Draft Integrated Feasibility Report and Environmental Assessment and Draft Finding of No Significant Impact

APPENDIX C: ECONOMICS

Whittier, Alaska

June 2018

US Army Corps of Engineers
Alaska District

APPENDIX C
ECONOMICS

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1. OVERVIEW

Figure C-1. Whittier, Alaska
Courtesy: City of Whittier

1.1 Bottom Line Up Front

The economic analysis presented in this appendix evaluated a final array of four alternatives to provide protected boat launch facilities in Whittier. All alternatives are economically justified. Based on the preliminary National Economic Development (NED) analysis, the Tentatively Selected Plan (TSP) is Alternative 7, a 6-lane Boat Launch with North Entrance Channel at the head of Passage Canal, with a benefit-cost ratio of 3.5 and average annual net benefits of approximately $2.26 million. Results of the NED analysis are summarized in Table C-1.

Table C-2. Summary of Costs and Benefits by Alternative

Alternative	Total PV Costs	Total AAEQ	Total AAEQ Benefits	Total Net Benefits	Benefit-Cost Ratio
6	$21,330,000	$790,000	$2,666,000	$1,876,000	3.4
7	$24,135,000	$894,000	$3,152,000	$2,258,000	3.5
8	$22,511,000	$834,000	$2,646,000	$1,812,000	3.2
9	$26,304,000	$974,000	$3,142,000	$2,168,000	3.2

1.2 Introduction

The purpose of this economic analysis is to evaluate whether the proposed improvements at Whittier, Alaska are economically justified. This analysis is conducted from a National Economic

Development (NED) perspective, where NED benefits are defined as the change in value of goods and services that accrue to the nation as a whole as a result of constructing the project. NED costs are defined as the total economic costs of constructing and maintaining the project. The average annual economic benefits of the project are compared to the average annual economic costs to provide an estimated benefit-cost ratio. A project with a benefit-cost ratio greater than 1.0 is considered economically justified. Guidance is contained in U.S. Army Corps of Engineers (USACE) Engineering Regulation (ER) 1105-2-100 as well as recent Economic Guidance Memoranda issued by Headquarters USACE (HQUSACE).

1.3 Project Description

Whittier is located near the head of Passage Canal in western Prince William Sound (PWS). It is approximately 60 road miles from Anchorage, 172 road miles from Seward, 358 road miles from Valdez, and 419 road miles from Fairbanks. Whittier provides the only road access to western PWS. It is 125 nautical miles from Seward and 96 nautical miles from Valdez. Whittier is a year-round, ice-free, deep-water port and focal point for marine activity and freight transfer from sea-train barges servicing southcentral Alaska.[1] The quality of the fishing and recreation experience in PWS and the proximity to the largest population center of the state puts enormous pressure on Whittier's limited harbor facilities. As such, overcrowded conditions cause operational inefficiencies and damages to vessels and marine infrastructure at Whittier.

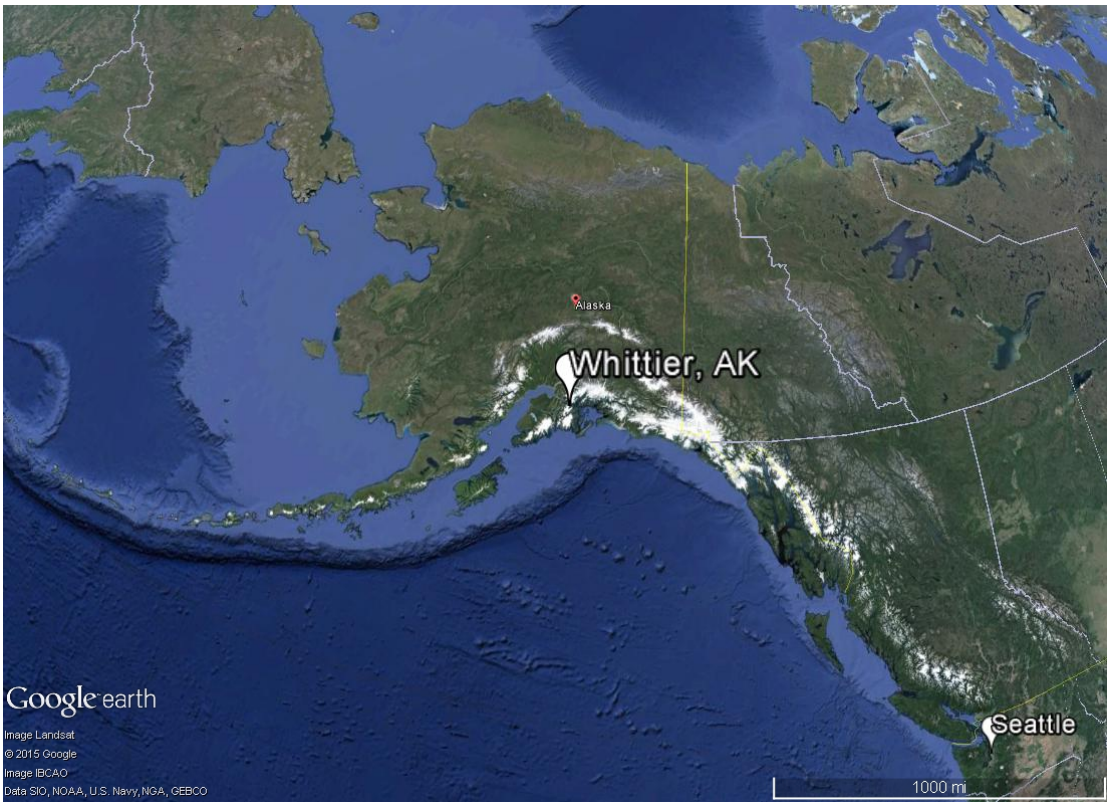


Figure C-2. Location of Whittier, Alaska

[1] Whittier Comprehensive Plan Update (2012).

1.4 Problems and Opportunities

The primary problem identified in this analysis relates to overcrowded boat launching and moorage conditions, which cause operational inefficiencies, damages to vessels and harbor infrastructure, and reduce opportunities for commercial fishing, subsistence, and recreational activities in Whittier. Insufficient moorage, boat launch capacity, and upland support facilities limit access to PWS from Whittier, creating economic inefficiencies to the region and Nation.

Particular problems identified include:

- Delays to all transportation modes occurring in Whittier, including vessels, pedestrians, vehicles, and trains, as they converge into the upland area adjacent to the existing harbor.
- Delays to transient harbor users as they converge upon the often congested launch facilities of the existing harbor.
- Vessel and harbor infrastructure damages beyond normal wear and tear due to excessive rafting, rushed launching and recovery, or not being able to access the harbor during a storm.
- Lost business opportunities for commercial fishing vessels, charter fishing boats, site seeing tour boats, and water taxis.
- Lost opportunities for recreational boat owners for sightseeing, fishing, and access to hunting grounds.
- Significant unmet demand for moorage demonstrated by a waiting list that includes hundreds of boats waiting for years to get a slip. This is confounded by minimal turnover of existing slip owners.
- Congestion of the uplands causes inefficiencies in transferring goods for transport to Anchorage.
- The lack of moorage impacts the composition of the local fleet, as transient vessels are generally limited to sizes that are easily transported via boat trailer.
- There is no separation of users (sea kayakers, boat launch users, transient vessels, fishing charters, glacier cruises, commercial fishing, recreational vessels, etc.) within the harbor. This adds to the overall inefficiency of the harbor.
- The existing harbor is bounded by the Alaska Marine Ferry terminal to the east and a cruise ship terminal to the west. When these facilities are in use, it only exacerbates the congestion and inefficiencies experienced at the harbor. Additionally, the limited openings of the single lane tunnel concentrates periods of traffic, further exacerbating congestion in Whittier.
- Moorage is not available for the high volume of transient vessels during commercial fishing openers and the summer recreational season, potentially causing vessels to travel long distances to other moorage opportunities.
- Moorage is not available for transient vessels seeking a harbor of refuge, forcing owners to incur delays and risk damages by anchoring while waiting for an opening.

Additionally, there are:

- Lost opportunity for individuals to gather subsistence resources.
- Delays in oil spill response.
- Life and human safety risks exist with users crossing over rafted vessels, hurrying the loading and unloading of trailered craft, and crossing the railroad tracks and between rail cars to access upland parking.
- Lack of adequate uplands restricts support facilities such as vehicle parking, boat storage and repair sites, and areas safe for pedestrians. Facilities that do exist are congested and inefficient.

Particular opportunities identified include:

- Supporting economic growth in Whittier
- Decreasing life and human safety risks

2. SOCIOECONOMICS

2.1 Demographic Profiles

The City of Whittier is located near the head of Passage Canal in western PWS in the southcentral portion of the State of Alaska. Table C-2 provides population data for the United States, Alaska, and Whittier over the last 20 years for which data is available.

Table C-1. Whittier City Geographical Area – Total Population Data

Area	% Change '00-'16	2016	2010	2000
United States	14.8%	323,127,513	308,745,105	281,421,906
Alaska	18.3%	741,894	710,231	626,932
City of Whittier	34.1%	244	220	182

Source: 2000 Census, 2010 Census, 2016 Population Estimate; Census Bureau

An estimated 244 residents lived in the City of Whittier in 2017. This represents a population increase of 10.9 percent since 2010 and an increase of 34.1 percent since 2000. It should also be noted that despite having a 2017 population of only 244, as the closest small boat harbor to Anchorage and as the gateway to PWS, the town of Whittier and its harbor facilities service the demands of a much larger population.

Based on 2016 census estimates, 64.5 percent of Whittier residents are white, 9.4 percent of residents are Asian, 7.2 percent are Hispanic or Latino, and 6.6 percent are American Indian or Alaska Native. In the state of Alaska, 65.6 percent of residents are white, 6 percent are Asian, 6.7 percent are Hispanic or Latino, and 14.1 percent are American Indian or Alaska Native. Table C-3 displays racial demographics for the Nation, State, and the City of Whittier.

Table C-2. Population by Race

	City of Whittier	State of Alaska	United States
Total	318	736,855	318,558,162
White alone	64.5%	65.6%	73.3%
Black or African American alone	2.2%	3.3%	12.6%
American Indian and Alaska Native alone	6.6%	14.1%	0.8%
Asian alone	9.4%	6.0%	5.2%
Native Hawaiian and Other Pacific Islander alone	3.8%	1.2%	0.2%
Two or more races	12.3%	8.5%	3.1%
Hispanic or Latino	7.2%	6.7%	17.3%
White alone, not Hispanic or Latino	63.2%	62.0%	62.0%

Source: 2012-2016 American Community Survey 5-Year Estimates, Census Bureau

2.2 Employment and Income

In 2016, approximately 75 percent of the Whittier population was 16 years old and older. Of that population, 59.8 percent was in the labor force. The unemployment rate for the city was 22.3 percent[2], nearly three times the unemployment rate for both the State of Alaska at 7.8 percent and the United States at 7.4 percent.[3] Table C-4 lists occupational data for the study area.

Table C-3. Civilian Labor Force by Occupation

	City of Whittier	State of Alaska	United States
Civilian employed population 16 years old and older	124	353,954	148,001,326
OCCUPATION			
Management, business, science, and arts occupations	27 / 21.8%	129,916 / 36.7%	54,751,318 / 37.0%
Service occupations	26 / 21.0%	62,543 / 17.7%	26,765,182 / 18.1%
Sales and office occupations	33 / 26.6%	78,806 / 22.3%	35,282,759 / 23.3%
Natural resources, construction, and maintenance occupations	23 / 18.5%	43,695 / 12.3%	13,171,632 / 8.9%
Production, transportation, and material moving occupations	15 / 12.1%	38,994 / 11.0%	18,030,435 / 12.2%

Source: 2012-2016 American Community Survey 5-Year Estimates, Census Bureau

In 2016, the median household income of Whittier was $47,813, which is below the State of Alaska median income of $74,444 and the national median income of $55,322. The mean household income was $67,255. Table C-5 shows the number of households in the City of Whittier, Alaska, and the United States and the percentage of each by their respective incomes.

[2] Calculated as the percent of workforce filing unemployment insurance (IU) claims in 2016
[3] U.S. Census Bureau, 2012-2016 American Community Survey 5-Year Estimates

Table C-4. Family Income

	City of Whittier	State of Alaska	United States
Total Households	119	250,235	117,716,237
Less than $10,000	3.4%	3.7%	7.0%
$10,000 to $14,999	3.4%	3.4%	5.1%
$15,000 to $24,999	17.6%	7.1%	10.2%
$25,000 to $34,999	8.4%	7.0%	9.9%
$35,000 to $49,999	20.2%	11.4%	13.2%
$50,000 to $74,999	19.3%	17.9%	17.8%
$75,000 to $99,999	9.2%	14.8%	12.3%
$100,000 to $149,999	10.9%	19.2%	13.5%
$150,000 to $199,999	0.0%	8.8%	5.4%
$200,000 or more	7.6%	6.8%	5.7%

Source: *2012-2016 American Community Survey 5-Year Estimates, Census Bureau*

2.3 Land Use

Whittier has access to a prohibitively small amount of land due to surrounding mountains and its location at the head of Passage Canal. Exacerbating the lack of land resources is the City's small amount of land ownership in the area, which includes about 15 percent of the waterfront. Much of the waterfront and other land in Whittier are owned by various government entities and the Alaska Railroad, which leases about 5,000 feet of waterfront to the City. In total, the Railroad owns approximately 8,000 feet of waterfront.[4]

The State of Alaska is the largest landowner in Whittier, with the City being the second largest landowner. The Federal government, which at one time was the sole landowner in Whittier, owns approximately 3,650 acres of land. This includes acreages in the Chugach National Forest, the dock along Whittier's eastern waterfront, and lands at the head of Passage Canal.[5]

The City of Whittier has worked to acquire or lease land from both the Federal government and the State of Alaska. Land acquisitions include land located east of Whittier in the Emerald Bay and Shotgun Cove areas, which have been slated for future development as a possible site for airport relocation and residential, commercial, and industrial development.[6] Even with these acquisitions there are approximately 8,000 acres of land within the City's boundaries, some of which have a grade greater than 33 percent and have limited use.

Additional information on community resources such as infrastructure, services, and public buildings and public areas can be found in the Existing Conditions section of this appendix.

[4] http://whittieralaska.gov/docs/Whittier-Comprehensive-Plan-Update-2012.pdf
[5] Ibid.
[6] Ibid.

3. MARINE RESOURCES

3.1 Introduction

Whittier small boat harbor facilities primarily support fishing vessels for commercial, subsistence, charter, and recreational use. Therefore, demand for harbor facilities depends on the viability of fishery resources in the region. [7] This section describes the fisheries in the Whittier area including historical catch and values, fisheries management institutions and practices, and expectations for the future.

3.2 Fisheries

3.2.1 Commercial Fisheries

Salmon fisheries are a major economic driver in PWS, and form the lion's share of commercial fishing activity in the area followed by smaller harvests of halibut and other species. Shellfish fisheries experience low participation and are probably supplemental to the primary salmon fishing endeavors. Likewise, participation in groundfish and sablefish fisheries is low. Despite low participation in these non-salmon fisheries, commercial fishing is expected to continue to be a viable industry in Whittier due to the strength of salmon fisheries in the region.[8]

The PWS Management Area encompasses all coastal waters and inland drainages entering the Gulf of Alaska between Cape Suckling and Cape Fairfield. Prince William Sound is a mixture of glacier-hewn fjords, rainforest-blanketed islands, and rugged mountain peaks. PWS's complex coastline, protected waters, and close proximity to nutrient-rich Gulf of Alaska waters support a broad array of marine life. PWS salmon and herring fisheries, along with other natural resources, such as copper, oil, and gold, were integral in forming the modern economic landscape of Alaska, and Whittier in particular. Salmon fisheries in PWS have greatly expanded since the mid-1970s, largely due to the addition of hatchery produced salmon. PWS is home to five salmon hatcheries, including the largest pink salmon and second largest chum and sockeye salmon enhancement programs in the state. Salmon fisheries in PWS harvest upwards of 74 million fish annually. Beginning in the early 1900s with razor clams, diverse shellfish fisheries including those for shrimp and scallops as well as king, Dungeness and Tanner crabs, sustained area residents through the 1980s. As shellfish resources declined, fisheries developed for groundfish including Pacific cod, sablefish, and pollock.

The 2017 Prince William Sound Area commercial salmon harvest was approximately 56.15 million fish. Harvest was composed of 48.73 million pink, 1.43 million sockeye, 5.42 million chum, 554,000 coho, and 13,600 Chinook salmon. The 2017 harvest included 50.34 million (90 percent) commercial common property fish (CCPF) and 5.82 million (10 percent) hatchery cost

[7] Demand for other resources such as rail-barge cargo, ferry, or cruise ship traffic are discussed in Section 4.4 of this appendix.

[8] For more information on the 2018 salmon forecasts, see the Alaska Department of Fish and Game Division of Commercial Fisheries News Release dated 1/18/2018.

recovery and broodstock fish. Table C-6 summarizes the 2017 Prince William Sound Area commercial salmon harvest.

Table C-5. 2017 Prince William Sound Area Commercial Salmon Harvest Estimates (thousands of fish)

District	Chinook	Sockeye	Coho	Pink	Chum	Total
Bering River	36	2,593	118,172	105	14	120,920
Copper River	13,139	569,321	304,042	68,826	11,639	966,967
Eastern	60	15,024	46,041	17,671,121	317,219	18,049,465
Northern	8	16,925	12,401	7,330,193	128,629	7,488,156
Coghill	74	118,369	14,438	1,113,153	3,036,549	4,282,583
Northwestern	2	20,564	1,341	1,451,741	46,886	1,520,534
Eshamy	89	620,999	4,077	350,317	120,221	1,095,703
Southwestern	136	50,973	20,187	11,629,000	446,044	12,146,340
Montague	94	10,000	7,425	3,381,639	539,333	3,938,491
Southeastern	5	991	732	676,741	52,037	730,506
Unakwik	0	764	0	208	70	1,042
CCPF Total	**13,643**	**1,426,523**	**528,856**	**43,673,044**	**4,698,641**	**50,340,707**
Hatchery						
Solomon Gulch	0	0	25,263	1,602,084	0	1,627,347
Cannery Creek	0	0	0	527,103	0	527,103
Wally Noerenberg	0	0	0	1,061,669	723,981	1,785,650
Main Bay	0	10,000	0	0	0	0
Armin F. Koernig	0	0	0	1,866,288	0	1,866,288
Hatchery Total [a]	**0**	**10,000**	**25,263**	**5,057,144**	**723,981**	**5,816,388**
PWS Total Harvest	**13,643**	**1,436,523**	**554,119**	**48,730,188**	**5,422,622**	**56,157,095**

The estimated value of the combined commercial salmon harvest, including hatchery sales, was approximately $128 million. During the 2017 season, 518 drift gillnet, 29 set gillnet, and 229 purse seine permit holders fished in at least one fishing period. Drift gillnet ex-vessel harvest value was an estimated $38.47 million (average permit earnings of $74,200); set gillnet ex-vessel harvest value was about $1.56 million (average permit earnings of $53,800); and purse seine ex-vessel harvest value was an estimated $71.79 million (average permit earnings of $313,500).[9]

The outlook for commercial fishing in Whittier and Prince William Sound is considered good. Salmon stocks, which comprise the vast majority of commercial harvest in Whittier, are healthy and in some cases increasing. Despite low participation in non-salmon fisheries, commercial fishing is expected to continue to be a viable industry in Whittier due to the strength of salmon fisheries. The presence of a land-based processor (Whittier Seafood) also attracts commercial fishers to Whittier. Table C-7 summarizes the 2018 forecast for salmon in Prince William Sound.[10]

[9] Alaska Department of Fish and Game Division of Commercial Fisheries News Release dated 10/03/2017.
[10] For more information on the 2018 salmon forecasts, see the Alaska Department of Fish and Game Division of Commercial Fisheries News Release dated 1/18/2018.

Table C-6. 2018 Prince William Sound Area Formal Salmon Forecast Summary (thousands of fish)

Area/Production Type	Species	Forecast Type	Forecast Point	Forecast Range	% Above/Below 10-yr Average
Copper River					
Wild Production	Chinook Salmon	Total Run	43	19–66	4.4% Below
Wild Production	Sockeye Salmon	Total Run	1,736	1,264–2,208	16.5% Below
Gulkana Hatchery Production	Sockeye Salmon	Total Run	148	108–188	
Total Production	Sockeye Salmon	Total Run	1,884	1,391–2,376	
Coghill Lake					
Wild Production	Sockeye Salmon	Total Run	183	95–407	22.0% Above
Prince William Sound					
Wild Production	Pink Salmon	CCP Harvest	2,020	310–13,151	20.7% Below
Wild Production	Chum Salmon	CCP Harvest	391	189–594	83.6% Above

Source: Alaska Department of Fish and Game Division of Commercial Fisheries

3.2.2 Sport Fisheries

Sport fisheries in Prince William Sound target five species of Pacific salmon, several species of groundfish (halibut, rockfish, and lingcod), and shrimp. Small populations of freshwater fish such as cutthroat trout and Dolly Varden are also available. These fisheries depend mainly on wild stocks but salmon are also raised in state and private non-profit hatcheries in Prince William Sound. King and silver salmon are the main sport fisheries out of Whittier, and these species feed on hatchery fish. Sport fishing in the Whittier area is generally conducted from chartered or private fishing vessels usually targeting salmon or halibut. Whittier's road access to the major population centers of the Municipality of Anchorage and the Matanuska-Susitna Borough make it a popular destination for anglers.

The king season runs from May through early July while the silver salmon season runs mid-July through mid-September. Sport fishers tend to troll for king salmon in Passage Canal or around Ester Island. Silver salmon are stocked at hatcheries in Whittier and Chenega in western PWS. Sport fishers generally fish for silver salmon at Knight Island, Montague Island, Jackpot Bay, Culross Passage, Esther Island, and Perry Island. Boat anglers out of Whittier troll or mooch for silver salmon around Pigot Point at the head of Passage Canal.

Red, pink, and chum salmon are also present in Prince William Sound. Small runs of red salmon are available in PWS during most of the summer. In western PWS, Eshamy Lagoon, Coghill Lake, and Main Bay are popular destinations for sport fishers. According to the Alaska Department of Fish and Game (ADF&G), Coghill River is the most popular destination for red salmon in western PWS, and can be accessed by boat from Whittier or float plane into Coghill Lake. Pink salmon return to PWS from mid-June through late August with peak season typically occurring in late July. The main pink salmon fisheries in western PWS occur at Sawmill Bay on Evans Island, at Lake Bay, and at Cannery Creek in Unakwik Inlet. Chum salmon are usually

taken by anglers targeting other salmon species in western PWS, particularly king or red salmon. Hatchery chum are generally found around Esther Island and Montague Island.

Other species harvested in Prince William Sound include groundfish (halibut, rockfish, and lingcod), shrimp, and small populations of cutthroat trout and Dolly Varden. Along with salmon, halibut is usually one of the most popular species targeted by sport fishers out of Whittier. Peak season for halibut typically runs from early June to mid-August. Rockfish are available year-round, though some seasonal restrictions exist. Peak season for lingcod is early July through late September; the season is closed January 1 to June 30. Fishing for shrimp is open from April 15 to September 15, with catches being highly variable depending on location fished. Small populations of cutthroat trout are occasionally found in fresh waters of western PWS. According to the ADF&G, PWS is the extreme northern and western range for cutthroat trout, so management is conservative and special restrictions apply.[11] Fishing for cutthroat trout is closed from April 15 to June 14 to protect spawning fish. The Copper River Delta Special Management Area for Trout has been established to protect unique stocks of trout east of the Copper River. Dolly Varden are also present in many streams throughout PWS and the Copper River Delta, with the best opportunities occurring July through September.[12]

Whittier is in the North Gulf Coast/PWS (J) sport fishing region of Southcentral Alaska (Figure C-3). Between 2007 and 2016 there were approximately 250,000 angler-days fished per year on average for the North Gulf Coast/PWS region. Of these, approximately 80,000 days (32 percent) were fished in western PWS, which includes Whittier and Passage Canal. About 60 percent of days fished in western PWS were trips out of Whittier. Although there was a slight downward trend in days fished between 2007 and 2012 for each region, the number of days fished has remained steady and consistent with historical averages.[13] Table C-8 and Figure C-4 show comparisons of angler-days fished by region.

[11] http://www.adfg.alaska.gov/static/fishing/PDFs/sport/byarea/southcentral/westernpws.pdf
[12] http://www.adfg.alaska.gov/sf/FishingReports/index.cfm?ADFG=R2.reportDetail&Area_key=11
[13] In 2016, approximately 39,300, 70,990, and 222,600 days were fished in Whittier, western PWS, and the North Gulf Coast/Prince William Sound region of Southcentral Alaska, respectively. Historic averages for each region are approximately 47,900, 80,000, and 250,000 angler-days fished.

Figure C-3. Southcentral Alaska Sport Fishing Regions

Source: Alaska Department of Fish and Game, Alaska Sport Fishing Survey, Southcentral Alaska Region. http://www.adfg.alaska.gov/sf/sportfishingsurvey/index.cfm?ADFG=region.home

Table C-7. Angler-days Fished in Southcentral Alaska, 2007-2016

Year	Whittier	Western PWS	North Gulf Coast/PWS
2007	64,716	96,834	318,595
2008	52,597	83,012	262,336
2009	57,404	84,684	268,736
2010	42,842	69,539	235,772
2011	40,738	84,333	238,423
2012	29,554	58,017	194,166
2013	52,860	91,223	256,191
2014	60,568	92,004	250,580
2015	38,692	68,084	246,949
2016	39,368	70,990	222,651
10-Year Average	47,934	79,872	249,440

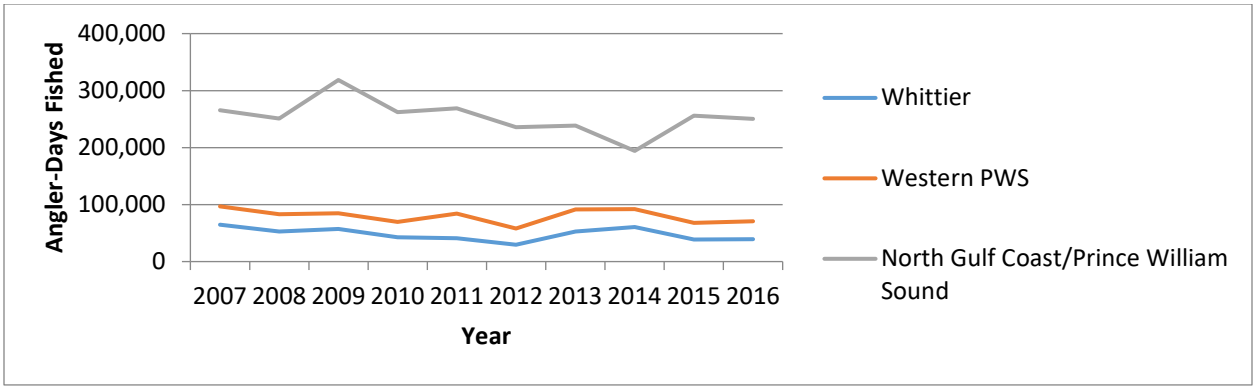


Figure C-4. Angler-Days Fished, Prince William Sound 2007-2016

Source: Alaska Department of Fish and Game, Alaska Sport Fishing Survey, Southcentral Alaska Region

3.2.3 Subsistence

Subsistence in Alaska. Subsistence fishing and hunting are important for the economics and cultures of many families and communities in Alaska. Subsistence uses exist alongside other important uses of fish and game in Alaska including commercial fishing, sport fishing, and personal use fishing. All Alaska residents are eligible to participate in subsistence fisheries, and there are several subsistence fishing opportunities in PWS. While salmon comprises the majority of the subsistence catch in the Sound, halibut may also be caught by residents of rural communities through the Federal subsistence halibut program. Other subsistence fisheries include herring, bottomfish and shellfish.

State and Federal laws define subsistence uses as the "customary and traditional uses" of wild resources for a variety of purposes. The uses include harvest and processing of wild resources for food, clothing, fuel, transportation, construction, arts, crafts, sharing and customary trade. Under Alaska's subsistence statute, the Alaska Board of Fisheries must identify fish stocks that support subsistence fisheries and, if there is a harvestable surplus of these stocks, adopt regulations that provide reasonable opportunities for these subsistence uses to take place. Subsistence uses of fish and land mammals are given priority over commercial fishing and recreational fishing and hunting in state and Federal law. This means that when a harvestable portion of a fish stock or game population is not sufficient for all public uses, subsistence uses are restricted last by regulations.

Subsistence hunting and fishing are restricted in non-rural areas of Alaska by the state and Federal subsistence programs. Federal law allows subsistence harvests only by residents of rural areas, while state law permits subsistence harvests by any Alaska resident in areas outside the boundaries of "nonsubsistence areas." The Alaska Joint Board of Fisheries and Game has determined that the areas around Anchorage, the Matanuska-Susitna Valley, the Kenai Peninsula, Fairbanks, Juneau, Ketchikan, and Valdez are nonsubsistence areas, where fish and game harvests may be allowed under sport, personal use, general, or commercial regulations, but not under subsistence regulations. The Federal Subsistence Board has defined similar non-rural areas.

The subsistence food harvest by Alaska residents represents about 0.9% of the fish and game harvested annually in Alaska. This total includes all noncommercial harvests by residents of rural areas plus harvests taken under subsistence fishing and hunting regulations by residents of nonsubsistence areas. “Personal use fishing,” and hunting under general regulations by Alaska residents, produces an additional 0.2% of all harvests. Sport fishing and hunting (sport fishing by Alaskans and nonresidents and all nonresident hunting) take 0.4%. Commercial fisheries rounds out the total, accounting for about 98.5% of the statewide harvest (Figure C-5).

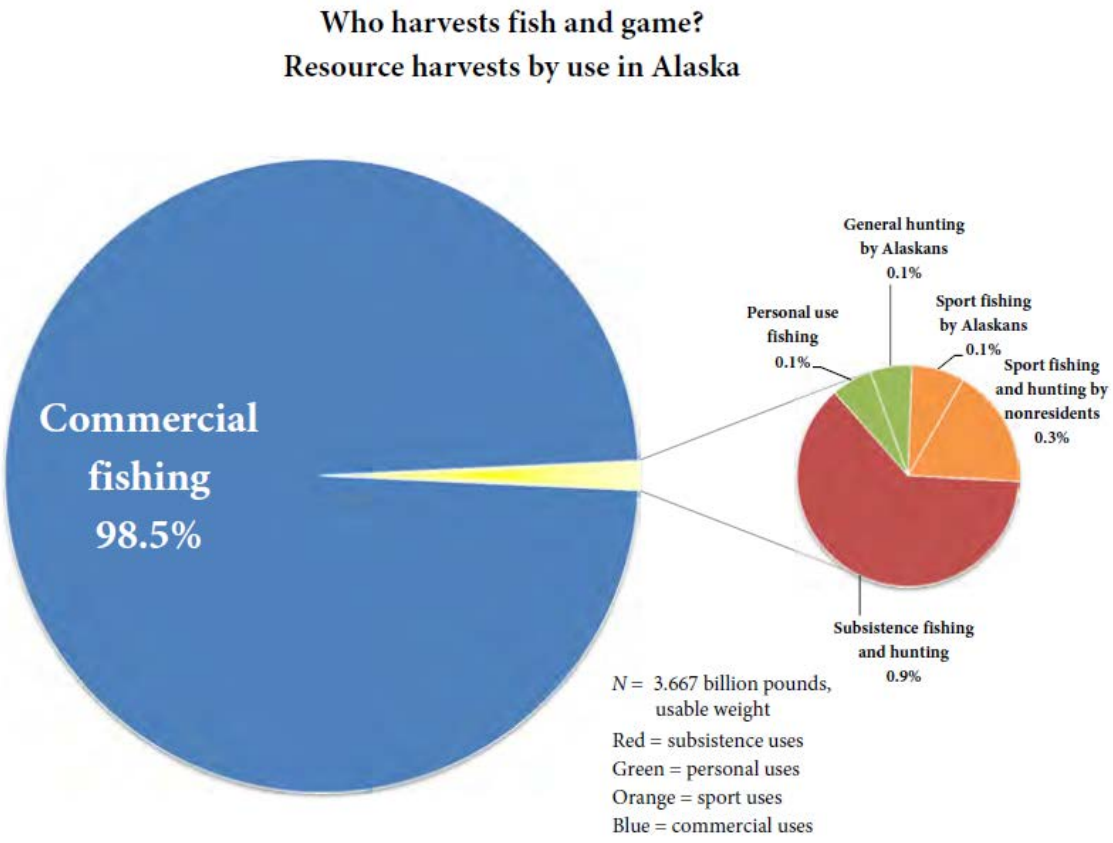


Figure C-5. Resources Harvested by Use in Alaska

Source: Alaska Department of Fish and Game Division of Subsistence, 2014

Though relatively small in the statewide picture, subsistence fishing, hunting, and gathering provide a major part of the food supply of rural Alaska. The Alaska Department of Fish and Game (ADF&G) Division of Subsistence estimates about 34.3 million pounds (usable weight) of wild foods are harvested annually by residents of rural areas of the state, and 11.6 million pounds by urban residents in all noncommercial fisheries and hunts. Per capita, the annual wild food harvest is about 275 pounds per person per year (about 0.75 lbs. a day per person) and 19 lbs. per person per year for urban areas (Table C-9).

Table C-8. Wild Food Harvests in Alaska, Pounds Harvested by Area

Area of Residence	Annual Wild Food Harvest (per capital)	Annual Wild Food Harvest (total pounds)
Rural Areas		
Rural Southcentral	145	1,040,416
Kodiak Island	158	2,192,138
Rural Southeast	189	5,213,268
Southwest-Aleutians	206	3,396,436
Rural Interior	317	3,100,075
Western	370	9,119,599
Arctic	405	10,267,357
Subtotal	*275*	*34,329,290*
Urban Areas		
Anchorage Area	15	4,585,868
Fairbanks-Delta	16	1,735,734
Juneau Area	19	614,812
Prudhoe Bay	19	41,452
Mat-Su Area	22	2,146,530
Valdez	31	126,416
Ketchikan Area	32	440,397
Kenai Peninsula	35	1,949,008
Subtotal	*19*	*11,640,216*
Alaska Total	**63**	**45,969,506**

Source: Alaska Department of Fish and Game Division of Subsistence, 2014

Subsistence Resources in Prince William Sound. All Alaska residents are eligible to participate in subsistence fisheries, and there are several subsistence fishing opportunities in PWS. PWS is divided up into fishing districts. The Eastern, Southwestern, and Copper River Districts each have their own regulations, while general regulations apply to all other districts. Resources harvested in PWS for subsistence are described below.

Salmon. In the Eastern and Southwestern Districts, salmon fishing is open from May 15 to October 31. From May 15 until 2 days before the commercial opener fishing is open, 7 days a week, during the commercial season, and 7 days a week 2 days after the closure of the commercial season through October 31. Legal gear for this fishery includes seine nets up to 50 fathoms in length and 100 meshes deep with a maximum mesh size of 4 inches, or gillnets up to 100 fathoms in length with a maximum mesh size of 6 ¼ inch. Pink salmon may only be taken in fresh water with dip nets.

In the General Districts, that is all other districts besides the Eastern, Southwestern, and Copper River Districts, fishing is open in conformance with commercial fishing regulations regarding

gear, open areas, and open periods. Annual limits are 15 salmon for a household of one, 30 salmon for a household of 2; and 10 salmon for each additional person in the household thereafter. There is a limit of 5 Chinook salmon per permit.

In December 2017, the Alaska Board of Fisheries passed a proposal that established additional subsistence fishing opportunity in PWS salmon fisheries. After May 15, during the commercial fishing season in a salmon fishing district, salmon may be harvested on Saturdays from 6:00 am to 10:00 pm. Prior to this change, subsistence salmon fishing was only allowed during the commercial salmon season concurrent with commercial fishing periods.[14]

Herring. In December 2017, the Alaska Board of Fisheries passed a proposal that established subsistence herring permits in PWS. Starting in 2018, a subsistence herring permit will be required in PWS to harvest herring for subsistence purposes. The permit will have annual reporting requirements, but does not limit the quantity of herring harvested.

Non-Salmon Finfish. PWS has plentiful ocean fish besides salmon and halibut that can be harvested for subsistence, including lingcod, rockfish, and sharks. Lingcod, rockfish, and sharks may be harvested in PWS using a single hand troll, single hand-held line, or single long-lin. Both lingcod and rockfish may also be kept if they are harvested incidentally in another subsistence finfish fishery such as salmon.

Lingcod may be harvested for subsistence July 1 - December 31. From May 1 through September 15, the daily bag limit of rockfish is 5 fish and possession limit is 10 fish, of which only 2 per day and 2 in possession may be non-pelagic rockfish. From September 16 through April 30, the daily bag and possession limit of rockfish is 10 fish, of which only 2 per day and 2 in possession may be non-pelagic rockfish. The daily bag limit for sharks is 1 fish and the possession limit is 2 fish.

Shellfish. Golden king crab and Tanner crab may be harvested in PWS outside the Valdez nonsubsistence use area by obtaining a subsistence crab permit from the Division of Commercial Fisheries in Cordova or Anchorage. Golden king crab and Tanner crab may be harvested between October 1 and March 31. Shrimp may be harvested between April 15 and September 15. The Dungeness and king crab subsistence fisheries in the PWS area are currently closed until stocks of these crabs recover enough to provide a harvestable surplus.

Subsistence in Whittier. Fish comprise the largest portion of the subsistence harvest in Whittier followed by land mammals and marine invertebrates. Most methods of subsistence harvest require a vessel to reach harvest grounds. Table C-10 shows characteristics of the subsistence harvest for Whittier for 1990, the most recent available data for Whittier.

[14] Prince William Sound Salmon Fishery News Release #12017 Alaska Board of Fisheries Actions: Prince William Sound Area23 Feb 2018.

Table C-9. Whittier Subsistence Harvests

Resource	Percent Using	Percent Attempting to Harvest	Percent Harvesting	Estimated Harvest (lbs)	Pounds Harvested per Household	Pounds Harvested per Capita
All Resources	93.7	78.9	76.8	22,308	216.59	79.93
Fish	89.5	60	57.9	14,969	145.33	53.64
Land Mammals	56.8	12.3	7.9	3,064	29.75	10.98
Marine Mammals	7.6	1.1	1.1	265	2.57	0.95
Birds and Eggs	20.7	16.5	15.3	383	3.72	1.37
Bird Eggs	1.1	1.1	1.1	11	0.1	0.04
Marine Invertebrates	52.4	15.5	15.5	2,494	24.22	8.94
Vegetation	77.9	72.6	72.6	1,133	11	4.06

Note: The most recent harvest data for Whittier is 1990, which is considered representative of subsistence harvest in Whittier.
Source: Alaska Department of Fish and Game

3.2.4 Charter Fisheries

The ADF&G issues licenses for guide and charter services in the state. Depending on the targeted fishery, the requirements could include vessel registration, guide/charter license, fishing tags, logbook submittal requirements, and other reporting functions. Charter and guide services follow roughly the same harvesting window as the commercial and subsistence fisheries with some restrictions on total catch.

Targeted species for charter and guide services are generally the five salmon species and halibut, though there are other fishing opportunities as well. The State of Alaska Department of Commerce lists seven active businesses in Whittier that primarily offer charter fishing excursions and an internet search for fishing charter services in Whittier shows nine businesses; however, many charter businesses operating out of Whittier are licensed elsewhere.[15] Charter vessels are generally smaller class (in the 28-32 foot range) in order to offer a more intimate setting and strong customer service. Charter/guide companies will often partner with local inns and B&B's or provide accommodations as a side business.

3.3 Summary and Outlook

The fishing industry in Whittier and PWS is considered strong. Fisheries activities will continue to fluctuate as resource abundance varies, regulations change, or technical breakthroughs are made. Overall, the biological stock is healthy and the presence of the land-based processing plant at Whittier offers opportunities for commercial and charter fishers to timely deliver and process catch for shipping while the harvest is fresh. Finally, road access to Whittier allows the major population centers of Alaska to participate in recreational and subsistence activities in the waters of PWS.

4. ECONOMIC ANALYSIS

4.1 Purpose and Scope

The purpose of this economic analysis is to evaluate a proposal to build a protected boat launch facility at the head of Passage Canal in Whittier. Doing so would reduce overcrowding and congestion in the existing Whittier small boat harbor and associated upland facilities, which would alleviate operational inefficiencies, damages to vessels and marine infrastructure, and improve opportunities for commercial fishing, subsistence, and recreational activities at Whittier.

The study was conducted and the report prepared in accordance with goals and procedures for water resources planning as contained in Engineer Regulation 1105-2-100, *Planning Guidance*

[15] For example, licenses for charter businesses operating out of Whittier may be registered in the Municipality of Anchorage, the Matanuska-Susitna Borough, or elsewhere in Alaska.

Notebook, and the project authorization. Alternatives were examined for their feasibility, considering engineering, economic, environmental, and other criteria.

It is worth noting that, while previous studies evaluated alternatives to expand moorage and boat launching facilities at Whittier, the local sponsor requested that the Corps suspend further analysis of alternatives that provided moorage due to concerns about meeting construction cost-sharing requirements. Although the sponsor is hopeful to expand any protected boat launch facility constructed as a result of this study to provide moorage at a later date, this analysis does not consider benefits associated with moorage given the sponsor's request as well as uncertainty about the timing and funding of such potential development.

Some discussion about moorage occurs in this appendix because moorage and boat launching issues at Whittier are intertwined. Given that the current launch facilities are located within the existing Whittier Harbor, creating additional launch facilities at the head of the bay is expected to reduce overcrowding and congestion issues at all launch facilities in Whittier and within the existing harbor. As detailed in subsequent sections of this appendix, these overcrowding and congestion issues result in damages and inefficiencies that could be alleviated with navigation improvements.

4.2 General Methodology

This section describes the methods used to conduct the economic analysis of navigation improvements at Whittier. Primary data collection efforts included an Office of Management and Budget (OMB)-approved mail-out survey, personal interviews, and other follow-up research and data gathering.

The basic methodology utilized in the compilation of this report consisted of three steps. First, a review of published information was conducted on the history, present status, future prospects for harbor operations at Whittier. Next, local harbor officials, harbor users, and maritime specialists operating in Whittier were interviewed. Finally, selection and description of NED benefits and related construction and life cycle costs were made for the proposed improvement alternatives that appear cost effective and achievable.

NED benefits are assessed for the alternatives identified in the Project Alternatives section and follow the methodology for small boat harbor navigation analysis described in the Planning Guidance Notebook[16] and other relevant Corps of Engineers regulations and policy guidance. Benefits equal the difference between without- and with-project costs associated with transportation delays, damages to vessels and harbor infrastructure, and enhanced access for commercial fishing, subsistence, and recreational activities, as well as utilization of unemployed or underemployed labor resources during project construction.

All costs were calculated using Fiscal Year (FY) 2018 (October 2017) price levels and then converted to Average Annual Equivalent (AAEQ) values using the FY 2018 Federal discount

[16] https://planning.erdc.dren.mil/toolbox/library/ERs/entire.pdf

rate of 2.750 percent, assuming a 50-year period of analysis. The benefits estimated for each alternative were compared to its cost to determine its economic justification. The plan that reasonably maximizes net benefits (benefits less cost) is the NED plan. The NED plan is usually the Federal recommended plan, and may or may not be the locally preferred plan.

4.3 Data Collection Techniques

An Office of Management and Budget-approved mail-out survey, personal interviews, and other research was conducted in order to ascertain expected and future conditions at Whittier, including the level of demand for moorage and boat launching facilities. The survey was the primary data-gathering tool with other methods supplementing survey results. The resulting information was used to inform the benefits model used to determine whether the project was justified from an economic perspective. The survey was mailed to 1,855 boat owners and permit holders in the region. There were 519 responses for an overall response rate of 28 percent.

As this is a small boat harbor project located in a rural Alaskan community, there is limited empirical data with which to conduct economic analysis. Supplemental data were also collected through informal interviews and additional follow-up research.

4.3.1 Whittier Small Boat Harbor Survey

The purpose of the Whittier Small Boat Harbor Survey was to gather primary data from Whittier harbor users, identify and describe existing conditions, and determine potential benefits from navigation improvements.

Research Questions. The survey gathered information about use patterns and expenditures from individuals who used the Whittier small boat harbor during the 2007 study period. Although the study was put on hold after the survey for a variety of reasons, harbor conditions have not changed substantially since 2007 so the survey results are still considered valid and representative of existing conditions. Responses to the questions allow the study team to identify the without-project conditions by documenting vessel characteristics, existing and anticipated future use of the harbor.

Sampling Strategy. Surveys were mailed to vessel owners and permit holders with 2007 fishing permits in the PWS region. Permanent and transient users of the harbor in that year totaled 1,855; all were mailed a copy of the survey. The return of 519 surveys was large enough to attain a 95 percent confidence interval with a standard error of + /– 3.28 percent (Table C-11). The margin of error and the confidence level indicate how well the survey sample represents the entire population—in this case, the 2007 users of the Whittier Small Boat Harbor.

Table C-10. Survey Response Summary

Type of Vessel	Number Responding	Standard Error for 95% Confidence Interval
Recreation/Subsistence	389	+/– 3.82
Charter/Sightseeing/Water Taxi	21	+ /– 15.13
Commercial Fishing	107	+/– 6.48
Total	**519**	**+/– 3.28**

Collection Procedures. Harbor personnel mailed the survey questionnaires with a cover letter under the signature of the City Manager. The letter and the survey clearly stated the distribution was on behalf of research efforts by USACE. Each survey included a pre-addressed return envelope to encourage return. Additional survey questionnaires were also available on the City of Whittier's webpage. Potential respondents were advised that completed surveys could be returned to the harbormaster's office by fax or in person.

Follow-Up Procedures. Each questionnaire was assigned a unique identification number for follow-up purposes. A tally of responses was taken to determine if response levels had reached the survey goal. Whittier City and harbormaster staff encouraged local residents to respond to surveys. After completed surveys were tallied from the first round of mailings, harbormaster staff sent reminders to non-respondents to encourage reply.

Survey Data Analysis Plan. The Alaska District economics team prepared a Microsoft Access database for data entry by City of Whittier personnel. The database was delivered to the City of Whittier and harbor staff received a training session to get comfortable with the process. After data entry was completed, the Alaska District economics team analyzed Access database outputs using Microsoft Excel.

4.3.2 Interviews

Informal interviews were conducted with project stakeholders throughout the study process. This includes information gathering at the re-scoping charette held in Whittier in February 2013 and on follow-up site visits in 2015, 2017, and 2018. The City of Whittier provided valuable information such as the current harbor slip list and waiting list. Additional interviews included the local fish processing facility, the Whittier harbormaster, recreational boaters, and charter operators.

4.3.3 Additional Research

Other input data for the economic analysis was gathered through website research and previously published data from sources such as the ADF&G, the Commercial Fisheries Entry Commission (CFEC), International Pacific Halibut Commission (IPHC), the Pacific States Marine Fisheries Commission (PSMFC), and others. Data sources are listed in throughout the document to credit

those agencies responsible. These items are described in more detail as appropriate in the following sections.

4.4 Model Development

Based on early coordination with the Deep Draft Navigation Planning Center of Expertise (DDN-PCX), it was determined appropriate to develop a project-specific spreadsheet model for this economic analysis. The USACE-certified HarborSym model was not used because the navigation problems and alternatives evaluated in this study are unrelated to deep draft navigation, and the study area lacks detailed information necessary for inputs into the HarborSym model.

The model was developed by Alaska District economists and consists of an Excel spreadsheet that calculates the benefits and costs of the proposed navigation improvements at Whittier. Model development was based on the USACE Planning Guidance Notebook (ER 1105-2-100). Coordination with the DDN-PCX concerning model approval for one-time use is ongoing.

Benefits are calculated by examining avoided damages, reduced delays, and other savings categories based on comparing without- and with-project conditions for commercial and recreational vessels operating in the study area. Data utilized in the model include the results of the Whittier Small Boat Harbor Survey; fisheries data from the ADF&G, Alaska CFEC, and the PSMFC; harbor use data from the Whittier Harbormaster's office; current Consumer Price Index, Employment Cost index, and Civil Works Construction Cost Index; internet searches for various pieces of information; and previously published USACE small boat harbor evaluations. In addition to analysis of the benefit categories detailed in subsequent sections of this appendix, the model also includes sheets for inputs and assumptions, project costs, interest during construction, summary pages, and benefit-cost ratio calculations. Sensitivity analysis was performed to account for uncertainty in various variables. @Risk, an Excel add-in, was used to perform Monte Carlo analyses to address the uncertainty associated with some items.

4.5 Existing Conditions

The following sections describe the current conditions at the Whittier Small Boat Harbor.

4.5.1 Marine Facilities

Whittier is located on the northeast shore of the Kenai Peninsula at the head of Passage Canal in Western PWS. Transportation services to the community are by road, rail, state ferry, and boat. Whittier is also accessible by plane but air travel is restricted by frequent adverse weather conditions and the airstrip is rarely used.

Whittier Small Boat Harbor provides moorage, vessel tendering and repair, haul-out services, and other related amenities to boaters. The harbor has 358 slips available for permanent and transient moorage as well as a three-lane boat launch ramp. Separate facilities adjacent to the harbor include cruise ship, Alaska State ferry, and rail-barge loading and unloading facilities

(Figure C-9). A private harbor, the Cliffside Marina, was constructed in 2004 and provides moorage for 103 vessels. Space constraints limit dry storage, service areas, and parking near the Whittier small boat harbor and these facilities. These areas are used to capacity during the peak boating season.

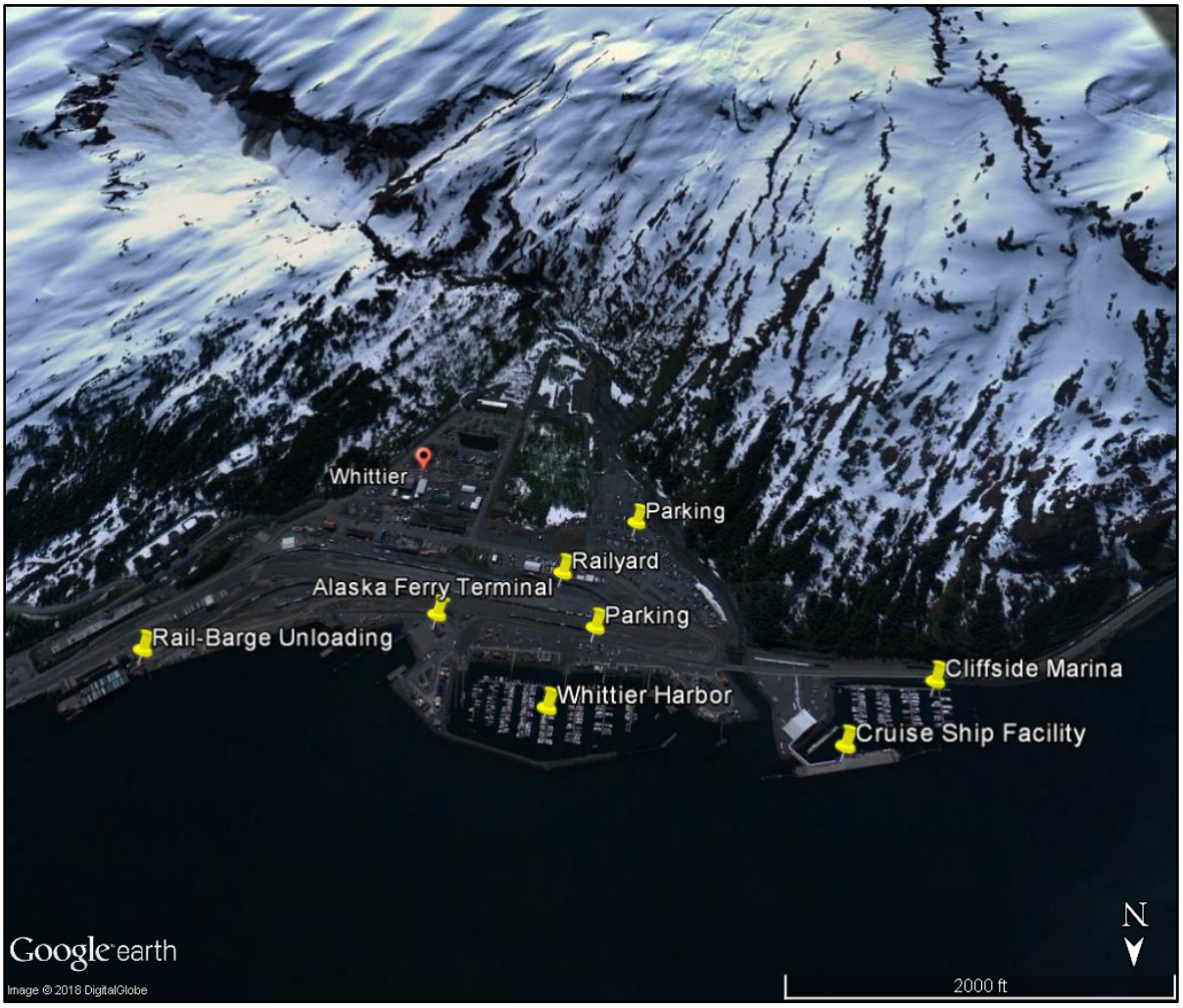


Figure C-6. Existing Whittier Harbor and Surrounding Facilities

Whittier Harbor. In 1972, construction of Whittier Harbor just east of the mouth of Whittier Creek was completed, primarily with State of Alaska funds. The harbor was designed with 100 berths, and upon opening, was immediately filled to capacity. A 225-foot sheet-pile breakwater extension and a 130-foot floating breakwater were added in 1972 and 1978, respectively. In 1980, the State of Alaska funded expansion of the original harbor to contain 332 slips. This expansion also immediately filled to capacity upon opening. A new float and access pier and ramp for loading passengers aboard day-tour excursion boats were completed in 1992. Whittier received ownership of the facility from the Alaska Department of Transportation & Public Facilities in 2004. A 2010 project added 26 additional slips to the harbor, bringing the total number of slips to 358. Whittier Harbor is seen in the center of Figure C-10.

Support facilities include a harbormaster's office, a 30-ton boatlift and dock, electric and water utilities, two boat maintenance grids, and marine fuel service facilities. In addition, the harbor features the Ocean Dock, which serves large day-cruise vessels and the City Dock, which is used primarily by commercial fishermen. A crane, boom, and net are available for unloading their catches of shrimp, halibut, or salmon. A boat lift may be used on the City Dock to hoist boats out of or into the water.

Figure C-7. Whittier Marine Facilities

Source: City of Whittier. http://whittieralaska.gov/photo_gallery.html

Current harbor configuration allows for 358 slips, which are divided between permanent and transient moorage (Table C-12). In addition, approximately 420 linear feet of moorage is available to transient vessels and vessels too long to fit into existing slips. This transient float (Alpha Float) accommodates approximately ten vessels depending on vessel length. According to harbormaster records, 263 slips (about 73 percent of all slips) are available for permanent moorage. These harbor users have moorage agreements with the City of Whittier, pay a fee for moorage, and have a designated slip for their vessel. Transient vessels are those that utilize moorage at the Whittier harbor but do not have a designated permanent moorage slip. Current facilities can accommodate about 95 transient vessels depending on length. The majority of slips

(59 percent) accommodate vessels less than 28 feet in length, with approximately 82 percent of slips accommodating vessels less than 37 feet in length.

Table C-11. Existing Whittier Harbor Moorage Capacity (Supply)

Slip Length	0-28'	28-34'	34-37'	37-45'	45-54'	54-60'	>60'	Alpha Float	Total
Permanent slips	134	40	36	32	20	0	0	1	263
Transient slips	78	2	2	2	2	0	0	9	95
Total	**212**	**42**	**38**	**34**	**22**	**0**	**0**	**10**	**358**
Percent of Total	**59%**	**12%**	**11%**	**9%**	**6%**	**0%**	**0%**	**3%**	**100%**

The harbormaster maintains a waitlist for moorage. Some of the waitlisted vessels are accommodated by rafting at various docks in the harbor, while other vessels utilize the launch ramps or forego mooring or launching at Whittier altogether. While the number of rafted vessels fluctuates throughout the year, there were approximately 54 vessels rafted in Whittier harbor at the time of this report (Table C-13). Figure C-11 is the Whittier Harbor Boat Slip Map from the City of Whittier website.

Table C-12. Vessels Rafting in Whittier Harbor

Slip Length	0-28'	28-34'	34-37'	37-45'	45-54'	54-60'	>60'	Alpha Float	Total
Rafted Vessels	12	4	4	4	4	0	0	26	54

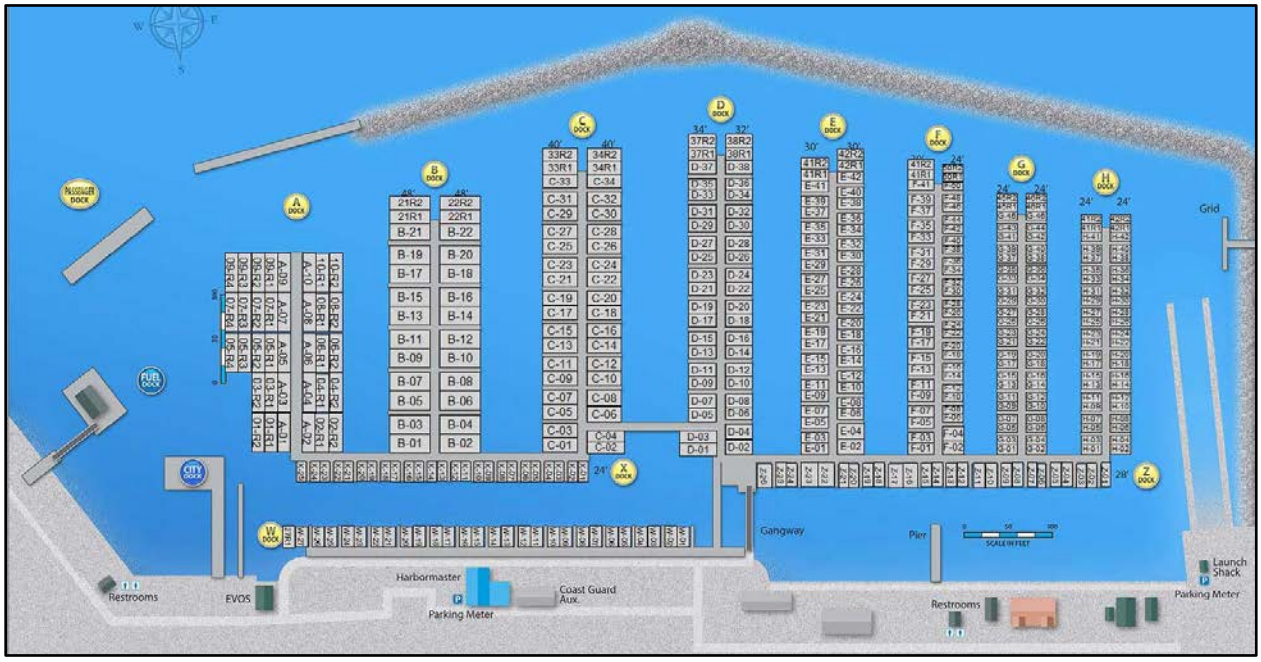


Figure C-8. Whittier Harbor Slip Map. http://www.whittieralaska.gov

In addition to providing permanent and transient moorage, there is a 3-lane boat launch ramp inside the harbor that allows two lanes of traffic to go one direction and one lane going the other.

Existing boat launch capacity is estimated based on the number of existing launch lanes, the number of peak hours available to launch/retrieve a vessel, and the average amount of time it would take to launch a vessel under various scenarios of congestion. Assumptions about these parameters are based on discussions with harbor staff, survey response data, and a review of literature about planning and design guidelines for small boat harbors.[17] For the purposes of this analysis, total daily launch capacity assumes low congestion with a typical launch time of 20 minutes. Using this approach, existing launch capacity is estimated to be approximately 108 launches per day (Table C-14).

Table C-13. Existing Whittier Boat Launch Capacity (Supply)

Variable Description	Calculation
Existing Number of Launch Lanes	3
Average Time per Launch (hours)	0.33
Launches per hour, per lane	3
Launches per hour, all lanes	9
Typical Launch/Retrieve Window (hours)	12
Total launches per day, per lane	36
Total launches per day, all lanes	**108**

Private Marina. A private harbor, the Cliffside Marina, was constructed in 2004 and provides moorage for 103 vessels. The harbor is approximately 100 feet deep at the entrance and 25 feet deep at the shallowest point, and is protected by a combination of sheet pile and floating breakwaters. Slips are acquired from the marina under a lease-ownership agreement. The few slips currently available are selling for between $125,000 and $175,000. Cliffside Marina can be seen shore side of the cruise ship in Figure C-9.

[17] Planning and Design Guidelines for Small Craft Harbors, ASCE Manuals and Reports on Engineering Practice No. 50 (2012).

Figure C-9. Cliffside Marine and Cruise Ship Terminal

Courtesy: City of Whittier. http://whittieralaska.gov/photo_gallery.html
**The tank farm in the upper portion of this photo has now been removed.*

Cruise Ship Terminal. A cruise ship terminal was constructed in Whittier in 2002. Prior to this expansion, cruise ships docked at the ferry facility east of Whittier Harbor. Princess Cruises operates ships ranging in capacity from 672 passengers to 2,600 passengers, and generally uses Whittier as a beginning/end port for its cruises to/from the Pacific Northwest. The vast majority of arriving passengers use Whittier as a transfer point for travel to other points in Alaska. Van, bus, rail, and private transfers are available to shuttle arriving passengers from Whittier to other points within the state. According to the Alaska Cruise Association, Whittier is scheduled to have 38 cruises from Princess Cruises during the 2018 cruise season from 12 May to 12 September.

Cruise ships utilize a floating dock with an adjacent 20,000 square foot cruise ship terminal, which was completed in 2004. The terminal is shown in Figure C-10, adjacent to Cliffside Marina.

Figure C-10. Whittier Cruise Ship Terminal
Courtesy: City of Whittier. http://whittieralaska.gov/photo_gallery.html

Alaska Marine Highway System Ferry Terminal. The Alaska Marine Highway System connects Whittier to other communities in PWS and Southeast Alaska (Figure C-11). Ferry service for Whittier to neighboring PWS communities is provided seven days per week in summer and two to three days per week in winter. By ferry, Whittier is approximately 5 hours and 45 minutes from Valdez and 6 hours and 45 minutes from Cordova.

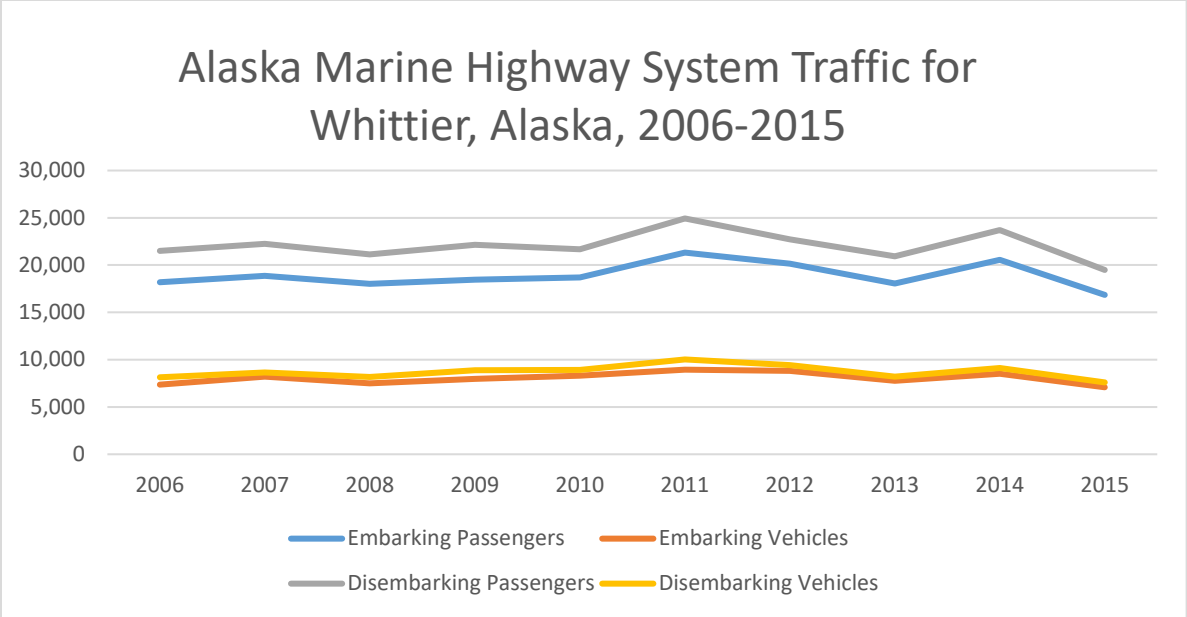
PWS is serviced from Whittier by the *MV Aurora*, *MV Fairweather*, and *MV Kennicott*. The Aurora has a capacity of 24 crew, 250 passengers and 40 vehicles. The Fairweather has a capacity of 10 crew, 210 passengers, and 34 vehicles. The Kennicott is designed to carry 55 crew members, 499 passengers, and approximately 93 vehicles. A cross-gulf route, is also serviced by the *MV Kennicott*, connecting Whittier to Southeast Alaska twice per month in the summer. Tourist traffic comprises a significant percentage of Alaska Marine Highway System traffic in the summer, especially between Valdez and Whittier.

Ferry traffic and passenger counts have remained steady over the last decade, with 2015 traffic being slightly below 10-year averages for all categories listed in Table C-15.

Figure C-11. Alaska Marine Highway System, Available Routes to and from Whittier Alaska
http://www.dot.state.ak.us/amhs/comm/whittier.shtml

Table C-14. Alaska Marine Highway System Traffic for Whittier, Alaska 2006-2015

Year	Embarking Passengers	Embarking Vehicles	Disembarking Passengers	Disembarking Vehicles	Port Departures
2006	18,189	7,379	21,520	8,153	419
2007	18,879	8,196	22,236	8,654	381
2008	18,020	7,494	21,139	8,160	356
2009	18,464	7,986	22,139	8,901	417
2010	18,712	8,326	21,672	8,916	340
2011	21,323	8,945	24,933	10,026	380
2012	20,143	8,830	22,724	9,413	413
2013	18,041	7,771	20,917	8,220	375
2014	20,543	8,528	23,697	9,110	405
2015	16,851	7,082	19,488	7,598	320
10-year Average	18,917	8,054	22,047	8,715	381



Marine Freight Operations. Alaska Marine Lines operates one freight barge per week between Seattle and Whittier.[18] The number of containers per barge differs with the mix of containers, which come in 20-foot, 24-foot, 40-foot, and 53-foot sizes.[19] Alaska Marine Line's barges range from 150 feet to 420 feet in length and have a container capacity ranging from 160 to 950 containers. The Whittier Provider was built in 2001 and is 420 feet long with a capacity of 264 containers.[20]

According to the Waterborne Commerce Statistics Center, Whittier ranks 3rd among Southcentral Alaskan ports in terms of total tonnage, behind only Nikishka and Anchorage. Table C-16 shows commodity movements for the top four ports in Southcentral Alaska from 2012 to 2016. Based on the components of the freight, it is assumed that most freight coming into Whittier is distributed throughout Alaskan communities located on the road and/or rail system (Table C-17).

Table C-15. Commodity Freight by Community (1,000 short tons), 2012-2016
Source: Waterborne Commerce of the United States

Year	Homer	Whittier	Anchorage	Nikishka
2012	139,830	263,054	2,842,912	3,891,093
2013	219,082	292,418	2,949,456	4,484,225
2014	449,568	363,043	2,864,362	4,425,284
2015	192,048	376,988	3,540,605	5,156,956
2016	232,702	345,175	3,215,121	4,724,918
5-Year Average	246,646	328,136	3,082,491	4,536,495

[18] http://www.lynden.com/aml/barge-schedule.html
[19] Ibid.
[20] http://www.lynden.com/aml/tools/equipment/marine-equipment/index.html

Table C-16. Commodity Freight through Whittier (1,000 short tons), 2012-2016

Source: Waterborne Commerce of the United States

	2012	2013	2014	2015	2016
All Commodities	**263,054**	**292,418**	**363,043**	**376,988**	**345,175**
Crude Petroleum	264	306	338	373	36
Gasoline, Jet Fuel, Kerosene	144	0	1	0	0
Distillate, Residual & Other Fuel Oils; Lube Oil & Greases	1,230	0	43	40	0
Petroleum Pitches, Coke, Asphalt, Naphtha and Solvents	3,923	5	462	190	647
Petroleum Products NEC	6,599	8,119	4,240	3,510	5,079
Fertilizers	2,202	5,085	887	717	528
Other Chemicals and Related Products	15,834	25,263	8,724	8,765	8,583
Forest Products, Lumber, Logs, Woodchips	3,773	8,359	8,516	9,793	6,995
Sand, Gravel, Stone, Rock, Limestone, Soil, Dredged Material	478	222	5,469	2,383	4,431
Iron Ore and Iron & Steel Waste & Scrap	49	0	22	41	0
Sulphur (Dry), Clay & Salt	0	0	0	48	3,456
Slag	109	676	40	10	61
Other Non-Metal. Min.	2,423	4,305	6,566	6,265	0
Paper & Allied Products	6,111	5,469	7,089	5,606	5,746
Building Cement & Concrete; Lime; Glass	7,437	11,874	21,448	27,338	23,254
Primary Iron and Steel Products (Ingots, Bars, Rods, etc.)	1,154	3,176	2,284	3,122	2,651
Primary Non-Ferrous Metal Products; Fabricated Metal Prods.	7,967	9,952	23,016	22,854	15,142
Primary Wood Products; Veneer; Plywood	11	1,616	2,990	3,013	1,774
Fish	25,718	31,975	31,789	31,676	17,278
Barley, Rye, Oats, Rice and Sorghum Grains	0	0	0	0	30
65 Oilseeds (Soybean, Flaxseed and Others)	0	0	64	109	43
66 Vegetable Products	0	0	0	0	109
67 Animal Feed, Grain Mill Products, Flour, Processed Grains	7,774	9,230	11,507	10,476	8,990
68 Other Agricultural Products; Food and Kindred Products	77,144	85,215	98,559	98,866	74,694
70 All Manufactured Equipment, Machinery and Products	92,235	81,345	128,685	139,752	163,207
80 Waste Material; Garbage, Landfill, Sewage Sludge, Waste Water	28	70	273	2,032	2,281
99 Unknown or Not Elsewhere Classified	447	156	31	9	160

Alaska Railroad. Whittier is also an entry point for freight entering Alaska to be carried by the Alaska Railroad. In addition to handling containers arriving by ship, the railroad operates rail barges from Whittier to Seattle as well as rail barges in concert with the Canadian National (CN) Aquatrain with service to/from Prince Rupert, BC.[21] Historical data for freight tonnage and railcar movement through Whittier are shown in Table C-18.

Table C-17. Alaska Railroad Whittier Freight Movements, 2005-2014

Source: Alaska Railroad

Year	Tonnage	Railcars
2005	486,924	9,181
2006	485,634	9,416
2007	521,082	9,429
2008	465,781	8,469
2009	466,089	7,853
2010	410,137	6,335
2011	410,842	6,820
2012	436,863	7,070
2013	427,135	6,872
2014	504,716	8,237
10-year average	461,520	7,968

The Alaska Railroad provides summer passenger service to and from Whittier. Table C-19 shows historical passenger numbers in Whittier during the summer season. Passenger counts have fluctuated based on route availability and the opening of the Anton Anderson Memorial Tunnel to vehicle traffic. Historically, rail passengers were carried via shuttle train between Portage and Whittier either in traditional railcars or in their own vehicles loaded onto flatbed railcars. The shuttle averaged approximately 180,000 passengers per year between 1990 and 1999 with a peak of 195,000 passengers in 1996. When the Anton Anderson Memorial Tunnel opened in 2000, the number of people arriving in Whittier on the train dropped significantly, which led to the discontinuation of the Portage Shuttle in 2001. Beginning in 1997, the Glacier Discovery Train has carried passengers between Anchorage and Whittier, averaging approximately 23,000 passengers per year since its inception. Since 2004, the Alaska Railroad has been under contract to tow railcars owned by Princess Cruises. These trains have averaged about 57,000 passengers per year since the service's inception.

Given Whittier's location at the head of Passage Canal, the marine facilities described in this section are confined to a small geographic area, which further contributes to congestion as multiple user groups converge in Whittier.

[21] http://www.cn.ca/en/our-business/supply-chain-solutions/marine-services

Table C-18. Alaska Railroad Passenger Counts, Whittier, AK, 2005-2014
Source: Alaska Railroad

Year	Glacier Discovery Train	Tow Contractors	Total
2005	21,000	46,000	66,000
2006	21,000	57,000	78,000
2007	22,000	66,000	88,000
2008	27,000	61,000	88,000
2009	21,000	60,000	81,000
2010	20,000	52,000	71,000
2011	21,000	52,000	73,000
2012	19,000	66,000	86,000
2013	20,000	62,000	82,000
2014	21,000	52,000	74,000
10-year average	21,300	57,400	78,700

4.5.2 Proximity to Other Harbors

In addition to Whittier, vessel owners have two other major harbor choices in PWS: Valdez and Cordova, whose sailing distance from Whittier is approximately 5.5 and 6.5 hours by ferry, respectively. Valdez is the site of the largest harbor in PWS and is located at the north end of the Sound. Cordova is at the south end of the Sound but is not on the road system. Each of these marine facilities is briefly discussed. The coastal village of Tatitlek, which offers some moorage, is also discussed. PWS is shown in Figure C-11.

Valdez. Valdez is located on the north shore of Port Valdez, a deep-water fjord in PWS. It has an estimated population of 3,862 residents.[22] It is 96 nautical miles from Whittier; travel time by small boat is approximately 10 hours at 10 knots.[23] Valdez is on the road system with an estimated highway drive time from Whittier to Valdez of almost 8 hours (355 miles).

The Valdez small boat harbor has about 511 slips, which accommodate a combination of tenders, commercial fishing, recreational, and charter vessels. The harbor has slips ranging from 20’ to 65’ and has approximately 900’ of transient dock space.[24] Moorage demand in the Valdez small boat harbor has steadily increased over the past 20 years. During the summer months, mid-May through mid-September, there is a greater demand for moorage than the current facilities are able to meet. An Army Corps of Engineers feasibility study estimated demand for additional moorage in Valdez to be 389 slips: 333 recreation, 24 charters, 26 commercial fishing vessels, and 6 tenders.[25] In December 2011, the Assistant Secretary of the Army approved the recommended NED plan proposed in the Valdez feasibility study to construct a 320-slip harbor expansion.

[22] U.S. Census Bureau, 2016.
[23] Distance Between United States Ports Report from 2002, NOAA
[24] http://www.ci.valdez.ak.us/harbor
[25] Valdez Harbor Expansion Feasibility Study (2010).

An expansion of the Valdez harbor is unlikely to decrease demand for moorage and boat launching at Whittier. While the Valdez harbor expansion is considered an important consideration for potential improvements at Whittier, these harbors are more aligned as complementary harbors than they are as competing harbors.

Additionally, the Whittier and Valdez harbors serve customers from different regions of Alaska due to their geographic location at opposite sides of PWS. The majority of Whittier's waitlisted vessels are from the Municipality of Anchorage, whereas only about 5 percent of vessels on the waitlist for Valdez harbor are from Anchorage. Similarly, less than 1 percent of vessels on Whittier's waitlist are from Fairbanks (interior Alaska) while nearly half the vessels on Valdez's waitlist are from interior Alaska.[26] Therefore, it is anticipated that the harbor expansion at Valdez will not decrease demand for moorage or boat launching at Whittier.

Cordova. Cordova is located on Orca Inlet at the southeastern entry to PWS. It has an estimated population of 2,286 residents. It is 96 nautical miles from Whittier; travel time by boat is approximately 10 hours at 10 knots.[27] Cordova has direct access to the Gulf of Alaska but no road access.

Commercial fishing is a major industry contributing to Cordova's economy. Cordova also has four active seafood processors. In 2017, 519 commercial fishing permits were issued with Cordova addresses. Of these, 317 permits were fished, or one for about every 7 residents.[28] There is currently no need to maintain a waitlist for permanent moorage. The harbor has run at about 85 percent capacity in recent years. Slips are not always available for all size boats but rafting of vessels is uncommon. During the peak months of April through September, the harbor accommodates up to 400 transient vessels, the majority of which are commercial fishing vessels. The harbor is capable of mooring 727 vessels with slips ranging in size from 24 feet to 70 feet. At this time there are no plans for harbor expansion.

Tatitlek. Tatitlek is an Alaskan Native coastal village located on northeastern PWS in Southcentral Alaska. It has an estimated population of 93 residents. Tatitlek does not have protected moorage and is not accessible by road. It is 28 nautical miles southwest of Valdez (3 hours travel time by boat at 10 knots). The number of boats moored at unprotected anchor buoys at Tatitlek includes 12 commercial fishing boats and 15 fair-weather boats used in sheltered waters. Each year Tatitlek is visited by transient vessels, some making repeat visits during the May-September period. A feasibility study to provide permanent moorage at Tatitlek considered three harbor designs: 30-, 54-, and 80-slip plans. At this time, plans for building protected moorage at Tatitlek have been put on hold.

[26] As of this report writing, about 80 percent of Whittier's waitlisted vessels are from the Municipality of Anchorage while less than 1 percent are from Fairbanks (interior Alaska). About 47 percent of Valdez's waitlisted vessels are from interior Alaska while only 5 percent are from the Municipality of Anchorage.
[27] Distance Between United States Ports Report from 2002, NOAA
[28] https://www.cfec.state.ak.us/gpbycen/2017/261507.htm

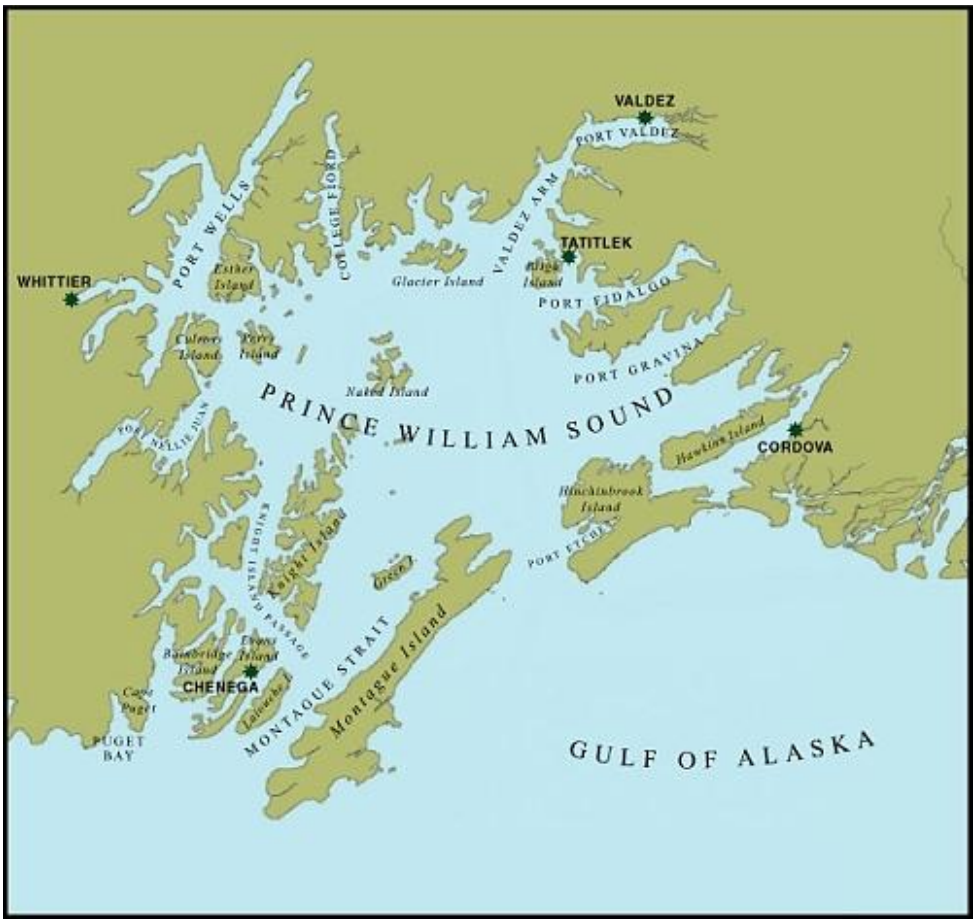


Figure C-12. Prince William Sound Map
Courtesy: Cordova Chamber of Commerce

4.5.3 Current Harbor Use

Whittier Harbor is used by a diverse group. The town is well situated for commercial and charter fishing, as well as a popular recreational and subsistence harbor for residents on the road system in Southcentral Alaska. The quality of the fishing and recreation experience in PWS and the proximity to the largest population center of the state puts enormous pressure on Whittier's limited harbor facilities.

As previously discussed, overcrowded launching and moorage conditions result in operational inefficiencies, damages to vessels and harbor infrastructure, and reduce opportunities for commercial fishing, subsistence, and recreational activities in Whittier. Insufficient boat launch capacity, moorage, and upland support facilities limit access to PWS from Whittier, creating economic inefficiencies to the region and Nation.

4.5.4 Existing Fleet Composition

The existing vessel fleet is a mixture of commercial fishing, charter/sightseeing/water taxi, and recreational and subsistence vessels. Other harbor users include the U.S. Coast Guard, the Alaska

Marine Highway System ferries, Ship Escort and Response Vessel System (SERVS) vessels, and tenders. Based on data from the Whittier Small Boat Harbor User Survey, the following vessel characteristics shown in Table C-20 are typical of the Whittier fleet. Approximately 53 percent of survey respondents had vessels less than 28 feet in length, followed by the 28-34 foot category with about 23 percent of respondents.

Table C-19. Whittier Fleet Characteristics (n = 518)

Length overall (ft)	0-28	>28-34	>34-37	>37-45	>45-54	>54-60	>60
Number of Vessels	276	118	33	42	33	8	8
Average Beam	8.6	10.6	11.5	13.2	14.8	17.8	21.4
Average Draft (unloaded)	2.8	3.1	3.5	4.1	4.8	5.1	7.6
Average Draft (loaded)	3.2	3.6	3.9	4.4	5.8	6.2	8.6

The largest vessels anticipated to regularly use existing harbor facilities are tender vessels. A list of tenders that have historically used the harbor was used to determine design vessel dimension for alternatives containing moorage, which were evaluated in early phases of this study. The design vessel for these moorage alternatives is 80 feet long with a beam of 21 feet and draft of 12 feet. The design vessel for alternatives containing boat launch facilities only is 37 feet long with a beam of 11.5 feet and draft of 4.5 feet.

4.5.5 Demand Analysis

As previously mentioned, this analysis focuses on navigation improvements to boat launching facilities at Whittier. Some discussion about moorage occurs because moorage and boat launching issues at Whittier are intertwined. Given that current launch facilities are located within the existing Whittier Harbor, creating additional launch facilities at the head of the bay is expected to reduce overcrowding and congestion issues at all launch facilities in Whittier and within the existing harbor. As detailed in subsequent sections of this appendix, these overcrowding and congestion issues result in damages and inefficiencies that could be alleviated with navigation improvements.

Peak demand for boat launching and moorage occurs during the summer season of mid-May through mid-October. During this time commercial fishing, charter/sightseeing/water taxi, and recreation and subsistence vessels all attempt to utilize the harbor facilities. Harbor facilities typically operate at capacity during the fishing season.

Boat launch users trailer their vessels to Whittier, using the launch ramp facilities at the harbor to begin and end their voyage. Substantial growth in the use of the boat launch ramp has occurred since the opening of the Anton Anderson Tunnel in 2000 to vehicles, making Whittier Harbor more accessible to boaters. Boat launch users contribute substantially to congestion. Vessels using the boat launch must enter and exit the harbor through the same harbor openings as permanent and transient vessels, use the same fueling facilities, fish cleaning stations, etc. The boat launch is at the far end of the harbor requiring all vessels that launch to travel through the entire harbor. Boat launch users add to the delays experienced by all users of the harbor by increasing the amount of vessel traffic in the facility. It is important to note that the boat launch

facilities are heavily used, in part, because demand for moorage exceeds moorage capacity at the existing harbor, so some vessel owners who may desire moorage (if it were available) utilize the boat launch instead.

Demand for boat launching and moorage at Whittier is based on responses to the Whittier Small Boat Harbor User Survey, personal interviews, and other research conducted to estimate harbor use. Demand is divided into three categories: permanent moorage, transient moorage, and boat launch. Note that the "Other" category indicates survey respondents who did not specify their moorage type. Survey results indicate demand for both launching and moorage exceeds supply. When added to those vessels currently utilizing Whittier harbor facilities, total demand for moorage can be calculated (Table C-21).

Table C-20. Total Demand for Moorage at Whittier

Description	0-28'	28-34'	34-37'	37-45'	45-54'	54-60'	>60'	Total
Commercial Fishing Vessels								
Permanent	7	11	1	4	4	0	0	25
Transient	99	121	4	11	28	11	4	277
Boat Launch	18	0	0	0	0	0	0	18
Other	7	28	0	0	14	4	4	57
Total	131	160	4	14	46	14	7	377
Charter Vessels								
Permanent	4	0	1	7	0	0	0	11
Transient	0	7	1	11	11	11	4	43
Boat Launch	11	0	0	0	0	0	0	11
Other	0	0	0	0	0	0	4	4
Total	14	7	1	18	11	11	7	68
Recreation/Subsistence Vessels								
Permanent	203	53	36	43	11	0	0	345
Transient	228	97	29	47	39	0	7	447
Boat Launch	352	53	18	0	0	0	0	423
Other	46	36	14	21	11	4	7	138
Total	829	239	97	111	60	4	14	1354
Other Vessels								
Permanent	0	4	0	0	0	0	0	4
Transient	0	4	0	0	0	0	0	4
Boat Launch	0	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	0
Total	0	7	0	0	0	0	0	7
Total Vessels	**974**	**413**	**102**	**143**	**117**	**28**	**28**	**1806**

Table C-22 summarizes demand by moorage type. Boat launch users comprise about 25 percent of total demand. While survey results indicate some boat launch users have vessels in the 34- to 37-foot length range, these vessels are assumed to be trailered through the Anton Anderson tunnel and launched infrequently. The majority of boat launch vessels (about 96 percent) are less

than 34 feet in length and can utilize launch facilities on a regular basis. Of the approximately 1,800 vessels demanding moorage or boat launching at Whittier, nearly 1,400 (77 percent) are less than 34 feet long.

Table C-21. Demand Summary by Moorage Type

Description	0-28'	28-34'	34-37'	37-45'	45-54'	54-60'	>60'	Total	Percent of Total
Permanent	214	68	38	54	15	0	0	385	21%
Transient	327	229	34	69	78	22	15	771	43%
Boat Launch	381	53	18	0	0	0	0	452	25%
Other	53	64	14	21	25	8	15	199	11%
Total Vessels	**974**	**413**	**102**	**143**	**117**	**29**	**28**	**1806**	**100%**
Percent of Total	**54%**	**23%**	**6%**	**8%**	**6%**	**2%**	**2%**	**100%**	

While it is reasonable to assume that permanent moorage users would utilize moorage each day, it is important to note that not all users demanding transient moorage or access to boat launch facilities would use the harbor every day. To account for this, a range of demand scenarios was estimated using an @Risk Simulation. This analysis assumes between 25 and 100 percent of transient and boat launch users utilize the harbor daily during peak season. The mean value from the simulation is used to estimate the mostly likely scenario for daily harbor use, as shown in Table C-23. The results of this demand analysis inform the NED analysis used to determine whether the alternatives proposed in Section 4.6 are economically justified.

Table C-22. Demand Summary by Moorage Type, @Risk Simulation

Description	0-28'	28-34'	34-37'	37-45'	45-54'	54-60'	>60'	Total	Percent of Total
Permanent	214	67	37	53	14	0	0	386	30%
Transient	191	133	19	40	46	12	8	449	35%
Boat Launch	222	31	10	0	0	0	0	263	20%
Other	53	64	14	21	25	7	14	199	15%
Total Vessels	**680**	**296**	**81**	**115**	**85**	**20**	**22**	**1297**	**100%**
Percent of Total	**52%**	**23%**	**6%**	**9%**	**7%**	**2%**	**2%**	**100%**	

4.6 Without Project Conditions

The following sections describe the expected conditions at the Whittier Small Boat Harbor in the absence of Federal investment in navigation improvements at Whittier.

Several critical assumptions were made when conducting the future without-project economic analysis. Chief among them is that the existing fishery will continue to support the fleet. This is a critical assumption supported by the fact that all fisheries present in the Whittier area are highly regulated in order to assure future viability of the resource.

4.6.1 Fleet Composition

Because of the inherent uncertainty surrounding the forecast of any growth in fisheries and related marine resources, a conservative "no growth" approach was taken in determining the future fleet at Whittier. Conversely, there is no evidence that demand for boat launching and moorage at Whittier will decrease over time. Therefore, it is assumed that the fleet identified in Existing Condition section of this appendix will remain stable throughout the period of analysis.[29]

4.6.2 Planned Development

As previously stated, due to concerns about meeting construction cost-sharing requirements, the local sponsor requested that the Corps suspend further development of alternatives providing moorage and to focus the study upon smaller scale protected boat launch facilities. The City of Whittier, however, is hopeful to expand any protected boat launch facility constructed as a result of this study to provide moorage at a later date as finances permit. Given uncertainty about the timing and funding of such development, no corresponding moorage benefits have been included in this economic analysis. Navigation related improvements currently planned by the City include addressing erosion concerns extending from the Ocean Dock to the Fuel Dock and rebuilding the City and Ocean Docks including a replacement of the boat lift currently located on the City Dock.

4.6.3 Future Without-Project Expectations (Damages and Inefficiencies)

Absent Federal investment, it is assumed that damages and inefficiencies will continue to occur at Whittier. As the closest road accessible small boat harbor facility to Anchorage, Alaska's largest population center, Whittier will continue to serve as the Gateway to PWS and provide support for commercial fishing, subsistence, and recreational activities. Under future without project conditions, harbor facilities in Whittier are expected to remain heavily congested and lack sufficient boat launching and moorage capabilities to meet demand. Upland harbor facilities will similarly remain heavily congested.

These overcrowded conditions will continue to result in inefficiencies to all harbor users, transportation delays, damages to vessels and harbor infrastructure, and safety concerns. Commercial fishing, subsistence, and recreational opportunities will continue to be hindered. Without such improvements, these transportation inefficiencies, damages, safety concerns, and lost opportunities are expected to persist throughout the period of analysis. The expected future levels of these damages and inefficiencies, including their associated future without project costs, are discussed below.

Harbor Operations. Absent Federal action, adverse impacts to harbor operations due to overcrowding and congestion at the boat launch and within moorage areas are expected to continue throughout the period of analysis. These impacts include costs related to the time harbor

staff spends coordinating congestion-related moves of vessels at the launch itself and vessels that are rafted or hot-berthed within the harbor. This time could be better spent in other productive activities and, to the extent possible, relieving harbor staff of this burden is an efficiency gain from improving boat launching facilities. Overcrowding and congestion also reduce the life of boat launch ramps and floats within the moorage basin. Costs associated with harbor infrastructure degrading faster than expected due to overcrowding are considered a damage that could be reduced with navigation improvements. These harbor operations costs have a present value of approximately $670,000 with an average annual value of $25,000 over the period of analysis.

Vessel Delays. Whittier harbor users face delays while launching vessels as well as entering, exiting, and within the harbor. A portion of these delays is due to congestion, overcrowding, and lack of maneuvering space, and could be reduced or alleviated with improved boat launch facilities. Data from Whittier Small Boat Harbor Survey were used to quantify delay costs and determine what delays could be reduced or alleviated with navigation improvements. The present value of commercial vessel delays resulting from existing harbor conditions is approximately $3.6 million with an average annual cost of $130,000 over the period of analysis.

Travel Cost Inefficiencies. In addition to vessel delays experienced when launching vessels, boat launch users must travel further to the existing launch facilities near the city center than they would if launch facilities were located at the head of the bay. Absent navigation improvements at the head of the bay, harbor users would continue to incur these higher landside transportation costs throughout the period of analysis.[30] These landside transportation costs have a present value of about $900,000 with an average annual cost of $34,000 over the period of analysis.

Vessel Damages. Vessels utilizing the existing boat launch facilities and harbor in Whittier are subject to damages beyond normal wear and tear due to congested/overcrowded conditions. Data from Whittier Small Boat Harbor Survey were used to determine average annual damage costs, the number of vessels experiencing damages, and what damages could be alleviated with navigation improvements. Over the period of analysis, these damages have a present value of approximately $9.0 million with an average annual cost of $335,000.

Commercial Fishing Harvest. Congestion/overcrowded harbor conditions also create inefficiencies for commercial fishermen, resulting in lost commercial harvesting opportunities. Lost commercial harvest expected to occur without navigation improvements is calculated using escapement data and sustainable escapement goals for pink, chum, and sockeye salmon in PWS. The Northern, Coghill, Northwestern, and Eshamy districts are used to approximate the commercial fishing area accessed from Whittier. The value of the lost commercial harvest is based on escapement above sustainable escapement goals and ex-vessel values estimated by the ADF&G. Absent Federal action, this foregone harvest has a present value of approximately $29 million with an average annual value of $1.1 million over the period of analysis.

[30] See IWR Report 10-R-4 for discussion of benefits associated with reducing landside transportation costs.

Subsistence Harvest. In addition to lost commercial harvesting opportunities, congestion and overcrowding at existing harbor facilities also reduces opportunities to harvest subsistence resources. Corps guidance defines subsistence fishing as "fishing, primarily for personal or family consumption, by those whose incomes are at or below the minimum subsistence level set by the Department of Commerce".[31] Subsistence fishing is considered commercial fishing for cost allocation purposes.

Subsistence is defined by the Department of Commerce as follows:

> *TITLE 50 - WILDLIFE AND FISHERIES*
> *CHAPTER I - UNITED STATES FISH AND WILDLIFE SERVICE, DEPARTMENT OF THE INTERIOR*
> *SUBCHAPTER C - THE NATIONAL WILDLIFE REFUGE SYSTEM*
> *PART 36 - ALASKA NATIONAL WILDLIFE REFUGES*
> *subpart b - SUBSISTENCE USES*
> *36.13 - Subsistence fishing.*
> *Fish may be taken by local rural residents for subsistence uses in compliance with applicable State and Federal law.*

The Department of Commerce regulations do not define a subsistence level income as referred to in Corps regulations. The Department's definition focuses on the local rural aspect of resident's fishing with a clear deferment of the definition to the state definitions and regulations. As described in the Marine Resources section of this appendix, all Alaska residents are eligible to participate in subsistence fisheries under state law, and there are several subsistence fishing opportunities in PWS.

The value of foregone subsistence harvest expected to occur without navigation improvements is based on subsistence data and harvest replacement values from the ADF&G Division of Subsistence and responses to the Whittier Small Boat Harbor Survey. The portion of Alaska's population that qualifies to participate in subsistence harvesting at Whittier is based on ADF&G data on subsistence participation by geographic area and the portion of survey respondents who indicated they participate in subsistence activities. Over the period of analysis, this foregone subsistence harvest has a present value of approximately $16.9 million with an average annual value of $625,000. This equates to about $500 per subsistence user each year.

Labor Resource Inefficiencies. Corps policy provides guidance on the NED benefit evaluation procedure for unemployed or underemployed labor resources, which is defined as …"*the economic effects of the direct use of otherwise unemployed or underemployed labor resources during project construction or installation*".[32]

This guidance further defines the criteria required for benefit inclusion:

[31] ER 1105-2-100 Appendix E-14 Special Considerations d. Subsistence Fishing.
[32] ER 1105-2-100, Appendix D, Page D-31

"Benefits from use of otherwise unemployed or underemployed labor resources may be recognized as a project benefit if the area has substantial and persistent unemployment at the time the plan is submitted for authorization and for appropriations to begin construction. Substantial and persistent unemployment exists in an area when:

(a) The current rate of unemployment, as determined by appropriate annual statistics for the most recent 12 consecutive months, is 6 percent or more and has averaged at least 6 percent for the qualifying time periods specified in subparagraph (b) below and:

(b) The annual average rate of unemployment has been at least: (a) 50 percent above the national average for three of the preceding four calendar years, or (b) 75 percent above the national average for two of the preceding three calendar years, or (c) 100 percent above the national average for one of the preceding two calendar years".

Given the criteria above and unemployment trends in Whittier, construction of a navigation project at Whittier qualifies for labor resource benefits. Absent Federal investment, these benefits are considered a foregone opportunity to utilize unemployed or underemployed labor resources in the region, and have a present value of approximately $8.7 million with an average annual value of $324,000.

Recreation Unit Day Value (UDV). The UDV method is utilized to calculate the value of recreational activities as they are expected to exist in the absence of a Federal project. This value serves as a baseline for which to evaluate the beneficial increase in recreation value expected to occur with the proposed navigation improvements at Whittier.

This analysis uses the UDV method as described in USACE Economic Guidance Memorandum (EGM 18-03) for fiscal year 2018 to estimate the value of recreational use in both the future without- and future with-project conditions. The EGM provides guidelines for assigning point values to recreational activities and provides a table showing the range of daily values that correspond to point value scores. Points are awarded based on criteria that address the quality of the recreational area, the number and types of activities enjoyed in the area, and the availability of substitute activities nearby. The UDV method then uses this point system to determine day values for recreation.

According to Corps guidelines, outdoor recreation activities can be classified as either "general" or "specialized". "General" refers to a recreation day that primarily involves activities attractive to outdoor users and that generally require the development and maintenance of convenient access and adequate facilities. In contrast, "specialized" refers to a recreation day that involves activities where opportunities are more limited, intensity of use is low, and a high degree of skill is required. Based on the above criteria and the fact that individuals travel from around the world to visit and engage in recreational opportunities in Prince William Sound, the recreation experiences available

are considered “specialized”. Whittier has two categories of recreational users: those who engage in specialized fishing and hunting and those who come for the specialized recreational experience of whale watching, glacier viewing, and camping in the wilderness. The UDV for specialized fishing and hunting is approximately $30 per day, while the UDV for other specialized recreation is about $21.

Absent Federal action, these specialized recreational activities have an estimated present value of approximately $59.4 million, with an average annual value of about $2.2 million over the period of analysis.

Recreation Unit Day Value for Discouraged Users. Respondents to the Whittier Small Boat Harbor User Survey were asked “With the proposed new harbor in place, do you think you would use your boat more often than you do under the present conditions?” Respondents indicating they would use the harbor more often were further asked, “If yes, please estimate how many additional days you think you would use your boat annually.”

The monetary value of lost recreational opportunities for discouraged users was calculated utilizing UDV by taking the percent of the fleet that indicated they would seek additional usage if harbor conditions improved, multiplied by the corresponding number of days that fleet indicated they would use their vessel annually. This provides an average number of additional desired use days for the fleet. The UDV was then estimated based on the portion of users expected to engage in sightseeing versus fishing to assign a monetary value to the lost days of usage due to current harbor conditions. Absent Federal action, these recreational opportunities foregone by discouraged users have a present value of approximately $41.3 million and an average annual value of $1.5 million over the period of analysis.

4.6.4 Summary of Future Without Project Condition

Absent Federal action to provide navigation improvements at Whittier, harbor and upland navigation facilities in Whittier are expected to remain heavily congested and lack sufficient boat launching and moorage capabilities to meet demand, resulting in inefficiencies to harbor operations and all harbor users, transportation delays, damages to vessels and harbor infrastructure, safety concerns, underutilization of labor resources, and lost opportunities for commercial fishing, subsistence, and recreational activities (Table C-24). Over the period of analysis, these adverse impacts incurred as a result of current and expected future harbor conditions have a present value of $190 million with an average annual value of $7.6 million.

Table C-23. Summary of Future Without Project Conditions

Category:	Present	Average Annual
Harbor Operations Costs	$671,000	$25,000
Vessel Delays	$3,559,000	$132,000
Travel Cost Inefficiencies	$909,000	$34,000
Vessel Damages	$9,037,000	$335,000
Commercial Harvest Inefficiencies	$28,976,000	$1,073,000
Subsistence Harvest Inefficiencies	$16,872,000	$625,000
Labor Resources Underutilization	$8,749,000	$324,000
Recreation UDV	$59,366,000	$2,199,000
Recreation UDV Discouraged Users	$41,326,000	$1,531,000
Total	**$190,306,000**	**$7,572,000**

4.7 With Project Conditions

The following section describes the anticipated conditions at Whittier assuming that a project has been constructed. The expected changes in the operating procedures at the harbor and boat launch facilities are the basis for the economic analysis.

4.7.1 Assumptions

This analysis assumes that the damages and inefficiencies identified in the Without Project Condition section of this appendix are based on the current level of overcrowding and congestion at Whittier harbor facilities, which is a result of excess demand for boat launching and moorage at Whittier. As such, a relationship exists between demand and the level of damages and inefficiencies expected to occur. This analysis assumes that the degree to which these damages and inefficiencies are reduced is based on the extent to which each alternative meets demand.

The NED benefits evaluated for the proposed navigation improvements stem from shifting boat launch activity away from the existing harbor near the city center, alleviating congestion and overcrowding in the existing harbor facilities, and providing additional launch facilities to accommodate excess demand. Benefits are expected to result from savings in transportation costs accruing to harbor users, reduced operational inefficiencies, reduced damages to vessels and harbor infrastructure, enhanced opportunities for commercial fishing, subsistence, and recreational activities in Whittier, as well as through the direct use of otherwise unemployed or underemployed labor resources during project construction. Boat launch users as well as permanent and transient vessels utilizing the existing harbor are expected to experience time savings “with” a project in the form of reduced transit time delays. Users of the launch facilities at the head of the bay would also experience additional time and landside transportation cost savings due to the reduced distance these boaters would travel to launch a vessel from the head of the bay instead of the existing harbor.

The period of analysis is 50 years, beginning with the base year of 2022, the project effective date, to 2073. The FY 2018 Federal discount rate of 2.750 percent is used to discount benefits

and costs. The report uses methodology for small boat harbor navigation analysis described in the Engineering Regulation 1105-2-100[33] and other relevant Corps of Engineers regulations and policy guidance.

4.7.2 Project Alternatives

Nine alternatives were evaluated along with the future without project condition (No Action). Alternatives 1 through 5 were investigated during the early stages of this study and were not carried forward for detailed analysis. Alternatives 6 through 9 comprise the final array of alternatives evaluated in this appendix and are described below. The NED analysis was conducted for Alternatives 6 through 9.

The primary differences between Alternatives 6, 7, 8, and 9 concern boat launch capacity, breakwater alignment, entrance channel location, and the likelihood of encountering contaminated sediments during project construction.

Alternatives 6 and 7 include 4-lane and 6-lane launch ramps, respectively, a dredged entrance and maneuvering channel, and a rubble-mound breakwater with the entrance to the north. The breakwater alignment for these alternatives is longer and more costly than the south facing entrance channel due to the significant wave's southwest angle of incidence. Alternatives 6 and 7 do have the advantage of being less likely to encounter sediment contamination during project construction at levels that would require transport for off-site upland treatment. The north breakwater alignment also has the advantage of a lower cost for future mooring basin expansion to the north since less breakwater would have to be demolished for a northward breakwater extension. However, this analysis does not consider benefits associated with future moorage due to the uncertainty about the timing and funding of such developments.

Alternatives 8 and 9 include 4-lane and 6-lane launch ramps, respectively, a dredged entrance and maneuvering channel, and a rubble-mound breakwater with the entrance to the south of the launch ramps. The breakwater alignment is shorter and less costly than the north-oriented breakwater alternatives. Compared to Alternatives 6 and 7, Alternatives 8 and 9 are considered to have a higher likelihood of encountering contaminated sediments during project construction, resulting in higher project costs due to the need to transport dredged material for off-site upland treatment. The south breakwater alignment also has the disadvantage of a higher cost for future mooring basin expansion to the north since more breakwater would have to be demolished for a northward breakwater extension. Again, however, no benefits associated with potential future moorage are considered in this analysis. Preliminary alternative designs are shown in Figures C-12, C-13, C-14, and C-15.

[33] https://planning.erdc.dren.mil/toolbox/library/ERs/entire.pdf

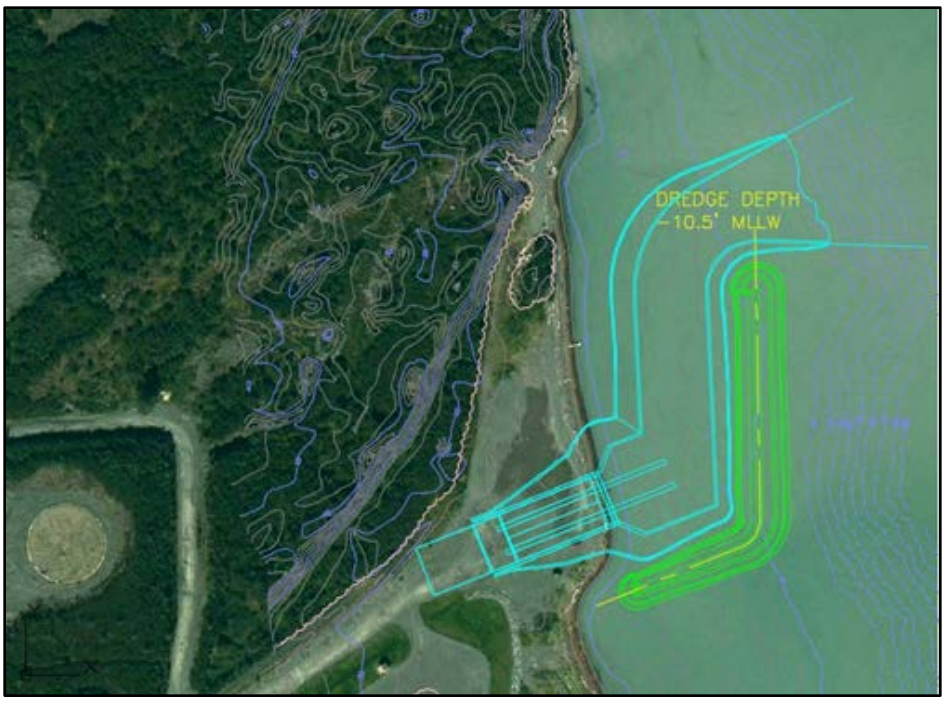


Figure C-13. Alternative 6: 4-Lane Boat Launch with North Channel Entrance

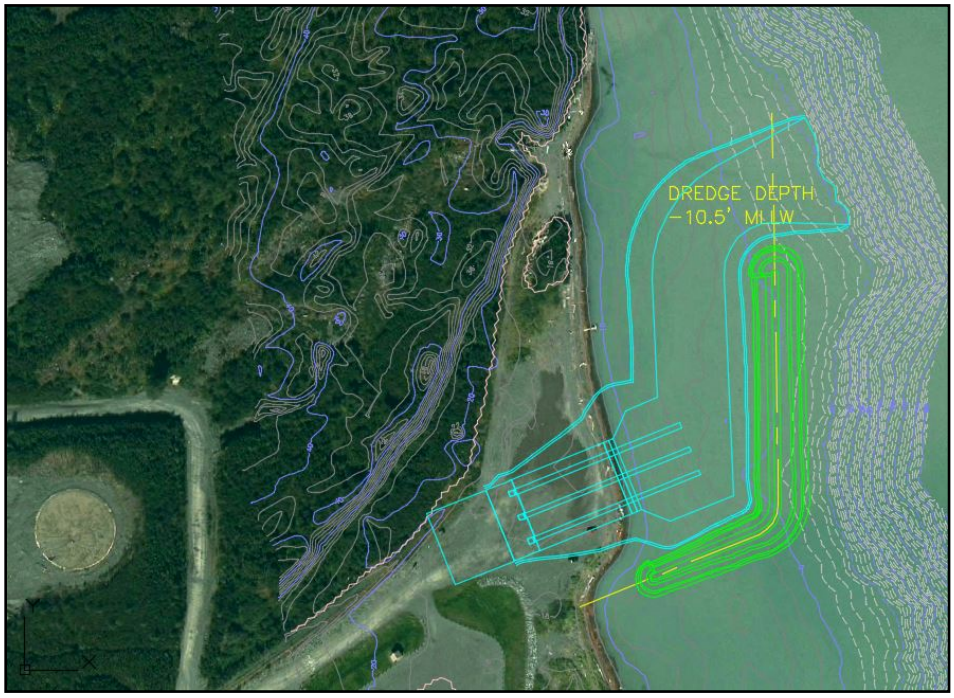


Figure C-14. Alternative 7: 6-Lane Boat Launch with North Channel Entrance

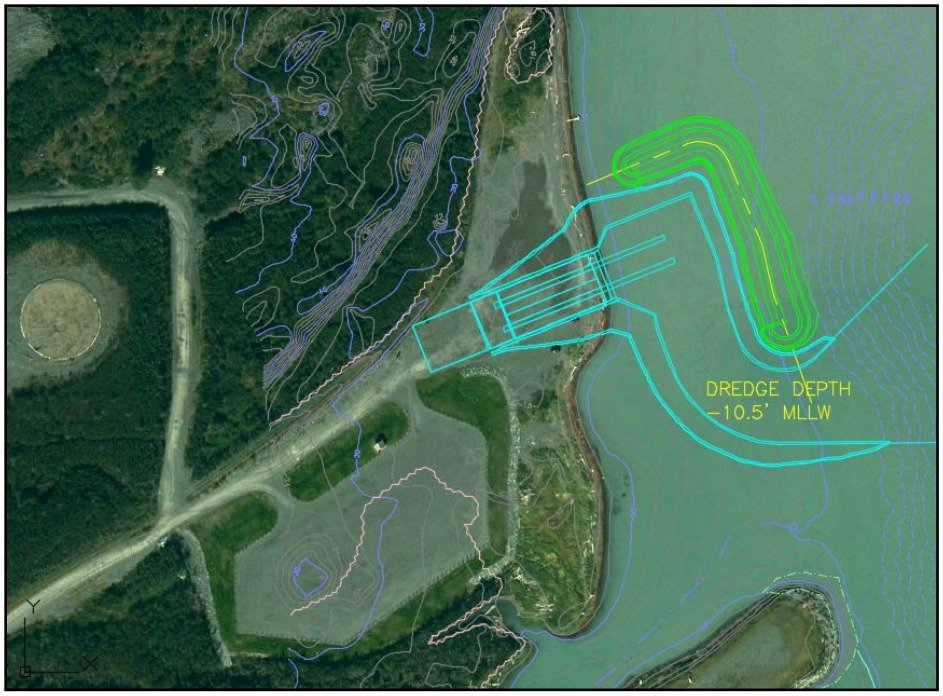


Figure C-15. Alternative 8: 4-Lane Boat Launch with South Channel Entrance

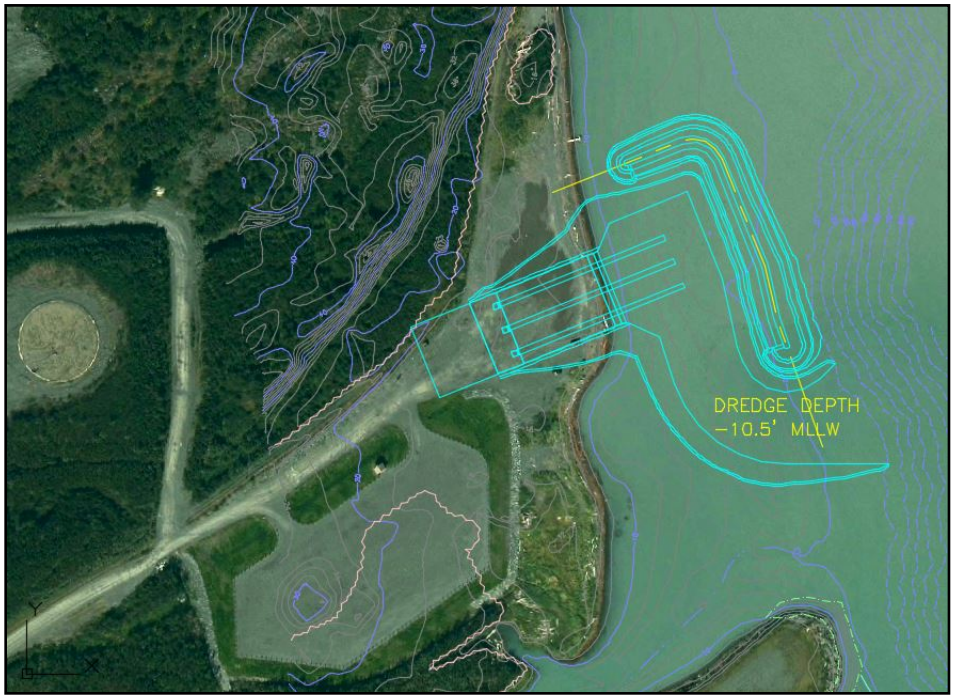


Figure C-16. Alternative 9: 6-Lane Boat Launch with South Channel Entrance

4.7.3 Project Benefits

The economic benefits of small boat harbor projects result from enhanced access to commercial fishing activities and recreational boating and sport fishing opportunities.[34] Project benefits at Whittier are typical of small boat harbor projects in Alaska and include: transportation cost savings, reductions in vessel damages, vessel delays, and infrastructure damages, as well as improved commercial harvest, subsistence harvest, and recreational experience. Benefits associated with utilizing otherwise unemployed or underemployed labor resources during project construction are also considered.

Each alternative provides a varying degree of reduction in damages and inefficiencies for each benefit category described in the Without Project Conditions section. The level to which these damages and inefficiencies are reduced is based on the extent to which each alternative reduces congestion and overcrowding, which is a function of how well Whittier's harbor facilities accommodate demand for boat launching and moorage. Although each alternative is expected to meet all demand for launching, even during peak periods such as summer holiday weekends, no alternative adds moorage. As such, some congestion and overcrowding is expected to still occur in the existing harbor due to unmet demand for permanent and transient moorage. Further, some alternatives better account for discouraged use as described at the end of this section.

As noted in previous sections of this appendix, the City of Whittier is hopeful to expand any protected boat launch facility constructed as a result of this study to provide moorage at a later date. Although such development would meet demand for moorage, no corresponding moorage benefits have been included in this analysis due to the uncertainty about the timing and funding of such development. Therefore, a portion of the damages and inefficiencies identified in this study are assumed to continue to occur throughout the period of analysis.

Harbor Operations. A portion of the harbor operations costs identified in Section 4.6 are expected to still occur in the future because no alternatives add moorage; therefore, some excess demand for moorage will occur that cannot be accommodated by having launch facilities at the head of the bay. The portion of these costs remaining under FWP conditions is based on the degree to which rafting and congestion in the existing harbor is reduced by each alternative.

Vessel Delays. Similar to harbor operations costs, some delays are expected to occur because some excess demand for moorage cannot be met by the proposed launch facilities. Having the existing launch facilities located adjacent to existing moorage facilities results in boat launch users adding to overall congestion and overcrowding within the existing harbor. As such, some delays for transient and permanent moorage users can be reduced by adding launch facilities at the head of the bay. However, installing new launch facilities at the head of the bay will not directly meet demand for permanent and transient moorage, so some delays associated with these user groups are expected to occur into the future.

[34] https://planning.erdc.dren.mil/toolbox/library/ERs/entire.pdf

Travel Cost Inefficiencies. With new launch facilities at the head of the bay, landside transportation costs for vessel owners utilizing the boat launch are expected to fall due to the shorter time and distance required to access the new facilities. It is important to note that these transportation cost reduction benefits are only calculated for commercial fishing vessels expected to utilize the launch facilities at the head of the bay.

Vessel Damages. Like with vessel delays, reducing overcrowding and congestion is expected to result in fewer damages to vessels beyond normal wear and tear into the future. However, some damages are expected to still occur because demand for moorage will still exceed moorage supply at Whittier.

Commercial Fishing Harvest. Navigation improvements provide an opportunity to expand the commercial fishing harvest by vessels based out of Whittier. Because no alternatives include moorage for permanent and transient commercial fishing vessels, this analysis only considers benefits for the increased commercial catch that could be harvested by commercial boat launch users. The lost/foregone commercial harvest that could be captured under FWP conditions by these users is based on the portion of boat launch demand comprised of commercial users, escapement above sustainable escapement goals, and ex-vessel values estimated by ADF&G.

Subsistence Harvest. In addition to improving commercial harvesting opportunities, improving boat launch capacity and reducing congestion/overcrowding in the existing harbor would enhance access for harvesting subsistence resources, which translates to an increase in harvest value based on the replacement cost analysis described in the Without Project Conditions section.[35]

Labor Resource Inefficiencies. It is expected that currently unemployed labor from Whittier would be utilized in the construction of the project. The initial investment would create new jobs, thereby directly reducing unemployment. There would be demands for both labor and construction materials required for the project, and incomes of individuals in associated industries would be increased indirectly due to the interrelationship and interdependence of these industries. These conditions would stimulate the local economy and raise the general level of income. There are also regional effects of increased employment, which are described in Section 4.10 below.

Recreation Unit Day Value (UDV). An increase in recreation value is expected to occur with the proposed navigation improvements at Whittier. Note that the Recreation UDV calculations shown in this section represent the total increased value of recreation. Benefits are calculated as the difference between the total recreation value estimated in the Without Project and With Project Conditions sections of this appendix.

[35] Increase in subsistence activity is based on similar USACE studies involving navigation improvements and access to subsistence resources for Valdez (2011) and Craig, Alaska (2014).

Recreation Unit Day Value for Discouraged Users. With the proposed navigation improvements at Whittier, a portion of the recreational opportunities and corresponding UDV foregone by discouraged users is expected to be realized. Benefits realized are based on each alternative's ability to satisfy this increase in usage (i.e. demand). Alternatives 7 and 9 (6 lanes) are expected to accommodate all of the desired additional usage, while alternatives 6 and 8 (4 lanes) are estimated to meet about 75 percent of this added demand.

4.7.4 Summary of Future With Project Condition

The following tables summarize the cost of damages and inefficiencies expected to still occur under future with project conditions. As previously noted, the difference between future without-project and future with-project costs are project benefits, which are presented in the Total Project Benefits section. Table C-25 shows the total present value of future with-project damages. Table C-26 shows average annual values based on the Fiscal Year 2018 discount rate and 50-year period of analysis.

Table C-24. Present Value of Future With Project Damages and Inefficiencies

Category	Alt 6	Alt 7	Alt 8	Alt 9
Harbor Operations Costs	$472,000	$472,000	$472,000	$472,000
Vessel Delays	$1,281,000	$576,000	$1,281,000	$576,000
Travel Cost Inefficiencies	$779,000	$909,000	$779,000	$909,000
Vessel Damages	$1,770,000	$447,000	$1,770,000	$447,000
Commercial Harvest Inefficiencies	$24,492,000	$24,492,000	$24,492,000	$24,492,000
Subsistence Harvest Inefficiencies	$18,715,000	$18,715,000	$18,715,000	$18,715,000
Labor Resources Underutilized	$0	$0	$0	$0
Recreation UDV	$74,938,000	$75,507,000	$74,938,000	$75,507,000
Recreation UDV Discouraged Users	$9,940,000	$0	$9,940,000	$0
Total	**$132,387,000**	**$121,118,000**	**$132,387,000**	**$121,118,000**

Table C-25. Average Annual Value of Future With Project Damages and Inefficiencies

Category	Alt 6	Alt 7	Alt 8	Alt 9
Harbor Operations Costs	$17,000	$17,000	$17,000	$17,000
Vessel Delays	$47,000	$21,000	$47,000	$21,000
Travel Cost Inefficiencies	$29,000	$34,000	$29,000	$34,000
Vessel Damages	$66,000	$17,000	$66,000	$17,000
Commercial Harvest Inefficiencies	$907,000	$907,000	$907,000	$907,000
Subsistence Harvest Inefficiencies	$693,000	$693,000	$693,000	$693,000
Labor Resources Underutilized	$0	$0	$0	$0
Recreation UDV	$2,776,000	$2,797,000	$2,776,000	$2,797,000
Recreation UDV Discouraged Users	$368,000	$0	$368,000	$0
Total	**$4,903,000**	**$4,486,000**	**$4,903,000**	**$4,486,000**

4.7.5 Total Project Benefits

Each alternative provides a certain amount of relief from existing and expected future damages and inefficiencies. The differences between the expected level of damages and inefficiencies absent Federal action (without project condition) and those that will occur under the various with project conditions are benefits that accrue to the project and form the basis for selecting a recommended plan.

Total annual project benefits were determined at FY18 price levels by calculating average annual reductions in transportation costs, vessel damages, vessel delays, harbor infrastructure damages, as well as average annual increases in commercial fishing harvests, subsistence harvests, and recreational value. Benefits are discounted to the FY18 price level using the Federal discount rate of 2.750 percent, over a 50-year period of analysis.

Tables C-27 and C-28 show the present value and average annual value of benefits, respectively, by benefit category for each alternative.

Table C-26. Present Value of Benefits by Alternative

Category:	Alt 6	Alt 7	Alt 8	Alt 9
Harbor Operations Benefits	$199,000	$199,000	$199,000	$199,000
Vessel Delays Avoided	$2,278,000	$2,983,000	$2,278,000	$2,983,000
Travel Cost Savings	$779,000	$909,000	$779,000	$909,000
Vessel Damages Avoided	$7,267,000	$8,589,000	$7,267,000	$8,589,000
Commercial Harvest Gains	$4,484,000	$4,484,000	$4,484,000	$4,484,000
Subsistence Harvest Gains	$1,843,000	$1,843,000	$1,843,000	$1,843,000
Returns on Labor Resources	$7,706,000	$8,749,000	$7,183,000	$8,479,000
Recreation UDV Gained	$16,020,000	$16,020,000	$16,020,000	$16,020,000
Recreation UDV Gained for Discouraged Users	$31,386,000	$41,326,000	$31,386,000	$41,326,000
Total	**$71,962,000**	**$85,102,000**	**$71,439,000**	**$84,832,000**

Table C-27. Average Annual Benefits by Alternative

Category:	Alt 6	Alt 7	Alt 8	Alt 9
Harbor Operations Benefits	$7,000	$7,000	$7,000	$7,000
Vessel Delays Avoided	$84,000	$110,000	$84,000	$110,000
Travel Cost Savings	$29,000	$34,000	$29,000	$34,000
Vessel Damages Avoided	$269,000	$318,000	$269,000	$318,000
Commercial Harvest Gains	$166,000	$166,000	$166,000	$166,000
Subsistence Harvest Gains	$68,000	$68,000	$68,000	$68,000
Returns on Labor Resources	$285,000	$324,000	$266,000	$314,000
Recreation UDV Gained	$593,000	$593,000	$593,000	$593,000
Recreation UDV Gained for Discouraged Users	$1,163,000	$1,531,000	$1,163,000	$1,531,000
Total	**$2,664,000**	**$3,151,000**	**$2,645,000**	**$3,141,000**

4.7.6 Project Costs

Rough Order of Magnitude (ROM) costs were developed for the alternatives including those to construct and maintain facilities. Cost risk contingencies were included to account for uncertain items such as sediment characterization and dredged material disposal methods. Interest during construction assumes a 2-year construction window. Initial estimates of operations and maintenance assume 15 percent of breakwater armor rock would be replaced in 25 years. Project costs were developed without escalation and are in 2018 dollars. The combination of project first costs, interest during construction, and operations and maintenance costs form the total investment cost and was used to determine the average annual equivalent cost of each alternative.

Based on existing information about potential sediment management and dredged material disposal options, the north entrance alternatives (Alternatives 6 and 7) are expected to require less sediment treatment off-site than the south entrance alternatives (Alternatives 8 and 9). It is assumed that 5 percent of dredged material would require off-site treatment for the north entrance alternatives, whereas 15 percent of dredged material would require off-site treatment for the south entrance alternatives. These differences are accounted for in the cost estimates.

Table C-29 displays the ROM costs for each alternative.

Table C-28. Rough Order of Magnitude Costs by Alternative

Item	Alt 6	Alt 7	Alt 8	Alt 9
Mobilization and Demobilization	$959,000	$959,000	$959,000	$959,000
Breakwaters	$4,191,000	$4,253,000	$3,419,000	$3,980,000
Breakwater	$3,167,000	$3,167,000	$2,546,000	$3,011,000
Topographic/Hydrographic	$453,000	$453,000	$453,000	$453,000
Navigation Aids	$58,000	$58,000	$58,000	$58,000
Slope Protection Rock	$513,000	$575,000	$362,000	$458,000
Dredge Maneuvering Basin	$4,342,000	$4,642,000	$3,932,000	$4,343,000
Disposal of Dredge Spoils	$1,934,000	$2,070,000	$4,282,000	$4,748,000
Boat Launch Ramp	$4,465,000	$6,697,000	$4,465,000	$6,697,000
LERRS	$345,000	$345,000	$345,000	$345,000
Construction Management	$1,400,000	$1,400,000	$1,400,000	$1,400,000
PED	$2,549,000	$2,549,000	$2,549,000	$2,549,000
Project Cost	**$20,243,00**	**$22,973,00**	**$21,409,00**	**$25,080,000**
IDC	$558,000	$633,000	$590,000	$691,000
O&M	$529,000	$529,000	$512,000	$533,000
Total Investment Cost	**$21,330,00**	**$24,135,00**	**$22,511,00**	**$26,304,000**

Average annual costs (Table C-30) were developed by combining the initial construction costs with the annual Operations and Maintenance costs for each alternative using the FY18 Federal Discount Rate of 2.75 percent along with a period of analysis of 50 years.

Table C-29. Average Annual Cost by Alternative

Cost Type	Alt 6	Alt 7	Alt 8	Alt 9
AAEQ Investment	$770,000	$874,000	$815,000	$955,000
AAEQ OMRR&R	$20,000	$20,000	$19,000	$20,000
Total AAEQ Cost	**$790,000**	**$894,000**	**$834,000**	**$975,000**

4.8 Net Benefits and Benefit Cost Ratio

Net benefits and the benefit cost ratio are determined using the average annual benefits and average annual costs for each alternative. Net benefits are determined by subtracting the average annual equivalent costs from the average annual benefits for each alternative, the benefit cost ratio is determined by dividing average annual benefits by average annual costs. Table C-31 summarizes project costs, benefits, and the benefit-cost ratio by alternative. The plan that reasonably maximizes net benefits is Alternative 7, the 6-lane boat launch the north entrance channel.

Table C-30. Summary of Costs and Benefits by Alternative

Alternative	Total PV Costs	Total AAEQ Cost	Total AAEQ Benefits	Total Net Benefits	Benefit-Cost Ratio
6	$21,330,000	$790,000	$2,666,000	$1,876,000	3.4
7	$24,135,000	$894,000	$3,152,000	$2,258,000	3.5
8	$22,511,000	$834,000	$2,646,000	$1,812,000	3.2
9	$26,304,000	$974,000	$3,142,000	$2,168,000	3.2

Note: A portion of the project benefits are related to recreational navigation. Corps Policy requires that initially these benefits account for less than 50% of the average annual benefits required for project justification. When less than 50% of benefits are from recreation, the benefit-to-cost ratio for all alternatives is greater than 1.0 (i.e. economically justified), and Alternative 7 is still the recommended plan with a BCR of 2.3. Since the project is justified, additional recreation benefits can be counted, resulting in an overall benefit-to-cost ratio of 3.5 for Alternative 7.

4.9 Risk and Sensitivity

In the interest of further testing the sensitivity of project justification to uncertainty in parameters, future scenarios must be assessed. The analysis of these scenarios is intended to illustrate the effect of changes in different assumptions on project benefits and project justification.

Because of the inherent uncertainty surrounding the forecast of any growth in fisheries and related marine resources, a conservative “no growth” approach was taken in determining the future fleet in Whittier. As discussed in the marine resources section of this appendix, the fishing industry in Whittier and PWS is considered strong and is expected to continue to support demand for boat launching and other harbor facilities at Whittier. Fisheries activities will continue to fluctuate as resource abundance varies, regulations change, or technical breakthroughs are made. Possible regulatory actions likely would result in an easing of catch regulations given the stability of the fisheries in the PWS Management Area, leading to an increase in fish harvests

and demand for harbor facilities at Whittier. As previously discussed, the City of Whittier is also hopeful to expand any protected boat launch facility at the head of the bay to include moorage. However, given uncertainty about the timing and funding of such development, this analysis does not consider any benefits that may result from future moorage at Whittier. At this time, however, not enough information is known to assign probabilities to any of these scenarios. They are simply intended to provide information to better understand the economic risks associated with the Tentatively Selected Plan.

A sensitivity analysis regarding project costs and benefits was conducted in which the percent of dredged material requiring upland treatment was varied from 5 percent to 50 percent for each alternative. Under all scenarios, Alternative 7 is economically justified and reasonably maximizes net benefits, with a benefit cost ratio ranging from 2.8 to 3.5 as shown in Table C-32.

Table C-31. Sensitivity Analysis Summary

Percent of Sediment Requiring Treatment	Total PV Cost	Total AAEQ Costs	Total AAEQ Benefits	Total Net Benefits	BCR
5	$24,135,000	$894,000	$3,152,000	$2,258,000	3.5
10	$25,829,000	$957,000	$3,176,000	$2,219,000	3.3
25	$28,746,000	$1,065,000	$3,217,000	$2,152,000	3.0
50	$31,946,000	$1,183,000	$3,263,000	$2,080,000	2.8

4.10 Regional Economic Development Analysis

The Regional Economic Development (RED) account measures changes in the distribution of regional economic activity that would result from each alternative plan. Evaluations of regional effects are measured using nationally consistent projection of income, employment, output and population.

In addition to the regional benefits presented below, economic benefits that accrue to the region but not necessarily the nation are expected to result from the shifting of vessels from outside of the region to Whittier. These vessels would bring revenue to the region in the form of boat launch fees, additional sales tax revenues on purchases of fuel and groceries for the vessel, additional corporate income taxes to the State of Alaska, and crew patronage of local businesses. Additionally, in order to access Whittier, vessels must be trailered through the Anton Anderson Memorial Tunnel. This equates to lost revenue for the State of Alaska associated with tunnel fees that would have been paid if harbor conditions had not discouraged potential users. The loss of these toll fees to the State of Alaska is directly related to the congestion at the harbor. The adverse impact of lost revenue to the state of Alaska associated with tunnel fees would be improved in a with-project scenario and therefore is considered a potential benefit to the regional economy.

4.10.1 Regional Analysis

The USACE Online Regional Economic System (RECONS) is a system designed to provide estimates of regional, state, and national contributions of Federal spending associated with Civil

Works and American Recovery and Reinvestment Act (ARRA) Projects. It also provides a means for estimating the forward linked benefits (stemming from effects) associated with non-Federal expenditures sustained, enabled, or generated by USACE Recreation, Navigation, and Formally Utilized Sites Remedial Action Program (FUSRAP). Contributions are measured in terms of economic output, jobs, earnings, and/or value added. The system was used to perform the following regional analysis for the Whittier Navigation Improvements Project.

4.10.2 Summary

The USACE Institute for Water Resources, the Louis Berger Group, and Michigan University developed the regional economic impact modeling tool called RECONS to provide estimates of regional and national job creation and retention and other economic measures such as income, value added, and sales. This modeling tool automates calculations and generates estimates of jobs and other economic measures such as income and sales associated with USACE's ARRA spending and annual Civil Works program spending. This is done by extracting multipliers and other economic measures from more than 1,500 regional economic models that were built specifically for USACE's project locations. These multipliers were then imported to a database and the tool matches various spending profiles to the industry sectors by location to produce economic impact estimates. The Tool will be used as a means to document the performance of direct investment spending of the USACE as directed by the ARRA. The Tool also allows the USACE to evaluate project and program expenditures associated with the annual expenditure by the USACE.

4.10.3 Results of Economic Impact Analysis

This RED impact analysis was evaluated using the ROM costs for Alternative 7 at three geographical levels: Local, State and National. The local represents the Southcentral Alaska impact area. The State level includes the State of Alaska. The National level includes the 48 contiguous United States.

Table C-33 displays the breakdown of overall spending of the total project construction costs among the major industry sectors. The spending profile also identifies the geographical capture rate, also called Local Purchase Coefficient (LPC) in RECONS, of the cost components. The geographic capture rate is the portion of USACE spending on industries (sales) captured by industries located within the impact area. In many cases, IMPLAN's trade flows Regional Purchase Coefficients (RPCs) are utilized as a proxy to estimate where the money flows for each of the receiving industry sectors of the cost components within each of the impact areas. For Whittier, Purchase Coefficient's were not changed from their default values for breakwater construction projects (that include dredging).

Table C-32. Input Assumptions (Spending and LPCs)

Category	Spending (%)	Spending Amount	Local LPC (%)	State LPC (%)	National LPC (%)
Dredging Fuel	6%	$1,401,353	32%	80%	90%
Metals and Steel Materials	4%	$987,839	12%	24%	90%
Textiles, Lubricants, and Metal Valves and Parts (Dredging)	2%	$482,433	7%	8%	65%
Pipeline Dredge Equipment and Repairs	5%	$1,194,596	12%	35%	100%
Aggregate Materials	3%	$666,217	49%	87%	97%
Switchgear and Switchboard Apparatus Equipment	0%	$68,919	7%	8%	80%
Hopper Equipment and Repairs	2%	$436,487	1%	1%	97%
Construction of Other New Nonresidential Structures	14%	$3,124,328	50%	68%	100%
Industrial and Machinery Equipment Rental and Leasing	7%	$1,677,029	28%	82%	100%
Planning, Environmental, Engineering & Design Studies and Services	5%	$1,056,758	37%	63%	100%
USACE Overhead	7%	$1,516,218	52%	52%	100%
Repair and Maintenance Construction Activities	4%	$941,893	37%	82%	100%
Industrial Machinery and Equipment Repair and Maintenance	11%	$2,412,165	64%	95%	100%
USACE Wages and Benefits	13%	$3,055,409	75%	100%	100%
Private Sector Labor or Staff Augmentation	15%	$3,514,869	100%	100%	100%
All Other Food Manufacturing	2%	$436,487	9%	20%	90%
Total	**100%**	**$22,973,000**	**-**	**-**	**-**

Table C-34 displays the geographical capture amounts for each of the three geographical impact analyses, which is that portion of spending that is captured in each impact area. It initially measures $12,036,946 at the local impact level and increases to $17,089,750 at the State level, and expands to a $22,465,781 capture at the national level. The labor income represents all forms of employment earnings. In IMPLAN's regional economic model, it is the sum of employee compensation and proprietor income. The Gross Regional Product (GRP) which is also known as value added, is equal to gross industry output (i.e., sales or gross revenues) less its intermediate inputs (i.e., the consumption of goods and services purchased from other U.S. industries or imported). The number of jobs equates to the labor income.

Tables C-35, C-36, and C-37 present the economic impacts by Industry Sector both for each geographical region. Impacts at the national level show a tremendous expansion most certainly due to the multiple turnovers of money that ripple throughout the national economy.

Table C-33. Overall Summary Economic Impacts

Impact Areas	Impacts	Regional	State	National
Total Spending		$22,973,000	$22,973,000	$22,973,000
Direct Impact				
	Output	$12,036,946	$17,089,750	$22,465,781
	Job	241.01	277.88	323.43
	Labor Income	$7,855,333	$10,111,713	$12,375,899
	GRP	$8,927,403	$11,922,032	$14,780,860
Total Impact				
	Output	$16,292,182	$29,008,668	$59,800,983
	Job	279.89	359.22	548.37
	Labor Income	$9,068,099	$14,083,794	$24,560,041
	GRP	$11,411,852	$19,084,439	$35,884,445

Table C-34. Economic Impact at Regional Level

IMPLAN No.	Industry Sector	Sales	Jobs	Labor Income	GRP
	Direct Effects				
115	Petroleum refineries	$337,685	0.04	$7,772	$47,849
171	Steel product manufacturing from purchased steel	$7,012	0.01	$1,067	$1,323
198	Valve and fittings other than plumbing manufacturing	$3,537	0.01	$771	$1,549
201	Fabricated pipe and pipe fitting manufacturing	$32,352	0.12	$6,400	$12,771
26	Mining and quarrying sand, gravel, clay, and ceramic and refractory minerals	$116,766	0.81	$49,337	$59,383
268	Switchgear and switchboard apparatus manufacturing	$161	0.00	$30	$67
290	Ship building and repairing	$230	0.00	$81	$93
319	Wholesale trade businesses	$209,980	1.44	$73,392	$155,792
322	Retail Stores - Electronics and appliances	$898	0.01	$313	$443
323	Retail Stores - Building material and garden supply	$105,283	1.35	$45,865	$69,667
324	Retail Stores - Food and beverage	$2,663	0.05	$1,247	$1,895
326	Retail Stores - Gasoline stations	$36,983	0.53	$14,875	$25,711
332	Transport by air	$312	0.00	$30	$87
333	Transport by rail	$12,121	0.03	$3,837	$6,487
334	Transport by water	$3,617	0.01	$646	$1,067
335	Transport by truck	$226,554	1.90	$90,617	$113,147
337	Transport by pipeline	$5,333	0.01	$1,447	$1,370
36	Construction of other new nonresidential structures	$1,567,975	12.47	$433,188	$565,528
365	Commercial and industrial machinery and equipment rental and leasing	$477,787	1.82	$99,427	$244,273
375	Environmental and other technical consulting services	$395,754	4.80	$227,671	$229,044
386	Business support services	$786,312	20.11	$348,460	$341,672
39	Maintenance and repair construction of nonresidential structures	$345,528	3.12	$108,613	$145,824
417	Commercial and industrial machinery and equipment repair and maintenance	$1,542,939	16.35	$857,797	$1,093,079
439	* Employment and payroll only (Federal government, non-military)	$2,291,557	29.61	$1,965,996	$2,291,557
5001	Labor	$3,514,869	146.38	$3,514,869	$3,514,869
69	All other food manufacturing	$12,739	0.04	$1,584	$2,856
	Total Direct Effects	$12,036,946	241.01	$7,855,333	$8,927,403
	Secondary Effects	$4,255,236	38.89	$1,212,767	$2,484,448
	Total Effects	**$16,292,182**	**279.89**	**$9,068,099**	**$11,411,852**

Table C-35. Economic Impact at State Level

IMPLAN No.	Industry Sector	Sales	Jobs	Labor Income	GRP
	Direct Effects				
115	Petroleum refineries	$989,915	0.12	$27,254	$140,268
171	Steel product manufacturing from purchased steel	$103,994	0.22	$34,003	$41,145
198	Valve and fittings other than plumbing manufacturing	$3,537	0.01	$771	$1,549
201	Fabricated pipe and pipe fitting manufacturing	$299,070	1.16	$62,265	$118,063
26	Mining and quarrying sand, gravel, clay, and ceramic and refractory minerals	$304,870	2.31	$128,817	$155,045
268	Switchgear and switchboard apparatus manufacturing	$161	0.00	$30	$67
290	Ship building and repairing	$1,354	0.01	$478	$547
319	Wholesale trade businesses	$227,926	1.56	$81,218	$169,765
322	Retail Stores - Electronics and appliances	$1,270	0.01	$474	$653
323	Retail Stores - Building material and garden supply	$123,342	1.58	$54,556	$82,246
324	Retail Stores - Food and beverage	$3,019	0.06	$1,427	$2,155
326	Retail Stores - Gasoline stations	$37,529	0.53	$15,100	$26,093
332	Transport by air	$1,336	0.01	$302	$561
333	Transport by rail	$12,121	0.03	$3,837	$6,487
334	Transport by water	$7,655	0.02	$1,404	$2,729
335	Transport by truck	$309,454	2.59	$129,553	$160,141
337	Transport by pipeline	$14,977	0.03	$5,206	$4,982
36	Construction of other new nonresidential structures	$2,138,217	17.00	$692,539	$868,634
365	Commercial and industrial machinery and equipment rental and leasing	$1,375,906	5.24	$324,073	$761,571
375	Environmental and other technical consulting services	$669,952	8.12	$415,485	$417,557
386	Business support services	$786,312	20.11	$348,460	$341,672
39	Maintenance and repair construction of nonresidential structures	$772,012	6.98	$311,102	$398,039
417	Commercial and industrial machinery and equipment repair and maintenance	$2,282,420	24.18	$1,293,740	$1,642,248
439	* Employment and payroll only (Federal government, non-military)	$3,052,350	39.44	$2,657,766	$3,052,350
5001	Labor	$3,514,869	146.38	$3,514,869	$3,514,869
69	All other food manufacturing	$56,183	0.17	$6,985	$12,596
	Total Direct Effects	$17,089,750	277.88	$10,111,713	$11,922,032
	Secondary Effects	$11,918,918	81.34	$3,972,081	$7,162,407
	Total Effects	**$29,008,668**	**359.22**	**$14,083,794**	**$19,084,439**

Table C-36. Economic Impact at National Level

IMPLAN No.	Industry Sector	Sales	Jobs	Labor Income	GRP
	Direct Effects				
115	Petroleum refineries	$1,049,259	0.13	$36,503	$178,107
171	Steel product manufacturing from purchased steel	$715,564	1.49	$241,694	$292,260
198	Valve and fittings other than plumbing manufacturing	$247,389	0.86	$61,341	$119,115
201	Fabricated pipe and pipe fitting manufacturing	$943,432	3.69	$226,208	$395,418
26	Mining and quarrying sand, gravel, clay, and ceramic and refractory minerals	$329,085	2.50	$147,145	$177,805
268	Switchgear and switchboard apparatus manufacturing	$43,091	0.14	$10,196	$21,031
290	Ship building and repairing	$417,572	1.96	$147,280	$170,419
319	Wholesale trade businesses	$534,042	3.65	$215,476	$408,120
322	Retail Stores - Electronics and appliances	$2,205	0.03	$916	$1,231
323	Retail Stores - Building material and garden supply	$123,342	1.58	$54,556	$82,246
324	Retail Stores - Food and beverage	$3,055	0.06	$1,446	$2,182
326	Retail Stores - Gasoline stations	$37,836	0.54	$15,227	$26,308
332	Transport by air	$1,336	0.01	$319	$593
333	Transport by rail	$27,248	0.12	$8,666	$14,659
334	Transport by water	$7,672	0.02	$1,476	$2,884
335	Transport by truck	$344,240	2.89	$145,892	$179,860
337	Transport by pipeline	$15,410	0.03	$5,895	$5,648
36	Construction of other new nonresidential structures	$3,124,328	24.84	$1,141,030	$1,392,790
365	Commercial and industrial machinery and equipment rental and leasing	$1,674,579	6.38	$412,996	$933,600
375	Environmental and other technical consulting services	$1,056,618	12.81	$686,049	$689,136
386	Business support services	$1,515,739	38.76	$810,708	$799,122
39	Maintenance and repair construction of nonresidential structures	$941,624	8.51	$391,631	$498,344
417	Commercial and industrial machinery and equipment repair and maintenance	$2,411,348	25.55	$1,391,094	$1,737,995
439	* Employment and payroll only (Federal government, non-military)	$3,055,409	39.48	$2,660,547	$3,055,409
5001	Labor	$3,514,869	146.38	$3,514,869	$3,514,869
69	All other food manufacturing	$329,489	1.04	$46,739	$81,709
	Total Direct Effects	$22,465,781	323.43	$12,375,89	$14,780,860
	Secondary Effects	$37,335,203	224.95	$12,184,14	$21,103,585
	Total Effects	**$59,800,983**	**548.37**	**$24,560,04**	**$35,884,445**

The total Whittier Navigation Improvements Project Economic Impact for the State of Alaska geographical area, as displayed in Table C-36, is composed of $29,008,668 in sales, 359 jobs, $14,083,794 in labor income, and a contribution of $19,084,439 to GRP.

4.11 Summary of Accounts and Plan Comparison

Plan formulation was performed for this study with a focus on contributing to NED with consideration of all effects, beneficial or adverse, to each of the four evaluation accounts identified in the P&G. Plan selection was based on a weighting of the projected effects of each alternative on the four evaluation accounts. The PDT reviewed qualitative and quantitative information for major project effects and for major potential effect categories.

4.11.1 National Economic Development

The results of the NED analysis were discussed in the previous section with Alternative 7 maximizing net benefits.

4.11.2 Regional Economic Development

Economic benefits that accrue to the region but not necessarily the nation include increased income and employment associated with the construction of a project. Regarding construction spending, further analysis of regional economic benefits is detailed in the RED analysis section this appendix. The RED analysis includes the use of regional economic impact models to provide estimates of regional job creation, retention, and other economic measures such as sales, or value added. Each alternative has a positive effect on RED commensurate with its construction expenditure.

4.11.3 Environmental Quality

Environmental Quality displays the non-monetary effects of the alternatives on natural resources and is described more fully in the environmental assessment sections of the draft feasibility report.

4.11.4 Other Social Effects

Other social effects displays the non-monetary effects of the alternatives on the population of the project area. These affected aspects are health and safety, quality of life, and educational, cultural, and social services.

Construction of this project in Whittier supports the local economy and provides income to a small community. This injection of income to the City of Whittier supports the provision of public services to the community and improves quality of life. Beneficial effects of each alternative also include a temporary increase in jobs, associated demand for temporary housing, and spending of disposable income.

Construction of this project is also anticipated to reduce overcrowding/congestion in and around the harbor and city center in Whittier, resulting in health and safety benefits for residents and visitors to Whittier, including those involved with navigation in particular. As described in the NED analysis, reductions in vessel delays, damages from overcrowded conditions, and in the amount of time harbor personnel spend on moving boats in the crowded harbor are considered to be gains in efficiency and benefits to the nation. With crowded conditions frequently come short tempers as harbor users attempt to park in overcrowded parking lots, wait long periods to use the boat launch, and endure strangers walking over their rafted boats. It is expected that relieving congested harbor conditions by shifting boat launch activities to the head of the bay will improve safety, result in fewer police responses to the harbor, and reduce the amount of time harbor staff must spend in resolving incidents.

4.11.5 Four Accounts Evaluation Summary

Based on this analysis of the four accounts, each alternative has positive effects for the RED and OSE accounts, and temporary negative effects for the EQ account. Based on its preference in the NED account, the TSP for this study is Alternative 7. This plan includes a 6-lane launch ramp, dredged entrance and maneuvering channel, and a rubble-mound breakwater. Table C-38 shows a summary of the four accounts for all alternatives, with the TSP highlighted in yellow.

Table C-37. Four Accounts Evaluation Summary

Alternative	Net Annual NED Benefits (BC Ratio)	Average Annual Cost	EQ	RED	OSE
No Action	$0	$0	Neutral	Neutral	Neutral
6	$1,876,000 (3.4)	$790,000	Negative	Increased employment and income for the region and state	Beneficial
7	$2,258,000 (3.5)	$894,000	Negative	Increased employment and income for the region and state	Beneficial
8	$1,812,000 (3.2)	$834,000	Negative	Increased employment and income for the region and state	Beneficial
9	$2,168,000 (3.2)	$974,000	Negative	Increased employment and income for the region and state	Beneficial