STATE OF ALASKA

DEPARTMENT OF TRANSPORTATION & PUBLIC FACILITIES

NORTHERN REGION

KOTZEBUE TO CAPE BLOSSOM ROAD

RECONNAISSANCE STUDY

STATE PROJECT NO. 76884

FEBRUARY 2011

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ACRONYMS

AASHTO	American Association of State Highway and Transportation Officials
ADNR	Alaska Department of Natural Resources
ANCSA	Alaska Native Claims Settlement Act
BIA	Bureau of Indian Affairs
DCCED	Alaska Department of Commerce, Community and Economic Development
DOT&PF	Alaska Department of Transportation and Public Facilities
KEA	Kotzebue Electric Association
KIC	Kikiktagruk Inupiat Corporation
NANA	Northwest Arctic Native Association
NWAB	Northwest Arctic Borough
NWI	National Wetlands Inventory
ROW	Right-of-Way
USACE	U.S. Army Corps of Engineers
VORTAC	Very High Frequency Omni-Directional Radio Range Tactical Air Navigation Aid

EXECUTIVE SUMMARY

The purpose of this reconnaissance study is to evaluate preliminary road alignment options beginning in Kotzebue and terminating at Cape Blossom. These options are evaluated based on topography (alignment, grade); soils conditions; erosion and sediment control; hydrology including spring break up; availability of construction materials; maintenance; snow and icing problems; right of way and utility considerations; development and potential development areas for the community; wetlands; cultural and historic resources; fish and wildlife issues; subsistence; community input; and of course, cost.

To date, Alaska Department of Transportation and Public Facilities (DOT&PF) has evaluated several preliminary alternatives including the alternatives evaluated in the 1981 report: "Kotzebue to Chicago Creek Highway Project." Other options include variations to the preliminary alignments presented in that report, connections to the community near the windmill farm, as well as to Ted Steven's Way. The lack of suitable material in the Baldwin Peninsula drives costs of the alternatives. Three options for construction methods have been evaluated for this report: Construct the road completely from barged in gravel; construct the road from local gravel; construct the road embankment from local fine grained material dredged from the proposed Cape Blossom port site. This report also evaluates the requirements for a staged project, in order to capitalize on funding opportunities as they become available.

Many studies have been performed historically for this project. In an effort not to reproduce work that has already been completed, a resource library has been developed and included as Appendix A. The reports listed in the resource library are available electronically from DOT&PF. Field work for this study was limited to what was needed in order to develop cost estimates and additional alignment options.

A staged project most efficiently capitalizes on existing funding opportunities. In general terms, to construct a road to Cape Blossom would cost approximately $3.2 million per mile for a two lane road, and approximately $2.4 million per mile for a single lane road. These costs assume developing borrow sources along the route and using fine grained soil to construct the embankment, allowing the road to settle and consolidate over time. Additional costs are to be expected to cross the single large drainage encountered at Sadie Creek.

The next step in the Kotzebue to Cape Blossom Road Project is to begin the Preliminary Design and Environmental Process, and to further evaluate the alignments identified in this report. This report has not identified a preferred alternative. The information in this report may be used to analyze the alternatives and identify a preferred alternative. Additional data collection such as imagery collection, survey, and geotechnical studies have been identified as essential elements of the preliminary design/environmental stage.

INTRODUCTION

The Kotzebue to Cape Blossom Road Reconnaissance Study is a Federal Highways Administration funded project administered through the DOT&PF, Northern Region. This study was developed by utilizing historic reports and verifying assumptions within the reports with data collection activities. The purpose of this study is to address the feasibility of a road connecting the community of Kotzebue to a City planned port at Cape Blossom. All historic reports, as well as data and reports generated as part of this project, are listed in Appendix A and are available by request from DOT&PF.

The Kotzebue to Cape Blossom Road was first studied in the early 1980's by Michael Baker Jr., Inc. for the State of Alaska in an effort to gain access to coal resources at Chicago Creek Alaska (Reference Resource Library, Appendix A). This study included identification of several alignments from Kotzebue to Coal Creek heading Southeast through the Baldwin Peninsula for approximately 150 miles. The Michael Baker study includes a collection and analysis of existing data, aerial reconnaissance of the general route alternatives, alignment maps, and an onsite investigation. In addition to these alignments, an alternate alignment is presented in a supplemental Michael Baker Jr., Inc. report that specifically addresses access to Cape Blossom. This supplemental report describes the physical characteristics of

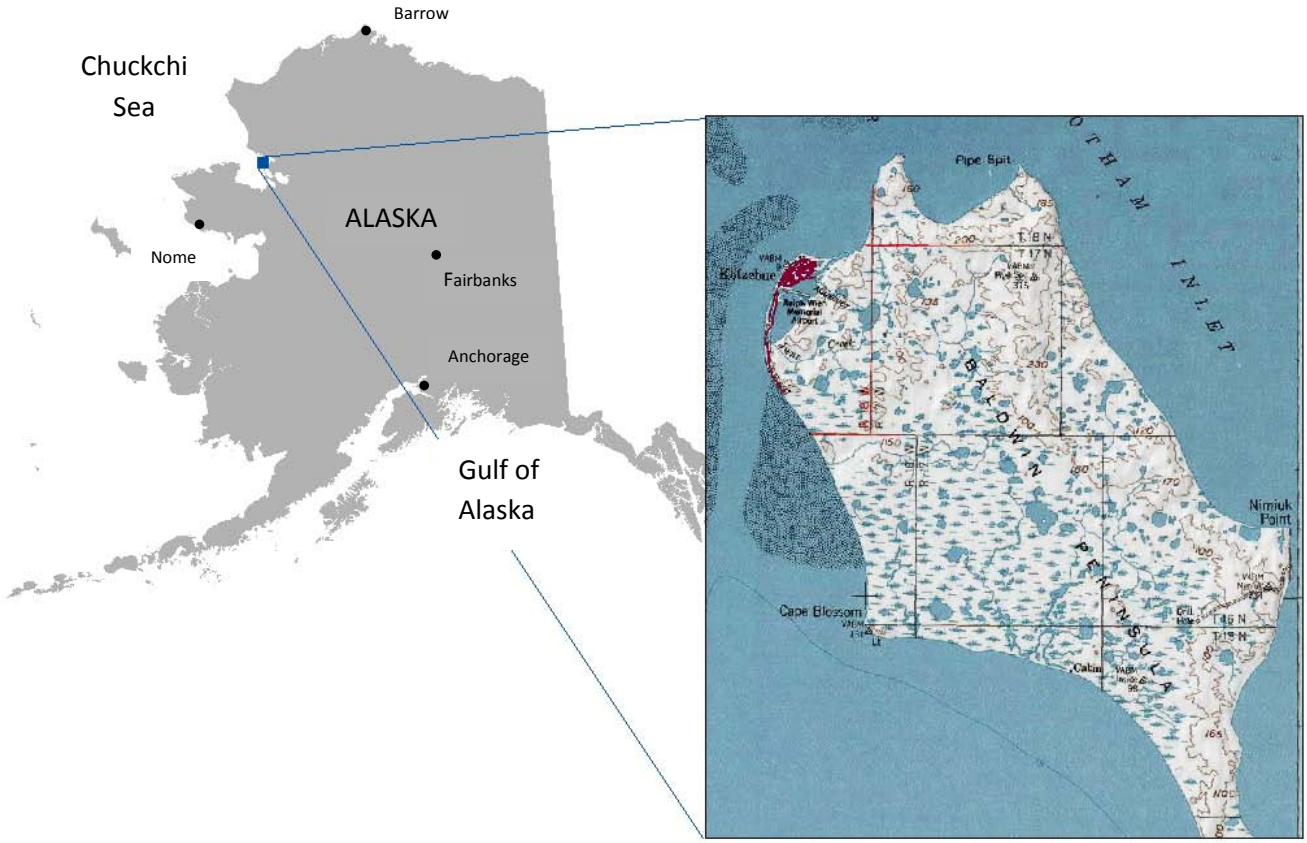

FIGURE 1 - LOCATION MAP OF BALDWIN PENINSULA

the alignment routes, soils conditions, vegetation, land status as of September 1, 1981, and environmental features. This report also included a cost estimate and haul analysis for construction materials. A plan and profile index map is included as available information.

The Chicago Creek study was followed in 1983 by the "Feasibility Analysis: Kotzebue Deep Water Port/Airport Analysis" prepared for the City of Kotzebue. The objective of this report was to determine the overall feasibility of developing a deep water port and transshipment port at Kotzebue and to ascertain the feasibility of locating an airport near the deep water port. This report identifies the alternative alignment of the Chicago Creek Road as the basis for access to the deep water port in the feasibility study. The feasibility analysis also addresses the physical environment, wind and climate studies, bathymetry of the region, biological setting, soils, permafrost, oceanography, sea ice, and hydrology. This analysis evaluated additional deep water port sites at Kotzebue and Isthmus, and states that the Cape Blossom site is the most advantageous because deep water (35 foot depth) is only 6,400 feet from shore, and the site is relatively close to Kotzebue (approximately 15 miles). In comparison, to get to a 35 foot water depth at Kotzebue would require dredging to 13 miles from the shore. Cape Blossom was selected as the "the best location to develop a deep water port".

Other reports have been completed evaluating the feasibility of a port at Cape Blossom by the Corp of Engineers since the 1980's reports, but are not as comprehensive or as broad in scope. These reports are listed in Appendix A and have similar conclusions as the reports identified previously. The most recent studies were developed in 2004 by the Corp of Engineer's and focus on port developments, and not road developments. An airport relocation feasibility study was developed in 2007 by DOT&PF addressing airport relocation issues, many of which apply to the Cape Blossom Road Reconnaissance Study. These studies are referenced throughout this report.

After evaluating historic studies related to this project, DOT&PF identified data gaps for further data acquisition. These data gaps included identifying current community needs, design criteria, material site considerations and subsurface conditions, topography characterization, coastal engineering considerations, and hydrology. DOT&PF collected additional data to help fill these data gaps.

This reconnaissance study focuses on preliminary alignments to construct a road from Kotzebue to Cape Blossom, as well as the associated impacts and considerations. Construction costs are addressed, considering local vs. barged in materials, project staging, and project timeframes. Project permitting and environmental considerations are also included.

PRELIMINARY PURPOSE AND NEED

The purpose of the Kotzebue to Cape Blossom Road is to provide access between Kotzebue and a port site at Cape Blossom. Kotzebue serves as a transportation and economic center for Northwest Alaska. Nearly all regional supplies arrive in Kotzebue by ocean shipments between June and September. There are no roads or railroads to Kotzebue. A port site with deeper water is needed to more economically deliver fuel and commodities to the community and in turn, the region. Currently, all loads are lightered to Kotzebue from larger vessels that are restricted to waters 15 miles offshore, due to shallow water depths. This method of delivery results in increased costs for the region for goods and energy needs. Additionally, land availability at the current port is limited, and storage problems exist. A new port site at Cape Blossom would allow larger vessels to dock and provide room for expansion.

Another need for the Cape Blossom Road is to provide access for the community to development areas, recreation and subsistence areas, and private landholdings. The community has expansion plans to extend into the higher elevation areas to the east and south of Kotzebue. The City of Kotzebue Comprehensive Plan (December 2000), the city's community planning document, explains the need for housing developments, along with the expansion of the sewer and water utilities, airport expansion/relocation, and the development of a small boat harbor. Also, Sadie Creek has been identified in public meetings as a potential recreational and subsistence area that would receive greater use if access was available. A road to Cape Blossom would also allow access to private landholdings along the western coast of the Baldwin Peninsula, where current access is limited to four wheelers, snow machines, or boats.

In 2010, the Northwest Arctic Borough, the City of Kotzebue, and the Native Village of Kotzebue identified the Kotzebue to Cape Blossom Road as their highest priority transportation project.

FIGURE 2 - VIEW OF THE CITY OF KOTZEBUE

EXISTING CONDITIONS AND DATA AVAILABILITY

Existing conditions can best be summarized by referencing existing reports that have addressed the conditions of the region over time, mainly the 1981 "Kotzebue to Chicago Creek Highway Project" prepared by Michael Baker Jr., Inc. for the State of Alaska. Other reports documenting existing conditions include "Feasibility Analysis, Kotzebue Deep Water Port/Airport" prepared by Tetra Tech and Wright Forssen Associates, and reports developed by PDC, Inc. as part of the Kotzebue Airport Relocation Feasibility Study prepared in January 2008. In general these reports have covered conditions for the entire Baldwin Peninsula by evaluating road/airport/port options.

LOCAL/REGIONAL SETTING

Kotzebue is located at approximately 66.9° North and 162.6° West (Section 3, Township 17N, Range 18W, Kateel River Meridian) on the Baldwin Peninsula in the Kotzebue Sound, on a 3-mile-long spit. A total of 27.0 square miles of land and 1.7 square miles of water are within its city limits. The mouth of the Kobuk, Noatak and Selawik Rivers are near Kotzebue.

Kotzebue is the largest of the eleven communities in the NWAB. NANA (the area's regional native corporation) and the NWAB share the same boundaries. Kotzebue Airport serves as the regional air transportation hub for the 10 other communities in the NWAB (Ambler, Buckland, Deering, Kiana, Kivalina, Kobuk, Noatak, Noorvik, Selawik, and Shungnak) and to some extent for the Red Dog Mine, 90 miles north of Kotzebue, as well as for the village of Point Hope further up the coast in the North Slope Borough (*Northwest Arctic Transportation Plan,* 2004, DOT&PF). NANA generates revenues to provide jobs and social services such as healthcare and education for the native Alaskans in its region.

In 2007, the state demographer estimated Kotzebue's population at 3,135, almost 44 percent of the total estimated Borough population of 7,133 (Alaska Department of Commerce, Community and Economic Development).

TABLE 1 - NORTHWEST ARCTIC BOROUGH POPULATION (DCCED 2007)

Northwest Arctic Borough Population		Percentage of the Borough Population
Ambler	278	3.9 %
Buckland	457	6.4 %
Deering	133	1.9 %
Kiana	391	5.5 %
Kivalina	398	5.6 %
Kobuk	119	1.7 %
Kotzebue	**3,135**	**44.0 %**
Noatak	489	6.9 %
Noorvik	636	8.9 %
Selawik	828	11.6 %
Shungnak	269	3.8 %
Total Population	**7,133**	

HISTORY

Kotzebue has been occupied by Inupiat Eskimos for at least 10,000 years. The Inupiat name for Kotzebue is Qikiqtaġruk (ki-kik-tug-rook), which means “the place that is almost island”. "Qikiqtaġruk" was the hub of ancient arctic trading routes long before European contact, due to its coastal location near a number of rivers. The German Lt. Otto Von Kotzebue "discovered" Kotzebue Sound in 1818 for Russia. The community was named after the Kotzebue Sound in 1899 when a post office was established. Since the turn of the century, expansion of economic activities and services in the area has enabled Kotzebue to develop relatively rapidly. The City was formed in 1958. An Air Force Base and White Alice Communications System were later constructed.

FACILITIES

Water is supplied by the 100-acre-foot Devil’s Lake Reservoir, located two miles from the city. VORTAC Lake had previously supplied water to the city as well, but is now deemed inoperable. Water from Devil’s Lake is treated and stored in two 1.5-million-gallon tanks, which is approximately 10 days worth of water for the City of Kotzebue. Water is heated with a waste heat recovery system at the electric plant, and distributed in circulating mains. Piped sewage is treated in a 32-acre zero discharge facultative lagoon west of the airport. Significant improvements are needed to this 30-year-old facility. Around 80% of homes are fully plumbed, and 521 homes are served by the City system. The 30-year-old PVC water and sewer mains are currently undergoing replacement. A new transfer station and Class 2 permitted landfill with balefill has recently been completed. Recycling and hazardous waste disposal have been improved. Kotzebue uses ten 50 kilowatt wind turbines to supplement electricity.

TRANSPORTATION

Air is the primary means of transportation year-round. The state-owned Ralph Wien Memorial Airport supports daily jet service to Anchorage and several air taxis to the region's villages. It has a 5,900 foot long by 150 foot wide main paved runway and 3,800 foot long by 100 foot wide crosswind gravel runway. A seaplane base is also operated by the state.

The shipping season lasts 100 days, from early July to early October, when the Kotzebue Sound is ice-free. Due to river sediments deposited by the Noatak River 4 miles above Kotzebue, the harbor is shallow. Deep draft vessels must anchor 15 miles out, and cargo is lightered to shore and warehoused. Shallow draft barges are employed for these lightering operations, as well as for local material transportation. There are 26 miles of local gravel roads, used by cars, trucks and motorcycles during the summer. Several of the main roads within Kotzebue are paved. Snow machines are used in the winter months extensively for travel to outlying villages.

CLIMATE

Climate data is important in developing design criteria for road embankments and drainage structures, as well as for analyzing maintenance needs for a proposed road. Current and historical data is available at the University of Alaska in Fairbanks through their website

(http://climate.gi.alaska.edu/Climate/Location/West/Kotzebue.html). For this reconnaissance study, a preliminary evaluation of the data was performed to establish road embankment heights and to make assumptions for drainage structures. The next phase of this project would evaluate this data in more detail.

FIGURE 3 - KOTZEBUE IN THE WINTER

A thermal analysis program was used to make preliminary evaluations of subsurface thaw consolidation. This information is necessary to determine an appropriate embankment height. The goal is to design an embankment with minimum thaw of the subsurface – to ensure stability. Thaw depths were calculated using parameters found in the MUT1D (Multi User-Friendly Thermal Model in 1 Dimension) and BERG2 (Micro-Computer Estimation of Freeze and Thaw Depths and Thaw Consolidation). The following parameters were used to develop a thermal model for the Cape Blossom Road:

TABLE 2 - KOTZEBUE CLIMATE DATA

Mean Annual Surface Temperature	28.4 ºF
Sine Wave Amplitude	44.6 ºF
Thaw Season Surface n-Factor	1.9 – 0.9
Freeze Season Surface n-Factor	0.9
Air Thawing Index (F-days)	2400 ºF-days
Air Freezing Index (F-days)	6500 ºF-days
Mean Annual Air Temp (F-deg)	20.76 ºF
Amplitude of Air Temp Sine Wave	36.5 ºF
Moisture Content	10% - 45%

Initial calculations determined subsurface thaw to be at depths of 5.0 – 7.0 ft. Numerous models were analyzed, with specifications of 8 ft to 12 ft embankments and moisture contents of 10% to 45%. An embankment height of 8 ft satisfies the minimum criteria for subsurface thaw consolidation and has a lower up-front project cost. Historically, it has been noted that in Arctic conditions with variable moisture contents and significant amounts of permafrost and ice lenses, a more conservative approach of installing a 10 ft embankment reduces the maintenance costs over the lifetime of the road.

Precipitation was evaluated for use in developing drainage structure estimates and in evaluating Stormwater Pollution Prevention Plan needs. According to the University of Alaska, the mean precipitation for Kotzebue is 10.05 inches. The annual extreme precipitation amount is 14.76 inches (in 1990). The highest one day maximum precipitation for the area is 1.64 inches (in 1978).

Snowfall, in combination with wind, is evaluated to determine potential snow drifting effects a road my cause. The mean annual snowfall is 49.4 inches with a mean annual snow depth of 12 inches. The highest total annual snowfall for Kotzebue is 88 inches (in 1965), with a one day maximum of 19 inches in 1938. The wind in Kotzebue has been studied in the past at the Kotzebue Airport. A wind record was evaluated from 1945 to 1987 to establish wind trends in Kotzebue. The wind study indicates winds occur up to 18 mph from any directions, but stronger winds above 18mph come primarily from the Northeast and South. Wind data collection devices at the airport confirm that the predominant winds are from the North Northeast, and the South Southwest.

SADIE CREEK DRAINAGE

The Sadie Creek Drainage Area is estimated to be 35 square miles. Discharge for selected storm events was calculated in accordance with the procedures outlined by Curran, J.H., Meyer, D.F., and Tasker, G.D., (2003) for the Sadie Creek area. Table 3 summarizes calculated surface water discharges for various return periods. In the regression equation, **A** is the drainage basin area in square miles.

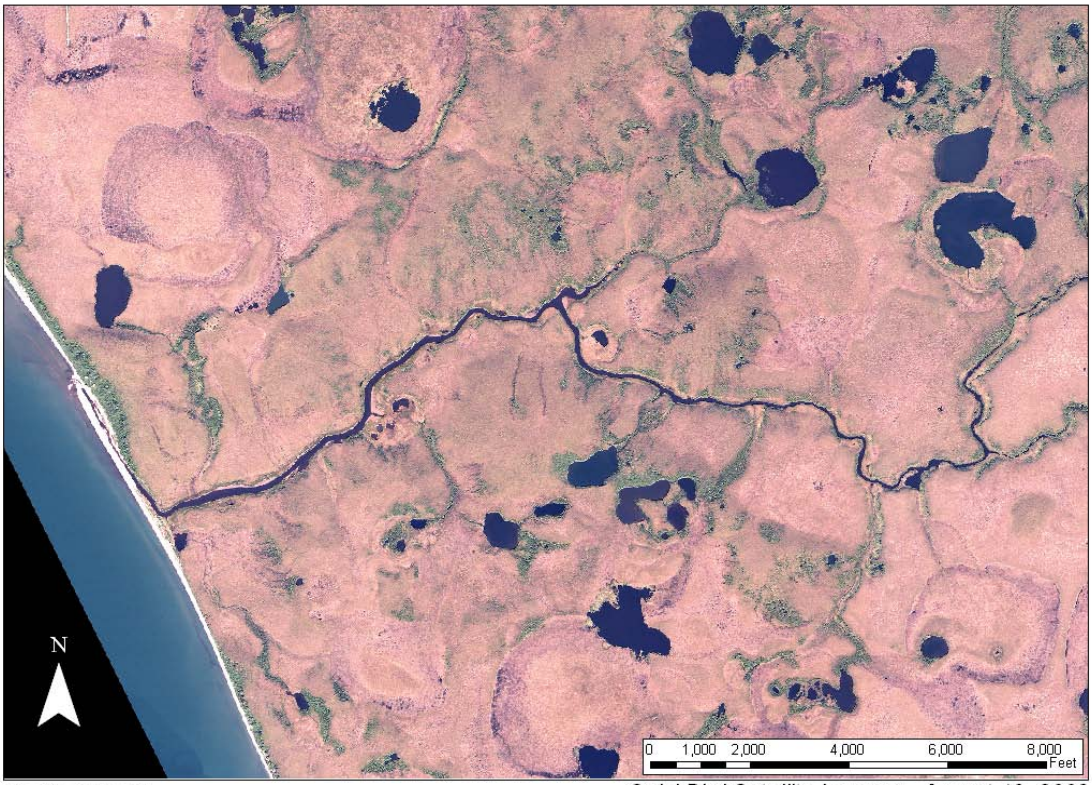

FIGURE 4 - SATELLITE IMAGE OF SADIE CREEK

TABLE 3 - SADIE CREEK ESTIMATED DISCHARGE FOR SELECTED RETURN PERIODS

Flood Event	Regression Equation	Discharge *Cubic Feet Per Second*	Average Standard Error of Prediction *Log Units*	Average Standard Error of Prediction *Percent*	Average Equivalent Years of Record
Q_2	28.07 $\mathbf{A}^{0.8916}$	668.242	0.212	52	1.3
Q_5	47.51 $\mathbf{A}^{0.8691}$	1044.082	0.204	50	1.5
Q_{10}	61.00 $\mathbf{A}^{0.8588}$	1292.336	0.203	49	1.9
Q_{25}	78.33 $\mathbf{A}^{0.8486}$	1600.384	0.205	50	2.5
Q_{50}	91.29 $\mathbf{A}^{0.8424}$	1824.509	0.208	51	3.0
Q_{100}	104.2 $\mathbf{A}^{0.8370}$	2042.926	0.211	52	3.3
Q_{200}	117.1 $\mathbf{A}^{0.8322}$	2256.994	0.216	53	3.6
Q_{500}	134.2 $\mathbf{A}^{0.8266}$	2535.591	0.223	55	3.9

Design storm rainfall totals are presented in the following chart.

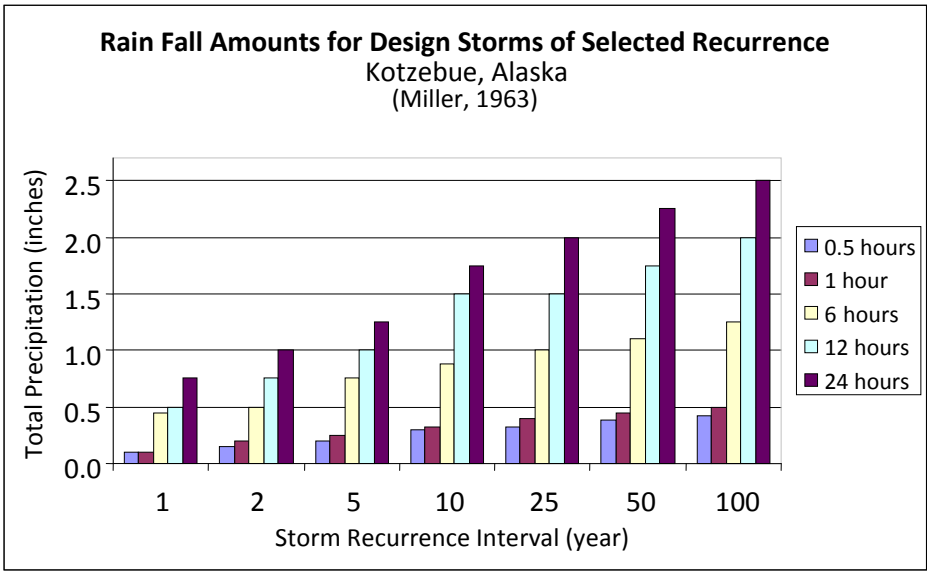

FIGURE 5 - RAIN FALL AMOUNTS FOR DESIGN STORMS OF SELECTED RECURRENCE

SOILS, GEOLOGY AND MATERIAL SOURCES

OVERVIEW

The following information was collected by R&M Consultants, Inc. for the *Kotzebue Airport Relocation Feasibility Study, October 2007.*

The Baldwin Peninsula is a narrow land feature, of about 150 to 175 square-miles, bounded on the west by Kotzebue Sound, off the Chukchi Sea, and on the east by Hotham Inlet. The peninsula is interpreted to be a terminal moraine, created at the end of a pre-Wisconsin glacial advance (e.g. Hamilton, 1994; and Huston et al., 1990). Currently, the peninsula is unglaciated and situated in the Kobuk-Selawik Lowlands physiographic division, characterized by rolling, lake-dotted lowlands with gently sloping hills to about 350 feet in elevation, surrounded by coastal, wave-cut bluffs and a narrow beach (Wahrhaftig, 1965). Surface drainage from the peninsula generally flows to the west, into Kotzebue Sound, following June Creek, Sadie Creek, Riley Creek and two or more other unnamed courses east of Cape Blossom. The peninsula's vegetation is generally moist to wet tundra (AEIDC, 1975).

The Upper Baldwin Peninsula is underlain by continuous permafrost (Brown et al., 1997) likely extending to depths of at least several hundred feet. The permafrost is considered shallow and contains significant volumes of ground ice, regardless of elevation or topography. The basis of this interpretation is the prevalent thermokarst terrain (e.g. thermokarst lakes, thaw sinks, thermo-erosional niches, beaded streams, thaw bulbs, and ice-wedge casts), and the massive ground ice forms visible in many of the coastal bluffs and indicated by polygon-patterned ground. The shallow permafrost also appears to be moderately warm (i.e., above about 28 to 30°F).

The surficial geology of the Upper Baldwin Peninsula is comprised of variable marine, estuarine, glaciomarine and glacial sediments, (e.g. Hamilton, 1994; and Krause, 1985), over Mid- to Late Tertiary sandstone, conglomerate and shale, early Tertiary volcanic rock, and Pre-Tertiary metamorphic rock (e.g. Decker et al., 1988; and Kirschner, 1994). There are no bedrock outcrops on the peninsula, and the depth of unconsolidated surficial deposits is unknown. A test well drilled at Kotzebue in the early 1950s to a depth of 326 feet did not encounter bedrock (Williams, 1970).

The surficial soil deposits can be grouped into six general units:

- **Estuary deposits -** consisting of the fine-grain silt and clays that eroded from the coastal bluffs, or were discharged from the Kobuk and Noatak Rivers. Around Kotzebue, such deposits are described as loose to medium dense, silt and organic silt.
- **Beach deposits** - sand and fine, rounded to subrounded gravel accumulated around portions of the Upper Peninsula. Likely comprised of materials eroded from the glacial till and glaciofluvial units exposed in the coastal bluffs, and then transported by long shore currents (notable spits have formed around the Upper Peninsula at Kotzebue, Pipe Spit and Nimiuk Point). These coarse-grained deposits, where present, are typically narrow and thin; although similar coarse-grained materials have been reported more than one-half mile offshore of Sadie Creek and Cape Blossom.

FIGURE 6 - MASSIVE ICE FORMS SEEN ALONG THE COASTLINE OF THE BALDWIN PENINSULA

- **Lagoon deposits** - generally consisting of soft organic-rich silts and fine sands, situated between the beach and coastal bluff (e.g. along east side of the Kotzebue Airport).
- **Upland silt** - away from the coast, this unit mantles the Upper Peninsula, consisting of very fine-grained, non- to moderately plastic silt, including eolian, colluvium and lake (lacustrine) deposits. Locally, this unit is up or greater than 90 feet thick and likely interspersed with amorphous and coarse organic matter (including buried layers of peat and wood from old forests). These types of soils are typically ice-rich, and very unstable and susceptible to rapid erosion when unfrozen.
- **Glaciofluvial deposits –** this course-grained unit has been observed as sporadic (discontinuous) thin sections in the coastal bluff around the peninsula, sandwiched between the upland silt and glacial till units. From limited observation, this unit also appears to contain some cobble and boulder sized materials.
- **Glacial till** - a heterogeneous mix of non to moderately plastic fine-grained glacial and reworked marine deposits. The Upper Baldwin Peninsula is cored by a glacial till. Based on very limited information, the top of the glacial till near Kotzebue may be above sea-level, but may occur deeper, below sea-level, near Sadie Creek and along the coast on either side of Cape Blossom.

Existing Material Sources

There are currently several existing material sources that have been used on the Baldwin Peninsula for past projects. Isaac Lake near the airport has been successfully used to extract gravel in the past, but recent operations have indicated that the usable gravel from the lake is becoming very limited. Nimiuk Point is a source of material that has been used for many construction projects in the past, most recently, the Kotzebue East Side Obstruction Removal Project which was completed in 2007. Nimiuk point is located on the east side of the Baldwin Peninsula, approximately 18 miles SE of Kotzebue (a distance of 25 miles by barge). The East Side Obstruction Removal Project required 310,000 tons of borrow material meeting Standard Airport Specifications. The material from Nimiuk Point was hauled using shallow draft barges due to the shallow water near Kotzebue. Beach material has also been used in the past for construction projects, but is limited in quantity and quality, and is not considered a reliable source for large capital works projects.

FIGURE 7 - MATERIAL SITE AT NIMIUK POINT

POTENTIAL MATERIAL SOURCES

Based on conceptual estimates 400,000 to 750,000 cubic yards of borrow material may be required for the construction of Cape Blossom Road. There are two general areas of interest on the Upper Baldwin Peninsula which may contain coarse-grained material suitable for forming new embankments and possible aggregate for pavements, including beach (and offshore) deposits near Cape Blossom, and the buried glaciofluvial deposits in the northeastern prtion of the peninsula. Recent exploration offshore at Cape Bloosom indicate near shore sediments are silts and sands, with very minor gravel. These soils are abundant, but poorly suited for embankment construction. Beach gravels are high-quality, meeting specification for crushed aggregate, but low fines content as well as small grainsize and restricted distribution reduce their attractiveness as a material source.

While no substantial exploration has been completed in the northeastern Baldwin Peninsula, this area may have the greatest potential for containing significant quantities of suitable borrow and aggregate on the Baldwin Peninsula. Recent test holes encountered significant thickesses of gravel at depths of 20 to 60 feet below ground surface. Additional exploration is planned to further define these gravels. The few available samples from surface and test holes indicate this material is well-graded to poorly-graded gravel. Its suitability for aggregate products is uncertain due to variable Degradation values.

There are other known, or previously considered (by others) sites around the Kotzebue Sound region, which could be developed to provide borrow, aggregate and/or rock materials. Table 4 summarizes seven potential areas which may be found, subject to field exploration, to contain significant volumes of materials suitable for this project. The recent R&M report describing current conditions is provided in Appendix E.

TABLE 4 - POTENTIAL MATERIAL SOURCE AREAS, KOTZEBUE SOUND REGION

Areas of Interest	*Type of Materials Likely Present*	*Potential to Produce Significant Quantities*
Baldwin Peninsula		
1 Cape Blossom Beach	Sand, gravel and silt	Poor
2 Northeast Coast	Sand, gravel and silt	Poor (to High?)
Other Kotzebue Sound Areas		
3 Lower Noatak River	Sand, gravel and bedrock	High
4 Deering-Candle	Bedrock	High
5 Candle-Buckland	Bedrock	Moderate to High
6 Noorvik-Kiana	Sand, gravel and bedrock	High
7 Lower Baldwin Peninsula	Sand and gravel	Poor to Moderate

LAND STATUS

In October 2006, McClintock Land Associates, Inc. prepared the Kotzebue Airport Relocation Feasibility Study, Land Status Report for the DOT&PF. This report identified existing land interest, ownership of adjacent property, rights-of-way, and other land settlement agreements in the project area. The Land Status Report inventoried all ANCSA conveyance documents, U.S. Surveys, BLM and State Master Title Plats, recorded plats and subdivisions, agreements, leases, rights-of-way, 17(b) easements, and Native Allotment certifications for land actions within the project area. This information was used in the drafting of the preliminary alignments. A Land Status Report for the Baldwin Peninsula (prepared for the Airport Study) is located in Appendix D. A map describing land status is also shown in Appendix D. Additional information on Land Status is also described in the Environmental Overview section later in the report.

In general, acquiring the right-of-way (ROW) for a road to Cape Blossom would involve native corporation lands. There are two Native Corporations that hold the interest in the lands needed for a ROW to a deep water port at Cape Blossom. The Kikiktagruk Inupiat Corporation (KIC) holds the surface estate to both patented and interim conveyed lands that could potentially be impacted by this project. The NANA Regional Corporation holds the subsurface estate to both patented and interim conveyed lands that could be impacted by the project. NANA also holds the surface and subsurface estate to certain patented lands on the peninsula that could be impacted by the project.

The native allotments in the area can generally be avoided, and do not impact road alignments. Native Allotments may be impacted in the vicinity of the deep water port, but until more details are developed on the feasibility of the deep water port site, the exact location is undetermined. There is both corporation land and native allotments in the vicinity of the deep water port. The Land Status Map, as well as the Land Status Report in Appendix D describes the allotments.

There are two 17(b) Easements (25 foot trail easements) that could be impacted by a road to Cape Blossom: the Trail to Buckland (EIN 12, D1) and the Trail to Noorvik (EIN 8, D1, and D9). The uses allowed on these 25 foot trail easements are travel by foot, dogsled, animals, snowmobiles, two and three wheeled vehicles, and small all terrain vehicles (less than 3000lbs GVW). The season of use is limited to winter. If an all season road is constructed to Cape Blossom, considerations of the road impacts should be included in the environmental process and engineering of the road. Trail crossings and road access will need to be considered. 17(b) Easements are shown on the land status map in Appendix D.

The Kotzebue Electric Association (KEA) has a lease from KIC for a windmill farm (tract 1) that is approximately 3 miles from Kotzebue (Map 5 in Appendix B shows the lease boundaries). An existing road runs from Kotzebue's Ted Steven's Way via Hillside Road through the windmill farm, and this existing road would make for an economical starting point for a road to Cape Blossom, if this option is evaluated only based on road length. The ROW of the existing road should be evaluated in the next phase of this project to determine ROW width and if the ROW will be sufficient for the project.

ROW Requirements

For the purposes of future development and planning a road to Cape Blossom, this study assumes a 300 foot wide ROW would be acquired to facilitate the commercial activities that are anticipated as a result of the road. Additional ROW will also be required at the Deep Water Port. But until more work is done developing the deep water port concept, the ROW cannot be estimated at this time. Below is a table listing the road ROW acreages for the most direct routes to Cape Blossom.

TABLE 5 - RIGHT OF WAY ACREAGE REQUIREMENTS FOR MOST DIRECT ROUTES

		Route 'A' Segments ACFIJ	Route 'B' Segments BCFIJ	Route 'D' Segments DHIJ	Route 'E' Segments EJ
Road Length	**Miles**	**11.2**	**10.5**	**12.7**	**20.3**
Right Of Way Needed	**Acres**	**312.7**	**381.8**	**461.8**	**738.2**

ENVIRONMENTAL OVERVIEW

The Kotzebue to Cape Blossom road is intended to provide access to a proposed deep water port at Cape Blossom. Having a deep water port near Kotzebue, the regional hub, would promote economic growth and reduce the costs for fuel and commodities in the NWAB. In addition, the proposed road would provide safer and more efficient access to recreational and subsistence use areas, ANCSA 14(c) campsites and Native allotments, as well as facilitate future opportunities for development and community expansion for residents of Kotzebue.

Although the proposed project would provide benefits for the region's residents, it is understood that it must be constructed and maintained in a manner protective of public health and cultural interests. This environmental overview provides an aid to identifying studies that may be required during the environmental process, and encourages public involvement in the eventual selection of a preferred road route.

The Baldwin Peninsula was recently studied during the Kotzebue Airport Relocation Feasibility investigation performed in 2006 and 2007 by PDC, Inc. for the DOT&PF (Airport Study). The Airport Study conducted and summarized preliminary research on selected environmental impact categories, including: Air Quality, Coastal Resources, Compatible Land Use, Construction Impacts, Section 4f; Farmlands; Fish and Wildlife; Threatened and Endangered Species; Floodplains; Hazardous Materials; Historical, Architectural, Archaeological and Cultural Resources; Light Emissions and Visual Impacts; Natural Resources and Energy Supply; Noise; Water Quality; Wetlands; and Wild and Scenic Rivers.

AIR QUALITY

The Airport Study identifies Kotzebue as not currently being located in an air quality Non-Attainment Area as defined by 18 AAC 50.030, and as described in 40 C.F.R. 81. Kotzebue had been found to exceed federal 24-hour PM_{10} ambient air quality standards during monitoring which took place between 2002 and 2004. This monitoring program is described in a report authored by Sierra Research, Inc. entitled "*Alaska Rural Dust Control Alternatives*." Five PM_{10} monitoring stations were set up for this study. Four of five referenced monitoring stations were set up at a busy, unpaved roadway, and the fifth was set away from the roadway, but still within the community.

How PM_{10} air quality standards would be affected by a road to Cape Blossom is uncertain. At this time there are no residences or commercial developments along the proposed road alignment options. Airborne particulates caused by temporary construction activities and affecting ambient air quality would be mitigated by watering. Eventually, the completed road could potentially be maintained by the City of Kotzebue, and long term dust issues would need to be addressed in a maintenance agreement with the city.

COASTAL RESOURCES

The proposed road project lies within the NWAB Coastal Zone District Boundary. The DOT&PF will design the proposed road to be compatible with subsistence use areas, and to allow for the free passage and movement of fish and wildlife with due consideration of historic, migratory patterns. It is recognized that the southern portion of Kotzebue Lagoon supports concentrations of waterfowl during the spring and fall migrations, and that the area under consideration for the proposed deep water port is recognized to seasonally support nesting waterfowl. These two areas are listed as "Sensitive Use Areas", as defined in the Borough Comprehensive Plan, AS 46.40.030. Coastal resource issues will be addressed by coordination with the NWAB as outlined in the NWAB Coastal Management Plan, and with ADNR, ADF&G and USFWS during the environmental process. Local and Traditional Knowledge will also be incorporated into evaluations of these areas to fully capture any potential impact concerns.

COMPATIBLE LAND USE

The Airport Study identifies the following, potential land use conflicts that could apply to a road to Cape Blossom, and that will need to be resolved as part of the environmental process for a road project:

- Subsistence activities;
- ANSCA 17(b) trail easements, Native Allotments, and ANCSA 14(c) campsites;
- nesting and habitat areas for migratory birds and other wildlife;
- current and future landfill operation and development;
- windmill farm operation;
- cemeteries;
- community potable water sources;
- community expansion and development; and,
- existing and future airport development and operation.

SUBSISTENCE ACTIVITIES

Subsistence gathering, hunting and fishing occur throughout the Baldwin Peninsula. Specific, important areas will be addressed in a future environmental document, but it may be assumed that subsistence activities may occur anywhere in proximity to a new road to Cape Blossom. Such a road would certainly facilitate easier access to existing gathering, hunting and fishing areas, and consequently may encourage their greater overall use.

The NWAB Planning Commission would likely consider the proposed road to Cape Blossom as "Related to Community Service". This land use area designation is required before any permits are issued for the development of a transportation corridor as required by the Borough Management Plan (Title 9, Article VIII, Section 9.28.220). The Borough's Planning Commission has also indicated that the proposed port area would be re-zoned as a "Resource Development District" to facilitate its development. Land use

issues associated with the project will be addressed by, and coordinated with, the Borough Planning Commission during the environmental process. Additionally, the proposed road will be designed and constructed to be compliant with the NWAB Coastal Management Plan.

ANCSA 17(b) Trail Easements

ANCSA 17(b) trail easements will likely be intersected by a road to Cape Blossom. The DOT&PF will design the proposed road to incorporate crossings where trail intersections occur.

Proposed road routes to the east of Kotzebue Lagoon would cross two 17(b) trail easements, EIN 8 (the trail to Buckland) and EIN 12 (the trail to Noorvik). Both EIN 8 and EIN 12 are designated twenty-five foot wide easements. Twenty-five foot easements restrict allowable uses to travel by foot, dogsled, animals, snowmobiles, two and three wheeled vehicles, and small all-terrain vehicles (less than 3000 lbs. gross vehicle weight). In addition, use is limited to the winter season.

An alternative road route to the south, along the coastline, could possibly encounter 17(b) trail easements EIN 15 and EIN 53. These two easements are designated as sixty feet in width. A sixty foot wide trail easement broadens the range of travel modes allowed to include, in addition to modes listed for twenty-five foot easements, larger all-terrain vehicles (greater than 3,000 lbs. gross vehicle weight), tracked vehicles, four-wheel-drive vehicles, automobiles and trucks. Additionally, there are no seasonal restrictions on use.

Native Allotments

Native Allotments occur throughout the Baldwin Peninsula but are concentrated primarily along coastal areas. All potential road alignment options can avoid Native Allotments excepting, possibly, those parcels located directly at the proposed Cape Blossom Deep Water Port site. While there is one potential alignment that may avoid all allotments near one port site option, not enough data yet exists on potential port locations to consider that routing a viable option. Until sufficient bathymetric and other port site data is acquired, the probability of avoiding Native Allotments near any future, proposed facility remains unknown.

Solid Waste Landfill

The City of Kotzebue operates a solid waste landfill located approximately 3 miles south of the city. The City recognizes the need to plan for a new landfill for future use, though an alternative location has not been selected at this time. The future landfill site is not anticipated to be affected by the road alignment options, however the City Manager's site selection process would benefit from the proposed road. Expanding the available road system to Cape Blossom will allow consideration of additional, prospective landfill sites that are currently inaccessible.

Windmill Farm

An electrical power generating windmill farm is located approximately 4 miles south of the City of Kotzebue. The windmill farm is operated by the Kotzebue Electric Association (KEA) on land leased from KIC. The windmill farm consists of ten, 50-kilowatt wind turbines and their associated, on-site infrastructure, which are operated to supplement the electrical needs of Kotzebue.

An existing road leads from the City of Kotzebue to the windmill farm. The terminus of this existing road is proposed as the starting point of the shortest road alignment option considered for this project (Map 5 in Appendix B). KEA has expressed concerns that increased vehicular traffic on this road may compromise public safety and security at the windmill farm. The DOT&PF will need to address KEA's concerns regarding this proposed road option.

It is possible that perimeter fencing around the windmill farm would be sufficient to alleviate KEA's concerns. It may also bear out that extending the windmill farm road will allow travelers an opportunity to continue on to more remote recreational and subsistence areas, such as Sadie Creek, thereby relieving vehicle and pedestrian congestion, and their associated risks, at its current terminus.

FIGURE 8 - KEA WINDMILL FARM

CEMETERIES

Two cemeteries are located in Kotzebue; one in town, and a second on the hillside to the east of Kotzebue Lagoon. The proposed routes to Cape Blossom are sufficiently distant from the cemeteries that no impacts are anticipated. As part of any future, environmental documentation process, additional studies will be conducted to ensure these cemeteries are not negatively impacted. One positive impact of a new road to Cape Blossom would be that the City of Kotzebue Planning Commission, which has recognized a need for a new cemetery, will be able to consider additional, prospective cemetery sites along the route.

Municipal Water Sources

The City of Kotzebue currently obtains potable drinking water from a surface water source at Devil's Lake. VORTAC Lake previously supplied water for the city, but the pump at that location is currently inoperable. Water has been pumped from these two lakes into pipelines connecting to a treatment plant, where the product is filtered, disinfected, and transferred to storage tanks for distribution throughout the community.

The DOT&PF will design, construct, and maintain the new road to be protective of the watershed areas of Devil's Lake and VORTAC Lake. The proposed routes are sufficiently distant from both source lakes that no impacts to their respective watersheds are anticipated. Additionally, the City of Kotzebue is in the process of securing funds to complete municipal groundwater wells. The proposed road is not anticipated to affect groundwater recharge areas or groundwater aquifers. However, additional studies may be required during the environmental process to fully confirm that a road to Cape Blossom does not compromise the safety or integrity of community potable water sources.

Community Development

New expansion and community developments for the City of Kotzebue are greatly hindered by the lack of suitable building lots remaining within the city's core area. Limitations on economic growth due to constraints on available housing and commercial areas are addressed in the *City of Kotzebue Comprehensive Plan; Adopted December 07, 2000*.

The City of Kotzebue has developed community expansion plans focusing on areas to its southwest and southeast. These plans are incorporated in the *City of Kotzebue Comprehensive Plan*. A road to Cape Blossom may influence future city expansion plans and, in community meetings, future expansion of the city was discussed as a component of the need for this project. The community would like to expand its current residential and commercial property to areas located at higher elevations due to uncertainties of reported climate change, and potential for associated sea level increases. A road to Cape Blossom may provide feasible access to valuable residential and commercial-use expansion areas.

A master plan is currently being developed to address a potential airport relocation project. Criteria for determining a suitable airport site may be affected by potential road alignments, particularly if road alignment locations interfere with the airport relocation options. The existing airport location should also be considered during route selection due to the currently restricted road access through airport property. Due to safety and security concerns, access to a Cape Blossom road from the community will require the use of Ted Steven's Way and the BIA road, avoiding the integration of existing roads through airport property.

ANCSA 14(c) Campsites

ANCSA 14(c) campsites are present throughout the coastal areas near Kotzebue. Project road alignment options are not anticipated to impact these campsites directly, however. easier access to some campsites may be an indirect effect of any selected road option leading to Cape Blossom.

CONSTRUCTION IMPACTS

Typical construction impacts for a road would be short term. Water and Air Quality impacts would be addressed in the Erosion and Sediment Control Plan developed during the design process. The one major drainage in the area, Sadie Creek, would require special consideration to ensure minimal water quality impacts at this location. Another short term construction impact is noise. Since the road alignment options are well south of the community, noise is anticipated to have minimal impact on existing receptors.

SECTION 4F

As described in the Airport Study, no publicly owned parks, recreation areas, wildlife refuges, or any publically or privately owned historical sites, are known to be in the vicinity of potential Cape Blossom road alignment options.

HISTORIC AND ARCHAEOLOGICAL

During the Airport Study, a report was prepared by Northern Land Use Research, Inc. that evaluated the greater Baldwin Peninsula. Due to confidentiality of archaeological site location information, that report is not included in the appendices of this document. The Baldwin Peninsula does contain known, and has potential for discovery of unknown cultural resources. Preliminary design work and environmental investigations will be conducted in a manner that ensures potential project impacts to cultural resources are identified and mitigated.

WATER QUALITY

Construction of a road to Cape Blossom has the potential to cause sediment laden runoff to enter waterways. In order to prevent this, any Contractor constructing the project will be required to develop an Erosion Sediment Control Plan that addresses both non-point sources of storm water runoff and potential runoff pollutants such as fuel and hazardous materials staged at storage areas. Addressing storm water runoff should begin during preliminary design work and environmental investigations, with an emphasis on Sadie Creek Crossing and the coastal areas near Cape Blossom. During construction, the Contractor will be required to hold an approved Storm Water Pollution Prevention Plan that addresses water quality issues for the project.

WETLANDS

The Airport Study evaluated wetlands within the Baldwin Peninsula by using aerial photography, National Wetlands Inventory Maps, and performing a reconnaissance over-flight of the area. The resulting report is included in Appendix C. The majority of the Baldwin Peninsula is considered wetlands. Construction of a road to Cape Blossom would require a U.S. Army Corps of Engineers permit in order to place fill, or excavate, in wetlands. High value wetlands are anticipated to be present in the vicinity of Sadie Creek and Cape Blossom. The report also anticipates high value wetlands will be

present further southeast of Cape Blossom. An order-of-magnitude estimate of wetlands fill required for this project is included as Table 6. A 30% contingency factor was applied in calculating these project footprints due to the unknowns in topography, and lack of survey data at this point in the study.

TABLE 6 - WETLANDS FILL ACREAGE REQUIREMENTS FOR MOST DIRECT ROUTES

		Route 'A' Segments ACFIJ	Route 'B' Segments BCFIJ	Route 'D' Segments DHIJ	Route 'E' Segments EJ
Road Length	**Miles**	**11.2**	**10.5**	**12.7**	**20.3**
Approx. Wetlands Fill Footprint Two Lane Road	**Acres**	**104**	**126**	**152**	**243**
Approx. Wetlands Fill Footprint Single Lane Road	**Acres**	**87**	**107**	**123**	**205**

FISH AND WILDLIFE

The Airport Study describes preliminary estimates of fish and wildlife resources on the Baldwin Peninsula. No anadromous fish streams are reported as cataloged for the project area according to the Alaska Department of Fish and Game's "*Atlas to the Catalog of Waters Important to the Spawning, Rearing or Migration of Anadromous Fishes*" publication. Terrestrial wildlife species that the project area was reported to support include caribou, moose, brown bear, and small mammals such as Arctic ground squirrels, snowshoe hares, red fox, river otters, lemmings and voles. Year round bird species noted as frequenting the project area include the Common raven and ptarmigan. Migratory birds seasonally inhabiting the project area include numerous species of waterfowl (geese, ducks, mergansers and swans), shorebirds and neo-tropical songbirds. Sadie Creek has been identified as supporting populations of breeding water birds including loons, waterfowl,, and seabirds such as various gulls and Arctic Terns. Breeding Tundra Swans have been documented in the lakes within the project area.

While no federally-listed Threatened or Endangered wildlife species are likely to inhabit, or be directly impacted by, the project, there has recently been a sweeping designation of Critical Habitat throughout the project area for federally-listed, Threatened polar bears. This Critical Habitat designation will require conscientious consultations with, and possibly project permitting by, the U.S. Fish and Wildlife Service. More detailed discussions on potential project fish and wildlife issues and a recent Technical Memorandum on polar bear Critical Habitat produced for another project near Kotzebue, can be found in Appendix C.

Environmental Impact Categories Not Addressed in Detail

Farmlands, Noise, Environmental Justice, Floodplains, and Natural Resources impacts have not been addressed in this report, though will be fully addressed during the formal environmental process for the project.

Anticipated Permits

The following is a list of anticipated permits and permitting agencies for this project:

- **U.S. Army Corp of Engineers Section 404 Permit – Wetlands Fill**

  Construction of the road will fill and/or excavate wetlands, and will require this permit.

- **State of Alaska, Department of Natural Resources, Division of Coastal Management - Coastal Project Questionnaire and Consistency Determination**

  The Kotzebue to Cape Blossom Road Project is within the NWAB Coastal Management Zone as defined by the Alaska Department of Natural Resources, and will require this application and action.

- **Northwest Arctic Borough Title 9 – Zoning and Land Use**

  All projects within the Northwest Arctic Borough require this application.

- **U.S. Fish and Wildlife Service Section 10 (ESA) Incidental Take Permit**

  Required for activities where a federally-listed species (i.e., polar bears) may be adversely affected by construction activities such as damage to, or losses of, designated Critical Habitat.

ROAD DESIGN

DESIGN CRITERIA

Using AASHTO's Guidelines for Geometric Design of Very Low-Volume Local Roads (ADT ≤ 400), the road to Cape Blossom would be classified as a rural industrial/commercial access road. The design traffic volume would be 100 vehicles per day or less, with a design speed of 30 mph. A road grade of 6% or less is recommended for roads with low-speed vehicle operation. The dimensions used for a two-lane or single-lane are shown in the table below.

TABLE 7 – ROAD DIMENSIONS

Roadway Surface	Unpaved
Roadway Width (Including Shoulders)	24'
Bridge Width	27'
Minimum Embankment Height	8'
Road Side Slopes	3:1
24" Culverts	5 per mile
Separation Geotextile	84'

The typical section for this project would consist of a minimum of 8' embankment at centerline. Although this amount of fill will not necessarily eliminate road settlement issues related to subsurface thawing, it will allow the subsurface to remain reasonably frozen, and maintenance levels would be acceptable for a gravel road constructed in this region. The typical section for a two lane road would be 24' wide, and the typical section in areas found to have significant snow drifting problems, a 4:1 side slope is recommended. A minimum of 3:1 slopes are recommended for the road for embankment stability and driver safety.

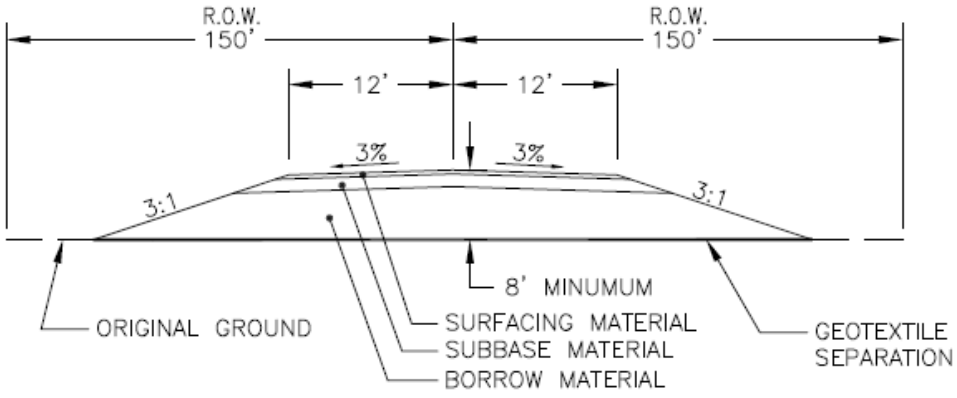

Figure 9 - Recommended Typical Section

Due to the uncertainty of finding a suitable borrow site for gravel fill material, use of dredged ocean bottom material has been explored. This is fine grained silty material and is generally not suitable for roadway embankment however a few successful projects have used a silt embankment. In order to construct a road with this material, the material would be placed and compacted and then allowed to settle for multiple years before final construction of the roadway surface. The advantage to using dredged material is its relative low cost compared to barging in gravel material if no local gravel source is available, however the construction process will extend the time before a usable roadway is finished.

FIGURE 10 - CONSTRUCTION OF A SILT EMBANKMENT AT ALAKANUK AIRPORT (SEPT. 2008)

A road to Cape Blossom is anticipated to be designed for vehicle traffic to and from cape Blossom for both commercial and recreational uses. Large hauling vehicles to haul cargo and fuel would utilize the road potentially year round, if bulk fuel storage was available at Cape Blossom. Recreational travel would potentially occur year round as well, to access private landholdings along the coastline. Current vehicles in Kotzebue include cars, pick-up trucks, fuel hauling vehicles, and maintenance vehicles. Future design work would include identifying a vehicle inventory for the community, and specific vehicles that may be used for transporting cargo and supplies to Kotzebue from a Deep Water Port at Cape Blossom.

Figure 11 - Typical Industrial Haul Road, Northwest Alaska

PRELIMINARY ALIGNMENTS OPTIONS

In order to develop preliminary alignments of the Kotzebue to Cape Blossom road, the 1981 Kotzebue to Chicago Creek Reconnaissance Study was revisited. The alignments proposed in the 1981 report were overlaid on top of a USGS topographic map (see Map 1, Appendix B). The results showed portions of the alignments interfering with recent development in Kotzebue, passing through native allotments, and did not address any hydrology issues. The 1981 alternate alignments were adjusted with the aid of the 2006 land status map from McClintock Land Associates, mosaic orthographic imagery from September 2004 to August 2006, and USGS 5-meter elevation data. Other considerations were also addressed in the revised preliminary alignments, such as: the starting point for the routes, utilizing the existing road to the windmill farm; crossing Sadie Creek; and the option to take a longer more elevated route. The adjusted preliminary alignments are mapped in black on the USGS topographic map along with the native allotments (see Map 2, Appendix B).

The preliminary routes are broken into segments to allow for a cost analysis of the different alternatives (see Map 3, Appendix B). Segment 'A' shows the existing 2.3 mile road from the New Hillside Road to the windmill farm and is not included in construction costs. Segment 'B' would construct a new 1.9 mile road beginning from New Hillside Road and ending at the windmill farm. Segment 'D' and 'E' begin at Ted Steven's Way and follow the higher elevations of the Baldwin Peninsula. The beginning segments of all the preliminary alignments are shown on Map 4, Appendix B. Map 5 in Appendix B shows how Segments 'A', 'B', and 'C' interact with the existing road through the windmill farm.

A close-up of Sadie Creek is shown on Map 6 in Appendix B. A drainage structure will be required to pass a road over Sadie Creek. Two options are examined in the preliminary alignments. Segment 'F' passes over a single wide section of the creek, while Segment 'H' passes over two narrower sections of the creek. Distances of the most direct routes starting from Routes 'A', 'B', 'D', and 'E' are shown in the table below.

TABLE 8 - LENGTH OF MOST DIRECT ROUTES

	Miles
Route 'A' – ACFIJ	*11.2*
Route 'B' – BCFIJ	*10.5*
Route 'D' – DHIJ	*12.7*
Route 'E' – EJ	*20.3*

DRAINAGE STRUCTURES

Drainage structures such as culverts will be required throughout a proposed road to Cape Blossom to ensure continuous drainage across the road, and to equalize drainage areas where needed.

Based on a reconnaissance field visit, the crossing of Sadie Creek will require a bridge. Depending on the route selected, either one or two bridges would be needed. A crossing on segment "F" would require a single 420 foot bridge. A crossing on segment "H" would cross two branches of Sadie Creek and would require one 100 foot bridge and one 220 foot bridge. These lengths are initial estimates based on limited information and will require further field study to refine. A reconnaissance report further detailing bridge requirements is attached as Appendix E.

No fish studies have been performed for Sadie Creek or other drainages, although local conversations indicate that fish do occur in lower portions of Sadie Creek.

ICE ROADS

An alternative option to constructing a conventional embankment fill road would be to construct seasonal ice roads from the deep water port at Cape Blossom to haul materials and supplies to Kotzebue. The grades of all of the alignments could accommodate an ice road, although special considerations would have to be made for drainage crossings, especially Sadie Creek. The advantage to an ice road is that there is less immediate cost to construct than a fill embankment. The cost of constructing ice roads year after year, and the maintenance of the ice roads would add up over time, and more studies would be needed to evaluate these costs. The Community would also not have all season access to the deep water port, which would require a large storage facility for the barging season, until an ice road could be built to ship the supplies to Kotzebue. The disadvantages of an ice road are the short season that is available for ice road construction and use, the continued cost of ice road maintenance and to construct ice roads each year; specialized equipment and training required to construct ice roads, and the increased cost of operating equipment in the wintertime, versus a summer all season operation.

Ice roads are regularly used by the oil and gas industry on the North Slope and Foothills regions of Alaska as well as by the Canadian Northwest Territories Department of Transportation. Ice roads are also occasionally constructed for conducting a winter haul of material as part of DOT&PF construction projects. Due to the variation in geographic location, climate and design loads of past ice roads, the cost for construction vary greatly and would be hard to predict without further study. Construction costs and the length of time the ice road could be available to traffic would also vary from year to year depending on seasonal temperatures.

In order to pursue the ice road options, additional studies would be required to evaluate potential water sources for ice road construction, including bathymetric and ice surveys and fish studies. Permitting Agencies would include the Department of Natural Resourced, Army Corp of Engineers, the Department of Coastal Ocean Management, and the Department of Fish and Game. Other agencies may be required depending on the alignment and water source used.

CONSTRUCTION THROUGH INNOVATIVE READINESS TRAINING

It is possible that a road to Cape Blossom could be constructed though the U.S. Military's Innovative Readiness Training (IRT) program. This is a program managed by the Office of the Assistant Secretary of Defense, Reserve Affairs through which state or local agencies can request military support for various activities including construction projects. In order for a project to be considered under this program, it must a) consist to activities which support the assigned military unit's readiness training requirements, b) not endorse or favor any non-governmental entity, and c) have obtained certification of non-competition with other available public or private sector service organizations. Further coordination with the Office of the Assistant Secretary of Defense would be required to determine how construction under the IRT program would affect design and scheduling of the project.

COST ESTIMATES

There are two major variables in the cost of this project: 1) the typical section selected and 2) the availability of a local material source. A variation in the roadway embankment height or side slope will have a direct effect on the volume of material required and thus a proportional impact on the overall cost. Initial estimates based on past projects show that if a local material source is available, construction costs would be less than half of those if material must be barged in.

Estimated costs in this report are for construction only and do not include construction engineering or State overhead costs.

COST VARIATION DUE TO CHANGES IN TYPICAL SECTION

There are three variables associated with the typical section which greatly affect cost.

Roadway Width. A roadway width of 24 feet has been selected as the minimum desirable for this type of road. Increasing the width would provide an additional safety factor but is not required based on the very low traffic volumes anticipated. A narrower road could be constructed as a single lane road with turnouts in order to allow passing. A 16 foot road with turnouts would cost 80% to 90% that of the 24 foot road.

Embankment Side Slope. The recommended side slope for this road is 3:1. This slope is considered traversable and would not present additional hazard to drivers. An alternative to save money would be to steepen the slope to 2:1. This would reduce the material required by between 15% and 20% depending on embankment height.

Embankment Height. The selected embankment height must be high enough to minimize snow drifting and thaw of permafrost under the embankment but must be balanced with the added cost for higher embankment. The minimum embankment height that was considered is 6 feet. This is high enough to minimize potential snow drifting and would provide some thermal protection for the permafrost. However similar roads on the North Slope have required significant annual maintenance to repair settlement due to thaw action. An embankment height of 8 feet satisfies the minimum criteria for subsurface thaw consolidation. Historically, it has been noted that in Arctic conditions with variable moisture contents and significant amounts of permafrost and ice lenses, a more conservative approach of installing a 10 feet embankment reduces the maintenance costs over the lifetime of the road. For this road the recommended embankment height is 8 feet.

The table 9 shows how changing side slope and embankment height affects the amount of fill material required.

TABLE 9 – CUBIC YARDS OF MATERIAL PER MILE

Side Slope	Embankment Height		
	6'	8'	10'
3:1	49,000	75,000	105,500
2:1	42,000	62,500	86,000

COST VARIATION DUE MATERIAL SOURCES AVAILABLE

Due to the limited borrow material on the Baldwin Peninsula, the cost of the road will be highly dependent on where the material comes from. Three possible methods for construction have been identified 1) identify and use a local borrow material site, 2) barge borrow material in from elsewhere in the region and 3) dredge sea bottom material from the Cape Blossom port site. Based on past cost estimates, it will likely cost over twice as much to barge material rather than use a local source.

For these three material sources, estimated costs for construction are shown in Table 10. Costs shown include the cost of embankment, geotextile separation, culverts and bridges plus $5 million for in mobilization, surveying and other costs.

TABLE 10 – ESTIMATED COSTS BASED ON MATERIAL SOURCE (8' EMBANKMENT, 3:1 SIDE SLOPES)

	Route "A" Segments ACFIJ	Route "B" Segments BCFIJ	Route "D" Segments DHIJ	Route "E" Segments EJ
Total Length (miles)	11.2	10.5	12.7	20.3
Local Borrow Material	$ 48,300,000	$ 50,600,000	$ 57,600,000	$ 81,900,000
Barged Borrow Material	$ 130,600,000	$ 141,800,000	$ 168,100,000	$ 258,600,000
Dredged Borrow Material	$ 44,400,000	$ 46,000,000	$ 51,600,000	$ 71,000,000

These costs are for the recommended typical section. One option which would save on construction costs would be to build using an 8 foot embankment with 2:1 side slopes as described under the discussion on typical sections. Table 11 is identical to Table 10 but using the smaller typical section.

TABLE 11 – ESTIMATED COSTS BASED ON MATERIAL SOURCE (6' EMBANKMENT, 2:1 SIDE SLOPES)

	Route "A" Segments ACFIJ	Route "B" Segments BCFIJ	Route "D" Segments DHIJ	Route "E" Segments EJ
Total Length (miles)	11.2	10.5	12.7	20.3
Local Borrow Material	$ 35,300,000	$ 36,300,000	$ 40,200,000	$ 54,000,000
Barged Borrow Material	$ 80,300,000	$ 86,200,000	$ 100,800,000	$ 150,900,000
Dredged Borrow Material	$ 34,300,000	$ 35,000,000	$ 38,200,000	$ 49,700,000

PROJECT PHASING

This construction of this road has the potential to constructed in phases based on when funding becomes available. In addition to funding, the breakdown of phases would depend on local material availability, logical termini and project time frames. Based on the recommended route 'A', there are two easily identifiable logical termini: Sadie Creek and the end of the existing road to the KEA windmill farm.

PHASED OPTION 1: CONSTRUCT TO SADIE CREEK

An option for a phased project would be to construct up to Sadie Creek. This option would be 4.6 miles long and include improving the existing road in segment 'A' as well as construction of segments 'C' and 'F' up to Sadie Creek. Table 12 shows the estimate costs for this option using the recommended typical section as well as a minimized typical section. Costs shown include the cost of embankment, geotextile separation, culverts plus $1.5 million for in mobilization, surveying and other costs.

TABLE 12 – ESTIMATED COSTS FOR CONSTRUCTION TO SADIE CREEK

	8' embankment 3:1 side slopes	6' embankment 2:1 side slopes
Local Borrow Material	$ 17,300,000	$ 13,300,000
Barged Borrow Material	$ 41,900,000	$ 26,800,000
Dredged Borrow Material	$ 17,500,000	$ 14,400,000

PHASED OPTION 2: IMPROVE EXISTING ROAD

An option for a phased project would be to improve existing 2.7 miles of road from Ted Steven Way out to where it ends at the KEA Windmill Farm. This option would be less expensive that constructing to Sadie Creek and would provide a logical termi for the road. Costs shown include the cost of embankment, geotextile separation, culverts and $1.5 million for in mobilization.

TABLE 13 – ESTIMATED COSTS FOR CONSTRUCTION TO WINDMILL FARM

	8' embankment 3:1 side slopes	6' embankment 2:1 side slopes
Local Borrow Material	$ 6,400,000	$ 5,100,000
Barged Borrow Material	$ 14,200,000	$ 9,300,000
Dredged Borrow Material	$ 5,800,000	$ 4,800,000

COST FOR INNOVATIVE READINESS TRAINING CONSTRUCTION

If this project is constructed under the military's IRT program, the cost of construction would be reduced because labor costs could be excluded. Table 14 shows estimated costs for construction as an IRT program. This estimate includes material costs only and assumes a local borrow source is available with only surface course being barged in. A royalty of $5 per ton of local borrow is assumed.

TABLE 14 – ESTIMATED COSTS FOR IRT CONSTRUCTION

	Route "A" Segments ACFIJ	Route "B" Segments BCFIJ	Route "D" Segments DHIJ	Route "E" Segments EJ	To Sadie Creek
8' embankment 3:1 side slopes	$ 21,200,000	$ 21,600,000	$ 23,400,000	$ 30,200,000	$ 5,300,000
6' embankment 2:1 side slopes	$ 16,900,000	$ 16,896,624	$ 17,700,000	$ 21,100,000	$ 4,000,000

RECOMMENDED STUDIES FOR DESIGN

SPRING BREAK-UP STUDIES

Limited data exists for Sadie Creek and spring break-up, as well as several smaller drainages in the region. Spring break-up data will be needed for developing bridge and drainage structure designs. A hydrology study would be useful for any future environmental and design work for a future project. The estimated cost for a hydrology study for this project is $300,000.

GEOTECHNICAL STUDIES

Further reconnaissance explorations at specific material source sites are needed, including: aerial-photography interpretation; topographic and bathymetric mapping; test borings supplemented with geophysical surveys to characterize the foundation and material conditions (e.g., soils, ground ice and temperature), and laboratory testing to characterize the general soil index and physical properties.

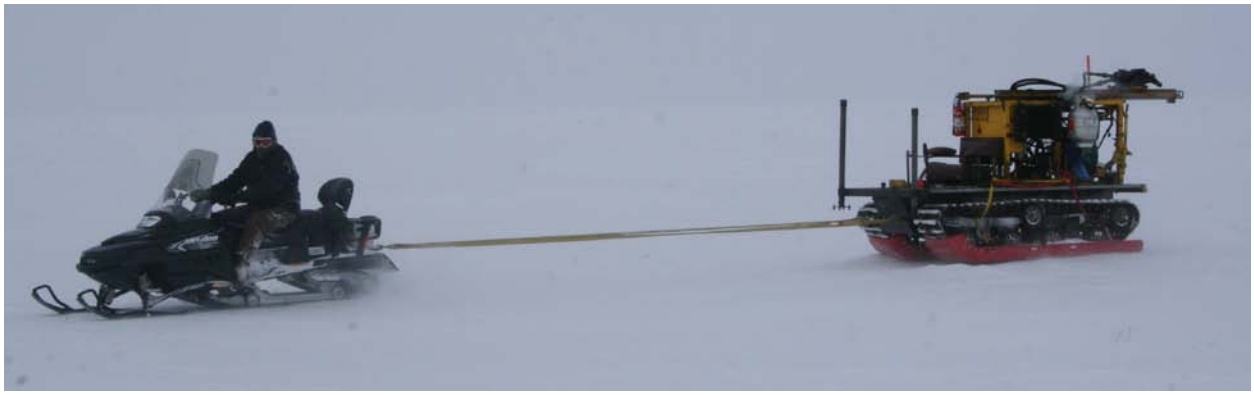

FIGURE 12 - DOT&PF'S B24 DRILL TRANSPORTED BY SNOWMACHINE

GIS DATABASE DEVELOPMENT

Development of a comprehensive GIS database for the Baldwin Peninsula including engineering and environmental data for the project, as well as archiving imagery and photography, land status and survey information of the area would be useful for a future environmental document and design project. The estimated cost for the development of a GIS Database is $60,000.

REFERENCES

American Association of State Highway and Transportation Officials, **Guidelines for Geometric Design of Very Low-Volume Local Roads (ADT ≤ 400)**, 2001.

Arctic Environmental Information and Data Center (AEIDC). 1975. **Alaska Regional Profiles Northwest Region**, University of Alaska.

Brown, J, O. J. Ferrains, Jr., J. A. Heginbottom, E. S Melnikov (eds.). 1997. **Circum Arctic Map of Permafrost and Ice Conditions**. U.S. Geological Survey Circum-Pacific Map Series CP-45.

City of Kotzebue, **City of Kotzebue Comprehensive Plan**; December 2000.

Curran, J.H., Meyer, D.F., and Tasker, G.D., **Estimating the Magnitude and Frequency of Peak Streamflows for Ungaged Sites on Streams in Alaska and Conterminous Basins in Canada:** U.S. Geological Survey Water-Resources Investigations Report 03-4188, 2003.

Hamilton, T.D. 1994. **Late Cenozoic Glaciation of Alaska**. *In* Plafker, G., and Berg, H.C. (eds). The Geology of Alaska: Vol. G-1, The Geology of North America. Boulder, Colorado, Geologic Society of America.

Huston, M., J. Brigham-Grette, and A.M. Hopkins, 1990. **Paleogeographic Significance of Middle Pleistocene Glaciomarine Deposits on Baldwin Peninsula, Northwest West Alaska**. Annals of Glaciology, v. 1, p. 111-114.

Krause, K. 1985. Kotzebue Quadrangle, Engineering Geology, Alaska Division of Geological and Geophysical Surveys, Public Data File 85-42A, Sheet 11 of 26.

McClintock Land Associates, Inc., **Kotzebue Airport Relocation Feasibility Study, Land Status Report**, October 2006.

Michael Baker, Jr., Inc., **Reconnaissance Study for Kotzebue to Chicago Creek Highway Project**; vol. 1-3, December 1981.

Miller, J.F., **Probable Maximum Precipitation and Rainfall-Frequency Data for Alaska**: U.S. Department of Commerce Technical Paper No. 47, 1963.

PDC, Inc. Engineers, **Kotzebue Airport Relocation Feasibility Study**; January 2008.

Plafker, G., L.M. Gilpin, and J.C. Lahr, 1993. **Neotectonic Map of Alaska**. *In* Plafker, G., and Berg, H.C. (eds). 1994. The Geology of Alaska: Vol. G-1, The Geology of North America. Boulder, Colorado, Geologic Society of America.

R&M Consultants, Inc. **Kotzebue Airport Relocation Feasibility Study: Existing Conditions: Soils**. October 2007.

Wahrhaftig, C. 965. **Physiographic Divisions of Alaska**. Geological Survey Professional Paper 482.

Williams, J. R. 1970. **Regional Ground Water in the Permafrost Regions of Alaska**. Geological Survey Professional Paper 696.

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