CHAPTER 5

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CHAPTER 6

PERSONS AND AGENCIES CONTACTED

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Anderson, Cindy. Alaska Department of Natural Resources.

Anderson, Duane. R&M Consultants.

Berg, Catherine. Project Planning, U.S. Fish and Wildlife Service.

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CHAPTER 7

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7.0 LIST OF PREPARERS AND CONTRIBUTORS

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APPENDIX A

PUBLIC INVOLVEMENT

APPENDIX A
PUBLIC INVOLVEMENT

INTRODUCTION

Public involvement is at the heart of NEPA. It ensures that potentially affected communities (whether they are Government Hill residents; federal, state, and/or local government agencies; Native Alaskan villages and tribes; interest groups; or private citizens) are informed and involved in the NEPA and decision-making process.

For purposes of the Project, public involvement includes:

- Notifying government agencies and organizations early in the development of the Project to identify potential effects on the natural and/or human environment.
- Holding public meetings (when appropriate) during the early stage of the NEPA process to provide information to the public, receive comments, and identify any issues or concerns the public might have with the Project efforts.
- Advertising meetings in local newspapers (including Anchorage and surrounding communities) to ensure broadest dissemination of the NEPA-related efforts.
- Preparing informative posters/displays and newsletters covering the Project and alternatives, possible environmental issues, and the environmental and consultation process.

Scoping is an important aspect of public involvement that ensures public input early in the environmental analysis process, identifies community-specific issues and concerns, and solicits potential viable alternatives to expansion efforts. This appendix presents an analysis of written and verbal responses of issues and concerns raised during the scoping period for the Marine Terminal Redevelopment EA.

Scoping identifies the issues and concerns that are of particular interest to the affected populace. This information is then used to assist resource specialists in data collection and analysis for the draft EA development process. This summary is based on all public written comments received from January 15, 2004 to February 15, 2004 (the official scoping period) and agency comments received from January through June 2004.

SCOPING PROCESS

The first step in scoping was the public announcement of the POA's intention to conduct an EA for the Project. Advertisements were placed a week before the meeting in the *Anchorage Daily News* and the *Frontiersman*, describing the proposal and alternatives. The advertisement invited the public to attend the scoping open house on January 15, 2004 and provided the time, date, and the location of the meeting. In addition to the advertisements, a flyer inviting Anchorage citizens to the scoping meeting was also sent to 850 recipients, including Government Hill residents, interest groups, and local companies.

In addition to public scoping, the POA conducted three agency scoping meetings – on January 12, 2004, February 26, 2004, and June 24, 2004 – to solicit concerns from local, state, and federal agency representatives. The POA also conducted separate meetings with the USACE, NOAA Fisheries, Alaska SHPO, and Native Alaskan elders.

PUBLIC SCOPING MEETING

The scoping meeting was designed in an "open house" format to create a comfortable atmosphere for attendees. POA, MARAD, and Anchorage Port Expansion Team representatives were available to answer any questions and address issues and concerns from citizens.

The open house meeting was held at Egan Convention Center in Anchorage. Attendees were welcomed at the door by Anchorage Port Expansion Team members. The greeters asked attendees to sign-in, distributed hand-out materials, and directed them to the first display.

Six displays were developed to inform the public. These were designed to enhance public understanding of the NEPA process, the need for the proposed action, how the alternatives were designed and selected, the composition of the Anchorage Port Expansion Team, and the current status of the Project. A bathymetric map of Cook Inlet and an electronic and poster presentation of the USACE flow table for the POA were also shown to the public. All scoping materials, as well as the displays used at the meeting, are posted on the Anchorage Port Expansion website at www.portofanchorage.org.

The public was provided several venues for commenting during the scoping period. Attendees could submit written comments they brought with them, complete a comment form provided by the Anchorage Port Expansion Team, send comments to the Anchorage Port Expansion Team address, or e-mail comments to expansioncomment@portofanchorage.org.

SCOPING MEETING SCHEDULE

The Anchorage Port Expansion Team planned a scoping meeting at one location in Anchorage; the schedule, location, and attendance level for the scoping meeting is provided in Table A-1.

Table A-1 Schedule of Meeting and Attendance			
City/Town	***Date***	***Location***	***Number of Attendees***
Anchorage	January 15, 2004	William A Egan Civic & Convention Center, Summit Room	41

COMMENT AND ISSUE SUMMARY

Table A-2 outlines the number of attendees and comments received (either written or computer-generated) during the scoping period.

Table A-2 Scoping Meeting Comment Summary		
Scoping Location	***Attended***	***Comments***
Anchorage	41	3

The three public comments ranged from support for the POA expansion, to a question regarding choice of alternatives and why the POA cannot be moved to Fire Island, to an email requesting examination of scouring, sedimentation, and dredging.

AGENCY SCOPING MEETINGS

Issues of concern mentioned at the three agency scoping meetings include effects on:

- Traffic and transportation;
- Air quality;
- Noise impacts from construction and operations on neighborhoods;
- Beluga whales;
- Fish habitat;
- Shorebirds;
- Safety;
- Water quality;
- Cultural resources;
- Hazardous materials and waste;
- Local plans;
- Local and state economy; and
- Cumulative actions in the area.

A summary of these comments are included in the Agency Comment Matrix in Table A-3.

Table A-3 Agency Comment Matrix

Sources of Comments or Issues	*Agency or Entity*	*Issue*	*Addressed in EA*
1-12-04 Agency Scoping Mtg.	MOA, Planning Department	How well will traffic flow at full build out? How will traffic affect air quality?	Section 3.4.3 Transportation
1-12-04 Agency Scoping Mtg.	MOA, Planning Department	Where will gravel come from?	Section 3.3.1 Geology and Soils
1-12-04 Agency Scoping Mtg.	MOA, Planning Department	How does the EA fit into the Master Plan? Will the Master Plan be updated?	Section 3.4.1 Land Use and Coastal Zone Consistency
1-12-04 Agency Scoping Mtg.	MOA, Planning Department	How will spill plans and emergency response issues be dealt with?	Section 3.3.3 Water Quality
1-12-04 Agency Scoping Mtg.	MOA, Planning Department	How will full build out affect city planning?	Section 3.4.1 Land Use and Coastal Zone Consistency
1-12-04 Agency Scoping Mtg.	MOA, Planning Department	Will increased operations affect fish & wildlife?	Section 3.3.4 Biological Resources
1-12-04 Agency Scoping Mtg.	Elmendorf AFB	Will POA expansion interfere with access to LF04 and how will it affect the ROD?	Section 3.2.3 Hazardous Materials and Waste
1-12-04 Agency Scoping Mtg.	Elmendorf AFB	Security outside dock	Section 3.2.4 Safety
1-12-04 Agency Scoping Mtg.	Elmendorf AFB	Visual impacts to Government Hill Historic District	Section 3.4.7 Cultural Resources
1-12-04 Agency Scoping Mtg.	Elmendorf AFB	Location of fill for construction	Section 3.3.1 Geology and Soils
1-12-04 Agency Scoping Mtg.	Elmendorf AFB	What are the cumulative effects of the bridge project with the POA expansion?	Chapter 4
1-12-04 Agency Scoping Mtg.	Elmendorf AFB	What is the cumulative effect on belugas?	Chapter 4
1-12-04 Agency Scoping Mtg.	Elmendorf AFB	How will the POA expansion relate to military staging decisions (Stryker Brigade)?	Chapter 1
1-12-04 Agency Scoping Mtg.	Elmendorf AFB	What will be the effect of expansion on Elmendorf's flight line/ clear zone/lighting?	Section 3.2.4 Safety
1-12-04 Agency Scoping Mtg.	USEPA	Would wetlands be affected?	Section 3.3.4 Biological Resources
1-12-04 Agency Scoping Mtg.	USEPA	Air quality	Section 3.2.1 Air Quality

Table A-3 Agency Comment Matrix (con't)

Sources of Comments or Issues	*Agency or Entity*	*Issue*	*Addressed in EA*
1-12-04 Agency Scoping Mtg.	USEPA	What effect would the expansion have on water quality/stormwater runoff treatment?	Section 3.3.3 Water Quality
1-12-04 Agency Scoping Mtg.	Fort Richardson, Director of Public Works	How would it relate to military deployments?	Chapter 1
1-12-04 Agency Scoping Mtg.	U.S. Coast Guard, Marine Safety Office	How will it affect security plans for new facilities?	Chapter 1
1-12-04 Agency Scoping Mtg.	NOAA Fisheries	What will be the effect on beluga whales?	Section 3.3.4 Biological Resources
1-12-04 Agency Scoping Mtg.	NOAA Fisheries	What would be the effect of construction noise on belugas?	Section 3.3.4 Biological Resources
1-12-04 Agency Scoping Mtg.	NOAA Fisheries	Interested in increased public whale viewing areas north of boat launch	Section 3.3.4 Biological Resources
1-12-04 Agency Scoping Mtg.	NOAA Fisheries	How will stormwater runoff affect fish habitat?	Section 3.3.4 Biological Resources
1-12-04 Agency Scoping Mtg.	NOAA Fisheries	How will snow removal affect water quality?	Section 3.3.3 Water Quality
1-12-04 Agency Scoping Mtg.	NOAA Fisheries	Cumulative effects and impacts to the entrance to Ship Creek	Section 3.3.2 Hydrodynamics Section 4.4 Cumulative
1-12-04 Agency Scoping Mtg.	Elmendorf AFB, Alaska Command	Cumulative impacts (POA expansion and Knik Arm Bridge)	Section 3.3.2 Hydrodynamics Section 4.4 Cumulative
1-12-04 Agency Scoping Mtg.	Alaska SHPO	Ground disturbance in barge area and effects to archaeological sites	Section 3.4.7 Cultural Resources
1-12-04 Agency Scoping Mtg.	Alaska SHPO	Will material sources be surveyed?	Section 3.4.7 Cultural Resources
1-12-04 Agency Scoping Mtg.	Alaska SHPO	Two known archaeological sites within Project area limits	Section 3.4.7 Cultural Resources
1-12-04 Agency Scoping Mtg.	Elmendorf AFB	Impact of noise on Cherry Hill housing area	Section 3.2.2 Noise
1-12-04 Agency Scoping Mtg.	Elmendorf AFB	Effect of construction truck traffic on transportation	Section 3.4.3 Transportation

Table A-3 Agency Comment Matrix (con't)			
Sources of Comments or Issues	***Agency or Entity***	***Issue***	***Addressed in EA***
1-12-04 Agency Scoping Mtg.	Elmendorf AFB	Possible conflict with electronics and the Elephant Cage	Section 3.2.4 Safety
1-12-04 Agency Scoping Mtg.	OPMP	Concerned about when to participate in review process	Section 2.4.2 Other Regulatory and Permit Requirements
1-12-04 Agency Scoping Mtg.	Fort Richardson	Ship Creek	Section 3.3.2 Hydrodynamics
1-12-04 Agency Scoping Mtg.	Fort Richardson	Operational issues/general concerns include construction impacts to Defense Fuels property	Section 3.2.3 Hazardous Materials and Waste
2-26-04 Agency Scoping Mtg.	U.S. Coast Guard	Effects on bird nesting	Section 3.3.4 Biological Resources
2-26-04 Agency Scoping Mtg.	USEPA	Biotic sampling	Section 3.3.4 Biological Resources
2-26-04 Agency Scoping Mtg.	NOAA Fisheries	Beluga whales migration and staging areas	Section 3.3.4 Biological Resources
2-26-04 Agency Scoping Mtg.	NOAA Fisheries	Dredging and Essential Fish Habitat	Section 3.3.5 Essential Fish Habitat
2-26-04 Agency Scoping Mtg.	NOAA Fisheries	Effects of sheet pile vs. pile-supported dock on fish	Section 3.3.4 Biological Resources
2-26-04 Agency Scoping Mtg.	ADNR	Migratory corridor for shore birds	Section 3.3.4 Biological Resources
2-26-04 Agency Scoping Mtg.	USFWS	Migratory birds	Section 3.3.4 Biological Resources
2-26-04 Agency Scoping Mtg.	Fort Richardson	Cumulative Impacts	Chapter 4
2-26-04 Agency Scoping Mtg.	NOAA Fisheries	Transportation effects	Section 3.4.3 Transportation
Correspondence	Individual	Tak'at Fish Camp	Section 3.4.7 Cultural Resources
3-1-04 381 Intelligence Squadron Mtg.	381 Intelligence Squadron Logistics/Maintenance	EM interference during construction, especially with welding and communications work	Section 3.2.4 Safety
3-1-04 381 Intelligence Squadron Mtg.	381 Intelligence Squadron Flight Commander	Suggested mitigating factors: shield power cables, low sodium lights	Section 3.2.4 Safety

Table A-3 Agency Comment Matrix (con't)			
Sources of Comments or Issues	***Agency or Entity***	***Issue***	***Addressed in EA***
3-1-04 381 Intelligence Squadron Mtg.	Airspace Manager, Elmendorf AFB	Relating to air traffic control tower on Elmendorf AFB (has 9 antennas)	Section 3.2.4 Safety
1-28-04 USACE, Alaska District Mtg.	Operations Branch, USACE, Alaska District	What can 2D hydrographic model tell you?	Section 3.3.2 Hydrodynamics
1-28-04 USACE, Alaska District Mtg.	Project Manager, Regulatory Branch, USACE, Alaska District	How much change in channel? Is it part of the environmental process?	Section 3.3.2 Hydrodynamics
1-28-04 USACE, Alaska District Mtg.	Project Manager, Regulatory Branch, USACE, Alaska District	Where will the sediment go?	Section 3.3.1 Geology and Soils
1-28-04 USACE, Alaska District Mtg.	Project Manager, Regulatory Branch, USACE, Alaska District	Why is the expansion so big?	Chapter 1
2-5-04 USACE, Alaska District Follow-up Mtg.	Project Manager, Regulatory Branch, USACE, Alaska District	Reasons for not using landside instead of tidelands - AF property/Elephant Cage/CZ & APZ	Chapter 2
2-5-04 USACE, Alaska District Follow-up Mtg.	Regulatory Branch, USACE, Alaska District	What impact will the POA expansion have on maintenance dredging?	Section 3.3.1 Geology and Soils
2-26-04 USACE, Alaska District 2nd Follow-up Mtg.	Regulatory Branch, USACE, Alaska District	Loss of wetlands (tidelands)	Section 3.3.4 Biological Resources
1-9-04 GAC Mtg.	Municipality of Anchorage	Socioeconomic benefits	Section 3.4.6 Socioeconomics
1-9-04 GAC Mtg.	Geotechnical Advisory Committee	Seismic resistance	Section 3.3.1 Geology and Soils

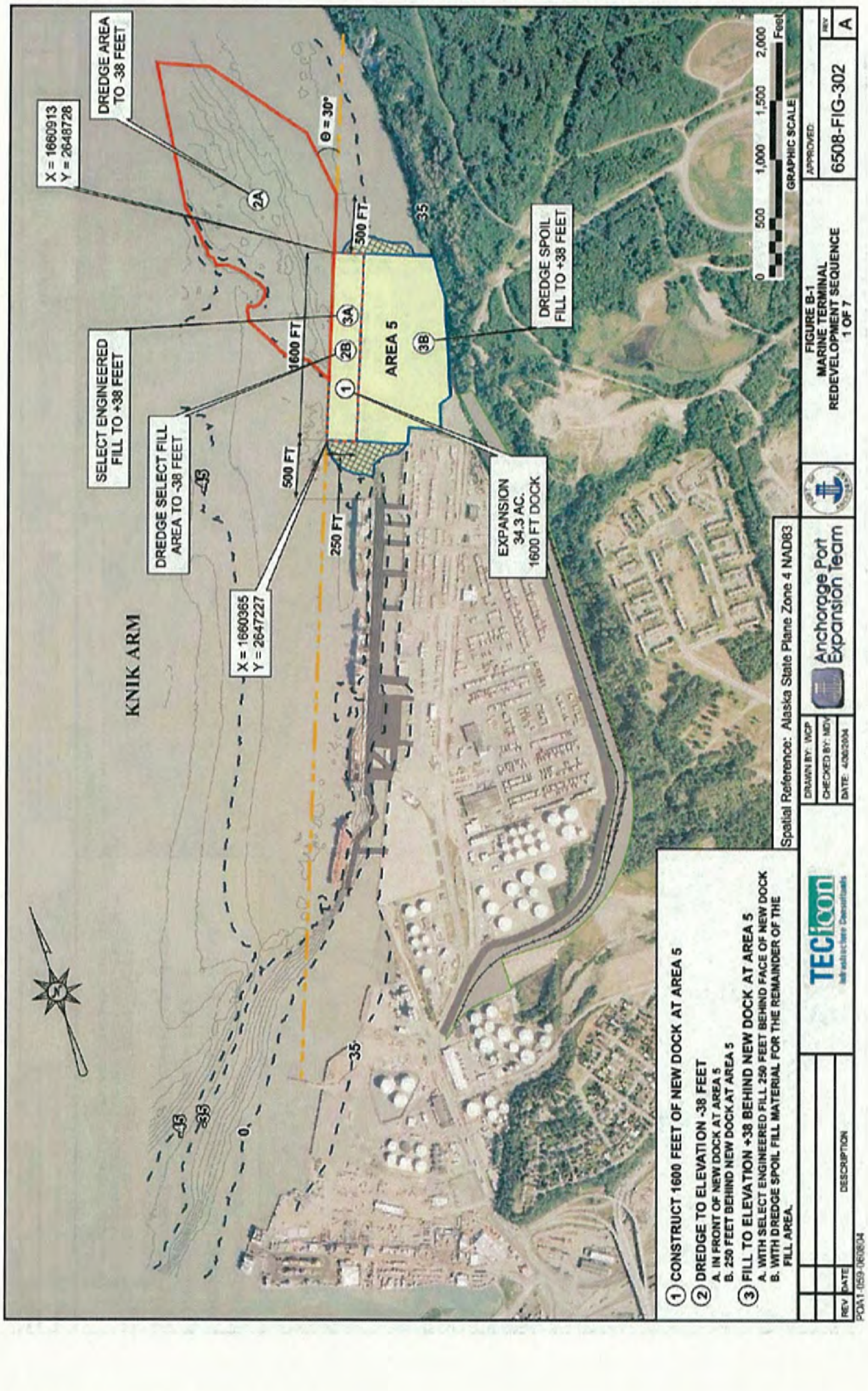
CONCLUSION

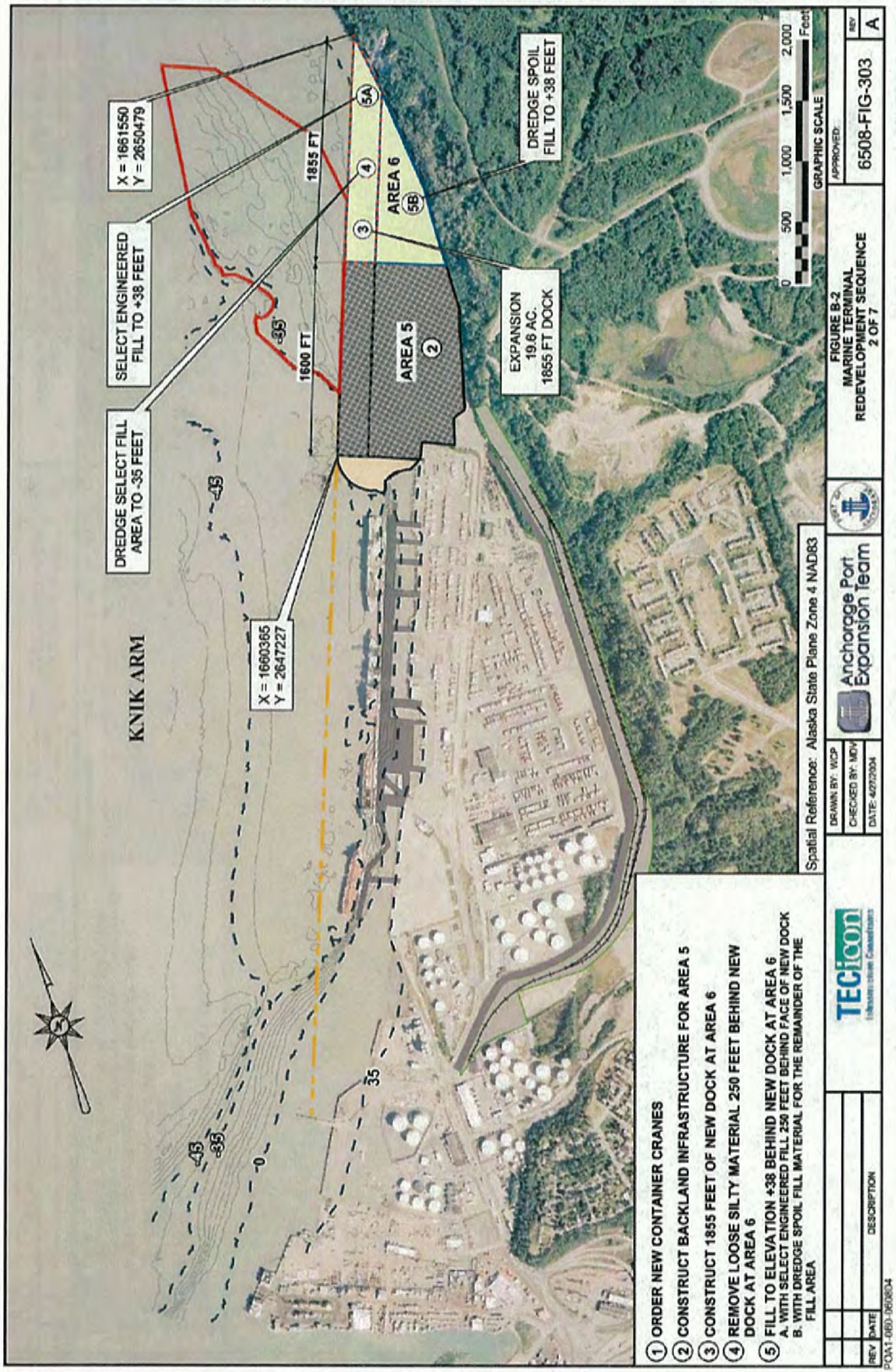
The scoping process for the Marine Terminal Redevelopment EA resulted in both public and agency input into the document. The public and agencies were adequately notified of the proposal and scoping process – 850 flyers were posted to local residents, three agency scoping meetings were conducted, and over 30 agency participants from federal, state, and local agencies gave input on issues and concerns. Forty-one people attended the public scoping meeting on January 15, 2004. The public was given ample opportunity to comment over the 30-day comment period; three comments were received. Relevant issues and concerns received during the scoping period were addressed in the draft EA.

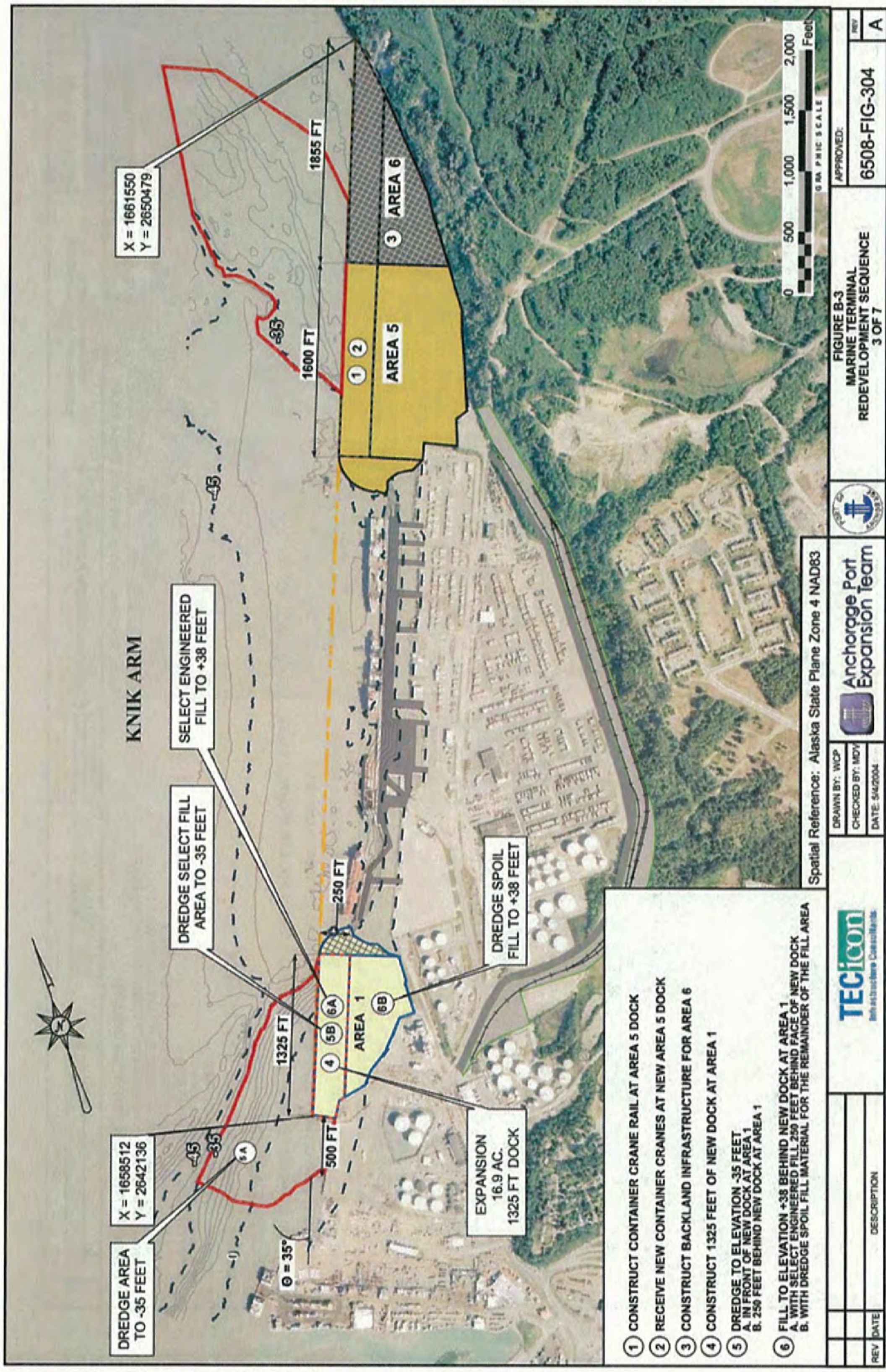
In addition to public scoping, MARAD and the POA published the Draft Marine Terminal Redevelopment EA on August 11, 2004. The document publication was announced in the *Federal Register* (MARAD 2004a) and in local newspapers, and the document was made available to the public and agencies through public websites (www.portofanchorage.org and http://dms.dot.gov), at the Loussac Library, and by providing individual copies on request. A public comment period was held from August 11 to September 17, 2004 (MARAD 2004b). The goal during this process was to solicit comments concerning the analysis presented in the draft EA. MARAD and the POA received comments from the public, federal, state, and municipal agencies. Following the public comment period, a final EA was prepared. This document is a revision of the draft EA, including consideration of all comments, and provides the MARAD decisionmaker with a comprehensive review of the proposed action and alternatives and their potential environmental consequences. A summary of the comments received during the public comment period is included in Appendix H.

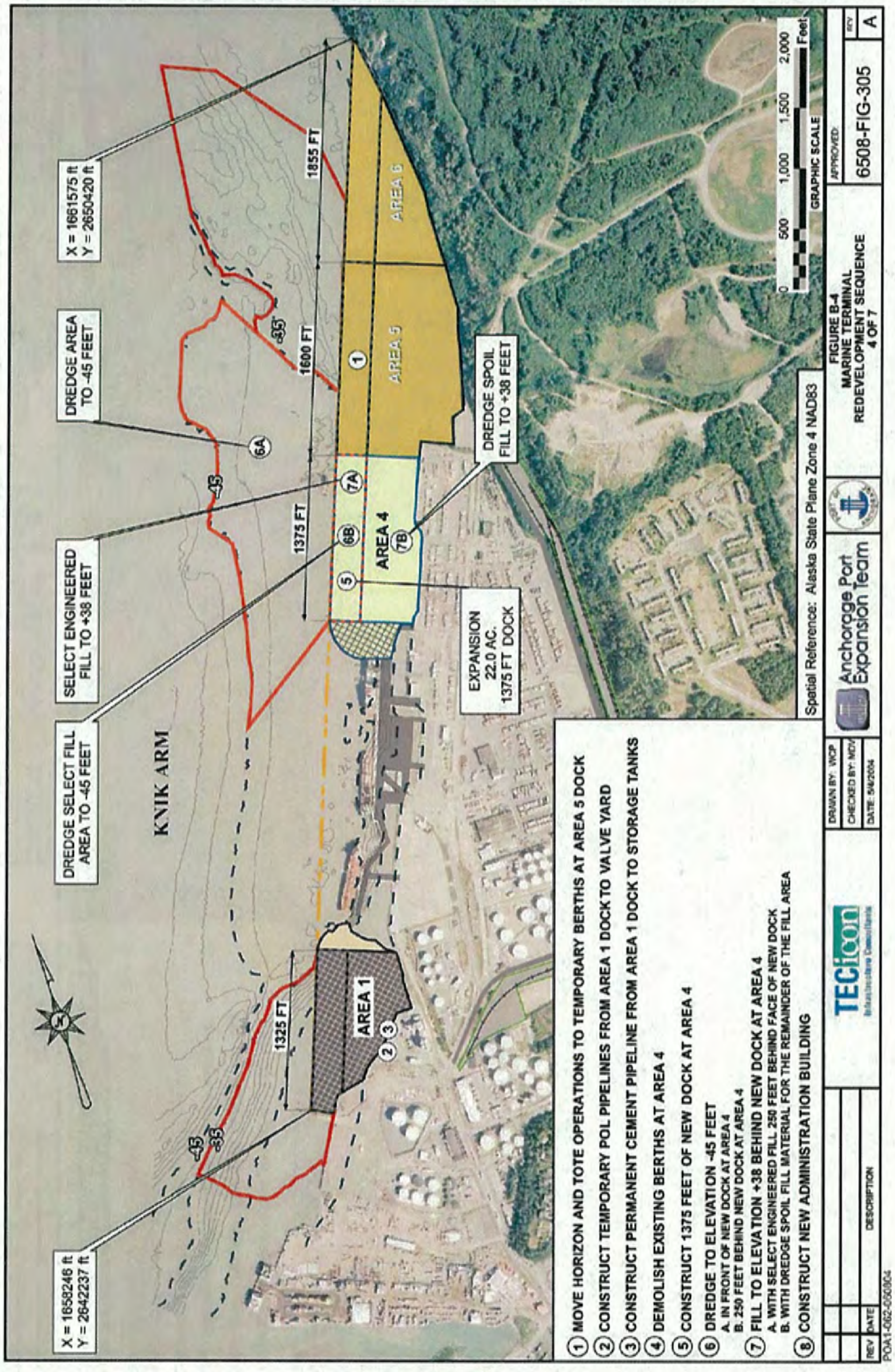
APPENDIX B

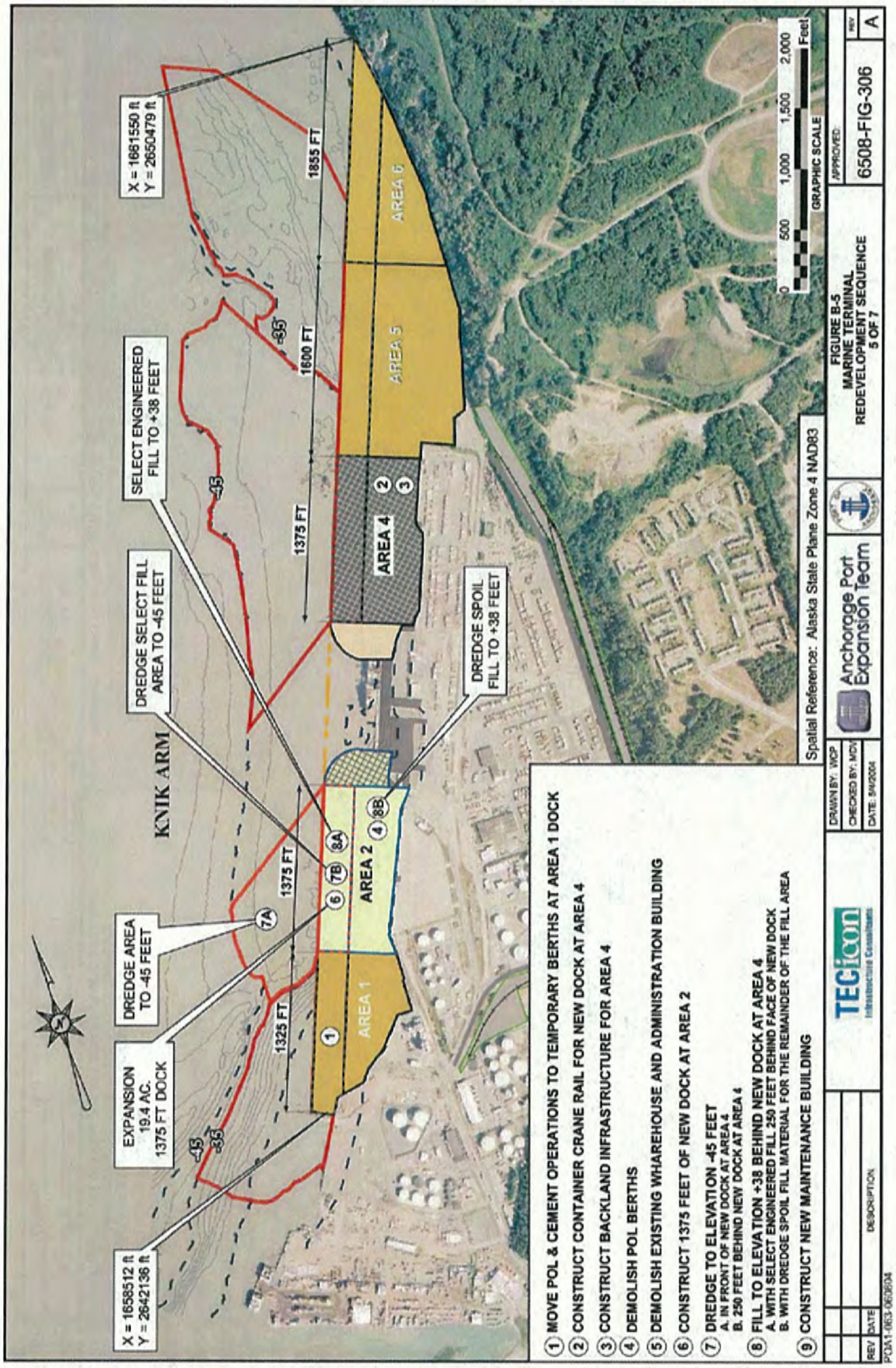
AREA CONSTRUCTION SEQUENCING

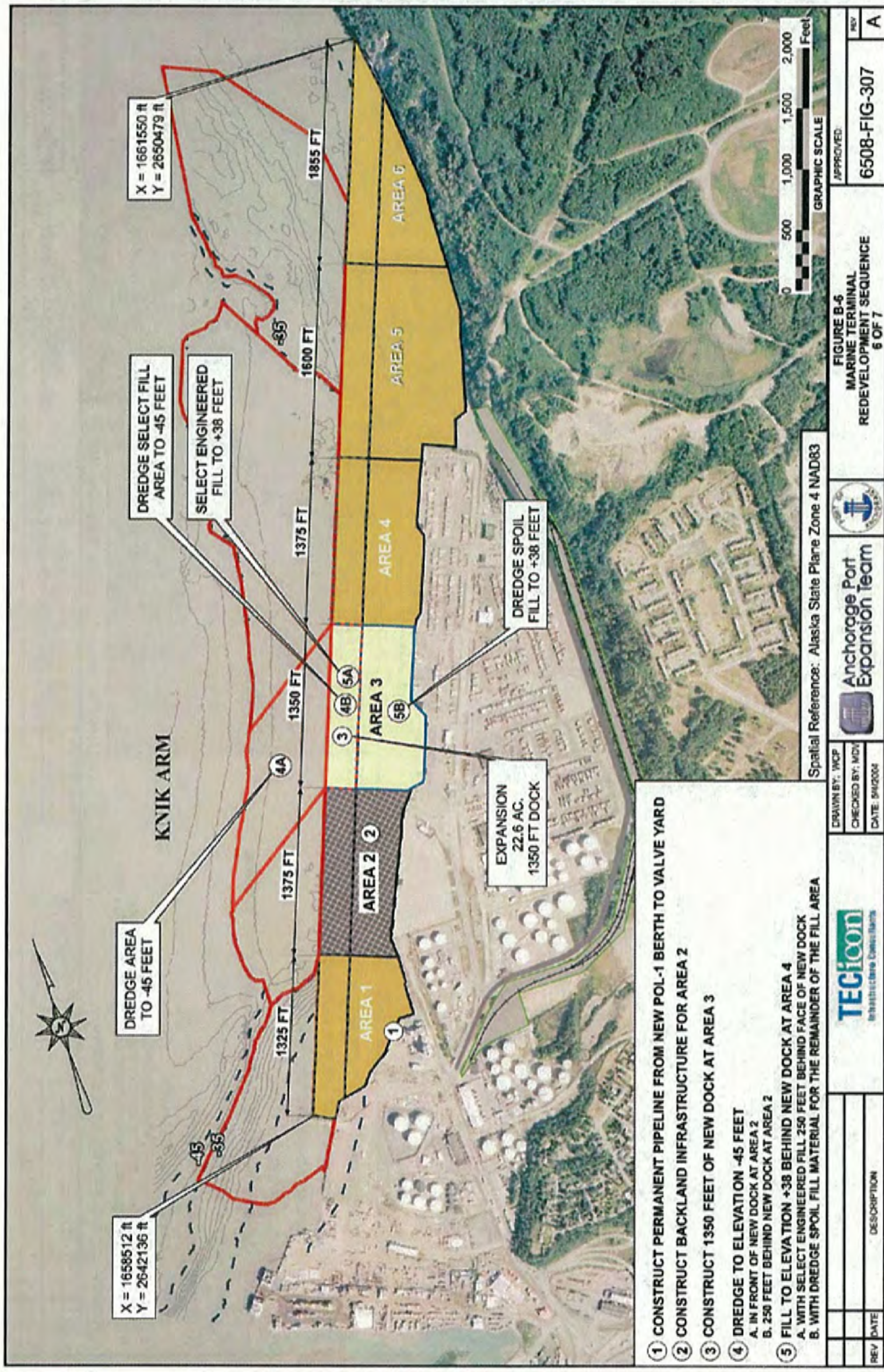

KNIK ARM
X = 1660913
Y = 2648726
DREDGE AREA TO -38 FEET
θ = 30°
SELECT ENGINEERED FILL TO +38 FEET
DREDGE SELECT FILL AREA TO -38 FEET
X = 1660365
Y = 2647227
1600 FT
500 FT
500 FT
250 FT
AREA 5
EXPANSION 34.3 AC. 1600 FT DOCK
DREDGE SPOIL FILL TO +38 FEET
1 CONSTRUCT 1600 FEET OF NEW DOCK AT AREA 5
2 DREDGE TO ELEVATION -38 FEET
A. IN FRONT OF NEW DOCK AT AREA 5
B. 250 FEET BEHIND NEW DOCK AT AREA 5
3 FILL TO ELEVATION +38 BEHIND NEW DOCK AT AREA 5
A. WITH SELECT ENGINEERED FILL 250 FEET BEHIND FACE OF NEW DOCK
B. WITH DREDGE SPOIL FILL MATERIAL FOR THE REMAINDER OF THE FILL AREA.
Spatial Reference: Alaska State Plane Zone 4 NAD83
TECicon
Anchorage Port Expansion Team
FIGURE B-1
MARINE TERMINAL REDEVELOPMENT SEQUENCE
1 OF 7
GRAPHIC SCALE
0 500 1,000 1,500 2,000 Feet
6508-FIG-302
A

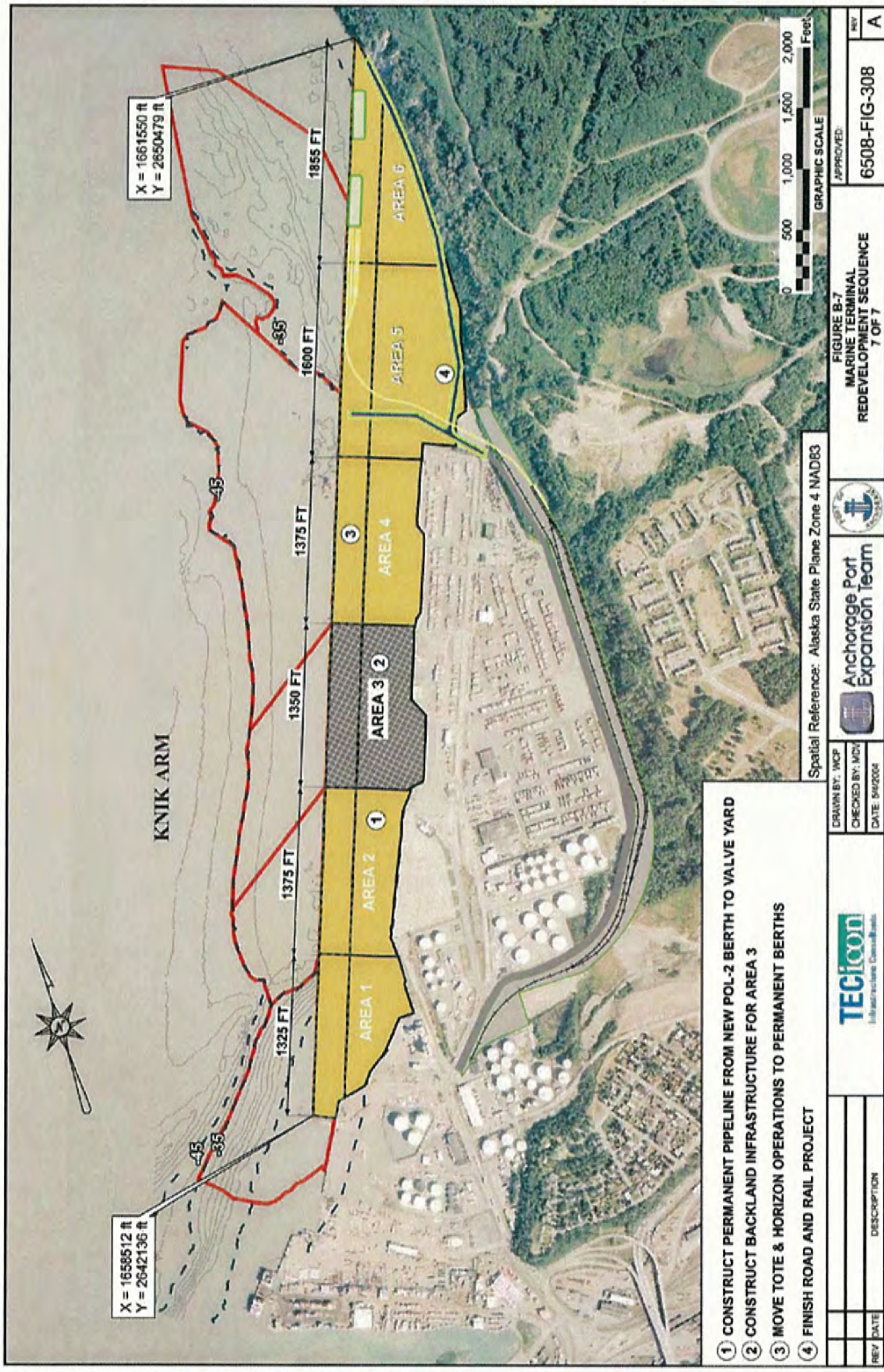

KNIK ARM
DREDGE SELECT FILL AREA TO -35 FEET
SELECT ENGINEERED FILL TO +38 FEET
X = 1661550
Y = 2650479
X = 1660365
Y = 2647227
1855 FT
1600 FT
AREA 5
AREA 6
EXPANSION
19.6 AC.
1855 FT DOCK
DREDGE SPOIL
FILL TO +38 FEET
① ORDER NEW CONTAINER CRANES
② CONSTRUCT BACKLAND INFRASTRUCTURE FOR AREA 5
③ CONSTRUCT 1855 FEET OF NEW DOCK AT AREA 6
④ REMOVE LOOSE SILTY MATERIAL 250 FEET BEHIND NEW DOCK AT AREA 6
⑤ FILL TO ELEVATION +38 BEHIND NEW DOCK AT AREA 6
A. WITH SELECT ENGINEERED FILL 250 FEET BEHIND FACE OF NEW DOCK
B. WITH DREDGE SPOIL FILL MATERIAL FOR THE REMAINDER OF THE FILL AREA
Spatial Reference: Alaska State Plane Zone 4 NAD83
GRAPHIC SCALE
Anchorage Port Expansion Team
FIGURE B-2
MARINE TERMINAL
REDEVELOPMENT SEQUENCE
2 OF 7
6508-FIG-303
A


KNIK ARM
DREDGE AREA TO -35 FEET
X = 1658512 Y = 2642136
X = 1661550 Y = 2650479
DREDGE SELECT FILL AREA TO -35 FEET
SELECT ENGINEERED FILL TO +38 FEET
DREDGE SPOIL FILL TO +38 FEET
EXPANSION 16.9 AC. 1325 FT DOCK
1325 FT
500 FT
250 FT
1600 FT
1855 FT
AREA 1
AREA 5
AREA 6
Θ = 35°
1 CONSTRUCT CONTAINER CRANE RAIL AT AREA 5 DOCK
2 RECEIVE NEW CONTAINER CRANES AT NEW AREA 5 DOCK
3 CONSTRUCT BACKLAND INFRASTRUCTURE FOR AREA 6
4 CONSTRUCT 1325 FEET OF NEW DOCK AT AREA 1
5 DREDGE TO ELEVATION -35 FEET
A. IN FRONT OF NEW DOCK AT AREA 1
B. 250 FEET BEHIND NEW DOCK AT AREA 1
6 FILL TO ELEVATION +38 BEHIND NEW DOCK AT AREA 1
A. WITH SELECT ENGINEERED FILL 250 FEET BEHIND FACE OF NEW DOCK
B. WITH DREDGE SPOIL FILL MATERIAL FOR THE REMAINDER OF THE FILL AREA
Spatial Reference: Alaska State Plane Zone 4 NAD83
Anchorage Port Expansion Team
TECicon
DRAWN BY: WCP
CHECKED BY: MDY
DATE: 5/4/2004
FIGURE B-3
MARINE TERMINAL REDEVELOPMENT SEQUENCE
3 OF 7
6508-FIG-304
A
0 500 1,000 1,500 2,000 Feet
POA1-061-060804


KNIK ARM
X = 1658246 ft
Y = 2642237 ft
DREDGE SELECT FILL AREA TO -45 FEET
SELECT ENGINEERED FILL TO +38 FEET
DREDGE AREA TO -45 FEET
X = 1661575 ft
Y = 2650420 ft
1325 FT
1375 FT
1600 FT
1855 FT
AREA 1
AREA 4
AREA 5
AREA 6
EXPANSION
22.0 AC.
1375 FT DOCK
DREDGE SPOIL FILL TO +38 FEET
1 MOVE HORIZON AND TOTE OPERATIONS TO TEMPORARY BERTHS AT AREA 5 DOCK
2 CONSTRUCT TEMPORARY POL PIPELINES FROM AREA 1 DOCK TO VALVE YARD
3 CONSTRUCT PERMANENT CEMENT PIPELINE FROM AREA 1 DOCK TO STORAGE TANKS
4 DEMOLISH EXISTING BERTHS AT AREA 4
5 CONSTRUCT 1375 FEET OF NEW DOCK AT AREA 4
6 DREDGE TO ELEVATION -45 FEET
A. IN FRONT OF NEW DOCK AT AREA 4
B. 250 FEET BEHIND NEW DOCK AT AREA 4
7 FILL TO ELEVATION +38 BEHIND NEW DOCK AT AREA 4
A. WITH SELECT ENGINEERED FILL 250 FEET BEHIND FACE OF NEW DOCK
B. WITH DREDGE SPOIL FILL MATERIAL FOR THE REMAINDER OF THE FILL AREA
8 CONSTRUCT NEW ADMINISTRATION BUILDING
Spatial Reference: Alaska State Plane Zone 4 NAD83
GRAPHIC SCALE
0 500 1,000 1,500 2,000 Feet
TECicon
Anchorage Port Expansion Team
FIGURE B-4
MARINE TERMINAL REDEVELOPMENT SEQUENCE
4 OF 7
6508-FIG-305
A


KNIK ARM
X = 1658512 ft
Y = 2642136 ft
EXPANSION
19.4 AC.
1375 FT DOCK
DREDGE AREA
TO -45 FEET
DREDGE SELECT FILL
AREA TO -45 FEET
SELECT ENGINEERED
FILL TO +38 FEET
DREDGE SPOIL
FILL TO +38 FEET
X = 1661550 ft
Y = 2650479 ft
1325 FT
1375 FT
1375 FT
1600 FT
1855 FT
-45
-35
AREA 1
AREA 2
AREA 4
AREA 5
AREA 6
1 MOVE POL & CEMENT OPERATIONS TO TEMPORARY BERTHS AT AREA 1 DOCK
2 CONSTRUCT CONTAINER CRANE RAIL FOR NEW DOCK AT AREA 4
3 CONSTRUCT BACKLAND INFRASTRUCTURE FOR AREA 4
4 DEMOLISH POL BERTHS
5 DEMOLISH EXISTING WHAREHOUSE AND ADMINISTRATION BUILDING
6 CONSTRUCT 1375 FEET OF NEW DOCK AT AREA 2
7 DREDGE TO ELEVATION -45 FEET
A. IN FRONT OF NEW DOCK AT AREA 4
B. 250 FEET BEHIND NEW DOCK AT AREA 4
8 FILL TO ELEVATION +38 BEHIND NEW DOCK AT AREA 4
A. WITH SELECT ENGINEERED FILL 250 FEET BEHIND FACE OF NEW DOCK
B. WITH DREDGE SPOIL FILL MATERIAL FOR THE REMAINDER OF THE FILL AREA
9 CONSTRUCT NEW MAINTENANCE BUILDING
Spatial Reference: Alaska State Plane Zone 4 NAD83
GRAPHIC SCALE
0 500 1,000 1,500 2,000 Feet
TECicon
Anchorage Port Expansion Team
FIGURE B-5
MARINE TERMINAL
REDEVELOPMENT SEQUENCE
5 OF 7
6508-FIG-306
A


KNIK ARM
DREDGE AREA TO -45 FEET
DREDGE SELECT FILL AREA TO -45 FEET
SELECT ENGINEERED FILL TO +38 FEET
DREDGE SPOIL FILL TO +38 FEET
EXPANSION 22.6 AC. 1350 FT DOCK
X = 1658512 ft Y = 2642136 ft
X = 1661550 ft Y = 2650479 ft
1325 FT
1375 FT
1350 FT
1375 FT
1600 FT
1855 FT
AREA 1
AREA 2
AREA 3
AREA 4
AREA 5
AREA 6
1 CONSTRUCT PERMANENT PIPELINE FROM NEW POL-1 BERTH TO VALVE YARD
2 CONSTRUCT BACKLAND INFRASTRUCTURE FOR AREA 2
3 CONSTRUCT 1350 FEET OF NEW DOCK AT AREA 3
4 DREDGE TO ELEVATION -45 FEET
A. IN FRONT OF NEW DOCK AT AREA 2
B. 250 FEET BEHIND NEW DOCK AT AREA 2
5 FILL TO ELEVATION +38 BEHIND NEW DOCK AT AREA 4
A. WITH SELECT ENGINEERED FILL 250 FEET BEHIND FACE OF NEW DOCK
B. WITH DREDGE SPOIL FILL MATERIAL FOR THE REMAINDER OF THE FILL AREA
Spatial Reference: Alaska State Plane Zone 4 NAD83
Anchorage Port Expansion Team
TEC/con
GRAPHIC SCALE
0 500 1,000 1,500 2,000 Feet
FIGURE B-6
MARINE TERMINAL REDEVELOPMENT SEQUENCE
6 OF 7
6508-FIG-307


KNIK ARM
X = 1658512 ft
Y = 2642136 ft
X = 1661550 ft
Y = 2650479 ft
1325 FT
1375 FT
1350 FT
1375 FT
1600 FT
1855 FT
AREA 1
AREA 2
AREA 3
AREA 4
AREA 5
AREA 6
① CONSTRUCT PERMANENT PIPELINE FROM NEW POL-2 BERTH TO VALVE YARD
② CONSTRUCT BACKLAND INFRASTRUCTURE FOR AREA 3
③ MOVE TOTE & HORIZON OPERATIONS TO PERMANENT BERTHS
④ FINISH ROAD AND RAIL PROJECT
Spatial Reference: Alaska State Plane Zone 4 NAD83
GRAPHIC SCALE
Anchorage Port Expansion Team
FIGURE B-7
MARINE TERMINAL
REDEVELOPMENT SEQUENCE
7 OF 7
6508-FIG-308

APPENDIX C

AIR QUALITY

Table C-1 Summary CO Emissions

Baseline CO Emissions (tons)	
Port Generated Traffic	
Truck	63
Rail	0
Auto	69
Port Operations	
Crane	5
Vessel	6
Hostler	13
TOTAL BASELINE	156

Projected CO Emissions (tons)			
Port Generated Traffic	2010	2015	2020
Truck	3	10	26
Rail	1	1	1
Auto	15	24	44
Port Operations			
Crane	1	1	3
Vessel	1	2	2
Hostler	2	4	7
Construction			
Maximum Season	73	---	---
TOTAL CHANGE	96	41	83

Table C-2 Summary Locomotive Operational CO Emissions

SD70 Locomotive
Duty-cycle Average Fuel consumption

	pounds/hour	gal/hour
Line-haul	394	56
Switch	133	19

Year	Train Movements per day	Train Time in Mode (hours/day)		Daily Fuel Consumption (gal)		CO Emission Factor (grams/gal)		Total CO Emission (tons)		Total Combined Annual CO Emissions (tons)	Change from Baseline (annual)
		Switch	*Line Haul*	*Switch*	*Line Haul*	*Switch*	*Line Haul*	*Switch*	*Line Haul*		
2003	0	0.733	0.25	0.000	0.000	38.1	26.6	0.00	0.00	0.00	0.00
2005	0	0.733	0.25	0.000	0.000	38.1	26.6	0.00	0.00	0.00	0.00
2008	1	0.733	0.25	41.640	41.952	38.1	26.6	0.64	0.45	1.09	1.09
2020	1	0.733	0.25	41.640	41.952	38.1	26.6	0.64	0.45	1.09	1.09
2025	2	0.733	0.25	83.280	83.904	38.1	26.6	1.28	0.90	2.17	2.17

Assumptions:
- Trains each have 3 locomotives
- Travel through Maintenance Area is 14 miles of ARRC track
- 4 miles is within the yards with a speed limit of 10 mph, and is characterized by switch operation
- 10 miles is outside of the yards with an average speed of 40 mph
- Each train idles for 20 minutes within the yard area per train movement
- gal = gallon

Table C-3 Vessel Calls Operational CO Emissions

Assumptions and Methodology based on the MOA Emission Calculation Procedures based on Emission Factors Derived from Procedures for Emission Inventory Preparation, Volume IV: Mobile Source EPA-450, 4-81-026d (revised), July 1989

Year	Total Vessel Calls (per year)	Vessel Calls (per day)	CO Emission Factors (per ship per day)			Total CO Emissions (tons)		Change from Baseline (annual)
			Dockside	*Underway*	*Total*	*Daily*	*Annual*	
2003	491	1	16	8	24	0	6	0
2005	514	1	16	8	24	0	6	0
2008	542	1	16	8	24	0	6	1
2010	565	2	16	8	24	0	7	1
2015	625	2	16	8	24	0	7	2
2020	690	2	16	8	24	0	8	2
2025	763	2	16	8	24	0	9	3

Table C-4 Container Crane Operational CO Emissions

Emission Factors taken from Nonroad Engine and Vehicle Emission Study Report PBN92126960, USEPA, Office of Mobile Sources, November 1991.

Year	Total Hours of Crane Operation (per year)	Container Crane (hp)	Load Factor (%)	CO Emission Factor (g/bhp-hr)	Annual CO Emissions (tons)	Change from Baseline (annual)
2003	3,256	725	43%	4.2	4.695	0.00
2005	3,434	725	43%	4.2	4.952	0.26
2008	3,599	725	43%	4.2	5.190	0.49
2010	3,750	725	43%	4.2	5.408	0.71
2015	4,144	725	43%	4.2	5.976	1.28
2020	4,579	725	43%	4.2	6.603	1.91
2025	5,060	725	43%	4.2	7.297	2.60

Horsepower (hp) is estimated for a 45 T (rated 40 long tons) dockside container crane
2 engines at 300 hp continuous rated (main hoist)
1 engine at 125 hp continuous rated (trolley travel motor)
g/bhp-hr = grams per boiler horsepower per hour

Table C-5 Yard Hostler Operational CO Emissions

Emission Factors taken from Nonroad Engine and Vehicle Emission Study Report PBN92126960, US EPA, Office of Mobile Sources, November 1991.

Year	Total Yard Hostler hours (per year)	Yard Hostler (hp)	Load Factor (%)	CO Emission Factor (g/bhp-hr)	Annual CO Emissions (tons)	Change from Baseline (annual)
2003	59,500	173	41%	2.8	13.014	0.00
2005	62,750	173	41%	2.8	13.725	0.71
2008	65,770	173	41%	2.8	14.386	1.37
2010	68,532	173	41%	2.8	14.990	1.98
2015	75,728	173	41%	2.8	16.564	3.55
2020	83,680	173	41%	2.8	18.303	5.29
2025	92,466	173	41%	2.8	20.225	7.21

Emission Factor (EF) is for off-highway diesel trucks

Note there are also emission factors for off-highway tractors:
Load Factor = 65%, EF = 14.68 grams per boiler horsepower-hour

hp = horsepower
g/bhp-hr = grams per boiler horsepower per hour

Table C-6 Truck and Privately Owned Vehicle Operational CO Emissions

Assumptions:

Travel through Maintenance Area is 10 miles roundtrip

Total Annual Truck Emissions						
Year	*Truck Trips (per year)*	*CO Emission Factor (grams/mile)*	*Average Roundtrip (miles)*	*Grams to Pounds*	*Total CO Emissions (tons)*	*Change from 2003*
2003	277,700	20.508	2,777,000	125,442.1	63	0
2005	292,279	20.508	2,922,790	132,027.7	66	3
2008	280,135	20.508	2,801,350	126,542.0	63	1
2010	291,901	20.508	2,919,010	131,857.0	66	3
2015	322,550	20.508	3,225,500	145,701.7	73	10
2020	356,418	20.508	3,564,180	161,000.4	81	18
2025	393,842	20.508	3,938,420	177,905.5	89	26

Total Annual POV Emissions						
Year	*Auto Trips (per year)*	*CO Emission Factor (grams/mile)*	*Average Roundtrip (miles)*	*Grams to Pounds*	*Total CO Emissions (tons)*	*Change from 2003*
2003	303,576	20.508	3,035,760	137,130.8	69	0
2005	319,488	20.508	3,194,880	144,318.5	72	4
2008	335,088	20.508	3,350,880	151,365.3	76	7
2010	370,032	20.508	3,700,320	167,150.1	84	15
2015	408,408	20.508	4,084,080	184,485.3	92	24
2020	450,840	20.508	4,508,400	203,652.6	102	33
2025	497,640	20.508	4,976,400	224,793.0	112	44

Table C-7 Proposed Action Total Construction Emissions

Construction Activity	Equipment Type	Number per Shift	Number of Days in Use	Hours of Operation per Shift	hp	Load	CO Emission Factors (g/bhp-hr)
Demolition	Tracked Dozer	1	70	16	160	57.5%	3.800
	Back Hoe	1	70	16	74	46.5%	6.800
	Dump Truck	3	70	16	489	41.0%	2.800
Transport of Fill	Train	1	137	16		50.0%	---
	Barge	2	137	16		70.0%	---
	Dump Trucks	160	9	16	489	41.0%	2.800
Dock Construction	Barge Pile Driver	1	128	10	325	62.0%	9.200
	Dock Dredgers	2	130	10	2,000	75.0%	---
	Hopper Barge	2	130	10	2,000	70.0%	---
	Tugboats	2	130	10	1,600	70.0%	---
Compaction	Pile Driver	1	60	10	325	62.0%	9.200

hp = horsepower

g/bhp-hr = grams per boiler horsepower per hour

Total Construction Emission Calculations Proposed Action			
Tons per Phase Duration			
Activity	***Equipment Type***	***CO***	***PM_{10}***
Demolition	Tracked Dozer	0.4316	
	Back Hoe	0.2889	
	Dump Truck	2.0792	
Fill Transport	Train	0.6880	
	Barge	9.4512	
	Dump Trucks	14.2574	
Fill	Operations		71.4000
Dock Construction	Barge Pile Driver	2.6156	
	Dock Dredgers	12.8700	
	Hopper Barge	#VALUE!	
	Tugboats	#VALUE!	
	Pile Driver	1.2261	
Construction Travel	Trucks (travel)	0.3252	
	POVs (travel)	1.5810	
	Trucks (idle)	0.0149	
	TOTAL	***#VALUE!***	***71.4000***

POVs = Privately Owned Vehicles

Table C-8 Proposed Action - Construction Related Truck and Privately Owned Vehicle CO Emissions

Travel	CO Emission Factor (grams/mile)	Total Miles	Grams to Pounds	Total CO Emissions (tons) Maximum Construction Year
Truck (HDDV)[1]	20.508	14,400	650.4740088	0.325237004
POV (HBW local)[2]	20.508	70,000	3,162.026432	1.581013216

[1]Assumes 160 trucks/day for 9 days/10 miles round trip per truck
[2]Assumes 50 cars avg/140 days/10 miles round trip average per car
HDDV = Heavy Duty Diesel Vehicle
HBW = Home-Based Work

Idle		CO Emission Factor Summer	Time	Summer Grams to Pounds	Total CO Emissions Summer (tons)
Truck (HDDV)	grams/hour	94		0.00000	0.00000
	grams/min	1.57	8,640	29.87841	0.01494

Assumes 6 minutes idle/truck/160 trucks per day/9 days

Table C-9 Proposed Action - Construction Related Locomotive CO Emissions

SD70 Locomotive Duty-Cycle Average Fuel Consumption		
	(lb/hr)	*(gal/hr)*
Line-haul	394	56
Switch	133	19

Assumptions:

- Trains each have 3 locomotives
- Travel through Maintenance Area is 14 miles of ARRC track
- 4 miles is within the yards with a speed limit of 10 mph, and is characterized by switch operation
- 137 days maximum year
- 10 miles is outside of the yards with an average speed of 40 mph
- Each train idles for 20 minutes within the yard area per train movement

	Train Time in Mode (hrs/day)			Daily Fuel Consumption		CO Emission Factor (g/gal)		Annual CO Emissions (tons)		
	Train Movements per day	*Switch*	*Line Haul*	*Switch*	*Line Haul*	*Switch*	*Line Haul*	*Switch*	*Line Haul*	*TOTAL*
Construction Season	1	0.733	0.25	41.640	41.952	38.1	26.6	0.24	0.45	0.69

grams/gallon = g/gal

Table C-10 Proposed Action - Construction Related Fill and Dredging Emissions

Equipment	LF	Rated (hp)	hours/day	days	total hrs
Dock Dredgers	75%	2,000	12	260	3,120

Emission Factors (lb/hp-hr) (Ref 1)				
VOC	CO	NO_X	PM_{10}	SO_X
0.0007	0.0055	0.0240	0.0007	0.0081

Emissions (tons)				
VOC	CO	NO_X	PM_{10}	SO_X
1.65	12.87	56.16	1.64	18.93

Equipment	LF	Rated (hp)	hours/day	days	total hrs
Transport Barge	70%	2,000	---	---	1,644
Dock Tug Boats	70%	1,600	---	---	2,600
Dock Hopper Barges	70%	2,000	---	---	2,600

Emission Factors (g/kw-hr) (Ref 2)				
VOC	CO	NO_X	PM_{10}	SO_X
0.5000	5.0000	16.5000	0.2700	---
0.5000	5.0000	16.5000	0.2700	---
0.5000	5.0000	16.5000	0.2700	---

	Emissions (tons)				
	VOC	CO	NO_X	PM_{10}	SO_X
	0.95	9.45	31.19	0.51	--
	1.20	11.96	39.46	0.65	--
	1.49	14.95	49.33	0.81	--
TOTAL	2.85	24.83	95.62	2.28	18.93

No_x = Nitrous Oxides
So_x = Sulfur Oxides

Fill Operations	months	acres	month-acre	cubic yards	cubic yards (by thousands)
Construction Season	5.00	34.00	170.00	2,218,537.00	2,218.54

LF = Load Factor
hp = horsepower

Emission Factors (Ref 3)	PM_{10}
Fill TOTAL	71.4000

lb/hp-hr = pounds per horsepower hour
g/kwh = grams per kilowatt hour

ASSUMPTIONS:

Average scow capacity	4,000 cubic yards
Tug trips	5 trips
20 nautical miles for scow to disposal site	40 nautical miles round trip
Average speed	10 knots
1 Kilowatt =	1.341hp
Time for each disposal round trip	4 hours
Total tug time for 2 tugs per day	20 hours

REFERENCES:

1) AP-42 Compilation of Air Pollutant Emission Factors, Chapter 3,4 Large Stationary Diesel and all Stationary Dual Fuel Engines, October 1996
2) Final Regulatory Impact Analysis: Control of Emissions from Marine Diesel Engines, US EPA, November 1999. Table 3-3 Emissions Data from Baseline Category 2 Marine Diesel Engines
3) Improvement of Specific Emission Factors (BACM Project No. 1). Final Report. Midwest Research Institue, Kansas City, MO. March 1996 Level 1 , worst case scenario, emissions factor was applied for fill operations.

Table C-11 Total Construction Emissions for No-Action

Construction Activity	Equipment Type	No. per Shift	No. of Days in Use	Hrs. of Operation per Shift	Rated (hp)	Load	CO Emission Factors (g/bhp-hr)
Demolition	Tracked Dozer	1	160	16	160	57.5%	3.800
	Back Hoe	1	160	16	74	46.5%	6.800
	Dump Truck	3	160	16	489	41.0%	2.800
Transport of Fill	Train	1	0	16		50.0%	---
	Barge	2	0	16		70.0%	---
	Dump Trucks	160	0	16	489	41.0%	2.800
Dock Construction	Barge Pile Driver	1	180	12	325	62.0%	9.200
	Dock Dredgers	2	0	10	2,000	75.0%	---
	Hopper Barge	2	0	10	2,000	70.0%	---
	Tugboats	2	0	10	1,600	70.0%	---
Compaction	Pile Driver	1	0	10	325	62.0%	9.200

hp = Horsepower
g/bhp-hr = grams per boiler horsepower per hour

Total Construction Emission Calculations			
Tons per Phase Duration			
Activity	***Equipment Type***	***CO***	***PM_{10}***
Demolition	Tracked Dozer	0.9865	
	Back Hoe	0.6603	
	Dump Truck	4.7525	
Steel Transport	Train	0.6880	
	Barge	0.6899	
	Dump Trucks	0.0000	
Fill	Operations		0.0000
Dock Construction	Barge Pile Driver	4.4139	
	Dock Dredgers	0.0000	
	Hopper Barge	0.0000	
	Tugboats	0.0000	
	Pile Driver	0.0000	
Construction Travel	Trucks (travel)	0.1016	
	POVs (travel)	1.5810	
	Trucks (idle)	0.0299	
	TOTAL	***14***	***0.0000***

Table C-12 Construction Related Truck and Privately Owned Vehicle CO Emissions for No-Action

Travel	CO Emission Factor (grams/mile)	Total Miles	Grams to Pounds	Total CO Emissions (tons)
Truck (HDDV)[1]	20.508	4,500	203.2731278	0.101636564
POV (HBWlocal)[2]	20.508	70,000	3,162.026432	1.581013216

[1]Assumes 160 trucks/day for 9 days/10 miles round trip per truck

[2]Assumes 50 cars avg/140 days/10 miles round trip average per car

HDDV = Heavy Duty Diesel Vehicle

HBW = Home Based Work

Idle		2005 CO Emission Factor Summer	Time	Summer Grams to Pounds	2005 Total CO Emissions Summer (tons)
Truck (HDDV)	grams/hour	94		0.00000	0.00000
	grams/min	1.57	17280	59.75683	0.02988

Assumes 12 minutes idle/truck/50 trucks per day/9 days

Table C-13 Construction Related Locomotive CO Emissions for No-Action

SD70 Locomotive Duty-Cycle Average Fuel Consumption		
	(pounds/ hour)	*(gal/ hour)*
Line-haul	394	56
Switch	133	19

gal = gallon

Assumptions:

Trains each have 3 locomotives
Travel through Maintenance Area is 14 miles of ARRC track
4 miles is within the yards with a speed limit of 10 mph, and is characterized by switch operation
137 days in maximum year
10 miles is outside of the yards with an average speed of 40 mph
Each train idles for 20 minutes within the yard area per train movement

	Train Time in Mode (hours/day)			Daily Fuel Consumption		Emission Factor (grams/gal)		Annual CO Emissions (tons)		
	Train Movements per day	*Switch*	*Line Haul*	*Switch*	*Line Haul*	*Switch*	*Line Haul*	*Switch*	*Line Haul*	*TOTAL*
Construction Season	1	0.733	0.25	41.640	41.952	38.1	26.6	0.24	0.45	0.69

gal = gallon

Table C-14 Construction Related Fill and Dredging Emissions for No-Action

Equipment	LF	Rated hp	hours/day	days	total hrs	Emission Factors (lb/hp-hr) (Ref 1) VOC	CO	NO_X	PM_{10}	SO_X	Emissions (tons) VOC	CO	NO_X	PM_{10}	SO_X
Dock Dredgers	75%	2,000	0	0	0	0.0007	0.0055	0.0240	0.0007	0.0081	0.00	0.00	0.00	0.00	0.00

Equipment	LF	Rated hp	hours/day	days	total hrs	Emission Factors (g/kw-hr) (Ref 2) VOC	CO	NO_X	PM_{10}	SO_X	Emissions (tons) VOC	CO	NO_X	PM_{10}	SO_X
Transport Barge	70%	2,000	12	10	120	0.5000	5.0000	16.5000	0.2700	---	0.07	0.69	2.28	0.04	--
Dock Tug Boats	70%	1,600	---	---	0	0.5000	5.0000	16.5000	0.2700	---	0.00	0.00	0.00	0.00	--
Dock Hopper Barges	70%	2,000	---	---	0	0.5000	5.0000	16.5000	0.2700	---	0.00	0.00	0.00	0.00	--
TOTAL											0.00	0.00	0.00	0.00	0.00

Fill Operations	months	acres	month-acre	cubic yards	cubic yards (by thousands)
Construction Season	0.00	34.00	0.00	2218537.00	2218.54

Emission Factors (Ref 3)	PM_{10}
Fill TOTAL	0.0000

LF = Load Factor
hp = horsepower

lb/hp-hr = pounds per horsepower per hour
g/kwh = grams per kilowatt hour

No_x = Nitrous Oxides
So_x = Sulfur Oxides

ASSUMPTIONS:

Average scow capacity	4,000 cubic yards
Tug trips	5 trips
20 nautical miles for scow to disposal site	40 nautical miles round trip
Average speed	10 knots
1 Kilowatt =	1.341 hp
Time for each disposal round trip	4 hours
Total tug time for 2 tugs per day	20 hours

REFERENCES:

1) AP-42 Compilation of Air Pollutant Emission Factors, Chapter 3,4 Large Stationary Diesel and all Stationary Dual Fuel Engines, October 1996
2) Final Regulatory Impact Analysis: Control of Emissions from Marine Diesel Engines, US EPA, November 1999. Table 3-3 Emissions Data from Baseline Category 2 Marinee Diesel Engines
3) Improvement of Specific Emission Factors (BACM Project No. 1). Final Report. Midwest Research Institue, Kansas City, MO. March 1996 Level 1 , worst case scenario, emissions factor was applied for fill operations.

APPENDIX D

NOISE

APPENDIX D
NOISE

This appendix describes the approach to the noise analysis for the Marine Terminal Redevelopment EA. The approach consists of tracking the noise levels through different phases of the Project at eight specific points of interest. Tracking the noise at each of the specific points included determining the baseline noise levels, noise levels generated through the different phases of construction, and the noise level when the POA is in full operation in 2025. Baseline noise measurements were made in June 2004 to quantify the existing noise levels. These noise levels were used in the modeling process to compute the incremental changes resulting from the proposed action and to assess the impact at each of the sites chosen for the analysis.

There were four parts to the noise analysis: 1) the identification of noise- and vibration-sensitive land uses surrounding the Project area; 2) the quantification of the baseline noise and vibration levels at each of the sites identified; 3) the development of an inventory of the noise sources resulting from the Project; and 4) the determination of the expected noise and vibration impacts at each of the sites. The inventory consisted of the number and location of each of the sources, the expected periods of operation during each phase of the Project, and the reference noise level for each noise source measured at some quantifiable distance, typically 50 feet, from the source. The analysis considered propagation effects such as spherical spreading, ground absorption, and the effect of acoustic barriers that could result from buildings or topographic features. The expected noise levels were compared to the baseline noise levels to determine the severity of the impact. Any sites identified falling within the criteria of severe impact were analyzed to determine viable methods to reduce the noise level.

Noise Metrics Used in Analysis

The two primary noise metrics used in the analysis were the *hourly equivalent sound level* (Leq(1)) and the *day-night average sound level* (Ldn). Both metrics are denoted as dBA. The letter "A" indicates that the sound level has been A-weighted, which means the sound has been filtered to reduce low frequency and high frequency sounds similar to the way the human ear filters sound frequencies. Without the A-weighting, the sound levels reported in this report could represent sound levels that people cannot hear. A-weighted sound levels were used because they accurately characterize the expected sound level for this Project and can be used to determine the associated impacts.

The hourly equivalent sound level (Leq(1)) describes the noise events averaged over a 1-hour period in time. This metric was used to analyze noise sensitive land uses including tracts of land where quiet is an intended purpose for the land use. Some examples include outdoor amphitheaters, national historic landmarks, and parks. Another application of this metric was in situations where it is important to avoid activity interference such as schools, libraries, and churches.

The Ldn describes a noise exposure averaged over a 24-hour period, with noise events between 10 p.m. and 7 a.m. increased by ten decibels (or dB) to account for the greater nighttime sensitivity to noise when people are sleeping. This metric was used in the analysis of residential areas (apartment complexes, residential suburbs, and hospitals).

Description of Analysis Methodology

The very nature of transit projects often necessitates locating the Project area close to a concentration of people in urban areas. Noise and vibration is always a concern with these projects during the planning stages through the development phases, and to the final implementation phase of the project. The FHWA and FTA have developed a standard procedure for the analysis of the impacts. This procedure is described below with adaptation to this specific Project's needs.

Identification of Noise and Vibration Sensitive Land Uses

The first phase of the noise analysis was the identification of noise sensitive land uses. Initial screening for noise-sensitive sites began with maps that show land use near the POA. From these maps, initial sites were chosen for the analysis. Eight locations were chosen for the noise study, including four at the POA and four within the nearby residential areas—two at Cherry Hill housing on Elmendorf AFB and two on Government Hill. Locations of these properties are presented in section 3.2.2 of the EA.

Quantification of the Existing Noise Environment

The intent of the baseline noise measurements was to measure the ambient background noise levels, which are the sounds that are heard without noise resulting from identifiable sources. Identifiable sources could be traffic noise, barking dogs, factory noise, or children at play. Baseline noise levels were made over a continuous 24-hour period at each of the specific points. The noise metrics included a 1-hour Leq, Ldn, Lmax, L1, L10, L50, L33, L90, and L99. All noise metrics were reported as A-weighted sound levels. The measurements were made during calm atmospheric conditions, when the wind speeds were reported to be less than ten knots, and when there were no adverse weather conditions such as rain, sleet, or snow.

Noise measurements were made in open areas where there are no hard reflecting surfaces such as buildings or cliffs. A noise expert visited each site at different times in the day to verify that there was no unusual human activity that might suddenly appear during the measurement phase. If any occurred, it was noted.

Inventory of Noise Sources for Impact Analysis

An inventory of equipment was developed based on the major construction activities (i.e. dredging, filling, paving, demolition). The types of noise sources included in the inventory were all transit modes, all construction operations, and all fixed facilities that could accompany the proposed action. It was important to consider all of the sources because an equivalent noise level can result from a single source that produces a high noise level or multiple lower noise sources acting together. The hourly equivalent sound level and the day-night average sound level are noise metrics with an integration period of 1 hour and 24 hours, respectively. Any calculations involving these metrics require specific definition on the number of pieces of equipment, the expected periods of operation during each phase of construction, and the frequency of use.

Sound levels for construction equipment are reported as either sound pressure level at a specific distance, or as sound power level. For consistency purposes, sound pressure level was used for all source level definition (Tables D-1 to D-5).

Determination of Expected Noise Levels

Noise calculations were based on standard acoustical techniques for propagating sound levels in urban areas. The calculations included spherical spreading, air absorption, ground attenuation, screening from buildings and barriers, and topographic effects. The calculations assumed standard atmospheric conditions during the summer months when people are more active outdoors. Results for Alternatives A, B, C, and No Action are presented in Table D-6.

The noise impact criteria used in Table D-6 are applied to transportation related projects to define when a project could have adverse effects on the community. Generally, there are three levels of impact: no impact, impact, and severe impact. The FTA noise impact criteria are included as Figure D-1. Each noise study site was individually evaluated using these criteria to determine the expected level of impact, given its type of land use. For this analysis, an increase in noise levels 2.5 dBA or more above baseline in Category 2 or 3 areas was considered to be an impact. Based on baseline noise levels and the estimated noise level derived from this analysis, there would be no adverse affects to residential areas or parks from construction activities for Alternatives A, B, and C. There would be an adverse impact to residential areas and parks under the no-action alternative.

Mitigation

If an impact is found to be severe, a detailed analysis is performed to determine the exact cause for the impact to develop corrective actions to reduce the severity. Often noise from transportation-related projects can be reduced at the source using sound attenuation techniques. However, in the POA noise study, no impacts resulted from construction or operations under any of the design alternatives. Noise impacts under the no-action alternative could be mitigated through the construction of sound barriers during pile driving.

Table D-1 Sound Levels During Construction - Alternative A

Sound Levels of Construction Equipment

Description	Number of vehicles	Horsepower	Power (kilowatts)	Sound Power (dBA)	50	100	500	1,000	2,000	3,000	4,000	5,000
					Distance in feet from source							
Pile Driver	1	NA	NA	130	95	88	70	63	55	51	48	45
Grader, wheeled	1	300	223.5	111	76	69	51	44	36	32	29	26
Truck, wheeled	2	300	223.5	111	79	72	54	47	39	35	32	29
Bulldozer, tracked	1	300	223.5	111	76	69	51	44	36	32	29	26
Trencher, wheeled	1	300	223.5	111	76	69	51	44	36	32	29	26
Backhoe, wheelec	1	250	186.25	110	75	68	50	43	35	31	28	25
	Total Level Leq, dBA				96	88	71	63	56	51	48	46
	Total Day/Night - assume no nighttime ops and 10 hours per day of construction operations.			16	94	86	69	61	54	49	46	44

Trains

Number Locomotives	Number of Cars	Trains per Day	Speed (mph)	50	100	500	1,000	2,000	3,000	4,000	5,000
				Distance in feet from source							
2	80	1	15	61.6	57.1	46.6	42.1	37.6	35.0	33.1	31.6
Total Level Leq, dBA				61.6	57.1	46.6	42.1	37.6	35.0	33.1	31.6
Total Day/Night - assume no nighttime ops				48	43	33	28	24	21	19	18

Assumes Jointed Track with no barriers or obstructions

Cars and Trucks

Description	Number of Vehicles per hour	Speed (mph)	50	100	500	1,000	2,000	3,000	4,000	5,000
			Distance in feet from source							
Cars	10	30	41.2	36.7	26.2	21.7	17.1	14.5	12.6	11.2
Trucks	35	30	58.6	54.1	43.6	39.1	34.6	31.9	30.1	28.6
Total Level Leq, dBA			59	54	44	39	35	32	30	29
Total Day/Night - assume no nighttime ops and 10 hours per day of traffic operations.		16	57	52	42	37	33	30	28	27

Ships

Number of Ships	Average Day Hours	Average Night Hours	50	100	500	1,000	2,000	3,000	4,000	5,000
			Distance in feet from source							
6	12	0	78.2	70.7	53.2	45.7	38.2	33.8	30.7	28.2
Total Level Leq, dBA			78.2	70.7	53.2	45.7	38.2	33.8	30.7	28.2
Day-Night Average Sound Level, dBA			75.2	67.7	50.2	42.7	35.2	30.8	27.6	25.2

Table D-2 Sound Levels During Construction - Alternative B

Sound Levels of Construction Equipment												
					Distance in feet from source							
Description	Number of vehicles	Horsepower	Power (kilowatts)	Sound Power (dBA)	50	100	500	1,000	2,000	3,000	4,000	5000
Pile Driver	1	NA	NA	136	101	94	76	69	61	57	54	51
Grader, wheeled	1	300	223.5	111	76	69	51	44	36	32	29	26
Truck, wheeled	2	300	223.5	111	79	72	54	47	39	35	32	29
Bulldozer, tracked	1	300	223.5	111	76	69	51	44	36	32	29	26
Trencher, wheeled	1	300	223.5	111	76	69	51	44	36	32	29	26
Backhoe, wheeled	1	250	186.25	110	75	68	50	43	35	31	28	25
	Total Level Leq, dBA				101	94	76	69	61	57	54	51
	Total Day/Night - assume no nighttime ops and 10 hours per day of construction operations.			16	100	92	75	67	60	55	52	50

Trains

				Distance in feet from source							
Number Locomotives	Number of Cars	Trains per Day	Speed (mph)	50	100	500	1,000	2,000	3,000	4,000	5,000
2	80	1	15	61.6	57.1	46.6	42.1	37.6	35.0	33.1	31.6
Total Level Leq, dBA				61.6	57.1	46.6	42.1	37.6	35.0	33.1	31.6
Total Day/Night - assume no nighttime ops				48	43	33	28	24	21	19	18

Assumes Jointed Track with no barriers or obstructions

Cars and Trucks

			Distance in feet from source							
Description	Number of Vehicles per hour	Speed (mph)	50	100	500	1,000	2,000	3,000	4,000	5,000
Cars	10	30	41.2	36.7	26.2	21.7	17.1	14.5	12.6	11.2
Trucks	35	30	58.6	54.1	43.6	39.1	34.6	31.9	30.1	28.6
Total Level Leq, dBA			59	54	44	39	35	32	30	29
Total Day/Night - assume no nighttime ops and 10 hours per day of traffic operations.		16	57	52	42	37	33	30	28	27

Ships

			Distance in feet from source							
Number of Ships	Average Day Hours	Average Night Hours	50	100	500	1,000	2,000	3,000	4,000	5,000
6	12	0	78.2	70.7	53.2	45.7	38.2	33.8	30.7	28.2
Total Level Leq, dBA			78.2	70.7	53.2	45.7	38.2	33.8	30.7	28.2
Day-Night Average Sound Level, dBA			75.2	67.7	50.2	42.7	35.2	30.8	27.6	25.2

Table D-3 Sound Levels During Construction - Alternative C

Sound Levels of Construction Equipment												
					Distance in feet from source							
Description	Number of vehicles	Horsepower	Power (kilowatts)	Sound Power (dBA)	50	100	500	1,000	2,000	3,000	4,000	5,000
Pile Driver	1	NA	NA	130	95	88	70	63	55	51	48	45
Grader, wheeled	1	300	223.5	111	76	69	51	44	36	32	29	26
Truck, wheeled	2	300	223.5	111	79	72	54	47	39	35	32	29
Bulldozer, tracked	1	300	223.5	111	76	69	51	44	36	32	29	26
Trencher, wheeled	1	300	223.5	111	76	69	51	44	36	32	29	26
Backhoe, wheeled	1	250	186.25	110	75	68	50	43	35	31	28	25
	Total Level Leq, dBA				96	88	71	63	56	51	48	46
	Total Day/Night - assume no nighttime ops and 10 hours per day of construction operations.			16	94	86	69	61	54	49	46	44

Trains

				Distance in feet from source							
Number Locomotives	Number of Cars	Trains per Day	Speed (mph)	50	100	500	1,000	2,000	3,000	4,000	5,000
2	80	1	15	61.6	57.1	46.6	42.1	37.6	35.0	33.1	31.6
Total Level Leq, dBA				61.6	57.1	46.6	42.1	37.6	35.0	33.1	31.6
Total Day/Night - assume no nighttime ops				48	43	33	28	24	21	19	18

Assumes Jointed Track with no barriers or obstructions

Cars and Trucks

			Distance in feet from source							
Description	Number of Vehicles per hour	Speed (mph)	50	100	500	1,000	2,000	3,000	4,000	5,000
Cars	10	30	41.2	36.7	26.2	21.7	17.1	14.5	12.6	11.2
Trucks	35	30	58.6	54.1	43.6	39.1	34.6	31.9	30.1	28.6
Total Level Leq, dBA			59	54	44	39	35	32	30	29
Total Day/Night - assume no nighttime ops and 16 hours per day of traffic operations.		16	57	52	42	37	33	30	28	27

Ships

			Distance in feet from source							
Number of Ships	Average Day Hours	Average Night Hours	50	100	500	1,000	2,000	3,000	4,000	5,000
6	12	0	78.2	70.7	53.2	45.7	38.2	33.8	30.7	28.2
Total Level Leq, dBA			78.2	70.7	53.2	45.7	38.2	33.8	30.7	28.2
Day-Night Average Sound Level, dBA			75.2	67.7	50.2	42.7	35.2	30.8	27.6	25.2

Table D-4 Sound Levels During Operations

Sound Levels of Operations Equipment												
					Distance in feet from source							
Description	Number of vehicles	Horsepower	Power (kilowatts)	Sound Power (dBA)	50	100	500	1,000	2,000	3,000	4,000	5,000
Pile Driver	0.001	NA	NA	130	65	58	40	33	25	21	18	15
Grader, wheeled	0.001	300	223.5	111	46	39	21	14	6	2	-1	-4
Truck, wheeled	0.001	300	223.5	111	46	39	21	14	6	2	-1	-4
Bulldozer, tracked	0.001	300	223.5	111	46	39	21	14	6	2	-1	-4
Trencher, wheeled	0.001	300	223.5	111	46	39	21	14	6	2	-1	-4
Backhoe, wheeled	0.001	250	186.25	110	45	38	20	13	5	1	-2	-5
	Total Level Leq, dBA				66	58	41	33	26	21	18	16
	Total Day/Night - assume no nighttime ops and 10 hours per day of construction operations.			0	42	34	17	9	2	-3	-6	-8

Trains

				Distance in feet from source							
Number Locomotives	Number of Cars	Trains per Day	Speed (mph)	50	100	500	1,000	2,000	3,000	4,000	5,000
2	50	2	15	63.9	59.4	48.9	44.4	39.8	37.2	35.3	33.9
Total Level Leq, dBA				63.9	59.4	48.9	44.4	39.8	37.2	35.3	33.9
Total Day/Night - assume no nighttime ops				50	46	35	31	26	23	22	20

Assumes Jointed Track with no barriers or obstructions

Cars and Trucks

			Distance in feet from source							
Description	Number of Vehicles per hour	Speed (mph)	50	100	500	1,000	2,000	3,000	4,000	5,000
Cars	160	30	53.2	48.7	38.2	33.7	29.2	26.5	24.7	23.2
Trucks	215	30	66.5	62.0	51	47.0	42.5	39.8	37.9	36.5
Total Level Leq, dBA			67	62	52	47	43	40	38	37
Total Day/Night - assume no nighttime ops and 10 hours per day of traffic operations.		10	63	58	48	43	39	36	34	33

Ships

			Distance in feet from source							
Number of Ships	Average Day Hours	Average Night Hours	50	100	500	1,000	2,000	3,000	4,000	5,000
4	10	0	76.5	68.9	51.5	43.9	36.4	32.0	28.9	26.5
Total Level Leq, dBA			76.5	68.9	51.5	43.9	36.4	32.0	28.9	26.5
Day-Night Average Sound Level, dBA			73.1	65.6	48.1	40.6	33.0	28.6	25.5	23.1

Table D-5 Sound Levels During Construction - No-Action Alternative

Sound Levels of Construction Equipment

Description	Number of vehicles	Horsepower	Power (kilowatts)	Sound Power (dBA)	Distance in feet from source: 50	100	500	1,000	2,000	3,000	4,000	5,000
Pile Driver	1	NA	NA	130	95	88	70	63	55	51	48	45
Grader, wheeled	1	300	223.5	111	76	69	51	44	36	32	29	26
Truck, wheeled	2	300	223.5	111	79	72	54	47	39	35	32	29
Bulldozer, tracked	1	300	223.5	111	76	69	51	44	36	32	29	26
Trencher, wheeled	1	300	223.5	111	76	69	51	44	36	32	29	26
Backhoe, wheeled	1	250	186.25	110	75	68	50	43	35	31	28	25
	Total Level Leq, dBA				96	88	71	63	56	51	48	46
	Total Day/Night - assume no nighttime ops and 10 hours per day of construction operations.			16	94	86	69	61	54	49	46	44

Trains

Number Locomotives	Number of Cars	Trains per Day	Speed (mph)	Distance in feet from source: 50	100	500	1,000	2,000	3,000	4,000	5,000
2	80	1	15	61.6	57.1	46.6	42.1	37.6	35.0	33.1	31.6
Total Level Leq, dBA				61.6	57.1	46.6	42.1	37.6	35.0	33.1	31.6
Total Day/Night - assume no nighttime ops				48	43	33	28	24	21	19	18

Assumes Jointed Track with no barriers or obstructions

Cars and Trucks

Description	Number of Vehicles per hour	Speed (mph)	Distance in feet from source: 50	100	500	1,000	2,000	3,000	4,000	5,000
Cars	10	30	41.2	36.7	26.2	21.7	17.1	14.5	12.6	11.2
Trucks	35	30	58.6	54.1	43.6	39.1	34.6	31.9	30.1	28.6
Total Level Leq, dBA			59	54	44	39	35	32	30	29
Total Day/Night - assume no nighttime ops and 16 hours per day of traffic operations.		16	57	52	42	37	33	30	28	27

Ships

Number of Ships	Average Day Hours	Average Night Hours	Distance in feet from source: 50	100	500	1,000	2,000	3,000	4,000	5,000
6	12	0	78.2	70.7	53.2	45.7	38.2	33.8	30.7	28.2
Total Level Leq, dBA			78.2	70.7	53.2	45.7	38.2	33.8	30.7	28.2
Day-Night Average Sound Level, dBA			75.2	67.7	50.2	42.7	35.2	30.8	27.6	25.2

Table D-6 Results for Alternatives

Site Number	Measurement Site Description	Continous or Spot Measurements	Baseline (Ldn)	Model Noise Sources During Construction Alternative A				Total Noise (Ldn)	Increase in Noise Level (dB)	Impact Critera
				Construction Noise (Leq [24])	Rail (Leq [24])	Cars and Trucks (Leq [24])	Ships (Leq [24])			
1	Port Northern Berth	Spot	70	80	57	54	71	80.9	10.9	No Impact
2	Port Building, Observation Deck	Continous 88 hours round 1 and 49 hours round 2	66	80	57	54	71	80.7	14.7	No Impact
3	Port Sourthern Berth	Spot	75	80	57	54	71	81.6	6.6	No Impact
4	Corner of Termina	Spot	70	67	46	41	53	71.8	1.8	No Impact
5	Government Hill/ McKay Park	Continous 55 hours round 1 and 49 hours round 2	63	56	40	37	40	63.8	0.8	No Impact
6	Brown's Point Park	Spot	60	54	38	36	38	61.0	1.0	No Impact
7	Cherry Hill Housing, North End	Spot	65	56	40	37	40	65.5	0.5	No Impact
8	Cherry Hill Housing, South End	Continous 24 hours round 1 and 49 hours round 2	63	54	38	35	38	63.5	0.5	No Impact

Site Number	Measurement Site Description	Continous or Spot Measurements	Baseline (Ldn)	Model Noise Sources During Construction Alternative B				Total Noise (Ldn)	Increase in Noise Level (dB)	Impact Critera
				Construction Noise (Leq [24])	Rail (Leq [24])	Cars and Trucks (Leq [24])	Ships (Leq [24])			
1	Port Northern Berth	Spot	70	83	57	54	71	83.5	13.5	No Impact
2	Port Building, Observation Deck	Continous 88 hours round 1 and 49 hours round 2	66	83	57	54	71	83.4	17.4	No Impact
3	Port Sourthern Berth	Spot	75	83	57	54	71	83.9	8.9	No Impact
4	Corner of Termina	Spot	70	71	46	41	53	73.6	3.6	No Impact
5	Government Hill/ McKay Park	Continous 55 hours round 1 and 49 hours round 2	63	61	40	37	40	65.2	2.2	No Impact
6	Brown's Point Park	Spot	60	58	38	36	38	62.2	2.2	No Impact
7	Cherry Hill Housing, North End	Spot	65	61	40	37	40	66.5	1.5	No Impact
8	Cherry Hill Housing, South End	Continous 24 hours round 1 and 49 hours round 2	63	58	38	35	38	64.2	1.2	No Impact

Table D-6 Results for Alternatives - (con't)

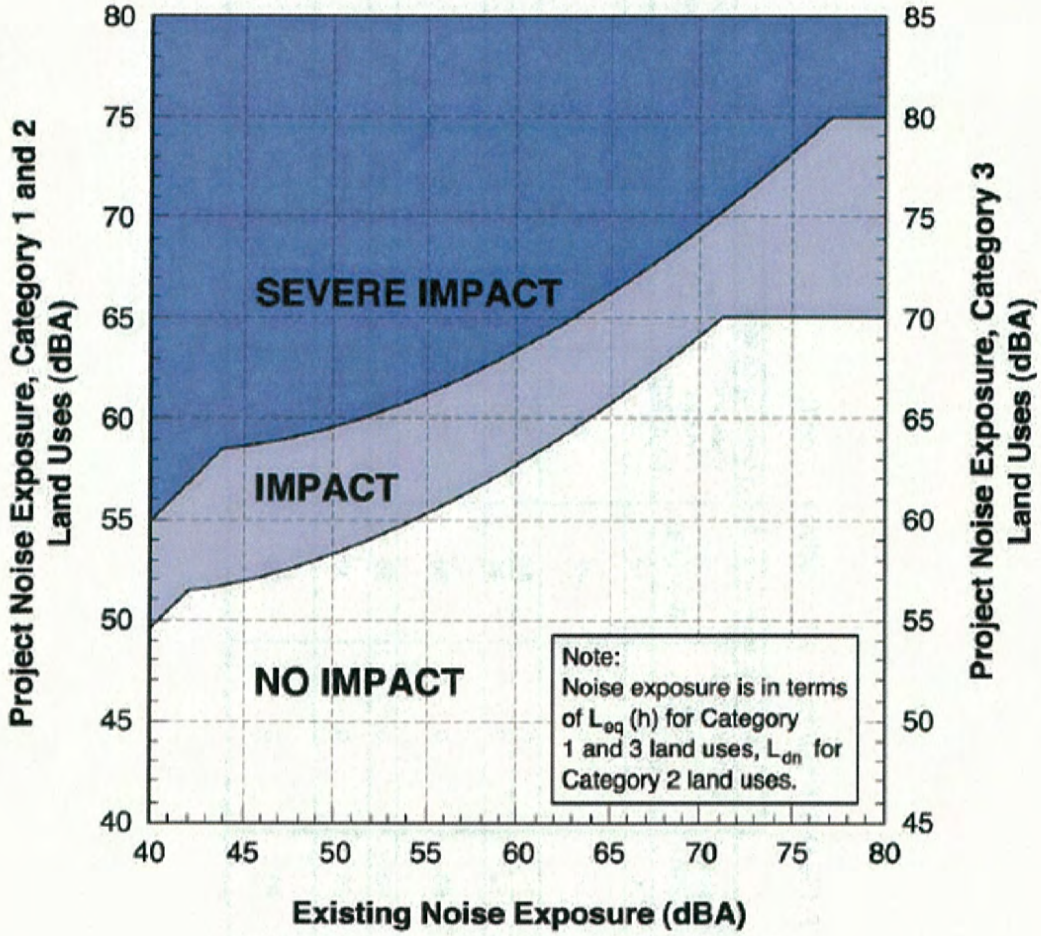
Site Number	Measurement Site Description	Continous or Spot Measurements	Baseline (Ldn)	Model Noise Sources During Construction Alternative C: Construction Noise (Leq [24])	Rail (Leq [24])	Cars and Trucks (Leq [24])	Ships (Leq [24])	Total Noise (Ldn)	Increase in Noise Level (dB)	Impact Critera
1	Port Northern Berth	Spot	70	80	57	54	71	80.9	10.9	No Impact
2	Port Building, Observation Deck	Continous 88 hours round 1 and 49 hours round 2	66	80	57	54	71	80.7	14.7	No Impact
3	Port Sourthern Berth	Spot	75	80	57	54	71	81.6	6.6	No Impact
4	Corner of Termina	Spot	70	67	46	41	53	71.8	1.8	No Impact
5	Government Hill/ McKay Park	Continous 55 hours round 1 and 49 hours round 2	63	56	40	37	40	63.8	0.8	No Impact
6	Brown's Point Park	Spot	60	54	38	36	38	61.0	1.0	No Impact
7	Cherry Hill Housing, North End	Spot	65	56	40	37	40	65.5	0.5	No Impact
8	Cherry Hill Housing, South End	Continous 24 hours round 1 and 49 hours round 2	63	54	38	35	38	63.5	0.5	No Impact

Site Number	Measurement Site Description	Continous or Spot Measurements	Baseline (Ldn)	Model Noise Sources During Construction No-Action Alternative: Construction Noise (Leq [24])	Rail (Leq [24])	Cars and Trucks (Leq [24])	Ships (Leq [24])	Total Noise (Ldn)	Increase in Noise Level (dB)	Impact Critera
1	Port Northern Berth	Spot	70	85	42	44	60	85.1	15.1	No Impact
2	Port Building, Observation Deck	Continous 88 hours round 1 and 49 hours round 2	66	80	42	44	60	80.2	14.2	No Impact
3	Port Sourthern Berth	Spot	75	76	42	44	60	78.6	3.6	No Impact
4	Corner of Termina	Spot	70	76	43	48	54	77.0	7.0	No Impact
5	Government Hill/ McKay Park	Continous 55 hours round 1 and 49 hours round 2	63	63	38	37	39	66.0	3.0	Impact
6	Brown's Point Park	Spot	60	62	38	36	36	64.1	4.1	Impact
7	Cherry Hill Housing, North End	Spot	65	63	42	37	39	67.1	2.1	No Impact
8	Cherry Hill Housing, South End	Continous 24 hours round 1 and 49 hours round 2	63	62	42	36	39	65.6	2.6	Impact

Table D-6 Results for Alternatives - (con't)

Site Number	Measurement Site Description	Continous or Spot Measurements	Baseline (Ldn)	Model Noise Sources During Operatopms 2025				Total Noise (Ldn)	Increase in Noise Level (dB)	Impact Critera
				Construction Noise (Leq [24])	Rail (Leq [24])	Cars and Trucks (Leq [24])	Ships (Leq [24])			
1	Port Northern Berth	Spot	70	0	49	52	51	70.2	0.2	No Impact
2	Port Building, Observation Deck	Continous 88 hours round 1 and 49 hours round 2	66	0	49	52	51	66.4	0.4	No Impact
3	Port Sourthern Berth	Spot	75	0	44	52	51	75.0	0.0	No Impact
4	Corner of Termina	Spot	70	0	44	52	44	70.1	0.1	No Impact
5	Government Hill/ McKay Park	Continous 55 hours round 1 and 49 hours round 2	63	0	38	49	36	63.2	0.2	No Impact
6	Brown's Point Park	Spot	60	0	36	43	34	60.1	0.1	No Impact
7	Cherry Hill Housing, North End	Spot	65	0	38	49	36	65.1	0.1	No Impact
8	Cherry Hill Housing, South End	Continous 24 hours round 1 and 49 hours round 2	63	0	36	43	34	63.1	0.1	No Impact

Figure D-1 FTA Noise Impact Criteria



(Source: FTA guidance manual, Figure 3-1)

APPENDIX E

HYDRODYNAMICS

Tidal Circulation Modeling Study To Support the Port of Anchorage Expansion

Bruce Ebersole and Layla Raad

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U.S. Army Engineer Research and Development Center's Coastal and Hydraulics Laboratory
Located at the Waterways Experiment Station, Vicksburg, Mississippi

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APPENDIX E
HYDRODYNAMICS

Introduction

The Port of Anchorage (POA) is planning a major expansion program that will occur over approximately the next 7 years. The objective of this study is to apply an existing hydrodynamic circulation model of upper Cook Inlet and the POA vicinity to characterize tidal circulation patterns at and near the Port for two conditions: existing conditions and a condition that represents the proposed complete expansion of the Port infrastructure. The hydrodynamic model applied here is currently being upgraded in support of work being done by the U.S. Army Corps of Engineers, Alaska District, to investigate sedimentation at the Port. The model enhancement program is ongoing, and the model in its present state of development was used to conduct this study.

Accuracy of the upgraded model was checked for this study, simply by comparing calculated water level values to measured water levels at National Oceanic and Atmospheric Administration (NOAA) stations. A significant amount of model validation was previously performed using measured current data for upper Cook Inlet, but for a model grid that had a regional focus (not a local, Port focus). That prior work has been extensively documented. Measurements indicated that in certain parts of upper Cook Inlet there is significant three-dimensional structure to the current fields, particularly in the gyres formed by strong flows past headlands, and deeper areas of the inlet gorge. Flows on the tidelands are expected to have less vertical structure, although current measurements there are rather sparse. Model enhancement and validation (involving comparison of model results with measured current data collected right at the Port) are continuing. This work is being funded by the District, but it will not be completed until late summer 2004. The purpose of additional validation work is to investigate model skill in predicting velocity conditions right at the Port, and in the gyre shed by Cairn Point, which most strongly influences currents at the Port. Calculated results presented in this study reflect those from a two-dimensional, depth-averaged model. The horizontal velocity structure of the gyres seems to be predicted reasonably well with the present model, at least qualitatively. But accuracy of flow field details right at the Port, and in the gyre near the Port, is less certain at this time.

Model simulation for a neap-spring tidal cycle during August 2002 was conducted with and without the proposed expansion. The model was forced with tidal constituents along its ocean boundary (which is seaward of Kodiak Island) and river flow at the locations where major freshwater discharges enter Upper Cook Inlet. Time series of water level and current speed and direction at selected stations in the study area were examined to assess the impact of the expansion on the tidal circulation. Also, circulation patterns in the port vicinity and surrounding area, were studied with and without the proposed expansion using a number of graphical display products and animations.

The influence of the proposed port expansion on flow and circulation in the region was examined; and a preliminary, cursory assessment of the impact of the port expansion on circulation and sedimentation in the harbor was made. Those results are documented here.

Previous Model

Cook Inlet lies between 59° and 61° 30′N latitude and 149° and 154° W longitude and covers more than $26\times10^3\,km^2$. This large tidal estuary flows into the Gulf of Alaska and has an average depth of 100 m (Raney 1993). As reported by the U.S. Coast and Geodetic Survey in 1969, Cook Inlet has the tenth highest mean spring tidal range in the world with a value of 10 m recorded for the Turnagain Arm (Raney 1993). Significant portions of Knik and Turnagain Arms are exposed at low tide. Several extensive tidelands are located in the upper Cook Inlet. Of the many rivers that discharge into the Inlet, three contribute about 70% of its total freshwater input. These are the Knik, Matanuska, and Susitna Rivers (Mulherin *et al.* 2001). Four rivers were considered in the model: the Knik, Matanuska, Susitna and Kenai rivers.

The Advanced CIRCulation hydrodynamic (ADCIRC-2DDI) model (Luettich, Westerink, Scheffner 1992) was used to evaluate the circulation pattern in the upper Cook Inlet area. Model water-surface and depth-averaged current data were examined and the accuracy of the model results was evaluated by comparing it to measured water level and current data collected during 2002.

ADCIRC is a system of computer programs for solving time dependent, varying free surface, circulation, and transport problems in two horizontal dimensions. These programs utilize the finite element method in space and therefore can be run on highly flexible, irregularly spaced grids. Fine resolution can be specified in the area of interest and coarse resolution can be specified in areas distant from the region of interest. Model accuracy is directly related to the ability to resolve shorelines and topographic features, and ADCIRC's unstructured grid system allows this to be done well. Model simulations included forcing with tidal constituents and river flow. The ADCIRC finite element grid domain included Cook Inlet and part of the Gulf of Alaska as seen in Figure 1.

The grid coastline was chosen in a geographic range defined by longitude of 157°-148.5° W and latitude of 55°-63° N. The coastline was extracted using NOAA Coastline Extractor. The digitized shoreline coordinates were obtained from the World Vector Shoreline (WVS). Shoreline data are based on Mean High Water (MHW) and is referenced to World Geodetic System (WGS 84).

The ADCIRC finite element grid is shown in Figure 2 with coarse resolution over the open ocean and increasing resolution toward the Port of Anchorage in upper Cook Inlet. Element areas vary greatly over the computational domain, with the ratio of the offshore element to the smallest element in the Anchorage

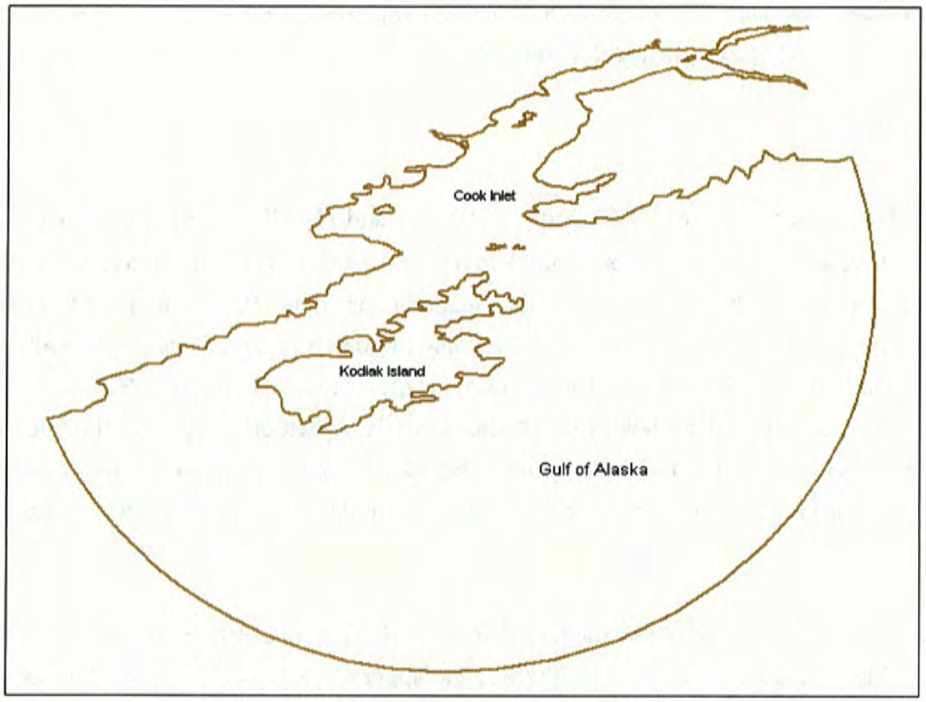

Figure 1 ADCIRC Domain

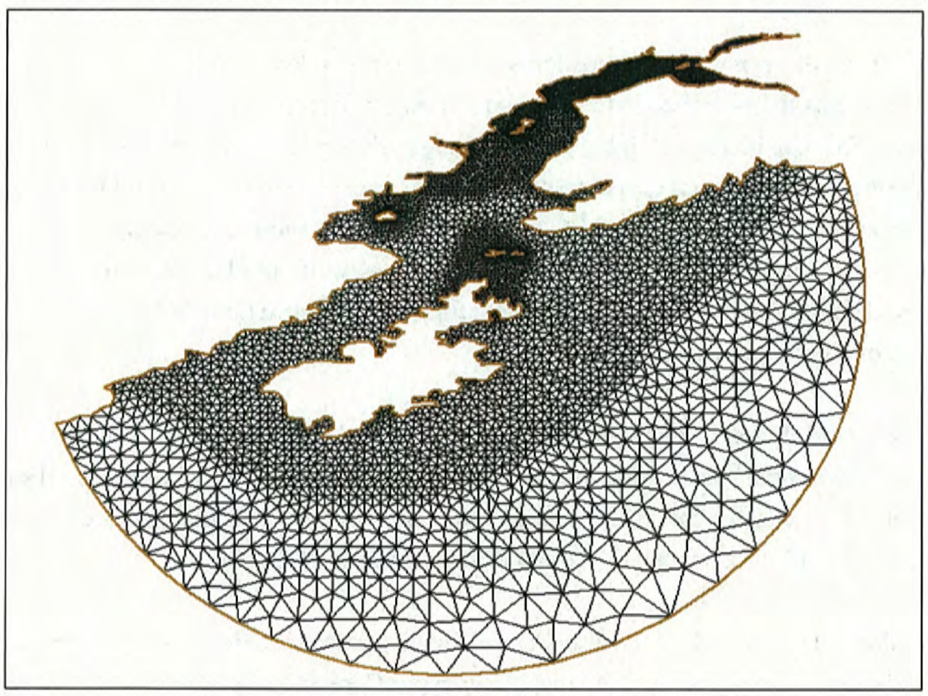

Figure 2 ADCIRC Grid

area being 8.5×10^4. Grid resolution can vary spatially, and grading between coarse and fine resolution should be done with regard to transition between element areas. A general rule is that adjacent elements should not differ in size by more than 50 percent (Donnell *et al.* 1996). More resolution was added to the study with finest node spacing of about 70 m near the Port of Anchorage as shown in Figure 3. The number of nodes and elements of the mesh were 26,841 and 50,448 respectively.

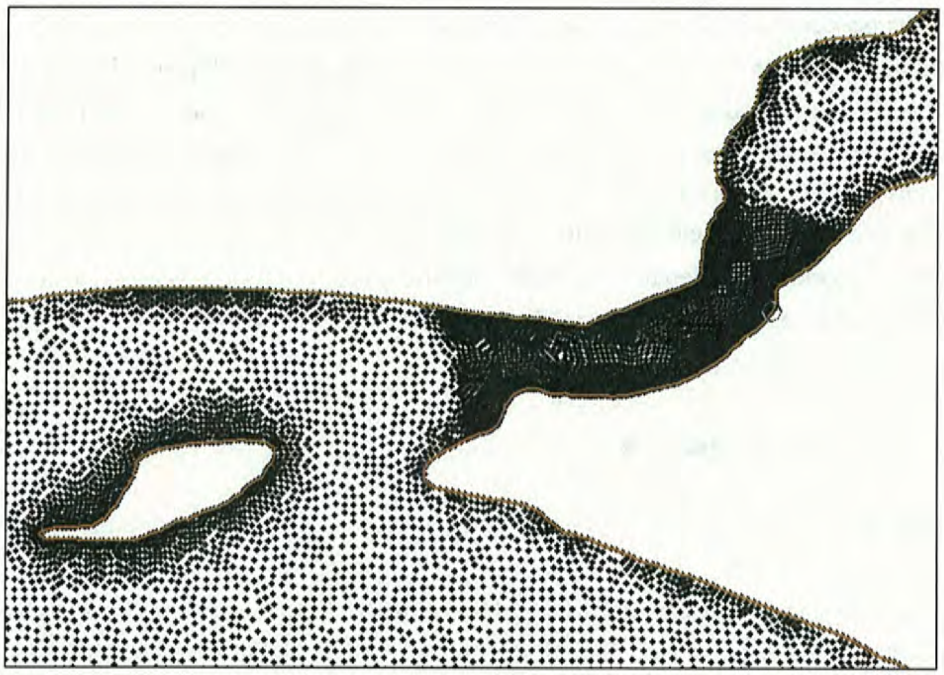

Figure 3 Details of ADCIRC Grid for the Port of Anchorage Area

The ADCIRC-2DDI model was developed to simulate regional-scale processes, with emphasis on simulating water surface elevation and current speed and direction in the upper Cook Inlet, with less emphasis on the immediate vicinity of the Port. Field measurements were conducted during 34 days in 2002 at fixed locations and also along transects during different tidal cycles to assess model skill in simulating regional scale hydrodynamic processes. The field measurements were used to characterize the current in the upper Cook Inlet and to evaluate the accuracy of the 2-D model in the area. That work has been extensively documented.

The two-dimensional ADCIRC model was capable of reproducing the details of the current field in the study area extending from just south of Fire Island to Cairn Point, when and where eddies were not present and also for areas of mild vertical current structure. Some of the eddies were captured qualitatively, with uncertain quantitative accuracy. To support detailed hydrodynamic and sedimentation studies at the Port, additional model refinement was needed, as well as more validation to currents right at the Port, and that work is ongoing.

Model Upgrade

The ADCIRC model required upgrading to address issues of sedimentation at the port, and this type of upgrade was needed to be able to accurately evaluate the impacts of the proposed Port of Anchorage Marine Terminal Expansion. The ADCIRC model upgrade included the following tasks:

- Improve representation of the irregular shoreline and structures in the port area and along the inlet shoreline between Cairn Point and Point Woronzof.
- Incorporate available depth survey data in the port vicinity closest to the model simulation time.
- Improve the representation of the tidal flat elevations along the shoreline between Cairn Point and Point Woronzof. Also, upgrade the tidal flat elevation in some areas of Susitna and Turnagain tidelands (to come later this summer). Previous work confirmed the importance of accurately representing the tidal flat elevations in the model.
- Reference upgraded grid depths to ADCIRC datums.
- Increase grid resolution in the port vicinity.
- Improve grid quality in the study area.

Improve Representation of Irregular Shoreline

Define New Shoreline

The original digitized shoreline of the ADCIRC grid was obtained from the WVS. This shoreline was used in the original model development. Shoreline data are based on MHW referenced to Mean Low Low Water (MLLW). This was a crude representation of the shoreline in the port vicinity, as shown in Figure 4.

To better resolve the shoreline, aerial imagery with 3-ft pixel resolution was obtained for the shoreline between Cairn Point and Point Woronzof. The date of the imagery was September 10, 2002 and the time was 20:06-22:26 GMT. The imagery was acquired in a registered .tiff format and its projection was Alaska State Plane, Zone 4. The horizontal datum was NAD 27 and the vertical datum was MLLW. Figure 5 shows the extent of coverage of the aerial imagery. Figure 6 shows the water level at Anchorage NOAA station during September 2002 and during the time the aerial imagery was acquired. The imagery was captured during ebb tide and consequently the tidal flat area along the shoreline, between Cairn Point and Point Woronzof, was partially exposed. The imagery was used to resolve the details of the shoreline within its coverage area. The vegetation line was considered as representative of the shoreline where applicable. In areas with revetment, the intersection of the water line with the exposed toe of the revetment was adopted as the shoreline, as was the case in the port area. Figure 7 shows the imagery and the new grid shoreline in the port vicinity.

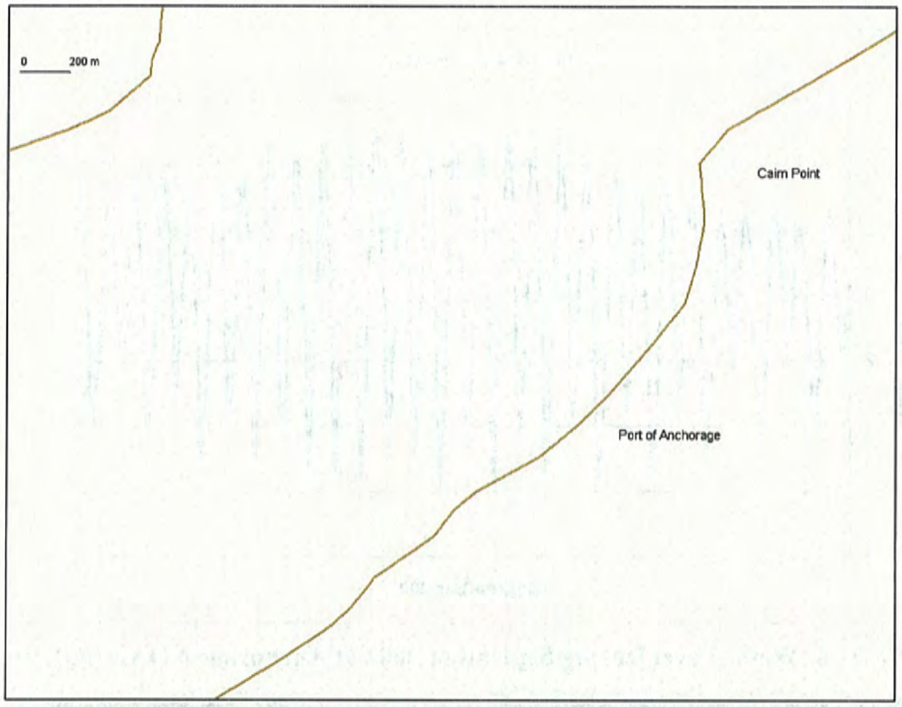

Figure 4 Previous ADCIRC-2DDI Grid Shoreline Representation

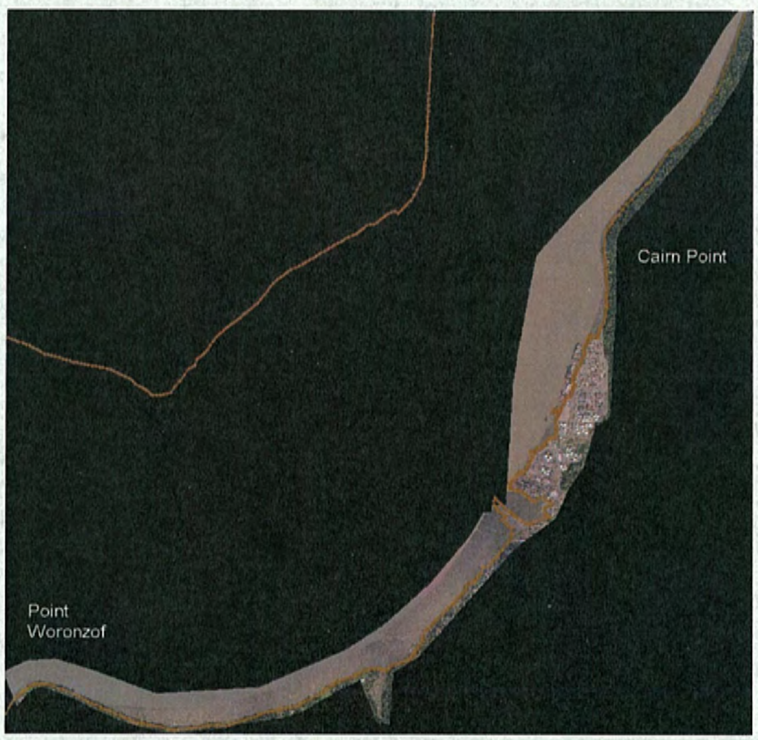

Figure 5 Extent of Aerial Imagery Coverage Used to Define the More Highly Resolved Shoreline

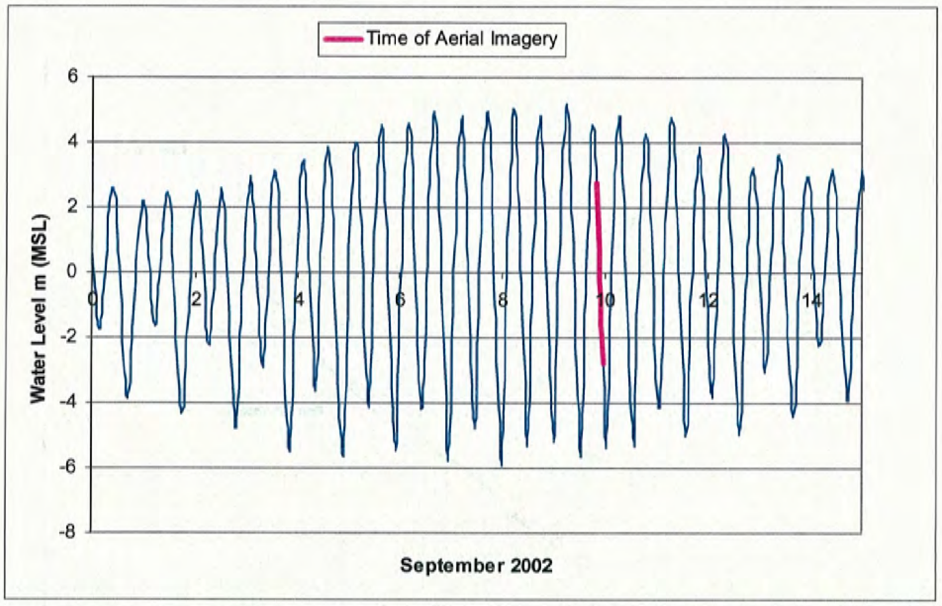

Figure 6 Water Level During September 2002 at Anchorage NOAA Station

Figure 7 Aerial Imagery and Resolved Shoreline in the Immediate Vicinity of the Port

Also, the coastline of the Nautical Chart 16665 (6th edition of 1997) was used to map the ADCIRC grid boundary. The new resolved shoreline in the port vicinity area is shown in Figure 8.

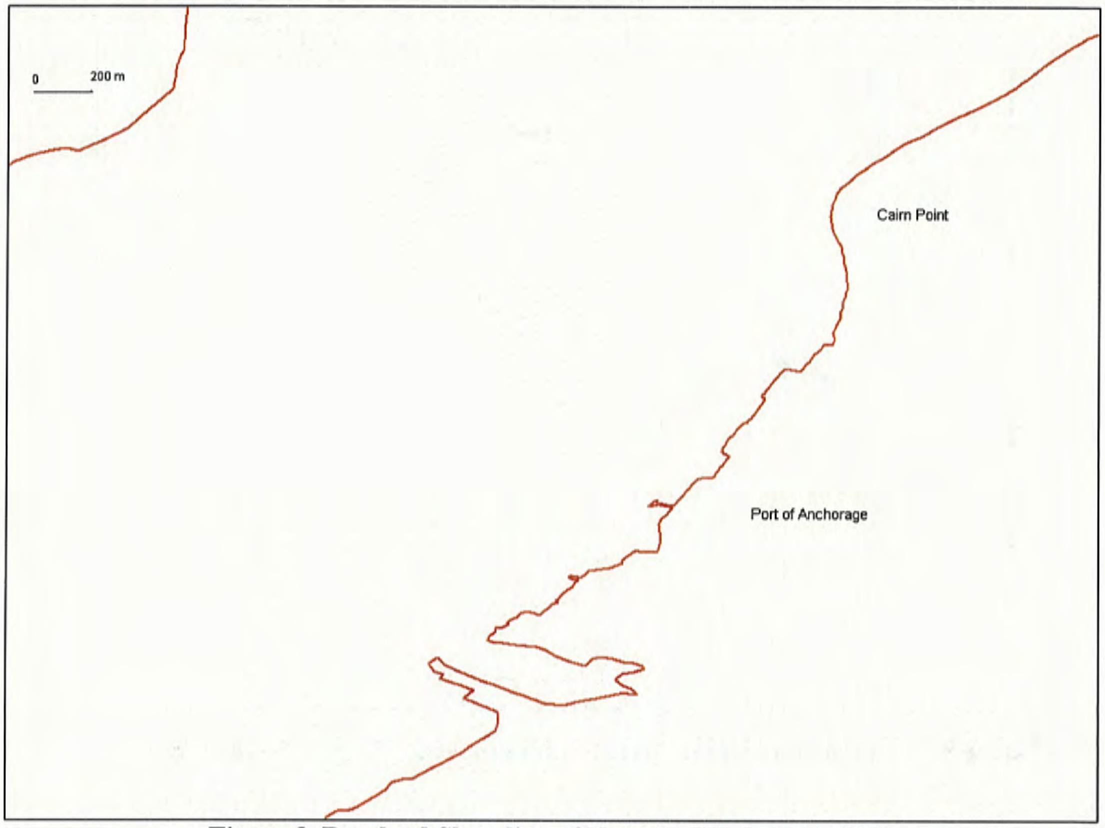

Figure 8 Resolved Shoreline of New ADCIRC-2DDI Grid

Modify Existing Grid

The existing grid should be modified to match the new shoreline. Therefore, some elements were eliminated and more elements were added to fit the new shoreline. In some areas where new elements were added, new small sections of grid mesh were created and then stitched to the old grid. The vertices' spacing of the new added grids were matched with the old shoreline node spacing to preserve the resolution of the grid in the neighboring areas.

Assign Depth Values to Shoreline

Most depth data are referenced to a tidal datum, and tidal datums change throughout Cook Inlet because of the varying tide range. Tide range predictions at 81 subordinate stations were obtained, during the previous study, by applying certain differences to the daily tide predictions of NOAA stations. Figure 9 shows the locations of the 81 subordinate stations. MHW was calculated as half the sum of spring and mean tidal range at the 81 stations. The previously created scatter XYZ file of the MHW values was used to assign MHW values to the newly created grid boundary nodes.

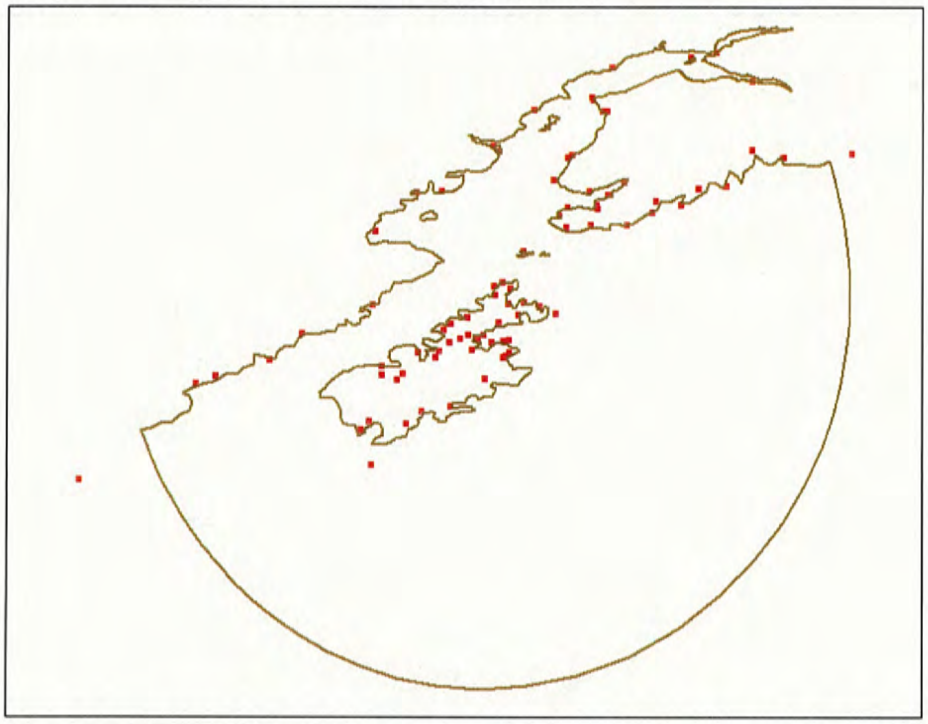

Figure 9 Location of 81 Subordinate Stations to Assign Depth Values to Shoreline

Update Depth Data in the Port Vicinity

The port area is very dynamic and the bottom topography can change significantly over a relatively short time. Therefore, bathymetric data collected closest to the simulation time should be incorporated in grid generation (Militello 1998).

The original GEOphysical Data System (GEODAS) bathymetric survey files were used to estimate the depth values at the new grid nodes for the area shown in Figure 10. The area was selected to accommodate the updated tidal flat survey data that were provided by the District. More details of the depth data in the area were obtained by using the original high-resolution survey files. The data are referenced to MLLW.

Depths in two areas in the port vicinity (shown in Figure 11) were also updated. The survey in front of the port was conducted during the dredging season of 2002 (July 29). The survey data to the north of the port consisted of two surveys, one conducted during August 2000 and the other was conducted during December 2000. The projection of the data was Alaska State Plane, Zone 4. The horizontal datum was NAD 83 and the vertical datum was MLLW. Both survey data sets were provided by the District.

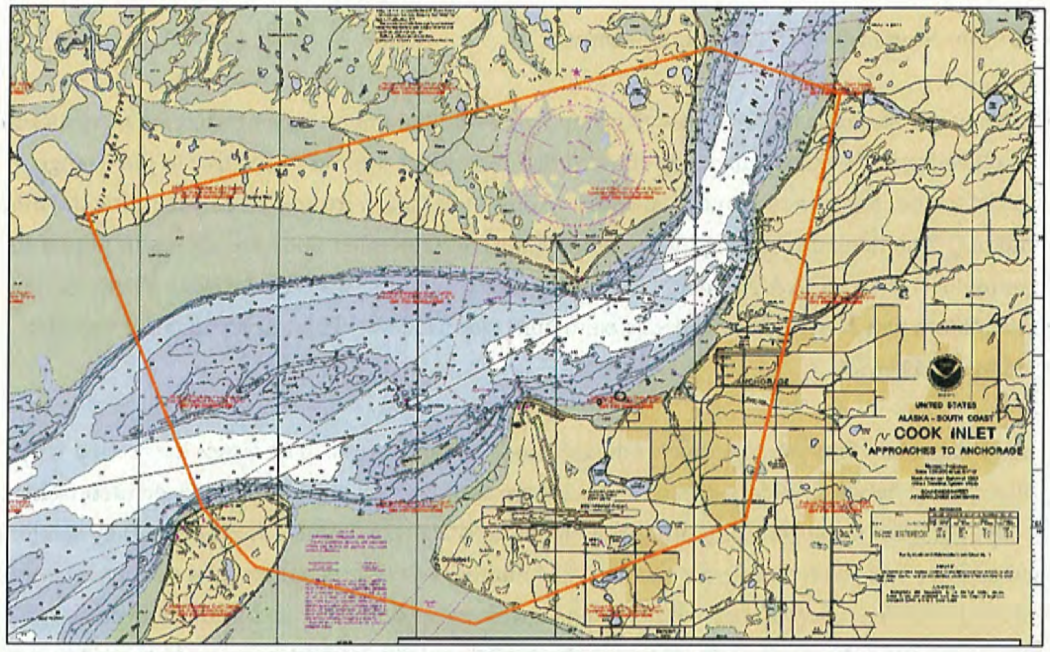

Figure 10 Area of Updated Depth Data

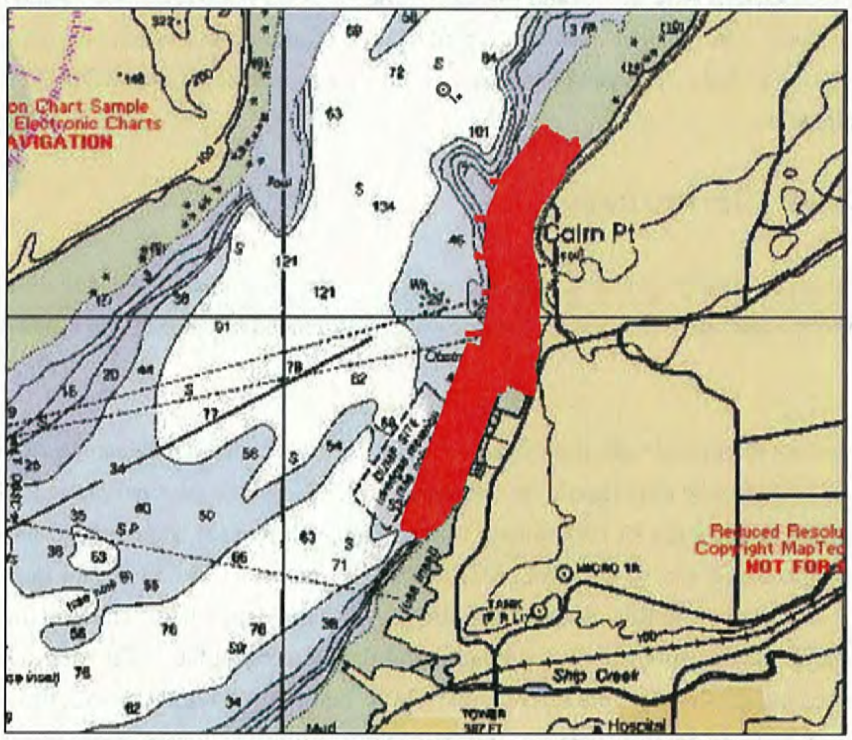

Figure 11 Updated Survey Data in the Port Vicinity

Improve Representation of Tidal Flat Elevation

The results of the previous regional modeling study showed the importance of accurately representing the tidal flat elevations. The previous study showed that the model was very sensitive to the change of elevation of the tidelands in the immediate area. Additional data were acquired to improve the quality of the modeling. The tidelands' survey data collected during September 2003 are shown in Figure 12 overlapping the 16665 NOAA Nautical Chart. The data projection was Alaska State Plane, Zone 4. The horizontal datum was NAD 83 and the vertical datum was MLLW. This survey data set was also provided by the District.

The survey data show limited coverage of the tidelands in some areas. The issues associated with interpolating data between widely spaced transects are well known, so contour lines created from the survey data points must be carefully produced. Contour lines were created from the survey scatter points and then contour lines were converted to arcs. The number of vertices per arc was selected according to the complexity of the covered area, with much human intervention. The arcs were smoothed and adjusted manually, by moving the vertices, to fit within the MHW and the MLLW lines, and be locally parallel to those lines. The MHW line was defined as the grid shoreline and the MLLW line was the zero contour defined from the GEODAS scatter data and from the 16665 NOAA Nautical Chart. Then the contours which cover the whole tidal flat area were converted back to scatter points which provided better coverage over the entire flats. The newly created scatter set was interpolated to ADCIRC grid to update the tidelands' elevation.

Referencing Depths to ADCIRC Datums

The GEODAS data, the newly created tidelands scatter data, the port survey data, and the survey data collected north of the port were merged. All depths were referenced to Geographic NAD 83 and to MLLW.

ADCIRC simulations are forced with time series of water level referenced to Mean Sea Level (MSL) and therefore the grid bathymetric data should be referenced to MSL. Since the tidal range varies in the study area, the spring tidal range at the 81 subordinate stations in the study area were used to obtain a grid of conversion factors to adjust survey data from MLLW to MSL datums. To convert the depth data from MLLW to MSL, half the spring tidal range should be added to the depth data. The grid area, where the depth data was updated, was split into five sub areas and the conversion factor for each sub area is shown in Figure 13. The new depth data were referenced to MSL before merging them with the rest of the old ADCIRC-2DDI unchanged depth scatter set. The new depth scatter data were interpolated to the new grid.

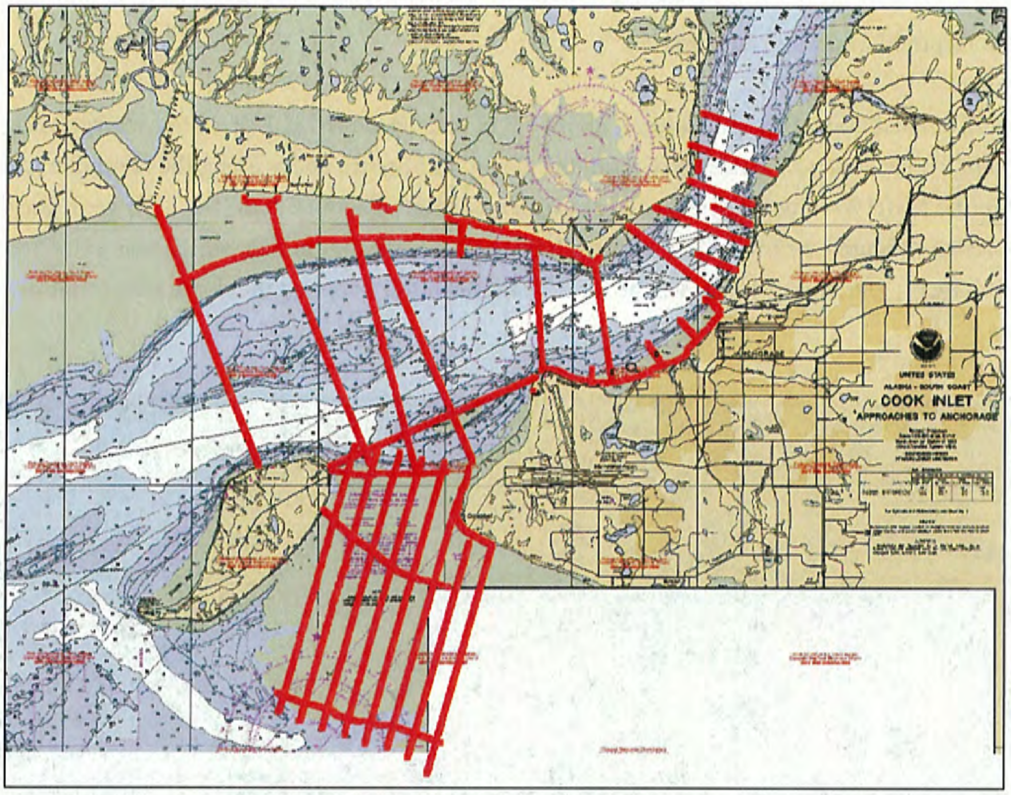

Figure 12 Tidal Flat Survey Data

Figure 13 Conversion Factors from MLLW to MSL in the Study Area

Tuning the Depth of Shoreline Grid Nodes

The MHHW at Anchorage NOAA station is about 8.8 m referenced to MLLW. After interpolating the updated bathymetric data to the ADCRIC grid, the elevation of some nodes along the shoreline was higher than the MHHW value. Therefore nodes with elevation of about 8.8 m (MLLW) were considered as the shoreline. Figure 14 shows the shoreline defined as the vegetation line, which was extracted from the aerial imagery; and Figure 15 shows the tuned shoreline after updating the depth data in the area.

Figure 14 Shoreline Before Updating the Depth in the Port Vicinity

Figure 15 Shoreline After Updating the Depth in the Port Vicinity

Increase Grid Resolution

The resolution of the grid was increased in an area near and including the Port, which extended about 3.8 km along the shoreline and extended about 550 m offshore as shown in Figure 16. The resolution in this refined area varies, with some elements having sizes of less than 15 m. Element areas vary greatly over the computational domain, with the ratio of the offshore element to the smallest element in the Anchorage area being 9.8×10^6. The number of nodes and elements of the upgraded grid were 37,148 and 70,605 respectively.

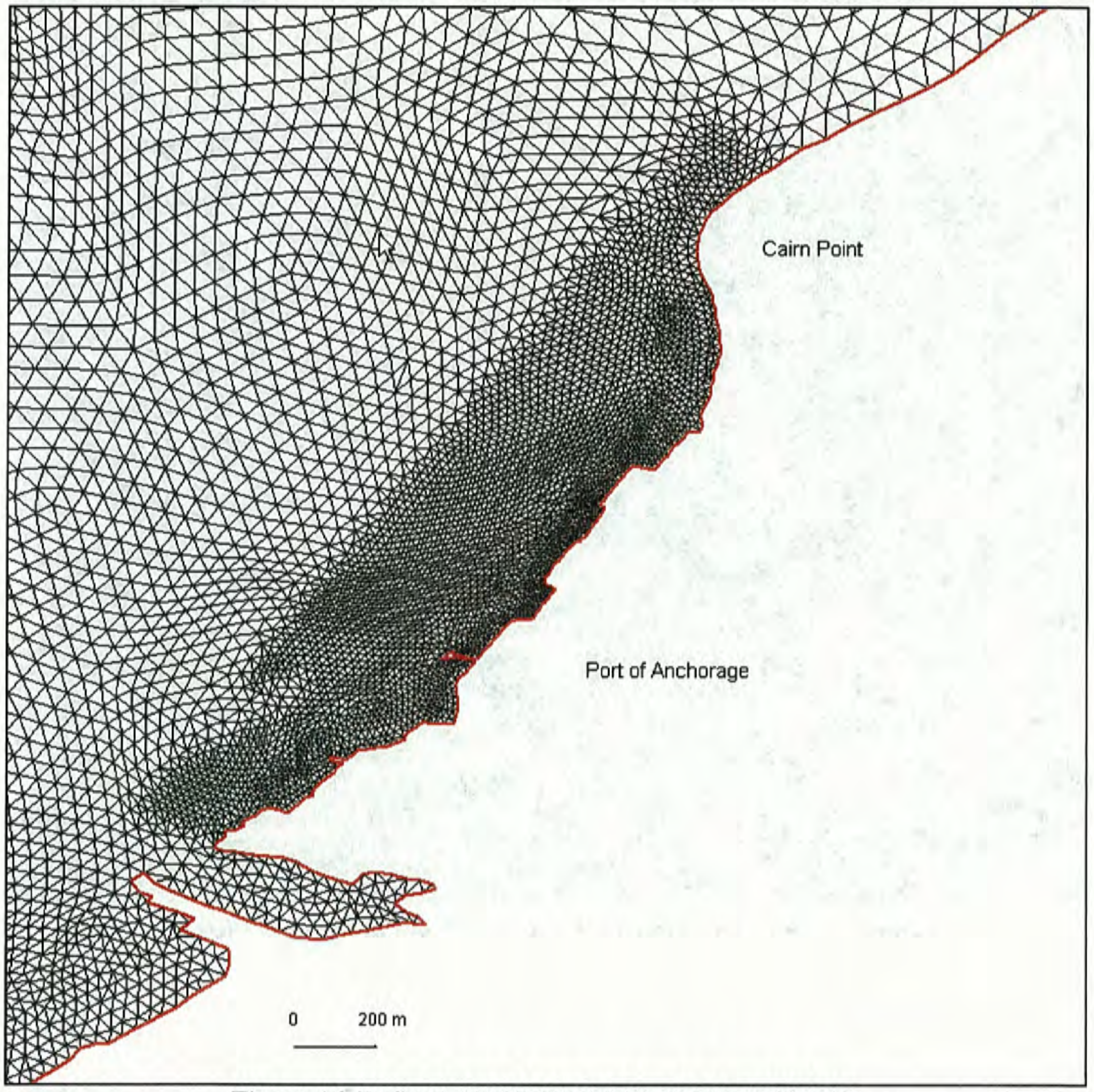

Figure 16 Refined ADCIRC Grid in the Port Vicinity

Improve Grid Quality

Grid quality was enhanced by improving the alignment of elements in the vicinity of the Port. Also alignment of skewed elements in low-resolution areas was improved to insure smooth flow circulation.