Juneau Access Improvements Project
Draft Supplemental Environmental Impact Statement

Appendix GG
Marine Segments Technical Report

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TABLE OF CONTENTS

This *Juneau Access Improvements Marine Segments Technical Report is a* technical appendix to the Draft Supplemental Environmental Impact Statement (DSEIS) for the Juneau Access Improvement (JAI) project. This 2014 *Juneau Access Improvements Marine Segments Technical Report* updates the September 2004 *Juneau Access Improvements Marine Segments Technical Report.*

The purpose of this *Marine Segments Technical Report* is to determine the annual and capital costs of the marine transportation portions of the JAI reasonable alternatives (marine segments). The JAI reasonable alternatives are:

1 – No Action;

1B – Enhanced Services with Existing AMHS Assets;

2B – East Lynn Canal Highway to Katzehin, Shuttles to Haines and Skagway;

3 – West Lynn Canal Highway;

4A – Fast Vehicle Ferry Service from Auke Bay;

4B – Fast Vehicle Ferry Service from Berners Bay;

4C – Conventional Monohull Service from Auke Bay; and

4D – Conventional Monohull Service from Berners Bay.

The JAI reasonable alternatives costs were obtained using a methodology consisting of three primary steps: a further definition of marine segments, determination of vessel size, and calculation of vessel annual and capital costs.

Further Definition of Marine Segments

Several significant changes impacted this updated marine segments analysis, compared to the 2004 Marine Segments report. The definition of reasonable alternatives has been revised and contains significantly more operational constraints. Also new day boat ferries are being designed and constructed by AMHS and these vessels need to be incorporated into this analysis.

The marine segments need to be further defined into viable ferry systems in order to determine cost components. The development of viable ferry systems followed the operational guidelines in the alternatives, but did require that many assumptions be made in the areas of: vessel operations, number of round-trips, and schedule calculations (i.e. vessel speed, mooring and loading operations, crew operations). These assumptions resulted in the system definitions of operational sailing hours, number of crews, and crew shift length and changeover port.

Vessel Size

The vessel operational cost model in this analysis is based on vessel size, measured by the number of vehicles the vessel carries in ASV (Alaska Standard Vehicle size). Vessel size is determined by two methods: a) using actual ASV capacity for existing AMHS vessels, and b) calculating ASV for vessels that would be new to the JAI system. The new vessel calculation uses the anticipated average daily traffic on a route and converts it to per trip capacity based on the vessel round-trips per day. The new vessel capacity

analysis also examines the issues of different vehicle lengths, different vehicle weights (payload analysis) and the number of passengers.

Costs

With the completion of the description and performance of each viable ferry system, the annual costs were calculated to provide a total annual cost for each JAI Marine Segment. These calculations included crew costs, fuel costs, vessel lay-up, maintenance and overhead costs. The cost of AMHS mainline ferry operations was also included in this analysis.

A different cost model was employed to generate acquisition/capital costs for each vessel.

The following tables summarize the ferry system characteristics and costs for all JAI reasonable alternatives.

Table 1A

Acquisition Cost Analysis Results

Alt	Route	Vessels			Acquisition $	
		#	Designation	# ASV	Per Route	Per Alternative
1. No Build						
Alt 1 - No Action						
	HNS-SGY HNS	1	DayACF	53	$ -	$ -
	AUK-HNS-AUK	1	DayACF	53	$ -	
	AUK-HNS-SGY-HNS-AUK	1	Mainliner		$ -	
Alt 1B - Enhanced Service with Existing AMHS Assets						
	HNS-SGY HNS	1	DayACF	53	$ -	$ -
	AUK-HNS-AUK	1	DayACF	53	$ -	
	SGY-AUK-SGY	1	MAL	88	$ -	
	AUK-HNS-SGY-HNS-AUK	1	Mainliner		$ -	
2 East Lynn Canal						
Alt. 2B - Road to KTZ, ferry to SGY and HNS						
	HNS-SGY HNS	1	Disp-1	18	$ 22,315,336	$ 22,315,336
	HNS-KTZ-HNS	1	DayACF-X	53	$ -	
	SGY-KTZ-SGY	1	DayACF-X	53	$ -	
Alt 3 - West Lynn Canal						
Alt. 3 - Road to HNS, ferry SAW-WHB, ferry HNS - SGY						
	HNS-SGY HNS	1	Disp-2	41	$ 48,905,598	$ 48,905,598
	SAW-WHB-SAW	2	DayACF	53	$ -	
Alt 4 - Marine Alternatives						
Alt. 4A - Fast from AUK						
	HNS-SGY HNS	1	Disp-1	18	$ 22,315,336	$ 186,721,305
	AUK-HNS-AUK / AUK-SGY-AUK	2	FVF-1	31	$ 164,405,969	
	AUK-HNS-SGY-HNS-AUK	1	Mainliner		$ -	
Alt. 4B - Fast from SAW in summer, AUK in winter						
	HNS-SGY HNS	1	Disp-1	18	$ 22,315,336	$ 218,932,354
	SAW-HNS-SAW / SAW-SGY-SAW	2	FVF-1	53	$ 196,617,018	
	AUK-HNS-SGY-HNS-AUK	1	Mainliner		$ -	
Alt. 4C - Displ from AUK						
	HNS-SGY HNS	1	Disp-1	18	$ 22,315,336	$ 22,315,336
	AUK-HNS-AUK	1	DayACF	53	$ -	
	AUK-SGY-AUK	1	DayACF	53	$ -	
	AUK-HNS-SGY-HNS-AUK	1	Mainliner		$ -	
Alt. 4D - Displ from SAW in summer, AUK in winter						
	HNS-SGY-HNS	1	Disp-1	18	$ 22,315,336	$ 22,315,336
	SAW-HNS-SAW	1	DayACF	53	$ -	
	SAW-SGY-SAW	1	DayACF	53	$ -	
	AUK-HNS-SGY-HNS-AUK	1	Mainliner		$ -	

Table 1B
Summary Vessel Characteristics and Operation Costs

Alt	Route	Season	Vessels			Crew Hrs		Op Hrs	# Trips	Annual $	
			#	Designation	# ASV	Vessel 1	Vessel 2	hrs/day	Trips per Wk	Per Vessel	Per Alternative
1. No Build											
Alt 1 - No Action						2 Mainlines to Haines/Skagway (S), 1 Mainline to Haines/Skagway (W)					
	HNS-SGY HNS	Summer	1	DayACF	53	8		6.53	13	$ 4,145,342	$15,354,091
		Winter	1	DayACF	53	8		6.53	6		
	AUK-HNS-AUK	Summer	1	DayACF	53	12		11.53	6	$ 6,036,830	
		Winter	1	DayACF	53	12		11.53	3		
	AUK-HNS-SGY-HNS-AUK	Summer	1	Mainliner					2	$ 5,171,919	
		Winter	1	Mainliner					1		
Alt 1B - Enhanced Service with Existing AMHS Assets						2 Mainlines to Haines/Skagway (S), 1 Mainline to Haines/Skagway (W)					
	HNS-SGY HNS	Summer	1	DayACF	53	8		6.53	13	$ 4,145,342	$23,641,636
		Winter	1	DayACF	53	8		6.53	6		
	AUK-HNS-AUK	Summer	1	DayACF	53	12		11.53	6	$ 6,036,830	
		Winter	1	DayACF	53	12		11.53	3		
	SGY-AUK-SGY	Summer	1	MAL	88	12 + 12		13.60	7	$ 8,287,545	
		Winter	0								
	AUK-HNS-SGY-HNS-AUK	Summer	1	Mainliner					2	$ 5,171,919	
		Winter	1	Mainliner					1		
2 East Lynn Canal											
Alt. 2B - Road to KTZ, ferry to SGY and HNS						Mainline service to terminate at Auke Bay					
	HNS-SGY HNS	Summer	1	Disp-1	18	8		6.53	14	$ 1,354,331	$17,561,593
		Winter	0								
	HNS-KTZ-HNS	Summer	1	DayACF-X	53	8 + 8		13.80	56	$ 7,649,921	
		Winter	1	DayACF-X	53	12		10.60	42		
	SGY-KTZ-SGY	Summer	1	DayACF-X	53	8 + 8		16.00	42	$ 8,557,341	
		Winter	1	DayACF-X	53	12		11.00	28		
Alt 3 - West Lynn Canal											
Alt. 3 - Road to HNS, ferry SAW-WHB, ferry HNS - SGY						Mainline service to terminate at Auke Bay					
	HNS-SGY HNS	Summer	1	Disp-2	41	8 + 8		15.60	42	$ 7,057,005	$19,363,768
		Winter	1	Disp-2	41	12		10.73	28		
	SAW-WHB-SAW	Summer	2	DayACF	53	8 + 8	8 + 8	16.00	84	$12,306,762	
		Winter	1	DayACF	53	12		11.00	28		
Alt 4 - Marine Alternatives											
Alt. 4A - Fast from AUK						2 Mainlines to Haines/Skagway (S), 1 Mainline to Haines/Skagway (W)					
	HNS-SGY HNS	Summer	1	Disp-1	18	8		6.53	13	$ 2,008,749	$33,694,592
		Winter	1	Disp-1	18	8		3.77	3		
	AUK-HNS-AUK AUK-SGY-AUK	Summer	2	FVF-1	31	8 + 8	8 + 8	13.33	14	$26,513,923	
		Winter	1	FVF-1	31	8 + 8		13.33	7		
	AUK-HNS-SGY-HNS-AUK	Summer	1	Mainliner					2	$ 5,171,919	
		Winter	1	Mainliner					1		
Alt. 4B - Fast from SAW in summer, AUK in winter						2 Mainlines to Haines/Skagway (S), 1 Mainline to Haines/Skagway (W)					
	HNS-SGY HNS	Summer	1	Disp-1	18	8		6.53	13	$ 2,008,749	$31,974,328
		Winter	1	Disp-1	18	8		3.77	3		
	SAW-HNS-SAW SAW-SGY-SAW	summer	2	FVF-1	53	12	12	9.43	14	$24,793,660	
	AUK-HNS-AUK AUK-SGY-AUK	winter	1	FVF-1	53	8 + 8		13.33	7		
	AUK-HNS-SGY-HNS-AUK	Summer	1	Mainliner					2	$ 5,171,919	
		Winter	1	Mainliner					1		
Alt. 4C - Displ from AUK						2 Mainlines to Haines/Skagway (S), 1 Mainline to Haines/Skagway (W)					
	HNS-SGY HNS	Summer	1	Disp-1	18	8		6.53	13	$ 2,008,749	$19,931,176
		Winter	1	Disp-1	18	8		3.77	3		
	AUK-HNS-AUK	Summer	1	DayACF	53	12		11.53	7	$ 6,239,710	
		Winter	1	DayACF	53	12		11.53	3.5		
	AUK-SGY-AUK	Summer	1	DayACF	53	12		11.60	7	$ 6,510,798	
		Winter	1	DayACF	53	12		11.60	3.5		
	AUK-HNS-SGY-HNS-AUK	Summer	1	Mainliner					2	$ 5,171,919	
		Winter	1	Mainliner					1		
Alt. 4D - Displ from SAW in summer, AUK in winter						2 Mainlines to Haines/Skagway (S), 1 Mainline to Haines/Skagway (W)					
	HNS-SGY-HNS	Summer	1	Disp-1	18	8		6.53	13	$ 2,008,749	$20,790,092
		Winter	1	Disp-1	18	8		3.77	3		
	SAW-HNS-SAW	Summer	1	DayACF	53	8 + 8		14.67	14	$ 6,679,671	
	AUK-HNS-AUK	Winter	1	DayACF	53	12		11.53	3.5		
	SAW-SGY-SAW	Summer	1	DayACF	53	8 + 8		15.60	14	$ 6,929,753	
	AUK-SGY-AUK	Winter	1	DayACF	53	12		11.60	3.5		
	AUK-HNS-SGY-HNS-AUK	Summer	1	Mainliner					2	$ 5,171,919	
		Winter	1	Mainliner					1		

This *Juneau Access Improvements Marine Segments Technical Report* updates the September 2004 *Juneau Access Improvements Marine Segments Technical Report,* referred to as the *2004 Marine Segments Report.* The *Juneau Access Improvements Marine Segments Technical Report* is a technical appendix to the Draft Supplemental Environmental Impact Statement (DSEIS) for the Juneau Access Improvement (JAI) project.

The purpose of this *Marine Segments Technical Report* is to determine the costs of each of the marine transportation portions of each JAI reasonable alternative (marine segment).

Definition of Alternatives

The alternatives in this report are based on the optimum alternatives from the 2004 Marine Segments Report. The Alaska Department of Transportation & Public Facilities (DOT&PF) has updated the alternatives to reflect the changes to the existing and programmed Alaska Marine Highway System (AMHS) assets available in the Lynn Canal corridor. An additional enhanced service alternative was added at the direction of the District Court. The new (August 26, 2013) marine alternatives were provided by the DOT&PF for analysis as follows:

Alternative 1 – No Action

The No Action Alternative (Alternative 1) includes a continuation of mainline ferry service in Lynn Canal and incorporates two Day Boat Alaska Class Ferries (ACF). The Alaska Marine Highway System (AMHS) would continue to be the (National Highway System) NHS route from Juneau to Haines and Skagway, and no new roads or ferry terminals would be built. In addition to the Day Boat ACFs, programmed improvements include improved vehicle and passenger staging areas at the Auke Bay and Haines ferry terminals to optimize traffic flow on and off the Day Boat ACFs as well as expansion of the Haines Ferry Terminal to include a new double bow berth to accommodate the Day Boat ACFs. This alternative is based on the most likely AMHS operations in the absence of any capital improvements specific to the Juneau Access Improvements (JAI) Project.

Mainline service would include two round-trips per week in the summer and one per week in the winter with Auke Bay-Haines-Skagway-Haines-Auke Bay routing. During the summer, one Day Boat ACF would make one round-trip between Auke Bay and Haines six days per week, and one would make two round-trips per day between Haines and Skagway six days per week. The Day Boat ACFs would not sail on the seventh day because the mainliner is on a similar schedule. In the winter, ferry service in Lynn Canal would be provided primarily by the Day Boat ACFs three times per week. The *M/V Malaspina* would no longer operate as a summer day boat in Lynn Canal.

Alternative 1B – Enhanced Service with Existing AMHS Assets

Alternative 1B includes all of the components of Alternative 1, No Action, but focuses on enhancing service using existing AMHS assets without major initial capital expenditures. Similar to Alternative 1, Alternative 1B includes: a continuation of mainline ferry service in Lynn Canal; the AMHS would continue to be the NHS route from Juneau to Haines and Skagway; no new roads or ferry terminals would be built; and in addition to the Day Boat ACFs, programmed improvements include improved vehicle and passenger staging

areas at the Auke Bay and Haines ferry terminals to optimize traffic flow on and off the Day Boat ACFs as well as expansion of the Haines Ferry Terminal to include a new double bow berth to accommodate the Day Boat ACFs. Service to other communities would remain the same as the No Action Alternative. Alternative 1B keeps the *M/V Malaspina* in service after the second Day Boat ACF is brought online to provide additional capacity in Lynn Canal. Enhanced services included as part of Alternative 1B are a 20 percent reduction in fares for trips in Lynn Canal and extended hours of operations for the reservation call center.

Mainline service would include two round-trips per week in the summer and one per week in the winter with Auke Bay-Haines-Skagway-Haines-Auke Bay routing. During the summer, the *M/V Malaspina* would make one round-trip per day seven days per week on a Skagway-Auke Bay-Skagway route, while one Day Boat ACF would make one round-trip between Auke Bay and Haines six days per week, and one would make two round-trips per day between Haines and Skagway six days per week. The Day Boat ACFs would not sail on the seventh day because the mainliner would be on a similar schedule. In the winter, ferry service in Lynn Canal would be provided primarily by the Day Boat ACFs three times per week.

Alternative 2B – East Lynn Canal Highway to Katzehin, Shuttles to Haines and Skagway

Alternative 2B would construct the East Lynn Canal Highway (50.8-miles including 47.9 miles of new highway and widening of 2.9 miles of the existing Glacier Highway) from Echo Cove around Berners Bay to a new ferry terminal two miles north of the Katzehin River. Ferry service would connect Katzehin to Haines and Skagway. In addition, this alternative includes modifications to the Skagway Ferry Terminal to include a new end berth and construction of a new conventional monohull ferry to operate between Haines and Skagway. Mainline ferry service would end at Auke Bay. This alternative assumes the following improvements will have been made independent of the JAI Project before Alternative 2B would come on-line: two Day Boat ACFs, improved vehicle and passenger staging areas at the Haines Ferry Terminal to optimize traffic flow on and off the Day Boat ACFs, and expansion of the Haines Ferry Terminal to include two new double bow berths.

During the summer months, one Day Boat ACF would make eight round-trips per day between Haines and Katzehin, a second Day Boat ACF would make six round-trips per day between Skagway and Katzehin, and the Haines-Skagway shuttle ferry would make two trips per day. During the winter, one Day Boat ACF would make six round-trips per day between Haines and Katzehin, and a second Day Boat ACF would make four round-trips per day between Skagway and Katzehin. The Haines-Skagway shuttle would not operate; travelers going between Haines and Skagway would travel to Katzehin and transfer ferries.

Alternative 3 – West Lynn Canal Highway

Alternative 3 would upgrade/extend the Glacier Highway (5.2 miles including 2.3 miles of new highway and widening of 2.9 miles of the existing Glacier Highway) from Echo Cove to Sawmill Cove in Berners Bay. New ferry terminals would be constructed at Sawmill Cove in Berners Bay and at William Henry Bay on the west shore of Lynn Canal, and the Skagway Ferry Terminal would be modified to include a new end berth. A new 38.9-mile highway would be constructed from the William Henry Bay Ferry Terminal to Haines with a bridge across the Chilkat River/Inlet connecting into Mud Bay Road. A new conventional monohull ferry would be constructed and would operate between Haines and Skagway. Mainline ferry service would end at Auke Bay. This alternative assumes the following improvements will have been made independent of the JAI Project before Alternative 3 would come on-line: two Day Boat ACFs, improved vehicle and passenger

staging areas at the Haines Ferry Terminal to optimize traffic flow on and off the Day Boat ACFs, and expansion of the Haines Ferry Terminal to include two new double bow berths.

During the summer, two Day Boat ACFs would make six round-trips per day between Sawmill Cove and William Henry Bay (total of 12 trips each direction), and the Haines-Skagway shuttle ferry would make six round-trips per day. During the winter, one Day Boat ACF would make four round-trips per day between Sawmill Cove and William Henry Bay, and the Haines-Skagway shuttle ferry would make four round-trips per day.

Alternatives 4A through 4D – Marine Alternatives

All four marine alternatives would include continued mainline ferry service in Lynn Canal with a minimum of two trips per week in the summer and one per week in the winter with Auke Bay-Haines-Skagway-Haines-Auke Bay routing. Each marine alternative includes a new conventional monohull shuttle that would make two round-trips per day between Haines and Skagway six days a week in the summer and a minimum of three round-trips per week between Haines and Skagway in the winter. The AMHS would continue to be the NHS route from Juneau to Haines and Skagway. These alternatives assume the following improvements will have been made independent of the JAI Project before the alternative comes on-line: improved vehicle and passenger staging areas at the Auke Bay and Haines ferry terminals to optimize traffic flow on and off the Day Boat ACFs and expansion of the Haines Ferry Terminal to include new double bow berths.

Alternative 4A – Fast Vehicle Ferry Service from Auke Bay

Alternative 4A would construct two new fast vehicle ferries (FVF). No new roads would be built for this alternative, and the Auke Bay Ferry Terminal would be expanded to include a new double stern berth. A new conventional monohull ferry would be constructed and would operate between Haines and Skagway. The *M/V Malaspina* would no longer operate as a summer day boat in Lynn Canal, and the Day Boat ACFs would no longer operate in Lynn Canal. The FVFs would make two round-trips between Auke Bay and Haines and two round-trips between Auke Bay and Skagway per day in the summer. During the winter, one FVF would make one round-trip between Auke Bay and Haines and one round-trip between Auke Bay and Skagway each day.

Alternative 4B – Fast Vehicle Ferry Service from Berners Bay

Similar to Alternative 4A, Alternative 4B would construct two new FVFs. This alternative would upgrade/extend Glacier Highway (5.2 miles including 2.3 miles of new highway and widening of 2.9 miles of the existing Glacier Highway) from Echo Cove to Sawmill Cove in Berners Bay where a new ferry terminal would be constructed. The Auke Bay Ferry Terminal would be expanded to include a new double stern berth. A new conventional monohull ferry would be constructed and would operate between Haines and Skagway. The *M/V Malaspina* would no longer operate as a summer day boat in Lynn Canal, and the Day Boat ACFs would no longer operate in Lynn Canal. In the summer, the FVFs would make two round-trips between Sawmill Cove and Haines and two round-trips between Sawmill Cove and Skagway per day. During the winter, one FVF would make one round-trip between Auke Bay and Haines and one round-trip between Auke Bay and Skagway each day.

Alternative 4C – Conventional Monohull Service from Auke Bay

Alternative 4C would use Day Boat ACFs to provide additional ferry service in Lynn Canal. No new roads would be built for this alternative. The Auke Bay Ferry Terminal would be expanded to include a new double stern berth, and the Skagway Ferry Terminal would be expanded to include a new end berth. A new conventional monohull

ferry would be constructed and would operate between Haines and Skagway. In the summer, one Day Boat ACF would make one round-trip per day between Auke Bay and Haines, and one Day Boat ACF would make one round-trip per day between Auke Bay and Skagway. During the winter, one Day Boat ACF would alternate between a round-trip to Haines one day and a round-trip to Skagway the next day.

Alternative 4D – Conventional Monohull Service from Berners Bay

Alternative 4D would use Day Boat ACFs to provide additional ferry service in Lynn Canal. This alternative would upgrade/extend Glacier Highway (5.2 miles including 2.3 miles of new highway and widening of 2.9 miles of the existing Glacier Highway) from Echo Cove to Sawmill Cove in Berners Bay where a new ferry terminal would be constructed. The Auke Bay Ferry Terminal would be expanded to include a new double stern berth, and the Skagway Ferry Terminal would be expanded to include a new end berth. This alternative includes construction of a new conventional monohull ferry that would operate between Haines and Skagway. In the summer, the Day Boat ACFs would make two trips per day between Sawmill Cove and Haines and two trips per day between Sawmill Cove and Skagway. During the winter, a Day Boat ACF would operate from Auke Bay, alternating between a round-trip to Haines one day and to Skagway the next day.

Basic Methodology

The goal of the Marine Segments Technical Report is to determine operating and capital vessel costs for the JAI reasonable alternatives. Calculation of these costs requires the following basic methodology:

1) Further definition of marine segments into viable ferry systems
2) Determination of Vessel Size
3) Calculation of Operating and Capital Costs.

Further Definition of Marine Segments

In order to define cost components, it is necessary to expand each marine segment into a viable ferry system. For each viable ferry system, the type of vessel, number of vessels, length of operation per day, number of crews, and the route travelled must be quantified.

Vessel Size

The vessel operational cost model in this report is based on vessel size. All vessel sizes in this report are defined by Alaska Standard Vehicle (ASV) capacity. So vessel size must be determined prior to running operational cost calculations.

Vessel size is determined by two methods: 1) for existing or programmed AMHS vessels the actual size is used, or 2) for new vessels the size is determined by calculation. Vessel size is calculated by taking the average daily traffic on a route and converting it to per trip capacity based on vessel operating schedule.

Costs

Vessel operating costs and capital cost information for each marine segment are determined by the use of two cost models.

Operating Costs

The operating cost model calculates the cost of: crew, fuel, maintenance, overhead, and vessel lay-up costs. As mentioned above, this model is based on vessel size in ASV capacity.

Capital Costs

The capital cost model calculates vessel acquisition costs (construction plus program cost) and vessel capital improvement costs based on estimated vessel lifespan. This model is based on the volume of vessel spaces and the amount of installed mechanical and electrical power.

Detailed Methodology

The detailed methodology employed in each of the above described basic categories is described in detail in the following chapters of this report.

Terminology

There are many assumptions and calculations used for this analysis, which require terminology specific to this project. These terms are listed below.

Alternatives. Alternatives are defined as the combination of highways and/or vessels proposed to improve Juneau Access, as identified in the Updated Alternative Descriptions. Some alternatives specify vessel routes and specific programmed vessels, and some alternatives specify route and vessel type (like a high speed ferry).

AMHS. Alaska Marine Highway System.

ASV. Alaska Standard Vehicle. A unit of measurement of car deck area on a vessel equal to ten feet by twenty feet, used by the AMHS.

Day Boat. Day boat is a term used to describe the scheduling of a vessel. A day boat is scheduled so that it returns to its home port at night and the crew does not sleep on the vessel at night. A day boat does not generally have crew quarters or a galley.

DB ACF. Day Boat Alaska Class Ferry. This is the new AMHS day boat ferry currently scheduled to be constructed.

Displacement Vessel (Displ.). A displacement vessel means a steel hulled vessel with relatively slow speed (15 knots). Displacement vessels are like the existing AMHS fleet, except the displacement vessels for this study are day boats.

High Speed Ferry (HSF). A high speed ferry (HSF) is an aluminum hull catamaran capable of making at least 30 knots of speed loaded. HSF vessels do not have galleys or crew quarters and are very similar to the AMHS vessel M/V Fairweather.

Mainline Service (Mainliners). Mainline ferry service is provided by the AMHS which traditionally starts at either Bellingham, WA or Prince Rupert, BC.

Marine Segments. The marine transportation portions of the JAI reasonable alternatives.

Mooring and Loading Operations (MLOPS). Vessel mooring and loading operations.

Passenger (PAX). A passenger is a person riding the ferry, not part of the vessel's crew.

Routes. Routes are specific transportation links within configurations. A configuration may have several routes and routes may be different depending on the season. Routes are always considered round-trips in this study, because day boats need to return to home port at night. Routes are sometimes called "links" in other JAI studies.

SADT. Summer Average Daily Traffic, defined as May through September.

Sister ship. A sister ship is a vessel that is very similar to another vessel. Usually a sister ship is created from the same plans and has the same type of machinery, accommodations, and outfitting as the original vessel.

Terminal Descriptions. The following abbreviations are used for terminals:

AUK – Auke Bay Ferry Terminal (Juneau)

HNS – Haines Ferry Terminal

SGY – Skagway Ferry Terminal

KTZ – New Ferry Terminal two miles north of the Katzehin River

SAW – New Ferry Terminal at Sawmill Cove in Berners Bay

WHB – New Ferry Terminal at William Henry Bay on the west shore of Lynn Canal

WADT. Winter Average Daily Traffic, defined as October through April.

3. FURTHER DEFINITION OF MARINE SEGMENTS

Each reasonable alternative in the JAI project serves as a basic definition of a specific transportation solution. To facilitate detailed cost analysis, the marine portion of each reasonable alternative (marine segment) needs to be further defined into a more fully described and viable transportation system. In the case of the marine segments, this means configuration into a viable ferry system, including number of vessels, type and size of vessel, length of crew shift, number of crew shifts, and operational schedule.

Several significant changes have occurred since the issue of the previous JAI Marine Segments Report.

First, a large amount of analysis and public input on the JAI Marine Segments occurred which resulted in the State modifying alternative definitions. The definition of each reasonable alternative now includes many specific operational details of each intended ferry system. Functionally, these new definitions form operational requirements of each new system and they are incorporated into this study accordingly.

Secondly, the State has designed and funded new Day Boat ferry vessels for the AMHS, which should start construction in 2014. These new assets are incorporated in the study, where appropriate.

The expansion of alternatives is based on the assumptions listed below.

General Assumptions

General

- The configuration of each representative ferry system must provide a reasonable and efficient means of implementing the associated public ferry service. The configuration of each marine segment is now determined by alternative definition. Since AMHS is ultimately responsible for providing regional ferry service, the way it implements final service could be different than the representative system.
- Proven technology is required with systems and vessels suitable for reliable year-round service in Southeast Alaska.
- Vessels and systems should be compatible with existing or programmed AMHS assets to the extent practicable.

Vessel Operation

- Vessel speeds should be as efficient as possible and based on realistic and or historical vessel speeds in Southeast Alaska.
- Vessel mooring and loading operations (MLOPS) should be as efficient as possible and based on historically achievable MLOPS for public transit vessels. Where necessary, MLOPS may be slightly adjusted to provide optimum schedules.
- Vessels must be suitable for the existing environmental conditions. This goal will be achieved by utilizing vessel sizes that already have a successful operating history in Southeast Alaska.

Route Arrangement

- Route arrangement (i.e. order of terminal stops), identification of backup vessels and road closure contingencies, are now determined by the alternative definitions, in Section 1 - Introduction.

Miscellaneous

- A significant change in terminal support personnel is not planned for most alternatives. On routes that require high sailing frequency, berths and vessels must be able to accommodate rapid docking and loading, without significant additional terminal support personnel.
- Night crew. Day Boats that sail for the majority of time their crew is aboard require additional night crew to clean and conduct maintenance while the vessel is docked for the night. The cost of night crews is incorporated in this study.

Number or Round Trips

The number of round-trips for each route in each alternative is defined in the alternative definitions, in Section 1 - Introduction. For this analysis, the number of round-trips is assumed to be an operational requirement.

Route Leg Length

The physical characteristics of each route leg must be defined in order to calculate the time required for a vessel to travel from terminus to terminus. The full definition of leg length includes maneuvering distance at each terminal and cruising distance between terminals. Maneuvering distance is defined as the distance at each terminal with a no-wake limitation. Actual vessel courses from AMHS vessel navigation systems were used as a basis to define legs and established leg length and maneuvering distances where applicable. Table 2 shows the characteristics of the eight unique legs in this analysis.

Table 2

Proposed Leg Sailing Distances

Departure Terminal	Leg Name	Leg Length	Terminal 1 Name 1	Terminal 1 Manuv Dist 1	Terminal 2 Name 2	Terminal 2 Manuv Dist 2	Cruise Length
Auke Bay	AUK-HNS	66.24	Auke Bay	2.34	Haines	0.31	63.59
Auke Bay	AUK-SGY	74.68	Auke Bay	2.34	Skagway	0.13	72.21
Haines	HNS-KTZ	5.92	Haines	0.30	Katzehin	0.25	5.37
Haines	HNS-SGY	12.60	Haines	0.27	Skagway	0.13	12.20
Sawmill Cove	SAW-HNS	41.83	Sawmill Cove	0.61	Haines	0.33	40.89
Sawmill Cove	SAW-SGY	50.17	Sawmill Cove	0.61	Skagway	0.13	49.43
Sawmill Cove	SAW-WHB	10.05	Sawmill Cove	0.61	Wm Henry Bay	0.12	9.32
Skagway	SGY-KTZ	14.25	Skagway	0.13	Katzehin	0.25	13.87

Schedule Assumptions

Vessel Speed

Vessel speed for the two vessel types used in this analysis is based on realistic and historic vessel scheduling speeds for passenger/vehicle ferries in Southeast Alaska. For displacement vessels a 15 knots scheduling speed and 7 knots maneuvering speed is assumed. For HSF vessels a 30 knots scheduling speed and 8 knots maneuvering

speed is assumed. Traditionally, scheduling speed is assumed to be at least a 0.5 knot less than vessel maximum speed, to allow the vessel some leeway to make up for lost time and inclement weather.

Mooring and Loading Operations (MLOPS)

The period of time a vessel spends mooring at a terminal and loading and unloading can be a significant portion of time and can have a large impact on schedule and operation efficiency. Mooring and Loading Operations (MLOPS) have been analyzed since the previous JAI Marine Segments report as part of the Day Boat ACF Design Concept Report. Based on this work, MLOPs times were chosen for new JAI operations and are shown in Table 3. The MLOPS times are short and were selected in order to ensure the maximum possible level of service for each route. To achieve proposed schedules for some routes, vessels and terminals need to be designed for reduced MLOPS. Alternately, some combination of night crew assistance and overtime pay could be used to achieve similar results.

Assumptions about vessel startup and shutdown times are also provided in Table 3. Startup and shutdown times are based on typical times required for engine startup and shutdown for similar sized day boat vessels, assuming that night crew assistance will be available for servicing and replenishing vessel.

Table 3

Notional Vessel Characteristics

Vessel Type	Nominal Speed	Manuv Speed	Startup Time	Load Time	Unload Time	Shutdown Time
Displacement	15 kts	5 kts	30 mins	15 mins	15 mins	30 mins
High Speed Ferry	30 kts	8 kts	30 mins	15 mins	15 mins	30 mins

Crew Operations

There are a number of important assumptions associated with crew scheduling and operations for JAI Marine Segments.

- Many JAI Marine Segments vessels are “day boats.” Day boats are defined as vessels whose crew work only one shift and leave the vessel at the end of their shift. Day boats usually require that the vessel start and end each shift at the same port.
- Crew schedules for a single crew must be no more than 12 hours per day. This will prevent the need for operation of any vessel with back-up crew on board. Per USCG regulations, no crewmember can be on duty for more than 12 consecutive hours, on a regular basis.
- Vessel Schedules should reflect day boat crew schedules that are efficient and that have a historically reasonable chance of being provided under a marine union contract. Generally these schedules are some combination of 8 and 12 hours per work day. Overtime costs should be minimized.
- Schedules should provide for 16-18 hours per day of service in the summer and 10-12 hours per day of service in the winter. Operation shall occur during waking/daylight hours, if possible. For day boats, 24 hour per day service is not planned to allow for the necessary daily supply and maintenance of vessels.

The crew operation assumptions have a major impact on day boat schedules.

Schedule Calculations

Once the number of round-trips, route lengths, MLOPS times, vessel speeds, and crew operation assumptions are known, it is possible to create viable vessel schedules. Vessel schedules are a sequential series of events beginning with the startup and ending with the shutdown of the vessel.

To develop schedules, a first sailing departure time was assumed, time was added for appropriate MLOPs, and then time was added for transit to the next port. This sequence was repeated until the correct number of round-trips was reached. Slight adjustments were made to subsequent departures in order to schedule vessel departures on five-minute divisions of the hour.

Transit times were calculated using route leg distances and vessel speed characteristics. Time underway represents the time required to travel from terminal to terminal, taking into account maneuvering times and distances, and the time and distance cruising at speed.

Optimizing crew operation is a complicated and iterative process. Total crew time is calculated from the first load time through the last unload time for completed round-trips. In order to determine the number of crews and length of crew shifts, each round trip of the schedule was assigned to a crew, such that the number of round-trips per crew shift was maximized. Once a crew completed their shift (8 or 12 hours), a new crew was provided. (Since there are no crew accommodations on day boats, the crew change must occur at the original departure terminal.) In some instances crew do not complete their entire 8 or 12 hour shift prior to crew change.

Schedules and crew operational plans were developed for each vessel in each alternative and are shown in detail in *Attachment C - JAI Marine Alternatives Operating and Capital Costs* of this report. The schedules developed in this analysis are for the purpose of illustrating and costing one possible viable ferry system. As discussed previously, AMHS may choose to implement and schedule service differently.

Further Definition of Marine Segments

For each marine segment, the type of vessel, the number of vessels, crew schedules and route operating hours required for each season for each route is specified. Additionally, a back-up solution is described. Table 4 shows the marine segments configurations developed for Alt. 1 thru Alt. 3. Table 5 below shows the configurations for the marine segments, Alt. 4A thru Alt. 4D.

Table 4

Configuration Definitions for Marine Segments Alt. 1 thru Alt. 3

Alt	Route	Season	# Vessels	Type	Crew Hrs		Op Sch	Link
					Vessel 1	Vessel 2	hrs/day	Back-up
1. No Build								
Alt 1 - No Action								
	HNS-SGY HNS	Summer	1	DB ACF	8		8	Road / AMHS
							4	
		Winter	1	DB ACF	8		8	
	AUK-HNS-AUK	Summer	1	DB ACF	12		12	2nd boat
		Winter	1	DB ACF	12		12	
	AUK-HNS-SGY-HNS-AUK	Summer	1	Mainliner	12+12		24	
		Winter	1	Mainliner	12+12		24	
Alt 1B - Enhanced Service with Existing AMHS Assets								
	HNS-SGY HNS	Summer	1	DB ACF	8		8	Road / AMHS
							4	
		Winter	1	DB ACF	12		12	
	AUK-HNS-AUK	Summer	1	DB ACF	12		12	2nd boat
		Winter	1	DB ACF	12		12	
	SGY-AUK-SGY	summer	1	Mal	12+12		24	AMHS
	AUK-HNS-SGY-HNS-AUK	Summer	1	Mainliner	12+12		24	
		Winter	1	Mainliner	12+12		24	
2 East Lynn Canal								
Alt. 2B - Road to KTZ, ferry to SGY and HNS								
	HNS-SGY-HNS	summer	1	Displ	8		8	Road / AMHS
	HNS-KTZ-HNS	summer	1	DB ACF	8+8		16	2nd boat
		winter	1	DB ACF	12		12	
	SGY-KTZ-SGY	summer	1	DB ACF	8+8		16	2nd boat
		winter	1	DB ACF	12		12	
Alt 3 - West Lynn Canal								
Alt. 3 - Road to HNS, ferry SAW-WHB, ferry HNS - SGY								
	HNS-SGY-HNS	summer	1	Displ	8+8		16	Road / AMHS
		winter	1	Displ	12		12	
	SAW-WHB-SAW	summer	2	DB ACF	8+8	8+8	16	2nd boat
		winter	1	DB ACF	12		12	

Table 5

Configuration Definitions for the Marine Segments – Alts. 4A – 4D

Alt	Route	Season	# Vessels	Type	Crew Hrs		Op Sch	Link
					Vessel 1	Vessel 2	hrs/day	Back-up
Alt 4 - Marine Alternatives								
Alt. 4A - Fast from AUK								
	HNS-SGY-HNS	summer	1	Displ	8		8	Road / AMHS
							4	
		winter	1	Displ	8		8	
	AUK-HNS-AUK AUK-SGY-AUK	summer	2	Fast	8+8	8+8	16	2nd boat
	AUK-HNS-AUK AUK-SGY-AUK	winter	1	Fast	8		8	
	AUK-HNS-SGY-HNS-AUK	Summer	1	Mainliner	12+12		24	
		Winter	1	Mainliner	12+12		24	
Alt. 4B - Fast from SAW in summer, AUK in winter								
	HNS-SGY-HNS	summer	1	Displ	8		8	Road / AMHS
							4	
		winter	1	Displ	8		8	
	SAW-HNS-SAW SAW-SGY-SAW	summer summer	2	Fast Fast	12	12	12	2nd boat
	AUK-HNS-AUK AUK-SGY-AUK	winter	1	Fast	8+8		16	
	AUK-HNS-SGY-HNS-AUK	Summer	1	Mainliner	12+12		24	
		Winter	1	Mainliner	12+12		24	
Alt. 4C - Displ from AUK								
	HNS-SGY-HNS	summer	1	Displ	8		8	Road / AMHS
							4	
		winter	1	Displ	8		8	
	AUK-HNS-AUK	Summer	1	DB ACF	12		12	2nd boat
	AUK-SGY-AUK	Summer	1	DB ACF	12		12	
	AUK-HNS-AUK AUK-SGY-AUK	winter	1	DB ACF	12		12	
	AUK-HNS-SGY-HNS-AUK	Summer	1	Mainliner	12+12		24	
		Winter	1	Mainliner	12+12		24	
Alt. 4D - Displ from SAW in summer, AUK in winter								
	HNS-SGY-HNS	summer	1	Displ	8		8	Road / AMHS
							4	
		winter	1	Displ	8		8	
	SAW-HNS-SAW	Summer	1	DB ACF	8+8		16	2nd boat
	SAW-SGY-SAW	Summer	1	DB ACF	8+8		16	
	AUK-HNS-AUK AUK-SGY-AUK	winter	1	DB ACF	12		12	
	AUK-HNS-SGY-HNS-AUK	Summer	1	Mainliner	12+12		24	
		Winter	1	Mainliner	12+12		24	

The vessel operational cost model in this analysis is based on vessel size, which is measured by the number of vehicles a vessel can carry. The number of vehicles is based on a standard vehicle space of 10 feet by 20 feet, called an Alaska Standard Vehicle (ASV).

Vessel size is determined by two methods: 1) for existing or programmed AMHS vessels the actual size is used, or 2) for new vessels the size is determined by calculation.

Size of Existing Vessels

Many of the configurations of the JAI marine segments are based on existing vessels. The capacity of these vessels is provided by AMHS and shown in Table 6.

Table 6
Existing Vessel Capacity

Vessel	ASV Capacity	Passenger Capacity
LeConte	34	250
Malaspina	88	500
Matanuska	88	500
Taku	69	370
Columbia	134	625
Day Boat ACF	53	300

Size Calculation

For vessels that would be designed and built for JAI marine segments, vessel size must be calculated. Vessel size is calculated by taking the anticipated average daily traffic on a route and calculating per trip vessel capacity based on the number of round-trips per day.

Traffic Data

Traffic Forecasts

In order to calculate vessel capacity requirements, traffic projections for specific marine segments routes are needed. These projections were provided to this analysis by the Fehr and Peers Juneau Access Improvements Project Traffic Forecast Report 2013 and the McDowell Group Juneau Access Haines/Skagway Traffic Forecast, November 2012.

The traffic breakdown by category of cargo: passenger (PAX), passenger automobile (PAX-ASV), recreational vehicle (RV), and commercial truck (Van) was provided by Fehr and Peers. This breakdown of traffic by category is required so that vessel capacity can correctly account for the type of traffic traveling a route.

Traffic projections are for 30 years and projections are provided in SADT and WADT increments. In general, winter traffic is so low it does not impact this analysis. SADT traffic data represents projected round-trip daily traffic for the summer months. It does not reflect peak week or peak daily traffic that might occur for a special event. (See

traffic reports for further information.) The State intends that traffic peaks be resolved by operational measures, such as adding additional vessels or additional vessel sailings.

AMHS Mainline Traffic Capacity

For Alternatives 1A, 1B, and 4A – 4D, AMHS would continue to operate traditional mainline ferry vessels in North Lynn Canal. This "Mainline" service is assumed to be the traditional AUK-HNS-SGY-HNS-AUK round trip and would consist of two AMHS mainline vessel trips per week in the summer (typically the Columbia and Matanuska) and one trip per week in the winter (typically the Matanuska). In order to size the new JAI Marine Segment vessels, the JAI traffic forecasts must be reduced by the available AMHS mainline capacity.

For the summer season, the mainline capacity is based on one Columbia trip per week (134 ASV capacity) and one Matanuska trip per week (88 ASV capacity). This gives a one-way capacity of 222 ASV per week, or a total round-trip capacity of 444 ASV per week.

Since the JAI traffic forecasts are provided in SADT (summer average daily traffic round-trip) the weekly round-trip mainliner capacity must be converted to daily round-trip traffic by dividing the total weekly round-trip capacity (444) by 7 days per week, giving approximately 63 SADT.

Based on AMHS annual traffic reports, the historical Haines/Skagway traffic split is 60/40 percent. Using this traffic split, 38 SADT, of the 63 SADT, is attributed to the Juneau-Haines portion of the mainline route and 25 SADT is attributed to the Juneau-Skagway portion. Since the mainliner stops at Haines on both the north and south bound trip, the available capacity for Haines-Skagway segment is 38 SADT. Winter capacity is conservatively assumed to be one half of the summer capacity. Table 7 shows the values of the available traffic capacity of planned JAI mainline vessels by route.

Table 7
Available Traffic Capacity of planned JAI Mainline Vessels

Leg	SADT	WADT
AUK - HNS	38	19
AUK – SGY	25	12
HNS – SGY	38	19

JAI Marine Segment's Traffic Capacity

The Fehr and Peers and McDowell Group traffic forecasts were made between cities, not for each route. The projections from the two forecasts had to be merged and arranged to take into account the direction and arrangement of the marine transportation routes. For example, some alternatives do not have direct route from Juneau to Skagway, meaning that all Juneau to Skagway traffic must travel on the Juneau to Haines route, then on the Haines to Skagway route.

This analysis assumes that the traffic forecast completed by Fehr and Peers includes all traffic in the JAI corridor, including the traffic passing through Juneau on AMHS mainline vessels. Therefore, the amount of traffic on JAI Day boat vessels was reduced by 100% of the planned AMHS mainline capacity for each alternative.

The actual traffic numbers by route used in this analysis are shown in the Data Tables in *Attachment E – Data Tables* of this report.

Payload Calculations

As discussed previously, vessel size for this analysis is measured in units of Alaska Standard Vehicles (ASV). However, when considering the design of a new vessel there are several payload values that must be investigated: 1) number of vehicles, 2) number of passengers (PAX), and 3) total payload weight in long tons.

To be considered an acceptable JAI Marine Segments ferry, each vessel must be sized so it can carry the maximum required payload. The vessel sizing calculations in this analysis calculate required vessel characteristics (ASV, PAX, and Payload long ton) for each vessel on the route with maximum traffic, in accordance with the below methodology. Then new vessels are sized so that their selected vessel characteristics are greater than those required. These calculations are shown in *Attachment A - AMHS Mainline Operating Costs* of this report.

Vehicle Capacity

While vessel vehicle capacity is measured in units of ASV, it is not true that all traffic comes in 20 foot length increments. Many vehicles are longer than 20 feet and they require additional lane length. To calculate vessel capacity, the required total lane length is calculated as the sum of the lengths of different types of vehicles and then total lane length is divided by twenty feet (the length of an ASV) to calculate the vessel capacity in ASV.

Required lane length is calculated by identifying the maximum vehicle count required for each vehicle type on each route. Multiplying the count and length for each vehicle type and summing the results yields the total required lane length. The results for each vehicle type are again rounded up to the nearest whole number of vehicles.

Each vehicle type has a specified length as shown in Table 8. PAX-ASV is a passenger vehicle.

Table 8

Vehicle Type Length

PAX-ASV	RV	Van
(feet)	(feet)	(feet)
20	24	40

Payload Capacity

Payload capacity is the total weight a vessel must carry measured in long tons. Payload is calculated by multiplying the count and weight for each vehicle type and summing the results. Vehicle type weights used in calculating Payload Requirements are shown in Table 9.

Table 9

Vehicle Type Weight

PAX-ASV	RV	Van
(lbs)	(lbs)	(lbs)
6,000	12,000	40,000

Passenger Capacity

Passenger capacity is the total number of passengers a vessel must carry. The required total number of passengers is calculated by multiplying the SADT forecast by an occupancy ratio. The occupancy ratio was provided by Fehr and Peers.

Once the description and performance of each viable ferry system is known, the annual costs of each system can be calculated. Then these costs can be summarized to provide a total annual cost of each JAI Marine Segment alternative.

To determine annual ferry system costs, this analysis uses a cost estimation model that estimates annual vessel costs components including: crew costs, fuel cost, maintenance cost, vessel lay-up, and administrative overhead costs. Separate cost models were created for displacement and high speed vessels due to the significant operational differences between the two vessel types.

The cost estimate model works by calculating a cost for each separate cost category, based on vessel size in ASV. The cost basis for each category is taken from best curve fit of actual costs. The accuracy of this type of cost model is reasonable and possible because the model is comparing vessels of very similar characteristics; for example steel day boat ferries between 18 and 100 ASV capacity.

The sections below describe the methodology for developing each of the annual vessel cost model categories.

Crew Cost

Total vessel crew costs are based on hourly rates of each crew position, the vessel size and its required crew complement and the total time on duty.

Published AMHS crew cost data from 2012 is used as a basis for determining the hourly rate for each crew position. For each position, the base hourly rate is combined with paid leave (at 25% of base rate), benefits (at 55% of base rate) and cost of living differentials to calculate a fully burdened hourly rate for 2013.

Following the hour rate calculation, Code of Federal Regulations (CFR), and U.S. Coast Guard policy was consulted to identify rules for minimum operating crew complements for a range of vessel sizes, based on ASV, for both displacement vessels and high speed ferries. In addition to regulations, AMHS crew lists for the existing day boats (M/V Lituya and FVF Fairweather) were examined to provide a realistic crew complement for existing AMHS labor contracts. As the vessels are day boats, it is assumed that each crew consists of only the personnel required to operate the vessel for up to a maximum of 12 hours, with no onboard crew accommodations and no crew members working overtime. In some cases, crew positions in addition to those required by regulatory agencies are included, based on AMHS operational requirements such as ticket sales.

Additional night crew costs are calculated separately for both displacement vessels and high speed ferries. Due to the high vessel usage rate for day boat service, it is assumed that a night crew is required for vessel cleaning and minor preventative vessel maintenance.

A total hourly rate for day boat crews and night crews by vessel ASV capacity is calculated for different sized vessels. The calculated hourly rates were plotted against vessel capacity as shown in Figure 1 and 2 below.

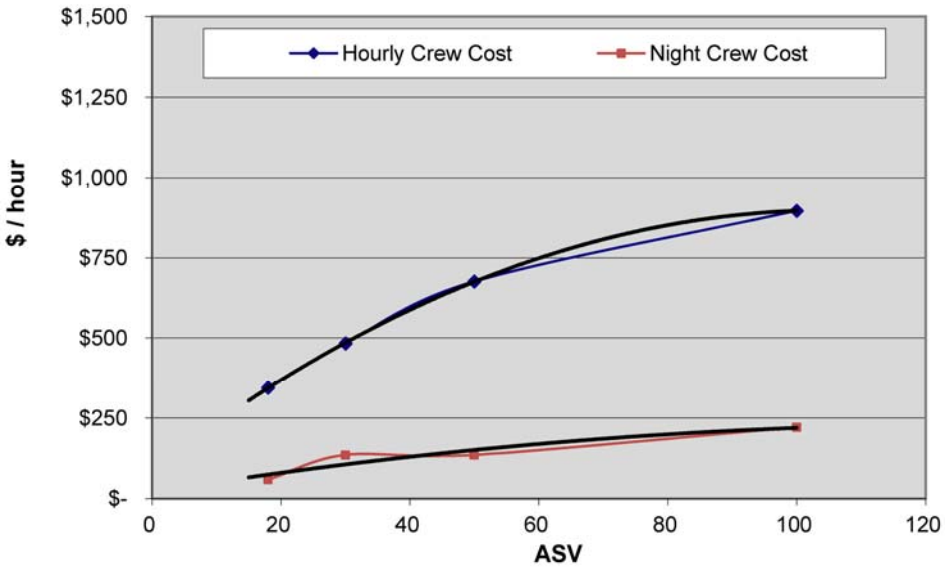

Figure 1
Displacement Hourly Crew Cost Model

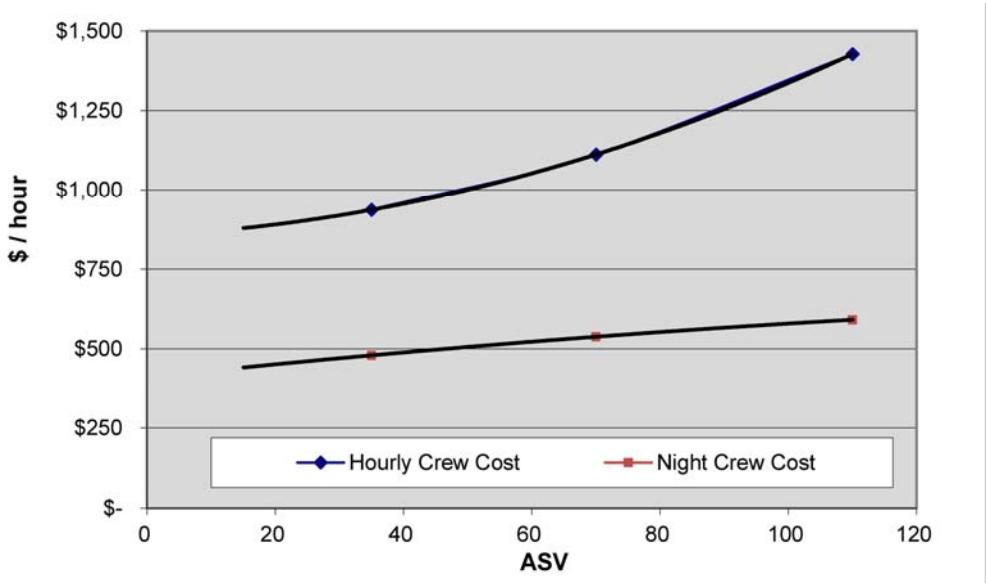

Figure 2
High Speed Ferry Hourly Crew Cost Model

Total crew costs for each route within an alternative are calculated by multiplying the hourly crew cost for the appropriate vessel size by the total seasonal crew hours. Total seasonal crew hours are determined by multiplying crew time per week (per vessel) by the seasonal number of vessels, and the number of crew weeks for each season. These results by season are then summed for a total annual crew cost.

For Alternative 1B, the Juneau-Skagway route utilizes an existing AMHS mainline vessel (Malaspina) in a day boat style operation. Since this vessel has a 24 hour crew, the model developed for day boat crew costs could not be used. Rather the actual crew complement is used along with the fully burdened hourly rates for 2013 to estimate the total hourly crew rate of $1,321.57 per hour. This rate is multiplied by 24 hours per day times 7 days per week and by the number of operation weeks to estimate the crew costs for the Malaspina in JAI day boat service.

Fuel Cost

The basis for calculating fuel cost differs between displacement vessels and high speed ferries. However for both types of vessels, a specific consumption rate of 0.0451 gal / hp-hr was calculated based on a weight-based specific consumption rate of 0.320 lbs / hp-hr and a specific weight of diesel fuel of 7.10 lbs / gal. Fuel consumption rates in gallons per hour for representative vessels are then calculated as described below. To determine total annual fuel cost, consumption rates for the appropriate vessel type and size are multiplied by total time underway (hours) and the cost of fuel at 3.38 dollars per gallon. Fuel costs are not calculated for warm-up or idle time.

Displacement Vessels

Fuel consumption calculations for displacement vessels are based on installed main engine horsepower (not counting generators and boilers) and the specific consumption rate. To develop the curve shown in Figure 3, the specific consumption rate is simply multiplied by the installed horsepower of representative AMHS displacement vessels. Although a vessel's main engines do not normally run at full installed horse power, the full installed horse power fuel consumption rate was used to account for the additional fuel being used to generate electricity and heat on the vessel. The results were plotted against representative vessel ASV capacities to develop approximate fuel consumption costs for a range of displacement vessel sizes.

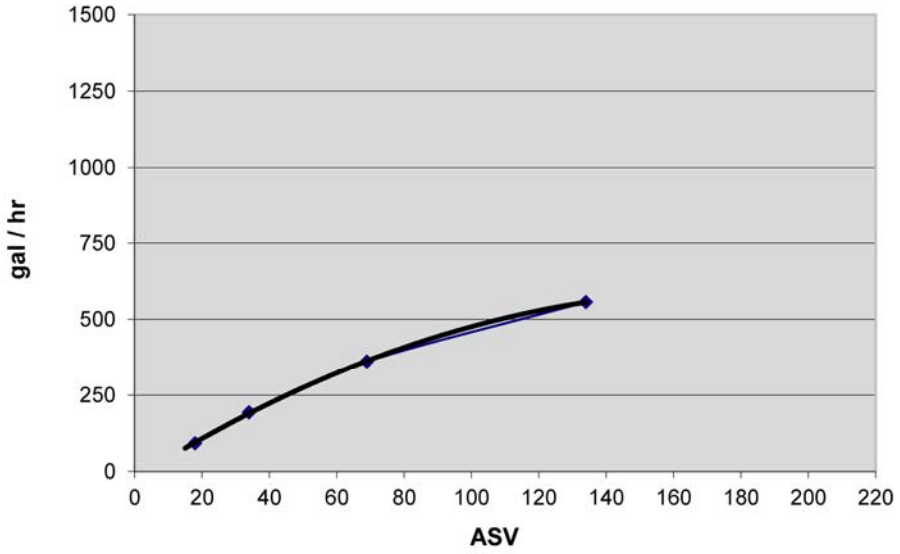

Figure 3
Displacement Vessel Fuel Consumption Model

High Speed Ferries

Power ratings for the representative set of high speed ferries are available in kilowatts and can be converted to horsepower. Due to a lack of good historical information on possible operational speed reductions, which might be caused by hull fouling etc., HSF fuel consumption rates for representative high speed ferries are estimated at a power consistent with a speed two knots greater than the required service speed of 30 knots. Fuel consumption is then calculated by multiplying the specific fuel consumption by the calculated power required at 32 knots. These values were plotted against vessel capacity assuming a linear increase in fuel consumption for increased capacity, as shown in Figure 4 below.

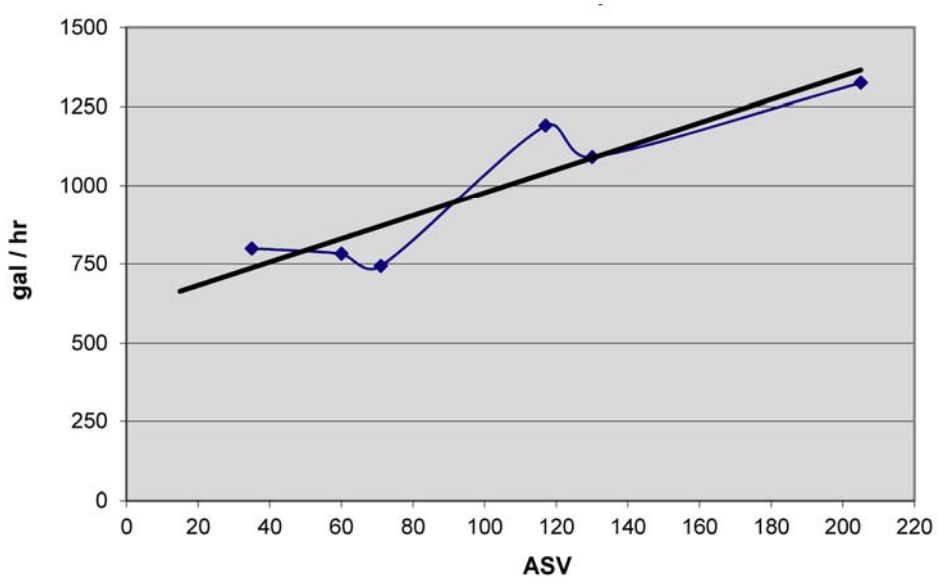

Figure 4
High Speed Ferry Fuel Consumption Model

Vessel Lay-up

Vessel lay-up is defined as the period of time that the vessel sits idle for many days in a non-operational status. For this analysis, a lay-up period typically occurs over the winter period when a vessel is taken off line due to lower seasonal traffic demands.

Crew costs are not included in lay-up costs, assuming that there would be no crew on watch. Annual maintenance costs (calculated in another section) do include maintenance costs for lay-up periods.

The first portion of lay-up costs is the moorage cost which is the cost to rent tie up space for a vessel during the lay-up period. Discussion with AMHS financial personnel indicated that the typical moorage cost is $2.50 / ft-day. Although AMHS may own the final location of vessel moorage, for comparison purposes a cost of $2.50 / ft-day is assumed for moorage cost for all vessels in this study. The moorage cost is added to the heating and hotel costs discussed below.

Displacement Vessels

Heating and power costs were estimated for representative AMHS vessels. These estimated costs are for day boat type vessels. The heating and hotel costs were added to the moorage cost and plotted against vessel capacity in units of ASV as shown in Figure 5.

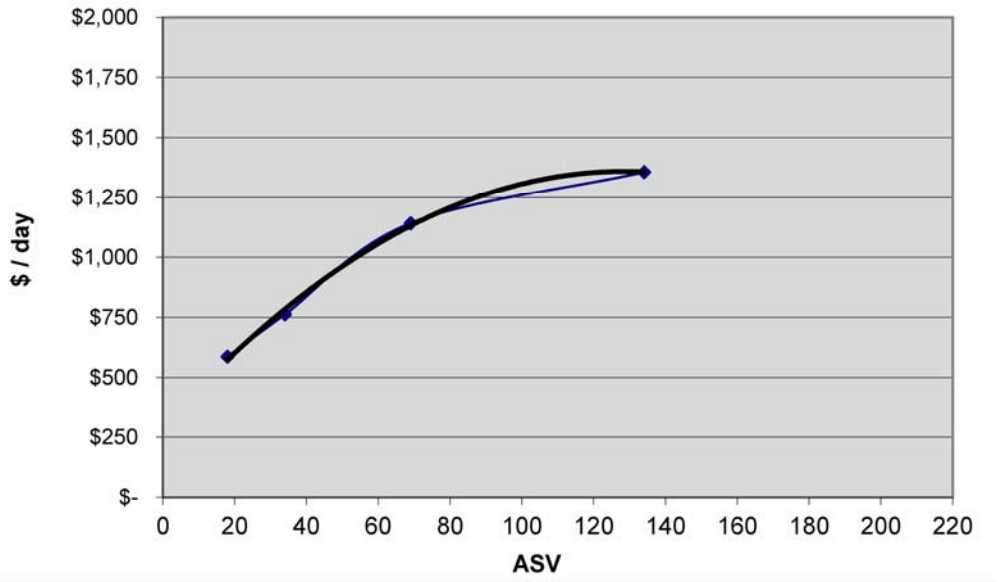

Figure 5
Displacement Vessel Winter Lay-up Cost Model

High Speed Ferries

High speed ferry lay-up costs are estimated with a slightly different model because these vessels are weight sensitive and are usually heated with only electric heat. Recent data from the M/V Fairweather was used to determine electrical power consumption necessary to maintain minimal hotel and equipment temperatures. Assuming $0.11 per kilowatt hour and 440 volt service requirements, heating costs are calculated on a cost per foot per day basis. For a representative set of high speed ferries these costs with moorage costs added were plotted against the ASV capacity of these vessels, as shown in Figure 6.

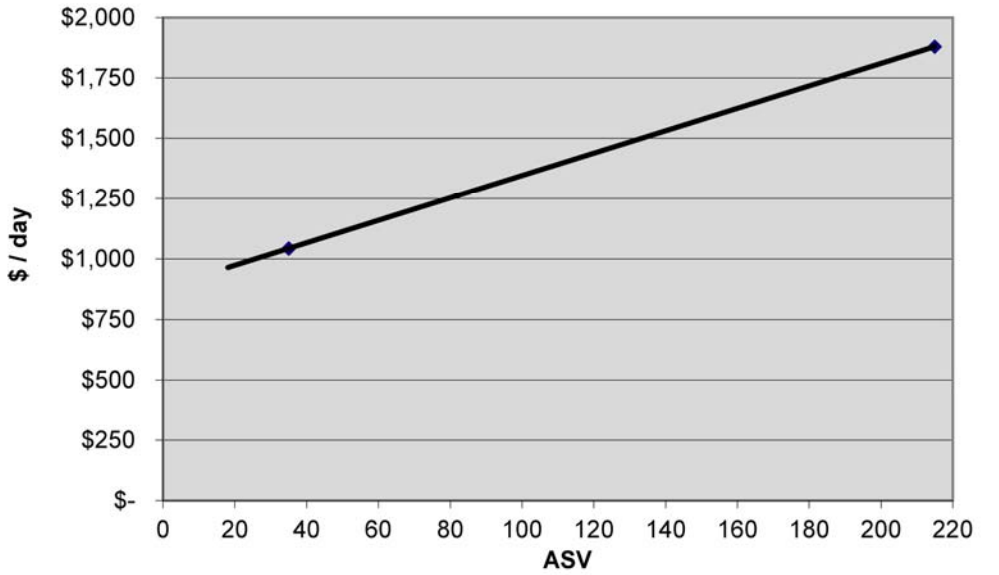

Figure 6
High Speed Ferry Winter Lay-up Cost Model

Maintenance

Maintenance costs are subdivided into two components. The first is operational maintenance, which is based on operating hours and captures the costs required for day-to-day vessel operation. Examples of this cost would be the labor to change engine oil, the cost to purchase lubricants, filters, etc. The second component is annual overhaul costs, which accounts for major maintenance done as part of regularly scheduled overhauls. Annual overhaul costs include required regulatory inspections and other work that cannot be accomplished as a portion of daily vessel maintenance. Maintenance costs do not include the refurbishment costs defined in the capital improvement program. The derivation of the cost of each of these components is described below.

Operational Maintenance

To calculate a cost per operating hour, installed horsepower is multiplied by a cost factor of dollars per horsepower hour ($ / hp-hr). The cost factor was derived from existing AMHS operational and maintenance cost data, installed horsepower and annual operating hours. The same approach was taken for both vessel types and the results were plotted against vessel capacity as shown in Figure 7 and 8.

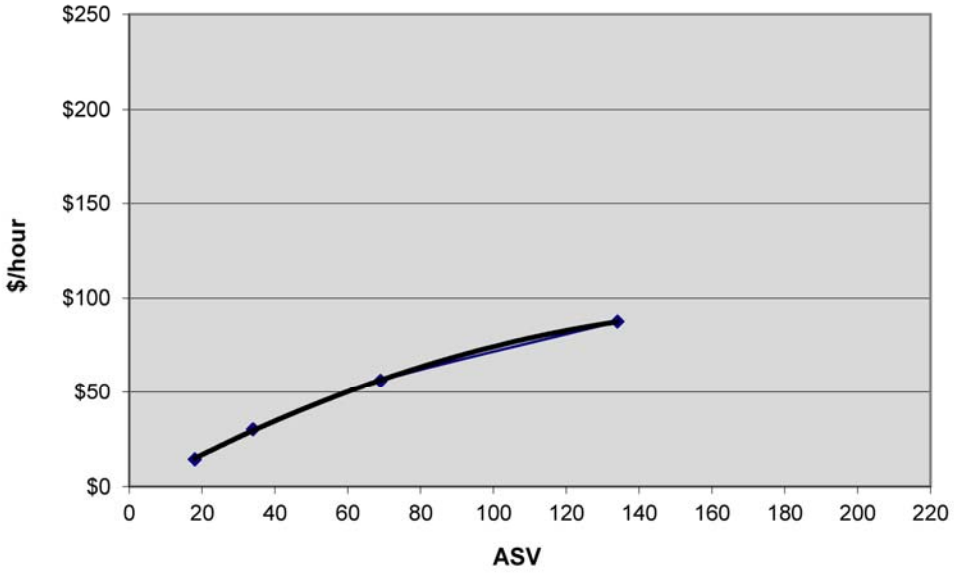

Figure 7
Displacement Vessel Hourly Operational Cost Model

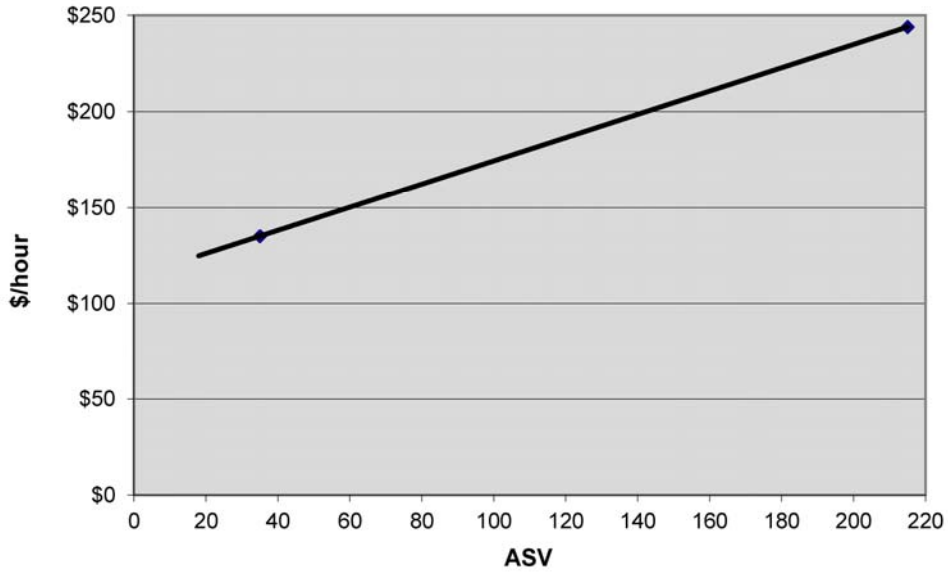

Figure 8
High Speed Ferry Hourly Operational Cost Model

Annual Overhaul Cost

Displacement Vessels:

To model annual overhaul costs, current and historic annual overhaul costs for existing AMHS vessels were examined then modified by specific cost components to reflect the overhaul cost of a day boat of the same size. Cost components are developed for differences in: a) crew accommodation and galley space, b) passenger accommodation space, and c) age of vessel.

Further modification of the AMHS data is required because the standard AMHS vessel overhaul cycle is one year. A review of USCG rules indicated that most of the day boat vessels selected in this study would require overhauls every two years. Assuming that overhauls will occur in conjunction with USCG requirements, the AMHS annual overhaul cost data is modified to include a modest cost savings gained by contracting for and conducting all required overhaul work in one interval as opposed to doing the same amount of work in two separate phases.

Annual overhaul costs for displacement vessels (for a two year overhaul cycle) were plotted against vessel capacity as shown in Figure 9.

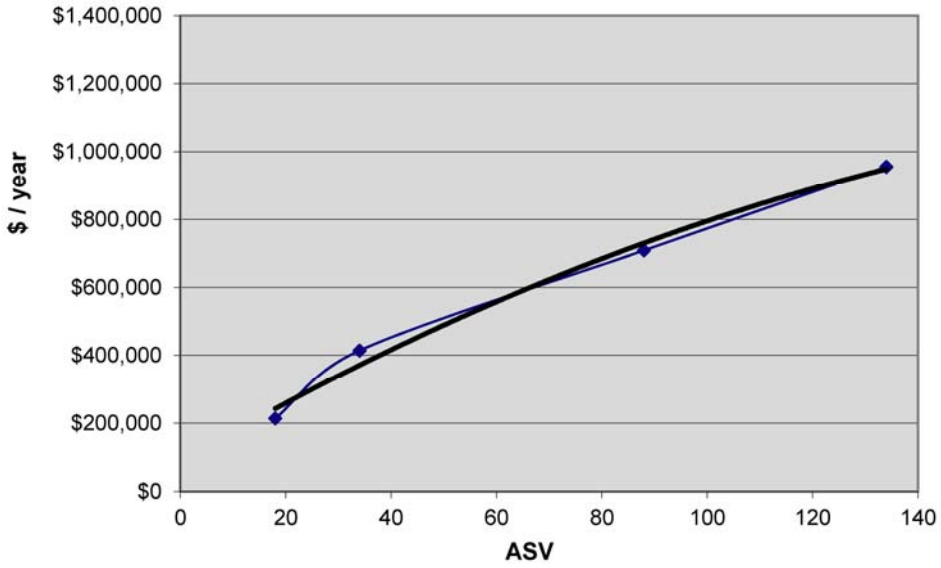

Figure 9
Displacement Vessel Annual Overhaul Cost Model

High Speed Ferries

Historic overhaul cost data for existing high speed ferries in the U.S. is very limited, therefore the cost model for calculating overhaul cost for new HSFs as a function of ASV is simpler than that described above for displacement vessels. AMHS historical data shows the overhaul cost of this vessel type to be approximately 1.13 percent of construction costs. This estimate was used to generate anticipated annual overhaul costs of HSFs.

Annual overhaul costs for high speed ferries (for a two year overhaul cycle) were plotted against vessel capacity as shown in Figure 10.

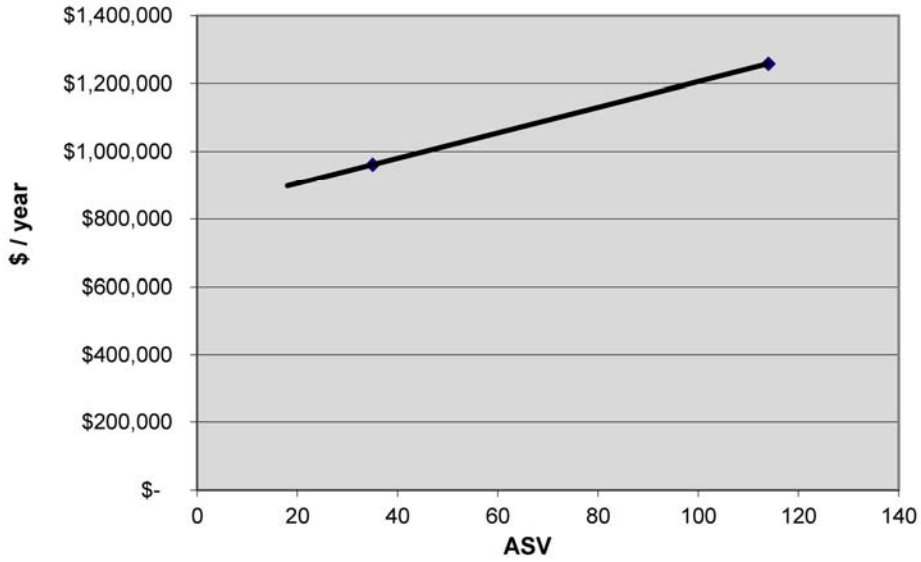

Figure 10
High Speed Ferry Annual Overhaul Cost Model

For Alternative 1B, the Juneau-Skagway route utilizes an existing AMHS mainline vessel (Malaspina) in a day boat style operation. Since the Malaspina is a mainline style vessel, the overhaul cost model developed for day boat vessels cannot be used. Rather the actual fiscal year 2012 overhaul cost was scaled by the percentage of time the vessel intends to operate North Lynn Canal JAI service. The Malaspina annual JAI overhaul cost is approximately $655,000.

Management

Management (or overhead) costs are all of the costs necessary to operate a ferry system that are not previously accounted for by separate cost categories. An example would be the costs associated with accounting and operational support personnel.

Unlike the other annual cost models, the management/overhead cost model is not indexed by vessel size. A primary assumption for this analysis is that overhead costs are reasonably constant between different sized vessels, so long as the vessels are day boats with minimum services as described for this study.

This analysis assumes that any new vessels will be incorporated into the existing administrative and support infrastructure of the AMHS. The benefit of this plan is that existing overhead cost information is available for analysis. The challenge of using the existing AMHS information is twofold:

a) Not all existing AMHS overhead costs would apply to the new vessels because they are day boats specially designed to have minimum overhead costs. Included in these non-applicable categories are Overhaul Costs (modeled separately above) and Shore Operations.

b) The incremental change of an overhead cost is not proportional to the number of vessels added to a mature system. For example, headquarters finance/personnel processes are generally automated. Therefore, the addition of 6-12 paychecks (that would represent the crew of an additional vessel) would not require an increase of 1/9th or 11% of the current budget, but rather some small fraction of that amount to cover additional paper and mailing expenses. For this study, separate “overhead discount factors” have been created for each applicable category to estimate the reduction in overhead charges that would apply to the marine segments vessels.

Overhead Discount Factors

Support Services:

These are land-based services provided to the Southeast Region operation for food service and similar operations. The discount applied to this category is 75%. The reason for this is that no galleys will be aboard new vessels, but there will be some supplies that will require limited support services.

Marine Engineering:

This function is the support provided by AMHS in managing its engineering contractors and oversight of overhaul and vessel construction. The impact of a new vessel on this category will be significant as additional assistance will be necessary, but some responsibilities will likely be absorbed by current staff. The discount applied is 50%.

Operations Management:

This function involves scheduling crew and other miscellaneous operations management. Since new vessels would be operating as day boats with small crews on regular fixed schedules, the requirement for operations management is not as great as vessels in the existing AMHS fleet. The discount applied to this category is 50%.

Overhaul (excluding Personnel Support):

This category is previously accounted for in the Maintenance cost model.

Shore Operations:

This category is not applicable to our analysis because terminal operators and line handlers are not planned for the new terminals.

Reservations and Marketing:

The addition of the marine segments routes will add incremental costs to AMHS operations. Since the AMHS has significant reservation capabilities there is a reduction in overhead costs so the overhead discount rate applied is 75%.

While many of the marine segment configurations will require reservations some do not. For simplicity, the overall discount rate of 75% is applied to all marine segment configurations.

Overhead Cost Calculation

Final overhead costs are calculated per vessel operational day. To begin the final overhead calculation, an inflation adjusted average for each overhead category over the period FY10-FY12 is calculated. These annual values are then divided by the total number of AMHS vessel operational weeks for each year to create an average per vessel weekly overhead rate. Then the discount rate is applied to calculate the appropriate reduction in cost for each overhead category. Finally, all categories are summarized into a total overhead cost per operational week and divided by 7 to determine the total overhead cost per operational day.

Table 10 shows the results of the overhead cost calculations.

Table 10

AMHS Overhead / Operating Data

System-Wide Overhead Costs	AMHS Avg Weekly Overhead (per Vessel)	Discount	Marine Segments Weekly Overhead (per Vessel)
Shore Operations	$ 19,932	100%	$ -
Reservations and Marketing	$ 6,452	75%	$ 1,613
Operations Management	$ 10,837	50%	$ 5,418
Marine Engineering	$ 5,504	50%	$ 2,752
Support Services	$ 5,905	75%	$ 1,476
Totals	$ 48,629.23		**$ 11,260**

Marine Segments Daily Overhead Cost (per vessel)	**$ 1,609**

6. AMHS MAINLINE ANNUAL COSTS

As indicated in the definition of alternatives in *Section 1- Introduction*, Alternatives 1, 1B, & 4A-D all include the continuation of traditional AMHS mainline ferry service in North Lynn Canal (NLC). For the purpose of comparing costs between all the alternatives, the annual operating costs for continuation of existing AMHS mainline service are included in the appropriate alternatives.

Calculation of the AMHS mainline operating costs is a complex process that is made more difficult by the large number of vessels routinely used by AMHS for mainline service (5), the wide variation in AMHS yearly service schedules, and the fact that only a portion of AMHS mainline service is provided in North Lynn Canal. Based on an examination of schedules, it was determined that the mainline service provided in fiscal year 2012 was a reasonable definition of North Lynn canal mainline service and this schedule was used as a base point for cost analysis. This schedule requires that the applicable portion of the operational cost of the three vessels providing the majority of NLC mainline service (Columbia, Matanuska and Taku) be summarized.

The AMHS provided North Lynn Canal operating and cost data for each vessel in fiscal year 2012. Detailed calculations of the mainline operating costs are included in *Attachment A – AMHS Mainline Operating Costs*. The calculation of mainline vessel costs attributed to operation in North Lynn Canal are separated into the following four categories.

Non-Fuel Operating Expenditures

AMHS provided a breakdown of non-fuel operating expenditures by vessel for fiscal year 2012. The portion of these expenditures for mainline vessel is attributed to North Lynn Canal operation based on the number of days the vessel operated in NLC.

Fuel Expenditures

AMHS provided a breakdown of fuel operating expenditures by vessel for fiscal year 2012. The portion of these expenditures for mainline vessels is attributed to North Lynn Canal operation based on the number of miles each vessel traveled in NLC.

Shoreside Costs

AMHS provided shore side costs including Support Services, Marine Engineering, Operations Managements, Reservations & Marketing, and Shore Operations attributed to North Lynn Canal. The portion of these costs attributed to mainline service in North Lynn Canal is based on the number of mainline operating days in North Lynn Canal as a percentage of the total NLC operating days.

Overhaul Costs

AMHS provided vessel overhaul costs for each mainline vessel operating in NLC during fiscal year 2012. The portion of the overhaul costs attributed to North Lynn Canal operation is based on the number of days each vessel operated in NLC.

7. ACQUISITION AND CAPITAL IMPROVEMENT COSTS

The sections below describe the methodology for developing the acquisition and Capital Improvement Plan (CIP) cost for each new vessel in the Marine Segments study. Acquisition costs for existing or programmed JAI vessels are not provided in this analysis, although AMHS Vessel Replacement Costs were estimated for a different study and can be found in *Attachment B – AMHS Vessel Replacement Costs.*

Vessel Acquisition

Acquisition costs have two primary components: 1) the construction cost to design, fabricate, and deliver the vessel; and 2) the "program" costs necessary for the State to conduct pre-construction design and manage the construction of the vessel.

Construction Cost

Since the new vessels in the Marine Segments analysis are of two primary types, separate cost models were created for displacement and high speed vessels. Within each group of vessels, there is significant functional commonality between vessel sizes to allow acquisition costs to be reasonably accurately indexed by vessel size (in ASV).

For displacement vessels, current (2013) estimated construction cost for existing AMHS vessels were used as data points. Where needed, these costs were adjusted to reflect the fact that day boats would have very limited passenger accommodations and no crew accommodations.

Little information is available for construction of very large high speed catamarans in the U.S. There is a good construction cost data point for the M/V Fairweather size vessel (35 ASV) as well as the Hawaii Superferry size vessel (280 subcompact cars) but there is a lot of uncertainty about data points for intermediate high speed vessels.

Program Cost

Vessel program costs are somewhat variable depending on how much design is undertaken prior to construction and if the vessel is very large and requires a lot of construction time. Actual program costs were estimated based on recent AMHS experience building the M/V Lituya and M/V Fairweather. In both the displacement and high speed vessel programs a figure of approximately twenty eight percent of construction cost was the estimate of program cost and was applied to both acquisition cost models.

Cost Models

The curves for the acquisition cost models are shown below in Figure 11 and Figure 12 and in *Attachment E – Data Tables*.

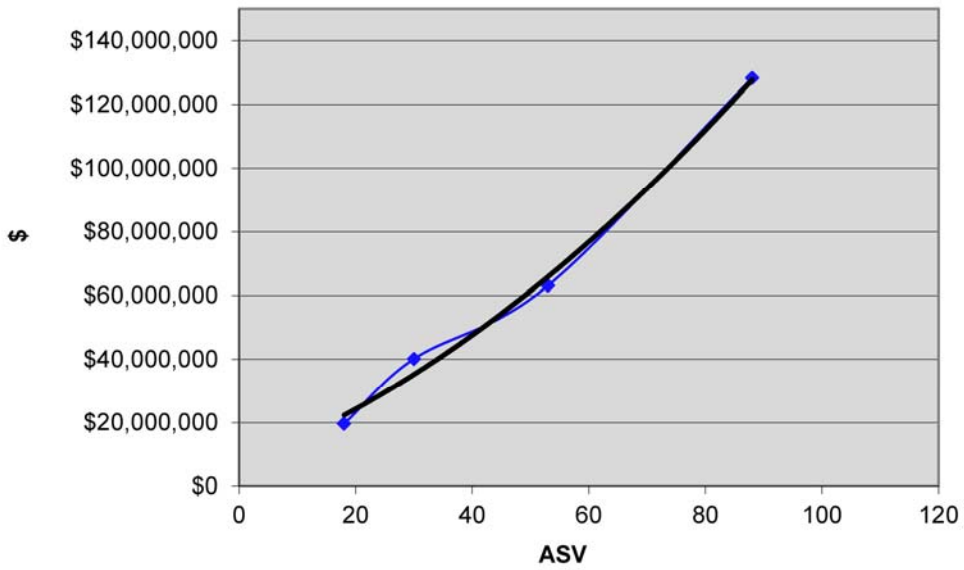

Figure 11
Displacement Vessel Acquisition Cost Model

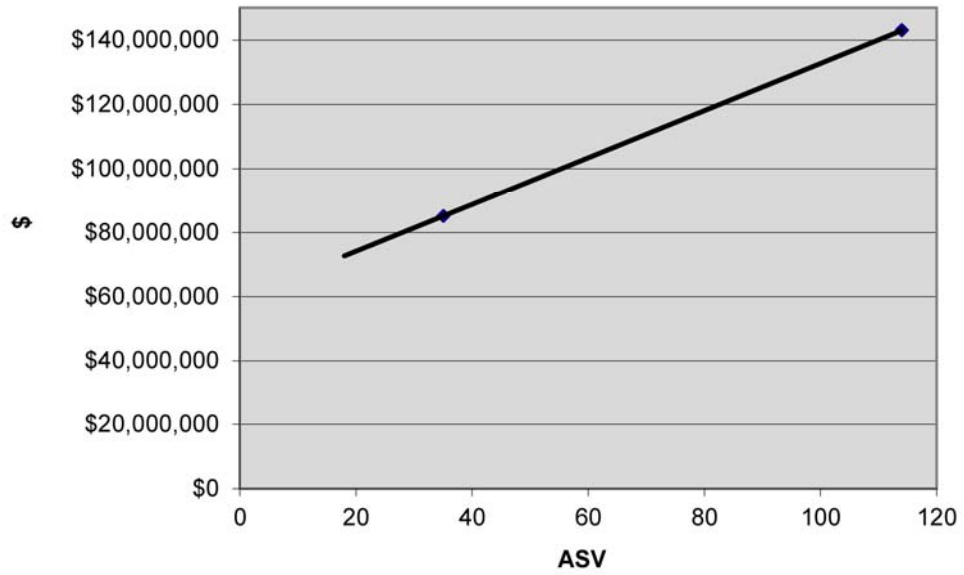

Figure 12
High Speed Vessel Acquisition Cost Model

Capital Improvement Plan

The expected lifespan of a ferry vessel in this study is estimated at 60 years for displacement vessels and 32 years for a high speed vessel. The lifespan for displacement vessels is based on existing AMHS and Washington State Ferry experience. The lifespan for high speed vessels is approximate and is based on AMHS estimates.

In order for a vessel to continue to operate for the duration of its estimated life span, it must receive adequate annual maintenance and periodic refurbishment. The plan of periodic refurbishment is called a Capital Improvement Plan (CIP).

The AMHS prepares a lot of capital improvement plans. These plans are specific to vessel type, vessel use, and vessel condition. However, some general trends are typical for the different types of vessels operated by the AMHS. These trends are used to generate typical CIPs for each type of vessel. Typical CIPs are based on the type of vessel, the vessel's life span, and the type of refurbishment to be undertaken.

The refurbishment costs for each vessel included in the JAI reasonable alternatives are shown in *Attachment D – Capital Improvements Plan.*

Summary

Using the detailed methodology discussed above and the definition of alternatives provided by the State, the operating and acquisition costs for each route was calculated. The results of the Marine Segments analysis are summarized in Table 11 (acquisition costs) and Table 12 (operating costs) below.

Table 11

Acquisition Cost Analysis Results

Alt	Route	Vessels			Acquisition $	
		#	Designation	# ASV	Per Route	Per Alternative
1. No Build						
Alt 1 - No Action						
	HNS-SGY HNS	1	DayACF	53	$ -	$ -
	AUK-HNS-AUK	1	DayACF	53	$ -	
	AUK-HNS-SGY-HNS-AUK	1	Mainliner		$ -	
Alt 1B - Enhanced Service with Existing AMHS Assets						
	HNS-SGY HNS	1	DayACF	53	$ -	$ -
	AUK-HNS-AUK	1	DayACF	53	$ -	
	SGY-AUK-SGY	1	MAL	88	$ -	
	AUK-HNS-SGY-HNS-AUK	1	Mainliner		$ -	
2 East Lynn Canal						
Alt. 2B - Road to KTZ, ferry to SGY and HNS						
	HNS-SGY HNS	1	Disp-1	18	$ 22,315,336	$ 22,315,336
	HNS-KTZ-HNS	1	DayACF-X	53	$ -	
	SGY-KTZ-SGY	1	DayACF-X	53	$ -	
Alt 3 - West Lynn Canal						
Alt. 3 - Road to HNS, ferry SAW-WHB, ferry HNS - SGY						
	HNS-SGY HNS	1	Disp-2	41	$ 48,905,598	$ 48,905,598
	SAW-WHB-SAW	2	DayACF	53	$ -	
Alt 4 - Marine Alternatives						
Alt. 4A - Fast from AUK						
	HNS-SGY HNS	1	Disp-1	18	$ 22,315,336	$ 186,721,305
	AUK-HNS-AUK / AUK-SGY-AUK	2	FVF-1	31	$ 164,405,969	
	AUK-HNS-SGY-HNS-AUK	1	Mainliner		$ -	
Alt. 4B - Fast from SAW in summer, AUK in winter						
	HNS-SGY HNS	1	Disp-1	18	$ 22,315,336	$ 218,932,354
	SAW-HNS-SAW / SAW-SGY-SAW	2	FVF-1	53	$ 196,617,018	
	AUK-HNS-SGY-HNS-AUK	1	Mainliner		$ -	
Alt. 4C - Displ from AUK						
	HNS-SGY HNS	1	Disp-1	18	$ 22,315,336	$ 22,315,336
	AUK-HNS-AUK	1	DayACF	53	$ -	
	AUK-SGY-AUK	1	DayACF	53	$ -	
	AUK-HNS-SGY-HNS-AUK	1	Mainliner		$ -	
Alt. 4D - Displ from SAW in summer, AUK in winter						
	HNS-SGY-HNS	1	Disp-1	18	$ 22,315,336	$ 22,315,336
	SAW-HNS-SAW	1	DayACF	53	$ -	
	SAW-SGY-SAW	1	DayACF	53	$ -	
	AUK-HNS-SGY-HNS-AUK	1	Mainliner		$ -	

Table 12
Annual Operating Cost Analysis Results

Alt	Route	Season	Vessels			Crew Hrs		Op Hrs	# Trips	Annual $	
			#	Designation	# ASV	Vessel 1	Vessel 2	hrs/day	Trips per Wk	Per Vessel	Per Alternative
1. No Build											
Alt 1 - No Action						2 Mainlines to Haines/Skagway (S), 1 Mainline to Haines/Skagway (W)					
	HNS-SGY HNS	Summer	1	DayACF	53	8		6.53	13	$ 4,145,342	$15,354,091
		Winter	1	DayACF	53	8		6.53	6		
	AUK-HNS-AUK	Summer	1	DayACF	53	12		11.53	6	$ 6,036,830	
		Winter	1	DayACF	53	12		11.53	3		
	AUK-HNS-SGY-HNS-AUK	Summer	1	Mainliner					2	$ 5,171,919	
		Winter	1	Mainliner					1		
Alt 1B - Enhanced Service with Existing AMHS Assets						2 Mainlines to Haines/Skagway (S), 1 Mainline to Haines/Skagway (W)					
	HNS-SGY HNS	Summer	1	DayACF	53	8		6.53	13	$ 4,145,342	$23,641,636
		Winter	1	DayACF	53	8		6.53	6		
	AUK-HNS-AUK	Summer	1	DayACF	53	12		11.53	6	$ 6,036,830	
		Winter	1	DayACF	53	12		11.53	3		
	SGY-AUK-SGY	Summer	1	MAL	88	12 + 12		13.60	7	$ 8,287,545	
		Winter	0								
	AUK-HNS-SGY-HNS-AUK	Summer	1	Mainliner					2	$ 5,171,919	
		Winter	1	Mainliner					1		
2 East Lynn Canal											
Alt. 2B - Road to KTZ, ferry to SGY and HNS						Mainline service to terminate at Auke Bay					
	HNS-SGY HNS	Summer	1	Disp-1	18	8		6.53	14	$ 1,354,331	$17,561,593
		Winter	0								
	HNS-KTZ-HNS	Summer	1	DayACF-X	53	8 + 8		13.80	56	$ 7,649,921	
		Winter	1	DayACF-X	53	12		10.60	42		
	SGY-KTZ-SGY	Summer	1	DayACF-X	53	8 + 8		16.00	42	$ 8,557,341	
		Winter	1	DayACF-X	53	12		11.00	28		
Alt 3 - West Lynn Canal											
Alt. 3 - Road to HNS, ferry SAW-WHB, ferry HNS - SGY						Mainline service to terminate at Auke Bay					
	HNS-SGY HNS	Summer	1	Disp-2	41	8 + 8		15.60	42	$ 7,057,005	$19,363,768
		Winter	1	Disp-2	41	12		10.73	28		
	SAW-WHB-SAW	Summer	2	DayACF	53	8 + 8	8 + 8	16.00	84	$12,306,762	
		Winter	1	DayACF	53	12		11.00	28		
Alt 4 - Marine Alternatives											
Alt. 4A - Fast from AUK						2 Mainlines to Haines/Skagway (S), 1 Mainline to Haines/Skagway (W)					
	HNS-SGY HNS	Summer	1	Disp-1	18	8		6.53	13	$ 2,008,749	$33,694,592
		Winter	1	Disp-1	18	8		3.77	3		
	AUK-HNS-AUK AUK-SGY-AUK	Summer	2	FVF-1	31	8 + 8	8 + 8	13.33	14	$26,513,923	
		Winter	1	FVF-1	31	8 + 8		13.33	7		
	AUK-HNS-SGY-HNS-AUK	Summer	1	Mainliner					2	$ 5,171,919	
		Winter	1	Mainliner					1		
Alt. 4B - Fast from SAW in summer, AUK in winter						2 Mainlines to Haines/Skagway (S), 1 Mainline to Haines/Skagway (W)					
	HNS-SGY HNS	Summer	1	Disp-1	18	8		6.53	13	$ 2,008,749	$31,974,328
		Winter	1	Disp-1	18	8		3.77	3		
	SAW-HNS-SAW SAW-SGY-SAW	summer	2	FVF-1	53	12	12	9.43	14	$24,793,660	
	AUK-HNS-AUK AUK-SGY-AUK	winter	1	FVF-1	53	8 + 8		13.33	7		
	AUK-HNS-SGY-HNS-AUK	Summer	1	Mainliner					2	$ 5,171,919	
		Winter	1	Mainliner					1		
Alt. 4C - Displ from AUK						2 Mainlines to Haines/Skagway (S), 1 Mainline to Haines/Skagway (W)					
	HNS-SGY HNS	Summer	1	Disp-1	18	8		6.53	13	$ 2,008,749	$19,931,176
		Winter	1	Disp-1	18	8		3.77	3		
	AUK-HNS-AUK	Summer	1	DayACF	53	12		11.53	7	$ 6,239,710	
		Winter	1	DayACF	53	12		11.53	3.5		
	AUK-SGY-AUK	Summer	1	DayACF	53	12		11.60	7	$ 6,510,798	
		Winter	1	DayACF	53	12		11.60	3.5		
	AUK-HNS-SGY-HNS-AUK	Summer	1	Mainliner					2	$ 5,171,919	
		Winter	1	Mainliner					1		
Alt. 4D - Displ from SAW in summer, AUK in winter						2 Mainlines to Haines/Skagway (S), 1 Mainline to Haines/Skagway (W)					
	HNS-SGY-HNS	Summer	1	Disp-1	18	8		6.53	13	$ 2,008,749	$20,790,092
		Winter	1	Disp-1	18	8		3.77	3		
	SAW-HNS-SAW	Summer	1	DayACF	53	8 + 8		14.67	14	$ 6,679,671	
	AUK-HNS-AUK	Winter	1	DayACF	53	12		11.53	3.5		
	SAW-SGY-SAW	Summer	1	DayACF	53	8 + 8		15.60	14	$ 6,929,753	
	AUK-SGY-AUK	Winter	1	DayACF	53	12		11.60	3.5		
	AUK-HNS-SGY-HNS-AUK	Summer	1	Mainliner					2	$ 5,171,919	
		Winter	1	Mainliner					1		

Discussion

Detailed Results

The complete definition of each configuration and the detailed results of each calculation are shown in *Attachment C – JAI Marine Alternatives Operating and Capital Costs*.

Price of Fuel

The price of fuel used in this analysis is 3.38 dollars per gallon, based on the price AMHS paid in early 2013. If the price of fuel increases, not all alternatives will be affected the same. For example, HSF operating costs are typically more affected by a fuel cost increase because they use a significantly greater amount of fuel than displacement vessels. The different sensitivities to a change in the cost of fuel is shown for each alternative annual operating cost in Figure 13.

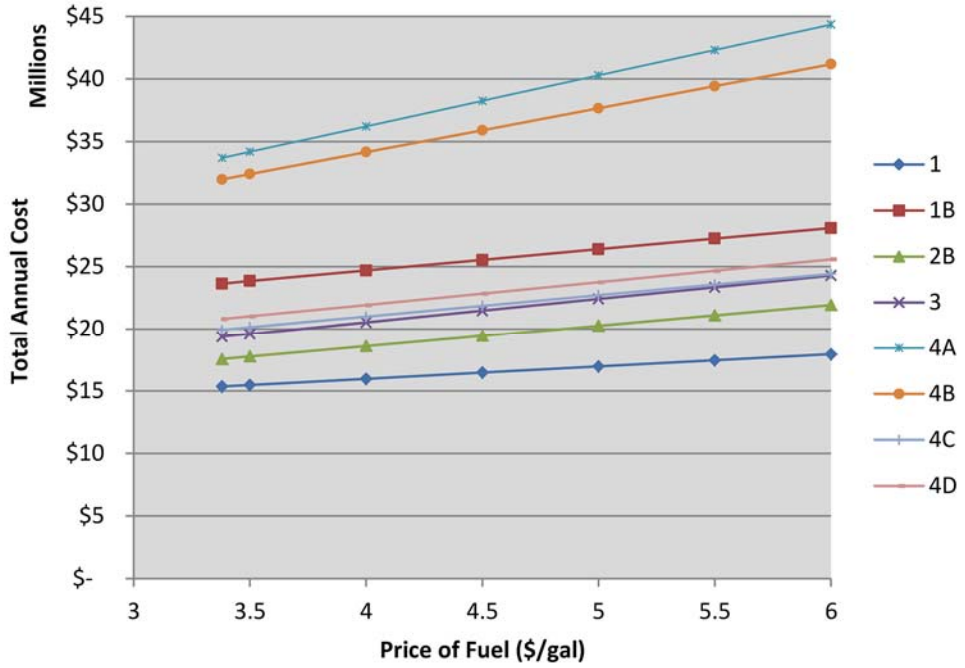

Figure 13
Total Annual Configuration Cost per Price of Fuel

Notes and Limitations

Load/Unload Time

The load and unload times in this analysis are more aggressive than existing AMHS load and unload times and will require special consideration when vessels and terminals are designed. This change to current AMHS operations is required due to the high sailing frequencies on most of the routes and day boat style operation assumed throughout this study. Fast turnaround times are critical to the success and cost effectiveness of high frequency ferry systems.

Actual Implementation of new Ferry systems

This study intends to provide equal comparisons between the marine segments of the JAI reasonable alternatives. Specific implementation of any JAI marine segment will require further study to verify the assumptions made in this study and to integrate existing AMHS assets. The final selection of new vessels and the identification of the vessel (and terminal) characteristics necessary to meet the identified system requirements will also need to be determined.

Data Sources

A variety of data sources were used to analyze the marine segments described by the Juneau Access Improvements Alternatives. They include:

- Alaska Marine Highway System 2012 Annual Financial Report
- Alaska Marine Highway System 20012 Annual Traffic Volume Report
- *Juneau Access Improvements Supplemental Environmental Impact Statement, Lynn Canal Wind and Wave Climatology Study Multi-year Extremes Rev. B,* May 31, 2013, The Glosten Associates.
- *Juneau Access Improvements Supplemental Environmental Impact Statement, Lynn Canal Wind and Wave Climatology Study for Vessel Operations Rev. B,* June 4, 2013, The Glosten Associates.
- *Juneau Access Improvements Supplemental Environmental Impact Statement, Seakeeping and Motion Sickness Incidence – Sawmill Cove to William Henry Bay Rev –,* July 23, 2013, The Glosten Associates.
- *Juneau Access Improvements Supplemental Environmental Impact Statement, Seakeeping and Motion Sickness Incidence Rev –,* June 28, 2013, The Glosten Associates.
- *Juneau Access Improvements Project Supplemental Environmental Impact Statement Traffic Forecast Report,* September 2013, Fehr & Peers
- *Juneau Access Haines/Skagway Traffic Forecast,* November 2012, McDowell Group, Inc.
- *Juneau Access Improvements Supplemental Draft Environmental Impact Statement, Appendix B Marine Segments Technical Report,* September 2004, Coastwise Corporation.
- Code of Federal Regulations, Title 46 – SHIPPING, CHAPTER I--COAST GUARD, DEPARTMENT OF HOMELAND SECURITY, PART 15--MANNING REQUIREMENTS.
- Code of Federal Regulations, Title 46 – SHIPPING, CHAPTER I--COAST GUARD, DEPARTMENT OF HOMELAND SECURITY, PART 71—Inspection & Certification
- U.S. Department Of Labor, Bureau of Labor Statistics, Consumer Price Index, All Urban Consumers - (CPI-U), 2010 – 2013.

Various other data sources, both published and unpublished were used in this analysis as well. These include conversations with appropriate AMHS staff, vessel data sheets for comparative vessels, power systems technical data, etc.

Attachment

The following attachments are provided for the Marine Segments Report.

Attachment A - AMHS Mainline Operating Costs
Attachment B - AMHS Vessel Replacement Costs
Attachment C - JAI Marine Segments Operating and Capital Costs
Attachment D - Capital Improvement Plan (CIP)
Attachment E - Data Tables

JAI AMHS Mainline Operating Costs
Lynn Canal Annual Operating Expenditures - 2012

Alternatives 1, 1B, & 4A-D all include traditional mainline service in North Lynn Canal.

The AMHS has five vessels it could assign to mainline service in North Lynn Canal. Attempting to model vessel operating cost sharing between five vessels over multiple years is beyond the scope of this report. As a reasonable approximation, this analysis uses the vessel cost data for fiscal year 2012.

AMHS provided the vessel cost information, number of operating days in Lynn Canal, and number of miles operation in Lynn Canal for each of the AMHS vessels

As a reasonable approximation, this report assumes that the Matanuska, Columbia and Taku are the only vessels operating on mainline routes during 2012. A detailed analysis of vessel service during FY 2012 is beyond the scope of this report

Comparison of Vessel Operating Days

	Vessel Days			
Vessel	**Total**	**NLC**	**NLC %**	**Mainline Days**
Aurora	105.2	-	0.0%	
Chenega	136.7	-	0.0%	
Columbia	122.6	15.3	12.5%	15.3
Fairweather	226.8	5.8	2.5%	
Kennicott	176.4	-	0.0%	
LeConte	274.3	110.9	40.4%	
Lituya	289.5	-	0.0%	
Malaspina	156.3	99.7	63.8%	
Matanuska	241.3	24.8	10.3%	24.8
Taku	276.8	0.8	0.3%	0.8
Tustumena	245.7	-	0.0%	
Contract Vessels	8.6	-	0.0%	
Total Vessel Days	**2,260.0**	**257.2**	**11.4%**	**40.9**

Comparison of Non-Fuel Operating Expenditures (By Operating Days)

	Total Non-Fuel Operating Expenses ($000)			
Vessel	**Total**	**NLC %**	**NLC $$$**	**Mainliner $$$**
Aurora	$ 4,969.7	0.0%	$ -	
Chenega	$ 6,526.4	0.0%	$ -	
Columbia	$ 15,170.6	12.5%	$ 1,894.2	$ 1,894.2
Fairweather	$ 6,797.6	2.5%	$ 172.9	
Kennicott	$ 14,983.8	0.0%	$ -	
LeConte	$ 9,145.5	40.4%	$ 3,697.0	
Lituya	$ 1,410.6	0.0%	$ -	
Malaspina	$ 11,908.4	63.8%	$ 7,593.2	
Matanuska	$ 16,609.6	10.3%	$ 1,707.9	$ 1,707.9
Taku	$ 15,171.5	0.3%	$ 45.7	$ 45.7
Tustumena	$ 10,688.8	0.0%	$ -	
Contract Vessels	$ 77.0	0.0%	$ -	
Sub Total Direct	$ 113,459.4	13.3%	$ 15,110.9	**$ 3,647.8**
				24% *% Mainliner*

JAI AMHS Mainline Operating Costs
Lynn Canal Annual Operating Expenditures - 2012

Comparison of Vessel Miles

Vessel	Vessel Miles Total	NLC	NLC %	Mainline Miles
Aurora	27,010.0	-	0.0%	
Chenega	40,874.0	-	0.0%	
Columbia	53,193.0	2,444.0	4.6%	2444
Fairweather	56,979.0	2,728.0	4.8%	
Kennicott	61,911.0	-	0.0%	
LeConte	53,825.0	10,708.0	19.9%	
Lituya	16,608.0	-	0.0%	
Malaspina	39,601.0	13,147.0	33.2%	
Matanuska	79,750.0	3,640.0	4.6%	3640
Taku	80,286.0	94.0	0.1%	94
Tustumena	57,198.0	-	0.0%	
Contract Vessels	2,908.0	-	0.0%	
Total Vessel Miles	**570,143.0**	**32,761.0**	**5.7%**	**6178.0**

Comparison of Fuel Expenditures (By Vessel Miles)

Vessel	Total Fuel Expenses ($000) Total	NLC %	NLC $$$	Mainline $$$
Aurora	$ 1,225.3	0.0%	$ -	
Chenega	$ 3,638.6	0.0%	$ -	
Columbia	$ 5,272.4	4.6%	$ 242.2	$ 242.2
Fairweather	$ 4,071.4	4.8%	$ 194.9	
Kennicott	$ 6,137.2	0.0%	$ -	
LeConte	$ 2,688.5	19.9%	$ 534.9	
Lituya	$ 329.4	0.0%	$ -	
Malaspina	$ 2,827.6	33.2%	$ 938.7	
Matanuska	$ 4,882.4	4.6%	$ 222.8	$ 222.8
Taku	$ 4,262.5	0.1%	$ 5.0	$ 5.0
Tustumena	$ 2,745.2	0.0%	$ -	
Contract Vessels	$ -	0.0%	$ -	
Sub Total Fuel	$ 38,080.6	5.6%	$ 2,138.6	**$ 470.1**

JAI AMHS Mainline Operating Costs
Lynn Canal Annual Operating Expenditures - 2012

Comparison of Shoreside Costs

	Shoreside Expenses ($000)			
Shoreside Cost Categories	**Total**	**NLC %**	**NLC $$$**	**Mainline $$$**
Support Services	$ 2,363.0	13.3%	$ 314.7	$ 75.97
Marine Engineering	$ 2,059.0	13.3%	$ 274.2	$ 66.20
Operations Management	$ 4,450.0	13.3%	$ 592.7	$ 143.07
Reservations & Marketing	$ 2,475.0	12.3%	$ 304.2	$ 73.44
Shore Operations	$ 8,155.0	20.4%	$ 1,666.0	$ 402.17
Subtotal Shoreside Costs	$ 19,502.0	16.2%	$ 3,151.8	**$ 760.85**

Comparison of Overhaul Costs (By Operating Days)

	Overhaul Expenses ($000)		
Vessel	**Total FY 12**	**NLC %**	**NLC $$$**
Columbia	$ 1,533.4	12.5%	$ 191.5
Matanuska	$ 942.7	10.3%	$ 96.9
Taku	$ 1,601.7	0.3%	$ 4.8
Sub Total State Overhaul	$ 4,077.8	7%	$ 293.2

Mainline Annual Cost Summary ($000)

Annual Operating Expenditures	$ 3,647.8
Total Fuel Expenses	$ 470.1
Shoreside Costs	$ 760.85
State Overhaul Costs	$ 293.22
Total NLC Mainliner Costs	***$ 5,171.9***

Notes:

1) NLC - North Lynn Canal

2) $000 - All costs are in thousands of dollars.

AMHS Vessel Replacement Costs [1]

	LeConte	Columbia	Matanuska / Malaspina	Taku	Day Boat ACF
A) Hull Structure (Below Main Deck)					
1 Hull Structure	8.5 M $	28.7 M $	22.8 M $	18.6 M $	10.6 M $
2 Crew/Passenger Flat Structure	0.6 M $	2.1 M $	1.1 M $	1.0 M $	0.0 M $
B) Superstructure (Above Main Deck)					
1 Superstructure	2.7 M $	20.4 M $	11.2 M $	8.4 M $	4.6 M $
2 Enclosed car deck	2.5 M $	8.3 M $	6.3 M $	5.4 M $	2.1 M $
C) Accommodation Outfit					
1 Low density Spaces	1.2 M $	9.8 M $	6.8 M $	4.9 M $	6.0 M $
2 High density Spaces	17.4 M $	121.9 M $	69.8 M $	51.2 M $	3.7 M $
3 Car Deck	4.0 M $	15.3 M $	9.7 M $	8.1 M $	3.3 M $
D) Machinery					
1 Engines, propulsion, etc	6.7 M $	16.2 M $	10.6 M $	10.5 M $	6.5 M $
2 Special Equipment	0.0 M $	5.0 M $	0.0 M $	0.0 M $	3.5 M $
3 Electrical	5.4 M $	12.6 M $	8.3 M $	5.5 M $	4.5 M $
Subtotal	**48.9 M $**	**240.3 M $**	**146.6 M $**	**113.5 M $**	**44.9 M $**
E) Lofting/Trials&Testing/Delivery (to west coast)/Insurance	4.6 M $	22.8 M $	13.9 M $	10.8 M $	4.3 M $
Subtotal	**53.6 M $**	**263.1 M $**	**160.5 M $**	**124.3 M $**	**49.2 M $**
F) SOLAS	0.0 M $	26.3 M $	16.1 M $	12.4 M $	0.0 M $
Total Vessel Capital Cost					
Lower Range	**48.22 M $**	**260.45 M $**	**158.92 M $**	**123.06 M $**	**44.28 M $**
Upper Range	**58.94 M $**	**318.33 M $**	**194.23 M $**	**150.41 M $**	**54.12 M $**
Mean	**53.6 M $**	**289.4 M $**	**176.6 M $**	**136.7 M $**	**49.2 M $**
Project Engineering 13.5%	7.23 M $	39.07 M $	23.84 M $	18.46 M $	6.64 M $
ICAP 4.79%	2.57 M $	13.86 M $	8.46 M $	6.55 M $	2.36 M $
Contingency 10%	5.36 M $	28.94 M $	17.66 M $	13.67 M $	4.92 M $
Vessel Program Cost	**68.74 M $**	**371.26 M $**	**226.53 M $**	**175.42 M $**	[2] **63.11 M $**

(1) The above cost estimates are for in kind vessel replacement only (same size, capacity, # of decks, etc). AMHS frequently replaces vessels with larger, multipurpose vessels which increases acquisition costs. Model is in 2013 $.

(2) The Day Boat ACF is still in the early design process. The Day Boat ACF capital cost shown is based on the same parametric cost model used to generate the replacement costs for existing AMHS vessels. More accurate cost estimates will be known as the design progresses.

Forecast of AMHS Vessel Replacement Age

Forecasting vessel replacement age is very complex and is subject to vessel condition, vessel mission, funding, etc. For the purpose of this study, it is assumed that the average vessel replacement age will be 60 years, starting from the date of original construction. Approximate vessel replacement years are forecasted below.

	LeConte	Columbia	Matanuska / Malaspina	Taku	Day Boat ACF
Current (2013) Age	39	39	50	50	Currently in Design Phases
Replacement Year	**2034**	**2034**	**2023**	**2023**	

AMHS Vessel Replacement Costs

The replacement costs of existing AMHS vessels in JAI Lynn Canal service will be prorated by the percentage of operation provided in North Lynn Canal (NLC).

Mainline Replacement Costs

Alternatives 1, 1B, & 4A-D all include traditional mainline service in North Lynn Canal (NLC).

The AMHS has five vessels it could assign to mainline service in NLC. Attempting to model vessel replacement cost sharing between five vessels is beyond the scope of this report. As a reasonable approximation, this analysis assumes that two primary mainline vessels (Columbia and Matanuska) operate in NLC.

Mainline operation is assumed to be two trips per week in the summer (Columbia and Matanuska) and one trip per week in the winter (Matanuska, except when in overhaul). As shown in Attachment A, 12.5% of the Columbia and 10.3% of the Matanuska cost can be attributed to NLC operation.

	LeConte	Columbia	Matanuska / Malaspina	Taku	Day Boat ACF
Mainline Route Sharing		12.5%	10.3%		
NLC Portion of Capital Cost		**46.41 M $**	**23.33 M $**		

Malaspina Replacement Costs (Alternative 1B)

Alternative 1B includes NLC use of the Malaspina during the summer months. During the winter, the Malaspina is shared and operates on AMHS mainline routes. Assuming annual availability of 40 weeks and vessel operation in NLC for 22 weeks, the NLC portion of the replacement cost is 55% of the total cost.

The Malaspina is larger than required for both the summer NLC dayboat service in Alternative 1B, and winter mainline service. For this report, the Malaspina replacement cost is based on a more appropriately sized vessel such as the Taku.

	LeConte	Columbia	Matanuska / Malaspina	Taku	Day Boat ACF
Alt 1B (Malaspina) sharing				55%	
NLC Portion of Capital Cost				**96.48 M $**	

Introduction

The following is an attachment of the *Juneau Access Improvements (JAI) Marine Segments Technical Report* dated 2014. The intent of this attachment is to document the detailed cost calculations used to estimate the operating and capital costs for each marine route of each alternative.

A detailed discussion of the definitions and methodology used in the calculations, and this attachment, is included in the body of the Marine Segments report.

General Notes

In general, exclusions or anomalies in the calculations are described in footnotes located below the Summary Section of each alternative. However, the following general notes apply to all alternatives:

1) Many alternatives continue to use existing AMHS mainline service for two trips per week in the summer. These routes are described as “AUK-HNS-SGY-HNS-AUK” and the vessels described as “Mainliners.” The “Mainliner” operational costs attributed to North Lynn Canal service are not calculated by the Coastwise operation cost model. Instead the Mainline operational costs are based on existing AMHS mainline service, which are calculated in Attachment A. Where applicable, the Mainline operational costs are summarized in each of the Alternative Summary sections.

2) Existing AMHS vessels or vessels currently programmed for State acquisition are assumed to have zero capital (vessel acquisition) cost.

3) Vessels shown operating for a full year are also shown to include costs for overhaul periods. This is an anomaly, as a vessel in overhaul by definition cannot be operating. However, from a practical standpoint, this is a reasonable way to account for total annual operation cost as the vessel in overhaul would be temporarily replaced with a similar AMHS vessel and the cost to operate the temporary AMHS vessel is already included in the annual cost analysis.

Summary of Alternatives

Alt	Route	Season	Vessels			Crew Hrs		Op Hrs	# Trips	Annual $	
			#	Designation	# ASV	Vessel 1	Vessel 2	hrs/day	Trips per Wk	Per Vessel	Per Alternative
1. No Build											
Alt 1 - No Action						2 Mainlines to Haines/Skagway (S), 1 Mainline to Haines/Skagway (W)					
	HNS-SGY HNS	Summer	1	DayACF	53	8		6.53	13	$ 4,145,342	
		Winter	1	DayACF	53	8		6.53	6		
	AUK-HNS-AUK	Summer	1	DayACF	53	12		11.53	6	$ 6,036,830	$15,354,091
		Winter	1	DayACF	53	12		11.53	3		
	AUK-HNS-SGY-HNS-AUK	Summer	1	Mainliner					2	$ 5,171,919	
		Winter	1	Mainliner					1		
Alt 1B - Enhanced Service with Existing AMHS Assets						2 Mainlines to Haines/Skagway (S), 1 Mainline to Haines/Skagway (W)					
	HNS-SGY HNS	Summer	1	DayACF	53	8		6.53	13	$ 4,145,342	
		Winter	1	DayACF	53	8		6.53	6		
	AUK-HNS-AUK	Summer	1	DayACF	53	12		11.53	6	$ 6,036,830	
		Winter	1	DayACF	53	12		11.53	3		$23,641,636
	SGY-AUK-SGY	Summer	1	MAL	88	12 + 12		13.60	7	$ 8,287,545	
		Winter	0								
	AUK-HNS-SGY-HNS-AUK	Summer	1	Mainliner					2	$ 5,171,919	
		Winter	1	Mainliner					1		
2 East Lynn Canal											
Alt. 2B - Road to KTZ, ferry to SGY and HNS						Mainline service to terminate at Auke Bay					
	HNS-SGY HNS	Summer	1	Disp-1	18	8		6.53	14	$ 1,354,331	
		Winter	0								
	HNS-KTZ-HNS	Summer	1	DayACF-X	53	8 + 8		13.80	56	$ 7,649,921	$17,561,593
		Winter	1	DayACF-X	53	12		10.60	42		
	SGY-KTZ-SGY	Summer	1	DayACF-X	53	8 + 8		16.00	42	$ 8,557,341	
		Winter	1	DayACF-X	53	12		11.00	28		
Alt 3 - West Lynn Canal											
Alt. 3 - Road to HNS, ferry SAW-WHB, ferry HNS - SGY						Mainline service to terminate at Auke Bay					
	HNS-SGY HNS	Summer	1	Disp-2	41	8 + 8		15.60	42	$ 7,057,005	
		Winter	1	Disp-2	41	12		10.73	28		$19,363,768
	SAW-WHB-SAW	Summer	2	DayACF	53	8 + 8	8 + 8	16.00	84	$12,306,762	
		Winter	1	DayACF	53	12		11.00	28		
Alt 4 - Marine Alternatives											
Alt. 4A - Fast from AUK						2 Mainlines to Haines/Skagway (S), 1 Mainline to Haines/Skagway (W)					
	HNS-SGY HNS	Summer	1	Disp-1	18	8		6.53	13	$ 2,008,749	
		Winter	1	Disp-1	18	8		3.77	3		
	AUK-HNS-AUK	Summer	2	FVF-1	31	8 + 8	8 + 8	13.33	14	$26,513,923	$33,694,592
	AUK-SGY-AUK	Winter	1	FVF-1	31	8 + 8		13.33	7		
	AUK-HNS-SGY-HNS-AUK	Summer	1	Mainliner					2	$ 5,171,919	
		Winter	1	Mainliner					1		
Alt. 4B - Fast from SAW in summer, AUK in winter						2 Mainlines to Haines/Skagway (S), 1 Mainline to Haines/Skagway (W)					
	HNS-SGY HNS	Summer	1	Disp-1	18	8		6.53	13	$ 2,008,749	
		Winter	1	Disp-1	18	8		3.77	3		
	SAW-HNS-SAW SAW-SGY-SAW	summer	2	FVF-1	53	12	12	9.43	14	$24,793,660	$31,974,328
	AUK-HNS-AUK AUK-SGY-AUK	winter	1	FVF-1	53	8 + 8		13.33	7		
	AUK-HNS-SGY-HNS-AUK	Summer	1	Mainliner					2	$ 5,171,919	
		Winter	1	Mainliner					1		
Alt. 4C - Displ from AUK						2 Mainlines to Haines/Skagway (S), 1 Mainline to Haines/Skagway (W)					
	HNS-SGY HNS	Summer	1	Disp-1	18	8		6.53	13	$ 2,008,749	
		Winter	1	Disp-1	18	8		3.77	3		
	AUK-HNS-AUK	Summer	1	DayACF	53	12		11.53	7	$ 6,239,710	
		Winter	1	DayACF	53	12		11.53	3.5		$19,931,176
	AUK-SGY-AUK	Summer	1	DayACF	53	12		11.60	7	$ 6,510,798	
		Winter	1	DayACF	53	12		11.60	3.5		
	AUK-HNS-SGY-HNS-AUK	Summer	1	Mainliner					2	$ 5,171,919	
		Winter	1	Mainliner					1		
Alt. 4D - Displ from SAW in summer, AUK in winter						2 Mainlines to Haines/Skagway (S), 1 Mainline to Haines/Skagway (W)					
	HNS-SGY-HNS	Summer	1	Disp-1	18	8		6.53	13	$ 2,008,749	
		Winter	1	Disp-1	18	8		3.77	3		
	SAW-HNS-SAW	Summer	1	DayACF	53	8 + 8		14.67	14	$ 6,679,671	
	AUK-HNS-AUK	Winter	1	DayACF	53	12		11.53	3.5		$20,790,092
	SAW-SGY-SAW	Summer	1	DayACF	53	8 + 8		15.60	14	$ 6,929,753	
	AUK-SGY-AUK	Winter	1	DayACF	53	12		11.60	3.5		
	AUK-HNS-SGY-HNS-AUK	Summer	1	Mainliner					2	$ 5,171,919	
		Winter	1	Mainliner					1		

Alternative Summary

Alternative: 1

Alt	Route	Season	Vessels			Crew Hrs		Op Schedule		
			No.	Designation	# ASV	Vessel 1	Vessel 2	hrs/day	Days per Week	Round trips per day
1. No Build										
Alt 1 - No Action			2 Mainlines to Haines/Skagway (S), 1 Mainline to Haines/Skagway (W)							
	HNS-SGY-HNS	Summer	1	DayACF	53	8	-	6.53	6	2
						8	-	6.53	1	1
		Winter	1	DayACF	53	8		6.53	3	2
	AUK-HNS-AUK	Summer	1	DayACF	53	12	-	11.53	6	1
		Winter	1	DayACF	53	12		11.53	3	1
	AUK-HNS-SGY-HNS-AUK	Summer	1	Mainliner					2	1
		Winter	1	Mainliner					1	1

Configuration Cost Summary

Route Name	Annual Costs					Total Annual Costs	Capital Costs
	Crew	Fuel	Lay-up	Maintenance	Overhead		
HNS-SGY-HNS	$ 2,387,395	$ 805,275	$ -	$ 577,890	$ 374,782	***$ 4,145,342***	
AUK-HNS-AUK	$ 2,984,316	$ 2,070,784	$ -	$ 624,532	$ 357,198	***$ 6,036,830***	
AUK-HNS-SGY-HNS-AUK	$ 3,647,773	$ 470,078	$ -	$ 293,218	$ 760,850	***$ 5,171,919***	
Configuration Total	*$ 9,019,484*	*$ 3,346,137*	*$ -*	*$ 1,495,640*	*$ 1,492,830*	**$ 15,354,091**	

Notes:

Route Operation and Schedule Model

Route: HNS-SGY-HNS

Route Service Input (Management Plan Appendix A)

Season	Operation hrs / day	Vsl Days/ Wk	Vessel Description		
			Quantity	Type	Designation
Summer	8.00	6.5	1	Displ	DayACF
Winter	8.00	3.0	1	Displ	DayACF

Crew / Vessel Availability

Season	Vessel No.	Crew Shift		Vessel Preparation Times				Vessel Availability (hrs)
		Crew 1 (hrs)	Crew 2 (hrs)	Startup (mins)	Load (mins)	Unload (mins)	Shutdown (mins)	
Summer	Vessel 1	8.00	-	30	15	15	30	7.00
		-	-	-	-	-	-	-
Winter	Vessel 1	8.00	-	30	15	15	30	7.00

Route Transit Time

Leg No.	Speed	Outbound		Cruise At Speed	Inbound		Round Trip Time Underway		Round Trip Total Transit Time [1]	
		Load	Manuv		Manuv	Unload				
	(knots)	(hrs)	(hrs)	(hrs)	(hrs)	(hrs)	(hrs)	(mins)	(hrs)	(mins)
HNS-SGY	15.00	0.25	0.05	0.81	0.03	0.25	-	53	1	23
SGY-HNS	15.00	0.25	0.03	0.81	0.05	0.25	-	53	1	23
	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-
Total Route Time		**0.50**	**0.08**	**1.62**	**0.08**	**0.50**	1	46	2	46

1) Transit time = Time Underway + Load + Unload

HNS-SGY-HNS Daily Schedules

Model Schedule

Notional schedules are developed to verify number of round trips and determine crew times. Schedule start times are arbitrary. Notional schedules are not intended to show route connections or homeport locations. Final schedules and homeport locations will be based on system implementation.

Summer

	Vessel 1	1st Dep	6:00 AM	1st Load	5:45 AM

Total Crew Time		Circuit	Depart	Arrive	Depart	Arrive
Crew 1	Crew 2	No.	Haines	Skagway	Skagway	Haines
3.30		1	6:00 AM	6:53 AM	7:25 AM	8:18 AM
6.63		2	8:50 AM	9:43 AM	10:15 AM	11:08 AM

Winter

	Vessel 1	1st Dep	8:00 AM	1st Load	7:45 AM

Total Crew Time	Circuit	Depart	Arrive	Depart	Arrive
Crew 1	No.	Haines	Skagway	Skagway	Haines
3.30	1	8:00 AM	8:53 AM	9:25 AM	10:18 AM
6.63	2	10:50 AM	11:43 AM	12:15 PM	1:08 PM

Route Operation and Schedule Model

Daily Schedule Statistics (per day)

Season	Round Trips		Daily Underway Time				Daily Operational Time [2,3]			
	Vessel 1	Vessel 2	Vessel 1		Vessel 2		Vessel 1		Vessel 2	
	(# / day)	(# / day)	(hrs / day)	% of Day	(hrs / day)	% of Day	(hrs / day)	% of Day	(hrs / day)	% of Day
Summer	2	-	3.53	14.7%	-		6.53	27.2%	0.00	0.0%
Winter	2		3.53	14.7%			6.53	27.2%		

[2] Daily Operational Time = (Round Trip Transit Time * Number of Round Trips) + Startup + Shutdown

[3] Schedule operational time may be slightly greater due to departure time adjustments

Daily Crew Statistics (per day)

Season	Vessel No.	# of Crews (per day)	Crew Shift		Crew Usage			
			Crew 1 (hrs / day)	Crew 2 (hrs / day)	Crew 1		Crew 2	
					(hrs / day)	% of Shift	(hrs / day)	% of Shift
Summer	Vessel 1	1	8	-	6.63	82.9%		
Summer		-	-	-				
Winter	Vessel 1	1	8		6.63	82.9%		

HNS-SGY-HNS Weekly Service Summary (per week)

Season	Vessel No.	Crew (days/wk)	Crew Time [4]		Vessel Operation (days/wk)	Trips /Wk	Underway Time (hrs / wk)	Operating Hours (hrs / wk)
			Crew 1 (hrs / wk)	Crew 2 (hrs / wk)				
Summer	Vessel 1	7	56.00	-	6.5	13.0	22.97	42.47
Summer			-	-	-	-	-	-
Winter	Vessel 1	5	40.00		3.0	6.0	10.60	19.60

[4] Crew Time = Crew shift * Crew days per week

Route Cost Model

Route: HNS-SGY-HNS

Vessel Definition

Type	ASV
Displ	53

Season Definition

Season	#Days	# Weeks	# Op Days
Summer	153	21.9	142
Winter	212	30.3	91

Annual Operational Costs

1. Crew Costs (by week)

Season	# Weeks	Crew Time (hrs/week) Vessel #1	Vessel #2	Total Crew (hrs / season)	Crew Cost ($ / hr)	Total Cost ($ / season)
Summer	21.9	56.00	-	1,224.00	$ 698.74	$ 855,254
Night [1)]		84.00	-	1,836.00	$ 156.55	$ 287,418
Winter	30.3	40.00		1,211.43	$ 698.74	$ 846,470
Night [1)]		84.00		2,544.00	$ 156.55	$ 398,252
Total	**52.1**					**$ 2,387,395**

[1)] Night Crew is capped to 84 hrs per week. Night crew may be re-assigned to watch vessel on non-operational days.

2. Fuel Consumption Costs (by week)

Season	# Weeks	Time Underway Vessel #1 (hrs / wk)	Vessel #2 (hrs / wk)	Total Underway (hrs / season)	Fuel Cost ($ / gal)	Fuel Consumption (gal / hr)	Total Cost ($ / season)
Summer	21.9	22.97	-	501.99	$ 3.38	289.48	$ 491,166
Winter	30.3	10.60		321.03	$ 3.38	289.48	$ 314,109
Total	**52.1**			**823.01**			**$ 805,275**

3. Winter Lay-up Cost (by day)

Season	# Days	# Vessels	Cost / Day	Total
winter	212	-	$ -	**$ -**

Annual Overhead Costs (by day)

Season	Annual Operating Days Vessel #1	Vessel #2	Total	($ / day)	Route Overhead Costs Vessel #1	Vessel #2	Total
Summer	142	-	142	$ 1,609	$ 228,593	$ -	$ 228,593
Winter	91		91	$ 1,609	$ 146,189		$ 146,189
Total	**233**	**-**	**233**		**$ 374,782**	**$ -**	**$ 374,782**

Annual Maintenance Costs (by week)

Season	# weeks	Annual Operating Hours Vessel #1 (hrs / wk)	Vessel #2 (hrs / wk)	Total (hrs / wk)	Total (hrs / season)
Summer	21.9	42.47	-	42.47	928
Winter	30.3	19.60		19.60	594
Total	**52.1**				**1,522**

	Vessel Operation (eng op hrs)	($ / hr)	Vessel Overhaul (# Vessels)	($ / Vessel)	Total Cost
Operating	1,522	$ 44.91			$ 68,342
Overhaul			1.0	$ 509,547	$ 509,547
Total Vessel Maintenance Costs					**$ 577,890**

Total Annual Route Costs

Total Annual Operational Costs	$ 3,192,670
Total Annual Layup Costs	$ -
Total Annual Overhead Costs	$ 374,782
Total Annual Maintenance Costs	$ 577,890
Total Annual Costs	**$ 4,145,342**

Route Operation and Schedule Model

Route: AUK-HNS-AUK

Route Service Input (Management Plan Appendix A)

Season	Operation hrs / day	Vsl Days/ Wk	Vessel Description		
			Quantity	Type	Designation
Summer	12.00	6.0	1	Displ	DayACF
Winter	12.00	3.0	1	Displ	DayACF

Crew / Vessel Availability

Season	Vessel No.	Crew Shift		Vessel Preparation Times				Vessel Availability
		Crew 1 (hrs)	Crew 2 (hrs)	Startup (mins)	Load (mins)	Unload (mins)	Shutdown (mins)	(hrs)
Summer	Vessel 1	12.00	-	30	15	15	30	11.00
		-	-	-	-	-	-	-
Winter	Vessel 1	12.00	-	30	15	15	30	11.00

Route Transit Time

Leg No.	Speed	Outbound		Cruise	Inbound		Round Trip		Round Trip	
		Load	Manuv	At Speed	Manuv	Unload	Time Underway		Total Transit Time [1]	
	(knots)	(hrs)	(hrs)	(hrs)	(hrs)	(hrs)	(hrs)	(mins)	(hrs)	(mins)
AUK-HNS	15.00	0.25	0.47	4.24	0.06	0.25	4	46	5	16
HNS-AUK	15.00	0.25	0.06	4.24	0.47	0.25	4	46	5	16
	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-
Total Route Time		**0.50**	**0.53**	**8.48**	**0.53**	**0.50**	9	32	10	32

1) Transit time = Time Underway + Load + Unload

AUK-HNS-AUK Daily Schedules

Model Schedule

Notional schedules are developed to verify number of round trips and determine crew times. Schedule start times are arbitrary. Notional schedules are not intended to show route connections or homeport locations. Final schedules and homeport locations will be based on system implementation.

Summer

	Vessel 1	1st Dep	6:00 AM	1st Load	5:45 AM

Total Crew Time		Circuit	Depart	Arrive	Depart	Arrive
Crew 1	Crew 2	No.	Auke Bay	Haines	Haines	Auke Bay
11.60		1	6:00 AM	10:46 AM	11:20 AM	4:06 PM

Winter

	Vessel 1	1st Dep	8:00 AM	1st Load	7:45 AM

Total Crew Time		Circuit	Depart	Arrive	Depart	Arrive
Crew 1		No.	Auke Bay	Haines	Haines	Auke Bay
11.60		1	8:00 AM	12:46 PM	1:20 PM	6:06 PM

Route Operation and Schedule Model

Daily Schedule Statistics (per day)

Season	Round Trips		Daily Underway Time				Daily Operational Time [2,3]			
	Vessel 1	Vessel 2	Vessel 1		Vessel 2		Vessel 1		Vessel 2	
	(# / day)	(# / day)	(hrs / day)	% of Day	(hrs / day)	% of Day	(hrs / day)	% of Day	(hrs / day)	% of Day
Summer	1	-	9.53	39.7%	-		11.53	48.1%	0.00	0.0%
Winter	1		9.53	39.7%			11.53	48.1%		

2) Daily Operational Time = (Round Trip Transit Time * Number of Round Trips) + Startup + Shutdown

3) Schedule operational time may be slightly greater due to departure time adjustments

Daily Crew Statistics (per day)

Season	Vessel No.	# of Crews (per day)	Crew Shift		Crew Usage			
			Crew 1 (hrs / day)	Crew 2 (hrs / day)	Crew 1 (hrs / day)	Crew 1 % of Shift	Crew 2 (hrs / day)	Crew 2 % of Shift
Summer	Vessel 1	1	12	-	11.60	96.7%		
Summer		-	-	-				
Winter	Vessel 1	1	12		11.60	96.7%		

AUK-HNS-AUK Weekly Service Summary (per week)

Season	Vessel No.	Crew (days/wk)	Crew Time [4]		Vessel Operation (days/wk)	Trips /Wk	Underway Time (hrs / wk)	Operating Hours (hrs / wk)
			Crew 1 (hrs / wk)	Crew 2 (hrs / wk)				
Summer	Vessel 1	7	84.00	-	6.0	6.0	57.20	69.20
Summer			-	-	-	-	-	-
Winter	Vessel 1	4	48.00		3.0	3.0	28.60	34.60

4) Crew Time = Crew shift * Crew days per week

Route Cost Model

Route: AUK-HNS-AUK

Vessel Definition

Type	ASV
Displ	53

Season Definition

Season	#Days	# Weeks	# Op Days
Summer	153	21.9	131
Winter	212	30.3	91

Annual Operational Costs

1. Crew Costs (by week)

Season	# Weeks	Crew Time (hrs/week) Vessel #1	Vessel #2	Total Crew (hrs / season)	Crew Cost ($ / hr)	Total Cost ($ / season)
Summer	21.9	84.00	-	1,836.00	$ 698.74	$ 1,282,881
Night [1)]		84.00	-	1,836.00	$ 156.55	$ 287,418
Winter	30.3	48.00		1,453.71	$ 698.74	$ 1,015,764
Night [1)]		84.00		2,544.00	$ 156.55	$ 398,252
Total	**52**					**$ 2,984,316**

[1)] Night Crew is capped to 84 hrs per week. Night crew may be re-assigned to watch vessel on non-operational days.

2. Fuel Consumption Costs (by week)

Season	# Weeks	Time Underway Vessel #1 (hrs / wk)	Vessel #2 (hrs / wk)	Total Underway (hrs / season)	Fuel Cost ($ / gal)	Fuel Consumption (gal / hr)	Total Cost ($ / season)
Summer	21.9	57.20	-	1,250.23	$ 3.38	289.48	$ 1,223,282
Winter	30.3	28.60		866.17	$ 3.38	289.48	$ 847,502
Total	**52**			**2,116.40**			**$ 2,070,784**

3. Winter Lay-up Cost (by day)

Season	# Days	# Vessels	Cost / Day	Total
winter	212	-	$ -	**$ -**

Annual Overhead Costs (by day)

Season	Annual Operating Days Vessel #1	Vessel #2	Total	($ / day)	Route Overhead Costs Vessel #1	Vessel #2	Total
Summer	131	-	131	$ 1,609	$ 211,009	$ -	$ 211,009
Winter	91		91	$ 1,609	$ 146,189		$ 146,189
Total	**222**	**-**	**222**		**$ 357,198**	**$ -**	**$ 357,198**

Annual Maintenance Costs (by week)

Season	# weeks	Annual Operating Hours Vessel #1 (hrs / wk)	Vessel #2 (hrs / wk)	Total (hrs / wk)	Total (hrs / season)
Summer	21.9	69.20	-	69.20	1,513
Winter	30.3	34.60		34.60	1,048
Total	**52**				**2,560**

	Vessel Operation (eng op hrs)	($ / hr)	Vessel Overhaul (# Vessels)	($ / Vessel)	Total Cost
Operating	2,560	$ 44.91			$ 114,985
Overhaul			1.0	$ 509,547	$ 509,547
Total Vessel Maintenance Costs					**$ 624,532**

Total Annual Route Costs

Total Annual Operational Costs	$ 5,055,100
Total Annual Layup Costs	$ -
Total Annual Overhead Costs	$ 357,198
Total Annual Maintenance Costs	$ 624,532
Total Annual Costs	**$ 6,036,830**

Alternative Summary

Alternative: 1B

Alt	Route	Season	Vessels			Crew Hrs		Op Schedule		
			No.	Designation	# ASV	Vessel 1	Vessel 2	hrs/day	Days per Week	Round trips per day
1. No Build										
Alt 1A - Enhanced Service with Existing AMHS Assets			2 Mainlines to Haines/Skagway (S), 1 Mainline to Haines/Skagway (W)							
	HNS-SGY-HNS	Summer	1	DayACF	53	8	-	6.53	6	2
						8	-	6.53	1	1
		Winter	1	DayACF	53	8		6.53	**3**	2
	AUK-HNS-AUK	Summer	1	DayACF	53	12		11.53	6	1
		Winter	1	DayACF	53	12		11.53	**3**	1
	SGY-AUK-SGY	Summer	1	MAL	88	24		13.60	7	1
		Winter	0	MAL	88	-		-	**0**	0
	AUK-HNS-SGY-HNS-AUK	Summer	1	Mainliner					2	1
		Winter	1	Mainliner					1	1

Alternative Cost Summary

Route Name	Annual Costs					Total Annual Costs	Capital Costs
	Crew	Fuel	Lay-up	Maintenance	Overhead		
HNS-SGY-HNS	$ 2,387,395	$ 805,275	$ -	$ 577,890	$ 374,782	***$ 4,145,342***	
AUK-HNS-AUK	$ 2,984,316	$ 2,070,784	$ -	$ 624,532	$ 357,198	***$ 6,036,830***	
SGY-AUK-SGY	$ 4,852,800	$ 2,391,443	$ -	$ 797,125	$ 246,177	***$ 8,287,545***	
AUK-HNS-SGY-HNS-AUK	$ 3,647,773	$ 470,078	$ -	$ 293,218	$ 760,850	***$ 5,171,919***	
Alternative Total	*$ 13,872,283*	*$ 5,737,580*	*$ -*	*$ 2,292,765*	*$ 1,739,007*	**$ 23,641,636**	**$ -**

Notes:

1) In this alternative the M/V Malaspina is shared: the vessel needs to function on AMHS mainline routes during the winter and then operate in Lynn Canal during the summer. Assuming annual vessel availability is 40 weeks and the vessel operates in Lynn Canal 22 weeks, the Lynn Canal portion of annual operation is 55%.

2) Since the Malaspina is an existing AMHS vessel, actual AMHS crew cost is used instead of calculated.

3) Since the Malaspina is an existing AMHS vessel, actual AMHS overhaul costs are used to estimate overhaul costs attributed to Lynn Canal. The total overhaul cost is reduced to 55% to reflect the overhaul cost associated with Lynn Canal service.

4) Since the Malaspina is intended to operate on other AMHS routes during winter months, no layup costs are included.

Route Operation and Schedule Model

Route: HNS-SGY-HNS

Route Service Input (Management Plan Appendix A)

Season	Operation hrs / day	Vsl Days/ Wk	Vessel Description		
			Quantity	Type	Designation
Summer	8.00	6.5	1	Displ	DayACF
Winter	8.00	3.0	1	Displ	DayACF

Crew / Vessel Availability

Season	Vessel No.	Crew Shift		Vessel Preparation Times				Vessel Availability
		Crew 1 (hrs)	Crew 2 (hrs)	Startup (mins)	Load (mins)	Unload (mins)	Shutdown (mins)	(hrs)
Summer	Vessel 1	8.00	-	30	15	15	30	7.00
		-	-	-	-	-	-	-
Winter	Vessel 1	8.00	-	30	15	15	30	7.00

Route Transit Time

Leg No.	Speed	Outbound		Cruise	Inbound		Round Trip		Round Trip	
		Load	Manuv	At Speed	Manuv	Unload	Time Underway		Total Transit Time [1]	
	(knots)	(hrs)	(hrs)	(hrs)	(hrs)	(hrs)	(hrs)	(mins)	(hrs)	(mins)
HNS-SGY	15.00	0.25	0.05	0.81	0.03	0.25	-	53	1	23
SGY-HNS	15.00	0.25	0.03	0.81	0.05	0.25	-	53	1	23
	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-
Total Route Time		**0.50**	**0.08**	**1.62**	**0.08**	**0.50**	1	46	2	46

[1)] Transit time = Time Underway + Load + Unload

HNS-SGY-HNS Daily Schedules

Model Schedule

Summer

		Vessel 1	1st Dep	6:00 AM	1st Load	5:45 AM
Total Crew Time		**Circuit**	**Depart**	**Arrive**	**Depart**	**Arrive**
Crew 1	**Crew 2**	**No.**	**Haines**	**Skagway**	**Skagway**	**Haines**
3.30		1	6:00 AM	6:53 AM	7:25 AM	8:18 AM
6.63		2	8:50 AM	9:43 AM	10:15 AM	11:08 AM

Winter

		Vessel 1	1st Dep	8:00 AM	1st Load	7:45 AM
Total Crew Time		**Circuit**	**Depart**	**Arrive**	**Depart**	**Arrive**
Crew 1		**No.**	**Haines**	**Skagway**	**Skagway**	**Haines**
3.30		1	8:00 AM	8:53 AM	9:25 AM	10:18 AM
6.63		2	10:50 AM	11:43 AM	12:15 PM	1:08 PM

Route Operation and Schedule Model

Daily Schedule Statistics (per day)

Season	Round Trips		Daily Underway Time				Daily Operational Time [2,3]			
	Vessel 1	Vessel 2	Vessel 1		Vessel 2		Vessel 1		Vessel 2	
	(# / day)	(# / day)	(hrs / day)	% of Day	(hrs / day)	% of Day	(hrs / day)	% of Day	(hrs / day)	% of Day
Summer	2	-	3.53	14.7%	-		6.53	27.2%	0.00	0.0%
Winter	2		3.53	14.7%			6.53	27.2%		

[2] Daily Operational Time = (Round Trip Transit Time * Number of Round Trips) + Startup + Shutdown

[3] Schedule operational time may be slightly greater due to departure time adjustments

Daily Crew Statistics (per day)

Season	Vessel No.	# of Crews (per day)	Crew Shift		Crew Usage			
			Crew 1 (hrs / day)	Crew 2 (hrs / day)	Crew 1 (hrs / day)	Crew 1 % of Shift	Crew 2 (hrs / day)	Crew 2 % of Shift
Summer	Vessel 1	1	8	-	6.63	82.9%		
Summer		-	-	-				
Winter	Vessel 1	1	8		6.63	82.9%		

HNS-SGY-HNS Weekly Service Summary (per week)

Season	Vessel No.	Crew (days/wk)	Crew Time [4]		Vessel Operation (days/wk)	Trips /Wk	Underway Time (hrs / wk)	Operating Hours (hrs / wk)
			Crew 1 (hrs / wk)	Crew 2 (hrs / wk)				
Summer	Vessel 1	7	56.00	-	6.5	13.0	22.97	42.47
Summer			-	-	-	-	-	-
Winter	Vessel 1	5	40.00		3.0	6.0	10.60	19.60

[4] Crew Time = Crew shift * Crew days per week

Route Cost Model

Route: HNS-SGY-HNS

Vessel Definition

Type	ASV
Displ	53

Season Definition

Season	#Days	# Weeks	# Op Days
Summer	153	21.9	142
Winter	212	30.3	91

Annual Operational Costs

1. Crew Costs (by week)

Season	# Weeks	Crew Time (hrs/week) Vessel #1	Vessel #2	Total Crew (hrs / season)	Crew Cost ($ / hr)	Total Cost ($ / season)
Summer	21.9	56.00	-	1,224.00	$ 698.74	$ 855,254
Night [1)]		84.00	-	1,836.00	$ 156.55	$ 287,418
Winter	30.3	40.00		1,211.43	$ 698.74	$ 846,470
Night [1)]		84.00		2,544.00	$ 156.55	$ 398,252
Total	**52**					**$ 2,387,395**

[1)] Night Crew is capped to 84 hrs per week. Night crew may be re-assigned to watch vessel on non-operational days.

2. Fuel Consumption Costs (by week)

Season	# Weeks	Time Underway Vessel #1 (hrs / wk)	Vessel #2 (hrs / wk)	Total Underway (hrs / season)	Fuel Cost ($ / gal)	Fuel Consumption (gal / hr)	Total Cost ($ / season)
Summer	21.9	22.97	-	501.99	$ 3.38	289.48	$ 491,166
Winter	30.3	10.60		321.03	$ 3.38	289.48	$ 314,109
Total	**52**			**823.01**			**$ 805,275**

3. Winter Lay-up Cost (by day)

Season	# Days	# Vessels	Cost / Day	Total
winter	212	-	$ -	**$ -**

Annual Overhead Costs (by day)

Season	Annual Operating Days Vessel #1	Vessel #2	Total	($ / day)	Route Overhead Costs Vessel #1	Vessel #2	Total
Summer	142	-	142	$ 1,609	$ 228,593	$ -	$ 228,593
Winter	91		91	$ 1,609	$ 146,189		$ 146,189
Total	**233**	**-**	**233**		**$ 374,782**	**$ -**	**$ 374,782**

Annual Maintenance Costs (by week)

Season	# weeks	Annual Operating Hours Vessel #1 (hrs / wk)	Vessel #2 (hrs / wk)	Total (hrs / wk)	Total (hrs / season)
Summer	21.9	42.47	-	42.47	928
Winter	30.3	19.60		19.60	594
Total	**52**				**1,522**

	Vessel Operation		Vessel Overhaul		Total
	(eng op hrs)	($ / hr)	(# Vessels)	($ / Vessel)	Cost
Operating	1,522	$ 44.91			$ 68,342
Overhaul			1.0	$ 509,547	$ 509,547
Total Vessel Maintenance Costs					**$ 577,890**

Total Annual Route Costs

Total Annual Operational Costs	$ 3,192,670
Total Annual Layup Costs	$ -
Total Annual Overhead Costs	$ 374,782
Total Annual Maintenance Costs	$ 577,890
Total Annual Costs	**$ 4,145,342**

Route Operation and Schedule Model

Route: AUK-HNS-AUK

Route Service Input (Management Plan Appendix A)

Season	Operation hrs / day	Vsl Days/ Wk	Vessel Description		
			Quantity	Type	Designation
Summer	12.00	6.0	1	Displ	DayACF
Winter	12.00	3.0	1	Displ	DayACF

Crew / Vessel Availability

Season	Vessel No.	Crew Shift		Vessel Preparation Times				Vessel Availability
		Crew 1 (hrs)	Crew 2 (hrs)	Startup (mins)	Load (mins)	Unload (mins)	Shutdown (mins)	(hrs)
Summer	Vessel 1	12.00	-	30	15	15	30	11.00
		-	-	-	-	-	-	-
Winter	Vessel 1	12.00	-	30	15	15	30	11.00

Route Transit Time

Leg No.	Speed	Outbound		Cruise	Inbound		Round Trip		Round Trip	
		Load	Manuv	At Speed	Manuv	Unload	Time Underway		Total Transit Time [1]	
	(knots)	(hrs)	(hrs)	(hrs)	(hrs)	(hrs)	(hrs)	(mins)	(hrs)	(mins)
AUK-HNS	15.00	0.25	0.47	4.24	0.06	0.25	4	46	5	16
HNS-AUK	15.00	0.25	0.06	4.24	0.47	0.25	4	46	5	16
	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-
Total Route Time		**0.50**	**0.53**	**8.48**	**0.53**	**0.50**	9	32	10	32

[1)] Transit time = Time Underway + Load + Unload

AUK-HNS-AUK Daily Schedules

Model Schedule

Summer

		Vessel 1	1st Dep	6:00 AM	1st Load	5:45 AM
Total Crew Time		**Circuit**	**Depart**	**Arrive**	**Depart**	**Arrive**
Crew 1	**Crew 2**	**No.**	**Auke Bay**	**Haines**	**Haines**	**Auke Bay**
11.60		1	6:00 AM	10:46 AM	11:20 AM	4:06 PM

Winter

		Vessel 1	1st Dep	8:00 AM	1st Load	7:45 AM
Total Crew Time		**Circuit**	**Depart**	**Arrive**	**Depart**	**Arrive**
Crew 1		**No.**	**Auke Bay**	**Haines**	**Haines**	**Auke Bay**
11.60		1	8:00 AM	12:46 PM	1:20 PM	6:06 PM

Route Operation and Schedule Model

Daily Schedule Statistics (per day)

Season	Round Trips		Daily Underway Time				Daily Operational Time [2,3]			
	Vessel 1	Vessel 2	Vessel 1		Vessel 2		Vessel 1		Vessel 2	
	(# / day)	(# / day)	(hrs / day)	% of Day	(hrs / day)	% of Day	(hrs / day)	% of Day	(hrs / day)	% of Day
Summer	1	-	9.53	39.7%	-		11.53	48.1%	0.00	0.0%
Winter	1		9.53	39.7%			11.53	48.1%		

[2] Daily Operational Time = (Round Trip Transit Time * Number of Round Trips) + Startup + Shutdown

[3] Schedule operational time may be slightly greater due to departure time adjustments

Daily Crew Statistics (per day)

Season	Vessel No.	# of Crews (per day)	Crew Shift		Crew Usage			
			Crew 1 (hrs / day)	Crew 2 (hrs / day)	Crew 1 (hrs / day)	Crew 1 % of Shift	Crew 2 (hrs / day)	Crew 2 % of Shift
Summer	Vessel 1	1	12	-	11.60	96.7%		
Summer		-	-	-				
Winter	Vessel 1	1	12		11.60	96.7%		

AUK-HNS-AUK Weekly Service Summary (per week)

Season	Vessel No.	Crew (days/wk)	Crew Time [4]		Vessel Operation (days/wk)	Trips /Wk	Underway Time (hrs / wk)	Operating Hours (hrs / wk)
			Crew 1 (hrs / wk)	Crew 2 (hrs / wk)				
Summer	Vessel 1	7	84.00	-	6.0	6.0	57.20	69.20
Summer			-	-	-	-	-	-
Winter	Vessel 1	4	48.00		3.0	3.0	28.60	34.60

[4] Crew Time = Crew shift * Crew days per week

Route Cost Model

Route: AUK-HNS-AUK

Vessel Definition

Type	ASV
Displ	53

Season Definition

Season	#Days	# Weeks	# Op Days
Summer	153	21.9	131
Winter	212	30.3	91

Annual Operational Costs

1. Crew Costs (by week)

Season	# Weeks	Crew Time (hrs/week) Vessel #1	Vessel #2	Total Crew (hrs / season)	Crew Cost ($ / hr)	Total Cost ($ / season)
Summer	21.9	84.00	-	1,836.00	$ 698.74	$ 1,282,881
Night [1)]		84.00	-	1,836.00	$ 156.55	$ 287,418
Winter	30.3	48.00		1,453.71	$ 698.74	$ 1,015,764
Night [1)]		84.00		2,544.00	$ 156.55	$ 398,252
Total	**52**					**$ 2,984,316**

[1)] Night Crew is capped to 84 hrs per week. Night crew may be re-assigned to watch vessel on non-operational days.

2. Fuel Consumption Costs (by week)

Season	# Weeks	Time Underway Vessel #1 (hrs / wk)	Vessel #2 (hrs / wk)	Total Underway (hrs / season)	Fuel Cost ($ / gal)	Fuel Consumption (gal / hr)	Total Cost ($ / season)
Summer	21.9	57.20	-	1,250.23	$ 3.38	289.48	$ 1,223,282
Winter	30.3	28.60		866.17	$ 3.38	289.48	$ 847,502
Total	**52**			**2,116.40**			**$ 2,070,784**

3. Winter Lay-up Cost (by day)

Season	# Days	# Vessels	Cost / Day	Total
winter	212	-	$ -	**$ -**

Annual Overhead Costs (by day)

Season	Annual Operating Days Vessel #1	Vessel #2	Total	($ / day)	Route Overhead Costs Vessel #1	Vessel #2	Total
Summer	131	-	131	$ 1,609	$ 211,009	$ -	$ 211,009
Winter	91		91	$ 1,609	$ 146,189		$ 146,189
Total	**222**	**-**	**222**		**$ 357,198**	**$ -**	**$ 357,198**

Annual Maintenance Costs (by week)

Season	# weeks	Annual Operating Hours Vessel #1 (hrs / wk)	Vessel #2 (hrs / wk)	Total (hrs / wk)	Total (hrs / season)
Summer	21.9	69.20	-	69.20	1,513
Winter	30.3	34.60		34.60	1,048
Total	**52**				**2,560**
	Vessel Operation		**Vessel Overhaul**		**Total**
	(eng op hrs)	($ / hr)	(# Vessels)	($ / Vessel)	**Cost**
Operating	2,560	$ 44.91			$ 114,985
Overhaul			1.0	$ 509,547	$ 509,547
Total Vessel Maintenance Costs					**$ 624,532**

Total Annual Route Costs

Total Annual Operational Costs	$ 5,055,100
Total Annual Layup Costs	$ -
Total Annual Overhead Costs	$ 357,198
Total Annual Maintenance Costs	$ 624,532
Total Annual Costs	**$ 6,036,830**

Route Operation and Schedule Model

Route: SGY-AUK-SGY

Route Service Input (Management Plan Appendix A)

Season	Operation hrs / day	Vsl Days/ Wk	Vessel Description		
			Quantity	Type	Designation
Summer	12.00	7.0	1	Displ	MAL
Winter	-	0.0	0	Displ	MAL

Crew / Vessel Availability

Season	Vessel No.	Crew Shift		Vessel Preparation Times				Vessel Availability
		Crew 1 (hrs)	Crew 2 (hrs)	Startup (mins)	Load (mins)	Unload (mins)	Shutdown (mins)	(hrs)
Summer	Vessel 1	12.00	12.00	30	30	30	30	23.00
		-	-	-	-	-	-	-
		-	-	-	-	-	-	-

Route Transit Time

Leg No.	Speed	Outbound		Cruise At Speed	Inbound		Round Trip Time Underway		Round Trip Total Transit Time [1]	
		Load	Manuv		Manuv	Unload				
	(knots)	(hrs)	(hrs)	(hrs)	(hrs)	(hrs)	(hrs)	(mins)	(hrs)	(mins)
SGY-AUK	15.00	0.50	0.03	4.81	0.47	0.50	5	18	6	18
AUK-SGY	15.00	0.50	0.47	4.81	0.03	0.50	5	18	6	18
	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-
Total Route Time		**1.00**	**0.50**	**9.62**	**0.50**	**1.00**	10	36	12	36

1) Transit time = Time Underway + Load + Unload

SGY-AUK-SGY Daily Schedules

Model Schedule

Summer

Vessel 1	1st Dep	6:00 AM	1st Load	5:30 AM
Total Crew Time		**Circuit**	**Depart**	**Arrive**	**Depart**	**Arrive**
Crew 1	**Crew 2**	**No.**	**Skagway**	**Auke Bay**	**Auke Bay**	**Skagway**
12.00	1.63	1	6:00 AM	11:18 AM	12:20 PM	5:38 PM

Daily Schedule Statistics (per day)

Season	Round Trips		Daily Underway Time				Daily Operational Time [2,3]			
	Vessel 1 (# / day)	Vessel 2 (# / day)	Vessel 1 (hrs / day)	Vessel 1 % of Day	Vessel 2 (hrs / day)	Vessel 2 % of Day	Vessel 1 (hrs / day)	Vessel 1 % of Day	Vessel 2 (hrs / day)	Vessel 2 % of Day
Summer	1	-	10.60	44.2%	-		13.60	56.7%	0.00	0.0%
Winter	0		0.00	N/A			0.00	N/A		

2) Daily Operational Time = (Round Trip Transit Time * Number of Round Trips) + Startup + Shutdown

3) Schedule operational time may be slightly greater due to departure time adjustments

Daily Crew Statistics (per day)

Season	Vessel No.	# of Crews (per day)	Crew Shift		Crew Usage			
			Crew 1 (hrs / day)	Crew 2 (hrs / day)	Crew 1 (hrs / day)	Crew 1 % of Shift	Crew 2 (hrs / day)	Crew 2 % of Shift
Summer	Vessel 1	2	12	12	12.00	100.0%	1.63	13.6%
Summer		-	-	-				
Winter		-	-					

SGY-AUK-SGY Weekly Service Summary (per week)

Season	Vessel No.	Crew (days/wk)	Crew Time [4]		Vessel Operation (days/wk)	Trips /Wk	Underway Time (hrs / wk)	Operating Hours (hrs / wk)
			Crew 1 (hrs / wk)	Crew 2 (hrs / wk)				
Summer	Vessel 1	7	84.00	84.00	7.0	7.0	74.20	95.20
Summer			-	-	-	-	-	-
Winter			-		-	-	-	-

4) Crew Time = Crew shift * Crew days per week

Route Cost Model

Route: SGY-AUK-SGY

Vessel Definition

Type	ASV
Displ	88

Season Definition

Season	#Days	# Weeks	# Op Days
Summer	153	21.9	153
Winter	212	30.3	0

Annual Operational Costs

1. Crew Costs (by week)

Season	# Weeks	Crew Time (hrs/week) Vessel #1	Vessel #2	Total Crew (hrs / season)	Crew Cost ($ / hr)	Total Cost ($ / season)
Summer	21.9	168.00	-	3,672.00	$ 1,321.57	$ 4,852,800
Night [1)]		-	-	-		$ -
Winter	30.3	-		-		$ -
Night [1)]		-		-		$ -
Total	**52**					**$ 4,852,800**

[1)] Night Crew is capped to 84 hrs per week. Night crew may be re-assigned to watch vessel on non-operational days.

2. Fuel Consumption Costs (by week)

Season	# Weeks	Time Underway Vessel #1 (hrs / wk)	Vessel #2 (hrs / wk)	Total Underway (hrs / season)	Fuel Cost ($ / gal)	Fuel Consumption (gal / hr)	Total Cost ($ / season)
Summer	21.9	74.20	-	1,621.80	$ 3.38	436.26	$ 2,391,443
Winter	30.3	-		-	$ 3.38	436.26	$ -
Total	**52**			**1,621.80**			**$ 2,391,443**

3. Winter Lay-up Cost (by day)

Season	# Days	# Vessels	Cost / Day	Total
winter	212		$ -	**$ -**

Annual Overhead Costs (by day)

Season	Annual Operating Days Vessel #1	Vessel #2	Total	($ / day)	Route Overhead Costs Vessel #1	Vessel #2	Total
Summer	153	-	153	$ 1,609	$ 246,177	$ -	$ 246,177
Winter	0		-	$ 1,609	$ -		$ -
Total	**153**	**-**	**153**		**$ 246,177**	**$ -**	**$ 246,177**

Annual Maintenance Costs (by week)

Season	# weeks	Annual Operating Hours Vessel #1 (hrs / wk)	Vessel #2 (hrs / wk)	Total (hrs / wk)	Total (hrs / season)
Summer	21.9	95.20	-	95.20	2,081
Winter	30.3	-		-	-
Total	**52**				**2,081**

	Vessel Operation		Vessel Overhaul		Total
	(eng op hrs)	($ / hr)	(# Vessels)	($ / Vessel)	Cost
Operating	2,081	$ 67.96			$ 141,411
Overhaul			55%	$ 1,200,000	$ 655,714
Total Vessel Maintenance Costs					**$ 797,125**

Total Annual Route Costs

Total Annual Operational Costs	$ 7,244,242
Total Annual Layup Costs	$ -
Total Annual Overhead Costs	$ 246,177
Total Annual Maintenance Costs	$ 797,125
Total Annual Costs	**$ 8,287,545**

Alternative Summary

Alternative: 2B

Alt	Route	Season	Vessels			Crew Hrs		Op Schedule		
			No.	Designation	# ASV	Vessel 1	Vessel 2	hrs/day	Days per Week	Round trips per day
2 East Lynn Canal										
Alt 2B - Road to KTZ, ferry to SGY and HNS						Mainline service to terminate at Auke Bay				
	HNS-SGY-HNS	Summer	1	Disp-1	18	8	-	6.53	7	2
		Winter	0	Disp-1	18	-		-	0	0
	HNS-KTZ-HNS	Summer	1	DayACF-X	53	16	-	13.80	7	8
		Winter	1	DayACF-X	53	12		10.60	7	6
	SGY-KTZ-SGY	Summer	1	DayACF-X	53	16	-	16.00	7	6
		Winter	1	DayACF-X	53	12		11.00	7	4

Alternative Cost Summary

Route Name	Annual Costs					Total Annual Costs	Capital Costs
	Crew	Fuel	Lay-up	Maintenance	Overhead		
HNS-SGY-HNS	$ 556,249	$ 173,218	$ 121,647	$ 257,041	$ 246,177	***$ 1,354,331***	$ 22,315,336
HNS-KTZ-HNS	$ 4,077,960	$ 2,279,389	$ -	$ 705,287	$ 587,285	***$ 7,649,921***	
SGY-KTZ-SGY	$ 4,077,960	$ 3,167,883	$ -	$ 724,212	$ 587,285	***$ 8,557,341***	
Alternative Total	*$ 8,712,169*	*$ 5,620,489*	*$ 121,647*	*$ 1,686,541*	*$ 1,420,747*	**$ 17,561,593**	**$ 22,315,336**

Notes:

1. HNS-KTZ and SGY-KTZ route load and unload times are reduced to 10 minutes (by using notional vessel DayACF-X) each to achieve desired round trips in 8 hour crew day. This speed assumes enhanced terminals and reduced mooring times. Alternatively, some combination of nightcrew assistance and overtime pay could be used to achieve similar results with 15 minute load and unload times.

2) This alternative does not include any mainline service beyond Auke Bay.

3) HNS-SGY route requires a 17 ASV vessel, However, due to seakeeping considerations, the selected minimum vessel has a capacity of 18 ASV (similar to the existing AMHS vessel M/V Lituya).

Route Operation and Schedule Model

Route: HNS-SGY-HNS

Route Service Input (Management Plan Appendix A)

Season	Operation hrs / day	Vsl Days/ Wk	Vessel Description		
			Quantity	Type	Designation
Summer	8.00	7.0	1	Displ	Disp-1
Winter	-	0.0	0	Displ	Disp-1

Crew / Vessel Availability

Season	Vessel No.	Crew Shift		Vessel Preparation Times				Vessel Availability (hrs)
		Crew 1 (hrs)	Crew 2 (hrs)	Startup (mins)	Load (mins)	Unload (mins)	Shutdown (mins)	
Summer	Vessel 1	8.00	-	30	15	15	30	7.00
		-	-	-	-	-	-	-
		-	-	-	-	-	-	-

Route Transit Time

Leg No.	Speed	Outbound		Cruise	Inbound		Round Trip		Round Trip	
		Load	Manuv	At Speed	Manuv	Unload	Time Underway		Total Transit Time [1]	
	(knots)	(hrs)	(hrs)	(hrs)	(hrs)	(hrs)	(hrs)	(mins)	(hrs)	(mins)
HNS-SGY	15.00	0.25	0.05	0.81	0.03	0.25	-	53	1	23
SGY-HNS	15.00	0.25	0.03	0.81	0.05	0.25	-	53	1	23
	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-
Total Route Time		**0.50**	**0.08**	**1.62**	**0.08**	**0.50**	1	46	2	46

1) Transit time = Time Underway + Load + Unload

HNS-SGY-HNS Daily Schedules

Model Schedule

Notional schedules are developed to verify number of round trips and determine crew times. Schedule start times are arbitrary. Notional schedules are not intended to show route connections or homeport locations. Final schedules and homeport locations will be based on system implementation.

Summer

		Vessel 1	1st Dep	8:00 AM	1st Load	7:45 AM
Total Crew Time		**Circuit**	**Depart**	**Arrive**	**Depart**	**Arrive**
Crew 1	**Crew 2**	**No.**	**Haines**	**Skagway**	**Skagway**	**Haines**
3.30		1	8:00 AM	8:53 AM	9:25 AM	10:18 AM
6.63		2	10:50 AM	11:43 AM	12:15 PM	1:08 PM

Route Operation and Schedule Model

Daily Schedule Statistics (per day)

Season	Round Trips		Daily Underway Time				Daily Operational Time [2,3]			
	Vessel 1	Vessel 2	Vessel 1		Vessel 2		Vessel 1		Vessel 2	
	(# / day)	(# / day)	(hrs / day)	% of Day	(hrs / day)	% of Day	(hrs / day)	% of Day	(hrs / day)	% of Day
Summer	2	-	3.53	14.7%	-		6.53	27.2%	0.00	0.0%
Winter	0		0.00	N/A			0.00	N/A		

[2] Daily Operational Time = (Round Trip Transit Time * Number of Round Trips) + Startup + Shutdown

[3] Schedule operational time may be slightly greater due to departure time adjustments

Daily Crew Statistics (per day)

Season	Vessel No.	# of Crews (per day)	Crew Shift		Crew Usage			
			Crew 1 (hrs / day)	Crew 2 (hrs / day)	Crew 1		Crew 2	
					(hrs / day)	% of Shift	(hrs / day)	% of Shift
Summer	Vessel 1	1	8	-	6.63	82.9%		
Summer		-	-	-				
Winter		-	-					

HNS-SGY-HNS Weekly Service Summary (per week)

Season	Vessel No.	Crew (days/wk)	Crew Time [4]		Vessel Operation (days/wk)	Trips /Wk	Underway Time (hrs / wk)	Operating Hours (hrs / wk)
			Crew 1 (hrs / wk)	Crew 2 (hrs / wk)				
Summer	Vessel 1	7	56.00	-	7.0	14.0	24.73	45.73
Summer			-	-	-	-	-	-
Winter		0	-		-	-	-	-

[4] Crew Time = Crew shift * Crew days per week

Route Cost Model

Route: HNS-SGY-HNS Vessel Sizing

Vessel Size and Selection

1. Traffic Forecast

Route Link No.	Name	2038 Summer Average Daily Traffic - One Way PAX-ASV	RV	VAN	PAX
2B-1	HNS-SGY	26	2	1	63
2B-2	SGY-HNS	26	2	1	63
-		-	-	-	-
-		-	-	-	-
Largest Link One Way		**26**	**2**	**1**	**63**
Weekly One Way Traffic		**182**	**14**	**7**	**441**

2. Required Vessel Capacity per Sailing — Assuming 14 Trips per week

		PAX-ASV	RV	VAN	PAX	Total
Capacity		13	1	1	32	
Lane Length	(ft)	260	24	40	N/A	324
Payload	(lbs)	78,000	12,000	40,000	N/A	130,000

3. Required Vessel Characteristics

Type	ASV (#)	PAX (#)	Payload (lton)
Displ	**17**	32	59

4. Selected Vessel Characteristics

	ASV	PAX	Deadweight
Selection Basis	18		
Selected Characteristics		32	59

Route Cost Model

Route: HNS-SGY-HNS

Vessel Definition

Type	ASV
Displ	18

Season Definition

Season	#Days	# Weeks	# Op Days
Summer	153	21.9	153
Winter	212	30.3	0

Annual Operational Costs

1. Crew Costs (by week)

Season	# Weeks	Crew Time (hrs/week) Vessel #1	Vessel #2	Total Crew (hrs / season)	Crew Cost ($ / hr)	Total Cost ($ / season)
Summer	21.9	56.00	-	1,224.00	$ 343.28	$ 420,176
Night [1)]		84.00	-	1,836.00	$ 74.11	$ 136,072
Winter	30.3	-		-	$ 343.28	$ -
Night [1)]		-		-	$ 74.11	$ -
Total	**52**					**$ 556,249**

[1)] Night Crew is capped to 84 hrs per week. Night crew may be re-assigned to watch vessel on non-operational days.

2. Fuel Consumption Costs (by week)

Season	# Weeks	Time Underway Vessel #1 (hrs / wk)	Vessel #2 (hrs / wk)	Total Underway (hrs / season)	Fuel Cost ($ / gal)	Fuel Consumption (gal / hr)	Total Cost ($ / season)
Summer	21.9	24.73	-	540.60	$ 3.38	94.80	$ 173,218
Winter	30.3	-		-	$ 3.38	94.80	$ -
Total	**52**			**540.60**			**$ 173,218**

3. Winter Lay-up Cost (by day)

Season	# Days	# Vessels	Cost / Day	Total
winter	212	1.0	$ 573.80	**$ 121,647**

Annual Overhead Costs (by day)

Season	Annual Operating Days Vessel #1	Vessel #2	Total	($ / day)	Route Overhead Costs Vessel #1	Vessel #2	Total
Summer	153	-	153	$ 1,609	$ 246,177	$ -	$ 246,177
Winter	0		-	$ 1,609	$ -		$ -
Total	**153**	**-**	**153**		**$ 246,177**	**$ -**	**$ 246,177**

Annual Maintenance Costs (by week)

Season	# weeks	Annual Operating Hours Vessel #1 (hrs / wk)	Vessel #2 (hrs / wk)	Total (hrs / wk)	Total (hrs / season)
Summer	21.9	45.73	-	45.73	1,000
Winter	30.3	-		-	-
Total	**52**				**1,000**

	Vessel Operation (eng op hrs)	($ / hr)	Vessel Overhaul (# Vessels)	($ / Vessel)	Total Cost
Operating	1,000	$ 14.75			$ 14,746
Overhaul			1.0	$ 242,295	$ 242,295
Total Vessel Maintenance Costs					**$ 257,041**

Total Annual Route Costs

Total Annual Operational Costs	$ 729,466
Total Annual Layup Costs	$ 121,647
Total Annual Overhead Costs	$ 246,177
Total Annual Maintenance Costs	$ 257,041
Total Annual Costs	**$ 1,354,331**

Vessel Capital Cost

	$ / Vessel	# Vessels	Total
Vessel Acquisition Cost	$ 22,315,336	1	
Total Vessel Capital Costs			**$ 22,315,336**

Route Operation and Schedule Model

Route: HNS-KTZ-HNS

Route Service Input (Management Plan Appendix A)

Season	Operation hrs / day	Vsl Days/ Wk	Vessel Description		
			Quantity	Type	Designation
Summer	16.00	7.0	1	Displ	DayACF-X
Winter	12.00	7.0	1	Displ	DayACF-X

Crew / Vessel Availability

Season	Vessel No.	Crew Shift		Vessel Preparation Times				Vessel Availability (hrs)
		Crew 1 (hrs)	Crew 2 (hrs)	Startup (mins)	Load (mins)	Unload (mins)	Shutdown (mins)	
Summer	Vessel 1	8.00	8.00	30	10	10	30	15.00
		-	-	-	-	-	-	-
Winter	Vessel 1	12.00	-	30	10	10	30	11.00

Route Transit Time

Leg No.	Speed	Outbound		Cruise At Speed	Inbound		Round Trip Time Underway		Round Trip Total Transit Time [1]	
		Load	Manuv		Manuv	Unload				
	(knots)	(hrs)	(hrs)	(hrs)	(hrs)	(hrs)	(hrs)	(mins)	(hrs)	(mins)
HNS-KTZ	15.00	0.17	0.06	0.36	0.05	0.17	-	28	-	48
KTZ-HNS	15.00	0.17	0.05	0.36	0.06	0.17	-	28	-	48
	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-
Total Route Time		**0.33**	**0.11**	**0.72**	**0.11**	**0.33**	-	56	1	36

1) Transit time = Time Underway + Load + Unload

HNS-KTZ-HNS Daily Schedules

Model Schedule

Notional schedules are developed to verify number of round trips and determine crew times. Schedule start times are arbitrary. Notional schedules are not intended to show route connections or homeport locations. Final schedules and homeport locations will be based on system implementation.

Summer

		Vessel 1	1st Dep	6:00 AM	1st Load	5:50 AM
Total Crew Time		**Circuit**	**Depart**	**Arrive**	**Depart**	**Arrive**
Crew 1	**Crew 2**	**No.**	**Haines**	**Katzehin**	**Katzehin**	**Haines**
2.13		1	6:00 AM	6:28 AM	6:50 AM	7:18 AM
3.80		2	7:40 AM	8:08 AM	8:30 AM	8:58 AM
5.47		3	9:20 AM	9:48 AM	10:10 AM	10:38 AM
7.13		4	11:00 AM	11:28 AM	11:50 AM	12:18 PM
	1.67	5	12:40 PM	1:08 PM	1:30 PM	1:58 PM
	3.33	6	2:20 PM	2:48 PM	3:10 PM	3:38 PM
	5.00	7	4:00 PM	4:28 PM	4:50 PM	5:18 PM
	7.17	8	5:40 PM	6:08 PM	6:30 PM	6:58 PM

Winter

		Vessel 1	1st Dep	8:00 AM	1st Load	7:50 AM
Total Crew Time		**Circuit**	**Depart**	**Arrive**	**Depart**	**Arrive**
Crew 1		**No.**	**Haines**	**Katzehin**	**Katzehin**	**Haines**
2.13		1	8:00 AM	8:28 AM	8:50 AM	9:18 AM
3.80		2	9:40 AM	10:08 AM	10:30 AM	10:58 AM
5.47		3	11:20 AM	11:48 AM	12:10 PM	12:38 PM
7.13		4	1:00 PM	1:28 PM	1:50 PM	2:18 PM
8.80		5	2:40 PM	3:08 PM	3:30 PM	3:58 PM
10.97		6	4:20 PM	4:48 PM	5:10 PM	5:38 PM

Route Operation and Schedule Model

Daily Schedule Statistics (per day)

Season	Round Trips		Daily Underway Time				Daily Operational Time [2,3]			
	Vessel 1	Vessel 2	Vessel 1		Vessel 2		Vessel 1		Vessel 2	
	(# / day)	(# / day)	(hrs / day)	% of Day	(hrs / day)	% of Day	(hrs / day)	% of Day	(hrs / day)	% of Day
Summer	8	-	7.47	31.1%	-		13.80	57.5%	0.00	0.0%
Winter	6		5.60	23.3%			10.60	44.2%		

[2] Daily Operational Time = (Round Trip Transit Time * Number of Round Trips) + Startup + Shutdown

[3] Schedule operational time may be slightly greater due to departure time adjustments

Daily Crew Statistics (per day)

Season	Vessel No.	# of Crews (per day)	Crew Shift		Crew Usage			
			Crew 1 (hrs / day)	Crew 2 (hrs / day)	Crew 1 (hrs / day)	Crew 1 % of Shift	Crew 2 (hrs / day)	Crew 2 % of Shift
Summer	Vessel 1	2	8	8	7.13	89.2%	7.17	89.6%
Summer		-	-	-				
Winter	Vessel 1	1	12		10.97	91.4%		

HNS-KTZ-HNS Weekly Service Summary (per week)

Season	Vessel No.	Crew (days/wk)	Crew Time [4]		Vessel Operation (days/wk)	Trips /Wk	Underway Time (hrs / wk)	Operating Hours (hrs / wk)
			Crew 1 (hrs / wk)	Crew 2 (hrs / wk)				
Summer	Vessel 1	7	56.00	56.00	7.0	56.0	52.27	96.60
Summer			-	-	-	-	-	-
Winter	Vessel 1	7	84.00		7.0	42.0	39.20	74.20

[4] Crew Time = Crew shift * Crew days per week

Route Cost Model

Route: HNS-KTZ-HNS

Vessel Definition

Type	ASV
Displ	53

Season Definition

Season	#Days	# Weeks	# Op Days
Summer	153	21.9	153
Winter	212	30.3	212

Annual Operational Costs

1. Crew Costs (by week)

Season	# Weeks	Crew Time (hrs/week) Vessel #1	Crew Time (hrs/week) Vessel #2	Total Crew (hrs / season)	Crew Cost ($ / hr)	Total Cost ($ / season)
Summer	21.9	112.00	-	2,448.00	$ 698.74	$ 1,710,509
Night [1)]		56.00	-	1,224.00	$ 156.55	$ 191,612
Winter	30.3	84.00		2,544.00	$ 698.74	$ 1,777,587
Night [1)]		84.00		2,544.00	$ 156.55	$ 398,252
Total	**52**					**$ 4,077,960**

[1)] Night Crew is capped to 84 hrs per week. Night crew may be re-assigned to watch vessel on non-operational days.

2. Fuel Consumption Costs (by week)

Season	# Weeks	Time Underway Vessel #1 (hrs / wk)	Time Underway Vessel #2 (hrs / wk)	Total Underway (hrs / season)	Fuel Cost ($ / gal)	Fuel Consumption (gal / hr)	Total Cost ($ / season)
Summer	21.9	52.27	-	1,142.40	$ 3.38	289.48	$ 1,117,777
Winter	30.3	39.20		1,187.20	$ 3.38	289.48	$ 1,161,612
Total	**52**			**2,329.60**			**$ 2,279,389**

3. Winter Lay-up Cost (by day)

Season	# Days	# Vessels	Cost / Day	Total
winter	212	-	$ -	**$ -**

Annual Overhead Costs (by day)

Season	Annual Operating Days Vessel #1	Vessel #2	Total	($ / day)	Route Overhead Costs Vessel #1	Vessel #2	Total
Summer	153	-	153	$ 1,609	$ 246,177	$ -	$ 246,177
Winter	212		212	$ 1,609	$ 341,108		$ 341,108
Total	**365**	**-**	**365**		**$ 587,285**	**$ -**	**$ 587,285**

Annual Maintenance Costs (by week)

Season	# weeks	Annual Operating Hours Vessel #1 (hrs / wk)	Vessel #2 (hrs / wk)	Total (hrs / wk)	Total (hrs / season)
Summer	21.9	96.60	-	96.60	2,111
Winter	30.3	74.20		74.20	2,247
Total	**52**				**4,359**

	Vessel Operation (eng op hrs)	($ / hr)	Vessel Overhaul (# Vessels)	($ / Vessel)	Total Cost
Operating	4,359	$ 44.91			$ 195,740
Overhaul			1.0	$ 509,547	$ 509,547
Total Vessel Maintenance Costs					**$ 705,287**

Total Annual Route Costs

Total Annual Operational Costs	$ 6,357,349
Total Annual Layup Costs	$ -
Total Annual Overhead Costs	$ 587,285
Total Annual Maintenance Costs	$ 705,287
Total Annual Costs	**$ 7,649,921**

Route Operation and Schedule Model

Route: SGY-KTZ-SGY

Route Service Input (Management Plan Appendix A)

Season	Operation hrs / day	Vsl Days/ Wk	Vessel Description		
			Quantity	Type	Designation
Summer	16.00	7.0	1	Displ	DayACF-X
Winter	12.00	7.0	1	Displ	DayACF-X

Crew / Vessel Availability

Season	Vessel No.	Crew Shift		Vessel Preparation Times				Vessel Availability (hrs)
		Crew 1 (hrs)	Crew 2 (hrs)	Startup (mins)	Load (mins)	Unload (mins)	Shutdown (mins)	
Summer	Vessel 1	8.00	8.00	30	10	10	30	15.00
		-	-	-	-	-	-	-
Winter	Vessel 1	12.00	-	30	10	10	30	11.00

Route Transit Time

Leg No.	Speed	Outbound		Cruise At Speed	Inbound		Round Trip Time Underway		Round Trip Total Transit Time [1]	
		Load	Manuv		Manuv	Unload				
	(knots)	(hrs)	(hrs)	(hrs)	(hrs)	(hrs)	(hrs)	(mins)	(hrs)	(mins)
SGY-KTZ	16.50	0.17	0.03	0.84	0.05	0.17	-	55	1	15
KTZ-SGY	16.50	0.17	0.05	0.84	0.03	0.17	-	55	1	15
	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-
Total Route Time		**0.33**	**0.08**	**1.68**	**0.08**	**0.33**	1	50	2	30

1) Transit time = Time Underway + Load + Unload

SGY-KTZ-SGY Daily Schedules

Model Schedule

Notional schedules are developed to verify number of round trips and determine crew times. Schedule start times are arbitrary. Notional schedules are not intended to show route connections or homeport locations. Final schedules and homeport locations will be based on system implementation.

Summer

		Vessel 1	1st Dep	6:00 AM	1st Load	5:50 AM
Total Crew Time		**Circuit**	**Depart**	**Arrive**	**Depart**	**Arrive**
Crew 1	**Crew 2**	**No.**	**Skagway**	**Katzehin**	**Katzehin**	**Skagway**
3.00		1	6:00 AM	6:55 AM	7:15 AM	8:10 AM
5.50		2	8:30 AM	9:25 AM	9:45 AM	10:40 AM
8.00		3	11:00 AM	11:55 AM	12:15 PM	1:10 PM
	2.50	4	1:30 PM	2:25 PM	2:45 PM	3:40 PM
	5.00	5	4:00 PM	4:55 PM	5:15 PM	6:10 PM
	8.00	6	6:30 PM	7:25 PM	7:45 PM	8:40 PM

Winter

		Vessel 1	1st Dep	8:00 AM	1st Load	7:50 AM
Total Crew Time		**Circuit**	**Depart**	**Arrive**	**Depart**	**Arrive**
Crew 1		**No.**	**Skagway**	**Katzehin**	**Katzehin**	**Skagway**
3.00		1	8:00 AM	8:55 AM	9:15 AM	10:10 AM
5.50		2	10:30 AM	11:25 AM	11:45 AM	12:40 PM
8.00		3	1:00 PM	1:55 PM	2:15 PM	3:10 PM
11.00		4	3:30 PM	4:25 PM	4:45 PM	5:40 PM

Route Operation and Schedule Model

Daily Schedule Statistics (per day)

Season	Round Trips		Daily Underway Time				Daily Operational Time [2,3]			
	Vessel 1	Vessel 2	Vessel 1		Vessel 2		Vessel 1		Vessel 2	
	(# / day)	(# / day)	(hrs / day)	% of Day	(hrs / day)	% of Day	(hrs / day)	% of Day	(hrs / day)	% of Day
Summer	6	-	11.00	45.8%	-		16.00	66.7%	0.00	0.0%
Winter	4		7.33	30.6%			11.00	45.8%		

[2] Daily Operational Time = (Round Trip Transit Time * Number of Round Trips) + Startup + Shutdown

[3] Schedule operational time may be slightly greater due to departure time adjustments

Daily Crew Statistics (per day)

Season	Vessel No.	# of Crews (per day)	Crew Shift		Crew Usage			
			Crew 1 (hrs / day)	Crew 2 (hrs / day)	Crew 1		Crew 2	
					(hrs / day)	% of Shift	(hrs / day)	% of Shift
Summer	Vessel 1	2	8	8	8.00	100.0%	8.00	100.0%
Summer		-	-	-				
Winter	Vessel 1	1	12		11.00	91.7%		

SGY-KTZ-SGY Weekly Service Summary (per week)

Season	Vessel No.	Crew (days/wk)	Crew Time [4]		Vessel Operation (days/wk)	Trips /Wk	Underway Time (hrs / wk)	Operating Hours (hrs / wk)
			Crew 1 (hrs / wk)	Crew 2 (hrs / wk)				
Summer	Vessel 1	7	56.00	56.00	7.0	42.0	77.00	112.00
Summer			-	-	-	-	-	-
Winter	Vessel 1	7	84.00		7.0	28.0	51.33	77.00

[4] Crew Time = Crew shift * Crew days per week

Route Cost Model

Route: SGY-KTZ-SGY

Vessel Definition

Type	ASV
Displ	53

Season Definition

Season	#Days	# Weeks	# Op Days
Summer	153	21.9	153
Winter	212	30.3	212

Annual Operational Costs

1. Crew Costs (by week)

Season	# Weeks	Crew Time (hrs/week) Vessel #1	Vessel #2	Total Crew (hrs / season)	Crew Cost ($ / hr)	Total Cost ($ / season)
Summer	21.9	112.00	-	2,448.00	$ 698.74	$ 1,710,509
Night [1)]		56.00	-	1,224.00	$ 156.55	$ 191,612
Winter	30.3	84.00		2,544.00	$ 698.74	$ 1,777,587
Night [1)]		84.00		2,544.00	$ 156.55	$ 398,252
Total	**52**					**$ 4,077,960**

[1)] Night Crew is capped to 84 hrs per week. Night crew may be re-assigned to watch vessel on non-operational days.

2. Fuel Consumption Costs (by week)

Season	# Weeks	Time Underway Vessel #1 (hrs / wk)	Vessel #2 (hrs / wk)	Total Underway (hrs / season)	Fuel Cost ($ / gal)	Fuel Consumption (gal / hr)	Total Cost ($ / season)
Summer	21.9	77.00	-	1,683.00	$ 3.38	289.48	$ 1,646,725
Winter	30.3	51.33		1,554.67	$ 3.38	289.48	$ 1,521,158
Total	**52**			**3,237.67**			**$ 3,167,883**

3. Winter Lay-up Cost (by day)

Season	# Days	# Vessels	Cost / Day	Total
winter	212	-	$ -	**$ -**

Annual Overhead Costs (by day)

Season	Annual Operating Days Vessel #1	Vessel #2	Total	($ / day)	Route Overhead Costs Vessel #1	Vessel #2	Total
Summer	153	-	153	$ 1,609	$ 246,177	$ -	$ 246,177
Winter	212		212	$ 1,609	$ 341,108		$ 341,108
Total	**365**	**-**	**365**		**$ 587,285**	**$ -**	**$ 587,285**

Annual Maintenance Costs (by week)

Season	# weeks	Annual Operating Hours Vessel #1 (hrs / wk)	Vessel #2 (hrs / wk)	Total (hrs / wk)	Total (hrs / season)
Summer	21.9	112.00	-	112.00	2,448
Winter	30.3	77.00		77.00	2,332
Total	**52**				**4,780**
	Vessel Operation		**Vessel Overhaul**		**Total**
	(eng op hrs)	($ / hr)	(# Vessels)	($ / Vessel)	**Cost**
Operating	4,780	$ 44.91			$ 214,665
Overhaul			1.0	$ 509,547	$ 509,547
Total Vessel Maintenance Costs					**$ 724,212**

Total Annual Route Costs

Total Annual Operational Costs	$ 7,245,843
Total Annual Layup Costs	$ -
Total Annual Overhead Costs	$ 587,285
Total Annual Maintenance Costs	$ 724,212
Total Annual Costs	**$ 8,557,341**

Alternative Summary

Alternative: 3

Alt	Route	Season	Vessels			Crew Hrs		Op Schedule		
			No.	Designation	# ASV	Vessel 1	Vessel 2	hrs/day	Days per Week	Round trips per day
3. West Lynn Canal										
Alt 3 - road to HNS, ferry SAW-WHB, ferry HNS-SGY						Mainline service to terminate at Auke Bay				
	HNS-SGY-HNS	Summer	1	Disp-2	41	16	-	15.60	7	6
		Winter	1	Disp-2	41	12		10.73	7	4
	SAW-WHB-SAW	Summer	2	DayACF	53	16	16	16.00	7	6
		Winter	1	DayACF	53	12		11.00	7	4

Alternative Cost Summary

Route Name	Annual Costs					Total Annual Costs	Capital Costs
	Crew	Fuel	Lay-up	Maintenance	Overhead		
HNS-SGY-HNS	$ 3,475,917	$ 2,405,707	$ -	$ 588,096	$ 587,285	***$ 7,057,005***	$ 48,905,598
SAW-WHB-SAW	$ 5,980,081	$ 3,939,225	$ 210,298	$ 1,343,697	$ 833,462	***$ 12,306,762***	
Alternative Total	*$ 9,455,998*	*$ 6,344,932*	*$ 210,298*	*$ 1,931,792*	*$ 1,420,747*	**$ 19,363,768**	**$ 48,905,598**

Notes:

1) HNS-SGY route load and unload times are reduced to 10 minutes each (by using notional vessel Disp-2) to achieve desired round trips in 8 hour crew day. This speed assumes enhanced terminals and reduced mooring times. Alternatively, some combination of nightcrew assistance and overtime pay could be used to achieve similar results with 15 minute load and unload times.

2) This alternative does not include any mainline service beyond Auke Bay.

Route Operation and Schedule Model

Route: HNS-SGY-HNS

Route Service Input (Management Plan Appendix A)

Season	Operation hrs / day	Vsl Days/ Wk	Vessel Description		
			Quantity	Type	Designation
Summer	16.00	7.0	1	Displ	Disp-2
Winter	12.00	7.0	1	Displ	Disp-2

Crew / Vessel Availability

Season	Vessel No.	Crew Shift		Vessel Preparation Times				Vessel Availability (hrs)
		Crew 1 (hrs)	Crew 2 (hrs)	Startup (mins)	Load (mins)	Unload (mins)	Shutdown (mins)	
Summer	Vessel 1	8.00	8.00	30	10	10	30	15.00
		-	-	-	-	-	-	-
Winter	Vessel 1	12.00	-	30	10	10	30	11.00

Route Transit Time

Leg No.	Speed	Outbound		Cruise At Speed	Inbound		Round Trip Time Underway		Round Trip Total Transit Time [1]	
		Load	Manuv		Manuv	Unload				
	(knots)	(hrs)	(hrs)	(hrs)	(hrs)	(hrs)	(hrs)	(mins)	(hrs)	(mins)
HNS-SGY	15.00	0.17	0.05	0.81	0.03	0.17	-	53	1	13
SGY-HNS	15.00	0.17	0.03	0.81	0.05	0.17	-	53	1	13
	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-
Total Route Time		**0.33**	**0.08**	**1.62**	**0.08**	**0.33**	1	46	2	26

1) Transit time = Time Underway + Load + Unload

HNS-SGY-HNS Daily Schedules

Model Schedule

Notional schedules are developed to verify number of round trips and determine crew times. Schedule start times are arbitrary. Notional schedules are not intended to show route connections or homeport locations. Final schedules and homeport locations will be based on system implementation.

Summer

		Vessel 1	1st Dep	6:00 AM	1st Load	5:50 AM
Total Crew Time		**Circuit**	**Depart**	**Arrive**	**Depart**	**Arrive**
Crew 1	**Crew 2**	**No.**	**Haines**	**Skagway**	**Skagway**	**Haines**
2.97		1	6:00 AM	6:53 AM	7:15 AM	8:08 AM
5.47		2	8:30 AM	9:23 AM	9:45 AM	10:38 AM
7.97		3	11:00 AM	11:53 AM	12:15 PM	1:08 PM
	2.50	4	1:30 PM	2:23 PM	2:45 PM	3:38 PM
	5.00	5	4:00 PM	4:53 PM	5:15 PM	6:08 PM
	8.00	6	6:30 PM	7:23 PM	7:45 PM	8:38 PM

Winter

		Vessel 1	1st Dep	8:00 AM	1st Load	7:50 AM
Total Crew Time		**Circuit**	**Depart**	**Arrive**	**Depart**	**Arrive**
Crew 1		**No.**	**Haines**	**Skagway**	**Skagway**	**Haines**
2.97		1	8:00 AM	8:53 AM	9:15 AM	10:08 AM
5.47		2	10:30 AM	11:23 AM	11:45 AM	12:38 PM
7.97		3	1:00 PM	1:53 PM	2:15 PM	3:08 PM
10.97		4	3:30 PM	4:23 PM	4:45 PM	5:38 PM

Route Operation and Schedule Model

Daily Schedule Statistics (per day)

Season	Round Trips		Daily Underway Time				Daily Operational Time [2,3]			
	Vessel 1	Vessel 2	Vessel 1		Vessel 2		Vessel 1		Vessel 2	
	(# / day)	(# / day)	(hrs / day)	% of Day	(hrs / day)	% of Day	(hrs / day)	% of Day	(hrs / day)	% of Day
Summer	6	-	10.60	44.2%	-		15.60	65.0%	0.00	0.0%
Winter	4		7.07	29.4%			10.73	44.7%		

[2] Daily Operational Time = (Round Trip Transit Time * Number of Round Trips) + Startup + Shutdown

[3] Schedule operational time may be slightly greater due to departure time adjustments

Daily Crew Statistics (per day)

Season	Vessel No.	# of Crews (per day)	Crew Shift		Crew Usage			
			Crew 1 (hrs / day)	Crew 2 (hrs / day)	Crew 1		Crew 2	
					(hrs / day)	% of Shift	(hrs / day)	% of Shift
Summer	Vessel 1	2	8	8	7.97	99.6%	8.00	100.0%
Summer		-	-	-				
Winter	Vessel 1	1	12		10.97	91.4%		

HNS-SGY-HNS Weekly Service Summary (per week)

Season	Vessel No.	Crew (days/wk)	Crew Time [4]		Vessel Operation (days/wk)	Trips /Wk	Underway Time (hrs / wk)	Operating Hours (hrs / wk)
			Crew 1 (hrs / wk)	Crew 2 (hrs / wk)				
Summer	Vessel 1	7	56.00	56.00	7.0	42.0	74.20	109.20
Summer			-	-	-	-	-	-
Winter	Vessel 1	7	84.00		7.0	28.0	49.47	75.13

[4] Crew Time = Crew shift * Crew days per week

Route Cost Model

Route: HNS-SGY-HNS Vessel Sizing

Vessel Size and Selection

1. Traffic Forecast

Route Link No.	Name	2038 Summer Average Daily Traffic - One Way PAX-ASV	RV	VAN	PAX
3-1	HNS-SGY	206	12	5	509
3-2	SGY-HNS	206	12	5	509
-		-	-	-	-
-		-	-	-	-
Largest Link One Way		**206**	**12**	**5**	**509**
Weekly One Way Traffic		**1,442**	**84**	**35**	**3,563**

2. Required Vessel Capacity per Sailing — Assuming 42 Trips per week

		PAX-ASV	RV	VAN	PAX	Total
Capacity		35	2	1	85	
Lane Length	(ft)	700	48	40	N/A	788
Payload	(lbs)	210,000	24,000	40,000	N/A	274,000

3. Required Vessel Characteristics

Type	ASV (#)	PAX (#)	Payload (lton)
Displ	**40**	85	123

4. Selected Vessel Characteristics

	ASV	PAX	Deadweight
Selection Basis	41		
Selected Characteristics		85	123

Route Cost Model

Route: HNS-SGY-HNS

Vessel Definition

Type	ASV
Displ	41

Season Definition

Season	#Days	# Weeks	# Op Days
Summer	153	21.9	153
Winter	212	30.3	212

Annual Operational Costs

1. Crew Costs (by week)

Season	# Weeks	Crew Time (hrs/week) Vessel #1	Crew Time (hrs/week) Vessel #2	Total Crew (hrs / season)	Crew Cost ($ / hr)	Total Cost ($ / season)
Summer	21.9	112.00	-	2,448.00	$ 596.87	$ 1,461,135
Night [1)]		56.00	-	1,224.00	$ 131.73	$ 161,234
Winter	30.3	84.00		2,544.00	$ 596.87	$ 1,518,434
Night [1)]		84.00		2,544.00	$ 131.73	$ 335,114
Total	**52**					**$ 3,475,917**

[1)] Night Crew is capped to 84 hrs per week. Night crew may be re-assigned to watch vessel on non-operational days.

2. Fuel Consumption Costs (by week)

Season	# Weeks	Time Underway Vessel #1 (hrs / wk)	Time Underway Vessel #2 (hrs / wk)	Total Underway (hrs / season)	Fuel Cost ($ / gal)	Fuel Consumption (gal / hr)	Total Cost ($ / season)
Summer	21.9	74.20	-	1,621.80	$ 3.38	228.13	$ 1,250,532
Winter	30.3	49.47		1,498.13	$ 3.38	228.13	$ 1,155,175
Total	**52**			**3,119.93**			**$ 2,405,707**

3. Winter Lay-up Cost (by day)

Season	# Days	# Vessels	Cost / Day	Total
winter	212	-	$ -	**$ -**

Annual Overhead Costs (by day)

Season	Annual Operating Days Vessel #1	Annual Operating Days Vessel #2	Annual Operating Days Total	($ / day)	Route Overhead Costs Vessel #1	Route Overhead Costs Vessel #2	Route Overhead Costs Total
Summer	153	-	153	$ 1,609	$ 246,177	$ -	$ 246,177
Winter	212		212	$ 1,609	$ 341,108		$ 341,108
Total	**365**	**-**	**365**		**$ 587,285**	**$ -**	**$ 587,285**

Annual Maintenance Costs (by week)

Season	# weeks	Annual Operating Hours Vessel #1 (hrs / wk)	Annual Operating Hours Vessel #2 (hrs / wk)	Annual Operating Hours Total (hrs / wk)	Total (hrs / season)
Summer	21.9	109.20	-	109.20	2,387
Winter	30.3	75.13		75.13	2,275
Total	**52**				**4,662**

	Vessel Operation		Vessel Overhaul		Total
	(eng op hrs)	($ / hr)	(# Vessels)	($ / Vessel)	Cost
Operating	4,662	$ 35.37			$ 164,904
Overhaul			1.0	$ 423,191	$ 423,191
Total Vessel Maintenance Costs					**$ 588,096**

Total Annual Route Costs

Total Annual Operational Costs	$ 5,881,625
Total Annual Layup Costs	$ -
Total Annual Overhead Costs	$ 587,285
Total Annual Maintenance Costs	$ 588,096
Total Annual Costs	**$ 7,057,005**

Vessel Capital Cost

	$ / Vessel	# Vessels	Total
Vessel Acquisition Cost	$ 48,905,598	1	
Total Vessel Capital Costs			**$ 48,905,598**

Route Operation and Schedule Model

Route: SAW-WHB-SAW

Route Service Input (Management Plan Appendix A)

Season	Operation hrs / day	Vsl Days/ Wk	Vessel Description		
			Quantity	Type	Designation
Summer	16.00	7.0	2	Displ	DayACF
Winter	12.00	7.0	1	Displ	DayACF

Crew / Vessel Availability

Season	Vessel No.	Crew Shift		Vessel Preparation Times				Vessel Availability
		Crew 1 (hrs)	Crew 2 (hrs)	Startup (mins)	Load (mins)	Unload (mins)	Shutdown (mins)	(hrs)
Summer	Vessel 1	8.00	8.00	30	15	15	30	15.00
Summer	Vessel 2	8.00	8.00	30	15	15	30	15.00
Winter	Vessel 1	12.00	-	30	15	15	30	11.00

Route Transit Time

Leg No.	Speed	Outbound		Cruise At Speed	Inbound		Round Trip Time Underway		Round Trip Total Transit Time [1]	
		Load	Manuv		Manuv	Unload				
	(knots)	(hrs)	(hrs)	(hrs)	(hrs)	(hrs)	(hrs)	(mins)	(hrs)	(mins)
SAW-WHB	15.00	0.25	0.12	0.62	0.02	0.25	-	45	1	15
WHB-SAW	15.00	0.25	0.02	0.62	0.12	0.25	-	45	1	15
	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-
Total Route Time		**0.50**	**0.14**	**1.24**	**0.14**	**0.50**	1	30	2	30

1) Transit time = Time Underway + Load + Unload

SAW-WHB-SAW Daily Schedules

Model Schedule

Notional schedules are developed to verify number of round trips and determine crew times. Schedule start times are arbitrary. Notional schedules are not intended to show route connections or homeport locations. Final schedules and homeport locations will be based on system implementation.

Summer

		Vessel 1	1st Dep	6:00 AM	1st Load	5:45 AM
Total Crew Time		**Circuit**	**Depart**	**Arrive**	**Depart**	**Arrive**
Crew 1	**Crew 2**	**No.**	**Sawmill Cove**	**Wm Henry Bay**	**Wm Henry Bay**	**Sawmill Cove**
3.00		1	6:00 AM	6:45 AM	7:15 AM	8:00 AM
5.50		2	8:30 AM	9:15 AM	9:45 AM	10:30 AM
8.00		3	11:00 AM	11:45 AM	12:15 PM	1:00 PM
	2.50	4	1:30 PM	2:15 PM	2:45 PM	3:30 PM
	5.00	5	4:00 PM	4:45 PM	5:15 PM	6:00 PM
	8.00	6	6:30 PM	7:15 PM	7:45 PM	8:30 PM

		Vessel 2	1st Dep	7:15 AM	1st Load	7:00 AM
Total Crew Time		**Circuit**	**Depart**	**Arrive**	**Depart**	**Arrive**
Crew 1	**Crew 2**	**No.**	**Sawmill Cove**	**Wm Henry Bay**	**Wm Henry Bay**	**Sawmill Cove**
3.00		1	7:15 AM	8:00 AM	8:30 AM	9:15 AM
5.50		2	9:45 AM	10:30 AM	11:00 AM	11:45 AM
8.00		3	12:15 PM	1:00 PM	1:30 PM	2:15 PM
	2.50	4	2:45 PM	3:30 PM	4:00 PM	4:45 PM
	5.00	5	5:15 PM	6:00 PM	6:30 PM	7:15 PM
	8.00	6	7:45 PM	8:30 PM	9:00 PM	9:45 PM

Winter

		Vessel 1	1st Dep	8:00 AM	1st Load	7:45 AM
Total Crew Time		**Circuit**	**Depart**	**Arrive**	**Depart**	**Arrive**
Crew 1		**No.**	**Sawmill Cove**	**Wm Henry Bay**	**Wm Henry Bay**	**Sawmill Cove**
3.00		1	8:00 AM	8:45 AM	9:15 AM	10:00 AM
5.50		2	10:30 AM	11:15 AM	11:45 AM	12:30 PM
8.00		3	1:00 PM	1:45 PM	2:15 PM	3:00 PM
11.00		4	3:30 PM	4:15 PM	4:45 PM	5:30 PM

Route Operation and Schedule Model

Daily Schedule Statistics (per day)

Season	Round Trips		Daily Underway Time				Daily Operational Time [2,3]			
	Vessel 1	Vessel 2	Vessel 1		Vessel 2		Vessel 1		Vessel 2	
	(# / day)	(# / day)	(hrs / day)	% of Day	(hrs / day)	% of Day	(hrs / day)	% of Day	(hrs / day)	% of Day
Summer	6	6	9.00	37.5%	9.00	37.5%	16.00	66.7%	16.00	66.7%
Winter	4		6.00	25.0%			11.00	45.8%		

2) Daily Operational Time = (Round Trip Transit Time * Number of Round Trips) + Startup + Shutdown

3) Schedule operational time may be slightly greater due to departure time adjustments

Daily Crew Statistics (per day)

Season	Vessel No.	# of Crews (per day)	Crew Shift		Crew Usage			
			Crew 1 (hrs / day)	Crew 2 (hrs / day)	Crew 1		Crew 2	
					(hrs / day)	% of Shift	(hrs / day)	% of Shift
Summer	Vessel 1	2	8	8	8.00	100.0%	8.00	100.0%
Summer	Vessel 2	2	8	8	8.00	100.0%	8.00	100.0%
Winter	Vessel 1	1	12		11.00	91.7%		

SAW-WHB-SAW Weekly Service Summary (per week)

Season	Vessel No.	Crew (days/wk)	Crew Time [4]		Vessel Operation (days/wk)	Trips /Wk	Underway Time (hrs / wk)	Operating Hours (hrs / wk)
			Crew 1 (hrs / wk)	Crew 2 (hrs / wk)				
Summer	Vessel 1	7	56.00	56.00	7.0	42.0	63.00	112.00
Summer	Vessel 2	7	56.00	56.00	7.0	42.0	63.00	112.00
Winter	Vessel 1	7	84.00		7.0	28.0	42.00	77.00

4) Crew Time = Crew shift * Crew days per week

Route Cost Model

Route: SAW-WHB-SAW

Vessel Definition

Type	ASV
Displ	53

Season Definition

Season	#Days	# Weeks	# Op Days
Summer	153	21.9	153
Winter	212	30.3	212

Annual Operational Costs

1. Crew Costs (by week)

Season	# Weeks	Crew Time (hrs/week) Vessel #1	Crew Time (hrs/week) Vessel #2	Total Crew (hrs / season)	Crew Cost ($ / hr)	Total Cost ($ / season)
Summer	21.9	112.00	112.00	4,896.00	$ 698.74	$ 3,421,017
Night [1)]		56.00	56.00	2,448.00	$ 156.55	$ 383,224
Winter	30.3	84.00		2,544.00	$ 698.74	$ 1,777,587
Night [1)]		84.00		2,544.00	$ 156.55	$ 398,252
Total	**52**					**$ 5,980,081**

[1)] Night Crew is capped to 84 hrs per week. Night crew may be re-assigned to watch vessel on non-operational days.

2. Fuel Consumption Costs (by week)

Season	# Weeks	Time Underway Vessel #1 (hrs / wk)	Time Underway Vessel #2 (hrs / wk)	Total Underway (hrs / season)	Fuel Cost ($ / gal)	Fuel Consumption (gal / hr)	Total Cost ($ / season)
Summer	21.9	63.00	63.00	2,754.00	$ 3.38	289.48	$ 2,694,641
Winter	30.3	42.00		1,272.00	$ 3.38	289.48	$ 1,244,584
Total	**52**			**4,026.00**			**$ 3,939,225**

3. Winter Lay-up Cost (by day)

Season	# Days	# Vessels	Cost / Day	Total
winter	212	1.0	$ 991.97	**$ 210,298**

Annual Overhead Costs (by day)

Season	Annual Operating Days Vessel #1	Annual Operating Days Vessel #2	Annual Operating Days Total	($ / day)	Route Overhead Costs Vessel #1	Route Overhead Costs Vessel #2	Route Overhead Costs Total
Summer	153	153	306	$ 1,609	$ 246,177	$ 246,177	$ 492,354
Winter	212		212	$ 1,609	$ 341,108		$ 341,108
Total	**365**	**153**	**518**		**$ 587,285**	**$ 246,177**	**$ 833,462**

Annual Maintenance Costs (by week)

Season	# weeks	Annual Operating Hours Vessel #1 (hrs / wk)	Annual Operating Hours Vessel #2 (hrs / wk)	Annual Operating Hours Total (hrs / wk)	Total (hrs / season)
Summer	21.9	112.00	112.00	224.00	4,896
Winter	30.3	77.00		77.00	2,332
Total	**52**				**7,228**

	Vessel Operation (eng op hrs)	Vessel Operation ($ / hr)	Vessel Overhaul (# Vessels)	Vessel Overhaul ($ / Vessel)	Total Cost
Operating	7,228	$ 44.91			$ 324,602
Overhaul			2.0	$ 509,547	$ 1,019,095
Total Vessel Maintenance Costs					**$ 1,343,697**

Total Annual Route Costs

Total Annual Operational Costs	$ 9,919,306
Total Annual Layup Costs	$ 210,298
Total Annual Overhead Costs	$ 833,462
Total Annual Maintenance Costs	$ 1,343,697
Total Annual Costs	**$ 12,306,762**

Alternative Summary

Alternative: 4A

Alt	Route	Season	Vessels			Crew Hrs		Op Schedule		
			No.	Designation	# ASV	Vessel 1	Vessel 2	hrs/day	Days per Week	Round trips per day
4. Marine Alternatives										
Alt 4A - Fast from AUK			2 Mainlines to Haines/Skagway (S), 1 Mainline to Haines/Skagway (W)							
	HNS-SGY-HNS	Summer	1	Disp-1	18	8	-	6.53	6	2
						8	-	6.53	1	1
		Winter	1	Disp-1	18	8		3.77	3	1
	AUK-HNS-AUK	Summer	2	FVF-1	31	16	16	13.33	7	1
	AUK-SGY-AUK	Winter	1	FVF-1	31	16		13.33	7	1
	AUK-HNS-SGY-HNS-AUK	Summer	1	Mainliner					2	1
		Winter	1	Mainliner					1	1

Alternative Cost Summary

Route Name	Annual Costs					Total Annual Costs	Capital Costs
	Crew	Fuel	Lay-up	Maintenance	Overhead		
HNS-SGY-HNS	$ 1,160,654	$ 212,276	$ -	$ 261,037	$ 374,782	***$ 2,008,749***	$ 22,315,336
AUK-HNS-AUK AUK-SGY-AUK	$ 9,600,784	$ 13,054,377	$ 217,176	$ 2,808,124	$ 833,462	***$ 26,513,923***	$ 164,405,969
AUK-HNS-SGY-HNS-AUK	$ 3,647,773	$ 470,078	$ -	$ 293,218	$ 760,850	***$ 5,171,919***	
Alternative Total	*$ 14,409,211*	*$ 13,736,732*	*$ 217,176*	*$ 3,362,379*	*$ 1,969,094*	**$ 33,694,592**	**$ 186,721,305**

Notes:

1) HNS-SGY route requires a 14 ASV vessel, However, due to seakeeping considerations, the selected minimum vessel has a capacity of 18 ASV (similar to the existing AMHS vessel M/V Lituya).

2) AUK-HNS-AUK and AUK-SGY-AUK routes assume two 8 hour crews per vessel to ensure no crew works more than 12 hours. Because route lengths are different, each vessel would make one trip to each port every day. For example, one vessel would complete the AUK-HNS-AUK route in the morning, then complete the AUK-SGY-AUK route in the afternoon. The other vessel would be on the opposite schedule.

Route Operation and Schedule Model

Route: HNS-SGY-HNS

Route Service Input (Management Plan Appendix A)

Season	Operation hrs / day	Vsl Days/ Wk	Vessel Description		
			Quantity	Type	Designation
Summer	8.00	6.5	1	Displ	Disp-1
Winter	8.00	3.0	1	Displ	Disp-1

Crew / Vessel Availability

Season	Vessel No.	Crew Shift		Vessel Preparation Times				Vessel Availability (hrs)
		Crew 1 (hrs)	Crew 2 (hrs)	Startup (mins)	Load (mins)	Unload (mins)	Shutdown (mins)	
Summer	Vessel 1	8.00	-	30	15	15	30	7.00
		-	-	-	-	-	-	-
Winter	Vessel 1	8.00	-	30	15	15	30	7.00

Route Transit Time

Leg No.	Speed	Outbound		Cruise	Inbound		Round Trip		Round Trip	
		Load	Manuv	At Speed	Manuv	Unload	Time Underway		Total Transit Time [1]	
	(knots)	(hrs)	(hrs)	(hrs)	(hrs)	(hrs)	(hrs)	(mins)	(hrs)	(mins)
HNS-SGY	15.00	0.25	0.05	0.81	0.03	0.25	-	53	1	23
SGY-HNS	15.00	0.25	0.03	0.81	0.05	0.25	-	53	1	23
	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-
Total Route Time		**0.50**	**0.08**	**1.62**	**0.08**	**0.50**	1	46	2	46

1) Transit time = Time Underway + Load + Unload

HNS-SGY-HNS Daily Schedules

Model Schedule

Notional schedules are developed to verify number of round trips and determine crew times. Schedule start times are arbitrary. Notional schedules are not intended to show route connections or homeport locations. Final schedules and homeport locations will be based on system implementation.

Summer

	Vessel 1	1st Dep	8:00 AM	1st Load	7:45 AM
Total Crew Time	Circuit	Depart	Arrive	Depart	Arrive
Crew 1 / Crew 2	No.	Haines	Skagway	Skagway	Haines
3.30	1	8:00 AM	8:53 AM	9:25 AM	10:18 AM
6.63	2	10:50 AM	11:43 AM	12:15 PM	1:08 PM

Winter

	Vessel 1	1st Dep	8:00 AM	1st Load	7:45 AM
Total Crew Time	Circuit	Depart	Arrive	Depart	Arrive
Crew 1	No.	Haines	Skagway	Skagway	Haines
3.80	1	8:00 AM	8:53 AM	9:25 AM	10:18 AM

Route Operation and Schedule Model

Daily Schedule Statistics (per day)

Season	Round Trips		Daily Underway Time				Daily Operational Time [2,3]			
	Vessel 1	Vessel 2	Vessel 1		Vessel 2		Vessel 1		Vessel 2	
	(# / day)	(# / day)	(hrs / day)	% of Day	(hrs / day)	% of Day	(hrs / day)	% of Day	(hrs / day)	% of Day
Summer	2	-	3.53	14.7%	-		6.53	27.2%	0.00	0.0%
Winter	1		1.77	7.4%			3.77	15.7%		

[2] Daily Operational Time = (Round Trip Transit Time * Number of Round Trips) + Startup + Shutdown

[3] Schedule operational time may be slightly greater due to departure time adjustments

Daily Crew Statistics (per day)

Season	Vessel No.	# of Crews (per day)	Crew Shift		Crew Usage			
			Crew 1 (hrs / day)	Crew 2 (hrs / day)	Crew 1 (hrs / day)	Crew 1 % of Shift	Crew 2 (hrs / day)	Crew 2 % of Shift
Summer	Vessel 1	1	8	-	6.63	82.9%		
Summer		-	-	-				
Winter	Vessel 1	1	8		3.80	47.5%		

HNS-SGY-HNS Weekly Service Summary (per week)

Season	Vessel No.	Crew (days/wk)	Crew Time [4]		Vessel Operation (days/wk)	Trips /Wk	Underway Time (hrs / wk)	Operating Hours (hrs / wk)
			Crew 1 (hrs / wk)	Crew 2 (hrs / wk)				
Summer	Vessel 1	7	56.00	-	6.5	13.0	22.97	42.47
Summer			-	-	-	-	-	-
Winter	Vessel 1	5	40.00		3.0	3.0	5.30	11.30

[4] Crew Time = Crew shift * Crew days per week

Route Cost Model

Route: HNS-SGY-HNS Vessel Sizing

Vessel Size and Selection

1. Traffic Forecast

Route Link No.	Name	2038 Summer Average Daily Traffic - One Way PAX-ASV	RV	VAN	PAX
4A-1	HNS-SGY	8	1	1	27
4A-2	SGY-HNS	8	1	1	27
-		-	-	-	-
-		-	-	-	-
Largest Link One Way		**8**	**1**	**1**	**27**
Weekly One Way Traffic		**56**	**7**	**7**	**189**

2. Required Vessel Capacity per Sailing — Assuming 13 Trips per week

		PAX-ASV	RV	VAN	PAX	Total
Capacity		5	1	1	15	
Lane Length	(ft)	100	24	40	N/A	164
Payload	(lbs)	30,000	12,000	40,000	N/A	82,000

3. Required Vessel Characteristics

Type	ASV (#)	PAX (#)	Payload (lton)
Displ	**9**	15	37

4. Selected Vessel Characteristics

	ASV	PAX	Deadweight
Selection Basis	18		
Selected Characteristics		15	37

Route Cost Model

Route: HNS-SGY-HNS

Vessel Definition

Type	ASV
Displ	18

Season Definition

Season	#Days	# Weeks	# Op Days
Summer	153	21.9	142
Winter	212	30.3	91

Annual Operational Costs

1. Crew Costs (by week)

Season	# Weeks	Crew Time (hrs/week) Vessel #1	Vessel #2	Total Crew (hrs / season)	Crew Cost ($ / hr)	Total Cost ($ / season)
Summer	21.9	56.00	-	1,224.00	$ 343.28	$ 420,176
Night [1)]		84.00	-	1,836.00	$ 74.11	$ 136,072
Winter	30.3	40.00		1,211.43	$ 343.28	$ 415,861
Night [1)]		84.00		2,544.00	$ 74.11	$ 188,545
Total	**52.1**					**$ 1,160,654**

[1)] Night Crew is capped to 84 hrs per week. Night crew may be re-assigned to watch vessel on non-operational days.

2. Fuel Consumption Costs (by week)

Season	# Weeks	Time Underway Vessel #1 (hrs / wk)	Vessel #2 (hrs / wk)	Total Underway (hrs / season)	Fuel Cost ($ / gal)	Fuel Consumption (gal / hr)	Total Cost ($ / season)
Summer	21.9	22.97	-	501.99	$ 3.38	94.80	$ 160,845
Winter	30.3	5.30		160.51	$ 3.38	94.80	$ 51,432
Total	**52.1**			**662.50**			**$ 212,276**

3. Winter Lay-up Cost (by day)

Season	# Days	# Vessels	Cost / Day	Total
winter	212	-	$ -	**$ -**

Annual Overhead Costs (by day)

Season	Annual Operating Days Vessel #1	Vessel #2	Total	($ / day)	Route Overhead Costs Vessel #1	Vessel #2	Total
Summer	142	-	142	$ 1,609	$ 228,593	$ -	$ 228,593
Winter	91		91	$ 1,609	$ 146,189		$ 146,189
Total	**233**	**-**	**233**		**$ 374,782**	**$ -**	**$ 374,782**

Annual Maintenance Costs (by week)

Season	# weeks	Annual Operating Hours Vessel #1 (hrs / wk)	Vessel #2 (hrs / wk)	Total (hrs / wk)	Total (hrs / season)
Summer	21.9	42.47	-	42.47	928
Winter	30.3	11.30		11.30	342
Total	**52.1**				**1,270**

	Vessel Operation		Vessel Overhaul		Total
	(eng op hrs)	($ / hr)	(# Vessels)	($ / Vessel)	Cost
Operating	1,270	$ 14.75			$ 18,742
Overhaul			1.0	$ 242,295	$ 242,295
Total Vessel Maintenance Costs					**$ 261,037**

Total Annual Route Costs

Total Annual Operational Costs	$ 1,372,930
Total Annual Layup Costs	$ -
Total Annual Overhead Costs	$ 374,782
Total Annual Maintenance Costs	$ 261,037
Total Annual Costs	**$ 2,008,749**

Vessel Capital Cost

	$ / Vessel	# Vessels	Total
Vessel Acquisition Cost	$ 22,315,336	1	
Total Vessel Capital Costs			**$ 22,315,336**

Route Operation and Schedule Model

Route: AUK-HNS-AUK AUK-SGY-AUK

Route Service Input (Management Plan Appendix A)

Season	Operation hrs / day	Vsl Days/ Wk	Vessel Description		
			Quantity	Type	Designation
Summer	16.00	7.0	2	HSF	FVF-1
Winter	16.00	7.0	1	HSF	FVF-1

Crew / Vessel Availability

Season	Vessel No.	Crew Shift		Vessel Preparation Times				Vessel Availability (hrs)
		Crew 1 (hrs)	Crew 2 (hrs)	Startup (mins)	Load (mins)	Unload (mins)	Shutdown (mins)	
Summer	Vessel 1	8.00	8.00	30	15	15	30	15.00
Summer	Vessel 2	8.00	8.00	30	15	15	30	15.00
Winter	Vessel 1	8.00	8.00	30	15	15	30	15.00

Route Transit Time

Leg No.	Speed	Outbound		Cruise At Speed	Inbound		Round Trip Time Underway		Round Trip Total Transit Time [1]	
		Load	Manuv		Manuv	Unload				
	(knots)	(hrs)	(hrs)	(hrs)	(hrs)	(hrs)	(hrs)	(mins)	(hrs)	(mins)
AUK-HNS	30.00	0.25	0.29	2.12	0.04	0.25	2	27	2	57
HNS-AUK	30.00	0.25	0.04	2.12	0.29	0.25	2	27	2	57
AUK-SGY	30.00	0.25	0.29	2.41	0.02	0.25	2	43	3	13
SGY-AUK	30.00	0.25	0.02	2.41	0.29	0.25	2	43	3	13
Total Route Time		**1.00**	**0.64**	**9.06**	**0.64**	**1.00**	10	20	12	20

1) Transit time = Time Underway + Load + Unload

AUK-HNS-AUK AUK-SGY-AUK Daily Schedules

Model Schedule

Notional schedules are developed to verify number of round trips and determine crew times. Schedule start times are arbitrary. Notional schedules are not intended to show route connections or homeport locations. Final schedules and homeport locations will be based on system implementation.

Summer

		Vessel 1	1st Dep	6:00 AM	1st Load	5:45 AM				
Total Crew Time		**Circuit**	**Depart**	**Arrive**	**Depart**	**Arrive**	**Depart**	**Arrive**	**Depart**	**Arrive**
Crew 1	**Crew 2**	**No.**	**Auke Bay**	**Haines**	**Haines**	**Auke Bay**	**Auke Bay**	**Skagway**	**Skagway**	**Auke Bay**
6.45	6.97	1	6:00 AM	8:27 AM	9:00 AM	11:27 AM	12:00 PM	2:43 PM	3:15 PM	5:58 PM

		Vessel 2	1st Dep	6:00 AM	1st Load	5:45 AM				
Total Crew Time		**Circuit**	**Depart**	**Arrive**	**Depart**	**Arrive**	**Depart**	**Arrive**	**Depart**	**Arrive**
Crew 1	**Crew 2**	**No.**	**Auke Bay**	**Haines**	**Haines**	**Auke Bay**	**Auke Bay**	**Skagway**	**Skagway**	**Auke Bay**
6.45	6.97	1	6:00 AM	8:27 AM	9:00 AM	11:27 AM	12:00 PM	2:43 PM	3:15 PM	5:58 PM

Winter

		Vessel 1	1st Dep	6:00 AM	1st Load	5:45 AM				
Total Crew Time		**Circuit**	**Depart**	**Arrive**	**Depart**	**Arrive**	**Depart**	**Arrive**	**Depart**	**Arrive**
Crew 1	**Crew 2**	**No.**	**Auke Bay**	**Haines**	**Haines**	**Auke Bay**	**Auke Bay**	**Skagway**	**Skagway**	**Auke Bay**
6.45	6.97	1	6:00 AM	8:27 AM	9:00 AM	11:27 AM	12:00 PM	2:43 PM	3:15 PM	5:58 PM

Route Operation and Schedule Model

Daily Schedule Statistics (per day)

Season	Round Trips		Daily Underway Time				Daily Operational Time [2,3]			
	Vessel 1	Vessel 2	Vessel 1		Vessel 2		Vessel 1		Vessel 2	
	(# / day)	(# / day)	(hrs / day)	% of Day	(hrs / day)	% of Day	(hrs / day)	% of Day	(hrs / day)	% of Day
Summer	1	1	10.33	43.1%	10.33	43.1%	13.33	55.6%	13.33	55.6%
Winter	1		10.33	43.1%			13.33	55.6%		

[2] Daily Operational Time = (Round Trip Transit Time * Number of Round Trips) + Startup + Shutdown

[3] Schedule operational time may be slightly greater due to departure time adjustments

Daily Crew Statistics (per day)

Season	Vessel No.	# of Crews (per day)	Crew Shift		Crew Usage			
			Crew 1 (hrs / day)	Crew 2 (hrs / day)	Crew 1		Crew 2	
					(hrs / day)	% of Shift	(hrs / day)	% of Shift
Summer	Vessel 1	2	8	8	6.45	80.6%	6.97	87.1%
Summer	Vessel 2	2	8	8	6.45	80.6%	6.97	87.1%
Winter	Vessel 1	2	8	8	6.45	80.6%	6.97	87.1%

AUK-HNS-AUK AUK-SGY-AUK Weekly Service Summary (per week)

Season	Vessel No.	Crew (days/wk)	Crew Time [4]		Vessel Operation (days/wk)	Trips /Wk	Underway Time (hrs / wk)	Operating Hours (hrs / wk)
			Crew 1 (hrs / wk)	Crew 2 (hrs / wk)				
Summer	Vessel 1	7	56.00	56.00	7.0	7.0	72.33	93.33
Summer	Vessel 2	7	56.00	56.00	7.0	7.0	72.33	93.33
Winter	Vessel 1	7	56.00	56.00	7.0	7.0	72.33	93.33

[4] Crew Time = Crew shift * Crew days per week

Route Cost Model

Route: AUK-HNS-AUK AUK-SGY-AUK Vessel Sizing

Vessel Size and Selection

1. Traffic Forecast

Route Link No.	Name	2038 Summer Average Daily Traffic - One Way PAX-ASV	RV	VAN	PAX
4A-3	AUK-HNS	51	3	2	179
4A-4	HNS-AUK	51	3	2	179
4A-5	AUK-SGY	45	3	2	179
4A-6	SGY-AUK	45	3	2	179
Largest Link One Way		**51**	**3**	**2**	**179**
Weekly One Way Traffic		**357**	**21**	**14**	**1,253**

2. Required Vessel Capacity per Sailing — Assuming 14 Trips per week

		PAX-ASV	RV	VAN	PAX	Total
Capacity		26	2	1	90	
Lane Length	(ft)	520	48	40	N/A	608
Payload	(lbs)	156,000	24,000	40,000	N/A	220,000

3. Required Vessel Characteristics

Type	ASV (#)	PAX (#)	Payload (lton)
HSF	**31**	90	99

4. Selected Vessel Characteristics

	ASV	PAX	Deadweight
Selection Basis	31		
Selected Characteristics		90	99

Route Cost Model

Route: AUK-HNS-AUK AUK-SGY-AUK

Vessel Definition

Type	ASV
HSF	31

Season Definition

Season	#Days	# Weeks	# Op Days
Summer	153	21.9	153
Winter	212	30.3	212

Annual Operational Costs

1. Crew Costs (by week)

Season	# Weeks	Crew Time (hrs/week) Vessel #1	Crew Time (hrs/week) Vessel #2	Total Crew (hrs / season)	Crew Cost ($ / hr)	Total Cost ($ / season)
Summer	21.9	112.00	112.00	4,896.00	$ 922.56	$ 4,516,834
Night [1)]		56.00	56.00	2,448.00	$ 471.68	$ 1,154,672
Winter	30.3	112.00		3,392.00	$ 922.56	$ 3,129,310
Night [1)]		56.00		1,696.00	$ 471.68	$ 799,969
Total	**52.1**					**$ 9,600,784**

[1)] Night Crew is capped to 84 hrs per week. Night crew may be re-assigned to watch vessel on non-operational days.

2. Fuel Consumption Costs (by week)

Season	# Weeks	Time Underway Vessel #1 (hrs / wk)	Time Underway Vessel #2 (hrs / wk)	Total Underway (hrs / season)	Fuel Cost ($ / gal)	Fuel Consumption (gal / hr)	Total Cost ($ / season)
Summer	21.9	72.33	72.33	3,162.00	$ 3.38	721.55	$ 7,711,659
Winter	30.3	72.33		2,190.67	$ 3.38	721.55	$ 5,342,718
Total	**52.1**			**5,352.67**			**$ 13,054,377**

3. Winter Lay-up Cost (by day)

Season	# Days	# Vessels	Cost / Day	Total
winter	212	1.0	$ 1,024.42	**$ 217,176**

Annual Overhead Costs (by day)

Season	Annual Operating Days Vessel #1	Vessel #2	Total	($ / day)	Route Overhead Costs Vessel #1	Vessel #2	Total
Summer	153	153	306	$ 1,609	$ 246,177	$ 246,177	$ 492,354
Winter	212		212	$ 1,609	$ 341,108		$ 341,108
Total	**365**	**153**	**518**		**$ 587,285**	**$ 246,177**	**$ 833,462**

Annual Maintenance Costs (by week)

Season	# weeks	Annual Operating Hours Vessel #1 (hrs / wk)	Vessel #2 (hrs / wk)	Total (hrs / wk)	Total (hrs / season)
Summer	21.9	93.33	93.33	186.67	4,080
Winter	30.3	93.33		93.33	2,827
Total	**52.1**				**6,907**

	Vessel Operation		Vessel Overhaul		Total
	(eng op hrs)	($ / hr)	(# Vessels)	($ / Vessel)	Cost
Operating	6,907	$ 132.65			$ 916,197
Overhaul			2.0	$ 945,964	$ 1,891,927
Total Vessel Maintenance Costs					**$ 2,808,124**

Total Annual Route Costs

Total Annual Operational Costs	$ 22,655,161
Total Annual Layup Costs	$ 217,176
Total Annual Overhead Costs	$ 833,462
Total Annual Maintenance Costs	$ 2,808,124
Total Annual Costs	**$ 26,513,923**

Vessel Capital Cost

	$ / Vessel	# Vessels	Total
Vessel Acquisition Cost	$ 82,202,984	2	
Total Vessel Capital Costs			**$ 164,405,969**

Alternative Summary

Alternative: 4B

Alt	Route	Season	Vessels			Crew Hrs		Op Schedule		
			No.	Designation	# ASV	Vessel 1	Vessel 2	hrs/day	Days per Week	Round trips per day
4. Marine Alternatives										
Alt 4B - Fast from SAW in Summer, AUK in Winter						2 Mainlines to Haines/Skagway (S), 1 Mainline to Haines/Skagway (W)				
	HNS-SGY-HNS	Summer	1	Disp-1	18	8	-	6.53	6	2
						8	-	6.53	1	1
		Winter	1	Disp-1	18	8		3.77	3	1
	SAW-HNS-SAW SAW-SGY-SAW	Summer	2	FVF-1	53	12	12	9.43	7	1
	AUK-HNS-AUK AUK-SGY-AUK	Winter	1	FVF-1	53	16		13.33	7	1
	AUK-HNS-SGY-HNS-AUK	Summer	1	Mainliner					2	1
		Winter	1	Mainliner					1	1

Alternative Cost Summary

Route Name	Annual Costs					Total Annual Costs	Capital Costs
	Crew	Fuel	Lay-up	Maintenance	Overhead		
HNS-SGY-HNS	$ 1,160,654	$ 212,276	$ -	$ 261,037	$ 374,782	***$ 2,008,749***	$ 22,315,336
SAW-HNS-SAW SAW-SGY-SAW	$ 9,665,594	$ 11,183,913	$ 255,745	$ 2,879,081	$ 809,327	***$ 24,793,660***	$ 196,617,018
AUK-HNS-SGY-HNS-AUK	$ 3,647,773	$ 470,078	$ -	$ 293,218	$ 760,850	***$ 5,171,919***	
Alternative Total	*$ 14,474,021*	*$ 11,866,267*	*$ 255,745*	*$ 3,433,336*	*$ 1,944,959*	**$ 31,974,328**	**$ 218,932,354**

Notes:

1) HNS-SGY route requires a 14 ASV vessel. However, due to seakeeping considerations, the selected minimum has a capacity of 18 ASV (similar to the existing AMHS vessel M/V Lituya).

2) AUK-HNS-AUK and AUK-SGY-AUK routes assume two 8 hour crews per vessel to ensure no crew works more than 12 hours. Because route lengths are different, each vessel would make one trip to each port every day. For example, one vessel would complete the AUK-HNS-AUK route in the morning, then complete the AUK-SGY-AUK route in the afternoon. The other vessel would be on the opposite schedule.

3) This alternatives' cost model is based on 138 day summer service to Sawmill Bay and 227 day winter service to Auke Bay. Summer and winter seasons are modified for environmental concerns (herring and eulachon spawning, as well as humpback whale and Stellar Sea Lion concentrations).

Route Operation and Schedule Model

Route: HNS-SGY-HNS

Route Service Input (Management Plan Appendix A)

Season	Operation hrs / day	Vsl Days/ Wk	Vessel Description		
			Quantity	Type	Designation
Summer	8.00	6.5	1	Displ	Disp-1
Winter	8.00	3.0	1	Displ	Disp-1

Crew / Vessel Availability

Season	Vessel No.	Crew Shift		Vessel Preparation Times				Vessel Availability (hrs)
		Crew 1 (hrs)	Crew 2 (hrs)	Startup (mins)	Load (mins)	Unload (mins)	Shutdown (mins)	
Summer	Vessel 1	8.00	-	30	15	15	30	7.00
		-	-	-	-	-	-	-
Winter	Vessel 1	8.00	-	30	15	15	30	7.00

Route Transit Time

Leg No.	Speed	Outbound		Cruise At Speed	Inbound		Round Trip Time Underway		Round Trip Total Transit Time [1]	
		Load	Manuv		Manuv	Unload				
	(knots)	(hrs)	(hrs)	(hrs)	(hrs)	(hrs)	(hrs)	(mins)	(hrs)	(mins)
HNS-SGY	15.00	0.25	0.05	0.81	0.03	0.25	-	53	1	23
SGY-HNS	15.00	0.25	0.03	0.81	0.05	0.25	-	53	1	23
	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-
Total Route Time		**0.50**	**0.08**	**1.62**	**0.08**	**0.50**	1	46	2	46

1) Transit time = Time Underway + Load + Unload

HNS-SGY-HNS Daily Schedules

Model Schedule

Notional schedules are developed to verify number of round trips and determine crew times. Schedule start times are arbitrary. Notional schedules are not intended to show route connections or homeport locations. Final schedules and homeport locations will be based on system implementation.

Summer

	Vessel 1	1st Dep	6:00 AM	1st Load	5:45 AM

Total Crew Time		Circuit	Depart	Arrive	Depart	Arrive
Crew 1	Crew 2	No.	Haines	Skagway	Skagway	Haines
3.30		1	6:00 AM	6:53 AM	7:25 AM	8:18 AM
6.63		2	8:50 AM	9:43 AM	10:15 AM	11:08 AM

Winter

	Vessel 1	1st Dep	8:00 AM	1st Load	7:45 AM

Total Crew Time		Circuit	Depart	Arrive	Depart	Arrive
Crew 1		No.	Haines	Skagway	Skagway	Haines
3.80		1	8:00 AM	8:53 AM	9:25 AM	10:18 AM

Route Operation and Schedule Model

Daily Schedule Statistics (per day)

Season	Round Trips		Daily Underway Time				Daily Operational Time [2,3]			
	Vessel 1	Vessel 2	Vessel 1		Vessel 2		Vessel 1		Vessel 2	
	(# / day)	(# / day)	(hrs / day)	% of Day	(hrs / day)	% of Day	(hrs / day)	% of Day	(hrs / day)	% of Day
Summer	2	-	3.53	14.7%	-		6.53	27.2%	0.00	0.0%
Winter	1		1.77	7.4%			3.77	15.7%		

[2] Daily Operational Time = (Round Trip Transit Time * Number of Round Trips) + Startup + Shutdown

[3] Schedule operational time may be slightly greater due to departure time adjustments

Daily Crew Statistics (per day)

Season	Vessel No.	# of Crews (per day)	Crew Shift		Crew Usage			
			Crew 1 (hrs / day)	Crew 2 (hrs / day)	Crew 1		Crew 2	
					(hrs / day)	% of Shift	(hrs / day)	% of Shift
Summer	Vessel 1	1	8	-	6.63	82.9%		
Summer		-	-	-				
Winter	Vessel 1	1	8		3.80	47.5%		

HNS-SGY-HNS Weekly Service Summary (per week)

Season	Vessel No.	Crew (days/wk)	Crew Time [4]		Vessel Operation (days/wk)	Trips /Wk	Underway Time (hrs / wk)	Operating Hours (hrs / wk)
			Crew 1 (hrs / wk)	Crew 2 (hrs / wk)				
Summer	Vessel 1	7	56.00	-	6.5	13.0	22.97	42.47
Summer			-	-	-	-	-	-
Winter	Vessel 1	5	40.00		3.0	3.0	5.30	11.30

[4] Crew Time = Crew shift * Crew days per week

Route Cost Model

Route: HNS-SGY-HNS Vessel Sizing

Vessel Size and Selection

1. Traffic Forecast

Route Link No.	Name	2038 Summer Average Daily Traffic - One Way PAX-ASV	RV	VAN	PAX
4B-1	HNS-SGY	8	1	1	27
4B-2	SGY-HNS	8	1	1	27
-		-	-	-	-
-		-	-	-	-
Largest Link One Way		**8**	**1**	**1**	**27**
Weekly One Way Traffic		**56**	**7**	**7**	**189**

2. Required Vessel Capacity per Sailing — Assuming 13 Trips per week

		PAX-ASV	RV	VAN	PAX	Total
Capacity		5	1	1	15	
Lane Length	(ft)	100	24	40	N/A	164
Payload	(lbs)	30,000	12,000	40,000	N/A	82,000

3. Required Vessel Characteristics

Type	ASV (#)	PAX (#)	Payload (lton)
Displ	**9**	15	37

4. Selected Vessel Characteristics

	ASV	PAX	Deadweight
Selection Basis	18		
Selected Characteristics		15	37

Route Cost Model

Route: HNS-SGY-HNS

Vessel Definition

Type	ASV
Displ	18

Season Definition

Season	#Days	# Weeks	# Op Days
Summer	153	21.9	142
Winter	212	30.3	91

Annual Operational Costs

1. Crew Costs (by week)

Season	# Weeks	Crew Time (hrs/week) Vessel #1	Vessel #2	Total Crew (hrs / season)	Crew Cost ($ / hr)	Total Cost ($ / season)
Summer	21.9	56.00	-	1,224.00	$ 343.28	$ 420,176
Night [1)]		84.00	-	1,836.00	$ 74.11	$ 136,072
Winter	30.3	40.00		1,211.43	$ 343.28	$ 415,861
Night [1)]		84.00		2,544.00	$ 74.11	$ 188,545
Total	**52.1**					**$ 1,160,654**

[1)] Night Crew is capped to 84 hrs per week. Night crew may be re-assigned to watch vessel on non-operational days.

2. Fuel Consumption Costs (by week)

Season	# Weeks	Time Underway Vessel #1 (hrs / wk)	Vessel #2 (hrs / wk)	Total Underway (hrs / season)	Fuel Cost ($ / gal)	Fuel Consumption (gal / hr)	Total Cost ($ / season)
Summer	21.9	22.97	-	501.99	$ 3.38	94.80	$ 160,845
Winter	30.3	5.30		160.51	$ 3.38	94.80	$ 51,432
Total	**52.1**			**662.50**			**$ 212,276**

3. Winter Lay-up Cost (by day)

Season	# Days	# Vessels	Cost / Day	Total
winter	212	-	$ -	**$ -**

Annual Overhead Costs (by day)

Season	Annual Operating Days Vessel #1	Vessel #2	Total	($ / day)	Route Overhead Costs Vessel #1	Vessel #2	Total
Summer	142	-	142	$ 1,609	$ 228,593	$ -	$ 228,593
Winter	91		91	$ 1,609	$ 146,189		$ 146,189
Total	**233**	**-**	**233**		**$ 374,782**	**$ -**	**$ 374,782**

Annual Maintenance Costs (by week)

Season	# weeks	Annual Operating Hours Vessel #1 (hrs / wk)	Vessel #2 (hrs / wk)	Total (hrs / wk)	Total (hrs / season)
Summer	21.9	42.47	-	42.47	928
Winter	30.3	11.30		11.30	342
Total	**52.1**				**1,270**

	Vessel Operation		Vessel Overhaul		Total
	(eng op hrs)	($ / hr)	(# Vessels)	($ / Vessel)	Cost
Operating	1,270	$ 14.75			$ 18,742
Overhaul			1.0	$ 242,295	$ 242,295
Total Vessel Maintenance Costs					**$ 261,037**

Total Annual Route Costs

Total Annual Operational Costs	$ 1,372,930
Total Annual Layup Costs	$ -
Total Annual Overhead Costs	$ 374,782
Total Annual Maintenance Costs	$ 261,037
Total Annual Costs	**$ 2,008,749**

Vessel Capital Cost

	$ / Vessel	# Vessels	Total
Vessel Acquisition Cost	$ 22,315,336	1	
Total Vessel Capital Costs			**$ 22,315,336**

Route Operation and Schedule Model

Route: SAW-HNS-SAW SAW-SGY-SAW

Route Service Input (Management Plan Appendix A)

Season	Operation hrs / day	Vsl Days/ Wk	Vessel Description		
			Quantity	Type	Designation
Summer	12.00	7.0	2	HSF	FVF-1
Winter	-				

Crew / Vessel Availability

Season	Vessel No.	Crew Shift		Vessel Preparation Times				Vessel Availability
		Crew 1 (hrs)	Crew 2 (hrs)	Startup (mins)	Load (mins)	Unload (mins)	Shutdown (mins)	(hrs)
Summer	Vessel 1	12.00	-	30	15	15	30	11.00
Summer	Vessel 2	12.00	-	30	15	15	30	11.00
		-	-	-	-	-	-	-

Route Transit Time

Leg No.	Speed	Outbound		Cruise At Speed	Inbound		Round Trip Time Underway		Round Trip Total Transit Time [1]	
		Load	Manuv		Manuv	Unload				
	(knots)	(hrs)	(hrs)	(hrs)	(hrs)	(hrs)	(hrs)	(mins)	(hrs)	(mins)
SAW-HNS	30.00	0.25	0.08	1.36	0.04	0.25	1	28	1	58
HNS-SAW	30.00	0.25	0.04	1.36	0.08	0.25	1	28	1	58
SAW-SGY	30.00	0.25	0.08	1.65	0.02	0.25	1	45	2	15
SGY-SAW	30.00	0.25	0.02	1.65	0.08	0.25	1	45	2	15
Total Route Time		**1.00**	**0.22**	**6.02**	**0.22**	**1.00**	6	26	8	26

1) Transit time = Time Underway + Load + Unload

SAW-HNS-SAW SAW-SGY-SAW Daily Schedules

Model Schedule

Notional schedules are developed to verify number of round trips and determine crew times. Schedule start times are arbitrary. Notional schedules are not intended to show route connections or homeport locations. Final schedules and homeport locations will be based on system implementation.

Summer

Vessel 1	1st Dep	6:00 AM	1st Load	5:45 AM	

Total Crew Time		Circuit	Depart	Arrive	Depart	Arrive	Depart	Arrive	Depart	Arrive
Crew 1	Crew 2	No.	Sawmill Cove	Haines	Haines	Sawmill Cove	Sawmill Cove	Skagway	Skagway	Sawmill Cove
9.50		1	6:00 AM	7:28 AM	8:00 AM	9:28 AM	10:00 AM	11:45 AM	12:15 PM	2:00 PM

Vessel 2	1st Dep	6:00 AM	1st Load	5:45 AM	

Total Crew Time		Circuit	Depart	Arrive	Depart	Arrive	Depart	Arrive	Depart	Arrive
Crew 1	Crew 2	No.	Sawmill Cove	Haines	Haines	Sawmill Cove	Sawmill Cove	Skagway	Skagway	Sawmill Cove
9.50		1	6:00 AM	7:28 AM	8:00 AM	9:28 AM	10:00 AM	11:45 AM	12:15 PM	2:00 PM

Route Operation and Schedule Model

Daily Schedule Statistics (per day)

Season	Round Trips		Daily Underway Time				Daily Operational Time [2,3]			
	Vessel 1	Vessel 2	Vessel 1		Vessel 2		Vessel 1		Vessel 2	
	(# / day)	(# / day)	(hrs / day)	% of Day	(hrs / day)	% of Day	(hrs / day)	% of Day	(hrs / day)	% of Day
Summer	1	1	6.43	26.8%	6.43	26.8%	9.43	39.3%	9.43	39.3%
Winter	0		0.00	N/A			0.00	N/A		

[2] Daily Operational Time = (Round Trip Transit Time * Number of Round Trips) + Startup + Shutdown

[3] Schedule operational time may be slightly greater due to departure time adjustments

Daily Crew Statistics (per day)

Season	Vessel No.	# of Crews (per day)	Crew Shift		Crew Usage			
			Crew 1 (hrs / day)	Crew 2 (hrs / day)	Crew 1		Crew 2	
					(hrs / day)	% of Shift	(hrs / day)	% of Shift
Summer	Vessel 1	1	12	-	9.50	79.2%		
Summer	Vessel 2	1	12	-	9.50	79.2%		
Winter		-	-	-				

SAW-HNS-SAW SAW-SGY-SAW Weekly Service Summary (per week)

Season	Vessel No.	Crew (days/wk)	Crew Time [4]		Vessel Operation (days/wk)	Trips /Wk	Underway Time (hrs / wk)	Operating Hours (hrs / wk)
			Crew 1 (hrs / wk)	Crew 2 (hrs / wk)				
Summer	Vessel 1	7	84.00	-	7.0	7.0	45.03	66.03
Summer	Vessel 2	7	84.00	-	7.0	7.0	45.03	66.03
Winter			-	-	-	-	-	-

[4] Crew Time = Crew shift * Crew days per week

Route Operation and Schedule Model

Route: AUK-HNS-AUK AUK-SGY-AUK

Route Service Input (Management Plan Appendix A)

Season	Operation hrs / day	Vsl Days/ Wk	Vessel Description		
			Quantity	Type	Designation
Summer	-				
Winter	16.00	7.0	1	HSF	FVF-1

Crew / Vessel Availability

Season	Vessel No.	Crew Shift		Vessel Preparation Times				Vessel Availability (hrs)
		Crew 1 (hrs)	Crew 2 (hrs)	Startup (mins)	Load (mins)	Unload (mins)	Shutdown (mins)	
		-	-	-	-	-	-	-
		-	-	-	-	-	-	-
Winter	Vessel 1	8.00	8.00	30	15	15	30	15.00

Route Transit Time

Leg No.	Speed	Outbound		Cruise	Inbound		Round Trip		Round Trip	
		Load	Manuv	At Speed	Manuv	Unload	Time Underway		Total Transit Time [1]	
	(knots)	(hrs)	(hrs)	(hrs)	(hrs)	(hrs)	(hrs)	(mins)	(hrs)	(mins)
AUK-HNS	30.00	0.25	0.29	2.12	0.04	0.25	2	27	2	57
HNS-AUK	30.00	0.25	0.04	2.12	0.29	0.25	2	27	2	57
AUK-SGY	30.00	0.25	0.29	2.41	0.02	0.25	2	43	3	13
SGY-AUK	30.00	0.25	0.02	2.41	0.29	0.25	2	43	3	13
Total Route Time		**1.00**	**0.64**	**9.06**	**0.64**	**1.00**	10	20	12	20

[1)] Transit time = Time Underway + Load + Unload

AUK-HNS-AUK AUK-SGY-AUK Daily Schedules

Model Schedule

Notional schedules are developed to verify number of round trips and determine crew times. Schedule start times are arbitrary. Notional schedules are not intended to show route connections or homeport locations. Final schedules and homeport locations will be based on system implementation.

Winter

Vessel 1	1st Dep	8:00 AM	1st Load	7:45 AM	

Total Crew Time		Circuit	Depart	Arrive	Depart	Arrive	Depart	Arrive	Depart	Arrive
Crew 1	Crew 2	No.	Auke Bay	Haines	Haines	Auke Bay	Auke Bay	Skagway	Skagway	Auke Bay
5.45	5.97	1	8:00 AM	10:27 AM	11:00 AM	1:27 PM	2:00 PM	4:43 PM	5:15 PM	7:58 PM

Route Operation and Schedule Model

Daily Schedule Statistics (per day)

Season	Round Trips		Daily Underway Time				Daily Operational Time [2,3]			
	Vessel 1	Vessel 2	Vessel 1		Vessel 2		Vessel 1		Vessel 2	
	(# / day)	(# / day)	(hrs / day)	% of Day	(hrs / day)	% of Day	(hrs / day)	% of Day	(hrs / day)	% of Day
Summer	0	-	0.00	N/A	-		0.00	N/A	0.00	0.0%
Winter	1		10.33	43.1%			13.33	55.6%		

[2] Daily Operational Time = (Round Trip Transit Time * Number of Round Trips) + Startup + Shutdown

[3] Schedule operational time may be slightly greater due to departure time adjustments

Daily Crew Statistics (per day)

Season	Vessel No.	# of Crews (per day)	Crew Shift		Crew Usage			
			Crew 1 (hrs / day)	Crew 2 (hrs / day)	Crew 1 (hrs / day)	Crew 1 % of Shift	Crew 2 (hrs / day)	Crew 2 % of Shift
Summer		-	-	-				
Summer		-	-	-				
Winter	Vessel 1	2	8	8	5.45	68.1%	5.97	74.6%

AUK-HNS-AUK AUK-SGY-AUK Weekly Service Summary (per week)

Season	Vessel No.	Crew (days/wk)	Crew Time [4]		Vessel Operation (days/wk)	Trips /Wk	Underway Time (hrs / wk)	Operating Hours (hrs / wk)
			Crew 1 (hrs / wk)	Crew 2 (hrs / wk)				
Summer			-	-	-	-	-	-
Summer			-	-	-	-	-	-
Winter	Vessel 1	7	56.00	56.00	7.0	7.0	72.33	93.33

[4] Crew Time = Crew shift * Crew days per week

Route Cost Model

Route: SAW-HNS-SAW SAW-SGY-SAW Vessel Sizing

Vessel Size and Selection

1. Traffic Forecast

Route Link No.	Name	2038 Summer Average Daily Traffic - One Way PAX-ASV	RV	VAN	PAX
4B-3	SAW-HNS	93	5	2	327
4B-4	HNS-SAW	93	5	2	327
4B-5	SAW-SGY	78	5	2	327
4B-6	SGY-SAW	78	5	2	327
Largest Link One Way		**93**	**5**	**2**	**327**
Weekly One Way Traffic		**651**	**35**	**14**	**2,289**

2. Required Vessel Capacity per Sailing — Assuming 14 Trips per week

		PAX-ASV	RV	VAN	PAX	Total
Capacity		47	3	1	164	
Lane Length	(ft)	940	72	40	N/A	1,052
Payload	(lbs)	282,000	36,000	40,000	N/A	358,000

3. Required Vessel Characteristics

Type	ASV (#)	PAX (#)	Payload (lton)
HSF	**53**	164	160

4. Selected Vessel Characteristics

	ASV	PAX	Deadweight
Selection Basis	53		
Selected Characteristics		164	160

Route Cost Model

Route: SAW-HNS-SAW SAW-SGY-SAW

Vessel Definition

Type	ASV
HSF	53

Season Definition

Season	#Days	# Weeks	# Op Days
Summer	138	19.7	138
Winter	227	32.4	227

Annual Operational Costs

1. Crew Costs (by week)

Season	# Weeks	Crew Time (hrs/week) Vessel #1	Crew Time (hrs/week) Vessel #2	Total Crew (hrs / season)	Crew Cost ($ / hr)	Total Cost ($ / season)
Summer	19.7	84.00	84.00	3,312.00	$ 1,014.98	$ 3,361,620
Night [1)]		84.00	84.00	3,312.00	$ 510.44	$ 1,690,592
Winter	32.4	112.00		3,632.00	$ 1,014.98	$ 3,686,415
Night [1)]		56.00		1,816.00	$ 510.44	$ 926,967
Total	**52.1**					**$ 9,665,594**

[1)] Night Crew is capped to 84 hrs per week. Night crew may be re-assigned to watch vessel on non-operational days.

2. Fuel Consumption Costs (by week)

Season	# Weeks	Time Underway Vessel #1 (hrs / wk)	Time Underway Vessel #2 (hrs / wk)	Total Underway (hrs / season)	Fuel Cost ($ / gal)	Fuel Consumption (gal / hr)	Total Cost ($ / season)
Summer	19.7	45.03	45.03	1,775.60	$ 3.38	802.87	$ 4,818,459
Winter	32.4	72.33		2,345.67	$ 3.38	802.87	$ 6,365,454
Total	**52.1**			**4,121.27**			**$ 11,183,913**

3. Winter Lay-up Cost (by day)

Season	# Days	# Vessels	Cost / Day	Total
winter	227	1.0	$ 1,126.63	**$ 255,745**

Annual Overhead Costs (by day)

Season	Annual Operating Days Vessel #1	Annual Operating Days Vessel #2	Annual Operating Days Total	($ / day)	Route Overhead Costs Vessel #1	Route Overhead Costs Vessel #2	Route Overhead Costs Total
Summer	138	138	276	$ 1,609	$ 222,042	$ 222,042	$ 444,084
Winter	227		227	$ 1,609	$ 365,243		$ 365,243
Total	**365**	**138**	**503**		**$ 587,285**	**$ 222,042**	**$ 809,327**

Annual Maintenance Costs (by week)

Season	# weeks	Annual Operating Hours Vessel #1 (hrs / wk)	Annual Operating Hours Vessel #2 (hrs / wk)	Annual Operating Hours Total (hrs / wk)	Total (hrs / season)
Summer	19.7	66.03	66.03	132.07	2,604
Winter	32.4	93.33		93.33	3,027
Total	**52.1**				**5,630**

	Vessel Operation (eng op hrs)	Vessel Operation ($ / hr)	Vessel Overhaul (# Vessels)	Vessel Overhaul ($ / Vessel)	Total Cost
Operating	5,630	$ 145.95			$ 821,753
Overhaul			2.0	$ 1,028,664	$ 2,057,328
Total Vessel Maintenance Costs					**$ 2,879,081**

Total Annual Route Costs

Total Annual Operational Costs	$ 20,849,507
Total Annual Layup Costs	$ 255,745
Total Annual Overhead Costs	$ 809,327
Total Annual Maintenance Costs	$ 2,879,081
Total Annual Costs	**$ 24,793,660**

Vessel Capital Cost

	$ / Vessel	# Vessels	Total
Vessel Acquisition Cost	$ 98,308,509	2	
Total Vessel Capital Costs			**$ 196,617,018**

Alternative Summary

Alternative: 4C

Alt	Route	Season	Vessels			Crew Hrs		Op Schedule		
			No.	Designation	# ASV	Vessel 1	Vessel 2	hrs/day	Days per Week	Round trips per day
4. Marine Alternatives										
Alt 4C - Displ from AUK			2 Mainlines to Haines/Skagway (S), 1 Mainline to Haines/Skagway (W)							
	HNS-SGY-HNS	Summer	1	Disp-1	18	8	-	6.53	6	2
						8	-	6.53	1	1
		Winter	1	Disp-1	18	8		3.77	3	1
	AUK-HNS-AUK	Summer	1	DayACF	53	12	-	11.53	7	1
		Winter	1	DayACF	53	12		11.53	3.5	1
	AUK-SGY-AUK	Summer	1	DayACF	53	12	-	11.60	7	1
		Winter	1	DayACF	53	12		11.60	3.5	1
	AUK-HNS-SGY-HNS-AUK	Summer	1	Mainliner					2	1
		Winter	1	Mainliner					1	1

Alternative Cost Summary

Route Name	Annual Costs					Total Annual Costs	Capital Costs
	Crew	Fuel	Lay-up	Maintenance	Overhead		
HNS-SGY-HNS	$ 1,160,654	$ 212,276	$ -	$ 261,037	$ 374,782	***$ 2,008,749***	$ 22,315,336
AUK-HNS-AUK	$ 2,658,219	$ 2,415,915	$ 105,149	$ 643,696	$ 416,731	***$ 6,239,710***	
AUK-SGY-AUK	$ 2,658,219	$ 2,686,227	$ 105,149	$ 644,472	$ 416,731	***$ 6,510,798***	
AUK-HNS-SGY-HNS-AUK	$ 3,647,773	$ 470,078	$ -	$ 293,218	$ 760,850	***$ 5,171,919***	
Alternative Total	*$ 10,124,865*	*$ 5,784,496*	*$ 210,298*	*$ 1,842,422*	*$ 1,969,094*	**$ 19,931,176**	**$ 22,315,336**

Notes:

1) HNS-SGY route requires a 14 ASV vessel. However, due to seakeeping considerations, the selected minimum vessel has a capacity of 18 ASV (similar to the existing AMHS vessel M/V Lituya).

2) AUK-SGY route startup/shutdown times have been reduced to maintain schedule. To avoid crew overtime costs, system implementation may require some combination of special vessel/terminal interface and nightcrew assistance.

3) Winter service to Haines and Skagway is on alternating days, providing each city 7 days service in two weeks. To calculate vessel operating costs, the vessel on each route is assumed to operate 7 days per week for half the winter season (106 days).

Route Operation and Schedule Model

Route: HNS-SGY-HNS

Route Service Input (Management Plan Appendix A)

Season	Operation hrs / day	Vsl Days/ Wk	Vessel Description		
			Quantity	Type	Designation
Summer	8.00	6.5	1	Displ	Disp-1
Winter	8.00	3.0	1	Displ	Disp-1

Crew / Vessel Availability

Season	Vessel No.	Crew Shift		Vessel Preparation Times				Vessel Availability (hrs)
		Crew 1 (hrs)	Crew 2 (hrs)	Startup (mins)	Load (mins)	Unload (mins)	Shutdown (mins)	
Summer	Vessel 1	8.00	-	30	15	15	30	7.00
		-	-	-	-	-	-	-
Winter	Vessel 1	8.00	-	30	15	15	30	7.00

Route Transit Time

Leg No.	Speed	Outbound		Cruise At Speed	Inbound		Round Trip Time Underway		Round Trip Total Transit Time [1]	
		Load	Manuv		Manuv	Unload				
	(knots)	(hrs)	(hrs)	(hrs)	(hrs)	(hrs)	(hrs)	(mins)	(hrs)	(mins)
HNS-SGY	15.00	0.25	0.05	0.81	0.03	0.25	-	53	1	23
SGY-HNS	15.00	0.25	0.03	0.81	0.05	0.25	-	53	1	23
	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-
Total Route Time		**0.50**	**0.08**	**1.62**	**0.08**	**0.50**	1	46	2	46

1) Transit time = Time Underway + Load + Unload

HNS-SGY-HNS Daily Schedules

Model Schedule

Notional schedules are developed to verify number of round trips and determine crew times. Schedule start times are arbitrary. Notional schedules are not intended to show route connections or homeport locations. Final schedules and homeport locations will be based on system implementation.

Summer

Vessel 1	1st Dep	8:00 AM	1st Load	7:45 AM	
Total Crew Time		**Circuit**	**Depart**	**Arrive**	**Depart**	**Arrive**
Crew 1	**Crew 2**	**No.**	**Haines**	**Skagway**	**Skagway**	**Haines**
3.30		1	8:00 AM	8:53 AM	9:25 AM	10:18 AM
6.63		2	10:50 AM	11:43 AM	12:15 PM	1:08 PM

Winter

Vessel 1	1st Dep	8:00 AM	1st Load	7:45 AM	
Total Crew Time	**Circuit**	**Depart**	**Arrive**	**Depart**	**Arrive**
Crew 1	**No.**	**Haines**	**Skagway**	**Skagway**	**Haines**
3.80	1	8:00 AM	8:53 AM	9:25 AM	10:18 AM

Route Operation and Schedule Model

Daily Schedule Statistics (per day)

Season	Round Trips		Daily Underway Time				Daily Operational Time [2,3]			
	Vessel 1	Vessel 2	Vessel 1		Vessel 2		Vessel 1		Vessel 2	
	(# / day)	(# / day)	(hrs / day)	% of Day	(hrs / day)	% of Day	(hrs / day)	% of Day	(hrs / day)	% of Day
Summer	2	-	3.53	14.7%	-		6.53	27.2%	0.00	0.0%
Winter	1		1.77	7.4%			3.77	15.7%		

[2] Daily Operational Time = (Round Trip Transit Time * Number of Round Trips) + Startup + Shutdown

[3] Schedule operational time may be slightly greater due to departure time adjustments

Daily Crew Statistics (per day)

Season	Vessel No.	# of Crews (per day)	Crew Shift		Crew Usage			
			Crew 1 (hrs / day)	Crew 2 (hrs / day)	Crew 1 (hrs / day)	Crew 1 % of Shift	Crew 2 (hrs / day)	Crew 2 % of Shift
Summer	Vessel 1	1	8	-	6.63	82.9%		
Summer		-	-	-				
Winter	Vessel 1	1	8		3.80	47.5%		

HNS-SGY-HNS Weekly Service Summary (per week)

Season	Vessel No.	Crew (days/wk)	Crew Time [4]		Vessel Operation (days/wk)	Trips /Wk	Underway Time (hrs / wk)	Operating Hours (hrs / wk)
			Crew 1 (hrs / wk)	Crew 2 (hrs / wk)				
Summer	Vessel 1	7	56.00	-	6.5	13.0	22.97	42.47
Summer			-	-	-	-	-	-
Winter	Vessel 1	5	40.00		3.0	3.0	5.30	11.30

[4] Crew Time = Crew shift * Crew days per week

Route Cost Model

Route: HNS-SGY-HNS Vessel Sizing

Vessel Size and Selection

1. Traffic Forecast

Route Link No.	Name	2038 Summer Average Daily Traffic - One Way PAX-ASV	RV	VAN	PAX
4C-1	HNS-SGY	8	1	1	27
4C-2	SGY-HNS	8	1	1	27
-		-	-	-	-
-		-	-	-	-
Largest Link One Way		**8**	**1**	**1**	**27**
Weekly One Way Traffic		**56**	**7**	**7**	**189**

2. Required Vessel Capacity per Sailing — Assuming 13 Trips per week

		PAX-ASV	RV	VAN	PAX	Total
Capacity		5	1	1	15	
Lane Length	(ft)	100	24	40	N/A	164
Payload	(lbs)	30,000	12,000	40,000	N/A	82,000

3. Required Vessel Characteristics

Type	ASV (#)	PAX (#)	Payload (lton)
Displ	**9**	15	37

4. Selected Vessel Characteristics

	ASV	PAX	Deadweight
Selection Basis	18		
Selected Characteristics		15	37

Route Cost Model

Route: HNS-SGY-HNS

Vessel Definition

Type	ASV
Displ	18

Season Definition

Season	#Days	# Weeks	# Op Days
Summer	153	21.9	142
Winter	212	30.3	91

Annual Operational Costs

1. Crew Costs (by week)

Season	# Weeks	Crew Time (hrs/week) Vessel #1	Vessel #2	Total Crew (hrs / season)	Crew Cost ($ / hr)	Total Cost ($ / season)
Summer	21.9	56.00	-	1,224.00	$ 343.28	$ 420,176
Night [1)]		84.00	-	1,836.00	$ 74.11	$ 136,072
Winter	30.3	40.00		1,211.43	$ 343.28	$ 415,861
Night [1)]		84.00		2,544.00	$ 74.11	$ 188,545
Total	**52.1**					**$ 1,160,654**

[1)] Night Crew is capped to 84 hrs per week. Night crew may be re-assigned to watch vessel on non-operational days.

2. Fuel Consumption Costs (by week)

Season	# Weeks	Time Underway Vessel #1 (hrs / wk)	Vessel #2 (hrs / wk)	Total Underway (hrs / season)	Fuel Cost ($ / gal)	Fuel Consumption (gal / hr)	Total Cost ($ / season)
Summer	21.9	22.97	-	501.99	$ 3.38	94.80	$ 160,845
Winter	30.3	5.30		160.51	$ 3.38	94.80	$ 51,432
Total	**52.1**			**662.50**			**$ 212,276**

3. Winter Lay-up Cost (by day)

Season	# Days	# Vessels	Cost / Day	Total
winter	212	-	$ -	**$ -**

Annual Overhead Costs (by day)

Season	Annual Operating Days Vessel #1	Vessel #2	Total	($ / day)	Route Overhead Costs Vessel #1	Vessel #2	Total
Summer	142	-	142	$ 1,609	$ 228,593	$ -	$ 228,593
Winter	91		91	$ 1,609	$ 146,189		$ 146,189
Total	**233**	**-**	**233**		**$ 374,782**	**$ -**	**$ 374,782**

Annual Maintenance Costs (by week)

Season	# weeks	Annual Operating Hours Vessel #1 (hrs / wk)	Vessel #2 (hrs / wk)	Total (hrs / wk)	Total (hrs / season)
Summer	21.9	42.47	-	42.47	928
Winter	30.3	11.30		11.30	342
Total	**52.1**				**1,270**

	Vessel Operation		Vessel Overhaul		Total
	(eng op hrs)	($ / hr)	(# Vessels)	($ / Vessel)	Cost
Operating	1,270	$ 14.75			$ 18,742
Overhaul			1.0	$ 242,295	$ 242,295
Total Vessel Maintenance Costs					**$ 261,037**

Total Annual Route Costs

Total Annual Operational Costs	$ 1,372,930
Total Annual Layup Costs	$ -
Total Annual Overhead Costs	$ 374,782
Total Annual Maintenance Costs	$ 261,037
Total Annual Costs	**$ 2,008,749**

Vessel Capital Cost

	$ / Vessel	# Vessels	Total
Vessel Acquisition Cost	$ 22,315,336	1	
Total Vessel Capital Costs			**$ 22,315,336**

Route Operation and Schedule Model

Route: AUK-HNS-AUK

Route Service Input (Management Plan Appendix A)

Season	Operation hrs / day	Vsl Days/ Wk	Vessel Description		
			Quantity	Type	Designation
Summer	12.00	7.0	1	Disp	DayACF
Winter	12.00	7.0	1	Disp	DayACF

Crew / Vessel Availability

Season	Vessel No.	Crew Shift		Vessel Preparation Times				Vessel Availability (hrs)
		Crew 1 (hrs)	Crew 2 (hrs)	Startup (mins)	Load (mins)	Unload (mins)	Shutdown (mins)	
Summer	Vessel 1	12.00	-	30	15	15	30	11.00
		-	-	-	-	-	-	-
Winter	Vessel 1	12.00	-	30	15	15	30	11.00

Route Transit Time

Leg No.	Speed	Outbound		Cruise At Speed	Inbound		Round Trip Time Underway		Round Trip Total Transit Time [1]	
		Load	Manuv		Manuv	Unload				
	(knots)	(hrs)	(hrs)	(hrs)	(hrs)	(hrs)	(hrs)	(mins)	(hrs)	(mins)
AUK-HNS	15.00	0.25	0.47	4.24	0.06	0.25	4	46	5	16
HNS-AUK	15.00	0.25	0.06	4.24	0.47	0.25	4	46	5	16
	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-
Total Route Time		**0.50**	**0.53**	**8.48**	**0.53**	**0.50**	9	32	10	32

1) Transit time = Time Underway + Load + Unload

AUK-HNS-AUK Daily Schedules

Model Schedule

Notional schedules are developed to verify number of round trips and determine crew times. Schedule start times are arbitrary. Notional schedules are not intended to show route connections or homeport locations. Final schedules and homeport locations will be based on system implementation.

Summer

Vessel 1	1st Dep	6:00 AM	1st Load	5:45 AM	
Total Crew Time		**Circuit**	**Depart**	**Arrive**	**Depart**	**Arrive**
Crew 1	**Crew 2**	**No.**	**Auke Bay**	**Haines**	**Haines**	**Auke Bay**
11.60		1	6:00 AM	10:46 AM	11:20 AM	4:06 PM

Winter

Vessel 1	1st Dep	6:00 AM	1st Load	5:45 AM	
Total Crew Time		**Circuit**	**Depart**	**Arrive**	**Depart**	**Arrive**
Crew 1	**Crew 2**	**No.**	**Auke Bay**	**Haines**	**Haines**	**Auke Bay**
11.60		1	6:00 AM	10:46 AM	11:20 AM	4:06 PM

Route Operation and Schedule Model

Daily Schedule Statistics (per day)

Season	Round Trips		Daily Underway Time				Daily Operational Time [2,3]			
	Vessel 1	Vessel 2	Vessel 1		Vessel 2		Vessel 1		Vessel 2	
	(# / day)	(# / day)	(hrs / day)	% of Day	(hrs / day)	% of Day	(hrs / day)	% of Day	(hrs / day)	% of Day
Summer	1	-	9.53	39.7%	-		11.53	48.1%	0.00	0.0%
Winter	1		9.53	39.7%			11.53	48.1%		

2) Daily Operational Time = (Round Trip Transit Time * Number of Round Trips) + Startup + Shutdown

3) Schedule operational time may be slightly greater due to departure time adjustments

Daily Crew Statistics (per day)

Season	Vessel No.	# of Crews (per day)	Crew Shift		Crew Usage			
			Crew 1 (hrs / day)	Crew 2 (hrs / day)	Crew 1 (hrs / day)	Crew 1 % of Shift	Crew 2 (hrs / day)	Crew 2 % of Shift
Summer	Vessel 1	1	12	-	11.60	96.7%		
Summer		-	-	-				
Winter	Vessel 1	1	12	-	11.60	96.7%		

AUK-HNS-AUK N/AN/A Weekly Service Summary (per week)

Season	Vessel No.	Crew (days/wk)	Crew Time [4]		Vessel Operation (days/wk)	Trips /Wk	Underway Time (hrs / wk)	Operating Hours (hrs / wk)
			Crew 1 (hrs / wk)	Crew 2 (hrs / wk)				
Summer	Vessel 1	7	84.00	-	7.0	7.0	66.73	80.73
Summer			-	-	-	-	-	-
Winter	Vessel 1	7	84.00	-	7.0	7.0	66.73	80.73

4) Crew Time = Crew shift * Crew days per week

5) This winter service is shared with Skagway. For the Cost model, the vessel operation is set to 7 days per week, for half of the winter season.

Route Cost Model

Route: AUK-HNS-AUK

Vessel Definition

Type	ASV
Displ	53

Season Definition

Season	#Days	# Weeks	# Op Days
Summer	153	21.9	153
Winter	106	15.1	106

* 106 days is half of the winter season

Annual Operational Costs

1. Crew Costs (by week)

Season	# Weeks	Crew Time (hrs/week) Vessel #1	Vessel #2	Total Crew (hrs / season)	Crew Cost ($ / hr)	Total Cost ($ / season)
Summer	21.9	84.00	-	1,836.00	$ 698.74	$ 1,282,881
Night [1)]		84.00	-	1,836.00	$ 156.55	$ 287,418
Winter	15.1	84.00		1,272.00	$ 698.74	$ 888,794
Night [1)]		84.00		1,272.00	$ 156.55	$ 199,126
Total	**37.0**					**$ 2,658,219**

[1)] Night Crew is capped to 84 hrs per week. Night crew may be re-assigned to watch vessel on non-operational days.

2. Fuel Consumption Costs (by week)

Season	# Weeks	Time Underway Vessel #1 (hrs / wk)	Vessel #2 (hrs / wk)	Total Underway (hrs / season)	Fuel Cost ($ / gal)	Fuel Consumption (gal / hr)	Total Cost ($ / season)
Summer	21.9	66.73	-	1,458.60	$ 3.38	289.48	$ 1,427,162
Winter	15.1	66.73		1,010.53	$ 3.38	289.48	$ 988,753
Total	**37.0**			**2,469.13**			**$ 2,415,915**

3. Winter Lay-up Cost (by day)

Season	# Days	# Vessels	Cost / Day	Total
winter	106	1.0	$ 991.97	**$ 105,149**

Annual Overhead Costs (by day)

Season	Annual Operating Days Vessel #1	Vessel #2	Total	($ / day)	Route Overhead Costs Vessel #1	Vessel #2	Total
Summer	153	-	153	$ 1,609	$ 246,177	$ -	$ 246,177
Winter	106		106	$ 1,609	$ 170,554		$ 170,554
Total	**259**	**-**	**259**		**$ 416,731**	**$ -**	**$ 416,731**

Annual Maintenance Costs (by week)

Season	# weeks	Annual Operating Hours Vessel #1 (hrs / wk)	Vessel #2 (hrs / wk)	Total (hrs / wk)	Total (hrs / season)
Summer	22	80.73	-	80.73	1,765
Winter	15	80.73		80.73	1,223
Total	**37**				**2,987**

	Vessel Operation (eng op hrs)	($ / hr)	Vessel Overhaul (# Vessels)	($ / Vessel)	Total Cost
Operating	2,987	$ 44.91			$ 134,149
Overhaul			1.0	$ 509,547	$ 509,547
Total Vessel Maintenance Costs					**$ 643,696**

Total Annual Route Costs

Total Annual Operational Costs	$ 5,074,134
Total Annual Layup Costs	$ 105,149
Total Annual Overhead Costs	$ 416,731
Total Annual Maintenance Costs	$ 643,696
Total Annual Costs	**$ 6,239,710**

Route Operation and Schedule Model

Route: AUK-SGY-AUK

Route Service Input (Management Plan Appendix A)

Season	Operation hrs / day	Vsl Days/ Wk	Vessel Description		
			Quantity	Type	Designation
Summer	12.00	7.0	1	Displ	DayACF
Winter	12.00	7.0	1	Displ	DayACF

Crew / Vessel Availability

Season	Vessel No.	Crew Shift		Vessel Preparation Times				Vessel Availability (hrs)
		Crew 1 (hrs)	Crew 2 (hrs)	Startup (mins)	Load (mins)	Unload (mins)	Shutdown (mins)	
Summer	Vessel 1	12.00	-	-	15	15	-	12.00
		-	-	-	-	-	-	-
Winter	Vessel 1	12.00	-	-	15	15	-	12.00

Route Transit Time

Leg No.	Speed	Outbound		Cruise At Speed	Inbound		Round Trip Time Underway		Round Trip Total Transit Time [1]	
		Load	Manuv		Manuv	Unload				
	(knots)	(hrs)	(hrs)	(hrs)	(hrs)	(hrs)	(hrs)	(mins)	(hrs)	(mins)
AUK-SGY	15.00	0.25	0.47	4.81	0.03	0.25	5	18	5	48
SGY-AUK	15.00	0.25	0.03	4.81	0.47	0.25	5	18	5	48
	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-
Total Route Time		**0.50**	**0.50**	**9.62**	**0.50**	**0.50**	10	36	11	36

[1)] Transit time = Time Underway + Load + Unload

AUK-SGY-AUK Daily Schedules

Model Schedule

Notional schedules are developed to verify number of round trips and determine crew times. Schedule start times are arbitrary. Notional schedules are not intended to show route connections or homeport locations. Final schedules and homeport locations will be based on system implementation.

Summer

Vessel 1	1st Dep	6:00 AM	1st Load	5:45 AM	
Total Crew Time		**Circuit**	**Depart**	**Arrive**	**Depart**	**Arrive**
Crew 1	**Crew 2**	**No.**	**Auke Bay**	**Skagway**	**Skagway**	**Auke Bay**
11.63		1	6:00 AM	11:18 AM	11:50 AM	5:08 PM

Winter

Vessel 1	1st Dep	6:00 AM	1st Load	5:45 AM	
Total Crew Time	**Circuit**	**Depart**	**Arrive**	**Depart**	**Arrive**
Crew 1	**No.**	**Auke Bay**	**Skagway**	**Skagway**	**Auke Bay**
11.63	1	6:00 AM	11:18 AM	11:50 AM	5:08 PM

[2)] This schedule requires both reduced startup and shutdown times and loading/unloading during startup/shutdown. Alternatively, the vessel speed can be increased to 16.5 knots resulting in increased fuel consumption and costs.

Route Operation and Schedule Model

Daily Schedule Statistics (per day)

Season	Round Trips		Daily Underway Time				Daily Operational Time [2,3]			
	Vessel 1	Vessel 2	Vessel 1		Vessel 2		Vessel 1		Vessel 2	
	(# / day)	(# / day)	(hrs / day)	% of Day	(hrs / day)	% of Day	(hrs / day)	% of Day	(hrs / day)	% of Day
Summer	1	-	10.60	44.2%	-		11.60	48.3%	0.00	0.0%
Winter	1		10.60	44.2%			11.60	48.3%		

2) Daily Operational Time = (Round Trip Transit Time * Number of Round Trips) + Startup + Shutdown

3) Schedule operational time may be slightly greater due to departure time adjustments

Daily Crew Statistics (per day)

Season	Vessel No.	# of Crews (per day)	Crew Shift		Crew Usage			
			Crew 1 (hrs / day)	Crew 2 (hrs / day)	Crew 1 (hrs / day)	Crew 1 % of Shift	Crew 2 (hrs / day)	Crew 2 % of Shift
Summer	Vessel 1	1	12	-	11.63	96.9%		
Summer		-	-	-				
Winter	Vessel 1	1	12		11.63	96.9%		

AUK-SGY-AUK Weekly Service Summary (per week)

Season	Vessel No.	Crew (days/wk)	Crew Time [4]		Vessel Operation (days/wk)	Trips /Wk	Underway Time (hrs / wk)	Operating Hours (hrs / wk)
			Crew 1 (hrs / wk)	Crew 2 (hrs / wk)				
Summer	Vessel 1	7	84.00	-	7.0	7.0	74.20	81.20
Summer			-	-	-	-	-	-
Winter	Vessel 1	7	84.00		7.0	7.0	74.20	81.20

4) Crew Time = Crew shift * Crew days per week

5) This winter service is shared with Haines. For the Cost model, the vessel operation is set to 7 days per week, for half of the winter season.

Route Cost Model

Route: AUK-SGY-AUK

Vessel Definition

Type	ASV
Displ	53

Season Definition

Season	#Days	# Weeks	# Op Days
Summer	153	21.9	153
Winter	106	15.1	106

* 106 days is half of the winter season

Annual Operational Costs

1. Crew Costs (by week)

Season	# Weeks	Crew Time (hrs/week) Vessel #1	Vessel #2	Total Crew (hrs / season)	Crew Cost ($ / hr)	Total Cost ($ / season)
Summer	21.9	84.00	-	1,836.00	$ 698.74	$ 1,282,881
Night [1)]		84.00	-	1,836.00	$ 156.55	$ 287,418
Winter	15.1	84.00		1,272.00	$ 698.74	$ 888,794
Night [1)]		84.00		1,272.00	$ 156.55	$ 199,126
Total	**37.0**					**$ 2,658,219**

[1)] Night Crew is capped to 84 hrs per week. Night crew may be re-assigned to watch vessel on non-operational days.

2. Fuel Consumption Costs (by week)

Season	# Weeks	Time Underway Vessel #1 (hrs / wk)	Vessel #2 (hrs / wk)	Total Underway (hrs / season)	Fuel Cost ($ / gal)	Fuel Consumption (gal / hr)	Total Cost ($ / season)
Summer	21.9	74.20	-	1,621.80	$ 3.38	289.48	$ 1,586,844
Winter	15.1	74.20		1,123.60	$ 3.38	289.48	$ 1,099,382
Total	**37.0**			**2,745.40**			**$ 2,686,227**

3. Winter Lay-up Cost (by day)

Season	# Days	# Vessels	Cost / Day	Total
winter	106	1.0	$ 991.97	**$ 105,149**

Annual Overhead Costs (by day)

Season	Annual Operating Days Vessel #1	Vessel #2	Total	($ / day)	Route Overhead Costs Vessel #1	Vessel #2	Total
Summer	153	-	153	$ 1,609	$ 246,177	$ -	$ 246,177
Winter	106		106	$ 1,609	$ 170,554		$ 170,554
Total	**259**	**-**	**259**		**$ 416,731**	**$ -**	**$ 416,731**

Annual Maintenance Costs (by week)

Season	# weeks	Annual Operating Hours Vessel #1 (hrs / wk)	Vessel #2 (hrs / wk)	Total (hrs / wk)	Total (hrs / season)
Summer	21.9	81.20	-	81.20	1,775
Winter	15.1	81.20		81.20	1,230
Total	**37.0**				**3,004**

	Vessel Operation (eng op hrs)	($ / hr)	Vessel Overhaul (# Vessels)	($ / Vessel)	Total Cost
Operating	3,004	$ 44.91			$ 134,924
Overhaul			1.0	$ 509,547	$ 509,547
Total Vessel Maintenance Costs					**$ 644,472**

Total Annual Route Costs

Total Annual Operational Costs	$ 5,344,446
Total Annual Layup Costs	$ 105,149
Total Annual Overhead Costs	$ 416,731
Total Annual Maintenance Costs	$ 644,472
Total Annual Costs	**$ 6,510,798**

Alternative Summary

Alternative: 4D

Alt	Route	Season	Vessels			Crew Hrs		Op Schedule		
			No.	Designation	# ASV	Vessel 1	Vessel 2	hrs/day	Days per Week	Round trips per day
4. Marine Alternatives										
Alt 4D - Displ from SAW in Summer, AUK in Winter						2 Mainlines to Haines/Skagway (S), 1 Mainline to Haines/Skagway (W)				
	HNS-SGY-HNS	Summer	1	Disp-1	18	8	-	6.53	6	2
						8	-	6.53	1	1
		Winter	1	Disp-1	18	8		3.77	3	1
	SAW-HNS-SAW	Summer	1	DayACF	53	16	-	14.67	7	2
	AUK-HNS-AUK	Winter	1	DayACF	53	12		11.53	3.5	1
	SAW-SGY-SAW	Summer	1	DayACF	53	16	-	15.60	7	2
	AUK-SGY-AUK	Winter	1	DayACF	53	12		11.60	3.5	1
	AUK-HNS-SGY-HNS-AUK	Summer	1	Mainliner					2	1
		Winter	1	Mainliner					1	1

Alternative Cost Summary

Route Name	Annual Costs					Total Annual Costs	Capital Costs
	Crew	Fuel	Lay-up	Maintenance	Overhead		
HNS-SGY-HNS	$ 1,160,654	$ 212,276	$ -	$ 261,037	$ 374,782	***$ 2,008,749***	$ 22,315,336
SAW-HNS-SAW	$ 2,875,402	$ 2,629,346	$ 112,093	$ 658,971	$ 403,859	***$ 6,679,671***	
SAW-SGY-SAW	$ 2,875,402	$ 2,873,306	$ 112,093	$ 665,094	$ 403,859	***$ 6,929,753***	
AUK-HNS-SGY-HNS-AUK	$ 3,647,773	$ 470,078	$ -	$ 293,218	$ 760,850	***$ 5,171,919***	
Alternative Total	*$ 10,559,230*	*$ 6,185,006*	*$ 224,185*	*$ 1,878,320*	*$ 1,943,350*	**$ 20,790,092**	**$ 22,315,336**

Notes:

1) HNS-SGY route requires a 14 ASV vessel, However, due to seakeeping considerations, the selected minimum vessel has a capacity of 18 ASV (similar to the existing AMHS vessel M/V Lituya)s.

2) AUK-SGY route startup/shutdown times have been reduced to maintain schedule. To avoid crew overtime costs, system implementation may require some combination of special vessel/terminal interface and nightcrew assistance.

3) Winter service to Haines and Skagway is on alternating days, providing each city 7 days service in two weeks. To calculate vessel operating costs, the vessel on each route was assumed to operate 7 days per week for half the winter season (113 days).

4) This cost model is based on 138 day summer service to Sawmill Bay and 226 day winter service to Auke Bay. Summer and winter seasons are modified for environmental concerns (herring and eulachon spawning, as well as humpback whale and Stellar Sea Lion concentrations).

Route Operation and Schedule Model

Route: HNS-SGY-HNS

Route Service Input (Management Plan Appendix A)

Season	Operation hrs / day	Vsl Days/ Wk	Vessel Description		
			Quantity	Type	Designation
Summer	8.00	6.5	1	Displ	Disp-1
Winter	8.00	3.0	1	Displ	Disp-1

Crew / Vessel Availability

Season	Vessel No.	Crew Shift		Vessel Preparation Times				Vessel Availability (hrs)
		Crew 1 (hrs)	Crew 2 (hrs)	Startup (mins)	Load (mins)	Unload (mins)	Shutdown (mins)	
Summer	Vessel 1	8.00	-	30	15	15	30	7.00
		-	-	-	-	-	-	-
Winter	Vessel 1	8.00	-	30	15	15	30	7.00

Route Transit Time

Leg No.	Speed	Outbound		Cruise At Speed	Inbound		Round Trip Time Underway		Round Trip Total Transit Time [1]	
		Load	Manuv		Manuv	Unload				
	(knots)	(hrs)	(hrs)	(hrs)	(hrs)	(hrs)	(hrs)	(mins)	(hrs)	(mins)
HNS-SGY	15.00	0.25	0.05	0.81	0.03	0.25	-	53	1	23
SGY-HNS	15.00	0.25	0.03	0.81	0.05	0.25	-	53	1	23
	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-
Total Route Time		**0.50**	**0.08**	**1.62**	**0.08**	**0.50**	1	46	2	46

1) Transit time = Time Underway + Load + Unload

HNS-SGY-HNS Daily Schedules

Model Schedule

Notional schedules are developed to verify number of round trips and determine crew times. Schedule start times are arbitrary. Notional schedules are not intended to show route connections or homeport locations. Final schedules and homeport locations will be based on system implementation.

Summer

		Vessel 1	1st Dep	8:00 AM	1st Load	7:45 AM
Total Crew Time		**Circuit**	**Depart**	**Arrive**	**Depart**	**Arrive**
Crew 1	**Crew 2**	**No.**	**Haines**	**Skagway**	**Skagway**	**Haines**
3.30		1	8:00 AM	8:53 AM	9:25 AM	10:18 AM
6.63		2	10:50 AM	11:43 AM	12:15 PM	1:08 PM

Winter

		Vessel 1	1st Dep	8:00 AM	1st Load	7:45 AM
Total Crew Time		**Circuit**	**Depart**	**Arrive**	**Depart**	**Arrive**
Crew 1		**No.**	**Haines**	**Skagway**	**Skagway**	**Haines**
3.80		1	8:00 AM	8:53 AM	9:25 AM	10:18 AM

Route Operation and Schedule Model

Daily Schedule Statistics (per day)

Season	Round Trips		Daily Underway Time				Daily Operational Time [2,3]			
	Vessel 1	Vessel 2	Vessel 1		Vessel 2		Vessel 1		Vessel 2	
	(# / day)	(# / day)	(hrs / day)	% of Day	(hrs / day)	% of Day	(hrs / day)	% of Day	(hrs / day)	% of Day
Summer	2	-	3.53	14.7%	-		6.53	27.2%	0.00	0.0%
Winter	1		1.77	7.4%			3.77	15.7%		

[2] Daily Operational Time = (Round Trip Transit Time * Number of Round Trips) + Startup + Shutdown

[3] Schedule operational time may be slightly greater due to departure time adjustments

Daily Crew Statistics (per day)

Season	Vessel No.	# of Crews (per day)	Crew Shift		Crew Usage			
			Crew 1 (hrs / day)	Crew 2 (hrs / day)	Crew 1 (hrs / day)	Crew 1 % of Shift	Crew 2 (hrs / day)	Crew 2 % of Shift
Summer	Vessel 1	1	8	-	6.63	82.9%		
Summer		-	-	-				
Winter	Vessel 1	1	8		3.80	47.5%		

HNS-SGY-HNS Weekly Service Summary (per week)

Season	Vessel No.	Crew (days/wk)	Crew Time [4]		Vessel Operation (days/wk)	Trips /Wk	Underway Time (hrs / wk)	Operating Hours (hrs / wk)
			Crew 1 (hrs / wk)	Crew 2 (hrs / wk)				
Summer	Vessel 1	7	56.00	-	6.5	13.0	22.97	42.47
Summer			-	-	-	-	-	-
Winter	Vessel 1	5	40.00		3.0	3.0	5.30	11.30

[4] Crew Time = Crew shift * Crew days per week

Route Cost Model

Route: HNS-SGY-HNS Vessel Sizing

Vessel Size and Selection

1. Traffic Forecast

Route Link No.	Name	2038 Summer Average Daily Traffic - One Way PAX-ASV	RV	VAN	PAX
4D-1	HNS-SGY	8	1	1	27
4D-2	SGY-HNS	8	1	1	27
-		-	-	-	-
-		-	-	-	-
Largest Link One Way		**8**	**1**	**1**	**27**
Weekly One Way Traffic		**56**	**7**	**7**	**189**

2. Required Vessel Capacity per Sailing — Assuming 13 Trips per week

		PAX-ASV	RV	VAN	PAX	Total
Capacity		5	1	1	15	
Lane Length	(ft)	100	24	40	N/A	164
Payload	(lbs)	30,000	12,000	40,000	N/A	82,000

3. Required Vessel Characteristics

Type	ASV (#)	PAX (#)	Payload (lton)
Displ	**9**	15	37

4. Selected Vessel Characteristics

	ASV	PAX	Deadweight
Selection Basis	18		
Selected Characteristics		15	37

Route Cost Model

Route: HNS-SGY-HNS

Vessel Definition

Type	ASV
Displ	18

Season Definition

Season	#Days	# Weeks	# Op Days
Summer	153	21.9	142
Winter	212	30.3	91

Annual Operational Costs

1. Crew Costs (by week)

Season	# Weeks	Crew Time (hrs/week) Vessel #1	Vessel #2	Total Crew (hrs / season)	Crew Cost ($ / hr)	Total Cost ($ / season)
Summer	21.9	56.00	-	1,224.00	$ 343.28	$ 420,176
Night [1)]		84.00	-	1,836.00	$ 74.11	$ 136,072
Winter	30.3	40.00		1,211.43	$ 343.28	$ 415,861
Night [1)]		84.00		2,544.00	$ 74.11	$ 188,545
Total	**52.1**					**$ 1,160,654**

[1)] Night Crew is capped to 84 hrs per week. Night crew may be re-assigned to watch vessel on non-operational days.

2. Fuel Consumption Costs (by week)

Season	# Weeks	Time Underway Vessel #1 (hrs / wk)	Vessel #2 (hrs / wk)	Total Underway (hrs / season)	Fuel Cost ($ / gal)	Fuel Consumption (gal / hr)	Total Cost ($ / season)
Summer	21.9	22.97	-	501.99	$ 3.38	94.80	$ 160,845
Winter	30.3	5.30		160.51	$ 3.38	94.80	$ 51,432
Total	**52.1**			**662.50**			**$ 212,276**

3. Winter Lay-up Cost (by day)

Season	# Days	# Vessels	Cost / Day	Total
winter	212	-	$ -	**$ -**

Annual Overhead Costs (by day)

Season	Annual Operating Days Vessel #1	Vessel #2	Total	($ / day)	Route Overhead Costs Vessel #1	Vessel #2	Total
Summer	142	-	142	$ 1,609	$ 228,593	$ -	$ 228,593
Winter	91		91	$ 1,609	$ 146,189		$ 146,189
Total	**233**	**-**	**233**		**$ 374,782**	**$ -**	**$ 374,782**

Annual Maintenance Costs (by week)

Season	# weeks	Annual Operating Hours Vessel #1 (hrs / wk)	Vessel #2 (hrs / wk)	Total (hrs / wk)	Total (hrs / season)
Summer	21.9	42.47	-	42.47	928
Winter	30.3	11.30		11.30	342
Total	**52.1**				**1,270**

	Vessel Operation (eng op hrs)	($ / hr)	Vessel Overhaul (# Vessels)	($ / Vessel)	Total Cost
Operating	1,270	$ 14.75			$ 18,742
Overhaul			1.0	$ 242,295	$ 242,295
Total Vessel Maintenance Costs					**$ 261,037**

Total Annual Route Costs

Total Annual Operational Costs	$ 1,372,930
Total Annual Layup Costs	$ -
Total Annual Overhead Costs	$ 374,782
Total Annual Maintenance Costs	$ 261,037
Total Annual Costs	**$ 2,008,749**

Vessel Capital Cost

	$ / Vessel	# Vessels	Total
Vessel Acquisition Cost	$ 22,315,336	1	
Total Vessel Capital Costs			**$ 22,315,336**

Route Operation and Schedule Model

Route: SAW-HNS-SAW

Route Service Input (Management Plan Appendix A)

Season	Operation hrs / day	Vsl Days/ Wk	Vessel Description		
			Quantity	Type	Designation
Summer	16.00	7.0	1	Disp	DayACF
Winter	-	0.0	0		

Crew / Vessel Availability

Season	Vessel No.	Crew Shift		Vessel Preparation Times				Vessel Availability
		Crew 1 (hrs)	Crew 2 (hrs)	Startup (mins)	Load (mins)	Unload (mins)	Shutdown (mins)	(hrs)
Summer	Vessel 1	8.00	8.00	30	15	15	30	15.00
		-	-	-	-	-	-	-
		-	-	-	-	-	-	-

Route Transit Time

Leg No.	Speed	Outbound		Cruise	Inbound		Round Trip		Round Trip	
		Load	Manuv	At Speed	Manuv	Unload	Time Underway		Total Transit Time [1]	
	(knots)	(hrs)	(hrs)	(hrs)	(hrs)	(hrs)	(hrs)	(mins)	(hrs)	(mins)
SAW-HNS	15.00	0.25	0.12	2.73	0.07	0.25	2	55	3	25
HNS-SAW	15.00	0.25	0.07	2.73	0.12	0.25	2	55	3	25
	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-
Total Route Time		**0.50**	**0.19**	**5.46**	**0.19**	**0.50**	5	50	6	50

1) Transit time = Time Underway + Load + Unload

SAW-HNS-SAW Daily Schedules

Model Schedule

Notional schedules are developed to verify number of round trips and determine crew times. Schedule start times are arbitrary. Notional schedules are not intended to show route connections or homeport locations. Final schedules and homeport locations will be based on system implementation.

Summer

		Vessel 1	1st Dep	6:00 AM	1st Load	5:45 AM
Total Crew Time		**Circuit**	**Depart**	**Arrive**	**Depart**	**Arrive**
Crew 1	**Crew 2**	**No.**	**Sawmill Cove**	**Haines**	**Haines**	**Sawmill Cove**
7.33		1	6:00 AM	8:55 AM	9:25 AM	12:20 PM
	7.33	2	12:50 PM	3:45 PM	4:15 PM	7:10 PM

Route Operation and Schedule Model

Daily Schedule Statistics (per day)

Season	Round Trips		Daily Underway Time				Daily Operational Time [2,3]			
	Vessel 1	Vessel 2	Vessel 1		Vessel 2		Vessel 1		Vessel 2	
	(# / day)	(# / day)	(hrs / day)	% of Day	(hrs / day)	% of Day	(hrs / day)	% of Day	(hrs / day)	% of Day
Summer	2	-	11.67	48.6%	-		14.67	61.1%	0.00	0.0%
Winter	0		0.00	N/A			0.00	N/A		

[2] Daily Operational Time = (Round Trip Transit Time * Number of Round Trips) + Startup + Shutdown

[3] Schedule operational time may be slightly greater due to departure time adjustments

Daily Crew Statistics (per day)

Season	Vessel No.	# of Crews (per day)	Crew Shift		Crew Usage			
			Crew 1 (hrs / day)	Crew 2 (hrs / day)	Crew 1		Crew 2	
					(hrs / day)	% of Shift	(hrs / day)	% of Shift
Summer	Vessel 1	2	8	8	7.33	91.7%	7.33	91.7%
Summer		-	-	-				
Winter		-	-	-				

SAW-HNS-SAW N/AN/A Weekly Service Summary (per week)

Season	Vessel No.	Crew (days/wk)	Crew Time [4]		Vessel Operation (days/wk)	Trips /Wk	Underway Time (hrs / wk)	Operating Hours (hrs / wk)
			Crew 1 (hrs / wk)	Crew 2 (hrs / wk)				
Summer	Vessel 1	7	56.00	56.00	7.0	14.0	81.67	102.67
Summer			-	-	-	-	-	-
Winter			-	-	-	-	-	-

[4] Crew Time = Crew shift * Crew days per week

Route Operation and Schedule Model

Route: AUK-HNS-AUK

Route Service Input (Management Plan Appendix A)

Season	Operation hrs / day	Vsl Days/ Wk	Vessel Description		
			Quantity	Type	Designation
Summer	-	0.0	0		
Winter	12.00	7.0	1	Disp	DayACF

Crew / Vessel Availability

Season	Vessel No.	Crew Shift		Vessel Preparation Times				Vessel Availability (hrs)
		Crew 1 (hrs)	Crew 2 (hrs)	Startup (mins)	Load (mins)	Unload (mins)	Shutdown (mins)	
		-	-	-	-	-	-	-
		-	-	-	-	-	-	-
Winter	Vessel 1	12.00	-	30	15	15	30	11.00

Route Transit Time

Leg No.	Speed	Outbound		Cruise At Speed	Inbound		Round Trip Time Underway		Round Trip Total Transit Time [1]	
		Load	Manuv		Manuv	Unload				
	(knots)	(hrs)	(hrs)	(hrs)	(hrs)	(hrs)	(hrs)	(mins)	(hrs)	(mins)
AUK-HNS	15.00	0.25	0.47	4.24	0.06	0.25	4	46	5	16
HNS-AUK	15.00	0.25	0.06	4.24	0.47	0.25	4	46	5	16
	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-
Total Route Time		**0.50**	**0.53**	**8.48**	**0.53**	**0.50**	9	32	10	32

1) Transit time = Time Underway + Load + Unload

AUK-HNS-AUK Daily Schedules

Model Schedule

Notional schedules are developed to verify number of round trips and determine crew times. Schedule start times are arbitrary. Notional schedules are not intended to show route connections or homeport locations. Final schedules and homeport locations will be based on system implementation.

Winter

Vessel 1	1st Dep	6:00 AM	1st Load	5:45 AM
Total Crew Time	**Circuit**	**Depart**	**Arrive**	**Depart**	**Arrive**
Crew 1 / **Crew 2**	**No.**	**Auke Bay**	**Haines**	**Haines**	**Auke Bay**
11.60	1	6:00 AM	10:46 AM	11:20 AM	4:06 PM

Route Operation and Schedule Model

Daily Schedule Statistics (per day)

Season	Round Trips		Daily Underway Time				Daily Operational Time [2,3]			
	Vessel 1	Vessel 2	Vessel 1		Vessel 2		Vessel 1		Vessel 2	
	(# / day)	(# / day)	(hrs / day)	% of Day	(hrs / day)	% of Day	(hrs / day)	% of Day	(hrs / day)	% of Day
Summer	0	-	0.00	N/A	-		0.00	N/A	0.00	0.0%
Winter	1		9.53	39.7%			11.53	48.1%		

2) Daily Operational Time = (Round Trip Transit Time * Number of Round Trips) + Startup + Shutdown

3) Schedule operational time may be slightly greater due to departure time adjustments

Daily Crew Statistics (per day)

Season	Vessel No.	# of Crews (per day)	Crew Shift		Crew Usage			
			Crew 1 (hrs / day)	Crew 2 (hrs / day)	Crew 1 (hrs / day)	Crew 1 % of Shift	Crew 2 (hrs / day)	Crew 2 % of Shift
Summer		-	-	-				
Summer		-	-	-				
Winter	Vessel 1	1	12	-	11.60	96.7%		

AUK-HNS-AUK N/AN/A Weekly Service Summary (per week)

Season	Vessel No.	Crew (days/wk)	Crew Time [4]		Vessel Operation (days/wk)	Trips /Wk	Underway Time (hrs / wk)	Operating Hours (hrs / wk)
			Crew 1 (hrs / wk)	Crew 2 (hrs / wk)				
Summer			-	-	-	-	-	-
Summer			-	-	-	-	-	-
Winter	Vessel 1	7.0	84.00	-	7.0	7.0	66.73	80.73

4) Crew Time = Crew shift * Crew days per week

5) This winter service is shared with Skagway. For the Cost model, the vessel operation is set to 7 days per week, for half of the winter season.

Route Cost Model

Route: SAW-HNS-SAW

Vessel Definition

Type	ASV
Displ	53

Season Definition

Season	#Days	# Weeks	# Op Days
Summer	138	19.7	138
Winter	113	16.1	113

* 113 days is half of the winter season

Annual Operational Costs

1. Crew Costs (by week)

Season	# Weeks	Crew Time (hrs/week) Vessel #1	Vessel #2	Total Crew (hrs / season)	Crew Cost ($ / hr)	Total Cost ($ / season)
Summer	19.7	112.00	-	2,208.00	$ 698.74	$ 1,542,812
Night [1)]		56.00	-	1,104.00	$ 156.55	$ 172,826
Winter	16.1	84.00		1,356.00	$ 698.74	$ 947,488
Night [1)]		84.00		1,356.00	$ 156.55	$ 212,276
Total	**35.9**					**$ 2,875,402**

[1)] Night Crew is capped to 84 hrs per week. Night crew may be re-assigned to watch vessel on non-operational days.

2. Fuel Consumption Costs (by week)

Season	# Weeks	Time Underway Vessel #1 (hrs / wk)	Vessel #2 (hrs / wk)	Total Underway (hrs / season)	Fuel Cost ($ / gal)	Fuel Consumption (gal / hr)	Total Cost ($ / season)
Summer	19.7	81.67	-	1,610.00	$ 3.38	289.48	$ 1,575,299
Winter	16.1	66.73		1,077.27	$ 3.38	289.48	$ 1,054,048
Total	**35.9**			**2,687.27**			**$ 2,629,346**

3. Winter Lay-up Cost (by day)

Season	# Days	# Vessels	Cost / Day	Total
winter	113	1.0	$ 991.97	**$ 112,093**

Annual Overhead Costs (by day)

Season	Annual Operating Days Vessel #1	Vessel #2	Total	($ / day)	Route Overhead Costs Vessel #1	Vessel #2	Total
Summer	138	-	138	$ 1,609	$ 222,042	$ -	$ 222,042
Winter	113		113	$ 1,609	$ 181,817		$ 181,817
Total	**251**	**-**	**251**		**$ 403,859**	**$ -**	**$ 403,859**

Annual Maintenance Costs (by week)

Season	# weeks	Annual Operating Hours Vessel #1 (hrs / wk)	Vessel #2 (hrs / wk)	Total (hrs / wk)	Total (hrs / season)
Summer	19.7	102.67	-	102.67	2,024
Winter	16.1	80.73		80.73	1,303
Total	**35.9**				**3,327**

	Vessel Operation (eng op hrs)	($ / hr)	Vessel Overhaul (# Vessels)	($ / Vessel)	Total Cost
Operating	3,327	$ 44.91			$ 149,424
Overhaul			1.0	$ 509,547	$ 509,547
Total Vessel Maintenance Costs					**$ 658,971**

Total Annual Route Costs

Total Annual Operational Costs	$ 5,504,748
Total Annual Layup Costs	$ 112,093
Total Annual Overhead Costs	$ 403,859
Total Annual Maintenance Costs	$ 658,971
Total Annual Costs	**$ 6,679,671**

Route Operation and Schedule Model

Route: SAW-SGY-SAW

Route Service Input (Management Plan Appendix A)

Season	Operation hrs / day	Vsl Days/ Wk	Vessel Description		
			Quantity	Type	Designation
Summer	16.00	7.0	1	Displ	DayACF
Winter	-	0.0	0		

Crew / Vessel Availability

Season	Vessel No.	Crew Shift		Vessel Preparation Times				Vessel Availability
		Crew 1 (hrs)	Crew 2 (hrs)	Startup (mins)	Load (mins)	Unload (mins)	Shutdown (mins)	(hrs)
Summer	Vessel 1	8.00	8.00	30	15	15	30	15.00
		-	-	-	-	-	-	-
		-	-	-	-	-	-	-

Route Transit Time

Leg No.	Speed	Outbound		Cruise	Inbound		Round Trip		Round Trip	
		Load	Manuv	At Speed	Manuv	Unload	Time Underway		Total Transit Time [1]	
	(knots)	(hrs)	(hrs)	(hrs)	(hrs)	(hrs)	(hrs)	(mins)	(hrs)	(mins)
SAW-SGY	16.50	0.25	0.12	3.00	0.03	0.25	3	9	3	39
SGY-SAW	16.50	0.25	0.03	3.00	0.12	0.25	3	9	3	39
	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-
Total Route Time		**0.50**	**0.15**	**6.00**	**0.15**	**0.50**	6	18	7	18

1) Transit time = Time Underway + Load + Unload

SAW-SGY-SAW Daily Schedules

Model Schedule

Notional schedules are developed to verify number of round trips and determine crew times. Schedule start times are arbitrary. Notional schedules are not intended to show route connections or homeport locations. Final schedules and homeport locations will be based on system implementation.

Summer

	Vessel 1	1st Dep	6:00 AM	1st Load	5:45 AM

Total Crew Time		Circuit	Depart	Arrive	Depart	Arrive
Crew 1	Crew 2	No.	Sawmill Cove	Skagway	Skagway	Sawmill Cove
7.82		1	6:00 AM	9:09 AM	9:40 AM	12:49 PM
	7.83	2	1:20 PM	4:29 PM	5:00 PM	8:09 PM

Route Operation and Schedule Model

Daily Schedule Statistics (per day)

Season	Round Trips		Daily Underway Time				Daily Operational Time [2,3]			
	Vessel 1	Vessel 2	Vessel 1		Vessel 2		Vessel 1		Vessel 2	
	(# / day)	(# / day)	(hrs / day)	% of Day	(hrs / day)	% of Day	(hrs / day)	% of Day	(hrs / day)	% of Day
Summer	2	-	12.60	52.5%	-		15.60	65.0%	0.00	0.0%
Winter	0		0.00	N/A			0.00	N/A		

[2] Daily Operational Time = (Round Trip Transit Time * Number of Round Trips) + Startup + Shutdown

[3] Schedule operational time may be slightly greater due to departure time adjustments

Daily Crew Statistics (per day)

Season	Vessel No.	# of Crews (per day)	Crew Shift		Crew Usage			
			Crew 1 (hrs / day)	Crew 2 (hrs / day)	Crew 1		Crew 2	
					(hrs / day)	% of Shift	(hrs / day)	% of Shift
Summer	Vessel 1	2	8	8	7.82	97.7%	7.83	97.9%
Summer		-	-	-				
Winter		-	-					

SAW-SGY-SAW Weekly Service Summary (per week)

Season	Vessel No.	Crew (days/wk)	Crew Time [4]		Vessel Operation (days/wk)	Trips /Wk	Underway Time (hrs / wk)	Operating Hours (hrs / wk)
			Crew 1 (hrs / wk)	Crew 2 (hrs / wk)				
Summer	Vessel 1	7	56.00	56.00	7.0	14.0	88.20	109.20
Summer			-	-	-	-	-	-
Winter			-		-	-	-	-

[4] Crew Time = Crew shift * Crew days per week

Route Operation and Schedule Model

Route: AUK-SGY-AUK

Route Service Input (Management Plan Appendix A)

Season	Operation hrs / day	Vsl Days/ Wk	Vessel Description		
			Quantity	Type	Designation
Summer	-	0.0	0		
Winter	12.00	7.0	1	Displ	DayACF

Crew / Vessel Availability

Season	Vessel No.	Crew Shift		Vessel Preparation Times				Vessel Availability (hrs)
		Crew 1 (hrs)	Crew 2 (hrs)	Startup (mins)	Load (mins)	Unload (mins)	Shutdown (mins)	
		-	-	-	-	-	-	-
		-	-	-	-	-	-	-
Winter	Vessel 1	12.00	-	-	15	15	-	12.00

Route Transit Time

Leg No.	Speed	Outbound		Cruise	Inbound		Round Trip		Round Trip	
		Load	Manuv	At Speed	Manuv	Unload	Time Underway		Total Transit Time [1]	
	(knots)	(hrs)	(hrs)	(hrs)	(hrs)	(hrs)	(hrs)	(mins)	(hrs)	(mins)
AUK-SGY	15.00	0.25	0.47	4.81	0.03	0.25	5	18	5	48
SGY-AUK	15.00	0.25	0.03	4.81	0.47	0.25	5	18	5	48
	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-
Total Route Time		**0.50**	**0.50**	**9.62**	**0.50**	**0.50**	10	36	11	36

[1)] Transit time = Time Underway + Load + Unload

AUK-SGY-AUK Daily Schedules

Model Schedule

Notional schedules are developed to verify number of round trips and determine crew times. Schedule start times are arbitrary. Notional schedules are not intended to show route connections or homeport locations. Final schedules and homeport locations will be based on system implementation.

Winter

Vessel 1	1st Dep	6:00 AM	1st Load	5:45 AM
Total Crew Time	**Circuit**	**Depart**	**Arrive**	**Depart**	**Arrive**
Crew 1	**No.**	**Auke Bay**	**Skagway**	**Skagway**	**Auke Bay**
11.63	1	6:00 AM	11:18 AM	11:50 AM	5:08 PM

[2)] This schedule requires both reduced startup and shutdown times and loading/unloading during startup/shutdown. Alternatively, the vessel speed can be increased to 16.5 knots resulting in increased fuel consumption and costs.

Route Operation and Schedule Model

Daily Schedule Statistics (per day)

Season	Round Trips		Daily Underway Time				Daily Operational Time [2,3]			
	Vessel 1	Vessel 2	Vessel 1		Vessel 2		Vessel 1		Vessel 2	
	(# / day)	(# / day)	(hrs / day)	% of Day	(hrs / day)	% of Day	(hrs / day)	% of Day	(hrs / day)	% of Day
Summer	0	-	0.00	N/A	-		0.00	N/A	0.00	0.0%
Winter	1		10.60	44.2%			11.60	48.3%		

2) Daily Operational Time = (Round Trip Transit Time * Number of Round Trips) + Startup + Shutdown

3) Schedule operational time may be slightly greater due to departure time adjustments

Daily Crew Statistics (per day)

Season	Vessel No.	# of Crews (per day)	Crew Shift		Crew Usage			
			Crew 1 (hrs / day)	Crew 2 (hrs / day)	Crew 1 (hrs / day)	Crew 1 % of Shift	Crew 2 (hrs / day)	Crew 2 % of Shift
Summer		-	-	-				
Summer		-	-	-				
Winter	Vessel 1	1	12		11.63	96.9%		

AUK-SGY-AUK Weekly Service Summary (per week)

Season	Vessel No.	Crew (days/wk)	Crew Time [4]		Vessel Operation (days/wk)	Trips /Wk	Underway Time (hrs / wk)	Operating Hours (hrs / wk)
			Crew 1 (hrs / wk)	Crew 2 (hrs / wk)				
Summer			-	-	-	-	-	-
Summer			-	-	-	-	-	-
Winter	Vessel 1	7.0	84.00		7.0	7.0	74.20	81.20

4) Crew Time = Crew shift * Crew days per week

5) This winter service is shared with Skagway. For the Cost model, the vessel operation is set to 7 days per week, for half of the winter season.

Route Cost Model

Route: SAW-SGY-SAW

Vessel Definition

Type	ASV
Displ	53

Season Definition

Season	#Days	# Weeks	# Op Days
Summer	138	19.7	138
Winter	113	16.1	113

* 113 days is half of the winter season

Annual Operational Costs

1. Crew Costs (by week)

Season	# Weeks	Crew Time (hrs/week) Vessel #1	Crew Time (hrs/week) Vessel #2	Total Crew (hrs / season)	Crew Cost ($ / hr)	Total Cost ($ / season)
Summer	19.7	112.00	-	2,208.00	$ 698.74	$ 1,542,812
Night [1)]		56.00	-	1,104.00	$ 156.55	$ 172,826
Winter	16.1	84.00		1,356.00	$ 698.74	$ 947,488
Night [1)]		84.00		1,356.00	$ 156.55	$ 212,276
Total	**35.9**					**$ 2,875,402**

[1)] Night Crew is capped to 84 hrs per week. Night crew may be re-assigned to watch vessel on non-operational days.

2. Fuel Consumption Costs (by week)

Season	# Weeks	Time Underway Vessel #1 (hrs / wk)	Time Underway Vessel #2 (hrs / wk)	Total Underway (hrs / season)	Fuel Cost ($ / gal)	Fuel Consumption (gal / hr)	Total Cost ($ / season)
Summer	19.7	88.20	-	1,738.80	$ 3.38	289.48	$ 1,701,323
Winter	16.1	74.20		1,197.80	$ 3.38	289.48	$ 1,171,983
Total	**35.9**			**2,936.60**			**$ 2,873,306**

3. Winter Lay-up Cost (by day)

Season	# Days	# Vessels	Cost / Day	Total
winter	113	1.0	$ 991.97	**$ 112,093**

Annual Overhead Costs (by day)

Season	Annual Operating Days Vessel #1	Vessel #2	Total	($ / day)	Route Overhead Costs Vessel #1	Vessel #2	Total
Summer	138	-	138	$ 1,609	$ 222,042	$ -	$ 222,042
Winter	113		113	$ 1,609	$ 181,817		$ 181,817
Total	**251**	**-**	**251**		**$ 403,859**	**$ -**	**$ 403,859**

Annual Maintenance Costs (by week)

Season	# weeks	Annual Operating Hours Vessel #1 (hrs / wk)	Vessel #2 (hrs / wk)	Total (hrs / wk)	Total (hrs / season)
Summer	19.7	109.20	-	109.20	2,153
Winter	16.1	81.20		81.20	1,311
Total	**35.9**				**3,464**

	Vessel Operation (eng op hrs)	($ / hr)	Vessel Overhaul (# Vessels)	($ / Vessel)	Total Cost
Operating	3,464	$ 44.91			$ 155,547
Overhaul			1.0	$ 509,547	$ 509,547
Total Vessel Maintenance Costs					**$ 665,094**

Total Annual Route Costs

Total Annual Operational Costs	$ 5,748,707
Total Annual Layup Costs	$ 112,093
Total Annual Overhead Costs	$ 403,859
Total Annual Maintenance Costs	$ 665,094
Total Annual Costs	**$ 6,929,753**

Capital Improvements Plan (CIP)

New Displacement Vessels

Alt.	New JAI Displacement Vessels Required	Construction Cost
Alt 1	N/A	
Alt 1B	N/A	
Alt 2B	HNS-SGY Shuttle (18 ASV)	22.3 M $
Alt 3	HNS-SGY Shuttle (41 ASV)	48.9 M $
Alt 4A	HNS-SGY Shuttle (18 ASV)	22.3 M $
Alt 4B	HNS-SGY Shuttle (18 ASV)	22.3 M $
Alt 4C	HNS-SGY Shuttle (18 ASV)	22.3 M $
Alt 4D	HNS-SGY Shuttle (18 ASV)	22.3 M $

New JAI Vessel Refurbishment Costs (2013 $) including Project Engineering, ICAP, and Contingency*

Year	Project	HNS-SGY Shuttle (18 ASV)		HNS-SGY Shuttle (41 ASV)		Day Boat ACF	
		Projected Cost	% of Construction	Projected Cost	% of Construction	Projected Cost	% of Construction
4	Post construction	0.7 M $	3.0%	1.5 M $	3.0%	1.9 M $	3.0%
10	Hotel refurb minor, #1	0.8 M $	3.7%	1.8 M $	3.7%	2.5 M $	4.0%
15	Painting #1	1.4 M $	6.4%	3.1 M $	6.4%	3.3 M $	5.3%
20	Mech and Piping, #1	0.4 M $	1.9%	0.9 M $	1.9%	1.3 M $	2.1%
20	Hotel refurb minor, #2	0.8 M $	3.7%	1.8 M $	3.7%	2.5 M $	4.0%
30	Propulsion Machinery mid-life	3.4 M $	15.4%	7.5 M $	15.4%	10.1 M $	16.0%
30	Electric and aux. equip. mid-life	1.4 M $	6.4%	3.1 M $	6.4%	4.4 M $	6.9%
30	Structural repair mid-life	0.4 M $	1.7%	0.8 M $	1.7%	0.9 M $	1.4%
30	Major hotel refurb, mid-life	3.3 M $	14.8%	7.3 M $	14.8%	10.0 M $	15.8%
30	Painting, #2	1.4 M $	6.4%	3.1 M $	6.4%	3.3 M $	5.3%
40	Mech and Piping, #2	0.4 M $	1.9%	0.9 M $	1.9%	1.3 M $	2.1%
40	Hotel refurb minor, #3	0.8 M $	3.7%	1.8 M $	3.7%	2.5 M $	4.0%
40	Safety & funct., #1 + spec. equip	1.8 M $	8.2%	4.0 M $	8.2%	6.7 M $	10.6%
45	Structural repair late-life	1.0 M $	4.3%	2.1 M $	4.3%	2.2 M $	3.5%
45	Painting, #3	1.4 M $	6.4%	3.1 M $	6.4%	3.3 M $	5.3%
45	Safety and functional, #2	1.6 M $	7.0%	3.4 M $	7.0%	4.4 M $	7.0%
50	Hotel refurb minor, #4	1.1 M $	4.9%	2.4 M $	4.9%	3.3 M $	5.3%

Refurbishment costs based on Capital replacement and refurbishment estimates created for AMHS
Prices include: 13.5% Project Engineering, 4.79% ICAP, and 10% Contingency costs
Lifespan is assumed to be 60 years

Mainliner Refurbishment Costs (2013 $) including Project Engineering, ICAP, and Contingency

Year	Project	LeConte Current Age = 39		Columbia Current Age = 39		Matanuska /Malaspina Current Age = 50		Taku Current Age = 50	
		Actual Year	Projected Cost	Actual Year	Projected Cost	Actual Year	Projected Cost	Actual Year	Projected Cost
4	Post construction		2.1 M $		11.1 M $		6.8 M $		5.3 M $
10	Hotel refurb minor, #1		4.3 M $		28.3 M $		16.6 M $		12.4 M $
15	Painting #1		2.8 M $		11.5 M $		8.0 M $		6.4 M $
20	Mech and Piping, #1		1.5 M $		3.6 M $		2.4 M $		1.6 M $
20	Hotel refurb minor, #2		4.3 M $		28.3 M $		16.6 M $		12.4 M $
30	Propulsion Machinery mid-life	2016	10.3 M $	2013	24.9 M $		16.4 M $		16.1 M $
30	Electric and aux. equip. mid-life	2010	5.2 M $	2020	12.1 M $		8.0 M $		5.3 M $
30	Structural repair mid-life	2016	0.7 M $	2020	3.1 M $		2.1 M $		1.7 M $
30	Major hotel refurb, mid-life	2014	17.4 M $	2020	113.1 M $		66.4 M $		49.4 M $
30	Painting, #2	2016	2.8 M $	2020	11.5 M $		8.0 M $		6.4 M $
40	Mech and Piping, #2	2025	1.5 M $	2025	3.6 M $		2.4 M $		1.6 M $
40	Hotel refurb minor, #3	2025	4.3 M $	2025	28.3 M $		16.6 M $		12.4 M $
40	Safety & funct., #1 +spec. equip	2025	4.8 M $	2025	29.2 M $		15.9 M $		12.3 M $
45	Structural repair late-life	2030	1.8 M $	2030	7.6 M $		5.3 M $		4.3 M $
45	Painting, #3	2030	2.8 M $	2030	11.5 M $		8.0 M $		6.4 M $
45	Safety and functional, #2	2030	4.8 M $	2030	26.0 M $	2015	15.9 M $	2015	12.3 M $
50	Hotel refurb minor, #4	2040	5.8 M $	2040	37.7 M $	2015	22.1 M $	2015	16.5 M $

Prices include: 13.5% Project Engineering, 4.79% ICAP, and 10% Contingency costs
Lifespan is assumed to be 60 years

Capital Improvements Plan (CIP)

New Fast Vehicle Ferries

Alt	New Fast Vehicle Ferry Required	Construction Cost
Alt 1	N/A	
Alt 1B	N/A	
Alt 2B	N/A	
Alt 3	N/A	
Alt 4A	FVF-1 (31 ASV)	82.2 M $
Alt 4B	FVF-1 (53 ASV)	98.3 M $
Alt 4C	N/A	
Alt 4D	N/A	

New FVF Refurbishment Costs (2013 $)

including Project Engineering, ICAP, and Contingency*

Year	Project	FVF-1 (31 ASV) Projected Cost	FVF-1 (31 ASV) % of Construction	FVF-1 (53 ASV) Projected Cost	FVF-1 (53 ASV) % of Construction
2	Post construction	4.1 M $	5%	4.9 M $	5%
8	Structural repair, #1	4.1 M $	5%	4.9 M $	5%
8	Hotel refurb minor, #1	5.8 M $	7%	6.9 M $	7%
11	Propulsion Machinery, #1	20.6 M $	25%	24.6 M $	25%
11	Mech and Piping, #1	8.2 M $	10%	9.8 M $	10%
11	Painting #1	4.1 M $	5%	4.9 M $	5%
11	Safety and functional, #1	8.2 M $	10%	9.8 M $	10%
16	Electric and aux. equip. mid-life	12.3 M $	15%	14.7 M $	15%
16	Structural repair, #2	4.1 M $	5%	4.9 M $	5%
16	Major hotel refurb, mid-life	12.3 M $	15%	14.7 M $	15%
21	Propulsion Machinery, #2	20.6 M $	25%	24.6 M $	25%
21	Mech and Piping, #2	8.2 M $	10%	9.8 M $	10%
21	Painting, #2	4.1 M $	5%	4.9 M $	5%
21	Safety and functional, #2	8.2 M $	10%	9.8 M $	10%
24	Structural repair, #3	4.1 M $	5%	4.9 M $	5%
24	Hotel refurb minor, #2	5.8 M $	7%	6.9 M $	7%

* Prices include: 13.5% Project Engineering, 4.79% ICAP, and 10% Contingency costs
** Lifespan is assumed to be 32 years

Notional Vessel Speeds and MLOPS

Vessel No.	Designation	Vessel Type	Speed	Manuv Sp	Startup	Load	Unload	Shutdown
1	DayACF	Displacement	15	5	30	15	15	30
2	DayACF-X	Displacement	15	5	30	10	10	30
3	Disp-1	Displacement	15	5	30	15	15	30
4	Disp-2	Displacement	15	5	30	10	10	30
5	MAL	Displacement	15	5	30	30	30	30
6	FVF-1	Fast Veh Ferry	30	8	30	15	15	30
7								
8								

MLOPS: Mooring and Loading Operations
Speed: Vessel cruising speed
Manuv Sp: Vessel Maneuvering speed
Startup: Time required to startup vessel at beginning of day prior to first sailing.
Shutdown: Time required to shutdown vessel at end of day after last sailing.
Load: Average time required to load a vessel.
Unload: Average time required to unload a vessel.

Route Leg Characteristics Table

Departure Terminal	Index No.	Leg Name	Leg Length	Terminal 1 Name 1	Terminal 1 Manuv Dist 1	Terminal 2 Name 2	Terminal 2 Manuv Dist 2
Skagway	1	SGY-HNS	12.60	Skagway	0.13	Haines	0.27
Skagway	2	SGY-KTZ	14.25	Skagway	0.13	Katzehin	0.25
Skagway	3	SGY-SAW	50.17	Skagway	0.13	Sawmill Cove	0.61
Skagway	4	SGY-AUK	74.68	Skagway	0.13	Auke Bay	2.34
Haines	5	HNS-SGY	12.60	Haines	0.27	Skagway	0.13
Haines	6	HNS-KTZ	5.92	Haines	0.30	Katzehin	0.25
Haines	7	HNS-SAW	41.83	Haines	0.33	Sawmill Cove	0.61
Haines	8	HNS-AUK	66.24	Haines	0.31	Auke Bay	2.34
Katzehin	9	KTZ-SGY	14.25	Katzehin	0.25	Skagway	0.13
Katzehin	10	KTZ-HNS	5.92	Katzehin	0.25	Haines	0.30
Sawmill Cove	11	SAW-SGY	50.17	Sawmill Cove	0.61	Skagway	0.13
Sawmill Cove	12	SAW-HNS	41.83	Sawmill Cove	0.61	Haines	0.33
Sawmill Cove	13	SAW-WHB	10.05	Sawmill Cove	0.61	Wm Henry Bay	0.12
Wm Henry Bay	14	WHB-SAW	10.05	Wm Henry Bay	0.12	Sawmill Cove	0.61
Auke Bay	15	AUK-HNS	66.24	Auke Bay	2.34	Haines	0.31
Auke Bay	16	AUK-SGY	74.68	Auke Bay	2.34	Skagway	0.13

30 Year Traffic Projections [1]

Average Daily Traffic (Seasonal Averages per day)

Alt	Route	Leg	Designator	Service	Season	City Specific Rnd Trip Traffic Forecast			Mainliner City Specific Capacity [4]			JAI Round Trip Traffic	JAI One Way Traffic	One-Way Vehicle Requirements [5]			
						JNU-HNS [2]	JNU-SGY [2]	HNS-SGY [3]	JNU-HNS	JNU-SGY	HNS-SGY			PAX-ASV	RV	Van	PAX
						SADT	SADT	SADT	SADT	SADT	SADT	SADT		93%	5%	2%	3.3
1	HNS-SGY-HNS	HNS-SGY	1-1	DB ACF	Summer		55	53	0	25	38	45	**23**	22	2	1	76
		SGY-HNS	1-2	DB ACF	Summer								**23**	22	2	1	76
	AUK-HNS AUK	AUK-HNS	1-3	DB ACF	Summer	85	55		38	25	0	77	**39**	37	2	1	129
		HNS-AUK	1-4	DB ACF	Summer								**39**	37	2	1	129
						WADT	WADT	WADT	WADT	WADT	WADT	WADT		96%	1%	3%	3.3
1	HNS-SGY-HNS	HNS-SGY	1-5	DB ACF	Winter		20	6	0	12	6	8	**4**	4	1	1	14
		SGY-HNS	1-6	DB ACF	Winter								**4**	4	1	1	14
	AUK-HNS-AUK	AUK-HNS	1-7	DB ACF	Winter	30	20		19	12	0	19	**10**	10	1	1	33
		HNS-SGY	1-8	DB ACF	Winter								**10**	10	1	1	33
						SADT	SADT	SADT	SADT	SADT	SADT	SADT		93%	5%	2%	3.3
1B	HNS-SGY-HNS	HNS-SGY	1B-1	DB ACF	Summer			53	0	0	38	15	**8**	8	1	1	27
		SGY-HNS	1B-2	DB ACF	Summer								**8**	8	1	1	27
	AUK-HNS AUK	AUK-HNS	1B-3	DB ACF	Summer	100			38	0	0	62	**31**	29	2	1	103
		HNS-AUK	1B-4	DB ACF	Summer								**31**	29	2	1	103
	SGY-AUK-SGY	HNS-SGY	1B-5	Mal	Summer		85		0	25	0	60	**30**	28	2	1	99
		SGY-HNS	1B-6	Mal	Summer								**30**	28	2	1	99
						WADT	WADT	WADT	WADT	WADT	WADT	WADT		96%	1%	3%	3.3
1B	HNS-SGY-HNS	HNS-SGY	1B-7	DB ACF	Winter		20	6	0	12	6	8	**4**	15	1	1	50
		SGY-HNS	1B-8	DB ACF	Winter								**4**	15	1	1	50
	AUK-HNS AUK	AUK-HNS	1B-9	DB ACF	Winter	30	20		19	12	0	19	**10**	10	1	1	33
		HNS-AUK	1B-10	DB ACF	Winter								**10**	15	1	1	50
						SADT	SADT	SADT				SADT		93%	5%	2%	2.3
2B	HNS-SGY-HNS	HNS-SGY	2B-1	Displ	Summer			53				53	**27**	26	2	1	63
		SGY-HNS	2B-2	Displ	Summer								**27**	26	2	1	63
	HNS-KTZ-HNS	HNS-KTZ	2B-3	DB ACF	Summer	725						725	**363**	338	19	8	835
		KTZ-HNS	2B-4	DB ACF	Summer								**363**	338	19	8	835
	SGY-KTZ-SGY	SGY-KTZ	2B-5	DB ACF	Summer		610					610	**305**	284	16	7	702
		KTZ-SGY	2B-6	DB ACF	Summer								**305**	284	16	7	702
						WADT	WADT	WADT				WADT		96%	1%	3%	2.3
2B	HNS-KTZ-HNS	HNS-KTZ	2B-7	DB ACF	Winter	250		6				256	**128**	123	2	4	295
		KTZ-HNS	2B-8	DB ACF	Winter								**128**	123	2	4	295
	SGY-KTZ-SGY	SGY-KTZ	2B-9	DB ACF	Winter		210	6				216	**108**	104	2	4	249
		KTZ-SGY	2B-10	DB ACF	Winter								**108**	104	2	4	249
						SADT	SADT	SADT				SADT		93%	5%	2%	2.3
3	HNS-SGY-HNS	HNS-SGY	3-1	Displ	Summer		380	61				441	**221**	206	12	5	509
		SGY-HNS	3-2	Displ	Summer								**221**	206	12	5	509
	SAW-WHB-SAW	SAW-WHB	3-3	DB ACF	Summer	675	380					1055	**528**	492	27	11	1215
		WHB-SAW	3-4	DB ACF	Summer								**528**	492	27	11	1215
						WADT	WADT	WADT				WADT		96%	1%	3%	2.3
3	HNS-SGY-HNS	HNS-SGY	3-5	Displ	Winter		130	7				137	**69**	67	1	3	159
		SGY-HNS	3-6	Displ	Winter								**69**	67	1	3	159
	SAW-WHB-SAW	SAW-WHB	3-7	DB ACF	Winter	235	130					365	**183**	176	2	6	421
		WHB-SAW	3-8	DB ACF	Winter								**183**	176	2	6	421

30 Year Traffic Projections [1]

Average Daily Traffic (Seasonal Averages per day)

Alt	Route	Leg	Designator	Service	Season	City Specific Rnd Trip Traffic Forecast			Mainliner City Specific Capacity [4]			JAI Round Trip Traffic	JAI One Way Traffic	One-Way Vehicle Requirements [5]			
						JNU-HNS [2]	JNU-SGY [2]	HNS-SGY [3]	JNU-HNS	JNU-SGY	HNS-SGY			PAX-ASV	RV	Van	PAX
						SADT	SADT	SADT	SADT	SADT	SADT	SADT		93%	5%	2%	3.3
4A	HNS-SGY-HNS	HNS-SGY	4A-1	Displ	Summer			53	0	0	38	15	**8**	8	1	1	27
		SGY-HNS	4A-2	Displ	Summer								**8**	8	1	1	27
	AUK-HNS-AUK	AUK-HNS	4A-3	HSF	Summer	145			38	0	0	107	**54**	51	3	2	179
		HNS-AUK	4A-4	HSF	Summer								**54**	51	3	2	179
	AUK-SGY-AUK	AUK-SGY	4A-5	HSF	Summer		120		0	25	0	95	**48**	45	3	1	159
		SGY-AUK	4A-6	HSF	Summer								**48**	45	3	1	159
						WADT	WADT	WADT	WADT	WADT	WADT	WADT		96%	1%	3%	3.3
4A	HNS-SGY-HNS	HNS-SGY	4A-7	Displ	Winter			6	0	0	6	0	**0**	0	0	0	0
		SGY-HNS	4A-8	Displ	Winter								**0**	0	0	0	0
	AUK-HNS-AUK	AUK-HNS	4A-9	HSF	Winter	50			19	0	0	31	**16**	16	1	1	53
		HNS-AUK	4A-10	HSF	Winter								**16**	16	1	1	53
	AUK-SGY-AUK	AUK-SGY	4A-11	HSF	Winter		40		0	12	0	28	**14**	14	1	1	47
		SGY-AUK	4A-12	HSF	Winter								**14**	14	1	1	47
						SADT	SADT	SADT	SADT	SADT	SADT	SADT		93%	5%	2%	3.3
4B	HNS-SGY-HNS	HNS-SGY	4B-1	Displ	Summer			53	0	0	38	15	**8**	8	1	1	27
		SGY-HNS	4B-2	Displ	Summer								**8**	8	1	1	27
	SAW-HNS-SAW	SAW-HNS	4B-3	HSF	Summer	235			38	0	0	197	**99**	93	5	2	327
		HNS-SAW	4B-4	HSF	Summer								**99**	93	5	2	327
	SAW-SGY-SAW	SAW-SGY	4B-5	HSF	Summer		190		0	25	0	165	**83**	78	5	2	274
		SGY-SAW	4B-6	HSF	Summer								**83**	78	5	2	274
						WADT	WADT	WADT	WADT	WADT	WADT	WADT		96%	1%	3%	3.3
4B	HNS-SGY-HNS	HNS-SGY	4B-7	Displ	Winter			6	0	0	6	0	**0**	0	0	0	0
		SGY-HNS	4B-8	Displ	Winter								**0**	0	0	0	0
	AUK-HNS-AUK	AUK-HNS	4B-9	HSF	Winter	50			19	0	0	31	**16**	16	1	1	53
		HNS-AUK	4B-10	HSF	Winter								**16**	16	1	1	53
	AUK-SGY-AUK	AUK-SGY	4B-11	HSF	Winter		40		0	12	0	28	**14**	14	1	1	47
		SGY-AUK	4B-12	HSF	Winter								**14**	14	1	1	47
						SADT	SADT	SADT	SADT	SADT	SADT	SADT		93%	5%	2%	3.3
4C	HNS-SGY-HNS	HNS-SGY	4C-1	Displ	Summer			53	0	0	38	15	**8**	8	1	1	27
		SGY-HNS	4C-2	Displ	Summer								**8**	8	1	1	27
	AUK-HNS-AUK	AUK-HNS	4C-3	DB ACF	Summer	90			38	0	0	52	**26**	25	2	1	86
		HNS-AUK	4C-4	DB ACF	Summer								**26**	25	2	1	86
	AUK-SGY-AUK	AUK-SGY	4C-5	DB ACF	Summer		75		0	25	0	50	**25**	24	2	1	83
		SGY-AUK	4C-6	DB ACF	Summer								**25**	24	2	1	83
						WADT	WADT	WADT	WADT	WADT	WADT	WADT		96%	1%	3%	3.3
4C	HNS-SGY-HNS	HNS-SGY	4C-7	Displ	Winter			6	0	0	6	0	**0**	0	0	0	0
		SGY-HNS	4C-8	Displ	Winter								**0**	0	0	0	0
	AUK-HNS-AUK	AUK-HNS	4C-9	DB ACF	Winter	30			19	0	0	11	**6**	6	1	1	20
		HNS-AUK	4C-10	DB ACF	Winter								**6**	6	1	1	20
	AUK-SGY-AUK	AUK-SGY	4C-11	DB ACF	Winter		25		0	12	0	13	**7**	7	1	1	24
		SGY-AUK	4C-12	DB ACF	Winter								**7**	7	1	1	24

30 Year Traffic Projections [1]

Average Daily Traffic (Seasonal Averages per day)

Alt	Route	Leg	Designator	Service	Season	City Specific Rnd Trip Traffic Forecast			Mainliner City Specific Capacity [4]			JAI Round Trip Traffic	JAI One Way Traffic	One-Way Vehicle Requirements [5]			
						JNU-HNS [2]	JNU-SGY [2]	HNS-SGY [3]	JNU-HNS	JNU-SGY	HNS-SGY			PAX-ASV	RV	Van	PAX
						SADT	SADT	SADT	SADT	SADT	SADT	SADT		93%	5%	2%	3.3
4D	HNS-SGY-HNS	HNS-SGY	4D-1	Displ	Summer			53	0	0	38	15	**8**	8	1	1	27
		SGY-HNS	4D-2	Displ	Summer								**8**	8	1	1	27
	SAW-HNS-SAW	SAW-HNS	4D-3	DB ACF	Summer	220			38	0	0	182	**91**	85	5	2	301
		HNS-SAW	4D-4	DB ACF	Summer								**91**	85	5	2	301
	SAW-SGY-SAW	SAW-SGY	4D-5	DB ACF	Summer		180		0	25	0	155	**78**	73	4	2	258
		SGY-SAW	4D-6	DB ACF	Summer								**78**	73	4	2	258
						WADT	WADT	WADT	WADT	WADT	WADT	WADT		96%	1%	3%	3.3
4D	HNS-SGY-HNS	HNS-SGY	4D-7	Displ	Winter			6	0	0	6	0	**0**	0	0	0	0
		SGY-HNS	4D-8	Displ	Winter								**0**	0	0	0	0
	AUK-HNS-AUK	AUK-HNS	4D-9	DB ACF	Winter	30			19	0	0	11	**6**	6	1	1	20
		HNS-AUK	4D-10	DB ACF	Winter								**6**	6	1	1	20
	AUK-SGY-AUK	AUK-SGY	4D-11	DB ACF	Winter		25		0	12	0	13	**7**	7	1	1	24
		SGY-AUK	4D-12	DB ACF	Winter								7	7	1	1	24

[1] This table is intended to consolidate and document the traffic forecast information. Traffic forecast information is used to size new vessels. For existing and programmed vessels, traffic forecast information can be used to verify adequate capacity.

[2] Juneau - Haines and Juneau - Skagway traffic numbers are from Table 5-3 of the Fehr and Peers Juneau Access Improvements Project Traffic Forecast Report, 2013

[3] Haines - Skagway traffic numbers are from page 13 of McDowell Group Juneau Access Haines/Skagway Traffic Forecast, November 2012. The State requested that forecast for the Enhanced Service Baseline be used to match the 0% growth predicted by Fehr and Peers Traffic Forecast.

[4] This report assumes that the traffic forecasts include traffic that is carried on AMHS mainline vessels. It is assumed that travelers will continue to use available AMHS mainline vessels in the JAI travel area Accordingly, the JAI traffic forecasts are reduced by the available traffic capacity of AMHS mainline vessels to determine required traffic capacity of JAI vessels. The calculation of available AMHS mainline vessel capacity for the JAI routes is described in the body of the Marine Segments Report.

[5] SADT traffic forecasts must be rendered into proper number of vehicles on a vessel, assuming the character and mix of different vehicle lengths. This methodology is described in the body of the Marine Segments Report

List of abbreviations is included in the text of the report.

Division of ASV, RV, and VAN is as defined in the JAI Marine Segments report, and is based on the historical mix of vehicle lengths.

Overhead Costs

Payload Length & Weight

ASV Length (feet)	ASV Weight (lbs)	RV Length (feet)	RV Weight (lbs)	Van Length (feet)	Van Weight (lbs)
20	6,000	24	12,000	40	40,000

AMHS Operating Weeks

Schedule	Op Weeks
2010	381.2
2011	405.1
2012	412.5

AMHS Overhead / Operating Data

System-Wide Overhead Costs	Impact / Vesel Wk	Discount	Avg / Op week	FY 2012	eq FY 2012	eq FY 12 / op wk	FY 2011	eq FY 2011	eq FY 12 / op wk	FY 2010	eq FY 2010	eq FY 12 / op wk
Shore Operations	$ -	100%	$ 19,932	$ 8,155,000	$ 8,249,661	$ 19,999	$ 7,810,000	$ 8,064,645	$ 19,908	$ 7,119,000	$ 7,581,504	$ 19,889
Reservations and Marketing	$ 1,613	75%	$ 6,452	$ 2,475,000	$ 2,503,729	$ 6,070	$ 2,577,000	$ 2,661,023	$ 6,569	$ 2,404,000	$ 2,560,182	$ 6,716
Operations Management	$ 5,418	50%	$ 10,837	$ 4,450,000	$ 4,501,654	$ 10,913	$ 4,140,000	$ 4,274,985	$ 10,553	$ 3,953,000	$ 4,209,817	$ 11,044
Marine Engineering	$ 2,752	50%	$ 5,504	$ 2,059,000	$ 2,082,900	$ 5,049	$ 2,108,000	$ 2,176,731	$ 5,373	$ 2,180,000	$ 2,321,629	$ 6,090
Support Services	$ 1,476	75%	$ 5,905	$ 2,363,000	$ 2,390,429	$ 5,795	$ 2,264,000	$ 2,337,818	$ 5,771	$ 2,201,000	$ 2,343,994	$ 6,149
Totals			$48,629.23	$19,502,000	$19,728,373	$ 47,826.36	$18,899,000	$19,515,201	$48,173.79	$17,857,000	$ 19,017,126	$ 49,888
Sum of Overhead per V Op Week	**$ 11,260**											

Ovhd Cost / Vessel Day	**$ 1,609**

Vessel Crew - Cost per Hour

ASV #	Displ ($ / hr)	HSF ($ / hr)	Displ Night ($ / hr)	HSF Night ($ / hr)
15	$ 304.55	$ 878.71	$ 65.63	$ 440.80
16	$ 317.61	$ 880.87	$ 68.48	$ 442.79
17	$ 330.52	$ 883.11	$ 71.31	$ 444.78
18	$ 343.28	$ 885.43	$ 74.11	$ 446.76
19	$ 355.90	$ 887.83	$ 76.89	$ 448.73
20	$ 368.38	$ 890.30	$ 79.65	$ 450.69
21	$ 380.71	$ 892.84	$ 82.38	$ 452.64
22	$ 392.89	$ 895.47	$ 85.08	$ 454.59
23	$ 404.93	$ 898.17	$ 87.76	$ 456.52
24	$ 416.83	$ 900.95	$ 90.42	$ 458.45
25	$ 428.58	$ 903.81	$ 93.05	$ 460.36
26	$ 440.18	$ 906.74	$ 95.65	$ 462.27
27	$ 451.64	$ 909.75	$ 98.23	$ 464.17
28	$ 462.96	$ 912.84	$ 100.79	$ 466.06
29	$ 474.13	$ 916.00	$ 103.32	$ 467.94
30	$ 485.15	$ 919.24	$ 105.82	$ 469.82
31	$ 496.03	$ 922.56	$ 108.30	$ 471.68
32	$ 506.77	$ 925.95	$ 110.76	$ 473.53
33	$ 517.36	$ 929.42	$ 113.19	$ 475.38
34	$ 527.81	$ 932.97	$ 115.59	$ 477.22
35	$ 538.11	$ 936.59	$ 117.97	$ 479.05
36	$ 548.26	$ 940.29	$ 120.33	$ 480.87
37	$ 558.27	$ 944.07	$ 122.66	$ 482.68
38	$ 568.14	$ 947.93	$ 124.96	$ 484.48
39	$ 577.86	$ 951.86	$ 127.24	$ 486.27
40	$ 587.44	$ 955.87	$ 129.50	$ 488.06
41	$ 596.87	$ 959.95	$ 131.73	$ 489.83
42	$ 606.15	$ 964.12	$ 133.93	$ 491.60
43	$ 615.30	$ 968.36	$ 136.11	$ 493.35
44	$ 624.29	$ 972.67	$ 138.27	$ 495.10
45	$ 633.14	$ 977.07	$ 140.40	$ 496.84
46	$ 641.85	$ 981.54	$ 142.51	$ 498.57
47	$ 650.41	$ 986.08	$ 144.59	$ 500.30
48	$ 658.83	$ 990.71	$ 146.64	$ 502.01
49	$ 667.10	$ 995.41	$ 148.67	$ 503.71
50	$ 675.23	$ 1,000.19	$ 150.68	$ 505.41
51	$ 683.21	$ 1,005.04	$ 152.66	$ 507.10
52	$ 691.05	$ 1,009.97	$ 154.61	$ 508.78
53	$ 698.74	$ 1,014.98	$ 156.55	$ 510.44
54	$ 706.28	$ 1,020.07	$ 158.45	$ 512.10
55	$ 713.69	$ 1,025.23	$ 160.33	$ 513.76

Vessel Crew - Cost per Hour

ASV #	Displ ($ / hr)	HSF ($ / hr)	Displ Night ($ / hr)	HSF Night ($ / hr)
56	$ 720.94	$ 1,030.47	$ 162.19	$ 515.40
57	$ 728.06	$ 1,035.78	$ 164.02	$ 517.03
58	$ 735.02	$ 1,041.18	$ 165.83	$ 518.66
59	$ 741.84	$ 1,046.65	$ 167.61	$ 520.27
60	$ 748.52	$ 1,052.19	$ 169.36	$ 521.88
61	$ 755.05	$ 1,057.82	$ 171.09	$ 523.48
62	$ 761.44	$ 1,063.52	$ 172.80	$ 525.07
63	$ 767.68	$ 1,069.29	$ 174.48	$ 526.65
64	$ 773.78	$ 1,075.15	$ 176.14	$ 528.22
65	$ 779.73	$ 1,081.08	$ 177.77	$ 529.78
66	$ 785.54	$ 1,087.09	$ 179.38	$ 531.34
67	$ 791.20	$ 1,093.17	$ 180.96	$ 532.88
68	$ 796.72	$ 1,099.33	$ 182.51	$ 534.42
69	$ 802.09	$ 1,105.57	$ 184.05	$ 535.95
70	$ 807.32	$ 1,111.89	$ 185.55	$ 537.47
71	$ 812.41	$ 1,118.28	$ 187.03	$ 538.98
72	$ 817.34	$ 1,124.75	$ 188.49	$ 540.48
73	$ 822.14	$ 1,131.30	$ 189.92	$ 541.97
74	$ 826.78	$ 1,137.92	$ 191.33	$ 543.45
75	$ 831.29	$ 1,144.62	$ 192.71	$ 544.93
76	$ 835.65	$ 1,151.40	$ 194.07	$ 546.39
77	$ 839.86	$ 1,158.25	$ 195.40	$ 547.85
78	$ 843.93	$ 1,165.18	$ 196.71	$ 549.30
79	$ 847.85	$ 1,172.19	$ 197.99	$ 550.74
80	$ 851.63	$ 1,179.27	$ 199.25	$ 552.17
81	$ 855.26	$ 1,186.43	$ 200.48	$ 553.59
82	$ 858.75	$ 1,193.67	$ 201.69	$ 555.00
83	$ 862.09	$ 1,200.98	$ 202.87	$ 556.40
84	$ 865.29	$ 1,208.38	$ 204.03	$ 557.80
85	$ 868.35	$ 1,215.85	$ 205.16	$ 559.18
86	$ 871.25	$ 1,223.39	$ 206.27	$ 560.56
87	$ 874.02	$ 1,231.01	$ 207.35	$ 561.93
88	$ 876.64	$ 1,238.71	$ 208.41	$ 563.29
89	$ 879.11	$ 1,246.49	$ 209.44	$ 564.64
90	$ 881.44	$ 1,254.34	$ 210.45	$ 565.98
91	$ 883.62	$ 1,262.27	$ 211.43	$ 567.31
92	$ 885.66	$ 1,270.28	$ 212.39	$ 568.64
93	$ 887.56	$ 1,278.36	$ 213.32	$ 569.95
94	$ 889.31	$ 1,286.52	$ 214.23	$ 571.26
95	$ 890.91	$ 1,294.76	$ 215.11	$ 572.56
96	$ 892.37	$ 1,303.07	$ 215.97	$ 573.85
97	$ 893.68	$ 1,311.47	$ 216.80	$ 575.13
98	$ 894.85	$ 1,319.93	$ 217.61	$ 576.40
99	$ 895.88	$ 1,328.48	$ 218.39	$ 577.66
100	$ 896.76	$ 1,337.10	$ 219.15	$ 578.91

Fuel Consumption
Data Table

ASV #	Displ (gal / hr)	HSF (gal / hr)
15	75.88	662.41
16	82.23	666.11
17	88.53	669.81
18	94.80	673.50
19	101.03	677.20
20	107.21	680.90
21	113.36	684.59
22	119.47	688.29
23	125.54	691.98
24	131.57	695.68
25	137.57	699.38
26	143.52	703.07
27	149.43	706.77
28	155.31	710.47
29	161.15	714.16
30	166.94	717.86
31	172.70	721.55
32	178.42	725.25
33	184.10	728.95
34	189.74	732.64
35	195.34	736.34
36	200.90	740.04
37	206.43	743.73
38	211.91	747.43
39	217.36	751.12
40	222.76	754.82
41	228.13	758.52
42	233.46	762.21
43	238.75	765.91
44	244.00	769.61
45	249.21	773.30
46	254.38	777.00
47	259.51	780.69
48	264.60	784.39
49	269.66	788.09
50	274.67	791.78
51	279.65	795.48
52	284.58	799.18
53	289.48	802.87
54	294.34	806.57
55	299.16	810.26

Fuel Consumption
Data Table

ASV #	Displ (gal / hr)	HSF (gal / hr)
56	303.94	813.96
57	308.68	817.66
58	313.38	821.35
59	318.05	825.05
60	322.67	828.75
61	327.25	832.44
62	331.80	836.14
63	336.31	839.83
64	340.77	843.53
65	345.20	847.23
66	349.59	850.92
67	353.94	854.62
68	358.25	858.32
69	362.52	862.01
70	366.76	865.71
71	370.95	869.40
72	375.11	873.10
73	379.22	876.80
74	383.30	880.49
75	387.33	884.19
76	391.33	887.89
77	395.29	891.58
78	399.21	895.28
79	403.09	898.97
80	406.93	902.67
81	410.74	906.37
82	414.50	910.06
83	418.23	913.76
84	421.91	917.46
85	425.56	921.15
86	429.16	924.85
87	432.73	928.54
88	436.26	932.24
89	439.75	935.94
90	443.20	939.63
91	446.61	943.33
92	449.99	947.03
93	453.32	950.72
94	456.61	954.42
95	459.87	958.11
96	463.08	961.81
97	466.26	965.51
98	469.40	969.20
99	472.50	972.90
100	475.56	976.60

Winter Lay-up Data Table

ASV #	Displ ($ / day)	HSF ($ / day)
15	530.65	950.08
16	545.16	954.73
17	559.55	959.37
18	573.80	964.02
19	587.93	968.66
20	601.93	973.31
21	615.80	977.96
22	629.55	982.60
23	643.16	987.25
24	656.65	991.89
25	670.00	996.54
26	683.23	1,001.19
27	696.34	1,005.83
28	709.31	1,010.48
29	722.15	1,015.12
30	734.87	1,019.77
31	747.46	1,024.42
32	759.92	1,029.06
33	772.25	1,033.71
34	784.46	1,038.35
35	796.53	1,043.00
36	808.48	1,047.65
37	820.30	1,052.29
38	831.99	1,056.94
39	843.55	1,061.58
40	854.99	1,066.23
41	866.30	1,070.88
42	877.47	1,075.52
43	888.52	1,080.17
44	899.45	1,084.81
45	910.24	1,089.46
46	920.90	1,094.11
47	931.44	1,098.75
48	941.85	1,103.40
49	952.13	1,108.04
50	962.28	1,112.69
51	972.31	1,117.34
52	982.20	1,121.98
53	991.97	1,126.63
54	1,001.61	1,131.27
55	1,011.12	1,135.92

Winter Lay-up Data Table

ASV #	Displ ($ / day)	HSF ($ / day)
56	1,020.50	1,140.57
57	1,029.76	1,145.21
58	1,038.89	1,149.86
59	1,047.88	1,154.50
60	1,056.75	1,159.15
61	1,065.50	1,163.80
62	1,074.11	1,168.44
63	1,082.59	1,173.09
64	1,090.95	1,177.73
65	1,099.18	1,182.38
66	1,107.28	1,187.03
67	1,115.25	1,191.67
68	1,123.10	1,196.32
69	1,130.81	1,200.96
70	1,138.40	1,205.61
71	1,145.86	1,210.26
72	1,153.19	1,214.90
73	1,160.40	1,219.55
74	1,167.47	1,224.19
75	1,174.42	1,228.84
76	1,181.23	1,233.49
77	1,187.93	1,238.13
78	1,194.49	1,242.78
79	1,200.92	1,247.42
80	1,207.23	1,252.07
81	1,213.40	1,256.72
82	1,219.45	1,261.36
83	1,225.37	1,266.01
84	1,231.17	1,270.65
85	1,236.83	1,275.30
86	1,242.37	1,279.95
87	1,247.77	1,284.59
88	1,253.05	1,289.24
89	1,258.20	1,293.88
90	1,263.23	1,298.53
91	1,268.12	1,303.18
92	1,272.89	1,307.82
93	1,277.53	1,312.47
94	1,282.04	1,317.11
95	1,286.42	1,321.76
96	1,290.67	1,326.41
97	1,294.80	1,331.05
98	1,298.80	1,335.70
99	1,302.66	1,340.34
100	1,306.40	1,344.99

Maintenance Cost Data Table

Operational Maintenance			Overhaul Maintenance		
ASV	Displ	HSF	ASV	Displ	HSF
#	($ / hr)	($ / hr)	#	($ / yr)	($ / yr)
15	$ 11.84	$ 122.98	15	$ 217,209	$ 885,818
16	$ 12.81	$ 123.59	16	$ 225,609	$ 889,577
17	$ 13.79	$ 124.19	17	$ 233,971	$ 893,336
18	$ 14.75	$ 124.80	18	$ 242,295	$ 897,095
19	$ 15.71	$ 125.40	19	$ 250,580	$ 900,854
20	$ 16.67	$ 126.00	20	$ 258,827	$ 904,613
21	$ 17.62	$ 126.61	21	$ 267,036	$ 908,372
22	$ 18.56	$ 127.21	22	$ 275,207	$ 912,131
23	$ 19.50	$ 127.82	23	$ 283,340	$ 915,891
24	$ 20.43	$ 128.42	24	$ 291,434	$ 919,650
25	$ 21.35	$ 129.03	25	$ 299,490	$ 923,409
26	$ 22.27	$ 129.63	26	$ 307,508	$ 927,168
27	$ 23.19	$ 130.24	27	$ 315,488	$ 930,927
28	$ 24.09	$ 130.84	28	$ 323,429	$ 934,686
29	$ 25.00	$ 131.45	29	$ 331,333	$ 938,445
30	$ 25.89	$ 132.05	30	$ 339,198	$ 942,204
31	$ 26.78	$ 132.65	31	$ 347,025	$ 945,964
32	$ 27.67	$ 133.26	32	$ 354,813	$ 949,723
33	$ 28.55	$ 133.86	33	$ 362,564	$ 953,482
34	$ 29.42	$ 134.47	34	$ 370,276	$ 957,241
35	$ 30.29	$ 135.07	35	$ 377,950	$ 961,000
36	$ 31.15	$ 135.68	36	$ 385,586	$ 964,759
37	$ 32.00	$ 136.28	37	$ 393,183	$ 968,518
38	$ 32.85	$ 136.89	38	$ 400,742	$ 972,277
39	$ 33.70	$ 137.49	39	$ 408,264	$ 976,036
40	$ 34.54	$ 138.09	40	$ 415,747	$ 979,796
41	$ 35.37	$ 138.70	41	$ 423,191	$ 983,555
42	$ 36.20	$ 139.30	42	$ 430,598	$ 987,314
43	$ 37.02	$ 139.91	43	$ 437,966	$ 991,073
44	$ 37.83	$ 140.51	44	$ 445,296	$ 994,832
45	$ 38.64	$ 141.12	45	$ 452,588	$ 998,591
46	$ 39.45	$ 141.72	46	$ 459,842	$ 1,002,350
47	$ 40.24	$ 142.33	47	$ 467,057	$ 1,006,109
48	$ 41.04	$ 142.93	48	$ 474,234	$ 1,009,869
49	$ 41.82	$ 143.53	49	$ 481,373	$ 1,013,628
50	$ 42.60	$ 144.14	50	$ 488,474	$ 1,017,387
51	$ 43.38	$ 144.74	51	$ 495,537	$ 1,021,146
52	$ 44.15	$ 145.35	52	$ 502,561	$ 1,024,905
53	$ 44.91	$ 145.95	53	$ 509,547	$ 1,028,664
54	$ 45.67	$ 146.56	54	$ 516,495	$ 1,032,423
55	$ 46.42	$ 147.16	55	$ 523,405	$ 1,036,182

Maintenance Cost Data Table

Operational Maintenance			Overhaul Maintenance		
ASV	Displ	HSF	ASV	Displ	HSF
#	($ / hr)	($ / hr)	#	($ / yr)	($ / yr)
56	$ 47.16	$ 147.77	56	$ 530,277	$ 1,039,942
57	$ 47.90	$ 148.37	57	$ 537,110	$ 1,043,701
58	$ 48.64	$ 148.98	58	$ 543,905	$ 1,047,460
59	$ 49.37	$ 149.58	59	$ 550,662	$ 1,051,219
60	$ 50.09	$ 150.18	60	$ 557,380	$ 1,054,978
61	$ 50.80	$ 150.79	61	$ 564,061	$ 1,058,737
62	$ 51.52	$ 151.39	62	$ 570,703	$ 1,062,496
63	$ 52.22	$ 152.00	63	$ 577,307	$ 1,066,255
64	$ 52.92	$ 152.60	64	$ 583,873	$ 1,070,014
65	$ 53.61	$ 153.21	65	$ 590,401	$ 1,073,774
66	$ 54.30	$ 153.81	66	$ 596,890	$ 1,077,533
67	$ 54.98	$ 154.42	67	$ 603,341	$ 1,081,292
68	$ 55.66	$ 155.02	68	$ 609,754	$ 1,085,051
69	$ 56.33	$ 155.62	69	$ 616,129	$ 1,088,810
70	$ 56.99	$ 156.23	70	$ 622,465	$ 1,092,569
71	$ 57.65	$ 156.83	71	$ 628,764	$ 1,096,328
72	$ 58.30	$ 157.44	72	$ 635,024	$ 1,100,087
73	$ 58.95	$ 158.04	73	$ 641,246	$ 1,103,847
74	$ 59.59	$ 158.65	74	$ 647,430	$ 1,107,606
75	$ 60.23	$ 159.25	75	$ 653,575	$ 1,111,365
76	$ 60.86	$ 159.86	76	$ 659,682	$ 1,115,124
77	$ 61.48	$ 160.46	77	$ 665,751	$ 1,118,883
78	$ 62.10	$ 161.07	78	$ 671,782	$ 1,122,642
79	$ 62.71	$ 161.67	79	$ 677,775	$ 1,126,401
80	$ 63.32	$ 162.27	80	$ 683,729	$ 1,130,160
81	$ 63.92	$ 162.88	81	$ 689,645	$ 1,133,919
82	$ 64.51	$ 163.48	82	$ 695,523	$ 1,137,679
83	$ 65.10	$ 164.09	83	$ 701,363	$ 1,141,438
84	$ 65.69	$ 164.69	84	$ 707,165	$ 1,145,197
85	$ 66.26	$ 165.30	85	$ 712,928	$ 1,148,956
86	$ 66.83	$ 165.90	86	$ 718,653	$ 1,152,715
87	$ 67.40	$ 166.51	87	$ 724,340	$ 1,156,474
88	$ 67.96	$ 167.11	88	$ 729,989	$ 1,160,233
89	$ 68.51	$ 167.71	89	$ 735,599	$ 1,163,992
90	$ 69.06	$ 168.32	90	$ 741,172	$ 1,167,752
91	$ 69.61	$ 168.92	91	$ 746,706	$ 1,171,511
92	$ 70.14	$ 169.53	92	$ 752,202	$ 1,175,270
93	$ 70.67	$ 170.13	93	$ 757,659	$ 1,179,029
94	$ 71.20	$ 170.74	94	$ 763,079	$ 1,182,788
95	$ 71.72	$ 171.34	95	$ 768,460	$ 1,186,547
96	$ 72.23	$ 171.95	96	$ 773,803	$ 1,190,306
97	$ 72.74	$ 172.55	97	$ 779,108	$ 1,194,065
98	$ 73.24	$ 173.15	98	$ 784,374	$ 1,197,825
99	$ 73.74	$ 173.76	99	$ 789,603	$ 1,201,584
100	$ 74.23	$ 174.36	100	$ 794,793	$ 1,205,343

Vessel Acquisition Cost Data Table

ASV #	Displ ($ / vessel)	HSF ($ / vessel)
15	$ 19,427,754	$ 70,489,876
16	$ 20,375,391	$ 71,221,945
17	$ 21,337,919	$ 71,954,014
18	$ 22,315,336	$ 72,686,084
19	$ 23,307,644	$ 73,418,153
20	$ 24,314,841	$ 74,150,222
21	$ 25,336,929	$ 74,882,292
22	$ 26,373,906	$ 75,614,361
23	$ 27,425,774	$ 76,346,430
24	$ 28,492,532	$ 77,078,499
25	$ 29,574,180	$ 77,810,569
26	$ 30,670,718	$ 78,542,638
27	$ 31,782,146	$ 79,274,707
28	$ 32,908,464	$ 80,006,777
29	$ 34,049,672	$ 80,738,846
30	$ 35,205,771	$ 81,470,915
31	$ 36,376,759	$ 82,202,984
32	$ 37,562,638	$ 82,935,054
33	$ 38,763,406	$ 83,667,123
34	$ 39,979,065	$ 84,399,192
35	$ 41,209,614	$ 85,131,262
36	$ 42,455,052	$ 85,863,331
37	$ 43,715,381	$ 86,595,400
38	$ 44,990,600	$ 87,327,469
39	$ 46,280,709	$ 88,059,539
40	$ 47,585,708	$ 88,791,608
41	$ 48,905,598	$ 89,523,677
42	$ 50,240,377	$ 90,255,747
43	$ 51,590,046	$ 90,987,816
44	$ 52,954,606	$ 91,719,885
45	$ 54,334,055	$ 92,451,955
46	$ 55,728,395	$ 93,184,024
47	$ 57,137,624	$ 93,916,093
48	$ 58,561,744	$ 94,648,162
49	$ 60,000,754	$ 95,380,232
50	$ 61,454,654	$ 96,112,301
51	$ 62,923,444	$ 96,844,370
52	$ 64,407,124	$ 97,576,440
53	$ 65,905,694	$ 98,308,509
54	$ 67,419,154	$ 99,040,578
55	$ 68,947,505	$ 99,772,647

Vessel Acquisition Cost Data Table

ASV #	Displ ($ / vessel)	HSF ($ / vessel)
56	$ 70,490,745	$ 100,504,717
57	$ 72,048,876	$ 101,236,786
58	$ 73,621,896	$ 101,968,855
59	$ 75,209,807	$ 102,700,925
60	$ 76,812,608	$ 103,432,994
61	$ 78,430,298	$ 104,165,063
62	$ 80,062,879	$ 104,897,132
63	$ 81,710,350	$ 105,629,202
64	$ 83,372,711	$ 106,361,271
65	$ 85,049,962	$ 107,093,340
66	$ 86,742,104	$ 107,825,410
67	$ 88,449,135	$ 108,557,479
68	$ 90,171,056	$ 109,289,548
69	$ 91,907,868	$ 110,021,617
70	$ 93,659,569	$ 110,753,687
71	$ 95,426,161	$ 111,485,756
72	$ 97,207,643	$ 112,217,825
73	$ 99,004,014	$ 112,949,895
74	$ 100,815,276	$ 113,681,964
75	$ 102,641,428	$ 114,414,033
76	$ 104,482,470	$ 115,146,102
77	$ 106,338,402	$ 115,878,172
78	$ 108,209,224	$ 116,610,241
79	$ 110,094,937	$ 117,342,310
80	$ 111,995,539	$ 118,074,380
81	$ 113,911,031	$ 118,806,449
82	$ 115,841,414	$ 119,538,518
83	$ 117,786,686	$ 120,270,587
84	$ 119,746,849	$ 121,002,657
85	$ 121,721,902	$ 121,734,726
86	$ 123,711,844	$ 122,466,795
87	$ 125,716,677	$ 123,198,865
88	$ 127,736,400	$ 123,930,934
89	$ 129,771,013	$ 124,663,003
90	$ 131,820,516	$ 125,395,072
91	$ 133,884,910	$ 126,127,142
92	$ 135,964,193	$ 126,859,211
93	$ 138,058,366	$ 127,591,280
94	$ 140,167,430	$ 128,323,350
95	$ 142,291,383	$ 129,055,419
96	$ 144,430,227	$ 129,787,488
97	$ 146,583,961	$ 130,519,557
98	$ 148,752,584	$ 131,251,627
99	$ 150,936,098	$ 131,983,696
100	$ 153,134,502	$ 132,715,765

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