

## 5 ALTERNATIVES DEVELOPMENT AND ANALYSIS

The objective of alternative development and analysis was to determine the most suitable alternative to meet the needs of the Kotzebue Airport. The 1998 Airport Master Plan (AMP) suggested considering relocation beyond the year 2018 as opposed to continuing to expand at the present site; the AMP states that “before such a large investment in the existing airport is made, the feasibility and timing of airport relocation should also be re-evaluated.” This chapter presents a summary of the benefits and drawbacks of each alternative, as revealed by the alternative analysis process.

The relocation feasibility study is not considering specific sites at this time, but rather relocation to three different general areas (Figure 5-1). Area 1 is the northern third of the Baldwin Peninsula; Area 2 is the middle third of the Baldwin Peninsula; and Area 3 is the southern third of the peninsula. Evaluation of these three overall areas rather than individual sites has allowed the study to focus on relocation feasibility as a whole, rather than on the benefits and drawbacks of specific sites. If relocation continues to be considered, then specific airport relocation sites will be investigated.

### 5.1 Alternatives

---

The four alternatives considered are to relocate the airport to a suitable site within Area 1, Area 2, or Area 3, or to improve the existing airport facility. So as not to overly complicate the analysis, the initial alternative development and analysis only considered primary elements of the airport facility. Although specific relocation sites were not evaluated for Alternatives 1, 2, and 3, the office study and field reconnaissance (see Appendix D) determined that within each “area” an airport facility could technically be developed (i.e., locations exist with topography that at least initially appear flat enough and oriented appropriately to the prevailing winds) that would meet the facility requirements set forth in Section 4.3. Figure 5-1 shows a possible airport layout that meets the facility requirements in each of the three potential relocation areas.

Figure 5-2 shows the improvements needed at the existing site to meet the essential facility requirements (Alternative 4). The most significant improvements are the lengthening of Runway 8-26 and the expansion (in length and width) of its safety area. A *Runway Safety Area Practicability Study* completed by DOT&PF in 2004 considered the feasibility of expanding the western safety area of Runway 8-26 900 feet into Kotzebue Sound. The practicability study estimated this would cost \$217 million and was “impractical due to environmental concerns and the prohibitive high cost.” Extending the eastern safety area by 800 feet across the lagoon and into the hillside on the far shore was estimated to cost \$15 million if it were constructed with box culverts and \$27 million with a bridge. Consequently, this relocation study’s Alternative 4 shifts the primary runway 900 feet to the east to provide the full 1,000-foot safety beyond the western end by lengthening the runway into the hillside, which though expensive is less costly than construction in Kotzebue Sound. Shifting the runway to the east also alleviates the conflict between the runway and the beach access road.

## 5.2 Evaluation Criteria

---

Evaluation of the alternatives assessed the advantages and disadvantages of the four alternatives with respect to safety, environmental impacts, and design quality. Specific evaluation criteria within these categories were developed with input from the community, the CAC, and DOT&PF. After the evaluation criteria were developed, their relative importance was established through DOT&PF's and the CAC's responses to a survey (Appendix F). The 17 evaluation criteria are listed below, in order of their importance within each category.

### *Safety*

- S1 ***Approach Capabilities:*** Approach limitations are often caused by terrain penetrations which can affect the approach minimums. Approaches also should not have schools or fuel facilities beneath them. The approach capabilities of a site affect medevac flights and ability to land during poor weather conditions or night operations. Day-to-day operations are generally not affected.
- S2 ***Wind Coverage and Other Meteorological Conditions:*** Wind coverage and adverse weather conditions affect day-to-day operations. Wind coverage affects the runway orientation. The higher the percentage of wind coverage a runway has, the closer to optimal the runway alignment is. The FAA requires a minimum of 95% wind coverage. Foggy and snowy conditions affect visibility, and snow accumulation affects maintenance costs. Snow and fog are affected by the terrain and prevailing winds.
- S3 ***Distance from Bird Attractants:*** The potential for bird and aircraft conflicts decreases with increased distance between the airport and bird attractants such as landfills, wastewater lagoons, and wetlands. The greater the distance allowed between an airport and a bird attractant, the better. FAA requires a minimum distance of 10,000 feet (~1.9 miles).
- S4 ***Airspace and Land Use Compatibility/Obstructions:*** Obstructions are objects within areas that are required to be clear for navigation purposes, such as the safety area or the object free zone. Examples at the existing Kotzebue Airport include parked aircraft within the object free area of Runway 17-35 and the road passing through the safety area of Runway 8-26. Additional requirements regarding the land use around airports include limiting public gatherings. In addition, roads should not be allowed within the first 1,050 feet of the runway protection zone (1,050 horizontal feet from the runway ends at a 50:1 slope provides the 17 feet of vertical clearance necessary over a road).
- S5 ***Safe Access:*** Safe access to the airport involves the ability of the public to travel to and from the airport in inclement weather. Residents have expressed concern that if the airport is relocated at a distance from the community, travel to and from the airport will be unsafe because of storms, icy roads, and poor road maintenance.
- S6 ***Airport Security:*** One way in which airport design incorporates airport security is by providing sufficient space for implementing security measures such as separate facilities for hunters and other passengers and increased apron and lease lot area for tightened cargo security. Airport security is enhanced by having the airport facility separate from the community so that recreational activities are not occurring in conflict with aviation activities.

***Environmental Impacts***

- E1 *Convenience of Access/Proximity to Community:*** Airport development close to the community has both benefits and drawbacks. The beneficial side includes ease of access. On the other hand, locating the airport at a distance from the community would open up new land for development, allow room for community expansion on the spit, and reduce airport noise at the community. To meet, this criterion an alternative must balance the benefits and drawbacks of distance from the community.
- E2 *User Costs:*** The increase in user cost for each airport alternative will be evaluated. Increased user costs stem from an increased travel distance to the airport affecting passengers, businesses, and residents, as well as the cost to leaseholders of relocating to the new airport site.
- E3 *Cultural Resources/Subsistence Impacts:*** Cultural resources and subsistence impacts are most likely to occur within a half mile of the coast, near the community of Kotzebue, and in a few isolated inland areas. Any relocation site should be chosen to limit impacts on cultural resources and subsistence activities.
- E4 *Floodplain and Watershed (Water Source) Impacts:*** An ideal relocation site would not impact the community water supply or be at risk for flooding.
- E5 *Land Ownership:*** A potential relocation site receives a lower score if the land purchase will impact Native allotments or privately held land.
- E6 *Wetlands/Fish and Wildlife Impacts:*** The location of the airport development site will affect the degree of impact the airport has on wetlands and fish and wildlife. Several areas have relatively high potential for wetlands and wildlife impacts. These include the area surrounding the Kotzebue Lagoon and Sadie Creek and two wetland areas along the southern coast of the Baldwin Peninsula.

***Design Quality***

- D1 *Geology/Long-Term Stability:*** An airport site with more favorable geotechnical conditions will result in less development and lower long-term maintenance and operations costs. Favorable geotechnical conditions also provide a safer facility by limiting pavement cracking and ground subsidence.
- D2 *Maintenance and Operations (M&O) Costs:*** Ensuring that M&O costs will be reasonable is an important airport development/improvement consideration. M&O costs are evaluated on a cost per mile basis, including the runways, taxiways, aprons, and access road. M&O costs are also affected by geotechnical conditions. See Appendix D for M&O cost estimates for each alternative.
- D3 *Construction Costs:*** The construction costs related to relocating the airport or improving the existing airport are affected by the availability of construction materials, surface and subsurface conditions, and the distance from the community, which affects utility extension and access road costs. See Appendix D for construction cost estimates for each alternative.
- D4 *Future Expansion Possibilities:*** An airport site that provides room for future expansion of runways, aprons, and lease lots scores high on this criterion.
- D5 *Utility Extension:*** This criterion assesses the reasonableness of extending utilities to the site, with consideration given to the prevalence of poor soil conditions and the potentially high cost of maintenance.

## 5.3 Results of Alternative Evaluation

---

The four alternatives were evaluated on the basis of the 17 evaluation criteria at a meeting with representatives from DOT&PF, the CAC, and the aviation consultants. At the meeting, the consultant team presented specific information about the alternatives to enable the participants to evaluate them. The evaluation criteria helped clearly delineate the benefits and drawbacks of each alternative. Each of the three entities participating ranked the alternatives for each criterion. This process generated much discussion about the feasibility of each alternative and what additional studies would aid in further evaluation.

Following is a summary of the alternatives with the results of the analysis. Table 5-1 lists the specific characteristics of the alternatives relevant to each criterion, with those that best meet each evaluation criteria listed in bold. Construction and maintenance cost estimates are provided in Appendix D.

### 5.3.1 Alternative 1 - Relocate Airport to Area 1

Relocating the airport to Area 1 is a strong alternative. This alternative is the best alternative in five of the six safety criteria: approach capabilities, wind coverage and other meteorological conditions, distance from bird attractants, airspace and land use compatibility/obstructions, and airport security.

In addition to safety benefits, this alternative also has design quality strengths. Although further investigation is needed to confirm this, the soil conditions in Area 1 are expected to be the most favorable of the three potential relocation areas. Good soil conditions will affect the long-term stability of the airport, the M&O costs, and the construction costs.

Alternative 1 also avoids high-value wetlands and areas of high wildlife use and shares (with Alternative 2) the advantage of proximity to the community, which allows safer access and limits user cost increases.

The weaknesses of Alternative 1 were found in the potential for cultural resources/subsistence impacts, watershed impacts, and high construction costs. Alternative 1 could indirectly impact subsistence activities along the northern coast of the peninsula and might impact the community's water source, Devil's Lake.

The possible airport layout for Area 1 (Figure 5-1) shows construction of the primary runway on top of a ridgeline. Good foundation soils are expected to exist in this area, which decreases the runway's required embankment depth and the related construction costs. However, the narrowness of the ridge results in large embankment quantities and high construction costs for the apron and lease lots.

There is anecdotal evidence that a potential material source may exist close by, meaning material could be hauled overland to the site rather than barged. Because subbase material contributes over 60 percent of the total construction cost (Figure 5-3), the ability to use local material would significantly reduce the overall costs of this alternative. The estimated construction cost is \$760 million if a local borrow source is found and developed, as opposed to \$1.29 billion otherwise. The lesser of these two costs is the most reasonable of the three relocation alternatives, but the higher is by far the most expensive. Further geotechnical investigation is needed to determine whether a local borrow source is available in order to more accurately

determine the cost of this alternative. In addition, because of the topographical constraints of the likely site, obtaining more detailed mapping of the area will also help true up the cost estimate.

### **5.3.2 Alternative 2 - Relocate Airport to Area 2**

Alternative 2 was the second strongest candidate in the safety and environmental impacts categories, but the weakest candidate in the design quality category. The primary advantages of Alternative 2 include the lowest potential impact on cultural resources and subsistence activities of the four alternatives and its proximity to the community, which would promote safe access and limit user cost increases. In addition, the land purchase for Alternative 2 is the least likely to involve private lands.

The drawbacks to Alternative 2 include the variable and hilly terrain, a likely sign of massive ice formations and variable permafrost (i.e., abrupt or dramatic changes in depth to permafrost). The hilly terrain affects approach capabilities and runway alignments, and increases the likelihood of snow drifting on the runways. The presence of variable permafrost will drive up construction and M&O costs and decrease long-term stability. In addition, Alternative 2 is likely to have the greatest impact on fish, wildlife, and high-value wetlands.

### **5.3.3 Alternative 3 - Relocate Airport to Area 3**

Alternative 3 scored well in the safety and design quality categories, but was the weakest alternative in the environmental impacts category, primarily because of its distance from the community.

The primary advantages of Alternative 3 include low construction costs and the possibility of locating the airport near to the proposed deep-water port facility development. The estimated construction cost for Alternative 3 with barged borrow (\$810 million<sup>1</sup>) is considerably less than the costs for Alternatives 1 and 2 with barged borrow (\$1.29 billion and \$950 million, respectively). If a local borrow source is found in Area 1, the cost of development in Area 1 (\$760 million) is estimated to be slightly less than the cost of development in Area 3 with barged borrow. While the primary drawback of Alternative 3 is its distance from the community, if the deep-water port facility is developed at Cape Blossom, it would be advantageous for the airport development to be located nearby, and the access road and utility extension cost could be shared between the two projects. Other advantages of Alternative 3 are that the area appears relatively level, so terrain would not limit future expansion to the airport facility, and that with the airport located at this distance from the community, water source impacts would not be an issue.

As mentioned above, the primary drawback to Alternative 3 is the distance from Kotzebue (12.8 miles). The greatest effects of this distance are the community's potential objections to traveling this far (80 percent of those who responded to the community and regional users questionnaire felt Area 3 was too far away), the increased user costs, and the increased safety concerns associated with travel. The access road length will also affect the airport's M&O costs. In addition, Area 3 has two high-value wetland areas which are considered bird attractants near to the potential airport site.

---

<sup>1</sup> Cost was reduced by \$94 million (half the cost to construct the access road) assuming co-location with the proposed deep-water port at Cape Blossom.

### 5.3.4 Alternative 4 - Improve the Existing Airport Facility

Alternative 4 is the strongest alternative in the environmental impact and design quality categories, but the weakest alternative in the safety category.

The primary advantages and disadvantages of Alternative 4 both lie in the existing airport's proximity to the community. Having the airport adjacent to the community allows Kotzebue residents convenient and safe access to the airport. Improving the airport at its existing location would keep user cost increases to a minimum, limit land purchase, and require minimal utility extension.

This alternative also ranked high for long-term stability, both because the majority of the runways and airport infrastructure have already experienced initial settlement and because the cut for the runway extension is expected to be deep enough to reach glacial till, which would minimize future settlement problems. The stability of the soils plays a significant role in reducing both construction and M&O costs.

Many of the weaknesses of this alternative stem from the safety concerns arising from the airport's location adjacent to the community. Conflicts with the community over land use, cultural resources, subsistence activities, and security would continue (see Section 1.2.1, Issues Related to the Existing Airport). Alternative 4 would only clear airspace obstructions to a TERPS approach; Part 77 terrain obstructions off of the east end of Runway 8-26 would not be removed (see ALP Sheets 8 and 11 in Appendix C). Because of the difficulty of installing lighting in the Kotzebue Sound, the improvements in Alternative 4 do not include installing approach lighting off the west end of Runway 8-26.

Other drawbacks of Alternative 4 include the frequent occurrence of fog at the existing airport; the potential for flooding; and the potential for impacts to Vortac and Devil's Lakes, the community watershed. The existing airport is also surrounded by bird attractants ranging from the Kotzebue Lagoon and the surrounding high-value wetlands to the landfill located south of the airport and fish drying racks located on the beach west of the airport.

The cost to construct Alternative 4 (\$560 million for a 7,500-foot runway) is lower than the cost for any of the relocation alternatives, with the greatest expense due to the extensive hillside removal (Figure 5-3). However, the improved existing facility would continue to be constrained by the community, Kotzebue Sound, and the hillside, and would have lower approach capabilities than at the relocation sites. Future expansion at this facility beyond the improvements called for here would be even more expensive and likely impractical.

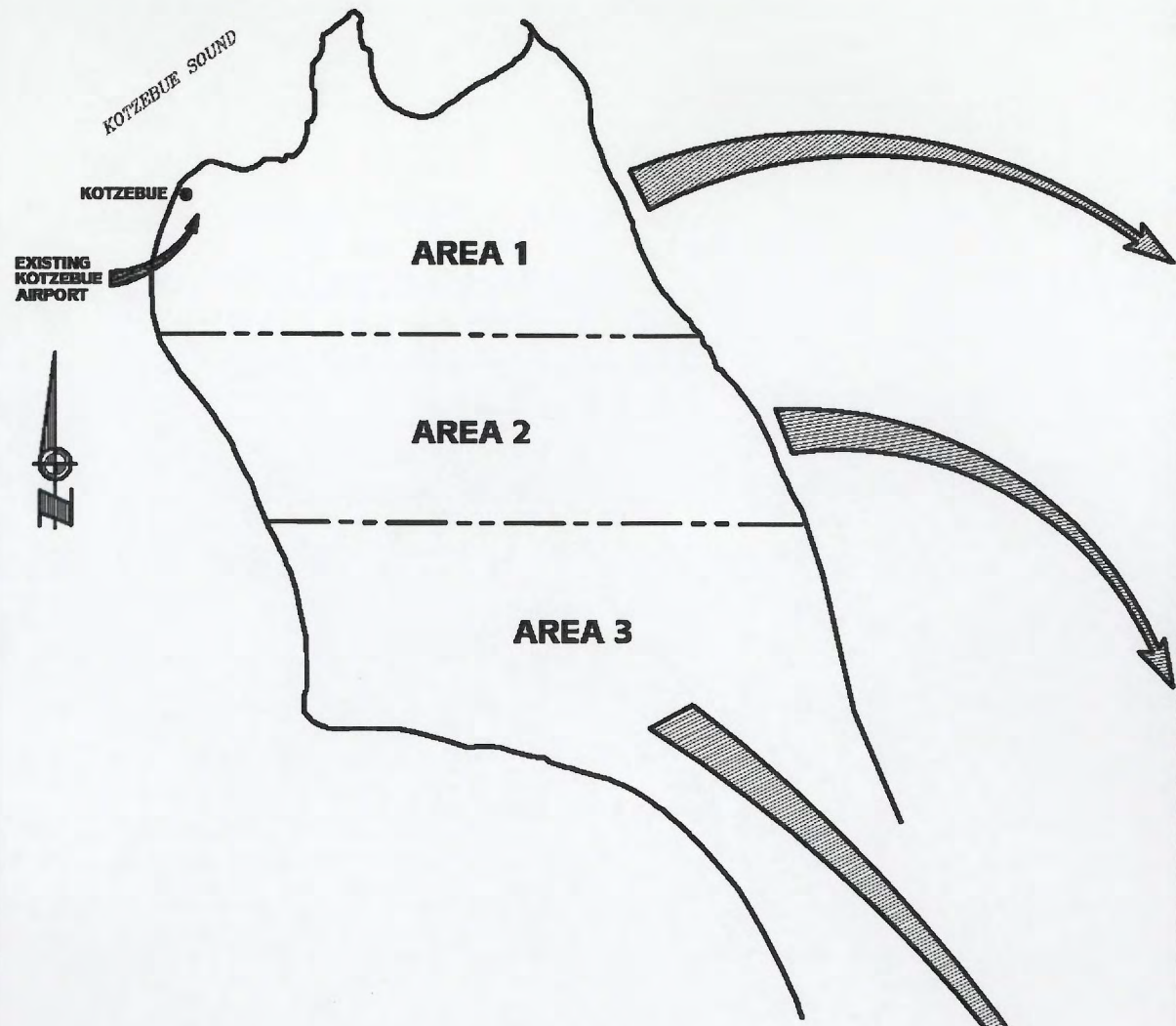
**Table 5-1 – Alternative Evaluation Matrix**

Criteria are listed in order of importance. The alternative that best fulfills each evaluation criterion is shown in bold.

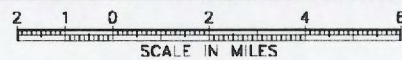
	<b>Alternative 1 Relocate Airport to Area 1</b>	<b>Alternative 2 Relocate Airport to Area 2</b>	<b>Alternative 3 Relocate Airport to Area 3</b>	<b>Alternative 4 Improve Existing Airport</b>
<b>Safety</b>				
<b>Approach Capabilities</b>	<b>Good approach capabilities; potential airport site is nearly the highest point on the peninsula</b>	Approach capability downgraded because of windmills and radio tower in proximity to potential approaches	<b>Good approach capability; potential airport site in lowland area</b>	Improvements would clear a TERPS approach, but Part 77 terrain obstructions would remain off of the east end of Runway 8-26 Kotzebue Sound prevents approach lighting on the west end of Runway 8-26
<b>Wind Coverage and Other Meteorological Conditions</b>	<b>Wind coverage with 12 knot crosswind Main runway = 89.8% coverage Combined runway = 95.2% coverage Fog unlikely</b>	Wind coverage with 12 knot crosswind Main runway = 84.7% coverage Combined runway = 95.5% coverage Fog is likely because of Sadie Creek Combination of terrain and runway alignments may lead to snow drifting on runways	<b>Wind coverage with 12 knot crosswind Main runway = 90.2% coverage Combined runway = 96.9% coverage Fog unknown, but suspected unlikely</b>	Wind coverage with 12 knot crosswind Main runway = 90.4% coverage Combined runway = 96.8% coverage Fog cover common
<b>Distance from Bird Attractants</b>	<b>Located in low-value wetlands</b>	Located near high-value wetlands	Located between two high-value wetland areas	Located near Kotzebue Lagoon, landfill, high-value wetlands, and fish drying racks
<b>Air Space and Land Use Compatibility/Obstructions</b>	<b>Site located in undeveloped area; airspace and land use conflicts unlikely</b>	<b>Same as Alternative 1</b>	<b>Same as Alternative 1</b>	Airport conflicts with the community over land use; terrain and community development limit airspace
<b>Safe Access</b>	Potential airport site 6.6 road miles from community	Potential airport site 5.9 road miles from community	Potential airport site 12.8 road miles from community	<b>Airport in close proximity to community</b>
<b>Airport Security</b>	<b>Sufficient land at potential airport site to put security measures in place</b>	<b>Same as Alternative 1</b>	<b>Same as Alternative 1</b>	Security hindered by lack of space for airport expansion and community subsistence activities at the beach
<b>Environmental Impacts</b>				
<b>Convenience of Access/Proximity to Community</b>	Airport a short distance from community; not as convenient for residents and visitors, but provides room for community expansion on spit, encourages the development of a transit industry, and provides access to new land	Same as Alternative 1	Airport a considerable distance from community, which would be inconvenient for airport users	<b>Airport remains within walking distance; community values the proximity of the existing airport</b>
<b>User Costs</b>	Airport relocated 6.6 road miles from community center; estimated upper limit for air carriers' and local businesses' additional costs from the increased travel distance to the airport is approximately \$479,100/year	Airport relocated 5.9 road miles from community center; estimated upper limit for air carriers' and local businesses' additional costs from the increased travel distance to the airport is approximately \$479,100/year	Airport relocated 12.8 road miles from community center; estimated upper limit for air carriers' and local businesses' additional costs from the increased travel distance to the airport is approximately \$1,262,400/year	<b>Airport stays at existing location; user cost increase is minimal</b>
<b>Cultural Resources/Subsistence Impacts</b>	Likely to have impacts on subsistence resources; cove is heavily used for subsistence activities; relocation may indirectly impact cultural resources and subsistence camps along shoreline	<b>Least likely to impact cultural resources or subsistence activities because of inland location; access road may aid in reaching berries and other resources</b>	Likely to have impact on subsistence resources, especially birds; airport access road also likely to impact cultural resources and subsistence activities along shoreline	Community's access to subsistence resources will be improved by making room for the road at the west end of Runway 8-26; burial ground will be near the extension of Runway 8-26; cultural resource and subsistence conflicts are inevitable because of proximity to community
<b>Floodplain and Watershed (Water Source) Impacts</b>	Flooding unlikely Airport site about 2.5 miles from Devil's Lake; water source protection may be necessary	Flooding unlikely Airport site about 2.0 miles from Devil's Lake; water source protection may not be necessary	<b>Flooding unlikely Airport site located 8.8 miles from Devil's Lake</b>	Potential for flooding issues Improvements will impact Vortac Lake
<b>Land Ownership</b>	Will require sizeable land purchase; may require private land purchase for access road.	Will require sizeable land purchase; unlikely to impact private land holdings.	Will require sizeable land purchase; likely to require private land purchase for access road.	<b>Land purchase for improving the airport would be limited; unfortunately, land close to the airport, such as the beach area, is not owned by the airport</b>
<b>Wetlands/Fish &amp; Wildlife Impacts</b>	<b>Development avoids high-value wetlands and areas of high wildlife use; large game may be attracted to ridge tops, which are potential runway sites</b>	Development in close proximity to high-value wetlands; highest wildlife use on the peninsula occurs in Area 2	Development between two high-value wetland areas; low wildlife potential, but long airport access road will travel through wildlife/wetland areas	Located in high-value wetland area Airport noise may affect seals and other marine life

Quality Design				
<b>Geology/Long-Term Stability</b>	Most likely of the three relocation areas to have stable foundation soils	Surface features suggest variable permafrost and massive ice formations; variable terrain may result in abrupt and dramatic changes in fill thickness	Surface features suggest variable permafrost and massive ice formations; runway may be placed on dry lake beds which would limit permafrost issues	<b>Primary runway extension likely to be relatively stable because cut will be deep enough to reach glacial till. A significant portion of runways and airport infrastructure have already settled and are mostly stable.</b>
<b>Maintenance &amp; Operation Costs (2006 \$; see Appendix D)</b>	\$2.78 million/year Relatively stable soil conditions	\$2.68 million/year Largely unstable foundation soils	\$2.83 million/year Somewhat stable foundation soils	<b>\$2.63 million/year Most initial settlement has already occurred</b>
<b>Construction Costs for 7,500' Runway (2006 \$; see Appendix D)</b>	\$760 million to \$1,290 million, depending on availability of local borrow Airport borrow quantity: 8,400,000 cy (\$490/\$980 million) Access road construction: 5.6 miles (\$54/\$86 million)	\$950 million Airport borrow quantity: 4,800,000 cy (\$570 million) Access road construction: 3.1 miles (\$60 million)	<b>\$810 million Airport borrow quantity: 4,000,000 cy (\$470 million) Access road construction: 9.7 miles (\$190 million)</b>	\$560 million Excavation quantity: 11,100,000 cy (\$280 million) Airport borrow quantity: 300,000 cy (\$40 million)
<b>Future Expansion Possibilities</b>	Somewhat limited by topography	Same as Alternative 1	<b>Not limited by topography; somewhat limited by prevalence of high-value wetlands.</b>	Severely limited by community & topography
<b>Utility Extension</b>	6.6 mile utility extension; fair soil conditions	5.9 mile utility extension; fair to poor soil conditions	12.8 mile utility extension; fair to poor soil conditions	<b>Minimal utility extension is needed</b>



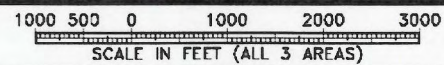
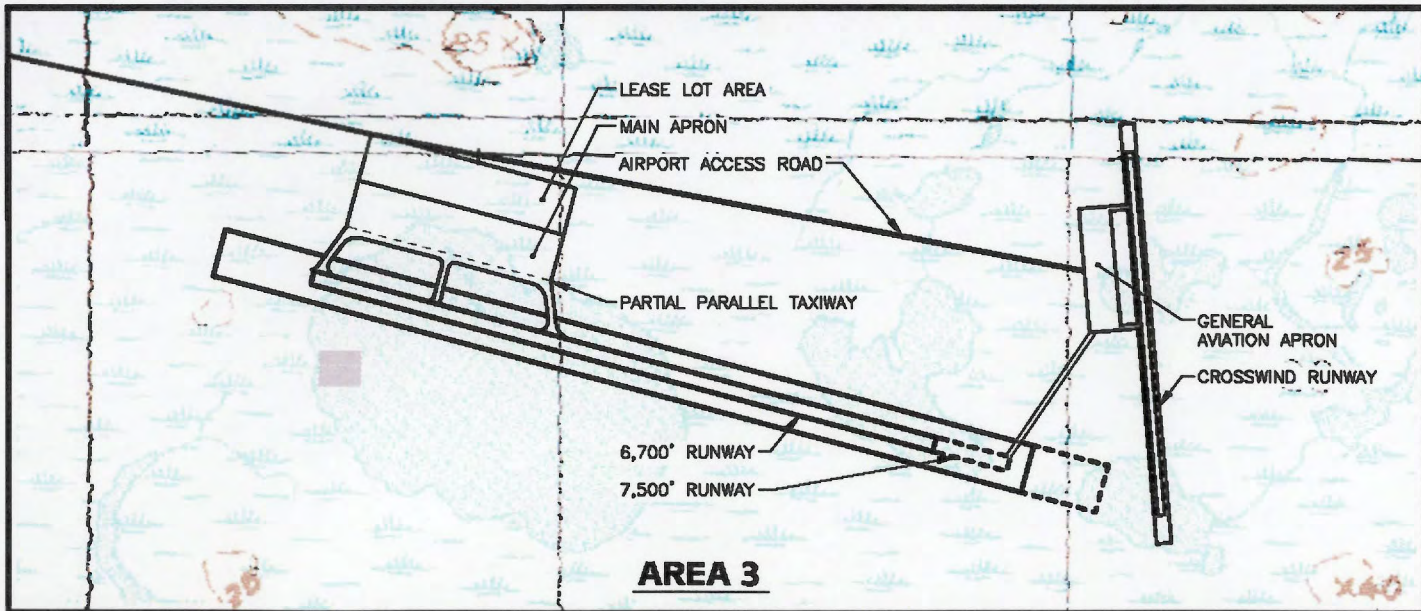
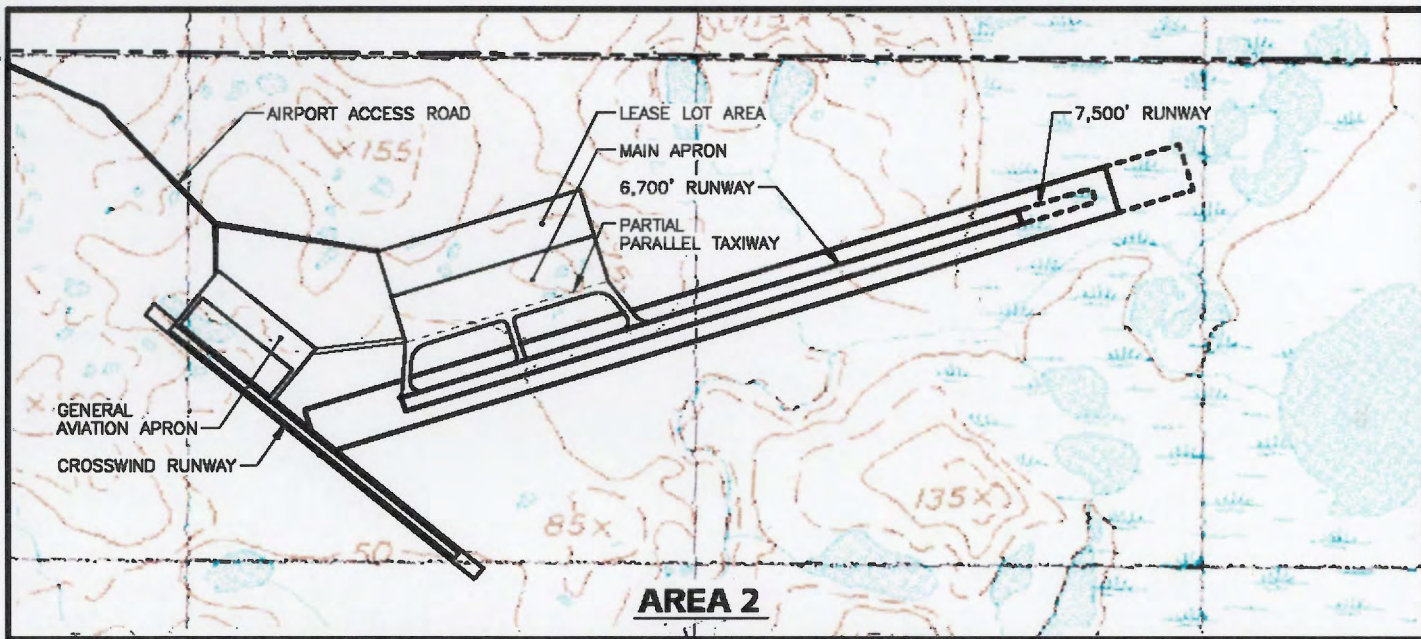
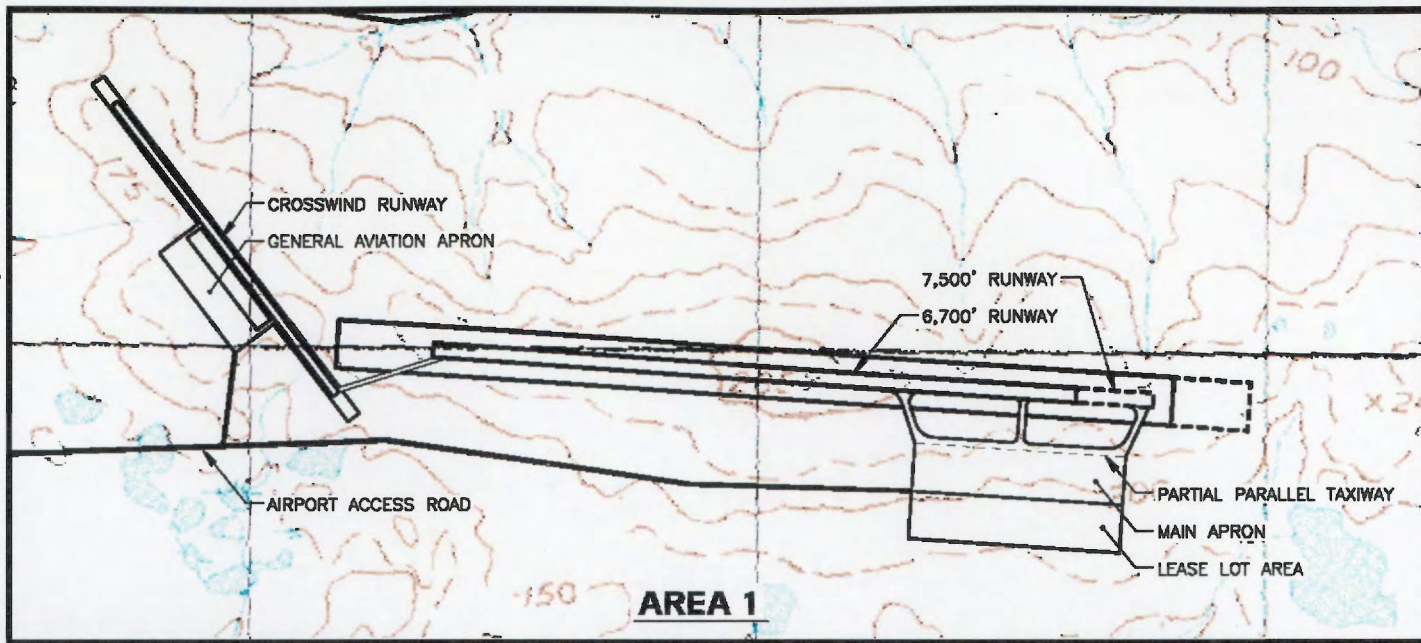


**BALDWIN PENINSULA VICINITY MAP**



**RELOCATED AIRPORT FEATURES**

- 6,700' (OR 7,500') x 150' PRIMARY RUNWAY
- 3,800' x 75' CROSSWIND RUNWAY
- PARTIAL PARALLEL TAXIWAY
- MAIN APRON (122,200 SY)
- LEASE LOT AREA (122,000 SY)
- GENERAL AVIATION APRON (47,000 SY)
- 36' WIDE AIRPORT ACCESS ROAD WITH 150' ROW



CONSULTANT :

PROJECT :  
**KOTZEBUE AIRPORT  
 RELOCATION FEASIBILITY STUDY**

**KOTZEBUE, ALASKA**

SHEET TITLE :  
**RELOCATION AREAS**

DESIGN	RAA
DRAWN	EDS
CHECKED	RLC
DATE	SEPT 2007

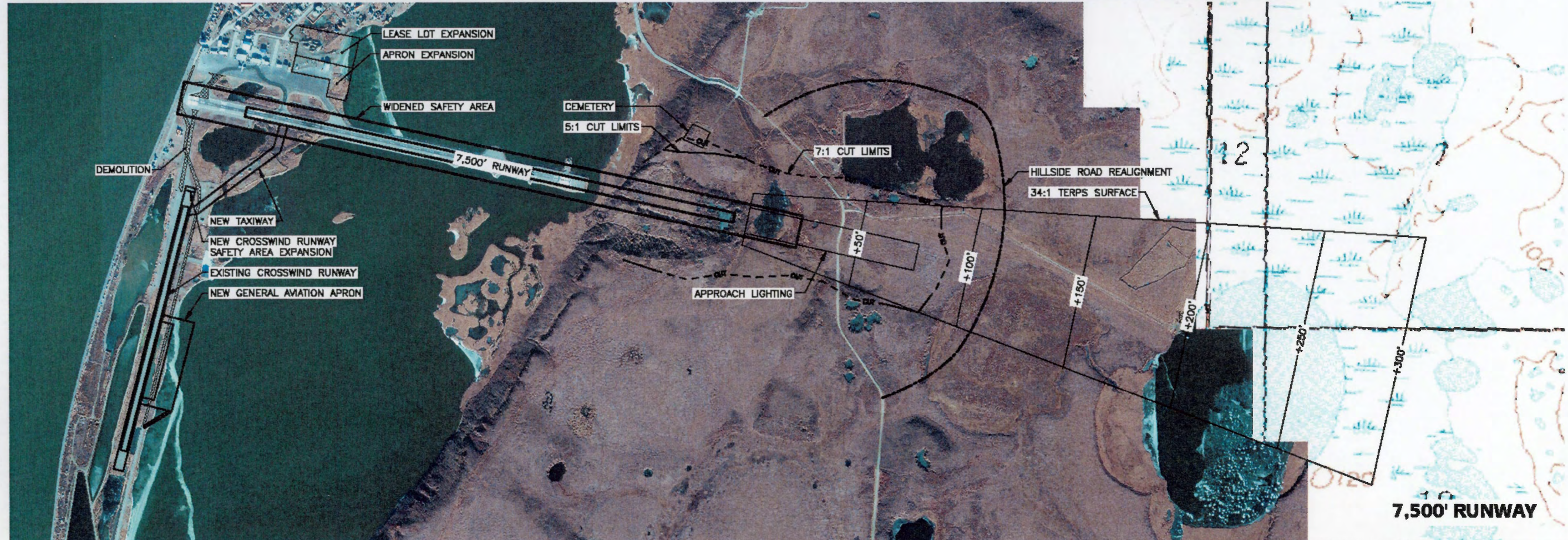
PROJECT No.  
**F05077**

**5-1**





**6,700' RUNWAY**



**7,500' RUNWAY**

CONSULTANT:

PREPARED BY:  
PDC, INC.

PROJECT:  
**KOTZEBUE AIRPORT  
RELOCATION FEASIBILITY STUDY**

**KOTZEBUE, ALASKA**

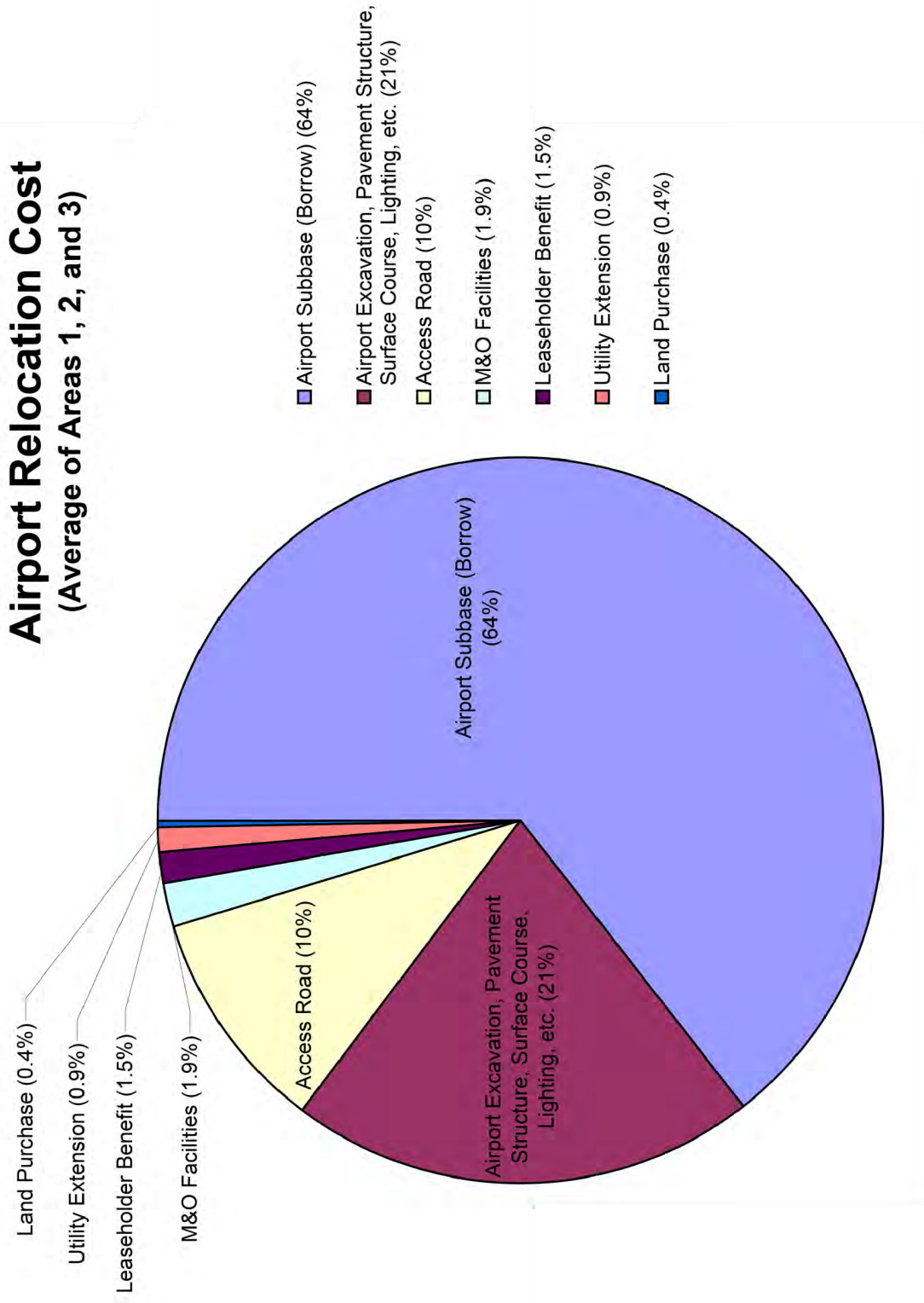
SHEET TITLE:  
**EXISTING AIRPORT  
IMPROVEMENTS  
6,700' AND 7,500'  
RUNWAYS**

DESIGN	RAA
DRAWN	GOs
CHECKED	RLC
DATE	SEPT 2007

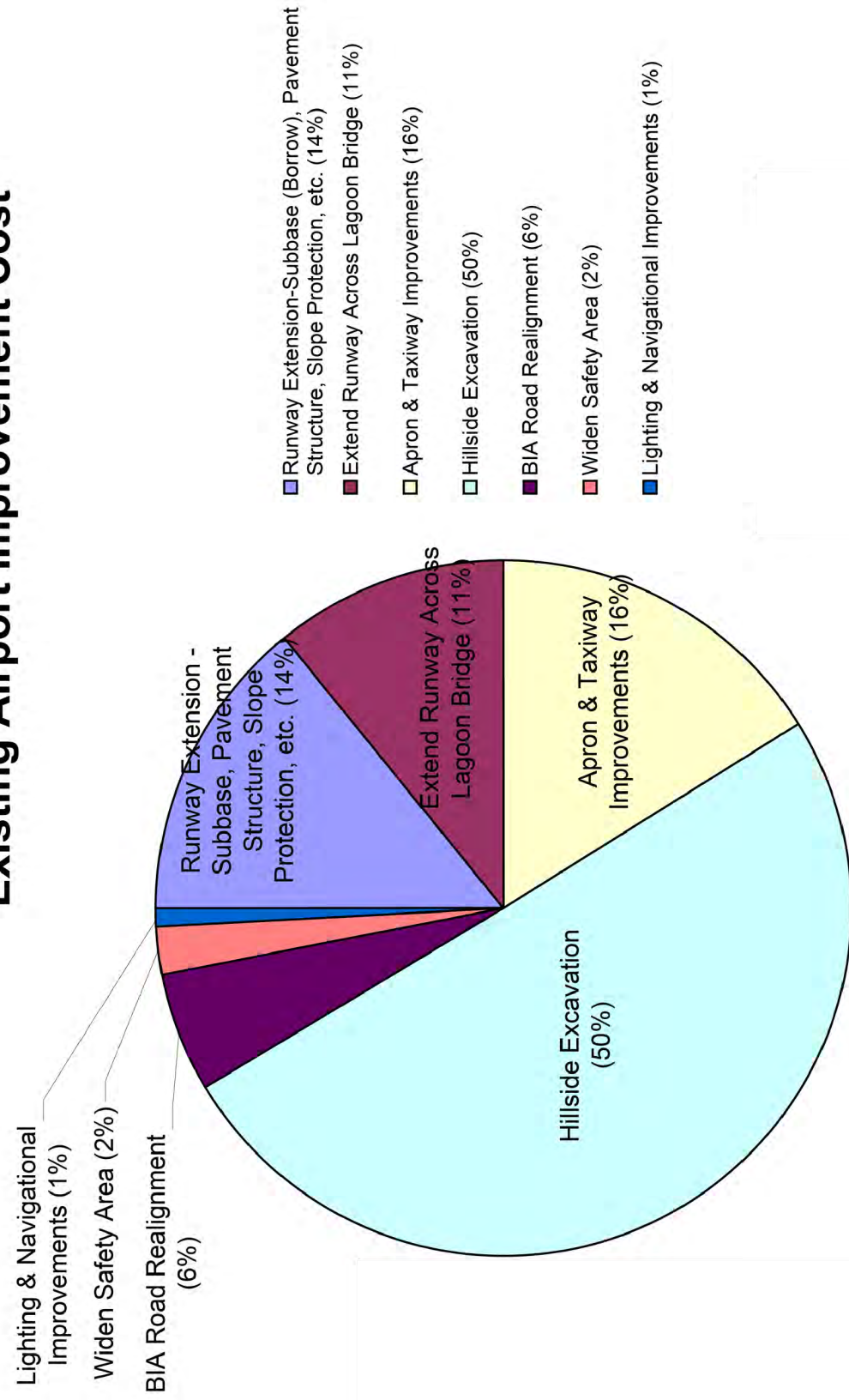
PROJECT No.  
**F05077**  
PAGE  
**5-2**



### Airport Relocation Cost (Average of Areas 1, 2, and 3)



### Existing Airport Improvement Cost



**FIGURE 5-3  
Construction Cost Breakdown**