Oregon International Port of Coos Bay

Proposed Section 204(f)/408 Channel Modification Project

Sub-Appendix 1

Aids to Navigation

January 2024 Draft

EXECUTIVE SUMMARY

Forty-six Aids to Navigation (ATON) are currently used to mark the federal navigation channel (FNC) between the channel entrance and River Mile (RM) 8.2; 20 range markers and 26 lateral markers. As a part of the Coos Bay Channel Modification Project (the Project), 38 existing ATON will be relocated. The proposed ATON were configured and located with input from the Coos Bay Pilots Association, U.S. Coast Guard (USCG), and recommendations stemming from full ship simulations conducted specifically for the Project. The design will be confirmed by the USCG and revised as needed in future submittals.

Fifty-two ATON are proposed to mark the Proposed Alteration (PA) Plan and include:

- 32 Lateral Markers (4 fixed, 28 buoys)
    - 7 existing lateral markers will remain in place (3 fixed, 4 buoys)
    - 19 lateral markers will be relocated (1 fixed, 18 buoys)
    - 6 New buoys are proposed
- 20 Range Markers
    - 1 range marker will remain in place
    - 19 range markers will be relocated

The total direct cost associated with relocating all the buoys and installing new buoys is estimated to be ?? million. The direct cost to relocate each fixed light or range marker is estimated to be ??. The total direct cost associated with relocating fixed range markers is expected to be ??. The approximate total cost for ATON work is ?? million; this value includes direct cost, indirect cost, and markup.

Of the relocated ATON, only two will remain outside of property administered by the Oregon Division of State Lands – two proposed range markers that share one structure are located on port property.

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ACRONYMS AND ABBREVIATIONS

2D	Two-dimensional
3D	Three-dimensional
3d HD	3D Hydrodynamic
ac	Acres
ADCP	Acoustic Doppler Current Profilers
AIS	Automatic identification system
AMD	Advanced Maintenance Dredging
ASA(CW)	Assistant Secretary of the Army for Civil Works
ATON	Aids to Navigation
BMPs	Best Management Practices
BOE	Basis of Estimate
BW	Boussinesq Wave
CBNS	Coos Bay North Spit
CDF	Confined Disposal Facility
CDIP	Coastal Data Information Program
CFR	Code of Federal Regulations
cfs	Cubic feet per second
CMOP	Coastal Margin Observation and Protection
CMS	Coastal Modeling System
CRA	Cost Risk Analysis
CSZ	Cascadia Subduction Zone
CWA	Clean Water Act
cy	Cubic yards
cy/yr	Cubic yards per year
CZMA	Coastal Zone Management Act
DBB	Design-Bid-Build
DDR	Design Documentation Report
DEA	David Evans and Associates, Inc.
DHI	Danish Hydraulic Institute
DMMP	Dredged Material Management Plan
DOGAMI	Oregon Department of Geology and Mineral Industries
DTM	Digital Terrain Model
EC	Engineering Circular
EIS	Environmental Impact Statement
ENSO	El Niño/Southern Oscillation
ER	Engineer Regulations
ERDC	Engineer Research and Development Center
ESA	Endangered Species Act
ETL	Engineer Technical Letter
FAA	Federal Aviation Administration
FERC	Federal Energy Regulatory Commission
FM	Flexible Mesh
FM HD	Flexible Mesh Hydrodynamic
FNC	Federal Navigation Channel
FR	Federal Register
ft	Foot or feet
FY	Fiscal Year
gpm	Gallons per minute
GRI	Geotechnical Resources, Inc.
HCSS	Heavy Construction Systems Specialists
HOWL	Highest Observed Water Level
HRA	Habitat Restoration Area
HSE	Health, safety and environment
IG	Infragravity
ILS	Instrument Landing System

ACRONYMS AND ABBREVIATIONS

in.	Inches
IWP	Industrial Waste Pond
JCLNG	Jordan Cove LNG Export Facility
lf	Linear feet
LiDAR	Light Detection and Ranging
LNG	Liquefied natural gas
LNGC	Liquefied natural gas carrier
LOA	Length Overall
LSB	Log-spiral Bay
LST	Longshore Transport
M&N	Moffatt & Nichol
MCR	Mouth of the Columbia River
MCX	Mandatory Center of Expertise
mcy	Million cubic yards
MHHW	Mean Higher High Water
MHW	Mean High Water
mi	Miles
MLLW	Mean Lower Low Water
MLW	Mean Low Water
mm	Millimeters
MMR	Major Maintenance Report
MOF	Material Offloading Facility
MPRSA	Marine Protection, Research, and Sanctuaries Act
MSL	Mean Sea Level
MTL	Mean Tide Level
MTO	Material takeoffs
NAIP	National Agricultural Imagery Program
NAVD88	North American Vertical Datum of 1988
NDBC	National Data Buoy Center
NED	National Economic Development
NEPA	National Environmental Policy Act
NGDC	National Geodetic Data Center
NM	Nautical Mile
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Service
NRC	National Research Council
NTPro	Navi Trainer Pro 5000
NW	Northwest
O&M	Operations and Maintenance
OCMP	Oregon Coastal Management Program
ODEQ	Oregon Department of Environmental Quality
ODLCD	Oregon Department of Land Conservation and Development
ODMDS	Ocean Dredged Material Disposal Site
ODSL	Oregon Department of State Lands
OESA	Oregon Endangered Species Act
OGMT	Oregon Gateway Marine Terminal
OIPCB or Port	Oregon International Port of Coos Bay
OPC	Opinion of probable costs
OPRD	Oregon Parks and Recreation Department
OSU	Oregon State University
PA	Proposed Alteration
POT	Peak-Over-Threshold
PRG	Project Review Group
PRG	Project Review Group

ACRONYMS AND ABBREVIATIONS

psi	pounds per square inch
PSU	Practical salinity unit
QC	Quality control
RAO	Response Amplitude Operators
RFP	Roseburg Forest Products
RM	River mile
RMS	Root-mean-squared
ROD	Record of Decision
SDPP	South Dunes Power Plant
SEF	Sediment Evaluation Framework
SELFE	Semi-implicit Eulerian-Lagrangian Finite Element
SHPO	Oregon State Historic Preservation Office
SL	Screening levels
SLC	Sea level change
SLR	Sea-level Rise
SMMP	Site Management/Monitoring Plan
SOORC	Southern Oregon Ocean Resource Commission
SSE	Safe Shutdown Earthquake
SW	Spectral Wave
SWORA	Southwest Oregon Regional Airport
TCX	Technical expertise
the “Project”	Coos Bay Section 204(f) Channel Modification Project
TIN	Triangular irregular networks
TSP	Tentatively Selected Plan
U.S.	United States
USACE	U.S. Army Corps of Engineers
USBLM	U.S. Bureau of Land Management
USC	United States Code
USCG	U.S. Coast Guard
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
USGS	U.S. Geological Survey
VFR	Visual flight rules
WIIN	Water Infrastructure Improvements for the Nation
WNW	West-northwest
WOP	Without Project
WRDA	Water Resources Development Act
WRRDA	Water Resources Reform and Development Act
WSP	Western Snowy Plover
WSW	West-southwest

1. INTRODUCTION

The Oregon International Port of Coos Bay (OIPCB or Port) is home to the second largest deep-draft coastal harbor between San Francisco and the Puget Sound, based on the tonnage of cargo transported through the Port. Access to the Port's facilities is provided by the Coos Bay Federal Navigation Channel (FNC), a federal channel that was first dredged in the early 1900s. The channel was last improved in 1998, when the channel was deepened by 2 feet (ft) from 35 ft to 37 ft. Since 1998, vessels calling at the Port have substantially increased in size.

1.1 Overview

The OIPCB seeks approval to modify portions of the Coos Bay, Oregon Federal Navigation Project, under the authority granted by Section 204(f) of the Water Resources Development Act (WRDA) of 1986, as amended by Section 1014(b) of the Water Resources Reform and Development Act (WRRDA) of 2014 and Section 1127 of Water Infrastructure Improvements for the Nation (WIIN) Act of 2016 (also referred to as WRDA 2016, hereinafter referred to as WIIN Act of 2016). Section 204 delegates authority to the Assistant Secretary of the Army for Civil Works (ASA(CW)) to approve requests by non-federal entities to design and construct non-federal improvements to federal navigation projects, and to assume federal responsibility for maintenance of those improvements after non-federal construction is completed. The proposed action also requires permission to modify the existing Coos Bay Federal Navigation Project under Section 14 of the Rivers and Harbors Appropriation Act of 1899, 33 United States Code (USC) 408 (Section 408).

1.2 Study Area Description

Coos Bay is located in Coos County, Oregon, on the southern Oregon coast, about 200 miles (mi) south of the mouth of the Columbia River (MCR) and 445 mi north of San Francisco Bay. It is the navigational approach to Charleston, Empire, North Bend, Glasgow, Coos Bay, and Eastside (Figure 1-1 and Figure 1-2). The bay is formed by the junction of Isthmus Slough, Coos River, South Slough, Kentuck Slough, Haynes Slough, and Winchester Creek, and is located at the foot of the Coast Range. Deep-draft navigation is limited to the lower 15 mi of the estuary.

The surface area of the Coos Bay estuary is about 12,000 acres (ac) (about 19 square mi). Tidelands, located from River Mile (RM) 0 through 15, comprise 20 percent to 30 percent of the estuary area. The inlet to the estuary, referred to as the Entrance Channel, is fully exposed to waves.

The Coos Bay estuary drains directly into the Pacific Ocean. The nearshore zone adjacent to the Entrance Channel is composed of fine- to medium-grained sediments and intermittent rock outcroppings. The coastal shelf within 8 mi of the inlet has a roughly 100:1 (Horizontal: Vertical) slope. Cape Arago, a headland that limits sediment transport and marks the southern boundary of the littoral cell, is located 2.5 mi south of the inlet.

The topography of the lower Coos River area is a combination of rugged mountain terrain, extensive sand dunes adjacent to the ocean, and relatively flat pasture land along the river. The terrain of the area is quite rugged, because the mountains are relatively young, denoted by the typical narrow, sinuous valleys and steep side slopes. Relief varies from sea level to just under 3,000 ft; however, most of the land lies between 500 ft and 1,500 ft in elevation.

Geotechnical investigations indicate the subsurface conditions in the channel typically vary from relatively clean sand to siltstone and sandstone sedimentary rock. The sedimentary rock is present near the mudline from about RM 2 to RM 6 and at Guano Rock from about RM 0.7 to RM 0.9.

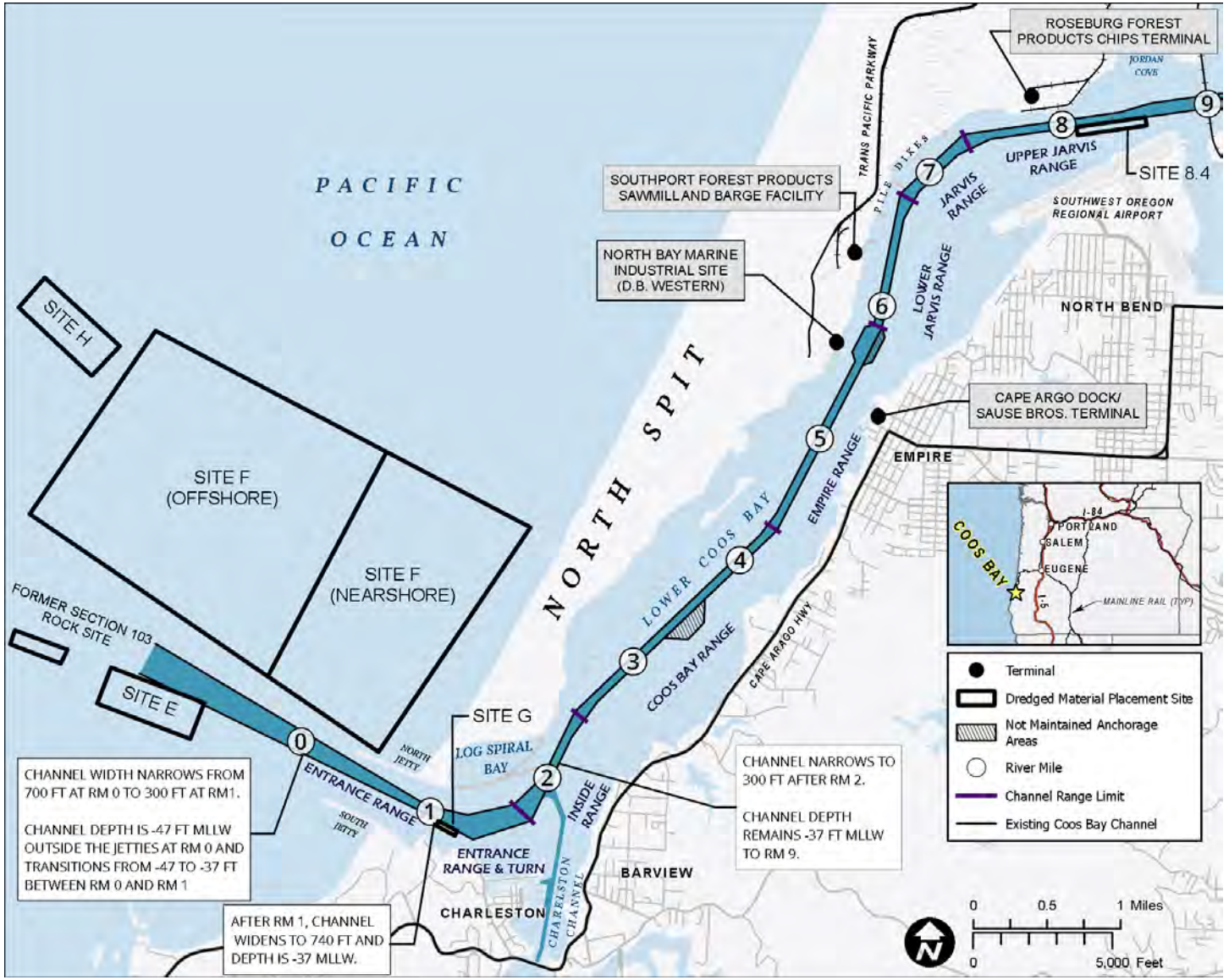


Figure 1-1
Coos Bay Project Vicinity Map, Upper Bay

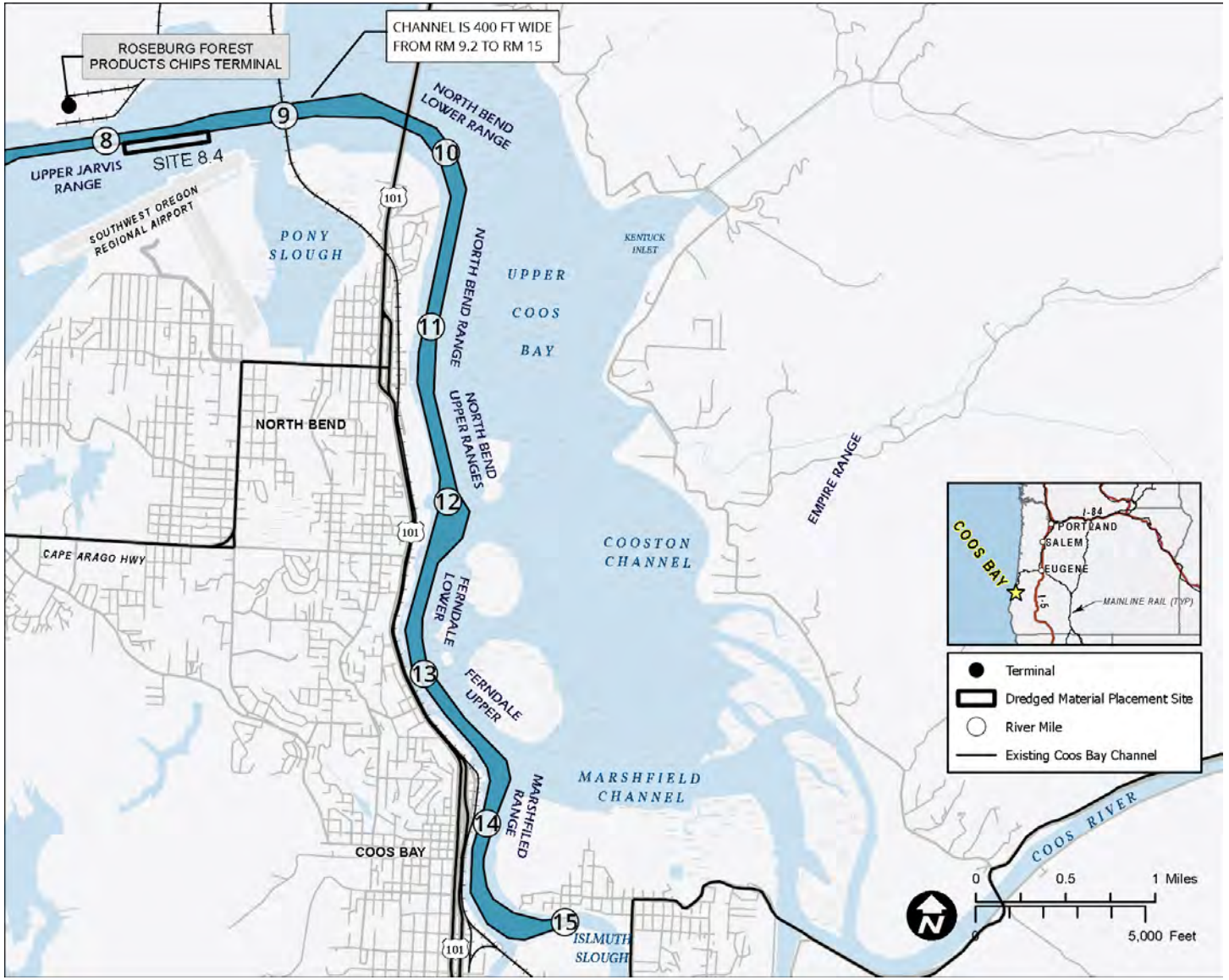


Figure 1-2
Coos Bay Project Vicinity Map, Lower Bay

1.3 Existing Navigation Channel

The Coos Bay Federal Navigation Project was first authorized by the Rivers and Harbors Appropriation Act of March 3, 1899, and has been subsequently modified in 1919, 1937, 1951, 1952, 1979, and 1998. The 1979 project represents the completion of the 1970 authorized which allowed the USACE to deepen and maintain the Entrance Channel at -45 ft Mean Lower Low Water (MLLW) and the inner channel to -35 ft MLLW. The most recent project modification was authorized in the fiscal year (FY) 1996 Energy and Water Development Appropriations Act, Public Law 104-46, which provided for deepening the channel by 2 ft to -47 ft MLLW from the ocean entrance to Guano Rock at RM 1, and to -37 ft MLLW from RM 1 to RM 15. Public Law 104-46 also provided for deepening the turning basin at RM 12 by 2 ft and expanding it by 100 ft, from 800 ft by 1,000 ft to 900 ft by 1,000 ft.

The U.S. Army Corps of Engineers (USACE) Federal Navigation Project consists of the following federally authorized elements:

- North Jetty (9,600 ft long) and South Jetty (3,900 ft long), located on either side of the Entrance Channel, including the two relic structures that extend from the root of the North Jetty, one of which extends into Log-spiral Bay (LSB) and the other of which extends into the estuary.
- An Entrance Channel with an authorized depth of -47 ft MLLW, which decreases from a nominal width of 700 ft at RM 0 to a nominal width of 300 ft at RM 1.
- An inner channel (from RM 1 to RM 15) that has an authorized depth of -37 ft MLLW, a nominal width of 300 ft from RM 1 to RM 9, and a nominal width of 400 ft from RM 9 to RM 15.
- Two (2) turning basins, both of which are 1,000 ft long. The first is located at RM 12, and has a width of 900 ft. The other, located at RM 14, has a width of 730 ft. Both have a depth of -37 ft MLLW, consistent with the channel depth.
- Five (5) pile dikes between RM 6.4 and RM 7.3 in the main channel.
- Continuation of the main channel beyond RM 15 (in the Isthmus Slough) with a width of 150 ft and a depth of -22 ft MLLW.
- A 150-ft-wide Charleston Access Channel that has a depth that varies from –17 to -14 ft MLLW.
- A breakwater and bulkhead at Charleston.
- Charleston Small Boat Basin (10 feet deep) constructed by USACE in 1956 and maintained by the OIPCB.
- Advance maintenance dredging (AMD) of the channel extends offshore to RM -0.55, where the width of maintenance is 1,060 ft. Authorized AMD is 5 ft of depth in the Entrance Channel (RM -0.55 to RM 1) and 1 ft of depth upstream of RM 1.

The USACE maintains the above elements (with the exception of the Charleston Small Boat Basin) to provide navigational access to Coos Bay. USACE maintenance of the main navigation channel and jetty features ensures ongoing deep-draft navigation access to Coos Bay.

1.4 Description of the 2023 Proposed Alteration (2023 PA)

To accommodate larger deep draft vessels and provide local, state, and federal economic benefits, the Port proposes navigation channel improvements to the Coos Bay Navigation Channel. These proposed channel improvements are hereinafter referred to as the 2023 Proposed Alteration (2023 PA) and they are summarized as follows:

- *Coos Bay Inside Range*: the channel from RM 1.3 to RM 2.8 on the red side of the channel was widened. The range heading of the Coos Bay Inside Range was changed by 1° from 28.0° - 208.0° to 27.0° - 207.0°.

- *Bend Widener at RM 4.0*: a bend widener was included in the 2023 PA to add an additional 50 ft on the green side in the turn from Coos Bay Range to Empire Range.

- *Post Panamax Generation 3 (PPX3) Containership Turning Basin at RM 5.0*: a larger turning basin at the container facility is needed to accommodate the PPX3 containership. Based on the vessel's dimension, the proposed turning basin is 2,000 feet long (parallel to the channel) and 1,600 feet wide. The turning basin's design bottom elevation is -45 ft MLLW, the same as the 2023 PA channel.

- *Capesize Turning Basin at RM 8.0*: a Capesize turning basin was added at RM 8.0 to replace the turning basin that was removed at RM 7.5. Operationally, this turning basin will be used by inbound empty vessels. Therefore, the turning basin's design bottom elevation is -37 ft MLLW. The deeper navigation channel (450-ft wide at -45 ft MLLW) continues through the length of the turning basin.

The above improvements are shown in Table 1-1 and Table 1-2; no dredging is proposed beyond the boundaries in these tables. The project vicinity is represented graphically in Figure 1-3. In this figure, the channel is labeled by RM. Figure 1-3 also shows the location of the adjacent federal infrastructure: the two jetties that run parallel to the channel from RM 0 to RM 1 and the pile dikes located along the north bank of the channel from RM 6.4 to RM 7.5.

Table 1-1

Channel Footprint for Existing Authorized Project and 2023 PA

Range(s) and RM	Existing Conditions	2023 PA
Longitudinal Extent		
Offshore Limit including Advanced Maintenance Dredging	RM -0.55[1]	RM -1
Offshore Limit of Navigation Channel	RM 0[1]	RM -0.9
Channel Width (ft)		
Offshore Inlet Offshore Limit of Navigation Channel to RM 0.3	700 narrowing to 550	1,280 narrowing to 600
Entrance Range RM 0.3 to 1.0	550 narrowing to 300	600
Entrance Range RM 1.0 to 2.0 and Turn	Varies up to 740	Varies up to 1,140
Inside Range RM 2.0 to 2.5	300	500
Coos Bay Range RM 2.5 to 4.3	300	450
Empire Range RM 4.3 to 5.9	300	450
Post Panamax Generation 3 Turning Basin RM 4.7 to 5.6	None	2,000 x 1,600
Lower Jarvis Range RM 5.9 to 6.8	300	450
Jarvis Turn RM 6.8 to 7.3	400	500
Upper Jarvis Range RM 7.3 to 8.2	300	450

Range(s) and RM	Existing Conditions	2023 PA
Capesize Turning Basin RM 7.6 to 8.0	None	2,000 × 1,100

Notes:

1. The authorized FNC starts at RM 0. However, advanced maintenance dredging (AMD) occurs further offshore, typically from the channel entrance to RM -0.55. The channel width at RM -0.55 is approximately 960 ft.

Table 1-2

Channel Depth for Existing Authorized Project and 2023 PA

	Navigation Bottom Elevation (ft, MLLW)		Advance Maintenance Dredging[1] (ft)	
Range(s) and RM	Existing Conditions	2023 PA	Existing Conditions	2023 PA
Offshore Inlet Offshore Limit of Navigation Channel to RM 0.3	-47	-57	5	6
Entrance Range RM 0.3 to 1.0	-47 decreasing to -37[2]	-57 decreasing to -45[3]	Varies 5 to 1[4]	Varies 1 or 6[5]
Entrance Range and Turn RM 1.0 to 2.0	-37	-45	1	1
Inside Range RM 2.0 to 2.5	-37	-45	1	1
Coos Bay Range RM 2.5 to 4.3	-37	-45	1	1
Empire Range RM 4.3 to 5.9	-37	-45	1	1
Post Panamax Generation 3 Turning Basin RM 4.7 to 5.6	None	-45	None	1
Lower Jarvis Range RM 5.9 to 6.8	-37	-45	1	1
Jarvis Turn RM 6.8 to 7.3	-37	-45	1	1
Upper Jarvis Range RM 7.3 to 8.2	-37	-45	1	1
Capesize Turning Basin RM 7.6 to 8.0	None[6]	-37[6]	None	1

Notes:

1. Capital dredging consists of the navigation depth plus AMD plus a rock buffer plus a portion of overdepth.
2. For the existing channel, the navigation depth decreases from a depth of 47 to -37 ft MLLW between RM 0.4 and RM 0.7. The channel is dredged farther offshore to allow for AMD.
3. For the 2023 PA, the navigation depth decreases by 12 ft between RM 0.3 (depth of -57 ft MLLW) and RM 1.0 (depth of -45 ft MLLW).
4. AMD of 5 ft starts at the offshore daylight line, approximately RM -0.6, and continues to RM 0.7.
5. AMD of 6 ft starts at the offshore daylight line. The AMD will be 1 ft in areas where Guano Rock is present (RM 0.7 to RM 1).

6. Under the Existing Conditions, there is no formal turning basin; vessels that visit RFP turn in existing deeper water at this location. Under the 2023 PA, incoming vessels will enter the channel and turn under ballast load, so it is not necessary to dredge beyond -37 ft MLLW.

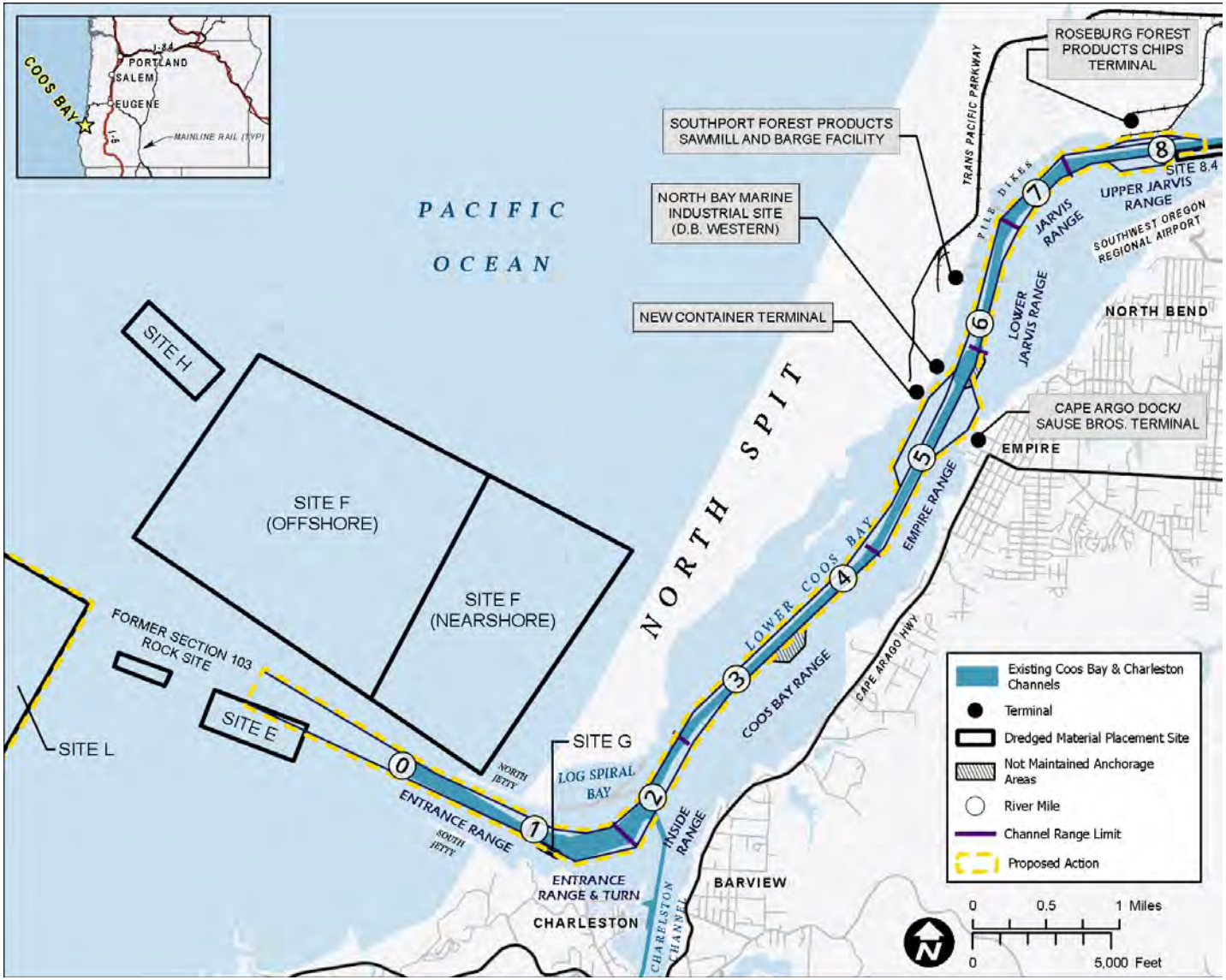


Figure 1-3
Summary of Proposed Alteration

1.5 Objective

This report describes the existing and proposed ATON associated with the existing Coos Bay FNC and the PA, respectively. The report identifies ownership and installation considerations for the new and relocated ATON.

1.6 Background

ATON serve mariners by helping them locate and navigate the federal channel at Coos Bay. Presently, 46 ATON are used to mark the FNC between the channel entrance and RM 8. As a part of the Coos Bay Channel Modification Project (the Project) the existing ATON will need to be removed, relocated, or supplemented with additional markers (see Attachment A). Most ATON relevant to the Project improvements serve one of two purposes: marking the lateral extents of the channel (lateral markers) and indicating the range centerline (range markers). Buoy K is technically a safe water mark but is discussed herein with the other lateral markers. Safe water marks are commonly used to mark offshore approach points and indicate that there is unobstructed water on all sides (USCG 2016). Typical types of ATON found in Coos Bay are shown in Figure 1-4.

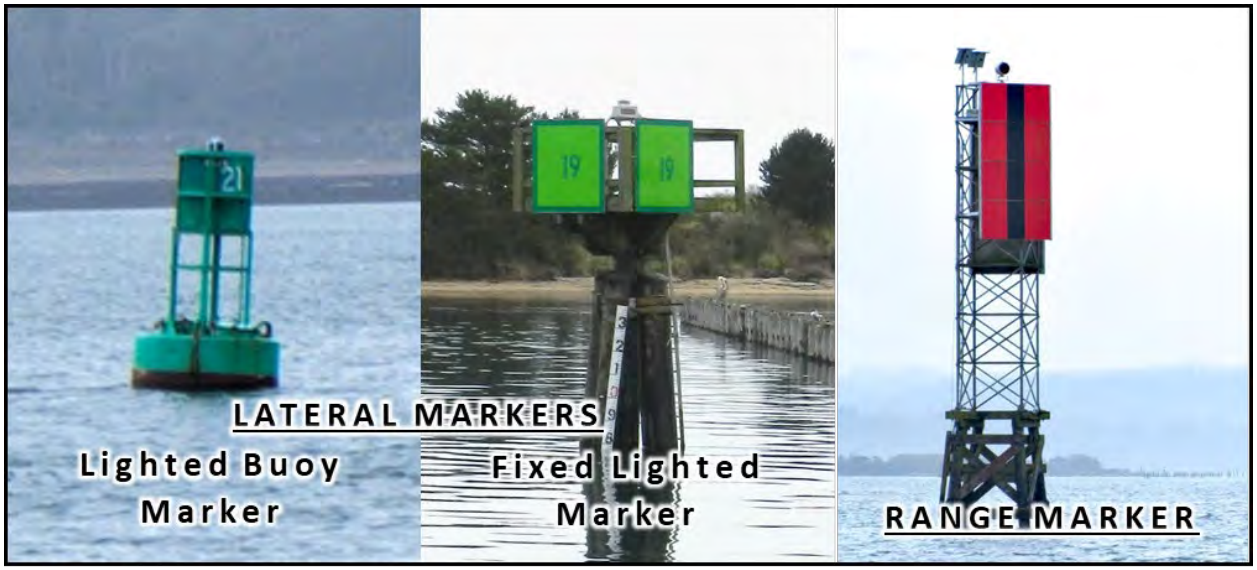


Figure 1-4
Typical Aids to Navigation in Coos Bay

1.7 Report Organization

This report is organized into the following sections:

- Section 2 provides a description of existing lateral markers within the Project area and proposed changes.
- Section 3 provides a description of existing range markers within the Project area and proposed changes.
- Section 4 provides a description of ownership, construction, and costs of the proposed ATON.

- Attachment A includes drawings of the proposed layout at an overview and enlarged scales.

2. LATERAL MARKERS

Typical designs for the lateral markers are shown in Figure 2-1 (fixed markers), Figure 2-2 (buoys), and Figure 2-3 (buoy sinkers). As these figures show, the fixed lights are attached to pile-supported structures. ATON are solar powered and contain a storage battery for nighttime use. The footprint of the larger three-pile structure depends on the depth, but is generally less than 12-ft by 12-ft.

Existing lateral markers are shown in Figure 2-1 and listed in Table 2-1. The existing lateral marker system up to RM 8 consists of 22 buoys and 4 fixed markers. The proposed ATON consist of 28 buoys and 4 fixed markers. All but 7 (3 fixed and 4 buoys) markers are to be relocated as a part of the channel modification project. Six (6) of the proposed buoys are new buoys. The proposed lateral marker configuration was tested and modified by the Coos Bay Pilots during full mission bridge simulations (Sub-appendix 7, Full Ship Simulation, to the 204(f)/408 Report Engineering Appendix). The Project's proposed lateral markers are shown in Figure 2-5 and listed in Table 2-2. The proposed lateral markers are shown at an enlarged scale in Attachment A.

The relocated markers[1] have been positioned following guidance provided by Coos Bay Pilots during ship simulation and will be coordinated with the U.S. Coast Guard (USCG). The buoys are proposed to be anchored at least 100 ft[2] outside of the channel edge. This ensures that the concrete buoy sinker remains away from the channel dredged slopes and that the buoy does not encroach upon the channel or maintenance dredging operations. All the relocated markers will maintain their existing marking and light characteristics.

One buoy, K, is enhanced with radio communication capabilities, reporting its up-to-date status and location to the national automatic identification system (AIS). AIS is an internationally adopted radio communication system primarily used to broadcast, among other things, a vessel's name, location, speed, and heading. The use of this system has been expanded to include ATON. AIS ATON can broadcast their presence, identity, position, and status every three minutes or as needed. AIS broadcast can originate from the ATON or from a base station. Therefore, if a buoy is sunk or temporarily removed, it can still appear in AIS.

[1] 10569152, corrected throughout
[2] Dr Checks 10569159

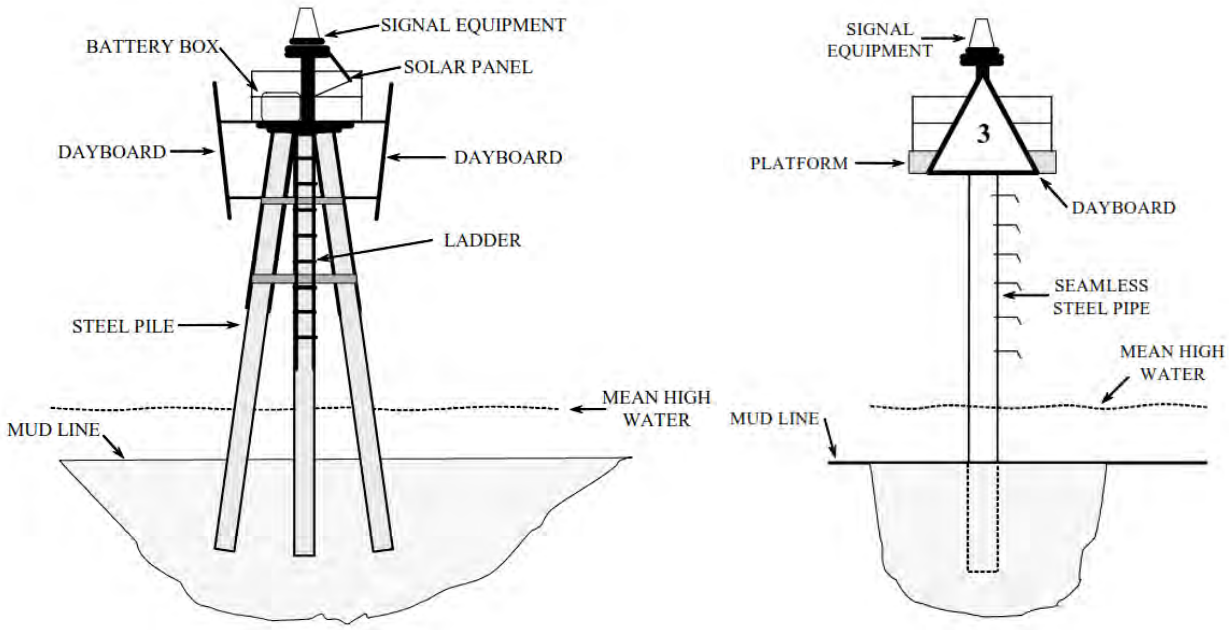
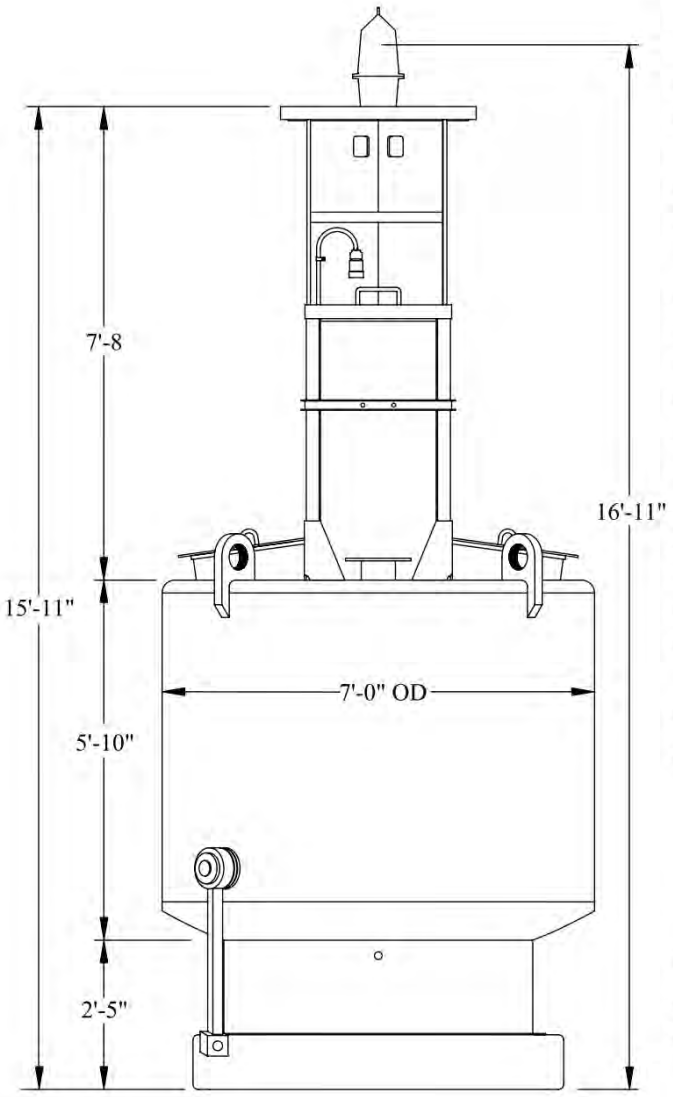


Figure 2-1
Schematics of Pipe Pile Beacon Structures (USCG 2005)



Physical Characteristics. (no mooring)

Buoy Weight	7,800 lbs.
Buoy Draft	5 ft. 6 in.
Focal Height of Light	11 ft. 5 in.
Freeboard	3 ft.
Minimum Freeboard	14 in.
Pounds-Per-Inch Immersion	205

Related Equipment.

Bell	85 lbs.
Horn	SA-850
Mooring Bridle	1-1/4 in. x 15 ft.
Mooring Chain	1-1/4 in.
Sinker (concrete)	8,500 lbs.

Operational Characteristics. (nominal)

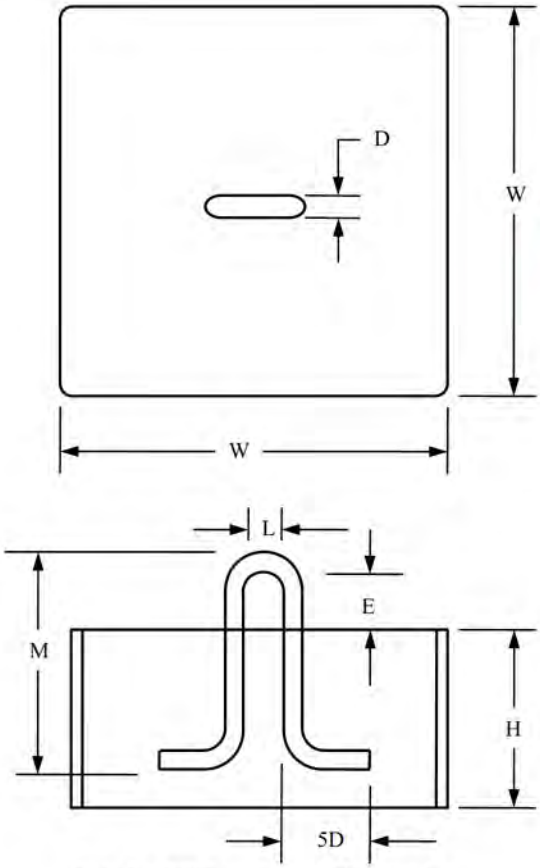
Daymark Visual Range	2.3 nm
Radar Range	2.7 nm
Mooring Depth (min.)	17 ft.

Maximum Mooring Depth.

Chain Size	Max Mooring Depth
1-1/2"	133'
1-1/4"	189'
1-1/8"	233'
1"	291'

Reference Documents. (use latest rev.)
G-SEC Drawing No. 121129(107323)
G-SEC Specification No. 464

Figure 2-2
Standard Buoy Data Sheet 2.K.8 (USCG 2010)



Note: For 500 lbs sinker and 250 lbs sinker, use the dimension 3D.

NOMINAL WEIGHT (LBS)	SINKER DIMENSIONS (IN)					
	W	H	D	L	E	M
20,000	70	51	2	5	5	22
18,000	70	46	2	5	5	22
15,000	70	38	2	5	5	22
12,500	60	43	2	5	5	22
8,500	60	30	2	5	5	22
6,500	60	23	2	5	5	22
5,000	50	25	2	5	5	22
4,000	50	20	2	5	5	22
3,000	50	15	2	5	5	17
2,000	36	20	1-1/2	5	5	22
1,000	36	10	1-1/2	5	5	12
500	22	14	1-1/2	5	5	17
250	22	8	1-1/2	5	5	11

Figure 2-3
Data Sheet 2.M.5: Concrete Sinkers (USCG 2010)

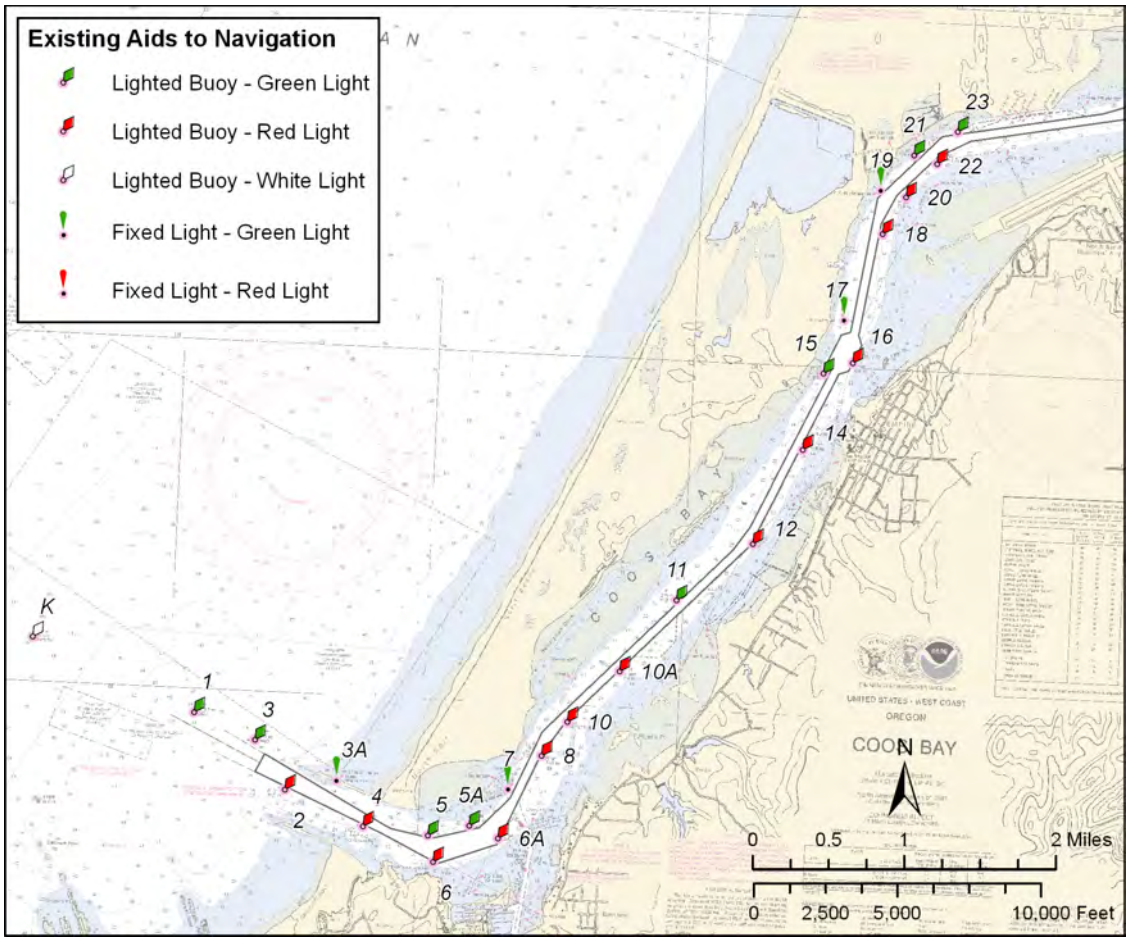


Figure 2-4
Existing Lateral Markers

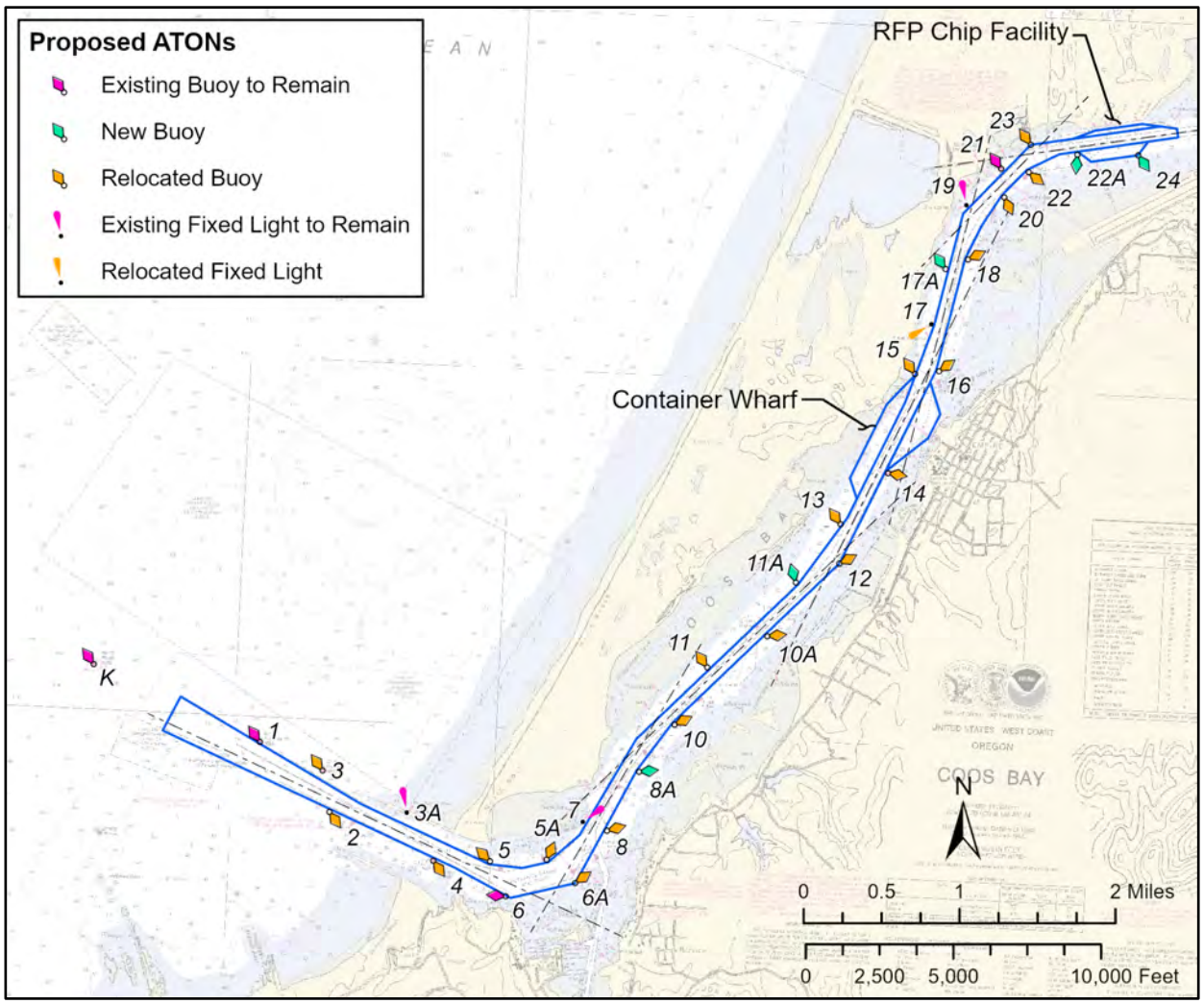


Figure 2-5
Proposed Lateral Markers

Table 2-1
Existing Lateral Markers (USCG 2016a)

Name		Light List Number	Latitude (degrees)	Longitude (degrees)	Light Description	Structure Description	Height (ft-MHW)	Range (NM)	Required Modification
Approach Lighted Whistle Buoy	K	8730	43.370832	-124.384873	Mo (A) Q	Red and white stripes	0	5	No Change
Entrance Lighted Bell Buoy	1	8735	43.364336	-124.363313	Fl G 2.5s	Green	0	3	No Change
Entrance Lighted Buoy	2	8750	43.357339	-124.350931	Fl R 4s	Red	0	3	Relocated
North Jetty Lighted Whistle Buoy	3	8755	43.361964	-124.355164	Fl G 4s	Green	0	4	Relocated
North Jetty Light	3A	8760	43.358415	-124.344228	Fl G 2.5s	Green pile structure	23	4	No Change
Guano Rock Lighted Whistle Buoy	4	8765	43.354143	-124.340490	Fl R 4s	Red	0	3	Relocated
Channel Lighted Bell Buoy	5	8775	43.353578	-124.331977	Q G	Green	0	3	Relocated
Channel Lighted Bell Buoy	5A	8780	43.354688	-124.326593	Fl G 4s	Green	0	4	Relocated
Channel Lighted Buoy	6	8792	43.351085	-124.331148	Fl R 2.5s	Red	0	3	No Change
Channel Lighted Buoy	6A	8794	43.353609	-124.322778	Q R	Red	0	4	Relocated
Channel Light	7	8800	43.358312	-124.321778	Fl G 6s	Square green board on pile structure	16	4	No Change
Channel Lighted Buoy	8	8825	43.361687	-124.317540	Fl R 6s	Red	0	4	Relocated
Channel Lighted Buoy	10	8830	43.365005	-124.314409	Fl R 4s	Red	0	3	Relocated
Channel Lighted Buoy	10A	8831	43.370083	-124.307855	Fl R 4s	Red	0	3	Relocated
Channel Lighted Buoy	11	8835	43.377143	-124.300850	Fl G 4s	Green	0	4	Relocated
Channel Lighted Buoy	12	8840	43.382845	-124.291192	Q R	Red	0	4	Relocated
Channel Lighted Buoy	14	8875	43.391967	-124.285169	Fl R 6s	Red	0	4	Relocated
Channel Lighted Buoy	15	8890	43.399339	-124.282908	Fl G 6s	Green	0	4	Relocated
Channel Lighted Buoy	16	8905	43.400473	-124.279147	Fl R 4s	Red	0	3	Relocated
Coos Bay Light	17	8920	43.404487	-124.280561	Fl G 4s	Square green board on dolphin	17	4	Relocated
Channel Lighted Buoy	18	8935	43.412912	-124.276030	Q R	Red	0	4	Relocated
Jarvis Dike Light	19	8940	43.417044	-124.276538	Fl G 4s	Square green board on multi-pile structure	16	4	No Change
Channel Lighted Buoy	20	8942	43.416539	-124.273128	Fl R 4s	Red	0	3	Relocated

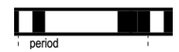
Name		Light List Number	Latitude (degrees)	Longitude (degrees)	Light Description	Structure Description	Height (ft-MHW)	Range (NM)	Required Modification
Channel Lighted Buoy	21	8951	43.420591	-124.272300	Fl G 4s	Green	0	4	No Change
Channel Lighted Buoy	22	8952	43.419858	-124.269284	Fl R 2.5s	Red	0	3	Relocated
Channel Lighted Buoy	23	8955	43.422996	-124.266778	Fl G 2.5s	Green	0	4	Relocated

Table 2-2
Proposed Lateral Markers

Name		Latitude (degrees)	Longitude (degrees)	Light Description	Structure Description	Height (ft-MHW)	Range (NM)	Required Modification
Approach Lighted Whistle Buoy	K	43.370832	-124.384873	Mo (A) Q	Red and white stripes	0	5	No Change
Entrance Lighted Bell Buoy	1	43.364331	-124.363299	Fl G 2.5s	Green	0	3	No Change
Entrance Lighted Buoy	2	43.358127	-124.354038	Fl R 4s	Red	0	3	Relocated
North Jetty Lighted Whistle Buoy	3	43.361432	-124.355499	Fl G 4s	Green	0	4	Relocated
North Jetty Light	3A	43.358410	-124.344213	Fl G 2.5s	Green pile structure	23	4	No Change
Guano Rock Lighted Whistle Buoy	4	43.354110	-124.340519	Fl R 4s	Red	0	3	Relocated (<50ft)
Channel Lighted Buoy	5	43.354245	-124.333336	Q G	Green	0	3	Relocated
Channel Lighted Buoy	5A	43.354650	-124.326140	Fl G 4s	Green	0	4	Relocated
Channel Lighted Buoy	6	43.351080	-124.331134	Fl R 2.5s	Red	0	3	No Change
Channel Lighted Buoy	6A	43.353216	-124.322348	Q R	Red	0	4	Relocated
Channel Light	7	43.358307	-124.321763	Fl G 6s	Square green board on pile structure	16	4	No Change
Channel Lighted Buoy	8	43.363231	-124.315067	Fl R 6s	Red	0	4	Relocated
Channel Lighted Buoy	8A	43.363160	-124.314887	Fl R 6s	Red	0	4	New
Channel Lighted Buoy	10	43.367691	-124.310647	Fl R 4s	Red	0	3	Relocated
Channel Lighted Buoy	10A	43.376259	-124.299379	Fl R 4s	Red	0	3	Relocated
Channel Lighted Buoy	11	43.373153	-124.306839	Fl G 4s	Green	0	4	Relocated
Channel Lighted Buoy	11A	43.373153	-124.306839	Fl G 4s	Green	0	4	New
Channel Lighted Buoy	12	43.383314	-124.290636	Q R	Red	0	4	Relocated
Channel Lighted Buoy	13	43.386947	-124.290680	Fl G 4s	Green	0	4	New
Channel Lighted Buoy	14	43.391900	-124.284974	Fl R 6s	Red	0	4	Relocated
Channel Lighted Buoy	15	43.398665	-124.283524	Fl G 6s	Green	0	4	Relocated
Channel Lighted Buoy	16	43.401564	-124.279062	Fl R 4s	Red	0	3	Relocated

Name		Latitude (degrees)	Longitude (degrees)	Light Description	Structure Description	Height (ft-MHW)	Range (NM)	Required Modification
Channel Light	17	43.405887	-124.280302	Fl G 4s	Square green board on dolphin	17	4	Relocated
Channel Lighted Buoy	17A	43.411057	-124.278795	Fl G 4s	Green	0	4	New
Channel Lighted Buoy	18	43.412039	-124.276008	Q R	Red	0	4	Relocated
Jarvis Dike Light	19	43.417044	-124.276538	Fl G 4s	Square green board on multi-pile structure	16	4	No Change
Channel Lighted Buoy	20	43.417955	-124.271774	Fl R 4s	Red	0	3	Relocated
Channel Lighted Buoy	21	43.420586	-124.272286	Fl G 4s	Green	0	4	No Change
Channel Lighted Buoy	22	43.421016	-124.262074	Fl R 2.5s	Red	0	3	Relocated
Channel Lighted Buoy	22A	43.422211	-124.262674	Fl R 4s	Red	0	3	New
Channel Lighted Buoy	24	43.422414	-124.254963	Fl R 4s	Red	0	3	New

Table 2-3
Selected ATON Abbreviations and Usage (USCG 2016a)

Abbreviation	Description
“2’, “10A”, “K”, …	Marker designation or short name. Lateral markers are numbered, other markers may be lettered. Letters may be used to augment numbers when lateral ATON are added to channels with previously completed numerical sequences.
48ft … ##ft	Height of the light above mean high water (MHW) in ft.
4s, 6s… #s	Period of a light rhythm in seconds.
B	Black, typically used a dayboard stripe color.
Fl	Flashing light rhythm in with a regularly repeating flash, shorter than the duration of darkness. 
G	Green colored buoy, light, or dayboard.
Iso	Isophase flashing rhythm. Durations of light and darkness are equal. 
K _ _	A rectangular dayboard followed by a letter representing the dayboard color and then by stripe color. Typically, twice as tall as it is wide.
Mo (A)	A light flashing Morse code for the letter A. 
NM (or M)	NM – a unit of length measuring exactly 1,852 meters; or approximately the distance spanned by one minute of arc in latitude. #M states the nominal range (distance in which a light or marker can be identified on a clear day) in NMs.
Q	A light rhythm in which flashes are produced at a rate of 60 flashes per minute (1 second period). 
R	Red colored buoy, light, or dayboard.
RFL (or FL)	Front range light.
RRL (or RL)	Rear range light.
W	White colored buoy, light, or dayboard.
Example	**Explanation**
KRB	A red rectangular dayboard with a black stripe.
Fl G 4s 16ft 4M “19”	Marker 19 - a green marker and light, flashing with a 4-second period, located 16 ft above MHW, with a nominal range of 4 NMs.
Iso R 6s 50ft	A red light flashing an isophase rhythm with a 6-second period, located 50 ft above MHW.

3. RANGE MARKERS

Typical modern designs for the range markers are shown in Figure 3-1. As these figures show, the range light and dayboards are attached atop a steel truss tower. The lights are solar powered and are equipped with a storage battery for nighttime use. The platforms supporting the in-water truss are 10-ft by 10-ft. The concrete footing of the land-based structure is typically 18-ft by 18-ft.

Existing range markers are shown in Figure 3-2 and listed in Table 3-1. The existing range marker system up to RM 8.2 consists of 20 range markers. It should be noted that Figure 3-2 shows 17 markers, while Table 3-1 includes 20 markers. The reason for this discrepancy is that the three range markers use the same structure: the front light for the Entrance Range and Coos Bay Inside Range A share a structure, the rear light for Coos Bay Range B and Lower Jarvis Range A share a structure, and the rear light for Upper Jarvis Range A and Lower Jarvis Range B share a structure. Table 3-1 shows these markers as having a slightly different latitude-longitude since the actual ATON are ~4 ft apart even though they share the structure.

All but one of the range markers are to be relocated in support of the project. No new range markers are being proposed. The proposed range marker configuration was tested and modified by the Coos Bay Pilots using full mission bridge simulations (Sub-appendix 7 to the 204(f)/408 Report Engineering Appendix). The Project's proposed range markers are shown Figure 3-3 and listed in Table 3-2. The proposed range marker layout is shown at an enlarged scale in Attachment A.

Required range marker light heights were estimated by using the USCG Range Design 3.0 program (USCG 1997). Range Design 3.0 inputs, calculated minimum light heights, existing light heights, and proposed light heights, are shown in Table 3-3. The Range Design 3.0 calculated minimum light heights were based on a safe height above water (mean higher high water [MHHW]) of 4 ft. The proposed range marker dayboard heights are shown in Table 3-4. The heights of the existing dayboards listed in Table 3-4 were estimated from photographs and oblique aerial images. Light specifications (e.g., intensity, lens type) will be developed in coordination with the USCG and reported in subsequent submittals.

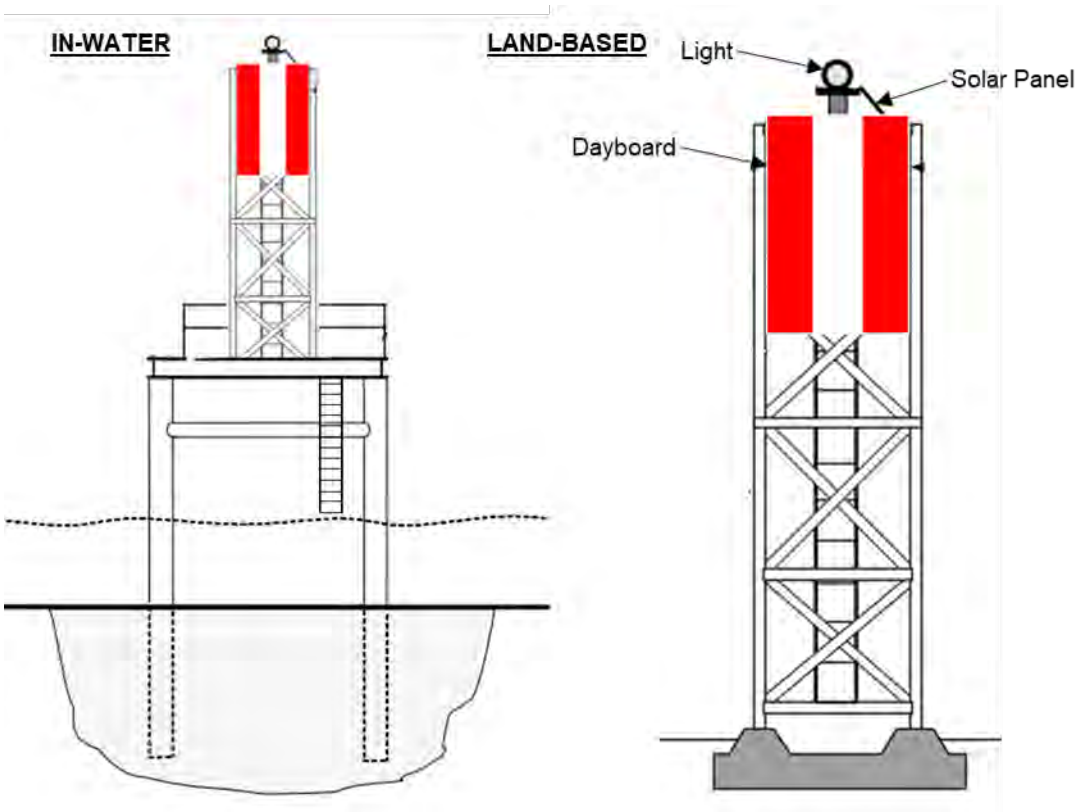


Figure 3-1
Schematics of Range Marker Structures (USCG 2005)

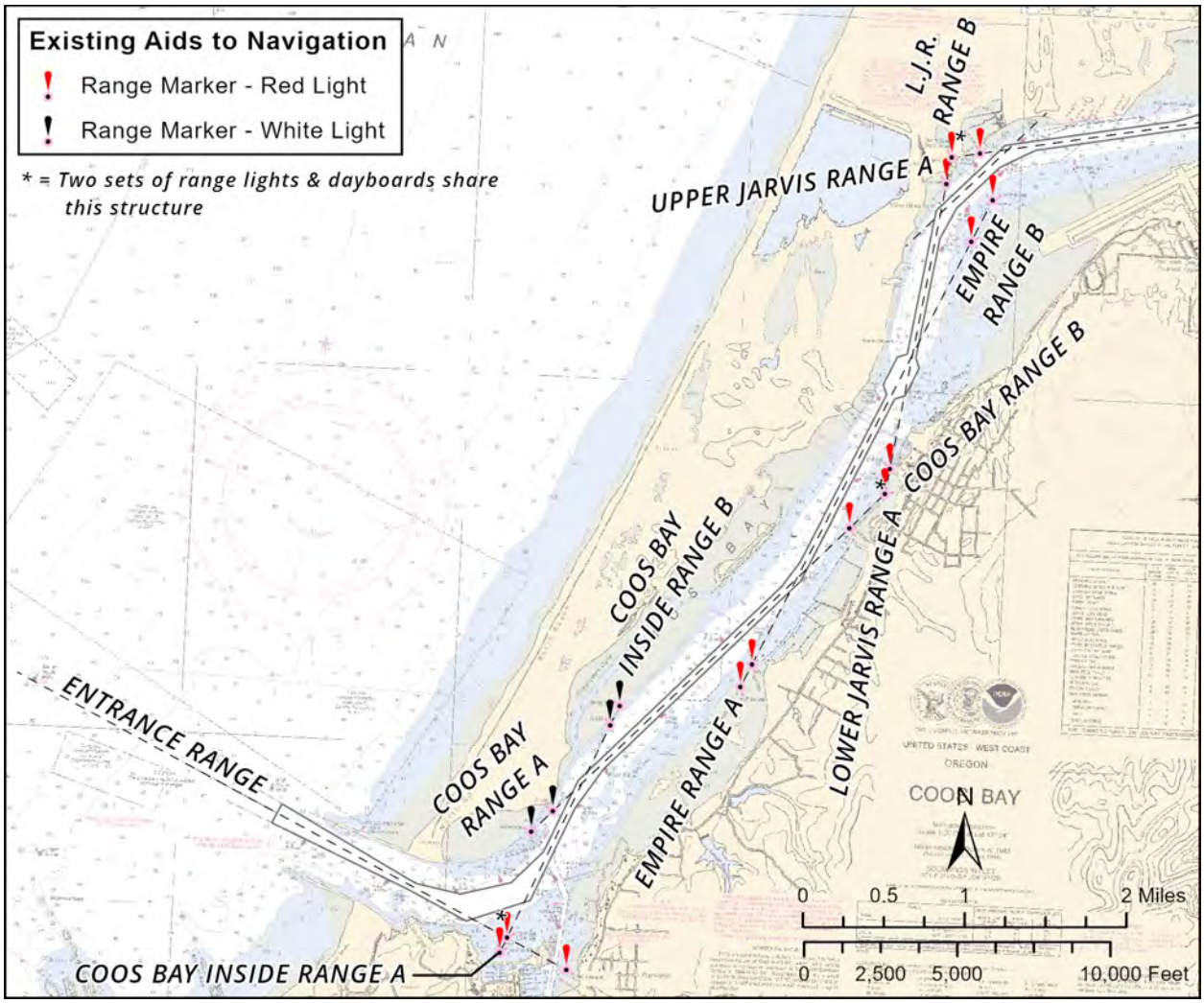


Figure 3-2
Existing Range Markers

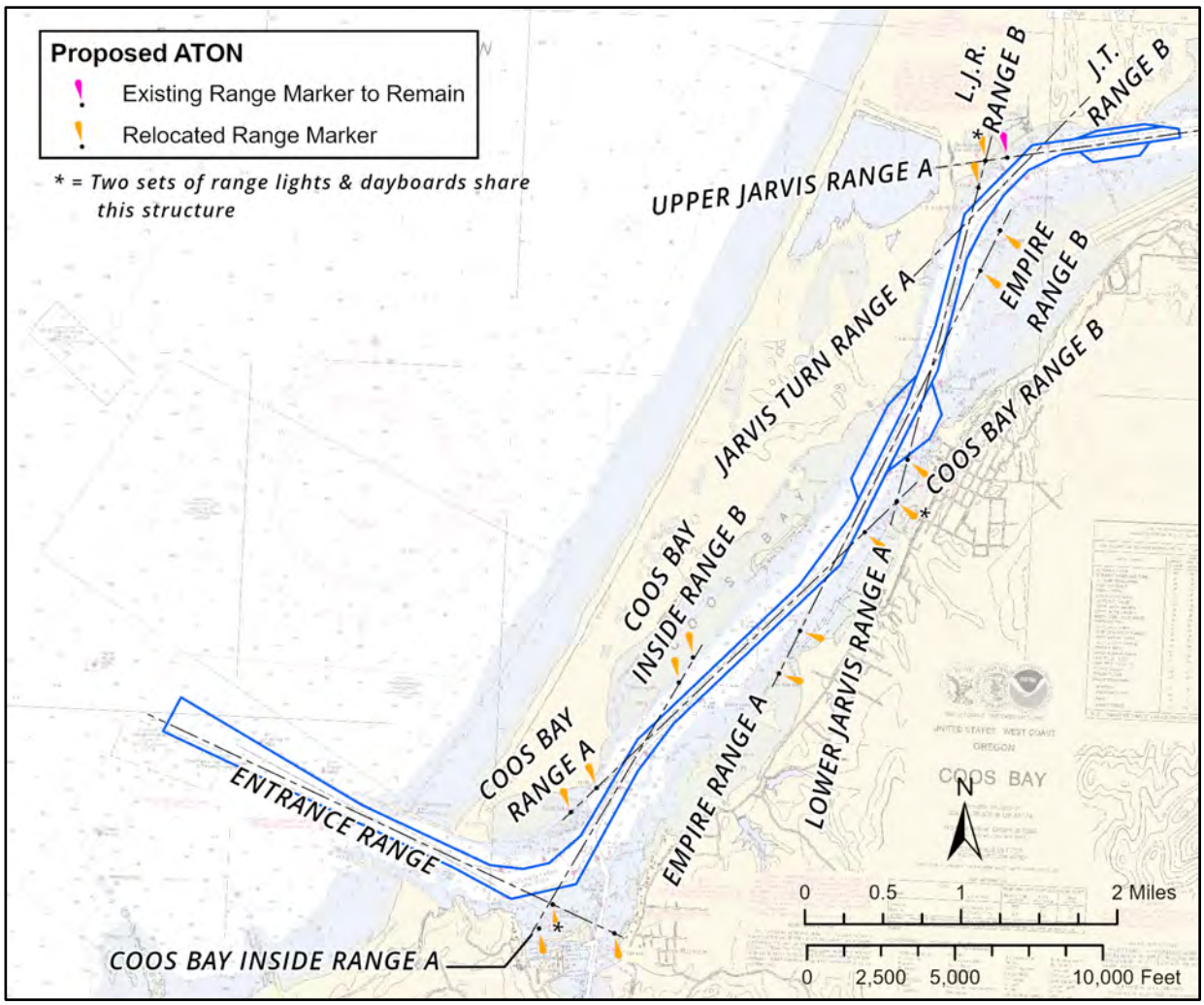


Figure 3-3
Proposed Range Markers

Table 3-1
Existing Range Markers (USCG 2016a)

Name	Light List Number	Latitude	Longitude	Light Description	Dayboard Description	Height (ft-HW)	Range (NM)	Change
Coos Bay Entrance Range Front Range Light	8740	43.349603°	-124.325475°	Q R	KRB	26	0	Relocated
Coos Bay Entrance Range Rear Range Light	8745	43.346964	-124.318016	Iso R 6s	KRB	64	0	Relocated
Coos Bay Inside Range A Front Light	8785	43.349602	-124.325446	Q R	KRB	32	0	Relocated
Coos Bay Inside Range A Rear Light	8790	43.348216	-124.326266	Iso R 6s	KRB	50	0	Relocated
Coos Bay Inside Range B Front Light	8805	43.369034	-124.314001	Q W	KRB	24	0	Relocated
Coos Bay Inside Range B Rear Light	8810	43.370806	-124.312956	Iso W 6s	KRB	43	0	Relocated
Coos Bay Range A Front Light	8815	43.361126	-124.320542	Q W	KWR	15	0	Relocated
Coos Bay Range A Rear Light	8820	43.359185	-124.323092	Iso W 6s	KWR	36	0	Relocated
Coos Bay Range B Front Light	8845	43.387634	-124.285753	Q R	KRW	28	0	Relocated
Coos Bay Range B Rear Light	8850	43.390803	-124.281584	Iso R 6s	KRW	36	0	Relocated

Name	Light List Number	Latitude	Longitude	Light Description	Dayboard Description	Height (ft-HW)	Range (NM)	Change
Empire Range A Front Light	8855	43.375044	-124.29693	Q R	KRB	22	0	Relocated
Empire Range A Rear Light	8860	43.372986	-124.298236	Iso R 6s	KRB	35	0	Relocated
Empire Range B Front Light	8865	43.413722	-124.272392	Q R	KRB	20	0	Relocated
Empire Range B Rear Light	8870	43.417524	-124.269979	Iso R 6s	KRB	38	0	Relocated
Jarvis Lower Range A Front Light	8910	43.393057	-124.281105	Q R	KRB	23	0	Relocated
Jarvis Lower Range A Rear Light	8915	43.390816	-124.281572	Iso R 6s	KRB	40	0	Relocated
Jarvis Lower Range B Front Light	8925	43.418805	-124.275751	Q R	KRB	16	0	Relocated
Jarvis Lower Range B Rear Light	8930	43.421183	-124.27525	Iso R 6s	KRB	48	0	Relocated
Jarvis Upper Range A Front Light	8945	43.421648	-124.271786	Q R	KRB	14	0	No Change
Jarvis Upper Range A Rear Light	8950	43.421191	-124.275247	Iso R 6s	KRB	48	0	Relocated

Table 3-2
Proposed Range Markers

Name	Light List Number	Latitude	Longitude	Light Description	Dayboard Description	Height (ft-MHW)	Range (NM)	Change
Coos Bay Entrance Range Front Range Light	8740	43.351	-124.326	Q R	KRB	26	TBD	Relocated
Coos Bay Entrance Range Rear Range Light	8745	43.348	-124.317	Iso R 6s	KRB	64	TBD	Relocated
Coos Bay Inside Range A Front Light	8785	43.351	-124.326	Q R	KRB	32	TBD	Relocated
Coos Bay Inside Range A Rear Light	8790	43.349	-124.327	Iso R 6s	KRB	50	TBD	Relocated
Coos Bay Inside Range B Front Light	8805	43.372°	-124.310°	Q W	KRB	24	TBD	Relocated
Coos Bay Inside Range B Rear Light	8810	43.374°	-124.309°	Iso W 6s	KRB	43	TBD	Relocated
Coos Bay Range A Front Light	8815	43.362°	-124.32°	Q W	KRW	20	TBD	Relocated
Coos Bay Range A Rear Light	8820	43.359°	-124.323°	Iso W 6s	KRW	42	TBD	Relocated
Coos Bay Range B Front Light	8845	43.387°	-124.287°	Q R	KRW	20	TBD	Relocated
Coos Bay Range B Rear Light	8850	43.389°	-124.284°	Iso R 6s	KRW	43	TBD	Relocated

Empire Range A Rear Light	8860	43.373°	-124.298°	Iso R 6s	KRB	41	TBD	Relocated
Empire Range B Front Light	8865	43.411°	-124.275°	Q R	KRB	20	TBD	Relocated
Empire Range B Rear Light	8870	43.415°	-124.272°	Iso R 6s	KRB	44	TBD	Relocated
Jarvis Lower Range A Front Light	8910	43.393°	-124.283°	Q R	KRB	23	TBD	Relocated
Jarvis Lower Range A Rear Light	8915	43.389°	-124.284°	Iso R 6s	KRB	40	TBD	Relocated
Jarvis Lower Range B Front Light	8925	43.419°	-124.275°	Q R	KRB	20	TBD	Relocated
Jarvis Lower Range B Rear Light	8930	43.421°	-124.275°	Iso R 6s	KRB	40	TBD	Relocated
Empire Range A Rear Light	8860	43.373°	-124.298°	Iso R 6s	KRB	41	TBD	Relocated
Jarvis Upper Range A Front Light	NO CHANGE – RANGE STRUCTURE TO REMAIN IN PLACE							
Jarvis Upper Range A Rear Light	8950	43.421°	-124.275°	Iso R 6s	KRB	43	TBD	Relocated

Table 3-3
Proposed Range Marker Light Height Design Table (USCG 1997)

Range	Reach Length (C)	Reach Width (W)	Distance from FL to near end of channel (M)	Distance between FL and RL (R)	Minimum FL Height (Range Design 3.0)	Existing FL Height	Proposed FL Height	Minimum RL Height (Range Design 3.0)	Existing RL Height	Proposed RL Height
Entrance Range	5900	600	1500	2310	20	26	26	29	64	64
Coos Bay Inside Range A	2700	600	1000	936	16	32	16	18	50	30
Coos Bay Inside Range B	4100	600	2400	972	16	24	16	23	43	26
Coos Bay Range A	5300	450	3400	1196	20	15	20	23	36	36
Coos Bay Range B	6500	450	2800	1498	20	28	20	23	39	35
Empire Range A	3400	450	4000	1605	16	22	18	23	35	29
Empire Range B	5100	450	4800	1509	20	20	20	23	38	35
Lower Jarvis Range A	2800	450	4700	1463	16	23	16	23	40	24
Lower Jarvis Range B	3800	450	2400	948	16	16	16	23	48	30
Upper Jarvis Range A	6800	300	1910	750	16	14	14	18	48	32

*Note: All distances in feet and heights are relative to MHW. The mean tidal ranges at Coos Bay is 5.7 ft. Safe height is assumed to be 4 ft.

Table 3-4
Proposed Range Marker Dayboard Height

Range	Minimum FL Height (Range Design 3.0)	Estimated Existing Front Dayboard Height	Proposed Front Dayboard Height	Minimum RL Height (Range Design 3.0)	Estimated Existing Rear Dayboard Height	Proposed Rear Dayboard Height
Entrance Range	12	16	16	16	16	16
Coos Bay Inside Range A	8	12	12	8	12	12
Coos Bay Inside Range B	8	8	12	12	12	12
Coos Bay Range A	12	12	16	16	12	16
Coos Bay Range B	16	16	16	16	16	16
Empire Range A	12	16	12	16	16	16
Empire Range B	16	16	16	16	16	16
Lower Jarvis Range A	12	16	12	12	16	12
Lower Jarvis Range B	8	12	12	8	12	12
Upper Jarvis Range A	12	12	12	8	12	16

Table 3-5
Proposed Range Headings

Range	Inbound Heading*	Outbound Heading*
Entrance Range	112.5°	292.5°
Coos Bay Inside Range	28.0°	208.0°
Coos Bay Range	43.8°	223.8°
Empire Range	24.0°	204.0°
Lower Jarvis Range	12.0°	192.0°
Jarvis Turn Range	41.9°	221.9°
Upper Jarvis Range	79.4°	259.4°

**Headings are measured according to the Global Mercator WGS 1984 projection (EPSG: 4326)*

4. OWNERSHIP, CONSTRUCTION, AND COSTS

ATON are operated and maintained by the USCG. The Port will construct the ATON to USCG standards, per engineering drawings provided by the USCG. The installed ATON would then be transferred to the USCG at a mutually agreeable time. Detailed construction assumptions are presented in Sub-appendix 11, *Construction Implementation*, to the *204(f)/408 Report Engineering Appendix*.

The USCG recommends against placing ATON on dry land, where real estate agreements or transaction are often required (USCG 2018b). Most of the relocated ATON will be constructed or deployed on submerged or tidelands, and therefore are to be located on property administered by the Oregon Division of State Lands. The one exception is the range structure that supports the Lower Jarvis Range B Rear Marker and Upper Jarvis Range A Rear Marker (these ATON share a structure). The structure is currently located on the North Spit, approximately 200 ft north-west from the shoreline of Jarvis Turn. This structure will move approximately 200 ft east towards the shoreline. It will remain on land owned by OIPCB. Due to the channel geometry, this dual marker structure must be located at the proposed upland location. Access to the site can be provided via the Trans Pacific Parkway via existing, unpaved, access roads.

The detailed cost estimate for the ATON is provided in Sub-appendix 12, *Basis of Estimate*, to the *204(f)/408 Report Engineering Appendix*[3]. The estimated direct cost of each buoy relocation is ??. Installation of new buoys cost ??. The total direct cost associated with relocating all the buoys and installing new buoys is estimated to be ?? million. The direct cost to relocate each fixed light or range marker is estimated to be ??. The total direct cost associated with relocating fixed range markers is expected to be ??. The approximate total cost for ATON work is ?? million; this value includes direct cost, indirect cost, and markup.

All ATON relocation will be performed with a crane barge, flat deck barge, and one tug; a detailed description of construction is presented in Sub-appendix 11, *Construction Implementation*. Sinkers can be removed through lifting and do not require divers. The complete process of removing and replacing the buoys takes approximately 20 hours total (both removing and re-installing) per buoy, using a crane barge, flat deck barge, and one tug. The approximate disturbance is 25 sq ft (Figure 2-3).

To relocate fixed markers, new pilings and platforms will be constructed using the Contractor's crane barge. After new range lights/markers are installed, the existing platforms will be removed and disposed of. The new deck structure will be fabricated in the staging area and installed using a crane barge, a flat deck barge, a tug, and a vibratory hammer and supporting plant. It is estimated to take approximately 40 install the skeleton tower support, deck structure, support beams and cross bracing, and piling. As noted above, the in-water footprint of the structures is less than 12' x 12', so the total disturbance is estimated to be less than 144 sq ft. After installation of the structures, USCG will install the new range boards and lights, using a crane barge similar to the installation for the structures. Removal of the existing towers will occur after new structures have been installed and are functioning. Debris will be disposed of in a landfill. Removal of existing towers takes approximately 35 hours per structure.

[3] *Costs in the 2019 version of the report provides costs for construction starting in the year 2021. The escalation factor is approximately 1.35 to get to 2024 dollar using CWCCIS indices. Costs in this report will be refined when Sub-appendix 12 is updated.*

All ATON will be relocated during the final phase of dredging. In addition, some ATON will require temporary relocation during dredging, prior to final relocation of ATON. It is anticipated that existing ATON within 50 ft of the PA channel will be temporarily relocated; this includes lateral markers 1, 2, 5, 6, 6A, 8, 10, 10A, 11, 12, 14, 15, 18, 20, and 23, all of which are buoys. The contractor will remove the ATON device (i.e., the sinker, chain, and buoy) one day prior to dredging within 50 feet of the sinker and replace it to its original location no more than one day after dredging within 50 ft of the buoy's location is complete.

5. REFERENCES

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ATTACHMENT A

Proposed ATON Drawings

River Mile

RangeLines

Proposed ATON

Existing Buoy, To Remain

New Buoy

Relocated Buoy

Existing Fixed Marker, To Remain

Relocated Fixed Marker

K, 1, 2, 3, 3A, 4, 5, 6, 5A, 6A, 7, 8, 8A, 10, 11, 10A, 11A, 12, 13, 14, 15, 16, 17, 17A, 18, 19, 20, 21, 22, 22A, 23, 24

North Beach

North Spit

Hungryman Cove

COOS BAY

EMPIRE

0 2,000 4,000 Feet

1" = 2,500'

Chart: 18587 (NGA Clear Date 8/25/2018)

| ATON_Design.aprx | by: KCL

moffatt & nichol

COOS BAY, OREGON SECTION 204(f) CHANNEL MODIFICATION PROJECT

Channel limits, Range Lines, and ATON

Overview

1/22/2024

Sheet 1 of 5

River Mile

RangeLines

Proposed ATON

Existing Buoy, To Remain

Relocated Buoy

Existing Fixed Marker, To Remain

RW "K"
Mo (A)
WHIS
AIS

K

Dump Site
(dredged material)
(see note S)
Depths from survey
of 2018

G "1"
Fl G 2.5s
BELL

1

CAUTION
The entrance channel is subject
to frequent changes

G "3"
Fl G 4s
WHIS

3

ENTRANCE RANGE

REGULATED NAVIGATION AREA
165.1325 (see note A)

COLREGS DEMARCATION
LINE 80.1320 (see note A)

2

R "2"
Fl R 4s

Fl G 2.5s 23ft 4M "3A"
HORN
(May 20 to Oct 1)

3A

Sand dunes

(see application)

Jetty

4

R "4"
Fl R 4s
WHISTLE

Guano
Rk

Rk

Y "BR"
Fl Y 4s

Baltimore Rock

46 (see note C)

1

0 1,000 2,000 Feet

1" = 1,000'

Chart: 18587 (NGA Clear Date 8/25/2018)

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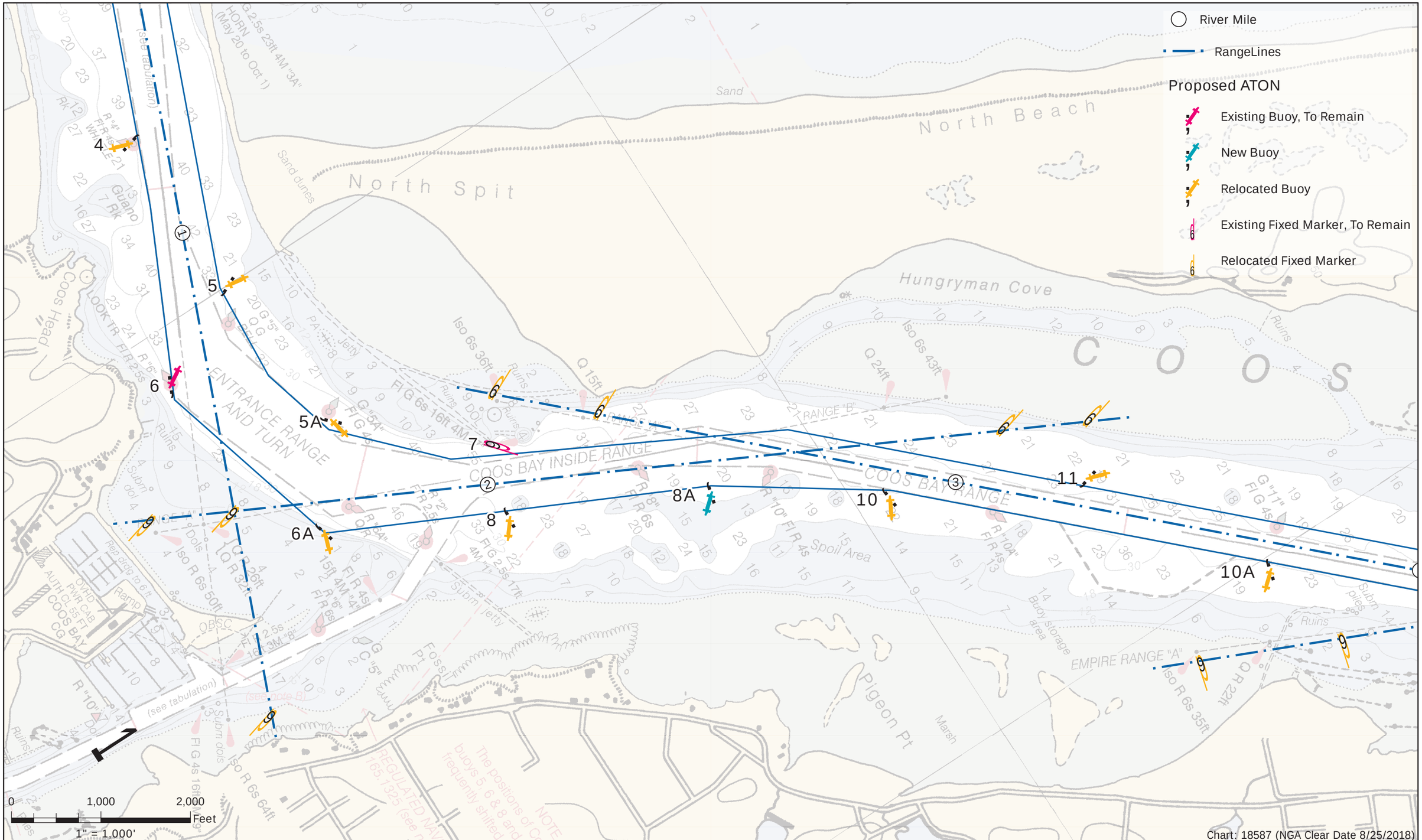
COOS BAY, OREGON SECTION 204(f) CHANNEL MODIFICATION PROJECT

Channel limits, Range Lines, and ATON

Entrance

1/22/2024



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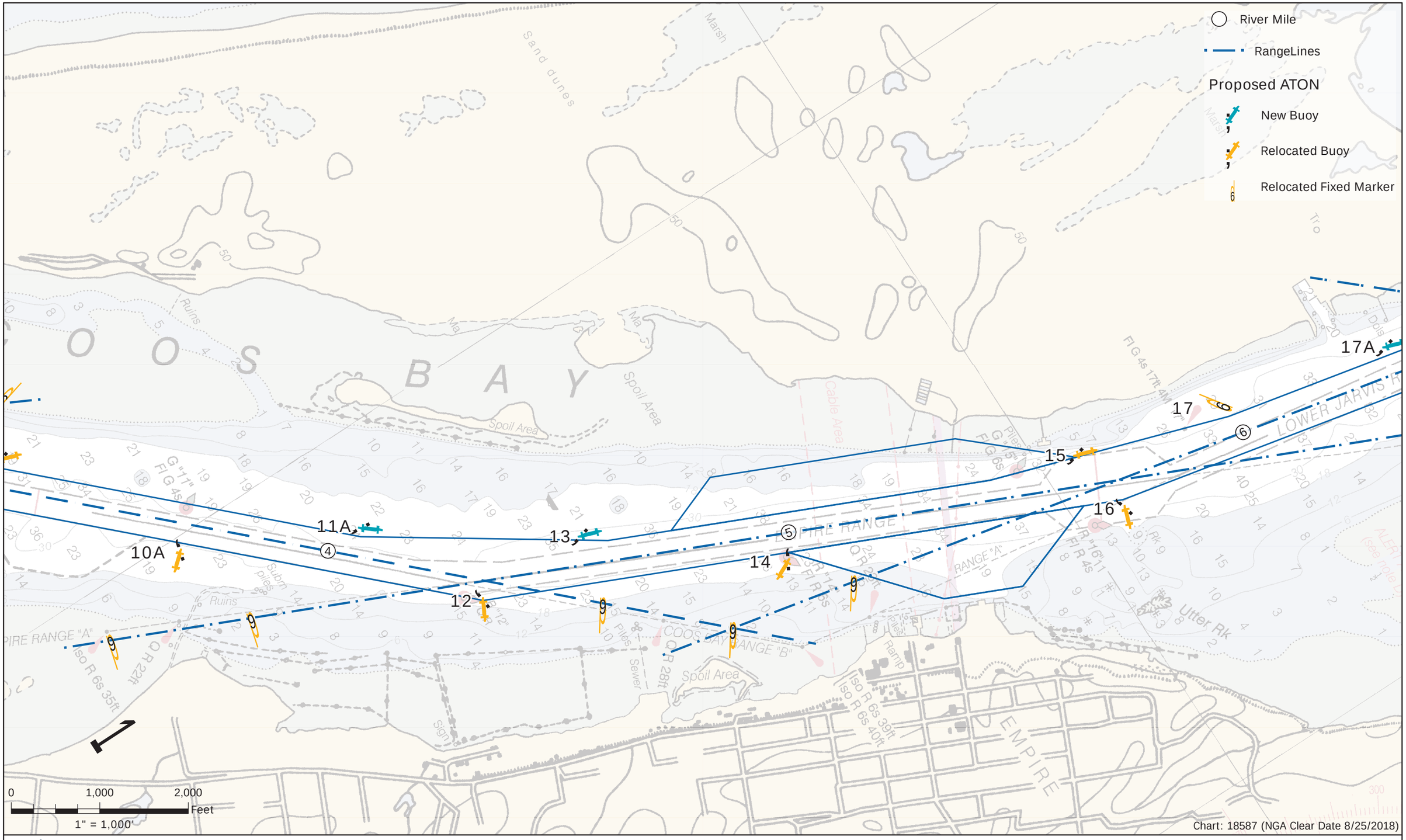
COOS BAY, OREGON SECTION 204(f) CHANNEL MODIFICATION PROJECT

Channel limits, Range Lines, and ATON

Inside & Coos Range

1/22/2024

Sheet 3 of 5



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COOS BAY, OREGON SECTION 204(f) CHANNEL MODIFICATION PROJECT

Channel limits, Range Lines, and ATON

Empire Range

1/22/2024

River Mile

RangeLines

Proposed ATON

Existing Buoy, To Remain

New Buoy

Relocated Buoy

Existing Fixed Marker, To Remain

Relocated Fixed Marker

19

21

23

17A

20

22

18

17

9

15

16

22A

24

0 1,000 2,000 Feet

1" = 1,000'

Chart: 18587 (NGA Clear Date 8/25/2018)

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COOS BAY, OREGON SECTION 204(f) CHANNEL MODIFICATION PROJECT

Channel limits, Range Lines, and ATON

Jarvis

1/22/2024

Sheet 5 of 5

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