PACAB

SPECIAL MEETING

MARCH 20, 2019

12:00 p.m.

Council Chambers

SEWARD PORT AND COMMERCE ADVISORY BOARD

March 20, 2019 **12:00 PM** **Council Chambers**

SPECIAL MEETING

Christy Terry
Chair
Term Expires 07/2019

Bruce Jaffa
Vice Chair
Term Expires 07/2021

Carl Hughes
Board Member
Term Expires 07/2020

Colby Lawrence
Board Member
Term Expires 07/2019

Laura Schneider
Board Member
Term Expires 07/2020

Lynda Paquette
Board Member
Term Expires 07/2021

Erin Lemas
Board Member
Term Expires 07/2021

Norm Regis
Acting City Manager

Brennan Hickok
Assistant City Manager

Norm Regis
Harbor Master

GeNeil Flaherty
Executive Liaison

1. **CALL TO ORDER**

2. **PLEDGE OF ALLEGIANCE**

3. **ROLL CALL**

4. **Citizens' comments on any subject except those items scheduled for public hearing.** *[Those who have signed in will be given the first opportunity to speak. Time is limited to 2 minutes per speaker and 30 minutes total time for this agenda item.]*

5. **Approval of agenda and consent agenda** *[Approval of Consent Agenda passes all routine items indicated by asterisk (*). Consent Agenda items are not considered separately unless a Board Member so requests. In the event of such a request, the item is returned to the Regular Agenda.]*

6. **NEW BUSINESS**
   - **A.** Special Meeting to approve letter with airport alternative recommendation to Council.

7. **BOARD COMMENTS**

8. **CITIZEN COMMENTS** [*5minutes per individual – Each individual has one opportunity to speak*]

9. **BOARD AND ADMINISTRATIVE RESPONSE TO CITIZEN'S COMMENTS**

10. **ADJOURNMENT**

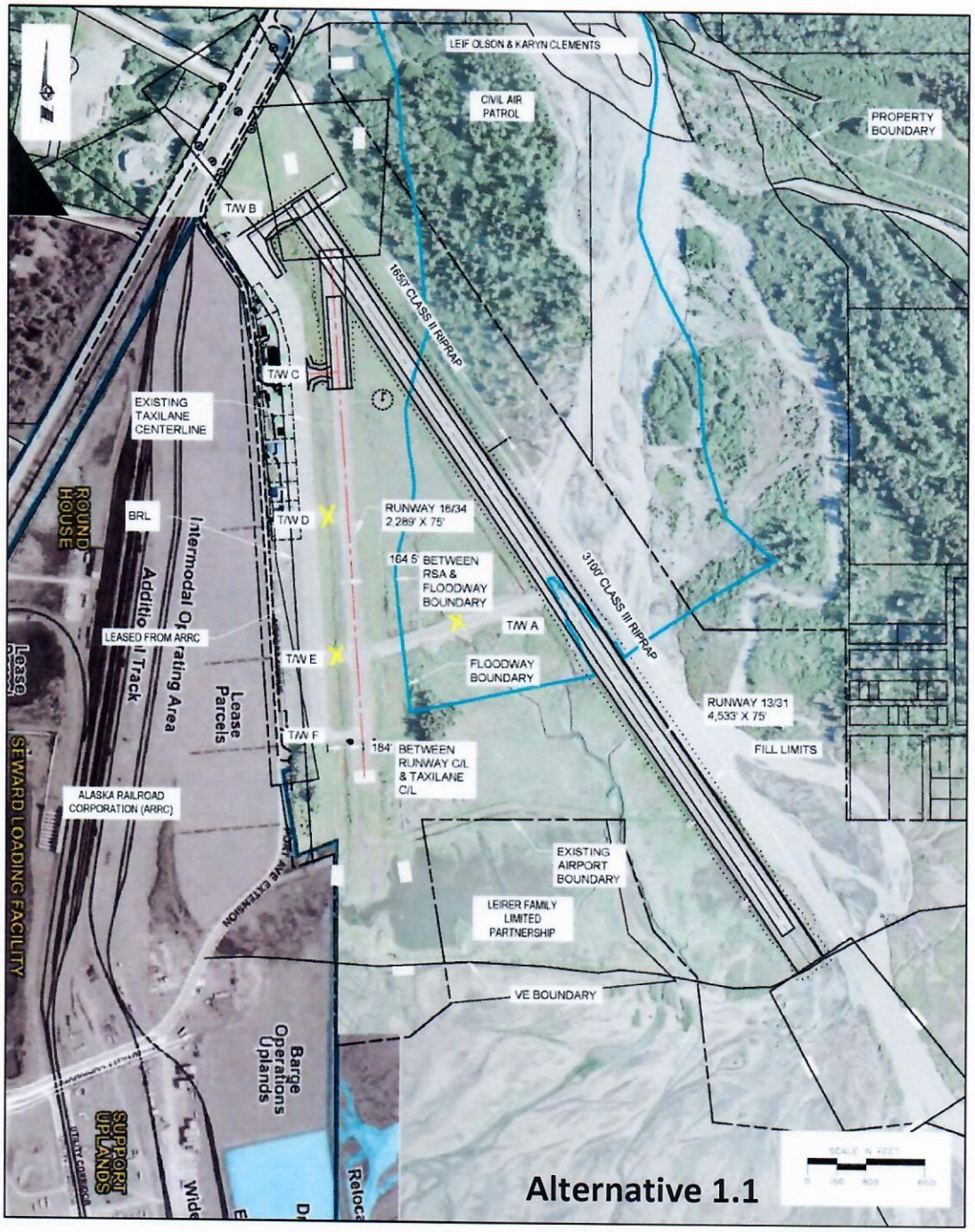
APPENDIX B

ALTERNATIVES DROPPED FROM FURTHER CONSIDERATION

APPENDIX B

Alternatives Dropped from Further Consideration

Alternatives Dropped from Further Consideration are described in Section 4.1 of this Environmental Assessment (EA). A description of preliminary alternatives dropped during the scoping phase of the project can be found in the Scoping Report (available at http://www.dot.alaska.gov/creg/sewardairport/documents.shtml). This appendix provides further explanation for the elimination of Alternative 1.1 as described in Section 4.1.1 of this EA.



Alternative 1.1 would reconstruct and raise Runway 13-31 above the 100-year flood level with 2 feet of freeboard (per Executive Order, dated January 30, 2015). The existing runway would remain at its current length of 4,533 feet. Riprap would have been installed within the Resurrection River to protect Runway 13-31. Taxiways B and C would have been reconstructed to match into Runway 13-31 raised profile and entrance Taxiways A, D, and E would have been reconfigured or eliminated to comply with new FAA guidance.

Runway 13-31 is located adjacent to the Resurrection River. Modeling, using 2 feet of freeboard above the 100-year flood level, showed up to a 4-foot increase in the base flood elevation (BFE) over portions of the upstream floodplain. The runway embankment was raised over 6 feet in some areas with an overall average rise of 4.4 feet. This additional fill would result in a backing up of floodwaters onto an additional 159 acres of private, state, and native allotments along the Resurrection River as compared to the No Build option or Alternative 2.2 (Alternative 2.2 would increase flooding on 22 acres, while reducing flooding on another 44 acres). Higher floodwater velocities produced by the river could result in increased erosion and scour over time of the proposed reinforced embankment.

Since this option produces fill into the regulatory floodway, a modification to the effective Flood Insurance Rate Map (FIRM) and Floodway Map would be required. The associated Letter of Map Revision (LOMR) would require extensive hydraulic analysis, would need to meet regulatory requirements, and will require mitigation for affected property owners. This would increase the cost of the project as well as the ultimate timeline for completion. The existing runway is currently under weight restrictions, due to past flood damage, limiting the type of aircraft that can access the airport.

Executive Order 11988 "requires federal agencies to avoid to the extent possible, the long and short-term adverse impacts associated with the occupancy and modification of the 100-year floodplains and to avoid direct or indirect support of floodplain development wherever there is a practicable alternative". Alternative 1.1 maintains the portion of the existing airport which lies within the regulatory floodway (sections of Runway 13-31 and Taxiway A). The location of Runway 13-31 to the Resurrection River puts the runway at a greater risk of overtopping during a major flood event, even after it is raised. At the very least, future maintenance and operation costs associated with higher than expected flood levels would be a burden. The airport's use for emergency services is crucial during flood events which could also impair highway travel.

To raise and reinforce Runway 13-31 would require placing riprap below the ordinary high water mark of the Resurrection River. This has implications for fish habitat within the river as well as navigability concerns for this braided river channel. These potential impacts would require further analysis if this alternative were carried forward into the EA.

DOT Order 5650 states "that DOT agencies should ensure that proper consideration is given to avoid and mitigate adverse floodplain impacts in agency actions...." Alternative 1.1 has a much greater impact to the floodplain than the No Build or Alternative 2.2.

Taken together, these considerations qualify the floodplain impacts associated with Alternative 1.1 as a significant encroachment on the floodplain, as defined in the following excerpt from Section 14.2.1.1 of the 1015.1F Desk Reference:

> *As defined in DOT Order 5650.2, significant encroachment is an encroachment in a floodplain that results in one or more of the following construction or flood-related*

> *impacts: 1) considerable probability of loss of human life, 2) likely future damage associated with the encroachment that could be substantial in cost or extent, including interruption of service on or loss of a vital transportation facility, and 3) a notable adverse impact on "natural and beneficial floodplain values."*

This guidance states that an alternative with a significant floodplain encroachment should not be selected if a practicable alternative exists. Alternative 2.2 does not qualify as a significant floodplain encroachment and would also allow for the eventual breaching of Runway 13-31, thereby restoring part of the original floodplain.

Furthermore, FAA Order 1050.1F provides the following Significance Threshold for Floodplains:

> *The action would cause notable adverse impacts on natural and beneficial floodplain values. Natural and beneficial floodplain values are defined in Paragraph 4.k of DOT Order 5650.2, Floodplain Management and Protection.*

Proposed actions that would result in impacts at or above these defined Significance Thresholds require preparation of an EIS.

DOT Order 5650.2, paragraph 4.k states that natural and beneficial floodplain values include, but are not limited to: natural moderation of floods, water quality maintenance, groundwater recharge, fish, wildlife, plants, open space, natural beauty, scientific study, outdoor recreation, agriculture, and forestry. The 1050.1F Desk Reference also references factors to consider when assessing impacts on a floodplain's natural and beneficial values. Most notably, "would the proposed action or alternative(s) cause flow alterations that would result in unacceptable upstream or downstream flooding?"

The selection of Alternative 1.1 as the proposed action could therefore result in the need to prepare an EIS for this project as the potential floodplain impacts meet or exceed the Significance Threshold set for floodplains.

Aircraft [edit]

The Coast Guard operates about 210 aircraft. Fixed-wing aircraft (such as Lockheed HC-130 Hercules turboprops) operate from Air Stations on long-duration missions. Helicopters (Aérospatiale HH-65 Dolphin, Sikorsky HH-60J Jayhawk, and Agusta MH-68 Stingray) operate from Air Stations, Air Facilities, and flight-deck equipped cutters, and can rescue people or intercept smuggling vessels. Some special MH- designated helicopters are armed with guns and some are equipped with armor to protect against small arms fire.

A USCG HC-130 Hercules near Oahu

The Coast Guard flies several aircraft types:

- 27 Lockheed HC-130 Hercules
- 42 Sikorsky MH-60T Jayhawk[23]
- 102 Airbus MH-65 Dolphin
- 11 HC-27J Spartan[24][25] Out of 14 on order.
- 18 CASA HC-144A Ocean Sentry.[26][27][28]
- 2 Gulfstream C-37A aircraft as a VIP transport for high-ranking Coast Guard and Homeland Security officials.[29]
- An unspecified number of RG-8A Condors.

The Coast Guard is planning to purchase 36 CASA CN-235 from Spanish aircraft manufacturer Construcciones Aeronáuticas SA (CASA) for medium range search. As of 26 February 2008, 3 aircraft have been delivered for testing and integration with a further 5 planned.[30] During testing, one aircraft was pulled into active duty for the search of downed Air Force pilots, in which the aircraft demonstrated its capabilities.

HC-144A Ocean Sentry (CASA CN-235-300 MP Persuader)

The Coast Guard was to purchase the Bell Eagle Eye UAV as part of the Deepwater program, but this has been cancelled.[31] The Coast Guard is currently preparing to launch a small UAS competition for the Legend-class NSC and future Heritage-class cutter.[32]

In addition to regular Coast Guard aircraft, privately owned general aviation aircraft are used by Coast Guard Auxiliarists for patrols and search-and-rescue missions.

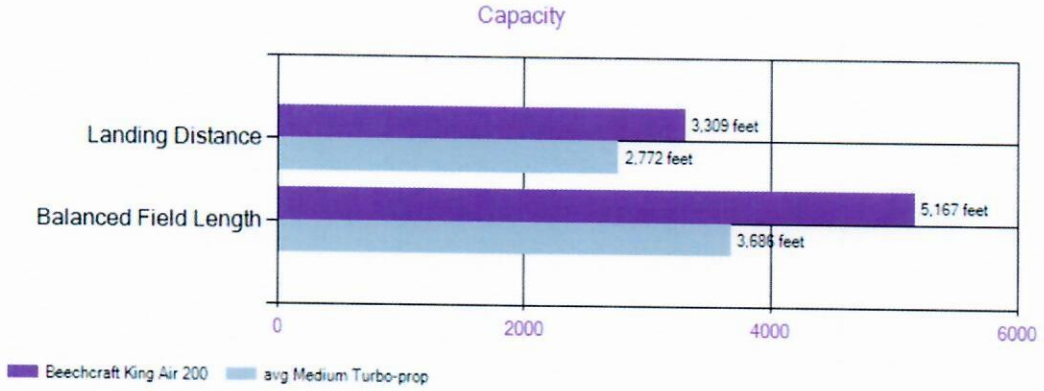
C-37A Gulfstream V

Specifications		
Primary Function	Special Air Missions	
Builder	Gulfstream Aerospace Corporation	
Performance		
Maximum Range (Mach 0.80, 8 passengers, 4 crew, NBAA IFR reserves)	6,500 nm	12,046 km
Long Range Cruise Speed	Mach 0.80, 459 ktas, 851 km/h	
Mmo (Maximum Allowable Mach Number)	Mach 0.885	
Takeoff Distance (SL, ISA, MTOW)	5,990 ft	1,826 m
Landing Distance (SL, ISA, MLW)	3,170 ft	966 m
Initial Cruise Altitude	41,000 ft	12,497 m
Maximum Cruise Altitude	51,000 ft	15,545 m

Required runway length

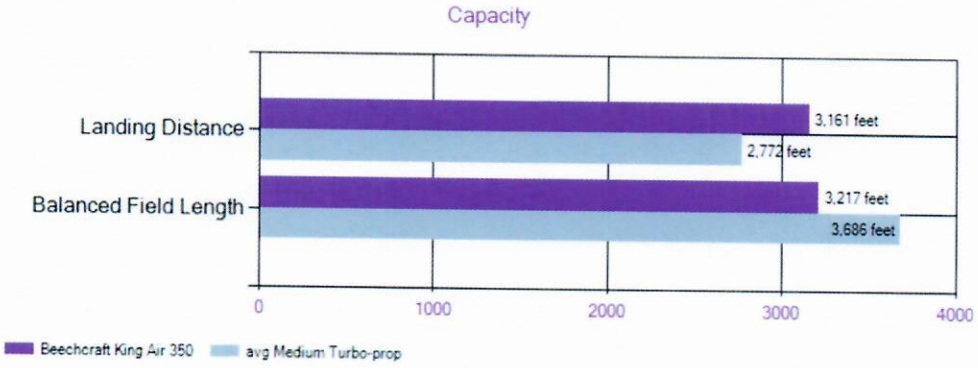
Balanced field length is the distance required to bring the aircraft up to take off speed and slow it to a full stop at an average air density and payload. Balanced field length is effected by many factors such as altitude, temperature, humidity and the condition of the runway which is effected by rain and snow. This calculation is performed by the pilot in command prior to every flight to ensure an adequate margin of safety in the event a take-off has to be aborted. **Landing distance** is the amount of runway required to land the aircraft at an average weight and air density and will vary greatly for each mission.

Balanced field length: 5,167 feet
landing distance: 3,309 feet



Balanced field length is the distance required to bring the aircraft up to take off speed and slow it to a full stop at an average air density and payload. Balanced field length is effected by many factors such as altitude, temperature, humidity and the condition of the runway which is effected by rain and snow. This calculation is performed by the pilot in command prior to every flight to ensure an adequate margin of safety in the event a take-off has to be aborted. **Landing distance** is the amount of runway required to land the aircraft at an average weight and air density and will vary greatly for each mission.

Balanced field length: 3,217 feet
landing distance: 3,161 feet



Description | Performance | Cabin | Video

Bombardier Learjet 35A

[hs_action id="6717"]

JETADVISORS®

Performance Ranges (Full Seats/Full Fuel)
Airport Performance/Takeoff Distance

Takeoff at Sea Level, feet	4,972
Takeoff at 5000' 25°C, feet	10,100
Landing Distance, feet	2,550
Certified Ceilings, feet	45,000
Fuel Consumption, gallons per hour	197
Total Variable Cost	$1,317
High Speed Cruise, knots	451
Ranges, Four Pax, Nautical Miles (NM)	2,056
600 NM Mission, Fight Time	1+24
1000 NM Mission, Flight Time	2+20

Cessna 208 Caravan

Technical Specifications

Exterior

Exterior Height: 14 ft 2 in
Wing Span: 52 ft 1 in
Length: 37 ft 7 in

Interior

Cabin Height: 4 ft 3 In
Cabin Width: 5 ft 2 In
Cabin Length: 14 ft 10 In
Cabin Volume: 271 cu ft
Door Height: 4 ft 1 In
Door Width: 4 ft 2 In
Internal Baggage: 32 cu ft

Occupancy

Crew: 1
Passengers: 9

Operating Weights

Max T/O Weight: 8000 Lb
Max Landing Weight: 7800 Lb
Operating Weight: 4940 Lb
Empty Weight: 3860 Lb
Fuel Capacity: 2224 lbs Lb
Payload W/Full Fuel: 871 Lb
Max Payload: 2860 Lb

Range

Normal Range: 325 nm
Max Range: 835 nm
Service Ceiling: 25000 ft

Distances

Balanced Field Length: 2055 ft
Landing Distance: 2508 ft

Performance

Rate of Climb: 1234 fpm
Max Speed: 186 kts
Normal Cruise: 175 kts
Economy Cruise: 147 kts
Cost per Hour: $ 659.12

Power Plant

Engines: 1
Engine Mfg: Pratt & Whitney Canada
Engine Model: PT6A-114A

Marketplace Information

The Aircraft Exchange currently has 5 (new or used) Caravan 208s on the market.

View GlobalAir.com Cessna 208 Caravan Marketplace

(Click to change the photo)

C-130 USCG

Performance (at max normal takeoff weight, unless indicated otherwise)	
Max. Cruising Speed	348 kts / 645 km/h
Economy Cruising Speed	339 kts / 628 km/h
Stalling Speed	100 kts / 185 km/h
Max. Rate of Climb at Sea Level	2,100 ft/min / 640 m/min
Time to 6,100 m	12 min
Cruising Altitude	28,000 ft / 8,535 m
Service Ceiling at 66,680 kg AUW	30,560 ft / 9,315 m
Service Ceiling, OEI, at 66,680 kg AUW	22,820 ft / 6,955 m
Takeoff Run	3,290 ft / 1,003 m
Takeoff Run to 15 m	4,700 ft / 1,433 m
Takeoff Run using max. effort procedures	1,800 ft / 549 m
Landing from 15 m at 58,967 kg AUW	2,550 ft / 777 m
Landing Run at 58,967 kg AUW	1,400 ft / 427 m
Runway LCN: asphalt	37
Runway LCN: concrete	42
Range with 18,144 kg payload and MIL-C-5011A reserves	2,835 nm / 5,250 km

TABLE C
Takeoff Length and Takeoff Weight Summary

Season[1,2]	Aircraft	Certificated Takeoff Weight (pounds)	Allowable Takeoff Weight (pounds)	Takeoff Distance (feet)[3]	Takeoff Weight (pounds) 7,800' ASDA	7,600' ASDA	7,200' ASDA	7,000' ASDA	6,900' ASDA
GENERAL AVIATION AIRCRAFT									
Summer	Cessna Citation V	15,900	15,500	6,600	15,500	15,500	15,500	15,500	15,500
Winter	Cessna Citation V	15,900	15,900	5,600	15,900	15,900	15,900	15,900	15,900
Summer	Beechjet 400A	16,100	14,000	7,200	14,000	14,000	14,000	13,900	13,800
Winter	Beechjet 400A	16,100	16,100	7,300	16,100	16,100	16,000	16,000	15,900
Summer	Bombardier Learjet 31A	17,000	15,700	8,400	15,300	15,100	14,700	14,300	14,100
Winter	Bombardier Learjet 31A	17,000	16,500	5,300	16,500	16,500	16,500	16,500	16,500
Summer	Bombardier Learjet 35A/36A	18,300	15,800	10,300	14,900	14,800	14,600	14,500	14,400
Winter	Bombardier Learjet 35A/36A	18,300	17,800	11,000	16,100	16,000	15,700	15,600	15,500
Summer	Canadair CL-600	53,000	44,000	10,700	36,200	35,800	34,400	33,800	33,500
Winter	Canadair CL-600	53,000	46,000	10,600	39,400	38,900	38,000	37,400	37,000
Summer	Bombardier Learjet 60	23,500	20,200	9,800	18,000	17,800	17,200	17,000	16,700
Winter	Bombardier Learjet 60	23,500	21,400	8,300	20,900	20,600	20,100	19,900	19,700
Summer	Gulfstream IV	74,600	64,000	9,800	58,000	57,000	56,000	55,500	55,000
Winter	Gulfstream IV	74,600	71,000	9,800	64,000	63,000	61,500	61,000	60,500
REGIONAL JET AIRCRAFT									
Summer	Fairchild Dornier 328J	34,524	31,700	7,700	31,500	31,500	30,900	30,400	30,200
Winter	Fairchild Dornier 328J	34,524	34,524	7,900	34,300	34,200	33,300	33,000	32,900
Summer[4]	Canadair CRJ 200LR	53,000	41,400	8,500	40,000	39,500	38,500	38,250	38,000
Winter	Canadair CRJ 200LR	53,000	47,600	9,200	45,000	44,500	43,500	43,000	42,500
Summer	AVRO RJ85	93,000	88,500	14,000	75,000	74,000	72,000	71,000	70,000
Winter	AVRO RJ85	93,000	93,000	10,100	84,000	83,000	81,000	80,000	79,000

[1] 77 Degrees Fahrenheit (July)
[2] 43 Degrees Fahrenheit (March)
[3] At Allowable Takeoff Weight
[4] ISA+30 Degrees Celsius

All distances and weights determined at 9,000 feet elevation, zero wind, zero runway gradient

Source: Aircraft Flight Planning Manuals (selected manufacturers)

Boeing:

BC-17 Globemaster III / 3,500ft (1,064m) / B, C, D *(non-verified)*
B717-200 / 3,600ft - 5,000ft (MLW) / B, some C
B737-700 / 3,500ft - 5,000ft (MLW) / B, C
B737-800 / 3,800ft - 5,800ft (MLW) / B, some C
B737-900 / 4,100ft - 5,900ft (MLW) / B, some C
B757-200 / 3,900ft - 5,100ft (MLW) / B, C
B767-300 / 3,700ft - 5,300ft (MLW) / B
B777-200 / 3,700ft - 5,300ft (MLW) / B
B777-200LR / 5,300ft - 5,300ft (MLW) / B
B777-300ER / 4,700ft - 6,200ft (MLW) / B
B787-8 / 4,400ft - 5,000ft (MLW) / B
B787-9 / 4,400ft - 6,200ft (MLW) / B
B787-10 / 5,500ft - 7,000ft (MLW) / B *(non-verified)*
B747-SOFIA / 3,500ft - 5,400ft (MLW) / B
B747-VC-25 / 4,300ft - 7,300ft (MLW) / B
B747-200 / 4,500ft - 7,300ft (MLW) / B
B747-400 / 5,500ft - 7,300ft (MLW) / B
B747-800 / 5,000ft - 7,400ft (MLW) / B
B747-SCA / 6,000ft - 8,000ft (MLW) / B

Bombardier:

Dash 8-Q400 / 4,230ft (MLW) / B, C, D
CRJ-200 / 4,850ft (MLW) / B, C, D

Embraer:

ERJ-170 / 3,300ft - 4,300ft (MLW) / B, C, D
ERJ-175 / 3,300ft - 4,300ft (MLW) / B, C, D
ERJ-190 / 3,300ft - 4,300ft (MLW) / B, C, D
ERJ-195 / 3,800ft - 5,000ft (MLW) / B, C, D

Ken Risse

From: Robert.D.Hornick@uscg.mil on behalf of Hornick, Robert D LT <Robert.D.Hornick@uscg.mil>
Sent: Thursday, August 14, 2014 12:18 PM
To: Ken Risse
Cc: Coulter, Nathan CDR
Subject: RE: PDC Engineering Facility Requirement - Seward

I do not know who does the pavement strength tests or who funds them. The LCN report I was stating came from an Air Force report. We just go by what is published in the AK aviation supplement.

As far as the use of an airfield during a mass casualty or natural disaster, if the runway is still usable we would/can use the C130 as an air ambulance to get people to higher level of care quicker.

As far as the chain of command, we normally get our direction through our district office in Juneau Alaska.

The H60 / H65 helicopters have used Seward before, and usually they only require gas. As stated earlier the C130's have not been there in a while. I will not say we will never use Seward for SAR, as we never know what situation will present itself. Having Seward available for use by C130's only allows for increased flexibility/capability to respond.

If Seward were rated for C130 use we would use it training pilots to land on shorter/narrower runways. Currently the only other field we use that is close to Sewards dimensions is Dutch Harbor and that is a 2 hr flight. You would probably see weekly flights stopping by for touch and go's. C130's would need no other services.

Let me know if you have any more questions.

LT Robert Hornick
C-130 Assistant Operations Officer
Robert.D.Hornick@uscg.mil
(W) 907-487-5586
(C) 858-752-3103

-----Original Message-----
From: prvs=296a1c91b=KenRisse@pdceng.com [mailto:prvs=296a1c91b=KenRisse@pdceng.com] On Behalf Of Ken Risse
Sent: Thursday, August 14, 2014 10:12 AM
To: Hornick, Robert D LT
Cc: Coulter, Nathan CDR
Subject: RE: PDC Engineering Facility Requirement - Seward

LT. Hornick,

Thanks for the reply. Can you tell me more about the way the Coast Guard would handle mass casualties or medical evacuations? For instance, if there were an accident with a fishing boat, cruise ship or other vessel with a dozen injuries, would the Coast Guard C-130 act as a medical ambulance moving mass casualties to hospitals in Anchorage or

other cities? If there were a natural disaster, not at sea, such as an earthquake, fire or flood, would the Coast Guard respond under FEMA direction?

For the pavement strength, you mentioned that it previously had an LCN of 14. Do you go by the published pavement strength in the 5010 records (currently not available), or does the military test pavement strength at airports it plans to use?

If there were no pavement strength limitations/restrictions, how many annual C-130 operations would you expect at Seward in a typical year?

Would Coast Guard search and rescue operations ever be based out of Seward? If so, what airport facilities are needed?

Thanks for your help.

Ken Risse, PE, Senior Associate
Civil Engineer

PDC Inc. Engineers
Planning Design Construction

1028 Aurora Drive | Fairbanks, Alaska 99709 v 907.452.1414 | f 907.456.2707 | www.pdceng.com
"Transforming Challenges into Solutions"

-----Original Message-----
From: Robert.D.Hornick@uscg.mil [mailto:Robert.D.Hornick@uscg.mil]
Sent: Wednesday, August 13, 2014 3:33 PM
To: Ken Risse
Cc: Coulter, Nathan CDR
Subject: RE: PDC Engineering Facility Requirement - Seward

Ken,
Understand you are inquiring about Coast Guard operations at the Seward airport with regards to C130 operations and impacts.
Since I have been here (2012) we have not used Seward due to the fact that it is no longer tested for the C130 bearing capacity. From what I have been told we used to operate there when it was certified for our weight.

The real impact for Coast Guard operations is for expedient planning in case of mass casualty or Medical Evacuation that would allow a quicker response via C130 than an H60. Additionally, if an H60 needed fuel and a fuel provider was not available at the airport the C130 could provide fuel. With the bearing capacity as it stands we would need a DOT waiver, which could take some time. The last report, before the 12,500 NOTAM restriction was established, is that the main Runway has an LCN of 14 equating to a max gross C130 weight of 100,000 lbs. With a runway length of 4500 we can normally operate at about 120,000 lbs, allowing enough fuel and gear to respond to the majority of situations.

Let me know if you have any questions.

LT Robert Hornick
C-130 Assistant Operations Officer
Robert.D.Hornick@uscg.mil
(W) 907-487-5586
(C) 858-752-3103

-----Original Message-----
From: Vojtech, Zachary R LT
Sent: Wednesday, August 13, 2014 2:58 PM
To: Hornick, Robert D LT
Cc: DeAngelo, Daniel J LT; Coulter, Nathan CDR
Subject: PDC Engineering Facility Requirement - Seward

Bob,

I received a phone call from Ken Risse who works for PDC Consulting Engineers, contract work with Dept of Transportation. They are putting together a Facility Requirement Chapter for the Seward airport and would like to know the importance of Seward in regards to the Coast Guard. Specifically, they are deciding whether or not the DOT should shorten the runway or change the weight capability, but would like to know impacts to our C-130 operations.

Ken Risse's phone number is 907-452-1414 and email is kenrisse@pdceng.com.

He will be completing this chapter by Friday, and would like to add our input to it before then.

Thank you.

Zach

LT Zach Vojtech
Air Station Kodiak
w: (907)487-5887

HYDRAULIC MAPPING AND MODELING
Kenneth F. Karle, P.E.
1091 West Chena Hills Drive, Fairbanks, AK 99709

July 6, 2016

Memorandum

To: Royce Conlon, P.E., PDC Inc. Engineers

From: Kenneth Karle, P.E., Hydraulic Mapping and Modeling

Subject: River Behavior Considerations for Channel Excavation

There appears to be continued interest from the public and others in investigating the use of channel diversion through excavation as a potential method to solve the flooding problems at the Seward Airport. This memo provides a brief explanation of the geomorphology of braided rivers and the hydraulic forces involved in bedload transport and deposition, and should provide additional justification, if needed, for the decision to select an alternative that does not include large-scale excavation of a new channel segment in the Resurrection River alluvial fan delta.

Braided River Geomorphology-The upper 8 miles of the Resurrection River takes the form of a meandering channel confined within a narrow meandering canyon. The channel transforms into a braided river as multiple glacially-fed tributaries provide water and sediment input, and ultimately transforms into an alluvial fan delta for approximately three miles before flowing into Resurrection Bay. Salmon Creek and Japanese Creek also provide water and sediment input to the alluvial fan delta.

The alluvial fan delta is braided in nature, and consists of interconnected distributary channels formed in coarse depositional materials. River conditions that are universally attributed to braided rivers include high bank sediment supply upstream, high bank erodibility, little to no vegetation, moderately steep gradients, and flashy runoff conditions which vary from low to high flows frequently (Leopold et al, 1964, and others).

Braided rivers are generally found in steep valleys relative to other types of rivers. A common explanation for braiding states that a river needs to dissipate energy as it moves downstream. Otherwise, velocity would continue to increase, which leads to downcutting and channel erosion. However, since many rivers cannot downcut because they discharge into a water body with fixed elevation, other actions are needed to dissipate energy. By braiding, a river increases its overall length, decreases its slope, and increases the amount of energy dissipated in longer channels and in bends. Equilibrium is maintained between energy gained and energy lost. The fan delta becomes a depositional zone to maintain its grade.

Though commonly referred to as a floodplain, the wide braided gravelly and unvegetated area where the channels, both active and abandoned, and gravel bars are located are not technically floodplains, but rather part of the active fan delta.

Sediment Deposition-The shear stress at the bed τ_0 is the force of moving water against the channel bed. Referred to as the tractive force, it determines the power of flow to dislodge and transport sediment particles. The equation for shear stress for steady gradually varied flow is:

$$\tau_0 = \gamma \, R \, S$$

Where τ_0 = bed shear stress
γ = specific weight of water
R = hydraulic radius
S = friction slope

As the slope S decreases, the shear stress decreases, along with the power to dislodge and transport sediment. Sediment in transport will settle out with a shallower slope.

For the 8500 foot reach upstream of the Seward Highway Bridge, the Resurrection River has an average slope of 0.005 feet/feet. The bed slope is relatively consistent; see Figure 1. In natural river systems, slopes are steepest near the headwaters and gradually flatten out near the mouth. This holds true for the Resurrection River as well. Downstream of the Seward Highway/ARRC bridges, the slope flattens out considerably. Resurrection Bay provides a fixed elevation water body (aside from tidal range). Unable to downcut, the river braids, decreases its slope, deposits sediment, and dissipates energy. The fan delta becomes a depositional zone to maintain its grade.

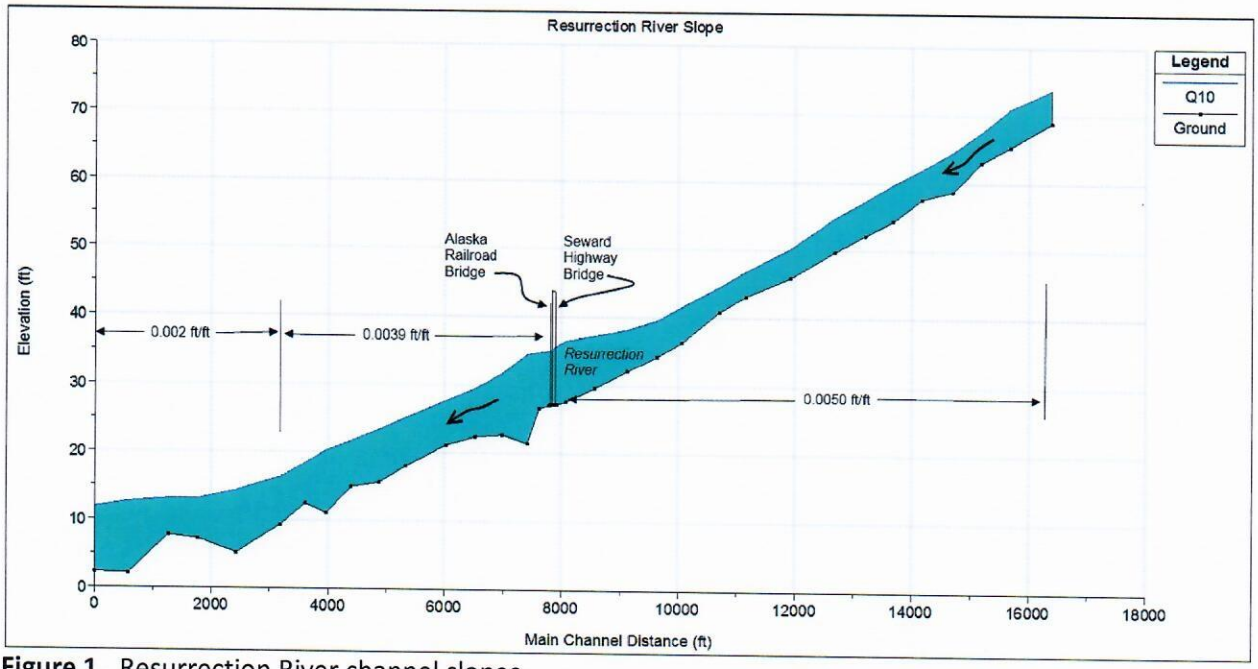


Figure 1. Resurrection River channel slopes.

Though there are several processes that are responsible for braiding, it is important to note the time frame in which these processes can occur. Researchers have noted that "Individual channels and bars in such rivers can evolve, migrate, and switch position within days or hours of competent flow, so that the overall pattern is bewilderingly variable and complex." (Ferguson et al, 1992). Others have noted that though some processes require high water stages, some do not, and braiding can occur at constant discharges.

Resurrection River Bedload Rates and Sediment Deposition-I have been unable to locate estimates of annual bedload rates for the Resurrection River; however, the general consensus is that the bedload rates are high. Multiple reports provide descriptions of high bedload rates, active channel migration, and severe sediment deposition. The Alaska Railroad estimates that the 1995 Resurrection River flood event dumped 60,000 cubic yards of sediment in the ARR docking harbor just off the east end of the river (T. Brooks, personal communication). The Corps of Engineers notes that Seward drainages carry glacial debris that is deposited in the streams and added to the alluvial fans at outlets (COE, 2008). A report by a multi-agency task force formed to pursue a comprehensive solution to flooding in Seward noted that:

> "..streams tributary to Resurrection River drain steep glaciated subbasins and deposit large quantities of coarse bed materials in alluvial fans at their mouths. These deposited materials are subsequently picked up and moved downstream through the Resurrection River valley, particularly during flood flows. Transport of these materials constantly modifies the major stream channels. The river migrates back and forth through many distributaries located in a flood plain ranging up to 1 mile in width."(Task Force, 1998).

A report by the Seward/Bear Creek Flood Service Area notes that streams in the Resurrection Bay watershed carry huge amounts of gravel and debris which:

> "guarantees that they will naturally meander over alluvial fans or through braided channels and definitely refuse to stay in one place." (SBCFSA, 2009).

A series of aerial photographs of the Seward Airport area, stretching from 1950 through 2014, documents the channel migration of the Resurrection River to the southwest across the alluvial fan delta. See Appendix 1 of this memo.

Excavation of active fan deltas has been conducted frequently in Alaska, primarily to utilize the gravel. For example, a long-term gravel excavation program on the Toklat River in Denali National Park and Preserve is unique within the national park system; its success is due to the high bedload and quick replenishment rates that refill the excavated channels within a few years or less (Karle, 2010).

MHW completed a study of river processes along another wide braided river system in Southcentral Alaska for the NRCS in order to assess various options to control bank erosion. The 2004 study, *'Matanuska River Erosion Assessment Design Study Report'* (USDA, 2004) focuses on a study area that encompassed the river floodplain from the Old Glenn Highway Bridge downstream approximately 6 miles to the Bodenburg Butte area. The NRCS report included an extensive study of gravel removal as a bank erosion protection alternative. Channel

excavations would be designed to reduce velocities and stresses on banks during high and moderate flow events (USDA, 2004).

The study utilized computer modeling to estimate the effect of channel excavations on flow pattern, hydraulic characteristics, and sediment transport. Excavated trenches were created within the river model and analyzed. The modeled trenches were 10 feet deep, 500 feet wide, and 2500, 3300, and 6500 feet long. The study authors acknowledged that such excavation requires construction practices of a large-scale mining operation. To be effective during moderate floods (2- to 10-year flood), the initial modeling involved the removal of approximately 2.2 million cubic yards of material. The authors noted that additional planning and modeling was needed to adjust the trenches to maximize effectiveness.

The following paragraph from the NRCS report describes a major disadvantage to this alternative. Italics have been added for emphasis.

> "From a geomorphologic perspective, the behavior of the excavated channels is of concern on the Matanuska River, since natural river instability may impact the effectiveness of the trenches to re-direct flows and reduce water levels. Since *braided channels characteristically exhibit irregular and unpredictable morphologic development, there can be no guarantee* that the proposed excavations will remain stable for a significant time period (i.e. multiple freshet seasons) to reduce flood levels and redirect flows, as intended. In addition, *there is a risk that bank erosion could continue* due to flow in the smaller subchannels even if the trenched channels are constructed. If an appreciable amount of the flow remains outside of the excavated channel, bank erosion may continue. In addition, flows through the initially straight excavations will likely erode their banks and eventually result in irregular excavated channel patterns with flow paths deviating from the constructed alignment." NRCS, 2004; p. 3-2.

Summary-Based on the general description of channel excavation for bank erosion control in the NRCS report, and the extensive experience of the authors with gravel excavation on braided rivers, I concur with ADOT&PF's recommendation that channel excavation is not a viable engineering solution to ameliorate or control flooding of the Seward Airport. There is no guarantee that an excavated channel would remain stable, or redirect flows, as intended, for the following reasons:

- Upstream of the Seward Highway Bridge, the Resurrection River, Salmon Creek and Japanese Creek all provide high inputs of sediment to the Resurrection River drainage.
- The slope of the alluvial fan delta downstream of the Seward Highway Bridge is less than the slope of the river upstream, creating a depositional environment.
- High sediment transport in the Resurrection River, even during low to moderate flows, could alter or fill an excavated channel on the alluvial fan delta within days.
- Remaining flow outside of the excavated channel may still cause sediment deposition, bank erosion, and flooding of the runway.

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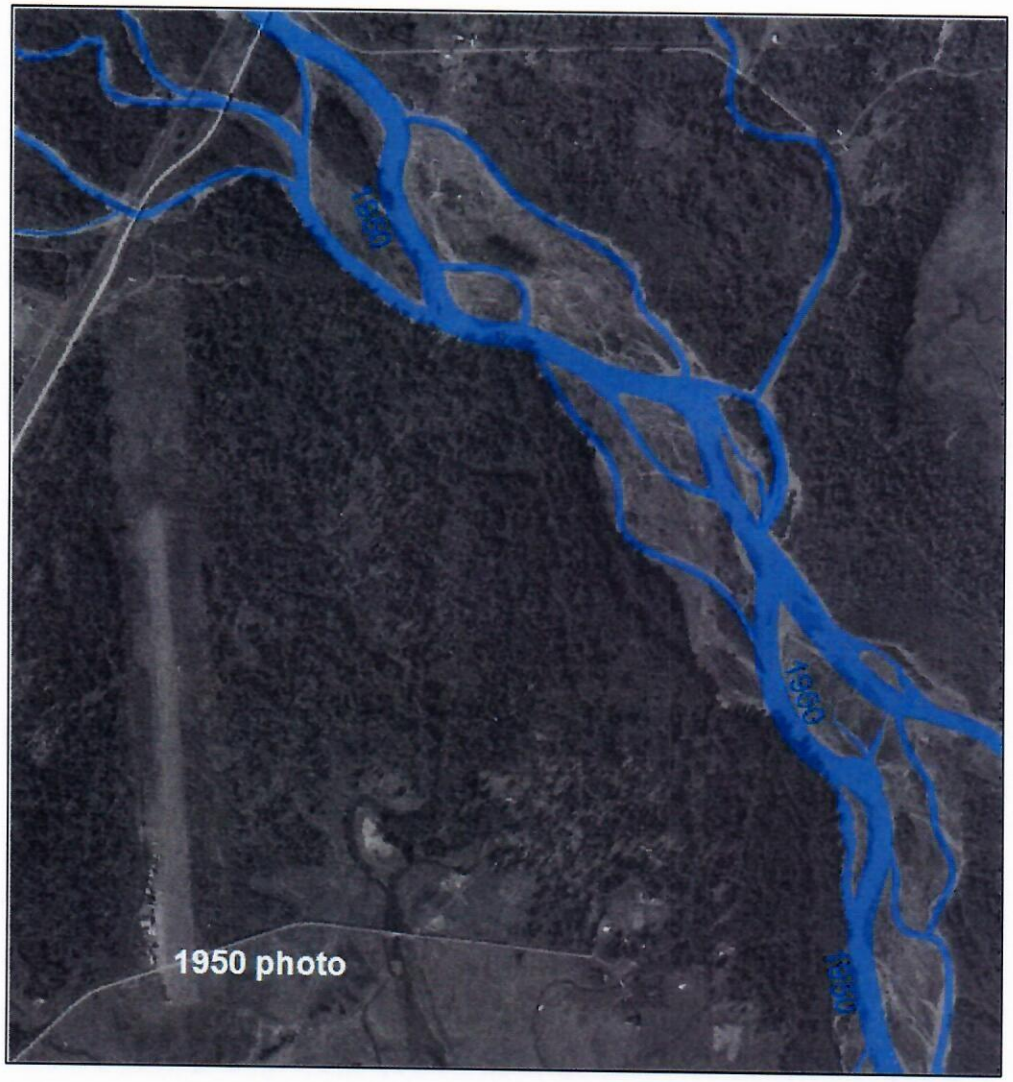
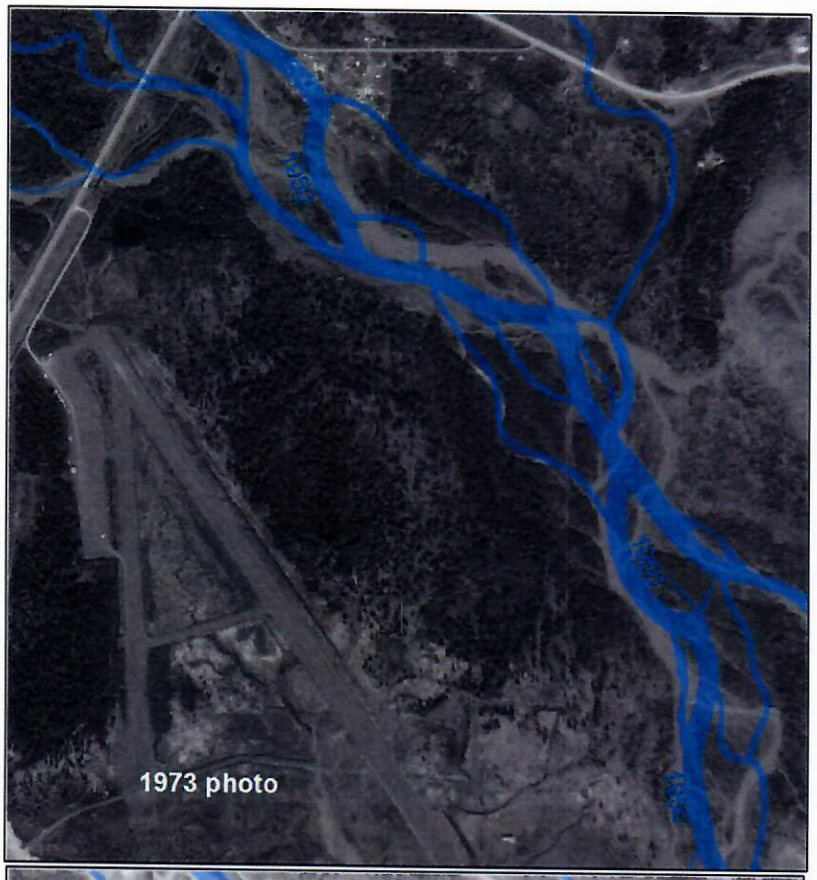
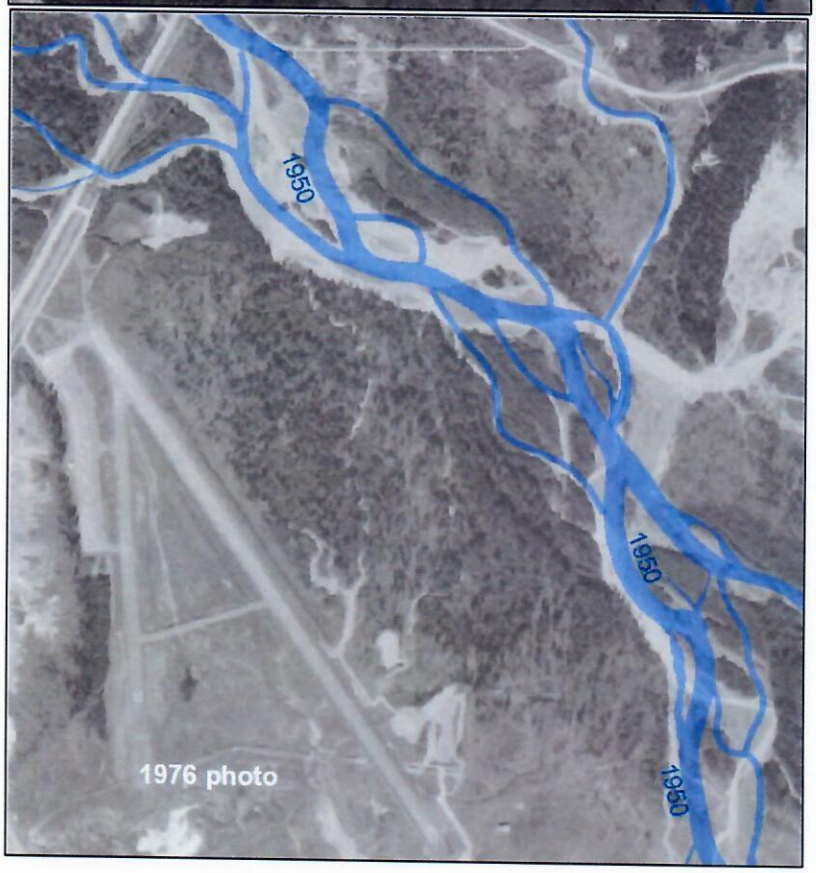
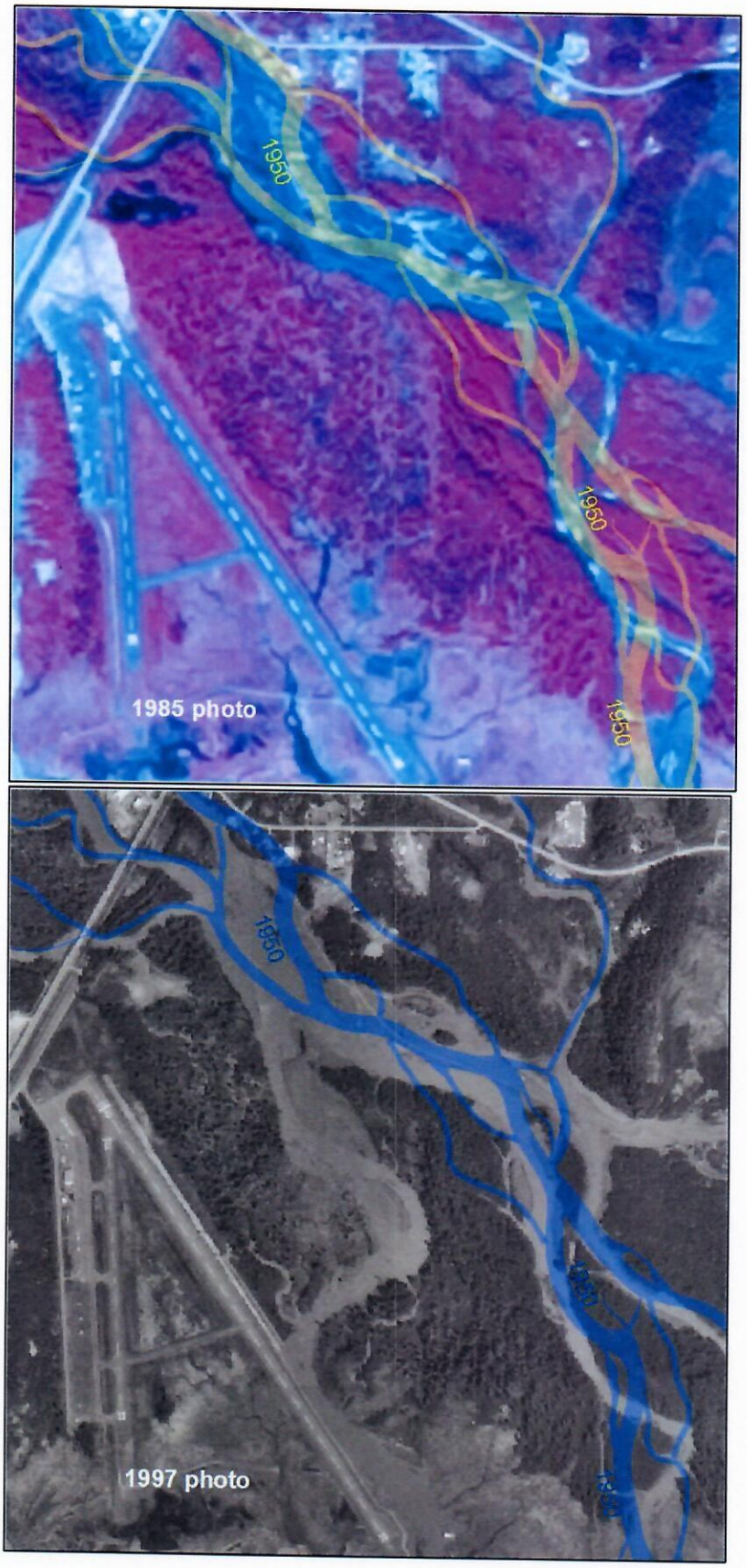
Appendix 1-Resurrection River Channel Locations, 1950 to 2014

The approximate location of the Resurrection River channel in 1950 is shaded in blue, and overlain on the following aerial images: 1950, 1973, 1976, 1985 (infrared imagery-channel shaded in yellow), 1997, 2011, and 2014.




1973 photo


1950
1950
1950
1976 photo


1950
1950
1985 photo
1950
1950
1997 photo

1950
1900
1850
2011 photo
1950
1900
1850
2014 photo