected would increase. But this alternative is considered both prudent and feasible, as it meets the Purpose and Need for better fuel farm access and would improve operations and safety at JNU. This alternative is carried forward for detailed environmental analysis.

2.4.3.3 FF-3: NO ACTION ALTERNATIVE

The No Action Alternative would retain the fuel farm access as it exists today with no change in route or entrance or exit location. Vehicles would exit the fuel farm to the east, travel on Alex Holden Way, and enter the Airport Operations Area through security gates. This alternative would require operators of the tankers to obtain street licenses for these vehicles, and it could force the operators to acquire different tankers to meet street vehicle requirements. In accordance with the regulations implementing NEPA, this alternative is carried forward for detailed environmental consideration.

2.4.3.4 FF-4: UPGRADE ROADS TO APPROPRIATE STANDARDS AND PURCHASE OF NEW FUEL TANKER TRUCKS

This alternative would continue use of the existing public access route on Cessna Drive and Alex Holden Way, but the roads would be upgraded to meet design standards for tanker trucks (standards are based on vehicle size and weight). The roads would have to be completely refurbished, with additional sub-base preparation and a thicker asphalt surface on top. The gate into Airport property might also have to be replaced.

This alternative provides the benefit of using an existing access route and eliminating the need for substantial new disturbance or crossing of Duck Creek. However, fuel vendors would still have to purchase new fuel tanker trucks that comply with weight and size limitations for use on public thoroughfares. Since these are not standard vehicles, they would have to be custom ordered and constructed, resulting in much higher costs than off-the-shelf trucks. This alternative does not satisfy the desire for simpler refueling operations at the Airport, nor does it address the public safety concerns of fuel trucks entering and using a public thoroughfare, or security objectives. Also, it does not alleviate the concern about access to the fuel farm in the event of a leak and fire.

This alternative is eliminated from further consideration, as it would not satisfy many of the concerns over public safety and security, and it would still place a substantial financial burden on the local fuel vendors to purchase "street-legal" fuel trucks. Although Cessna Drive recently experienced a partial upgrade including total removal and replacement of the road and core-bed, this work was done independently of Airport needs, and at any rate the completed effort does not satisfy the standards for design that would be needed for the on-Airport fuel tanker trucks.

2.4.3.5 SUMMARY OF FUEL FARM ACCESS ALTERNATIVES

The possible alternatives for fuel farm access were evaluated for technical feasibility, relative cost, relative environmental impacts and ability to meet purpose and need. Other important considerations for this action include maintenance of airfield security, protection of public safety, and increased refueling operations. Table 2-9 summarizes the results of the initial screening. Alternatives for a new fuel farm access road and installation of a fuel pipeline with refueling station are carried forward for detailed environmental analysis, as is the No Action Alternative.

2.5 REVISED WILDLIFE HAZARD MANAGEMENT PLAN

CBJ has proposed a number of habitat modifications to reduce and control each of the specific wildlife hazards identified in Section 1.4.4.3. These habitat modifications are, for the most part, described in the Wildlife Hazard Management Plan (WHMP) prepared by USDA Wildlife Services under the direction of CBJ (CBJ 2002a). Collectively, the habitat modifications from the WHMP, with some modifications identified by CBJ in communications and correspondence during development of this EIS, represent the Proposed Action for wildlife hazard management.

The WHMP also describes hazard control procedures, wildlife monitoring requirements, staff training requirements and the basis for program evaluation. However, the labor and funding to support these programs, or the level of activity within each, is generally not defined. In order to develop a range of alternatives other hazard reduction options involving habitat modification or hazard control (i.e., hazard repellent) techniques have been identified for this EIS. The proposed actions and hazard reduction options have been reviewed for effectiveness and ability to be implemented. Those determined to be viable methods for reducing wildlife hazards are retained for full analysis in the EIS and are organized into the wildlife hazard management alternatives, shown later in Section 2.5.4 and Table 2-12.

As a general rule, the degree of "active" wildlife management (in this sense, meaning day-to-day or frequent uses of repellent techniques by Airport staff) needed for each option would be inversely proportional to the extent of the habitat modification. For example, little or no habitat modification in the areas of most concern on the Airport would necessitate more rigorous active management involving one or more ongoing wildlife repellent measures. However, the relationship between habitat modification and active management is not linear or constant. There can be many reasons and situations where habitat modification is necessary to control wildlife hazards to a level that active management could not achieve. The relationship is site-specific and depends on many factors.

This EIS considers options for wildlife hazard control at JNU that range from habitat removal or alteration, to changes in active hazard management by the use of different repellent techniques. However, FAA recognizes that there needs to be some inherent flexibility in wildlife hazard management to account for changing degrees of wildlife activity, influenced by such factors as migration seasons, food availability, human activity, weather, and so forth. The Airport needs to be able to adapt to the hazards by increasing or decreasing, the use of hazard repellent and even depredation techniques, irrespective of other, regulated habitat modifications that may have been

approved for wildlife hazard control. The ability and authority to make adjustments in the type and degree of wildlife hazard control is vested in the Airport Manager, or delegated to the Wildlife Hazard Control Officer. Federal and state permits have been issued that provide a framework for the manner by which wildlife management takes place, particularly for the "take" of wildlife. The WHMP should provide the necessary detail for program implementation and monitoring. Therefore, this section of the EIS begins with a summary of control measures available on airports to reduce or manage wildlife hazards to aviation.

Section 2.5.1 provides an overview of hazard control techniques used at different airports, including the staffing levels used to control wildlife hazards. Section 2.5.2 summarizes wildlife hazard control activities employed at JNU and the level of personnel effort applied to the hazard management program. Section 2.5.3 identifies the specific wildlife hazards at various locations on the Airport and the possible technologies to control these hazards.

In accordance with federal regulations, the WHMP prioritized the proposed habitat modifications and land-use changes leading toward reduction of wildlife hazards (40 CFR §139.337). Section 2.5.4 of this EIS includes an independent evaluation of these priorities and the benefits of habitat modifications by considering the species of greatest probable risk to aircraft, and areas on and near the airfield where aircraft are most vulnerable to collisions with wildlife.

2.5.1 Review of Wildlife Hazard Control Methods and Personnel

There are many challenges faced in developing an adequate wildlife hazard management program for an airport like JNU that offers, both on the Airport and particularly the surrounding area, such attractive habitat for birds and other wildlife. One of the difficult tasks is determining what techniques are best suited to a particular environment and the relative merits or drawbacks associated with each of those techniques. For example, complete removal of habitat in a discrete location for a specific species of risk should subsequently require minimal hazard management, since the species would no longer be attracted to that area. It should be fairly straightforward to determine whether habitat removal can be effectively implemented, and if so, the cost can be estimated. However, important and more difficult questions concerning long-term effects of this action would still arise. For instance, what kind of habitat would subsequently remain? Once altered, would it attract different bird or wildlife species that could also present a risk to aviation? Would the different species necessitate changes in the active hazard management program?

In order to help identify the possible outcomes from proposed hazard management alternatives and also to ascertain their relative application at JNU, a survey of control methods was developed for the EIS. The surveys were sent to staff at 12 airports of varying size and aviation activity, at locations around the United States. Nine airports responded to the survey, ranging from very busy hub airports to smaller regional airports. While the survey by no means represents the complete perspective of all persons tasked with wildlife hazard management at U.S. civil airports, it does offer insight as to the value of different management techniques, and the level of staffing needed to maintain hazard control programs. It also provides some additional basis for determining whether or not a particular technique would work at JNU. The results of the survey are included in Appendix B to this EIS. A summary and analysis of the information received from the survey follows.

Table 2-9. Screening of Fuel Farm Access Alternatives

Alternative	Feasible	Relative Cost[1]	Benefits	Drawbacks	Included or Eliminated?[2]
FF-1 Develop New Access Road to Fuel Farm	Yes	Moderate ~$302,998	Increased operational efficiency: no public thoroughfares used or access gate passage Eliminates need to use public streets for fuel transport, increased public safety Enhanced Airport security Allows vendors to use existing truck fleet	Requires new crossing of Duck Creek, either bridge or bottomless arch culvert Some impact to wetlands/habitat Does not reduce truck travel distance	Included
FF-2 Install Pipelines from Fuel Farm to Central Fuel Distribution Port	Yes	High ~$721,726	Increased operational efficiency: no public thoroughfares used or access gate passage Eliminates need to use public streets for fuel transport, increased public safety Enhanced Airport security Reduces fuel truck travel distance Allows vendors to use existing truck fleet No additional Duck Creek culverts or crossings	Requires cut and fill construction or directional drilling to install pipe; some short-term environmental damage Space on airfield required for metered refueling station High costs associated with infrastructure development Environmental concerns associated with leaks or breaks in pipe, particularly if undetected for long time Some potential to encounter buried debris and/or contaminated materials	Included
FF-3 No Action[3]	Yes	None	No environmental impacts No capital cost expenditures	Does not meet purpose and need Continued concerns over public safety, Airport security, and inefficiency of refueling operation Illegal use of unlicensed trucks on public streets	Included
FF-4 Upgrade Roads and Purchase New Fuel Trucks	Yes	Moderate (Estimate not developed)	Takes advantage of existing access route Limited environmental impacts, no new crossing of Duck Creek Relatively low costs to FAA or CBJ (compared to new route)	Continued concerns over public safety, Airport security, and inefficiency of refueling operation Cost of new fuel trucks passed on to private vendors forced to replace existing fleet	Eliminated

[1] Cost relative to other alternatives.
[2] *Included* for detailed evaluation in the EIS or *Eliminated* from further consideration.
[3] Evaluation of the No Action Alternative is required by federal regulation.

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2.5.1.1 Hazard Control Staff

Smaller airports have limited resources to dedicate to wildlife hazard control activities. Similar to JNU, these airports typically do not have a dedicated wildlife control specialist and they conduct wildlife control activities "in-house" using a variety of airport personnel. Dedicated staff ranged from a high of 14 at one of the larger, busy hub airports in the northwest to zero at a couple of the regional airports. In addition to dedicated staff, most airports supplement their hazard management programs with individuals trained in wildlife control, but who have other duties at the airport. Airports without fulltime contract support often train a wide range of airport staff to assist including operations specialists, fire/rescue personnel, maintenance staff, and security forces.

JNU staff do receive annual and periodic wildlife hazard training from USDA Wildlife Services. This training includes wildlife deterrence techniques, bird identification, use of equipment and firearms/pyrotechnics, and the strategy used in developing and implementing an effective wildlife hazard control program.

Some airports rely on contract personnel to manage their wildlife hazard control programs. For example, at one of the busy hub airports the entire staff of wildlife control specialists is contracted to a private firm. Other airports may supplement their own staff with assistance from a private firm or USDA Wildlife Services, or contract specific components of their program, such as raptor control, to a firm specializing in such work.

2.5.1.2 Hazard Control Techniques

This section describes some of the techniques employed to control wildlife hazards that were evaluated in the airports survey. Other techniques not included in the survey, such as the use of wire grids, are described in Section 5.4 of the WHMP (CBJ 2002a).

Pyrotechnic Pistol. The most common control method was the 15mm (also called .22 caliber) pistol used at 8 of the 9 airports that responded to the survey. The 15mm pistol was determined to be effective at 7 of 9 airports and was rated as inexpensive (relative to other methods) by 7 of 9 airports as well.

Pyrotechnics (12 gauge). The 12 gauge pyrotechnic round was used at 7 of the 9 respondents. The 12 gauge round cost approximately three times more than the 15mm pistol, but it has a longer range and was identified as more effective.

Long-range Pyrotechnic Rounds. These pyrotechnics are represented by the Capa rounds. They are considered expensive to very expensive, but they are generally rated as effective to very effective. They have a longer range (up to 1,200 feet) than other pyrotechnics. However, most airports do not use these. Only one of the airports reported commonly using Capa rounds.

Propane Cannons. Propane cannons are used at more than half of the airports responding to the survey, and only one of these airports indicated the cannons are not an effective hazard management tool. Cost appears to be a factor in the use of propane cannons, with the initial costs ranging

from $250 to $2,500, depending on options. Effectiveness of propane cannons is highly dependent on the species being controlled as well as the experience of the control officer in implementing this program.

Bioacoustics. Bioacoustics include recorded distress calls, alarm calls, and predator calls projected over a loudspeaker system either permanently installed on buildings or other structures, or mounted on vehicles. The effective use of bioacoustics requires a good understanding of the bird species being controlled as well as local movement patterns. This is often referred to as a "finesse" tool. Only two of the responding airports use bioacoustics systems. Of the airports using bioacoustics, only one determined the system to be effective. No airport considered the method very expensive.

Other Sonic Devices. This category includes the stationary and mobile "noise makers" such as sirens, wailers, horns, etc. Only one airport commonly uses this method. Two airports reported them as not effective, and no airport reported them as effective. Cost does not appear to be a factor, as the only airport responding to this question evaluated them as not expensive.

Dogs. Trained dogs, most commonly Border collies, have seen a great increase in use over the past decade. Two airports reported commonly using dogs to assist in their control programs. One of these two airports rated dogs as a very effective tool and the other reported dogs as an effective hazard control technique. Cost may be an important factor in implementing such a program, as there is a perception that dogs are an expensive hazard control technology.

Falconry. No respondents to the survey use falconry and two airports cited the extremely high cost of this technique.

Perch Excluders. This method includes a range of products designed to prevent birds from perching on a structure, including wires to barbs and nets. (Recently, a facility in Kodiak has experienced some success using two looped, crossed plastic pipes over the top of a structure to prevent eagles and other birds from perching). Most airports responding to the survey do not use these devices. The effectiveness of this method is highly variable, possibly due to the wide range of products and the methods of installation. Costs are also highly variable: of the three airports using this technique, responses ranged from not expensive to expensive to very expensive.

Trap and Remove. Only one airport respondent commonly traps and removes birds from the airport, while two other airports occasionally trap and remove birds. All bird trapping and removal is done with contract support. Two of the airports report trapping as effective but no airport reports trapping as very effective. The cost of this process will range with the level of effort expended and survey results are evenly split from not expensive to very expensive.

Habitat Modifications. It should be recognized that habitat modifications as a control technique are believed integral to every civil airport; only one of the airports responding to the survey had not conducted (or reported conducting) any habitat alteration within the past five years. Habitat alterations included removal of wetlands, large-scale tree thinning, turf management, and most commonly, clearing of vegetation. However, each airport has unique habitat and land use require-

ments in the vicinity of the airport that may control the need for and degree of habitat alteration employed. It would be difficult to draw conclusions concerning the value of habitat alterations at JNU based on their use or lack of use at other airports.

Lethal Control. In some instances it can be deemed necessary to kill wildlife that remain a threat to aviation. This circumstance typically would arise when other repellent efforts to keep the animal away from aviation operations do not work. Lethal control may also be used to reduce wildlife populations. The airport surveys did not request information on the use of lethal control, such as the numbers of animals killed each year.

2.5.1.3 SUMMARY OF AIRPORT SURVEYS

Airports across the country use a wide range of strategies to manage wildlife hazards. With each airport situated in a different environmental setting and with different types of aviation activities, the level of control effort will vary accordingly. The wide range in manpower allocation of the survey responders underscores this point. For example, a large hub airport in north central Texas is located on 18,000 acres of land and supports over three quarter of a million operations each year. However, the airport has only one dedicated wildlife control specialist. In contrast, another large hub airport located on the Pacific northwest coast has less than half of the operations experienced by the Texas airport, yet it employs 14 dedicated wildlife control staff. This airport is located on a major migratory route used by a wide range of bird species, and presumably has a much greater potential for aircraft-bird strikes.

The value of the survey combined with literature review and practical experience from the EIS contractor staff has been to identify products that are used at airports, and to assess whether they are effective. The tools common to most airports are the 15mm pistol and 12 gauge pyrotechnic rounds. These devices are effective in controlling many species of birds, and they are also considered by most respondents to be relatively inexpensive. Propane cannons are also generally effective when properly used and are not considered very expensive, especially when used over a long period of time (since apparently their use will begin to instill a behavior in at least some species to avoid the areas where cannons are employed). Bioacoustics are not commonly used and have been shown to be somewhat difficult to use without some level of expertise. Falcons are not commonly employed and are considered expensive. Border collies or other dogs are also a relatively expensive control technology, but they are starting to be more commonly used and generally considered effective or very effective in hazard control programs. Perch excluders are effective when properly designed and installed.

2.5.2 CURRENT WILDLIFE HAZARD CONTROL ACTIVITIES AT JNU

Juneau International Airport operates a wildlife hazard control program that has relied, over the years, on a combination of habitat modifications and hazard repellent activities. Although the Airport has implemented some habitat modifications recommended in the WHMP (CBJ 2002a), more actions have been deferred until the EIS is completed and FAA issues a record of decision. The following summarizes current wildlife hazard control activities. More description may be found in Section 3.4 of the Wildlife Hazard Assessment (USDA 2001).

A number of different staff at JNU assist in wildlife hazard control duties, although these are secondary responsibilities to their primary assignments. JNU relies on the part-time efforts of Airport staff, with some contracted assistance provided by a local agent from USDA Wildlife Services.

JNU does not have a full-time wildlife hazard control officer. The Field Maintenance and Operations Supervisor may be considered the Wildlife Coordinator at JNU, with day-to-day responsibilities for program implementation. The program is carried out using Airport staff that have received some training in wildlife management but have other, primary responsibilities (maintenance, operations, etc.). Collectively, these personnel are considered Wildlife Patrol. In 2003, routine wildlife management conducted by Airport staff averaged approximately ½ man-hour per day assessing hazards and wildlife activity on the Airport. During the winter, another ½ hour of wildlife management would be spent during weekend days, while approximately 1 hour would be spent per day on weekends during summer. In addition, staff is required to respond to calls from the tower or Airport personnel or pilots concerning specific hazards[16]. During 2003, the Airport estimated that approximately 100 to 150 callouts required a response from personnel trained in wildlife hazard management (Mello 2004).

The Airport contracts to USDA Wildlife Services to provide information on animal control, develop plans and procedures for wildlife hazard management, and provide some training to staff. The Airport has estimated that $31,000 was spent on wildlife hazard control actions and training during 2003, including contracted assistance from USDA, supplies, training, and Airport personnel costs (Mello 2003)[17].

The Airport attempts to reduce bird activity in grassed areas by periodically mowing the infield. This effort requires approximately 3.5 man-days per mowing cycle, typically conducted 4 times per season. Wildlife patrol staff primarily use pyrotechnic devices to disperse wildlife, including capa rounds, propane cannons during times of heavy bird activity, and cracker shells. Other hazing activities include the use of spotlights and horns. Ultrasonic bird repellent devices were used in the sand shed at one time to disperse pigeons, but the birds soon returned. JNU does periodically kill birds with a shotgun to remove persistent individuals from a flock or as reinforcement for other non-lethal deterrent methods. The Airport maintains permits from the applicable federal and state agencies for this purpose.

A hunting program has been employed at JNU for some years that provides access to the airfield during the fall bird season. Hunters have to be educated concerning the unique problems associated with hunting on an active Airport, and specific instructions are provided concerning where hunting is not allowed and how firearms can and cannot be discharged. The Airport also distributes forms to hunters to track Airport use, bird activity and hunting success. The Wildlife Hazard Assessment identified some possible benefits to the wildlife control program from on-airfield hunting by dispersing birds or even reducing average flock size.

16. The Juneau air traffic control tower monitors wildlife activity and informs Airport staff concerning possible hazards.
17. This value includes a planned allocation of $10,000 to USDA Wildlife Services for contracted services, although no money was actually paid to USDA for that work in 2003.

Concerns have been raised in USDA's WHA and from local persons that hunting could possibly increase wildlife hazards. For example, there is no coordination between the air traffic control tower and hunters, and shots may stir the birds into flight when aircraft are on takeoff roll or approach to the runway. Also, dispersal of some species would increase the amount of time they spend in the air, causing uncontrolled bird movement in airspace including across runways. Correspondence from persons using the Dike Trail suggests this is not an unusual effect of hunting. There are anecdotal reports of ducks taking off from the float plane ponds in response to hunters shotguns, and flying directly over the airfield toward Auke Lake in the Runway 08 approach path. Some bird carcasses are not retrieved and they can attract other wildlife scavenger species. In addition, hunters use decoys and duck calls that actually attract birds that otherwise may have landed elsewhere, away from the airfield.

It is also possible that without a hunting program the habitat on the Airport could serve as a safe haven to waterfowl that are hunted on the surrounding Refuge. In other words, waterfowl populations could be even greater without the hunting program. Airport staff who have responsibility for wildlife hazard abatement and observe wildlife on a daily basis have expressed on numerous occasions that the hunting program serves as a bird deterrent. They strongly recommend that the hunting program be continued.

Dike Trail users also inadvertently startle wildlife, although it is believed to be a problem associated mostly with off-leash dog behavior. Many people have observed dogs run after eagles and other birds in the Refuge. This harassment is certainly stressful to the wildlife, and it also could increase numbers and frequency of birds in the air during aviation activity.

The assessment of wildlife hazards conducted by USDA identified a number of deficiencies in the Airports wildlife control program, including lack of adequate record keeping, insufficient time spent monitoring hazardous wildlife, and the fact that NOTAMs (Notice to Airmen) had not been issued documenting unresolved wildlife hazards. It was suggested that many of the day-to-day deficiencies could be attributed to the fact that wildlife control at JNU is the not primary responsibility of any one individual.

2.5.3 Wildlife Hazards at JNU and Options for Hazard Reduction

The following sections summarize the wildlife hazards and species associated with each area of concern on the Airport. Options for hazard reduction through habitat modification are then summarized for most of the problems. In some instances, increased wildlife management control (e.g., hazing, depredation, etc.) is proposed. Locations of proposed wildlife habitat modifications described in the Wildlife Hazard Management Plan are shown on Figure 2-20. More detail concerning the actions and alternatives carried forward for detailed analysis is provided in Section 2.9.

2.5.3.1 Birds Attracted to Vegetated Areas Near Runways and Taxiways

Airfield turf near the runway and taxiways presents some of the greatest potential risk to aircraft operations at the Airport. The species of birds that are attracted to these areas include Canada geese, other geese species and gulls, shorebirds, and insectivores, such as American pipits. These

birds are attracted to the grass infield because it provides cover and shelter. Certain species feed on the grass, and it also offers foraging potential for worms, insects and mice. Some of the birds, such as geese and gulls, have large body masses and exhibit flocking behaviors that may result in multiple strikes to aircraft arriving or departing the Airport. 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:

- ***Eliminate Grassed Infield Areas by Paving.*** This action represents the most assured remedy for the problem. Turf would be removed, and the infield areas would be re-graded and paved with asphalt or concrete. This action would eliminate most food sources and cover for all bird species. Depressions in pavement may collect rainwater or snowmelt that would attract birds.
- ***Install Synthetic Ground Cover on Infield.*** Some or all of the grass could be replaced with a synthetic material that would not attract wildlife but still allow surface water infiltration. Relatively new artificial turf products are on the market that may be suitable for use at Airports and could have properties attractive for this use.
- ***Alteration of Vegetation Management Practices to Attract Less Wildlife.*** The WHMP and current Airport wildlife control procedures already call for turf management practices that reduce wildlife attractants. One option is to mow grass shorter so that it does not adequately shield species that might otherwise be attracted to it for cover. Another alternative offered in the WHMP is to allow grasses in the infield areas to grow for most of the season to reduce bird accessibility to worms and insects. Of course, these two options could not be implemented in unison. However undertaken, the turf management should be conducted to target specific species and with an understanding that other species may be attracted to the new cover.
- ***No Action.*** This option would result in no changes to the habitat in the infield areas.

2.5.3.2 Birds Attracted to Wetlands on the West Portion of Airport Property

The extensive wetlands on and near Airport property attract a variety and abundance of wildlife, especially birds, because they contain fish and aquatic invertebrates that serve as food sources. Waterfowl, shorebirds, raptors, and gulls attracted to wetlands pose a particular threat to aircraft. The wetlands on the west, both on and off Airport property, are problematic because of their proximity to the runway. Tidal flows and storm-water pond in depressions and channels in this area, providing opportunities for birds to drink, bath, and forage. Fish and post-spawn carcasses become trapped in depressions, providing easy forage opportunities for eagles and gulls. Aircraft departing to the west and landing to the east pass over wetland habitat at low elevations, increasing the risk of aircraft-bird collision. 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:

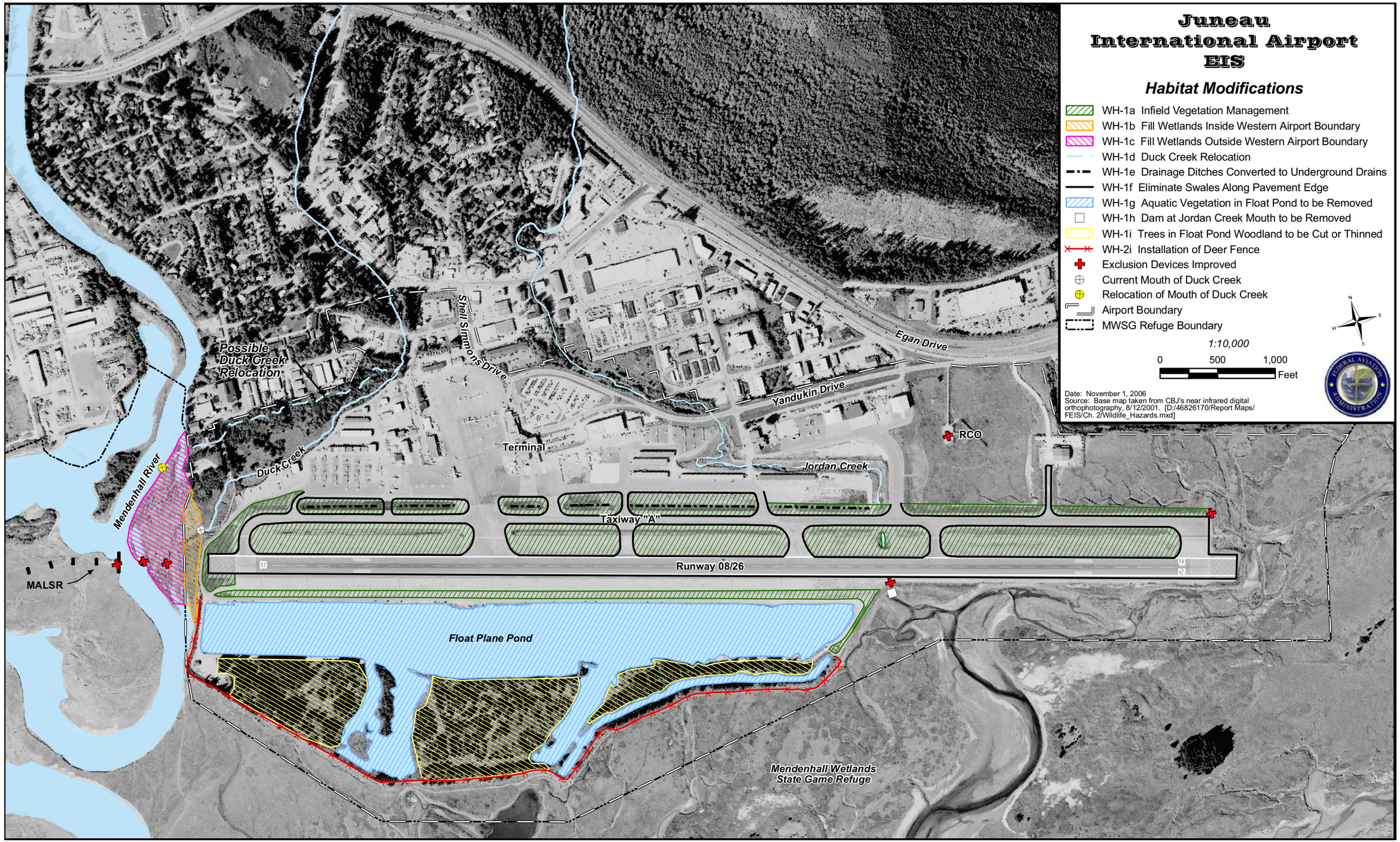

Figure 2-20. Locations of proposed wildlife habitat modifications.

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