APPENDIX B:

DRAFT ENGINEER'S DESIGN REPORT

Saint Mary's Airport (KSM)

Airport Improvements Project

DOT&PF No. Z605630000

Draft Engineer's Design Report

Prepared by:

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August 2021

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Prepared for:

State of Alaska
Department of Transportation and Public Facilities
Northern Region Design & Construction - Aviation

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LIST OF ACRONYMS

AC ..... FAA Advisory Circular
AOA ..... Airport Operations Area
ALP ..... Airport Layout Plan
ARC ..... Airport Reference Code
CABC ..... Crushed Aggregate Base Course
CASC ..... Crushed Aggregate Surface Course
CSPP ..... Construction Safety & Phasing Plan
DOT&PF ..... Alaska Department of Transportation & Public Facilities
EEB ..... Electrical Equipment Building
FAA ..... Federal Aviation Administration
FAR ..... Federal Aviation Regulations
GS ..... Glideslope
ICAP ..... Indirect Cost Allocation Plan
ILS ..... Instrument Landing System
KSM or PASM ..... Saint Mary's Airport
LOC ..... Localizer
M&O ..... Maintenance and Operations
MIRL ..... Medium Intensity Runway Edge Lights
MALSR ..... Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights
NAVAID ..... Navigational Aid
OFA ..... Object Free Area
PAPI ..... Precision Approach Path Indicator
REIL ..... Runway End Identifier Lights
RPZ ..... Runway Protection Zone
RSA ..... Runway Safety Area
RWY ..... Runway
TDG ..... Taxiway Design Group
TOFA ..... Taxiway Object Freeway Area
TSA ..... Taxiway Safety Area
TWY ..... Taxiway
TL ..... Taxilane
VASI ..... Visual Approach Slope Indicator

Notice to Users

This report reflects the current state of design and reflects design decisions made at the time of publication. Changes frequently occur during the design process that may significantly affect final design. Persons who may rely on information contained in this document should check with DOT&PF for the current design. Contact the Project Manager, Christopher Johnston, at 907-451-2322 or chris.johnston@alaska.gov for this information.

1.0 INTRODUCTION

1.1 Foreword

Saint Mary's Airport (KSM) is located approximately seven road miles west of the community of Saint Mary's, which lies on the north bank of the Andreafsky River five miles from the confluence with the Yukon River. Saint Mary's is located 450 air miles west-northwest of Anchorage and 515 air miles southwest of Fairbanks. The community is served by barge and air transport. The Saint Mary's barge landing on the Andreafsky River provides the only deep-water dock in the Yukon Delta. A 22-mile local gravel road links the village of Saint Mary's to the villages of Andreafsky, Pitka's Point, and Mountain Village. This road is not maintained during winter months.

KSM has two runways: Runway 17/35 is a gravel runway measuring 6,000-feet by 150-feet, and Runway 6/24 is a gravel runway measuring 1,520-feet by 60-feet. Gravel taxiways (Taxiways A and B) connect Runway 17/35 to the 250-foot by 1,360-foot main apron. The southern half of the main apron is paved (150,000 SF) and the remainder of the apron is surfaced with gravel. Taxiway A also connects Runway 17/35 to the 295-foot by 345-foot gravel General Aviation (GA) Apron (DOT&PF 2020).

1.2 Scope of Work

The Alaska Department of Transportation and Public Facilities (DOT&PF) in cooperation with the Federal Aviation Administration (FAA) proposes to upgrade existing facilities at KSM. Work will include the following:

DOWL Design Elements:

- Resurfacing of unpaved Runway 17/35 and extending the Runway Safety Area (RSA) north approximately 450 feet.
- Resurfacing of unpaved Runway 6/24 and widening of existing RSA embankment by approximately 35 feet.
- Resurfacing unpaved Taxiways A and B
- Resurfacing the transient apron and the unpaved portion of the main apron
- Repaving the main asphalt apron
- Addressing drainage issues within the embankment and structural sections throughout.
- Drainage improvements, including new conveyance ditches and culvert replacement
- Demolition of existing FAA-owned Navigational Aids, including Runway 17 Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights (MALSR) and existing Visual Approach Slope Indicators (VASI).
- Demolition of existing lighting equipment.
- Layout of new lighted signs.

FAA Navigational Aid Design Elements

The FAA will complete design of new FAA Navigational Aids via a Reimbursable Agreement between FAA and DOT&PF. FAA Design elements include:

- New Precision Approach Path Indicators (PAPI) for each end of Runway 17/35
- New Runway End Identifier Lights (REIL) at the Runway 17 threshold and the Runway 35 displaced threshold.

Electrical Design Elements

New electrical design will be completed under a separate contract. Electrical design components include the following:

- Replacement of all existing runway edge lighting with new Medium Intensity Runway Edge Lighting (MIRL) systems, including new lighting regulators.
- Replacement of existing Medium Intensity Taxiway Edge Lighting (MITL) on Taxiways A and B, and west apron, including new regulators.
- Design of new power service to new lighted airfield signs on provided layout.
- Replacement of the primary wind cone and foundation.
- Replacement of the segmented circle.
- Replacement of the supplementary wind cone and foundation.
- Replacement of the Electrical Equipment Building and backup generator.
- Replacement of the airport beacon.

The DOT&PF anticipates that construction of this project will begin in 2022 and is expected to last two construction seasons.

1.3 Draft Engineer's Design Report (EDR) Objectives

This draft EDR is intended to provide a narrative of the design process; it describes the technical aspects of the project design, including a review of existing conditions, statement of design criteria and assumptions, modifications to DOT&PF standards, phasing elements, and preliminary quantity and cost estimates. Note that since the geotechnical investigation at the project site is still pending, substantial design changes to materials and typical sections that would not normally occur after this point in the design process may be necessary.

Section 2, Design Analysis, generally follows the DOT&PF Alaska Aviation Preconstruction Manual, Attachment E *Engineer's Design Report Outline.*

2.0 DESIGN ANALYSIS

2.1 Airport Layout Considerations

Dimensions, grades, horizontal, and vertical layout will conform to the current FAA Advisory Circular (AC) 150/5300-13A, Change 1, *Airport Design*. Airport dimensions will generally follow the near-term layout provided in the recent Airport Layout Plan (ALP) update, with exceptions as noted in the tables below. Runway 17/35 will be designed to Airport Design Group (ADG) B-III, including extending the RSA embankment north of Runway 17 and displacing the runway 35 threshold north to provide the standard 600' RSA prior to each runway threshold. Runway 17/35 design dimensions are shown in **Table 2-1** below.

Table 2-1 – Summary of Runway 17/35 Design Dimensions

Dimension	Existing	ADG B-III Standard	Design
Runway Length	6,000'	-	6,000'
Runway Width	150'	100'[1]	150'
Runway Shoulder Width	20'	20'	20'
RSA Width	300'	300'	300'
RSA Length beyond Runway Threshold (Runway 17 / Runway 35 end)	195'/185'	600'/600'	600'/600'
Runway Object Free Area (OFA) Width	800'	800'	800'
Runway OFA Length Beyond Runway Threshold	1000'	600'	600'

[1]Existing 150' runway width will be maintained to support critical Lockheed C-130 (FAA Design Group C-IV) revenue operations without special operational procedures that would be required with a 100' runway width. See *St. Mary's Airport Layout Plan Narrative Report*, July 2020.

Runway 6/24 will be designed to ADG A-I, except the RSA width will be widened to the ultimate ADG B-II standard as shown in the ALP. Runway 6/24 design dimensions are shown in **Table 2-2 below**.

Table 2-2 – Summary of Runway 6/24 Design Dimensions

Dimension	Existing	ADG A-I Standard	Design
Runway Length	1,520'	-	1,520'
Runway Width	60'	60'	60'
Runway Shoulder Width	10'	10'	10'
RSA Width	115'	120'	150'[1]

Dimension	Existing	ADG A-I Standard	Design
RSA Length beyond Runway Threshold	240'/225'	240'	240'
Runway Object Free Area (OFA) Width	250'	250'	250'
Runway OFA Length Beyond Runway Threshold	200'	200'	200'

[1]The Runway Safety Area width will be designed to the B-II ADG as shown in the ultimate configuration in the current Airport Layout Plan.

Taxiways A and B will be designed to Taxiway Design Group (TDG) 3 standards as shown in the current ALP and detailed in **Table 2-3** below.

Table 2-3 – Summary of Taxiways A & B Design Dimensions

Dimension	Existing	TDG 3 Standard	Project Design
Taxiway Width	75'	50'[1]	75'
Taxiway Shoulder Width	20'	20'	20'
Taxiway Edge Safety Margin	10'	10'	10'
Taxiway Safety Area (TSA) Width	118'	118'	118'
Taxiway Object Free Area (TOFA) Width	186'	186'	186'

[1]The existing 75-foot taxiway width will be maintained, as a reduction in taxiway width would likely impact scheduled freight operations and could reduce the safety and utility of the airport.

Taxiway fillet dimensions will generally follow existing layouts to maintain existing aircraft operations.

2.2 Soils & Grading

Historic Project and Subsurface Data Overview

The following is a summary of key elements from a review of the available historic subsurface investigations available:

- The original runways, taxiways, and aprons were paved in 1977. The pavement had failed by 1978 and was removed from all areas except the main apron. Local soils were used for embankment and aggregates.
- Subsequent projects have resurfaced the runways, taxiways, and aprons with locally obtained aggregate.
- All local soil materials are a variation of sandstone and siltstone, exhibiting low degradation and Nordic Abrasion Test values.

- Existing gravel surfacing material is substandard, with low degradation values that contribute to product breakdown over time, contributing to high amounts of fines. Several previous projects have used locally available aggregates that consistently exhibit low degradation values.

- There are existing embankment drainage issues in many locations. Water is present in the surface and subsurface of many runway, taxiway, and apron areas.

- On Runway 17/35, a 1971 report indicates that all native material was removed down to bedrock and replaced with imported fill. Degradation of surfacing materials over time has been observed and is a contributing factor to the high fines and moisture contents.

- Runway 6/24 appears to have been built on approximately 6' of fill above 2.5' of native material consisting of compressed peat and silt. Permafrost degradation is likely occurring beneath the runway embankment.

- The paved portion of the apron originally included 3 inches of asphalt over base course. Currently it consists of approximately 1.5 inches of asphalt. This layer is very brittle and exhibits cracking and heaving under aircraft loading. Historic borings have shown variable groundwater levels and permafrost remaining in some locations. Base and subbase materials have been documented at greater than 15% fines content.

Significant historical geotechnical data has been collected. However, additional subsurface exploration is planned for this project to determine thermal state, presence of thaw sensitive materials or ice, extent of soil degradation, and drainage information that will aid in design of key project elements, including runway resurfacing methods, embankment construction, and new PAPI and REIL foundations. The design team is coordinating with DOT&PF on a focused geotechnical investigation to provide additional borings and subsurface data. Results from this investigation will be included in future reports once they are available. The results of this investigation may substantially impact material selection and typical sections throughout this project.

Required Soils

Soils and aggregates required for this project include FAA and DOT&PF Aviation Specification Crushed Aggregate Surfacing Course (P-299), Borrow (P-152) for the runways, taxiways, and aprons; and Subbase Course (P-154) for embankment. The borrow material will be suitable excavated material from the project or local material sources and will be a 1-inch minus gradation per the borrow definition in Specification P-152. Crushed Aggregate Base Course (P-209) and Hot Mix Asphalt (P-401) aggregates are proposed for the new asphalt on the paved apron and are also expected to be imported.

Uncertainties

Final design of the runway, taxiway, and apron typical sections is pending the results of the geotechnical field program expected to be completed in late summer of 2021. The typical sections and material quantities included in this PIH Draft Engineer's Design Report are preliminary and based on historical data and assumptions concerning soil conditions. As such, the design, specifications, and cost of the project may need to be substantially revised based on the geotechnical field program's results.

Available Aggregates

An onsite investigation and review of existing reports was conducted to determine local availability of surfacing aggregates (surface course, base course, and asphalt aggregate), subbase course, and borrow material in existing material sites close to St. Mary's Airport. Originally, sources in Nome, Marshall, Mountain Village, and St. Mary's were considered possible sources for the surfacing aggregates. After the investigation and document review, it was determined that the quality of material from the Mountain Village and St. Mary's material sites would not be suitable for use as surfacing aggregate due to low degradation values. Further, the Mt. Village material is typically of lesser quality than the St. Mary's material and was therefore dismissed as a subbase or borrow source due to the extra haul length required. Current recommendations for design include the following:

- All surfacing aggregates, including Crushed Aggregate Surface Course (P-209), Crushed Aggregate Base Course (P-209), and asphalt aggregates (P-401), will be imported to St. Mary's by barging.

- Borrow (P-152) and Subbase Course (P-154) for embankment fill material and RSA structural sections outside of runway, taxiway, and apron surfaces are proposed to come from existing material sites near the airport or from suitable project excavation.

Internal Drainage & Frost Depth

Internal drainage within the runways, taxiway, and apron areas is generally poor, with high fines contents likely contributing to capillary action, drawing water to the surface. Our proposed typical sections for areas with heavy aircraft loading (all but Runway 6/24) include a geotextile layer that extends from centerline to edge of embankment. This will be a geotextile for separation and drainage within the structural section and will be capable of wicking moisture out of the embankment section. The use of a wicking geotextile of this nature will require ditching or adequate fill slope adjacent to embankment edges to prevent backwards wicking of water from embankment areas back into the structural section. Proposed ditches are described in the drainage section below.

2.3 Drainage

2.3.1 Existing Runoff Patterns

A preliminary review of site conditions and known drainage features indicates runoff generally sheet flows from existing runways, taxiways, and apron areas into surrounding vegetation. Runoff from Taxiway B and the apron areas is collected on the west side and conveyed in ditches to the southeast corner of the intersection of Taxiway B and Runway 17/35, where it enters one of two culverts. One culvert extends north under Taxiway B, and the other extends west under Runway 17/35 and daylights beyond the RSA embankment. The Taxiway B culvert is the lower invert by a few inches. The runway culvert is reported to be partially filled with gravel surfacing, but this could not be confirmed during the spring site visit. The inlet is a known ponding area during spring thaw.

Proposed design elements are depicted in the PIH plans, and generally include the following:

- Construction of new conveyance ditches on the east and west sides of Runway 17/35. This will include new ditches located outside the RSA embankment with a minimum depth

currently planned at two feet below the wicking geotextile layer. Conveyance ditches will extend from a high point on Runway 17/35 near Taxiway B to the north and south, generally in areas that currently do not drain off existing embankment. New conveyance ditches have been designed for the 10-year design flow per section 5-2.1 of FAA Advisory Circular (AC) 150/5320-5D *Airport Drainage Design*. This design is detailed later in this section.

- Expansion of existing drainage ditches on the west edge of the paved apron and south side of Taxiway B. These ditches will be increased in size and depth to ensure water drains from the new asphalt pavement, gravel apron areas, and taxiway sections. These ditches will connect to the culvert inlets near the southeast corner of the Runway 17/35/Taxiway B intersection.

- Replacement of the two existing culverts: the 36" culvert under Taxiway B and the 24" culvert under Runway 17/35. Both culverts are anticipated to be replaced with new 36" diameter culverts to ensure adequate drainage capacity. Replacement of the culvert under Runway 17/35 may require the use of pipe jacking or pipe bursting methods to ensure half-width operations can be maintained throughout construction. This will be explored in more detail later in design. Installation of this culvert will be coordinated with the phasing plans to ensure Runway 17/35 maintains operations throughout construction.

2.3.2 Rainfall and Runoff Data

A rainfall intensity of 0.07 in/hour was used for capacity design. This was obtained from the National Weather Service Hydrometeorological Design Studies Center Precipitation Frequency Data Server (PFDS) for the St. Mary's station using the 10-year recurrence interval, 24-hour duration (https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_ak.html).

2.3.3 Capacity and Structure Design

New conveyance ditches have been designed in conformance with Section 2-3 and Section 5 of AC 150/5320-5D *Airport Drainage Design* using the runoff data above and assuming trapezoidal channels. The rainfall intensity derived above was input into the Rational Method equation to determine peak discharge flow rates within each drainage area. These flow rates were then input into Manning's equation to determine depth of flow in each new trapezoidal ditch. Drainage calculations are included in **Appendix A**.

All new conveyance ditches will have sufficient capacity for the 10-year, 24-hour duration storm. Actual ditch dimensions and depth have been increased above these minimums to provide additional capacity during spring runoff to ensure water does not interact with the proposed geotextile for drainage within the structural sections.

2.3.4 Ponding, Erosion Control, and Extraordinary Features

There are known ponding issues at the airport during spring runoff and significant rainfall events. As noted above, the bottom width and overall depth of proposed conveyance ditches have been increased to reduce the effects of ponding. New ditch bottoms will also be excavated to bedrock where possible while maintaining positive drainage. The forthcoming geotechnical investigation is expected to provide additional information regarding soil and bedrock conditions and proposed conveyance ditch locations.

2.4 Pavement Design

The asphalt portion of the main apron is in a very poor condition and is not suitable for overlay. A new asphalt pavement section is proposed to replace this asphalt pavement. Advisory Circular (AC) 150/5320-6F *Airport Pavement Design and Evaluation* and the *FAARFIELD* pavement design application were used to develop a new pavement section for the main apron.

Frost Design

New asphalt pavement will be designed using the reduced subgrade strength method outlined in AC 150/5320-6F. Additional frost depth consideration for limited subgrade frost penetration or full frost protection design methods would require significant layers of insulation and non-frost susceptible layers, which is assumed to be beyond the scope and funding availability of this project.

Fleet Mix

The design fleet mix was developed based on information provided in the ALP Narrative Report (ALP narrative) provided by DOT&PF. Bombardier Dash 8-100 operations were adjusted to match current RAVN scheduled air service operations and C-130 cargo operations were adjusted based on discussions with the airport manager. Growth factors for the 20-year pavement design life were interpolated from Table 2 in the ALP narrative. The resulting fleet mix is shown in **Table 2-4** below.

Table 2-4 – Design Aircraft Fleet Mix

Aircraft	FAARFIELD Representative Aircraft	Max Takeoff Weight (MTOW)[1]	Annual Operations	Annual Departures	Growth Rate
Bombardier Dash 8-100	Dash 7	34,500	520	260	4.2%
Beechcraft 1900	Super King Air 350	17,120	990	495	4.2%
Cessna 208 Caravan	Cessna 208B	8,000	3,700	1,850	4.2%
Cessna 207	Stationair-206	3,600	4,600	2,300	4.2%
C-130	C-130	155,000	160	80	4.2%

[1]Design MTOW adjusted for Dash 8-100 (Ravn Aircraft), Beechcraft 1900, Cessna 208 Caravan, and Cessna 207.

Subgrade Conditions & CBR

Based on a review of historic geotechnical data, subsurface soils indicate a frost group 2 (FG-2) gravelly soil with 10%-20% fines content. A CBR of 10 was used for preliminary design and is expected to be a conservative for these silty sand (SM) to silty gravel (GM) conditions.

Proposed Pavement Sections

The FAA pavement design software FAARFIELD was used to design the proposed asphalt apron pavement section. Several options were considered, including a traditional section as well as

options including cement treated base and cement stabilized subgrade options. The proposed asphalt apron section consists of Hot Mix Asphalt (P-401) over Crushed Aggregate Base Course (P-209), over Borrow (P-152). A geotextile for separation and drainage will also be placed on the subgrade similar to other unpaved airport areas to minimize water infiltration into the pavement section layers. A 6-inch layer of insulation board is also proposed below the Borrow to protect against frost action. The resulting pavement section is shown in **Table 2-5** below.

Table 2-5 – Asphalt Apron Pavement Section

Material	Thickness (inches)
P-401 Asphalt Mixture Surface Course	4.0
P-209 Crushed Aggregate Base Course	6.0
Geotextile for Separation & Drainage	-
Borrow (P-152)	8.0
Insulation Board	6.0
Total Asphalt Pavement Section Depth	**24.0**

FAARFIELD requires the use of non-standard layers to complete the design of unpaved sections. Adjustments were made to the program to evaluate several Runway 17/35 surfacing options. The proposed unpaved section for areas experiencing heavy aircraft traffic, including Runway 17/35, Taxiways A and B, and the Transient Apron are shown in **Table 2-6** below. This section will only be used within the designed width of the Taxiways A and B (75' width) and Runway 17/35 (150' width), as well as within the Transient Apron areas. The section shown in **Table 2-7** is proposed on runway shoulders, taxiway shoulders, TSA, RSA, and the heavy aircraft shoulder. This section utilizes P-152 Borrow to reduce the quantity of imported P-299 Crushed Aggregate Surface Course required for the project, which results in significant cost savings.

Table 2-6 – Unpaved Heavy Aircraft Section

Material	Thickness (inches)
P-299 Crushed Aggregate Surface Course	9.0
P-152 Borrow	12.0
Geotextile for Separation & Drainage	-
Total Unpaved Heavy Aircraft Section Depth	**21.0**

Table 2-7 – Heavy Aircraft Shoulder Section

Material	Thickness (inches)
P-152 Borrow	21.0

The proposed unpaved section for areas experiencing only light aircraft loading, including Runway 6/24, is included in **Table 2-8** below.

Table 2-8 – Unpaved Light Aircraft Section

Material	Thickness (inches)
P-299 Crushed Aggregate Surface Course	9.0
P-152 Borrow	6.0
Total Unpaved Light Aircraft Section Depth	15.0

Similar to the heavy aircraft section, the shoulders and RSA of Runway 6/24 will solely use 1-inch minus Subbase Course for the full depth. This is shown in **Table 2-10** below.

Table 2-9 –Light Aircraft Shoulder Section

Material	Thickness (inches)
P-152 Borrow	15.0

2.5 Signage

This project will remove existing lighted airport signs and install new lighted signs. A preliminary layout of proposed signs has been completed and is included in the plans. In general, signs are replaced in-kind or upgraded to meet existing FAA sign layout standards. Additional signs are proposed to delineate the intersection of Runway 35, Runway 24, and Taxiway A more clearly.

2.6 Lighting

This project includes removal and replacement of the following airfield lighting equipment:

- Removal of existing Runway 17/35 MIRL and existing Runway 6/24 MIRL and installation of a new MIRL system on each runway, including new lighting regulators.

- Removal of existing Taxiways A and B MITL and installation of a new MITL system on each taxiway, including new lighting regulators. Taxiway lighting will extend around radii and tangents on the west side of the transient and paved main aprons.

- Removal and replacement of primary lighted wind cone and segmented circle.

- Removal and replacement of secondary wind cone.

Existing runway edge lighting may be utilized for temporary lighting during Runway 17/35 half-width operations.

Lighting component design will be completed by a separate consultant under a separate contract with DOT&PF.

2.7 Navigational Aids (Navaids)

This project will include the following changes to FAA-owned Navaids:

- Removal of existing Runway 17 MALSR.
- Removal of existing Runway 17 and Runway 35 VASI.
- Installation of new Precision Approach Path Indicators (PAPI) for each end of Runway 17/35
- Installation of new REIL at the Runway 17 end and at the new Runway 35 displaced threshold.

Design of new Navaids will be completed by the FAA under a reimbursable agreement with DOT&PF. Design responsibility of the electrical system for the Navaids will be determined once the separate DOT&PF contract for electrical design is executed.

2.8 Material Source Analysis

The following material sources have been identified as potential sites for the aggregates needed to complete the proposed airport improvements. Some materials are required to be imported from outside of St. Mary's to ensure suitable material that will meet DOT&PF Aviation specifications.

Crushed Aggregate Surface Course (P-299)

Nome
The Sound Quarry in Nome is an established quarry with known quantity and acceptable qualities of aggregate meeting project specifications.

Marshall
This site is a new source near Marshall on Pilcher Mountain and requires development by the owner. Permitting, equipment mobilization, and construction of a haul road from this material site to the Yukon River, and a new barge landing are required. This site could provide a significant cost savings to the project due to its proximity to St. Mary's. DOT&PF is currently assisting with environmental studies, public involvement, and coordination with the owner in light of this benefit. The unknowns of owner progress and timing on design and permitting might preclude this site from being a viable option for this project.

Borrow (P-152)

The primary source for borrow will be salvaged material excavated from the existing runway, taxiway, and apron areas as well as material available at the Pitkas Point pit as described below. Excavated material will need to be hauled to the stockpile are or Pitkas Point pit and processed prior to use to ensure it meets DOT&PF specifications for borrow, which includes suitable material that passes a 1-inch sieve.

Pitkas Point
Pitkas Point is the preferred source for any new material required due to the apparent harder sandstone (confirmed by recent test results), as compared to other local material sites. It is important to confirm there is sufficient quantity to supply the project. One concern is unacceptable amounts of Shale mixed in the material. A geotechnical investigation and topographic survey are planned to confirm the site material quality and quantity.

Subbase Course (P-154)

Subbase Course (P-154) is available from several existing local material sources, including "West Ridge", Pitkas Point, St. Mary's Pit, or suitable excavated soils from the existing runways. This will be a standard FAA P-154 Subbase Course, passing a 3-inch sieve.

Asphalt Aggregates (P-401)
Asphalt aggregates have similar requirements to surface course soils with higher degradation values. This material will be imported to the site from either Nome or Marshall.

Crushed Surfacing Base Course (P-209)
Similar to the asphalt and surfacing aggregates, the P-209 specification requires higher degradation values that cannot be met by local aggregates; this material will be imported to the site from either Nome or Marshall.

2.9 Barge Haul Analysis

Nome
It is estimated that this 240-mile (one way) route will take 3.5 days for a single round trip to St. Mary's carrying approximately 2,200 tons of material. There could be additional delays with this route to wait for suitable tides to enter the mouth of the Yukon River, and weather could impact crossing the Norton Sound. A 10% factor is added to this barge route to account for these factors.

Marshall
This route is 60 miles (one way) on the Yukon River and will not have to deal with tides or open water weather conditions. Fog can sometimes impede river navigation, but it is not common. No additional cost factor has been added to this route.

Current project estimates assume that material will be imported from the more expensive alternative, Nome.

2.10 Barge Landings

City of St. Mary's Barge Landing
The City of St. Mary's barge landing is readily available for use without development. This site requires a 1,200 cubic yard stockpile area (estimated footprint of ~10,000 sf) at the wharf for most of the summer. Haul trucks traveling through the town would create safety and dust concerns and will require coordination with and approval of the City. This barge landing location also requires the use of a longer, steeper haul route as described later in this section.

Airport Barge Landing
The airport barge landing is dependent on several factors for it to become a viable barge landing for use in this project. These factors include permitting, construction of a new barge landing facility in the Yukon River and associated equipment at the edge of the river, coordination with and potential approval from Boreal Fisheries, and coordination with the community of Saint Mary's regarding subsistence fisheries at this location. This site is on Airport property, leads to a significantly shorter haul route to the Airport, and the haul route is expected to accommodate larger haul trucks due to the flatter grades. Challenges include potential conflicts with the Boreal Fisheries operations, securing a permitted window for in-water construction of the barge landing that works with construction timing (and river ice), and the impact to subsistence fishing. The barge landing is proposed to be temporary, so all improvements will be removed after construction is complete.

Barge Landing Options: Two options will be advanced with the permitting to provide contractors with flexibility, assuming both options are viable:

- Option 1: Causeway into the river with truck haul for offloading the barge; a variation on this would be to drive sheet pile to contain the soil.

- Option 2: Pilings with conveyor for offloading the barge.

Both options will be updated with bathymetric survey data, when available.

Permitting. Anticipated required permits include:

- Essential Fish Habitat Consultation (National Marine Fisheries Service)
- Title 16 permit (ADF&G)
- Wetland Permit, to be included in the large project permit (USACE)

2.11 Haul Route Analysis

St. Mary's Barge Landing to St. Mary's Airport
This route is an approximately 11-mile round trip from the barge site to the Airport. Drawbacks are steep grades possibly exceeding 10%, trucking through town and occupying the barge landing upland area (material staging) for most of the summer, and road weight restrictions limiting the haul truck sizes. Maintenance of this haul route is expected to be required. Dust impacts in St. Mary's could be significant at times and will require mitigation measures.

Airport Barge Landing to St. Mary's Airport
This route is more direct at 3.2 miles round trip with no grades exceeding 8%. The road is of unknown structure and is expected to require some level of surface enhancement and

maintenance to support the haul trucks. A geotechnical exploration program is proposed for the route to be included as supplemental information for use by the contractor to determine the effort required. This will allow DOT&PF to place enhancement and maintenance costs on the contractor through the bid documents.
Current project cost estimates assume that the more expensive St. Mary's Barge Landing will be used for this project.

2.12 Project Phasing

Construction is anticipated to be completed over two construction seasons. Phase 1 will include importing aggregates to a local airport pit and the construction of the Runway 17 RSA expansion. The remaining phases of work will be in the second construction season and will include resurfacing of all airport surfaces and replacement of all runway and taxiway lighting.

Runway 17/35 operations must be maintained throughout construction; this is a critical phasing element. To accomplish this, the project phasing includes the use of half-width operations on Runway 17/35 during construction within the Runway 17/35 RSA. Half width operations will comply with the FAA Alaska Region Airports Division – Runway Half Width Operation Construction Guidance memorandum and preliminary project phasing meeting this guidance is included in the draft Construction Safety and Phasing Plan (CSPP). Half-width construction will include daylight operations on Runway 17/35 and construction at night with temporary changes to critical airport dimensions as shown below in **Table 2-10**.

Table 2-10 – Runway 17/35 Half-Width Operation Dimensions

Element	Normal Airport Condition	Half-Width Condition
Runway 17/35 Width	150'	100'[1]
Runway 17/35 Safety Area Width	300'	150'
Runway Edge Light Distance from Runway Edge	10'	2' – 10'
RSA Transverse Slope	1.0% - 2.0%	2.0% - 5.0%

[1]This temporary width assumes a portion of the existing RSA embankment will serve as usable runway during construction.

3.0 MODIFICATIONS TO AGENCY STANDARDS

3.1 Modifications to DOT&PF Design Standards

There are no proposed modifications to DOT&PF Design Standards.

3.2 Modifications to FAA Design Standards

There are no proposed modifications to FAA Design Standards included in this project.

3.3 Modifications to DOT&PF Construction Standards

There are currently no proposed significant changes to the DOT&PF standard aviation specifications. Existing AASHTOWare Project (AWP) bid items will be used for all bid items, and measurement and payment section of technical specifications will be reviewed to ensure all applicable pay items are included in these specifications.

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4.0 COST ESTIMATE

4.1 Engineer's Estimate

An estimate of construction quantities and associated construction costs is included in **Table 4-1** below. This estimate includes costs for barging surfacing aggregates from Nome and hauling to the airport via the St. Mary's barge landing. If surfacing aggregates are obtained from Marshall and the Airport Barge Landing is used, the unit prices for imported aggregates are expected to be decreased.

Table 4-1 – Preliminary Baseline Construction Estimate

Bid Item Subtotal	$ 25,121,405
Construction Engineering (15%)	$ 3,768,211
Indirect Cost Allocation Plan (ICAP) (6.34%)	$ 1,831,602
Contingency (10%)	$ 3,072,122
Plans-in-Hand (PIH) Project Engineer's Estimate	$ 33,793,339

A detailed Project Engineer's Estimate is included in **Appendix B**. This estimate is based on design quantities, site inspections, recent bid data for similarly sized airport DOT&PF projects, experience on similar projects, and contacts made with local contractors.

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5.0 PROJECT SCHEDULE

5.1 Time Constraints

Hauling of imported materials and stockpiling near the airport will be required during the first construction season. Embankment work to extend the Runway 17 RSA is also expected to occur in the first construction season. Drainage improvements, airfield electrical improvements, Runway 6/24 RSA embankment widening, and resurfacing of both runways, both taxiways, and apron areas are anticipated to be completed in the second year of construction.

5.2 Recommended Schedule

Design, bidding, and construction are expected to follow the approximate schedule outlined below:

- Plans-in-Hand (PIH): 8/20/2021
- Pre-PS&E: 10/12/2021
- Final PS&E: 2/3/2022
- Bidding: March 2022
- Construction (Season 1): Summer 2022
- Construction (Season 2): Summer 2023

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APPENDIX A: DRAINAGE CALCULATIONS

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DOWL

8320 154th Avenue NE Redmond, WA 98052
Tele: (425) 869-2670 FAX: (425) 869-2679

Calculated by: K. Eagle

Date: 8/20/2021

RWY 17-35 Ditch RT 1 (STA 22+00)

Storm Event	Q (cfs)	Left x:1	Bot. Width (ft)	Right x:1	Chan. Slope (ft/ft)	Open Channel (Rubble) n= 0.030 Depth (ft)	n	V (fps)
10 yr	0.713	4	6	4	0.006	0.12	0.03	0.90

Q=CIA

C: 0.8 (Street)
I (in/hr): 0.07 (10 yr, 24hr)
A (acres): 12.74047

Q (cfs): 0.713466

RWY 17-35 Ditch LT 1 (STA 44+00)

Storm Event	Q (cfs)	Left x:1	Bot. Width (ft)	Right x:1	Chan. Slope (ft/ft)	Open Channel (Rubble) n= 0.030 Depth (ft)	n	V (fps)
10 yr	0.289	4	6	4	0.004	0.08	0.03	0.55

Q=CIA

C: 0.8 (Street)
I (in/hr): 0.07 (10 yr, 24hr)
A (acres): 5.165289

Q (cfs): 0.289256

RWY 17-35 Ditch LT 2 (STA 59+00)

Storm Event	Q (cfs)	Left x:1	Bot. Width (ft)	Right x:1	Chan. Slope (ft/ft)	Open Channel (Rubble) n= 0.030 Depth (ft)	n	V (fps)
10 yr	0.053	4	6	4	0.006	0.03	0.03	0.33

Q=CIA

C: 0.8 (Street)
I (in/hr): 0.07 (10 yr, 24hr)
A (acres): 0.949656

Q (cfs): 0.053181

RWY 17-35 Ditch RT 2 (STA 59+00)

Storm Event	Q (cfs)	Left x:1	Bot. Width (ft)	Right x:1	Chan. Slope (ft/ft)	Open Channel (Rubble) n= 0.030 Depth (ft)	n	V (fps)
10 yr	0.131	4	6	4	0.006	0.04	0.03	0.47

Q=CIA

C: 0.8 (Street)
I (in/hr): 0.07 (10 yr, 24hr)
A (acres): 2.34068

Q (cfs): 0.131078

RWY 17-35 Ditch LT 3 (STA 66+00)

Storm Event	Q (cfs)	Left x:1	Bot. Width (ft)	Right x:1	Chan. Slope (ft/ft)	Open Channel (Rubble) n= 0.030 Depth (ft)	n	V (fps)
10 yr	0.312	4	6	4	0.003	0.10	0.03	0.50

Q=CIA

C: 0.8 (Street)
I (in/hr): 0.07 (10 yr, 24hr)
A (acres): 5.580349

Q (cfs): 0.3125

TWY B Ditch RT 1 (STA 305+00)

Storm Event	Q (cfs)	Left x:1	Bot. Width (ft)	Right x:1	Chan. Slope (ft/ft)	Open Channel (Rubble) n= 0.030 Depth (ft)	n	V (fps)
10 yr	0.274	4	6	4	0.025	0.05	0.03	0.98

Q=CIA

C: 0.8 (Street)
I (in/hr): 0.07 (10 yr, 24hr)
A (acres): 4.887741

Q (cfs): 0.273713

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APPENDIX B: AASHTOWARE (AWP) PIH ESTIMATE

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Plans-in-Hand (PIH) Project Engineer's Estimate

State Project Number: Z605630000 **Federal Project Number:**

Project Description: ST MARY'S AIRPORT IMPROVEMENTS

Project Line #	Proposal Line #	Item #	Description	Unit	Qty.	Price	Ext. Amount	Owner Furnished Material
Category: Basic Bid								
10		D701.010.0036	CS Pipe, 36-inch	LF	640.00	150.00	96,000.00	
20		D701.090.0000	Rip Rap	TON	30.00	75.00	2,250.00	
30		G100.010.0000	Mobilization and Demobilization	LS	All Required	1,000,000.00	1,000,000.00	
40		G115.010.0000	Worker Meals and Lodging, or Per Diem	LS	All Required	200,000.00	200,000.00	
50		G130.010.0000	Field Office	LS	All Required	25,000.00	25,000.00	
60		G130.020.0000	Field Laboratory	LS	All Required	15,000.00	15,000.00	
70		G130.060.0000	Nuclear Testing Equipment Storage Shed	EACH	1.00	10,000.00	10,000.00	
80		G131.010.0000	Engineering Transportation (Truck)	EACH	2.00	20,000.00	40,000.00	
90		G135.010.0000	Construction Surveying by the Contractor	LS	All Required	75,000.00	75,000.00	
100		G135.020.0000	Extra Three Person Survey Party	HR	25.00	300.00	7,500.00	
110		G200.010.0000	Contractor Quality Control Program	LS	All Required	50,000.00	50,000.00	
120		G210.010.0000	Contractor Safety Plan Compliance Document	LS	All Required	25,000.00	25,000.00	
130		G700.010.0000	Airport Flagger	CS	All Required	25,000.00	25,000.00	
140		G710.010.0000	Highway Traffic Maintenance	LS	All Required	40,000.00	40,000.00	
150		L125.010.0000	Airport Lighting	LS	All Required	500,000.00	500,000.00	
160		L125.130.0000	Airport Sign, L-858	EACH	9.00	5,000.00	45,000.00	
170		L125.180.0000	Temporary Runway Lighting System	LS	All Required	85,000.00	85,000.00	
180		L145.010.0000	Standby Generator and Enclosure	LS	All Required	220,000.00	220,000.00	
190		P151.010.0000	Clearing	ACRE	9.80	2,500.00	24,500.00	
200		P152.010.0000	Unclassified Excavation	CY	184,060.00	15.00	2,760,900.00	
210		P152.250.0000	Borrow Measured in Final Position	CY	171,270.00	30.00	5,138,100.00	
220		P154.010.0000	Subbase Course	CY	64,250.00	20.00	1,285,000.00	
230		P165.010.0000	Removal of Structures	LS	All Required	100,000.00	100,000.00	
240		P167.020.0000	Dust Palliative	LS	All Required	300,000.00	300,000.00	

Plans-in-Hand (PIH) Project Engineer's Estimate

State Project Number: Z605630000 **Federal Project Number:**

Project Description: ST MARY'S AIRPORT IMPROVEMENTS

Project Line #	Proposal Line #	Item #	Description	Unit	Qty.	Price	Ext. Amount	Owner Furnished Material
250		P190.010.0000	Insulation Board	SF	158,720.00	4.00	634,880.00	
260		P209.020.0000	Crushed Aggregate Base Course	TON	5,700.00	130.00	741,000.00	
270		P299.010.0000	Crushed Aggregate Surface Course	CY	42,960.00	130.00	5,584,800.00	
280		P401.010.0010	Hot Mix Asphalt Type I, Class A	TON	4,210.00	915.00	3,852,150.00	
290		P401.020.5828	Asphalt Binder, PG 58-28	TON	240.00	1,000.00	240,000.00	
300		P610.010.0000	Structural Portland Cement Concrete	CY	26.00	500.00	13,000.00	
310		P640.020.0000	Segmented Circle (Panel-Type)	LS	All Required	45,000.00	45,000.00	
320		P641.010.0000	Erosion, Sediment, and Pollution Control Administration	LS	All Required	15,000.00	15,000.00	
330		P641.030.0000	Temporary Erosion, Sediment, and Pollution Control	LS	All Required	50,000.00	50,000.00	
340		P641.040.0000	Temporary Erosion, Sediment, and Pollution Control Additives	CS	All Required	10,000.00	10,000.00	
350		P641.070.0000	SWPPP Manager	LS	All Required	25,000.00	25,000.00	
360		P650.020.0000	Soil Anchor Tie-down	SET	4.00	4,000.00	16,000.00	
370		P670.010.0000	Hazard Marker Barrier, Plastic	EACH	40.00	450.00	18,000.00	
380		P671.010.0000	Runway Closure Marker, Vinyl Mesh	EACH	4.00	3,000.00	12,000.00	
390		P671.020.0000	Runway Closure Marker, Illuminated	EACH	4.00	15,000.00	60,000.00	
400		P671.040.0000	Taxiway Closure Marker, Vinyl	EACH	2.00	2,500.00	5,000.00	
410		P681.010.0000	Geotextile, Separation	SY	15,030.00	2.50	37,575.00	
420		P682.010.0000	Geotextile, Drainage	SY	338,550.00	5.00	1,692,750.00	

Category Basic Bid Total:		**$25,121,405.00**
Minus Contractor Furnished CENG Items:		$0.00
Exc Subtotal:		$25,121,405.00
Construction Engineering Percent/Amount:	15%	$3,768,210.75
Minus Contractor Furnished CENG Items:		$0.00
State Forces CENG Amount:		**$3,768,210.75**

Plans-in-Hand (PIH) Project Engineer's Estimate

State Project Number: Z605630000 **Federal Project Number:**

Project Description: ST MARY'S AIRPORT IMPROVEMENTS

Project Line #	Proposal Line #	Item #	Description	Unit	Qty.	Price	Ext. Amount	Owner Furnished Material
			Basic Bid Owner Furnished Material Total:				**$0.00**	
			Category Subtotal (Pay Items + SF CENG + Furn Materials):				$28,889,615.75	
			Indirect Cost Allocation Plan (ICAP) Percent/Amount:		6.34%		**$1,831,601.64**	
			Category Basic Bid Estimate Total:				**$30,721,217.39**	
			Pay Item Total: Z605630000				**$25,121,405.00**	**42 Items**
			SF CENG Amount:				**$3,768,210.75**	
			Owner Furnished Materials (Not part of the Contract):				**$0.00**	
			ICAP Amount:				**$1,831,601.64**	
			Project Estimate Total:				**$30,721,217.39**	
			Estimate Bid Contingency Percent/Amount:		10.00%		**$3,072,121.74**	
			Project Estimate Total + Estimate Bid Contingency:				**$33,793,339.13**	

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