Navigation Improvements

ALASKA DEEP-DRAFT ARCTIC PORT SYSTEM

Cost Engineering
Appendix XXXXX

U.S. Army Corps of Engineers
Alaska District

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Section **Page**

1 Overview

This paper discusses the cost assumptions and construction methodology utilized in the Current Working Estimates (CWEs) for the ALASKA DEEP-DRAFT ARCTIC PORT Feasibility Study.

The study area is located along the Bering Sea in the Cities of Nome, Teller and Port Clarence, Alaska. The City of Nome was built along the Bering Sea on the south coast of the Seward Peninsula, facing Norton Sound. It lies 539 air miles northwest of Anchorage, a 75-minute flight. It lies 102 miles south of the Arctic Circle and 161 miles east of Russia. Teller is located on a spit 72 miles northwest of Nome on the eastern side of Port Clarence. Port Clarence is a bay located west of Teller on the Seward Peninsula.

Project purpose is to investigate the feasibility of navigation improvements at Nome and Port Clarence as part of a larger system of port facilities in the Arctic.

2 Direct Cost

The deep draft nature of the project alternatives warranted supportable dredge cost estimates. The Cost Engineering Dredge Estimating Program (CEDEP) program was used to compute mechanical dredging unit costs for various depths and exposures. Unit costs for dredge mob/demob and excavate/dispose operations were calculated using the Mechanical Dredge CEDEP program. Dredging unit cost within the CEDEP program is based on the input volumes, areas and depths for each dredge segment; plus the assumed dredge plant, cycle time, work shift,.

Each CEDEP dredging unit cost accounts for the dredging operation of a single event with fixed constraints. Multiple unit costs were developed for the sets of constraints pertinent to each project alternative. Unit costs for the mechanical dredge, tug & scow disposal, mob/demob and shore crews were integrated in MCACES MII.

The direct dredging unit costs were transferred to MCACES Mii software program to incorporate indirect costs and merge with other task costs. Some task costs utilized cost line items from the Unit Price Book by RS MEANS, and other task costs were derived by constructing crews and developing production rates. The CWE task layout meets the Standard USACE Civil Works Work Breakdown Structure (WBS).

There are separate MCACES MII estimates for each project alternative proposed at Nome (single contract for each alternative) and an MII estimate for each alternative at Point Spencer and Cape Riley (single contract). It is presumed that each alternative could take 1 to 3 years to construct, and combinations of alternatives at different sites would take so long as to warrant either multiple concurrent contracts or a joint venture of 2 or more marine contractors to accomplish the work in an efficient and reasonable timeframe. Construction start was assumed to be early 2019 with completion by 2021.

Labor rates used to develop the estimate were provided from latest Davis-Bacon Wage Rates for Alaska, Heavy and Dredging; as well as the Alaska Laborers' & Mechanics Minimum Rates of Pay, latest edition.

Equipment rates are based on the US Army Corps of Engineers EP 1110-1-8 "Construction Equipment Ownership and Expense Schedule", Region 9, and CEDEP.

3 Dredge Quantity and Material Analysis

In Nome, there is ample history of both construction dredging and O&M dredging costs. In-water dredge disposal has traditionally been within a short haul of the dredge locations. O&M dredging has typically been by cutter-head pipeline with discharge into shallow water seaward of land. However, both Point Spencer (Port Clarence) and Cape Riley (Teller) have little cost history available and the risks are somewhat higher. In-water disposal areas are within some miles of the dredge sites, and the dredge operation climate in these locations is assumed to be fair.

Material classification for initial dredging of virgin materials assumed: Dense Clays, Hard-packed Sand, Blasted Rock and Boulders. Although no blasting of dredge materials is anticipated, the materials in deep water away from shore have not been dredged and are likely to require heavy clamshell buckets with potential for partial filling.

4 Dredge Equipment Selection

Equipment selection and sizing were developed through construction cost estimator experience and consultation with the PDT. It has been typical for barge-mounted lattice-cranes with clamshell buckets to handle most construction dredging at water depths over 25 ft.

A medium-sized 21cy clamshell dredge with tug and scow is selected due to the water depth and haul to the disposal. Selected scow maximum safe load capacity is assumed at 2,700 CY.

The dredge and construction equipment are expected to operate on a 20 hr / 7 day basis. Construction is planned to occur during a period of seasonably mild climate between May and September, however storms frequently roll in from the Bering Sea, and moderate winds can raise the wave climate as well as lower the wind chill factor. Construction coordination is expected to schedule most or all of the breakwater work prior to general dredging.

5 Fuel Adjustments

The Nome area is subject to fuel price fluctuations. Historically when winter fuel deliveries could not be made, it caused a critical shortage of heating, power-generating and motor fuels in the area. Marine diesel fuel cost was estimated from historical experience.

6 Quantity Analysis

Quantities are given volume estimates from designers. Hauling distances were estimated by Cost Engineering. Possible issues to resolve include exact location of disposal areas given the many private mining claims in the near-shore. Given volumes were used to run the CEDEP estimates and develop dredging unit costs.

7 Dredging Construction Methodology

Dredging operations mirror the deepening work that took place at Port of Anchorage, in 2010-2012. The selected mechanical dredge for Nome is comparable with the equipment used by the contractor in that contract.

8 Dredge Mobilization and Demobilization

Includes dredge crews, barge-mounted crane dredge, dump scow(s) and dredge setup and dismantle. Since there are few extra dredges on the west coast, a possible scenario is that a mechanical dredge would mob/demob from the Gulf of Mexico or from the east coast to take on a multi-year dredge contract.

9 Dredging Schedule

Dredging operations are performed 20-hours a day, 7 days a week with short daily shut-downs for repairs and crew change-overs. Dredging crew operation is performed 12-hours a day, 7 days a week given transit time from shore facilities to dredge and return. Current safety restrictions limit likelihood of on-dredge sleeping quarters, although tug crews stay aboard. Dredging contracts limit heavy equipment operations on the roads between 7:00 am and 7:00 pm, but port operations and marine construction equipment is often allowed to work 24-hours a day.

Estimated initial Nome dredging duration amounts to 4 months, excluding mob/demob.

10 Mitigation and Monitoring Costs

Habitat mitigation costs consist of marine mammal monitoring.

11 Dredging Alternatives

The hopper dredge method was considered because it is the most likely method used for beach nourishment in this region. However, a combination of hopper dredge and pipeline cutterhead dredge was considered as an alternate procedure but conceptually it was determined to be less economical.

During the PDT's screening process the exclusive use of the hydraulic cutterhead and direct pipeline method was discarded due to project conditions or criteria. Dredging will take place in the open-ocean and clamshell dredges work better in adverse sea conditions. Borrow site may or may not be available at the time dredging events are scheduled specially in the out years.

12 Rubble mound Construction

The breakwaters will be required to provide protection for the harbor and access to the docks. Adequate capacity for land vehicles to carry supplies, equipment and personnel between ships and shore facilities is required to support port operations. There is ample history of building rubble mound breakwaters in the area, and quarry sources of acceptable material are within reach. It will be the contractors' option as to where to procure the needed quarry products.

The Cape Nome quarry has provided high-quality stone materials for many projects in the Bering Sea area. And there is land access as well as barge access for transportation of materials. This was assumed as the source for the estimates.

The existing rock breakwaters at Nome will be modified and/or extended to provide for deep water access and protection. Other aggregate products can be obtained from borrow sites in the

area as well. Mining operations have left stockpiles of materials which can be utilized cost effectively.

13 Dock Construction

Docks will be required in deep water to service the design vessels. Pre-cast concrete caisson docks can be constructed on the US west coast in facilities with adequate harbors and float-towed to the Bering Sea. This method was assumed for the new deep-water docks.

Costs of large deep-water docks are subject to fluctuations depending on final design features, dimensions, and costs of constituent materials at the time of manufacture. A general ROM unit cost was used to develop the cost of design, construction and installation. Other unit costs for dredging and fill were also used to support the dock construction costs.

14 Utility Construction

Some support between land facilities and docked ships is presumed to be required for regular and safe operations in the port. Costs of utility lines carrying water, fuel, electricity and communications will be developed more fully as the design details are developed. The current working estimates for utilities were created using major assumptions and RS Means cost book items.

15 Contractor Markups

The CWE is based on performing the work using the “Invitation for Bid” contract mechanism. A full and open competition will ensure the best proposals from experienced contractors.

16 Planning, Engineering and Design (PED) and Construction Management

Planning, Engineering and Design (PED) and Construction Management estimates were based on labor-hour estimates provided by section chiefs. Associated burdened hourly rates were extracted from CEFMS.

17 Contingency

Contingency costs for alternative selection were derived from the Abbreviated Risk Analysis. A follow-on Cost and Schedule Risk Analysis (CSRA) will refine the preliminary contingencies for the final project budget. Please refer to the risk analysis study.

18 Escalation

Construction Escalation is based on the Civil Works Construction Cost Index System (CWCCIS) EM 1110-2-1304, dated 31 March 2013.

Real Estate escalation is based on the Construction Price Yearly Index (CPI)

Estimate was inflated to mid-point of construction. Please refer to the Total Project Cost Summary (TPCS) for cost breakdown.

Deep Water Port Study, Nome Alt #1A Rev 1
Alaska Deep-Draft Arctic Port study - Nome Alt #1A Revised Outer Channel to -28 MLLW.
\\Y\P\CW\02 W\Alaska Regional Ports\Deep-Draft Arctic Ports\1 Recon\Alt #1 - Nome

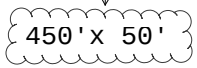
Nome is a regional center of transportation for surrounding villages. There are two state-owned airports. The Nome Airport has two paved runways; one is 6,001' long and 150' wide, and the other is 5,576' by 150' wide. Scheduled jet flights are available, as well as charter and helicopter services. The city field offers a 1,950' long by 110' wide gravel airstrip.

Nome was built along the Bering Sea on the south coast of the Seward Peninsula, facing Norton Sound. It lies 539 air miles northwest of Anchorage, a 75-minute flight. It lies 102 miles south of the Arctic Circle and 161 miles east of Russia.

January temperatures range from -3 to 11 °F; July temperatures are typically 44 to 65 °F. Average annual precipitation is 18 inches, with 56 inches of snowfall.

If vessel activity in the Arctic increases as much as projected, it will result in a significantly increased Federal mission. The primary purpose of the Alaska Deep-Draft Arctic Ports study is to investigate the alternatives for developing deep-draft Arctic ports in Alaska to best serve state and national interests for generations to come. In the first phase, all potential sites north of Nunivak Island will be identified and evaluated.

Description of Project: The project is to construct a 2150 LF extension of the existing causeway into deep water with rubble-mound embankment of similar construction to provide landing access to deep draft vessels. Demo existing causeway nose and spur breakwater. Construct one [redacted] dock of pre-cast concrete caissons. Construct 2 mooring dolphins of steel piles. Construct extensions of utility lines to new caisson dock to provide fuel, water, and electricity hookups. Dredge new inner (-22) and outer (-28) channels with 2ft advanced maintenance over-dredge. Construct gates to limit public access and improve causeway traffic flow to service ships.



Estimated by	CENPOA-EN-CE
Designed by	CENPOA-EN-G-HH
Prepared by	Al Arruda
Preparation Date	2/2/2015
Effective Date of Pricing	10/1/2013
Estimated Construction Time	1,090 Days

Labor ID: EQ ID: EP11R09 Currency in US dollars TRACES MII Version 4.2

Description	Quantity	UOM	ContractCost	Escalation	Contingency	SIOH	ProjectCost
Project Cost Summary Report			**154,042,833**	**0**	**44,914,710**	**15,916,603**	**214,874,146**
A CG Items	**3.00**	**YR**	**148,585,265**	**0**	**43,550,318**	**15,370,847**	**207,506,430**
GNF	**1.00**	**LS**	**105,294,952**	**0**	**30,568,896**	**10,869,108**	**146,732,955**
Mobilization and Demobilization, complete	**6.00**	**LS**	**6,309,390**	**0**	**1,767,891**	**646,182**	**8,723,463**
Equipment Standby	**912.00**	**HR**	**231,059**	**0**	**64,743**	**23,664**	**319,466**
Equipment Road Transport	**6.00**	**EA**	**74,258**	**0**	**20,807**	**7,605**	**102,671**
Mob Construction Facilities & Supplies	**6.00**	**EA**	**449,555**	**0**	**125,965**	**46,042**	**621,562**
Barge Mobilization	**14,070.00**	**MI**	**5,249,753**	**0**	**1,470,981**	**537,659**	**7,258,393**
Mob Personnel	**54.00**	**PN**	**70,339**	**0**	**19,709**	**7,204**	**97,252**
Demo Existing Causeway Spur	**1.00**	**EA**	**1,529,811**	**0**	**428,653**	**156,677**	**2,115,141**
A06 Remove (E) Causeway Head "A1" Rock (22 ton)	**14,000.00**	**CY**	**467,516**	**0**	**130,998**	**47,881**	**646,395**
A14 Remove (E) Causeway Head "B2" Rock (2 ton)	**4,600.00**	**CY**	**67,717**	**0**	**18,974**	**6,935**	**93,627**
A08 Demo Causeway Rock Spur	**36,100.00**	**CY**	**994,578**	**0**	**278,681**	**101,861**	**1,375,119**
Extend Causeway	**2,150.00**	**LF**	**92,094,966**	**0**	**25,805,009**	**9,431,998**	**127,331,974**
A0410 Dredge for Causeway BW toe	**45,425.00**	**BCY**	**591,597**	**0**	**165,765**	**60,589**	**817,951**
A06 "A1" Rock (A22)	**181,600.00**	**CY**	**38,053,191**	**0**	**10,662,504**	**3,897,256**	**52,612,950**
A12 "A5" Rock	**33,450.00**	**CY**	**5,709,099**	**0**	**1,599,690**	**584,703**	**7,893,492**
A14 "B2" Rock	**100,300.00**	**CY**	**17,868,680**	**0**	**5,006,804**	**1,830,039**	**24,705,523**
A13 "B3" Rock (B22 Rock)	**15,410.00**	**CY**	**2,733,193**	**0**	**765,841**	**279,923**	**3,778,956**
A15 "C1" Rock (C8 Rock)	**30,700.00**	**CY**	**4,818,921**	**0**	**1,350,262**	**493,535**	**6,662,717**
A17 "C2" Rock	**11,140.00**	**CY**	**1,600,932**	**0**	**448,581**	**163,961**	**2,213,474**
A19 "D" Filter (D8 Rock)	**49,145.00**	**CY**	**5,849,050**	**0**	**1,638,904**	**599,036**	**8,086,990**
A16 5 "E" Fill	**178,900.00**	**BCY**	**14,870,305**	**0**	**4,166,659**	**1,522,957**	**20,559,922**
A0410 Dredge Outer channel and Maneuvering area	**152,220.00**	**BCY**	**1,984,434**	**0**	**961,260**	**235,655**	**3,181,349**
A0410 5 MECHANICAL DREDGING	**152,220.00**	**BCY**	**1,984,434**	**0**	**961,260**	**235,655**	**3,181,349**
A0410 Dredge Inner channel Maneuvering area	**287,400.00**	**BCY**	**3,181,565**	**0**	**1,541,150**	**377,817**	**5,100,533**

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Description	Quantity	UOM	ContractCost	Escalation	Contingency	SIOH	ProjectCost
A0410 5 MECHANICAL DREDGING Above -20	212,400.10	BCY	2,351,280	0	1,138,960	279,219	3,769,460
A0410 5 MECHANICAL DREDGING Below -20	75,002.78	BCY	830,285	0	402,190	98,598	1,331,073
A23 Hydro & Topo Surveys for above	4.00	EA	194,786	0	64,933	20,777	280,496
A2302 Hydrographic Survey	4.00	EA	50,704	0	24,561	6,021	81,286
A2305 Topographic Survey	20.00	ACR	144,082	0	40,372	14,756	199,210
LSF	1.00	LS	43,290,314	0	12,981,422	4,501,739	60,773,474
Construct Docks	1.00	EA	16,172,614	0	5,346,666	1,721,542	23,240,822
Caisson Dock	450.00	LF	14,908,411	0	4,928,721	1,586,971	21,424,102
Mooring Dolphins	2.00	EA	1,264,202	0	417,945	134,572	1,816,720
A16 Causeway Fill & Surface	2,150.00	LF	25,002,805	0	7,005,786	2,560,687	34,569,278
A16 5 "E" Fill	188,450.00	BCY	15,664,108	0	4,389,083	1,604,255	21,657,447
A1611 "F" Fill	82,075.00	BCY	9,161,521	0	2,567,058	938,286	12,666,866
Surface (D1) Course	3,950.00	CY	177,176	0	49,645	18,146	244,966
Utilities	2,200.00	LF	2,096,047	0	623,364	217,553	2,936,965
Water	2,200.00	LF	379,926	0	112,990	39,433	532,350
Electric	2,200.00	LF	1,072,580	0	318,985	111,325	1,502,891
Fuel	2,200.00	LF	589,387	0	175,284	61,174	825,845
Trenching & Backfill	2,200.00	LF	54,154	0	16,105	5,621	75,880
Site Improvements	1.00	EA	18,848	0	5,605	1,956	26,409
Security Gates	40.00	LF	18,848	0	5,605	1,956	26,409
O&MRRR	1.00	EA	5,457,568	0	1,364,392	545,757	7,367,717
Dredge Channel (2%/Yr at yrs. +10)	1.00	YR	1,530,259	0	382,565	153,026	2,065,850
Mobilization and Demobilization, complete	2.00	LS	746,446	0	186,611	74,645	1,007,702
Equipment Standby	928.00	HR	155,763	0	38,941	15,576	210,280
Equipment Road Transport	2.00	EA	7,481	0	1,870	748	10,100
Mob Construction Facilities & Supplies	2.00	EA	114,569	0	28,642	11,457	154,668

Currency in US dollars

Description	Quantity	UOM	ContractCost	Escalation	Contingency	SIOH	ProjectCost
Barge Mobilization	1,440.00	MI	427,824	0	106,956	42,782	577,562
Mob Personnel	10.00	PN	13,196	0	3,299	1,320	17,815
A0410 Outer channel and Maneuvering area	9,580.00	BCY	330,659	0	82,665	33,066	446,389
PIPELINE DREDGING	9,580.00	CY	330,659	0	82,665	33,066	446,389
A0410 Inner channel Maneuvering area	12,000.00	BCY	414,186	0	103,547	41,419	559,152
PIPELINE DREDGING	12,000.00	CY	414,186	0	103,547	41,419	559,152
A23 Hydro & Topo Surveys for above	4.00	EA	38,969	0	9,742	3,897	52,608
A2302 Hydrographic Survey	4.00	EA	38,969	0	9,742	3,897	52,608
Replace Armor on Causeway (2%/Yr at yr. +25)	1.00	YR	2,394,256	0	598,564	239,426	3,232,246
Mobilization and Demobilization, complete	2.00	LS	1,745,404	0	436,351	174,540	2,356,295
Equipment Standby	928.00	HR	289,126	0	72,281	28,913	390,320
Equipment Road Transport	2.00	EA	24,633	0	6,158	2,463	33,254
Barge Mobilization	4,690.00	MI	1,339,471	0	334,868	133,947	1,808,285
Mob Personnel	28.00	PN	36,949	0	9,237	3,695	49,882
A06 "A1" Rock (A22)	3,600.00	CY	562,349	0	140,587	56,235	759,171
A06 2 5 22 Ton ROCK Placement	3,600.00	LCY	562,349	0	140,587	56,235	759,171
A12 "A5" Rock	600.00	CY	86,504	0	21,626	8,650	116,780
A12 5 5 8 Ton ROCK Placement	600.00	LCY	86,504	0	21,626	8,650	116,780
Repair Caissons (2%/Yr at yrs. +20)	1.00	YR	767,327	0	191,832	76,733	1,035,891
Mobilization and Demobilization, complete	2.00	LS	746,446	0	186,611	74,645	1,007,702
Equipment Standby	928.00	HR	155,763	0	38,941	15,576	210,280
Equipment Road Transport	2.00	EA	7,481	0	1,870	748	10,100
Mob Construction Facilities & Supplies	2.00	EA	114,569	0	28,642	11,457	154,668
Barge Mobilization	1,440.00	MI	427,824	0	106,956	42,782	577,562
Mob Personnel	10.00	PN	13,196	0	3,299	1,320	17,815
Surface Repairs	150.00	SF	5,938	0	1,485	594	8,017

Labor ID: EQ ID: EP11R09 Currency in US dollars TRACES MII Version 4.2

Description	Quantity	UOM	ContractCost	Escalation	Contingency	SIOH	ProjectCost
Internal Repairs	300.00	SF	14,943	0	3,736	1,494	20,173
Repair Dolphin Anodes (2%/Yr at yrs. +15)	1.00	YR	765,725	0	191,431	76,573	1,033,729
Mobilization and Demobilization, complete	2.00	LS	754,363	0	188,591	75,436	1,018,391
Equipment Standby	928.00	HR	155,763	0	38,941	15,576	210,280
Equipment Road Transport	2.00	EA	7,481	0	1,870	748	10,100
Mob Construction Facilities & Supplies	2.00	EA	114,569	0	28,642	11,457	154,668
Barge Mobilization	1,440.00	MI	427,824	0	106,956	42,782	577,562
Mob Personnel	16.00	PN	21,114	0	5,278	2,111	28,504
Anodes	10.00	EA	11,362	0	2,840	1,136	15,339
New Anodes - Pile protection	10.00	EA	11,362	0	2,840	1,136	15,339

Currency in US dollars