RULEMAKING AND LETTERS OF AUTHORIZATION APPLICATION

for
Construction Activities Associated with the Port of Anchorage Marine Terminal Redevelopment Project

July 15, 2009 – July 15, 2014

United States Department of Transportation
Maritime Administration
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Washington, DC 20590

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ACRONYMS AND ABBREVIATIONS

μPa	microPascal
ADF&G	Alaska Department of Fish and Game
APU	Alaska Pacific University
ARRC	Alaska Railroad Corporation
BMPs	Best Management Practices
CFR	Code of Federal Regulations
CIMMC	Cook Inlet Marine Mammal Council
cy	cubic yard
dB	decibel
dBA	A-weighted decibel
dB peak	Instantaneous peak sound pressure level
DFSP-A	Defense Fuel Support Point-Anchorage
EA	Environmental Assessment
EAFB	Elmendorf Air Force Base
EEZ	Exclusion Economic Zone
EFH	Essential Fish Habitat
ESA	Endangered Species Act
ft	feet
FONSI	Finding of No Significant Impact
FR	Federal Register
GPS	Global Positioning System
HTL	high tide line
Hz	hertz
ICRC	Integrated Concepts & Research Corporation
IHA	Incidental Harassment Authorization
KABATA	Knik Arm Bridge and Toll Authority
kHz	kilohertz
kJ	kilojoule
km	kilometer
km^2	square kilometer
LGL	LGL Alaska Research Associates, Inc.
LO-LO	load on/load off
LOA	Letters of Authorization
m	meter

ACRONYMS AND ABBREVIATIONS (continued)

MLLW	Mean Lower Low Water
mm	millimeters
MMPA	Marine Mammal Protection Act
MOA	Municipality of Anchorage
mph	miles per hour
ms	millisecond
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NMML	National Marine Mammal Laboratory
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
OCSP	open cell sheet pile
OSP	Optimum Sustainable Population
Pa	Pascal
POA	Port of Anchorage Administration, the Municipal Agency
POL	petroleum, oils, and lubricants
POC	Plan of Cooperation
Port	Port of Anchorage facilities
Project	Marine Terminal Redevelopment Project
PTS	permanent threshold shift
re 1 μPa	referenced to one micropascal
rms	root-mean-squared
RO-RO	roll on/roll off
SEIS	Supplemental Environmental Impact Statement
SEL	sound energy level
SPL	sound pressure level
TL	Transmission Loss
TTS	temporary threshold shift
URS	URS Corporation
USACE	United States Army Corps of Engineers
USC	United States Code
USCG	United States Coast Guard
YTD	year-to-date

INTRODUCTION

The National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS) regulations governing the issuance of Incidental Harassment Authorizations (IHAs) and Letters of Authorization (LOAs) permitting the incidental, but not intentional, take of marine mammals under certain circumstances are codified in 50 Code of Federal Regulations (CFR) Part 216, Subpart I (Sections 216.101-216.108). The Marine Mammal Protection Act (MMPA) defines take to mean "to harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal" (16 United States Code [USC] Chapter 31, Section 1362 (13)). Section 216.104 sets out 14 specific items that must be addressed in requests for rulemaking and renewal of regulations pursuant to Section 101(a)(5) of the MMPA. The 14 items are addressed in Sections 1.0 through 14.0 of this Rulemaking Application.

The Port of Anchorage Administration (POA) and lead federal action agency, the U.S. Department of Transportation Maritime Administration (Maritime Administration), request a five-year authorization for the incidental, but not the intentional, multi-year behavioral disturbance of Level B take of marine mammals during in-water construction activities associated with the Marine Terminal Redevelopment Project (Project) underway at the Port of Anchorage from July 15, 2009 through July 15, 2014.

This Application provides information and evaluation necessary to meet the requirements mandated by Section 7 of the Endangered Species Act (ESA), the National Environmental Policy Act (NEPA), and MMPA.

This Application was prepared by Integrated Concepts & Research Corporation (ICRC), with subcontracted services provided by URS Corporation (URS). ICRC is contracted with the Maritime Administration to provide and procure program and project administration, permitting, planning, design and construction services deemed necessary to complete the Project.

The Port of Anchorage is located on the Knik Arm in upper Cook Inlet, Alaska. Refer to Figure I-1 Map of Alaska and Figure I-2 Map of Cook Inlet, Alaska.

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1.0 DESCRIPTION OF ACTIVITIES

A detailed description of the specific activity or class of activities that can be expected to result in incidental taking of marine mammals.

1.1 PROJECT PURPOSE

The Marine Terminal Redevelopment Project at the Port of Anchorage (the Project) is designed to upgrade and expand the existing Port of Anchorage facilities (the Port) by removing and replacing aging and obsolete structures and providing additional dock and backland areas, without disruption of maritime service during construction. The Port serves 85 percent of the population within the State of Alaska by providing 90 percent of all consumer goods and is an economic engine for the State of Alaska. The rehabilitation and expansion of the Port is critical to improving national defense capabilities and provides additional land and facilities necessary to support military deployments during and after construction. The Port is one of nineteen nationally designated Strategic Ports with direct calls scheduled by the Department of Defense for critical deployments in-and-out of Alaska's military bases and training facilities (Fort Greely, Eielson Air Force Base, Fort Wainwright, Fort Richardson, and Elmendorf Air Force Base [EAFB]) to Iraq, Afghanistan, and other defense theaters around the globe. Port of Anchorage operations began in the early 1960s with little build-up in the past fifty years and is currently under-serving Alaska's transportation system as its primary hub.

Located within the Municipality of Anchorage (MOA) on Knik Arm in upper Cook Inlet (see Figure 1-1), the existing 129-acre Port facility (see Figure 1-2) is currently operating at or above sustainable practicable capacity for the various types of cargo handled at the facility. In addition, the existing infrastructure and support facilities are substantially past their design life, have degraded to levels of marginal safety, and are in many cases functionally obsolete. The Project will replace, upgrade, and expand the current Port facility to address existing needs and projected future needs, allowing the Port to adequately support the economic growth of Anchorage and the State of Alaska through 2025 and beyond. The tonnage of goods moving through the Port has exceeded predicted rates and is anticipated to continue to grow at a rate equal to or greater than the population growth of Alaska.

The Port of Anchorage Administration (POA) began a federal, state, and municipal dock replacement and expansion program in 2003, with the U.S. Department of Transportation Maritime Administration (Maritime Administration) as the lead federal agency. This Project was undertaken specifically by the government to reduce transportation conflicts and traffic congestion and to improve intermodal transportation and commerce for the MOA, the State of Alaska, and the nation's military.

Upon completion, the rehabilitated and enlarged Port will provide the supply and transportation industry efficient ship-to-shore connections with a new rail line extension connecting the waterfront to Alaska's mainline railbelt, new roads with direct connections into the State's highway system, state-of-the-art cargo off-loading and handling facilities, and deeper and wider berths to accommodate modern shipping vessels. This multi-year Project replaces aged and deteriorating dock structures, which are functionally outdated and marginally safe, with new facilities capable of serving the commercial and military ships that call at this vital seaport. The existing dock structure is neither capable nor efficient enough for modern maritime intermodal operations.

The Port's 50-year-old, 35-foot gauge cranes cannot reach required distances to serve modern vessels and must be replaced with three 100-foot gauge modern cranes to load and off-load cargo. The 9-acre narrow gauge trestle dock must be demolished and replaced with a 135-acre off-loading facility to accommodate larger cranes, open berthing, intermodal ship-to-shore transfers, and adequate secured cargo storage. Currently, $4-5 Million is spent annually on under-dock repairs by the POA, while crucial surface operations and cargo transfers continue to remain inadequate.

The new facility is being constructed in phases to accommodate the shipping industry to avoid impact to day-to-day intermodal transfer operations and ensure continual service to 85 percent of the State; to coincide with the U.S. Army Corps of Engineers' (USACE) on-going annual harbor maintenance program to maintain shipping lanes at the Port during construction; and to align with incremental funding and Port revenues. The funding plan calls for 52 percent federal funds with 48 percent of remaining funds at the local level (State and Municipal revenue bonds, Port revenues).

Upon completion, the Project will address the following needs.

- ***Necessary replacement of obsolete dock infrastructure****:* Certain elements of the existing Port infrastructure are functionally obsolete and are near or below design safety standards for seismic events, which are common in the region. Development at the Port will replace aging and obsolete infrastructure, update and upgrade utilities and other support systems, and add additional infrastructure to support current and future needs.
- ***Additional surface capacity to accommodate growth in current customers****:* Current and near-future cargo-handling capacity will continue to exceed maintainable, safe, and efficient levels. Operational analyses and the projected population growth for the MOA and the State of Alaska have identified a need for approximately 135 additional acres of land for storage, queuing, and cargo transfer from ship to shore (and *vice versa*).
- ***Additional shipping berths to eliminate shipping conflicts and provide service to new and existing customers****:* Expected growth of operations coupled with existing customer demand will result in at least a 40 percent growth in ship calls, causing berthing conflicts, increased waiting times for berths, and increased transportation costs to the public. The expanded and upgraded Port will be capable of safely and efficiently handling commerce and military needs until 2025 and beyond. Currently, cement and fuel barges may not call at the Port concurrently.
- ***Deeper drafts, longer berths, larger cranes for off-loading, and more streamlined intermodal transportation to efficiently handle new ships with the ability to move the increasing amount of cargo out to the public***: Current trends in maritime transportation have produced larger, longer ships that cannot be supported by the current Port facilities. The deeper drafts and wider beams of these large ships require longer, deeper berths, and cranes with a wider reach capacity for unloading. Failure to expand would result in increasing inefficiencies and cost for shipping goods to Alaskan customers, and more frequent trips with smaller vessels. Operational limitations of the existing Port infrastructure requires restricted loading procedures at other ports of origin to accommodate the limited crane reach at the Port significantly impacting operations and cargo handling inefficiencies at these other locations.
- ***Additional lighting, gates, and other protective features to meet new security requirements under the new Maritime Security mandates***: The Port, like all U.S. ports, must construct facilities and implement measures to comply with the Maritime Transportation Security Act of

2002 and with the associated waterfront U.S. Coast Guard (USCG) maritime security regulations, which were designed to protect the nation's ports and waterways from terrorist attack.

- ***Additional space and improved berthing to support military rapid deployments without conflicting with commercial customers***: As a critical conduit for military deployment, the MOA and the State of Alaska will need to maintain a sustained commitment that embodies a long-term plan, integrating intermodal efficiency with that of heightened security and positive cargo control. Current berthing facilities at the Port are insufficient to accommodate both military and commercial ships supporting Alaska-based combat and support units. Expansion of facilities and increase in efficiencies are also critical for the POA to maintain the Port's designation as a Strategic Seaport.

In addition, the Project will address specific design criteria for the area such as:

- ***Ability to withstand harsh marine conditions:*** The waters of the upper Cook Inlet present challenges in the form of strong currents, the second most widely fluctuating tidal range in the world, seasonal ice buildup, high corrosivity, high sedimentation, and scour on structures from ice and silt.
- ***Ability to withstand seismic events:*** The Port facility is located in an area of high seismic activity. The POA has imposed stringent seismic design standards of modern Port infrastructure to provide appropriate and redundant stability and structural integrity during major seismic events to ensure continual cargo supply to Alaska if such a disaster were to occur in the Port's service region.
- ***Ability to provide potential fish habitat along the face of the dock:*** The final design of the new structure will provide void spaces that may be used as fish habitat structures at selected intervals along the vertical face. These void structures may provide refuge for fish. The primary purpose is not for fish habitat.

1.2 FINAL PROJECT

The existing Port facility is made up of industrial wharves, internal circulation roads, underground and overhead utility easements, and variable land lease areas for various tenant operations. Pre-development, the Port facility consisted of 129 acres of land owned and controlled by the MOA or leased by the MOA from adjacent property holders: the Alaska Railroad Corporation (ARRC), the U.S. Army, and EAFB. The Project involves construction of infrastructure to initially relocate current shipping and waterfront operations to interim areas, condemning and demolition of the existing dock facilities, and reconstruction of facilities.

During construction, container operations must relocate to an interim area north of the existing Port, with fully functional off-loading cranes and ramps. Bulk cargo and fuel operations must relocate south of the existing Port near storage facilities for these commodities. As ship-to-shore operations relocate to interim areas during construction, previous facilities will be taken out of service and demolished. The Port can then begin reconstruction and expansion at the site of the existing dock. Upon completion, the Project adds 135 acres of surface area to the facility. The new Port will provide a total of 264 acres. Figure 1-3 demonstrates a before and after illustration of the Port.

Over 65 unimproved acres have been completed to date in preparation of accepting new container cranes (under production) and relocating shipping operations by the year 2010: thus far, 26.8 acres were added in 2006, 22.4 acres were added in 2007, and 18.4 acres were added in 2008. Future efforts will add 8.4 acres in 2010, 14.15 acres will be added in 2011, 29.85 acres will be added in 2012, and 15.35 acres will be added in 2013. Figure 1-4 shows the phasing plan for the construction. After the new unimproved land is developed, the surface areas are typically improved the following construction season to install utilities and final operating surface. Once the surface area is finished, ship mooring appurtenances are added such as protective fenders and mooring appurtenances.

The completed marine terminal at the Port will include: seven modern dedicated ship berths; two dedicated barge berths; rail access and intertie to railbelt; roadway improvements; security and lighting improvements; slope stability improvements; drainage improvements; modern shore-side docking facilities; equipment to accommodate cruise passengers, bulk, break-bulk, roll on/roll off (RO-RO) and load on/load off (LO-LO) cargo, general cargo short-term storage, military queuing and staging, and petroleum, oils, and lubricants (POL) transfer and storage; and additional land area to support expanding military and commercial operations.

1.3 PROJECT SCHEDULE

In-water construction began in 2006 and is anticipated to continue through November of 2014 with marine mammal monitoring continuing one year post-construction through 2015 ck references to 2015 throughout. In-water construction activities to date were authorized by NMFS with two Letters of Concurrence and an IHA in 2008 (effective through July 14, 2009). In-water construction activities scheduled to occur between July 15, 2009 and July 15, 2014 would be authorized by NMFS by this rulemaking. Sheet pile installation for the Port substructure and in-water fill placement of earthen materials behind the substructure are anticipated to be complete prior to July 15, 2014.

Although construction is scheduled to be completed by 2014, in-water work that could potentially continue after July 15, 2014 would consist of in-water installation of fender piles to support protective shipping fenders at an established off-set distance from the Port structure (for mooring purposes). Activities after July 15, 2014 would be authorized by NMFS under subsequent incidental take requests.

The Project components are divided into several construction phases to accommodate continuous Port operations through construction. The following construction areas are shown on Figure 1-4:

- North Backlands (2006-2010)
- Barge Berths (2007-2009)
- South Backlands (2007-2011)
- North Extension (2008-2010)
- South Extension (2010-2011)
- North Replacement (2011-2013)
- South Replacement (2012-2014)

Project construction includes both in-water and out-of-water activities. Only the in-water activities have the potential to incidentally harass marine mammals due to underwater noise disturbance in the Project area. Therefore, this Application addresses those construction activities that would take place in-water between July 15, 2009 and July 15, 2014; including dredging, placement of fill material in subtidal and intertidal areas, installation of open cell sheet pile (OCSP) waterfront substructures, and installation of final docks and fendering systems to accommodate off-shore shipping operations. Out-of-water construction continues throughout this time period, and includes land-based vibracompaction activities, land-based installation of tail walls through fill, final fill placement to bring unimproved areas to proper grade, installation of utilities and utility extensions, overhead lighting, rail extensions, roadway extensions, crane rail installations, drainage improvements, and final concrete or asphalt surfacing.

Final completion of in-water work has the potential to be extended if individual construction phases incur delay. Potential causes of schedule delay might include: changes in planned construction sequencing due to changes in commercial or military maritime operations, changes in harbor dredging schedules to maintain navigation, longer than anticipated settlement and consolidation time for foundation soils or other unanticipated site conditions, national security requirements prohibiting or delaying construction access, delays in steel production or longer than anticipated delivery or availability of construction materials, changes in planned funding or financing, prolonged work stoppages due to presence and protection of marine mammals or other regulatory actions affecting construction schedules, prolonged shut downs due to inclement weather, or other force majeure causes.

The following provides a summary of Project components and schedule. A summary of in-water construction activities throughout the life of the Project is provided in Table 1-1. Photos illustrating specific construction activities are provided in Appendix A.

Table 1-1
Summary of In-Water Construction Activities for the Project

Year	Location of Activity[1]	Description of Activity	Amount[2]	Number of Piles[3]
2006	North Backlands	Placement of earth and rock fill	26.8 acres 586,700 cy	0
2007	Barge Berths	Placement of earth and rock fill	13.8 acres 729,000 cy	0
	South Backlands	Placement of earth and rock fill	8.6 acres 130,800 cy	0
2008	Barge Berths	Fender pile installation	723 ft of dock face	22
		OCSP installation	1,066 ft of dock face	1,550
		Temporary pile installation	1,066 ft of dock face	156
	North Extension	Placement of fill	18.4 acres 1,297,000 cy	0
		Placement of rock	48,000 cy	0
		Construction dredging	146,300 cy	0
2009	Barge Berths	Fender pile installation	360 ft of dock face	14
	North Extension	OCSP installation	1,840 ft of dock face	4,106
		Temporary pile installation	1,840 ft of dock face	268
		Placement of fill	260,500 cy	0
2010	South Extension	OCSP installation	1,000 ft of dock face	1,831
		Temporary pile installation	1,000 ft of dock face	145
		Fender pile installation	1,000 ft of dock face	36

1 See Figure 1-4.
2 A portion of the placement of fill quantities may be out-of-water due to construction requirements. Therefore, in-water fill quantities are conservatively high.
3 Fender pile and temporary pile are round pipe piles; OCSP piles are flat sheets.
4 End of Application period.

Table 1-1 (continued) Summary of In-Water Construction Activities for the Project				
Year	**Location of Activity[1]**	**Description of Activity**	**Amount[2]**	**Number of Piles[3]**
2010 (continued)	South Extension	Construction dredging	169,000 cy	0
		Placement of fill	8.4 acres 500,000 cy	0
		Placement of rock	8,750 cy	0
	North Extension	Fender pile installation	1,840 ft of dock face	82
2011	North Replacement	OCSP installation	1,000 ft of dock face	2,718
		Temporary pile installation	1,000 ft of dock face	145
		Construction dredging	309,000 cy	0
		Placement of fill	14.15 acres 1,555,000 cy	0
		Placement of rock	8,000 cy	0
2012	North Replacement	OCSP installation	1,000 ft of dock face	2,718
		Temporary pile installation	1,000 ft of dock face	145
		Placement of fill	14.15 acres 1,555,000 cy	0
	South Replacement	OCSP installation	1,118 ft of dock face	3,034
		Temporary pile installation	1,118 ft of dock face	163
		Construction dredging	338,000 cy	0
		Placement of fill	15.35 acres 1,890,000 cy	0
2013	South Replacement	OCSP installation	1,118 ft of dock face	3,034
		Temporary pile installation	1,118 ft of dock face	163
		Placement of fill	15.35 acres 1,890,000 cy	0
	North Replacement	Fender pile installation	2,000 ft of dock face	94
Through July 15, 2014[4]	South Replacement	Fender pile installation	1,118 ft of dock face	41
After July 15, 2014	South Replacement	Fender pile installation	1,118 ft of dock face	41
2015	No in-water construction activities			

1 See Figure 1-4.
2 A portion of the placement of fill quantities may be out-of-water due to construction requirements. Therefore, in-water fill quantities are conservatively high.
3 Fender pile and temporary pile are round pipe piles; OCSP piles are flat sheets.
4 End of Application period.

1.3.1 Past Project Activities Completed Prior to this Application (2006-2007)

2006:

In-water construction activities in 2006 involved placing fill material and temporary liner rock protection on intertidal lands within a 26.8-acre footprint to construct the North Backlands. This work was authorized under the USACE Section 404/10 Permit POA-2003-502-2 issued in 2005 and a Letter of Concurrence (May 9, 2006) from the National Marine Fisheries Service (NMFS) stating that incidental takes were not likely to occur providing mitigation measures were fully implemented to further reduce the potential for incidental takes.

Scientific marine mammal monitoring (initiated in 2005 to collect baseline data and pre-construction marine mammal monitoring efforts) continued during 2006. In addition to the general observation program to document the movement and behavior of marine mammals within the Project area, construction based monitoring was also conducted. Construction based monitoring was in place during all in-water fill activities and in-water work was suspended whenever marine mammals were observed approaching or within the 50 meter (m) radius safety zone.

Construction activities in 2006 included the following elements:

- Land-based construction of a haul road connecting the Port with EAFB borrow sources (providing dual use as a military access road from Fort Richardson and EAFB to the waterfront) (see Photos 1 through 3 in Appendix A).
- In-water and out-of-water placement of approximately 472,200 cubic yards (cy) of fill material (see Photo 4 in Appendix A), adding a total of 26.8 surface acres.
- In-water and out-of-water placement of approximately 114,500 cy of liner rock to form a temporary dike.

2007:

Construction activities in 2007 were authorized under the USACE Section 404/10 Permit POA-2003-502-N issued in August 2007 (permit provided in Appendix B). The USACE Section 404/10 Permit sets forth mitigation conditions to limit the potential of incidental takes of marine mammals and also requires the POA to complete a petition for an (Incidental Harassment Authorization) IHA from NMFS. NMFS issued a Letter of Concurrence (October 4, 2007) for the 2007 work proposed by the POA stating that because takes of marine mammals were not likely to occur, incidental harassment authorization was not necessary provided mitigation conditions were fully implemented. Construction activities in 2007 were limited primarily to late season in-water fill activities, a test pile probing program, and underwater noise studies.

Construction activities in 2007 included the following elements:

- Marine mammal monitoring programs, including both scientific observation and construction-related observation.
- Substructure construction for South Backlands area: Approximately 8.6 acres of intertidal land was filled at the southern end of the Project area to initiate settlement in that area. This work included placing approximately 122,000 cy of in-water and out-of-water fill material and 8,800 cy of temporary liner rock. (See Photo 5 in Appendix A)
- Substructure construction for Barge Berth area: Approximately 13.8 acres of subtidal and intertidal fill was placed at the northernmost end of the Project area. Approximately 681,000 cy of in-water and out-of-water fill material and 48,000 cy of temporary liner rock were placed (see Photos 6 and 7 in Appendix A).
- In-water test pile probing study: In order to evaluate subsurface pile driving conditions, an H-pile probe was driven and removed several times using barge-mounted equipment in the North Extension project area to refine the design for future sheet pile installation. Safety and harassment zones were established and observed for marine mammal protection during pile probing.
- Underwater noise monitoring: During the test pile probing study, underwater noise levels were measured near pile driving activities to capture preliminary data for establishing underwater sound isopleths and marine mammal safety zones.

- The Maritime Administration (in collaboration with USACE) conducted subsurface contamination screening of ocean floor sediments in the Project area using barge mounted subsurface drilling equipment. No contamination was found (USACE 2006).

1.3.2 2008 Project Activities

The construction activities for 2008 are nearing completion and are authorized under the 2007 USACE Section 404/10 Permit and a 2008 IHA Permit issued by NMFS authorizing 34 takes by Level B harassment through July 14, 2009 (IHA provided in Appendix C). Construction-related activities are described below.

2008:

- Marine mammal monitoring programs were established, including both scientific observation and construction-related observations. Construction-related monitoring efforts include mandatory suspension of in-water pile driving activities if marine mammals enter pre-determined safety zones; these zones are based on in-water sound isopleths. Preliminary sound isopleths were developed using data collected during the 2007 test pile probing study. Monthly marine mammal sighting reports have been submitted to NMFS; an annual report will be submitted after this one-year IHA expires. Several stop-work orders have occurred thus far; the number of Level B takes by month are as follows:
    - July 2008 – 0
    - August 2008 – 0
    - September 2008 – 0
    - October 2008 – 3
- Barge Berths construction:
    - In-water work to complete the bulkhead structure for the Barge Berth area including installation of 1,066 linear feet (ft) of OCSP. This work involves the installation of approximately 2,500 tons of sheet pile to provide the basic structure for a dry barge berth and a wet barge berth.
    - Land-based construction activities for the Barge Berth include the placement of approximately 27,000 cy of fill material to bring the previously constructed surface to design grade (no in-water fill).
    - Land-based vibracompaction to densify fill previously placed in-water.
    - In-water installation of 723 linear ft of ship fendering systems and out-of-water construction of mooring appurtenances at the dry barge berth. The fenders at the dry barge berth consist of a single pipe pile spaced about 27 ft apart as opposed to two pipe piles spaced approximately 55 ft apart at all other berths.
- North Extension construction (year one):
    - In-water construction dredging to remove 146,300 cy of seafloor sediments prior to pile driving.
    - In-water and out-or water placement of approximately 1,297,500 cy of fill material for a total of 18.4 acres.
    - Land-based vibracompaction to densify fill previously placed in-water.
    - Recovery and reuse of 48,000 cy of temporary liner rock.
- Initial field testing for analyzing pile driving impacts on fish was conducted during pile driving at the Barge Berth using in-water equipment was conducted. This preliminary study involves

measurement of underwater sound levels and capture of live fish for preliminary observations; the study concludes in 2009.

- Underwater noise monitoring. Sound levels during various pile driving activities were measured to refine sound isopleths related to marine mammal safety and harassment zones and to establish baseline sound conditions in the absence of construction activities.

1.3.3 Project Activities Requested under this Application (2009-2014)

The following activities authorized under the 2007 USACE Section 404/10 Permit are anticipated to take place between July 15, 2009 and July 15, 2014. This Application seeks to have these activities authorized by NMFS. These activities are similar in nature to the work previously described and include:

2009:

- Continue marine mammal monitoring, both scientific observation and construction-related observation.
- Complete the study to evaluate potential impacts of in-water pile driving on local anadromous species of fish.
- Barge Berths construction (year three):
  - In-water installation of 360 linear ft of fendering at the Wet Barge Berth and out-of-water construction of mooring appurtenances.
  - Place Barge Berths into service (with unimproved surfaces).
- North Extension construction (year two):
  - In-water installation of 1,840 linear ft of OCSP.
  - In-water and out-of-water placement of 260,500 cy of fill.
  - Land-based vibracompaction to densify fill previously placed in-water.

2010:

- Continue marine mammal monitoring, both scientific observation and construction-related observation.
- North Backlands construction (year two):
  - Land-based placement of 16,000 tons asphalt surface.
- North Extension construction (year three):
  - In-water installation of 1,840 linear ft of ship fendering systems and out-of-water construction of mooring appurtenances.
  - Land-based placement of 750 linear ft of crane rail.
  - Land-based placement of 90,000 cy fill material to obtain final surface grades.
  - Land-based placement of 6,200 cy concrete surfacing.
  - Land-based installation of underground utilities.
  - Land-based placement of 15,800 tons of asphalt surfacing.
  - Off-loading and installation of new container cranes; crane commissioning.
  - North Extension becomes operational.
- South Extension and South Backlands construction (year one and year two):
  - In-water construction dredging to remove 169,000 cy prior to pile driving.
  - In-water and out-of-water placement of 500,000 cy fill to create 8.4 acres of surface area.
  - In-water installation of 1,000 linear ft OCSP bulkhead.

    - Land-based vibracompaction to densify fill previously placed in-water.
    - Land-based installation of wick drains to accelerate consolidation.
    - In-water placement of 8,750 cy temporary liner rock.
    - In-water installation of 1,000 ft ship fendering and mooring appurtenances.
    - Land-based installation of utilities and POL piping/transfer equipment.
    - Land-based placement of 2,800 cy concrete surface.
- Demolition of existing dock facilities at Terminals 2 and 3.

2011:

- Continue marine mammal monitoring, both scientific observation and construction-related observation.
- South Extension and South Backlands construction (year two and year three):
    - Land-based placement of 83,000 cy of fill material to obtain final surface grades.
    - Land-based installation of final utilities.
    - Land-based placement of 17,700 tons of asphalt surfacing.
    - South Extension and South Backlands become operational.
- In-water activities to remove and relocate USCG floating dock to South Extension area.
- North Replacement construction (year one):
    - In-water construction dredging to remove 309,000 cy prior to pile driving.
    - In-water and out-of-water placement of 50 percent of the 3,110,000 cy fill (total) required to create 28.3 acres of surface area (14.15 acres and 1,555,000 cy).
    - In-water installation of 50 percent of the 2,000 linear ft OCSP bulkhead required (1,000 linear ft).
    - In-water placement of 8,000 cy temporary liner rock.
    - Land-based vibracompaction to densify fill previously placed in-water.
- Demolition of existing dock facilities Terminal 1 and POL Terminals 1 and 2.

2012:

- Continue marine mammal monitoring, both scientific observation and construction-related observation.
- North Replacement construction (year two).
    - Remaining 50 percent of the in-water and out-of-water placement of 3,110,000 cy (total) fill to create 28.3 acres of surface area (14.15 acres and 1,555,000 cy).
    - Remaining 50 percent of the in-water installation of 2,000 linear ft OCSP bulkhead (1,000 linear ft).
    - Land-based vibracompaction to densify fill previously placed in-water.
- South Replacement construction (year one):
    - In-water construction dredging of 338,000 cy with fill.
    - In-water and out-of-water placement of 50 percent of the 3,780,000 cy of fill material (total) required to create 30.7 acres of surface area (15.35 acres and 1,890,000 cy).
    - In-water installation of 50 percent of the 2,236 linear ft OCSP bulkhead required (1,118 linear ft).
    - Land-based vibracompaction to densify fill previously placed in-water.

2013:

- Continue marine mammal monitoring, both scientific observation and construction-related observation.
- North Replacement (year three):
  - In-water installation of 2,000 ft ship fendering and out-of-water construction of mooring appurtenances.
  - Land-based placement of 92,000 cy of fill material (no in-water fill).
  - Land-based placement of 3,100 cy concrete.
  - Land-based installation of utilities.
  - Land-based placement of 20,000 tons asphalt surfacing.
  - North Replacement becomes operational.
- South Replacement construction (year two).
  - Remaining 50 percent of the in-water and out-of-water placement of 3,780,000 cy (total) fill to create 30.7 acres of surface area (15.35 acres and 1,890,000 cy).
  - Remaining 50 percent of the in-water installation of 2,236 linear ft OCSP bulkhead (1,118 linear ft).
  - Land-based vibracompaction to densify fill previously placed in-water.

January 1 through July 15, 2014:

- Continue marine mammal monitoring, both scientific observation and construction-related observation.
- South Replacement construction (year three):
  - Installation of 1,118 ft ship fendering and out-of-water construction of mooring appurtenances.
  - Land-based placement of 49,500 cy fill material (no in-water fill).
  - Land-based placement of 2,100 cy concrete.
  - Land-based placement of 15,500 tons asphalt surfacing.
  - Land-based installation of utilities.

1.3.4 Future Project Activities Scheduled to Take Place (After July 15, 2014)

The following activities may take place after July 15, 2014 and authorized under the 2007 USACE Section 404/10 Permit . NMFS authorization for the following activities may be requested in subsequent incidental take requests.

July 15 through December 31, 2014:

- Continue marine mammal monitoring, both scientific observation and construction-related observation.
- South Replacement construction (year four):
  - In-water installation of 1,118 ft ship fendering and out-of-water construction of mooring appurtenances.
  - Land-based placement of 49,500 cy fill material (no in-water fill).
  - Land-based placement of 2,100 cy concrete.
  - Land-based placement of 15,500 tons asphalt surfacing.
  - Land-based installation of utilities.

2015:

Scientific observations of marine mammals will be conducted for one year post-development.

1.4 DESCRIPTION OF IN-WATER CONSTRUCTION ACTIVITIES

1.4.1 Construction Dredging

In-water construction dredging is performed within the footprint of the OCSP structure prior to pile driving to remove soft sediments and provide a sound foundation for the steel retaining structure and fill. In some areas, additional construction dredging may be completed as needed to improve conditions for pile driving associated with installation of OCSP. Dredged materials will be transported approximately 3,000 ft offshore to the authorized disposal site currently used by USACE for harbor maintenance dredging. Dredged areas will be filled with clean granular fill using a barge or land-based methods within approximately seven days of dredging to prevent in-fill of the dredged areas with soft sediments.

Construction dredge equipment will typically be standard-size, barge mounted, clamshell or hydraulic dipper dredge (see Photo 8 in Appendix A), with tugboat support for maneuvering and placement, and another barge and tugboat to transport dredged material to the disposal site. Alternative equipment may include a cutter-head hopper dredge.

Harbor dredging for ship navigation and channel maintenance located outside the construction footprint is completed by separate federal action (by USACE). The USACE Alaska District is authorized by Congress with federal oversight to maintain navigable conditions and continuous ship access to the Port at a nominal depth of -35 Mean Lower Low Water (MLLW) (35 ft below elevation zero); harbor maintenance dredging occurs regularly during the ice free season on a daily basis. USACE has been authorized by Congress to widen the harbor area during Port construction to coincide with interim ship movements and to accommodate navigation at added berths. USACE is also authorized to deepen the harbor to -45 MLLW to accommodate larger vessels with deeper drafts. Harbor maintenance dredging, transitional dredging, and harbor deepening are separate federal actions not covered by this Application.

Figure 1-5 illustrates the adjacent Project and USACE dredge areas.

1.4.2 Placement of Fill Material

Project fill activities that will take place will require approximately 9.5 million cy of suitably engineered and clean granular fill and common fill material for placement behind vertical steel or rock-retaining features (see Photos 9 and 10 in Appendix A). The POA and the Maritime Administration, in cooperation with EAFB, will only use certified clean government-furnished fill material from two borrow sites on EAFB transported to the Port by truck. Some fill material may also be obtained from existing commercial sources as needed, and could include transport by barge, truck, or train to the Project site. Fill extraction and transport operations will be ongoing throughout the five-year construction period. The roads and borrow sites on EAFB are depicted on Figure 1-2.

Fill extraction, transport, off-loading, and final placement activities will be monitored and inspected to verify proper adherence to detailed specifications and permit requirements. Fill material is screened to ensure compliance with stringent specifications for grain size, will be laboratory tested to ensure all material placed is contaminant-free, and certified as fully suitable for the intended purpose.

The engineered granular fill material, consisting of clean sand, gravel, or stone, will be placed in the Project footprint; common fill, which may contain some silt or clay, may be used between the engineered fill and the existing shore to complete the backlands portion of each phase. Common fill is placed in dewatered conditions where and when possible. Off-road trucks and bulldozers will deposit and spread the fill material up to and behind the OCSP face wall. Some fill may be imported from other sources, transported over water, and placed in-water at the Project site by dump scows (barges capable of discharging fill material through the bottom of the vessel).

Following placement of fill, a land-based vibratory probe, constructed from an H-pile, and a vibratory pile driving hammer will be used to densify deep soils. The probe is driven into the fill at evenly spaced locations to vibrate and consolidate deep fill. Fill material placed above elevation +30 ft will be compacted in layers while being placed using conventional sheepsfoot or vibratory compaction equipment. Compaction and consolidation equipment will be used intermittently.

Large armor rock is placed in some areas for permanent erosion control. Liner rock will be placed on the temporary slopes exposed to tide and wave action at the end of interim construction phases for erosion protection. Rock placed on temporary slopes is recovered and reused as construction proceeds.

1.4.3 OCSP Design

The new bulkhead waterfront structure will comprise conjoining face and tail sheet-pile cells, forming a row of U-shaped OCSP structures, with the face placed parallel to and approximately 400 ft seaward of the existing dock face. The face of each OCSP cell is curved outward, creating a scalloped surface. Photo 11 in Appendix A depicts an example of an OCSP dock. Photos 12 through 14 in Appendix A show an existing sheet-pile wall adjacent to the South Backlands area (owned by Flint Hills Resources). This Project abuts and ties into the Flint Hills open cell sheet pile retaining wall; however, the existing Flint Hills structure is not part of this Project.

Individual face sheets are approximately 20 inches wide horizontally, 0.5-inch thick, and up to a maximum of 90 ft in vertical length; 17 sheets are required for each cell face. At each junction between cells, a tail wall is constructed, anchored to the face sheets with a wye connector. The tail walls are spaced 27.5 ft apart. The arc along the U-shaped face is about 28 ft. Approximately 30 linear ft of OCSP wall could be constructed in a 10-hour period.

The face sheets will be up to 80 ft in length in the areas with -35 ft berths and up to 90 ft long in the -45 ft berths. The tail wall sheets vary from 30 ft to 90 ft long, but generally are 70 ft for the primary tail walls and 30 ft for the tail wall extensions. The tail wall extensions are shorter because they contribute to global stability; the primary tail walls contribute to both internal and global stability.

Once installed and filled, these steel sheet pile cells will serve as retaining walls and provide the vertical bulkhead structure to accommodate vessels. In the open cell design (versus closed cell or caisson), the long tail walls act as a structural embedded anchor to stabilize the face sheets. The tail walls may be extended back up to 110 tail sheets of differing heights to meet design criteria, extending a maximum of 183 ft landward (horizontally) into the fill material from the face. The mass of the fill behind the dock structure on the tail walls further acts to hold the steel retaining structure in place.

The face and immediately adjoining primary tail walls are installed using in-water pile driving procedures from either land-based pile driving equipment (from a dike or contiguous fill) or barge-based pile driving equipment. The cell is then filled to design elevations with the earthen material, allowing the tail wall extensions to be installed with land-based equipment.

The dock face will be constructed in areas that are completely “submerged” (below low tide). Primary tail walls are installed in areas that are below low tide and in areas that are tidally influenced or “intertidal” (in-water during high tide and out of the water during low tide), and areas completely out-of-water. Only piles installed in the submerged and intertidal zones have the potential for impacting marine mammals. Table 1-2 summarizes the number of face and tail sheets and temporary piles to be placed each construction season in these two zones. Table 1-2 is for informational purposes; not for calculations.

Table 1-2
Open Cell Sheet Pile Quantity Through 2014
(for Submerged and Tidally Influenced Zones)

Year[1]	Location[2]	Face Length[3] (ft)	Number of Temporary Piles	Number of OCSP Face Sheets	Number of OCSP Tail Sheets	Weight (tons)
2009	North Extension	1,840	268	1,037	3,069	7,328
2010	South Extension	1,000	145	641	1,190	2,978
2011	North Replacement	1,000	145	641	2,077	4,879
2012	North Replacement	1,000	145	641	2,077	4,879
	South Replacement	1,118	163	709	2,325	5,442
2013	South Replacement	1,118	163	709	2,325	5,442
Total		**7,076**	**1,029**	**4,378**	**13,063**	**30,948**

1 No OCSP installation in 2014.
2 See Figure 1-4.
3 See Figure 2-1.

1.4.4 OCSP Installation Process

Installation of the sheet pile is a multi-stepped process. Photos 15 through 28 in Appendix A depict various stages of the installation process completed in 2008. The general process of OCSP installation is as follows:

1. Temporary pipe piles will be required to support the sheet pile driving templates during construction of each cell face. These temporary pipe piles are 30-36 inches in diameter and up to 80 ft long in the -45 ft berths and up to 70 ft long in the -35 ft berths. For each sheet pile template, two to four pipe piles will be temporarily placed, embedded 5-10 ft into the seabed or fill slope. Photo 15 in Appendix A shows temporary piles and a template in place. Temporary piles are typically driven using a vibratory hammer.

2. A steel template, shaped according to the face curvature of the cell, is placed on the temporary piles. This template is leveled and then temporarily welded in place. Walkways are installed extending from the fill to the template to allow personnel access. The walkway also serves as a template for the initial portion of the tail wall. Photo 16 in Appendix A shows a walkway and template.

3. A sheet pile is picked up by a crane and threaded onto the wye connector of the adjacent cell (already completed) or into the previously placed sheet pile (Photos 17 through 21 in Appendix A). The sheet pile is threaded until the "tip" (bottom edge) of the sheet reaches the fill or seabed to ensure a proper fit and to make sure that the bottom of the sheet pile is in line with the plan location (e.g. "tip elevation"). The crane then lifts the sheet pile several feet and allows the sheet pile to drop. The momentum of the sheet pile drives the tip into the embankment or seabed. This is the procedure that gives rise to the term "stabbing."

4. During portions of the stabbing process, shut down for purposes of mitigating sound exposure of marine mammals may not be practicable due to safety concerns of nearby personnel. If the sheet-pile wall is not secured in soil at the bottom, it could break free, especially during periods of stronger winds or currents, creating a safety hazard to sheet pile or other workers.

5. In areas where difficult driving conditions are encountered, the initial drop may not sufficiently embed the tip of the sheet pile deep enough. In these cases a "hairpin weight" (steel weight approximately 3 ft long [shaped like a hairpin] is set over the top of the sheet pile and then raised and dropped to drive the sheet in further (Photo 22 in Appendix A). In circumstances where driving conditions are very difficult, the vibratory or impact hammer may be used (and is recorded as vibratory or impact pile driving during stabbing).

6. Once the sheet pile has been placed, temporary welds are used to secure the sheet to the template to maintain the alignment (Photo 23 in Appendix A). Depending on the length of the sheets and existing tide, current and wind conditions, temporary welds may not be used on every sheet pile.

7. The adjacent sheet is threaded onto the interlock of the previous sheet and previous steps repeated. This procedure continues until one half of a cell face (8 or 9 sheet piles) or a full set of 17 sheet piles and the connecting wye are in place (Photos 20 and 24 in Appendix A).

8. Once a "set" (of face sheets) is stabilized against the template, the sheets are driven using either a vibratory or impact hammer (Photos 25 and 26 in Appendix A). The type of hammer used depends on subsurface conditions and the effort required to advance the sheet pile to final bury elevation. To maintain proper alignment of the advancing tip and to provide lateral stability to the sheet pile, the difference between the top of adjacent sheets can be no more that 5 ft at any time. Therefore, the sheets will be methodically driven in a stair-step pattern and the hammer will move back and forth along the cell until all sheets are driven to depth.

9. Pile driving is intermittent. This stair step driving pattern and continuous movement of equipment results in short intervals of actual driving time.

10. Under conditions where the impact hammer is being used, driving takes place from less than 1 minute to 17 minutes (averaging 6 minutes), followed by a period of no driving when the hammer is relocated (between 3 and 15 minutes). For the vibratory hammer, driving is in progress from less than 1 and up to 8 minutes (averaging 1.5 minutes) followed by a 1 to 5 minute period with no driving, while the vibratory hammer is moved and reset. Actual driving time is determined by local soil conditions. Where driving conditions allow, two or three adjacent sheet piles may be driven simultaneously (the grips on the vibratory hammer allow one or two sheets to be driven at a time, the grips on the impact hammer allow up to three sheets to be driven at a time). Depending on the length of the sheet pile being driven and soil conditions at the specific location, either hammer or both hammers may be used on any one sheet pile or set of sheet piles.

11. The "wye connector piles" connect tail walls to face walls. Wye connector piles are driven by vibratory hammer due to their shape.

12. Primary tail wall sheets adjacent to the cell face and within the submerged or tidally influenced area are set using the walkways as a template and driven as described in the preceding steps. Adjacent tail wall piles are generally set and driven concurrent with the adjoining face sheets (Photo 27 in Appendix A).

13. Once the face sheets and adjacent tail wall sheets approach final elevation, the temporary piles and template are removed. Driving of sheet pile to final elevation is accomplished after the template is removed. Once the face and primary tail wall sheets are driven to final elevation, fill is placed within the cell. The temporary piles and template are set up for the next cell in the sequence and the process is repeated. Multiple templates are used so the process can proceed in a "leapfrog" fashion and/or be conducted at different locations simultaneously (Photo 28 in Appendix A). Construction may proceed on three to four adjacent cells at the same time.

14. Tail wall sheet pile that are contained completely within the upland fill do not require a driving template and are installed using land-based pile driving operations; some trenching may be required in the fill to accommodate installation of the various sheet heights for the tail walls. Under some conditions, water may enter into excavated tail wall trenches behind the face; when water is present, tail wall construction will be considered as in-water work unless acquired in-water sound measurements demonstrate that there is no potential impact to marine life. To the extent practicable, construction methods will be employed to reduce the amount of in-water pile driving required for tail wall installation.

15. Concurrent with tail wall extensions, land-based vibracompaction activities densify the fill between and near the tail walls at evenly spaced locations to best consolidate fill. Fill material placed above elevation +30 MLLW will be compacted using conventional sheepsfoot or vibratory equipment from land-based operations.

A pile driving hammer would be used to install sheet and temporary piles to the desired tip elevation (such as the Delmag D30-42 diesel impact hammer with a 13,571 pound hammer with a maximum rated energy 101 kilojoules (kJ) or an APE model 200-6 vibratory hammer/extractor [see Photo 25 in Appendix A]).

The desired design tip elevation for each sheet is 15 ft below the authorized dredge depth. In areas where the harbor is maintained with a -35 ft MLLW shipping draft, the tip elevation is -50 ft MLLW; in areas where the harbor could be maintained with -45 ft MLLW draft, the tip elevation is -60 ft MLLW.

Estimates based upon currently available information and 2008 activities indicate that a vibratory pile driver will be used approximately 75 percent of the time, and an impact hammer for the remaining 25 percent of time.

1.4.5 Fendering Systems and Mooring Appurtenances

A ship fender pile system with fender panels will be installed waterside of the OCSP face, offset from the main structure along the berthing areas. Fender panels will be secured onto fender piles, extending through the tidal zone and below for the purpose of stopping and securing ships at all tidal ranges (see

Photos 29 and 30 in Appendix A for examples of typical fendering currently installed at the existing Port and nearby Port MacKenzie).

Permanent pipe piles will be driven waterside of the OCSP face (from land-based pile driving operations). Fender piles are round, approximately 36 inches in diameter, and up to 100 ft long in the -45 ft berths and up to 90 ft long in the -35 ft berths. Installation will be accomplished using vibratory and impact pile hammers. Impact hammers will be used only when vibratory methods are not sufficient to complete the designed installation.

As with OCSP installation, use of a vibratory pile driver for approximately 75 percent of the time, and an impact hammer for the remaining time (25 percent) is estimated. On average, it is expected to take approximately two hours of pile driving to install each fender pile.

Two fender piles will be placed approximately every 55 ft along the face of the newly constructed dock structure. Two container berths will have additional fenders placed in groups specifically for those vessels with docking procedure requiring the bow be placed against a fender group as the vessel rotates into the berth. Approximately 15 ft of the fender piles will be embedded below the seafloor, with the remaining portion left freestanding for final attachment of panels and fenders. Panels and fenders will be installed at low tide. Table 1-3 provides approximate numbers of fender pile to be installed by year. Table 1-3 is for informational purposes; not for calculations.

Table 1-3
Fender Pile Quantity Through 2014

Year	Location[1]	Face Length[2] (ft)	Number of Piles	Weight[3] (tons)
2009	Wet Barge Berth	360	14	198
2010	North Extension	1,840	82	1,159
	South Extension	1,000	36	509
2011	None	--	--	--
2012	None	--	--	--
2013	North Replacement	2,000	94	1,328
Before July 15, 2014	South Replacement	1,118	41	580
After July 15, 2014	South Replacement	1,118	41	580
Total		**7,436**	**308**	**4,354**

[1] See Figure 1-4.
[2] See Figure 2-1.
[3] Weight of pipe piles based on a 36-inch diameter and 3/4-inch wall thickness.

1.4.6 Demolition Activities

The existing dock will be demolished in two phases approximately one year apart. The existing dock has approximately nine acres of surface area comprised of a steel reinforced concrete deck supported by steel pilings. Additionally, a three-story combination administration building and warehouse occupy the southern portion of the existing dock. Above-deck building and warehouse demolition would occur entirely out-of-water. Pipe, wire, and other utility structures and materials would be salvaged from the deck and trestles prior to dock demolition by hand, with chipping hammers and small power tools, and forklifts.

The northern portion of the dock is scheduled to be demolished in the winter of 2010/2011 and the southern portion is scheduled for demolition in the winter of 2011/2012. Each demolition project is expected to be four to six months in duration with mechanical removal methods.

Dock demolition by mechanical means requires breaking the existing concrete away from the steel support structure. The reinforced concrete would be broken into small blocks and dropped by gravity to the seafloor below inside the final footprint. The concrete rubble would be encapsulated with 40 to 50 feet of gravel fill during construction operations. The breaking of concrete into manageable block would most likely be accomplished with large track-mounted excavators with hydraulically-actuated chipping hammers, out-of-water. The excavators would work from the surface of the existing dock. Sections of concrete would be loosened using chipping hammers, and exposed reinforcing steel would be cut away from the concrete blocks with long-handled torches. Demolition work would advance with equipment progressing from the further point moving toward shore until the final demolition areas are accessible from land. At periodic intervals, another excavator with a grapple attachment would reach out and collect and salvage the reinforcing steel. Once a portion of the concrete deck is fully removed, an excavator with a shear attachment would periodically cut, remove, and salvage the top 10 ft of the existing under-dock steel support piles as the piles come within reach; the remaining portions of existing pilings would be left in place and encapsulated in fill. Chipping concrete and salvaging of reinforcing steel can occur at any tide stage. Shearing and salvaging of pipe piles can occur at all but the very highest tides.

As an alternative, explosive demolition may be considered. Use of explosive demolition would limit in-water impacts to a one-time detonation of relatively short duration. Explosive charges would be set at designated locations to cut piles and break up the concrete deck. The detonation would be timed at low tide. Resulting rubble would be covered and encapsulated in clean fill.

1.5 APPLICABLE PERMITS/AUTHORIZATIONS

The following permits/authorizations are applicable to in-water work addressed by this Application:

- Port Intermodal Expansion Project Marine Terminal Redevelopment Environmental Assessment/Finding of No Significant Impact – March 2005
- USACE Section 404/10 Permit – August 2005
- NMFS Letter of Concurrence of No Incidental Take for 2006 (in-water fill) – May 2006
- Alaska Department of Natural Resources/Coastal Management Program Final Consistency Concurrence – July 7, 2006
- Alaska Department of Environmental Conservation/Division of Water Quality Section 401 Permit – July 21, 2006
- USACE Section 404/10 Permit – August 2007
- NMFS Letter of Concurrence of No Incidental Take for 2007 (in-water fill and test pile probing) – October 2007
- NMFS IHA for 2008 (dredging, in-water fill, pile driving) – July 15, 2008 through July 14, 2009

2.0 DATES, DURATION, AND GEOGRAPHICAL REGION OF ACTIVITIES

The dates and duration of such activity and the specific geographical region where it will occur.

2.1 GEOGRAPHIC SETTING

The following sections describe the overall geographic region of the Project site, comprised of the physical, acoustical, and biological environment. Aspects of the biological environment considered include Essential Fish Habitat (EFH), fish, and invertebrates.

2.1.1 Physical Environment

Cook Inlet is a large tidal estuary that flows into the Gulf of Alaska and is roughly 20,000 square kilometers (km^2), has 1,350 km of coastline (Rugh et al. 2000), and is generally divided into upper and lower regions by the East and West Forelands. Cook Inlet is comprised of large expanses of glacial flour deposits and extensive tidal mudflats and has an average depth of approximately 100 m. The NMFS Final Beluga Whale Subsistence Harvest Supplemental Environmental Impact Statement (SEIS) provides a detailed description of Cook Inlet's climate, geology, water quality, and physical properties and is incorporated herein by reference (NMFS 2008a). In summary, Cook Inlet is a seismically active region susceptible to earthquakes with magnitudes 6.0 to 8.8; has some of the highest tides in North America which are the driving force of surface circulation; and contains substantial quantities of mineral resources, including coal, oil, and natural gas. During winter months, sea, beach, and river ice are dominant physical forces within Cook Inlet. In the upper Cook Inlet, sea ice generally forms in October to November, developing through February or March.

Northern Cook Inlet bifurcates into Knik Arm to the north and Turnagain Arm to the east (Figure 1-1). Knik Arm is generally considered to begin at Point Woronzof, 7.4 kilometer (km) southwest of the Port. From Point Woronzof, Knik Arm extends more than 48 km in a north-northeasterly direction to the mouths of the Matanuska and Knik Rivers. Point MacKenzie, is located on the west side of Knik Arm approximately 6.7 km from the Port. Cairn Point is located just north of the Port and is the selected beluga whale monitoring site, due to its elevation above construction activities and uninterrupted northern and southern view of Knik Arm. This monitoring station is located on EAFB; a long-term access agreement is in place with the military authorizing the station. At Cairn Point, just northeast of the Port, Knik Arm narrows to about 2.4 km before widening to as much as 8 km at the tidal flats northwest of Eagle Bay at the mouth of Eagle River (Knik Arm Bridge and Toll Authority [KABATA] 2007).

Knik Arm comprises narrow channels flanked by large tidal flats composed of sand, mud, or gravel, depending upon location. Approximately 60 percent of Knik Arm is exposed at MLLW. The intertidal (tidally influenced) areas of Knik Arm are mudflats, both vegetated and unvegetated, which primarily consist of fine, silt-size glacial flour. Freshwater sources often are glacially born waters, which carry high-suspended sediment loads, as well as a variety of metals such as zinc, barium, mercury, and cadmium. Surface waters in Cook Inlet typically carry high silt and sediment loads, particularly during summer, making Knik Arm an extremely silty, turbid waterbody with low visibility through the water column. The Matanuska and Knik Rivers contribute the majority of fresh water and suspended sediment into the Knik Arm during summer months. Smaller rivers and creeks also enter along the sides of Knik Arm. Ship Creek, stocked twice each summer, serves as an important recreational fishing resource. Ship Creek flows into Knik Arm through the MOA industrial area; the mouth is approximately 0.6 km south of the southern end of the Project footprint.

Tides in Cook Inlet are semidiurnal, with two unequal high and low tides per tidal day (tidal day = 24 hours 50 minutes). The mean diurnal tidal range varies from roughly 19 ft at Homer to about 930 ft at Anchorage (Moore et al. 2000). Because of Knik Arm's predominantly shallow depths and narrow widths, tides near Anchorage are greater than in the main body of Cook Inlet. The tides at the Port of Anchorage can range about 40 ft, with an extreme observed high water of +34.6 ft and an extreme observed low water of -6.4 ft MLLW (NOAA 2008). Maximum current speeds in Knik Arm, observed during spring ebb tide, exceed 7 knots (12 ft/second). Current speeds along the existing Port dock face are approximately 2 knots (POA 2005).

During a typical spring tidal cycle at the Port, water moves from south to north during flood flow (KABATA 2007). During ebb flow, the water flows primarily to the south along the Port dock face, in response to the ebbing tide. As the ebb flow past Cairn Point strengthens, the strong ebb current forms a large eddy, or gyre, south of Cairn Point, in which water circulates in a counterclockwise motion. The evolving counterclockwise flowing eddy causes the initially south directed ebb flow at the Port to stop, and then reverse direction. At peak ebb flow, water moves to the north along the dock face, not to the south as one might expect during an ebbing tide. This eddy grows in size with time on the ebb cycle, and by the time low tide slack water occurs, the eddy extends slightly past the south end of the Port. The northerly-flowing water at the dock face due to the eddy gives way to increasingly stronger flood flow on the next incoming tide (POA 2005).

The MOA is located in the lower reaches of Knik Arm of upper Cook Inlet (Figure 1-2). The Port sits in the industrial waterfront of Anchorage, just south of Cairn Point and north of Ship Creek (Latitude 61° 15' N., Longitude 149° 52' W.; Seward Meridian). The Port's boundaries currently occupy an area of approximately 129 acres. Other commercial and industrial activities related to secured maritime operations are located near the Port on ARRC property immediately south on approximately 111 acres at a like elevation. EAFB is east of the Port, approximately 100 ft higher in elevation. The U.S. Army Defense Fuel Support Point-Anchorage (DFSP-A) site is located east of the Port, south of EAFB, and north of ARRC property. The perpendicular distance to the west bank directly across Knik Arm from the Port is approximately 4.2 km. The distance from the Port of Anchorage (east side) to nearby Port MacKenzie (west side) is approximately 4.9 km.

The navigation harbor at the Port is a dredged basin in the natural tidal flat. Ebersole and Raad (2004) describe sediment loads in upper Cook Inlet as quite high; spring thaws occur and accompanying river discharges introduce considerable amounts of sediment to the system. Natural sedimentation processes act to continuously infill the dredged basin each spring and summer season, probably working to recreate the general tidal flat structure in this region which is in some state of quasi-equilibrium with the predominant tidal currents.

The intertidal and subtidal (submerged) habitats directly surrounding the Port are shallow waters prevalent with tidal flats at the higher elevations. Habitat surveys completed to date indicate that the area immediately around the Port supports a wide diversity of marine and anadromous fish species and provides migration, rearing, and foraging habitat. Recent surveys indicate that shallow waters along the tidal flats of Knik Arm are used by all five species of Pacific salmon, saffron cod, and a variety of prey species such as eulachon and longfin smelt (Pentec 2004a, 2004b, 2005a, 2005b; Moulton 1997). Many of these species are prone to recreational and commercial sport fishing and serve as prey for larger fish and marine mammals.

2.1.2 Acoustical Environment

The physical characteristics of Knik Arm elevate ambient sound level due to wind and tides (see Section 6.0). The lower range of broadband (10 to 10,000 Hertz [Hz]) background sound levels obtained during underwater measurements at Port MacKenzie, located across Knik Arm from the Port, ranged from 115 decibels (dB) to 133 dB referenced to 1 microPascal (dB re 1 µPa) (Blackwell 2005). All underwater sound levels in this Application are referenced to 1 µPa. Background sound levels measured a year ago during the 2007 test pile probing study at the Project site ranged from 105 dB to 135dB (URS Corporation [URS] 2007). The ambient background sound pressure levels (SPLs) obtained in that study were highly variable. Most SPL recordings exceeded 120 dB. Background sound levels recently measured in 2008 at the Project site ranged from 125 dB to 155 dB (Scientific Fishery Systems 2008). These measurements were not devoid of industrial sounds from maritime operations and on-going USACE maintenance dredging and pile driving from construction was not underway at the time of the study. Therefore, these 2008 sound levels portray an accurate picture of background sound levels in Knik Arm nearest the Port.

2.1.3 Essential Fish Habitat (EFH)

EFH means those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. For the purpose of interpreting the definition of EFH, “waters” include aquatic areas that are used by fish and their associated physical, chemical, and biological properties and may include areas historically used by fish where appropriate. “Substrate” includes sediment, hard bottom, structures underlying the waters, and associated biological communities. “Necessary” means the habitat required to support a sustainable fishery and a healthy ecosystem. “Spawning, breeding, feeding, or growth to maturity” covers a species’ entire life cycle.

The NMFS and the North Pacific Fishery Management Council identified EFH in upper Cook Inlet for anadromous Pacific salmon; however, no salmon species that would be adversely affected by the Project are listed under the ESA. Designated EFH present in the vicinity of the Port is for both juvenile and adult life stages of Pacific cod, walleye pollock, sculpins, and eulachon (also called hooligan and candlefish). In addition, all streams, lakes, ponds, wetlands, and other water bodies that currently support or historically supported anadromous fish species (e.g., salmon) are considered freshwater EFH. Marine EFH for salmon fisheries in Alaska include all estuarine and marine areas utilized by Pacific salmon of Alaska origin, extending from the influence of tidewater and tidally submerged habitats to the limits of the U.S. Exclusion Economic Zone (EEZ). Details of EFH and the life stage of these species can be found in the “Knik Arm Crossing Essential Fish Habitat Assessment of the Proposed Action” and are incorporated by reference (KABATA 2007).

2.1.4 Fish

Knik Arm supports 14 to 18 species of fish including sticklebacks, sculpins, cod, Pacific herring, and five species of salmon (Pentec 2004a, 2004b, 2004c, 2004d, 2004e, 2005a, 2005b; Moulton 1997). All species of fish in this area play an important role in beluga diet and nutrition and as a resource to recreational sport fishing. The fish resources of upper Cook Inlet are primarily characterized by the spring to fall availability of migratory eulachon, outmigrating salmon smolt, and returning adult salmon. Species abundance and distribution vary greatly throughout the summer (Moore et al. 2000). Pentec (2005b) revealed that juvenile salmon were the most abundant fishes sampled with increasing abundance of Chinook and pink salmon beginning in April, peaking in May, and then sharply declining in July.

Coho, and to a lesser degree sockeye salmonids, had the largest and longest presence in Knik Arm of all juvenile salmonids. Coho were the most abundant juvenile salmonid in April, increasing to a peak in August (in 2005) before declining, but maintaining a presence in the nearshore Knik Arm through November (in 2004). Few sockeye were observed before May but they were more abundant from June through August, before declining in September and October.

Stomach content analysis of 39 juvenile Chinook salmon in Knik Arm show that aphids, mysids, and adult and aquatic insects from the orders Ephemeroptera (mayflies), Plecoptera (beetles), Diptera (flies), and the marine nereid polychaete, *Neanthes limnicola*, contributes substantially to the overall diet. Chum and trout stomach contents displayed a similar pattern of amphipods and other crustaceans and insects making up a large portion of fish diet. The extreme turbidity and poor visibility in Knik Arm likely severely limits the success of visual feeding by fish but visual feeding may be possible in microhabitats within the surface water in Knik Arm where short periods (minutes) of relative quiescence in the generally turbulent water allow partial clearing (Pentec 2005b). During the study, surface feeding by saffron cod was observed where they appeared to be feeding on crustaceans in the clearer surface water microhabitats. The authors also hypothesized that juvenile salmonids can also feed in these small lenses of clearer waters where prey can be seen. From observations, it appears that these areas can occur along shorelines as well as in the middle of Knik Arm. Recent tow-net sampling has shown substantial presence of juvenile salmonids in the open waters of Knik Arm during the spring (Pentec 2005a). Data from Pentec (2005b) and those of Moulton (1997) collected in offshore surface waters of upper Cook Inlet south of Fire Island suggest that juvenile salmon were not favoring shorelines as many of these fish, including many small individuals (e.g., chum and sockeye less than 50 millimeters [mm] in length) appeared to have very full stomachs. However, adult salmon displayed orientation to the narrow inshore areas (where they may gain some refuge from beluga whale predation) (Pentec 2005b).

The southernmost end of the Project area is located approximately 0.6 km north of the mouth of Ship Creek. Juvenile salmonids are reared at the Ship Creek Hatchery on Fort Richardson for two years prior to release at the smolt stage. Smolts released from this hatchery are ready for out-migration and it is believed that the smolts reside in the Ship Creek area for a limited period before migrating elsewhere in Knik Arm and/or Cook Inlet estuaries. Juvenile Chinook salmon sampled between Cairn Point and Point Woronzof were primarily of Ship Creek hatchery origin. Studies infer that salmon smolts around the Port and Ship Creek are flushed to the northern end of Knik Arm (primary beluga whale feeding habitat) by flood tides. The southern-most portion of the prime feeding habitat (i.e., mouth of Eagle River) is approximately 16 km from the proposed Project footprint. On high tide, beluga whales forage even farther north in the upper reaches of Knik Arm, approximately 48 km to the north of the Port.

2.1.5 Zooplankton and Invertebrates

Consideration of effects on marine mammal habitat is a component of the analysis associated with MMPA incidental take authorization. The total proposed Project for all activities will be 135 acres (67.6 acres were filled between 2006 and 2008). The remaining 67.4 acres requires the filling of intertidal and subtidal habitat; therefore, consideration of the living resources generally supported by this type of habitat is important to the analysis, due to the need to consider potential food web consequences that might affect the availability of certain fish species as prey for marine mammals, in particular beluga whales. Despite its harsh conditions, Knik Arm is a productive ecosystem. Fish and benthos sampling was conducted around the Port north to Eagle Bay during July through November 2004 and from April through September 2005 (Pentec 2005a, 2005b). These studies revealed that the area around the Port supported low benthic primary productivity except for small patches of macroalgae (rockweed and annual green algae) which are present on occasional boulders, ripraps, and tidal marshes. Plankton samples included three species of copepods, four additional species of amphipods, one additional species of mysid, and several additional classes, orders, and families of freshwater invertebrates. The zooplankton samples were generally characterized by eight primary taxonomic groups including Crangon shrimp, copepods, amphipods, mysids, fish and larval fish, isopods, terrestrial invertebrates, and the polychaete, *Neanthes limnicola*. Overall, the most abundant group captured were larval fish (55 percent of total catch), followed by amphipods (10.7 percent), mysids (10.1 percent), copepods (9.1 percent), and Crangon spp. (2.3 percent). In general, zooplankton abundance was low while crustaceans of sizes larger than could be consumed by juvenile salmon were abundant.

2.2 DATES AND DURATIONS OF ACTIVITIES

As discussed in Section 1.0, construction activities are identified by construction year and area. Typically in Anchorage, Alaska, a summer construction season begins April 15 and ends November 15 and is weather dependent; a typical winter construction season begins November 16 and extends through April 14 of the following year.

Pile driving and fill placement would occur during the summer construction season, ceasing once inclement weather either results in presence of harbor ice (limiting in-water pile driving and construction dredging activities) or frozen soils (limiting fill placement and consolidation activities). Demolition activities and miscellaneous surfacing activities, such as overhead utility installation, could occur during the winter construction season. Construction activities are also limited to work windows as described in Section 2.3.

2.2.1 In-water Pile Driving Activities

Table 2-1 shows the estimated hours for in-water pile driving by season using the following assumptions:

- Horizontal length of <u>submerged</u> wall includes face sheet and tail walls and assumes all pile driving will be in-water (see Figure 2-1).
- Horizontal length of <u>tidally</u> influenced wall includes tail walls and assumes 50 percent of pile driving will be in-water (assumes a mid-point between high tide line [HTL] and 0.0 ft MLLW(see Figure 2-1).
- Two pile driving crews may be working concurrent 10-hour shifts each season. Therefore, the total number of hours required for pile driving was divided by two.
- For each pile driving crew, 50 percent of the on-site work time will be spent pile driving. The remaining time on-site will be consumed relocating pile driving templates, moving pile driving equipment and hammers, and sorting materials prior to lifting into place. (During the 2008 season, records show actual pile driving time as significantly less than 50 percent of work time.)
- Activities of the two separate pile driving crews will not be coordinated or synchronized. One crew may be driving while the other crew is setting templates or conducting other preparatory activities. Conversely there may also be times when both crews are driving at the same time. To account for unsynchronized pile driving work, the total number hours for two crews working concurrently was multiplied by 75 percent to determine the hours of pile driving at the work site.
- Time estimates are based upon 10 hours to complete 30 feet of sheet-pile wall, 10 minutes to install and extract the temporary piles, and 2 hours to drive one fender pile.
- Vibratory hammers will be used 75 percent of the time and impact pile drivers used the remaining 25 percent of the time.

Table 2-1
Estimated Number of Hours for Pile Driving by Year

Year	Description	Location of Activity[1]	Face Length[2] (ft)	Length of Submerged Wall (ft)	Length of Tidally Influenced Wall[2,3] (ft)	Number of Sheet Piles	Number of Hairpin Uses[4]	Number of Fendering Piles	Number of Temporary Piles	Total Hours to Complete Pile Driving[4,5,6,7,8,9]	Number of Hours Vibratory Driving[10]	Number of Hours Impact Driving[10]
2009	fendering pile	Barge Berth	360	0	0	0	0	14	0	11	8	3
	sheet pile	North Extension	1,840	3,920	2,739	4,106	1,396	0	0	731	496	235
	temporary pile			0	0	0	0	0	268	17	17	0
2010	fendering pile	North Extension	1,840	0	0	0	0	82	0	62	46	15
	sheet pile	South Extension	1,000	1,554	1,506	1,831	623	0	0	320	216	103
	temporary pile			0	0	0	0	0	145	9	9	0
	fendering pile			0	0	0	0	36	0	27	20	7
2011	sheet pile	North Replacement	1,000	2,756	1,429	2,718	924	0	0	480	325	155
	temporary pile			0	0	0	0	0	145	9	9	0
2012	sheet pile	North Replacement	1,000	2,756	1,429	2,718	924	0	0	480	325	155
	temporary pile			0	0	0	0	0	145	9	9	0
	sheet pile	South Replacement	1,118	3,071	1,661	3,034	1,032	0	0	539	366	173
	temporary pile			0	0	0	0	0	163	10	10	0
2013	fendering pile	North Replacement	2,000	0	0	0	0	94	0	71	53	18
	sheet pile	South Replacement	1,118	3,071	1,661	3,034	1,032	0	0	539	366	173
	temporary pile			0	0	0	0	0	163	10	10	0
Prior to July 15, 2014[11]	fendering pile	South Replacement	1,118	0	0	0	0	41	0	30	23	8
After July 15, 2014	fendering pile	South Replacement	1,118	0	0	0	0	41	0	30	23	8
		TOTAL	13,512	17,128	10,425	17,441	5,931	308	1,029	3,384	2,332[12]	1,052[12]

1 See Figure 1-4.
2 See Figure 2-1.
3 Pile driving in tidally influenced areas would be half in-water and half out-of-water. Thus, hours calculated to pile driving in the tidally influenced area was divided by 2 (length of tidally influenced wall / 2).
4 Assumed 34 percent of sheet piles use the hairpin and it takes 4 minutes per hairpin use (number of piles x .07 hrs).
5 Assumed that 30 ft of wall completed in a 10-hour period for sheet piles (hours to complete pile driving = length of wall / 30 ft x 10 hrs).
6 Assumed it takes 2 hours per fender pile (number of piles x 2 hrs).
7 Assumed it takes 10 minutes per temporary pile (number of piles x 0.17 hrs).
8 Total pile driving hours divided by 2 for two crews.
9 75 percent of total available hours will be spent actually pile driving (hours for 2 crews to complete pile driving x 0.75).
10 75 percent vibratory/25 percent impact (hours to complete pile driving x 0.75 or 0.25).
11 End of Application period.
12 Total includes minor calculation rounding.

2.2.2 Dredging

Construction dredging will be required within the Project footprint to accommodate installation of sheet piles.

Table 2-2 shows the estimated number of days and hours required to complete planned dredging activities based upon the following assumptions:

- Production rate of 4,000 cy per day (historical USACE estimate).
- Assumed 10 hours per day will be spent dredging.

Table 2-2
Estimated Number of Dredging Hours by Year

Year	Activity	Location[1]	Amount of Dredging (cy)	Production Rate per day[2]	Required Dredging Days[3]	Number of Dredging Hours[4]
2009	none		0	0	0	0
2010	construction dredging	South Extension	169,000	4,000	42.3	423
2011	construction dredging	North Replacement	309,000	4,000	77.3	773
2012	construction dredging	South Replacement	338,000	4,000	84.5	845
2013	none		0	0	0	0
Before July 15, 2014[5]	none		0	0	0	0
After July 15, 2014	none		0	0	0	0
		Total	**816,000**		**204.1**	**2,041**

[1] See Figure 1-4.
[2] Production rate of 4,000 cy per day based on USACE estimates.
[3] Dredging days = amount of dredging / 4,000.
[4] Dredging hours = dredging days x 10 hours per day.
[5] End of Application period.

2.3 RESTRICTIONS TO CONSTRUCTION

Under the 2007 USACE Section 404/10 Permit and 2008 NMFS IHA, construction activities are restricted when visibility is impeded by weather conditions (sea state, winds, fog, snow) and daylight. The following text below describes the restrictions that can be quantified now and how those restrictions affect the calculation of available work hours for construction each year.

Daylight Restrictions. In-water activities such as pile driving will only be performed when the stipulated safety zone is illuminated by daylight. Civil twilight was used to estimate the available daylight hours for pile driving and marine mammal monitoring. Civil twilight is defined to begin in the morning and to end in the evening when the center of the sun is geometrically six degrees below the horizon. This is the limit at which twilight illumination is sufficient, under good weather conditions, for terrestrial objects to be clearly distinguished. The daylight restrictions are summarized daily for each construction season and are provided in Appendix D.

Tidal Restrictions. Except when the entire pile is out of the water due to shoreline elevation or tidal stage, impact pile driving will not take place within two hours on either side of low slack tide. This tidal stage restriction reduces the number of hours per day for in-water impact pile driving by eight hours, since there are two low tides in a 24-hour cycle. Low tide will not always occur during daylight work hours. Knik Arm's diurnal (two high and two low) tides are generally separated by approximately 6 hours. Therefore, low tides are generally separated by approximately 12 hours. The tidal restrictions are summarized daily for each construction season and are provided in Appendix D.

Piles may potentially be placed within the tidally influenced zone when they are not in direct contact with the water column, (i.e., when the zone is dewatered during the ebb tide). The tidally influenced zone encompasses the area above 0.0 ft MLLW to the point where HTL intersects the fill slope. Due to tidal fluctuations, 50 percent of the pile driving is estimated to occur in-water within this zone. Any piles driven outside of the submerged or tidally influenced zones are considered out-of-water pile driving and are not subject to the restrictions.

Restrictions for Smolt Releases. In-water activities must cease immediately for one week following the release of juvenile salmon smolt from the nearby Ship Creek Hatchery. Smolt releases are assumed to occur two times each summer. The exact dates are provided in advance annually by the Alaska Department of Fish and Game (ADF&G).

Based on these restrictions, the assumed total number of available work hours by construction season is summarized in Table 2-3. The daily breakdown of these restrictions is provided in Appendix D.

Table 2-3
Total Available Work Hours with Restrictions

Year	Available Number of Hours with Daylight/Tide Restrictions	Smolt Release Window[1] (14 days per summer)	Total Available Hours
2009	2,557	336	2,221
2010	2,561	336	2,225
2011	2,558	336	2,222
2012	2,556	336	2,220
2013	2,556	336	2,220
Before July 15, 2014[2]	1,432	336	1,096
After July 15, 2014	1,127	N/A	1,127

See daily breakdown in Appendix D.
1 Hatchery smolt are typically released twice per season; once in late May, and once in late June (lasting 7 days each).
2 End of Application period.

Visibility Restrictions. In-water activities such as pile driving will only be allowed when the stipulated safety and harassment zones are visible. Heavy rain or snowfall and fog conditions will necessitate a shut down of pile driving activities during periods when the stipulated safety and harassment zones are not fully visible. Sea state is an important factor for visibility whereby wind speed affects the observer's ability to view mammals in water (e.g., 25-31 miles per hour [mph] wind speed from 10 m above ground causes large waves with white foam crests and spray; NMFS Beaufort Scale Specification). Since visibility cannot be predicted, this restriction was not included in Table 2-3 calculations.

3.0 TYPE AND ABUNDANCE OF MARINE MAMMALS IN PROJECT AREA

The species and numbers of marine mammals likely to be found within the activity area.

3.1 SPECIES AND NUMBER IN THE PROJECT AREA

Of the 15 species of marine mammals that are residents or occur seasonally in Cook Inlet, only harbor seals (*Phoca vitulina richardsi*) and beluga whales (*Delphinapterus leucas*) are commonly observed in upper Cook Inlet (Shelden et al. 2003; National Marine Mammal Laboratory [NMML] 2004). Killer whales (*Orcinus orca*) and harbor porpoises (*Phocoena phocoena*) are infrequently to rarely observed in the Port area (Table 3-1). The population estimate for the harbor porpoise and harbor seal are for the Gulf of Alaska stocks, which include Cook Inlet. The population estimate for resident killer whales is for the Eastern North Pacific stock, whereas the estimate for the transient population is for the Gulf of Alaska, Aleutian Islands, and Bering Sea stocks, both of which overlap the Cook Inlet. Only the population estimate for the beluga whale stock is exclusive for Cook Inlet, since the stock is assumed to reside in Cook Inlet year-round. Except for the beluga whale, very small proportions of the populations for the other species occur in Cook Inlet and even fewer in upper Cook Inlet near the Project site. This Application assesses the potential impacts of the Project on these four species. Each species is discussed more fully in Section 4.0.

Table 3-1
Marine Mammal Species in Cook Inlet

Species	Abundance	Comments
Harbor seal (*Phoca vitulina richardsi*)	45,975 [1]	Occurs in the Project area. No special status or ESA listing.
Beluga whale (*Delphinapterus leucas*)	375 [2]	Occurs in the Project area. Listed as Depleted under the MMPA, Endangered under ESA.
Killer (Orca) whale (*Orcinus orca*)	1,123 Resident 314 Transient [3]	Occurs rarely in the Project area. No special status or ESA listing.
Harbor porpoise (*Phocoena phocoena*)	41,854 [4]	Occurs infrequently in the Project area. No special status or ESA listing.

Notes:
[1] Abundance estimate for the Gulf of Alaska stock (Angliss and Outlaw 2008; NMFS 2006a; 2006b)
[2] Abundance estimate for the Cook Inlet stock (NMFS 2008b)
[3] Abundance estimate for the Eastern North Pacific stock (Angliss and Outlaw 2005); the estimate for the transient population is for the Gulf of Alaska, Aleutian Islands, and Bering Sea stocks
[4] Abundance estimate for the Gulf of Alaska stock (Angliss and Outlaw 2008)

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4.0 DESCRIPTION OF MARINE MAMMALS IN PROJECT AREA

A description of the status, distribution, and seasonal distribution of the affected species or stocks of marine mammals likely to be affected by such activities.

4.1 HARBOR SEAL

Harbor seals range from Baja California north along the west coasts of the Washington, Oregon, and California, British Columbia, and Southeast Alaska; west through the Gulf of Alaska, Prince William Sound, and the Aleutian Islands; and north in the Bering Sea to Cape Newenham and the Pribilof Islands. There are three stocks in Alaska: Southeast Alaska stock, Gulf of Alaska stock (including Cook Inlet), and Bering Sea stock. The Gulf of Alaska stock was estimated to have 45,975 individuals (Angliss and Outlaw 2008). Harbor seals are taken incidentally during commercial fishery operations at an estimated annual mortality of 24 individuals (Angliss and Outlaw 2008).

Harbor seals inhabit the coastal and estuarine waters of Cook Inlet. A relatively small but unknown proportion of the population occurs in Cook Inlet. Harbor seals are more abundant in lower Cook Inlet than in upper Cook Inlet, but they occur in the upper inlet throughout most of the year (Rugh et al. 2005a; 2005b). Harbor seals haul out on rocks, reefs, beaches, and drifting glacial ice, and feed on capelin, eulachon, cod, pollock, flatfish, shrimp, octopus, and squid in marine, estuarine, and occasionally fresh waters. Harbor seals are non-migratory; their local movements are associated with tides, weather, season, food availability, and reproduction.

The major haul-out sites for harbor seals are located in lower Cook Inlet. The closest identified harbor seal haul-out site to the Port is approximately 40 km (25 miles) south along Chickaloon Bay in the southern portion of Turnagain Arm (Alaska Department of Natural Resources 1999; NMFS 2003). The presence of harbor seals in upper Cook Inlet is seasonal. Harbor seals are commonly observed along the Susitna River and other tributaries within upper Cook Inlet during eulachon and salmon migrations (NMFS 2003). During aerial surveys of upper Cook Inlet in 2001, 2002, and 2003, harbor seals were observed 24 to 96 km (15 to 60 miles) south-southwest of Anchorage at the Chickaloon, Little Susitna, Susitna, Ivan, McArthur, and Beluga Rivers (Rugh et al. 2005a). Harbor seals are sometimes observed in Knik Arm and in the vicinity of the Port, primarily near the mouth of Ship Creek (NMML 2004; Rugh et al. 2004a, 2004b; LGL Alaska Research Associates, Inc. [LGL] Unpublished Data).

On-going construction marine mammal monitoring at the Port was conducted from July through October 2008. Observers watched, observed, and recorded sightings of marine mammals concurrent with in-water construction activities. One harbor seal was sighted in Knik Arm on September 13, 2008 traveling north in the vicinity of the Port. The tide was at low flood stage. No in-water construction was occurring at the time and no change of behavior was observed.

Harbor seals respond to underwater sounds from approximately 1 to 180 kiloHertz (kHz) with the functional high frequency limit around 60 kHz and peak sensitivity at about 32 kHz (Kastak and Schusterman 1995). Hearing ability in the air is greatly reduced (by 25 to 30 dB); harbor seals respond to sounds from 1 to 22.5 kHz, with a peak sensitivity of 12 kHz (Kastak and Schusterman 1995). Chart 4-1 is an in-air audiogram and Chart 4-2 is an in-water audiogram for the harbor seal (taken from Nedwell et al. 2004). An audiogram shows the lowest level of sounds that the animal can hear (hearing threshold) at different frequencies (pitch). The y-axis of the audiogram is sound levels expressed in dB (either in-air or in-water) and the x-axis is the frequency of the sound expressed in kHz.

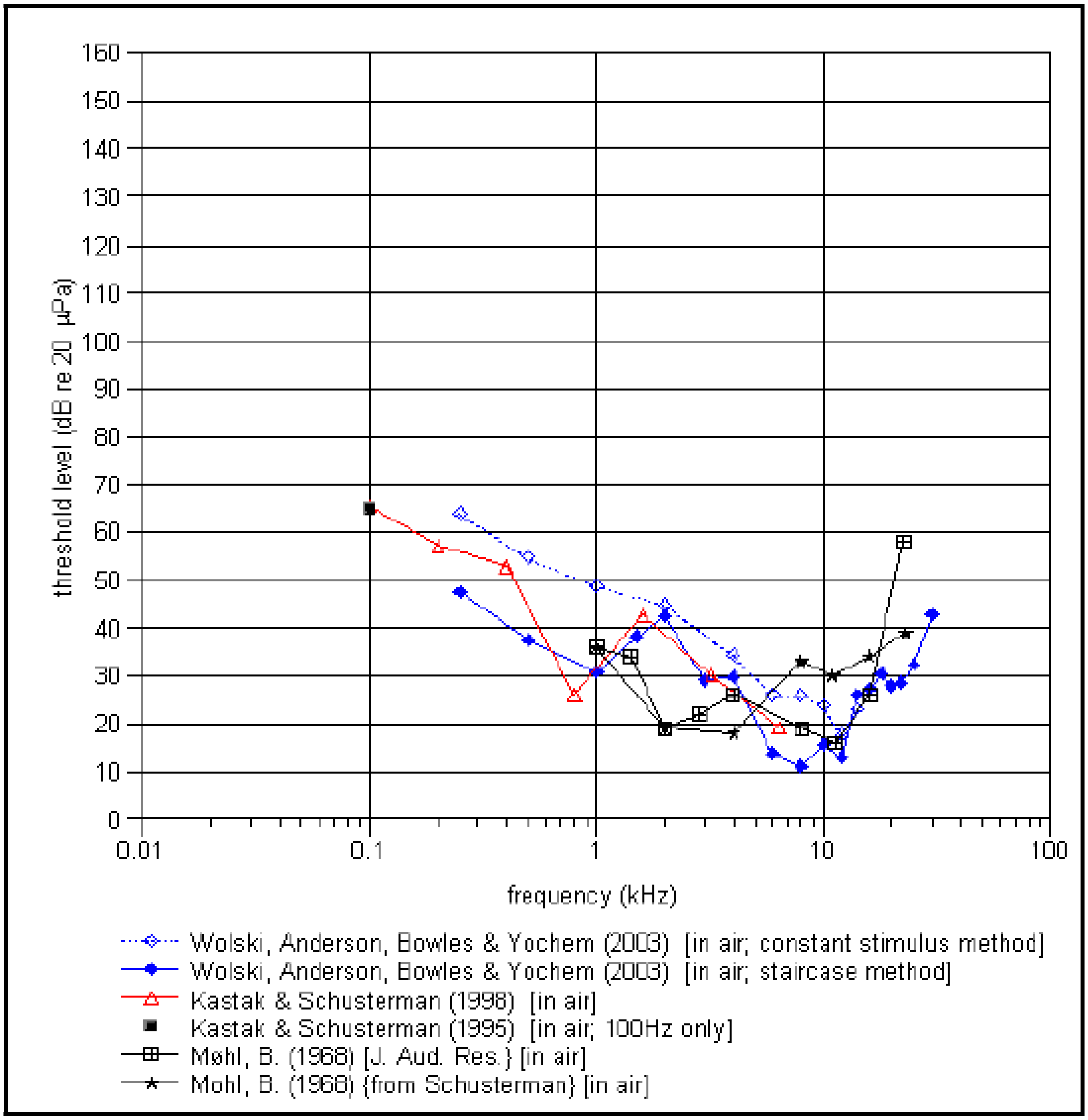

Chart 4-1. Harbor Seal In-air Audiogram (taken from Nedwell et al. 2004)

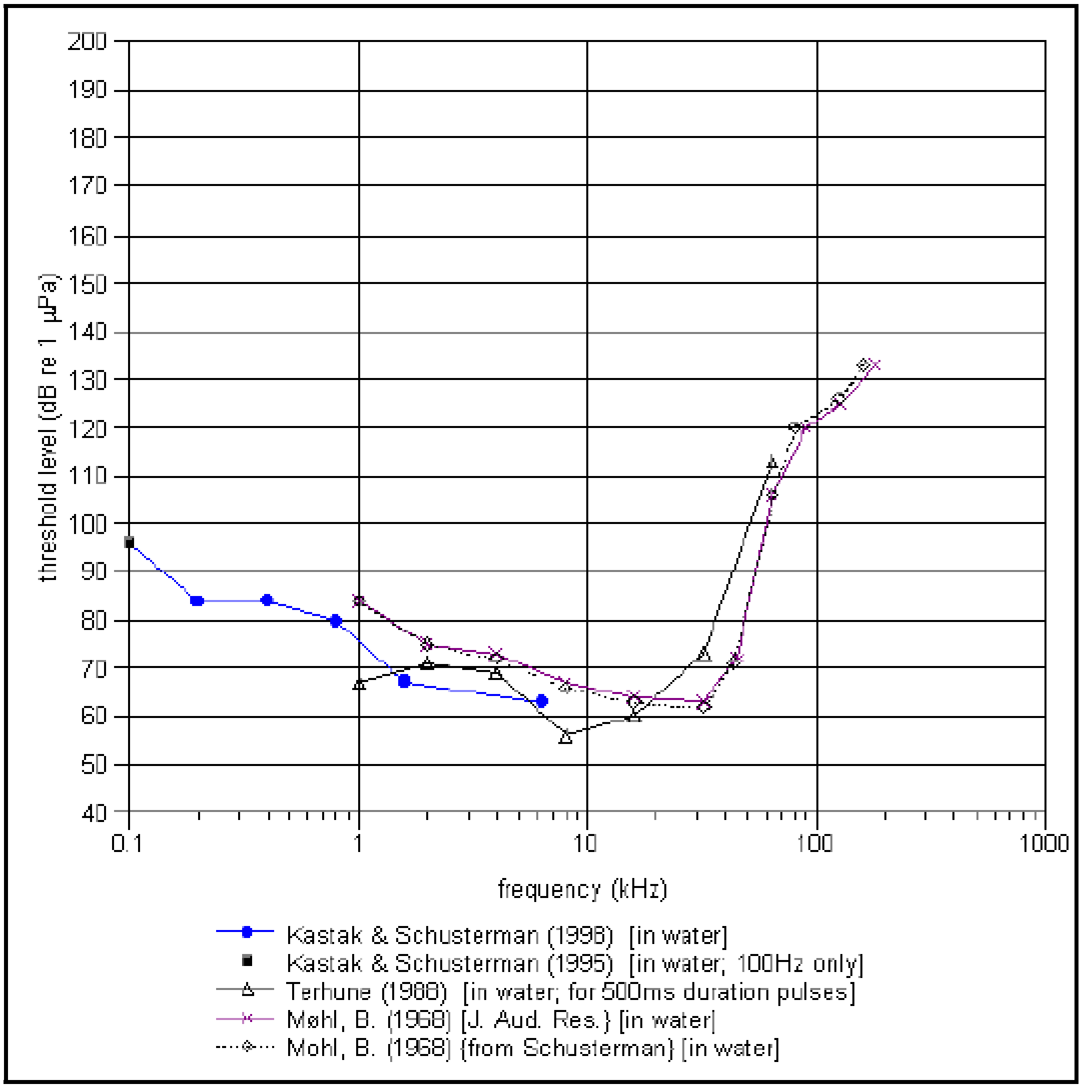

Chart 4-2. Harbor Seal In-water Audiogram (taken from Nedwell et al. 2004)

4.2 KILLER WHALE

The population of the North Pacific stock of killer whales contains an estimated 1,123 animals in the resident group and 314 animals in the transient group (Angliss and Outlaw 2005). Numbers of killer whales in Cook Inlet are small compared to the overall population and most are recorded in the lower Cook Inlet. Killer whales are rare in upper Cook Inlet, where transient killer whales are known to feed on beluga whales, and resident killer whales are known to feed on anadromous fish (Shelden et al. 2003). The availability of these prey species largely determines the likeliest times for killer whales to be in the area. Twenty-three sightings of killer whales were reported in the lower Cook Inlet between 1993 and 2004 in aerial surveys by Rugh et al. (2005a). Surveys over 20 years by Shelden et al. (2003) reported 11 sightings in upper Cook Inlet between Turnagain Arm, Susitna Flats, and Knik Arm. No killer whales were spotted during recent surveys by Funk et al. (2005), Ireland et al. (2005), Brueggeman et al. (2007a, 2007b, 2008), or Prevel Ramos et al. (2006, 2008). Eleven killer whale strandings have been reported in Turnagain Arm, six in May 1991, and five in August 1993. Very few killer whales, if any, are expected to approach or be in the vicinity of the Project area.

The hearing of killer whales is well developed. Szymanski et al. (1999) found that they responded to tones between 1 and 120 kHz, with the most sensitive range between 18 and 42 kHz. Their greatest sensitivity was at 20 kHz, which is lower than many other odontocetes, but it matches peak spectral energy reported for killer whale echolocation clicks. Chart 4-3 is an audiogram for the killer whale (taken from Nedwell et al. 2004).

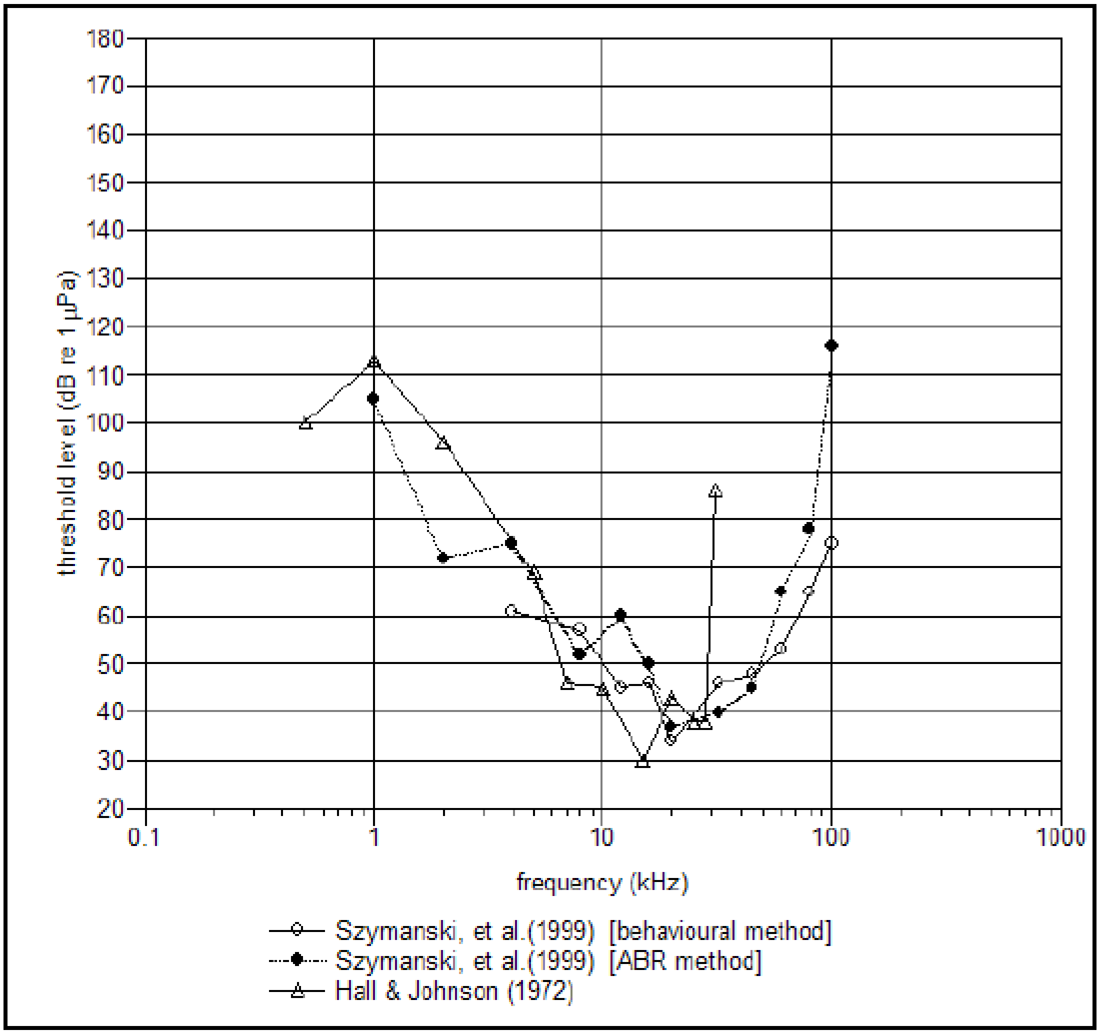

Chart 4-3. Killer Whale In-water Audiogram (taken from Nedwell et al. 2004)

4.3 HARBOR PORPOISE

Harbor porpoise stocks in Alaska are divided into three stocks: the Bering Sea stock, the Southeast Alaska stock, and the Gulf of Alaska stock. The Gulf of Alaska stock is currently estimated at 41,854 individuals (Angliss and Outlaw 2008). The most recent estimated density of animals in Cook Inlet is 7.2 per 1,000 km^2 (386 square miles) (Dahlheim et al. 2000) indicating that only a small number use Cook Inlet. Harbor porpoise have been reported in lower Cook Inlet from Cape Douglas to the West Foreland, Kachemak Bay, and offshore (Rugh et al. 2005a). Small numbers of harbor porpoises have been consistently reported in the upper Cook Inlet between April and October, except for a recent survey that recorded higher numbers than typical. Highest monthly counts include 17 harbor porpoises reported for spring through fall 2006 by Prevel Ramos et al. (2008), 14 for spring of 2007 by Brueggeman et al.

(2007a), 12 for fall of 2007 by Brueggeman et al. (2008), and 129 for spring through fall in 2007 by Prevel Ramos et al. (2008) between Granite Point and the Susitna River during 2006 and 2007; the reason for the recent spike in numbers (129) of harbor porpoises in the upper Cook Inlet is unclear and quite disparate with results of past surveys, suggesting it may be an anomaly. The spike occurred in July, which was followed by sightings of 79 harbor porpoise in August, 78 in September, and 59 in October in 2007. The number of porpoises counted more than once was unknown indicating that the actual numbers are likely smaller than reported.

The harbor porpoise has the highest upper-frequency limit of all odontocetes investigated. Kastelein et al. (2002) found that the range of best hearing was from 16 to 140 kHz, with a reduced sensitivity around 64 kHz. Maximum sensitivity (about 33 dB re 1 μPa) occurred between 100 and 140 kHz. This maximum sensitivity range corresponds with the peak frequency of echolocation pulses produced by harbor porpoises (120–130 kHz). Chart 4-4 is an audiogram for the harbor porpoise (taken from Nedwell et al. 2004).

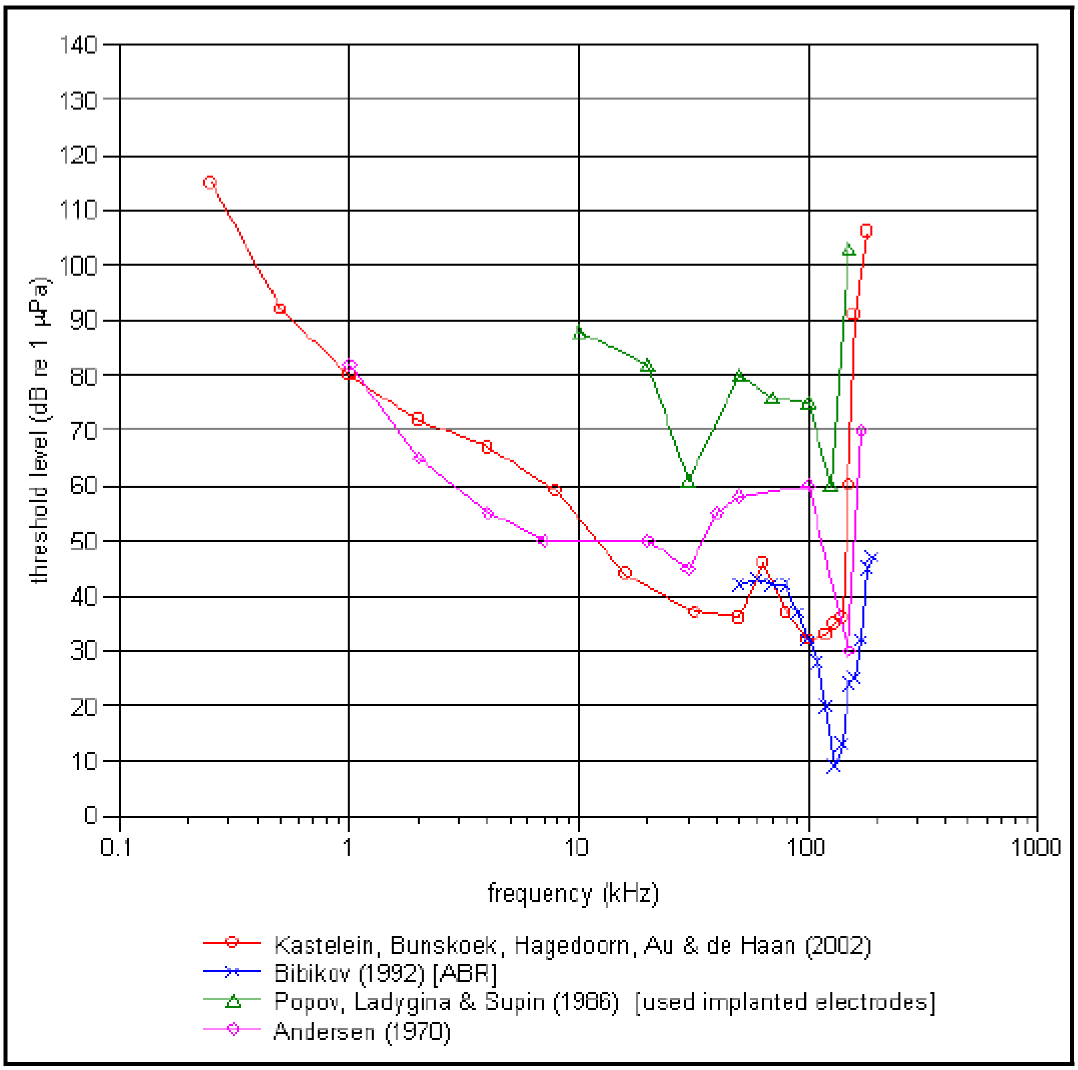

Chart 4-4. Harbor Porpoise In-water Audiogram (taken from Nedwell et al. 2004)

4.4 BELUGA WHALE

Beluga whales appear seasonally throughout much of Alaska, except in the Southeast region and the Aleutian Islands. Five stocks are recognized in Alaska: Beaufort Sea stock, eastern Chukchi Sea stock, eastern Bering Sea stock, Bristol Bay stock, and Cook Inlet stock (Angliss and Outlaw 2005). The Cook Inlet stock is the most isolated of the five stocks, since it is separated from the others by the Alaska Peninsula and resides year round in Cook Inlet (Laidre et al. 2000). Only the Cook Inlet stock inhabits the Project area.

4.4.1 Population

Cook Inlet beluga whales may have numbered fewer than several thousand animals but there were no systematic population estimates prior to 1994. Although ADF&G conducted a survey in August 1979, it did not include all of upper Cook Inlet, the area where almost all beluga whales are currently found during summer. However, it is the most complete survey of Cook Inlet prior to 1994 and incorporated a correction factor for beluga whales missed during the survey. Therefore, the ADF&G summary (Calkins 1989) provides the best available estimate for the historical beluga whale abundance in Cook Inlet. For management purposes, NMFS has adopted 1,300 beluga whales as the numerical value for the carrying capacity to be used in Cook Inlet. (65 Federal Register [FR] 34590)

NMFS began comprehensive, systematic aerial surveys on beluga whales in Cook Inlet in 1994. Unlike previous efforts, these surveys included the upper, middle, and lower inlet. These surveys documented a decline in abundance of nearly 50 percent between 1994 and 1998, from an estimate of 653 to 347 whales (Rugh et al. 2000). In response to this decline, NMFS initiated a status review on the Cook Inlet beluga whale stock pursuant to the MMPA and the ESA in 1998 (63 FR 64228). The annual abundance surveys conducted each June since 1999 provide the following abundance estimates: 367 beluga whales in 1999, 435 beluga whales in 2000, 386 beluga whales in 2001, 313 beluga whales in 2002, 357 beluga whales in 2003, 366 beluga whales in 2004, 278 beluga whales in 2005, 302 beluga whales in 2006, and 375 beluga whales in 2007 (Hobbs et al. 2000; Rugh et al. 2003, 2004a, 2004b, 2005a, 2005b, 2005c, 2006, 2007). NMFS announced the 2008 abundance survey as unchanged from 2007, estimating 375 whales number for 2008 (73 FR 62919).

These results show the population is not growing but has stabilized over the last ten years (NMFS 2008b; Angliss and Outlaw 2008; Hobbs et al. 2008). The Cook Inlet beluga whale population has been designated as depleted under the MMPA (65 FR 34590). This designation is because the current population estimate (375) places it at about 48 percent of the Optimum Sustainable Population (OSP) of 780 whales (60 percent of the estimated carrying capacity of 1,300 whales). The estimate has remained below half of the OSP, which is the threshold NMFS is required to use to designate the population as depleted under the MMPA (Angliss and Outlaw 2008).

In 1999, NMFS received petitions to list the Cook Inlet beluga whale stock as an endangered species under the ESA (64 FR 17347). However, NMFS determined that the population decline was due to over harvest by Alaska Native subsistence hunters and, because the Native harvest was regulated in 1999, listing this stock under the ESA was not warranted at the time (65 FR 38778). This decision was upheld in court. NMFS announced initiation of another Cook Inlet beluga whale status review under the ESA (71 FR 14836) and received another petition to list the Cook Inlet beluga whale under the ESA (71 FR 44614). In 2006, NMFS issued a decision on the status review on April 20, 2007 concluding that the Cook Inlet beluga whale is a distinct population segment that is in danger of extinction throughout its range; NMFS issued a proposed rule to list the Cook Inlet beluga whale as an endangered species (72 FR 19821). Public hearings were conducted in July 2007, and the comment period extended to August 3, 2007. On April 22, 2008, NMFS announced that it would delay the decision on the proposed rule until after it had assessed the population status in the summer of 2008, moving the deadline for the decision to October 20, 2008 (73 FR 21578). On October 17, 2008, NMFS announced that the population is listed as endangered under ESA (73 FR 62919). Critical habitat will be designated at a future date. NMFS also released the Final Conservation Plan (NMFS 2008b).

During the 2008 construction marine mammal monitoring underway at the Port (July through October 2008), there were 50 sightings of beluga whales recorded, either alone or in groups. In total, 329 beluga whales were observed in Knik Arm in the vicinity of the Port by the construction marine mammal observers stationed at the Port. It is unknown how many of the observations were repeat sightings of the same whale.

4.4.2 Hearing Abilities

In terms of hearing abilities, beluga whales are one of the most studied odontocetes because they are a common marine mammal in public aquariums around the world. Although they are known to hear a wide range of frequencies, their greatest sensitivity is around 10 to 100 kHz (Richardson et al. 1995), well above sounds produced by most industrial activities (<100 Hz or 0.1 kHz) recorded in Cook Inlet. Average hearing thresholds for captive beluga whales have been measured at 65 and 120.6 dB re 1 µPa at frequencies of 8 kHz and 125 Hz, respectively (Awbrey et al. 1988). Masked hearing thresholds were measured at approximately 120 dB re 1 µPa for a captive beluga whale at three frequencies between 1.2 and 2.4 kHz (Finneran et al. 2002). Beluga whales do have some limited hearing ability down to ~35 Hz, where their hearing threshold is about 140 dB re 1 µPa (Richardson et al. 1995). Thresholds for pulsed sounds will be higher, depending on the specific durations and other characteristics of the pulses (Johnson 1991). An audiogram for beluga whales from Nedwell et al. (2004) is provided in Chart 4-5.

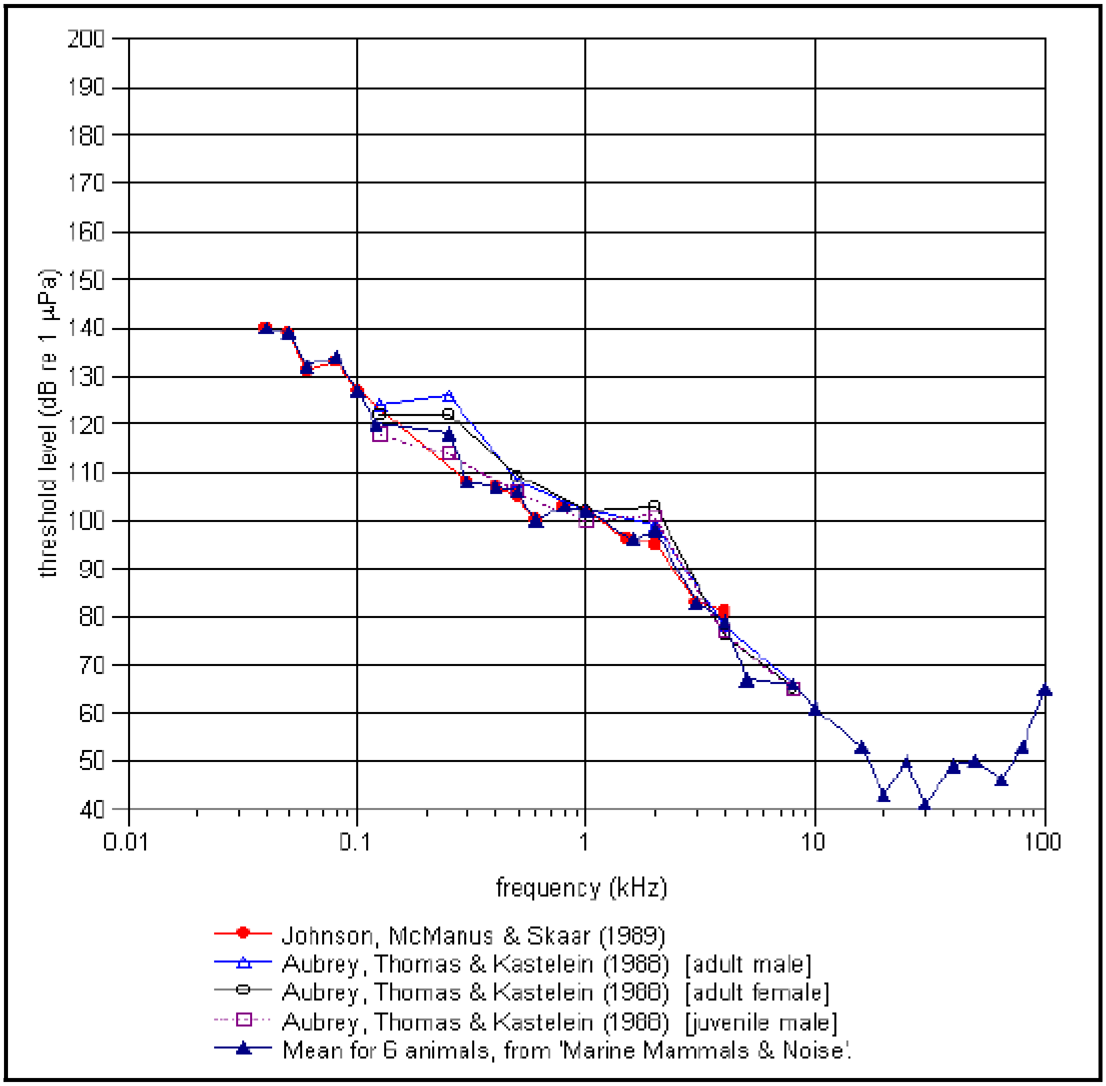

Chart 4-5. Beluga Whale In-water Audiogram (taken from Nedwell et al. 2004)

4.4.3 Distribution

The following discussion of the distribution of beluga whales in upper Cook Inlet is based upon NMML data including NMFS aerial surveys; NMFS data from satellite-tagged belugas, and opportunistic sightings (NMML 2004); baseline studies of beluga whale occurrence in Knik Arm conducted for KABATA (Funk et al. 2005); baseline studies of beluga whale occurrence in Turnagain Arm conducted in preparation for Seward Highway improvements (Markowitz et al. 2007); marine mammal surveys conducted at Ladd Landing to assess a coal shipping project (Prevel Ramos et al. 2008); marine mammal surveys off Granite Point, the Beluga River, and further down the inlet at North Ninilchik (Brueggeman et al. 2007a, 2007b, 2008); and the scientific monitoring program underway at the Port (Prevel Ramos et al. 2006; Markowitz and McGuire 2007; Cornick and Kendall 2008). These data have provided a relatively good picture of the distribution and occurrence of beluga whales in upper Cook Inlet, particularly in the lower Knik Arm and the Port Project area as shown on Figures 4-1 and 4-2 (Hobbs et al. 2005; Goetz et al. 2007).

4.4.3.1 NMFS Aerial Surveys

Since 1993, NMFS has conducted annual aerial surveys in June or July to document the distribution and abundance of beluga whales in Cook Inlet. In addition, to help establish beluga whale distribution in Cook Inlet throughout the year, aerial surveys were conducted every one to two months between June 2001 and June 2002 (Rugh et al. 2004a). These annual aerial surveys for beluga whales in Cook Inlet have provided systematic coverage of 13 to 33 percent of the entire inlet each June or July since 1994 including a 3-km (1.9 miles) wide strip along the shore and approximately 1,000 km (621 miles) of off-shore transects (Rugh et al. 2000, 2005a, 2005b, 2006, 2007). Surveys designed to coincide with known seasonal feeding aggregations (Table 1.3 in Rugh et al. 2000) were generally conducted on two to four days per year in June or July at or near low tide in order to reduce the search area (Rugh et al. 2000). However from June 2001 to June 2002, surveys were conducted during most months in an effort to assess seasonal variability in beluga whale distribution in Cook Inlet (Rugh et al. 2005a).

The collective survey results show that beluga whales have been consistently found near or in river mouths along the northern shores of upper Cook Inlet (i.e., north of East and West Foreland). In particular, beluga whale groups are seen in the Susitna River Delta, Knik Arm, and along the shores of Chickaloon Bay. Small groups had also been recorded seen farther south in Kachemak Bay, Redoubt Bay (Big River), and Trading Bay (McArthur River) prior to 1996, but very rarely thereafter. Since the mid-1990s, most (96 to 100 percent) beluga whales in upper Cook Inlet have been concentrated in shallow areas near river mouths, no longer occurring in the central or southern portions of Cook Inlet (Hobbs et al. 2008). Based on these aerial surveys, the concentration of beluga whales in the northernmost portion of Cook Inlet appears to be fairly consistent from June to October (Rugh et al. 2000, 2004a, 2005a, 2006, 2007).

4.4.3.2 NMFS Satellite Tag Data

In 1999, one beluga whale was tagged with a satellite transmitter, and its movements were recorded from June through September of that year. Since 1999, 18 beluga whales in upper Cook Inlet have been captured and fitted with satellite tags to provide information on their movements during late summer, fall, winter, and spring. Hobbs et al. (2005) described: 1) the recorded movements of two beluga whales (tagged in 2000) from September 2000 through January 2001; 2) the recorded movements of seven beluga whales (tagged in 2001) from August 2001 through March 2002; and 3) the recorded movements of eight beluga whales (tagged in 2002) from August 2002 through May 2003.

The concentration of beluga whales in the upper Cook Inlet appears to be fairly consistent from June to October based on aerial surveys (Rugh et al. 2000, 2004a, 2005a). Studies for KABATA in 2004 and 2005 confirmed the use of Knik Arm by beluga whales from July to October (Funk et al. 2005). Data from tagged whales (14 tags between July and March 2000 through 2003) show beluga whales use upper Cook Inlet intensively between summer and late autumn (Hobbs et al. 2005). As late as October, beluga whales tagged with satellite transmitters continued to use Knik Arm and Turnagain Arm and Chickaloon Bay, but some ranged into lower Cook Inlet south to Chinitna Bay, Tuxedni Bay, and Trading Bay (McArthur River) in the fall (Hobbs et al. 2005). In November, beluga whales moved between Knik Arm, Turnagain Arm, and Chickaloon Bay, similar to patterns observed in September (Hobbs et al. 2005). By December, beluga whales were distributed throughout the upper to mid-inlet. From January into March, they moved as far south as Kalgin Island and slightly beyond in central offshore waters. Beluga whales also made occasional excursions into Knik Arm and Turnagain Arm in February and March in spite of ice cover greater than 90 percent (Hobbs et al. 2005). While they moved widely around

Cook Inlet there was no indication from the tagged whales (Hobbs et al. 2005) that beluga whales had a seasonal migration in and out of Cook Inlet.

4.4.3.3 Opportunistic Sightings

Opportunistic sightings of beluga whales in Cook Inlet have been reported to the NMFS since 1977. Beluga whale sighting reports are maintained in a database by NMML. Their high visibility and distinctive nature make them well-suited for opportunistic sightings along public access areas (e.g., the Seward Highway along Turnagain Arm, the public boat ramp at Ship Creek). Opportunistic sighting reports come from a variety of sources including: NMFS personnel conducting research in Cook Inlet, ADF&G, commercial fishermen, pilots, POA personnel, and the general public. Location data range from precise locations (e.g., Global Positioning System [GPS]-determined latitude and longitude) to approximate distances from major landmarks. In addition to location data, most reports include date, time, approximate number of whales, and notable whale behavior (Rugh et al. 2000, 2004a, 2005a). Since opportunistic data are collected any time, and often multiple times a week, these data often provide an approximation of beluga whale locations and movements in those areas frequented by natural resource agency personnel, fishermen, and others.

In 2007, the POA installed public signage at both the Port entrance and at the public boat ramp near the mouth of Ship Creek which provides opportunistic reporting telephone numbers and reporting instructions. The POA trains Port operators, visitors, tenants, users, ship captains/pilots, and all maritime and construction personnel on how to properly document and report opportunistic sightings.

Depending upon the season, beluga whales can occur in both offshore and coastal waters. Although they remain in the general Cook Inlet area during the winter, they disperse throughout the upper and mid-inlet areas. Data from NMFS aerial surveys, opportunistic sighting reports, and satellite-tagged beluga whales confirm they are more widely dispersed throughout Cook Inlet during the winter months (November-April), with animals found between Kalgin Island and Point Possession (see Figures 4-1 and 4-2). Based upon monthly surveys (e.g., Rugh et al. 2000), opportunistic sightings, and satellite-tag data, there are generally fewer observations of these whales in the Anchorage and Knik Arm area from November through April (NMML 2004; Rugh et al. 2004a).

During the spring and summer, beluga whales are generally concentrated near the warmer waters of river mouths where prey availability is high and predator occurrence is low (Moore et al. 2000). Most beluga whale calving in Cook Inlet occurs from mid-May to mid-July in the vicinity of the river mouths, although Native hunters have described calving as early as April and as late as August (Huntington 2000).

Beluga whale concentrations in upper Cook Inlet during April and May correspond with eulachon migrations to rivers and streams in the northern portion of upper Cook Inlet (NMFS 2003; Angliss and Outlaw 2005). Data from NMFS aerial surveys, opportunistic sightings, and satellite-tagged beluga whales confirm that they are concentrated along the rivers and nearshore areas of upper Cook Inlet (Susitna River Delta, Knik Arm, and Turnagain Arm) from May through October (Figures 4-1 and 4-2) (NMML 2004; Rugh et al. 2004a). Beluga whales are commonly seen from early July to early October at the mouth of Ship Creek where they feed on salmon and other fish, and also in the vicinity of the Port (e.g., alongside docked ships and within 300 ft of the docks) (Great Land Trust 2000; Blackwell and Greene 2002; NMML 2004). Beluga whales have also been observed feeding immediately offshore of the tidelands north of the Port and south of Cairn Point (NMFS 2004).

4.4.3.4 Knik Arm Bridge and Toll Authority (KABATA) 2004-2005 Baseline Study

To assist in the evaluation of the potential impact of a proposed bridge crossing of Knik Arm north of Cairn Point, KABATA initiated a study to collect baseline environmental data on beluga whale activity and the ecology of Knik Arm. Boat and land-based observations were conducted in Knik Arm from July 2004 through July 2005. Land-based observations were conducted from nine stations along the shore of Knik Arm. The three primary stations were located at Cairn Point, Point Woronzof, and Birchwood. The majority of the beluga whales were observed north of Cairn Point. Temporal use of Knik Arm by beluga whales was related to tide height. During the study period, most beluga whales using Knik Arm stayed in the upper portion of Knik Arm north of Cairn Point. Approximately 90 percent of observations occurred during the months of August through November, and only during this time were whales consistently sighted in Knik Arm. The relatively low number of sightings in Knik Arm throughout the rest of the year suggested the whales were using other portions of Cook Inlet. In addition, relatively few beluga whales were sighted in the spring and early to mid-summer months. Beluga whales predominantly frequented Eagle Bay (mouth of Eagle River), Eklutna, and the stretch of coastline in between, particularly when they were present in greater numbers (Funk et al. 2005).

4.4.3.5 Seward Highway Study along Turnagain Arm

Markowitz et al. (2007) documented habitat use and behavior of beluga whales along the Seward Highway in Turnagain Arm from May through November 2006. This study was focused around the high tides when whales regularly traverse the near-shore channels to the mouths of rivers and streams, where they feed on fish. Most of the observations of whales occurred between the end of August and the end of October. No beluga whales were sighted in the study area in May, June, or July. The age composition of all whales observed was 58 percent adults, 17 percent subadults, 8 percent calves, and 17 percent unknown. Most beluga whale observations were in the upper Turnagain Arm, east of Bird Creek. The observation station closest to the Port was at Potter Creek but few beluga whales were sighted in the lower Turnagain Arm section of the Project area. About 80 percent of all beluga whale sightings were within 1,100 m off shore. About a third of all sightings in September were less than 50 m from shore while two-thirds of all sightings in October were within 50 m off shore. Most beluga whale movements were with the tide: eastward into the upper Turnagain Arm on the rising tide and westward out of Turnagain Arm on the falling tide. The few observations of beluga whales in the lower Turnagain Arm were close to the mid-tide, indicating that beluga whales may use these areas closer to the low tide rather than the high tide pattern observed in the upper Turnagain Arm.

4.4.3.6 Marine Mammal Surveys at Ladd Landing

Prevel Ramos et al. (2008) conducted surveys near Ladd Landing on the north side of upper Cook Inlet between Tyonek and the Beluga River from April through October in 2006 and July through October 2007. The results from 2006 indicated that July through October had the least amount of beluga whale activity in the Project area. Relatively few beluga whales were observed during the 2007 surveys near Ladd Landing, with three groups of one or two whales observed in July, two groups of three whales in September, and two groups averaging seven whales in October. Two groups of 20 whales were observed near the Susitna Flats in August. Some of these whales may have been recorded more than once. Most of the whales sighted were close to shore. Of the whales seen in 2006 and 2007, 60 to 75 percent were white, 16 to 18 percent were gray, and the color of 10 to 22 percent was unknown.

4.4.3.7 Marine Mammal Surveys at Granite Point, Beluga River, and North Ninilchik

Brueggeman et al. (2007a, 2007b, 2008) conducted vessel and aerial surveys in 2007 near the Beluga River between April 1 and May 15, Granite Point between September 29 and October 21, and North Ninilchik between October 25 and November 7. They recorded 148 to 162 belugas near the Beluga River with most observed during early May, 35 belugas near Granite Point with most observed in early to mid-October, and no belugas recorded off North Ninilchik. Most of the whales were observed near the shore. In addition, the movements indicated they were transiting through the areas to the head of the upper inlet. Small percentages of calves and yearlings were recorded with adults during the spring and early fall surveys. No belugas were observed at North Ninilchik which is considered marginal habitat because of a lack of habitat structure (bays, inlets, etc.) combined with easy public access, typical of the eastern shore of the inlet.

4.4.3.8 POA Marine Mammal Monitoring Program

The POA has conducted a NMFS-approved monitoring program for beluga whales and other marine mammals focused on the Port area beginning in 2005, to the present. Report summaries from all years are included in Section 13.0. Additional monitoring work will be conducted throughout the remainder of the Project, as described in Section 13.0.

The POA scientific monitoring started in 2005 conducted by LGL from August through November (Prevel Ramos et al. 2006) and April through November in 2006 (Markowitz and McGuire 2007). Alaska Pacific University (APU) resumed scientific monitoring October through November in 2007 (Cornick and Kendall 2008) and has been conducting monitoring in 2008 since July. Data on beluga whale sighting rates, grouping, behavior, and movement indicate that the Port is a relatively low use area, occasionally visited by lone whales or small groups of whales. They are observed most often at low tide in the fall, peaking in late August to early September. Although groups with calves have been observed to enter the Port area, data do not suggest that the area is an important nursery area.

Although the POA scientific monitoring studies indicate that the area is not used frequently by many beluga whales, it is apparently used for foraging habitat by whales traveling between lower and upper Knik Arm. In all years, diving and traveling were the most common behaviors observed, with many instances of confirmed feeding. Sighting rates at the Port range from 0.2 to 0.4 whales per hour (Prevel Ramos et al. 2006; Markowitz and McGuire 2007; Cornick and Kendall 2008), as compared to 3 to 5 whales per hour at Eklutna, 20 to 30 whales per hour at Birchwood, and 3 to 8 whales per hour at Cairn Point (Funk et al. 2005) indicating that these areas are of higher use than the Port.

When in-water pile driving construction began in 2008, data collected so far follow similar patterns as those data from 2005 through 2007 (beluga whale densities from these years is provided in Table 6-3). Few beluga whales were observed in July and early August; numbers of sightings increased in mid-August; with the highest numbers observed late August to mid-September. Summary tables for the 2008 year-to-date (YTD) sighting data associated with the construction marine mammal monitoring program are provided in Appendix E. In all years, beluga whales have been observed to enter the Project footprint while construction activities were taking place, including pile driving and dredging. The most commonly observed behaviors were traveling, diving, and suspected feeding.

4.4.4 Feeding

Hobbs et al. (2008) presents the most current analysis of stomach contents derived from stranded or harvested belugas in Cook Inlet. This analysis is continuing and provides information on prey availability and prey preferences of Cook Inlet belugas which is summarized below.

Cook Inlet belugas feed on a wide variety of prey species particularly those that are seasonally abundant. In spring, the preferred prey species are eulachon and cod. Other fish species found in the stomachs of belugas may be from secondary ingestion by cods that feed on polychaetes, shrimp, amphipods, mysids, as well as other fish (e.g., walleye pollock and flatfish), and invertebrates.

From late spring and throughout summer most beluga stomachs sampled contained Pacific salmon corresponding to the timing of fish runs in the area. Anadromous smolt and adult fish concentrate at river mouths and adjacent intertidal mudflats (Calkins 1989). Five Pacific salmon species: Chinook, pink, coho, sockeye, and chum spawn in rivers throughout Cook Inlet (Moulton 1997; Moore et al. 2000). Calkins (1989) recovered 13 salmon tags in the stomach of an adult beluga found dead in Turnagain Arm. Beluga hunters in Cook Inlet reported one whale having 19 adult Chinook salmon in its stomach (Huntington 2000). Salmon, overall, represent the highest percent frequency of occurrence of the prey species in Cook Inlet beluga stomachs. This suggests that their spring feeding in upper Cook Inlet, principally on fat-rich fish such as salmon and eulachon, is very important to the energetics of these animals.

In the fall, as anadromous fish runs begin to decline, belugas return to consume fish species (cod and bottom fish) found in nearshore bays and estuaries. Bottom fish include Pacific staghorn sculpin, starry flounder, and yellowfin sole. Stomach samples from Cook Inlet belugas are not available for winter months (December through March), although dive data from belugas tagged with satellite transmitters suggest whales feed in deeper waters during winter (Hobbs et al. 2005), possibly on such prey species as flatfish, cod, sculpin, and pollock.

NMFS has characterized the relative value of four habitats as part of the management and recovery strategy in its Draft and Final Conservation Plan (NMFS 2005, 2008b). These are sites where beluga whales are most consistently observed, where feeding behavior has been documented, and where dense numbers of whales occur within a relatively confined area of the inlet. Type 1 Habitat is termed "High Value/High Sensitivity" and includes what NMFS believes to be the most important and sensitive areas of the inlet for beluga whales. Type 2 Habitat is termed "High Value" and includes summer feeding areas and winter habitats in waters where whales typically occur in lesser densities or in deeper waters. Type 3 Habitat occurs in the offshore areas of the mid and upper inlet and also includes wintering habitat. Type 4 Habitat describes the remaining portions of the range of these whales within Cook Inlet.

The habitat that would be directly impacted from in-water construction activities at the Port, from both noise and fill, is considered Type 2 Habitat.

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5.0 REQUESTED TYPE OF INCIDENTAL TAKING AUTHORIZATION

The type of incidental taking authorization that is being requested and the method of incidental taking.

5.1 LETTERS OF AUTHORIZATION REQUEST FOR JULY 15, 2009 THROUGH JULY 15, 2014 PROJECT CONSTRUCTION

The POA and the Maritime Administration request a five-year Rulemaking from NMFS for incidental take by harassment (Level B as defined in 50 CFR 216.3) of small numbers of marine mammals during in-water construction work planned between July 15, 2009 and July 15, 2014. The operations outlined in Sections 1.0 and 2.0 have the potential to result in takes of marine mammals by noise disturbance during in-water construction activities including pile driving, dredging, and fill operations. The effects will depend upon the species as well as the distance and received level of the sound (see Section 7.0); however, temporary disturbance reactions are the most likely to occur. Due to the mitigation measures outlined in Section 11.0, no serious injury is anticipated. No intentional or lethal takes are expected.

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6.0 NUMBER OF INCIDENTAL TAKES BY ACTIVITIES

By age, sex, and reproductive condition, the number of marine mammals [by species] that may be taken by each type of taking, and the number of times such takings by each type of taking are likely to occur.

Project construction activities would involve increases in the local underwater noise environment in the vicinity of the Port primarily due to pile driving. Research suggests that increased noise may impact marine mammals in several ways. The following text provides a background on underwater sound, description of noise sources in the Port area, applicable noise criteria, a description of the methods used to calculate take, and the calculation of take.

6.1 UNDERWATER SOUND DESCRIPTORS

Sound is a physical phenomenon consisting of minute vibrations that travel through a medium, such as air or water. Sound is generally characterized by several variables, including frequency and intensity. Frequency describes the sound's pitch and is measured in Hz, while intensity describes the sound's loudness and is measured in dB. Decibels are measured using a logarithmic scale.

The method commonly used to quantify airborne sounds consists of evaluating all frequencies of a sound according to a weighting system reflecting that human hearing is less sensitive at low frequencies and extremely high frequencies than at the mid-range frequencies. This is called A-weighting, and the decibel level measured is called the A-weighted sound level (dBA). A filtering method to reflect hearing of marine mammals such as whales has not been developed for regulatory purposes. Therefore, sound levels underwater are not weighted and measure the entire frequency range of interest. In the case of marine construction work, the frequency range of interest is 10 to 10,000 Hz.

Table 6-1 summarizes commonly used terms to describe underwater sounds. Two common descriptors are the instantaneous peak SPL and the root-mean-square SPL (dB rms) during the pulse or over a defined averaging period. The peak sound pressure is the instantaneous maximum or minimum overpressure observed during each pulse or sound event and is presented in Pascals (Pa) or dB referenced to a pressure of one microPascal (dB re 1 µPa). The rms level is the square root of the energy divided by a defined time period. All sound levels throughout the remainder of this report are presented in dB re 1 µPa unless otherwise noted.

Table 6-1
Definition of Acoustical Terms

Term	Definition
Decibel, dB	A unit describing the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure. The reference pressure for water is 1 micro Pascal (µPa) and for air is 20 µPa (approximate threshold of human audibility).
Sound Pressure Level, SPL	Sound pressure is the force per unit area, usually expressed in micro Pascals (or 20 micro Newtons per square meter), where 1 Pascal is the pressure resulting from a force of 1 Newton exerted over an area of 1 m^2. The sound pressure level is expressed in decibels as 20 times the logarithm to the base 10 of the ratio between the pressure exerted by the sound to a reference sound pressure. Sound pressure level is the quantity that is directly measured by a sound level meter.

Table 6-1 (continued) Definition of Acoustical Terms	
Term	**Definition**
Frequency, Hz	Frequency is expressed in terms of oscillations, or cycles, per second. Cycles per second are commonly referred to as Hertz (Hz). Typical human hearing ranges from 20 Hz to 20,000 Hz.
Peak Sound Pressure (unweighted), dB re 1 µPa	Peak sound pressure level is based on the largest absolute value of the instantaneous sound pressure over the frequency range from 20 Hz to 20,000 Hz. This pressure is expressed in this report as dB re 1 µPa.
Root-Mean-Square (rms), dB re 1 µPa	The rms level is the square root of the energy divided by a defined time period. For pulses, the RMS has been defined as the average of the squared pressures over the time that comprise that portion of waveform containing 90 percent of the sound energy for one impact pile driving impulse.[1]
Total Acoustic Energy, dB re 1 µPa^2 sec	Proportionally equivalent to the time integral of the pressure squared, and described in this report in terms of µPa^2 sec over the duration of the impulse. Similar to the unweighted Sound Exposure Level (SEL) standardized in airborne acoustics to study noise from single events.
Waveforms, µPa over time	A graphical plot illustrating the time history of positive and negative sound pressure of individual pile strikes shown as a plot of µPa over time (i.e., seconds).
Frequency Spectra, dB over frequency range	A graphical plot illustrating the 6 to 12 Hz band center frequency sound pressure over a frequency range (e.g., 10 to 5,000 Hz in this report).
A-Weighting Sound Level, dBA	The sound pressure level in decibels as measured on a sound level meter using the A- or C-weighting filter network. The A-weighting filter de-emphasizes the low and high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective human reactions to noise.
Ambient Noise Level	The background sound level, which is a composite of noise from all sources near and far. The normal or existing level of environmental noise at a given location.

Transmission loss (TL) underwater is the decrease in acoustic intensity as an acoustic pressure wave propagates out from a source. TL parameters vary with frequency, temperature, sea conditions, current, source and receiver depth, water chemistry, and bottom composition and topography. For this site, TL is calculated using the formula:

TL = 20*Log(R),

R = the radial distance relative to the source to the receive-level-of-interest.

Spreading loss is typically between 10 dB (cylindrical spreading) and 20 dB (spherical spreading); typically referred to as 10 log and 20 log, respectively. Cylindrical spreading occurs when sound energy spreads outward in a cylindrical fashion bounded by the bottom sediment and water surface, such as

[1] Underwater sound measurement results obtained by Illingworth & Rodkin (2001) for the Pile Installation Demonstration Project in San Francisco Bay indicated that most impact pile driving impulses occurred over a 50 to 100 millisecond (ms) period. Most of the energy was contained in the first 30 to 50 ms. Analyses of that underwater acoustic data for various pile strikes at various distances demonstrated that the acoustic signal measured using the standard "impulse exponential time-weighting" on the sound level meter (35-ms rise time) correlated to the rms level measured over the duration of the pulse.

shallow water, resulting in a 3 dB reduction per doubling of distance. Spherical spreading occurs when the source encounters little to no refraction or reflection from boundaries (e.g., bottom, surface), such as in deep water, resulting in a 6 dB reduction per doubling of distance.

6.2 APPLICABLE NOISE CRITERIA

Under the MMPA, NMFS has defined levels of harassment for marine mammals. Level A harassment is defined as "…any act of pursuit, torment, or annoyance which has the potential to injure a marine mammal or marine mammal stock in the wild." Level B harassment is defined as "…any act of pursuit, torment, or annoyance which has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering."

Since 1997, NMFS has been using generic sound exposure thresholds to determine when an activity in the ocean that produces sound might result in impacts to a marine mammal such that a take by harassment might occur (70 FR 1871). NMFS is developing new science-based thresholds to improve and replace the current generic exposure level thresholds, but the criteria have not been finalized (Southall et al. 2007). The current Level A (injury) threshold for impact noise (e.g., impact pile driving) is 180 dB rms for cetaceans (whales, dolphins, and porpoises) and 190 dB rms for pinnipeds (seals, sea lions). The current Level B (disturbance) threshold for impact noise is 160 dB rms for cetaceans and pinnipeds. The current Level B threshold for continuous noise (e.g., vibratory pile driving) is 120 dB rms.

However, as previously determined by Blackwell and Green (2002, 2005), URS (2007), and Scientific Fishery Systems (2008) indicate background levels in Knik Arm are consistently at or above 125 dB and attempts to measure 120 dB from various sources were unsuccessful. Therefore, calculations for continuous noise exposure were used to the 125 dB instead of the 120 dB.

Level A harassment of marine mammals as a result of this Project is not likely to occur due to mitigation measures required and approved by NMFS and the conditional stipulations of the USACE Section 404/10 Permit; therefore, Level A harassment is not discussed in this Application.

6.3 DESCRIPTION OF NOISE SOURCES

Underwater sound levels in the Port area are comprised of multiple sources, including physical noise, biological noise, and man-made noise. Physical noise includes waves at the surface, currents, earthquakes, ice, and atmospheric noise. Biological noise includes sounds produced by marine mammals, fish, and invertebrates. Man-made noise consists of vessels (small and large), oil and gas operations, maintenance dredging, aircraft over flights, and construction noise. Noise levels associated with these sources are summarized by Richardson et al. (1995) and have been measured in Cook Inlet by Blackwell and Greene (2002), for pile driving at Port MacKenzie by Blackwell (2005), for test pile driving at the Port by URS (2007), and during sheet pile driving at the Port by Scientific Fishery Systems (2008). Table 6-2 summarizes the noise levels and frequency ranges of these sources.

Table 6-2 Representative Noise Levels of Sources			
Noise Source	**Frequency Range (Hz)**	**Noise Level from Source**	**Reference**
Small vessels	250 – 1,000	151 dB re 1 µPa at 1 m	Richardson et al. 1995
Tug docking gravel barge	200 – 1,000	149 dB re 1 µPa at 100 m	Blackwell and Greene 2002
Container ship	100 – 500	180 dB re 1 µPa at 1 m	Richardson et al. 1995
Drilling platform	80	119 dB re 1 µPa at 1.2 km	Blackwell and Greene 2002
Dredging operations	50 – 3,000	120 – 140 dB re 1 µPa at 500 m	URS Corporation 2007
Impact driving of 36-inch piles at Port MacKenzie	100 – 1,500	190 dB_{RMS} re 1 µPa at 62 m	Blackwell 2005
Vibratory driving of 36-inch piles at Port MacKenzie	400 – 2,500	164 dB_{RMS} re 1 µPa at 56 m	Blackwell 2005
Impact driving of 14-inch H-piles at the Port	100 – 1,500	194 dB_{PEAK} re 1 µPa at 19 m	URS Corporation 2007
Vibratory driving of 14-inch H-piles at the Port	400 – 2,500	168 dB_{RMS} re 1 µPa at 10 m	URS Corporation 2007
Dropping of sheet piles (stabbing) at the Port	data not available	123 dB_{RMS} at 64 m	Scientific Fishery Systems, Inc. 2008
Use of hairpin weight on sheet piles at the Port	data not available	165 dB_{RMS} at 100 m	Scientific Fishery Systems, Inc. 2008
Vibratory driving of sheet piles at the Port	10 – 16,000	141 dB_{RMS} at 757 m	Scientific Fishery Systems, Inc. 2008
Impact driving of sheet piles at the Port	50 – 8,000	167 dB_{RMS} at 301 m	Scientific Fishery Systems, Inc. 2008
Vibratory driving of 30-inch piles at the Port	data not available	144 dB_{RMS} at 35 m	Scientific Fishery Systems, Inc. 2008

6.3.1 Summary of 2007 Acoustic Monitoring

For the test pile driving study of 14-inch H-piles in 2007 at the Port, received rms SPLs during vibratory pile driving ranged from less than 120 dB at 600 m to 168 dB at 10 m. The highest peak level measured was 179 dB at 14 m. Most of the energy during vibratory installation of piles was between 400 and 2,500 Hz. Peak SPLs during impact pile driving ranged from 173 dB at 300 m to 194 dB at 19 m. Received rms SPLs ranged from 160 dB at 300 m to 177 dB 19 m. Most of the energy during the impact driving was between 100 and 1,500 Hz.

Based on that study, the distance to 160 and 120 dB isopleths for vibratory in-water pile driving was 50 m and 800 m, respectively. The distance to the 160 dB isopleths for impact pile driving was 350 m. These data were used to determine the marine mammal harassment zones for the 2008 IHA.

6.3.2 Summary of 2008 Acoustic Monitoring

Scientific Fishery Systems, Inc., under subcontract to ICRC, conducted detailed underwater sound level measurements in late September through early October 2008 during various in-water construction activities at the Port. The NMFS approved Underwater Noise Survey Plan 2008 is provided as Appendix F. Measurements were conducted of impact and vibratory driving of sheet piles, vibratory driving of temporary piles, dropping of sheet piles (stabbing), use of a hairpin weight on sheet piles, and background noise levels. No measurements were made for fender pile driving because that work was not ongoing.

The following text describes preliminary results of the study (Scientific Fishery Systems 2008). The analyses are preliminary and use the worst-case received levels. It is important to note that these levels are extremely conservative and not representative of the average noise level generated during the surveyed activities. Because the transmission loss characteristics in the Port area are unknown, Scientific Fishery Systems, Inc. assumed a standard spherical spreading of 20 log to determine source levels and distances to the appropriate NMFS thresholds. Blackwell (2005) measured a TL between 16 and 29 log, depending on depth of the hydrophone. Further analyses of the data will occur over the next 60 day period. If warranted, the estimated noise exposure may be recalculated based upon final analyses.

Sheet Piles

Preliminary worst-case SPL recorded during vibratory pile driving of sheet piles was 141 dB at 757 m. Assuming a TL of 20 log, the source level would be 198.8 dB at 1 m. The majority of the energy measured during vibratory installation of sheet pile was contained in two frequency bands; a low frequency band from 10 to 100 Hz and a mid-range frequency band from 1,200 to 10,000 Hz. During the POA acoustic survey in October 2008, the distance to 120 dB for vibratory pile driving was unobtainable since background noise levels were higher than 120 dB at all times (ranging from 125 to 155 dB). Scientific Fishery Systems, Inc. (2008 Unpublished) measured 125 dB during vibratory pile driving of sheet pile at 4,698 m.

The worst-case SPL recorded during impact pile driving of sheet piles was 167 dB at 301 m. Assuming a TL of 20 log, the source level would be 217 dB at 1 m and the distance to the 160 dB isopleth would be 740 m. Most of the energy during impact pile installation of sheet pile was between 160 Hz and 8,000 Hz.

Preliminary analyses of the data indicate that the spreading loss from both impact and vibratory driving of sheet piles is directional instead of spherical. This means that the sound does not radiate equally from the source in all directions, but radiates perpendicularly from the source across Knik Arm and does not radiate up or down Knik Arm. This suggests that marine mammals exposed to noise from driving of sheet piles would be limited to those individuals traveling directly in front of the Port pile driving activities, as opposed to within a spherical radius from the pile driving point. Preliminary analysis also shows that the average radii over the range of tide cycles may be substantially less than the worst-case radii. However, the estimated take of marine mammals was calculated using the worst-case radii of 740 m for impact pile driving of sheet pile and 4,698 m for vibratory pile driving of sheet pile. Figure 6-1 shows the isopleths for this preliminary worst-case scenario. The semi-circles represent the spherical spreading loss of the sound.

30-inch Temporary Piles

Preliminary worst-case SPL recorded during vibratory pile driving of 30-inch temporary piles was 144 dB at 35 m. Assuming a TL of 20 log, the source level would be 175 dB at 1 m and the distance to the 125 dB isopleth would be 312 m.

Stabbing of Sheet Piles and Hairpin Weight

Preliminary worst-case SPL recorded during dropping of the sheet piles while stabbing (in-water) was 123 dB at 64 m. Assuming a TL of 20 log, the source level would be 160 dB at 1 m and the distance to the 160 dB isopleth would be 1 m. Because it is assumed that no beluga whales would be within 1 m of the stabbing, no further analysis of noise exposure from dropping the sheet pile was performed.

Preliminary worst-case SPL recorded during use of the hairpin weight during stabbing of sheet pile was 165 dB at 100 m. Assuming a TL of 20 log, the source level would be 206 dB at 1 m and the distance to the 160 dB isopleth would be 205 m.

Background Noise

Background noise levels in the Port area (in the absence of Port construction) ranged from 125 to 155 dB. Data indicate that the background noise levels are influenced primarily by wind speed and secondarily by tide. For example, the lowest background level of 125 dB was measured when the wind speed was 1.9 m/second during ebb tide; the highest background level of 155 dB was measured when the wind speed was 3.5 m/second during flood tide. Scientific Fisheries Systems, Inc. attempted to identify the 120 dB isopleth during both vibratory and impact pile driving, but background noise levels were higher than 120 dB at all times.

6.4 DESCRIPTION OF TAKE CALCULATION METHODOLOGY

Calculating the take of beluga whales first requires estimating the number of beluga whales potentially exposed to pile driving noise within the harassment radii (160 dB for impact, 125 dB for vibratory) for in-water pile driving. This estimate is based upon the mean monthly density of beluga whales that could pass through the harassment radii and potentially be exposed to noise from in-water pile driving activity. The worst-case scenario of the isopleths radiating from the source in a semi-circle (rather than directional for sheet pile) was used. Take is then calculated based on the estimated number of beluga whales to potentially be exposed to noise. The following describes the methods used to estimate the number of beluga whales that could potentially be exposed to noise without any mitigation. However, the mitigation required under the rulemaking will result in fewer Level B takes of marine mammals.

1. Density of Beluga Whales

Using the scientific monitoring data from 2005 (Funk et al. 2005), 2006 (Markowitz and McGuire 2007), and 2007 (Cornick and Kendall 2008), the density of beluga whales was calculated by the number of individuals per month divided by the hours observed per month divided by the nearshore area (6 km^2). See Table 6-3 for summary of the density data. The use of 2005-2007 site specific data is appropriate because it was collected prior to any in-water pile driving activities at the Port.

Table 6-3 Beluga Whale Density Calculations in Nearshore Area							
Month	**Year[1]**	**Observation Hours[2]**	**Size of Nearshore Area[3] (km^2)**	**Individuals per month[4]**	**Number of groups per month[5]**	**Mean group size[6]**	**Whale Density[7] (whales/hr/km^2)**
April	2005	253	6	n/a	n/a	n/a	n/a
	2006	12	6	1	1	1.0	0.014
May	2005	304	6	n/a	n/a	n/a	n/a
	2006	60	6	2	2	1.0	0.006
June	2005	345	6	n/a	n/a	n/a	n/a
	2006	108	6	8	4	2.0	0.012
July	2004	96	6	n/a	n/a	n/a	n/a
	2005	339	6	n/a	n/a	n/a	n/a
	2006	84	6	2	1	2.0	0.004
August	2004	305	6	n/a	n/a	n/a	n/a
	2005	84	6	30	3	10.0	0.060
	2006	92	6	36	6	6.0	0.065
September	2004	584	6	n/a	n/a	n/a	n/a
	2005	96	6	27	5	5.4	0.047
	2006	96	6	23	6	3.8	0.040
October	2004	290	6	n/a	n/a	n/a	n/a
	2005	96	6	7	2	3.5	0.012
	2006	96	6	0	0	0.0	0.000
	2007	86	6	25	5	5.0	0.049

[1] Beluga whale monitoring data are from 2005 monitoring for KABATA (Funk et al. 2005) and 2006 and 2007 monitoring for POA (Markowitz & McGuire 2007; Cornick and Kendall 2008).
[2] Number of hours spent collecting data.
[3] The size of the nearshore area is based on data showing 80 percent of whales are within 1 km off shore and can be seen for distance of 6 km along Knik Arm (1 km x 6 km = 6 km^2).
[4] The number of individual whales per month observed in the monitoring studies.
[5] The number of groups of whales per month observed in the monitoring studies.
[6] Mean group size calculated by dividing individuals per month by number of groups per month.
[7] Whale density calculated by individuals per month divided by observation hours per month divided by nearshore area (6 km^2). The mean density of whales observed each month in the nearshore area (1 km X 6 km) was used for calculation of take.

The nearshore area is based upon data indicating beluga whales observed along the southeast shoreline of Knik Arm generally occur within 1 km of the shoreline. The area adjacent to the shoreline in the vicinity of the Port is approximately 1 km by 6 km for a total area of 6 km^2. See Figure 6-1 for an illustration of the nearshore area.

2. Duration of Pile Driving

The duration of the pile driving was estimated per month per year for each type of pile and installation technique (vibratory versus impact), as described in detail in Section 2.2.1 and summarized in Table 2-1. The detailed calculations are provided in Table 1 in Appendix G. As described in that section, in-water construction activities are conservatively estimated to take place each season between April 15 through November 15 by two crews working concurrently. The specific daily activities of the two separate pile driving crews will not be synchronized. One crew may be driving while the other crew is setting templates or conducting other preparatory activities. Conversely there may also be times when both crews are driving at the same time. Therefore, to account for the estimate that only 75 percent of the available hours will actually be spent pile driving, the total number hours for two crews working concurrently was reduced by multiplying the total hours by 75 percent. And finally, the total hours were divided between vibratory and impact using a 75 percent to 25 percent ratio, respectively. Table 6-4 shows the duration of pile driving separated into vibratory, impact and total hours.

3. Area of Noise Exposure

The area of noise exposure in km^2 is calculated based upon the radius of the measured underwater sound level for each pile type and installation technique to the appropriate NMFS noise exposure threshold (160 dB and 125 dB [modified from 120 dB]). The sound levels used for the sheet and temporary piles and hairpin were from the POA's 2008 preliminary acoustic monitoring program (Scientific Fishery Systems, Inc. 2008), and the sound levels used for the fender piles were from the Port MacKenzie acoustic monitoring (Blackwell 2005). The calculated area is the area of a semi-circle (A = πr2/2), assuming that noise from pile driving would radiate out spherically in-water. For example, the distance to the 160 dB isopleth for impact driving of sheet piles is 740 m; therefore, the area of noise exposure would be 0.860 km^2.

However, because beluga whales are primarily observed within 1 km off shore (Markowitz and McGuire 2007), the number of beluga whales passing through would be overestimated by assuming that the average beluga whale density is distributed throughout the entire area of noise exposure, particularly for the vibratory harassment zone (<5 km). Based upon the 2005-2007 POA monitoring reports, approximately 80 percent of whales are observed within 500 m off shore, 10 percent are observed within 1 km off shore, and the remaining 10 percent are observed across the Knik Arm. The area of noise exposure for each type of pile and installation technique is calculated for that area of beluga whale use only assuming either that distance (500 m, 1 km) or the distance to the appropriate threshold, whichever distance is less. Figure 6-1 shows the radii for the 80 percent (500 m) and 10 percent (1000 m). The detailed calculations are provided in Tables 2 and 3 in Appendix G.

The area of noise exposure for 80 percent of the beluga whales that occur within 500 m was calculated using a sound level radius of 500 m for vibratory and impact driving of sheet and fender piles, a radius of 205 m for use of the hairpin (distance to 160 dB), and a radius of 312 m (distance to 160 dB) for impact driving of temporary piles.

The area of noise exposure for the 10 percent of the beluga whales that occur within 1 km was calculated using a sound level radius of 1 km for vibratory driving of sheet and fender piles and impact driving of fender piles, and a radius of 740 m (distance to 160 dB) for impact driving of sheet piles.

The area of noise exposure for the 10 percent of the beluga whales that utilize the entire Knik Arm was calculated using a sound level radius of 1.96 km for impact driving of fender piles (distance to 160 dB), a radius of 4.70 km for vibratory driving of sheet piles (distance to 125 dB), and a radius of 4.99 km (distance to 125 dB) for vibratory driving of fender piles. The radii used for the latter two are based upon the distance to the background level of 125 dB, rather than the distance to the 120 dB NMFS threshold. Measurements by Blackwell and Greene (2002), Blackwell (2005), URS (2007), and Scientific Fishery Systems, Inc. (2008) indicate that background levels in Knik Arm are consistently above 125 dB and attempts to measure 120 dB from various sources were unsuccessful. Therefore, the area of noise exposure (and take) would be overestimated to include the area up to 120 dB.

6.5 CALCULATED NUMBER OF BELUGA WHALES POTENTIALLY EXPOSED TO NOISE

The estimated number of beluga whales that could potentially be exposed to noise levels above the NMFS thresholds is then calculated by multiplying the average density per month by the number of hours pile driving per month and then multiplied by the area of noise exposure. The numbers of beluga whales were rounded up to the nearest whole number per month.

This calculation is considered conservative because: 1) it assumes that new marine mammals enter the exposure area during in-water pile driving, and there are no repeat sightings, which is unlikely; 2) this method does not account for the mitigation measures undertaken by the POA to minimize impacts including mandatory shut downs as beluga whales approach and soft starts; and 3) approximately 40% of the total reported below can be attributed to rounding up to the nearest whole number per month. Table 6-4 shows the summary of beluga whales potentially exposed with the harassment radii. The estimates of exposure from vibratory, impact and total pile driving hours are shown.

6.5.1 Vibratory Driving Results

As shown in Table 6-4, the estimated number of beluga whales that could be exposed to noise from in-water vibratory pile driving for each month ranges from 4 to 22 in 2009, 3 to 13 in 2010, 2 to 14 in 2011, 3 to 28 in 2012, 3 to 19 in 2013, and 1 to 3 in 2014. The total number for each year ranges from 10 in 2014 to 76 in 2012. The total estimated number of beluga whales between 2009 and 2014 that could be harassed from in-water vibratory pile driving is 290 animals.

Table 6-4
Summary of Beluga Whales Potentially Exposed within Harassment Radii

		Hours Pile Driving			Estimated Number of Beluga Whales in Area		
Year	**Month**	**Vibratory**	**Impact**	**Total**	**Vibratory**	**Impact**	**Total**
2009	April	81	37	118	7	3	10
	May	57	26	83	4	3	7
	June	57	26	83	5	3	8
	July	81	37	118	4	3	7
	August	81	37	118	22	3	25
	September	81	37	118	16	3	19
	October	81	37	118	9	3	12
	TOTAL[1]	520	238	758	67	21	88
2010	April	46	20	65	4	3	7
	May	32	14	46	3	3	6
	June	32	14	46	4	3	7
	July	46	20	65	3	3	6
	August	46	20	65	13	3	16
	September	46	20	65	9	3	12
	October	46	20	65	5	3	8
	TOTAL[1]	292	125	417	41	21	62

[1] Totals include minor calculation rounding.

Table 6-4 (continued) Summary of Beluga Whales Potentially Exposed within Harassment Radii							
		Hours Pile Driving			**Estimated Number of Beluga Whales in Area**		
Year	**Month**	**Vibratory**	**Impact**	**Total**	**Vibratory**	**Impact**	**Total**
2011	April	52	24	76	4	2	6
	May	37	17	53	2	2	4
	June	37	17	53	3	2	5
	July	52	24	76	2	2	4
	August	52	24	76	14	2	16
	September	52	24	76	10	2	12
	October	52	24	76	6	2	8
	TOTAL[1]	334	155	489	41	14	55
2012	April	111	51	162	7	2	9
	May	78	36	114	3	2	5
	June	78	36	114	5	2	7
	July	111	51	162	3	2	5
	August	111	51	162	28	3	31
	September	111	51	162	20	2	22
	October	111	51	162	10	2	12
	TOTAL[1]	710	328	1,039	76	15	91
2013	April	67	30	97	6	3	9
	May	47	21	68	3	2	5
	June	47	21	68	4	3	7
	July	67	30	97	3	3	6
	August	67	30	97	19	3	22
	September	67	30	97	13	3	16
	October	67	30	97	7	3	10
	TOTAL[1]	429	191	620	55	20	75
Before July 15, 2014	April	8	3	11	1	1	2
	May	3	1	4	1	1	2
	June	3	1	4	1	1	2
	July	8	3	11	1	1	2
	TOTAL[1]	23	8	30	4	4	8
After July 15, 2014	August	8	3	10	3	1	4
	September	8	3	10	2	1	3
	October	8	3	10	1	1	2
	TOTAL[1]	23	8	30	6	3	9
	GRAND TOTALS	**2,332**	**1,052**	**3,384**	**290**	**98**	**388**

[1] Totals include minor calculation rounding.

6.5.2 Impact Driving Results

As shown in Table 6-4, the estimated number of beluga whales that could be exposed to noise from in-water impact pile driving ranges from 1 to 3 per month. The total number for each year ranges from 7 to

21. The total estimated number of beluga whales between 2009 and 2014 that could be harassed from in-water impact pile driving is 98 animals.

6.5.3 Total Pile Driving Results

As shown in Table 6-4, the estimated number of beluga whales that could potentially be exposed to noise for all in-water pile driving (both impact and vibratory) for each month ranges from 7 to 25 in 2009, 6 to 16 in 2010, 4 to 16 in 2011, 5 to 31 in 2012, 5 to 22 in 2013, and 2 to 4 in 2014 (before and after July 14). The total number for each year ranges from 17 in 2014 to 91 in 2012. Spring and early summer have the lowest levels of potential harassment per month, which is consistent with the known distribution of beluga whales during these months. The total estimated number of beluga whales between 2009 and 2014 that could be harassed from in-water pile driving is 388 animals. This total does not include any construction mitigation measures being implemented.

6.5.4 Low Tide Correction from Mitigation During Impact Pile Driving

Mitigation measures currently in place prohibit in-water impact pile driving for two hours on either side of low tide. The potential for affecting beluga whales at low slack tide during impact pile driving, the period of highest concentration, is therefore eliminated under this restriction. This mitigation correction for low tide is quantifiable and can be calculated for the purpose of determining requested takes. Sightings of beluga whales at low slack tide accounted for approximately 48 percent of all belugas observed in the Project area for all months in 2006 (Markowitz and McGuire 2007). Twenty-one percent of beluga whale observations in that study period occurred at low ebb and less than one percent occurred at low flood, and these animals would be avoided by the two-hour shut down on either side of low tide for in-water impact pile driving. The four-hour mandatory shut down of in-water impact pile driving around low tide assumes a reduction of the total number of beluga takes by approximately 70 percent (MNFS 2008c). This mitigation factor was applied to potential take numbers for each year for impact pile driving, reducing the number of beluga whales that could be harassed for all years; down to 2 to 4 each year. This is a total reduction of 19 for all years.

After applying the low tide correction factor of 70 percent, the total calculated number of beluga whales from 2009 to 2014 that could be harassed from in-water pile driving is 309. Table 6-5 shows the summary of beluga whales potentially exposed within the harassment radii with the low tide mitigation correction factor applied.

Table 6-5 Summary of Beluga Whales Potentially Exposed within Harassment Radii with Low Tide Correction				
Year		**Vibratory**	**Impact[1]**	**Total**
2009	TOTAL[2]	67	21	88
	With Low Tide Correction		4	**71**
2010	TOTAL[2]	41	21	62
	With Low Tide Correction		4	**45**
2011	TOTAL[2]	41	14	55
	With Low Tide Correction		2	**43**
2012	TOTAL[2]	76	15	91
	With Low Tide Correction		2	**78**
2013	TOTAL[2]	55	20	75
	With Low Tide Correction		4	**59**
Before July 15, 2014	TOTAL[2]	4	4	8
	With Low Tide Correction		1	**5**
After July 15, 2014	TOTAL[2]	6	3	9
	With Low Tide Correction		1	**7**
	GRAND TOTALS	290	98	388
	With Low Tide Correction		**19**	**309**

[1] Low tide correction applies only to impact pile driving.
[2] Calculated total with no mitigation factor applied.

6.6 BELUGA WHALES

Level B takes by harassment could potentially include beluga whales of all age and sex classes. Data on construction disturbance sensitivity of different age classes, including cow/calf pairs, are lacking. Calving occurs approximately mid-May through mid-July in the Cook Inlet region. Beluga whales using Knik Arm appear to calve primarily in the Susitna River Flats portion of upper Cook Inlet (Funk et al. 2005; Markowitz and McGuire 2007). There is no evidence that calving occurs in Knik Arm, as relatively few beluga whales use the area during the calving period. In 2006, the year with the broadest seasonal coverage for beluga whale observation, calves were observed in beluga whale groups sighted near the Port on five occasions of the 95-day observation effort, all during August and early September (Markowitz and McGuire 2007). Calves are typically seen with the larger whale groups (Markowitz and McGuire 2007). Monitoring and mitigation measures implemented for the Project will be used to minimize the number of takes by disturbance caused by in-water pile driving by shutting down when beluga whales approach the Project area. Because of these mitigation measures, take of calves is not anticipated; however, there is the possibility that a calf may be initially sighted already within the harassment zone, particularly in the vibratory harassment zone. Once calves are sighted, in-water construction work will immediately shut down and no further harassment would occur. Therefore, there is a chance that a few individual calves may be exposed to pile driving noise, but the effect on the population is expected to be negligible.

The soft start technique described in Section 11.0 for impact pile driving and the marine mammal observers monitoring the safety zone would also further reduce the probability of beluga whale takes during in-water pile driving. These mitigation measures will reduce impacts on individual beluga whales to a short-term, temporary disturbance. There is no evidence that construction activities at the Port have affected the distribution of beluga whales. Beluga whales have been observed in the same time period (peaking in August/September) in the Project area despite the presence of industrial activity, including Port operations, USACE dredging, and construction activities at the Port since 2005 (Prevel Ramos et al. 2006; Markowitz and McGuire 2007; Cornick and Kendall 2008; POA monthly monitoring reports 2008).

As shown in the POA 2008 monitoring reports (July, August, September, and October) provided in Appendix E, the number of beluga whales observed in the Port area by the construction monitoring program was 329. The 2008 observations included all whales seen by construction observers including those outside of the 2008 harassment radii, and regardless of any in-water or out-of-water construction activities. The number of whales observed per sighting ranged from 1 to 45. There was one sighting of 45 whales and one sighting of 30 whales. Only 5 out of 50 sightings were for a single whale. The average group size included 7 whales. Because of the mitigation measures implemented in 2008, there were 3 Level B takes of beluga whales from July through October 2008 (all 3 in the month of October).

There is no evidence to suggest that construction or other maritime activities (shipping, maintenance dredging) at the Port are affecting beluga use of the Project vicinity as evidenced by their relatively consistent seasonal use patterns and the presence of calves in the area each year (Prevel Ramos et al. 2006; Markowitz and McGuire 2007; Cornick and Kendall 2008; POA monthly monitoring reports 2008). These reports indicate that beluga whales are primarily transiting through the Port area while opportunistically foraging, and Port construction activities are not blocking this transit or displacing belugas from Knik Arm. Therefore, the impacts on the population from Port construction activities are expected to be negligible.

6.7 HARBOR SEALS

Harbor seals are observed in upper Cook Inlet throughout the year, but are only occasionally seen in Knik Arm. Salmon runs in Fish Creek and Ship Creek would likely attract harbor seals. Harbor seal takes by Level B harassment would be very low, if any at all, and likely would occur during the mid-summer and fall when anadromous prey fish return to Knik Arm, in particular near Ship Creek south of the Port area. All age and sex classes of harbor seals except newborn pups could occur in the Project area throughout the period of construction activity. Female harbor seals haul out at shoreline sites known as pupping sites and give birth from May to mid-July; and pups may be encountered at these haul-out areas. However, since there are no known pupping sites in the vicinity of the Port, harbor seal pups are not expected to be present during construction activities at the Port. Harbor seals are not known to regularly reside in the Port area and there are no known haul-out sites in or immediately near the Port vicinity, and any takes would primarily involve individuals that are transiting the area on foraging trips. Harbor seals that are disturbed by noise may change their behavior, and be temporarily displaced from the construction area for the short period they may pass through the Project area.

During marine mammal surveys in the area of the proposed Knik Arm Crossing Project, 22 sightings of harbor seals were reported over a 13-month period and approximately 14,000 observer hours (LGL Unpublished Data 2004-2005). These sightings occurred during October and September 2004, and June through September 2005. Also, in annual marine mammal surveys performed by NMFS from 1994 to 2005, 3 harbor seals were observed in Knik Arm (Rugh et al. 2005a). As shown in the 2008 summary reports (July, August, September, and October) provided in Appendix E, only 1 harbor seal was observed in the Port area by the construction monitoring program. The likelihood of encountering more than a few harbor seals within the vicinity of the proposed Project is small and the likelihood of exposing more than a very few of these harbor seals to 160 dB isopleth would be even smaller. The 190 dB isopleth is less than 10 m from the source; therefore, no exposure at this level would be anticipated.

Based on the available data from Knik Arm, the potential occurrence of harbor seals in Knik Arm is approximately 1.7 animals per month (LGL Unpublished Data 2004-2005). With in-water pile driving ranging from 2 to 162 hours per month during construction, the potential for exposure within the 160 dB isopleth is anticipated to be extremely low, substantially less than 1 animal per month. Level B take is conservatively estimated at a total of 2 harbor seals each year, for a total of 14 harbor seals for all years, based on the low rate of occurrence of harbor seals in the Port area. Therefore, because only a few individuals would be taken by harassment, there are no expected population level impacts to harbor seals.

6.8 KILLER WHALES

Numbers of killer whales in upper Cook Inlet are very small compared to the overall population. Most killer whale sightings are recorded in lower Cook Inlet. While very few, if any, are expected to approach the Project area, killer whales rarely are reported in upper Cook Inlet. Reported sightings are most likely to occur when their primary prey (anadromous fish for the resident killer whale group and beluga whales for the transient killer whale group) are also in the area (Shelden et al. 2003). Killer whales that are disturbed by noise may change their behavior, and be temporarily displaced from the construction area for the short period they may pass through the Port area.

With in-water pile driving ranging from 2 to 162 hours per month during construction, the potential for exposure within the 160 dB isopleth is anticipated to be extremely low, substantially less than 1 animal per month. Level B take is conservatively estimated at a total of 1 killer whale each year, for a total of 7 killer whales for all years.

6.9 HARBOR PORPOISES

During marine mammal surveys for the proposed Knik Arm Crossing Project, four sightings of harbor porpoises were reported over a 13-month period; these sightings occurred during April and May 2005. During POA test pile studies in October 2007, a single harbor porpoise was observed in the vicinity of the Port (URS 2007). Calculated occurrence of harbor porpoise in the general area of Knik Arm is approximately 0.3 animals per month. The take by Level B harassment would be no more than 1 animal per month; therefore, a total take of 1 harbor porpoise is calculated for each year of construction for a total of 7 harbor porpoises for all years. Because few harbor porpoises are expected to approach the Project area, takes are expected to have no more than a negligible effect on individual animals, with no effect on the population.

6.10 ALL MARINE MAMMALS

Table 6-6 shows the estimated potential exposure for beluga whales, killer whales, harbor porpoises, and harbor seals. The numbers for beluga whales includes the low tide mitigation correction factor.

Table 6-6 Total Estimated Marine Mammals Potentially Exposed within Harassment Radii-With Low Tide Mitigation				
	Beluga[1] Whales	**Killer Whales**	**Harbor Porpoises**	**Harbor Seals**
2009	71	1	1	2
2010	45	1	1	2
2011	43	1	1	2
2012	78	1	1	2
2013	59	1	1	2
Before July 15, 2014[2]	5	1	1	2
After July 15, 2014	7	1	1	2
Total[3]	**309**	**7**	**7**	**14**

[1] Low tide correction factor of 70 percent has been applied only to the beluga whale count
[2] End of Application period.
[3] Totals include minor calculation rounding.

6.11 TAKES REQUESTED

The total numbers of Level B incidental takes requested per year of marine mammals are provided below. The preliminary 2008 acoustic survey data has indicated that the Level B harassment radii have increased significantly from those calculated in 2007. This results in an increased potential for the marine mammals to be disturbed. Of the marine mammals present within the area, the Cook Inlet beluga whale would be the most affected by the Project activities as they are the most abundant and their presence is predictable.

Beluga Whales

The takes calculated mathematically for beluga whales from 2009 to 2014 range from 17 to 91 per year; with a median of 54 (Table 6-4). The lower number is for 2014; the least active year for in-water pile driving construction. Excluding 2014, the range would be 55 to 91 whales per year.

A number of construction mitigation measures are currently underway. However, the only construction mitigation effect that may be quantified at this time for future years is the shut down of impact pile driving for two hours before and after each low tide. This effect has been calculated and is shown in Table 6-5. With the low tide correction factor applied, the range of potential beluga whales takes from 2009 to 2014, is 12 to 78 per year, with a median of 45.

Other construction mitigation measures required by the USACE Section 404/10 Permit and the 2008 IHA Permit are ongoing and will continue. The effects of these measures are not quantifiable at this time. However, it is expected that continued implementation will further reduce the potential beluga whale takes.

Although the Port is a highly industrialized area supporting a large amount of ship traffic, beluga whales are present almost all year round. They are primarily transiting through the area while opportunistically foraging. The preliminary 2008 acoustic survey data recorded ambient noise levels consistently above 125 dB. This suggests that these animals have become desensitized and habituated to human-caused sound (NMFS 2008c) and may not avoid noise as much as animals which are used to quiet environments. Due to the gregarious nature of this mammal (e.g. travel in large groups) the potential for multiple Level B takes in one sighting is high.

Due to the considerations presented above, the POA and Maritime Administration request no less than a Level B incidental take limit of 34 beluga whales per year. Thirty-four whales are 9 percent of the estimated population.

Other Marine Mammals

Based upon the low sightings rates of harbor seals, killer whales and harbor porpoises in the Project area, the take calculations are difficult to perform mathematically. Therefore, the limits requested below reflect a small number of mammals, relative to population size.

- Harbor seals –20 per year
- Killer whales –20 per year
- Harbor porpoises –20 per year

These requested Level B takes are consistent with the 2008 IHA Permit, in which NMFS indicated that the authorized take numbers for harbor seals, killer whales and harbor porpoises were expected to remain the same throughout the Project.

7.0 DESCRIPTION OF IMPACT ON MARINE MAMMALS

The anticipated impact of the activity upon the species or stock.

7.1 GENERAL EFFECTS OF NOISE ON MARINE MAMMALS

Marine mammals use hearing and sound transmission to perform vital life functions. Introducing sound into their environment could be disrupting to those behaviors. Sound (hearing and vocalization/ echolocation) serves four primary functions for odontocetes, including: 1) providing information about their environment; 2) communication; 3) prey detection; and 4) predator detection. The distances to which construction noise associated with the Project are audible depend upon source levels, frequency, ambient noise levels, the propagation characteristics of the environment, and sensitivity of the receptor (Richardson et al. 1995). Although applicable criteria are 120 dB and 160 dB, the onsite 2008 ambient measurements exceed 120 dB and; therefore, 125 dB is used for determining Level B vibratory harassment isopleths for this Application.

Impact and vibratory pile driving introduce different types of sound (i.e., pulse vs. continuous noise) and; therefore, are perceived by animals differently. While the 120 dB for vibratory extends farther than the 160 dB for impact pile driving, exposure to impact pile driving is believed to likely result in a more severe behavioral response due to intensity and sound type.

The effects of sounds from pile driving on marine mammals might include one or more of the following: tolerance, masking of natural sounds, behavioral disturbance, and temporary or permanent hearing impairment, or non-auditory physical effects (Richardson et al. 1995). In assessing potential effects of noise, Richardson et al. (1995) has suggested four criteria for defining zones of influence. These zones are described below from greatest influence to least:

Zone of hearing loss, discomfort, or injury – the area within which the received sound level is potentially high enough to cause discomfort or tissue damage to auditory or other systems. This includes temporary threshold shifts (TTS, temporary loss in hearing) or permanent threshold shifts (PTS, loss in hearing at specific frequencies or deafness). Non-auditory physiological effects or injuries that theoretically might occur in marine mammals exposed to strong underwater sound include stress, neurological effects, bubble formation, resonance effects, and other types of organ or tissue damage. This zone would be considered Level A harassment; applicable NMFS criteria for this zone are 180 dB for cetaceans and 190 dB for pinnipeds.

Zone of masking – the area within which the noise may interfere with detection of other sounds, including communication calls, prey sounds, or other environmental sounds. This zone would be considered Level B harassment; applicable criteria for this zone are 160 dB for impact noise and 120 dB for continuous noise.

Zone of responsiveness – the area within which the animal reacts behaviorally or physiologically. The behavioral responses of marine mammals to sound is dependent upon a number of factors, including: 1) acoustic characteristics the noise source of interest; 2) physical and behavioral state of animals at time of exposure; 3) ambient acoustic and ecological characteristics of the environment; and 4) context of the sound (e.g., whether it sounds similar to a predator) (Richardson et al. 1995; Southall et al. 2007). However, temporary behavioral effects are often simply evidence that an animal has heard a sound and may not indicate lasting consequence for exposed individuals (Southall et al. 2007). This zone would be considered Level B harassment; applicable criteria for this zone are 160 dB for impact noise and 120 dB for continuous noise.

Zone of audibility – the area within which the marine mammal might hear the noise. Marine mammals as a group have functional hearing ranges of 10 Hz to 180 kHz, with best thresholds near 40 dB (Ketten 1998; Kastak et al. 2005; Southall et al. 2007). These data show reasonably consistent patterns of hearing sensitivity within each of three groups: small odontocetes (such as the harbor porpoise), medium-sized odontocetes (such as the beluga and killer whales), and pinnipeds (such as the harbor seal). Hearing capabilities of the species included in this Application are discussed in Section 4.0. There are no applicable criteria for the zone of audibility due to difficulties in human ability to determine the audibility of a particular noise for a particular species. This audibility zone does not fall in the sound range of a take as defined by NMFS.

7.1.1 Assessment of Acoustic Impacts

The Project would result in the loss of intertidal and subtidal habitat used by marine mammals and exposure to construction noise could result in behavioral and mild physiological changes in marine mammals. The increased level of in-water noise from the Project, specifically pile driving, is the primary concern to marine mammals. While dredging and fill placement would also result in increased noise levels into the environment, these activities are not expected to result in harassment of marine mammals. Dredging has been performed by USACE at the Port harbor for decades and marine mammals, specifically beluga whales, have become habituated to this activity as indicated by their observed interaction with such vessels and large ships (NMFS 2005; Blackwell and Greene 2002). Fill compaction and consolidation requires the use of a land-based vibratory pile driver through the fill; however, absorption of sound by the fill and sheet-pile wall would reduce sound levels below harassment level thresholds.

The following discussion addresses impacts to the marine mammals based on the zones of influence discussed in Section 7.1.

7.1.1.1 Zone of Hearing Loss

Temporary or permanent auditory or non-auditory physical effects from pile driving on marine mammals are not likely to occur due to mitigation measures required by NMFS and the USACE Section 404/10 Permit. No studies have determined levels that cause PTS in beluga whales. Laboratory experiments investigating TTS onset for beluga whales have been conducted for both pulsed and non-pulsed sounds. Finneran et al. (2000) exposed a trained captive beluga whale to a single pulse from an explosion simulator. No TTS threshold shifts were observed at the highest received exposure levels (179 dB re 1 μPa^2-s sound exposure level [SEL]; approximately 199 dB rms); amplitudes at frequencies below 1 kHz were not produced accurately to represent predictions for the explosions. Finneran et al. (2002) repeated the study using seismic water guns with a single acoustic pulse. Masked hearing TTS was 7 and 6 dB at 0.4 and 30 kHz, respectively, after exposure to intense single pulses (186 dB SEL; 208 dB rms). Schlundt et al. (2000) demonstrated temporary shifts in masked hearing thresholds for beluga whales occurring generally between 192 and 201 dB rms (192-201 dB SEL) after exposure to intense, non-pulse, 1-s tones at 3, 10, and 20 kHz. TTS onset occurred at mean sound exposure level of 195 dB rms (195 dB SEL). To date, no studies relating TTS onset to pile driving sounds have been conducted for any cetacean species.

Marine mammals would not be exposed to sounds at or near those levels eliciting TTS in the Finneran et al. (2002) or Schlundt et al. (2000) studies with this Project.

During in-air auditory threshold testing, Kastak and Schusterman (1994) inadvertently exposed a harbor seal to broadband construction noise for six days, averaging six to seven hours of intermittent exposure per day. When tested immediately upon cessation of the noise, a TTS of 8 dB at 100 Hz was evident. Following one week of recovery, the subject's threshold was within 2 dB of its original level.

Therefore, PTS and TTS as a result of Project construction activities are not expected to occur in any marine mammal species because source levels of pile driving are lower than those in the above-referenced TTS studies and the mitigation measures in place to avoid Level A takes (injury/mortality).

Romano et al. (2004) demonstrated that captive beluga whales exposed to high level impulsive sounds (i.e., seismic water gun and or single pure tones up to 201 dB rms) resembling sonar pings showed increased stress hormone levels of norepinephrine, epinephrine, and dopamine when TTS was reached. Thomas et al. (1990) exposed beluga whales to playbacks of an SEDCO 708 oil drilling platform in operation (40 Hz-20 kHz; source level 153 dB). Ambient sound pressure level at ambient conditions in the pool before playbacks was 106 dB and 134 to137 dB at the monitoring hydrophone across the pool during playbacks. All cell and platelet counts and 21 different blood chemicals, including epinephrine and norepinephrine, were within normal limits throughout baseline and playback periods and stress response hormone levels did not increase immediately after playbacks. The difference between the Romano et al. (2004) and Thomas et al. (1990) study could be the differences in the type of sound (oil drilling versus simulated underwater explosion), intensity and duration of the sound, the individual’s response, and the surrounding circumstances of the individual’s environment (Romano et al. 2004). The construction sound in the Thomas et al. (1990) study would be more similar to those of pile driving than those in the study investigating stress response to water guns and pure tones. Therefore, no more than short-term, low-hormone stress responses, if any, of beluga whales or other marine mammals would be expected as a result of exposure to pile driving.

7.1.1.2 Zone of Masking

Project construction activities could result in minor masking through overlapping frequencies of the marine mammal signals or by increasing sound levels such that animals are unable to detect important signals over the increased noise. Frequencies associated with vibratory pile driving potentially overlap with some frequencies of social calls of the marine mammals and could mask those calls. Beluga whale whistles have dominant frequencies in the 2 to 6 kHz range; other beluga whale call types include sounds at mean frequencies ranging upward from 1 kHz (Sjare and Smith 1986a, 1986b). Beluga whales also have a very well-developed high-frequency echolocation system with peak frequencies from 40 to 120 kHz and broadband source levels of up to 219 dB at 1 m (Au et al. 1985). Killer whales produce whistles between 1.5 and 18 kHz, and pulsed calls between 500 Hz to 25 kHz (Ford and Fischer 1983). Harbor porpoises produce acoustic signals in a very broad frequency range, <100 Hz to 160 kHz (Verboom and Kastelein 2004). Harbor seals produce social calls at 500 to 3,500 Hz and clicks from 8 to 150 kHz (reviewed in Richardson et al. 1995).

Blackwell (2005) and URS (2007) reported that most of the energy during vibratory activity was measured in the range of 400 to 2,500 Hz. The echolocation clicks produced by these marine mammals are far above the frequency range of the sounds produced by vibratory pile driving and other sounds produced by proposed construction activities. However, the lower frequency range of social calls from marine mammals in the Port area is in proximity of construction activities. Therefore, frequency masking could occur. Increased noise levels could also result in minor masking of some marine mammal signals. Blackwell (2005) and URS (2007) reported that background noise at the Port (physical environment and maritime operations) contributed more to received levels than did pile driving at distances greater than 1,300 m from the source. Therefore, beluga whales and other marine mammals in the Port area have likely become habituated to increased noise levels.

Vibratory pile driving would be the most likely source of masking because the sound emitted is continuous. Because of the mitigation measures in place to reduce impacts on marine mammals, any minor masking would occur at close proximity to the sound source, if it occurred at all. This also represents a very small area of ensonification relative to the width and size of Knik Arm, further reducing any effects on marine mammals. Beluga whales are able to adjust vocalization amplitude and frequency in response to increased noise levels (Scheifele et al. 2005). However, the energetic costs of adjusting vocalizations in response to increased noise levels is poorly understood, and it is uncertain how this would affect individual animals. As a result of the intermittent nature of pile driving and the relatively low use of the Project area by beluga whales, the likelihood of in-water construction activities masking beluga whale social calls or echolocation clicks is low. Furthermore, the mitigation measures in place to reduce the exposure of marine mammals to pile driving would further minimize the potential for masking to take place.

7.1.1.3 Zone of Responsiveness

In response to pile driving noise, temporary avoidance would be the most common response of marine mammals. Avoidance responses may be initially strong if the marine mammals move rapidly away from the source or weak if animal movement is only slightly deflected away from the source. Noise from pile driving could potentially displace marine mammals from the immediate proximity of pile driving activity. However, marine mammals would likely return after completion of pile driving as demonstrated by a variety of studies about temporary displacement of marine mammals by industrial activity (reviewed in Richardson et al. 1995). For example, beluga whales in the MacKenzie River estuary in the Beaufort Sea moved farther away during construction on an artificial island, but did not leave the area of construction (reviewed in Richardson et al. 1995). Furthermore, beluga whales in Cook Inlet have continued to utilize the habitat in the Port vicinity and Knik Arm despite it being heavily disturbed from maritime operations, maintenance dredging, and aircraft.

Other than the POA monitoring program, there have been no studies documenting behavioral responses of beluga whales to pile driving noise. Other studies have documented bottlenose dolphin and humpback dolphin behavioral responses to pile driving. These species are also considered mid-frequency odontocetes and have hearing capabilities similar to that of beluga whales. McIwen (2006) observed a temporary displacement of bottlenose dolphins during pile driving activities, although it was not determined if this displacement was a result of the pile driving noise itself or displacement of prey. Mhenni (1993) reported bottlenose dolphins appeared to be repelled by noise pulses obtained by striking an iron pipe held in the water. Furthermore, Wursig et al. (2000) reported Indo-Pacific humpback dolphins increased speeds of travel during pile driving and were found in lower abundance immediately after pile driving; however, no overt changes in behavior were observed.

The POA construction monitoring studies have not documented behavioral responses of individual beluga whales to pile driving because the activities have shut down when beluga whales enter the harassment zone. However, the presence of beluga whales in 2008 has followed a similar pattern to what has been observed prior to pile driving commencing at the Port, including similar behaviors (diving/feeding) and peak abundance in late August and September, suggesting pile driving activities have not affected overall beluga whale behavior. Furthermore, as discussed in Section 11.0, the mitigation measures will reduce impacts on individual beluga whales to a short-term, temporary disturbance. There is no evidence that construction, harbor dredging, or other activities at the Port have affected the distribution of beluga whales. Beluga whales have been observed in the same time period (peaking in September/October) in the Port area despite the presence of construction and other maritime activities (Prevel Ramos et al. 2006; Markowitz and McGuire 2007; Cornick and Kendall 2008; POA monthly monitoring reports 2008). There is no evidence to suggest that construction activities at the Port are affecting beluga whale use of Knik Arm as evidenced by the consistency of timing, location, and numbers of belugas (including calves) in the area each year (Prevel Ramos et al. 2006; Markowitz and McGuire 2007; Cornick and Kendall 2008; POA monthly monitoring reports 2008). These reports indicate that beluga whales are primarily transiting through the Port area while opportunistically foraging, and Project construction, harbor dredging, and other maritime activities are not blocking this transit. Therefore, the impacts on the Cook Inlet beluga whale population from Project construction activities are expected to be negligible.

Blackwell et al. (2004) reported that ringed seals showed little response to pile driving associated with construction activities in the Beaufort Sea of Alaska. Similarly, harbor seals did not seem to be affected by pile driving noise during construction activities in San Francisco Bay (Illingworth & Rodkin 2001).

There are no studies that have focused on the effects of pile driving noise on killer whales. However, because killer whales are rarely sighted near the Project area, it is unlikely that killer whales would be exposed to pile driving noise except in a rare instance.

There are few reports of the effects of pile driving on harbor porpoises, and none in Cook Inlet. The effects were studied by Tougaard et al. (2003) during the construction of the offshore wind farms at Horns Reef (North Sea) and Nysted (Baltic). At Horns Reef, the acoustic activity of porpoises decreased shortly after each pile driving event and went back to baseline conditions after three to four hours. However, harbor porpoises in Cook Inlet are exposed to a variety of industrial sounds and return to upper Cook Inlet each year, suggesting a level of habituation. Furthermore, harbor porpoise hearing is best at very high frequencies, well above the range of pile driving.

7.1.1.4 Habituation and Sensitization

Many marine mammals, including beluga whales, perform vital functions (e.g., feeding, resting, traveling, socializing) on a diel (i.e., 24 hour) cycle. Repeated or sustained disruption of these functions is more likely to have a demonstrable impact than a single exposure (Southall et al. 2007). However, it is possible that marine mammals exposed to repetitious construction sounds will become habituated, de-sensitized, and tolerant after initial exposure to these sounds, as demonstrated by beluga vessel tolerance (Richardson et al. 1995; Blackwell and Green 2002). Habituation and sensitizing is found to be common in marine mammals faced with introduced sounds into their environment. Harbor porpoises, dolphins, and seals have become habituated and desensitized to acoustic harassment deterrent devices such as pingers and "seal bombs" after repeated exposure (Mate and Harvey 1987; Cox et al. 2001). After repeated exposure, many acoustic harassment devices are no longer effective due to habituation.

Although the Port area is a highly industrialized area supporting a large amount of ship traffic, beluga whales are present almost year round. The original one-berth Port, which began operation in 1961, has since expanded to a five-berth terminal providing facilities for the movement of containerized freight, iron and steel products, bulk petroleum, and cement. In 2005, more than five million tons of various commodities moved across the Port's docks. Despite increased shipping traffic and upkeep operations (e.g., dredging) beluga whales continue to utilize waters within and surrounding the Port area, interacting with tugs and cargo freight ships (NMFS 2005; Markowitz and McGuire 2007). During the POA monitoring studies conducted by LGL and APU from 2005-2007, animals were consistently found in higher densities in the nearshore area (6 km^2) around the Port area throughout April to October each year where vessel presence was highest.

These studies indicate that beluga whales have become desensitized and habituated to the present level of human-caused disturbance. Therefore, it is anticipated that beluga whales will become increasingly habituated to the pile driving noise as they have to ship traffic, thereby minimizing harassment as construction continues over the years. Cook Inlet beluga whales have demonstrated a tolerance to ship traffic around the Port. Animals would be exposed to greater than current background noise levels from pile driving; however, background sound levels in Knik Arm are already higher than most other marine and estuarine systems due to strong currents, eddies, recreational vessel traffic, USCG patrols, and commercial and military shipping traffic entering and leaving the Port (Blackwell and Greene 2002; Blackwell 2005; URS 2007). During the POA's 2007 acoustic study by URS, ambient sound levels (in absence of any vessels) were recorded between 105 and 120 dB. Measurement near a tug pushing a barge raised those levels to approximately 135 dB when the vessel was 200 m from the hydrophone. Based upon the already elevated background noise around the Port area, low sound frequency, and a beluga's ability to compensate for masking, it can be reasonably expected that beluga whales would become habituated to the daily pile driving as they have for vessel traffic. It is expected that frequency and intensity of behavioral reactions, if present, will decrease when habituation occurs.

7.2 IMPACTS ON PREY DURING/AFTER THE ACTION

As described in the Port Intermodal Expansion Project Marine Terminal Redevelopment EA (Anchorage Port Expansion Team, Maritime Administration 2005), the loss of 135 acres of wetlands is not expected to result in reduced availability of prey for marine mammals. Fish studies were conducted in 2004 and 2005 to enumerate and identify fish species and how they use the habitat around the Port. These studies concluded that fish species abundance and diversity is highly variable throughout the year but overall juvenile salmon were the most prevalent around the Port. The habitat to be filled is used as migrating, rearing, and foraging habitat for fish. However, habitats with the same attributes as the area to be filled exist in other areas of Knik Arm. For example, the extreme turbidity and poor visibility in the Arm likely severely limits the success of visual feeding by fish but visual feeding may be possible in microhabitats within the surface water in the Arm where short periods (minutes) of relative quiescence in the generally turbulent water allow partial clearing. From observations, it appears that these areas can occur along shorelines as well as in the middle of the Arm. Fish collected in offshore surface waters of upper Cook Inlet south of Fire Island suggest that juvenile salmon were not favoring shorelines as many of these fish had very full stomachs. In addition, the Port is required, under their USACE permit, to adopt the following mitigation measures: 1) No in-water fill placement or pile driving activities shall occur within a one week period following smolt release from the Ship Creek hatchery; 2) in-water sheet pile will be driven with a vibratory hammer to the maximum extent possible prior to using an impact hammer; 3) the final design plan shall, wherever possible, incorporate end-of-phase construction joints that provide potential refuge habitat areas for salmonids in the non-structural voids; 4) a Fish Rescue and Release Plan will be implemented to capture and release inadvertently trapped fish during construction; and 5) the refuge area shall be monitored for a minimum of two years following construction to determine the extent and nature of use of salmonids. These mitigation measures, along with the natural ecology of fish (i.e., using habitats other than those to be filled) will increase fish survival rates and therefore decrease impacts of prey availability to beluga whales and would likely be part of, where applicable, other major construction activities by others in Knik Arm.

7.3 OTHER PROJECTS THAT MAY AFFECT MARINE MAMMALS

Other projects have been proposed in the area near or adjacent to the Port and could result in harassment to marine mammals and habitat degradation/loss. However, to date, only one application for an MMPA authorization from KABATA has been submitted to NMFS; the agency decision to issue this authorization is pending. Other potential projects of interest include on-going Cook Inlet oil and gas exploration, the proposed Knik Arm Ferry and ferry dock construction, Ship Creek watershed improvements, and any modifications which may be proposed at Port MacKenzie. Impacts of any future actions would be considered cumulatively with Port expansion and, if appropriate, mitigation measures would be set in place, such as staggering pile driving times for each project, to ensure that marine mammals had access to vital feeding grounds and that noise from construction would not cumulatively impact marine mammals in a way that would have more than a negligible impact of the population.

7.4 COASTAL DEVELOPMENT IMPACTS ON BELUGA WHALES

The cumulative effects of coastal development on Cook Inlet beluga whales are unknown. As summarized by Hobbs et al. (2008), the population is vulnerable to losses due to stranding, predation, or disease and that disturbance causing temporary or permanent abandonment of summer feeding areas could reduce their ability to survive the winter months. The risk factors to this population, including coastal development, are summarized in detail in the NMFS Conservation Plan (NMFS 2008b), the NMFS Subsistence Harvest Plan (NMFS 2008a), and recent status reviews (Hobbs et al. 2006, 2008). Coastline development in Cook Inlet (both during construction and on-going operations at developed sites) may lead to direct loss of habitat for beluga whales. Indirect impacts from development include in-water noise or discharges that affect water quality. Most habitat for beluga whales in Cook Inlet remains intact (NMFS 2008b). In the Port area, approximately 90 percent of Knik Arm remains undeveloped (NMFS 2008b). Several projects proposed by others may restrict passage of beluga whales through Knik Arm, an important feeding area for beluga whales.

7.5 SHIPPING IMPACTS ON BELUGA WHALES

While expansion at the Port of Anchorage is related to increased shipping traffic with increased accommodation of more commercial vessels, sighting data at the Port demonstrate the beluga whales are not repelled by these types of slow moving vessels serving the Port. Contrarily, belugas are more prone to avoid faster, more erratic moving watercraft such as jet skis and smaller recreational vessels. NMFS Alaska region and other non-profit organizations have developed outreach education programs and materials to inform the public of beluga whale presence and how to operate vessels while they are in the vicinity.

7.6 BELUGA WHALE CALVES

Beluga whales typically give birth to a single calf every two to three years, after a gestation period of approximately 14 months. Most of the calving in Cook Inlet is assumed to occur from mid-May to mid-July (Calkins 1983), although Native hunters have observed calving from April through August (Huntington 2000). Alaska Natives described calving areas within Cook Inlet as the northern side of Kachemak Bay in April and May, off the mouths of the Beluga and Susitna Rivers in May, and in Chickaloon Bay and Turnagain Arm during the summer. The warmer waters from these freshwater sources may be important to newborn calves during their first few days of life (Katona et al., 1983; Calkins, 1989). Mating follows the calving period. Reports on the age of sexual maturity vary from 10 years for females and 15 for males (Suydam et. al., 1999), to four to seven years for females and eight to nine years for males (Nowak, 1991). The area around the Port of Anchorage is not classified as a calving, nursery, or mating ground.

Reactions of marine mammals to anthropogenic noise can be contextual in nature based on a number of variables including behavior of animals at time of exposure. In addition, age class and reproductive status has been identified as a factor influencing impacts to marine mammals. For example, beluga calves depend on their mother's milk as their sole source of nutrition and lactation lasts up to 23 months (Braham 1984) though young whales begin to consume prey as early as 12 months of age (Burns and Seaman 1986). Therefore, it is believed the summer feeding period, when high quality prey are consumed in greatest quantities, is critical to pregnant and lactating beluga whales (NMFS 2008). In addition, marine mammal calves are believed to be more susceptible to anthropogenic stressors (e.g., noise) than adults. McIwem (2006) suggested that pile driving operations should be avoided when bottlenose dolphins are calving as lactating females and young claves are likely to be particularly vulnerable to such sound. Frankel and Clark (1998) investigated the relative importance of natural factors such as demographic composition of humpback whale pods in response to low frequency (75Hz with a 30Hz bandwidth) M-sequenced source signal transmitted from a 4-element hydrophone array (elements were placed at depths of 10, 20, 40, and 80m). They determined that two natural variables, the number of adults in a pod and the presence of a calf, had the greatest effect upon whale behavior in response to playbacks. Pods with calves had higher blow rates, longer times at the surface, and a higher ratio of time at the surface to time submerged. The presence of a calf; however, did not affect whale speed, whale bearings, or relative orientation to the playback vessel. While no data on the vocal responses of beluga whales mother/calf pairs in response to anthropogenic sound is available, Van Parijs and Corkeron (2001) determined that Indo-Pacific humpback dolphin mother/calf pairs increased vocal behaviors when vessel passed with 1.5 m more than groups without calves. The authors concluded that mother/calf pairs appear to be more disturbed than animals of other social/age classes and that mother/calf pairs exhibit an increased need to establish vocal contact after such disturbance. Distinct mating periods, calving dates, and calving areas for the Cook Inlet beluga population are not well documented; however, calves are present during the summer months (Huntington 2000, Hobbs et al. 2005). As stated before, the habitat around the Port is not identified as a calving or nursery ground; however, calves are known to be present. In 2005, monitoring at the Port reported groups with calves made up 6%, 12%, 8%, and 15% of all sightings from August to November, respectively (Ramos et al., 2006). Of the 26 groups observed in 2006 between April and November, 5 groups contained calves and these were sighted in August and September only (Markowitz and McGuire, 2007). Mean group size was significantly larger (Mann-Whitney, U = 2.0, P =0.004) when calves were present (mean = 8, standard deviation = 2.0) than when calves were not present (mean = 3 whales, standard deviation = 1.6). All five groups with calves (nursery groups) were observed to enter the Marine Terminal Redevelopment Footprint, and all five were sighted at either low ebb or low slack tide. In October and November of 2007, 2 out of 20 groups sighted contained calves (Cornick and Kendall 2008). Again, groups with calves were larger than groups without calves and both groups were sighted during low tide. However, in contrast to the 2006 sightings, neither group with calves entered the Project footprint.

Based upon the 2008 monitoring program underway, 27 calves were observed in the month of August and 2 calves were observed during October. In August, 12 of 35 groups sighted contained calves. In October, 1 of 3 groups sighted contained calves. No takes of beluga whale calves have occurred to date.

Monitoring and mitigation measures implemented for the Project will be used to minimize the number of takes by disturbance caused by in-water pile driving by shutting down when beluga whales approach the Project area. Because of these mitigation measures, take of calves is not anticipated; however, there is the possibility that a calf may be initially sighted already within the harassment zone, particularly in the 125 dB harassment zone. Once calves are sighted, in-water construction work will immediately shut down and no further harassment would occur. Therefore, there is a relatively small chance that a few individual calves may be exposed to pile driving noise; however, the mitigation measures currently in place should limit the exposure and impacts to individuals, mother-calve pairs, and the overall population are expected to be negligible.

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8.0 DESCRIPTION OF IMPACT ON SUBSISTENCE USES

The anticipated impact of the activity on the availability of the species or stocks of marine mammals for subsistence uses.

The Cook Inlet beluga whale has traditionally been hunted by Alaska Natives for subsistence purposes. For several decades prior to the 1980s, the Native Village of Tyonek residents were the primary subsistence hunters of Cook Inlet beluga whales. During the 1980s and 1990s, Alaska Natives from villages in the western, northwestern, and North Slope regions of Alaska either moved to or visited the south central region and participated in the yearly subsistence harvest (Stanek 1994). From 1994 to 1998, NMFS estimated 65 whales per year (range 21-123) were taken in this harvest, including those successfully taken for food, and those struck and lost. NMFS has concluded that this number is high enough to account for the estimated 14 percent annual decline in population during this time (Hobbs et al. 2008). Actual mortality may have been higher, given the difficulty of estimating the number of whales struck and lost during the hunts. In 1999, a moratorium was enacted (Public Law 106-31) prohibiting the subsistence take of Cook Inlet beluga whales except through a cooperative agreement between NMFS and the affected Alaska Native organizations. Since the Cook Inlet beluga whale harvest was regulated in 1999 requiring cooperative agreements, five beluga whales have been struck and harvested. Those beluga whales were harvested in 2001 (one animal), 2002 (one animal), 2003 (one animal), and 2005 (two animals). The Native Village of Tyonek agreed not to hunt or request a hunt in 2007, when no co-management agreement was to be signed (NMFS 2008a).

The 2008 Cook Inlet Beluga Whale Subsistence Harvest SEIS (NMFS 2008a) authorizes how many beluga whales can be taken during a five-year interval based on the five-year population estimates and ten-year measure of the population growth rate. Based on the current five-year abundance estimate, no hunt will occur between 2008 and 2012 (NMFS 2008a). The Cook Inlet beluga whale population and possible subsistence harvest will be reexamined by NMFS for the 2013-2017 five-year interval, using the previous five-year abundance estimates.

Residents of the Native Village of Tyonek are the primary subsistence users in Knik Arm area. Project activities will take place within the immediate vicinity of the Port, and no activities will take place in or near traditional subsistence hunting areas. The Tyonek community may harvest beluga whales that pass through the Port area as early as 2013; however, no hunting will take place in or near the industrial Port area. The disturbance and potential displacement of beluga whales by noise from construction activities in 2013 and 2014 are the principal concerns related to subsistence use. Project activities will not affect the accessibility of beluga whales to subsistence hunters. Since all anticipated takes from implementation of the Project would be takes by harassment involving temporary changes in behavior, construction activities associated with the Project activities would not impact the availability of the species or of the beluga whale stock for subsistence uses.

Data on the harvest of other marine mammals in Cook Inlet are lacking. The only data available for subsistence harvest of harbor seals, harbor porpoises, and killer whales in Alaska are in the marine mammal stock assessments (personal communication, Mahoney 2008). However, these numbers are for the Gulf of Alaska including Cook Inlet, and they are not indicative of the harvest in Cook Inlet. Because the proportion of marine mammals utilizing Cook Inlet, particularly upper Cook Inlet, the number harvested is expected to be extremely low. Therefore, because the Project activities would result in temporary disturbances to very few animals, the Project would not impact the availability of these other species for subsistence uses.

9.0 DESCRIPTION OF IMPACT ON MARINE MAMMAL HABITAT

The anticipated impact of the activity upon the habitat of the marine mammal populations, and the likelihood of restoration of the affected habitat.

9.1 EFFECTS OF PROJECT ACTIVITIES ON MARINE MAMMAL HABITAT

Construction activities in the vicinity of the Port would result in a long-term loss of some marine habitat due to intertidal and subtidal fill and dredging, as well as temporary changes in the noise environment.

9.1.1 Intertidal and Subtidal Fill

Between 2010 and 2013, the Project activities would fill the footprint area of the South Extension (8.4 acres), North Replacement (28.3 acres), and the South Replacements (30.7 acres) in submerged and tidally influenced areas. This loss of 67.4 acres of intertidal and subtidal habitat from creation of the new docks would be permanent. The total loss from all Project activities will be 135 acres (67.6 acres were filled between 2006 and 2008). The permanent loss of habitat will be mitigated as agreed by the POA during the USACE Section 404/10 permitting process. Based upon best available data and previous fish and invertebrate sampling efforts (U.S. Department of Transportation 1983; Pentec 2004a, 2004b, 2004c, 2004d, 2004e, 2005a, 2005b), the area for construction has a low diversity and abundance of marine vegetation, invertebrates, and fish. As a result of this low diversity and abundance, as well as the lack of significant marine habitat, no significant long-term impacts to local or regional fish or benthic populations are expected from this loss of habitat. However, because the use of this area by marine invertebrates and fish is not well understood, the actual impacts of construction are unknown.

9.1.2 Dredging

In the past, USACE typically dredged approximately 206 acres at the Port harbor on an annual basis. Figure 1-5 shows the area dredged annually by the USACE and overall Project construction dredging area anticipated in the Port area through 2014. USACE dredging will be necessary during Project construction to accommodate access to newly constructed berths at the Port. Upon completion of the Project activities, annual maintenance dredging would be required in the harbor.

Based upon best available data to include fish and invertebrate sampling efforts (U.S. Department of Transportation 1983; Pentec 2004a, 2004b, 2004c, 2004d, 2004e, 2005a, 2005b), the dredged areas for accommodating construction and long-term maintenance dredging of the harbor have a low fish diversity and abundance, and lower diversity and abundance of marine vegetation and invertebrates. The marine algae in this area is primarily found in algal mats in the intertidal zone; dredging is confined to the subtidal zone, which has little, if any, marine algae. Benthic invertebrates in the subtidal zone, when they occur, consist primarily of polychaetes (bristle worms).

Seafloor disruption will occur during some construction activities, resulting in disturbance to benthic communities in the Project footprint. However, the benthic communities have a naturally patchy distribution. In near-shore areas, the communities are subject to natural seasonal disruption by ice scour of exposed tideflats and shallow subtidal areas, suggesting that recovery of areas disturbed by construction activities will occur in a manner similar to recovery after natural disturbance. Anchoring of tugs and barges in the construction area is not expected to substantially disrupt the sparse benthic communities, and any effects will be temporary.

The waters of Knik Arm are naturally turbid during the summer months when glacial silt is at its maximum level. Some construction activities may disturb the seafloor with a temporary sediment plume. Any incremental construction-induced turbidity would likely be masked by naturally-occurring conditions. Overall, the effects of Project activities on benthic habitat between 2009 and 2014 will be localized, short-term, and indistinguishable from naturally occurring disturbances to the benthos.

9.1.3 Hydrology

Hydrologic modeling conducted for the March 2005 POA Marine Terminal Redevelopment EA (Anchorage Port Expansion Team, Maritime Administration 2005) suggested that the Project activities would slightly modify current conditions at the Port. The small modifications, while not significant to the overall environment, may actually be beneficial in terms of reducing the amount of dredging that would be needed to maintain the required depth for shipping operations. The modeling also indicates there would be no significant adverse impacts to current patterns in other parts of upper Cook Inlet, including at the mouth of Ship Creek, approximately 0.6 km south of the southern end of the Project footprint.

Other studies on the impacts to hydrology from the Project activities have been conducted by USACE for the POA and the Maritime Administration. These studies (USACE 2008a, 2008b) indicate that the proposed placement of the dock face further seaward may subject vessels to stronger flood currents. The expansion will also alter the strength and dynamics of the Cairn Point ebb gyre. However, these alterations are not expected to change prey distribution.

9.2 EFFECTS OF PROJECT ACTIVITIES ON MARINE MAMMAL PREY

Fish are the primary prey species for marine mammals in upper Cook Inlet, including Knik Arm. Beluga whales feed on a variety of fish, shrimp, squid, and octopus (Burns and Seaman 1986). Common prey species in Knik Arm include salmon, eulachon and cod. Harbor seals feed on fish such as pollock, cod, capelin, eulachon, Pacific herring, and salmon as well as a variety of benthic species, including crabs, shrimp, and cephalopods. Harbor seals are also opportunistic feeders with their diet varying with season and location. The preferred diet of the harbor seal in the Gulf of Alaska consists of pollock, octopus, capelin, eulachon, and Pacific herring (Calkins 1989). Other prey species include cod, flat fishes, shrimp, salmon, and squid (Hoover 1988). Harbor porpoises feed primarily on Pacific herring, cod, whiting (hake), pollock, squid, and octopus (Leatherwood et al. 1982). In the upper Cook Inlet area, harbor porpoise feed on squid and a variety of small schooling fish, which would likely include Pacific herring and eulachon (Bowen and Siniff 1999; NMFS unpublished data). Killer whales feed on either fish or other marine mammals depending on genetic type (resident versus transient respectively). Killer whales in Knik Arm are typically the transient type (Shelden et al. 2003) and feed on beluga whales and other marine mammals, such as harbor seal and harbor porpoise.

Placing fill in waters where fish are present can kill, injure, and isolate fish in the discharge area. Fish populations in Knik Arm could also be affected by noise from in-water pile driving and other construction-related noise, but likely not to the degree where prey availability to marine mammals would be significantly affected (NMFS 2008d). Although data on fish populations in Upper Cook Inlet are limited, historical documents related to studies (including Dames and Moore 1983 and Moulton 1996) and more recent studies (Houghton et al. 2005a, 2005b) indicated that a wide variety of fish species, including all five species of Pacific salmon, safion cod, and a variety of prey species such as eulachon and long fin smelt are present in the vicinity of the Port and use the habitat for migrating, rearing, and foraging. While there may be few definitive studies on the use of the near shore shallow coastal areas in the upper inlet, use of this type of habitat elsewhere by salmon and other species in Cook Inlet will supported in literature (NMFS July 2008d). In general, fish perceive underwater sounds in the frequency range of 50 to 2,000 Hz, with peak sensitivities below 800 Hz (Popper and Carlson 1998; Department of the Navy 2001). However, fish are sensitive to underwater impulsive sounds due to swimbladder resonance. As the pressure wave passes through a fish, the swimbladder is rapidly squeezed as the high pressure wave, and then under pressure component of the wave, passes through the fish. The swimbladder may repeatedly expand and contract at the high SPLs, creating pressure on the internal organs surrounding the swimbladder.

Permanent injury to fish from acoustic emissions has been shown for high-intensity sounds of several hours long. In a review on the effects of low-frequency noise to fish (NMFS 2004), a threshold of 180 dB peak sound level was used to define the potential injury to fish. Sound pressure levels greater than an average of 150 dB rms are expected to cause temporary behavioral changes such as a startle response or behaviors associated with stress. Although these SPLs are not expected to cause direct injury to a fish, they may decrease the ability of a fish to avoid predators.

Juvenile Chinook salmon sampled between Cairn Point and Point Woronzof showed that 80 to 85 percent of the fish were of hatchery origin (NMFS 2008d). This suggests that waters in the portion of the upper Cook Inlet are important to the hatchery produced smolts from Ship Creek. The remaining 15 to 20 percent of the fish was not of hatchery origin suggesting that the area within the Project footprint also provides important habitat for wild Chinook, likely including fish from other Knik Arm tributaries. However, other habitats around the Port and portions of Knik Arm exhibit the same attributes as the area around the Port, and a significant decrease in marine mammal prey availability is not anticipated. In addition, the area around the Port is not considered a primary feeding area for marine mammals. Stocking in Ship Creek would also minimize impact to prey availability. The stocking of Fish Creek and the mitigation measures currently in place are expected to reduce impacts to the point that beluga whale prey abundance would not be significantly negatively impacted. These same considerations limit any impact to this analysis resulting from the limited availability of data for the specific Project area.

Carlson (1994), in a review of 40 years of studies concerning the use of underwater sound to deter salmonids from hazardous areas at hydroelectric dams and other facilities, concluded that salmonids were able to respond to low-frequency sound and to react to sound sources within a few feet of the source. He speculated that the reason that underwater sound had no effect on salmonids at distances greater than a few feet is because they react to water particle motion/acceleration, not sound pressures. Detectable particle motion is produced within very short distances of a sound source, although sound pressure waves travel farther.

Hastings and Popper (2005) reviewed all pertinent peer-reviewed and unpublished papers on noise exposure of fish through early 2005. They proposed the use of SEL to replace peak SPL in pile driving criteria. This report identified interim thresholds based on SEL or sound energy. The interim thresholds for injury were based on exposure to a single pile driving pulse. The report also indicates that there was insufficient evidence to make any findings regarding behavioral effects associated with these types of sounds. Interim thresholds were identified for pile driving consisting of a single-strike peak sound pressure and a single strike SEL for onset of physical injury. A peak pressure criterion was retained to function in concert with the SEL value for protecting fishes from potentially damaging aspects of acoustic impact stimuli. The available scientific evidence suggested that a single-strike peak pressure of 208 dB and a single strike SEL of 187 dB were appropriate thresholds for the onset of physical injury to fishes.

Following the Hasting and Popper (2005) paper, NMFS developed their version of the dual criteria that included the single strike peak pressure threshold of 208 dB, but addressed the accumulation of multiple strikes through accumulation of sound energy by setting a criterion of 187 dB SEL. The accumulated SEL is calculated using an equal energy hypothesis that combines the SEL of a single strike to 10 times the 10-based logarithm of the number of pile strikes.

Based on measurements from the recent POA test pile study at the Port (URS 2007), the distance that noise would exceed the 187 dB rms thresholds for either vibratory and impact in-water pile driving would be less than 10 m. This suggests that fish would be exposed to higher levels of noise within a relatively short distance of the pile and for a relatively short period of time, thus limiting any negative effects on prey species of marine mammals.

POA will undertake mitigation measures to reduce impacts on fish from construction activities. These mitigation measures include:

- The POA will conduct an on-site fish study to analyze the impacts of vibratory and impact pile driving on salmonids. A logistics study was conducted without fish in July 2008 (URS 2008) and the full field program will be conducted in early June 2009. Consultation with the U.S. Fish and Wildlife Service (FWS) and NMFS was completed in 2008 to approve the study plan and schedule.
- No in-water construction activities (construction dredging, fill placement, or pile driving) will occur within a one week period following the two smolt releases planned by ADF&G from the Ship Creek Hatchery each summer.
- In-water pilings will be driven with a vibratory hammer to the maximum extent possible to further minimize any effects on fish.
- The final design of the dock structure incorporates end-of-phase construction joints (refer to Appendix H – Construction Joints) that provide potential refuge habitat areas for salmonids. These refuge areas will be monitored by the POA between May and August for at least two years following construction.

Because of the lack of definitive studies on how this Project's construction activities will affect prey availability for marine mammals, there is an uncertainty factor to analyze impacts. However, this uncertainty would be mitigated due to the low quality and quantity of marine habitat, low abundance and seasonality of salmonids and other prey, and mitigation measures all ready in place to reduce impacts to fish. Therefore, the impacts on marine mammal prey during Project construction activities are expected to be negligible.

10.0 DESCRIPTION OF IMPACT FROM LOSS OR MODIFICATION TO HABITAT

The anticipated impact of the loss or modification of habitat on the marine mammal populations involved.

Preliminary observation and monitoring data collected over the past two construction seasons suggest belugas are primarily transiting the area adjacent to the Project. Because the Project area has been considered industrialized since the 1960s and is actively used for commerce and transportation, planned construction activities are not expected to impose any permanent effects on marine mammal habitat or the presence and availability of prey species.

Annual maintenance dredging occurs daily from approximately May to November in the Anchorage harbor for navigation purposes. The Project area has historically incurred bottom disturbance from dredging to support year-round commerce. The total area of habitat impacted as a result of Project activities is approximately 135 acres, with 67.6 acres already filled (since 2006). This represents a very small amount (<1 percent) of the marine habitat available to mammal populations in Knik Arm. The greatest impact on marine mammals associated with the Project is a temporary loss of habitat due to construction noise. Long term effects of displacement by noise would be negligible.

The Project is not expected to result in permanent impacts to habitat used by marine mammals, or permanent impact to their food sources. Best management practices that focus on maintenance of water quality and fish refuge as well as other mitigation efforts will reduce negative impacts to habitat during construction. Indirectly, the Port has committed to estuary conservation and restoration efforts by providing over $8 Million into a compensatory mitigation account managed by USACE for habitat mitigation purposes. These funds will be applied toward local compensatory mitigation projects that contribute toward offsetting the functional losses attributed to the Project and must support salmon populations through restoration, enhancement, creation and/or preservation of existing nearby estuarine and associated lower riparian habitats. Individual restoration/conservation project funds will be allocated by a Compensatory Mitigation Committee established by USACE for nearby habitat improvements at Chester Creek, Six Mile Creek, and Ship Creek watersheds. As a result, the proposed activity is not expected to have any effects on feeding habitat or prey that could result in permanent or long-term consequences for individual marine mammals or their populations in Cook Inlet.

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11.0 MEASURES TO REDUCE IMPACTS TO MARINE MAMMALS

The availability and feasibility [economic and technological] of equipment, methods, and manner of conducting such activity or other means of effecting the least practicable adverse impact upon the affected species or stocks, their habitat, and on their availability for subsistence uses, paying particular attention to rookeries, mating grounds, and areas of similar significance.

11.1 GENERAL REQUIREMENTS

The Port Intermodal Expansion Project Marine Terminal Redevelopment EA (Anchorage Port Expansion Team, Maritime Administration 2005) is incorporated by reference which describes the alternatives analysis, and a Finding of No Significant Impact (FONSI) for the preferred alternative having the least practicable adverse impact to the environment.

Since the FONSI was issued, further mitigative design improvements include:

- The POA has reduced the total in-water material volume of fill from 12.3 to 10.5 million cy.
- Vertical sheet pile retaining walls have been replaced by the POA with riprap armored slopes where feasible. This change in design reduced the quantity of driven sheet piles (and durations of pile driving exposure to in-water noise impacts); additionally, the rock provides potential fish refuge.
- Total length of the dock face for berthing has been reduced by the POA from approximately 8,800 ft to 7,904 ft (7,436 ft of vertical sheet-pile wall and 468 ft of dry barge berth consisting of a rock-armored slope to elevation +10 ft with an offset sheet-pile wall to elevation +38 ft). This eliminates 896 ft of OCSP installation.
- Construction joints between phases have been modified to provide a break in the sheet pile with placement of a bridged deck with rock placed beneath and sloped back beneath the structure (see Appendix H for figures illustrating the construction joints). The rock provides potential fish refuge.

11.2 USACE REQUIREMENTS

The following USACE requirements to mitigate impacts to beluga whales are defined by the Special Conditions of the Department of the Army Permit (POA-2003-502-N, Section IV) issued by the USACE in August 2007 for Project activities. The POA is conducting Project activities in accordance with the USACE Section 404/10 Permit and the subsequent IHA issued in 2008. The USACE Section 404/10 Permit mitigation requirements are provided below:

1. *"The POA shall measure and evaluate construction and operationally generated noise introduced in Knik Arm at the Port of Anchorage. The applicant shall develop a 'Sound Index' to accurately represent noise levels associated with Port of Anchorage operations and construction activities, which must specifically include noise levels generated from pile driving, dockside activities, vessel traffic in the channel, dredging, and docking activities. The evaluation shall characterize current baseline operational noise levels at the Port of Anchorage and develop an engineering report that identifies structural and/operational noise reduction measures, if necessary, to minimize the baseline operational noise levels at the expanded port to the maximum extent practicable. The final report will be provided to the NMFS two years prior to construction*

completion.""The Port of Anchorage Sound Index will be collaborated with the concurrent beluga whale monitoring program to correlate construction and operationally generated noise exposures with beluga whale presence, absence, and any altered behavior observed during construction and operations (i.e., a dose-response analysis). An annual review of beluga observations and noise exposure data shall be provided to NMFS no later than 1 Feb annually. The annual review shall also identify relevant technological advances in sound attenuation. The POA shall employ practicable noise minimization measures identified in the annual reports in subsequent POA construction activities."

2. *"In collaboration with the NMFS, the Port of Anchorage shall continue to develop and maintain a beluga monitoring program to estimate the frequency at which beluga whales are present in the project footprint; characterize habitat use and behavior of belugas near the Port during ice free months; map sound levels and distance attenuation related to POA background noise and expansion activity; and to characterize and assess the impacts of received noise from the POA on beluga whale behavior and movements. POA shall consult with NMFS to develop the program and shall include the following:"*
    a. *"Include visual observations (share-based and opportunistic vessel observations) to monitor beluga movements, timing, group size, locations, identifiable behaviors and patterns, and use the area in the vicinity of the Project during operations through the construction period. The POA will also provide one year of post-construction monitoring in continued consultation with NOAA/NMFS."*
    b. *"Include a passive acoustic monitoring plan to correlate with visual observations. The POA shall install hydrophones (or employ other effective methodologies) necessary to detect and localize passing whales and to determine the proportion of belugas missed from visual surveys."*
    c. *"The POA will employ a marine mammal observation team separate from the construction contractor observer activities, for the duration of all construction activities."*
3. *"The Port of Anchorage shall establish and enforce safety radii and shut down standards around the in-water pile driving areas. Initially, the safety radii requiring shut down shall be for any whale observed within 650 meters of pile driving. The Port of Anchorage shall conduct on-site underwater noise surveys to verify the 190, 180 and 160 dB re 1 µPa rms isopleths from in-water pile driving activities for the POA expansion. Safety zones appropriate to the POA site conditions and equipment will then be empirically determined and implemented. The dB re 1 µPa rms safety zone should be in force unless the POA obtains authorization under the section 101 (a) of the Marine Mammal Protection Act for the incidental and unintentional taking of marine mammals; in which case the safety zones should be those provided within the authorization. The safety zone around pile driving areas shall be monitored for the presence of marine mammals before, during, and after any pile driving activity. If the safety radius is obscured by fog or poor lighting conditions, pile driving will cease until the entire safety radius is visible."*
4. *"Prior to the start of seasonal pile driving activities, the POA will require construction supervisors and crews, the marine-mammal monitoring team, the acoustical monitoring team, and all project managers to attend a briefing. The purpose of the briefing will be to establish the*

responsibilities of each party, define the chains of command, discuss communication procedures, provide an overview of monitoring purposes, and review operational procedures."

5. *"The Port of Anchorage shall formally notify the NMFS prior to the seasonal commencement of pile driving and provide weekly monitoring reports. A summary monitoring report will be submitted at the end of annual construction activities and a final report will be submitted at the end of the one year post construction monitoring season."*
6. *"The POA will establish daily "soft start" or "ramp up" procedures for pile-driving activities. The soft start technique will be used at the beginning of each piling installation to allow any marine mammal that may be in the area to leave before pile driving activities reach full energy. The soft start procedure will require contractors to initiate noise from vibratory hammers for 15 seconds at reduced energy followed by a 1-minute waiting period. This procedure will be repeated two additional times. If an impact hammer is used, contractors will be required to provide an initial start of 3 strikes at 40-percent energy, followed by a 1-minute waiting period, then two subsequent 3-strike sets. If marine mammals are sighted within the safety zone prior to the pile driving or during the soft start, the contractor will delay pile-driving continuation until the mammal has moved outside the safety zone. Pile installation will resume only after a qualified observer confirms that the marine mammal has moved outside the safety zone or after 15 minutes have elapsed since the marine mammal was last sighted."*
7. *"The POA will erect whale-notification signage in the waterfront viewing areas near the Ship Creek Public Boat Launch and within the secured Port entrance that is visible to all Port users. This signage will provide information on the beluga whale and notification procedures for reporting beluga whale sightings to the NMFS. The POA will consult with the NMFS to establish the signage criteria."*
8. *"During in-water construction activities, the POA shall ensure that construction contractors delegate supervisory responsibility to include on-site construction personnel to observe, record, and report marine mammal sightings and response actions taken, to include shut down or delay."*
9. *"The POA shall establish a long-term, formalized marine-mammal sighting and notification procedure for all Port users, visitors, tenants, or contractors during and after construction. The notification procedure shall clearly identify roles and responsibilities for reporting all marine mammal sightings. The POA will forward documentation of all reported marine mammal sightings to the NMFS."*
10. *"In-water impact pile-driving, excluding work when the entire pile is out of the water due to shoreline elevation or tidal stage, shall not occur within two hours of either side of each low tide."*

11.3 NMFS REQUIREMENTS

The NMFS mitigation measures discussed in this Section and as required in the IHA July 15, 2008 (NMFS 2008c) are designed to eliminate potential for injury and minimize harassment to marine mammals, particularly beluga whales. In addition to the mitigation measures currently in place, other methods of avoiding or limited impacts to marine mammals have been evaluated and found to be unsuitable at the present time:

- Sound deterrent/minimization techniques such as bubble curtains were considered for mitigation; however, these techniques have not proven successful in conditions similar to Knik Arm. Current speeds up to 11.2 ft [3.4 m]/sec, the high tidal range, and high silt content in Knik Arm limit the effectiveness of currently available sound reduction methods and technologies.
- Use of "press-in" pile installation methods was also investigated. This pile installation method uses hydraulic pressure to press piles into place without the use of impact or vibration. At the current time there is only one press-in pile machine that is capable of installing flat sheet pile. The press-in method has had limited success installing flat sheet pile up to 40 feet in length in soft soils. Soils at the Port are considerably more stiff and dense and the manufacturer of the press-in pile installation machine was doubtful that the method would be successful. Because of the length of piles and subsurface conditions in the Port area, vibratory or impact pile driving are the only practicable methods currently available for placing piles.
- Installation of piles during the winter when marine mammal use of Knik Arm is limited has also been suggested and evaluated. Ice flow in the water and buildup of ice on the exposed steel presents safety hazards to pile driving crews and makes the construction process slow and inefficient. Furthermore, visibility conditions are typically poor due to the loss of sunlight and inclement weather, which would reduce the time available for pile driving and would result in an inefficient and costly construction process.

The POA will work with pile driving subcontractors, bubble-curtain manufacturers, and other technologies to learn and test new sound-attenuation or minimization techniques applicable to the Knik Arm environment as technologies advance and new technologies or methods emerge. If promising technologies or methods become available and are implemented, NMFS would re-evaluate the potential impacts to marine mammals and adjust numbers and mitigation requirements accordingly, and consider these measures for future requests for incidental take authorizations. Should other mitigation measures be deemed necessary for future construction activities, these measures will be analyzed by NMFS and implemented after consultation and agreement with the POA. All pile driving related mitigation measures listed here apply only to in-water pile driving.

These following mitigations measures are currently being implemented under the IHA which expires on June 14, 2009. These mitigation requirements will be continued until modified by this Application. It is expected that the harassment radii will be modified in accordance with the results of the 2008 acoustic survey. Those results are preliminary at this writing (November 2008). However, Figure 6-1 shows the currently suggested harassment radii for 160 dB and 125 dB.

11.3.1 Shut Downs and Soft Starts

1) Scheduling of construction activities during low use period of beluga whales around the Port.

Tides have been shown to be an important physical characteristic in determining beluga movement within Knik Arm. Most beluga whales are expected to be foraging well north of the Port area during the flood and high tide. However, these northern areas are exposed during the ebb and low tide; therefore, animals move south toward Eagle Bay and sometimes as far south as the Knik Arm entrance to avoid being stranded by the lowering waters. Beluga whale sightings often varied significantly with tide height at and around the Port area. Beluga whales were most often sighted during the period around low tide (Funk et al. 2005; Prevel Ramos et al. 2006; Markowitz and McGuire 2007) and as the tide flooded, beluga whales typically moved into the upper reaches of Knik Arm (Funk et al. 2005). Opportunistic sighting data also support that highest beluga whale use near the Port is around low tide (NMFS 2005).

Due to this tidally influenced habitat use, impact pile driving, excluding work when the entire pile is out of the water due to shoreline elevation or tidal stage, shall not occur within two hours of either side of each low tide. (i.e., from two hours before low tide until two hours after low tide). For example, if low tide is at 1pm, impact pile driving will not take place from 11am to 3pm. However, vibratory pile driving will be allowed to commence/continue during this time.

2) Establishment of safety zones and shut down requirements.

Stabbing of the sheet pile is typically accomplished by lifting it with a crane and dropping into position. Only if this technique or use of a hairpin weight is insufficient, a vibratory hammer may be used. Due to safety concerns, the shut down of vibratory pile driving during the stabbing phase of sheet pile installation is not practicable, as described in Section 1.0. Therefore, the following shut down requirements apply to all in-water pile driving except during that specific phase of the sheet pile installation process. If stabbing must be performed with a vibratory pile driving hammer, stabbing is done at reduced energy (i.e., lower sound source level).

(a) Safety and Harassment Zones.

The POA's 2007 acoustic study determined the estimates of distances for 190 dB, 180 dB, 160 dB, and 120 dB isopleths from impact and vibratory pile driving. From this study, isopleth distances were determined at 10, 20, 350, and 800 m, respectively. In 2008 an acoustic study was conducted to identify updated isopleths. Preliminary data are being used in this Rulemaking Application and verified data will be utilized to develop a sound index profile. Although the safety zones of 190 and 180 dB isopleths are within 20 m for both types of pile driving, NMFS established a conservative 200 m mandatory shut down which would require the pile driving operations to shut down anytime a marine mammal enters this zone.

(b) Shut Down for Large Groups.

To reduce the chance of the POA reaching or exceeding authorized take and to minimize harassment to beluga whales, in-water pile driving operations shut down if a group of five or more beluga whales is sighted approaching the Level B harassment 160 dB and 120 dB isopleths. The updated acoustic survey suggest that this shut down should occur for 160 dB and 125 dB isopleths.

(c) Shut Down for Beluga Whale Calves.

Beluga whale calves are likely more susceptible to loud anthropogenic noise than juveniles or adults. If a calf is sighted approaching a harassment zone, in-water pile driving ceases and will not be resumed until the calf is confirmed to be out of the harassment zone and on a path away from such zone. If a calf or the group with a calf is not re-sighted within 15 minutes, pile driving may resume.

(d) Heavy Machinery Shut Downs.

For in-water heavy-machinery operations other than pile driving, if a marine mammal comes within 50 m of the machinery, operations cease and vessels slow to a reduced speed while still maintaining control of the vessel and safe working conditions to avoid physical injury. Such shut down operations include POA controlled construction dredging vessels, water based dump-scows (barges capable of discharging material through the bottom), standard barges, tug boats to position and move barges, barge-mounted hydraulic excavators or clamshell equipment used to place or remove material.

(e) If maximum authorized take is reached or exceeded for the year, any marine mammal entering into the harassment isopleths will trigger mandatory shut down.

3) Soft start requirements for pile driving activities.

A ‘‘soft start’’ technique is used at the beginning of each pile installation to allow any marine mammal that may be in the immediate area to leave before pile driving reaches full energy. The soft start requires pile driving operators to initiate noise from vibratory hammers for 15 seconds at reduced energy followed by 1-minute waiting period. The procedure is repeated two additional times. If an impact hammer is used, operators are required to provide an initial set of three strikes from the impact hammer at 40 percent energy, followed by a 1-minute waiting period, then two subsequent three–strike sets (NMFS 2003). If any marine mammal is sighted within the safety zone (200 m) prior to pile driving, or during the soft start, the hammer operator (or other authorized individual) delays pile driving until the animal has moved outside the safety zone. Furthermore, if marine mammals are sighted within a Level B harassment zone prior to initiating pile driving, operations are delayed until the animals move outside the zones in order to avoid take exceedance. Pile driving resumes only after a qualified observer determines that the marine mammal has moved outside the safety or harassment zone, or after 15 minutes have elapsed since the last sighting of the marine mammal within the safety zone.

4) Pile driving weather delays.

Adequate visibility is essential to beluga whale monitoring and determining take numbers. Pile driving is not conducted when weather conditions restrict clear, visible detection of all waters within and surrounding the harassment zones. Conditions that can impair whale observation and require in-water pile driving delays include, but are not limited to, fog and a rough sea state.

5) Notification of Commencement and Beluga Whale Sightings.

The POA formally notifies the NMFS Alaska Region and Office of Protected Resources prior to the seasonal commencement of pile driving and provides monthly monitoring reports once pile driving begins. A summary monitoring report is submitted to NMFS annually.

The POA has established a long-term, formalized marine-mammal sighting and notification procedure for all Port users, visitors, tenants, or contractors prior to and after construction activities. The notification procedure clearly identify roles and responsibilities for reporting all marine mammal sightings. The POA forwards documentation of all reported marine mammal sightings to NMFS.

6) Public Outreach.

In 2007 the POA has erected two whale-notification signs in the waterfront viewing areas: 1) near the Ship Creek Public Boat Launch; and 2) at the secured Port entrance visible to all Port users. This signage provides information on the beluga whale and notification procedures for reporting beluga whale sightings to the NMFS. The POA consulted with NMFS to establish the signage criteria.

11.3.2 Monitoring

A construction monitoring program is conducted at the Port at all times when in-water pile driving is taking place, and 30 minutes prior to pile driving commencement. All marine mammal sightings will be documented on NMFS-approved marine mammal sighting sheets. If a marine mammal is located within a designated harassment zone while pile driving is taking place, it will be documented as a "take".

Scientific Marine Mammal Monitoring

In addition to the trained construction marine mammal observers responsible for monitoring the safety and harassment zones and calling for shut down, an independent land-based beluga whale monitoring team shall report on: 1) the frequency at which beluga whales are present in the project footprint; 2) habitat use, behavior, and group composition near the Port area and correlate those data with construction activities; and 3) observed reactions of beluga whales in terms of behavior and movement during each sighting. These observers will monitor for beluga whales 8 hours per day (over two tide cycles) for 4 days per week but scheduling may change. These observers work in collaboration with the POA to immediately communicate any presence of beluga whales or other marine mammals in the area prior to or during pile driving. The POA keeps this monitoring team informed of all schedules for that day (e.g., "beginning vibratory pile driving at 9am for two hours") and any changes expected throughout the day.

Acoustic Monitoring

The POA implemented a NMFS-approved acoustic monitoring study upon commencement of 2008 in-water pile driving. This study confirms harassment isopleths for all types of piles used, including OCSP and fendering piles, and sound propagation levels during the "stabbing" process as this phase operates at reduced energy. The 2008 acoustic survey measured and evaluated construction and operationally generated noise introduced in Knik Arm and will be used to develop a "sound index" to accurately represent noise levels associated with Port operations and construction activities, which includes noise levels generated from pile driving, dockside activities, vessel traffic in the channel, dredging, and docking activities. The evaluation characterizes current baseline operational noise levels in the Port harbor. The 2008 acoustic survey results have been tabulated for the purposes of this Application and the findings are preliminary. A final report regarding harassment radii will be prepared and submitted to NMFS for review and approval.

The POA will prepare an engineering report that identifies potential structural and operational noise reduction measures to minimize the baseline operational noise levels at the expanded Port facility to the maximum extent practicable. The final report will be provided to the NMFS two years prior to construction completion, per NMFS request.

11.4 ADDITIONAL MITIGATION MEASURES FOR DUAL SOUND SOURCES

With two pile driving crews working, the potential exists for dual in-water sound sources. The intermittent nature of pile driving and the amount of time spent by each crew performing non-pile driving activities significantly reduce the potential for simultaneous pile driving to occur; however, as the potential does exist, management and mitigation measures will be developed and implemented to avoid or reduce impacts related to simultaneous in-water sound sources.

For the majority of work to be completed under this authorization, it is anticipated that pile driving crews would start at opposite ends of construction areas and work toward the center. Two mitigation alternatives are proposed: 1) While pile driving crews are separated by significant distances, separate safety and harassment zones would be established, monitored, and managed for each sound source. As the distance between pile driving crews decreases, the potential would exist for sound from the sources to combine. At present, there has not been an opportunity to measure actual sound from two pile driving crews driving pile simultaneously in close proximity. Existing data provided by NOAA (E-mail from Jaclyn Daly to Daniel Yuska, September 17, 2008) indicates that the source sound would be increased by up to 3 dB with a corresponding increase in sound attenuation distances. Generally accepted relationships for increased source sound levels will be used to establish expanded safety zones for those instances when simultaneous pile driving occurs. 2) Alternatively, the more likely mitigation measure would be to manage construction methods and daily work sequencing to prevent simultaneous pile driving when crews are working in close proximity. Due to the intermittent nature of the pile driving process, controls can be implemented to prevent emission of the simultaneous sound sources.

11.5 CONSERVATION AND RESTORATION MITIGATION

The POA is providing approximately $8 Million into a compensatory mitigation account managed by USACE. These funds will be applied toward local compensatory mitigation projects that contribute toward offsetting the functional losses attributed to the Project and must support salmon populations through restoration, enhancement, creation and/or preservation of existing nearby estuarine and associated lower riparian habitats. Mitigation projects would include the removal and restoration of historical fills and developments, the removal of fish passage barriers, the restoration of natural hydrodynamics and sediment transport patterns, the enhancement and/or creation of estuarine juvenile salmonid refuge and rearing habitat, restoration and enhancement of riparian buffers and streambanks, the preservation of estuarine and riparian habitats, and projects that protect natural riparian buffers and streambanks by providing public access and improving overall social function. Individual restoration/conservation project funds will be allocated by a Compensatory Mitigation Committee established by USACE for nearby habitat improvements at Chester Creek, Six Mile Creek, and Ship Creek watersheds.

12.0 MEASURES TO REDUCE IMPACTS TO SUBSISTENCE USERS

Where the proposed activity would take place in or near a Traditional Arctic Subsistence Hunting area and/or may affect the availability of a species or stock of marine mammal for Arctic subsistence uses, the applicant must submit either a plan of cooperation or information that identifies what measures have been taken and/or will be taken to minimize any adverse effects on the availability of marine mammals for subsistence uses.

The POA and the Maritime Administration will meet with the Cook Inlet Marine Mammal Council (CIMMC) to describe the Project activities and discuss subsistence concerns. The meeting(s) should be sufficient to comply with the LOA requirement for a Plan of Cooperation (POC). The meeting(s) will provide information on the time, location, and features of the Project, opportunities for involvement by local people, potential impacts to marine mammals, and mitigation measures to avoid or minimize impacts.

The features of the Project activities in combination with a number of actions to be taken by the POA and Maritime Administration during Project implementation should prevent any adverse effects on the availability of marine mammals for subsistence.

- The Project activities will take place outside of the traditional area for hunting marine mammals.
- In-water construction activities will follow mitigation procedures to minimize effects on the behavior of marine mammals and; therefore, opportunities for harvest by Alaska Native communities.
- Regional subsistence representatives may support recording marine mammal observations along with marine mammal biologists during the monitoring program and be provided annual reports.
- The combination of the Project location and size of the affected area, mitigation measures, and input from the CIMMC should result in Project activities having no affect on the availability of marine mammals for subsistence uses.

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13.0 MONITORING AND REPORTING

The suggested means of accomplishing the necessary monitoring and reporting that will result in increased knowledge of the species, the level of taking or impacts on populations of marine mammals that are expected to be present while conducting activities and suggested means of minimizing burdens by coordinating such reporting requirements with other schemes already applicable to persons conducting such activity. Monitoring plans should include a description of the survey techniques that would be used to determine the movement and activity of marine mammals near the activity site(s) including migration and other habitat uses, such as feeding. Guidelines for developing a site-specific monitoring plan may be obtained by writing to the Director, Office of Protected Resources.

13.1 PORT OF ANCHORAGE MARINE MAMMAL MONITORING PROGRAMS

The POA and the Maritime Administration are committed to avoiding or minimizing impacts to marine mammals from Project activities. The POA and the Maritime Administration have been working closely with NMFS and other agencies to address marine wildlife issues. In collaboration with NMML and NMFS, the POA and Maritime Administration have implemented three separate marine mammal monitoring programs:

1) The Scientific Marine Mammal Monitoring Program, which began in 2005 prior to construction, continues to present. The program was established to observe and assess whale movement, timing, group size, locations, and patterns prior to, during, and one year after construction.

2) The Construction Marine Mammal Monitoring Program, which began in 2006, was established to protect marine mammals from harassment by enforcing established shut down criteria during in-water pile driving while also providing behavioral and abundance data to the extent possible.

3) The POA Marine Mammal Opportunistic Sighting Program began in 2006 for Port personnel, tenants, users, operators, maritime operators, ship captains, construction personnel, security personnel, transportation providers, and visitors to voluntarily report sightings of beluga whales and other marine mammals.

The objectives of these monitoring programs are to:

- Estimate the frequency at which beluga whales or other marine mammals are present in and near the Port;
- Characterize habitat use and behavior of beluga whales or other marine mammals with respect to in-water construction activities and on-going maritime operations;
- Provide the construction supervisor with prompt notification of marine mammal proximity to expansion activities so construction can be shut down before any beluga whales or other marine mammals enter designated safety and harassment radii.

During whale monitoring and data collection activities, the particular emphasis will be on documenting the frequency of presence within and near the construction area and the evaluation of potential responses of beluga whales to construction activities. Providing real-time information to the construction personnel so that mitigation measures can be swiftly implemented will enhance the shore based protection program managed by the construction subcontractor.

The monitoring area includes all waters visible from the monitoring stations located near the Port, within Knik Arm, upper Cook Inlet, and just offshore of Anchorage harbor. The observers monitor all tide levels each month. Sightings within the Project footprint area are distinguished from value-added data collected on beluga whale and marine mammal occurrence and behavior outside the Project footprint. The following text describes each program and results of the monitoring in further detail.

13.2 SCIENTIFIC MARINE MAMMAL MONITORING PROGRAM

The sections below provide more details on the POA scientific monitoring program performed by LGL in 2005 and 2006 and APU in 2007 and 2008.

13.2.1 2005 Program

As part of a pre-construction scientific monitoring program initiated by the POA, LGL was subcontracted by ICRC to implement the program during regular Port operations. LGL monitored beluga whale activity within the vicinity of the Port from August through November 2005 and from April through July 2006; the two monitoring stations were located at the Port and at Cairn Point on EAFB.

Monitoring was conducted from May 3, 2006 until July 27, 2006 for 252 hours over 42 days (May = 60 hours, June = 108 hours, July = 84 hours). During these three months there were 17 beluga whale sightings, none of which were calves (each sighting represents one whale; because individual whales were not identified, individual whales may have been re-sighted several times over the course of the study). Beluga whales were sighted at a rate of 0.07 whales per hour. Mean estimated minimum group size was two whales (range one to five). Eight (47 percent) of all observed beluga whales were seen within the Project footprint. Average sighting rates were 0.03 beluga whales per hour within the Project footprint, and 0.04 beluga whales per hour outside of the Project footprint. Beluga whales were sighted relatively infrequently (8 of 42 days; 19 percent). Of the time beluga whales were observed in the area, they spent approximately 73 percent of the time within the Project footprint. Traveling and diving were the most commonly observed behaviors. Some milling behavior was observed, but no resting behavior. Suspected feeding activity was observed in the area between the base of Cairn Point and the North Backlands area. Beluga whale movements were most often to the north and south. Group formations were linear or parallel, and animals were typically in small, tight groups (one to three body lengths between individuals). Beluga whales were seen throughout the low to mid-tidal cycle (each six-hour monitoring shift was centered on low tide).

13.2.2 2006 Program

LGL was subcontracted by ICRC to continue the scientific monitoring program during North Backlands construction from August through November 2006. During this scientific monitoring, LGL also implemented a notification procedure that informed the construction supervisor of whale presence. No in-water pile driving took place in 2006; project activities involved dike construction and fill placement. During in-water construction activities the construction supervisor enforced a shut down criterion of 50 m when whales approached.

Scientific monitoring during North Backlands construction was conducted from August 2, 2006 until November 3, 2006 for 299 hours and 46 minutes over 51 days (August = 92 hours 6 minutes, September = 96 hours, October = 96 hours, November = 15 hours 40 minutes) (Markowitz and McGuire 2007). During these four months, there were 64 beluga whale sightings, including 5 calf sightings. Beluga whales were sighted at a rate of 0.21 whales per hour. Mean estimated minimum group size was 4 whales (range one to ten). Fifty-six (88 percent) of all observed beluga whales were seen within the Project footprint. Average sighting rates were 0.19 beluga whales per hour within the Project footprint, and 0.19 beluga whales per hour outside of the Project footprint. Beluga whales were sighted relatively infrequently (11 of 51 days; 22 percent). Of the time beluga whales were observed in the Port area, they spent approximately 75 percent of the time within the Project footprint. Traveling and diving were the most commonly observed behaviors. Some milling behavior was observed, but resting was not. Suspected feeding activity was observed in the area between the base of Cairn Point and the North Backlands fill area. Beluga whale movements were most often to the north and south, although in some instances animals milled without directionality. Group formations were most often linear or parallel, and animals were in groups that ranged from tight (one to three body lengths between individuals) to dispersed (up to 12 body lengths between animals). Beluga whales were seen throughout the low to mid-tidal cycle (each six-hour monitoring shift was centered on low tide), although beluga whale use of the Project footprint peaked around low tide.

2006 Survey Summary

Temporal patterns.

In order to learn more about the temporal patterns of beluga whale use of the area surrounding the Port, a monitoring program was conducted during the ice-free months (April through November) involving observations made from Cairn Point and from the existing dock. August and September showed the highest rates of sightings with means of 0.4 and 0.3 sightings per hour, respectively. Beluga whale sightings also varied according to tidal stage. The highest sighting rates occurred at low ebb and low slack water. Whales were also spotted more frequently in the late morning/afternoon than in other parts of the day.

Spatial distribution.

Spatial data were also collected by observers on shore using geo-referenced grid cell maps (Funk et al. 2005) and a surveyor's theodolite (Prevel Ramos et al. 2006). Eighty percent of sightings occurred within 500 m of the Project footprint, while 64 percent occurred within the Project footprint. Whales were sighted within the Project footprint once in April, once in May, three times in June, once in July, five times in August, and five times in September.

Behavior.

Group size and age class composition, behavior, and movement patterns were also studied to gain a better knowledge of how beluga whales use the Port area. Time spent within the Project footprint varied between months from 0 to 41 minutes. Mean horizontal swimming speed of whales tracked with the theodolite was 6 km per hour. Mean group size was three whales, and 40 percent of sightings were of single whales. Calves were spotted in 20 percent of sightings, usually as part of larger nursery groups with a mean of eight whales. Observed behaviors included foraging, diving, and feeding behaviors, both confirmed and suspected.

13.2.3 2007 Program

Scientific monitoring for 2007 during construction of Barge Berths and South Backlands work was subcontracted by ICRC to APU and overseen by Dr. Leslie Cornick (Cornick and Kendall 2008). APU field researchers employed the same monitoring protocols as LGL employed during the previous two seasons at the Port site. Monitoring was conducted from October 9 to November 20, 2007 for 139 hours and 25 minutes over 42 days (October = 85 hours 45 minutes, November = 53 hours 40 minutes). During these two months, there were 67 beluga whale sightings. Beluga whale movements were mapped on a grid system as in previous studies; theodolites were not used to triangulate positions during this period. Of the 42 days of observation, 20 groups of beluga whales were sighted during nine days. Beluga whales were sighted at a rate of 0.5 whales per hour. Mean estimated minimum group size was 4.3 whales (range 1 to 20). Seventy-nine percent of the groups were sighted along the southeast shoreline of Knik Arm, near the Port area, and 21 percent were sighted toward the northern shoreline. Beluga whales were seen throughout the tidal cycle (each 6-hour monitoring shift was centered around low tide). Contrary to the past two seasons, only 28 percent of the beluga whale sightings occurred around low tide.

2007 Survey Summary
Temporal patterns.

No seasonal distribution of sightings was possible because the monitoring effort was entirely in the fall. Sightings were evenly distributed across the time of day and there was no significant difference in the mean duration of sightings. The sighting rate (whales per hour of observational effort) was 0.40 in October and 0.97 in November. Sightings were evenly distributed across slack and ebb tidal stages but were never observed during flood tidal stages (low or high).

Spatial distribution.

Beluga whales were observed within the study area on 14 occasions between 9 October and 20 November. Five of these sightings (31 whales) were within or adjacent to the Project footprint while the rest (64 percent of sightings) were outside the Project footprint. Whales spent a total of 118 minutes within or adjacent to the Project footprint. A total of 27 adults, 22 sub-adults, y calves, and 5 unknown age whales were observed; no calves were observed within the project footprint.

Behavior.

Whales were primarily observed moving north through the Port area in tight groups. Some suspected feeding bouts were noted but not confirmed. No abrupt changes in behavior were observed.

13.2.4 2008 Program

Scientific monitoring was conducted by APU for the period June 24 to October 31, 2008. Observations took place at the Cairn Point observation station located on EAFB. Field methods are described in detail in APU’s Marine Mammal Monitoring Plan. Monitoring was conducted four days per week, eight hours per day, for two four hour shifts, covering the full range of tidal cycles, as practicable, during daylight hours of access to the observation station. A total of 76 days of observations were completed with a total of ~560 hours of observation. Monitoring days were scheduled to provide a sample of beluga whale use of the area under varying conditions (e.g., noise, vessel traffic, construction activities, and environmental conditions), while accommodating the logistical, safety, and security concerns of the POA, EAFB, ICRC, and APU.

Beluga whale sightings are summarized below in Table 13-1. These totals may include animals that were sighted more than once. Observed behaviors were primarily traveling, milling, and presumed foraging. No behaviors indicative of avoidance of the construction were observed.

Table 13-1
Summary of 2008 Sightings by Scientific Observers

Month	*# Groups*	*# Adults*	*# Subadults*	*# Calves*	*# Unknown*	**Total**
June - July	0	0	0	0	0	0
August	32	94	22	10	0	126
September	22	53	3	1	0	57
October	5	6	3	1	3	13
Total	59	153	28	13	3	196

13.2.5 2009-2015 Program

Scientific monitoring will continue throughout the remaining construction years and for a year post-construction. For each construction season, the monitoring program will produce an updated work plan, submit monthly reports, and provide an annual report. The POA will continue consultation with NMFS to continuously improve the scientific monitoring program.

13.3 CONSTRUCTION MARINE MAMMAL MONITORING

Construction marine mammal monitoring will take place concurrent with all in-water pile driving activities. Each season, construction subcontractors will station qualified dedicated marine mammal observers at the in-water construction site or other vantage locations to monitor for the presence of marine mammals approaching or within established safety and harassment zones. These zones must be fully visible at all times, or in-water work will stop until visibility returns. If a marine mammal is identified within designated zones while pile driving is taking place, it will be documented as a "take."

Each observer will be qualified in marine mammal species detection, identification and distance estimation; use of binoculars and other technology will be utilized for best viewing. Rotating shifts will be four hours in duration in order to avoid fatigue or eye strain. Observers will be required to complete a NMFS-approved marine mammal sighting form for each sighting and number them chronologically per sighting per day and record the following:

- Date and time of initial and final sighting.
- Location of observation station and sighting number for that day.
- Status of harassment zone visibility and Species.
- Number of marine mammals sighted, including age (adult, juveniles, calves) and group composition.
- Initial and final direction of travel.
- Tidal stage.
- Initial and final distances of marine mammal from in-water noise source.
- In-water projects activities at time of sighting and whether shut down occurred (or reason why shut down did not occur).
- Number of take count for that sighting

- Initial and change of behavior if applicable; and any other information to best describe the sighting and marine mammal reaction to in-water construction activities, including use of a grid map where the observer records approximate location of observer and the marine mammals sighted.

At the time of each sighting, the pile hammer operator must be immediately notified that there are beluga whales in the area, their direction, and if shutdown is necessary.

Prior to the start of seasonal pile driving activities, the POA will require construction supervisors and crews, marine mammal observers, and all project managers to attend a briefing on responsibilities of each part, defining chains of command, discussing communication procedures, providing overview of monitoring purposes, and reviewing operational procedures regarding beluga whales and other marine mammals.

The sections below provide more details on the construction monitoring program performed during construction activities.

13.3.1 2006-2008

Construction activities in 2006 through 2007 involved land-based rock dike construction. Marine mammal monitoring by construction observers enforced a 50 m shutdown per the USACE requirement to prevent any physical harm when dropping rock in-water from shore. Four shut downs occurred in the 2007 season for marine mammal protection.

In-water pile driving commenced upon authorization by NMFS IHA July 15, 2008. The construction observation team provided a Marine Mammal Monitoring Plan. This NMFS-approved Marine Mammal Monitoring Plan was developed by Dr. Jay Brueggeman of Canyon Creek Consulting, LLC for the construction subcontractor and included procedures to comply with marine mammal protection requirements contained from the USACE and NMFS permit conditions.

All marine mammal sightings were recorded on whale sighting notification form regardless if in-water activities were not conducted at the time (i.e., shutdown for poor visibility, land-based work only). A copy of the NMFS-approved sighting form is provided in Appendix I. The summary of the sightings between July through October 2008 are provided in Appendix E.

Cumulative data for 2008 observations from July through October are summarized below (See also cumulative table in Appendix E):

- Total number of sightings - 50
- Number of species of marine mammals – 329 beluga whales and one harbor seal
- Ages – 178 adults; 66 juveniles; 29 calves; 36 unknown aged whales; one unknown age harbor seal
- Number of animals in 200 m safety zone – 30
- Number of animals in harassment zones – 125
- Shutdowns – 10
- Level B Takes – 3 beluga whales (no calves)
- Total days of in-water pile driving – 81

- Total hours of in-water pile driving – 482.50
- Total hours in-water pile driving with Impact Hammer – 136.75
- Total hours in-water pile driving with Vibratory Hammer – 125.50
- Total hours in-water stabbing 72.50

The data reports are provided weekly to the USACE and NMFS Office of Protected Resources in Alaska and Maryland (covering Sunday through Saturday activities each week) and a monthly report provided by the tenth day of following month. Per the IHA, a report summarizing all sighting data will be provided 90 days after expiration of the IHA Permit in October 2008. This report shall characterize habitat use and behavior of marine mammals at and around the Port of Anchorage, characterize sound levels around the Port related to and in absence of all construction activities; and address and analyze impacts of construction related noise on marine mammal presence, behavior, and habitat use.

13.3.2 2009-2014

Future construction will also provide construction marine mammal monitoring. A draft Monthly Marine Mammal Plan for each season, if modified, will be available for NMFS review and approval prior to in-water construction activities.

13.4 OPPORTUNISTIC MONITORING

All beluga whales sighted by POA employees, tenants, contractors, and visitors at the Port will be recorded on a whale sighting notification form; the POA will convey this information to NMFS.

13.5 REPORTING PROGRAMS

During the 2009 through 2014 construction seasons, and unless directed otherwise, the POA will continue to provide marine mammal sighting data reports weekly to the USACE and NMFS Office of Protected Resources in Alaska and Maryland (covering Sunday through Saturday activities each week) and a monthly report provided by the tenth day of following month. The POA will comply with LOA annual reporting requirements.

The POA and the Maritime Administration will consult with NMFS after their review of each annual report, or sooner, to determine future recommendations for this monitoring, shut down, and reporting program.

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14.0 RESEARCH COORDINATION

Suggested means of learning of, encouraging, and coordinating research opportunities, plans, and activities relating to reducing such incidental taking and evaluating its effects.

Construction activities have been conducted in Alaska waters for over 25 years and, during this time there have been no noticeable adverse impacts on the marine mammal populations or their availability for subsistence uses. This includes previous pile driving activity involving larger and longer piles than those proposed for this Project.

To minimize the likelihood that impacts will occur to the species, stocks and subsistence use of marine mammals, all construction activities will be conducted in accordance with all federal, state, and local regulations. To further ensure there will be no adverse effects resulting from the planned construction activities, the POA and the Maritime Administration will continue to cooperate with the NMFS and other appropriate federal agencies (i.e., U.S. Fish and Wildlife Service, USCG, EAFB, U.S. Environmental Protection Agency, and USACE), the State of Alaska, CIMMC, Tyonek Village Council, Native Village of Eklutna, the affected communities, and other monitoring programs underway in the Cook Inlet to coordinate research opportunities and assess all measures than can be taken to eliminate or minimize any impacts from these activities.

The POA will also cooperate with all other marine mammal researchers in Southcentral Alaska in sharing field data and behavioral observations on beluga whales and other marine mammal species that occur in the Port area. This information will also be shared with other governmental and private groups conducting studies of beluga whales including NMFS, ADF&G, LGL, APU, Hubbs-Sea World Research Institute, and oil and gas exploration companies operating in Cook Inlet.

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FIGURES

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FIGURE I-1 – MAP OF ALASKA

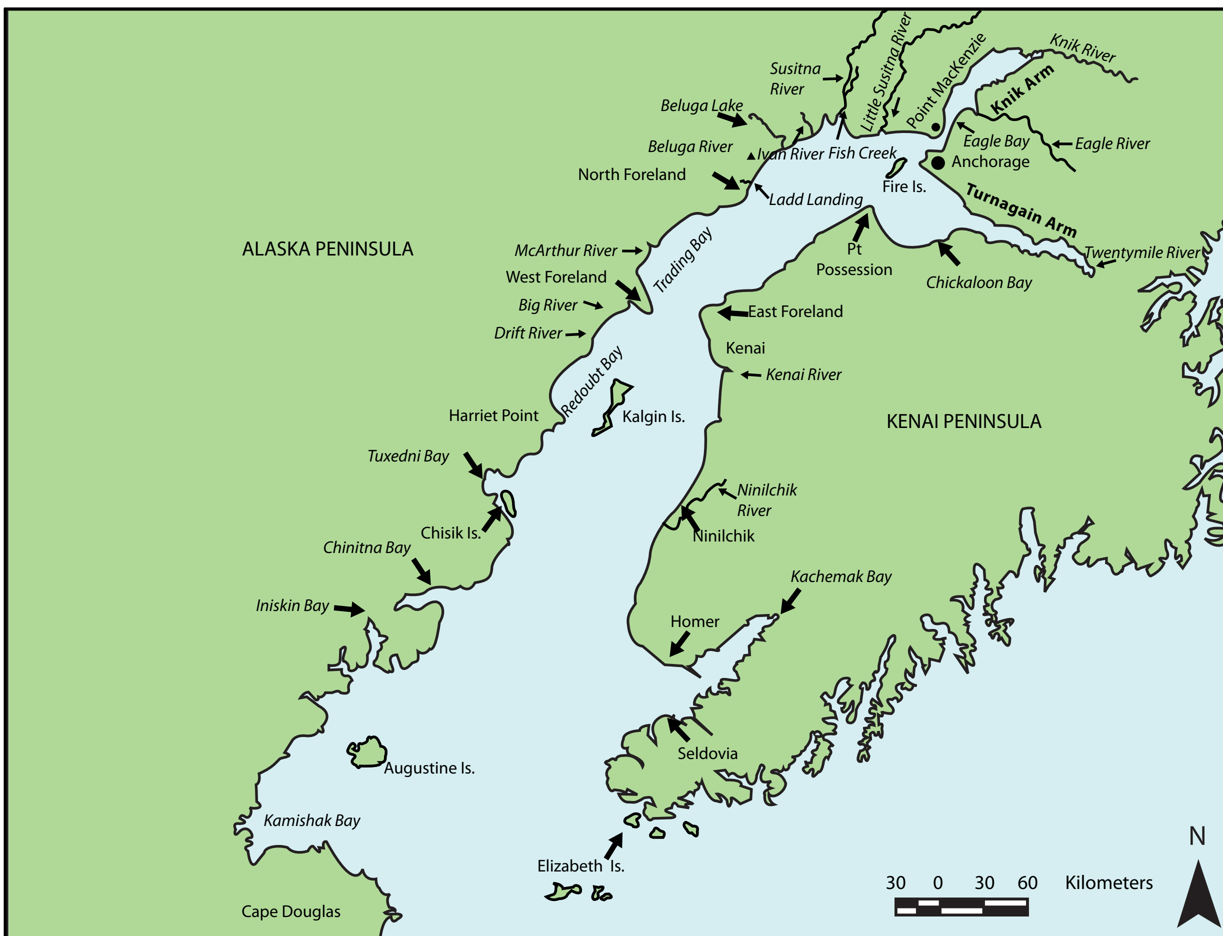

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FIGURE I-2 – MAP OF COOK INLET, ALASKA

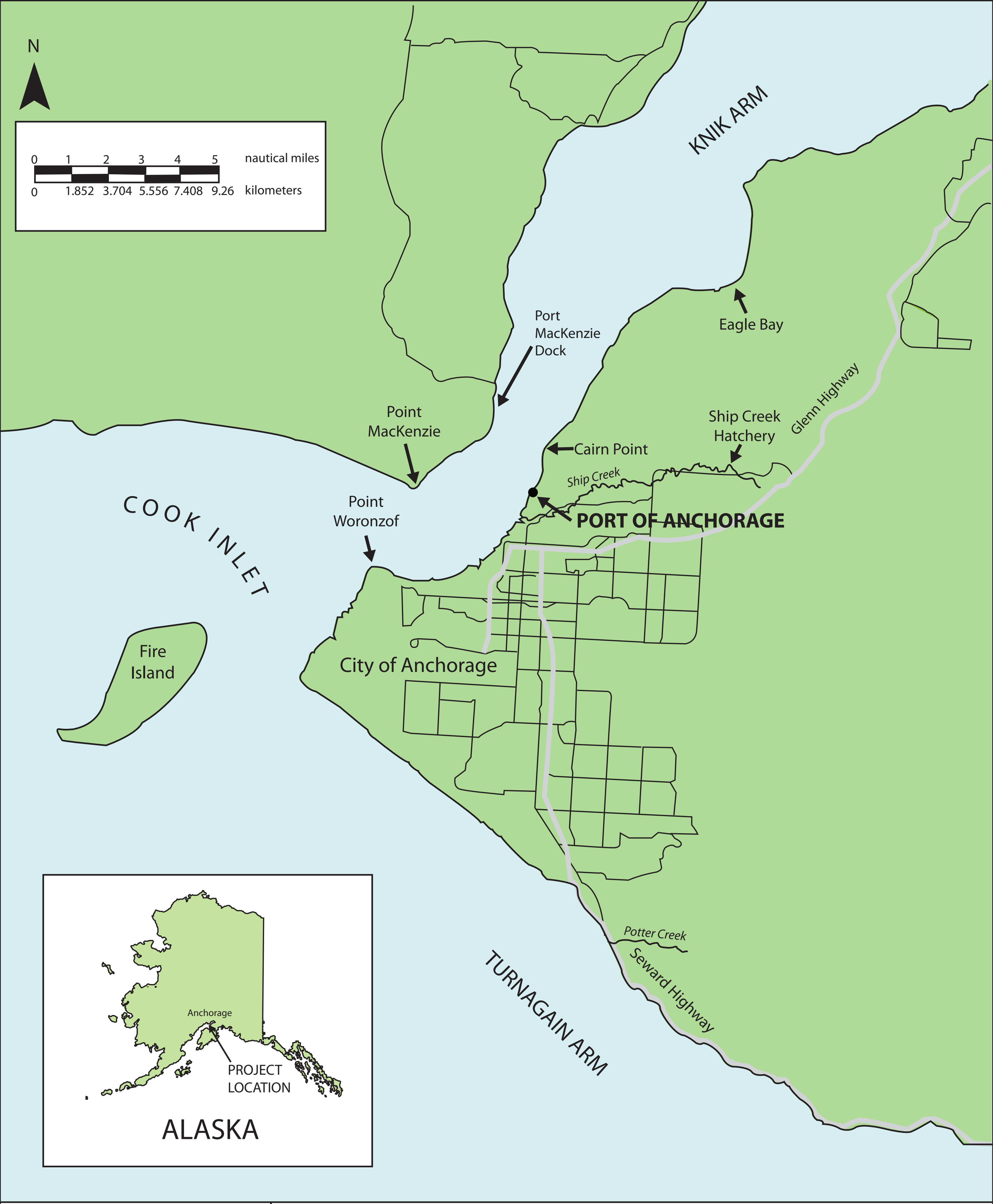

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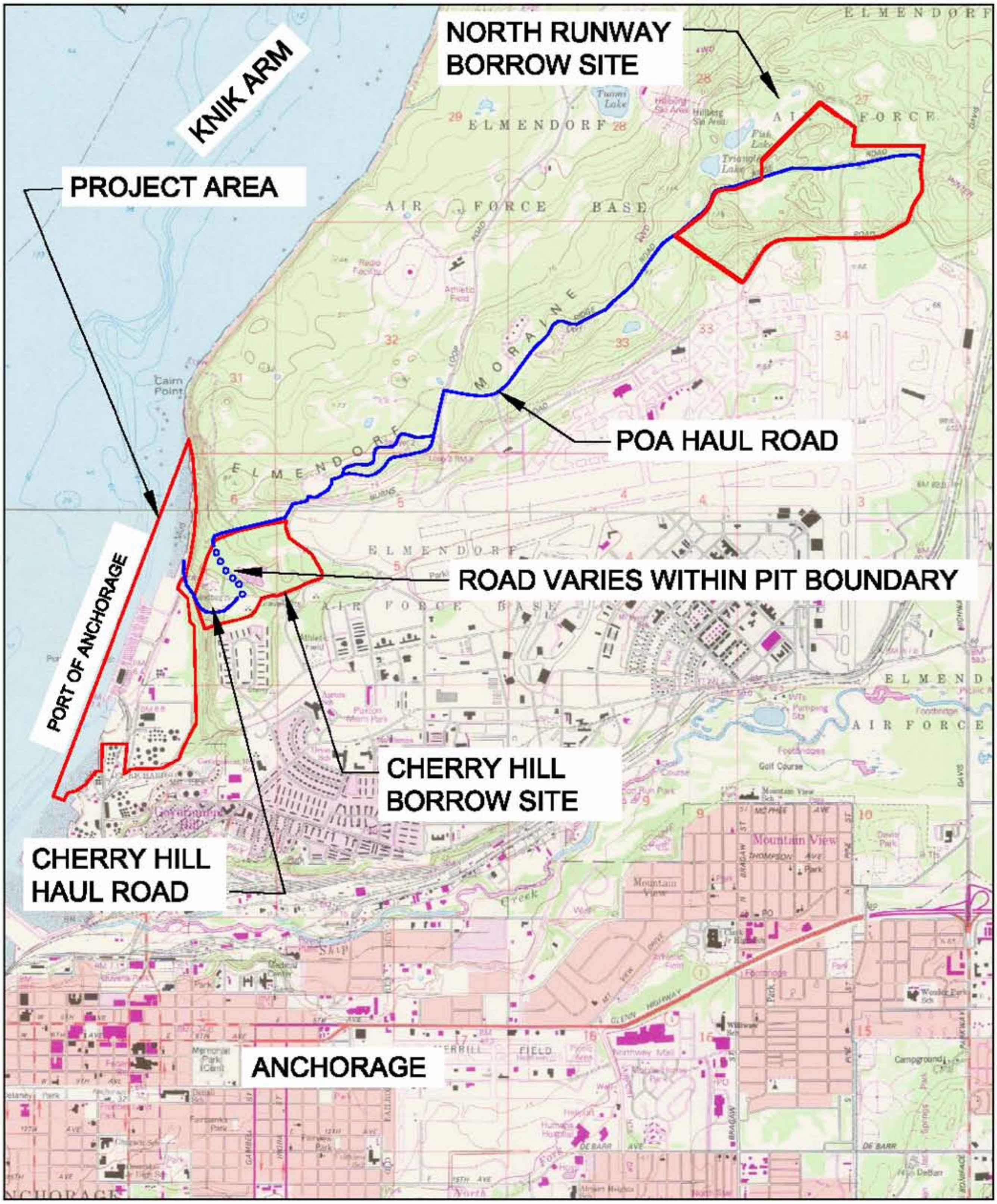
FIGURE 1-1 – PORT OF ANCHORAGE VICINITY MAP



PORT OF ANCHORAGE

PROJECT AREA MAP

FIGURE 1-2

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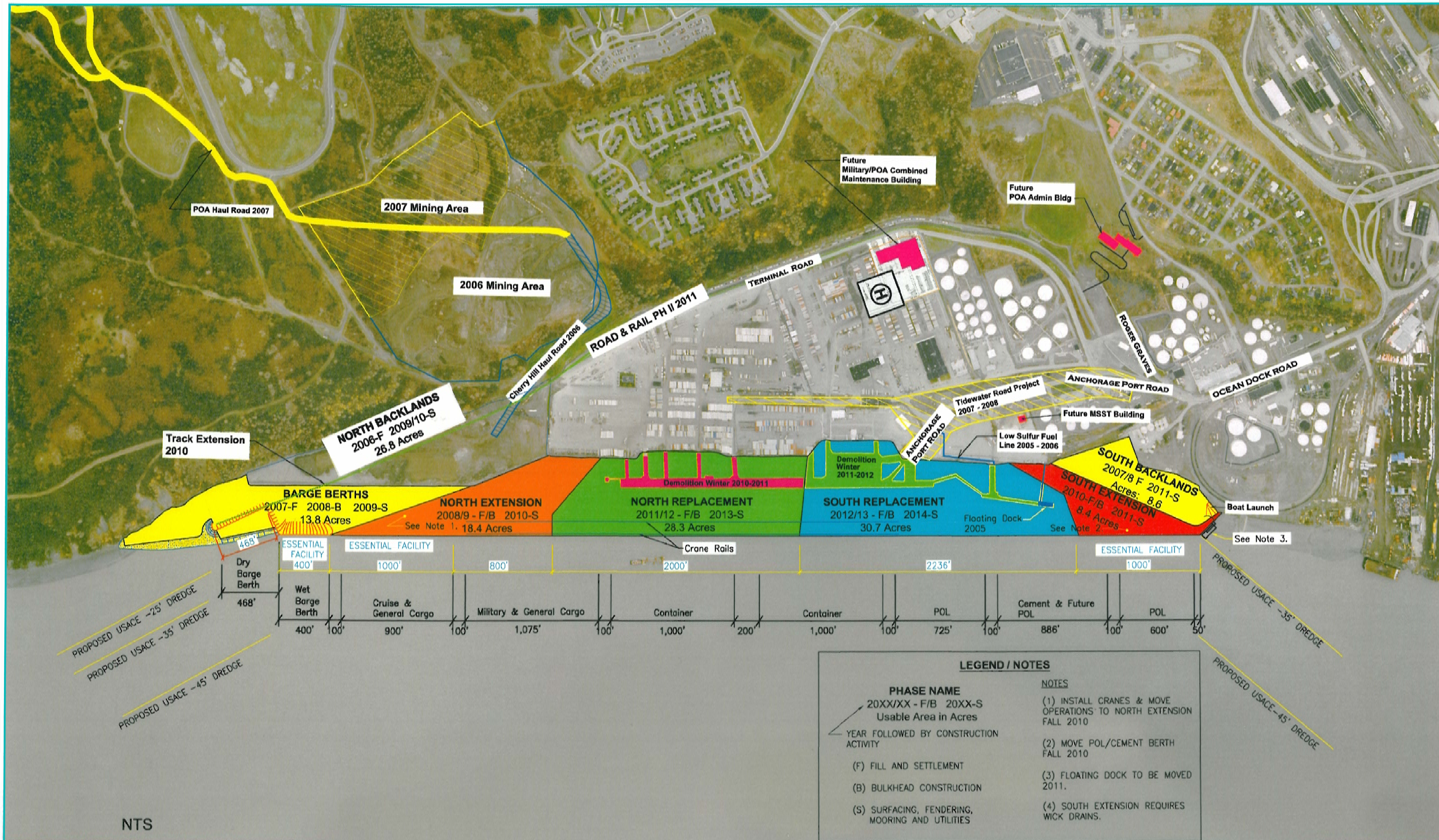
Port of Anchorage Intermodal Expansion Project

BEFORE AND AFTER FINAL PROJECT

Figure 1-3

Sheet 1 of 1

11-13-08



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Port of Anchorage Intermodal Expansion Project

PHASING PLAN

FIGURE 1-4

SHEET: 1 OF 1

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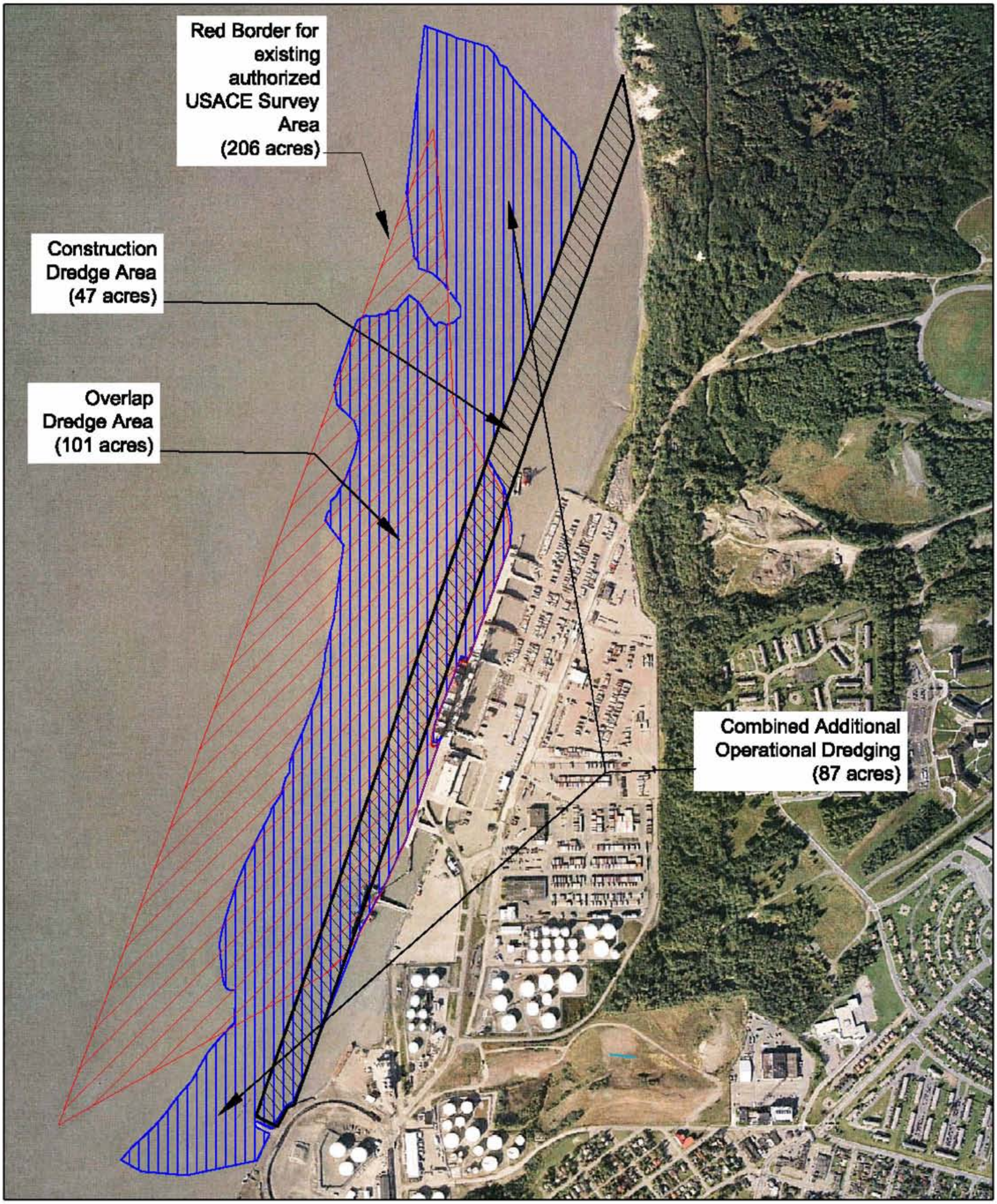
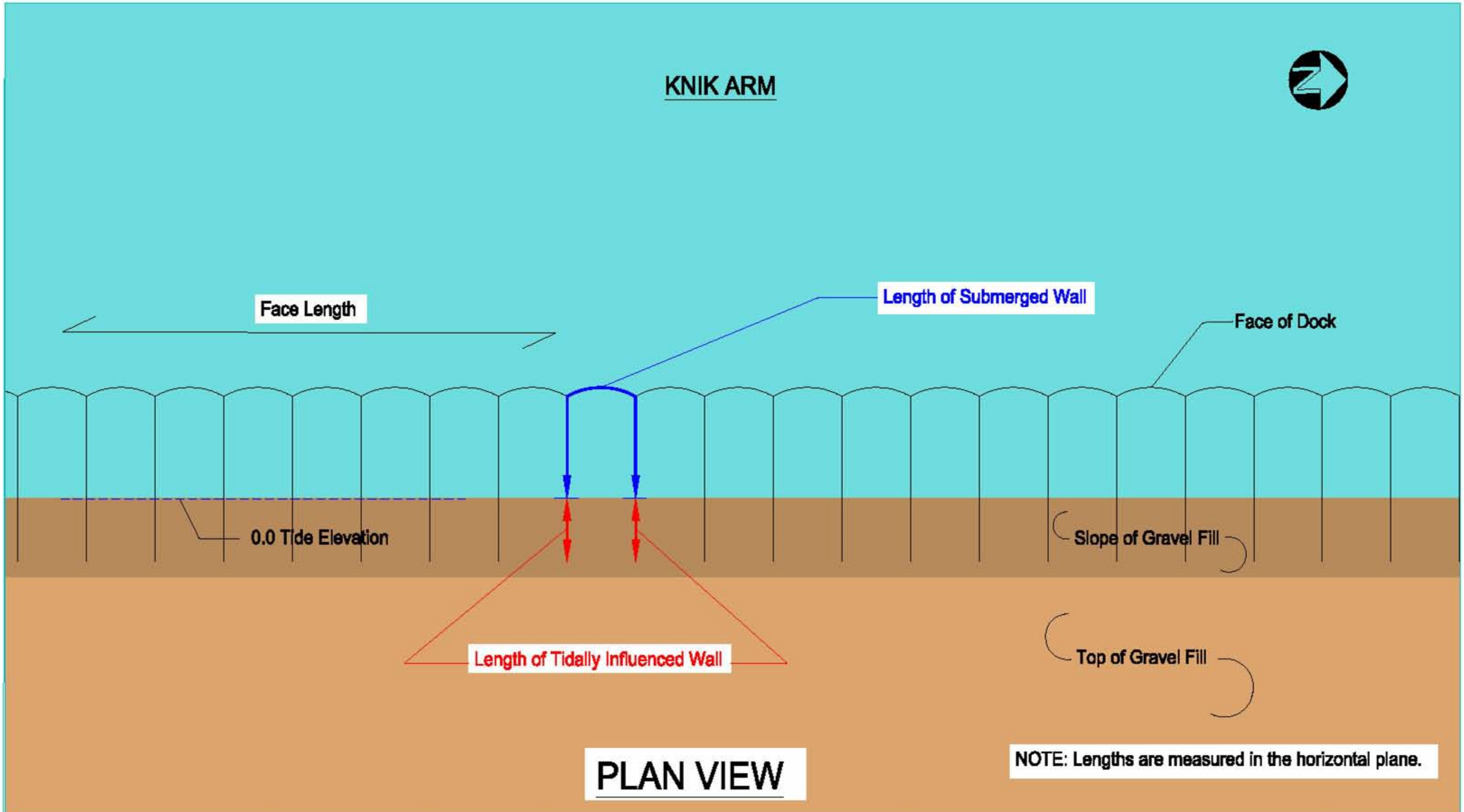


PORT OF ANCHORAGE

USACE & PORT DREDGE AREAS

FIGURE 1-5



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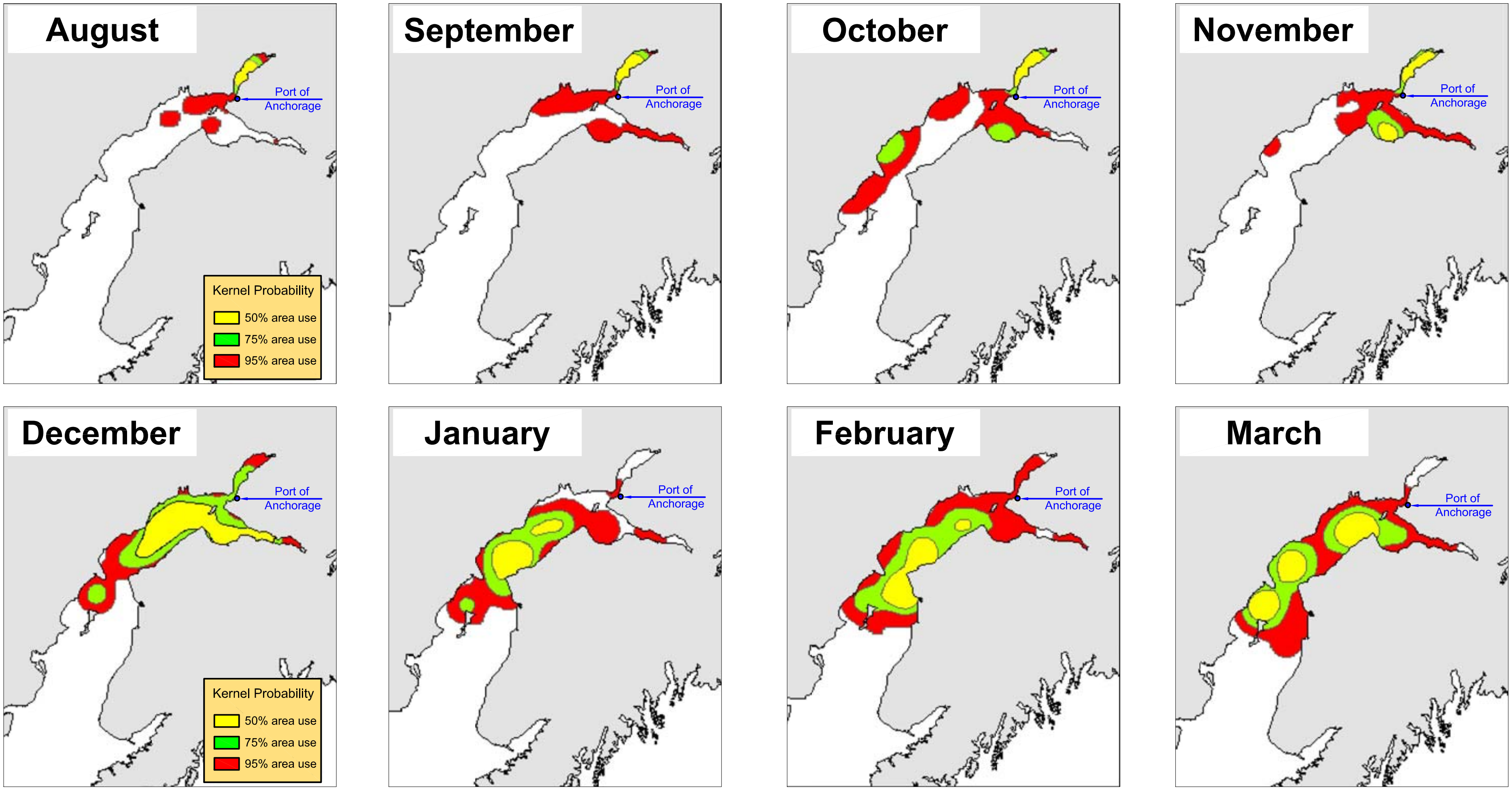
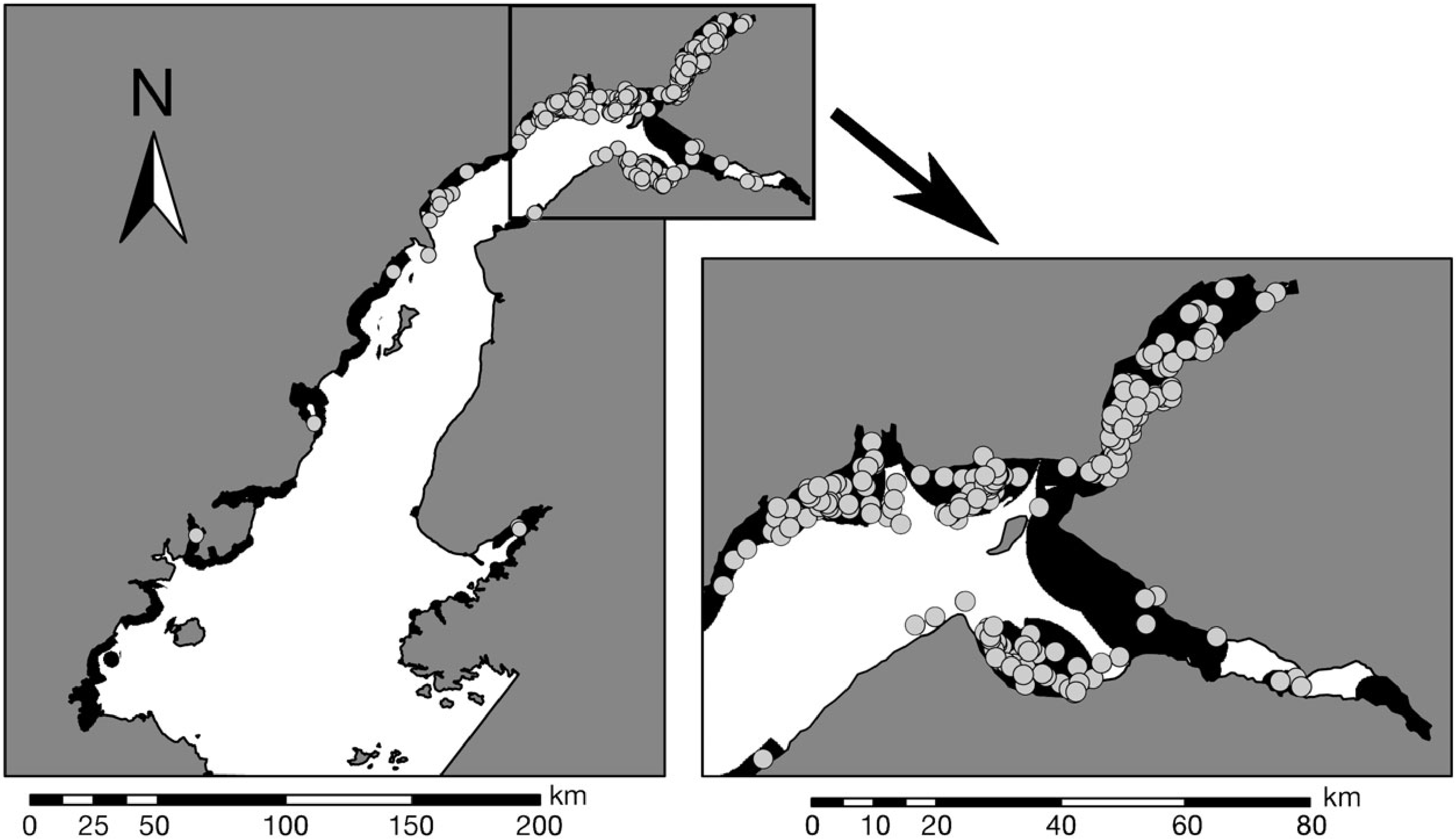
Port of Anchorage Intermodal Expansion Project
Location of Submerged & Tidally Influenced Walls
FIGURE 2 - 1

Sheet 1 of 1
11-12-08



Predicted beluga distribution by month based upon known locations of 14 satellite tagged belugas (predictions derived via kernel probability estimates; Hobbs et al. 2005). Note the large increase in total area use and offshore locations beginning in December and continuing through March. The red area (95 percent probability) encompasses the green (75 percent) and yellow (50 percent) regions (Conservation Plan for Cook Inlet Beluga Whale, NMFS, October 2008).

Anchorage Port Expansion Team / PORT OF ANCHORAGE We've got the goods. / ICRC 421 West First Avenue, Suite 200 Anchorage, Alaska 99501 (907) 561-4272 www.icrcsolutions.com	Port of Anchorage Intermodal Expansion Project **BELUGA WHALE DISTRIBUTION BY MONTH** **Figure 4-1**	Sheet 1 of 1 11-13-08



Cook Inlet beluga whale habitat use (black) as predicted by the Classification and Regression Tree model with beluga sightings from summer aerial surveys (1993-2004) shown as dots (Goetz et al. 2007).

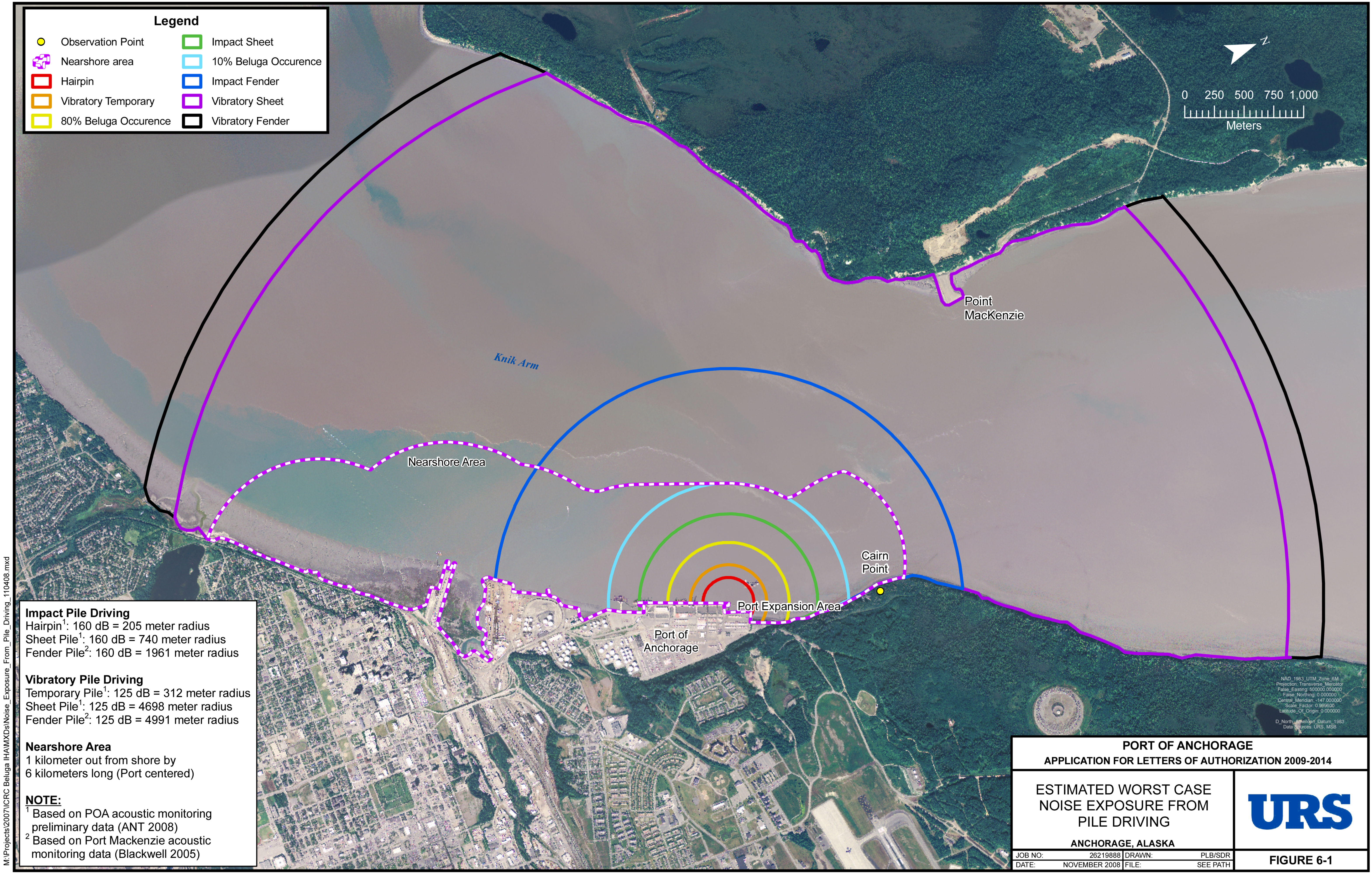
PORT OF ANCHORAGE
APPLICATION FOR LETTERS OF AUTHORIZATION 2009-2014

BELUGA WHALE HABITAT USE

ANCHORAGE, ALASKA

URS

JOB NO: 26219888	DRAWN: PLB	**FIGURE 4-2**
DATE: SEPT 2008	FILE: SEE PATH	


Legend
Observation Point
Nearshore area
Hairpin
Vibratory Temporary
80% Beluga Occurence
Impact Sheet
10% Beluga Occurence
Impact Fender
Vibratory Sheet
Vibratory Fender
N
0 250 500 750 1,000
Meters
Point MacKenzie
Knik Arm
Nearshore Area
Cairn Point
Port Expansion Area
Port of Anchorage
Impact Pile Driving
Hairpin[1]: 160 dB = 205 meter radius
Sheet Pile[1]: 160 dB = 740 meter radius
Fender Pile[2]: 160 dB = 1961 meter radius
Vibratory Pile Driving
Temporary Pile[1]: 125 dB = 312 meter radius
Sheet Pile[1]: 125 dB = 4698 meter radius
Fender Pile[2]: 125 dB = 4991 meter radius
Nearshore Area
1 kilometer out from shore by
6 kilometers long (Port centered)
NOTE:
[1] Based on POA acoustic monitoring preliminary data (ANT 2008)
[2] Based on Port Mackenzie acoustic monitoring data (Blackwell 2005)
NAD_1983_UTM_Zone_6M
Projection: Transverse_Mercator
False_Easting: 500000.000000
False_Northing: 0.000000
Central_Meridian: -147.000000
Scale_Factor: 0.999600
Latitude_Of_Origin: 0.000000
D_North_American_Datum_1983
Data Sources: URS, MSB
PORT OF ANCHORAGE
APPLICATION FOR LETTERS OF AUTHORIZATION 2009-2014
ESTIMATED WORST CASE NOISE EXPOSURE FROM PILE DRIVING
ANCHORAGE, ALASKA
URS
JOB NO: 26219888
DRAWN: PLB/SDR
DATE: NOVEMBER 2008
FILE: SEE PATH
FIGURE 6-1
M:\Projects\2007\CRC Beluga IHA\MXDs\Noise_Exposure_From_Pile_Driving_110408.mxd

APPENDIX A
Photo Log

Photo 1. Haul road construction in 2006.

Photo 2. 100-ton haul unit on the completed haul road on Elmendorf Air Force Base.

Photo 3. Completed haul road on Elmendorf Air Force Base.

Photo 4. North Backlands at the end of the 2006 construction season. Looking south from Cairn Point observation station.

Photo 5. South Backlands in 2008, fill work in progress.

Photo 6. Armor rock north of active docking areas, protects fill from erosion and provides fish habitat. Looking south from northern limit of the Project.

Photo 7. Barge Berth and North Backlands area at the end of the 2007 construction season. Looking south from the Cairn Point observation platform.

Photo 8. Hydraulic dipper dredge performing construction dredging for the North Extension.

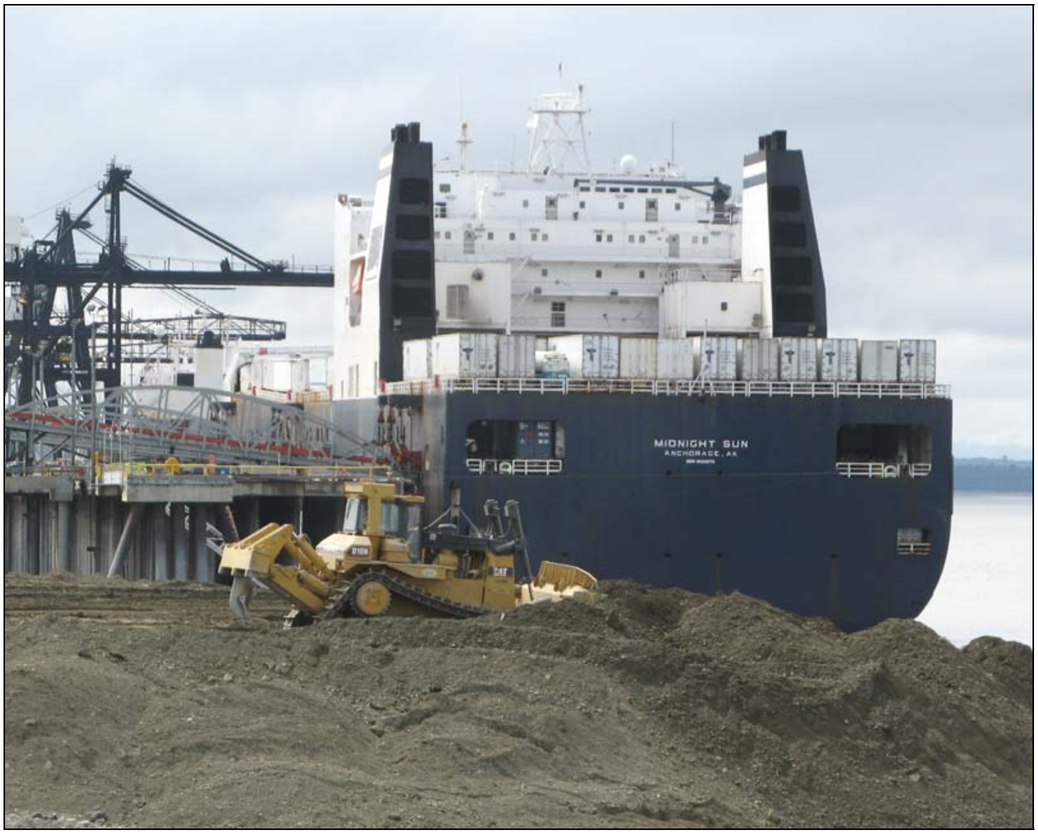


Photo 9. Caterpillar D-10 bulldozer pushing fill into place at the water front.

Photo 10. Fill material being placed.

Photo 11. Example of open cell sheet pile dock and fendering systems.

Photo 12. Flint Hills sheet pile wall looking along South Backlands dike to “tie in” point.

Photo 13. Flint Hills sheet pile wall looking south from the South Backlands.

Photo 14. Flint Hills sheet pile wall looking west along the South Backlands.

Photo 15. Temporary pile and template.

Photo 16. Walkway and template.

Photo 17. Crane picking up sheet pile.

Photo 18. Placing the sheet pile.

Photo 19. Close up of sheet pile being threaded.

Photo 20. Wye connector.

Photo 21. Interlocked sheet pile knuckle joint.

Photo 22. Hairpin weight used to set the sheet pile.

Photo 23. Temporary welds hold sheet piles to template.

Photo 24. Template with a full set of sheet pile. Template curvature matches design curvature of cell face.

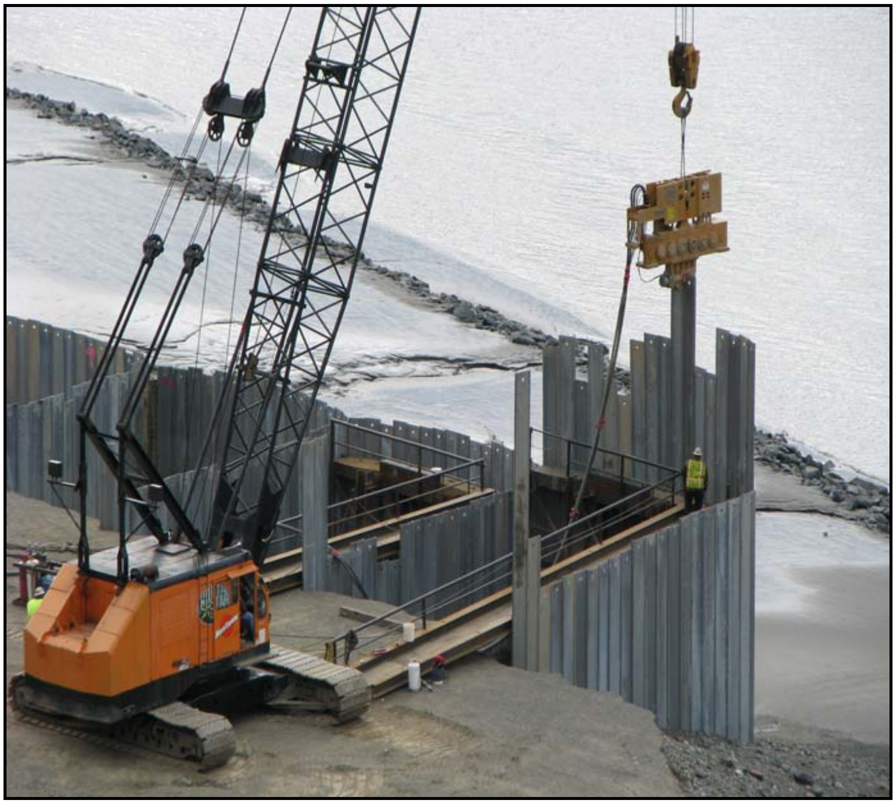


Photo 25. Vibratory hammer driving the sheet pile.

Photo 26. Impact hammer driving the sheet pile.

Photo 27. Tail walls.

Photo 28. Template and temporary piles are moved to begin the next cell.

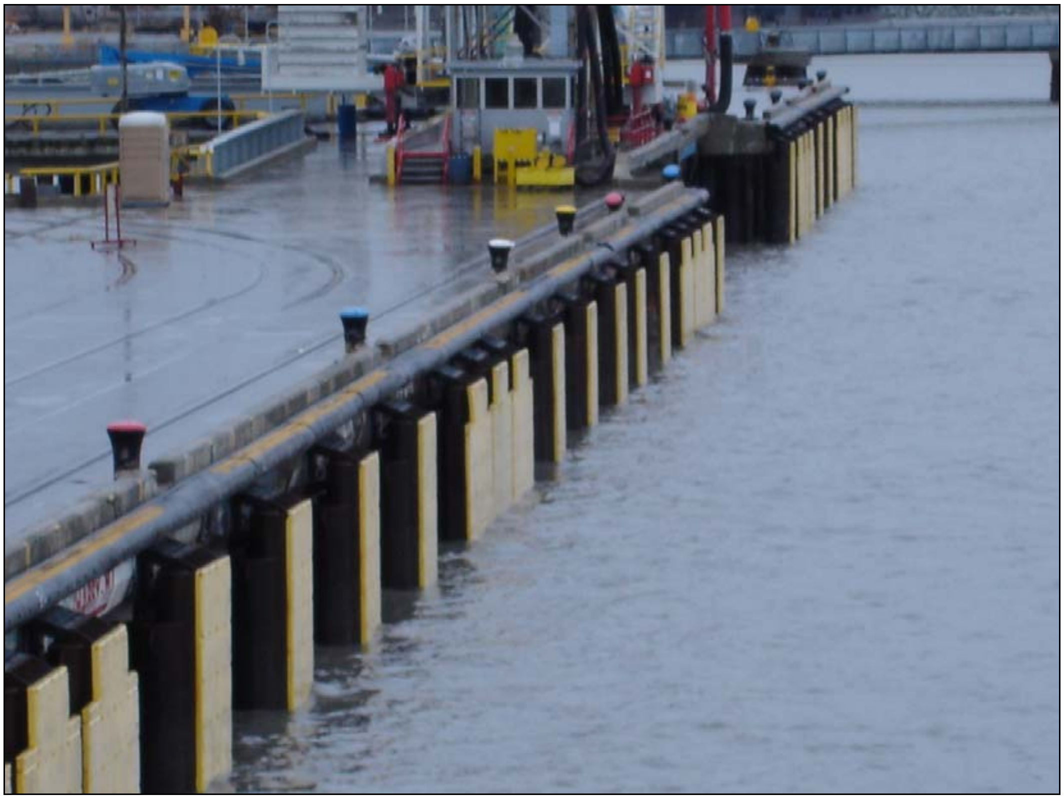


Photo 29. Existing fender system at the Port of Anchorage. New fenders will be similar.

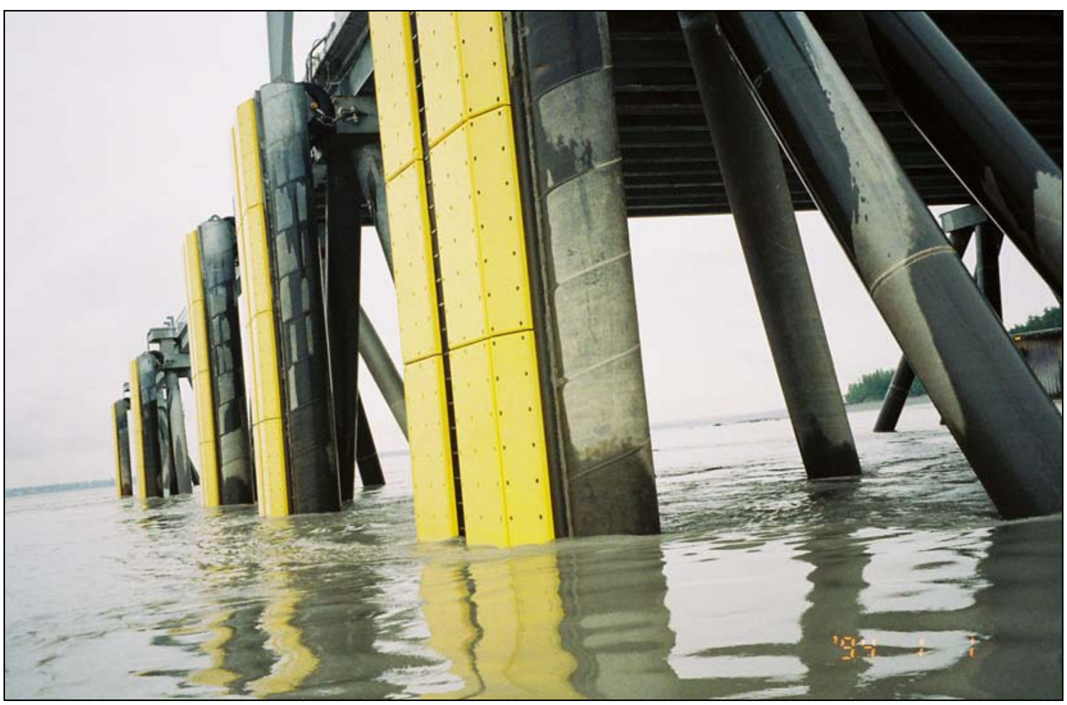


Photo 30. Fendering system at Port MacKenzie.

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APPENDIX B
USACE Section 404/10 Permit POA-2003-502-N

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DEPARTMENT OF THE ARMY PERMIT

Permittee: Port of Anchorage

Permit No.: POA-2003-502-N

Issuing Office: U.S. Army Engineer District, Alaska

NOTE: The term "you" and its derivatives, as used in this permit, means the permittee or any future transferee. The term "this office" refers to the appropriate district or division office of the Corps of Engineers having jurisdiction over the permitted activity or the appropriate official of that office acting under the authority of the commanding officer.

You are authorized to perform work in accordance with the terms and conditions specified below.

Project Description:

This permit authorizes work necessary for the construction of the Marine Terminal Redevelopment (Port Expansion) Project to expand, reorganize and improve the existing facilities at the Port of Anchorage to replace functionally obsolete structures; increase POA capacity, efficiency, and security; and accommodate the needs of the U.S. military for rapid deployment. The project involves the construction of a new open cell sheet pile (OCSP) dock in the tidelands west, northwest, and southwest of the existing dock. This permit authorizes the following work:

1. The discharge of fill material over 20.5 acres of wetlands associated with the development of the Cherry Hill and North End Runway borrow pits;

2. The dredging of approximately 258,000 cubic yards of sediment over approximately 21 acres necessary for the construction of the expanded dock and the discharge of the material at the existing Port of Anchorage maintenance dredging disposal site;

3. The discharge of approximately 9,663,420 cubic yards of clean fill material over 111 acres of intertidal and nearshore subtidal waters of Knik Arm necessary for the construction of the expanded dock.

All work will be performed in accordance with the attached plan, 9 sheets, dated July 2007.

Project Location:
The Port of Anchorage is located in the Knik Arm of Upper Cook Inlet, within section 31, T. 14 N., R. 3 W.; and sections 6 & 7, T. 13 N., R. 3 W; Seward Meridian; Latitude 61° 15' N., Longitude 149° 52' W.; in Anchorage, Alaska. The gravel extraction sites are located within sections 5 & 6, T. 13 N., R. 3 W.; and within sections 27, 28, 33, and 34, T. 14 N., R. 3 W.; Seward Meridian; on Elmendorf Air Force Base, northeast of the Port of Anchorage. Construction dredge material will be disposed at the designated maintenance dredging disposal area, located approximately 3,000 feet west of the existing dock.

Permit Conditions:

General Conditions:

1. The time limit for completing the work authorized ends on **August 31, 2014**. If you find that you need more time to complete the authorized activity, submit your request for a time extension to this office for consideration at least one month before the above date is reached.

2. You must maintain the activity authorized by this permit in conformance with the terms and conditions of this permit. You are not relieved of this requirement if you abandon the permitted activity, although you may make a good faith transfer to a third party in compliance with General Condition 4 below. Should you wish to cease to maintain the authorized activity or should you desire to abandon it without a good

faith transfer, you must obtain a modification of this permit from this office, which may require restoration of the area.

3. If you discover any previously unknown historic or archeological remains while accomplishing the activity authorized by this permit, you must immediately notify this office of what you have found. We will initiate the Federal and State coordination required to determine if the remains warrant a recovery effort or if the site is eligible for listing in the National Register of Historic Places.

4. If you sell the property associated with this permit, you must obtain the signature of the new owner in the space provided and forward a copy of the permit to this office to validate the transfer of this authorization.

5. If a conditioned water quality certification has been issued for your project, you must comply with the conditions specified in the certification as special conditions to this permit. For your convenience, a copy of the certification is attached if it contains such conditions.

6. You must allow representatives from this office to inspect the authorized activity at any time deemed necessary to ensure that it is being or has been accomplished in accordance with the terms and conditions of your permit.

Special Conditions:

I. Navigation:

The following conditions are to preserve free navigation, prevent navigational hazards, and to protect the interests of the United States in existing and future federal projects [(33 CFR Part 320.4(o)(3)].

1. Your use of the permitted activity must not interfere with the public's right to free navigation on all navigable waters of the United States.

2. You must install and maintain, at your expense, any safety lights and signals prescribed by the United States Coast Guard (USCG), through regulations or otherwise, on your authorized facilities. The USCG may be reached at the following address and telephone number: Commander (DPW), 17th Coast Guard District, P.O. Box 25517, Juneau, Alaska 99802; (907) 463-2269.

3. The permittee understands and agrees that, if future operations by the United States require the removal, relocation, or other alteration, of the structure or work herein authorized, or if, in the opinion of the Secretary of the Army or his authorized representative, said structure or work shall cause unreasonable obstruction to the free navigation of the navigable waters, the permittee will be required, upon due notice from the Corps of Engineers, to remove, relocate, or alter the structural work or obstructions caused thereby, without expense to the United States. No claim shall be made against the United States on account of any such removal or alteration.

4. Appropriate and practicable mitigation measures shall be employed as needed to minimize adverse affects to federal dredging operations, adjacent properties, and/or flow patterns of waters of the U.S. from temporary changes in sedimentation patterns during the construction phases of the project. The Port of Anchorage shall cooperate with adjacent industrial businesses (e.g., barge terminals) to ensure that all appropriate and practicable mitigation measures are implemented during construction to both minimize and compensate for adverse affects to their operations.

II. Cultural Resources

The following two conditions are to ensure compliance with Section 106 of the National Historic Preservation Act and at the request of the applicant.

1. Procedures for managing inadvertent discoveries of cultural resources or skeletal remains shall be employed as described in the Cultural Resources Monitoring Plan for Cherry Hill and North End Material Extraction report (Anchorage Port Expansion Team, April 2006, or approved revisions).

2. Prior to ground disturbing activities, POA shall photograph and document site conditions of and around the trees of interest identified by representatives of the Native Village of Eklutna (Anchorage

Port Expansion Team, Cultural Resources Survey: Port of Anchorage Haul Road, Appendix D; October, 2006.).

III. Borrow Pits:

The following condition is to prevent and minimize impacts to nesting migratory birds. Under the Migratory Bird Treaty Act (MBTA) (16 U.S.C. 703), it is illegal to "take" migratory birds, their eggs, feathers or nests.

1. To prevent impacts to nesting migratory birds, no vegetation clearing, fill placement, excavation, stockpiling, grading or other disturbing construction activities at the material extraction sites shall be conducted between 1 May and 15 July, except at sites that have been sufficiently disturbed or altered to the extent that suitable nesting habitat has been eliminated (e.g., covered or otherwise removed) prior to 1 May. If disturbing construction activities in areas containing potential nesting habitat are proposed after 1 May, the Port of Anchorage shall submit a plan to the Corps that demonstrates how compliance with the MBTA will be ensured. This plan must be coordinated with the USFWS and approved by the Corps prior to commencement of work that would potentially affect nesting habitat between 1 May and 15 July.

The following two conditions are necessary to prevent and minimize impacts to wetlands and aquatic organisms

2. The POA will establish a buffer between ground disturbing activities at the gravel extraction sites and adjacent wetland areas as necessary to prevent hydrological disturbances from development activities. Additionally, a buffer area shall be established around the Triangle/Fish Lake wetland complex and delineated onsite with silt fencing and signage and verified as adequate by the Corps prior to commencing extraction activities within 600 feet of the wetland complex. The extent and/or distance of the buffer boundaries shall be determined onsite based on vegetation, topography and hydrology as necessary to prevent an adverse disturbance to the wetland complex. The POA shall install and monitor a series of groundwater wells or piezometers in the western portion of the North End Borrow Pit to assure that gravel mining activities do not adversely affect adjacent wetland hydrology.

3. POA shall, to the extent practicable, limit disturbances to wetlands and open water areas where wood frogs are present to periods of time other than those known for breeding and tadpole growth (1 April to 15 July).

IV. Beluga Whales:

The following conditions are to prevent and minimize adverse impacts to marine mammals and to ensure compliance with the Marine Mammal Protection Act.

1. The POA has submitted petitions for an Incidental Harassment Authorization (IHA) for the 2007 construction season and a Letter of Authorization (LOA) for construction seasons 2008-2012 (Anchorage Port Expansion Team, Final Petition; January 2007) for Small Take Authorizations from the NOAA/NMFS under the Marine Mammal Protection Act (MMPA) for the incidental and unintentional taking of marine mammals. The conditions of the IHA and LOA Small Take Authorizations under the MMPA will be carried as special conditions of this DA permit unless otherwise noted by the Corps. The POA shall comply with the interim mitigation measures listed below to minimize project related adverse impacts to beluga whales. Upon receipt of the IHA and/or LOA MMPA authorizations, the Corps will reevaluate the terms or conditions of this permit and modify any conflicting conditions, if necessary.

   A. The POA shall measure and evaluate construction and operationally generated noise introduced in Knik Arm at the Port of Anchorage. The applicant shall develop a 'Sound Index' to accurately represent noise levels associated with Port of Anchorage operations and construction activities, which must specifically include noise levels generated from pile driving, dockside activities, vessel traffic in the channel, dredging, and docking activities. The evaluation shall characterize current baseline operational noise levels at the Port of Anchorage and develop an engineering report that identifies structural and/operational noise reduction measures, if necessary, to minimize the baseline operational noise levels at the expanded port to the maximum extent practicable. The final report will be provided to the NMFS two years prior to construction completion.

The Port of Anchorage Sound Index will be collaborated with the concurrent beluga whale monitoring program to correlate construction and operationally generated noise exposures with beluga whale presence, absence, and any altered behavior observed during construction and operations (i.e., a dose-response analysis). An annual review of beluga observations and noise exposure data shall be provided to NMFS no later than 1 Feb annually. The annual review shall also identify relevant technological advances in sound attenuation. The POA shall employ practicable noise minimization measures identified in the annual reports in subsequent POA construction activities.

B. In collaboration with the NMFS, the Port of Anchorage shall continue to develop and maintain a beluga monitoring program to estimate the frequency at which beluga whales are present in the project footprint; characterize habitat use and behavior of belugas near the Port during ice free months; map sound levels and distance attenuation related to POA background noise and expansion activity; and to characterize and assess the impacts of received noise from the POA on beluga whale behavior and movements. POA shall consult with NMFS to develop the program and shall include the following:

   a. Include visual observations (shore-based and opportunistic vessel observations) to monitor beluga movements, timing, group size, locations, identifiable behaviors and patterns, and use of the area in the vicinity of the Project during operations through the construction period. The POA will also provide one year of post-construction monitoring in continued consultation with NOAA/NMFS.

   b. Include a passive acoustic monitoring plan to correlate with visual observations. The POA shall install hydrophones (or employ other effective methodologies) necessary to detect and localize passing whales and to determine the proportion of belugas missed from visual surveys.

   c. The POA will employ a marine mammal observation team, separate from the construction contractor observer activities, for the duration of all construction activities.

C. The Port of Anchorage shall establish and enforce safety radii and shut down standards around the in-water pile driving areas. Initially, the safety radii requiring shut down shall be for any whale observed within 650 meters of pile driving. The Port of Anchorage shall conduct on-site underwater noise surveys to verify the 190, 180 and 160 dB re 1 μPa rms isopleths from in-water pile driving activities for the POA expansion. Safety zones appropriate to the POA site conditions and equipment will then be empirically determined and implemented. The 160 dB re 1 μPa rms safety zone should be in force unless the POA obtains authorization under the section 101 (a) of the Marine Mammal Protection Act for the incidental and unintentional taking of marine mammals; in which case the safety zones should be those provided within the authorization. The safety zone around pile driving areas shall be monitored for the presence of marine mammals before, during, and after any pile driving activity. If the safety radius is obscured by fog or poor lighting conditions, pile driving will cease until the entire safety radius is visible.

D. Prior to the start of seasonal pile driving activities, the POA will require construction supervisors and crews, the marine-mammal monitoring team, the acoustical monitoring team, and all project managers to attend a briefing. The purpose of the briefing will be to establish the responsibilities of each party, define the chains of command, discuss communication procedures, provide an overview of monitoring purposes, and review operational procedures.

E. The Port of Anchorage shall formally notify the NMFS prior to the seasonal commencement of pile driving and provide weekly monitoring reports. A summary monitoring report will be submitted at the end of annual construction activities and a final report will be submitted at the end of the one year post construction monitoring season.

F. The POA will establish daily "soft start" or "ramp up" procedures for pile-driving activities. The soft start technique will be used at the beginning of each piling installation to allow any marine mammal that may be in the area to leave before pile driving activities reach full energy. The soft start procedure will require contractors to initiate noise from vibratory hammers for 15 seconds at reduced energy followed by a 1-minute waiting period. This procedure will be repeated two additional times. If an impact hammer is used, contractors will be required to provide an initial start of 3 strikes at 40-percent energy, followed by a 1-minute waiting period, then two subsequent 3-strike sets. If marine mammals are sighted within the safety zone prior to pile driving or during the soft start, the contractor will delay pile-driving continuation until the mammal has moved outside the safety zone. Pile installation will resume only after a qualified observer confirms that the marine mammal has moved outside the safety zone or after 15 minutes have elapsed since the marine mammal was last sighted.

G. The POA will erect whale-notification signage in the waterfront viewing areas near the Ship Creek Public Boat Launch and within the secured Port entrance that is visible to all Port users. This signage will provide information on the beluga whale and notification procedures for reporting beluga whale sightings to the NMFS. The POA will consult with the NMFS to establish the signage criteria.

H. During in-water construction activities, the POA shall ensure that construction contractors delegate supervisory responsibility to include on-site construction personnel to observe, record, and report marine mammal sightings and response actions taken, to include shut down or delay.

I. The POA shall establish a long-term, formalized marine-mammal sighting and notification procedure for all Port users, visitors, tenants, or contractors prior to and after construction activities. The notification procedure shall clearly identify roles and responsibilities for reporting all marine mammal sightings. The POA will forward documentation of all reported marine mammal sightings to the NMFS.

2. In-water impact pile-driving, excluding work when the entire pile is out of the water due to shoreline elevation or tidal stage, shall not occur within two hours of either side of each low tide.

V. Fish

The following conditions are necessary to minimize impacts to anadromous fish populations.

1. The Port of Anchorage shall either avoid pile driving activities between 15 May and 15 August or conduct an on-site fish study to analyze the impacts of vibratory and impact hammer sheet pile driving activities on salmonids at various distances and measured sound pressure levels. The study plan shall be developed in consultation with local representatives of the U.S. Fish and Wildlife Service, the National Marine Fisheries Service, the Environmental Protection Agency, and approved by the Corps. The study plan should include a live cage fish study and hydroacoustic monitoring to assess the impacts of pile driving on the health and behavior of fish groups and individuals. The study plan shall be completed by 1 January 2008 and initiated in the 2008 construction season. The results shall be analyzed following the completion of the 2008 construction season and coordinated with the Corps and the aforementioned resource agencies. Based on the results of the study, this condition may be modified and/or supplemented to minimize adverse impacts to salmonids (including timing restrictions).

2. No in water fill placement or pile driving activities shall occur within a one week period following smolt releases from the Ship Creek Hatchery. The Port shall coordinate with hatchery staff to ensure compliance with this condition.

3. In-water sheet piles shall be driven with a vibratory hammer to the maximum extent possible (i.e., until desired depth is achieved and/or to refusal, prior to using an impact hammer).

4. The final design shall, wherever possible, incorporate end-of-phase construction joints that provide potential refuge habitat areas for salmonids in the non-structural voids. Although the spacing, size, and configuration of these structural joints will be dictated by stability and construction requirements, void spaces within these joints shall be developed to maximize the potential salmonid refuge value of the space. The design of the refuge area within the void space shall be approved by the Corps, in consultation with other federal resource agencies. The refuge area shall be monitored by the Port of Anchorage between 15 May and 15 August for a minimum of 2 years following construction to determine the extent and nature of use by salmonids. Based on the monitoring observations, this condition may be modified to improve the functional value of refuge areas if necessary.

VI. Design Coordination:
The following three conditions are to prevent and minimize adverse impacts to public safety and security and to protect the interests of the United States in existing and future federal projects:

1. A final analysis of the global and internal structural stability of the open cell sheet pile structure under static and seismic conditions shall be submitted to the Corps of Engineers a minimum of two months prior to sheetpile installation activities of 2008. The analysis shall state the assumptions made, data used, computational analyses performed, modeling input criteria used and output results generated (where modeling is applicable) that led to the final analysis. Additionally, to the maximum extent practicable, the final analysis shall, at minimum, include the following:

   a. Test the borrow source(s) to confirm the stability model input and determine the densification requirements. Provide your Quality Assurance Plan and the acceptance criteria for validating the densification of the backfill.

   b. For each soil profile, run static stability models with six feet of over dredge below the design project depth and at a water elevation of -5 ft. MLLW.

   c. Submit a plan that describes the proposed piezometer placements and all other instrumentation to be used to confirm how consolidation (and associated strength gain) is expected to occur, and to what degree. Additionally, the POA will submit annual reports of actual findings.

   d. Conduct a parametric sensitivity analysis, investigating strength, modulus, and geometry, with the model for seismic loading to determine if the model is sensitive to small changes in input parameters. The study shall further evaluate possible failure modes, to include toe heave.

   e. Define the target Factor of Safety for internal stability and model each construction phase area. All engineering parameters and design calculations for internal stability evaluation shall be included in the design analysis.

   f. Further evaluate earthquake loading by considering a minimum of five accelograms, with no more than two being synthetic, and refined target design response spectra criteria in the analysis. Specifically, develop design target spectra based on deterministic spectra for MCE scenario earthquakes from the Castle Mountain fault and Megathrust sources using M_{max} and closest distance parameters. Use a suite of ground motion attenuation models that are appropriate for the region and source. Combine this suite of models either by a weighting or enveloping procedure to develop final target spectra and match the selected accelograms to the target spectra. Review the latest information on USGS Alaska seismic hazard maps to assist in the selection of parameters and ground motion attenuation models. The development of the final suite of design ground motions shall be conducted by a professional engineering seismologist experienced with current practice for developing design ground motions for critical facilities.

   g. In light of the large strains predicted during an MCE, include laboratory residual shear strength tests in your analysis to investigate potential material responses.

   h. Develop compatible designs for adjacent cells with different seismic performance objectives.

2. The POA shall submit Open Cell Sheetpile design modifications to the Corps for review.

3. The POA shall submit as-built drawings of the OCSP structures, approved and stamped by the Engineer-of-Record, following completion of construction phases and the overall structure.

VII. Fill Material:
The following conditions are required to minimize adverse impacts of the discharge on special aquatic sites and other waters outside of the project area [33 CFR 320.4 (r), 40 CFR230.5 (j) and 40CFR 230 Subpart H, including parts 230.71, 230.72, 230.73, 230.75]]

1. Fill material shall consist of clean fill, free of unsuitable material (e.g., trash, debris, asphalt, etc.), and free of toxic pollutants.

2. All fill material shall be stabilized as necessary to prevent erosion and encroachment of fill material outside the authorized footprint before, during, and after construction. No fill or construction materials shall be stockpiled on adjacent mudflats outside of the authorized project boundary.

VIII. Compensatory Mitigation:
The following conditions are required to compensate for resource losses important to the human and aquatic environment. (33 CFR 320.4(r) and 40 CFR Parts 230.41 and 230.42)]

1. The Port of Anchorage shall provide funding equivalent to the monetary value of the debits of the authorized project impacts, as determined by the Anchorage Debit Credit Methodology, in accordance to the attached Memorandum of Agreement (MOA) concerning compensatory mitigation for the overall project. Compensatory mitigation funds from the account will be allocated primarily for construction related costs of selected mitigation projects, as specified in the MOA. In addition to the funding requirements, the Port of Anchorage shall provide for the project management actions necessary to obtain any applicable permits and/or authorizations, the preparation of necessary engineered designs, and monitoring of all selected mitigation projects as necessary.

2. In addition to the mitigation requirements specified above, the Port of Anchorage shall conduct a feasibility study to identify the most practicable and beneficial aquatic habitat restoration, enhancement, creation, and preservation projects available in the Lower Ship Creek watershed and estuary. The projects identified in this study will be used by the Corps, under consultation with a mitigation advisory committee (consisting of federal, state, and local resource agencies and other applicable stakeholders, as appropriate) to determine which project(s) shall be implemented and funded as part of the compensatory mitigation requirements of this permit. The content of the final feasibility study plan shall be approved by the Corps to ensure compliance with this requirement.

Special Information:

Any condition incorporated by reference into this permit by General Condition 5, remains a condition of this permit unless expressly modified or deleted, in writing, by the District Engineer or his authorized representative.

Further Information:

1. Congressional Authorities: You have been authorized to undertake the activity described above pursuant to:

(X) Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 403).

(X) Section 404 of the Clean Water Act (33 U.S.C. 1344).

( ) Section 103 of the Marine Protection, Research, and Sanctuaries Act of 1972 (33 U.S.C. 1413).

2. Limits of this authorization.

a. This permit does not obviate the need to obtain other Federal, State, or local authorization required by law.

b. This permit does not grant any property rights or exclusive privileges.

c. This permit does not authorize any injury to the property or rights of others.

d. This permit does not authorize interference with any existing or proposed Federal project.

3. Limits of Federal Liability. In issuing this permit, the Federal Government does not assume any liability for the following:

a. Damages to the permitted project or uses thereof as a result of other permitted or unpermitted activities or from natural causes.

b. Damages to the permitted project or uses thereof as a result of current or future activities undertaken by or on behalf of the United States in the public interest.

c. Damages to persons, property, or to other permitted or unpermitted activities or structures caused by the activity authorized by this permit.

d. Design or construction deficiencies associated with the permitted work.

e. Damage claims associated with any future modification, suspension, or revocation of this permit.

4. Reliance on Applicant's Data: The determination of this office that issuance of this permit is not contrary to the public interest was made in reliance on the information you provided.

5. Reevaluation of Permit Decision. This office may reevaluate its decision on this permit at any time the circumstances warrant. Circumstances that could require a revaluation include, but are not limited to, the following:

a. You fail to comply with the terms and conditions of this permit.

b. The information provided by you in support of your permit application proves to have been false, incomplete, or inaccurate (See 4 above).

c. Significant new information surfaces which this office did not consider in reaching the original public interest decision.

Such a reevaluation may result in a determination that it is appropriate to use the suspension, modification, and revocation procedures contained in 33 CFR 325.7 or enforcement procedures such as those contained in 33 CFR 326.4 and 326.5. The referenced enforcement procedures provide for the issuance of an administrative order requiring you to comply with the terms and conditions of your permit and for the initiation of legal action where appropriate. You will be required to pay for any corrective measures ordered by this office, and if you fail to comply with such directive, this office may in certain situations (such as those specified in 33 CFR 209.170) accomplish the corrective measures by contract or otherwise and bill you for the cost.

6. Extensions. General Condition 1 establishes a time limit for the completion of the activity authorized by this permit. Unless there are circumstances requiring either a prompt completion of the authorized activity or a reevaluation of the public interest decision, the Corps will normally give favorable consideration to a request for an extension of this time limit.

Your signature below, as permittee, indicates that you accept and agree to comply with the terms and conditions of this permit.

(PERMITTEE) AND TITLE

8-10-07
(DATE)

This permit becomes effective when the Federal official, designated to act for the Secretary of the Army, has signed below.

KEVIN J. WILSON
COLONEL, CORPS OF ENGINEERS
DISTRICT COMMANDER

10 Aug 2007
(DATE)

When the structures or work authorized by this permit are still in existence at the time the property is transferred the terms and conditions of this permit will continue to be binding on the new owner(s) of the property. To validate the transfer of this permit and the associated liabilities associated with compliance with its terms and conditions have the transferee sign and date below.

(TRANSFEREE)

(DATE)

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APPENDIX C
NMFS IHA Permit

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UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Silver Spring, MD 20910

JUL 15 2008

Governor William J. Sheffield
Port Director
Port of Anchorage
2000 Anchorage Port Road
Anchorage, Alaska 99501

Dear Mr. Sheffield:

Enclosed is an Incidental Harassment Authorization (IHA) issued to the Port of Anchorage and U.S. Department Maritime Administration, under the authority of Section 101(a)(5)(D) of the Marine Mammal Protection Act (16 U.S.C. 1361 et seq.). This Authorization allows for incidental take, by Level B harassment only, of Cook Inlet beluga whales (*Delphinapterus leucas*), harbor porpoises (*Phocoena phocoena*), killer whales (*Orcinus orca*), and harbor seals (*Phoca vitulina*), incidental to the Port of Anchorage Marine Terminal Redevelopment Project.

You are required to comply with the conditions contained in the IHA. In addition, you must cooperate with any Federal, state or local agency monitoring the impacts of your activities. Please note the reporting requirements outlined in Condition 6. All reports must be submitted to the NMFS Alaska Regional Office and Office of Protected Resources, Headquarters, before any future requests for an incidental take authorization, under section 101(a)(5), can be processed. The IHA requires monitoring by individuals trained in marine mammal observation during all times in-water pile driving is taking place. Reports, sighting sheets, and methodologies employed during marine mammal monitoring and acoustic surveys must be in the form of those approved by NMFS prior to issuance of this Authorization. All marine mammal observers must complete the NMFS approved sighting forms to the maximum extent practicable.

If you have any questions concerning the IHA or its requirements, please contact Jaclyn Daly or Jolie Harrison, NMFS, Office of Protected Resources, at (301) 713-2289.

Sincerely,

James H. Lecky
Director
Office of Protected Resources

Enclosure

DEPARTMENT OF COMMERCE

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

NATIONAL MARINE FISHERIES SERVICE

Incidental Harassment Authorization

The Port of Anchorage (Port) and the Department of Transportation Maritime Administration (MARAD) are hereby authorized under section 101(a)(5)(D) of the Marine Mammal Protection Act (16 U.S.C. 1371(a)(5)(D)) and 50 CFR 216.107, to harass marine mammals incidental to Port of Anchorage Marine Terminal Redevelopment Project.

1. This Authorization is valid from July 15, 2008, through July 14, 2008.

2. This Authorization is valid only for the Port of Anchorage Marine Terminal Redevelopment Project as described in the IHA application.

3. The holder of this Authorization is restricted to the following number and manner of take:

(a) The taking, by Level B harassment only, is limited to no more than 34 Cook Inlet beluga whales (*Delphinapterus leucas*), 20 harbor porpoises (*Phocoena phocoena*), 20 killer whales (*Orcinus orca*), and 20 harbor seals (*Phoca vitulina*). An animal should be considered taken if it enters the NMFS determined harassment isopleths (i.e., 350m for impact pile driving and 800m for vibratory pile driving).

(b) The taking by injury or death of the species listed in (a), or the taking by Level B harassment, injury or death of any other species of marine mammal, is prohibited and may result in the modification, suspension or revocation of this Authorization.

(c) The taking of any marine mammal in a manner prohibited under this Authorization must be reported immediately to the NMFS Alaska Regional Office at (907) 271-5006, and the Office of Protected Resources (NMFS), Headquarters, at (301) 713-2289.

4. The holder of this Authorization is required to cooperate with NMFS and any other Federal, state or local agency monitoring the impacts of the activity on marine mammals. The holder or designees must notify the Regional Administrator, Alaska, at least 2 weeks prior to the seasonal commencement of in-water pile driving.

5. Mitigation and Monitoring

The holder of this Authorization is required to comply with the following mitigation measures:

(a) Scheduling of construction activities during low use period of beluga whales around the Port

In-water impact pile driving shall not occur two hours either side of low tide meaning two hours before low tide until two hours after low tide. For example, if low tide is at 1pm, impact pile driving will not occur from 11am to 3pm. These tidal restrictions are not applicable to vibratory pile driving.

(b) Establishment of safety zones and shut-down requirements

NMFS acknowledges that shut-down of reduced energy vibratory pile driving during the "stabbing" phase of sheet pile installation may preclude shut-down from occurring due to safety concerns as the sheet pile by break free if it is not installed to a proper depth which could result in a safety and navigational hazard. Therefore, the following shut-down requirements apply to all in-water pile driving activities except those during the "stabbing" phase of the installation process.

(1) Safety Zones

No in-water pile driving (impact or vibratory) shall occur if any marine mammal is located within 200m of the pile hammer in any direction. If any marine mammal is sighted within this 200m safety zone prior to pile-driving, the hammer operator (or other authorized individual) will delay pile-driving until the animal has moved outside the safety zone or the animal is not resighted within 15 minutes.

(2) Shut-Down for Large Groups

To reduce the chance of the Port reaching or exceeding authorized take and to minimize harassment to beluga whales, if a group of more than 5 beluga whales is sighted within the Level B harassment isopleths, in-water pile driving shut down is required.

(3) Shut-down for Beluga Whale Calves

If a beluga whale calf is sighted within or approaching a harassment zone, any type of in-water pile driving shall cease and shall not be resumed until the calf is confirmed to be outside of the harassment zone and on a path away from such zone. If the calf or group with a calf is not re-sighted within 15 minutes, pile driving may resume.

(4) If maximum authorized take is reached or exceeded, any marine mammal entering into the harassment isopleths will trigger mandatory in-water pile driving shut down.

(5) For Port operated in-water heavy machinery work other than pile driving (i.e., dredging, dump scowles, tug boats used to move barges, barge mounted hydraulic excavators, or clamshell equipment used to place or remove material), if a marine mammal comes within 50 m, operations will cease and vessels will slow to a reduced speed while still maintaining control of the vessel and safe working conditions.

(c) "Soft start" and delays to in-water pile driving activities

(1) A "soft start" technique shall be used at the beginning of each day's in-water pile driving activities or if pile driving has ceased for more than one hour to allow any marine mammal that may be in the immediate area to leave before piling driving reaches full energy. The soft start requires contractors to initiate noise from vibratory hammers for 15 seconds at reduced energy followed by 1-minute waiting period. The procedure will be repeated two additional times. If an impact hammer is used, contractors will be required to provide an initial set of three strikes from the impact hammer at 40 percent energy, followed by a one minute waiting period, then two subsequent 3–strike sets.

(2) If marine mammals are sighted within or approaching the safety or harassment zones prior to commencement of pile driving, operations shall be delayed until the animals move outside the zones in order to avoid take exceedence.

(3) Pile driving shall not occur when weather conditions restrict clear, visible detection of all waters within harassment zones. Such conditions that can impair sightability include, but are not limited to, fog and rough sea state.

(d) Public Outreach

(1) The Port of Anchorage shall continue to employ use of a long-term, formalized marine-mammal sighting and notification procedures for all port users, visitors, tenants, or contractors prior to and after construction activities. The notification procedure shall clearly identify roles and responsibilities for reporting all marine mammal sightings. The Port shall forward documentation of all reported marine mammal sightings to the NMFS.

(2) The Port of Anchorage shall continue to post whale-notification signage at the port and in the waterfront viewing areas near the Ship Creek Public Boat Launch and within the secured Port entrance that is visible to all Port users. This signage will provide information on the beluga whale and notification procedures for reporting beluga whale sightings to the NMFS.

(e) Monitoring

(1) Marine Mammal Monitoring

Prior to the start of seasonal pile driving activities, the Port of Anchorage shall require construction supervisors and crews, the marine mammal monitoring team, the acoustical monitoring team, and all project managers to attend a briefing on responsibilities of each party, defining chains of command, discussing communication procedures, providing overview of monitoring purposes, and reviewing operational procedures regarding beluga whales.

Monitoring for marine mammals will take place concurrent with all pile driving activities and 30 minutes prior to pile driving commencement. One to two trained observer(s) will be placed at the Port at the best advantage point(s) practicable to monitor for marine mammals and will implement shut-down/delay procedures when applicable. The observer(s) will have no other construction related tasks while conducting monitoring. Each observer will be properly trained in marine mammal species detection, identification and distance estimation and will be equipped with binoculars. At time of each sighting, the pile hammer operator must be immediately notified that there are beluga whales in the area, their location and direction of travel, and if shut-down is necessary.

In addition, the Port shall employ a marine mammal monitoring team separate from the construction contractor observer activities, for the duration of all construction activities. This monitoring team; however, is not required to be present during all in-water pile driving operations. The Port and separate marine mammal monitoring team shall remain in contact to alert each other to marine mammal presence.

Marine mammal monitoring at the Port shall commence 30 minutes prior to and during all times in-water pile driving is taking place. Marine mammal sightings and all associated information will be logged on NMFS approved data sighting sheets. The following data must be collected during a marine mammal sighting on the NMFS approved marine mammal sighting data sheets:

- Date, time of initial sighting to end of sighting, tidal stage, and weather condition (including Beaufort Sea State);

- Species, number, group composition (i.e., age class), distance to pile driving hammer, and behavior (e.g., group cohesiveness, direction of travel, etc) of animals throughout duration of sighting;

- Any discrete behavioral reactions as well as how close marine mammal(s) approach pile driving hammer;

- The number (by species) of marine mammals that have been taken (i.e., entered the impact (350m) or vibratory (800m) harassment zones) or enter the 200 m shut down zone; and

- Pile driving activities occurring at the time of sighting and if and why shut down was or was not implemented.

(2) Acoustic Monitoring

(a) The Port shall carry out a one-time acoustic monitoring study upon commencement of in-water pile driving. The study will confirm or identify harassment isopleths for all types of piles used, including open-cell sheet piles and 36-inch steel piles, and the "stabbing" process. The acoustic study proposal shall be approved by NMFS prior to the start of seasonal in-water pile driving.

(b) The Port will also install hydrophones (or employ other effective methodologies) necessary to detect and localize, to the maximum extent practicable, passing whales and to determine the proportion of beluga whales missed from visual surveys. This study shall characterize sound levels around the Port related to and in absence of all construction activities.

6. Reporting

The holder of this authorization is required to submit a series of acoustic and marine mammal monitoring reports to the Office of Protected Resources and the Alaska Regional Administrator, NMFS. A monthly marine mammal report containing all sighting data sheets shall be submitted the 5th day of each month to NMFS OPR and NMFS AKR for the previous months sightings. Included with the reports will be the schedule of pile driving hours, by type (i.e., impact or vibratory), for that month. A final report summarizing all sighting data must be submitted to NMFS no later than 90 days after expiration of this IHA. This final report shall estimate the frequency in which marine mammals were present within the project footprint, characterize habitat use and behavior of marine mammals at and around the Port of Anchorage, characterize sound levels around the Port related to and in absence of all construction activities; and address and analyze impacts of construction related noise on marine mammal presence, behavior, and habitat use. The acoustic study report (as required in Condition 5(e)(2)(a)) identifying sound propagation and harassment isopleths for impact and vibratory pile driving will be due to NMFS 45 days after completion of the survey.

7. In the unanticipated event that any cases of marine mammal injury or mortality are judged to have possibly resulted from the Marine Terminal Redevelopment Project, the holder of this IHA is required to cease all activities immediately and report the incident to NMFS (see 3(c) above) and the local stranding network. Project activities shall then be postponed until NMFS is able to review the circumstances and work with the Port of Anchorage and MARAD to determine whether modifications to the activities are appropriate and necessary.

8. A copy of this Authorization must be in the possession of all contractors and marine mammal monitors operating under the authority of this Incidental Harassment Authorization.

James H. Lecky
Director
Office of Protected Resources
National Marine Fisheries Service

JUL 15 2008
Date

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APPENDIX D
Tide and Work Windows 2009-2014

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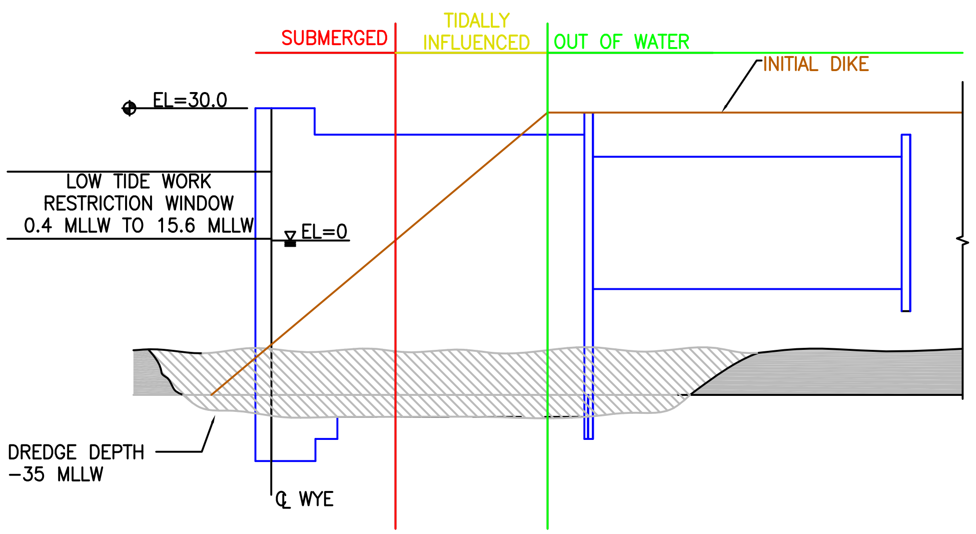
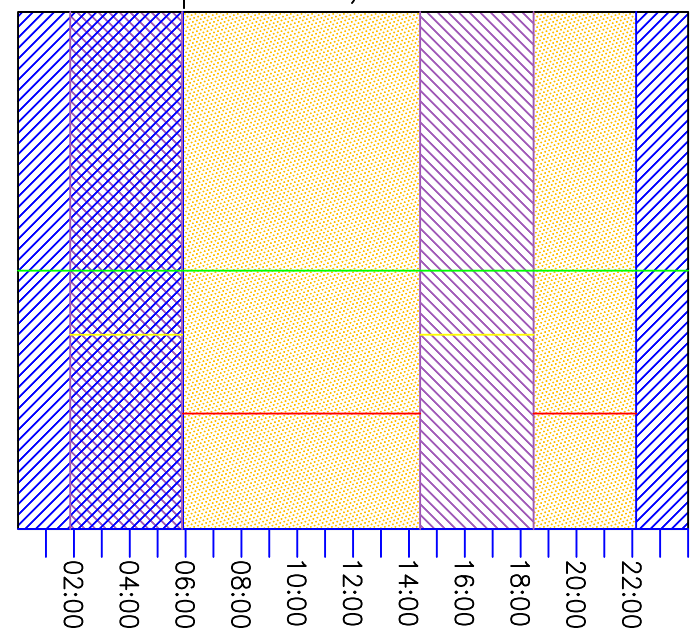


TYPICAL SECTION D-D

Represents the low tide window for April 12, 2009

April 12, 2009



Civil Twilight window

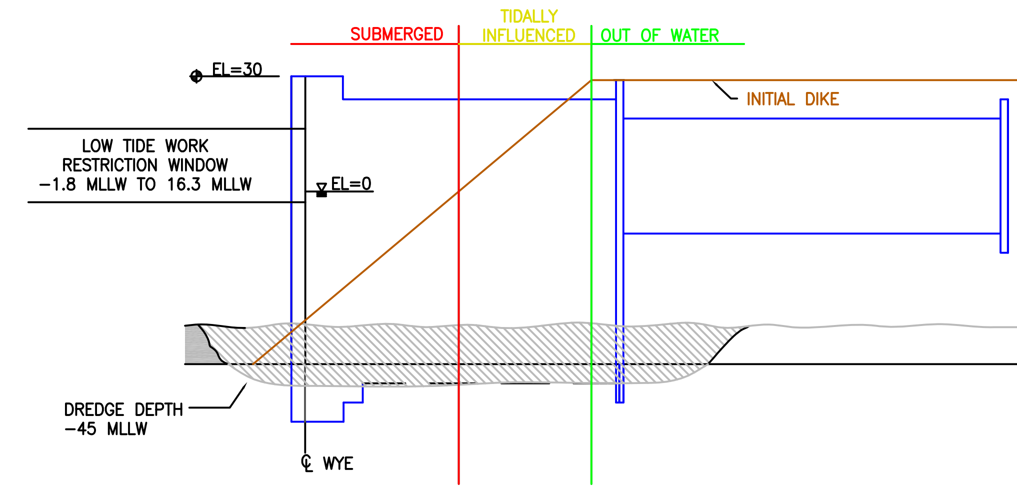
Low Tide window

Unrestricted Work window

Submerged Piledriving

Tidally Influenced Piledriving

Out of Water Piledriving

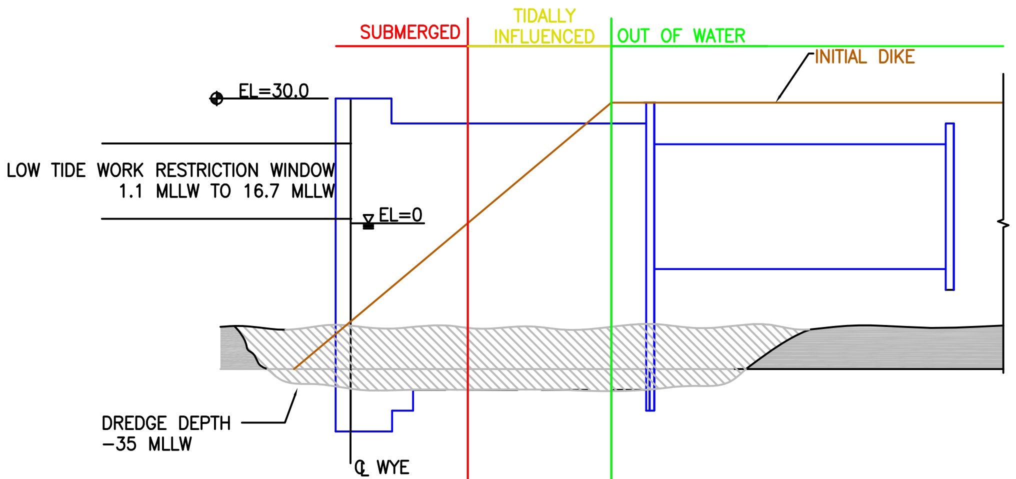


TYPICAL SECTION E-E

Represents the low tidal range for the entire month of April 2009

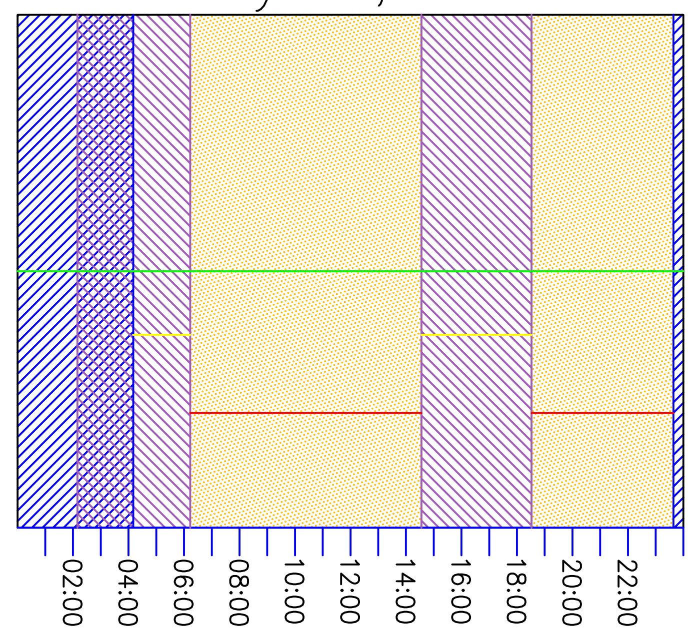
Date	Civil Twilight		2 Hours Before		Actual Low Tide		2 Hours After		2 Hours Before		Actual Low Tide		2 hours After		2 Hours Before		Actual Low Tide		2 Hours After		Unrestricted Work Window 1			Unrestricted Work Window 2			Unrestricted Work Window 3			Hourly Totals		
	Begin	End	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Start	End	Hours	Start	End	Hours	Start	End	Hours	Daily	Monthly	Yearly
4/1/2009	6:35	21:30	4:11	11.8	6:11	7.5	8:11	15.1	17:01	6.1	19:01	2.0	21:01	9.8							8:11	17:01	8.8	21:01	21:30	0.0				9.3	9.4	9.4
4/2/2009	6:32	21:33	5:18	12.4	7:18	8.8	9:18	15.8	18:13	7.1	20:13	2.9	22:13	10.5							9:18	18:13	8.9							8.9	18.3	18.3
4/3/2009	6:28	21:36	6:40	12.9	8:40	9.0	10:40	16.1	19:28	8.1	21:28	2.9	23:28	10.3							6:28	6:40	0.0	10:40	19:28	8.8				9.0	27.3	27.3
4/4/2009	6:25	21:39	7:57	13.1	9:57	7.7	11:57	14.7	20:35	8.8	22:35	2.0	0:35	9.5							6:25	7:57	1.5	11:57	20:35	8.6				10.2	37.5	37.5
4/5/2009	6:22	21:42					0:35	9.5	9:04	12.6	11:04	5.2	13:04	12.6	21:35	9.0	23:35	0.9	1:35	9.2	6:22	9:04	2.7	13:04	21:35	8.5				11.2	48.8	48.8
4/6/2009	6:18	21:44					1:35	9.2	10:03	11.5	12:03	2.6	14:03	10.9	22:27	9.3					6:18	10:03	3.8	14:03	21:44	7.7				11.5	60.2	60.2
4/7/2009	6:15	21:47	22:27	9.3	0:27	0.3	2:27	9.5	10:55	10.4	12:55	0.6	14:55	9.9	23:14	9.8					6:15	10:55	4.7	14:55	21:47	6.9				11.6	71.8	71.8
4/8/2009	6:11	21:50	23:14	9.8	1:14	0.5	3:14	10.3	11:43	9.5	13:43	-0.7	15:43	9.5	23:58	10.4					6:11	11:43	5.5	15:43	21:50	6.1				11.7	83.5	83.5
4/9/2009	6:08	21:53	23:58	10.4	1:58	1.3	3:58	11.7	12:27	8.9	14:27	-1.1	16:27	9.6							6:08	12:27	6.3	16:27	21:53	5.5				11.8	95.3	95.3
4/10/2009	6:04	21:56	0:39	11.1	2:39	2.6	4:39	13.2	13:09	8.2	15:09	-0.9	17:09	10.1							6:04	13:09	7.1	17:09	21:56	4.8				11.9	107.2	107.2
4/11/2009	6:01	21:59	1:17	11.6	3:17	4.1	5:17	14.6	13:47	7.8	15:47	-0.4	17:47	10.5							6:01	13:47	7.8	17:47	21:59	4.2				12.0	119.2	119.2
4/12/2009	5:58	22:02	1:54	11.8	3:54	5.4	5:54	15.6	14:24	7.2	16:24	0.4	18:24	10.8							5:58	14:24	8.4	18:24	22:02	3.7				12.1	131.3	131.3
4/13/2009	5:54	22:05	2:29	11.9	4:29	6.5	6:29	15.9	14:59	6.7	16:59	1.3	18:59	10.7							6:29	14:59	8.5	18:59	22:05	3.1				11.6	142.9	142.9
4/14/2009	5:51	22:08	3:04	12.0	5:04	7.5	7:04	15.7	15:35	6.6	17:35	2.4	19:35	10.5							7:04	15:35	8.5	19:35	22:08	2.6				11.1	154.0	154.0
4/15/2009	5:47	22:11	3:41	12.3	5:41	8.3	7:41	15.1	16:15	7.0	18:15	3.6	20:15	10.3							7:41	16:15	8.6	20:15	22:11	2.0				10.5	164.5	164.5
4/16/2009	5:44	22:14	4:29	12.6	6:29	9.2	8:29	14.9	17:08	7.6	19:08	4.9	21:08	10.6							8:29	17:08	8.7	21:08	22:14	1.1				9.8	174.3	174.3
4/17/2009	5:40	22:17	5:36	12.6	7:36	9.9	9:36	15.2	18:17	8.3	20:17	5.8	22:17	11.4							9:36	18:17	8.7	22:17	22:17	0.0				8.7	183.0	183.0
4/18/2009	5:37	22:20	6:54	12.7	8:54	9.6	10:54	15.0	19:29	9.2	21:29	5.8	23:29	11.7							5:37	6:54	1.3	10:54	19:29	8.6				9.9	192.9	192.9
4/19/2009	5:33	22:23	8:06	12.5	10:06	8.2	12:06	13.7	20:32	9.8	22:32	5.3	0:32	11.5							5:33	8:06	2.6	12:06	20:32	8.4				11.0	204.0	204.0
4/20/2009	5:30	22:26					0:32	11.5	9:07	11.7	11:07	6.1	13:07	12.3	21:27	10.1	23:27	4.6	1:27	11.6	5:30	9:07	3.6	13:07	21:27	8.3				12.0	215.9	215.9
4/21/2009	5:26	22:29					1:27	11.6	10:00	10.7	12:00	4.0	14:00	11.3	22:15	10.4					5:26	10:00	4.6	14:00	22:15	8.3				12.8	228.8	228.8
4/22/2009	5:23	22:32	22:15	10.4	0:15	4.2	2:15	12.2	10:47	9.6	12:47	2.2	14:47	10.7	23:00	10.7					5:23	10:47	5.4	14:47	22:32	7.8				13.2	242.0	242.0
4/23/2009	5:19	22:36	23:00	10.7	1:00	4.2	3:00	13.3	11:32	8.5	13:32	0.8	15:32	10.5	23:42	11.2					5:19	11:32	6.2	15:32	22:36	7.1				13.3	255.3	255.3
4/24/2009	5:15	22:39	23:42	11.2	1:42	4.6	3:42	14.4	12:15	7.4	14:15	-0.2	16:15	10.4							5:15	12:15	7.0	16:15	22:39	6.4				13.4	268.7	268.7
4/25/2009	5:12	22:42	0:23	11.5	2:23	5.0	4:23	15.4	12:56	6.5	14:56	-1.0	16:56	10.2							5:12	12:56	7.7	16:56	22:42	5.8				13.5	282.3	282.3
4/26/2009	5:08	22:45	1:05	11.7	3:05	5.4	5:05	16.3	13:38	5.7	15:38	-1.6	17:38	10.0							5:08	13:38	8.5	17:38	22:45	5.1				13.6	295.9	295.9
4/27/2009	5:05	22:48	1:46	11.8	3:46	5.6	5:46	16.5	14:20	5.1	16:20	-1.8	18:20	9.7							5:46	14:20	8.6	18:20	22:48	4.5				13.1	309.0	309.0
4/28/2009	5:01	22:52	2:29	11.9	4:29	5.9	6:29	16.3	15:04	5.0	17:04	-1.5	19:04	9.4							6:29	15:04	8.6	19:04	22:52	3.8				12.4	321.4	321.4
4/29/2009	4:58	22:55	3:16	11.9	5:16	6.2	7:16	16.0	15:53	5.2	17:53	-0.7	19:53	9.4							7:16	15:53	8.6	19:53	22:55	3.1				11.7	333.1	333.1
4/30/2009	4:54	22:58	4:10	11.9	6:10	6.7	8:10	15.8	16:48	6.0	18:48	0.6	20:48	9.7							8:10	16:48	8.6	20:48	22:58	2.2				10.8	343.9	343.9

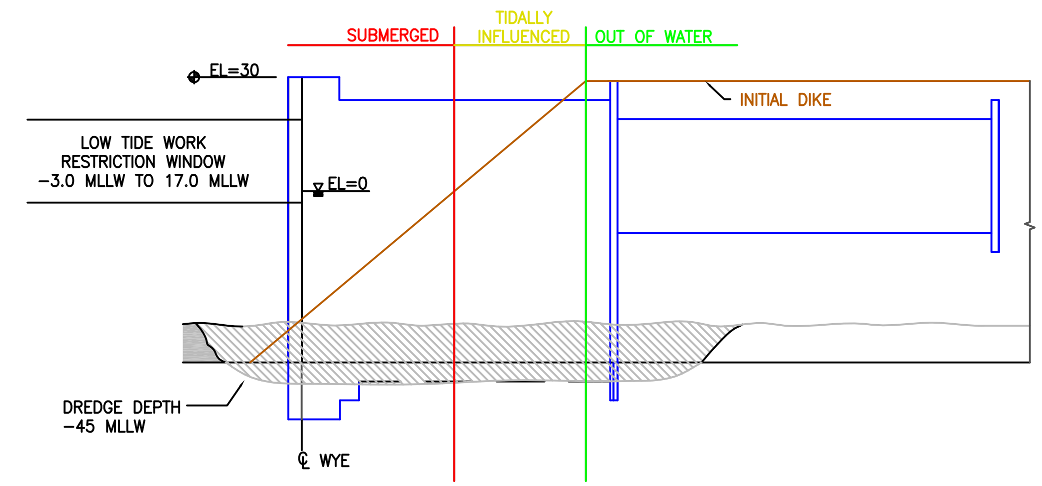
May 12, 2009



TYPICAL SECTION D-D

Represents the low tide window for May 12, 2009





TYPICAL SECTION E-E

Represents the low tidal range for the entire month of May 2009

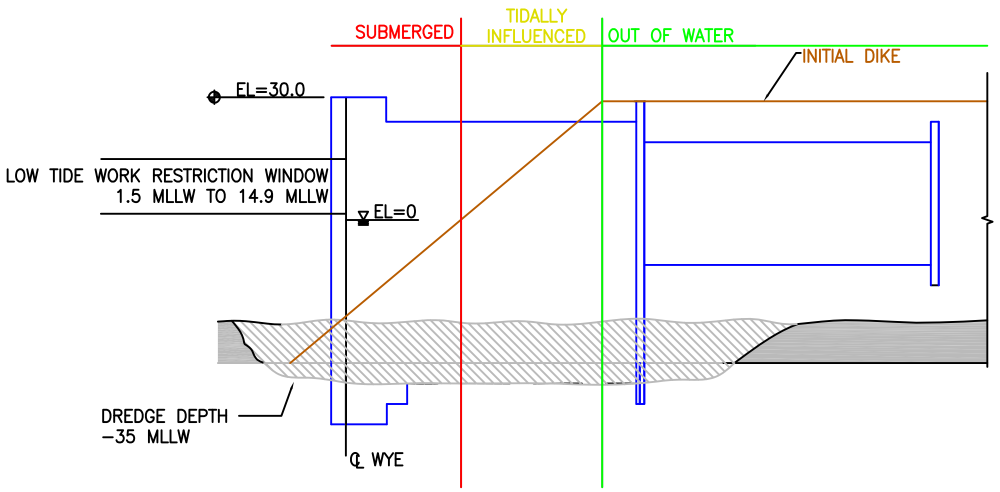
Civil Twilight window — Submerged Piledriving

Low Tide window — Tidally Influenced Piledriving

Unrestricted Work window — Out of Water Piledriving

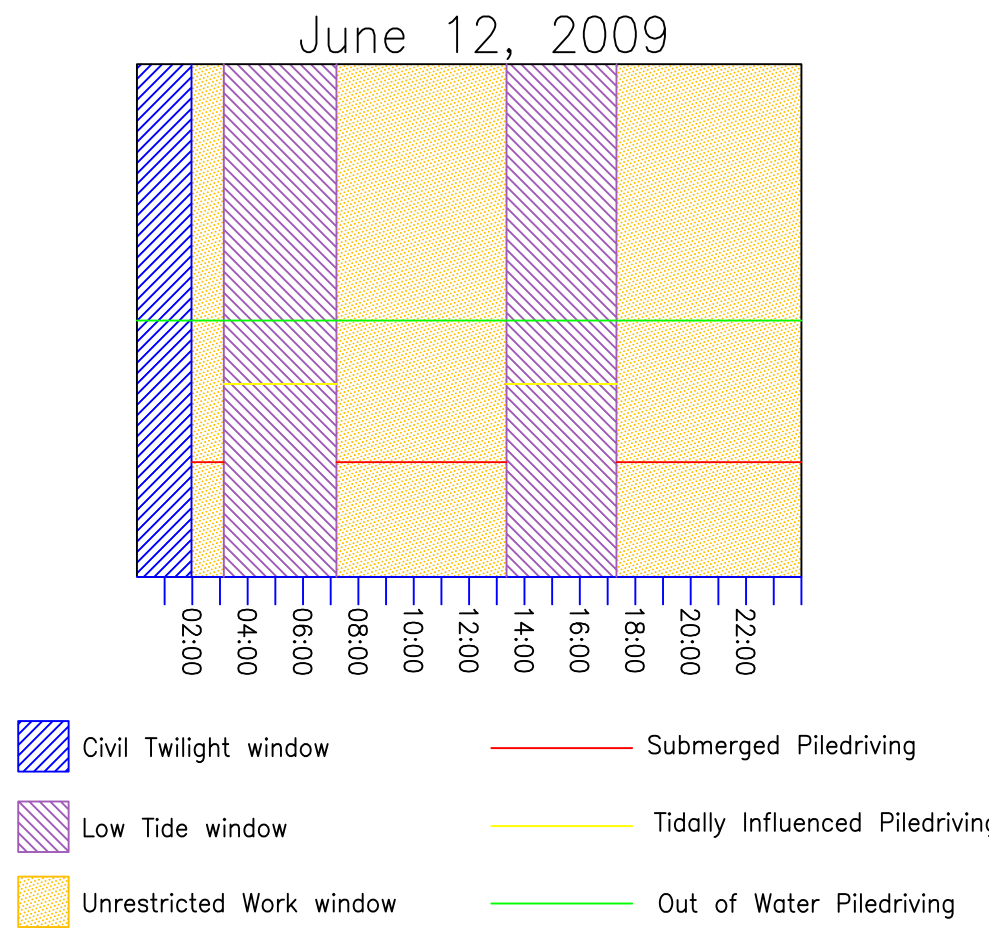
Ship Creek smolt releases, during which time no piledriving may be performed, typically occur during the second week of May.

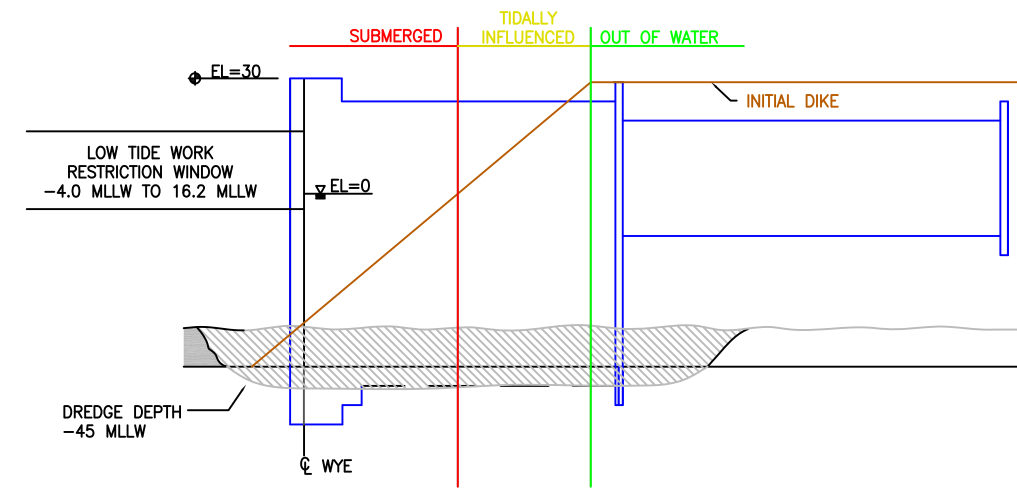
Date	Civil Twilight		2 Hours Before		Actual Low Tide		2 Hours After		2 Hours Before		Actual Low Tide		2 hours After		2 Hours Before		Actual Low Tide		2 Hours After		Unrestricted Work Window 1			Unrestricted Work Window 2			Unrestricted Work Window 3			Hourly Totals		
	Begin	End	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Start	End	Hours	Start	End	Hours	Start	End	Hours	Daily	Monthly	Yearly
5/1/2009	4:50	23:02	5:13	12.1	7:13	7.2	9:13	15.4	17:52	7.1	19:52	1.8	21:52	10.2							4:50	5:13	0.0	9:13	17:52	8.7	21:52	23:02	1.2	10.2	10.3	354.2
5/2/2009	4:47	23:05	6:25	12.2	8:25	6.9	10:25	14.6	19:00	8.2	21:00	2.5	23:00	10.4							4:47	6:25	1.6	10:25	19:00	8.6	23:00	23:05	0.0	10.3	20.6	364.5
5/3/2009	4:43	23:09	7:36	12.0	9:36	5.6	11:36	12.7	20:05	9.3	22:05	2.6	0:05	10.4							4:43	7:36	2.9	11:36	20:05	8.5				11.4	32.0	375.9
5/4/2009	4:39	23:12					0:05	10.4	8:43	11.2	10:43	3.5	12:43	10.9	21:04	10.1	23:04	2.5	1:04	10.5	4:39	8:43	4.1	12:43	21:04	8.4				12.4	44.5	388.4
5/5/2009	4:36	23:16					1:04	10.5	9:41	10.2	11:41	1.3	13:41	9.3	21:58	10.8	23:58	2.7	1:58	11.1	4:36	9:41	5.1	13:41	21:58	8.3				13.4	57.9	401.8
5/6/2009	4:32	23:19					1:58	11.1	10:34	9.2	12:34	-0.3	14:34	8.5	22:47	11.5					4:32	10:34	6.0	14:34	22:47	8.2				14.3	72.1	416.0
5/7/2009	4:28	23:23	22:47	11.5	0:47	3.3	2:47	12.1	11:21	8.7	13:21	-1.0	15:21	8.3	23:32	12.3					4:28	11:21	6.9	15:21	23:23	8.1				14.9	87.1	431.0
5/8/2009	4:25	23:26	23:32	12.3	1:32	4.3	3:32	13.4	12:05	8.2	14:05	-1.1	16:05	8.7							4:25	12:05	7.7	16:05	23:26	7.4				15.0	102.1	446.0
5/9/2009	4:21	23:30	0:14	13.0	2:14	5.4	4:14	14.7	12:46	7.9	14:46	-0.7	16:46	9.3							4:21	12:46	8.4	16:46	23:30	6.8				15.2	117.3	461.2
5/10/2009	4:17	23:34	0:55	13.2	2:55	6.5	4:55	15.9	13:25	7.5	15:25	-0.1	17:25	10.1							4:55	13:25	8.5	17:25	23:34	6.2				14.7	132.0	475.9
5/11/2009	4:14	23:37	1:33	13.2	3:33	7.2	5:33	16.6	14:01	7.0	16:01	0.6	18:01	10.5							5:33	14:01	8.5	18:01	23:37	5.6				14.1	146.1	490.0
5/12/2009	4:10	23:41	2:10	12.8	4:10	7.5	6:10	16.7	14:36	6.5	16:36	1.1	18:36	10.6							6:10	14:36	8.4	18:36	23:41	5.1				13.5	159.7	503.6
5/13/2009	4:06	23:45	2:46	12.4	4:46	7.7	6:46	16.2	15:10	6.3	17:10	1.7	19:10	10.3							6:46	15:10	8.4	19:10	23:45	4.6				13.0	172.7	516.6
5/14/2009	4:02	23:49	3:24	12.1	5:24	7.7	7:24	15.3	15:46	6.5	17:46	2.5	19:46	9.9							7:24	15:46	8.4	19:46	23:49	4.1				12.4	185.1	529.0
5/15/2009	3:58	23:52	4:08	11.9	6:08	7.9	8:08	14.6	16:28	7.2	18:28	3.5	20:28	9.7							3:58	4:08	0.0	8:08	16:28	8.3	20:28	23:52	3.4	11.9	197.1	541.0
5/16/2009	3:55	23:56	5:03	11.7	7:03	8.1	9:03	14.2	17:23	7.8	19:23	4.7	21:23	10.4							3:55	5:03	1.1	9:03	17:23	8.3	21:23	23:56	2.6	12.0	209.1	553.0
5/17/2009	3:51	0:00	6:11	11.3	8:11	8.0	10:11	14.0	18:30	8.6	20:30	5.6	22:30	11.7							3:51	6:11	2.3	10:11	18:30	8.3	22:30	23:59	1.5	12.2	221.3	565.2
5/18/2009	3:47	0:04	7:22	10.9	9:22	7.1	11:22	13.3	19:37	9.5	21:37	6.2	23:37	12.6							3:47	7:22	3.6	11:22	19:37	8.3	23:37	23:59	0.0	12.2	233.6	577.5
5/19/2009	3:43	0:08	8:26	10.3	10:26	5.5	12:26	12.0	20:37	10.4	22:37	6.3	0:37	13.3							3:43	8:26	4.7	12:26	20:37	8.2				12.9	246.5	590.4
5/20/2009	3:39	0:12					0:37	13.3	9:23	9.3	11:23	3.5	13:23	10.9	21:32	11.2	23:32	6.3	1:32	14.1	3:39	9:23	5.7	13:23	21:32	8.2				13.9	260.4	604.3
5/21/2009	3:35	0:16					1:32	14.1	10:15	8.2	12:15	1.7	14:15	10.1	22:23	11.8					3:35	10:15	6.7	14:15	22:23	8.1				14.8	275.3	619.2
5/22/2009	3:31	0:21	22:23	11.8	0:23	6.4	2:23	15.0	11:03	7.2	13:03	0.2	15:03	9.6	23:12	12.2					3:31	11:03	7.5	15:03	23:12	8.2				15.7	291.0	634.9
5/23/2009	3:27	0:25	23:12	12.2	1:12	6.5	3:12	15.9	11:49	6.4	13:49	-1.1	15:49	9.2	23:59	12.6					3:27	11:49	8.4	15:49	23:59	8.2				16.5	307.5	651.4
5/24/2009	3:23	0:29	23:59	12.6	1:59	6.5	3:59	16.6	12:35	5.6	14:35	-2.0	16:35	9.1							3:59	12:35	8.6	16:35	23:59	7.4				16.0	323.6	667.5
5/25/2009	3:19	0:33	0:46	12.7	2:46	6.3	4:46	17.0	13:20	5.1	15:20	-2.7	17:20	9.0							4:46	13:20	8.6	17:20	23:59	6.7				15.2	338.8	682.7
5/26/2009	3:14	0:38	1:32	12.6	3:32	5.8	5:32	16.8	14:05	4.9	16:05	-3.0	18:05	8.8							5:32	14:05	8.6	18:05	23:59	5.9				14.5	353.3	697.2
5/27/2009	3:10	0:42	2:20	12.2	4:20	5.3	6:20	16.5	14:51	4.9	16:51	-2.8	18:51	8.8							6:20	14:51	8.5	18:51	23:59	5.2				13.7	367.0	710.9
5/28/2009	3:06	0:47	3:09	11.7	5:09	4.9	7:09	15.8	15:39	5.2	17:39	-2.1	19:39	9.0							3:06	3:09	0.0	7:09	15:39	8.5	19:39	23:59	4.4	12.9	379.9	723.8
5/29/2009	3:01	0:52	4:01	11.4	6:01	4.8	8:01	14.8	16:30	5.9	18:30	-0.7	20:30	9.4							3:01	4:01	1.0	8:01	16:30	8.5	20:30	23:59	3.5	13.0	392.9	736.8
5/30/2009	2:56	0:57	4:59	11.2	6:59	4.8	8:59	13.9	17:26	7.1	19:26	1.0	21:26	10.1							2:56	4:59	2.1	8:59	17:26	8.5	21:26	23:59	2.6	13.1	406.0	749.9
5/31/2009	2:52	1:02	6:03	11.0	8:03	4.6	10:03	12.7	18:27	8.4	20:27	2.6	22:27	10.9							2:52	6:03	3.2	10:03	18:27	8.4	22:27	23:59	1.6	13.1	419.2	763.1



TYPICAL SECTION D-D

Represents the low tide window for June 12, 2009





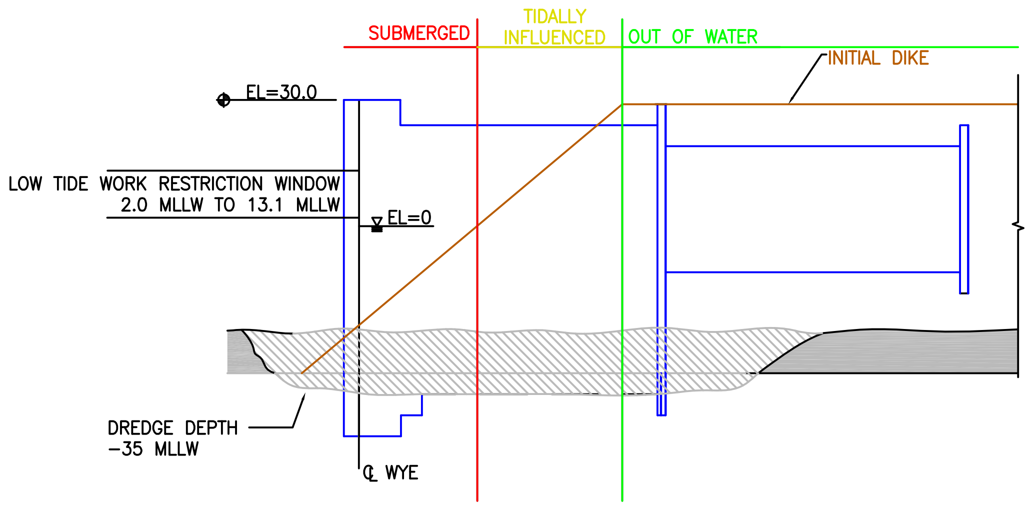
TYPICAL SECTION E-E

Represents the low tidal range for the entire month of June 2009

Ship Creek smolt releases, during which time no piledriving may be performed, typically occur during the third week of June.

Date	Civil Twilight		2 Hours Before		Actual Low Tide		2 Hours After		2 Hours Before		Actual Low Tide		2 hours After		2 Hours Before		Actual Low Tide		2 Hours After	
	Begin	End	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW
6/1/2009	2:46	1:07	7:11	10.6	9:11	3.8	11:11	11.3	19:30	9.9	21:30	3.9	23:30	11.6						
6/2/2009	2:41	1:13	8:16	10.1	10:16	2.5	12:16	9.6	20:31	11.2	22:31	4.7	0:31	12.1						
6/3/2009	2:35	1:19					0:31	12.1	9:16	9.3	11:16	1.0	13:16	8.3	21:28	12.2	23:28	5.3	1:28	12.7
6/4/2009	2:29	1:26					1:28	12.7	10:10	8.6	12:10	-0.2	14:10	7.6	22:20	13.0				
6/5/2009	2:21	1:35	22:20	13.0	0:20	5.9	2:20	13.5	10:58	8.3	12:58	-0.7	14:58	7.5	23:08	13.6				
6/6/2009	2:08	1:47	23:08	13.6	1:08	6.5	3:08	14.3	11:43	8.0	13:43	-0.7	15:43	8.0	23:53	14.0				
6/7/2009	1:58	1:58	23:53	14.0	1:53	7.1	3:53	15.2	12:25	7.8	14:25	-0.4	16:25	8.7						
6/8/2009	1:58	1:58	0:35	14.0	2:35	7.4	4:35	15.9	13:04	7.5	15:04	0.1	17:04	9.5						
6/9/2009	1:58	1:58	1:14	13.7	3:14	7.5	5:14	16.2	13:40	7.1	15:40	0.4	17:40	10.1						
6/10/2009	1:59	1:59	1:52	13.1	3:52	7.2	5:52	16.2	14:15	6.5	16:15	0.7	18:15	10.4						
6/11/2009	1:59	1:59	2:29	12.2	4:29	6.8	6:29	15.7	14:48	6.2	16:48	1.0	18:48	10.2						
6/12/2009	1:59	1:59	3:07	11.4	5:07	6.4	7:07	14.9	15:21	6.3	17:21	1.5	19:21	9.8						
6/13/2009	1:59	1:59	3:46	10.9	5:46	6.1	7:46	13.8	15:56	6.9	17:56	2.3	19:56	9.5						
6/14/2009	1:59	1:59	4:32	10.4	6:32	6.1	8:32	13.1	16:36	7.9	18:36	3.6	20:36	9.7						
6/15/2009	2:00	2:00	5:28	9.9	7:28	6.2	9:28	12.6	17:28	8.9	19:28	5.2	21:28	10.7						
6/16/2009	2:00	2:00	6:34	9.3	8:34	5.9	10:34	12.3	18:34	9.8	20:34	6.7	22:34	12.5						
6/17/2009	2:00	2:00	7:42	8.8	9:42	5.0	11:42	11.7	19:45	10.8	21:45	7.8	23:45	14.3						
6/18/2009	2:00	2:00	8:45	8.2	10:45	3.4	12:45	10.6	20:51	11.8	22:51	8.2	0:51	15.5						
6/19/2009	2:01	2:01					0:51	15.5	9:42	7.4	11:42	1.6	13:42	9.6	21:50	12.6	23:50	8.1	1:50	16.1
6/20/2009	2:01	2:01					1:50	16.1	10:36	6.5	12:36	-0.1	14:36	8.9	22:46	13.0				
6/21/2009	2:01	2:01	22:46	13.0	0:46	7.7	2:46	16.6	11:27	5.8	13:27	-1.6	15:27	8.5	23:39	13.1				
6/22/2009	2:01	2:01	23:39	13.1	1:39	6.9	3:39	16.7	12:16	5.3	14:16	-2.8	16:16	8.3						
6/23/2009	2:01	2:01	0:29	12.9	2:29	5.9	4:29	16.5	13:03	5.0	15:03	-3.6	17:03	8.2						
6/24/2009	2:02	2:02	1:18	12.4	3:18	4.7	5:18	16.0	13:49	4.9	15:49	-4.0	17:49	8.3						
6/25/2009	2:02	2:02	2:07	11.7	4:07	3.6	6:07	15.3	14:34	5.1	16:34	-3.7	18:34	8.5						
6/26/2009	2:02	2:02	2:55	11.0	4:55	2.8	6:55	14.3	15:19	5.5	17:19	-2.8	19:19	9.0						
6/27/2009	2:02	2:02	3:45	10.3	5:45	2.5	7:45	13.3	16:05	6.4	18:05	-1.1	20:05	9.7						
6/28/2009	2:02	2:02	4:38	9.9	6:38	2.6	8:38	12.4	16:55	7.5	18:55	1.1	20:55	10.7						
6/29/2009	2:03	2:03	5:36	9.7	7:36	2.9	9:36	11.5	17:50	9.0	19:50	3.5	21:50	11.9						
6/30/2009	2:03	2:03	6:40	9.5	8:40	3.0	10:40	10.5	18:51	10.7	20:51	5.7	22:51	13.0						

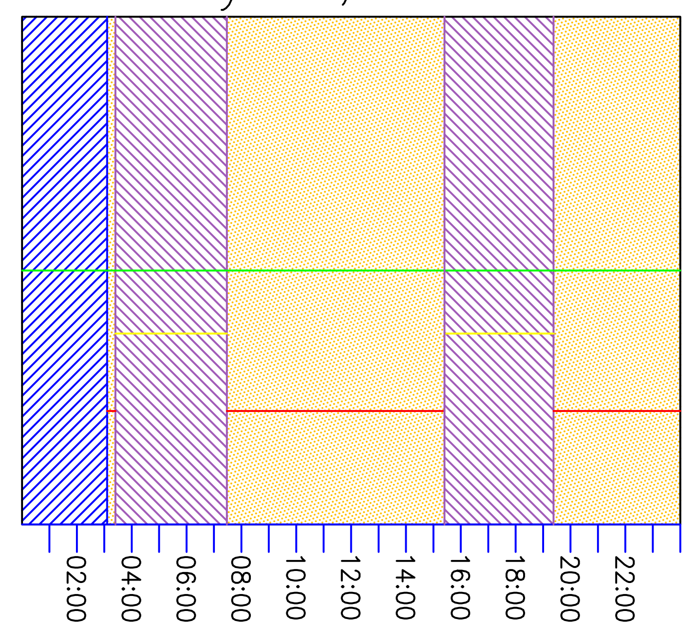
Date	Unrestricted Work Window 1			Unrestricted Work Window 2			Unrestricted Work Window 3			Hourly Totals		
	Start	End	Hours	Start	End	Hours	Start	End	Hours	Daily	Monthly	Yearly
6/1/2009	2:46	7:11	4.4	11:11	19:30	8.3	23:30	23:59	0.0	13.2	13.3	776.4
6/2/2009	2:41	8:16	5.6	12:16	20:31	8.3				13.8	27.1	790.2
6/3/2009	2:35	9:16	6.7	13:16	21:28	8.2				14.9	42.1	805.2
6/4/2009	2:29	10:10	7.7	14:10	22:20	8.2				15.9	57.9	821.0
6/5/2009	2:21	10:58	8.6	14:58	23:08	8.2				16.8	74.8	837.9
6/6/2009	3:08	11:43	8.6	15:43	23:53	8.2				16.8	91.5	854.6
6/7/2009	3:53	12:25	8.5	16:25	23:59	7.6				16.1	107.7	870.8
6/8/2009	4:35	13:04	8.5	17:04	23:59	6.9				15.4	123.1	886.2
6/9/2009	5:14	13:40	8.4	17:40	23:59	6.3				14.8	137.9	901.0
6/10/2009	5:52	14:15	8.4	18:15	23:59	5.8				14.1	152.0	915.1
6/11/2009	1:59	2:29	0.0	6:29	14:48	8.3	18:48	23:59	5.2	14.0	166.1	929.2
6/12/2009	1:59	3:07	1.1	7:07	15:21	8.2	19:21	23:59	4.7	14.0	180.1	943.2
6/13/2009	1:59	3:46	1.8	7:46	15:56	8.2	19:56	23:59	4.1	14.0	194.2	957.3
6/14/2009	1:59	4:32	2.6	8:32	16:36	8.1	20:36	23:59	3.4	14.0	208.2	971.3
6/15/2009	2:00	5:28	3.5	9:28	17:28	8.0	21:28	23:59	2.5	14.0	222.3	985.4
6/16/2009	2:00	6:34	4.6	10:34	18:34	8.0	22:34	23:59	1.4	14.0	236.3	999.4
6/17/2009	2:00	7:42	5.7	11:42	19:45	8.1	23:45	23:59	0.0	14.0	250.3	1013.4
6/18/2009	2:00	8:45	6.8	12:45	20:51	8.1				14.9	265.2	1028.3
6/19/2009	2:01	9:42	7.7	13:42	21:50	8.1				15.8	281.1	1044.2
6/20/2009	2:01	10:36	8.6	14:36	22:46	8.2				16.8	297.9	1061.0
6/21/2009	2:46	11:27	8.7	15:27	23:39	8.2				16.9	314.8	1077.9
6/22/2009	3:39	12:16	8.6	16:16	23:59	7.7				16.4	331.1	1094.2
6/23/2009	4:29	13:03	8.6	17:03	23:59	7.0				15.5	346.7	1109.8
6/24/2009	5:18	13:49	8.5	17:49	23:59	6.2				14.7	361.4	1124.5
6/25/2009	2:02	2:07	0.0	6:07	14:34	8.5	18:34	23:59	5.4	14.0	375.4	1138.5
6/26/2009	2:02	2:55	0.9	6:55	15:19	8.4	19:19	23:59	4.7	14.0	389.4	1152.5
6/27/2009	2:02	3:45	1.7	7:45	16:05	8.3	20:05	23:59	3.9	14.0	403.4	1166.5
6/28/2009	2:02	4:38	2.6	8:38	16:55	8.3	20:55	23:59	3.1	14.0	417.4	1180.5
6/29/2009	2:03	5:36	3.6	9:36	17:50	8.2	21:50	23:59	2.2	14.0	431.4	1194.5
6/30/2009	2:03	6:40	4.6	10:40	18:51	8.2	22:51	23:59	1.2	14.0	445.4	1208.5



TYPICAL SECTION D-D

Represents the low tide window for July 12, 2009

July 12, 2009



Civil Twilight window

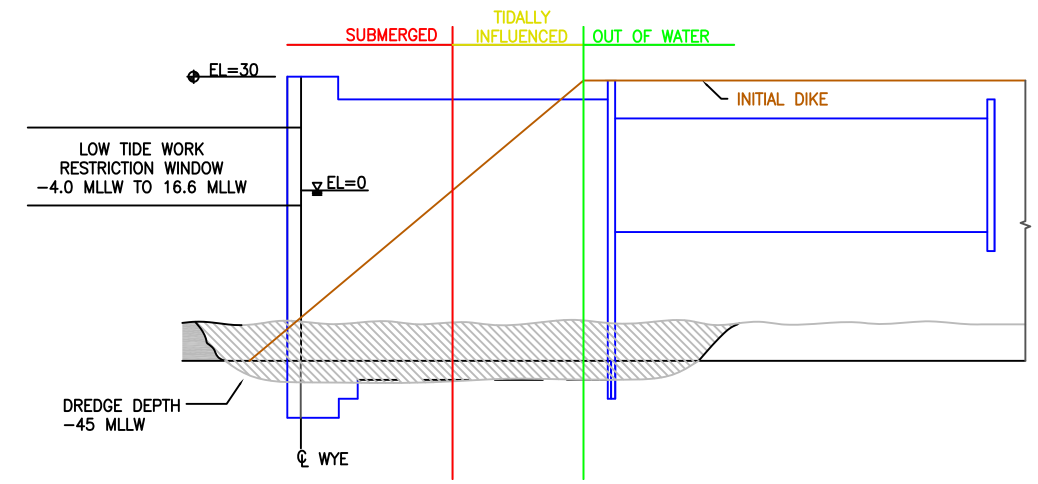
Low Tide window

Unrestricted Work window

Submerged Piledriving

Tidally Influenced Piledriving

Out of Water Piledriving

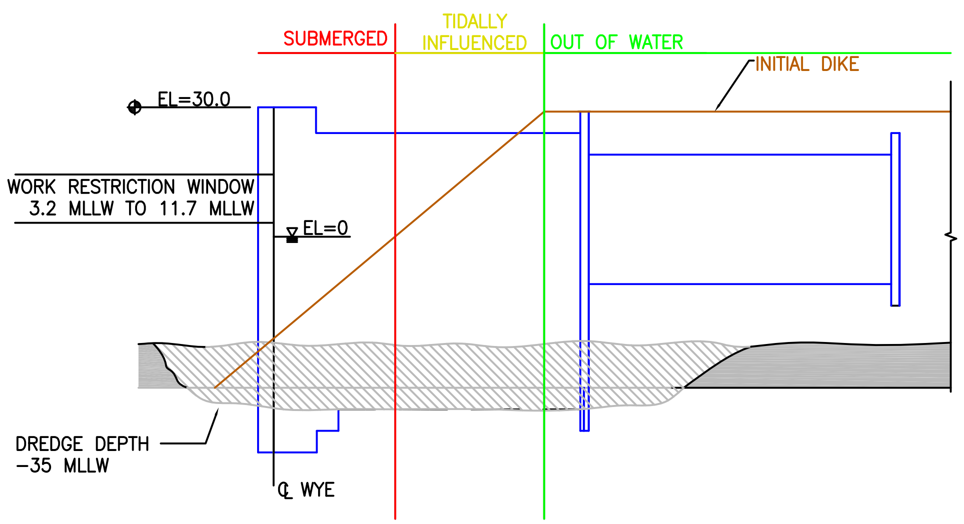


TYPICAL SECTION E-E

Represents the low tidal range for the entire month of July 2009

Date	Civil Twilight		2 Hours Before		Actual Low Tide		2 Hours After		2 Hours Before		Actual Low Tide		2 hours After	
	Begin	End	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW
7/1/2009	2:03	2:03	7:45	9.4	9:45	2.6	11:45	9.3	19:55	12.2	21:55	7.0	23:55	13.7
7/2/2009	2:03	2:03	8:48	9.0	10:48	1.7	12:48	8.2	20:57	13.4	22:57	7.7	0:57	13.9
7/3/2009	2:03	2:03					0:57	13.9	9:44	8.7	11:44	0.8	13:44	7.5
7/4/2009	2:04	2:04					1:54	14.1	10:35	8.3	12:35	0.1	14:35	7.4
7/5/2009	2:19	1:48	22:45	14.3	0:45	7.6	2:45	14.2	11:21	8.1	13:21	-0.2	15:21	7.7
7/6/2009	2:30	1:38	23:32	14.2	1:32	7.3	3:32	14.5	12:03	8.0	14:03	-0.2	16:03	8.3
7/7/2009	2:37	1:31	0:15	14.0	2:15	7.0	4:15	14.8	12:42	7.7	14:42	0.0	16:42	9.0
7/8/2009	2:44	1:24	0:56	13.3	2:56	6.5	4:56	15.1	13:19	7.3	15:19	0.2	17:19	9.8
7/9/2009	2:50	1:19	1:34	12.5	3:34	5.9	5:34	15.1	13:53	6.9	15:53	0.4	17:53	10.4
7/10/2009	2:56	1:13	2:11	11.5	4:11	5.2	6:11	14.8	14:25	6.5	16:25	0.6	18:25	10.6
7/11/2009	3:01	1:08	2:47	10.5	4:47	4.7	6:47	14.1	14:55	6.6	16:55	1.1	18:55	10.3
7/12/2009	3:06	1:04	3:23	9.6	5:23	4.3	7:23	13.1	15:26	7.2	17:26	2.0	19:26	10.1
7/13/2009	3:11	0:59	4:01	9.1	6:01	4.3	8:01	11.9	15:58	8.5	17:58	3.3	19:58	9.9
7/14/2009	3:16	0:54	4:46	8.7	6:46	4.5	8:46	11.1	16:39	9.8	18:39	5.2	20:39	10.6
7/15/2009	3:20	0:50	5:45	8.2	7:45	4.8	9:45	10.9	17:33	11.1	19:33	7.3	21:33	11.9
7/16/2009	3:25	0:46	6:58	7.7	8:58	4.6	10:58	11.1	18:53	11.7	20:53	9.0	22:53	14.4
7/17/2009	3:29	0:41	8:10	7.4	10:10	3.6	12:10	10.6	20:16	12.5	22:16	9.6	0:16	16.3
7/18/2009	3:33	0:37					0:16	16.3	9:14	7.1	11:14	1.9	13:14	9.5
7/19/2009	3:38	0:33					1:25	16.6	10:13	6.5	12:13	-0.1	14:13	8.7
7/20/2009	3:42	0:29	22:26	13.3	0:26	7.7	2:26	16.3	11:06	6.0	13:06	-1.8	15:06	8.0
7/21/2009	3:46	0:25	23:21	13.0	1:21	6.1	3:21	15.8	11:56	5.7	13:56	-3.1	15:56	7.8
7/22/2009	3:50	0:21	0:13	12.3	2:13	4.4	4:13	15.2	12:43	5.6	14:43	-3.9	16:43	7.9
7/23/2009	3:54	0:17	1:02	11.6	3:02	2.8	5:02	14.4	13:29	5.6	15:29	-4.0	17:29	8.5
7/24/2009	3:58	0:13	1:50	10.7	3:50	1.5	5:50	13.6	14:12	6.0	16:12	-3.5	18:12	9.1
7/25/2009	4:02	0:09	2:36	9.9	4:36	0.8	6:36	12.7	14:55	6.5	16:55	-2.2	18:55	10.0
7/26/2009	4:06	0:06	3:23	9.2	5:23	0.7	7:23	12.0	15:37	7.4	17:37	-0.1	19:37	11.0
7/27/2009	4:09	0:02	4:12	8.8	6:12	1.2	8:12	11.4	16:22	8.6	18:22	2.4	20:22	12.2
7/28/2009	4:13	23:58	5:05	8.7	7:05	2.2	9:05	11.0	17:11	10.1	19:11	5.2	21:11	13.3
7/29/2009	4:17	23:54	6:04	8.9	8:04	3.2	10:04	10.6	18:11	11.6	20:11	7.7	22:11	14.6
7/30/2009	4:20	23:50	7:10	9.2	9:10	3.7	11:10	10.0	19:19	13.1	21:19	9.2	23:19	15.2
7/31/2009	4:24	23:47	8:15	9.4	10:15	3.3	12:15	9.0	20:27	14.2	22:27	9.5	0:27	14.8

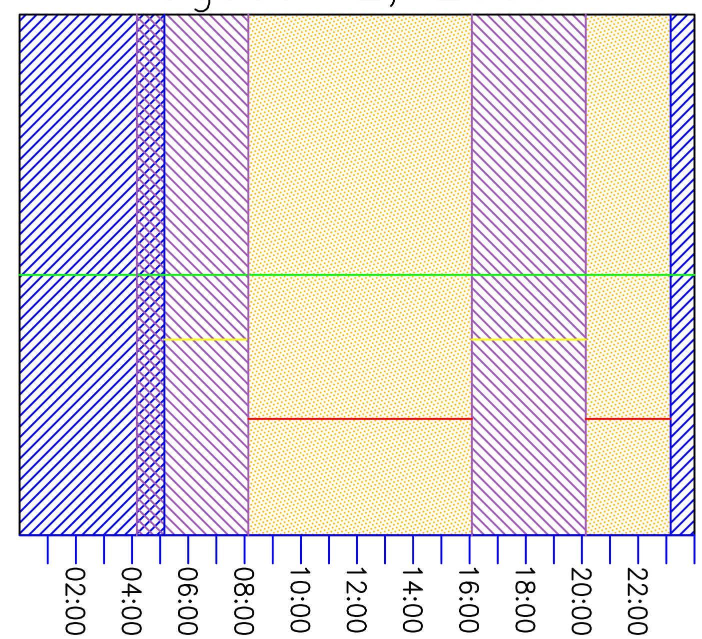
Date	2 Hours Before		Actual Low Tide		2 Hours After		Unrestricted Work Window 1			Unrestricted Work Window 2			Unrestricted Work Window 3			Hourly Totals		
	Time	MLLW	Time	MLLW	Time	MLLW	Start	End	Hours	Start	End	Hours	Start	End	Hours	Daily	Monthly	Yearly
7/1/2009							2:03	7:45	5.7	11:45	19:55	8.2	23:55	23:59	0.0	14.0	14.0	1222.4
7/2/2009							2:03	8:48	6.8	12:48	20:57	8.2				14.9	28.9	1237.4
7/3/2009	21:54	14.0	23:54	7.7	1:54	14.1	2:03	9:44	7.7	13:44	21:54	8.2				15.9	44.8	1253.3
7/4/2009	22:45	14.3					2:04	10:35	8.5	14:35	22:45	8.2				16.7	61.5	1270.0
7/5/2009	23:32	14.2					2:45	11:21	8.6	15:21	23:32	8.2				16.8	78.3	1286.8
7/6/2009							3:32	12:03	8.5	16:03	23:59	8.0				16.5	94.8	1303.3
7/7/2009							4:15	12:42	8.5	16:42	23:59	7.3				15.8	110.6	1319.0
7/8/2009							4:56	13:19	8.4	17:19	23:59	6.7				15.1	125.7	1334.1
7/9/2009							5:34	13:53	8.3	17:53	23:59	6.1				14.4	140.1	1348.6
7/10/2009							6:11	14:25	8.2	18:25	23:59	5.6				13.8	154.0	1362.4
7/11/2009							6:47	14:55	8.1	18:55	23:59	5.1				13.2	167.2	1375.6
7/12/2009							3:06	3:23	0.0	7:23	15:26	8.1	19:26	23:59	4.6	12.9	180.1	1388.6
7/13/2009							3:11	4:01	0.0	8:01	15:58	8.0	19:58	23:59	4.0	12.8	193.0	1401.4
7/14/2009							3:16	4:46	1.5	8:46	16:39	7.9	20:39	23:59	3.4	12.7	205.7	1414.2
7/15/2009							3:20	5:45	2.4	9:45	17:33	7.8	21:33	23:59	2.5	12.7	218.4	1426.9
7/16/2009							3:25	6:58	3.6	10:58	18:53	7.9	22:53	23:59	1.1	12.6	231.1	1439.5
7/17/2009							3:29	8:10	4.7	12:10	20:16	8.1				12.8	243.9	1452.3
7/18/2009	21:25	13.2	23:25	9.0	1:25	16.6	3:33	9:14	5.7	13:14	21:25	8.2				13.9	257.8	1466.2
7/19/2009	22:26	13.3					3:38	10:13	6.6	14:13	22:26	8.2				14.8	272.6	1481.1
7/20/2009	23:21	13.0					3:42	11:06	7.4	15:06	23:21	8.3				15.7	288.3	1496.7
7/21/2009							3:46	11:56	8.2	15:56	23:59	8.1				16.2	304.5	1513.0
7/22/2009							4:13	12:43	8.5	16:43	23:59	7.3				15.8	320.3	1528.8
7/23/2009							5:02	13:29	8.5	17:29	23:59	6.5				15.0	335.3	1543.8
7/24/2009							5:50	14:12	8.4	18:12	23:59	5.8				14.2	349.5	1558.0
7/25/2009							6:36	14:55	8.3	18:55	23:59	5.1				13.4	362.9	1571.4
7/26/2009							7:23	15:37	8.2	19:37	23:59	4.4				12.6	375.6	1584.0
7/27/2009							4:09	4:12	0.0	8:12	16:22	8.2	20:22	23:59	3.6	11.9	387.4	1595.9
7/28/2009							4:13	5:05	0.0	9:05	17:11	8.1	21:11	23:58	2.8	11.8	399.2	1607.7
7/29/2009							4:17	6:04	1.8	10:04	18:11	8.1	22:11	23:54	1.7	11.6	410.9	1619.4
7/30/2009							4:20	7:10	2.8	11:10	19:19	8.2	23:19	23:50	0.0	11.5	422.5	1630.9
7/31/2009							4:24	8:15	3.9	12:15	20:27	8.2				12.1	434.5	1643.0

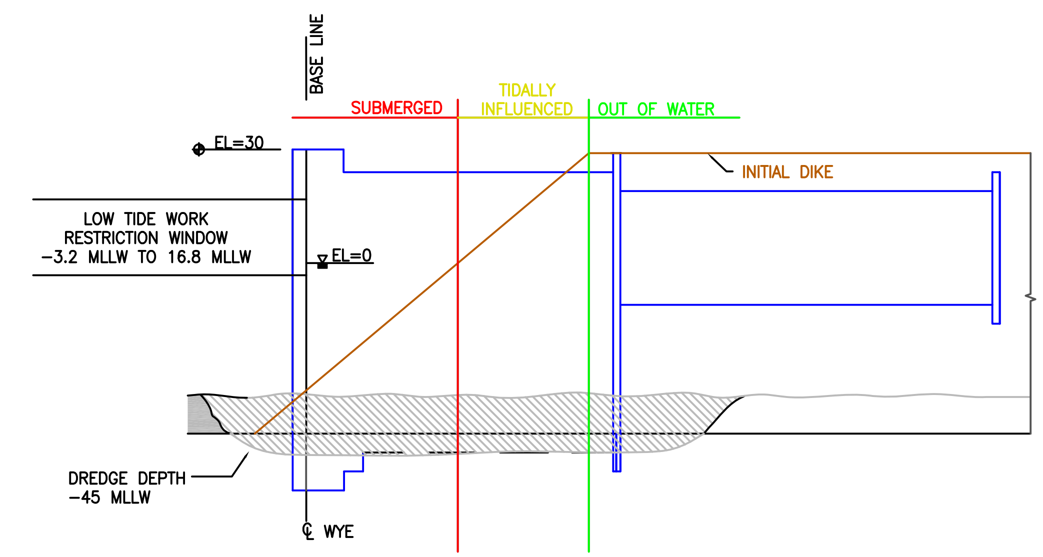


TYPICAL SECTION D-D

Represents the low tide window for August 12, 2009

August 12, 2009





TYPICAL SECTION E-E

Represents the low tidal range for the entire month of August 2009

Civil Twilight window

Low Tide window

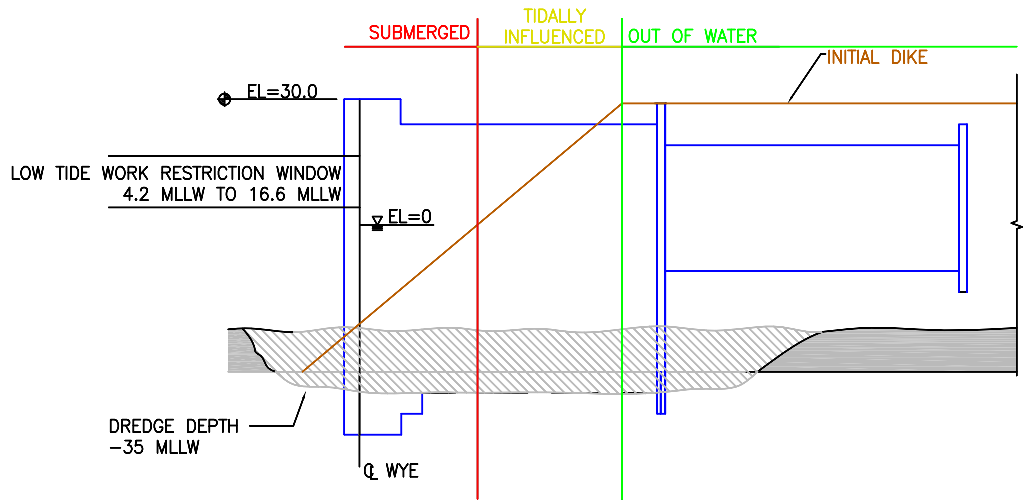
Unrestricted Work window

Submerged Piledriving

Tidally Influenced Piledriving

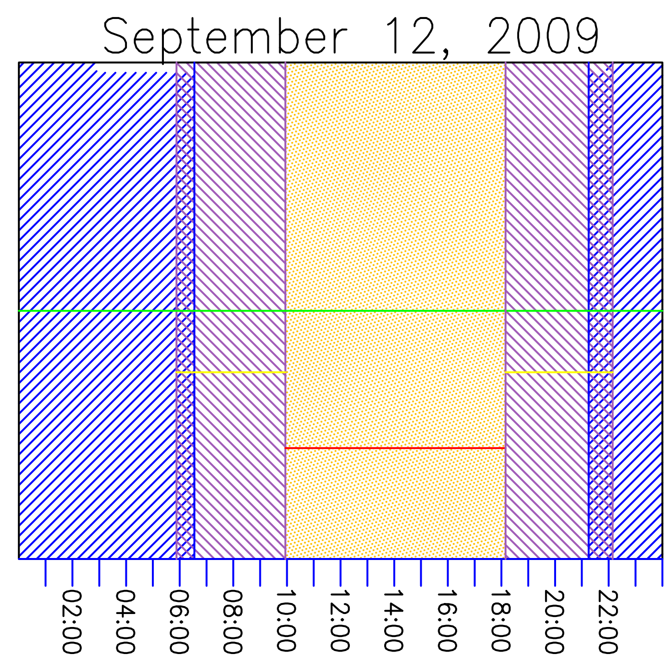
Out of Water Piledriving

Date	Civil Twilight		2 Hours Before		Actual Low Tide		2 Hours After		2 Hours Before		Actual Low Tide		2 hours After		2 Hours Before		Actual Low Tide		2 Hours After		Unrestricted Work Window 1			Unrestricted Work Window 2			Unrestricted Work Window 3			Hourly Totals		
	Begin	End	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Start	End	Hours	Start	End	Hours	Start	End	Hours	Daily	Monthly	Yearly
8/1/2009	4:28	23:43					0:27	14.8	9:16	9.2	11:16	2.4	13:16	8.2	21:29	14.5	23:29	8.8	1:29	14.1	4:28	9:16	4.8	13:16	21:29	8.2				13.0	13.1	1656.0
8/2/2009	4:31	23:39					1:29	14.1	10:09	8.9	12:09	1.4	14:09	7.8	22:23	14.2					4:31	10:09	5.6	14:09	22:23	8.2				13.9	27.0	1669.9
8/3/2009	4:35	23:36	22:23	14.2	0:23	7.7	2:23	13.6	10:56	8.6	12:56	0.6	14:56	7.8	23:11	13.7					4:35	10:56	6.4	14:56	23:11	8.3				14.6	41.6	1684.6
8/4/2009	4:38	23:32	23:11	13.7	1:11	6.5	3:11	13.4	11:38	8.4	13:38	0.2	15:38	8.2	23:54	13.1					4:38	11:38	7.0	15:38	23:32	7.9				14.9	56.5	1699.5
8/5/2009	4:42	23:28	23:54	13.1	1:54	5.6	3:54	13.4	12:17	8.2	14:17	0.1	16:17	9.0							4:42	12:17	7.6	16:17	23:28	7.2				14.8	71.3	1714.3
8/6/2009	4:45	23:24	0:34	12.4	2:34	4.8	4:34	13.6	12:54	7.9	14:54	0.3	16:54	10.1							4:45	12:54	8.2	16:54	23:24	6.5				14.7	86.0	1729.0
8/7/2009	4:49	23:21	1:13	11.4	3:13	4.1	5:13	13.8	13:28	7.7	15:28	0.7	17:28	11.0							5:13	13:28	8.3	17:28	23:21	5.9				14.2	100.2	1743.2
8/8/2009	4:52	23:17	1:49	10.4	3:49	3.5	5:49	13.7	14:00	7.5	16:00	1.2	18:00	11.7							5:49	14:00	8.2	18:00	23:17	5.3				13.5	113.7	1756.7
8/9/2009	4:55	23:14	2:24	9.4	4:24	3.0	6:24	13.2	14:29	7.7	16:29	1.9	18:29	11.8							6:24	14:29	8.1	18:29	23:14	4.8				12.9	126.5	1769.5
8/10/2009	4:59	23:10	2:58	8.5	4:58	2.8	6:58	12.3	14:58	8.3	16:58	2.9	18:58	11.6							6:58	14:58	8.0	18:58	23:10	4.2				12.2	138.8	1781.8
8/11/2009	5:02	23:06	3:33	7.9	5:33	2.8	7:33	11.1	15:28	9.6	17:28	4.2	19:28	11.3							7:33	15:28	7.9	19:28	23:06	3.7				11.6	150.4	1793.3
8/12/2009	5:05	23:03	4:12	7.6	6:12	3.2	8:12	10.1	16:05	11.0	18:05	6.1	20:05	11.7							8:12	16:05	7.9	20:05	23:03	3.0				10.9	161.2	1804.2
8/13/2009	5:09	22:59	5:04	7.5	7:04	3.9	9:04	9.8	16:56	12.2	18:56	8.2	20:56	12.7							9:04	16:56	7.9	20:56	22:59	2.1				9.9	171.2	1814.2
8/14/2009	5:12	22:55	6:20	7.2	8:20	4.5	10:20	10.7	18:20	12.6	20:20	10.1	22:20	15.1							5:12	6:20	1.1	10:20	18:20	8.0	22:20	22:55	0.0	9.7	181.0	1823.9
8/15/2009	5:15	22:52	7:40	7.4	9:40	3.9	11:40	10.7	19:53	13.2	21:53	10.3	23:53	16.8							5:15	7:40	2.4	11:40	19:53	8.2				10.6	191.6	1834.6
8/16/2009	5:18	22:48	8:50	7.5	10:50	2.3	12:50	9.7	21:07	13.6	23:07	8.9	1:07	16.3							5:18	8:50	3.5	12:50	21:07	8.3				11.8	203.5	1846.5
8/17/2009	5:21	22:45					1:07	16.3	9:51	7.2	11:51	0.3	13:51	8.7	22:09	13.2					5:21	9:51	4.5	13:51	22:09	8.3				12.8	216.3	1859.3
8/18/2009	5:24	22:41	22:09	13.2	0:09	6.7	2:09	15.2	10:45	6.8	12:45	-1.6	14:45	8.1	23:04	12.3					5:24	10:45	5.4	14:45	22:41	8.0				13.3	229.6	1872.6
8/19/2009	5:27	22:38	23:04	12.3	1:04	4.4	3:04	14.1	11:35	6.6	13:35	-2.7	15:35	8.1	23:55	11.4					5:27	11:35	6.1	15:35	22:38	7.1				13.2	242.8	1885.8
8/20/2009	5:30	22:34	23:55	11.4	1:55	2.3	3:55	13.2	12:21	6.7	14:21	-3.2	16:21	8.6							5:30	12:21	6.9	16:21	22:34	6.2				13.1	255.9	1898.9
8/21/2009	5:34	22:31	0:44	10.4	2:44	0.7	4:44	12.6	13:05	7.1	15:05	-2.8	17:05	9.6							5:34	13:05	7.5	17:05	22:31	5.5				13.0	268.9	1911.9
8/22/2009	5:37	22:27	1:30	9.5	3:30	-0.3	5:30	12.0	13:47	7.6	15:47	-1.7	17:47	10.7							5:37	13:47	8.2	17:47	22:27	4.7				12.9	281.8	1924.8
8/23/2009	5:40	22:24	2:15	8.8	4:15	-0.6	6:15	11.7	14:28	8.3	16:28	-0.1	18:28	12.0							6:15	14:28	8.2	18:28	22:24	4.0				12.2	294.0	1937.0
8/24/2009	5:43	22:20	2:58	8.3	4:58	-0.2	6:58	11.2	15:08	9.1	17:08	2.1	19:08	13.1							6:58	15:08	8.2	19:08	22:20	3.2				11.4	305.4	1948.4
8/25/2009	5:45	22:17	3:43	8.0	5:43	0.8	7:43	11.1	15:48	10.2	17:48	4.6	19:48	14.0							7:43	15:48	8.1	19:48	22:17	2.5				10.6	316.0	1959.0
8/26/2009	5:48	22:13	4:30	8.1	6:30	2.3	8:30	11.0	16:33	11.4	18:33	7.1	20:33	14.8							8:30	16:33	8.1	20:33	22:13	1.7				9.7	325.7	1968.7
8/27/2009	5:51	22:10	5:24	8.5	7:24	3.9	9:24	11.1	17:29	12.6	19:29	9.4	21:29	15.7							9:24	17:29	8.1	21:29	22:10	0.0				8.8	334.5	1977.5
8/28/2009	5:54	22:06	6:28	9.1	8:28	5.0	10:28	11.0	18:40	13.7	20:40	10.7	22:40	16.1							5:54	6:28	0.0	10:28	18:40	8.2				8.8	343.3	1986.3
8/29/2009	5:57	22:03	7:37	9.8	9:37	5.1	11:37	10.4	19:55	14.5	21:55	10.5	23:55	15.3							5:57	7:37	1.7	11:37	19:55	8.3				10.0	353.3	1996.3
8/30/2009	6:00	21:59	8:42	9.9	10:42	4.2	12:42	9.4	21:01	14.4	23:01	9.1	1:01	13.9							6:00	8:42	2.7	12:42	21:01	8.3				11.0	364.4	2007.4
8/31/2009	6:03	21:56					1:01	13.9	9:38	9.6	11:38	2.9	13:38	8.7	21:57	13.7	23:57	7.2	1:57	12.8	6:03	9:38	3.6	13:38	21:56	8.3				11.9	376.3	2019.3



TYPICAL SECTION D-D

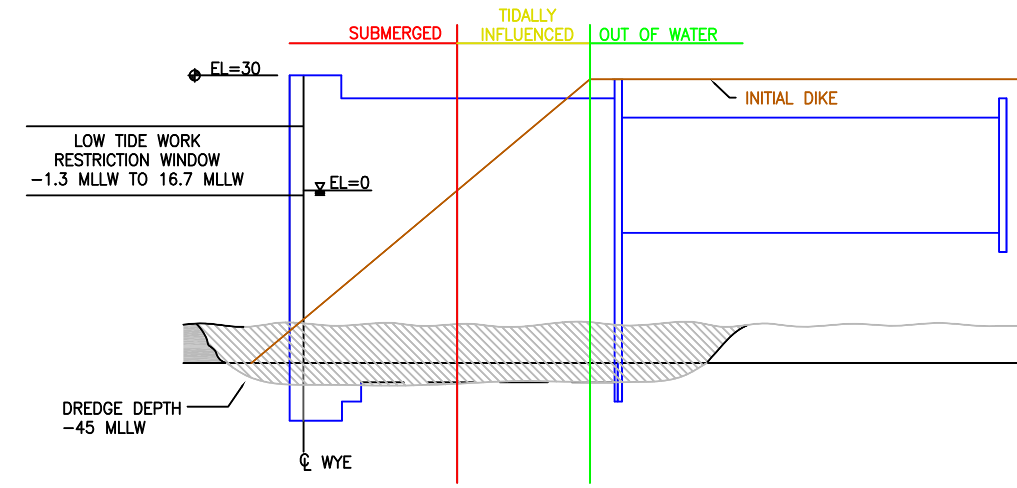
Represents the low tide window for September 12, 2009



Civil Twilight window — Submerged Piledriving

Low Tide window — Tidally Influenced Piledriving

Unrestricted Work window — Out of Water Piledriving

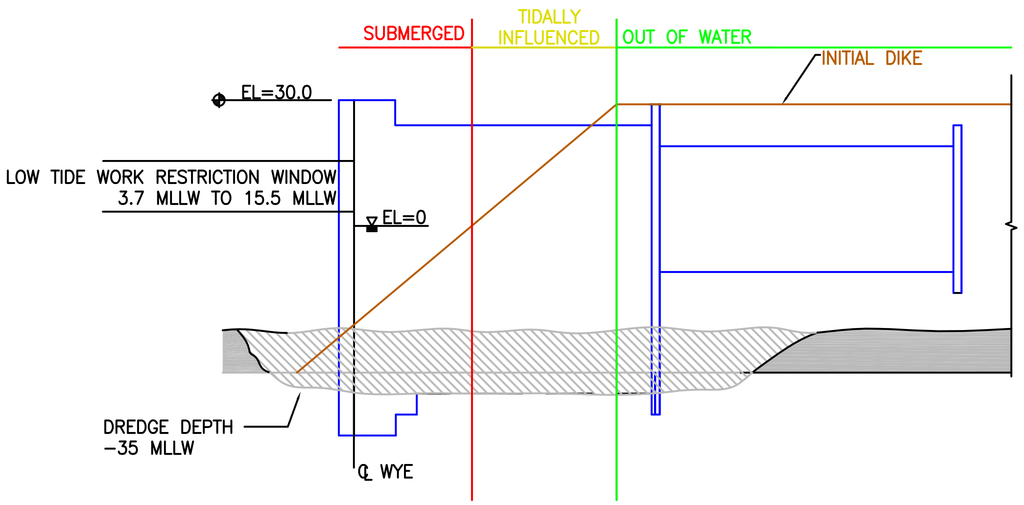


TYPICAL SECTION E-E

Represents the low tidal range for the entire month of September 2009

Date	Civil Twilight		2 Hours Before		Actual Low Tide		2 Hours After		2 Hours Before		Actual Low Tide		2 hours After		2 Hours Before		Actual Low Tide		2 Hours After	
	Begin	End	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW
9/1/2009	6:06	21:52					1:57	12.8	10:26	9.3	12:26	1.7	14:26	8.6	22:45	12.8				
9/2/2009	6:08	21:49	22:45	12.8	0:45	5.4	2:45	12.2	11:09	9.0	13:09	1.1	15:09	9.0	23:29	11.9				
9/3/2009	6:11	21:45	23:29	11.9	1:29	4.0	3:29	12.1	11:48	9.0	13:48	0.9	15:48	9.9						
9/4/2009	6:14	21:42	0:09	11.1	2:09	3.0	4:09	12.2	12:25	9.0	14:25	1.3	16:25	11.1						
9/5/2009	6:17	21:38	0:48	10.2	2:48	2.3	4:48	12.5	13:00	9.0	15:00	1.9	17:00	12.4						
9/6/2009	6:19	21:35	1:25	9.2	3:25	1.9	5:25	12.6	13:33	9.1	15:33	2.7	17:33	13.4						
9/7/2009	6:22	21:32	2:00	8.2	4:00	1.6	6:00	12.3	14:04	9.4	16:04	3.6	18:04	13.8						
9/8/2009	6:25	21:28	2:34	7.3	4:34	1.5	6:34	11.5	14:34	10.0	16:34	4.6	18:34	13.6						
9/9/2009	6:27	21:25	3:09	6.8	5:09	1.7	7:09	10.6	15:07	10.9	17:07	5.9	19:07	13.4						
9/10/2009	6:30	21:21	3:48	6.7	5:48	2.3	7:48	9.7	15:46	12.0	17:46	7.4	19:46	13.4						
9/11/2009	6:33	21:18	4:40	6.8	6:40	3.3	8:40	9.7	16:42	12.9	18:42	9.2	20:42	14.3						
9/12/2009	6:35	21:15	5:54	7.1	7:54	4.2	9:54	10.7	18:10	13.1	20:10	10.5	22:10	16.4						
9/13/2009	6:38	21:11	7:15	7.8	9:15	4.0	11:15	11.0	19:38	13.6	21:38	9.9	23:38	16.7						
9/14/2009	6:41	21:08	8:27	8.2	10:27	2.6	12:27	10.1	20:51	13.4	22:51	7.8	0:51	15.2						
9/15/2009	6:43	21:05					0:51	15.2	9:28	8.2	11:28	0.8	13:28	9.1	21:52	12.5	23:52	5.0	1:52	13.5
9/16/2009	6:46	21:01					1:52	13.5	10:23	7.9	12:23	-0.7	14:23	8.9	22:47	11.3				
9/17/2009	6:49	20:58	22:47	11.3	0:47	2.4	2:47	12.2	11:11	8.1	13:11	-1.4	15:11	9.2	23:37	10.2				
9/18/2009	6:51	20:55	23:37	10.2	1:37	0.4	3:37	11.3	11:57	8.4	13:57	-1.3	15:57	10.2						
9/19/2009	6:54	20:52	0:24	9.3	2:24	-0.8	4:24	10.9	12:40	9.1	14:40	-0.4	16:40	11.5						
9/20/2009	6:56	20:48	1:09	8.5	3:09	-1.3	5:09	10.8	13:22	9.7	15:22	1.1	17:22	13.1						
9/21/2009	6:59	20:45	1:51	8.1	3:51	-1.1	5:51	10.7	14:01	10.4	16:01	2.9	18:01	14.3						
9/22/2009	7:01	20:42	2:33	7.7	4:33	-0.3	6:33	11.0	14:39	11.1	16:39	4.8	18:39	15.1						
9/23/2009	7:04	20:38	3:14	7.5	5:14	1.0	7:14	11.2	15:18	11.7	17:18	6.7	19:18	15.7						
9/24/2009	7:07	20:35	3:55	7.6	5:55	2.6	7:55	11.2	15:59	12.5	17:59	8.5	19:59	15.8						
9/25/2009	7:09	20:32	4:43	8.0	6:43	4.3	8:43	11.4	16:51	13.2	18:51	10.1	20:51	16.1						
9/26/2009	7:12	20:29	5:42	8.7	7:42	5.7	9:42	11.7	18:01	13.7	20:01	11.0	22:01	16.4						
9/27/2009	7:14	20:26	6:51	9.6	8:51	6.2	10:51	11.6	19:18	14.1	21:18	10.6	23:18	15.5						
9/28/2009	7:17	20:22	7:59	10.2	9:59	5.6	11:59	10.9	20:27	13.8	22:27	8.9	0:27	13.8						
9/29/2009	7:19	20:19					0:27	13.8	8:59	10.2	10:59	4.4	12:59	10.2	21:25	12.9	23:25	6.6	1:25	12.3
9/30/2009	7:22	20:16					1:25	12.3	9:49	10.1	11:49	3.3	13:49	10.0	22:15	11.8				

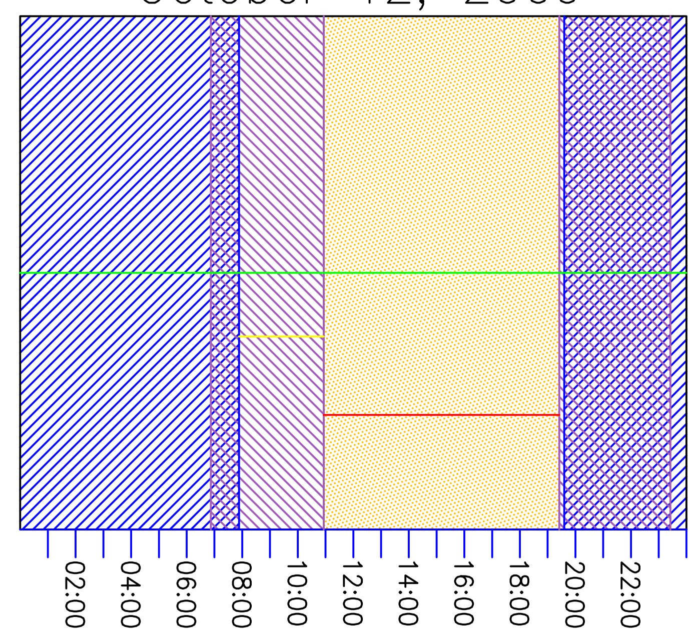
Date	Unrestricted Work Window 1			Unrestricted Work Window 2			Unrestricted Work Window 3			Hourly Totals		
	Start	End	Hours	Start	End	Hours	Start	End	Hours	Daily	Monthly	Yearly
9/1/2009	6:06	10:26	4.3	14:26	21:52	7.5				11.8	11.8	2031.1
9/2/2009	6:08	11:09	5.0	15:09	21:49	6.7				11.7	23.5	2042.8
9/3/2009	6:11	11:48	5.6	15:48	21:45	6.0				11.6	35.1	2054.4
9/4/2009	6:14	12:25	6.2	16:25	21:42	5.3				11.5	46.6	2065.9
9/5/2009	6:17	13:00	6.7	17:00	21:38	4.7				11.4	58.0	2077.3
9/6/2009	6:19	13:33	7.2	17:33	21:35	4.1				11.3	69.3	2088.6
9/7/2009	6:22	14:04	7.7	18:04	21:32	3.5				11.2	80.5	2099.8
9/8/2009	6:34	14:34	8.0	18:34	21:28	2.9				10.9	91.4	2110.7
9/9/2009	7:09	15:07	8.0	19:07	21:25	2.3				10.3	101.7	2121.0
9/10/2009	7:48	15:46	8.0	19:46	21:21	1.6				9.6	111.3	2130.6
9/11/2009	8:40	16:42	8.0	20:42	21:18	0.0				8.7	120.0	2139.3
9/12/2009	9:54	18:10	8.3							8.3	128.3	2147.5
9/13/2009	6:38	7:15	0.0	11:15	19:38	8.4				9.0	137.3	2156.6
9/14/2009	6:41	8:27	1.8	12:27	20:51	8.4				10.2	147.5	2166.8
9/15/2009	6:43	9:28	2.8	13:28	21:05	7.6				10.4	157.9	2177.2
9/16/2009	6:46	10:23	3.6	14:23	21:01	6.7				10.3	168.2	2187.5
9/17/2009	6:49	11:11	4.4	15:11	20:58	5.8				10.2	178.4	2197.6
9/18/2009	6:51	11:57	5.1	15:57	20:55	5.0				10.1	188.5	2207.7
9/19/2009	6:54	12:40	5.8	16:40	20:52	4.2				10.0	198.5	2217.7
9/20/2009	6:56	13:22	6.4	17:22	20:48	3.5				9.9	208.4	2227.6
9/21/2009	6:59	14:01	7.0	18:01	20:45	2.8				9.8	218.2	2237.4
9/22/2009	7:01	14:39	7.6	18:39	20:42	2.1				9.7	227.9	2247.2
9/23/2009	7:14	15:18	8.1	19:18	20:38	1.4				9.4	237.3	2256.6
9/24/2009	7:55	15:59	8.1	19:59	20:35	0.0				8.7	246.0	2265.3
9/25/2009	8:43	16:51	8.1							8.1	254.2	2273.4
9/26/2009	9:42	18:01	8.3							8.3	262.5	2281.8
9/27/2009	10:51	19:18	8.5							8.5	271.0	2290.2
9/28/2009	7:17	7:59	0.0	11:59	20:22	8.4				9.1	280.1	2299.4
9/29/2009	7:19	8:59	1.7	12:59	20:19	7.4				9.0	289.1	2308.4
9/30/2009	7:22	9:49	2.5	13:49	20:16	6.5				8.9	298.1	2317.3

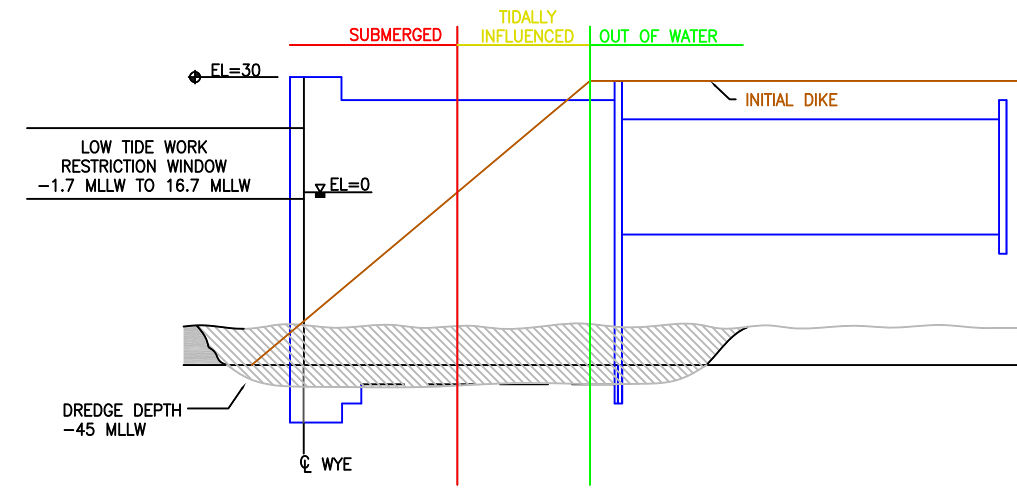


TYPICAL SECTION D-D

Represents the low tide window for October 12, 2009

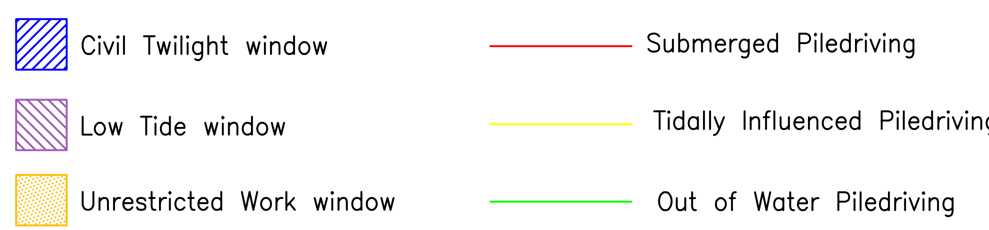
October 12, 2009





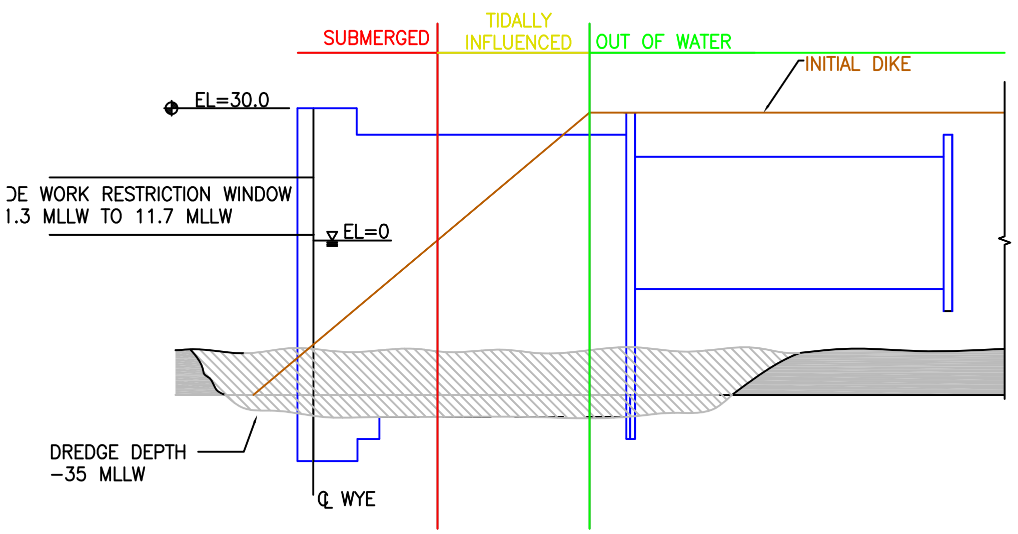
TYPICAL SECTION E-E

Represents the low tidal range for the entire month of October 2009



Date	Civil Twilight		2 Hours Before		Actual Low Tide		2 Hours After		2 Hours Before		Actual Low Tide		2 hours After		2 Hours Before		Actual Low Tide		2 Hours After	
	Begin	End	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW
10/1/2009	7:24	20:13	22:15	11.8	0:15	4.4	2:15	11.4	10:34	10.0	12:34	2.6	14:34	10.6	23:00	10.7				
10/2/2009	7:27	20:10	23:00	10.7	1:00	2.8	3:00	11.0	11:15	10.1	13:15	2.6	15:15	11.5	23:42	9.8				
10/3/2009	7:29	20:07	23:42	9.8	1:42	1.6	3:42	11.1	11:54	10.3	13:54	3.1	15:54	12.9						
10/4/2009	7:32	20:03	0:22	8.8	2:22	1.0	4:22	11.3	12:31	10.6	14:31	3.8	16:31	14.2						
10/5/2009	7:34	20:00	1:00	8.0	3:00	0.6	5:00	11.4	13:07	10.9	15:07	4.7	17:07	15.3						
10/6/2009	7:37	19:57	1:37	7.1	3:37	0.4	5:37	11.3	13:42	11.2	15:42	5.5	17:42	15.8						
10/7/2009	7:39	19:54	2:14	6.3	4:14	0.4	6:14	10.9	14:18	11.5	16:18	6.3	18:18	15.9						
10/8/2009	7:42	19:51	2:52	5.9	4:52	0.6	6:52	10.3	14:56	12.0	16:56	7.1	18:56	15.5						
10/9/2009	7:44	19:48	3:35	6.0	5:35	1.3	7:35	9.9	15:43	12.5	17:43	8.2	19:43	15.6						
10/10/2009	7:47	19:45	4:28	6.4	6:28	2.4	8:28	10.1	16:44	12.8	18:44	9.3	20:44	16.0						
10/11/2009	7:49	19:42	5:36	7.1	7:36	3.4	9:36	10.8	18:03	13.1	20:03	9.6	22:03	16.6						
10/12/2009	7:52	19:39	6:51	8.0	8:51	3.7	10:51	11.1	19:22	13.3	21:22	8.5	23:22	15.5						
10/13/2009	7:54	19:36	8:01	8.8	10:01	2.9	12:01	10.6	20:33	12.6	22:33	6.0	0:33	13.5						
10/14/2009	7:57	19:33					0:33	13.5	9:02	9.2	11:02	1.7	13:02	10.1	21:34	11.4	23:34	3.2	1:34	11.6
10/15/2009	7:59	19:30					1:34	11.6	9:57	9.4	11:57	0.9	13:57	10.2	22:28	10.2				
10/16/2009	8:02	19:27	22:28	10.2	0:28	0.7	2:28	10.2	10:46	9.8	12:46	0.8	14:46	10.8	23:17	9.2				
10/17/2009	8:04	19:24	23:17	9.2	1:17	-1.0	3:17	9.5	11:32	10.5	13:32	1.4	15:32	12.0						
10/18/2009	8:07	19:22	0:03	8.5	2:03	-1.7	4:03	9.3	12:16	11.2	14:16	2.6	16:16	13.5						
10/19/2009	8:09	19:19	0:47	8.0	2:47	-1.6	4:47	9.6	12:57	12.0	14:57	4.1	16:57	14.9						
10/20/2009	8:12	19:16	1:29	7.7	3:29	-1.0	5:29	10.2	13:37	12.4	15:37	5.6	17:37	16.0						
10/21/2009	8:14	19:13	2:08	7.4	4:08	0.0	6:08	10.7	14:15	12.7	16:15	6.9	18:15	16.6						
10/22/2009	8:17	19:10	2:46	7.2	4:46	1.2	6:46	11.0	14:53	12.8	16:53	7.9	18:53	16.7						
10/23/2009	8:19	19:08	3:24	7.2	5:24	2.5	7:24	11.1	15:33	12.9	17:33	8.9	19:33	16.4						
10/24/2009	8:22	19:05	4:05	7.5	6:05	3.8	8:05	11.2	16:20	13.0	18:20	9.6	20:20	16.0						
10/25/2009	8:24	19:02	4:54	8.1	6:54	5.1	8:54	11.3	17:22	13.1	19:22	10.1	21:22	15.8						
10/26/2009	8:26	18:59	5:58	8.8	7:58	6.1	9:58	11.9	18:35	13.0	20:35	9.8	22:35	15.2						
10/27/2009	8:29	18:57	7:06	9.7	9:06	6.3	11:06	12.0	19:45	12.7	21:45	8.3	23:45	13.7						
10/28/2009	8:31	18:54	8:10	10.3	10:10	5.9	12:10	11.9	20:47	11.9	22:47	6.2	0:47	12.1						
10/29/2009	8:34	18:52					0:47	12.1	9:05	10.7	11:05	5.2	13:05	11.9	21:41	10.7	23:41	4.0	1:41	11.0
10/30/2009	8:36	18:49					1:41	11.0	9:54	11.0	11:54	4.8	13:54	12.4	22:29	9.5				
10/31/2009	8:39	18:46	22:29	9.5	0:29	2.1	2:29	10.3	10:40	11.3	12:40	4.9	14:40	13.5	23:13	8.6				

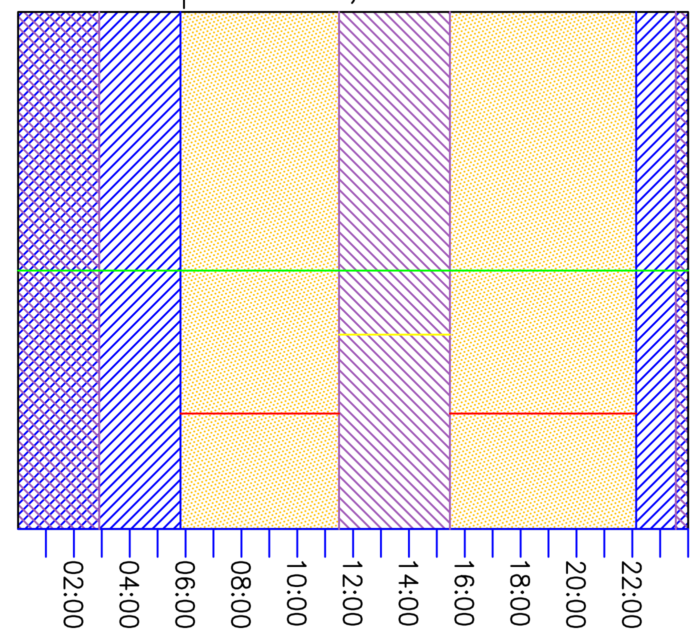
Date	Unrestricted Work Window 1			Unrestricted Work Window 2			Unrestricted Work Window 3			Hourly Totals		
	Start	End	Hours	Start	End	Hours	Start	End	Hours	Daily	Monthly	Yearly
10/1/2009	7:24	10:34	3.2	14:34	20:13	5.7				8.8	8.9	2326.2
10/2/2009	7:27	11:15	3.8	15:15	20:10	4.9				8.7	17.6	2334.9
10/3/2009	7:29	11:54	4.4	15:54	20:07	4.2				8.7	26.3	2343.6
10/4/2009	7:32	12:31	5.0	16:31	20:03	3.6				8.5	34.8	2352.1
10/5/2009	7:34	13:07	5.6	17:07	20:00	2.9				8.5	43.3	2360.6
10/6/2009	7:37	13:42	6.1	17:42	19:57	2.3				8.4	51.7	2369.0
10/7/2009	7:39	14:18	6.7	18:18	19:54	1.6				8.3	59.9	2377.3
10/8/2009	7:42	14:56	7.2	18:56	19:51	0.0				8.2	68.1	2385.4
10/9/2009	7:44	15:43	8.0	19:43	19:48	0.0				8.1	76.2	2393.5
10/10/2009	8:28	16:44	8.3							8.3	84.5	2401.8
10/11/2009	9:36	18:03	8.5							8.5	93.0	2410.3
10/12/2009	10:51	19:22	8.5							8.5	101.5	2418.8
10/13/2009	7:54	8:01	0.0	12:01	19:36	7.6				7.7	109.2	2426.6
10/14/2009	7:57	9:02	1.1	13:02	19:33	6.5				7.6	116.9	2434.2
10/15/2009	7:59	9:57	2.0	13:57	19:30	5.6				7.5	124.4	2441.7
10/16/2009	8:02	10:46	2.7	14:46	19:27	4.7				7.4	131.9	2449.2
10/17/2009	8:04	11:32	3.5	15:32	19:24	3.9				7.4	139.2	2456.6
10/18/2009	8:07	12:16	4.2	16:16	19:22	3.1				7.3	146.5	2463.8
10/19/2009	8:09	12:57	4.8	16:57	19:19	2.4				7.2	153.7	2471.0
10/20/2009	8:12	13:37	5.4	17:37	19:16	1.7				7.1	160.8	2478.1
10/21/2009	8:14	14:15	6.0	18:15	19:13	1.0				7.0	167.8	2485.2
10/22/2009	8:17	14:53	6.6	18:53	19:10	0.0				6.9	174.8	2492.1
10/23/2009	8:19	15:33	7.2							7.2	182.0	2499.3
10/24/2009	8:22	16:20	8.0							8.0	190.0	2507.3
10/25/2009	8:54	17:22	8.5							8.5	198.5	2515.8
10/26/2009	9:58	18:35	8.6							8.6	207.1	2524.4
10/27/2009	11:06	18:57	7.9							7.9	215.0	2532.3
10/28/2009	12:10	18:54	6.8							6.8	221.7	2539.0
10/29/2009	8:34	9:05	0.0	13:05	18:52	5.8				6.3	228.1	2545.4
10/30/2009	8:36	9:54	1.3	13:54	18:49	4.9				6.2	234.3	2551.6
10/31/2009	8:39	10:40	2.0	14:40	18:46	4.1				6.1	240.5	2557.8

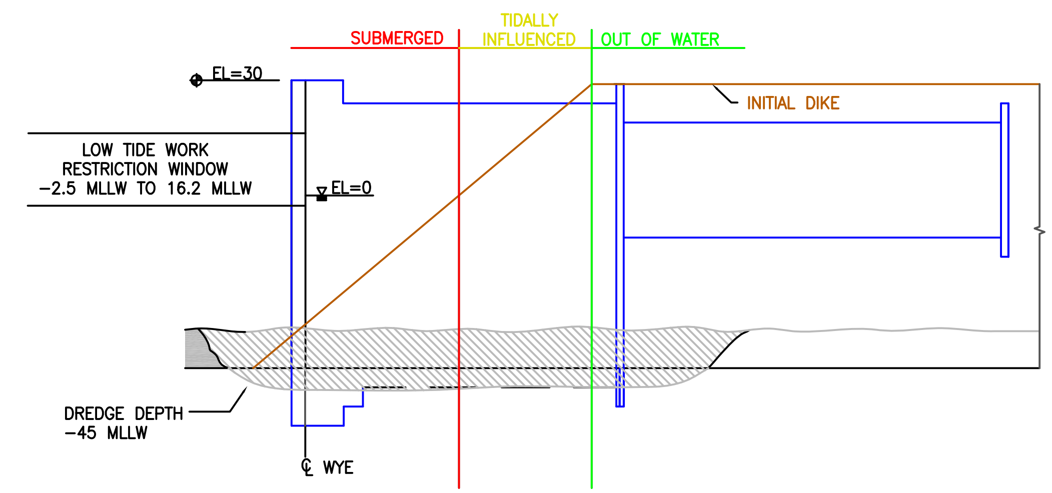


TYPICAL SECTION D-D

Represents the low tide window for April 12, 2010

April 12, 2010





TYPICAL SECTION E-E

Represents the low tidal range for the entire month of April 2010

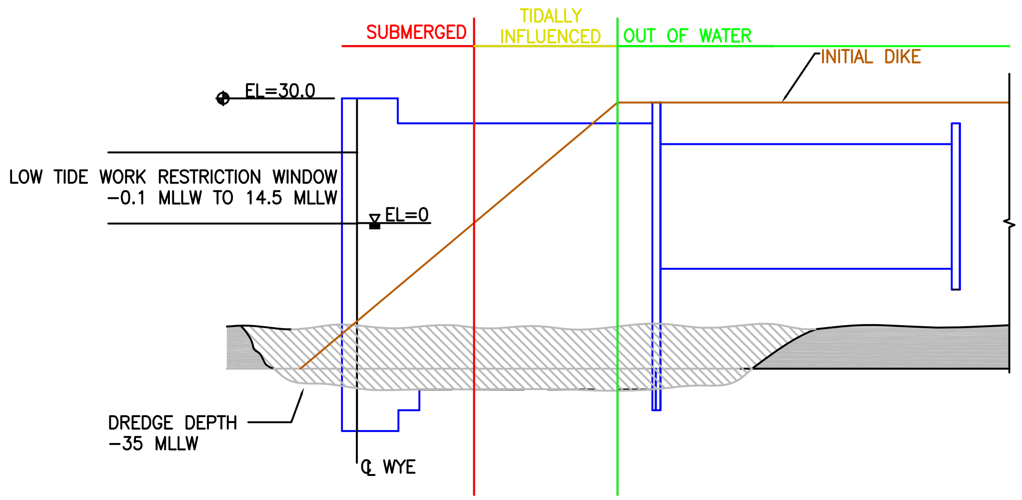
Civil Twilight window — Submerged Piledriving

Low Tide window — Tidally Influenced Piledriving

Unrestricted Work window — Out of Water Piledriving

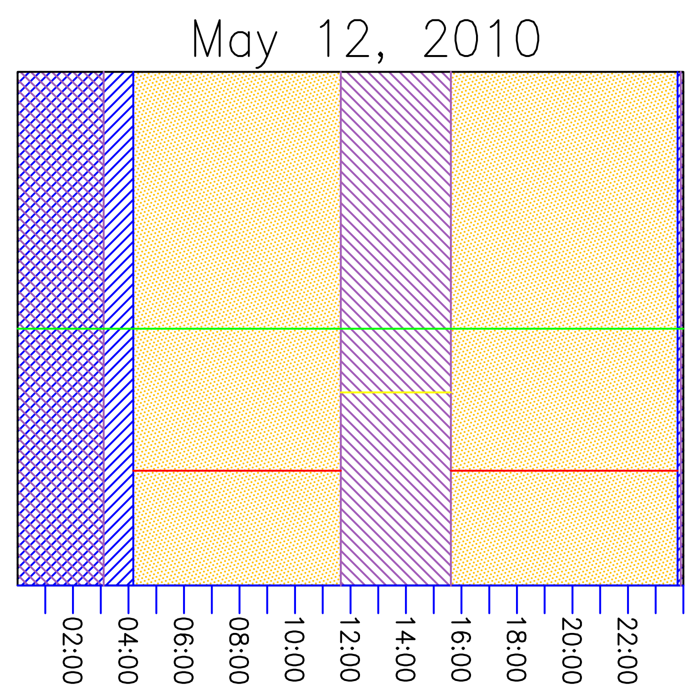
Date	Civil Twilight		2 Hours Before		Actual Low Tide		2 Hours After		2 Hours Before		Actual Low Tide		2 hours After	
	Begin	End	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW
4/1/2010	6:36	21:30	1:43	10.2	3:43	1.8	5:43	14.0	14:14	7.0	16:14	-2.0	18:14	10.1
4/2/2010	6:33	21:32	2:24	10.8	4:24	3.5	6:24	14.8	14:57	6.8	16:57	-0.8	18:57	10.4
4/3/2010	6:29	21:35	3:05	11.3	5:05	5.2	7:05	15.4	15:40	7.0	17:40	0.8	19:40	10.7
4/4/2010	6:26	21:38	3:48	11.8	5:48	6.9	7:48	15.7	16:25	7.5	18:25	2.7	20:25	10.9
4/5/2010	6:22	21:41	4:37	12.4	6:37	8.6	8:37	15.8	17:19	8.2	19:19	4.5	21:19	11.4
4/6/2010	6:19	21:44	5:38	13.0	7:38	9.7	9:38	15.8	18:23	9.2	20:23	5.7	22:23	11.7
4/7/2010	6:16	21:47	6:50	13.4	8:50	9.9	10:50	15.1	19:30	10.1	21:30	5.9	23:30	11.3
4/8/2010	6:12	21:49	8:01	13.4	10:01	8.6	12:01	13.6	20:33	10.5	22:33	5.3	0:33	10.8
4/9/2010	6:09	21:52					0:33	10.8	9:03	12.6	11:03	6.6	13:03	12.0
4/10/2010	6:05	21:55					1:27	10.5	9:56	11.5	11:56	4.4	13:56	10.8
4/11/2010	6:02	21:58	22:15	10.6	0:15	3.7	2:15	10.8	10:43	10.5	12:43	2.6	14:43	10.2
4/12/2010	5:58	22:01	22:58	10.8	0:58	3.5	2:58	11.7	11:27	9.4	13:27	1.3	15:27	10.1
4/13/2010	5:55	22:04	23:39	11.0	1:39	3.8	3:39	12.9	12:07	8.7	14:07	0.5	16:07	10.2
4/14/2010	5:51	22:07	0:17	11.4	2:17	4.4	4:17	14.2	12:47	7.8	14:47	0.1	16:47	10.6
4/15/2010	5:48	22:10	0:55	11.6	2:55	5.1	4:55	15.4	13:25	7.0	15:25	-0.1	17:25	10.8
4/16/2010	5:44	22:13	1:31	11.7	3:31	5.7	5:31	16.1	14:01	6.3	16:01	-0.2	18:01	10.6
4/17/2010	5:41	22:16	2:07	11.7	4:07	6.2	6:07	16.2	14:38	5.6	16:38	-0.1	18:38	10.2
4/18/2010	5:37	22:19	2:44	11.8	4:44	6.6	6:44	15.8	15:17	5.4	17:17	0.3	19:17	9.7
4/19/2010	5:34	22:22	3:25	12.0	5:25	7.2	7:25	15.3	16:01	5.6	18:01	1.1	20:01	9.4
4/20/2010	5:30	22:25	4:16	12.1	6:16	7.9	8:16	15.2	16:57	6.1	18:57	2.1	20:57	9.8
4/21/2010	5:27	22:28	5:22	12.1	7:22	8.4	9:22	15.5	18:05	6.8	20:05	3.0	22:05	10.5
4/22/2010	5:23	22:32	6:40	12.0	8:40	8.0	10:40	15.4	19:17	7.7	21:17	3.1	23:17	11.0
4/23/2010	5:20	22:35	7:53	11.8	9:53	6.3	11:53	14.0	20:23	8.5	22:23	2.5	0:23	10.9
4/24/2010	5:16	22:38					0:23	10.9	8:59	10.9	10:59	3.8	12:59	12.2
4/25/2010	5:13	22:41					1:22	10.9	9:57	9.8	11:57	1.2	13:57	10.5
4/26/2010	5:09	22:44	22:15	9.6	0:15	1.4	2:15	11.2	10:50	8.7	12:50	-0.9	14:50	9.4
4/27/2010	5:06	22:48	23:05	10.3	1:05	1.7	3:05	12.1	11:39	7.9	13:39	-2.1	15:39	8.8
4/28/2010	5:02	22:51	23:53	11.0	1:53	2.4	3:53	13.3	12:26	7.4	14:26	-2.5	16:26	8.9
4/29/2010	4:58	22:54	0:38	11.7	2:38	3.4	4:38	14.4	13:11	7.2	15:11	-2.2	17:11	9.3
4/30/2010	4:55	22:58	1:22	12.2	3:22	4.6	5:22	15.5	13:53	7.1	15:53	-1.4	17:53	9.8

Date	2 Hours Before		Actual Low Tide		2 Hours After		Unrestricted Work Window 1			Unrestricted Work Window 2			Unrestricted Work Window 3			Hourly Totals		
	Time	MLLW	Time	MLLW	Time	MLLW	Start	End	Hours	Start	End	Hours	Start	End	Hours	Daily	Monthly	Yearly
4/1/2010							6:36	14:14	7.6	18:14	21:30	3.3				10.9	10.9	10.9
4/2/2010							6:33	14:57	8.4	18:57	21:32	2.6				11.0	22.0	22.0
4/3/2010							7:05	15:40	8.6	19:40	21:35	1.9				10.5	32.5	32.5
4/4/2010							7:48	16:25	8.6	20:25	21:38	1.2				9.9	42.4	42.4
4/5/2010							8:37	17:19	8.7	21:19	21:41	0.0				9.1	51.5	51.5
4/6/2010							9:38	18:23	8.8							8.8	60.2	60.2
4/7/2010							6:16	6:50	0.0	10:50	19:30	8.7				9.2	69.5	69.5
4/8/2010							6:12	8:01	1.8	12:01	20:33	8.5				10.4	79.9	79.9
4/9/2010	21:27	10.6	23:27	4.3	1:27	10.5	6:09	9:03	2.9	13:03	21:27	8.4				11.3	91.2	91.2
4/10/2010	22:15	10.6					6:05	9:56	3.9	13:56	21:55	8.0				11.9	103.1	103.1
4/11/2010	22:58	10.8					6:02	10:43	4.7	14:43	21:58	7.3				12.0	115.0	115.0
4/12/2010	23:39	11.0					5:58	11:27	5.5	15:27	22:01	6.6				12.1	127.1	127.1
4/13/2010							5:55	12:07	6.2	16:07	22:04	6.0				12.2	139.3	139.3
4/14/2010							5:51	12:47	6.9	16:47	22:07	5.4				12.3	151.6	151.6
4/15/2010							5:48	13:25	7.6	17:25	22:10	4.8				12.4	164.0	164.0
4/16/2010							5:44	14:01	8.3	18:01	22:13	4.2				12.5	176.5	176.5
4/17/2010							6:07	14:38	8.5	18:38	22:16	3.7				12.2	188.7	188.7
4/18/2010							6:44	15:17	8.6	19:17	22:19	3.1				11.6	200.3	200.3
4/19/2010							7:25	16:01	8.6	20:01	22:22	2.4				11.0	211.3	211.3
4/20/2010							8:16	16:57	8.7	20:57	22:25	1.5				10.2	221.5	221.5
4/21/2010							9:22	18:05	8.7	22:05	22:28	0.0				9.1	230.6	230.6
4/22/2010							5:23	6:40	1.3	10:40	19:17	8.6				9.9	240.6	240.6
4/23/2010							5:20	7:53	2.6	11:53	20:23	8.5				11.1	251.6	251.6
4/24/2010	21:22	9.0	23:22	1.8	1:22	10.9	5:16	8:59	3.7	12:59	21:22	8.4				12.1	263.8	263.8
4/25/2010	22:15	9.6					5:13	9:57	4.7	13:57	22:15	8.3				13.0	276.8	276.8
4/26/2010	23:05	10.3					5:09	10:50	5.7	14:50	22:44	7.9				13.6	290.5	290.5
4/27/2010	23:53	11.0					5:06	11:39	6.6	15:39	22:48	7.2				13.7	304.2	304.2
4/28/2010							5:02	12:26	7.4	16:26	22:51	6.4				13.8	318.0	318.0
4/29/2010							4:58	13:11	8.2	17:11	22:54	5.7				14.0	332.0	332.0
4/30/2010							5:22	13:53	8.5	17:53	22:58	5.1				13.6	345.6	345.6



TYPICAL SECTION D-D

Represents the low tide window for May 12, 2010



Civil Twilight window

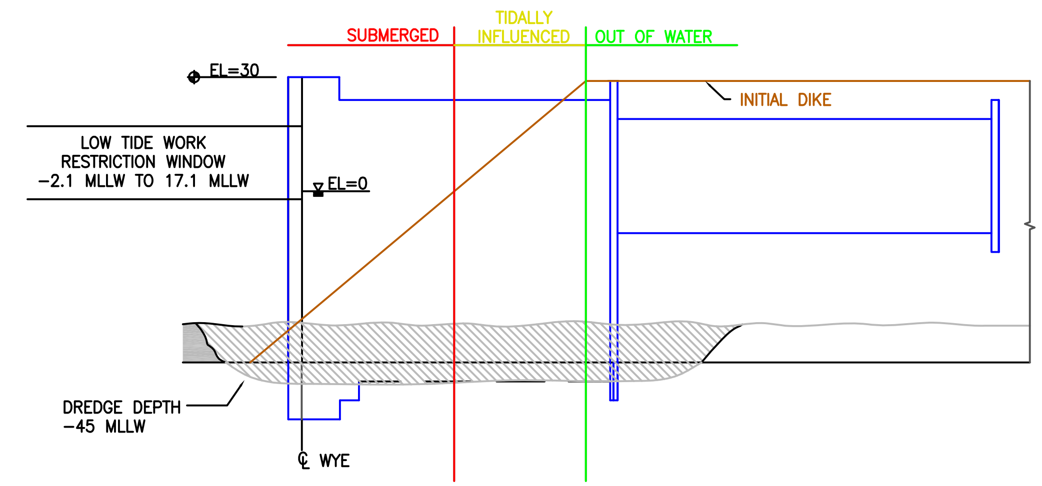
Low Tide window

Unrestricted Work window

Submerged Piledriving

Tidally Influenced Piledriving

Out of Water Piledriving



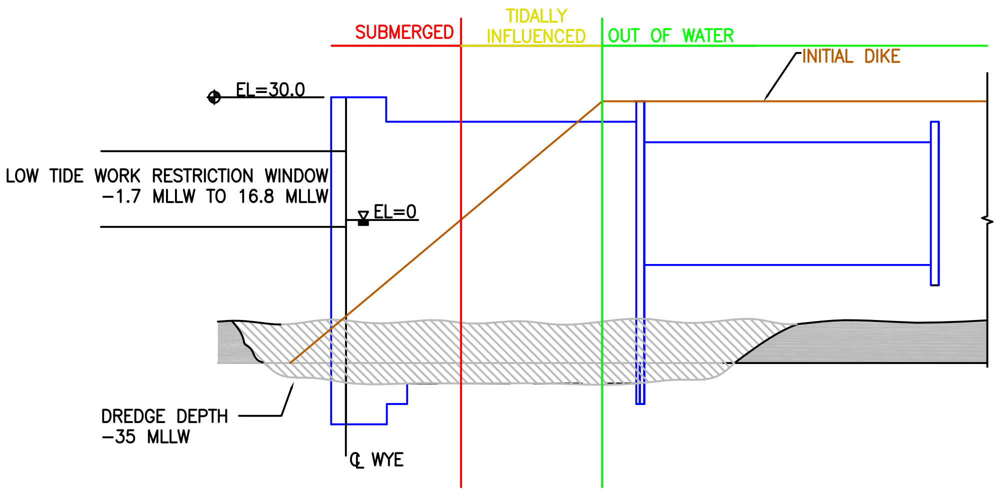
TYPICAL SECTION E-E

Represents the low tidal range for the entire month of May 2010

Ship Creek smolt releases, during which time no piledriving may be performed, typically occur during the second week of May.

Date	Civil Twilight		2 Hours Before		Actual Low Tide		2 Hours After		2 Hours Before		Actual Low Tide		2 hours After	
	Begin	End	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW
5/1/2010	4:51	23:01	2:03	12.5	4:03	5.6	6:03	16.0	14:34	7.0	16:34	-0.3	18:34	10.3
5/2/2010	4:48	23:04	2:44	12.5	4:44	6.6	6:44	16.2	15:14	7.0	17:14	1.0	19:14	10.7
5/3/2010	4:44	23:08	3:26	12.3	5:26	7.4	7:26	16.0	15:54	7.2	17:54	2.4	19:54	10.9
5/4/2010	4:40	23:11	4:11	12.2	6:11	8.1	8:11	15.6	16:39	7.6	18:39	3.9	20:39	11.1
5/5/2010	4:37	23:15	5:04	12.2	7:04	8.6	9:04	15.1	17:33	8.3	19:33	5.1	21:33	11.6
5/6/2010	4:33	23:18	6:09	12.0	8:09	8.5	10:09	14.5	18:36	9.1	20:36	6.0	22:36	12.0
5/7/2010	4:29	23:22	7:17	11.8	9:17	7.6	11:17	13.2	19:40	10.0	21:40	6.1	23:40	12.2
5/8/2010	4:26	23:25	8:22	11.1	10:22	5.9	12:22	11.8	20:39	10.7	22:39	5.9	0:39	12.3
5/9/2010	4:22	23:29					0:39	12.3	9:19	10.2	11:19	3.9	13:19	10.5
5/10/2010	4:18	23:33					1:32	12.7	10:09	9.3	12:09	2.1	14:09	9.5
5/11/2010	4:14	23:36	22:21	11.7	0:21	5.7	2:21	13.5	10:56	8.3	12:56	0.7	14:56	9.2
5/12/2010	4:11	23:40	23:06	12.2	1:06	6.0	3:06	14.5	11:40	7.6	13:40	-0.1	15:40	9.3
5/13/2010	4:07	23:44	23:49	12.7	1:49	6.4	3:49	15.6	12:22	7.0	14:22	-0.6	16:22	9.5
5/14/2010	4:03	23:48	0:31	12.9	2:31	6.7	4:31	16.5	13:03	6.4	15:03	-0.9	17:03	9.8
5/15/2010	3:59	23:51	1:13	12.9	3:13	6.8	5:13	17.1	13:43	5.8	15:43	-1.2	17:43	9.9
5/16/2010	3:56	23:55	1:54	12.6	3:54	6.7	5:54	17.1	14:23	5.3	16:23	-1.3	18:23	9.7
5/17/2010	3:52	23:59	2:36	12.2	4:36	6.4	6:36	16.6	15:05	5.0	17:05	-1.1	19:05	9.5
5/18/2010	3:48	0:03	3:21	11.8	5:21	6.2	7:21	15.9	15:50	5.1	17:50	-0.5	19:50	9.4
5/19/2010	3:44	0:07	4:12	11.4	6:12	6.1	8:12	15.2	16:41	5.7	18:41	0.5	20:41	9.7
5/20/2010	3:40	0:11	5:12	11.1	7:12	6.1	9:12	14.6	17:40	6.6	19:40	1.7	21:40	10.4
5/21/2010	3:36	0:15	6:20	10.8	8:20	5.5	10:20	13.7	18:46	7.7	20:46	2.7	22:46	11.3
5/22/2010	3:32	0:20	7:30	10.3	9:30	4.1	11:30	12.2	19:51	9.0	21:51	3.2	23:51	11.8
5/23/2010	3:28	0:24	8:36	9.6	10:36	2.1	12:36	10.5	20:52	10.2	22:52	3.5	0:52	12.2
5/24/2010	3:24	0:28					0:52	12.2	9:35	8.8	11:35	0.1	13:35	8.9
5/25/2010	3:20	0:32					1:49	12.7	10:30	8.0	12:30	-1.4	14:30	8.0
5/26/2010	3:15	0:37	22:42	12.0	0:42	4.2	2:42	13.5	11:20	7.6	13:20	-2.1	15:20	7.8
5/27/2010	3:11	0:41	23:32	12.7	1:32	4.8	3:32	14.4	12:07	7.5	14:07	-2.1	16:07	8.1
5/28/2010	3:07	0:46	0:19	13.2	2:19	5.6	4:19	15.2	12:52	7.4	14:52	-1.6	16:52	8.8
5/29/2010	3:02	0:51	1:03	13.5	3:03	6.2	5:03	15.8	13:33	7.4	15:33	-0.8	17:33	9.6
5/30/2010	2:58	0:56	1:45	13.3	3:45	6.6	5:45	16.2	14:12	7.2	16:12	0.1	18:12	10.2
5/31/2010	2:53	1:01	2:25	12.8	4:25	6.7	6:25	16.1	14:49	7.0	16:49	1.0	18:49	10.7

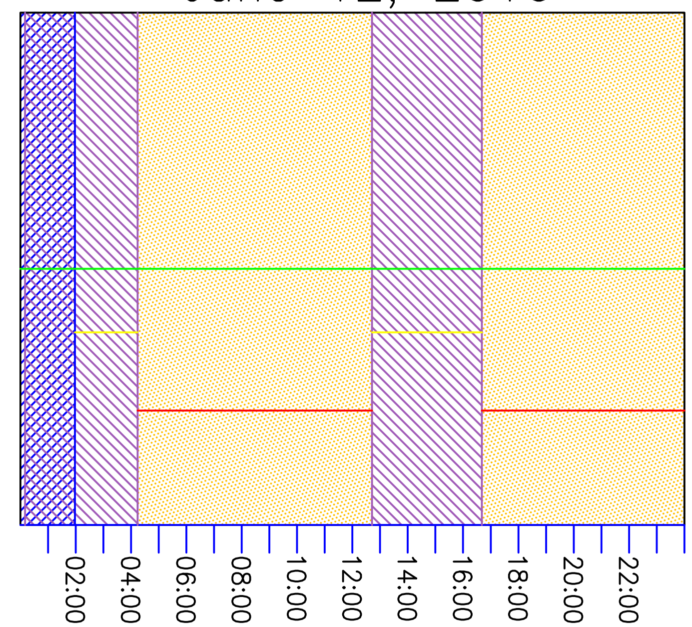
Date	2 Hours Before		Actual Low Tide		2 Hours After		Unrestricted Work Window 1			Unrestricted Work Window 2			Unrestricted Work Window 3			Hourly Totals		
	Time	MLLW	Time	MLLW	Time	MLLW	Start	End	Hours	Start	End	Hours	Start	End	Hours	Daily	Monthly	Yearly
5/1/2010							6:03	14:34	8.5	18:34	23:01	4.5				13.0	13.0	358.6
5/2/2010							6:44	15:14	8.5	19:14	23:04	3.9				12.4	25.4	371.0
5/3/2010							7:26	15:54	8.5	19:54	23:08	3.3				11.7	37.1	382.7
5/4/2010							8:11	16:39	8.5	20:39	23:11	2.6				11.0	48.1	393.8
5/5/2010							4:37	5:04	0.0	9:04	17:33	8.5	21:33	23:15	1.7	10.7	58.8	404.5
5/6/2010							4:33	6:09	1.6	10:09	18:36	8.5	22:36	23:18	0.0	10.8	69.6	415.3
5/7/2010							4:29	7:17	2.8	11:17	19:40	8.4				11.2	80.8	426.5
5/8/2010							4:26	8:22	3.9	12:22	20:39	8.3				12.2	93.1	438.7
5/9/2010	21:32	11.2	23:32	5.7	1:32	12.7	4:22	9:19	5.0	13:19	21:32	8.2				13.2	106.3	451.9
5/10/2010	22:21	11.7					4:18	10:09	5.9	14:09	22:21	8.2				14.1	120.4	466.0
5/11/2010	23:06	12.2					4:14	10:56	6.7	14:56	23:06	8.2				14.9	135.3	480.9
5/12/2010	23:49	12.7					4:11	11:40	7.5	15:40	23:40	8.0				15.5	150.8	496.4
5/13/2010							4:07	12:22	8.3	16:22	23:44	7.4				15.6	166.4	512.1
5/14/2010							4:31	13:03	8.5	17:03	23:48	6.8				15.3	181.8	527.4
5/15/2010							5:13	13:43	8.5	17:43	23:51	6.2				14.7	196.4	542.1
5/16/2010							5:54	14:23	8.5	18:23	23:55	5.6				14.0	210.5	556.1
5/17/2010							6:36	15:05	8.5	19:05	23:59	4.9				13.4	223.9	569.5
5/18/2010							7:21	15:50	8.5	19:50	23:59	4.2				12.7	236.6	582.2
5/19/2010							3:44	4:12	0.0	8:12	16:41	8.5	20:41	23:59	3.3	12.3	248.9	594.5
5/20/2010							3:40	5:12	1.5	9:12	17:40	8.5	21:40	23:59	2.3	12.3	261.2	606.9
5/21/2010							3:36	6:20	2.7	10:20	18:46	8.4	22:46	23:59	1.2	12.4	273.7	619.3
5/22/2010							3:32	7:30	4.0	11:30	19:51	8.4	23:51	23:59	0.0	12.5	286.2	631.8
5/23/2010							3:28	8:36	5.1	12:36	20:52	8.3				13.4	299.6	645.2
5/24/2010	21:49	11.1	23:49	3.7	1:49	12.7	3:24	9:35	6.2	13:35	21:49	8.2				14.4	314.0	659.7
5/25/2010	22:42	12.0					3:20	10:30	7.2	14:30	22:42	8.2				15.4	329.4	675.1
5/26/2010	23:32	12.7					3:15	11:20	8.1	15:20	23:32	8.2				16.3	345.8	691.4
5/27/2010							3:32	12:07	8.6	16:07	23:59	7.9				16.5	362.2	707.9
5/28/2010							4:19	12:52	8.6	16:52	23:59	7.1				15.7	377.9	723.6
5/29/2010							5:03	13:33	8.5	17:33	23:59	6.5				15.0	392.9	738.5
5/30/2010							5:45	14:12	8.5	18:12	23:59	5.8				14.3	407.2	752.8
5/31/2010							6:25	14:49	8.4	18:49	23:59	5.2				13.6	420.8	766.4



TYPICAL SECTION D-D

Represents the low tide window for June 12, 2010

June 12, 2010



Civil Twilight window

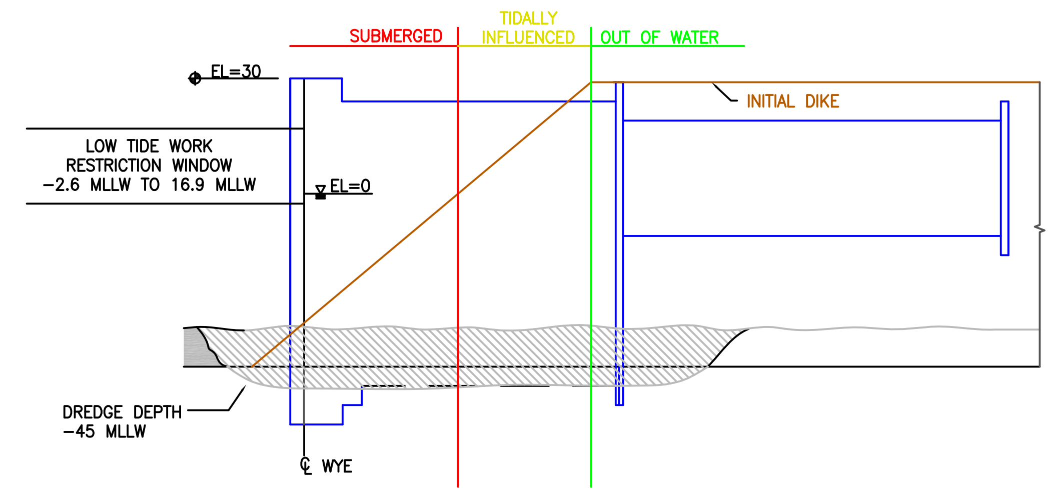
Low Tide window

Unrestricted Work window

Submerged Piledriving

Tidally Influenced Piledriving

Out of Water Piledriving



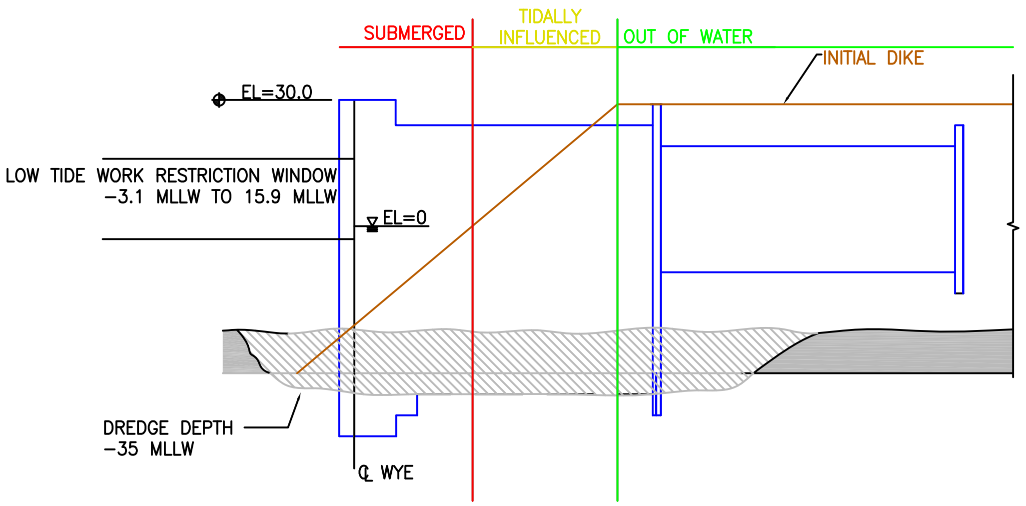
TYPICAL SECTION E-E

Represents the low tidal range for the entire month of June 2010

Ship Creek smolt releases, during which time no piledriving may be performed, typically occur during the third week of June.

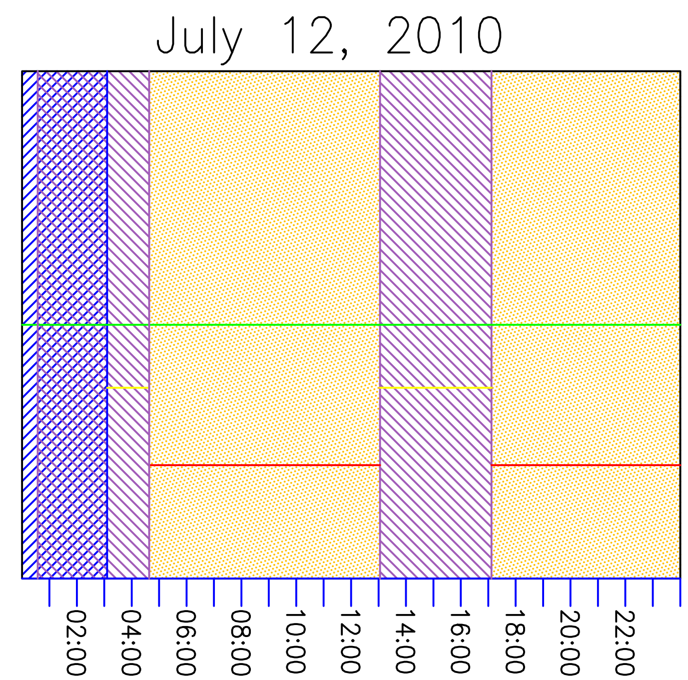
Date	Civil Twilight		2 Hours Before		Actual Low Tide		2 Hours After		2 Hours Before		Actual Low Tide		2 hours After	
	Begin	End	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW
6/1/2010	2:48	1:06	3:05	12.1	5:05	6.7	7:05	15.7	15:25	6.8	17:25	1.8	19:25	10.8
6/2/2010	2:42	1:12	3:45	11.5	5:45	6.7	7:45	14.8	16:02	7.0	18:02	2.8	20:02	10.7
6/3/2010	2:37	1:18	4:31	10.9	6:31	6.7	8:31	14.0	16:43	7.7	18:43	4.0	20:43	10.7
6/4/2010	2:30	1:25	5:25	10.5	7:25	6.7	9:25	13.3	17:35	8.5	19:35	5.3	21:35	11.4
6/5/2010	2:23	1:33	6:29	10.1	8:29	6.3	10:29	12.6	18:39	9.5	20:39	6.5	22:39	12.7
6/6/2010	2:12	1:43	7:36	9.6	9:36	5.3	11:36	11.6	19:45	10.6	21:45	7.3	23:45	13.7
6/7/2010	1:58	1:58	8:38	9.0	10:38	3.8	12:38	10.4	20:46	11.7	22:46	7.6	0:46	14.4
6/8/2010	1:58	1:58					0:46	14.4	9:34	8.3	11:34	2.2	13:34	9.5
6/9/2010	1:58	1:58					1:42	15.0	10:25	7.6	12:25	0.8	14:25	8.9
6/10/2010	1:59	1:59	22:34	13.1	0:34	7.7	2:34	15.7	11:13	6.9	13:13	-0.3	15:13	8.8
6/11/2010	1:59	1:59	23:23	13.4	1:23	7.6	3:23	16.3	11:58	6.4	13:58	-1.1	15:58	8.8
6/12/2010	1:59	1:59	0:10	13.4	2:10	7.2	4:10	16.8	12:42	5.9	14:42	-1.7	16:42	9.0
6/13/2010	1:59	1:59	0:55	13.2	2:55	6.6	4:55	16.9	13:25	5.4	15:25	-2.3	17:25	9.2
6/14/2010	1:59	1:59	1:40	12.5	3:40	5.7	5:40	16.7	14:07	5.0	16:07	-2.6	18:07	9.2
6/15/2010	2:00	2:00	2:24	11.8	4:24	4.8	6:24	15.9	14:49	4.9	16:49	-2.6	18:49	9.1
6/16/2010	2:00	2:00	3:10	10.9	5:10	4.0	7:10	15.0	15:33	5.1	17:33	-1.9	19:33	9.3
6/17/2010	2:00	2:00	4:00	10.2	6:00	3.5	8:00	14.0	16:21	5.6	18:21	-0.7	20:21	9.9
6/18/2010	2:00	2:00	4:56	9.6	6:56	3.3	8:56	13.1	17:13	6.8	19:13	1.1	21:13	10.6
6/19/2010	2:00	2:00	5:58	9.3	7:58	3.2	9:58	12.0	18:14	8.2	20:14	3.0	22:14	11.9
6/20/2010	2:01	2:01	7:05	9.1	9:05	2.6	11:05	10.8	19:19	9.9	21:19	4.6	23:19	12.9
6/21/2010	2:01	2:01	8:12	8.7	10:12	1.4	12:12	9.3	20:24	11.4	22:24	5.5	0:24	13.4
6/22/2010	2:01	2:01					0:24	13.4	9:14	8.3	11:14	0.1	13:14	8.0
6/23/2010	2:01	2:01					1:25	13.7	10:11	7.9	12:11	-1.0	14:11	7.3
6/24/2010	2:02	2:02	22:22	13.3	0:22	6.1	2:22	14.0	11:02	7.8	13:02	-1.5	15:02	7.2
6/25/2010	2:02	2:02	23:13	13.8	1:13	6.2	3:13	14.3	11:49	7.8	13:49	-1.4	15:49	7.7
6/26/2010	2:02	2:02	0:01	14.0	2:01	6.3	4:01	14.7	12:32	8.0	14:32	-0.9	16:32	8.4
6/27/2010	2:02	2:02	0:45	13.8	2:45	6.3	4:45	15.1	13:12	7.9	15:12	-0.3	17:12	9.4
6/28/2010	2:02	2:02	1:26	13.3	3:26	6.2	5:26	15.3	13:49	7.6	15:49	0.3	17:49	10.2
6/29/2010	2:03	2:03	2:05	12.4	4:05	5.8	6:05	15.3	14:23	7.1	16:23	0.8	18:23	10.7
6/30/2010	2:03	2:03	2:42	11.3	4:42	5.4	6:42	14.8	14:56	6.8	16:56	1.4	18:56	10.9

Date	2 Hours Before		Actual Low Tide		2 Hours After		Unrestricted Work Window 1			Unrestricted Work Window 2			Unrestricted Work Window 3			Hourly Totals		
	Time	MLLW	Time	MLLW	Time	MLLW	Start	End	Hours	Start	End	Hours	Start	End	Hours	Daily	Monthly	Yearly
6/1/2010							2:48	3:05	0.0	7:05	15:25	8.3	19:25	23:59	4.6	13.2	13.2	779.6
6/2/2010							2:42	3:45	1.1	7:45	16:02	8.3	20:02	23:59	4.0	13.3	26.6	793.0
6/3/2010							2:37	4:31	1.9	8:31	16:43	8.2	20:43	23:59	3.3	13.4	40.0	806.4
6/4/2010							2:30	5:25	2.9	9:25	17:35	8.2	21:35	23:59	2.4	13.5	53.5	819.9
6/5/2010							2:23	6:29	4.1	10:29	18:39	8.2	22:39	23:59	1.4	13.6	67.2	833.6
6/6/2010							2:12	7:36	5.4	11:36	19:45	8.2	23:45	23:59	0.0	13.8	81.0	847.4
6/7/2010							1:58	8:38	6.7	12:38	20:46	8.1				14.8	95.8	862.2
6/8/2010	21:42	12.5	23:42	7.7	1:42	15.0	1:58	9:34	7.6	13:34	21:42	8.1				15.7	111.6	878.0
6/9/2010	22:34	13.1					1:58	10:25	8.5	14:25	22:34	8.2				16.6	128.2	894.6
6/10/2010	23:23	13.4					2:34	11:13	8.7	15:13	23:23	8.2				16.8	145.1	911.5
6/11/2010							3:23	11:58	8.6	15:58	23:59	8.0				16.6	161.7	928.1
6/12/2010							4:10	12:42	8.5	16:42	23:59	7.3				15.8	177.6	944.0
6/13/2010							4:55	13:25	8.5	17:25	23:59	6.6				15.1	192.7	959.1
6/14/2010							5:40	14:07	8.5	18:07	23:59	5.9				14.3	207.0	973.4
6/15/2010							2:00	2:24	0.0	6:24	14:49	8.4	18:49	23:59	5.2	14.0	221.1	987.5
6/16/2010							2:00	3:10	1.2	7:10	15:33	8.4	19:33	23:59	4.5	14.0	235.1	1001.5
6/17/2010							2:00	4:00	2.0	8:00	16:21	8.4	20:21	23:59	3.7	14.0	249.1	1015.5
6/18/2010							2:00	4:56	2.9	8:56	17:13	8.3	21:13	23:59	2.8	14.0	263.2	1029.6
6/19/2010							2:00	5:58	4.0	9:58	18:14	8.3	22:14	23:59	1.8	14.0	277.2	1043.6
6/20/2010							2:01	7:05	5.1	11:05	19:19	8.2	23:19	23:59	0.0	14.0	291.2	1057.6
6/21/2010							2:01	8:12	6.2	12:12	20:24	8.2				14.4	305.6	1072.0
6/22/2010	21:25	12.6	23:25	5.9	1:25	13.7	2:01	9:14	7.2	13:14	21:25	8.2				15.4	321.1	1087.5
6/23/2010	22:22	13.3					2:01	10:11	8.2	14:11	22:22	8.2				16.4	337.4	1103.8
6/24/2010	23:13	13.8					2:22	11:02	8.7	15:02	23:13	8.2				16.9	354.3	1120.7
6/25/2010							3:13	11:49	8.6	15:49	23:59	8.2				16.8	371.1	1137.5
6/26/2010							4:01	12:32	8.5	16:32	23:59	7.5				16.0	387.1	1153.5
6/27/2010							4:45	13:12	8.5	17:12	23:59	6.8				15.3	402.4	1168.8
6/28/2010							5:26	13:49	8.4	17:49	23:59	6.2				14.6	417.0	1183.4
6/29/2010							2:03	2:05	0.0	6:05	14:23	8.3	18:23	23:59	5.6	14.0	431.0	1197.4
6/30/2010							2:03	2:42	0.7	6:42	14:56	8.2	18:56	23:59	5.1	14.0	444.9	1211.3



TYPICAL SECTION D-D

Represents the low tide window for July 12, 2010



Civil Twilight window

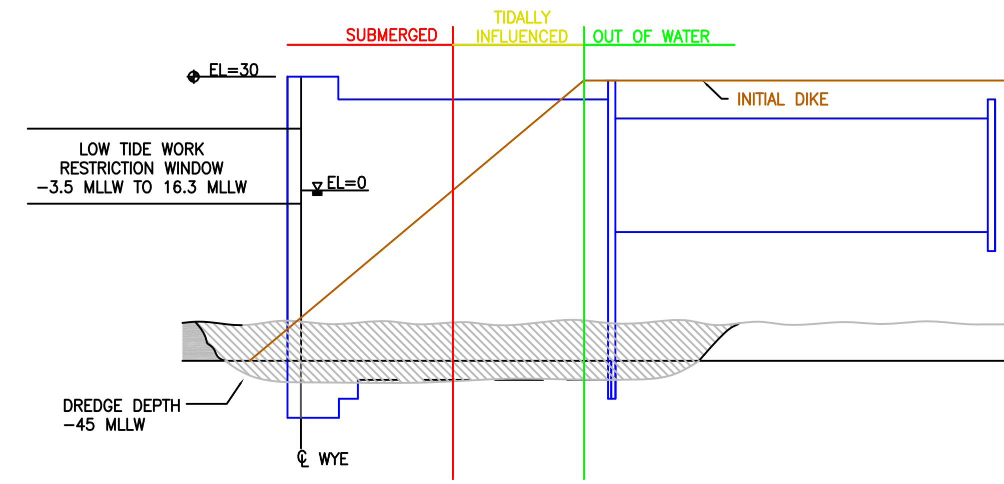
Low Tide window

Unrestricted Work window

Submerged Piledriving

Tidally Influenced Piledriving

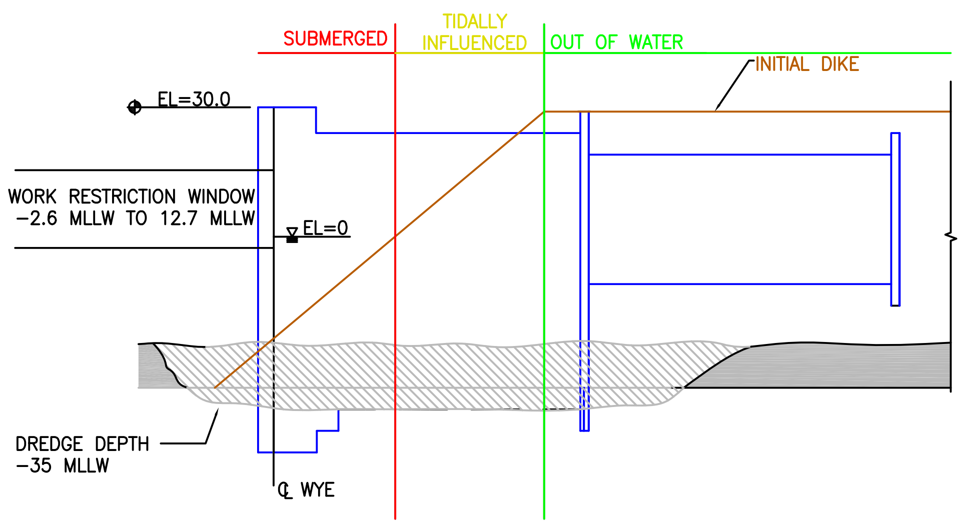
Out of Water Piledriving



TYPICAL SECTION E-E

Represents the low tidal range for the entire month of July 2010

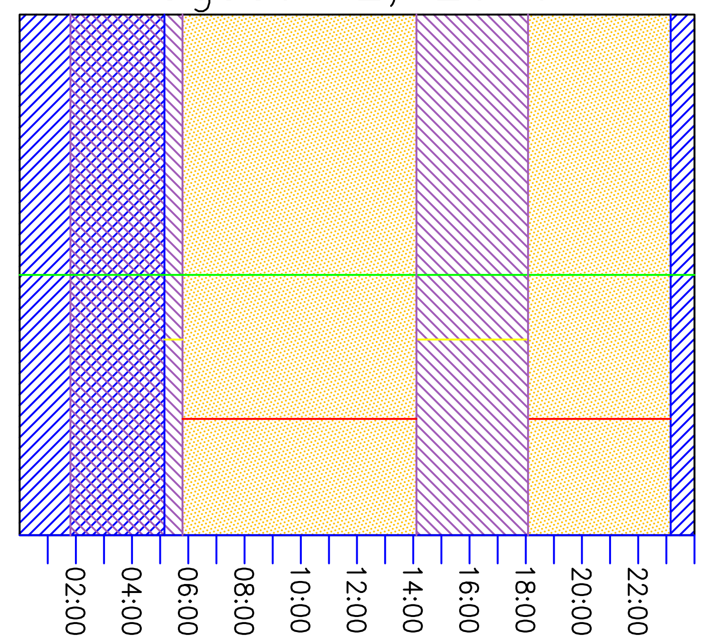
Date	Civil Twilight		2 Hours Before		Actual Low Tide		2 Hours After		2 Hours Before		Actual Low Tide		2 hours After		2 Hours Before		Actual Low Tide		2 Hours After		Unrestricted Work Window 1			Unrestricted Work Window 2			Unrestricted Work Window 3			Hourly Totals		
	Begin	End	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Start	End	Hours	Start	End	Hours	Start	End	Hours	Daily	Monthly	Yearly
7/1/2010	2:03	2:03	3:19	10.3	5:19	5.0	7:19	13.9	15:27	6.9	17:27	2.1	19:27	10.6							2:03	3:19	1.3	7:19	15:27	8.1	19:27	23:59	4.6	14.0	14.0	1225.3
7/2/2010	2:03	2:03	3:58	9.6	5:58	4.8	7:58	12.8	16:00	7.8	18:00	3.2	20:00	10.4							2:03	3:58	1.9	7:58	16:00	8.0	20:00	23:59	4.0	14.0	28.0	1239.3
7/3/2010	2:03	2:03	4:43	9.1	6:43	4.8	8:43	11.9	16:39	9.0	18:39	4.8	20:39	10.6							2:03	4:43	2.7	8:43	16:39	7.9	20:39	23:59	3.4	14.0	42.0	1253.3
7/4/2010	2:04	2:04	5:39	8.6	7:39	5.0	9:39	11.5	17:32	10.2	19:32	6.7	21:32	11.8							2:04	5:39	3.6	9:39	17:32	7.9	21:32	23:59	2.5	13.9	55.9	1267.3
7/5/2010	2:16	1:52	6:46	8.3	8:46	5.0	10:46	11.3	18:44	11.1	20:44	8.4	22:44	13.9							2:16	6:46	4.5	10:46	18:44	8.0	22:44	23:59	1.3	13.7	69.7	1281.0
7/6/2010	2:28	1:40	7:55	8.1	9:55	4.2	11:55	10.7	19:59	12.2	21:59	9.3	23:59	15.5							2:28	7:55	5.5	11:55	19:59	8.1	23:59	23:59	0.0	13.5	83.3	1294.6
7/7/2010	2:36	1:32	8:58	7.8	10:58	2.9	12:58	9.8	21:06	13.1	23:06	9.3	1:06	16.1							2:36	8:58	6.4	12:58	21:06	8.1				14.5	97.8	1309.1
7/8/2010	2:43	1:26					1:06	16.1	9:54	7.4	11:54	1.4	13:54	9.0	22:05	13.5					2:43	9:54	7.2	13:54	22:05	8.2				15.4	113.2	1324.5
7/9/2010	2:49	1:20	22:05	13.5	0:05	8.7	2:05	16.3	10:46	6.8	12:46	-0.1	14:46	8.6	22:59	13.5					2:49	10:46	8.0	14:46	22:59	8.2				16.2	129.4	1340.7
7/10/2010	2:54	1:15	22:59	13.5	0:59	7.8	2:59	16.3	11:34	6.3	13:34	-1.3	15:34	8.4	23:49	13.2					2:59	11:34	8.6	15:34	23:49	8.3				16.8	146.3	1357.6
7/11/2010	3:00	1:10	23:49	13.2	1:49	6.6	3:49	16.3	12:20	5.8	14:20	-2.4	16:20	8.5							3:49	12:20	8.5	16:20	23:59	7.7				16.2	162.5	1373.8
7/12/2010	3:05	1:05	0:36	12.6	2:36	5.2	4:36	15.9	13:04	5.4	15:04	-3.1	17:04	8.7							4:36	13:04	8.5	17:04	23:59	6.9				15.4	177.9	1389.2
7/13/2010	3:10	1:00	1:22	11.6	3:22	3.7	5:22	15.3	13:47	5.2	15:47	-3.5	17:47	9.0							5:22	13:47	8.4	17:47	23:59	6.2				14.6	192.5	1403.9
7/14/2010	3:14	0:55	2:08	10.5	4:08	2.4	6:08	14.5	14:29	5.2	16:29	-3.3	18:29	9.3							6:08	14:29	8.4	18:29	23:59	5.5				13.9	206.4	1417.7
7/15/2010	3:19	0:51	2:54	9.5	4:54	1.4	6:54	13.5	15:12	5.6	17:12	-2.4	19:12	9.9							6:54	15:12	8.3	19:12	23:59	4.8				13.1	219.5	1430.9
7/16/2010	3:24	0:47	3:42	8.7	5:42	0.9	7:42	12.4	15:57	6.4	17:57	-0.7	19:57	10.7							3:24	3:42	0.0	7:42	15:57	8.3	19:57	23:59	4.1	12.6	232.2	1443.5
7/17/2010	3:28	0:43	4:34	8.3	6:34	1.1	8:34	11.5	16:46	7.7	18:46	1.7	20:46	11.7							3:28	4:34	1.1	8:34	16:46	8.2	20:46	23:59	3.2	12.5	244.7	1456.1
7/18/2010	3:32	0:38	5:33	8.2	7:33	1.7	9:33	10.9	17:43	9.3	19:43	4.3	21:43	13.0							3:32	5:33	2.0	9:33	17:43	8.2	21:43	23:59	2.3	12.5	257.2	1468.6
7/19/2010	3:37	0:34	6:38	8.4	8:38	2.1	10:38	10.1	18:49	11.1	20:49	6.4	22:49	14.1							3:37	6:38	3.0	10:38	18:49	8.2	22:49	23:59	1.2	12.4	269.6	1481.0
7/20/2010	3:41	0:30	7:46	8.7	9:46	1.9	11:46	9.0	19:58	12.7	21:58	7.5	23:58	14.4							3:41	7:46	4.1	11:46	19:58	8.2	23:58	23:59	0.0	12.3	282.0	1493.3
7/21/2010	3:45	0:26	8:52	8.7	10:52	1.1	12:52	8.0	21:04	13.7	23:04	7.5	1:04	14.1							3:45	8:52	5.1	12:52	21:04	8.2				13.3	295.3	1506.7
7/22/2010	3:49	0:22					1:04	14.1	9:50	8.6	11:50	0.3	13:50	7.3	22:03	14.1					3:49	9:50	6.0	13:50	22:03	8.2				14.2	309.6	1520.9
7/23/2010	3:53	0:18	22:03	14.1	0:03	7.0	2:03	13.6	10:42	8.5	12:42	-0.3	14:42	7.2	22:56	14.0					3:53	10:42	6.8	14:42	22:56	8.2				15.1	324.7	1536.0
7/24/2010	3:57	0:14	22:56	14.0	0:56	6.4	2:56	13.4	11:29	8.5	13:29	-0.5	15:29	7.7	23:43	13.7					3:57	11:29	7.5	15:29	23:43	8.2				15.8	340.5	1551.8
7/25/2010	4:01	0:10	23:43	13.7	1:43	5.8	3:43	13.5	12:11	8.5	14:11	-0.3	16:11	8.5							4:01	12:11	8.2	16:11	23:59	7.8				16.0	356.5	1567.8
7/26/2010	4:05	0:07	0:26	13.2	2:26	5.3	4:26	13.8	12:49	8.4	14:49	0.1	16:49	9.6							4:26	12:49	8.4	16:49	23:59	7.2				15.6	372.1	1583.4
7/27/2010	4:08	0:03	1:05	12.5	3:05	4.8	5:05	14.0	13:24	8.1	15:24	0.6	17:24	10.6							5:05	13:24	8.3	17:24	23:59	6.6				14.9	387.0	1598.3
7/28/2010	4:12	23:59	1:42	11.4	3:42	4.3	5:42	14.0	13:56	7.7	15:56	1.1	17:56	11.3							5:42	13:56	8.2	17:56	23:59	6.1				14.3	401.3	1612.7
7/29/2010	4:16	23:55	2:18	10.2	4:18	3.8	6:18	13.8	14:27	7.4	16:27	1.7	18:27	11.7							6:18	14:27	8.2	18:27	23:55	5.5				13.6	415.0	1626.3
7/30/2010	4:20	23:51	2:52	9.1	4:52	3.3	6:52	12.9	14:55	7.7	16:55	2.4	18:55	11.4							6:52	14:55	8.1	18:55	23:51	5.0				13.0	428.0	1639.3
7/31/2010	4:23	23:48	3:27	8.3	5:27	3.2	7:27	11.9	15:24	8.7	17:24	3.5	19:24	11.0							7:27	15:24	8.0	19:24	23:48	4.4				12.4	440.4	1651.7



TYPICAL SECTION D-D

Represents the low tide window for August 12, 2010

August 12, 2010



Civil Twilight window

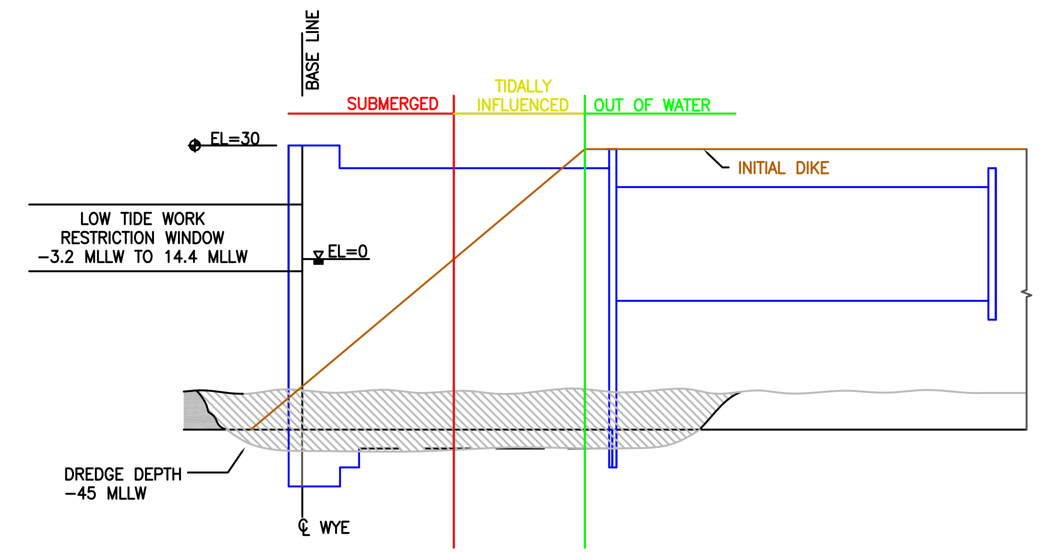
Low Tide window

Unrestricted Work window

Submerged Piledriving

Tidally Influenced Piledriving

Out of Water Piledriving

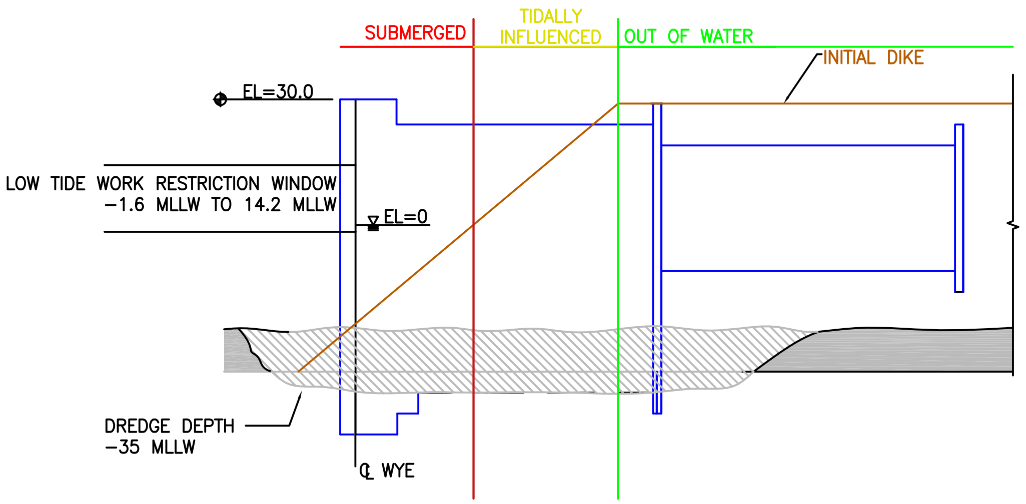


TYPICAL SECTION E-E

Represents the low tidal range for the entire month of August 2010

Date	Civil Twilight		2 Hours Before		Actual Low Tide		2 Hours After		2 Hours Before		Actual Low Tide		2 hours After	
	Begin	End	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW
8/1/2010	4:27	23:44	4:04	8.0	6:04	3.4	8:04	10.7	15:57	10.1	17:57	5.1	19:57	11.1
8/2/2010	4:30	23:40	4:50	7.9	6:50	4.0	8:50	10.1	16:40	11.6	18:40	7.1	20:40	11.8
8/3/2010	4:34	23:36	5:54	7.6	7:54	4.7	9:54	10.5	17:44	12.4	19:44	9.2	21:44	13.4
8/4/2010	4:38	23:33	7:11	7.6	9:11	4.8	11:11	11.0	19:17	12.7	21:17	10.5	23:17	16.1
8/5/2010	4:41	23:29	8:22	7.8	10:22	3.8	12:22	10.4	20:35	13.5	22:35	10.2	0:35	16.7
8/6/2010	4:44	23:25					0:35	16.7	9:24	7.6	11:24	2.2	13:24	9.5
8/7/2010	4:48	23:22					1:39	16.2	10:19	7.1	12:19	0.3	14:19	8.8
8/8/2010	4:51	23:18	22:36	13.2	0:36	7.0	2:36	15.6	11:09	6.6	13:09	-1.3	15:09	8.6
8/9/2010	4:55	23:14	23:27	12.4	1:27	5.0	3:27	15.0	11:56	6.1	13:56	-2.5	15:56	8.7
8/10/2010	4:58	23:11	0:15	11.4	2:15	3.1	4:15	14.3	12:40	6.0	14:40	-3.1	16:40	9.1
8/11/2010	5:01	23:07	1:02	10.2	3:02	1.3	5:02	13.5	13:23	6.1	15:23	-3.2	17:23	9.7
8/12/2010	5:05	23:04	1:48	9.1	3:48	-0.1	5:48	12.7	14:06	6.3	16:06	-2.6	18:06	10.6
8/13/2010	5:08	23:00	2:34	8.2	4:34	-0.8	6:34	11.9	14:48	7.0	16:48	-1.3	18:48	11.4
8/14/2010	5:11	22:56	3:20	7.6	5:20	-0.8	7:20	11.1	15:31	8.0	17:31	0.8	19:31	12.2
8/15/2010	5:14	22:53	4:10	7.4	6:10	0.0	8:10	10.7	16:18	9.3	18:18	3.3	20:18	13.2
8/16/2010	5:17	22:49	5:06	7.7	7:06	1.3	9:06	10.6	17:14	10.8	19:14	6.0	21:14	14.4
8/17/2010	5:20	22:46	6:09	8.4	8:09	2.6	10:09	10.3	18:20	12.4	20:20	8.2	22:20	15.3
8/18/2010	5:24	22:42	7:18	9.2	9:18	3.2	11:18	9.7	19:33	13.8	21:33	9.1	23:33	15.1
8/19/2010	5:27	22:39	8:26	9.6	10:26	2.9	12:26	8.8	20:43	14.4	22:43	8.5	0:43	14.0
8/20/2010	5:30	22:35					0:43	14.0	9:27	9.6	11:27	2.0	13:27	8.1
8/21/2010	5:33	22:31					1:44	12.9	10:19	9.4	12:19	1.1	14:19	7.9
8/22/2010	5:36	22:28	22:35	13.6	0:35	5.8	2:35	12.2	11:04	9.3	13:04	0.6	15:04	8.2
8/23/2010	5:39	22:24	23:21	12.8	1:21	4.6	3:21	12.1	11:45	9.2	13:45	0.6	15:45	9.2
8/24/2010	5:42	22:21	0:03	12.0	2:03	3.8	4:03	12.3	12:21	9.2	14:21	1.0	16:21	10.2
8/25/2010	5:45	22:17	0:41	11.2	2:41	3.1	4:41	12.5	12:56	9.1	14:56	1.6	16:56	11.6
8/26/2010	5:48	22:14	1:18	10.2	3:18	2.7	5:18	12.8	13:29	8.8	15:29	2.2	17:29	12.7
8/27/2010	5:51	22:10	1:53	9.1	3:53	2.3	5:53	12.7	13:59	8.9	15:59	3.0	17:59	13.2
8/28/2010	5:53	22:07	2:26	8.1	4:26	2.1	6:26	12.1	14:28	9.2	16:28	3.8	18:28	13.2
8/29/2010	5:56	22:03	2:59	7.4	4:59	2.1	6:59	11.3	14:56	10.1	16:56	4.9	18:56	12.7
8/30/2010	5:59	22:00	3:32	7.2	5:32	2.6	7:32	10.1	15:28	11.3	17:28	6.3	19:28	12.6
8/31/2010	6:02	21:56	4:11	7.4	6:11	3.4	8:11	9.4	16:08	12.6	18:08	8.1	20:08	12.9

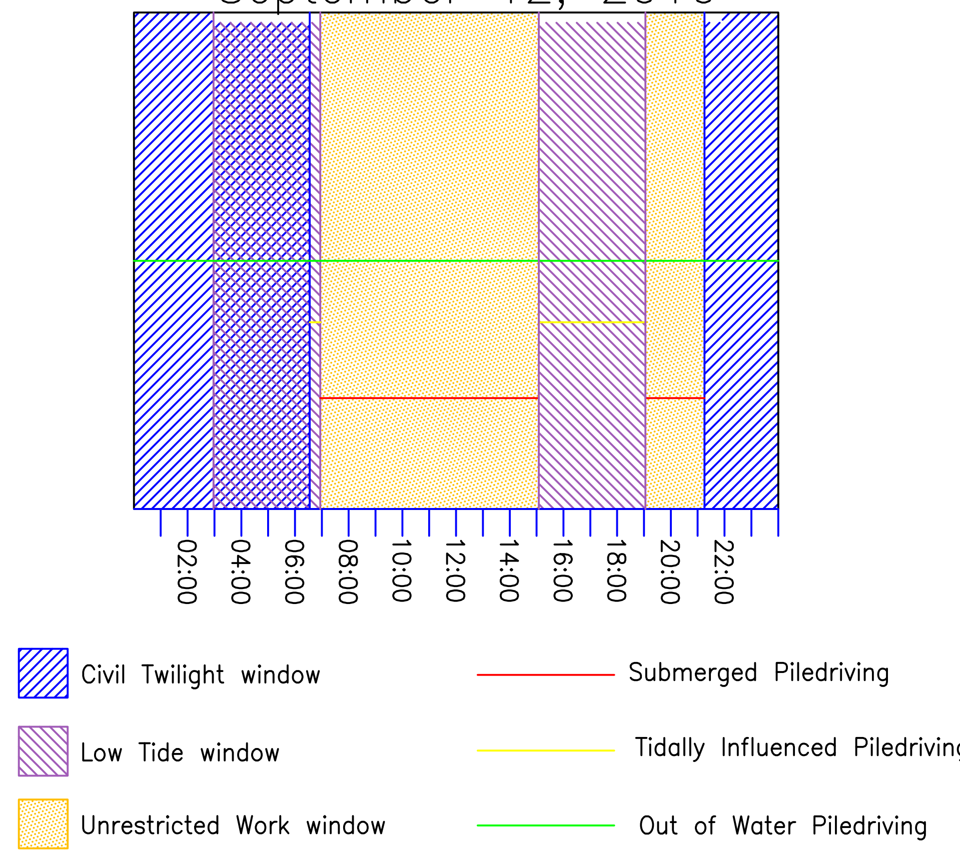
Date	2 Hours Before		Actual Low Tide		2 Hours After		Unrestricted Work Window 1			Unrestricted Work Window 2			Unrestricted Work Window 3			Hourly Totals		
	Time	MLLW	Time	MLLW	Time	MLLW	Start	End	Hours	Start	End	Hours	Start	End	Hours	Daily	Monthly	Yearly
8/1/2010							8:04	15:57	7.9	19:57	23:44	3.8				11.7	11.7	1663.4
8/2/2010							4:30	4:50	0.0	8:50	16:40	7.8	20:40	23:40	3.0	11.2	22.9	1674.6
8/3/2010							4:34	5:54	1.3	9:54	17:44	7.8	21:44	23:36	1.9	11.1	34.0	1685.7
8/4/2010							4:38	7:11	2.6	11:11	19:17	8.1	23:17	23:33	0.0	10.9	45.0	1696.7
8/5/2010							4:41	8:22	3.7	12:22	20:35	8.2				11.9	56.9	1708.6
8/6/2010	21:39	13.7	23:39	8.8	1:39	16.2	4:44	9:24	4.7	13:24	21:39	8.3				12.9	69.9	1721.6
8/7/2010	22:36	13.2					4:48	10:19	5.5	14:19	22:36	8.3				13.8	83.7	1735.4
8/8/2010	23:27	12.4					4:51	11:09	6.3	15:09	23:18	8.2				14.5	98.2	1749.9
8/9/2010							4:55	11:56	7.0	15:56	23:14	7.3				14.3	112.5	1764.2
8/10/2010							4:58	12:40	7.7	16:40	23:11	6.5				14.2	126.8	1778.5
8/11/2010							5:02	13:23	8.4	17:23	23:07	5.8				14.1	140.9	1792.6
8/12/2010							5:48	14:06	8.3	18:06	23:04	5.0				13.3	154.2	1805.9
8/13/2010							6:34	14:48	8.2	18:48	23:00	4.2				12.5	166.7	1818.4
8/14/2010							7:20	15:31	8.2	19:31	22:56	3.4				11.6	178.3	1830.0
8/15/2010							8:10	16:18	8.1	20:18	22:53	2.6				10.7	189.0	1840.7
8/16/2010							9:06	17:14	8.1	21:14	22:49	1.6				9.7	198.8	1850.5
8/17/2010							5:20	6:09	0.0	10:09	18:20	8.2	22:20	22:46	0.0	9.5	208.3	1860.0
8/18/2010							5:24	7:18	1.9	11:18	19:33	8.3				10.2	218.5	1870.2
8/19/2010							5:27	8:26	3.0	12:26	20:43	8.3				11.3	229.8	1881.5
8/20/2010	21:44	14.1	23:44	7.2	1:44	12.9	5:30	9:27	4.0	13:27	21:44	8.3				12.2	242.0	1893.7
8/21/2010	22:35	13.6					5:33	10:19	4.8	14:19	22:31	8.2				13.0	255.0	1906.7
8/22/2010	23:21	12.8					5:36	11:04	5.5	15:04	22:28	7.4				12.9	267.9	1919.6
8/23/2010							5:39	11:45	6.1	15:45	22:24	6.7				12.8	280.7	1932.4
8/24/2010							5:42	12:21	6.7	16:21	22:21	6.0				12.7	293.4	1945.1
8/25/2010							5:45	12:56	7.2	16:56	22:17	5.4				12.6	306.0	1957.7
8/26/2010							5:48	13:29	7.7	17:29	22:14	4.8				12.5	318.4	1970.1
8/27/2010							5:53	13:59	8.1	17:59	22:10	4.2				12.3	330.7	1982.4
8/28/2010							6:26	14:28	8.0	18:28	22:07	3.7				11.7	342.5	1994.2
8/29/2010							6:59	14:56	8.0	18:56	22:03	3.1				11.1	353.6	2005.3
8/30/2010							7:32	15:28	7.9	19:28	22:00	2.6				10.5	364.1	2015.8
8/31/2010							8:11	16:08	8.0	20:08	21:56	1.8				9.8	373.8	2025.5

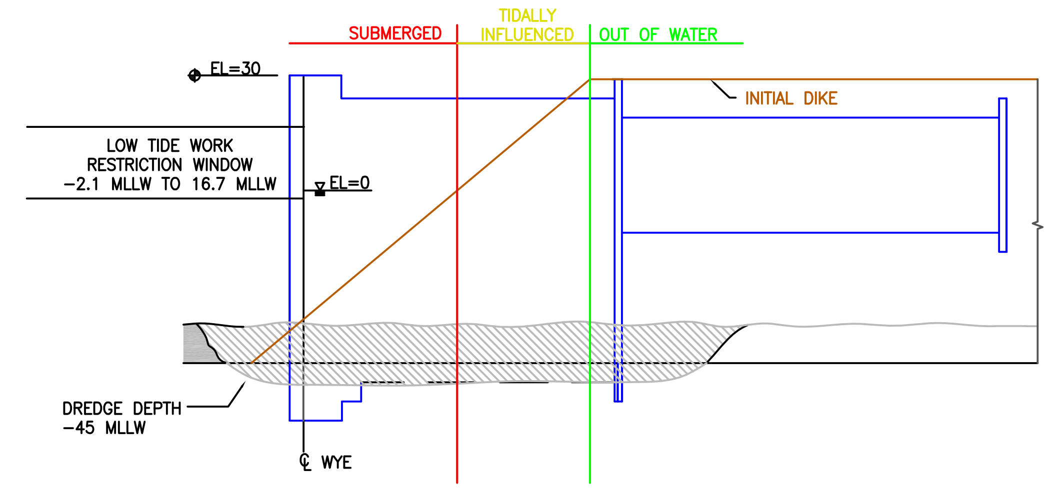


TYPICAL SECTION D-D

Represents the low tide window for September 12, 2010

September 12, 2010



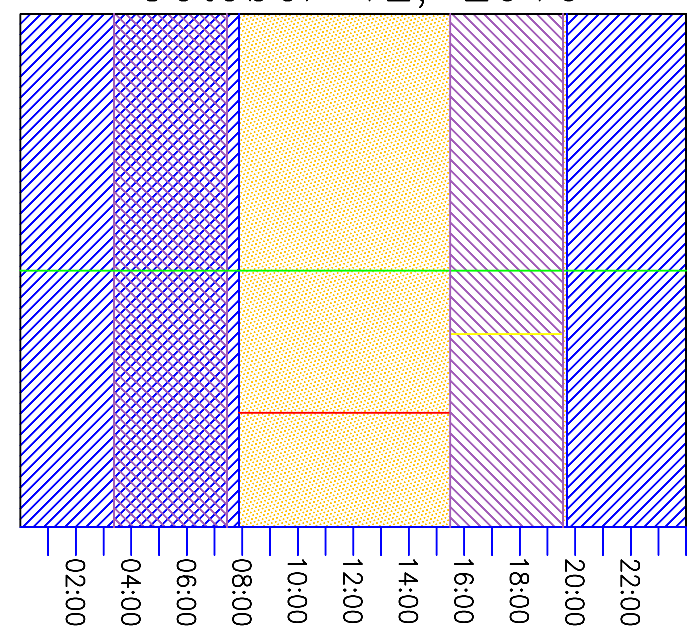


TYPICAL SECTION E-E

Represents the low tidal range for the entire month of September 2010

Date	Civil Twilight		2 Hours Before		Actual Low Tide		2 Hours After		2 Hours Before		Actual Low Tide		2 hours After		2 Hours Before		Actual Low Tide		2 Hours After		Unrestricted Work Window 1			Unrestricted Work Window 2			Unrestricted Work Window 3			Hourly Totals		
	Begin	End	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Start	End	Hours	Start	End	Hours	Start	End	Hours	Daily	Monthly	Yearly
9/1/2010	6:05	21:53	5:07	7.5	7:07	4.5	9:07	9.7	17:08	13.3	19:08	10.0	21:08	14.0							9:07	17:08	8.0	21:08	21:53	0.0				8.8	8.8	2034.3
9/2/2010	6:08	21:50	6:29	7.5	8:29	5.1	10:29	11.0	18:45	13.2	20:45	11.0	22:45	16.5							6:08	6:29	0.0	10:29	18:45	8.3				8.6	17.5	2043.0
9/3/2010	6:10	21:46	7:48	8.0	9:48	4.5	11:48	11.1	20:09	13.6	22:09	10.2	0:09	16.7							6:10	7:48	1.6	11:48	20:09	8.4				10.0	27.5	2053.0
9/4/2010	6:13	21:43					0:09	16.7	8:54	8.1	10:54	2.8	12:54	10.2	21:16	13.3	23:16	8.1	1:16	15.6	6:13	8:54	2.7	12:54	21:16	8.4				11.1	38.6	2064.1
9/5/2010	6:16	21:39					1:16	15.6	9:51	7.7	11:51	0.9	13:51	9.5	22:13	12.4					6:16	9:51	3.6	13:51	21:39	7.8				11.4	50.0	2075.5
9/6/2010	6:19	21:36	22:13	12.4	0:13	5.5	2:13	14.4	10:42	7.3	12:42	-0.7	14:42	9.3	23:05	11.1					6:19	10:42	4.4	14:42	21:36	6.9				11.3	61.3	2086.8
9/7/2010	6:21	21:32	23:05	11.1	1:05	3.0	3:05	13.3	11:30	7.1	13:30	-1.7	15:30	9.7	23:54	9.9					6:21	11:30	5.2	15:30	21:32	6.1				11.2	72.5	2098.0
9/8/2010	6:24	21:29	23:54	9.9	1:54	0.8	3:54	12.5	12:15	7.2	14:15	-2.0	16:15	10.4							6:24	12:15	5.9	16:15	21:29	5.3				11.1	83.6	2109.2
9/9/2010	6:27	21:26	0:41	8.8	2:41	-0.9	4:41	11.7	12:59	7.6	14:59	-1.6	16:59	11.5							6:27	12:59	6.5	16:59	21:26	4.5				11.0	94.6	2120.2
9/10/2010	6:30	21:22	1:27	7.8	3:27	-1.9	5:27	11.2	13:42	8.2	15:42	-0.6	17:42	12.5							6:30	13:42	7.2	17:42	21:22	3.7				10.9	105.5	2131.1
9/11/2010	6:32	21:19	2:13	7.1	4:13	-2.1	6:13	10.8	14:24	9.0	16:24	1.0	18:24	13.4							6:32	14:24	7.9	18:24	21:19	2.9				10.8	116.4	2141.9
9/12/2010	6:35	21:16	2:58	6.9	4:58	-1.6	6:58	10.5	15:07	10.0	17:07	3.0	19:07	14.2							6:58	15:07	8.2	19:07	21:16	2.2				10.3	126.7	2152.2
9/13/2010	6:37	21:12	3:45	7.1	5:45	-0.2	7:45	10.4	15:54	11.0	17:54	5.3	19:54	15.1							7:45	15:54	8.2	19:54	21:12	1.3				9.5	136.2	2161.7
9/14/2010	6:40	21:09	4:37	7.7	6:37	1.7	8:37	10.7	16:47	12.2	18:47	7.7	20:47	15.7							8:37	16:47	8.2	20:47	21:09	0.0				8.6	144.7	2170.3
9/15/2010	6:43	21:06	5:37	8.6	7:37	3.6	9:37	11.0	17:52	13.3	19:52	9.4	21:52	16.0							9:37	17:52	8.3							8.3	153.0	2178.5
9/16/2010	6:45	21:02	6:44	9.7	8:44	4.7	10:44	10.8	19:05	14.3	21:05	9.9	23:05	15.3							10:44	19:05	8.4							8.4	161.4	2186.9
9/17/2010	6:48	20:59	7:53	10.4	9:53	4.7	11:53	10.1	20:16	14.4	22:16	8.8	0:16	13.7							6:48	7:53	1.1	11:53	20:16	8.4				9.5	170.9	2196.4
9/18/2010	6:51	20:56					0:16	13.7	8:55	10.5	10:55	3.9	12:55	9.4	21:18	13.7	23:18	6.9	1:18	12.3	6:51	8:55	2.1	12:55	20:56	8.0				10.1	181.0	2206.5
9/19/2010	6:53	20:52					1:18	12.3	9:48	10.3	11:48	2.8	13:48	9.2	22:10	12.6					6:53	9:48	2.9	13:48	20:52	7.1				10.0	191.0	2216.5
9/20/2010	6:56	20:49	22:10	12.6	0:10	5.0	2:10	11.3	10:33	10.2	12:33	2.2	14:33	9.5	22:55	11.7					6:56	10:33	3.6	14:33	20:49	6.3				9.9	200.9	2226.5
9/21/2010	6:58	20:46	22:55	11.7	0:55	3.3	2:55	10.9	11:13	10.2	13:13	2.1	15:13	10.3	23:36	10.8					6:58	11:13	4.3	15:13	20:46	5.6				9.8	210.8	2236.3
9/22/2010	7:01	20:42	23:36	10.8	1:36	2.2	3:36	10.8	11:51	10.3	13:51	2.4	15:51	11.6							7:01	11:51	4.8	15:51	20:42	4.9				9.7	220.5	2246.0
9/23/2010	7:03	20:39	0:15	9.9	2:15	1.6	4:15	11.1	12:27	10.4	14:27	3.1	16:27	13.0							7:03	12:27	5.4	16:27	20:39	4.2				9.6	230.1	2255.6
9/24/2010	7:06	20:36	0:53	8.9	2:53	1.2	4:53	11.6	13:01	10.6	15:01	4.0	17:01	14.2							7:06	13:01	5.9	17:01	20:36	3.6				9.5	239.6	2265.2
9/25/2010	7:08	20:33	1:29	8.0	3:29	1.1	5:29	11.8	13:34	10.7	15:34	4.9	17:34	15.0							7:08	13:34	6.4	17:34	20:33	3.0				9.4	249.1	2274.6
9/26/2010	7:11	20:30	2:03	7.2	4:03	1.2	6:03	11.6	14:06	11.0	16:06	5.7	18:06	15.3							7:11	14:06	6.9	18:06	20:30	2.4				9.3	258.4	2284.0
9/27/2010	7:14	20:26	2:36	6.7	4:36	1.4	6:36	11.0	14:37	11.5	16:37	6.6	18:37	14.9							7:14	14:37	7.4	18:37	20:26	1.8				9.2	267.7	2293.2
9/28/2010	7:16	20:23	3:10	6.5	5:10	2.0	7:10	10.1	15:11	12.3	17:11	7.6	19:11	14.5							7:16	15:11	7.9	19:11	20:23	1.2				9.1	276.8	2302.4
9/29/2010	7:19	20:20	3:48	6.8	5:48	2.8	7:48	9.5	15:53	13.0	17:53	8.9	19:53	14.3							7:48	15:53	8.1	19:53	20:20	0.0				8.6	285.4	2310.9
9/30/2010	7:21	20:17	4:40	7.1	6:40	3.9	8:40	9.6	16:55	13.4	18:55	10.1	20:55	15.1							8:40	16:55	8.3							8.3	293.7	2319.2

October 12, 2010



Civil Twilight window

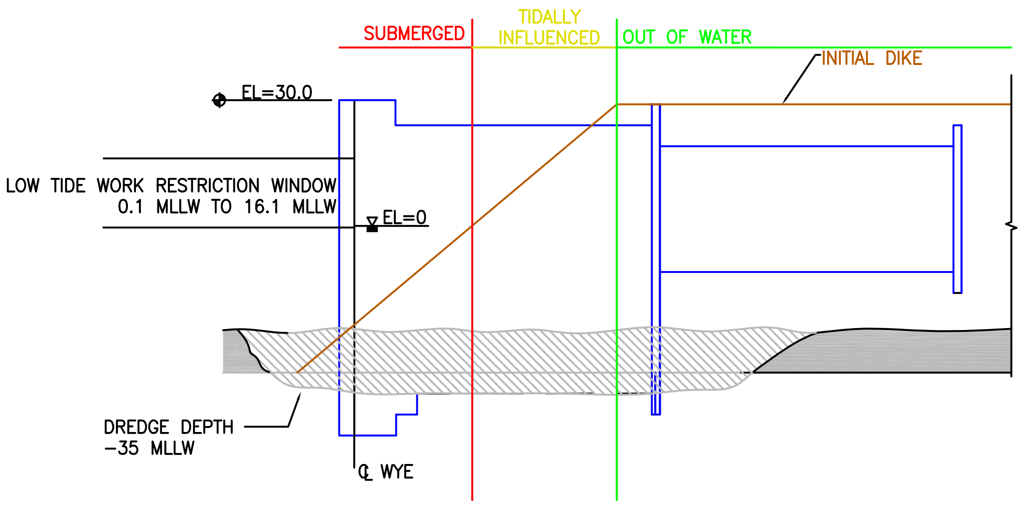
Low Tide window

Unrestricted Work window

Submerged Piledriving

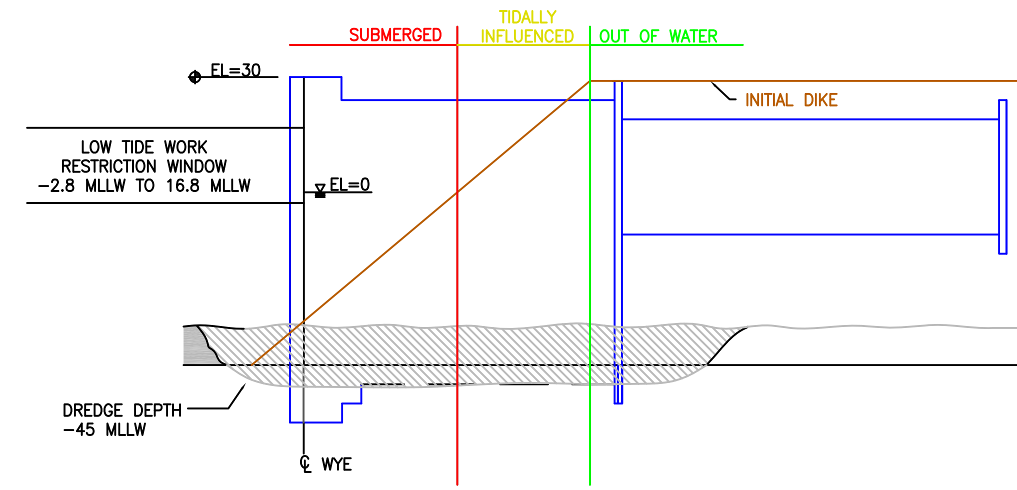
Tidally Influenced Piledriving

Out of Water Piledriving



TYPICAL SECTION D-D

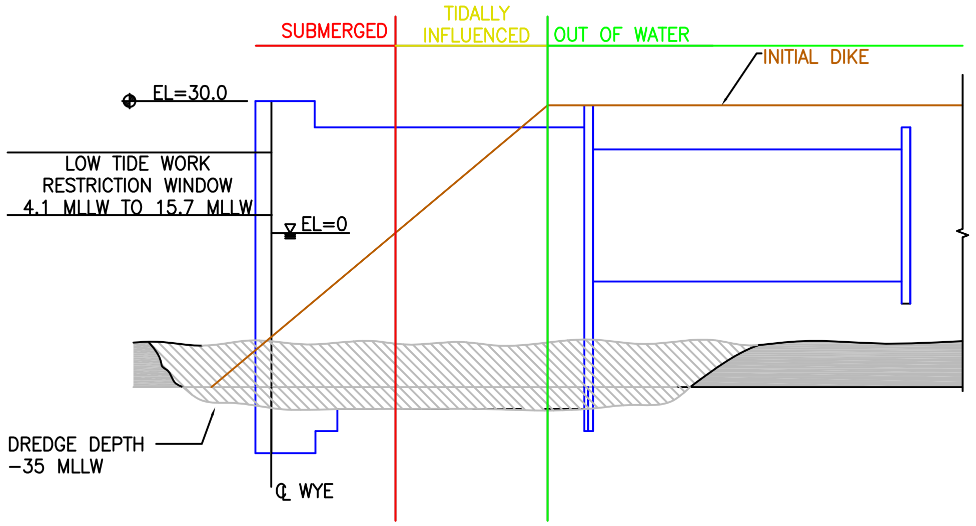
Represents the low tide window for October 12, 2010



TYPICAL SECTION E-E

Represents the low tidal range for the entire month of October 2010

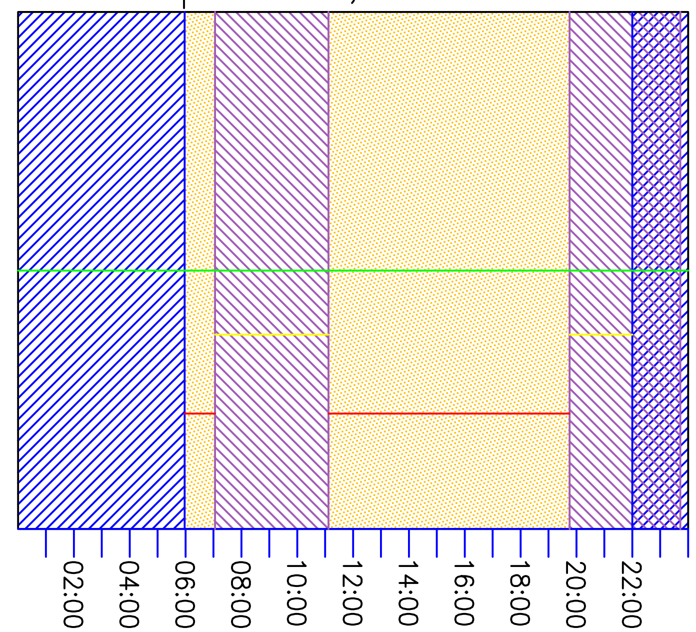
Date	Civil Twilight		2 Hours Before		Actual Low Tide		2 Hours After		2 Hours Before		Actual Low Tide		2 hours After		2 Hours Before		Actual Low Tide		2 Hours After		Unrestricted Work Window 1			Unrestricted Work Window 2			Unrestricted Work Window 3			Hourly Totals		
	Begin	End	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Start	End	Hours	Start	End	Hours	Start	End	Hours	Daily	Monthly	Yearly
10/1/2010	7:24	20:14	5:55	7.4	7:55	4.8	9:55	10.9	18:24	13.2	20:24	10.5	22:24	16.6							9:55	18:24	8.5							8.5	8.5	2327.7
10/2/2010	7:26	20:10	7:14	8.0	9:14	4.5	11:14	11.5	19:45	13.2	21:45	9.2	23:45	16.1							11:14	19:45	8.5							8.5	17.0	2336.2
10/3/2010	7:29	20:07	8:22	8.4	10:22	3.3	12:22	11.0	20:53	12.5	22:53	6.7	0:53	14.5							7:29	8:22	0.0	12:22	20:07	7.8				8.7	25.7	2344.9
10/4/2010	7:31	20:04					0:53	14.5	9:21	8.5	11:21	1.7	13:21	10.5	21:51	11.2	23:51	3.7	1:51	12.9	7:31	9:21	1.8	13:21	20:04	6.7				8.6	34.3	2353.5
10/5/2010	7:34	20:01					1:51	12.9	10:14	8.4	12:14	0.5	14:14	10.6	22:43	9.8					7:34	10:14	2.7	14:14	20:01	5.8				8.5	42.8	2362.0
10/6/2010	7:36	19:58	22:43	9.8	0:43	1.0	2:43	11.5	11:03	8.5	13:03	-0.1	15:03	11.2	23:33	8.5					7:36	11:03	3.5	15:03	19:58	4.9				8.4	51.2	2370.4
10/7/2010	7:39	19:55	23:33	8.5	1:33	-1.1	3:33	10.6	11:49	9.1	13:49	0.1	15:49	12.1							7:39	11:49	4.2	15:49	19:55	4.1				8.3	59.5	2378.7
10/8/2010	7:41	19:52	0:20	7.6	2:20	-2.4	4:20	10.0	12:35	9.6	14:35	0.9	16:35	13.4							7:41	12:35	4.9	16:35	19:52	3.3				8.2	67.7	2386.9
10/9/2010	7:44	19:49	1:07	6.9	3:07	-2.8	5:07	10.0	13:19	10.4	15:19	2.1	17:19	14.4							7:44	13:19	5.6	17:19	19:49	2.5				8.1	75.8	2395.0
10/10/2010	7:46	19:46	1:52	6.7	3:52	-2.5	5:52	10.0	14:02	11.2	16:02	3.5	18:02	15.2							7:46	14:02	6.3	18:02	19:46	1.8				8.0	83.8	2403.0
10/11/2010	7:49	19:43	2:36	6.8	4:36	-1.5	6:36	10.2	14:46	11.8	16:46	5.1	18:46	15.9							7:49	14:46	7.0	18:46	19:43	1.0				7.9	91.8	2411.0
10/12/2010	7:51	19:40	3:21	7.1	5:21	0.1	7:21	10.6	15:31	12.4	17:31	6.8	19:31	16.1							7:51	15:31	7.7	19:31	19:40	0.0				7.8	99.6	2418.8
10/13/2010	7:54	19:37	4:09	7.7	6:09	2.1	8:09	11.1	16:22	12.9	18:22	8.4	20:22	16.3							8:09	16:22	8.2							8.2	107.9	2427.0
10/14/2010	7:56	19:34	5:02	8.5	7:02	4.0	9:02	11.6	17:21	13.5	19:21	9.6	21:21	16.1							9:02	17:21	8.3							8.3	116.2	2435.4
10/15/2010	7:59	19:31	6:03	9.6	8:03	5.5	10:03	11.8	18:31	13.8	20:31	9.8	22:31	15.3							10:03	18:31	8.5							8.5	124.7	2443.9
10/16/2010	8:01	19:28	7:09	10.5	9:09	6.0	11:09	11.6	19:41	13.7	21:41	8.7	23:41	13.7							11:09	19:28	8.3							8.3	133.0	2452.2
10/17/2010	8:04	19:25	8:12	11.0	10:12	5.6	12:12	11.1	20:44	12.8	22:44	6.6	0:44	12.0							8:04	8:12	0.0	12:12	19:25	7.2				7.4	140.4	2459.6
10/18/2010	8:06	19:22					0:44	12.0	9:07	11.1	11:07	4.8	13:07	10.9	21:37	11.7	23:37	4.4	1:37	10.6	8:06	9:07	1.0	13:07	19:22	6.3				7.3	147.7	2466.9
10/19/2010	8:08	19:19					1:37	10.6	9:55	11.1	11:55	4.2	13:55	11.1	22:25	10.4					8:08	9:55	1.8	13:55	19:19	5.4				7.2	154.9	2474.1
10/20/2010	8:11	19:17	22:25	10.4	0:25	2.5	2:25	10.0	10:39	11.2	12:39	4.0	14:39	12.0	23:08	9.5					8:11	10:39	2.5	14:39	19:17	4.7				7.1	162.0	2481.2
10/21/2010	8:13	19:14	23:08	9.5	1:08	1.2	3:08	9.7	11:19	11.6	13:19	4.4	15:19	13.1	23:49	8.6					8:13	11:19	3.1	15:19	19:14	3.9				7.0	169.1	2488.3
10/22/2010	8:16	19:11	23:49	8.6	1:49	0.4	3:49	9.9	11:58	11.9	13:58	5.0	15:58	14.4							8:16	11:58	3.7	15:58	19:11	3.2				6.9	176.0	2495.2
10/23/2010	8:18	19:08	0:28	7.9	2:28	0.2	4:28	10.3	12:36	12.2	14:36	5.8	16:36	15.7							8:18	12:36	4.3	16:36	19:08	2.6				6.9	182.9	2502.1
10/24/2010	8:21	19:06	1:06	7.3	3:06	0.2	5:06	10.7	13:13	12.4	15:13	6.6	17:13	16.5							8:21	13:13	4.9	17:13	19:06	1.9				6.8	189.7	2508.9
10/25/2010	8:23	19:03	1:43	6.6	3:43	0.4	5:43	11.0	13:49	12.5	15:49	7.1	17:49	16.8							8:23	13:49	5.4	17:49	19:03	1.3				6.7	196.4	2515.6
10/26/2010	8:26	19:00	2:19	6.1	4:19	0.6	6:19	10.8	14:26	12.5	16:26	7.6	18:26	16.7							8:26	14:26	6.0	18:26	19:00	0.0				6.6	203.0	2522.2
10/27/2010	8:28	18:57	2:55	6.0	4:55	1.1	6:55	10.3	15:05	12.6	17:05	8.0	19:05	16.2							8:28	15:05	6.6							6.6	209.6	2528.8
10/28/2010	8:31	18:55	3:35	6.1	5:35	1.7	7:35	9.8	15:51	12.7	17:51	8.5	19:51	15.7							8:31	15:51	7.3							7.3	217.0	2536.2
10/29/2010	8:33	18:52	4:25	6.5	6:25	2.7	8:25	10.0	16:51	12.6	18:51	9.0	20:51	15.8							8:33	16:51	8.3							8.3	225.3	2544.5
10/30/2010	8:36	18:50	5:28	7.1	7:28	3.6	9:28	10.7	18:06	12.4	20:06	8.8	22:06	15.9							9:28	18:06	8.6							8.6	233.9	2553.1
10/31/2010	8:38	18:47	6:40	7.9	8:40	4.0	10:40	11.6	19:21	12.0	21:21	7.4	23:21	14.9							10:40	18:47	8.1							8.1	242.1	2561.3



TYPICAL SECTION D-D

Represents the low tide window for April 12, 2011

April 12, 2011



Civil Twilight window

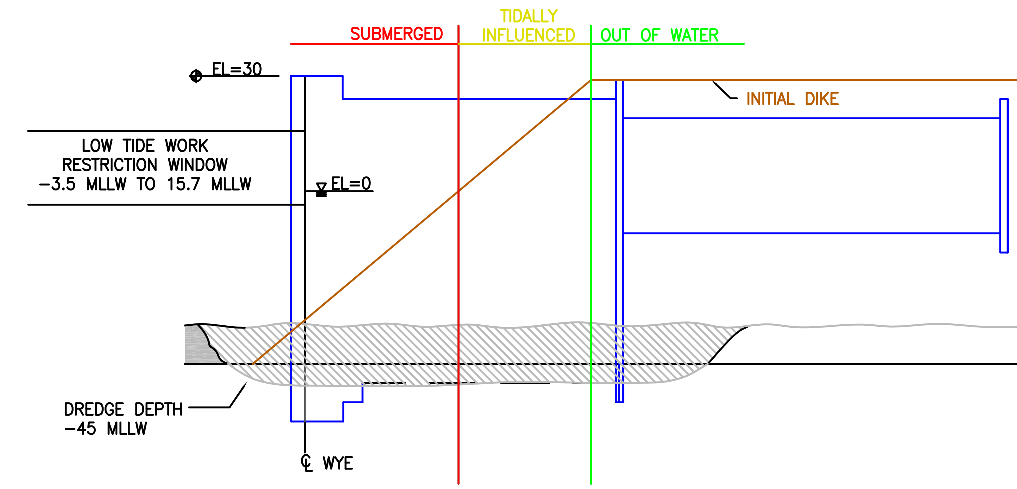
Low Tide window

Unrestricted Work window

Submerged Piledriving

Tidally Influenced Piledriving

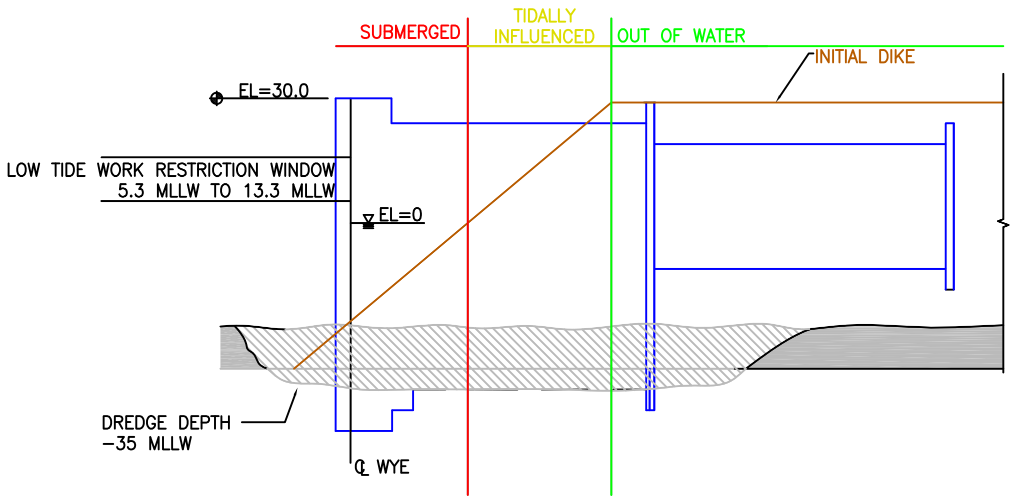
Out of Water Piledriving



TYPICAL SECTION E-E

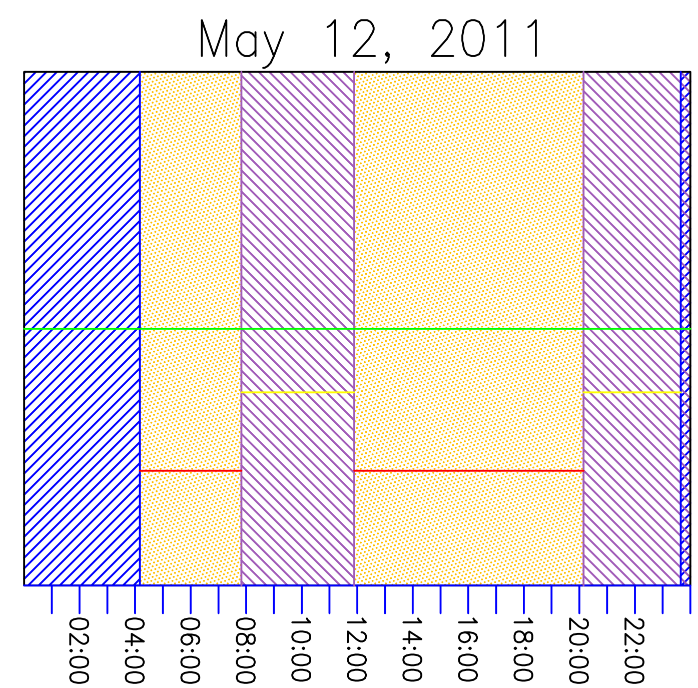
Represents the low tidal range for the entire month of April 2011

Date	Civil Twilight		2 Hours Before		Actual Low Tide		2 Hours After		2 Hours Before		Actual Low Tide		2 hours After		2 Hours Before		Actual Low Tide		2 Hours After		Unrestricted Work Window 1			Unrestricted Work Window 2			Unrestricted Work Window 3			Hourly Totals		
	Begin	End	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Start	End	Hours	Start	End	Hours	Start	End	Hours	Daily	Monthly	Yearly
4/1/2011	6:37	21:29	22:57	10.8	0:57	2.5	2:57	10.3	11:22	10.6	13:22	1.8	15:22	10.0	23:36	10.9					6:37	11:22	4.8	15:22	21:29	6.1				10.9	10.9	10.9
4/2/2011	6:33	21:32	23:36	10.9	1:36	2.8	3:36	11.4	12:02	9.8	14:02	1.0	16:02	10.2							6:33	12:02	5.5	16:02	21:32	5.5				11.0	21.9	21.9
4/3/2011	6:30	21:35	0:14	11.0	2:14	3.4	4:14	12.8	12:40	8.9	14:40	0.6	16:40	10.6							6:30	12:40	6.2	16:40	21:35	4.9				11.1	33.0	33.0
4/4/2011	6:27	21:37	0:49	11.1	2:49	4.1	4:49	14.0	13:17	7.9	15:17	0.4	17:17	11.0							6:27	13:17	6.8	17:17	21:37	4.4				11.2	44.2	44.2
4/5/2011	6:23	21:40	1:24	11.0	3:24	4.7	5:24	15.1	13:52	7.0	15:52	0.4	17:52	11.1							6:23	13:52	7.5	17:52	21:40	3.8				11.3	55.6	55.6
4/6/2011	6:20	21:43	1:57	11.0	3:57	5.3	5:57	15.4	14:25	6.3	16:25	0.5	18:25	10.7							6:20	14:25	8.1	18:25	21:43	3.3				11.4	67.0	67.0
4/7/2011	6:16	21:46	2:29	11.1	4:29	5.9	6:29	15.1	14:58	6.0	16:58	0.9	18:58	10.0							6:29	14:58	8.5	18:58	21:46	2.8				11.3	78.3	78.3
4/8/2011	6:13	21:49	3:02	11.6	5:02	6.6	7:02	14.5	15:33	6.1	17:33	1.6	19:33	9.3							7:02	15:33	8.5	19:33	21:49	2.3				10.8	89.1	89.1
4/9/2011	6:10	21:52	3:40	12.1	5:40	7.5	7:40	14.1	16:15	6.5	18:15	2.6	20:15	9.0							7:40	16:15	8.6	20:15	21:52	1.6				10.2	99.3	99.3
4/10/2011	6:06	21:55	4:30	12.5	6:30	8.6	8:30	14.1	17:14	6.9	19:14	3.8	21:14	9.7							8:30	17:14	8.7	21:14	21:55	0.0				9.4	108.8	108.8
4/11/2011	6:03	21:57	5:43	12.4	7:43	9.4	9:43	15.2	18:30	7.3	20:30	4.5	22:30	11.0							9:43	18:30	8.8							8.8	117.6	117.6
4/12/2011	5:59	22:00	7:06	12.2	9:06	9.1	11:06	15.7	19:44	8.0	21:44	4.1	23:44	11.6							5:59	7:06	1.1	11:06	19:44	8.6				9.8	127.4	127.4
4/13/2011	5:56	22:03	8:19	11.9	10:19	7.2	12:19	14.7	20:47	8.4	22:47	3.1	0:47	11.4							5:56	8:19	2.4	12:19	20:47	8.5				10.9	138.3	138.3
4/14/2011	5:52	22:06					0:47	11.4	9:21	10.9	11:21	4.6	13:21	13.2	21:44	8.6	23:44	2.0	1:44	11.4	5:52	9:21	3.5	13:21	21:44	8.4				11.9	150.2	150.2
4/15/2011	5:49	22:09					1:44	11.4	10:16	9.7	12:16	1.9	14:16	11.7	22:36	8.7					5:49	10:16	4.5	14:16	22:09	7.9				12.4	162.5	162.5
4/16/2011	5:45	22:12	22:36	8.7	0:36	1.2	2:36	11.9	11:08	8.3	13:08	-0.5	15:08	10.7	23:24	9.2					5:45	11:08	5.4	15:08	22:12	7.1				12.5	175.0	175.0
4/17/2011	5:42	22:15	23:24	9.2	1:24	1.0	3:24	12.5	11:57	7.3	13:57	-2.2	15:57	9.9							5:42	11:57	6.3	15:57	22:15	6.3				12.6	187.6	187.6
4/18/2011	5:38	22:18	0:12	9.7	2:12	1.2	4:12	13.5	12:45	6.5	14:45	-3.3	16:45	9.6							5:38	12:45	7.1	16:45	22:18	5.6				12.7	200.3	200.3
4/19/2011	5:35	22:21	0:58	10.3	2:58	1.8	4:58	14.3	13:31	6.1	15:31	-3.5	17:31	9.3							5:35	13:31	7.9	17:31	22:21	4.9				12.8	213.1	213.1
4/20/2011	5:31	22:25	1:44	10.8	3:44	2.6	5:44	15.0	14:17	6.0	16:17	-3.0	18:17	9.5							5:44	14:17	8.6	18:17	22:25	4.2				12.7	225.8	225.8
4/21/2011	5:28	22:28	2:29	11.3	4:29	3.7	6:29	15.4	15:03	6.2	17:03	-1.9	19:03	9.8							6:29	15:03	8.6	19:03	22:28	3.4				12.0	237.8	237.8
4/22/2011	5:24	22:31	3:16	11.6	5:16	5.0	7:16	15.6	15:50	6.8	17:50	-0.1	19:50	10.2							7:16	15:50	8.6	19:50	22:31	2.7				11.3	249.1	249.1
4/23/2011	5:21	22:34	4:05	12.1	6:05	6.3	8:05	15.5	16:40	7.6	18:40	1.9	20:40	10.7							8:05	16:40	8.6	20:40	22:34	1.9				10.5	259.6	259.6
4/24/2011	5:17	22:37	5:01	12.5	7:01	7.5	9:01	15.3	17:37	8.6	19:37	3.8	21:37	11.2							9:01	17:37	8.6	21:37	22:37	1.0				9.6	269.3	269.3
4/25/2011	5:14	22:40	6:05	12.8	8:05	8.1	10:05	14.7	18:40	9.7	20:40	5.0	22:40	11.4							5:14	6:05	0.0	10:05	18:40	8.6	22:40	22:40	0.0	9.5	278.7	278.7
4/26/2011	5:10	22:44	7:13	12.9	9:13	7.7	11:13	13.3	19:43	10.6	21:43	5.4	23:43	11.3							5:10	7:13	2.1	11:13	19:43	8.5				10.6	289.3	289.3
4/27/2011	5:06	22:47	8:18	12.4	10:18	6.2	12:18	11.6	20:42	11.1	22:42	5.1	0:42	11.1							5:06	8:18	3.2	12:18	20:42	8.4				11.6	301.0	301.0
4/28/2011	5:03	22:50					0:42	11.1	9:16	11.4	11:16	4.3	13:16	10.2	21:34	11.3	23:34	4.7	1:34	11.3	5:03	9:16	4.2	13:16	21:34	8.3				12.5	313.5	313.5
4/29/2011	4:59	22:54					1:34	11.3	10:06	10.4	12:06	2.4	14:06	9.3	22:20	11.6					4:59	10:06	5.1	14:06	22:20	8.2				13.4	326.9	326.9
4/30/2011	4:56	22:57	22:20	11.6	0:20	4.6	2:20	11.9	10:52	9.3	12:52	1.0	14:52	9.0	23:03	11.9					4:56	10:52	5.9	14:52	22:57	8.1				14.0	340.9	340.9



TYPICAL SECTION D-D

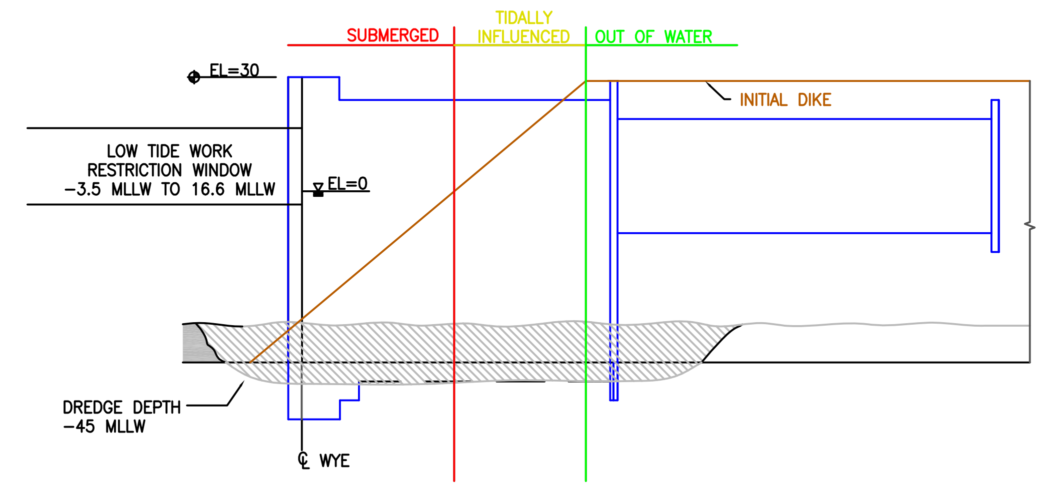
Represents the low tide window for May 12, 2011



Civil Twilight window — Submerged Piledriving

Low Tide window — Tidally Influenced Piledriving

Unrestricted Work window — Out of Water Piledriving

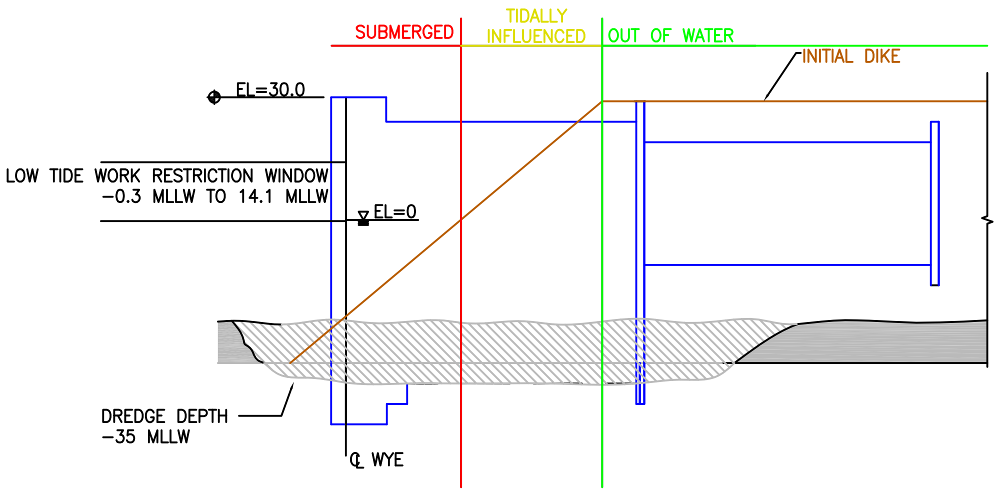


TYPICAL SECTION E-E

Represents the low tidal range for the entire month of May 2011

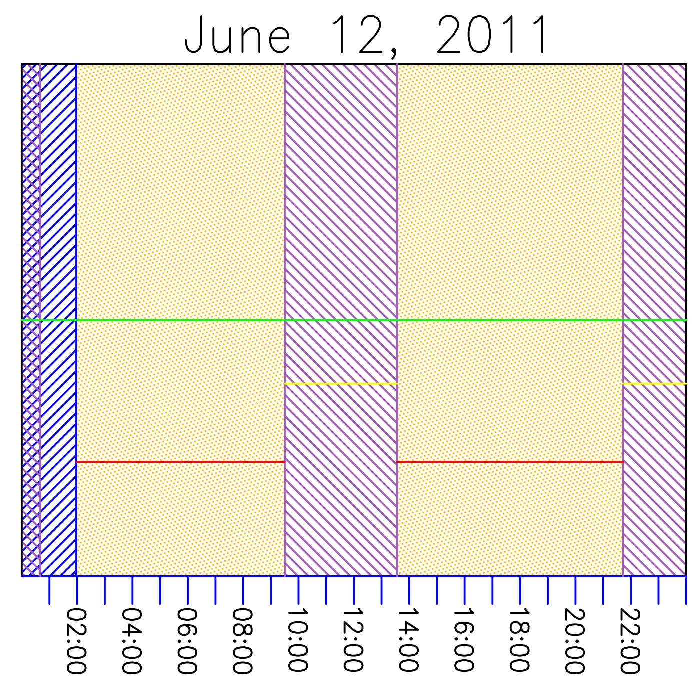
Ship Creek smolt releases, during which time no piledriving may be performed, typically occur during the second week of May..

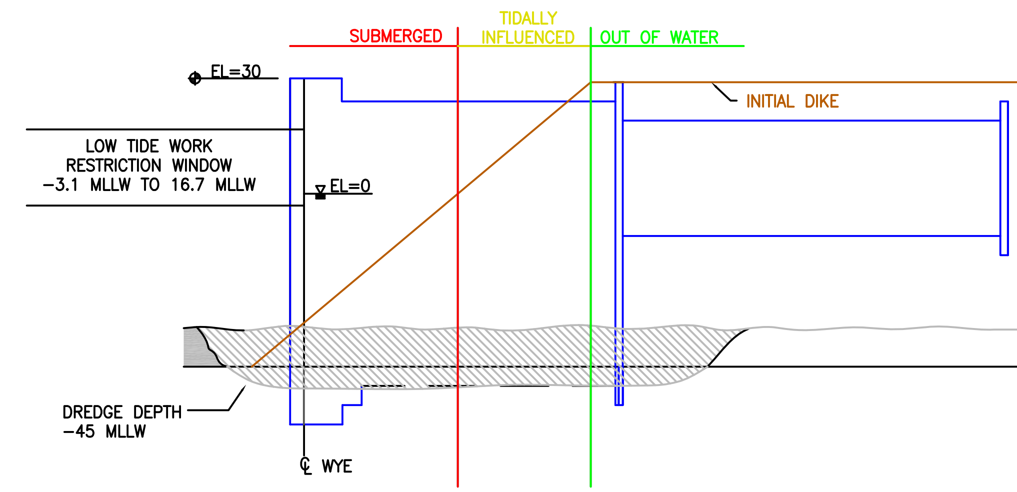
Date	Civil Twilight		2 Hours Before		Actual Low Tide		2 Hours After		2 Hours Before		Actual Low Tide		2 hours After		2 Hours Before		Actual Low Tide		2 Hours After		Unrestricted Work Window 1			Unrestricted Work Window 2			Unrestricted Work Window 3			Hourly Totals		
	Begin	End	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Start	End	Hours	Start	End	Hours	Start	End	Hours	Daily	Monthly	Yearly
5/1/2011	4:52	23:00	23:03	11.9	1:03	4.8	3:03	12.9	11:34	8.6	13:34	0.2	15:34	9.0	23:44	12.2					4:52	11:34	6.7	15:34	23:00	7.5				14.2	14.2	355.1
5/2/2011	4:48	23:04	23:44	12.2	1:44	5.2	3:44	14.1	12:15	7.8	14:15	-0.3	16:15	9.5							4:48	12:15	7.5	16:15	23:04	6.8				14.3	28.5	369.4
5/3/2011	4:45	23:07	0:24	12.4	2:24	5.8	4:24	15.3	12:54	7.2	14:54	-0.3	16:54	10.0							4:45	12:54	8.2	16:54	23:07	6.2				14.4	42.9	383.8
5/4/2011	4:41	23:10	1:02	12.5	3:02	6.3	5:02	16.1	13:31	6.6	15:31	-0.3	17:31	10.3							5:02	13:31	8.5	17:31	23:10	5.7				14.2	57.0	398.0
5/5/2011	4:38	23:14	1:40	12.4	3:40	6.6	5:40	16.6	14:07	6.1	16:07	-0.1	18:07	10.4							5:40	14:07	8.5	18:07	23:14	5.1				13.6	70.6	411.6
5/6/2011	4:34	23:17	2:16	12.2	4:16	6.8	6:16	16.4	14:43	5.6	16:43	0.2	18:43	10.2							6:16	14:43	8.5	18:43	23:17	4.6				13.0	83.7	424.6
5/7/2011	4:30	23:21	2:54	12.0	4:54	6.9	6:54	16.0	15:20	5.5	17:20	0.7	19:20	9.7							6:54	15:20	8.4	19:20	23:21	4.0				12.5	96.2	437.1
5/8/2011	4:27	23:25	3:35	11.8	5:35	7.1	7:35	15.3	16:01	5.8	18:01	1.4	20:01	9.4							7:35	16:01	8.4	20:01	23:25	3.4				11.9	108.0	449.0
5/9/2011	4:23	23:28	4:24	11.7	6:24	7.5	8:24	14.7	16:51	6.3	18:51	2.4	20:51	9.6							4:23	4:24	0.0	8:24	16:51	8.5	20:51	23:28	2.6	11.1	119.2	460.1
5/10/2011	4:19	23:32	5:27	11.3	7:27	7.6	9:27	14.7	17:55	6.9	19:55	3.3	21:55	10.6							4:19	5:27	1.1	9:27	17:55	8.5	21:55	23:32	1.6	11.2	130.4	471.4
5/11/2011	4:15	23:35	6:40	10.9	8:40	7.0	10:40	14.5	19:05	7.7	21:05	3.8	23:05	11.7							4:15	6:40	2.4	10:40	19:05	8.4	23:05	23:35	0.0	11.4	141.8	482.8
5/12/2011	4:12	23:39	7:50	10.4	9:50	5.3	11:50	13.3	20:11	8.6	22:11	3.7	0:11	12.3							4:12	7:50	3.6	11:50	20:11	8.4				12.0	153.8	494.8
5/13/2011	4:08	23:43					0:11	12.3	8:54	9.5	10:54	2.9	12:54	11.6	21:11	9.4	23:11	3.3	1:11	12.6	4:08	8:54	4.8	12:54	21:11	8.3				13.1	166.9	507.9
5/14/2011	4:04	23:47					1:11	12.6	9:52	8.3	11:52	0.4	13:52	10.1	22:07	10.1					4:04	9:52	5.8	13:52	22:07	8.3				14.1	181.0	521.9
5/15/2011	4:00	23:51	22:07	10.1	0:07	3.1	2:07	13.2	10:46	7.3	12:46	-1.6	14:46	9.1	23:00	10.7					4:00	10:46	6.8	14:46	23:00	8.2				15.0	196.0	537.0
5/16/2011	3:56	23:54	23:00	10.7	1:00	3.1	3:00	13.9	11:37	6.6	13:37	-2.9	15:37	8.5	23:51	11.3					3:56	11:37	7.7	15:37	23:51	8.2				15.9	212.0	552.9
5/17/2011	3:53	23:58	23:51	11.3	1:51	3.4	3:51	14.7	12:26	6.3	14:26	-3.5	16:26	8.4							3:53	12:26	8.6	16:26	23:58	7.6				16.1	228.1	569.0
5/18/2011	3:49	0:02	0:39	12.0	2:39	3.8	4:39	15.2	13:13	6.3	15:13	-3.3	17:13	8.6							4:39	13:13	8.6	17:13	23:59	6.8				15.4	243.5	584.4
5/19/2011	3:45	0:06	1:27	12.3	3:27	4.3	5:27	15.7	13:59	6.4	15:59	-2.6	17:59	9.2							5:27	13:59	8.5	17:59	23:59	6.0				14.6	258.0	599.0
5/20/2011	3:41	0:10	2:13	12.4	4:13	4.8	6:13	15.8	14:43	6.6	16:43	-1.5	18:43	9.7							6:13	14:43	8.5	18:43	23:59	5.3				13.8	271.8	612.8
5/21/2011	3:37	0:14	2:58	12.3	4:58	5.3	6:58	15.6	15:26	7.0	17:26	0.0	19:26	10.3							6:58	15:26	8.5	19:26	23:59	4.6				13.0	284.9	625.8
5/22/2011	3:33	0:18	3:45	12.0	5:45	5.9	7:45	15.3	16:10	7.4	18:10	1.7	20:10	10.8							3:33	3:45	0.0	7:45	16:10	8.4	20:10	23:59	3.8	12.5	297.4	638.3
5/23/2011	3:29	0:23	4:34	11.8	6:34	6.5	8:34	14.7	16:58	8.0	18:58	3.4	20:58	11.4							3:29	4:34	1.1	8:34	16:58	8.4	20:58	23:59	3.0	12.5	309.9	650.9
5/24/2011	3:25	0:27	5:30	11.6	7:30	6.9	9:30	14.0	17:51	8.9	19:51	5.0	21:51	12.0							3:25	5:30	2.1	9:30	17:51	8.4	21:51	23:59	2.2	12.6	322.5	663.5
5/25/2011	3:21	0:31	6:32	11.3	8:32	6.7	10:32	13.0	18:50	9.9	20:50	6.1	22:50	12.5							3:21	6:32	3.2	10:32	18:50	8.3	22:50	23:59	1.2	12.7	335.2	676.2
5/26/2011	3:16	0:36	7:36	10.9	9:36	5.6	11:36	11.6	19:51	10.9	21:51	6.5	23:51	12.8							3:16	7:36	4.3	11:36	19:51	8.3	23:51	23:59	0.0	12.7	348.0	688.9
5/27/2011	3:12	0:40	8:36	10.1	10:36	4.0	12:36	10.1	20:48	11.6	22:48	6.6	0:48	13.1							3:12	8:36	5.4	12:36	20:48	8.2				13.6	361.6	702.6
5/28/2011	3:08	0:45					0:48	13.1	9:30	9.2	11:30	2.3	13:30	9.0	21:41	12.2	23:41	6.5	1:41	13.5	3:08	9:30	6.4	13:30	21:41	8.2				14.6	376.2	717.1
5/29/2011	3:03	0:50					1:41	13.5	10:20	8.3	12:20	0.8	14:20	8.4	22:30	12.6					3:03	10:20	7.3	14:20	22:30	8.2				15.5	391.7	732.6
5/30/2011	2:59	0:54	22:30	12.6	0:30	6.6	2:30	14.1	11:06	7.7	13:06	-0.1	15:06	8.3	23:16	13.0					2:59	11:06	8.1	15:06	23:16	8.2				16.3	408.0	748.9
5/31/2011	2:54	1:00	23:16	13.0	1:16	6.7	3:16	14.9	11:50	7.2	13:50	-0.6	15:50	8.7							3:16	11:50	8.6	15:50	23:59	8.2				16.7	424.8	765.7



TYPICAL SECTION D-D

Represents the low tide window for June 12, 2011





TYPICAL SECTION E-E

Represents the low tidal range for the entire month of June 2011

Civil Twilight window

Submerged Piledriving

Low Tide window

Tidally Influenced Piledriving

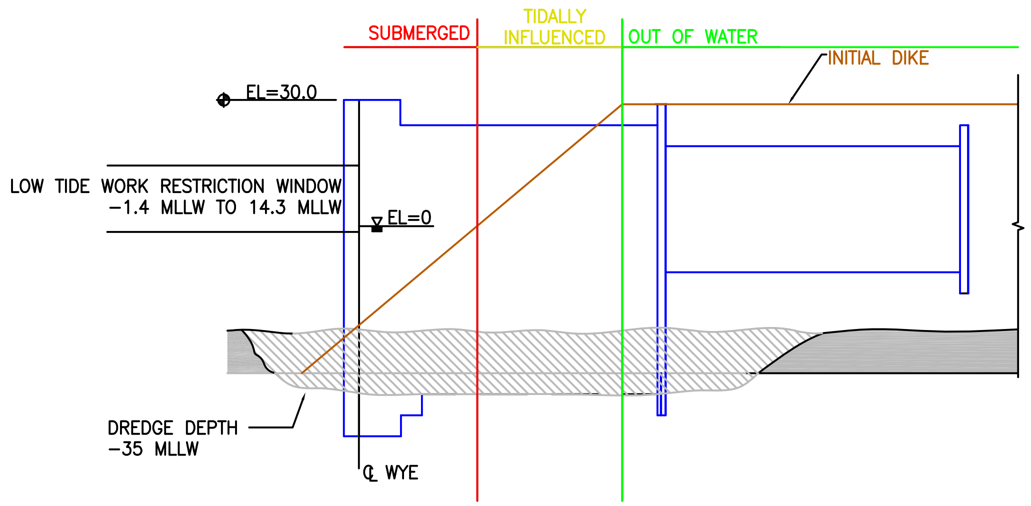
Unrestricted Work window

Out of Water Piledriving

Ship Creek smolt releases, during which time no piledriving may be performed, typically occur during the third week of June.

Date	Civil Twilight		2 Hours Before		Actual Low Tide		2 Hours After		2 Hours Before		Actual Low Tide		2 hours After	
	Begin	End	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW
6/1/2011	2:49	1:05	0:00	13.3	2:00	6.9	4:00	15.8	12:31	6.8	14:31	-0.8	16:31	9.1
6/2/2011	2:44	1:10	0:42	13.3	2:42	6.9	4:42	16.4	13:11	6.4	15:11	-0.8	17:11	9.6
6/3/2011	2:38	1:16	1:23	13.0	3:23	6.8	5:23	16.7	13:50	5.9	15:50	-0.9	17:50	10.0
6/4/2011	2:32	1:23	2:03	12.5	4:03	6.4	6:03	16.6	14:27	5.5	16:27	-0.8	18:27	10.0
6/5/2011	2:25	1:30	2:43	11.8	4:43	6.0	6:43	16.0	15:05	5.2	17:05	-0.6	19:05	9.8
6/6/2011	2:15	1:40	3:25	11.1	5:25	5.6	7:25	15.1	15:45	5.3	17:45	0.0	19:45	9.6
6/7/2011	1:58	1:58	4:12	10.5	6:12	5.3	8:12	14.2	16:30	5.9	18:30	1.0	20:30	9.7
6/8/2011	1:58	1:58	5:09	9.8	7:09	5.1	9:09	13.6	17:25	6.7	19:25	2.4	21:25	10.6
6/9/2011	1:58	1:58	6:14	9.3	8:14	4.6	10:14	12.9	18:30	7.8	20:30	3.7	22:30	12.0
6/10/2011	1:59	1:59	7:24	8.8	9:24	3.5	11:24	11.9	19:37	9.2	21:37	4.6	23:37	13.1
6/11/2011	1:59	1:59	8:30	8.3	10:30	1.6	12:30	10.3	20:42	10.4	22:42	4.9	0:42	13.7
6/12/2011	1:59	1:59					0:42	13.7	9:31	7.6	11:31	-0.3	13:31	8.9
6/13/2011	1:59	1:59					1:43	14.1	10:27	7.0	12:27	-1.9	14:27	7.9
6/14/2011	1:59	1:59	22:40	12.1	0:40	4.8	2:40	14.5	11:20	6.7	13:20	-2.8	15:20	7.6
6/15/2011	2:00	2:00	23:33	12.7	1:33	4.8	3:33	14.8	12:10	6.6	14:10	-3.1	16:10	7.8
6/16/2011	2:00	2:00	0:23	13.0	2:23	4.8	4:23	15.0	12:56	6.9	14:56	-2.7	16:56	8.3
6/17/2011	2:00	2:00	1:11	13.0	3:11	4.8	5:11	15.2	13:40	7.1	15:40	-2.0	17:40	9.1
6/18/2011	2:00	2:00	1:55	12.8	3:55	4.8	5:55	15.1	14:21	7.2	16:21	-1.0	18:21	9.9
6/19/2011	2:00	2:00	2:38	12.2	4:38	4.9	6:38	14.9	15:00	7.2	17:00	0.2	19:00	10.6
6/20/2011	2:01	2:01	3:20	11.5	5:20	5.0	7:20	14.5	15:37	7.3	17:37	1.6	19:37	11.0
6/21/2011	2:01	2:01	4:04	10.7	6:04	5.1	8:04	13.9	16:16	7.6	18:16	3.0	20:16	11.5
6/22/2011	2:01	2:01	4:51	10.1	6:51	5.4	8:51	13.1	16:58	8.4	18:58	4.7	20:58	11.9
6/23/2011	2:01	2:01	5:45	9.6	7:45	5.4	9:45	12.3	17:50	9.4	19:50	6.3	21:50	12.7
6/24/2011	2:02	2:02	6:47	9.3	8:47	5.1	10:47	11.5	18:53	10.5	20:53	7.6	22:53	13.7
6/25/2011	2:02	2:02	7:52	8.9	9:52	4.2	11:52	10.4	20:00	11.7	22:00	8.2	0:00	14.5
6/26/2011	2:02	2:02					0:00	14.5	8:52	8.5	10:52	2.8	12:52	9.3
6/27/2011	2:02	2:02					1:01	14.7	9:47	7.9	11:47	1.4	13:47	8.5
6/28/2011	2:02	2:02					1:57	14.9	10:38	7.4	12:38	0.2	14:38	8.2
6/29/2011	2:03	2:03	22:49	13.5	0:49	7.5	2:49	15.3	11:24	7.0	13:24	-0.5	15:24	8.2
6/30/2011	2:03	2:03	23:36	13.6	1:36	7.1	3:36	15.6	12:08	6.7	14:08	-1.0	16:08	8.7

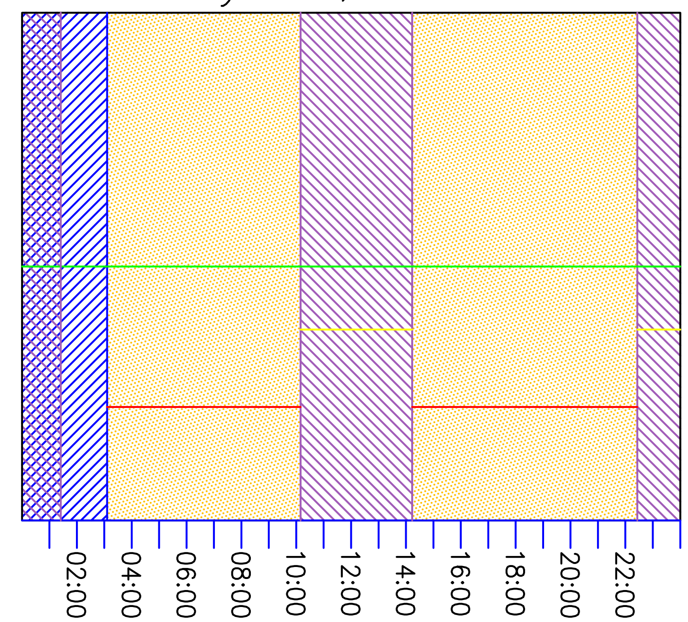
Date	2 Hours Before		Actual Low Tide		2 Hours After		Unrestricted Work Window 1			Unrestricted Work Window 2			Unrestricted Work Window 3			Hourly Totals		
	Time	MLLW	Time	MLLW	Time	MLLW	Start	End	Hours	Start	End	Hours	Start	End	Hours	Daily	Monthly	Yearly
6/1/2011							4:00	12:31	8.5	16:31	23:59	7.5				16.0	16.0	781.7
6/2/2011							4:42	13:11	8.5	17:11	23:59	6.8				15.3	31.3	797.0
6/3/2011							5:23	13:50	8.5	17:50	23:59	6.2				14.6	46.0	811.7
6/4/2011							6:03	14:27	8.4	18:27	23:59	5.6				14.0	59.9	825.6
6/5/2011							2:25	2:43	0.0	6:43	15:05	8.4	19:05	23:59	4.9	13.6	73.6	839.2
6/6/2011							2:15	3:25	1.2	7:25	15:45	8.3	19:45	23:59	4.3	13.8	87.3	853.0
6/7/2011							1:58	4:12	2.2	8:12	16:30	8.3	20:30	23:59	3.5	14.0	101.4	867.1
6/8/2011							1:58	5:09	3.2	9:09	17:25	8.3	21:25	23:59	2.6	14.0	115.5	881.2
6/9/2011							1:58	6:14	4.3	10:14	18:30	8.3	22:30	23:59	1.5	14.0	129.5	895.2
6/10/2011							1:59	7:24	5.4	11:24	19:37	8.2	23:37	23:59	0.0	14.0	143.6	909.3
6/11/2011							1:59	8:30	6.5	12:30	20:42	8.2				14.7	158.3	924.0
6/12/2011	21:43	11.4	23:43	4.9	1:43	14.1	1:59	9:31	7.5	13:31	21:43	8.2				15.7	174.1	939.8
6/13/2011	22:40	12.1					1:59	10:27	8.5	14:27	22:40	8.2				16.7	190.8	956.5
6/14/2011	23:33	12.7					2:40	11:20	8.7	15:20	23:33	8.2				16.9	207.7	973.4
6/15/2011							3:33	12:10	8.6	16:10	23:59	7.8				16.5	224.2	989.9
6/16/2011							4:23	12:56	8.6	16:56	23:59	7.1				15.6	239.8	1005.5
6/17/2011							5:11	13:40	8.5	17:40	23:59	6.3				14.8	254.7	1020.4
6/18/2011							5:55	14:21	8.4	18:21	23:59	5.7				14.1	268.8	1034.5
6/19/2011							2:00	2:38	0.0	6:38	15:00	8.4	19:00	23:59	5.0	14.0	282.8	1048.5
6/20/2011							2:01	3:20	1.3	7:20	15:37	8.3	19:37	23:59	4.4	14.0	296.8	1062.5
6/21/2011							2:01	4:04	2.1	8:04	16:16	8.2	20:16	23:59	3.7	14.0	310.8	1076.5
6/22/2011							2:01	4:51	2.8	8:51	16:58	8.1	20:58	23:59	3.0	14.0	324.9	1090.5
6/23/2011							2:01	5:45	3.7	9:45	17:50	8.1	21:50	23:59	2.2	14.0	338.9	1104.6
6/24/2011							2:02	6:47	4.8	10:47	18:53	8.1	22:53	23:59	1.1	14.0	352.9	1118.6
6/25/2011							2:02	7:52	5.8	11:52	20:00	8.1				14.0	366.9	1132.6
6/26/2011	21:01	12.6	23:01	8.2	1:01	14.7	2:02	8:52	6.8	12:52	21:01	8.2				15.0	381.9	1147.6
6/27/2011	21:57	13.2	23:57	7.9	1:57	14.9	2:02	9:47	7.8	13:47	21:57	8.2				15.9	397.8	1163.5
6/28/2011	22:49	13.5					2:02	10:38	8.6	14:38	22:49	8.2				16.8	414.7	1180.3
6/29/2011	23:36	13.6					2:49	11:24	8.6	15:24	23:36	8.2				16.8	431.5	1197.2
6/30/2011							3:36	12:08	8.5	16:08	23:59	7.9				16.4	447.9	1213.6



TYPICAL SECTION D-D

Represents the low tide window for July 12, 2011

July 12, 2011



Civil Twilight window

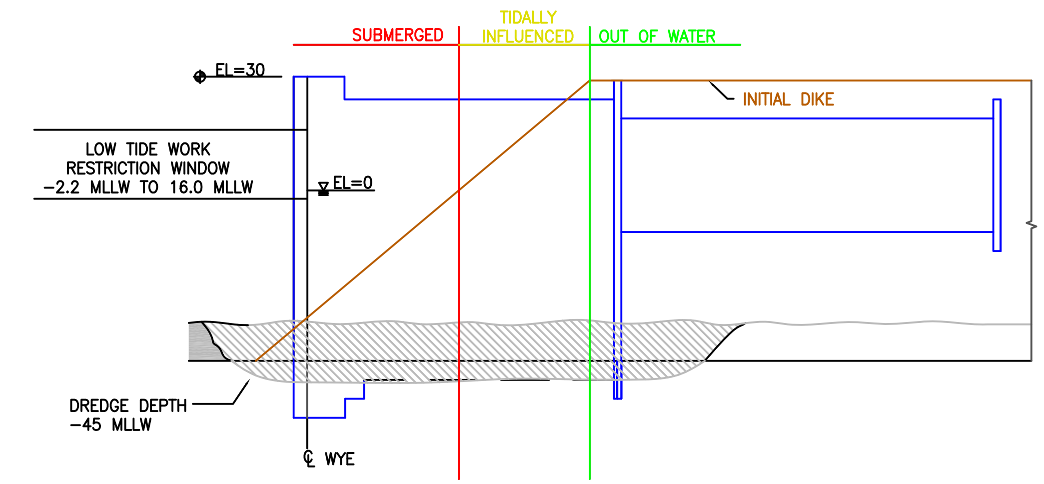
Low Tide window

Unrestricted Work window

Submerged Piledriving

Tidally Influenced Piledriving

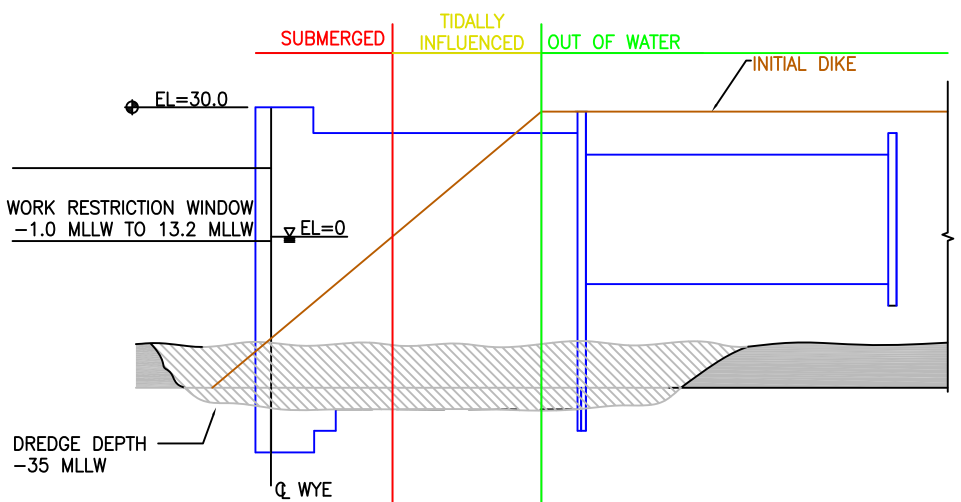
Out of Water Piledriving



TYPICAL SECTION E-E

Represents the low tidal range for the entire month of July 2011

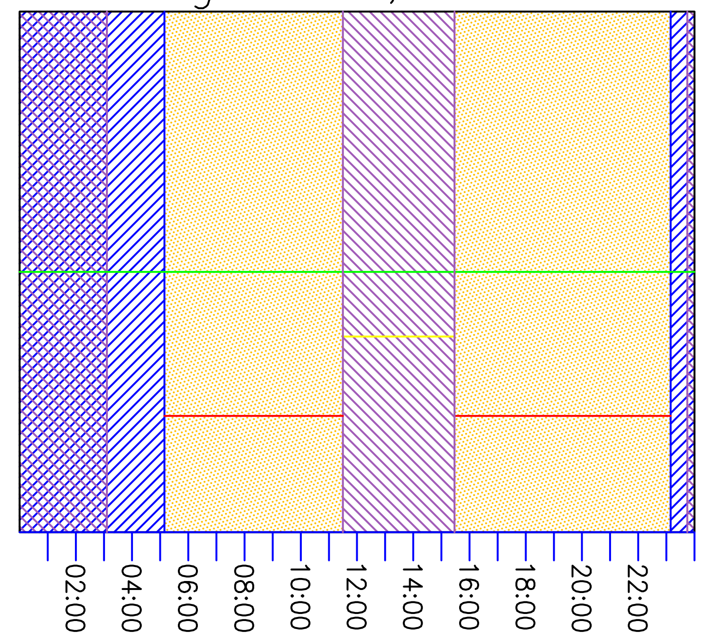
Date	Civil Twilight		2 Hours Before		Actual Low Tide		2 Hours After		2 Hours Before		Actual Low Tide		2 hours After		2 Hours Before		Actual Low Tide		2 Hours After		Unrestricted Work Window 1			Unrestricted Work Window 2			Unrestricted Work Window 3			Hourly Totals		
	Begin	End	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Start	End	Hours	Start	End	Hours	Start	End	Hours	Daily	Monthly	Yearly
7/1/2011	2:03	2:03	0:22	13.3	2:22	6.5	4:22	16.0	12:49	6.4	14:49	-1.4	16:49	9.1							4:22	12:49	8.5	16:49	23:59	7.2				15.6	15.7	1229.2
7/2/2011	2:03	2:03	1:04	12.8	3:04	5.8	5:04	16.0	13:29	5.9	15:29	-1.7	17:29	9.6							5:04	13:29	8.4	17:29	23:59	6.5				14.9	30.6	1244.2
7/3/2011	2:03	2:03	1:46	11.9	3:46	4.9	5:46	15.8	14:07	5.6	16:07	-1.8	18:07	9.8							5:46	14:07	8.4	18:07	23:59	5.9				14.2	44.9	1258.4
7/4/2011	2:03	2:03	2:27	10.9	4:27	4.0	6:27	15.1	14:46	5.3	16:46	-1.6	18:46	10.0							2:03	2:27	0.0	6:27	14:46	8.3	18:46	23:59	5.2	14.0	58.8	1272.4
7/5/2011	2:11	1:57	3:10	9.8	5:10	3.2	7:10	14.1	15:25	6.5	17:25	-0.9	19:25	10.0							2:11	3:10	1.0	7:10	15:25	8.3	19:25	23:59	4.6	13.8	72.7	1286.3
7/6/2011	2:25	1:42	3:56	9.0	5:56	2.7	7:56	13.0	16:08	6.2	18:08	0.4	20:08	10.3							2:25	3:56	1.5	7:56	16:08	8.2	20:08	23:59	3.9	13.6	86.3	1299.9
7/7/2011	2:34	1:34	4:49	8.3	6:49	2.6	8:49	12.2	16:58	7.3	18:58	2.2	20:58	11.2							2:34	4:49	2.3	8:49	16:58	8.2	20:58	23:59	3.0	13.4	99.8	1313.3
7/8/2011	2:41	1:27	5:50	8.0	7:50	2.7	9:50	11.5	17:59	8.6	19:59	4.3	21:59	12.6							2:41	5:50	3.2	9:50	17:59	8.2	21:59	23:59	2.0	13.3	113.1	1326.7
7/9/2011	2:47	1:21	6:59	7.9	8:59	2.3	10:59	10.8	19:09	10.2	21:09	5.8	23:09	14.0							2:47	6:59	4.2	10:59	19:09	8.2	23:09	23:59	0.0	13.2	126.4	1339.9
7/10/2011	2:53	1:16	8:07	7.9	10:07	1.3	12:07	9.4	20:19	11.7	22:19	6.4	0:19	14.5							2:53	8:07	5.2	12:07	20:19	8.2				13.4	139.8	1353.4
7/11/2011	2:58	1:11					0:19	14.5	9:12	7.7	11:12	-0.1	13:12	8.2	21:24	12.7	23:24	6.2	1:24	14.3	2:58	9:12	6.2	13:12	21:24	8.2				14.4	154.3	1367.9
7/12/2011	3:04	1:06					1:24	14.3	10:10	7.6	12:10	-1.4	14:10	7.3	22:24	13.1					3:04	10:10	7.1	14:10	22:24	8.2				15.3	169.7	1383.2
7/13/2011	3:09	1:01	22:24	13.1	0:24	5.6	2:24	14.1	11:04	7.4	13:04	-2.1	15:04	7.2	23:18	13.3					3:09	11:04	7.9	15:04	23:18	8.2				16.2	185.9	1399.4
7/14/2011	3:13	0:57	23:18	13.3	1:18	5.0	3:18	13.9	11:52	7.6	13:52	-2.2	15:52	7.5							3:18	11:52	8.6	15:52	23:59	8.1				16.7	202.6	1416.1
7/15/2011	3:18	0:52	0:07	13.3	2:07	4.6	4:07	13.8	12:37	7.8	14:37	-1.8	16:37	8.3							4:07	12:37	8.5	16:37	23:59	7.4				15.9	218.5	1432.0
7/16/2011	3:23	0:48	0:53	12.9	2:53	4.3	4:53	14.0	13:18	7.9	15:18	-1.1	17:18	9.4							4:53	13:18	8.4	17:18	23:59	6.7				15.1	233.6	1447.2
7/17/2011	3:27	0:44	1:35	12.4	3:35	4.1	5:35	14.1	13:56	7.9	15:56	-0.2	17:56	10.5							5:35	13:56	8.4	17:56	23:59	6.1				14.4	248.0	1461.6
7/18/2011	3:31	0:39	2:15	11.5	4:15	3.9	6:15	14.0	14:31	7.7	16:31	0.8	18:31	11.4							6:15	14:31	8.3	18:31	23:59	5.5				13.8	261.8	1475.4
7/19/2011	3:36	0:35	2:53	10.4	4:53	3.8	6:53	13.7	15:03	7.6	17:03	1.9	19:03	11.7							6:53	15:03	8.2	19:03	23:59	5.0				13.1	274.9	1488.5
7/20/2011	3:40	0:31	3:31	9.4	5:31	3.7	7:31	13.0	15:35	7.9	17:35	3.1	19:35	11.8							7:31	15:35	8.1	19:35	23:59	4.4				12.5	287.4	1501.0
7/21/2011	3:44	0:27	4:11	8.6	6:11	3.9	8:11	12.1	16:08	8.9	18:08	4.6	20:08	11.6							3:44	4:11	0.0	8:11	16:08	8.0	20:08	23:59	3.9	12.3	299.7	1513.3
7/22/2011	3:48	0:23	4:57	8.2	6:57	4.3	8:57	11.4	16:50	10.1	18:50	6.4	20:50	12.1							3:48	4:57	1.2	8:57	16:50	7.9	20:50	23:59	3.2	12.2	312.0	1525.5
7/23/2011	3:52	0:19	5:55	8.0	7:55	4.7	9:55	11.1	17:51	11.1	19:51	8.2	21:51	13.5							3:52	5:55	2.1	9:55	17:51	7.9	21:51	23:59	2.2	12.1	324.1	1537.7
7/24/2011	3:56	0:15	7:04	8.0	9:04	4.6	11:04	10.9	19:09	12.0	21:09	9.5	23:09	15.2							3:56	7:04	3.1	11:04	19:09	8.1	23:09	23:59	0.0	12.1	336.2	1549.8
7/25/2011	4:00	0:11	8:12	8.2	10:12	3.8	12:12	10.1	20:23	13.0	22:23	9.6	0:23	15.7							4:00	8:12	4.2	12:12	20:23	8.2				12.4	348.7	1562.2
7/26/2011	4:04	0:08					0:23	15.7	9:13	8.1	11:13	2.5	13:13	9.1	21:26	13.6	23:26	8.9	1:26	15.4	4:04	9:13	5.2	13:13	21:26	8.2				13.4	362.1	1575.6
7/27/2011	4:07	0:04					1:26	15.4	10:08	7.7	12:08	1.1	14:08	8.6	22:22	13.6					4:07	10:08	6.0	14:08	22:22	8.2				14.3	376.3	1589.9
7/28/2011	4:11	0:00	22:22	13.6	0:22	7.8	2:22	15.2	10:57	7.3	12:57	-0.1	14:57	8.5	23:12	13.2					4:11	10:57	6.8	14:57	23:12	8.3				15.0	391.4	1605.0
7/29/2011	4:15	23:56	23:12	13.2	1:12	6.6	3:12	15.1	11:42	6.9	13:42	-1.0	15:42	8.8	23:58	12.7					4:15	11:42	7.5	15:42	23:56	8.3				15.7	407.1	1620.7
7/30/2011	4:19	23:52	23:58	12.7	1:58	5.3	3:58	15.0	12:24	6.6	14:24	-1.6	16:24	9.3							4:19	12:24	8.1	16:24	23:52	7.5				15.6	422.7	1636.3
7/31/2011	4:22	23:49	0:43	11.7	2:43	4.0	4:43	14.9	13:05	6.2	15:05	-1.9	17:05	9.9							4:43	13:05	8.4	17:05	23:49	6.8				15.1	437.8	1651.4



TYPICAL SECTION D-D

Represents the low tide window for August 12, 2011

August 12, 2011



Civil Twilight window

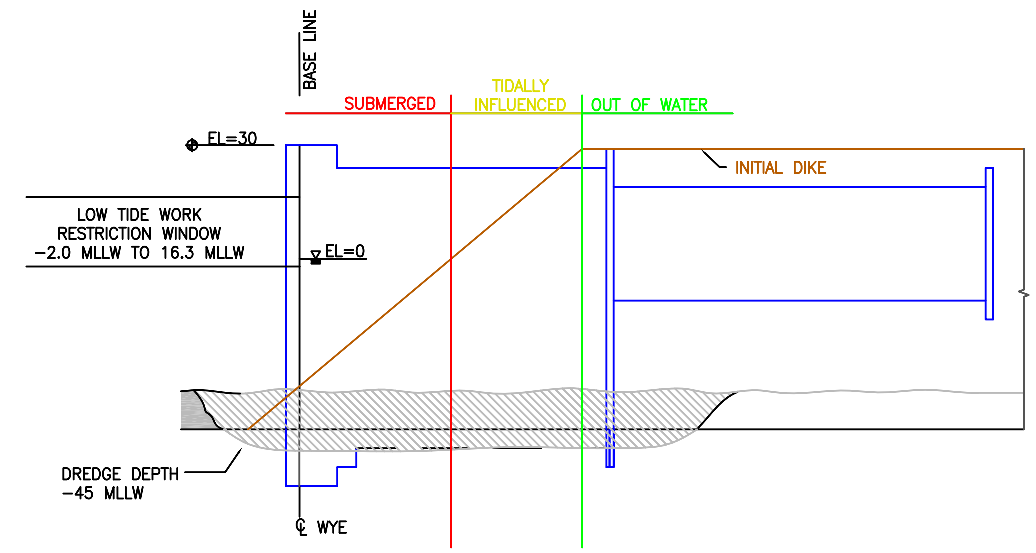
Low Tide window

Unrestricted Work window

Submerged Piledriving

Tidally Influenced Piledriving

Out of Water Piledriving

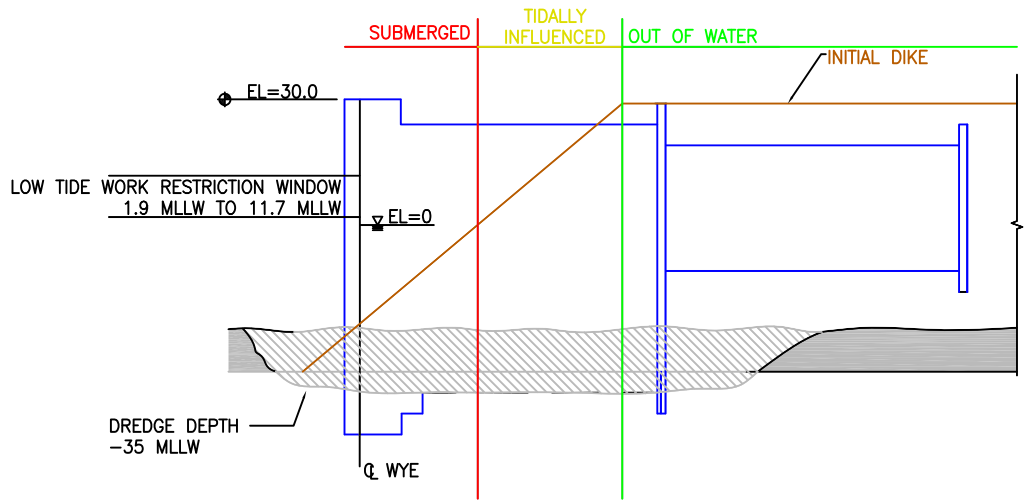


TYPICAL SECTION E-E

Represents the low tidal range for the entire month of August 2011

Date	Civil Twilight		2 Hours Before		Actual Low Tide		2 Hours After		2 Hours Before		Actual Low Tide		2 hours After	
	Begin	End	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW
8/1/2011	4:26	23:45	1:25	10.7	3:25	2.7	5:25	14.4	13:44	6.0	15:44	-2.0	17:44	10.4
8/2/2011	4:30	23:41	2:08	9.4	4:08	1.5	6:08	13.7	14:23	6.0	16:23	-1.7	18:23	10.8
8/3/2011	4:33	23:37	2:51	8.3	4:51	0.7	6:51	12.7	15:03	6.4	17:03	-0.7	19:03	11.2
8/4/2011	4:37	23:34	3:37	7.5	5:37	0.4	7:37	11.8	15:46	7.2	17:46	0.9	19:46	11.7
8/5/2011	4:40	23:30	4:28	7.1	6:28	0.8	8:28	11.1	16:35	8.5	18:35	3.1	20:35	12.6
8/6/2011	4:44	23:26	5:27	7.2	7:27	1.5	9:27	10.7	17:35	9.9	19:35	5.5	21:35	13.9
8/7/2011	4:47	23:23	6:35	7.7	8:35	2.1	10:35	10.3	18:47	11.5	20:47	7.2	22:47	15.0
8/8/2011	4:50	23:19	7:46	8.3	9:46	1.9	11:46	9.4	20:01	12.9	22:01	7.6	0:01	14.9
8/9/2011	4:54	23:15					0:01	14.9	8:53	8.6	10:53	0.9	12:53	8.2
8/10/2011	4:57	23:12					1:09	13.9	9:52	8.6	11:52	-0.2	13:52	7.4
8/11/2011	5:00	23:08	22:09	13.5	0:09	5.6	2:09	12.9	10:45	8.6	12:45	-0.9	14:45	7.3
8/12/2011	5:04	23:04	23:02	13.2	1:02	4.5	3:02	12.4	11:32	8.7	13:32	-1.0	15:32	7.9
8/13/2011	5:07	23:01	23:49	12.8	1:49	3.7	3:49	12.3	12:14	8.9	14:14	-0.6	16:14	8.9
8/14/2011	5:10	22:57	0:33	12.2	2:33	3.2	4:33	12.7	12:53	9.0	14:53	0.2	16:53	10.3
8/15/2011	5:13	22:54	1:13	11.4	3:13	2.9	5:13	13.0	13:28	8.9	15:28	1.1	17:28	11.6
8/16/2011	5:17	22:50	1:50	10.4	3:50	2.7	5:50	13.1	14:01	8.7	16:01	2.1	18:01	12.7
8/17/2011	5:20	22:46	2:25	9.2	4:25	2.6	6:25	12.9	14:31	8.6	16:31	3.0	18:31	13.0
8/18/2011	5:23	22:43	2:59	8.2	4:59	2.5	6:59	12.2	14:59	9.0	16:59	4.0	18:59	12.7
8/19/2011	5:26	22:39	3:34	7.5	5:34	2.7	7:34	11.3	15:29	10.0	17:29	5.2	19:29	12.3
8/20/2011	5:29	22:36	4:12	7.4	6:12	3.3	8:12	10.3	16:05	11.4	18:05	6.8	20:05	12.3
8/21/2011	5:32	22:32	5:03	7.5	7:03	4.3	9:03	10.3	16:58	12.4	18:58	8.7	20:58	13.2
8/22/2011	5:35	22:29	6:13	7.6	8:13	6.1	10:13	10.9	18:21	12.7	20:21	10.3	22:21	15.4
8/23/2011	5:38	22:25	7:29	8.2	9:29	5.0	11:29	11.0	19:47	13.3	21:47	10.4	23:47	16.3
8/24/2011	5:41	22:22	8:37	8.5	10:37	3.9	12:37	10.3	20:56	13.7	22:56	9.2	0:56	15.7
8/25/2011	5:44	22:18					0:56	15.7	9:35	8.3	11:35	2.3	13:35	9.6
8/26/2011	5:47	22:15					1:54	14.8	10:26	7.9	12:26	0.8	14:26	9.3
8/27/2011	5:50	22:11	22:46	12.5	0:46	5.5	2:46	14.3	11:12	7.5	13:12	-0.4	15:12	9.5
8/28/2011	5:53	22:08	23:33	11.5	1:33	3.6	3:33	13.8	11:56	7.2	13:56	-1.1	15:56	10.2
8/29/2011	5:56	22:04	0:18	10.3	2:18	1.9	4:18	13.3	12:38	7.1	14:38	-1.3	16:38	11.0
8/30/2011	5:59	22:01	1:03	9.0	3:03	0.4	5:03	12.9	13:19	7.1	15:19	-1.2	17:19	11.7
8/31/2011	6:01	21:57	1:46	7.9	3:46	-0.8	5:46	12.1	14:00	7.4	16:00	-0.6	18:00	12.4

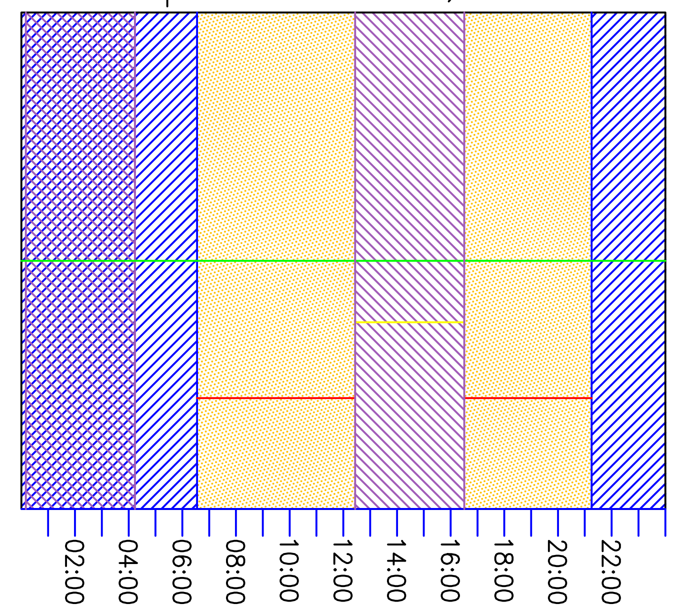
Date	2 Hours Before		Actual Low Tide		2 Hours After		Unrestricted Work Window 1			Unrestricted Work Window 2			Unrestricted Work Window 3			Hourly Totals		
	Time	MLLW	Time	MLLW	Time	MLLW	Start	End	Hours	Start	End	Hours	Start	End	Hours	Daily	Monthly	Yearly
8/1/2011							5:25	13:44	8.3	17:44	23:45	6.0				14.4	14.4	1665.8
8/2/2011							6:08	14:23	8.3	18:23	23:41	5.3				13.6	28.0	1679.3
8/3/2011							6:51	15:03	8.2	19:03	23:37	4.6				12.8	40.8	1692.1
8/4/2011							7:37	15:46	8.2	19:46	23:34	3.8				12.0	52.7	1704.1
8/5/2011							8:28	16:35	8.1	20:35	23:30	2.9				11.1	63.8	1715.2
8/6/2011							4:44	5:27	0.0	9:27	17:35	8.1	21:35	23:26	1.9	10.7	74.6	1725.9
8/7/2011							4:47	6:35	1.8	10:35	18:47	8.2	22:47	23:23	0.0	10.6	85.2	1736.6
8/8/2011							4:50	7:46	2.9	11:46	20:01	8.3				11.2	96.4	1747.8
8/9/2011	21:09	13.6	23:09	6.8	1:09	13.9	4:54	8:53	4.0	12:53	21:09	8.3				12.3	108.7	1760.1
8/10/2011	22:09	13.5					4:57	9:52	4.9	13:52	22:09	8.3				13.2	121.9	1773.3
8/11/2011	23:02	13.2					5:00	10:45	5.8	14:45	23:02	8.3				14.0	136.0	1787.4
8/12/2011	23:49	12.8					5:04	11:32	6.5	15:32	23:04	7.6				14.0	150.0	1801.4
8/13/2011							5:07	12:14	7.1	16:14	23:01	6.8				13.9	164.0	1815.4
8/14/2011							5:10	12:53	7.7	16:53	22:57	6.1				13.8	177.8	1829.2
8/15/2011							5:13	13:28	8.3	17:28	22:54	5.5				13.7	191.5	1842.9
8/16/2011							5:50	14:01	8.2	18:01	22:50	4.8				13.0	204.5	1855.9
8/17/2011							6:25	14:31	8.1	18:31	22:46	4.3				12.4	216.9	1868.3
8/18/2011							6:59	14:59	8.0	18:59	22:43	3.8				11.8	228.7	1880.1
8/19/2011							7:34	15:29	7.9	19:29	22:39	3.2				11.1	239.8	1891.2
8/20/2011							8:12	16:05	7.9	20:05	22:36	2.5				10.4	250.2	1901.6
8/21/2011							9:03	16:58	7.9	20:58	22:32	1.6				9.5	259.8	1911.1
8/22/2011							5:35	6:13	0.0	10:13	18:21	8.1	22:21	22:29	0.0	8.9	268.7	1920.1
8/23/2011							5:38	7:29	1.9	11:29	19:47	8.3				10.2	278.9	1930.3
8/24/2011							5:41	8:37	2.9	12:37	20:56	8.3				11.3	290.2	1941.6
8/25/2011	21:54	13.3	23:54	7.4	1:54	14.8	5:44	9:35	3.9	13:35	21:54	8.3				12.2	302.4	1953.8
8/26/2011	22:46	12.5					5:47	10:26	4.7	14:26	22:15	7.8				12.5	314.9	1966.3
8/27/2011	23:33	11.5					5:50	11:12	5.4	15:12	22:11	7.0				12.4	327.3	1978.6
8/28/2011							5:53	11:56	6.1	15:56	22:08	6.2				12.3	339.5	1990.9
8/29/2011							5:56	12:38	6.7	16:38	22:04	5.5				12.2	351.7	2003.1
8/30/2011							5:59	13:19	7.3	17:19	22:01	4.7				12.1	363.8	2015.2
8/31/2011							6:01	14:00	8.0	18:00	21:57	4.0				12.0	375.7	2027.1



TYPICAL SECTION D-D

Represents the low tide window for September 12, 2011

September 12, 2011



Civil Twilight window

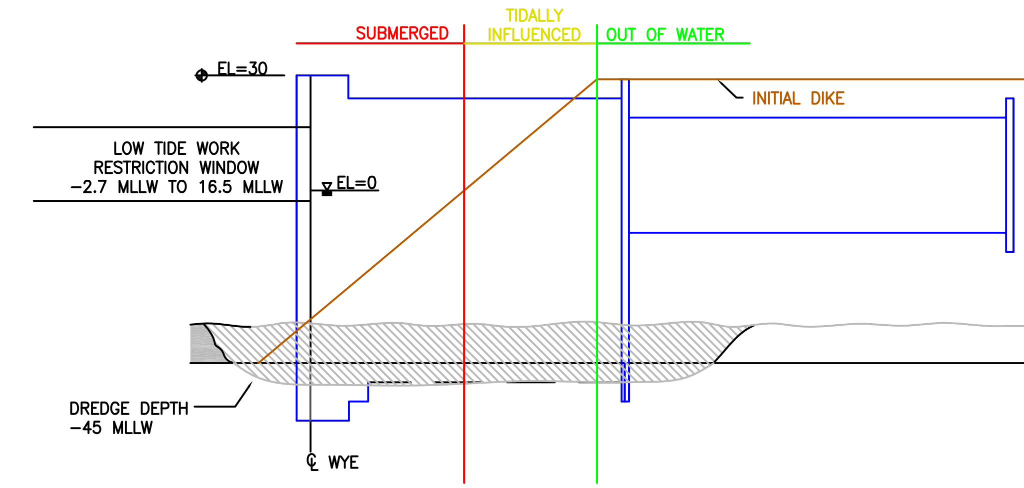
Low Tide window

Unrestricted Work window

Submerged Piledriving

Tidally Influenced Piledriving

Out of Water Piledriving

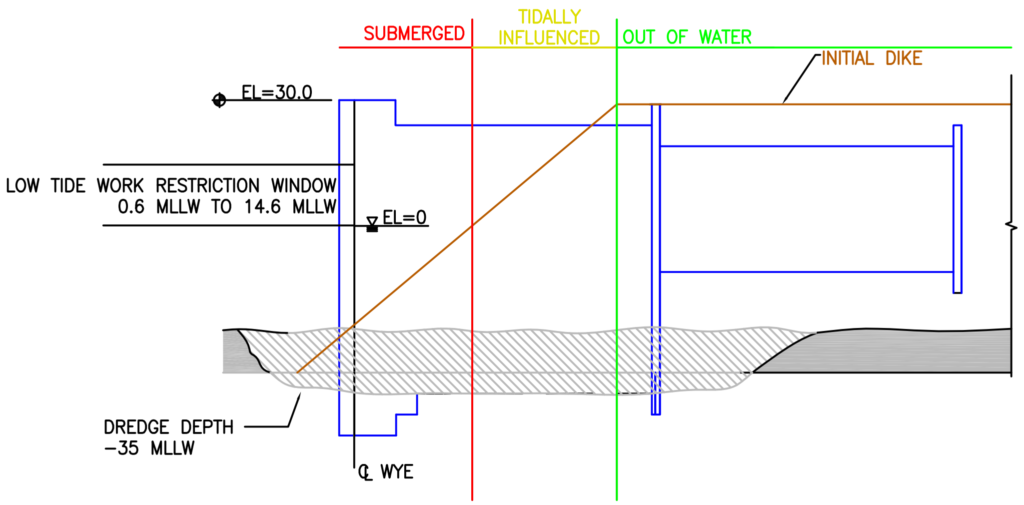


TYPICAL SECTION E-E

Represents the low tidal range for the entire month of September 2011

Date	Civil Twilight		2 Hours Before		Actual Low Tide		2 Hours After		2 Hours Before		Actual Low Tide		2 hours After	
	Begin	End	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW
9/1/2011	6:04	21:54	2:31	6.9	4:31	-1.4	6:31	11.5	14:41	8.1	16:41	0.6	18:41	12.9
9/2/2011	6:07	21:50	3:17	6.5	5:17	-1.2	7:17	10.9	15:26	8.9	17:26	2.3	19:26	13.6
9/3/2011	6:10	21:47	4:07	6.5	6:07	-0.3	8:07	10.5	16:16	10.0	18:16	4.5	20:16	14.3
9/4/2011	6:13	21:44	5:04	7.1	7:04	1.2	9:04	10.5	17:16	11.4	19:16	6.7	21:16	15.2
9/5/2011	6:15	21:40	6:11	8.1	8:11	2.5	10:11	10.5	18:28	12.8	20:28	8.2	22:28	15.5
9/6/2011	6:18	21:37	7:22	9.2	9:22	2.9	11:22	9.8	19:43	13.8	21:43	8.2	23:43	14.6
9/7/2011	6:21	21:33	8:30	9.8	10:30	2.4	12:30	8.9	20:52	13.9	22:52	6.9	0:52	13.0
9/8/2011	6:24	21:30					0:52	13.0	9:30	9.8	11:30	1.4	13:30	8.2
9/9/2011	6:26	21:27					1:52	11.7	10:22	9.8	12:22	0.7	14:22	8.3
9/10/2011	6:29	21:23	22:43	12.5	0:43	3.5	2:43	11.0	11:07	9.9	13:07	0.6	15:07	8.9
9/11/2011	6:32	21:20	23:28	11.8	1:28	2.5	3:28	10.9	11:47	10.2	13:47	1.1	15:47	10.1
9/12/2011	6:34	21:16	0:09	11.1	2:09	1.9	4:09	11.2	12:25	10.2	14:25	1.9	16:25	11.7
9/13/2011	6:37	21:13	0:48	10.2	2:48	1.7	4:48	11.8	12:59	10.3	14:59	2.9	16:59	13.1
9/14/2011	6:39	21:10	1:24	9.2	3:24	1.6	5:24	12.1	13:32	10.2	15:32	3.8	17:32	14.2
9/15/2011	6:42	21:06	1:58	8.2	3:58	1.6	5:58	12.1	14:03	10.1	16:03	4.7	18:03	14.7
9/16/2011	6:45	21:03	2:31	7.3	4:31	1.7	6:31	11.6	14:32	10.5	16:32	5.5	18:32	14.3
9/17/2011	6:47	21:00	3:04	6.7	5:04	2.0	7:04	10.8	15:03	11.2	17:03	6.4	19:03	13.8
9/18/2011	6:50	20:56	3:38	6.9	5:38	2.7	7:38	9.9	15:38	12.3	17:38	7.7	19:38	13.5
9/19/2011	6:53	20:53	4:20	7.4	6:20	3.8	8:20	9.5	16:27	13.1	18:27	9.2	20:27	13.9
9/20/2011	6:55	20:50	5:24	7.6	7:24	5.0	9:24	10.4	17:44	13.1	19:44	10.5	21:44	15.5
9/21/2011	6:58	20:47	6:44	8.1	8:44	5.5	10:44	11.5	19:13	13.3	21:13	10.5	23:13	16.5
9/22/2011	7:00	20:43	7:57	8.7	9:57	4.8	11:57	11.4	20:25	13.3	22:25	9.0	0:25	15.6
9/23/2011	7:03	20:40					0:25	15.6	8:59	8.7	10:59	3.4	12:59	10.9
9/24/2011	7:05	20:37					1:26	14.4	9:52	8.5	11:52	1.9	13:52	10.7
9/25/2011	7:08	20:34	22:19	11.3	0:19	4.1	2:19	13.3	10:41	8.2	12:41	0.8	14:41	11.0
9/26/2011	7:10	20:30	23:08	9.9	1:08	1.8	3:08	12.5	11:26	8.2	13:26	0.2	15:26	11.6
9/27/2011	7:13	20:27	23:54	8.7	1:54	-0.1	3:54	11.7	12:10	8.4	14:10	0.1	16:10	12.4
9/28/2011	7:15	20:24	0:40	7.5	2:40	-1.6	4:40	11.2	12:54	8.8	14:54	0.5	16:54	13.4
9/29/2011	7:18	20:21	1:25	6.6	3:25	-2.5	5:25	10.6	13:38	9.2	15:38	1.3	17:38	14.3
9/30/2011	7:20	20:18	2:11	6.1	4:11	-2.7	6:11	10.4	14:22	9.9	16:22	2.4	18:22	14.8

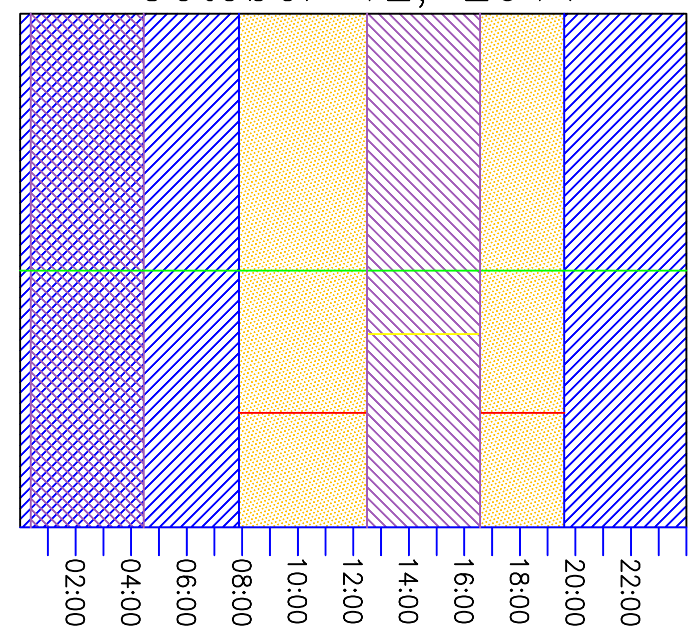
Date	2 Hours Before		Actual Low Tide		2 Hours After		Unrestricted Work Window 1			Unrestricted Work Window 2			Unrestricted Work Window 3			Hourly Totals		
	Time	MLLW	Time	MLLW	Time	MLLW	Start	End	Hours	Start	End	Hours	Start	End	Hours	Daily	Monthly	Yearly
9/1/2011							6:31	14:41	8.2	18:41	21:54	3.2				11.4	11.4	2038.5
9/2/2011							7:17	15:26	8.2	19:26	21:50	2.4				10.6	22.0	2049.1
9/3/2011							8:07	16:16	8.2	20:16	21:47	1.5				9.7	31.7	2058.8
9/4/2011							9:04	17:16	8.2	21:16	21:44	0.0				8.7	40.4	2067.5
9/5/2011							10:11	18:28	8.3							8.3	48.7	2075.8
9/6/2011							6:18	7:22	1.1	11:22	19:43	8.4				9.4	58.2	2085.3
9/7/2011							6:21	8:30	2.2	12:30	20:52	8.4				10.5	68.7	2095.8
9/8/2011	21:52	13.2	23:52	5.1	1:52	11.7	6:24	9:30	3.1	13:30	21:30	8.0				11.1	79.8	2107.0
9/9/2011	22:43	12.5					6:26	10:22	3.9	14:22	21:27	7.1				11.0	90.9	2118.0
9/10/2011	23:28	11.8					6:29	11:07	4.6	15:07	21:23	6.3				10.9	101.8	2128.9
9/11/2011							6:32	11:47	5.3	15:47	21:20	5.6				10.8	112.7	2139.8
9/12/2011							6:34	12:25	5.9	16:25	21:16	4.9				10.7	123.4	2150.5
9/13/2011							6:37	12:59	6.4	16:59	21:13	4.3				10.6	134.0	2161.1
9/14/2011							6:39	13:32	6.9	17:32	21:10	3.7				10.5	144.6	2171.7
9/15/2011							6:42	14:03	7.4	18:03	21:06	3.1				10.4	155.0	2182.1
9/16/2011							6:45	14:32	7.8	18:32	21:03	2.5				10.3	165.3	2192.5
9/17/2011							7:04	15:03	8.0	19:03	21:00	2.0				10.0	175.3	2202.4
9/18/2011							7:38	15:38	8.0	19:38	20:56	1.3				9.3	184.6	2211.8
9/19/2011							8:20	16:27	8.1	20:27	20:53	0.0				8.6	193.2	2220.3
9/20/2011							9:24	17:44	8.3							8.3	201.6	2228.7
9/21/2011							10:44	19:13	8.5							8.5	210.1	2237.2
9/22/2011							7:00	7:57	1.0	11:57	20:25	8.5				9.4	219.5	2246.6
9/23/2011	21:26	12.5	23:26	6.6	1:26	14.4	7:03	8:59	1.9	12:59	20:40	7.7				9.6	229.2	2256.3
9/24/2011	22:19	11.3					7:05	9:52	2.8	13:52	20:37	6.8				9.6	238.7	2265.9
9/25/2011	23:08	9.9					7:08	10:41	3.6	14:41	20:34	5.9				9.5	248.2	2275.3
9/26/2011	23:54	8.7					7:10	11:26	4.3	15:26	20:30	5.1				9.4	257.6	2284.7
9/27/2011							7:13	12:10	5.0	16:10	20:27	4.3				9.3	266.8	2294.0
9/28/2011							7:15	12:54	5.7	16:54	20:24	3.5				9.2	276.0	2303.1
9/29/2011							7:18	13:38	6.3	17:38	20:21	2.7				9.1	285.1	2312.2
9/30/2011							7:20	14:22	7.0	18:22	20:18	2.0				9.0	294.1	2321.2



TYPICAL SECTION D-D

Represents the low tide window for October 12, 2011

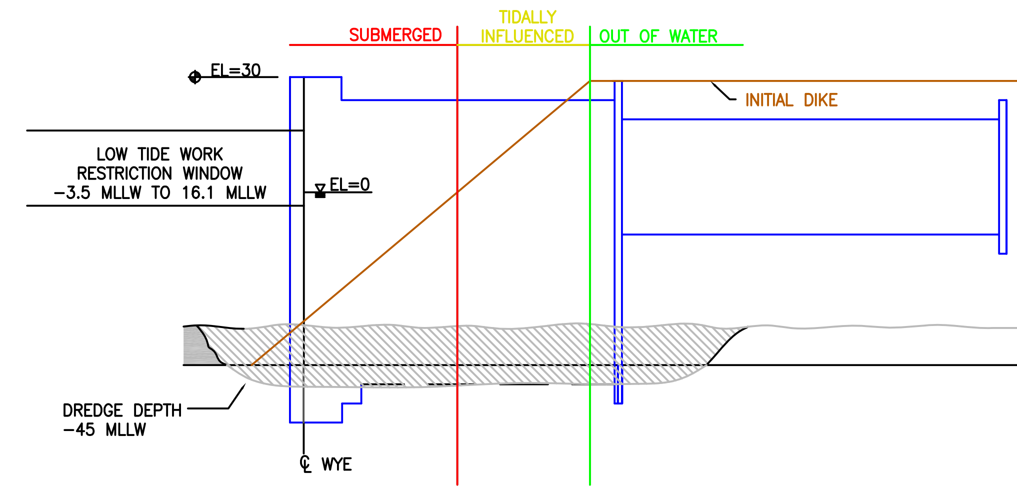
October 12, 2011



Civil Twilight window — Submerged Piledriving

Low Tide window — Tidally Influenced Piledriving

Unrestricted Work window — Out of Water Piledriving

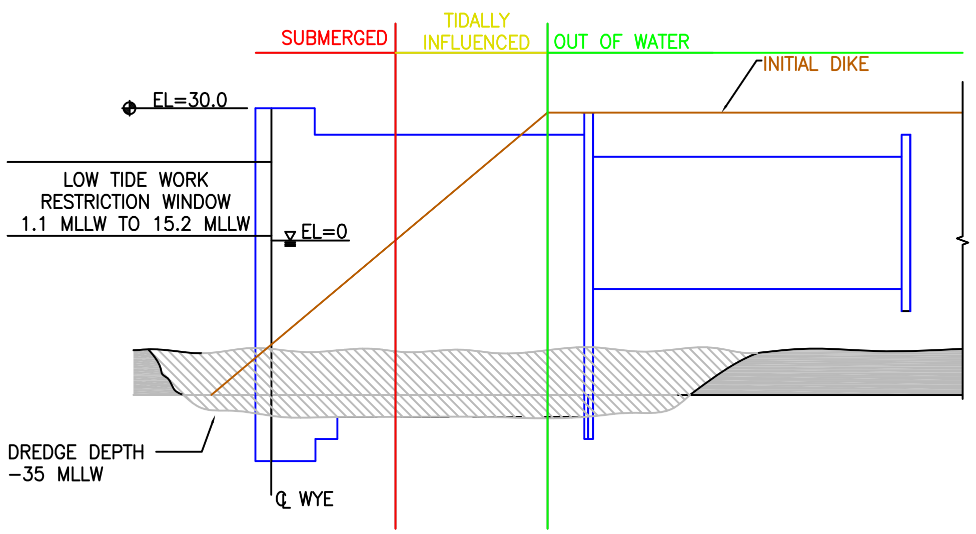


TYPICAL SECTION E-E

Represents the low tidal range for the entire month of October 2011

Date	Civil Twilight		2 Hours Before		Actual Low Tide		2 Hours After		2 Hours Before		Actual Low Tide		2 hours After	
	Begin	End	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW
10/1/2011	7:23	20:14	2:58	5.9	4:58	-2.1	6:58	10.3	15:08	10.7	17:08	3.9	19:08	15.2
10/2/2011	7:26	20:11	3:47	6.4	5:47	-0.7	7:47	10.3	15:59	11.5	17:59	5.7	19:59	15.5
10/3/2011	7:28	20:08	4:42	7.3	6:42	1.2	8:42	10.6	16:58	12.4	18:58	7.4	20:58	15.8
10/4/2011	7:31	20:05	5:44	8.6	7:44	3.0	9:44	10.9	18:07	13.4	20:07	8.4	22:07	15.4
10/5/2011	7:33	20:02	6:52	9.9	8:52	4.0	10:52	10.6	19:20	13.9	21:20	8.1	23:20	14.0
10/6/2011	7:36	19:59	8:00	10.6	10:00	4.0	12:00	10.1	20:29	13.5	22:29	6.6	0:29	12.2
10/7/2011	7:38	19:56					0:29	12.2	9:00	10.9	11:00	3.4	13:00	9.7
10/8/2011	7:41	19:53					1:27	10.7	9:51	11.0	11:51	2.8	13:51	9.7
10/9/2011	7:43	19:50	22:18	11.6	0:18	2.8	2:18	9.9	10:36	11.2	12:36	2.7	14:36	10.4
10/10/2011	7:46	19:47	23:02	10.7	1:02	1.5	3:02	9.6	11:17	11.4	13:17	3.1	15:17	11.6
10/11/2011	7:48	19:44	23:44	9.8	1:44	0.8	3:44	10.0	11:55	11.6	13:55	3.9	15:55	13.1
10/12/2011	7:50	19:41	0:22	9.1	2:22	0.6	4:22	10.4	12:32	11.7	14:32	4.8	16:32	14.6
10/13/2011	7:53	19:38	0:59	8.2	2:59	0.6	4:59	11.0	13:07	11.7	15:07	5.6	17:07	15.6
10/14/2011	7:55	19:35	1:35	7.4	3:35	0.7	5:35	11.3	13:40	11.8	15:40	6.3	17:40	16.1
10/15/2011	7:58	19:32	2:09	6.7	4:09	1.0	6:09	11.3	14:14	11.8	16:14	6.8	18:14	16.1
10/16/2011	8:00	19:29	2:42	6.3	4:42	1.5	6:42	10.7	14:48	12.1	16:48	7.4	18:48	15.6
10/17/2011	8:03	19:26	3:16	6.4	5:16	2.1	7:16	10.0	15:25	12.6	17:25	8.2	19:25	15.0
10/18/2011	8:05	19:23	3:55	6.9	5:55	3.1	7:55	9.6	16:12	12.9	18:12	9.1	20:12	14.8
10/19/2011	8:08	19:20	4:47	7.4	6:47	4.2	8:47	9.9	17:19	12.8	19:19	9.8	21:19	15.5
10/20/2011	8:10	19:17	5:59	7.8	7:59	5.1	9:59	11.3	18:39	12.6	20:39	9.6	22:39	15.9
10/21/2011	8:13	19:14	7:13	8.4	9:13	5.1	11:13	12.0	19:53	12.3	21:53	8.0	23:53	15.1
10/22/2011	8:15	19:12	8:19	8.9	10:19	4.3	12:19	12.2	20:56	11.3	22:56	5.5	0:56	13.6
10/23/2011	8:18	19:09					0:56	13.6	9:16	9.1	11:16	3.2	13:16	12.2
10/24/2011	8:20	19:06					1:51	12.0	10:08	9.3	12:08	2.4	14:08	12.5
10/25/2011	8:23	19:03	22:43	8.5	0:43	0.2	2:43	11.0	10:57	9.6	12:57	2.0	14:57	13.1
10/26/2011	8:25	19:01	23:32	7.2	1:32	-1.7	3:32	10.2	11:45	10.0	13:45	2.1	15:45	14.0
10/27/2011	8:28	18:58	0:19	6.4	2:19	-3.0	4:19	9.6	12:32	10.5	14:32	2.4	16:32	14.9
10/28/2011	8:30	18:55	1:06	5.9	3:06	-3.5	5:06	9.4	13:19	11.0	15:19	3.0	17:19	15.6
10/29/2011	8:33	18:53	1:53	5.7	3:53	-3.3	5:53	9.6	14:05	11.5	16:05	3.8	18:05	15.8
10/30/2011	8:35	18:50	2:40	5.9	4:40	-2.4	6:40	9.9	14:53	11.8	16:53	4.8	18:53	16.0
10/31/2011	8:38	18:48	3:27	6.6	5:27	-0.9	7:27	10.2	15:43	12.2	17:43	5.9	19:43	15.9

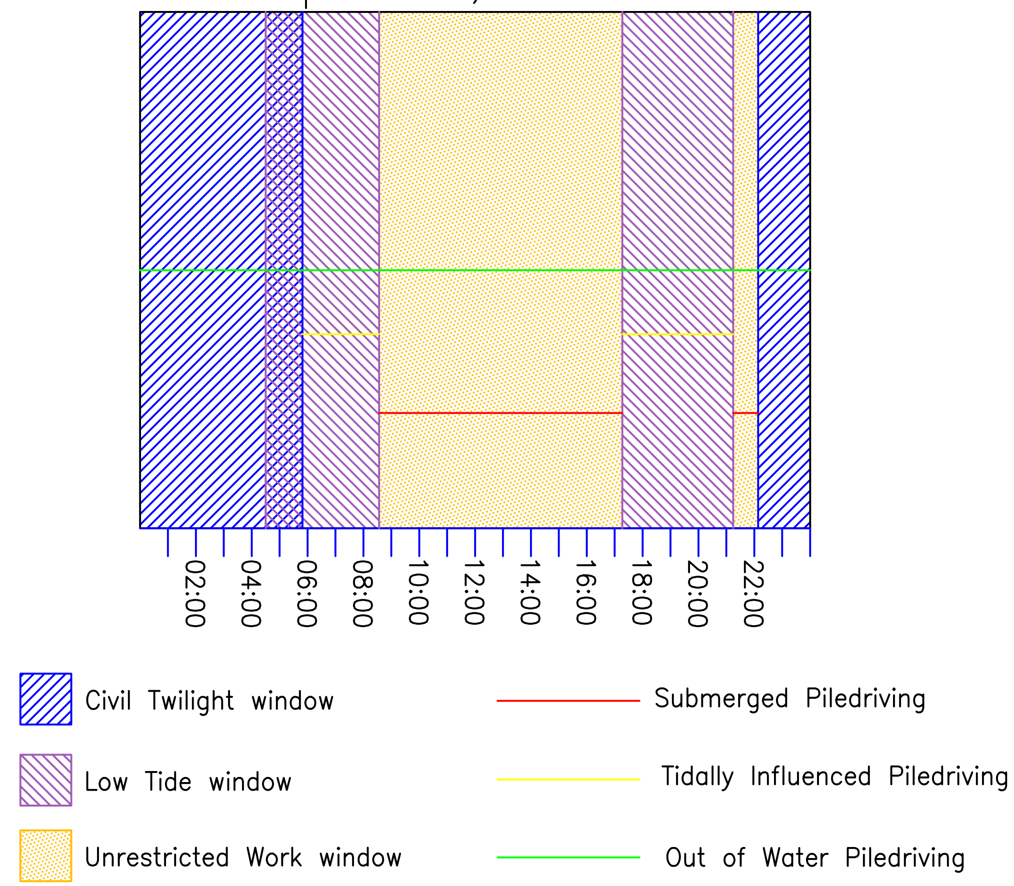
Date	2 Hours Before		Actual Low Tide		2 Hours After		Unrestricted Work Window 1			Unrestricted Work Window 2			Unrestricted Work Window 3			Hourly Totals		
	Time	MLLW	Time	MLLW	Time	MLLW	Start	End	Hours	Start	End	Hours	Start	End	Hours	Daily	Monthly	Yearly
10/1/2011							7:23	15:08	7.8	19:08	20:14	1.1				8.9	8.9	2330.1
10/2/2011							7:47	15:59	8.2	19:59	20:11	0.0				8.4	17.3	2338.5
10/3/2011							8:42	16:58	8.3							8.3	25.6	2346.8
10/4/2011							9:44	18:07	8.4							8.4	34.0	2355.2
10/5/2011							10:52	19:20	8.5							8.5	42.5	2363.7
10/6/2011							7:36	8:00	0.0	12:00	19:59	8.0				8.4	50.9	2372.1
10/7/2011	21:27	12.6	23:27	4.6	1:27	10.7	7:38	9:00	1.4	13:00	19:56	7.0				8.3	59.2	2380.5
10/8/2011	22:18	11.6					7:41	9:51	2.2	13:51	19:53	6.1				8.2	67.5	2388.7
10/9/2011	23:02	10.7					7:43	10:36	2.9	14:36	19:50	5.3				8.1	75.6	2396.8
10/10/2011	23:44	9.8					7:46	11:17	3.5	15:17	19:47	4.5				8.0	83.7	2404.9
10/11/2011							7:48	11:55	4.1	15:55	19:44	3.8				8.0	91.6	2412.9
10/12/2011							7:50	12:32	4.7	16:32	19:41	3.2				7.9	99.5	2420.7
10/13/2011							7:53	13:07	5.2	17:07	19:38	2.5				7.8	107.3	2428.5
10/14/2011							7:55	13:40	5.8	17:40	19:35	1.9				7.7	115.0	2436.2
10/15/2011							7:58	14:14	6.3	18:14	19:32	1.3				7.6	122.6	2443.8
10/16/2011							8:00	14:48	6.8	18:48	19:29	0.0				7.5	130.1	2451.3
10/17/2011							8:03	15:25	7.4	19:25	19:26	0.0				7.4	137.5	2458.8
10/18/2011							8:05	16:12	8.1							8.1	145.7	2466.9
10/19/2011							8:47	17:19	8.5							8.5	154.2	2475.4
10/20/2011							9:59	18:39	8.7							8.7	162.9	2484.1
10/21/2011							11:13	19:14	8.0							8.0	170.9	2492.2
10/22/2011							8:15	8:19	0.0	12:19	19:12	6.9				7.0	177.9	2499.1
10/23/2011	21:51	10.0	23:51	2.7	1:51	12.0	8:18	9:16	1.0	13:16	19:09	5.9				6.9	184.8	2506.0
10/24/2011	22:43	8.5					8:20	10:08	1.8	14:08	19:06	5.0				6.8	191.6	2512.8
10/25/2011	23:32	7.2					8:23	10:57	2.6	14:57	19:03	4.1				6.7	198.3	2519.5
10/26/2011							8:25	11:45	3.3	15:45	19:01	3.3				6.6	204.9	2526.2
10/27/2011							8:28	12:32	4.1	16:32	18:58	2.5				6.5	211.5	2532.7
10/28/2011							8:30	13:19	4.8	17:19	18:55	1.6				6.4	217.9	2539.1
10/29/2011							8:33	14:05	5.5	18:05	18:53	0.0				6.4	224.3	2545.5
10/30/2011							8:35	14:53	6.3							6.3	230.6	2551.8
10/31/2011							8:38	15:43	7.1							7.1	237.7	2558.9

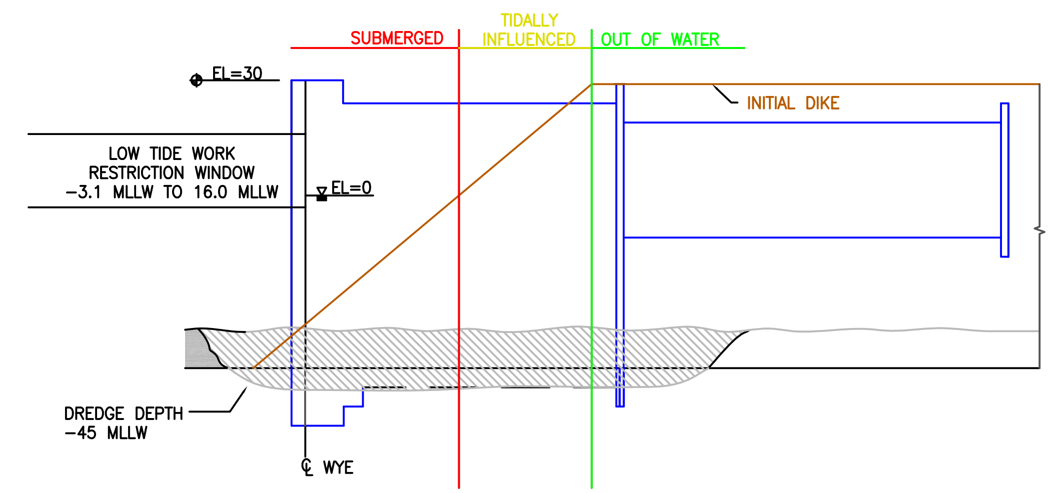


TYPICAL SECTION D-D

Represents the low tide window for April 12, 2012

April 12, 2012



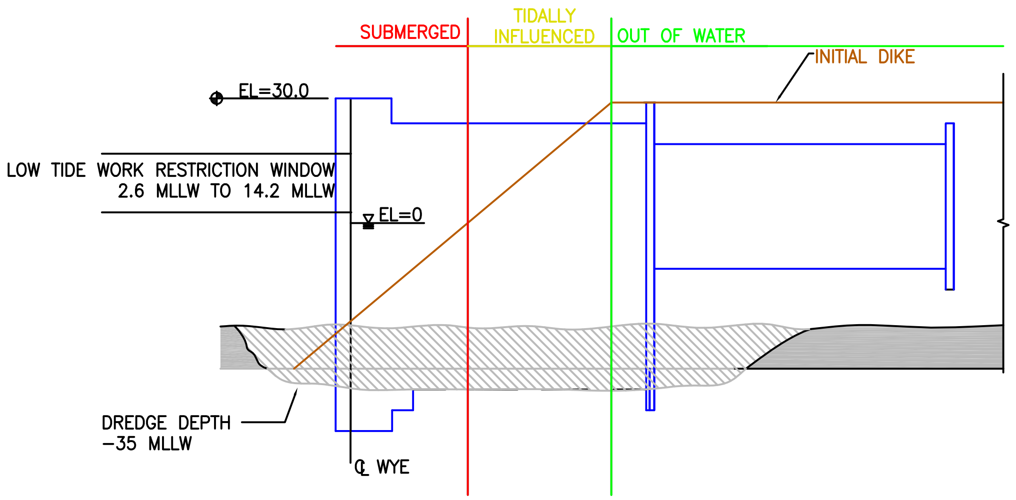


TYPICAL SECTION E-E

Represents the low tidal range for the entire month of April 2012

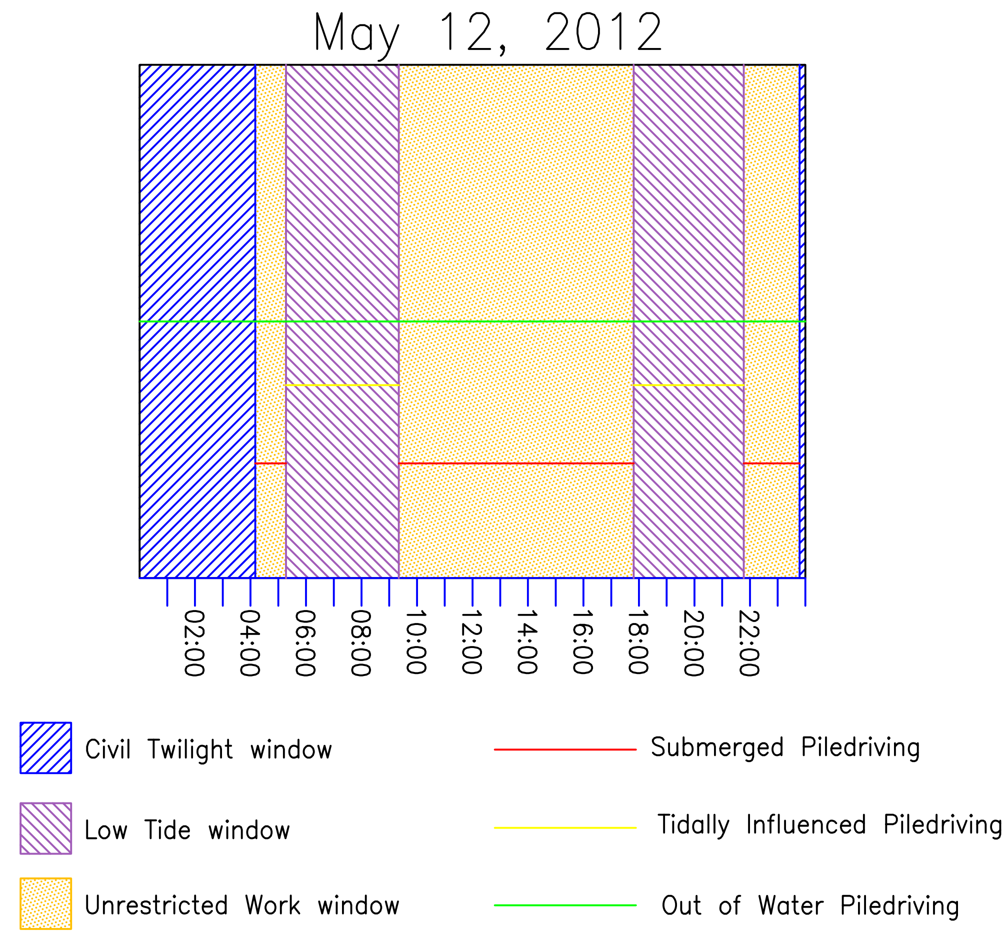
Date	Civil Twilight		2 Hours Before		Actual Low Tide		2 Hours After		2 Hours Before		Actual Low Tide		2 hours After	
	Begin	End	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW
4/1/2012	6:34	21:31	7:56	12.6	9:56	8.9	11:56	15.3	20:30	8.9	22:30	4.5	0:30	11.5
4/2/2012	6:31	21:34					0:30	11.5	9:01	12.2	11:01	7.0	13:01	14.2
4/3/2012	6:27	21:37					1:28	11.4	9:57	11.2	11:57	4.7	13:57	13.1
4/4/2012	6:24	21:40	22:18	9.0	0:18	2.3	2:18	11.5	10:47	10.1	12:47	2.5	14:47	12.2
4/5/2012	6:21	21:42	23:05	9.0	1:05	1.6	3:05	12.1	11:34	8.8	13:34	0.5	15:34	11.5
4/6/2012	6:17	21:45	23:50	9.1	1:50	1.3	3:50	12.9	12:20	7.6	14:20	-1.2	16:20	11.0
4/7/2012	6:14	21:48	0:34	9.3	2:34	1.3	4:34	13.7	13:06	6.4	15:06	-2.4	17:06	10.7
4/8/2012	6:10	21:51	1:18	9.5	3:18	1.5	5:18	14.4	13:50	5.8	15:50	-3.1	17:50	10.1
4/9/2012	6:07	21:54	2:02	9.8	4:02	2.0	6:02	14.7	14:36	5.4	16:36	-3.1	18:36	9.8
4/10/2012	6:04	21:57	2:48	10.2	4:48	2.9	6:48	15.0	15:23	5.5	17:23	-2.2	19:23	9.7
4/11/2012	6:00	22:00	3:37	10.7	5:37	4.1	7:37	15.1	16:15	6.1	18:15	-0.7	20:15	10.0
4/12/2012	5:57	22:03	4:32	11.3	6:32	5.6	8:32	15.2	17:13	7.1	19:13	1.1	21:13	10.4
4/13/2012	5:53	22:06	5:36	12.1	7:36	6.7	9:36	15.1	18:17	8.5	20:17	2.6	22:17	10.5
4/14/2012	5:50	22:09	6:46	12.8	8:46	7.0	10:46	14.1	19:25	9.7	21:25	3.3	23:25	10.3
4/15/2012	5:46	22:12	7:57	12.8	9:57	6.1	11:57	12.4	20:29	10.5	22:29	3.2	0:29	9.9
4/16/2012	5:43	22:15					0:29	9.9	9:01	12.2	11:01	4.3	13:01	10.7
4/17/2012	5:39	22:18					1:25	9.8	9:56	11.3	11:56	2.5	13:56	9.5
4/18/2012	5:36	22:21	22:15	11.2	0:15	2.8	2:15	10.3	10:45	10.4	12:45	1.1	14:45	9.1
4/19/2012	5:32	22:24	23:00	11.5	1:00	3.1	3:00	11.3	11:28	9.8	13:28	0.3	15:28	9.1
4/20/2012	5:29	22:27	23:41	11.8	1:41	3.7	3:41	12.7	12:09	9.1	14:09	0.0	16:09	9.6
4/21/2012	5:25	22:30	0:19	12.0	2:19	4.5	4:19	14.0	12:47	8.4	14:47	0.0	16:47	10.2
4/22/2012	5:22	22:33	0:56	12.0	2:56	5.2	4:56	15.2	13:24	7.5	15:24	0.1	17:24	10.7
4/23/2012	5:18	22:36	1:31	11.8	3:31	5.8	5:31	15.8	13:59	6.7	15:59	0.3	17:59	10.9
4/24/2012	5:14	22:40	2:06	11.5	4:06	6.1	6:06	16.0	14:32	6.1	16:32	0.6	18:32	10.6
4/25/2012	5:11	22:43	2:40	11.4	4:40	6.4	6:40	15.5	15:06	5.8	17:06	1.1	19:06	10.1
4/26/2012	5:07	22:46	3:16	11.5	5:16	6.8	7:16	14.7	15:41	6.1	17:41	1.8	19:41	9.4
4/27/2012	5:04	22:49	3:58	11.8	5:58	7.4	7:58	14.2	16:23	6.8	18:23	2.9	20:23	9.2
4/28/2012	5:00	22:53	4:52	11.8	6:52	8.1	8:52	14.2	17:21	7.3	19:21	4.1	21:21	10.0
4/29/2012	4:57	22:56	6:03	11.6	8:03	8.5	10:03	14.7	18:34	7.7	20:34	4.9	22:34	11.6
4/30/2012	4:53	22:59	7:19	11.3	9:19	7.8	11:19	14.7	19:43	8.5	21:43	5.0	23:43	12.3

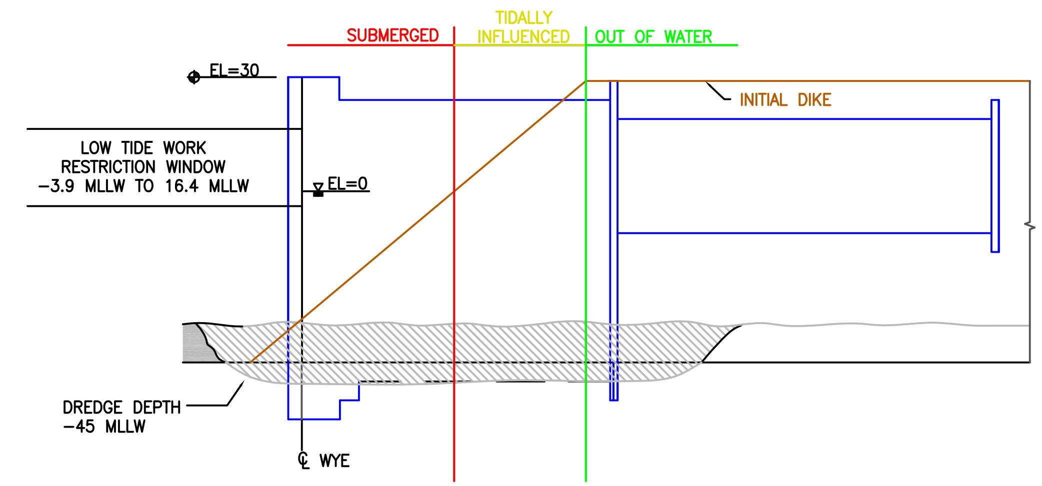
Date	2 Hours Before		Actual Low Tide		2 Hours After		Unrestricted Work Window 1			Unrestricted Work Window 2			Unrestricted Work Window 3			Hourly Totals		
	Time	MLLW	Time	MLLW	Time	MLLW	Start	End	Hours	Start	End	Hours	Start	End	Hours	Daily	Monthly	Yearly
4/1/2012							6:34	7:56	1.4	11:56	20:30	8.6				9.9	10.0	10.0
4/2/2012	21:28	9.0	23:28	3.3	1:28	11.4	6:31	9:01	2.5	13:01	21:28	8.5				11.0	21.0	21.0
4/3/2012	22:18	9.0					6:27	9:57	3.5	13:57	21:37	7.7				11.2	32.2	32.2
4/4/2012	23:05	9.0					6:24	10:47	4.4	14:47	21:40	6.9				11.3	43.5	43.5
4/5/2012	23:50	9.1					6:21	11:34	5.2	15:34	21:42	6.2				11.4	54.8	54.8
4/6/2012							6:17	12:20	6.1	16:20	21:45	5.4				11.5	66.3	66.3
4/7/2012							6:14	13:06	6.9	17:06	21:48	4.7				11.6	77.9	77.9
4/8/2012							6:10	13:50	7.7	17:50	21:51	4.0				11.7	89.7	89.7
4/9/2012							6:07	14:36	8.5	18:36	21:54	3.3				11.8	101.5	101.5
4/10/2012							6:48	15:23	8.6	19:23	21:57	2.6				11.2	112.7	112.7
4/11/2012							7:37	16:15	8.6	20:15	22:00	1.8				10.4	123.1	123.1
4/12/2012							8:32	17:13	8.7	21:13	22:03	0.0				9.5	132.6	132.6
4/13/2012							9:36	18:17	8.7							8.7	141.3	141.3
4/14/2012							5:50	6:46	0.0	10:46	19:25	8.7				9.6	150.9	150.9
4/15/2012							5:46	7:57	2.2	11:57	20:29	8.5				10.7	161.7	161.7
4/16/2012	21:25	10.9	23:25	2.9	1:25	9.8	5:43	9:01	3.3	13:01	21:25	8.4				11.7	173.4	173.4
4/17/2012	22:15	11.2					5:39	9:56	4.3	13:56	22:15	8.3				12.6	186.1	186.1
4/18/2012	23:00	11.5					5:36	10:45	5.2	14:45	22:21	7.6				12.8	198.8	198.8
4/19/2012	23:41	11.8					5:32	11:28	5.9	15:28	22:24	7.0				12.9	211.7	211.7
4/20/2012							5:29	12:09	6.7	16:09	22:27	6.3				13.0	224.7	224.7
4/21/2012							5:25	12:47	7.4	16:47	22:30	5.7				13.1	237.9	237.9
4/22/2012							5:22	13:24	8.0	17:24	22:33	5.2				13.2	251.1	251.1
4/23/2012							5:31	13:59	8.5	17:59	22:36	4.6				13.1	264.2	264.2
4/24/2012							6:06	14:32	8.4	18:32	22:40	4.2				12.6	276.8	276.8
4/25/2012							6:40	15:06	8.4	19:06	22:43	3.6				12.1	288.9	288.9
4/26/2012							7:16	15:41	8.4	19:41	22:46	3.1				11.5	300.4	300.4
4/27/2012							7:58	16:23	8.4	20:23	22:49	2.5				10.9	311.3	311.3
4/28/2012							8:52	17:21	8.5	21:21	22:53	1.6				10.0	321.3	321.3
4/29/2012							4:57	6:03	1.1	10:03	18:34	8.5	22:34	22:56	0.0	10.0	331.4	331.4
4/30/2012							4:53	7:19	2.4	11:19	19:43	8.4				10.8	342.2	342.2



TYPICAL SECTION D-D

Represents the low tide window for May 12, 2012



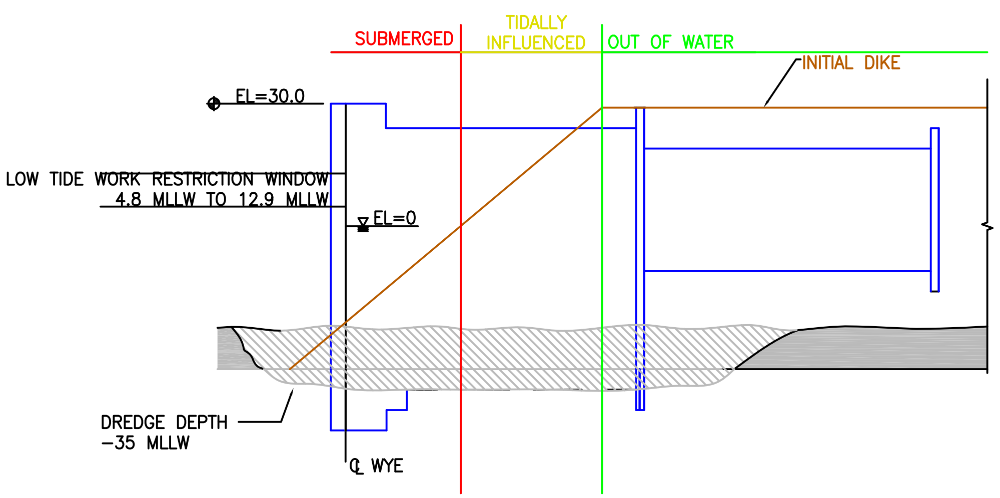


TYPICAL SECTION E-E

Represents the low tidal range for the entire month of May 2012

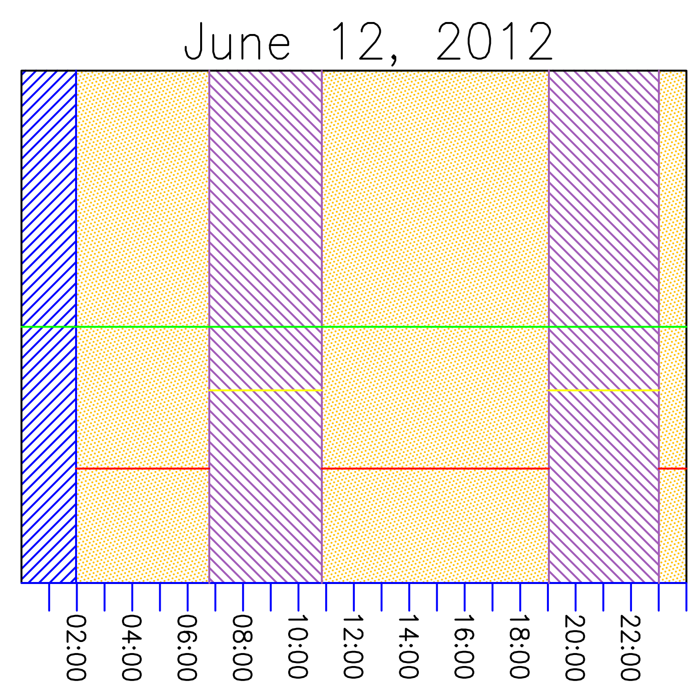
Ship Creek smolt releases, during which time no piledriving may be performed, typically occur during the second week of May.

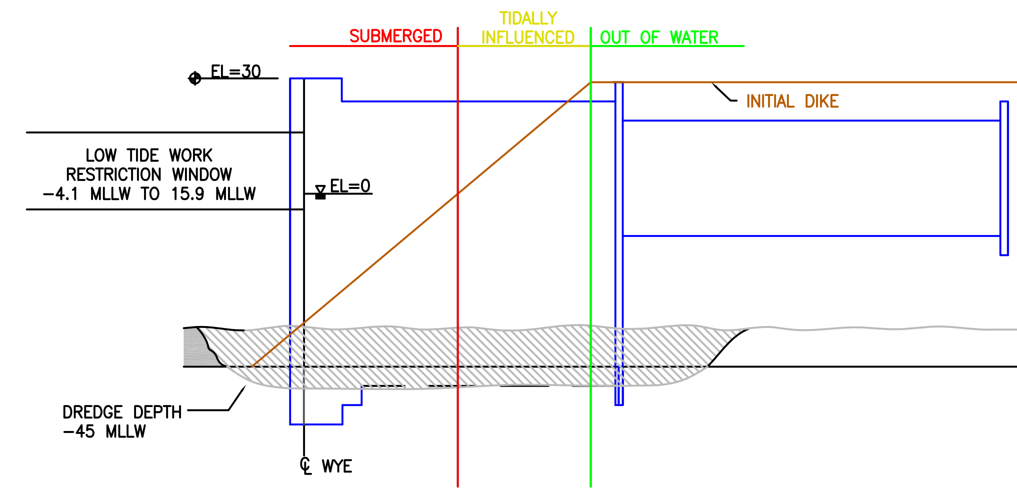
Date	Civil Twilight		2 Hours Before		Actual Low Tide		2 Hours After		2 Hours Before		Actual Low Tide		2 hours After		2 Hours Before		Actual Low Tide		2 Hours After		Unrestricted Work Window 1			Unrestricted Work Window 2			Unrestricted Work Window 3			Hourly Totals		
	Begin	End	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Start	End	Hours	Start	End	Hours	Start	End	Hours	Daily	Monthly	Yearly
5/1/2012	4:49	23:03	8:26	10.8	10:26	5.9	12:26	13.6	20:45	9.1	22:45	4.4	0:45	12.6							4:49	8:26	3.6	12:26	20:45	8.3				11.9	12.0	354.2
5/2/2012	4:46	23:06					0:45	12.6	9:25	9.7	11:25	3.6	13:25	12.2	21:41	9.5	23:41	3.8	1:41	13.0	4:46	9:25	4.7	13:25	21:41	8.3				12.9	24.9	367.2
5/3/2012	4:42	23:10					1:41	13.0	10:18	8.5	12:18	1.2	14:18	11.0	22:33	9.8					4:42	10:18	5.6	14:18	22:33	8.3				13.9	38.8	381.0
5/4/2012	4:38	23:13	22:33	9.8	0:33	3.3	2:33	13.6	11:09	7.3	13:09	-0.9	15:09	10.2	23:22	10.2					4:38	11:09	6.5	15:09	23:13	8.1				14.6	53.4	395.7
5/5/2012	4:35	23:17	23:22	10.2	1:22	3.0	3:22	14.2	11:58	6.3	13:58	-2.5	15:58	9.7							4:35	11:58	7.4	15:58	23:17	7.3				14.7	68.2	410.4
5/6/2012	4:31	23:20	0:11	10.6	2:11	3.0	4:11	15.0	12:46	5.6	14:46	-3.5	16:46	9.4							4:31	12:46	8.3	16:46	23:20	6.6				14.8	83.0	425.2
5/7/2012	4:27	23:24	0:59	10.9	2:59	3.0	4:59	15.4	13:32	5.4	15:32	-3.9	17:32	9.0							4:59	13:32	8.6	17:32	23:24	5.9				14.4	97.5	439.7
5/8/2012	4:24	23:27	1:46	11.2	3:46	3.1	5:46	15.5	14:20	5.2	16:20	-3.7	18:20	9.2							5:46	14:20	8.6	18:20	23:27	5.1				13.7	111.2	453.4
5/9/2012	4:20	23:31	2:34	11.3	4:34	3.5	6:34	15.5	15:06	5.7	17:06	-2.8	19:06	9.2							6:34	15:06	8.5	19:06	23:31	4.4				13.0	124.2	466.4
5/10/2012	4:16	23:35	3:24	11.4	5:24	4.1	7:24	15.3	15:55	6.3	17:55	-1.2	19:55	9.7							7:24	15:55	8.5	19:55	23:35	3.7				12.2	136.4	478.6
5/11/2012	4:13	23:38	4:16	11.6	6:16	4.9	8:16	14.7	16:48	7.2	18:48	0.7	20:48	10.3							4:13	4:16	0.0	8:16	16:48	8.5	20:48	23:38	2.9	11.4	147.8	490.1
5/12/2012	4:09	23:42	5:15	11.8	7:15	5.7	9:15	14.2	17:45	8.4	19:45	2.6	21:45	10.8							4:09	5:15	1.1	9:15	17:45	8.5	21:45	23:42	2.0	11.6	159.4	501.7
5/13/2012	4:05	23:46	6:19	12.0	8:19	5.9	10:19	13.1	18:47	9.7	20:47	4.0	22:47	11.3							4:05	6:19	2.2	10:19	18:47	8.5	22:47	23:46	1.0	11.7	171.2	513.4
5/14/2012	4:01	23:50	7:26	11.8	9:26	5.3	11:26	11.7	19:49	10.8	21:49	4.7	23:49	11.4							4:01	7:26	3.4	11:26	19:49	8.4	23:49	23:50	0.0	11.8	183.0	525.3
5/15/2012	3:57	23:53	8:29	11.2	10:29	3.9	12:29	10.1	20:47	11.5	22:47	4.9	0:47	11.6							3:57	8:29	4.5	12:29	20:47	8.3				12.8	195.9	538.1
5/16/2012	3:54	23:57					0:47	11.6	9:25	10.4	11:25	2.3	13:25	8.9	21:39	12.0	23:39	5.0	1:39	11.9	3:54	9:25	5.5	13:25	21:39	8.2				13.8	209.7	551.9
5/17/2012	3:50	0:01					1:39	11.9	10:15	9.5	12:15	0.9	14:15	8.3	22:27	12.4					3:50	10:15	6.4	14:15	22:27	8.2				14.6	224.3	566.6
5/18/2012	3:46	0:05	22:27	12.4	0:27	5.2	2:27	12.7	11:00	8.8	13:00	0.0	15:00	8.2	23:11	12.7					3:46	11:00	7.2	15:00	23:11	8.2				15.4	239.8	582.0
5/19/2012	3:42	0:09	23:11	12.7	1:11	5.6	3:11	13.7	11:43	8.2	13:43	-0.4	15:43	8.6	23:53	12.9					3:42	11:43	8.0	15:43	23:53	8.2				16.2	256.0	598.2
5/20/2012	3:38	0:13	23:53	12.9	1:53	6.0	3:53	14.7	12:23	7.7	14:23	-0.5	16:23	9.2							3:53	12:23	8.5	16:23	23:59	7.6				16.1	272.1	614.4
5/21/2012	3:34	0:17	0:33	12.9	2:33	6.3	4:33	15.6	13:02	7.1	15:02	-0.4	17:02	9.9							4:33	13:02	8.5	17:02	23:59	7.0				15.5	287.6	629.8
5/22/2012	3:30	0:22	1:12	12.7	3:12	6.5	5:12	16.2	13:39	6.5	15:39	-0.2	17:39	10.3							5:12	13:39	8.5	17:39	23:59	6.4				14.8	302.4	644.7
5/23/2012	3:26	0:26	1:50	12.3	3:50	6.5	5:50	16.4	14:14	6.0	16:14	0.1	18:14	10.4							5:50	14:14	8.4	18:14	23:59	5.8				14.2	316.6	658.8
5/24/2012	3:22	0:30	2:27	11.8	4:27	6.4	6:27	16.1	14:49	5.6	16:49	0.4	18:49	10.3							6:27	14:49	8.4	18:49	23:59	5.2				13.6	330.2	672.4
5/25/2012	3:18	0:35	3:05	11.4	5:05	6.3	7:05	15.4	15:23	5.7	17:23	0.9	19:23	9.7							7:05	15:23	8.3	19:23	23:59	4.6				12.9	343.1	685.3
5/26/2012	3:13	0:39	3:45	11.1	5:45	6.4	7:45	14.5	16:01	6.2	18:01	1.7	20:01	9.3							3:13	3:45	0.0	7:45	16:01	8.3	20:01	23:59	4.0	12.8	355.9	698.2
5/27/2012	3:09	0:44	4:33	10.8	6:33	6.5	8:33	13.9	16:46	7.0	18:46	2.8	20:46	9.4							3:09	4:33	1.4	8:33	16:46	8.2	20:46	23:59	3.2	12.9	368.8	711.0
5/28/2012	3:04	0:48	5:33	10.3	7:33	6.6	9:33	13.7	17:46	7.6	19:46	4.1	21:46	10.7							3:04	5:33	2.5	9:33	17:46	8.2	21:46	23:59	2.2	12.9	381.8	724.0
5/29/2012	3:00	0:53	6:42	9.8	8:42	6.1	10:42	13.4	18:56	8.3	20:56	5.0	22:56	12.3							3:00	6:42	3.7	10:42	18:56	8.2	22:56	23:59	1.1	13.0	394.8	737.0
5/30/2012	2:55	0:58	7:51	9.2	9:51	4.6	11:51	12.5	20:04	9.2	22:04	5.3	0:04	13.5							2:55	7:51	4.9	11:51	20:04	8.2				13.2	408.0	750.2
5/31/2012	2:50	1:04					0:04	13.5	8:54	8.4	10:54	2.5	12:54	11.1	21:06	10.1	23:06	5.1	1:06	14.1	2:50	8:54	6.1	12:54	21:06	8.2				14.3	422.3	764.5



TYPICAL SECTION D-D

Represents the low tide window for June 12, 2012





TYPICAL SECTION E-E

Represents the low tidal range for the entire month of June 2012

Civil Twilight window

Submerged Piledriving

Low Tide window

Tidally Influenced Piledriving

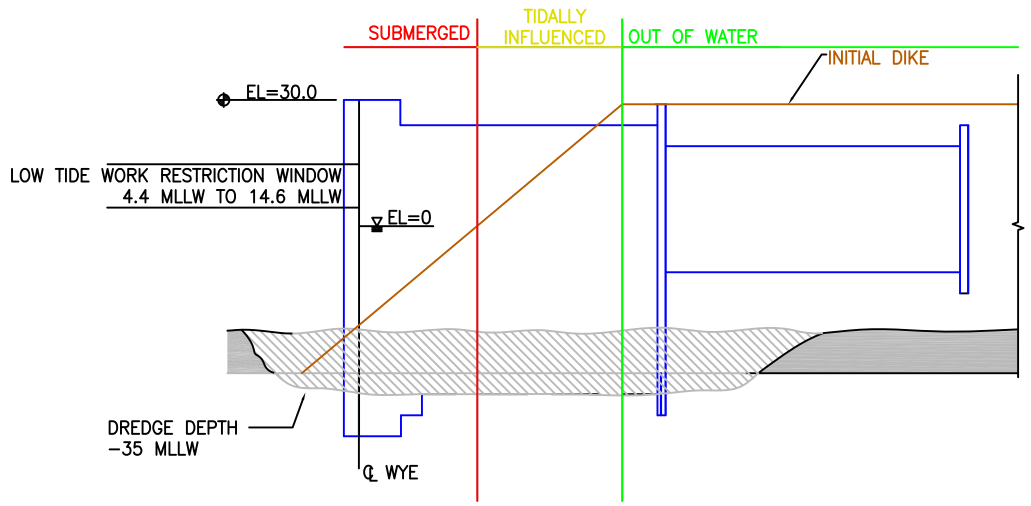
Unrestricted Work window

Out of Water Piledriving

Ship Creek smolt releases, during which time no piledriving may be performed, typically occur during the third week of June.

Date	Civil Twilight		2 Hours Before		Actual Low Tide		2 Hours After		2 Hours Before		Actual Low Tide		2 hours After		2 Hours Before		Actual Low Tide		2 Hours After	
	Begin	End	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW
6/1/2012	2:45	1:09					1:06	14.1	9:52	7.3	11:52	0.2	13:52	9.9	22:04	10.7				
6/2/2012	2:40	1:15	22:04	10.7	0:04	4.8	2:04	14.6	10:46	6.5	12:46	-1.7	14:46	9.0	22:59	11.2				
6/3/2012	2:33	1:21	22:59	11.2	0:59	4.4	2:59	15.1	11:38	5.8	13:38	-3.1	15:38	8.5	23:51	11.7				
6/4/2012	2:27	1:28	23:51	11.7	1:51	4.0	3:51	15.3	12:27	5.6	14:27	-3.9	16:27	8.2						
6/5/2012	2:18	1:37	0:42	11.9	2:42	3.7	4:42	15.5	13:16	5.5	15:16	-4.1	17:16	8.5						
6/6/2012	1:59	1:57	1:31	11.9	3:31	3.4	5:31	15.3	14:02	5.7	16:02	-3.8	18:02	8.7						
6/7/2012	1:58	1:58	2:19	11.8	4:19	3.3	6:19	15.0	14:48	6.0	16:48	-2.8	18:48	9.3						
6/8/2012	1:58	1:58	3:07	11.5	5:07	3.4	7:07	14.5	15:33	6.5	17:33	-1.3	19:33	9.9						
6/9/2012	1:58	1:58	3:56	11.2	5:56	3.8	7:56	13.9	16:19	7.3	18:19	0.6	20:19	10.6						
6/10/2012	1:59	1:59	4:48	11.0	6:48	4.4	8:48	13.2	17:08	8.2	19:08	2.7	21:08	11.4						
6/11/2012	1:59	1:59	5:46	10.7	7:46	4.9	9:46	12.5	18:02	9.4	20:02	4.6	22:02	12.2						
6/12/2012	1:59	1:59	6:48	10.5	8:48	4.8	10:48	11.5	19:02	10.6	21:02	6.1	23:02	12.9						
6/13/2012	1:59	1:59	7:50	10.2	9:50	4.0	11:50	10.1	20:03	11.7	22:03	6.8	0:03	13.3						
6/14/2012	2:00	2:00					0:03	13.3	8:49	9.6	10:49	2.7	12:49	8.9	21:00	12.5	23:00	7.0	1:00	13.5
6/15/2012	2:00	2:00					1:00	13.5	9:43	8.8	11:43	1.3	13:43	8.2	21:53	12.9	23:53	6.9	1:53	13.7
6/16/2012	2:00	2:00					1:53	13.7	10:32	8.1	12:32	0.2	14:32	7.9	22:42	13.2				
6/17/2012	2:00	2:00	22:42	13.2	0:42	6.7	2:42	14.1	11:17	7.6	13:17	-0.4	15:17	8.0	23:28	13.3				
6/18/2012	2:00	2:00	23:28	13.3	1:28	6.6	3:28	14.7	11:59	7.4	13:59	-0.7	15:59	8.4						
6/19/2012	2:01	2:01	0:12	13.2	2:12	6.4	4:12	15.3	12:40	7.0	14:40	-0.7	16:40	9.1						
6/20/2012	2:01	2:01	0:53	13.0	2:53	6.2	4:53	15.7	13:19	6.6	15:19	-0.7	17:19	9.9						
6/21/2012	2:01	2:01	1:33	12.4	3:33	5.9	5:33	15.9	13:56	6.2	15:56	-0.6	17:56	10.3						
6/22/2012	2:01	2:01	2:12	11.6	4:12	5.4	6:12	15.8	14:30	5.8	16:30	-0.3	18:30	10.4						
6/23/2012	2:01	2:01	2:50	10.8	4:50	5.0	6:50	15.1	15:04	5.7	17:04	0.1	19:04	10.2						
6/24/2012	2:02	2:02	3:29	10.1	5:29	4.7	7:29	14.1	15:39	6.1	17:39	0.8	19:39	9.8						
6/25/2012	2:02	2:02	4:13	9.4	6:13	4.5	8:13	13.1	16:19	6.8	18:19	2.0	20:19	9.7						
6/26/2012	2:02	2:02	5:05	8.9	7:05	4.5	9:05	12.4	17:09	7.8	19:09	3.6	21:09	10.5						
6/27/2012	2:02	2:02	6:10	8.2	8:10	4.3	10:10	12.1	18:15	8.6	20:15	5.2	22:15	12.3						
6/28/2012	2:03	2:03	7:20	7.9	9:20	3.4	11:20	11.5	19:29	9.7	21:29	6.2	23:29	14.2						
6/29/2012	2:03	2:03	8:27	7.5	10:27	1.8	12:27	10.3	20:38	10.9	22:38	6.3	0:38	14.9						
6/30/2012	2:03	2:03					0:38	14.9	9:29	7.0	11:29	-0.1	13:29	9.0	21:42	11.7	23:42	5.8	1:42	15.1

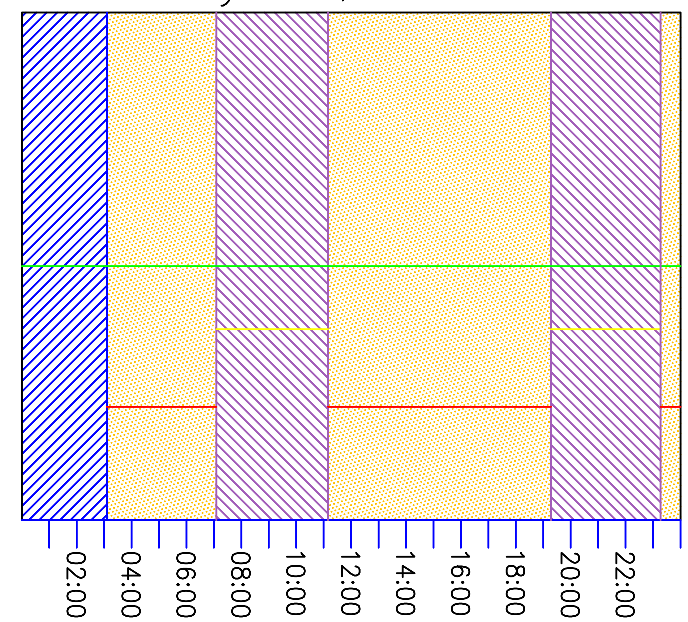
Date	Unrestricted Work Window 1			Unrestricted Work Window 2			Unrestricted Work Window 3			Hourly Totals		
	Start	End	Hours	Start	End	Hours	Start	End	Hours	Daily	Monthly	Yearly
6/1/2012	2:45	9:52	7.1	13:52	22:04	8.2				15.3	15.4	779.9
6/2/2012	2:40	10:46	8.1	14:46	22:59	8.2				16.3	31.7	796.2
6/3/2012	2:59	11:38	8.7	15:38	23:51	8.2				16.9	48.6	813.1
6/4/2012	3:51	12:27	8.6	16:27	23:59	7.6				16.2	64.8	829.3
6/5/2012	4:42	13:16	8.6	17:16	23:59	6.7				15.3	80.1	844.6
6/6/2012	5:31	14:02	8.5	18:02	23:59	6.0				14.5	94.6	859.1
6/7/2012	1:58	2:19	0.0	6:19	14:48	8.5	18:48	23:59	5.2	14.0	108.7	873.2
6/8/2012	1:58	3:07	1.2	7:07	15:33	8.4	19:33	23:59	4.5	14.0	122.7	887.2
6/9/2012	1:58	3:56	2.0	7:56	16:19	8.4	20:19	23:59	3.7	14.0	136.8	901.3
6/10/2012	1:59	4:48	2.8	8:48	17:08	8.3	21:08	23:59	2.9	14.0	150.8	915.4
6/11/2012	1:59	5:46	3.8	9:46	18:02	8.3	22:02	23:59	2.0	14.0	164.9	929.4
6/12/2012	1:59	6:48	4.8	10:48	19:02	8.2	23:02	23:59	1.0	14.0	178.9	943.5
6/13/2012	1:59	7:50	5.9	11:50	20:03	8.2				14.1	193.0	957.6
6/14/2012	2:00	8:49	6.8	12:49	21:00	8.2				15.0	208.1	972.6
6/15/2012	2:00	9:43	7.7	13:43	21:53	8.2				15.9	224.0	988.5
6/16/2012	2:00	10:32	8.5	14:32	22:42	8.2				16.7	240.7	1005.2
6/17/2012	2:42	11:17	8.6	15:17	23:28	8.2				16.8	257.5	1022.0
6/18/2012	3:28	11:59	8.5	15:59	23:59	8.0				16.5	274.1	1038.6
6/19/2012	4:12	12:40	8.5	16:40	23:59	7.3				15.8	289.9	1054.4
6/20/2012	4:53	13:19	8.4	17:19	23:59	6.7				15.1	305.0	1069.5
6/21/2012	5:33	13:56	8.4	17:56	23:59	6.1				14.5	319.5	1084.0
6/22/2012	2:01	2:12	0.0	6:12	14:30	8.3	18:30	23:59	5.5	14.0	333.5	1098.0
6/23/2012	2:01	2:50	0.0	6:50	15:04	8.2	19:04	23:59	4.9	14.0	347.5	1112.0
6/24/2012	2:02	3:29	1.5	7:29	15:39	8.2	19:39	23:59	4.4	14.0	361.5	1126.0
6/25/2012	2:02	4:13	2.2	8:13	16:19	8.1	20:19	23:59	3.7	14.0	375.5	1140.0
6/26/2012	2:02	5:05	3.1	9:05	17:09	8.1	21:09	23:59	2.9	14.0	389.5	1154.0
6/27/2012	2:02	6:10	4.1	10:10	18:15	8.1	22:15	23:59	1.8	14.0	403.5	1168.0
6/28/2012	2:03	7:20	5.3	11:20	19:29	8.2	23:29	23:59	0.0	14.0	417.5	1182.0
6/29/2012	2:03	8:27	6.4	12:27	20:38	8.2				14.6	432.1	1196.6
6/30/2012	2:03	9:29	7.4	13:29	21:42	8.2				15.7	447.8	1212.3

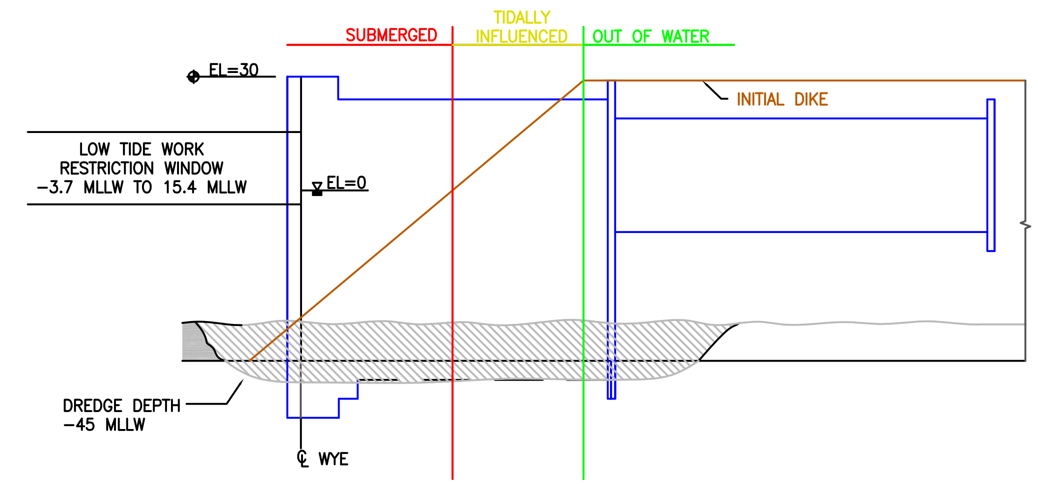


TYPICAL SECTION D-D

Represents the low tide window for July 12, 2012

July 12, 2012





TYPICAL SECTION E-E

Represents the low tidal range for the entire month of July 2012

Civil Twilight window

Low Tide window

Unrestricted Work window

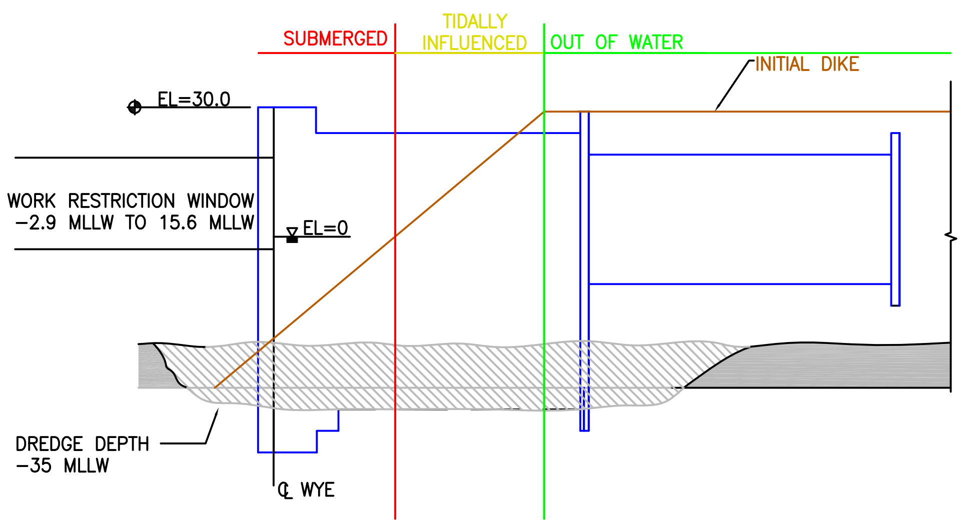
Submerged Piledriving

Tidally Influenced Piledriving

Out of Water Piledriving

Date	Civil Twilight		2 Hours Before		Actual Low Tide		2 Hours After		2 Hours Before		Actual Low Tide		2 hours After		2 Hours Before		Actual Low Tide		2 Hours After	
	Begin	End	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW
7/1/2012	2:03	2:03					1:42	15.1	10:27	6.4	12:27	-1.9	14:27	8.2	22:40	12.1				
7/2/2012	2:03	2:03	22:40	12.1	0:40	5.0	2:40	14.9	11:20	6.2	13:20	-3.1	15:20	7.7	23:35	12.3				
7/3/2012	2:03	2:03	23:35	12.3	1:35	4.2	3:35	14.8	12:10	6.1	14:10	-3.7	16:10	7.7						
7/4/2012	2:04	2:04	0:26	12.3	2:26	3.5	4:26	14.5	12:57	6.4	14:57	-3.7	16:57	8.1						
7/5/2012	2:23	1:46	1:15	12.0	3:15	2.9	5:16	14.3	13:43	6.5	15:43	-3.2	17:43	8.9						
7/6/2012	2:32	1:36	2:02	11.5	4:02	2.6	6:02	14.0	14:25	6.9	16:25	-2.1	18:25	9.7						
7/7/2012	2:39	1:29	2:47	11.0	4:47	2.5	6:47	13.7	15:06	7.2	17:06	-0.7	19:06	10.6						
7/8/2012	2:46	1:23	3:31	10.4	5:31	2.8	7:31	13.2	15:46	7.6	17:46	1.2	19:46	11.4						
7/9/2012	2:52	1:17	4:17	9.8	6:17	3.4	8:17	12.7	16:27	8.3	18:27	3.2	20:27	12.1						
7/10/2012	2:57	1:12	5:07	9.4	7:07	4.0	9:07	12.2	17:13	9.3	19:13	5.3	21:13	12.9						
7/11/2012	3:02	1:07	6:03	9.2	8:03	4.5	10:03	11.6	18:09	10.4	20:09	7.2	22:09	13.9						
7/12/2012	3:07	1:02	7:06	9.1	9:06	4.4	11:06	10.8	19:14	11.6	21:14	8.3	23:14	14.6						
7/13/2012	3:12	0:58	8:09	9.0	10:09	3.6	12:09	9.7	20:19	12.7	22:19	8.6	0:19	14.6						
7/14/2012	3:17	0:53					0:19	14.6	9:08	8.6	11:08	2.3	13:08	8.7	21:19	13.2	23:19	8.1	1:19	14.3
7/15/2012	3:21	0:49					1:19	14.3	10:01	8.2	12:01	1.0	14:01	8.0	22:14	13.3				
7/16/2012	3:26	0:45	22:14	13.3	0:14	7.3	2:14	14.2	10:50	7.7	12:50	0.1	14:50	7.9	23:03	13.3				
7/17/2012	3:30	0:40	23:03	13.3	1:03	6.5	3:03	14.2	11:34	7.5	13:34	-0.5	15:34	8.2	23:49	13.0				
7/18/2012	3:35	0:36	23:49	13.0	1:49	5.8	3:49	14.4	12:16	7.2	14:16	-0.8	16:16	8.9						
7/19/2012	3:39	0:32	0:32	12.5	2:32	5.1	4:32	14.7	12:55	7.0	14:55	-0.8	16:55	9.7						
7/20/2012	3:43	0:28	1:13	11.8	3:13	4.5	5:13	14.9	13:32	6.7	15:32	-0.8	17:32	10.5						
7/21/2012	3:47	0:24	1:52	10.9	3:52	3.8	5:52	14.8	14:07	6.4	16:07	-0.5	18:07	10.9						
7/22/2012	3:51	0:20	2:30	9.9	4:30	3.1	6:30	14.1	14:42	6.2	16:42	-0.1	18:42	11.0						
7/23/2012	3:55	0:16	3:10	8.8	5:10	2.6	7:10	13.3	15:17	6.5	17:17	0.7	19:17	10.8						
7/24/2012	3:59	0:12	3:52	8.0	5:52	2.4	7:52	12.2	15:55	7.4	17:55	2.0	19:55	10.8						
7/25/2012	4:03	0:08	4:41	7.5	6:41	2.6	8:41	11.4	16:43	8.5	18:43	3.9	20:43	11.5						
7/26/2012	4:07	0:05	5:42	7.2	7:42	2.9	9:42	11.1	17:46	9.5	19:46	5.9	21:46	13.1						
7/27/2012	4:10	0:01	6:54	7.2	8:54	2.8	10:54	11.0	19:04	10.7	21:04	7.2	23:04	15.0						
7/28/2012	4:14	23:57	8:05	7.5	10:05	1.8	12:05	10.0	20:19	11.9	22:19	7.2	0:19	15.4						
7/29/2012	4:18	23:53					0:19	15.4	9:10	7.5	11:10	0.2	13:10	8.7	21:26	12.6	23:26	6.2	1:26	14.8
7/30/2012	4:22	23:49					1:26	14.8	10:09	7.3	12:09	-1.4	14:09	7.8	22:25	12.7				
7/31/2012	4:25	23:46	22:25	12.7	0:25	4.8	2:25	13.9	11:03	7.1	13:03	-2.5	15:03	7.6	23:20	12.4				

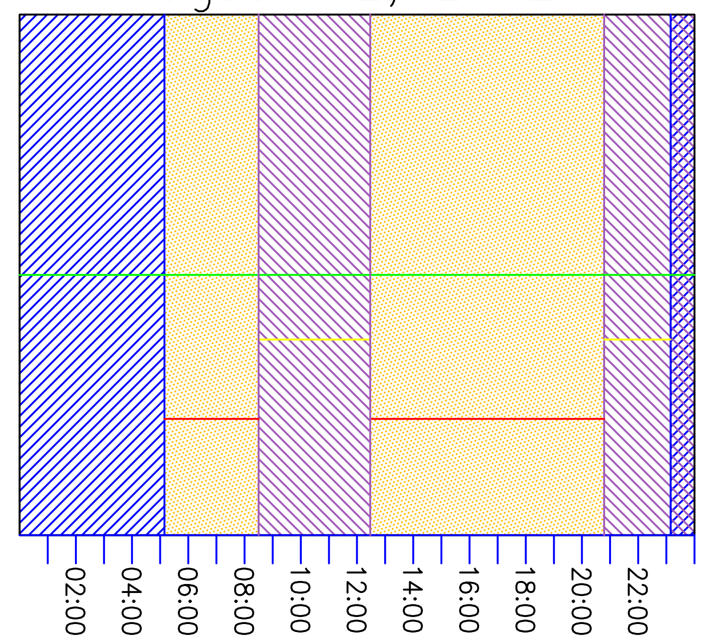
Date	Unrestricted Work Window 1			Unrestricted Work Window 2			Unrestricted Work Window 3			Hourly Totals		
	Start	End	Hours	Start	End	Hours	Start	End	Hours	Daily	Monthly	Yearly
7/1/2012	2:03	10:27	8.4	14:27	22:40	8.2				16.6	16.7	1229.0
7/2/2012	2:40	11:20	8.7	15:20	23:35	8.3				16.9	33.6	1245.9
7/3/2012	3:35	12:10	8.6	16:10	23:59	7.8				16.4	50.0	1262.4
7/4/2012	4:26	12:57	8.5	16:57	23:59	7.1				15.6	65.6	1277.9
7/5/2012	5:15	13:43	8.5	17:43	23:59	6.3				14.8	80.4	1292.7
7/6/2012	6:02	14:25	8.4	18:25	23:59	5.6				14.0	94.4	1306.7
7/7/2012	2:39	2:47	0.0	6:47	15:06	8.3	19:06	23:59	4.9	13.4	107.8	1320.1
7/8/2012	2:46	3:31	0.0	7:31	15:46	8.3	19:46	23:59	4.2	13.2	121.0	1333.3
7/9/2012	2:52	4:17	1.4	8:17	16:27	8.2	20:27	23:59	3.6	13.1	134.2	1346.5
7/10/2012	2:57	5:07	2.2	9:07	17:13	8.1	21:13	23:59	2.8	13.1	147.3	1359.6
7/11/2012	3:02	6:03	3.0	10:03	18:09	8.1	22:09	23:59	1.9	13.0	160.3	1372.6
7/12/2012	3:07	7:06	4.0	11:06	19:14	8.1	23:14	23:59	0.0	12.9	173.2	1385.5
7/13/2012	3:12	8:09	5.0	12:09	20:19	8.2				13.1	186.3	1398.7
7/14/2012	3:17	9:08	5.9	13:08	21:19	8.2				14.0	200.4	1412.7
7/15/2012	3:21	10:01	6.7	14:01	22:14	8.2				14.9	215.3	1427.6
7/16/2012	3:26	10:50	7.4	14:50	23:03	8.2				15.6	231.0	1443.3
7/17/2012	3:30	11:34	8.1	15:34	23:49	8.3				16.3	247.3	1459.6
7/18/2012	3:49	12:16	8.5	16:16	23:59	7.7				16.2	263.5	1475.8
7/19/2012	4:32	12:55	8.4	16:55	23:59	7.1				15.5	279.0	1491.3
7/20/2012	5:13	13:32	8.3	17:32	23:59	6.5				14.8	293.8	1506.1
7/21/2012	5:52	14:07	8.3	18:07	23:59	5.9				14.1	308.0	1520.3
7/22/2012	6:30	14:42	8.2	18:42	23:59	5.3				13.5	321.5	1533.8
7/23/2012	7:10	15:17	8.1	19:17	23:59	4.7				12.8	334.3	1546.6
7/24/2012	7:52	15:55	8.1	19:55	23:59	4.1				12.1	346.5	1558.8
7/25/2012	4:03	4:41	0.0	8:41	16:43	8.0	20:43	23:59	3.3	12.0	358.5	1570.8
7/26/2012	4:07	5:42	1.6	9:42	17:46	8.1	21:46	23:59	2.2	11.9	370.4	1582.7
7/27/2012	4:10	6:54	2.7	10:54	19:04	8.2	23:04	23:59	0.0	11.8	382.2	1594.6
7/28/2012	4:14	8:05	3.9	12:05	20:19	8.2				12.1	394.4	1606.7
7/29/2012	4:18	9:10	4.9	13:10	21:26	8.3				13.1	407.5	1619.8
7/30/2012	4:22	10:09	5.8	14:09	22:25	8.3				14.1	421.6	1633.9
7/31/2012	4:25	11:03	6.6	15:03	23:20	8.3				14.9	436.6	1648.9



TYPICAL SECTION D-D

Represents the low tide window for August 12, 2012

August 12, 2012



Civil Twilight window

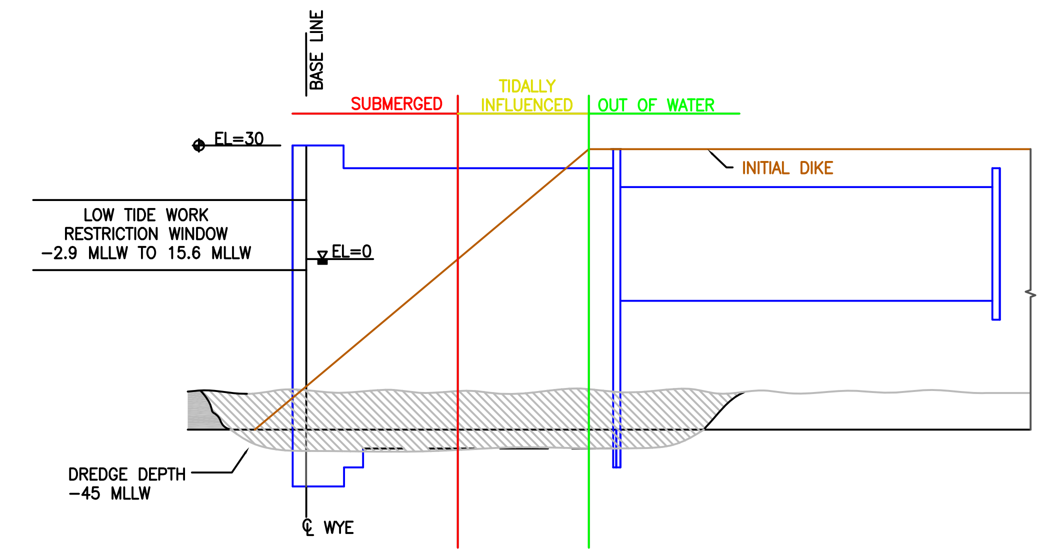
Low Tide window

Unrestricted Work window

Submerged Piledriving

Tidally Influenced Piledriving

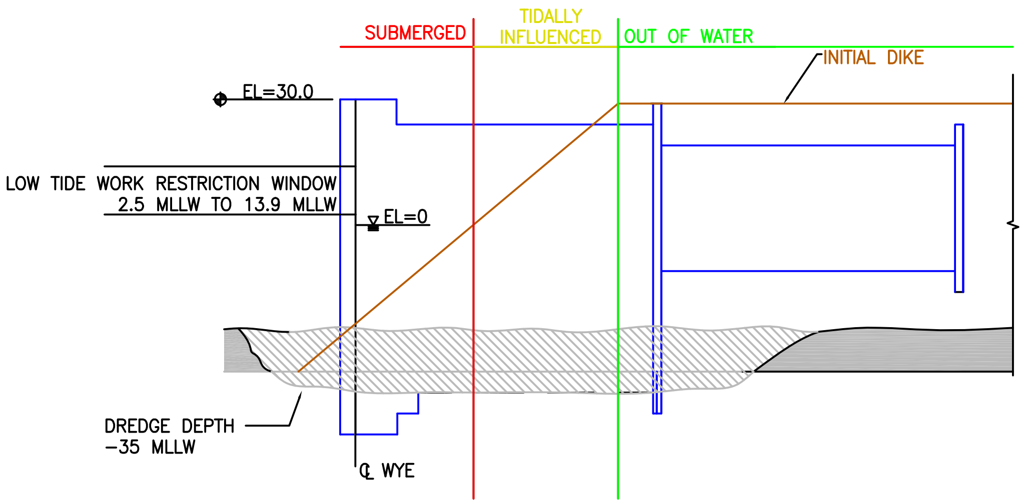
Out of Water Piledriving



TYPICAL SECTION E-E

Represents the low tidal range for the entire month of August 2012

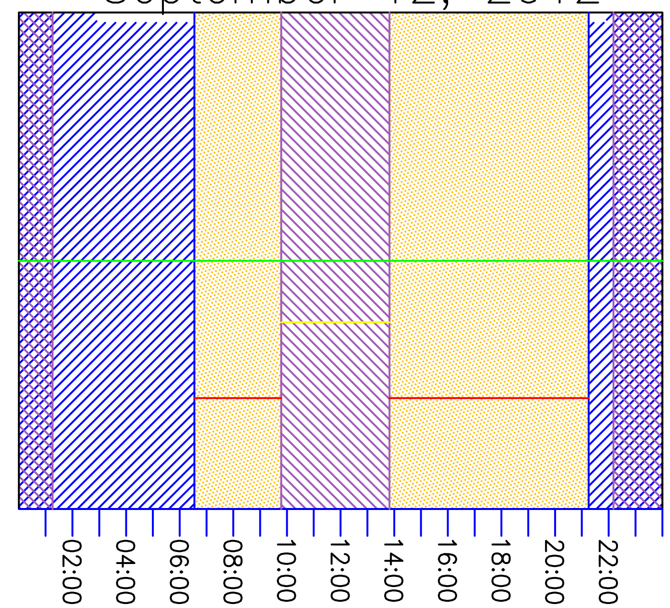
Date	Civil Twilight		2 Hours Before		Actual Low Tide		2 Hours After		2 Hours Before		Actual Low Tide		2 hours After		2 Hours Before		Actual Low Tide		2 Hours After		Unrestricted Work Window 1			Unrestricted Work Window 2			Unrestricted Work Window 3			Hourly Totals		
	Begin	End	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Start	End	Hours	Start	End	Hours	Start	End	Hours	Daily	Monthly	Yearly
8/1/2012	4:29	23:42	23:20	12.4	1:20	3.5	3:20	13.4	11:52	7.2	13:52	-2.9	16:52	7.9							4:29	11:52	7.4	15:52	23:42	7.9				15.2	15.3	1664.1
8/2/2012	4:32	23:38	0:10	12.1	2:10	2.6	4:10	13.0	12:37	7.6	14:37	-2.6	16:37	8.6							4:32	12:37	8.1	16:37	23:38	7.0				15.1	30.4	1679.3
8/3/2012	4:36	23:35	0:57	11.6	2:57	1.9	4:57	12.9	13:20	7.8	15:20	-1.8	17:20	9.8							4:57	13:20	8.4	17:20	23:35	6.3				14.7	45.1	1693.9
8/4/2012	4:39	23:31	1:41	11.0	3:41	1.7	5:41	12.9	13:59	8.1	15:59	-0.6	17:59	10.9							5:41	13:59	8.3	17:59	23:31	5.6				13.9	58.9	1707.8
8/5/2012	4:43	23:27	2:23	10.2	4:23	1.8	6:23	12.9	14:36	8.3	16:36	0.8	18:36	12.0							6:23	14:36	8.2	18:36	23:27	4.9				13.1	72.0	1720.9
8/6/2012	4:46	23:23	3:03	9.4	5:03	2.1	7:03	12.7	15:12	8.5	17:12	2.5	19:12	12.8							7:03	15:12	8.2	19:12	23:23	4.2				12.4	84.4	1733.3
8/7/2012	4:50	23:20	3:43	8.7	5:43	2.7	7:43	12.3	15:47	9.0	17:47	4.2	19:47	13.1							7:43	15:47	8.1	19:47	23:20	3.6				11.6	96.0	1744.9
8/8/2012	4:53	23:16	4:26	8.2	6:26	3.4	8:26	11.9	16:25	9.9	18:25	6.0	20:25	13.3							8:26	16:25	8.0	20:25	23:16	2.9				10.9	106.9	1755.8
8/9/2012	4:56	23:13	5:15	8.1	7:15	4.3	9:15	11.5	17:14	10.9	19:14	7.9	21:14	14.0							4:56	5:15	0.0	9:15	17:14	8.0	21:14	23:13	2.0	10.3	117.2	1766.1
8/10/2012	5:00	23:09	6:16	8.2	8:16	4.9	10:16	11.3	18:23	11.8	20:23	9.3	22:23	15.1							5:00	6:16	1.3	10:16	18:23	8.1	22:23	23:09	0.0	10.2	127.4	1776.3
8/11/2012	5:03	23:05	7:25	8.6	9:25	4.7	11:25	10.8	19:38	12.8	21:38	9.7	23:38	15.4							5:03	7:25	2.4	11:25	19:38	8.2				10.6	138.1	1786.9
8/12/2012	5:06	23:02	8:30	8.8	10:30	3.8	12:30	9.8	20:46	13.4	22:46	8.9	0:46	14.8							5:06	8:30	3.4	12:30	20:46	8.3				11.7	149.8	1798.6
8/13/2012	5:09	22:58					0:46	14.8	9:28	8.6	11:28	2.4	13:28	8.9	21:45	13.3	23:45	7.5	1:45	14.0	5:09	9:28	4.3	13:28	21:45	8.3				12.6	162.4	1811.3
8/14/2012	5:13	22:55					1:45	14.0	10:20	8.3	12:20	1.1	14:20	8.6	22:37	12.9					5:13	10:20	5.1	14:20	22:37	8.3				13.4	175.8	1824.7
8/15/2012	5:16	22:51	22:37	12.9	0:37	6.0	2:37	13.6	11:06	8.0	13:06	0.2	15:06	8.9	23:24	12.3					5:16	11:06	5.8	15:06	22:51	7.8				13.6	189.4	1838.3
8/16/2012	5:19	22:47	23:24	12.3	1:24	4.8	3:24	13.5	11:48	7.8	13:48	-0.3	15:48	9.5							5:19	11:48	6.5	15:48	22:47	7.0				13.5	202.9	1851.8
8/17/2012	5:22	22:44	0:08	11.6	2:08	3.7	4:08	13.7	12:28	7.7	14:28	-0.4	16:28	10.5							5:22	12:28	7.1	16:28	22:44	6.3				13.4	216.3	1865.2
8/18/2012	5:25	22:40	0:49	10.8	2:49	2.8	4:49	13.7	13:06	7.5	15:06	-0.3	17:06	11.4							5:25	13:06	7.7	17:06	22:40	5.6				13.3	229.6	1878.5
8/19/2012	5:28	22:37	1:29	9.7	3:29	1.9	5:29	13.6	13:43	7.3	15:43	0.1	17:43	12.2							5:29	13:43	8.2	17:43	22:37	4.9				13.2	242.8	1891.7
8/20/2012	5:31	22:33	2:09	8.5	4:09	1.1	6:09	13.1	14:19	7.3	16:19	0.6	18:19	12.5							6:09	14:19	8.2	18:19	22:33	4.3				12.4	255.2	1904.1
8/21/2012	5:34	22:30	2:49	7.5	4:49	0.7	6:49	12.3	14:56	7.7	16:56	1.5	18:56	12.5							6:49	14:56	8.1	18:56	22:30	3.6				11.7	266.9	1915.8
8/22/2012	5:37	22:26	3:31	6.8	5:31	0.7	7:31	11.3	15:37	8.5	17:37	2.9	19:37	12.7							7:31	15:37	8.1	19:37	22:26	2.8				10.9	277.9	1926.8
8/23/2012	5:40	22:23	4:21	6.5	6:21	1.2	8:21	10.9	16:25	9.6	18:25	4.8	20:25	13.2							8:21	16:25	8.1	20:25	22:23	2.0				10.1	288.0	1936.8
8/24/2012	5:43	22:19	5:20	6.8	7:20	2.1	9:20	10.8	17:30	10.6	19:30	6.8	21:30	14.7							9:20	17:30	8.2	21:30	22:19	0.8				9.0	297.0	1945.8
8/25/2012	5:46	22:16	6:31	7.4	8:31	2.6	10:31	10.8	18:47	11.9	20:47	7.9	22:47	15.6							5:46	6:31	0.0	10:31	18:47	8.3				9.0	306.0	1954.9
8/26/2012	5:49	22:12	7:44	8.2	9:44	2.2	11:44	10.1	20:04	12.8	22:04	7.5	0:04	15.2							5:49	7:44	1.9	11:44	20:04	8.3				10.3	316.3	1965.2
8/27/2012	5:52	22:09					0:04	15.2	8:51	8.5	10:51	1.0	12:51	8.9	21:11	13.1	23:11	5.9	1:11	13.7	5:52	8:51	3.0	12:51	21:11	8.3				11.3	327.7	1976.5
8/28/2012	5:55	22:05					1:11	13.7	9:51	8.5	11:51	-0.4	13:51	8.2	22:11	12.6					5:55	9:51	3.9	13:51	22:05	8.3				12.2	339.9	1988.7
8/29/2012	5:58	22:02	22:11	12.6	0:11	4.0	2:11	12.4	10:43	8.6	12:43	-1.3	14:43	8.0	23:04	12.0					5:58	10:43	4.8	14:43	22:02	7.3				12.1	352.0	2000.8
8/30/2012	6:01	21:58	23:04	12.0	1:04	2.4	3:04	11.7	11:31	8.7	13:31	-1.4	15:31	8.7	23:52	11.4					6:01	11:31	5.5	15:31	21:58	6.5				12.0	363.9	2012.8
8/31/2012	6:04	21:55	23:52	11.4	1:52	1.4	3:52	11.4	12:14	9.1	14:14	-0.8	16:14	9.8							6:04	12:14	6.2	16:14	21:55	5.7				11.9	375.8	2024.7

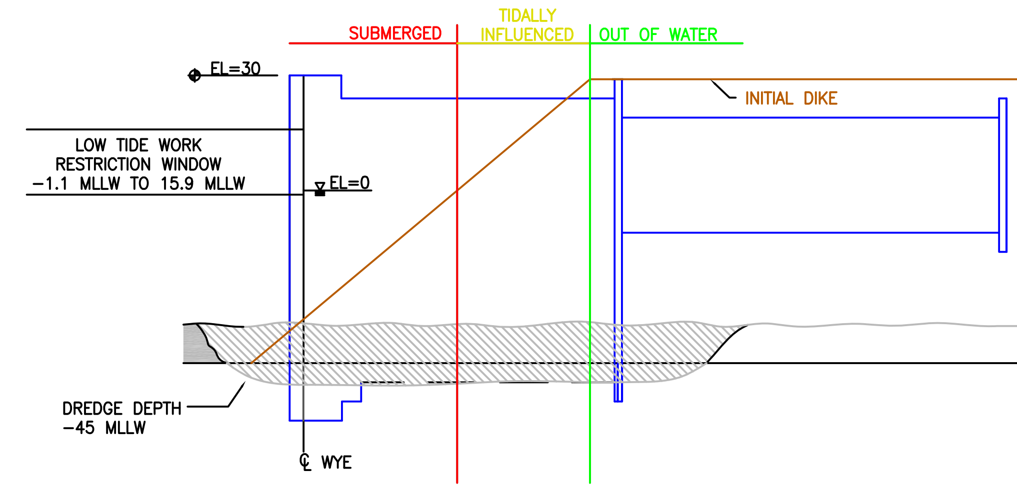


TYPICAL SECTION D-D

Represents the low tide window for September 12, 2012

September 12, 2012





TYPICAL SECTION E-E

Represents the low tidal range for the entire month of September 2012

Civil Twilight window

Low Tide window

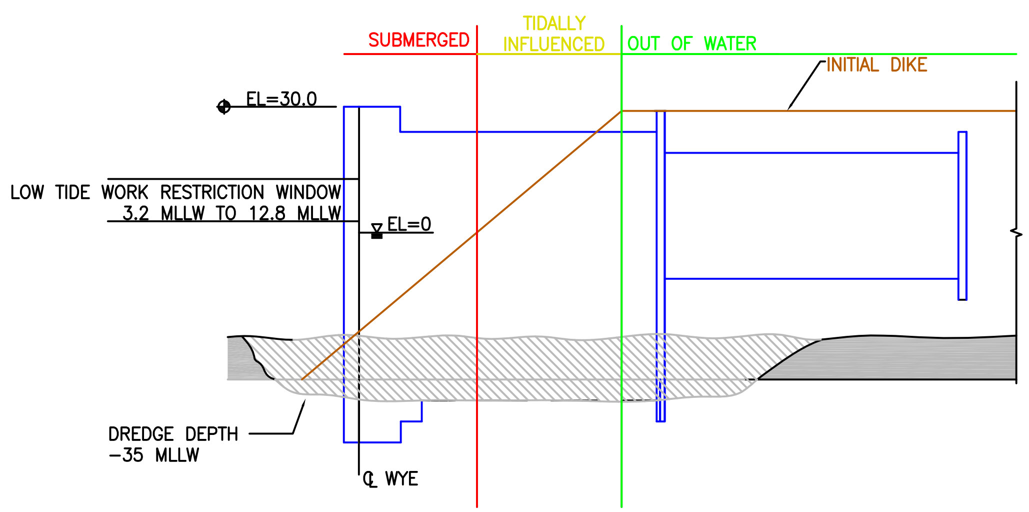
Unrestricted Work window

Submerged Piledriving

Tidally Influenced Piledriving

Out of Water Piledriving

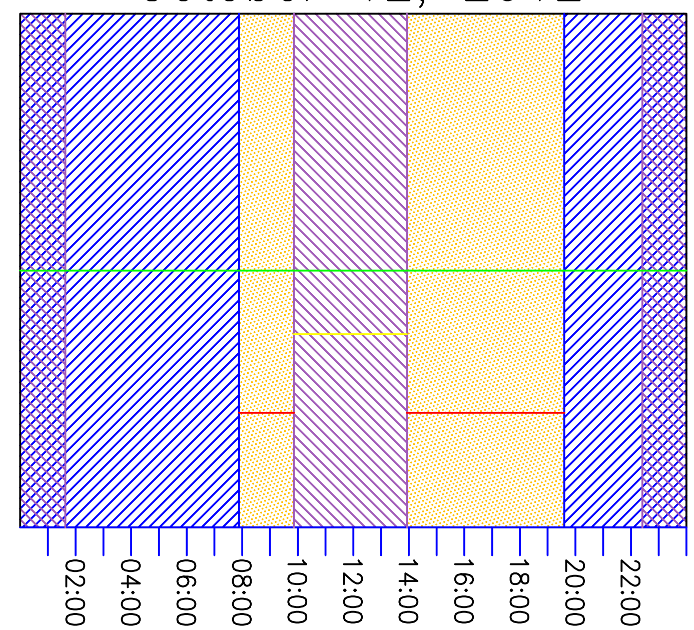
Date	Civil Twilight		2 Hours Before		Actual Low Tide		2 Hours After		2 Hours Before		Actual Low Tide		2 hours After		2 Hours Before		Actual Low Tide		2 Hours After		Unrestricted Work Window 1			Unrestricted Work Window 2			Unrestricted Work Window 3			Hourly Totals		
	Begin	End	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Start	End	Hours	Start	End	Hours	Start	End	Hours	Daily	Monthly	Yearly
9/1/2012	6:06	21:51	0:37	10.8	2:37	1.0	4:37	11.7	12:54	9.5	14:54	0.2	16:54	11.2							6:06	12:54	6.8	16:54	21:51	5.0				11.8	11.8	2036.5
9/2/2012	6:09	21:48	1:18	10.2	3:18	1.0	5:18	12.0	13:32	9.6	15:32	1.6	17:32	12.7							6:09	13:32	7.4	17:32	21:48	4.3				11.7	23.5	2048.2
9/3/2012	6:12	21:44	1:57	9.4	3:57	1.2	5:57	12.3	14:07	9.7	16:07	2.9	18:07	13.9							6:12	14:07	7.9	18:07	21:44	3.6				11.6	35.0	2059.7
9/4/2012	6:15	21:41	2:34	8.5	4:34	1.6	6:34	12.3	14:39	9.8	16:39	4.2	18:39	14.3							6:34	14:39	8.1	18:39	21:41	3.1				11.1	46.2	2070.9
9/5/2012	6:17	21:38	3:10	7.7	5:10	2.1	7:10	12.0	15:11	10.1	17:11	5.5	19:11	14.2							7:10	15:11	8.0	19:11	21:38	2.5				10.5	56.7	2081.4
9/6/2012	6:20	21:34	3:46	7.3	5:46	2.9	7:46	11.3	15:44	11.0	17:44	6.8	19:44	13.8							7:46	15:44	8.0	19:44	21:34	1.9				9.8	66.5	2091.2
9/7/2012	6:23	21:31	4:28	7.3	6:28	3.8	8:28	10.9	16:28	11.9	18:28	8.3	20:28	13.9							8:28	16:28	8.0	20:28	21:31	1.1				9.1	75.6	2100.3
9/8/2012	6:26	21:27	5:24	7.7	7:24	4.9	9:24	11.1	17:35	12.4	19:35	9.7	21:35	15.0							9:24	17:35	8.2							8.2	83.8	2108.5
9/9/2012	6:28	21:24	6:36	8.3	8:36	5.5	10:36	11.5	18:58	12.9	20:58	10.2	22:58	15.9							6:28	6:36	0.0	10:36	18:58	8.4				8.5	92.3	2117.0
9/10/2012	6:31	21:21	7:48	8.9	9:48	5.1	11:48	11.1	20:12	13.3	22:12	9.2	0:12	15.1							6:31	7:48	1.3	11:48	20:12	8.4				9.7	102.1	2126.7
9/11/2012	6:34	21:17					0:12	15.1	8:51	9.2	10:51	3.9	12:51	10.4	21:14	13.1	23:14	7.4	1:14	13.9	6:34	8:51	2.3	12:51	21:14	8.4				10.7	112.8	2137.4
9/12/2012	6:36	21:14					1:14	13.9	9:45	9.0	11:45	2.5	13:45	10.0	22:08	12.3					6:36	9:45	3.2	13:45	21:14	7.5				10.7	123.4	2148.1
9/13/2012	6:39	21:10	22:08	12.3	0:08	5.5	2:08	13.1	10:33	8.8	12:33	1.5	14:33	10.2	22:56	11.4					6:39	10:33	3.9	14:33	21:10	6.6				10.5	134.0	2158.7
9/14/2012	6:41	21:07	22:56	11.4	0:56	3.7	2:56	12.7	11:17	8.6	13:17	0.9	15:17	10.9	23:41	10.4					6:41	11:17	4.6	15:17	21:07	5.9				10.5	144.4	2169.1
9/15/2012	6:44	21:04	23:41	10.4	1:41	2.3	3:41	12.6	11:58	8.6	13:58	0.8	15:58	11.9							6:44	11:58	5.2	15:58	21:04	5.1				10.4	154.8	2179.5
9/16/2012	6:47	21:01	0:24	9.3	2:24	1.0	4:24	12.6	12:38	8.6	14:38	1.0	16:38	12.9							6:47	12:38	5.9	16:38	21:01	4.4				10.3	165.1	2189.8
9/17/2012	6:49	20:57	1:05	8.2	3:05	0.0	5:05	12.3	13:17	8.7	15:17	1.3	17:17	13.7							6:49	13:17	6.5	17:17	20:57	3.7				10.2	175.2	2199.9
9/18/2012	6:52	20:54	1:47	7.1	3:47	-0.7	5:47	11.9	13:57	8.9	15:57	1.9	17:57	14.2							6:52	13:57	7.1	17:57	20:54	3.0				10.1	185.3	2210.0
9/19/2012	6:54	20:51	2:29	6.3	4:29	-1.1	6:29	11.3	14:37	9.3	16:37	2.8	18:37	14.3							6:54	14:37	7.7	18:37	20:51	2.3				10.0	195.3	2220.0
9/20/2012	6:57	20:47	3:13	6.0	5:13	-0.8	7:13	10.7	15:22	9.9	17:22	4.1	19:22	14.6							7:13	15:22	8.2	19:22	20:47	1.4				9.6	204.9	2229.6
9/21/2012	7:00	20:44	4:03	6.1	6:03	0.1	8:03	10.5	16:14	10.8	18:14	5.7	20:14	15.0							8:03	16:14	8.2	20:14	20:44	0.0				8.7	213.6	2238.3
9/22/2012	7:02	20:41	5:02	6.7	7:02	1.5	9:02	10.8	17:18	11.7	19:18	7.2	21:18	15.6							9:02	17:18	8.3							8.3	221.9	2246.6
9/23/2012	7:05	20:38	6:10	7.8	8:10	2.6	10:10	10.9	18:33	12.7	20:33	7.9	22:33	15.6							10:10	18:33	8.4							8.4	230.3	2255.0
9/24/2012	7:07	20:34	7:21	9.0	9:21	2.8	11:21	10.4	19:48	13.2	21:48	7.0	23:48	14.2							7:07	7:21	0.0	11:21	19:48	8.5				8.7	239.0	2263.7
9/25/2012	7:10	20:31	8:28	9.7	10:28	2.1	12:28	9.5	20:55	13.0	22:55	5.1	0:55	12.3							7:10	8:28	1.3	12:28	20:31	8.1				9.4	248.4	2273.1
9/26/2012	7:12	20:28					0:55	12.3	9:27	9.9	11:27	1.1	13:27	8.9	21:54	12.1	23:54	3.0	1:54	10.9	7:12	9:27	2.3	13:27	20:28	7.0				9.3	257.7	2282.4
9/27/2012	7:15	20:25					1:54	10.9	10:20	10.0	12:20	0.6	14:20	9.1	22:45	11.3					7:15	10:20	3.1	14:20	20:25	6.1				9.2	266.9	2291.6
9/28/2012	7:17	20:21	22:45	11.3	0:45	1.4	2:45	10.0	11:06	10.3	13:06	0.7	15:06	9.9	23:31	10.7					7:17	11:06	3.8	15:06	20:21	5.3				9.1	276.0	2300.7
9/29/2012	7:20	20:18	23:31	10.7	1:31	0.4	3:31	9.9	11:48	10.8	13:48	1.5	15:48	11.3							7:20	11:48	4.5	15:48	20:18	4.5				9.0	285.0	2309.7
9/30/2012	7:22	20:15	0:14	10.0	2:14	0.2	4:14	10.4	12:28	11.1	14:28	2.6	16:28	13.0							7:22	12:28	5.1	16:28	20:15	3.8				8.9	293.9	2318.6



TYPICAL SECTION D-D

Represents the low tide window for October 12, 2012

October 12, 2012



Civil Twilight window

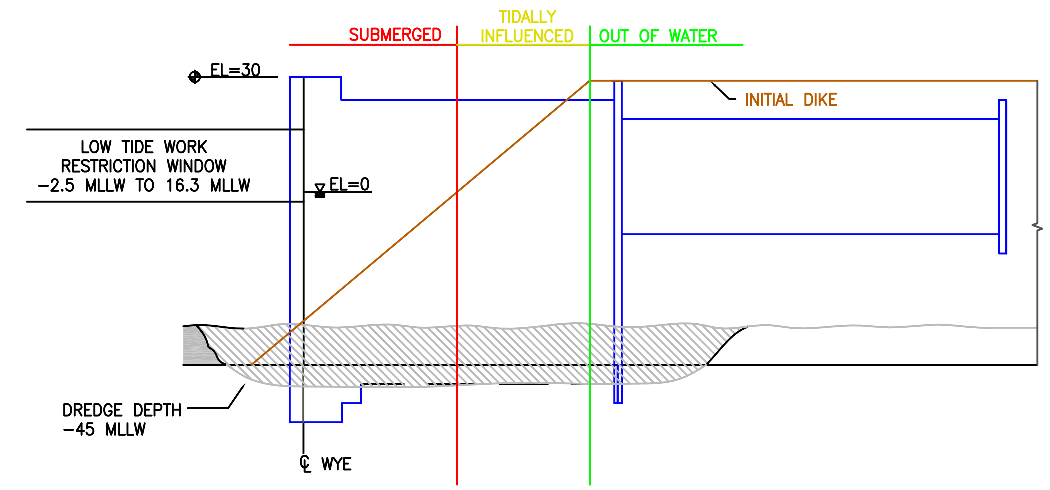
Low Tide window

Unrestricted Work window

Submerged Piledriving

Tidally Influenced Piledriving

Out of Water Piledriving

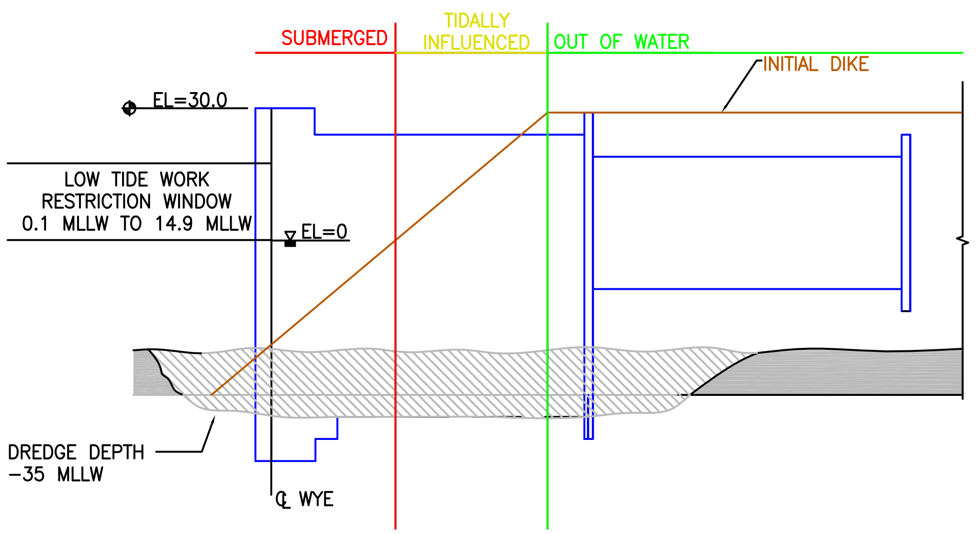


TYPICAL SECTION E-E

Represents the low tidal range for the entire month of October 2012

Date	Civil Twilight		2 Hours Before		Actual Low Tide		2 Hours After		2 Hours Before		Actual Low Tide		2 hours After	
	Begin	End	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW
10/1/2012	7:25	20:12	0:54	9.4	2:54	0.3	4:54	11.0	13:05	11.3	15:05	3.9	17:05	14.6
10/2/2012	7:27	20:09	1:31	8.6	3:31	0.7	5:31	11.5	13:39	11.3	15:39	5.0	17:39	15.4
10/3/2012	7:30	20:06	2:07	7.7	4:07	1.2	6:07	11.9	14:12	11.2	16:12	5.9	18:12	15.8
10/4/2012	7:32	20:03	2:40	7.0	4:40	1.7	6:40	11.5	14:44	11.3	16:44	6.6	18:44	15.4
10/5/2012	7:35	20:00	3:14	6.6	5:14	2.3	7:14	11.0	15:18	11.7	17:18	7.4	19:18	14.8
10/6/2012	7:37	19:56	3:50	6.9	5:50	3.2	7:50	10.2	16:00	12.3	18:00	8.4	20:00	14.4
10/7/2012	7:40	19:53	4:37	7.5	6:37	4.3	8:37	10.2	16:59	12.6	18:59	9.4	20:59	14.9
10/8/2012	7:42	19:50	5:44	7.9	7:44	5.4	9:44	11.3	18:18	12.6	20:18	9.9	22:18	15.7
10/9/2012	7:45	19:47	6:59	8.7	8:59	5.7	10:59	12.0	19:35	12.7	21:35	9.0	23:35	15.2
10/10/2012	7:47	19:44	8:07	9.3	10:07	5.2	12:07	11.9	20:40	12.4	22:40	7.2	0:40	13.9
10/11/2012	7:50	19:41					0:40	13.9	9:05	9.6	11:05	4.1	13:05	11.8
10/12/2012	7:52	19:38					1:36	12.8	9:56	9.6	11:56	3.2	13:56	12.0
10/13/2012	7:55	19:35	22:26	10.2	0:26	2.8	2:26	12.0	10:42	9.7	12:42	2.6	14:42	12.5
10/14/2012	7:57	19:32	23:13	9.0	1:13	0.9	3:13	11.5	11:27	9.7	13:27	2.4	15:27	13.5
10/15/2012	8:00	19:29	23:58	7.8	1:58	-0.6	3:58	11.2	12:10	9.9	14:10	2.5	16:10	14.3
10/16/2012	8:02	19:27	0:42	6.8	2:42	-1.7	4:42	10.9	12:54	10.1	14:54	2.8	16:54	15.2
10/17/2012	8:05	19:24	1:26	6.0	3:26	-2.4	5:26	10.5	13:37	10.4	15:37	3.1	17:37	15.5
10/18/2012	8:07	19:21	2:11	5.5	4:11	-2.5	6:11	10.3	14:22	10.7	16:22	3.7	18:22	15.7
10/19/2012	8:10	19:18	2:57	5.5	4:57	-2.0	6:57	10.1	15:10	11.1	17:10	4.6	19:10	15.7
10/20/2012	8:12	19:15	3:47	5.9	5:47	-0.9	7:47	10.3	16:04	11.5	18:04	5.6	20:04	15.8
10/21/2012	8:15	19:12	4:42	6.9	6:42	0.8	8:42	10.5	17:05	12.1	19:05	6.7	21:05	15.5
10/22/2012	8:17	19:10	5:45	8.1	7:45	2.3	9:45	10.9	18:15	12.7	20:15	7.0	22:15	14.8
10/23/2012	8:20	19:07	6:52	9.5	8:52	3.3	10:52	10.8	19:26	12.9	21:26	6.2	23:26	13.0
10/24/2012	8:22	19:04	7:59	10.4	9:59	3.4	11:59	10.6	20:33	12.3	22:33	4.4	0:33	11.1
10/25/2012	8:25	19:01					0:33	11.1	8:58	11.0	10:58	3.1	12:58	10.3
10/26/2012	8:27	18:59					1:32	9.6	9:51	11.4	11:51	2.9	13:51	10.6
10/27/2012	8:30	18:56	22:23	10.4	0:23	0.8	2:23	8.9	10:38	11.8	12:38	3.1	14:38	11.4
10/28/2012	8:32	18:53	23:08	9.8	1:08	-0.1	3:08	8.7	11:21	12.2	13:21	3.8	15:21	12.7
10/29/2012	8:35	18:51	23:51	9.1	1:51	-0.4	3:51	9.3	12:01	12.6	14:01	4.7	16:01	14.1
10/30/2012	8:37	18:48	0:30	8.6	2:30	-0.2	4:30	9.9	12:39	12.7	14:39	5.7	16:39	15.4
10/31/2012	8:40	18:46	1:07	8.0	3:07	0.2	5:07	10.6	13:16	12.5	15:16	6.4	17:16	16.3

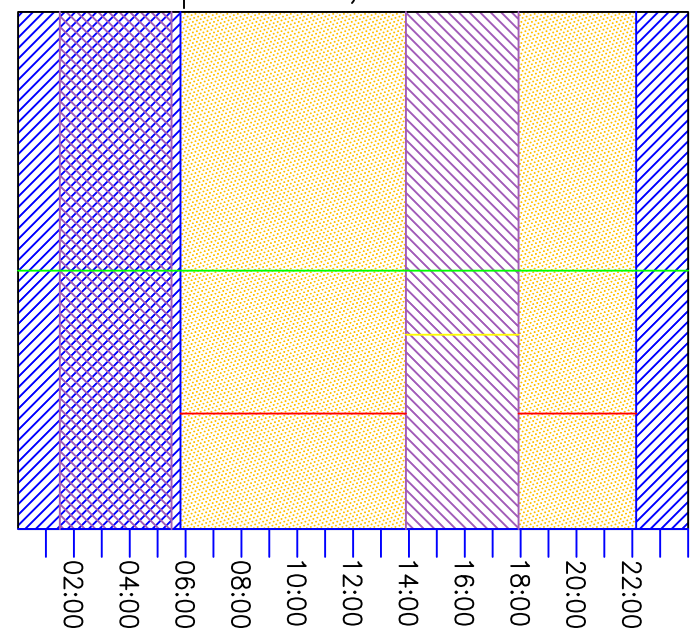
Date	2 Hours Before		Actual Low Tide		2 Hours After		Unrestricted Work Window 1			Unrestricted Work Window 2			Unrestricted Work Window 3			Hourly Totals		
	Time	MLLW	Time	MLLW	Time	MLLW	Start	End	Hours	Start	End	Hours	Start	End	Hours	Daily	Monthly	Yearly
10/1/2012							7:25	13:05	5.7	17:05	20:12	3.1				8.8	8.8	2327.4
10/2/2012							7:27	13:39	6.2	17:39	20:09	2.5				8.7	17.6	2336.1
10/3/2012							7:30	14:12	6.7	18:12	20:06	1.9				8.6	26.2	2344.8
10/4/2012							7:32	14:44	7.2	18:44	20:03	1.3				8.5	34.7	2353.3
10/5/2012							7:35	15:18	7.7	19:18	20:00	0.0				8.4	43.2	2361.8
10/6/2012							7:50	16:00	8.2							8.2	51.4	2370.0
10/7/2012							8:37	16:59	8.4							8.4	59.8	2378.3
10/8/2012							9:44	18:18	8.6							8.6	68.3	2386.9
10/9/2012							10:59	19:35	8.6							8.6	77.0	2395.5
10/10/2012							7:47	8:07	0.0	12:07	19:44	7.6				8.0	84.9	2403.5
10/11/2012	21:36	11.4	23:36	4.9	1:36	12.8	7:50	9:05	1.3	13:05	19:41	6.6				7.9	92.8	2411.4
10/12/2012	22:26	10.2					7:52	9:56	2.1	13:56	19:38	5.7				7.8	100.6	2419.2
10/13/2012	23:13	9.0					7:55	10:42	2.8	14:42	19:35	4.9				7.7	108.3	2426.9
10/14/2012	23:58	7.8					7:57	11:27	3.5	15:27	19:32	4.1				7.6	115.9	2434.5
10/15/2012							8:00	12:10	4.2	16:10	19:29	3.3				7.5	123.5	2442.0
10/16/2012							8:02	12:54	4.9	16:54	19:27	2.6				7.4	130.9	2449.5
10/17/2012							8:05	13:37	5.5	17:37	19:24	1.8				7.3	138.3	2456.8
10/18/2012							8:07	14:22	6.3	18:22	19:21	1.0				7.3	145.5	2464.1
10/19/2012							8:10	15:10	7.0	19:10	19:18	0.0				7.2	152.7	2471.3
10/20/2012							8:12	16:04	7.9							7.9	160.6	2479.2
10/21/2012							8:42	17:05	8.4							8.4	169.0	2487.6
10/22/2012							9:45	18:15	8.5							8.5	177.5	2496.1
10/23/2012							10:52	19:07	8.3							8.3	185.8	2504.3
10/24/2012							11:59	19:04	7.1							7.1	192.9	2511.4
10/25/2012	21:32	11.3	23:32	2.4	1:32	9.6	8:25	8:58	0.6	12:58	19:01	6.1				6.6	199.5	2518.1
10/26/2012	22:23	10.4					8:27	9:51	1.4	13:51	18:59	5.2				6.6	206.1	2524.6
10/27/2012	23:08	9.8					8:30	10:38	2.1	14:38	18:56	4.3				6.5	212.5	2531.1
10/28/2012	23:51	9.1					8:32	11:21	2.8	15:21	18:53	3.6				6.4	218.9	2537.5
10/29/2012							8:35	12:01	3.4	16:01	18:51	2.9				6.3	225.2	2543.8
10/30/2012							8:37	12:39	4.0	16:39	18:48	2.2				6.2	231.4	2550.0
10/31/2012							8:40	13:16	4.6	17:16	18:46	1.5				6.1	237.6	2556.1

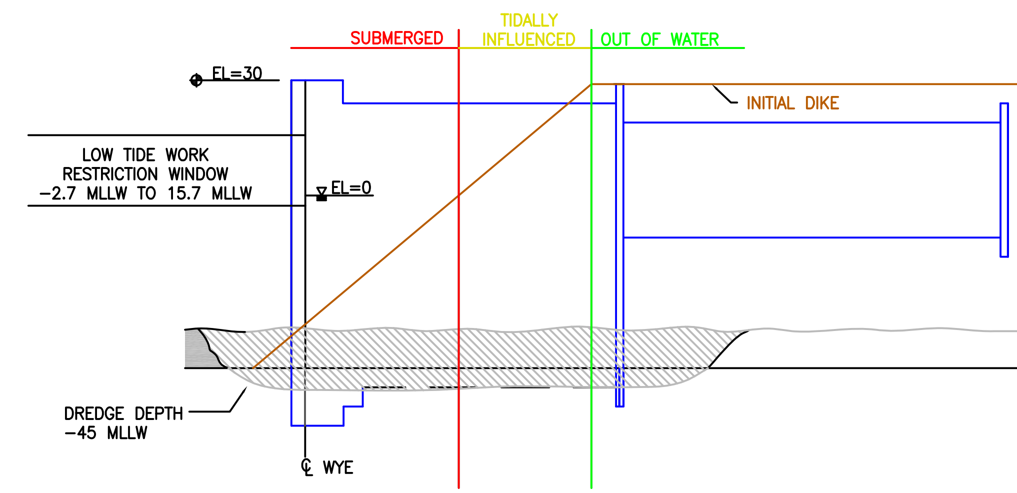


TYPICAL SECTION D-D

Represents the low tide window for April 12, 2013

April 12, 2013





TYPICAL SECTION E-E

Represents the low tidal range for the entire month of April 2013

Civil Twilight window

Low Tide window

Unrestricted Work window

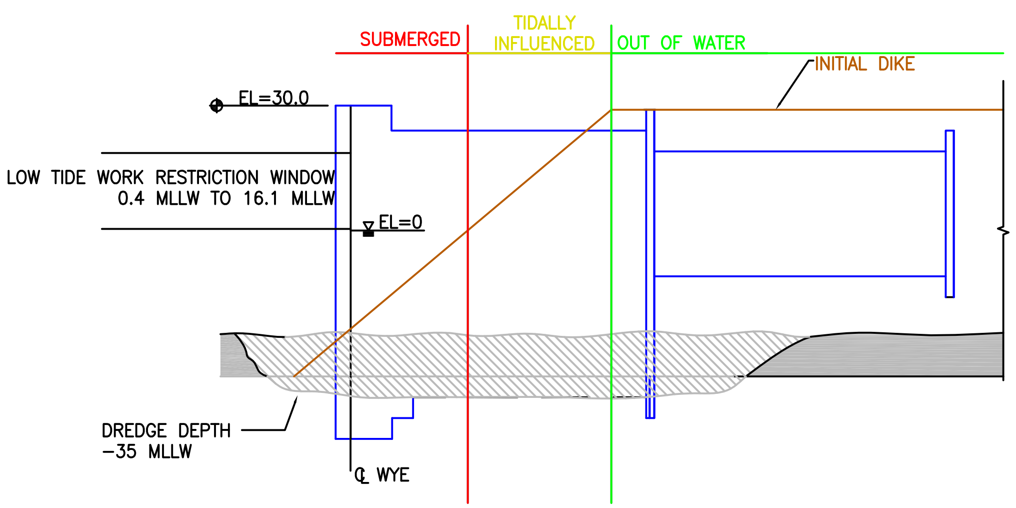
Submerged Piledriving

Tidally Influenced Piledriving

Out of Water Piledriving

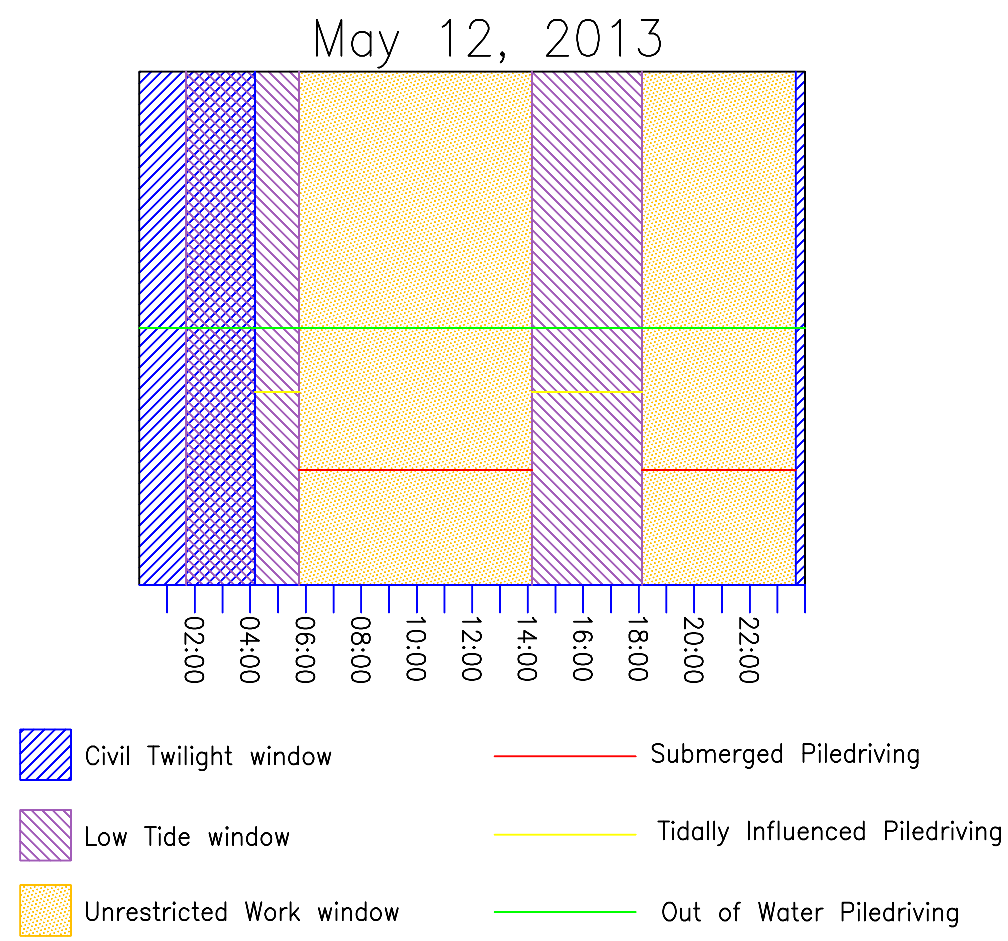
Date	Civil Twilight		2 Hours Before		Actual Low Tide		2 Hours After		2 Hours Before		Actual Low Tide		2 hours After	
	Begin	End	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW
4/1/2013	6:35	21:30	3:48	10.2	5:48	4.7	7:48	14.6	16:30	5.6	18:30	0.3	20:30	10.3
4/2/2013	6:32	21:33	4:45	10.8	6:45	6.0	8:45	15.0	17:31	6.5	19:31	1.6	21:31	10.6
4/3/2013	6:28	21:36	5:55	11.5	7:55	7.1	9:55	15.5	18:41	7.7	20:41	2.4	22:41	10.7
4/4/2013	6:25	21:39	7:10	12.3	9:10	6.9	11:10	14.8	19:51	8.8	21:51	2.3	23:51	10.2
4/5/2013	6:21	21:42	8:21	12.4	10:21	5.4	12:21	13.0	20:55	9.4	22:55	1.5	0:55	9.6
4/6/2013	6:18	21:45					0:55	9.6	9:25	11.8	11:25	3.3	13:25	11.3
4/7/2013	6:15	21:47					1:52	9.4	10:20	11.1	12:20	1.3	14:20	9.9
4/8/2013	6:11	21:50	22:43	10.0	0:43	0.5	2:43	9.9	11:11	10.2	13:11	-0.1	15:11	9.5
4/9/2013	6:08	21:53	23:29	10.5	1:29	1.0	3:29	10.9	11:56	9.7	13:56	-0.7	15:56	9.5
4/10/2013	6:04	21:56	0:11	11.1	2:11	1.9	4:11	12.2	12:39	9.2	14:39	-0.7	16:39	10.0
4/11/2013	6:01	21:59	0:51	11.4	2:51	3.0	4:51	13.6	13:19	8.6	15:19	-0.4	17:19	10.7
4/12/2013	5:57	22:02	1:29	11.4	3:29	4.1	5:29	14.9	13:56	7.8	15:56	0.1	17:56	11.2
4/13/2013	5:54	22:05	2:04	11.2	4:04	5.0	6:04	15.5	14:32	7.0	16:32	0.7	18:32	11.4
4/14/2013	5:51	22:08	2:38	11.0	4:38	5.8	6:38	15.5	15:06	6.4	17:06	1.4	19:06	11.1
4/15/2013	5:47	22:11	3:12	11.0	5:12	6.4	7:12	14.9	15:41	6.3	17:41	2.2	19:41	10.5
4/16/2013	5:44	22:14	3:50	11.3	5:50	7.1	7:50	14.2	16:21	6.8	18:21	3.3	20:21	10.1
4/17/2013	5:40	22:17	4:40	11.6	6:40	8.0	8:40	14.2	17:15	7.4	19:15	4.5	21:15	10.5
4/18/2013	5:37	22:20	5:48	11.7	7:48	8.7	9:48	14.7	18:26	8.0	20:26	5.4	22:26	11.7
4/19/2013	5:33	22:23	7:05	11.8	9:05	8.4	11:05	14.7	19:37	8.9	21:37	6.5	23:37	12.1
4/20/2013	5:30	22:26	8:14	11.7	10:14	7.1	12:14	13.6	20:39	9.6	22:39	4.9	0:39	12.0
4/21/2013	5:26	22:29					0:39	12.0	9:14	11.1	11:14	5.2	13:14	12.4
4/22/2013	5:22	22:32					1:34	12.2	10:07	10.1	12:07	3.2	14:07	11.5
4/23/2013	5:19	22:36	22:23	10.1	0:23	3.7	2:23	12.7	10:55	9.1	12:55	1.4	14:55	11.0
4/24/2013	5:15	22:39	23:09	10.3	1:09	3.4	3:09	13.5	11:41	8.0	13:41	-0.1	15:41	10.8
4/25/2013	5:12	22:42	23:54	10.4	1:54	3.4	3:54	14.5	12:25	7.1	14:25	-1.2	16:25	10.6
4/26/2013	5:08	22:45	0:37	10.6	2:37	3.4	4:37	15.2	13:09	6.1	15:09	-2.1	17:09	10.4
4/27/2013	5:05	22:49	1:20	10.7	3:20	3.4	5:20	15.6	13:52	5.5	15:52	-2.7	17:52	10.1
4/28/2013	5:01	22:52	2:04	10.7	4:04	3.5	6:04	15.7	14:37	5.0	16:37	-2.7	18:37	9.9
4/29/2013	4:57	22:55	2:50	10.6	4:50	3.8	6:50	15.5	15:23	5.1	17:23	-2.2	19:23	9.7
4/30/2013	4:54	22:59	3:40	10.7	5:40	4.3	7:40	15.3	16:15	5.5	18:15	-1.0	20:15	10.0

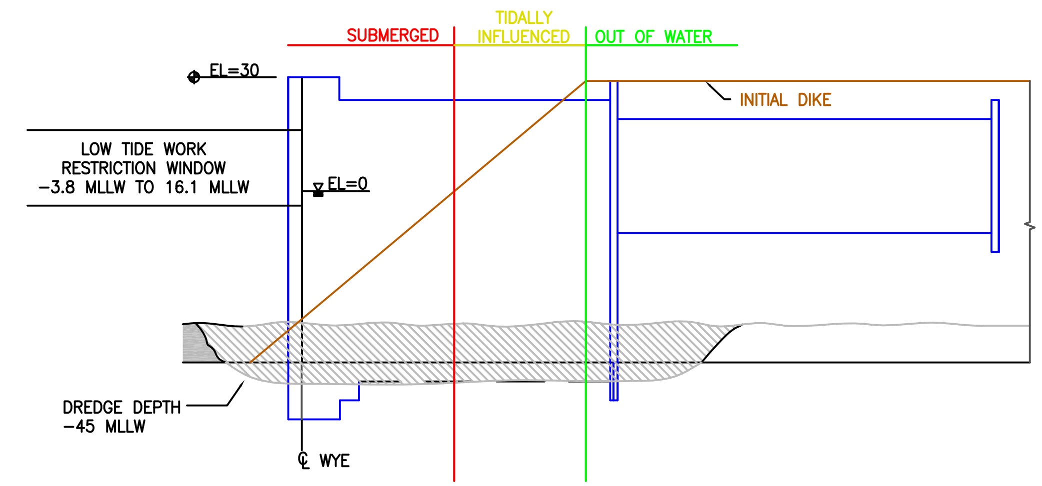
Date	2 Hours Before		Actual Low Tide		2 Hours After		Unrestricted Work Window 1			Unrestricted Work Window 2			Unrestricted Work Window 3			Hourly Totals		
	Time	MLLW	Time	MLLW	Time	MLLW	Start	End	Hours	Start	End	Hours	Start	End	Hours	Daily	Monthly	Yearly
4/1/2013							7:48	16:30	8.7	20:30	21:30	1.0				9.7	9.7	9.7
4/2/2013							8:45	17:31	8.8	21:31	21:33	0.0				8.8	18.6	18.6
4/3/2013							9:55	18:41	8.8							8.8	27.4	27.4
4/4/2013							6:25	7:10	0.0	11:10	19:51	8.7				9.4	36.8	36.8
4/5/2013							6:21	8:21	2.0	12:21	20:55	8.6				10.6	47.4	47.4
4/6/2013	21:52	9.7	23:52	0.8	1:52	9.4	6:18	9:25	3.1	13:25	21:45	8.4				11.5	58.9	58.9
4/7/2013	22:43	10.0					6:15	10:20	4.1	14:20	21:47	7.5				11.6	70.5	70.5
4/8/2013	23:29	10.5					6:11	11:11	5.0	15:11	21:50	6.7				11.7	82.2	82.2
4/9/2013							6:08	11:56	5.8	15:56	21:53	6.0				11.8	93.9	93.9
4/10/2013							6:04	12:39	6.6	16:39	21:56	5.3				11.9	105.8	105.8
4/11/2013							6:01	13:19	7.3	17:19	21:59	4.7				12.0	117.8	117.8
4/12/2013							5:57	13:56	8.0	17:56	22:02	4.1				12.1	130.0	130.0
4/13/2013							6:04	14:32	8.5	18:32	22:05	3.6				12.0	142.0	142.0
4/14/2013							6:38	15:06	8.5	19:06	22:08	3.1				11.5	153.5	153.5
4/15/2013							7:12	15:41	8.5	19:41	22:11	2.5				11.0	164.6	164.6
4/16/2013							7:50	16:21	8.5	20:21	22:14	1.9				10.4	175.0	175.0
4/17/2013							8:40	17:15	8.6	21:15	22:17	1.1				9.6	184.6	184.6
4/18/2013							5:37	5:48	0.0	9:48	18:26	8.6				8.8	193.5	193.5
4/19/2013							5:33	7:05	1.5	11:05	19:37	8.5				10.1	203.6	203.6
4/20/2013							5:30	8:14	2.7	12:14	20:39	8.4				11.2	214.8	214.8
4/21/2013	21:34	9.9	23:34	4.2	1:34	12.2	5:26	9:14	3.8	13:14	21:34	8.3				12.1	226.9	226.9
4/22/2013	22:23	10.1					5:22	10:07	4.8	14:07	22:23	8.3				13.0	240.0	240.0
4/23/2013	23:09	10.3					5:19	10:55	5.6	14:55	22:36	7.7				13.3	253.3	253.3
4/24/2013	23:54	10.4					5:15	11:41	6.4	15:41	22:39	7.0				13.4	266.7	266.7
4/25/2013							5:12	12:26	7.2	16:26	22:42	6.3				13.5	280.3	280.3
4/26/2013							5:08	13:09	8.0	17:09	22:45	5.6				13.6	293.9	293.9
4/27/2013							5:20	13:52	8.5	17:52	22:49	5.0				13.5	307.4	307.4
4/28/2013							6:04	14:37	8.6	18:37	22:52	4.3				12.8	320.3	320.3
4/29/2013							6:50	15:23	8.6	19:23	22:55	3.6				12.1	332.4	332.4
4/30/2013							7:40	16:15	8.6	20:15	22:59	2.8				11.3	343.7	343.7



TYPICAL SECTION D-D

Represents the low tide window for May 12, 2013





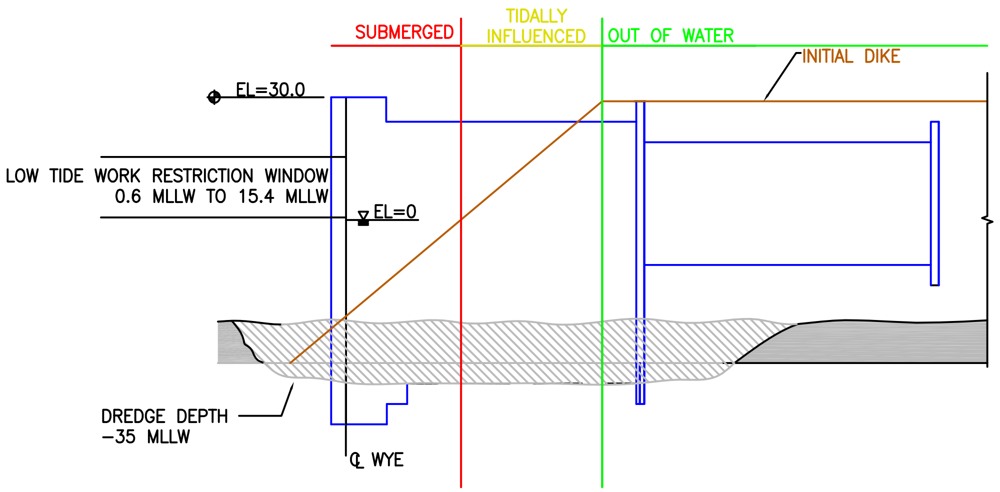
TYPICAL SECTION E-E

Represents the low tidal range for the entire month of May 2013

Ship Creek smolt releases, during which time no piledriving may be performed, typically occur during the second week of May.

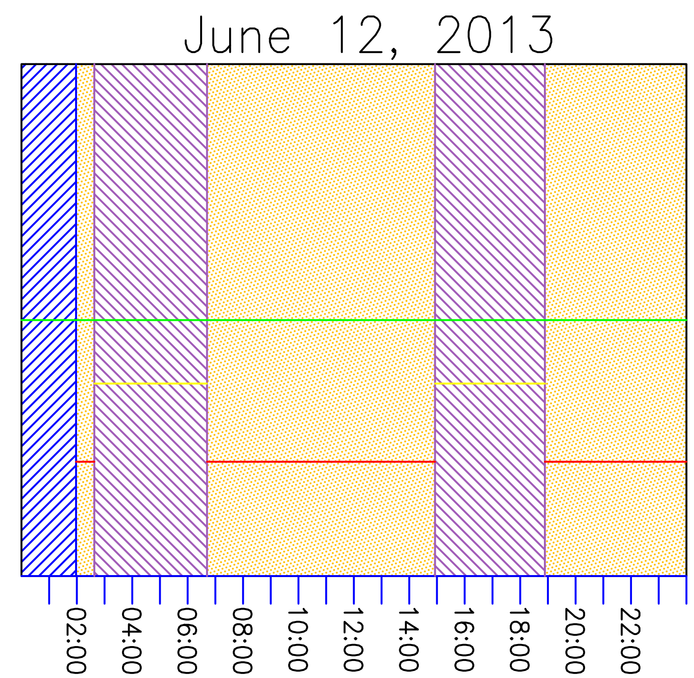
Date	Civil Twilight		2 Hours Before		Actual Low Tide		2 Hours After		2 Hours Before		Actual Low Tide		2 hours After	
	Begin	End	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW
5/1/2013	4:50	23:02	4:36	11.0	6:36	5.1	8:36	15.0	17:12	6.5	19:12	0.6	21:12	10.4
5/2/2013	4:47	23:05	5:40	11.4	7:40	5.6	9:40	14.5	18:16	7.8	20:16	1.9	22:16	10.7
5/3/2013	4:43	23:09	6:50	11.7	8:50	5.4	10:50	13.3	19:22	9.1	21:22	2.6	23:22	10.7
5/4/2013	4:39	23:12	7:59	11.6	9:59	4.1	11:59	11.5	20:25	10.1	22:25	2.7	0:25	10.5
5/5/2013	4:36	23:16					0:25	10.5	9:02	10.9	11:02	2.3	13:02	9.8
5/6/2013	4:32	23:19					1:23	10.7	9:58	10.1	11:58	0.6	13:58	8.7
5/7/2013	4:28	23:23	22:15	11.4	0:15	2.8	2:15	11.2	10:48	9.4	12:48	-0.5	14:48	8.3
5/8/2013	4:25	23:26	23:02	11.9	1:02	3.4	3:02	12.2	11:33	9.0	13:33	-0.9	15:33	8.4
5/9/2013	4:21	23:30	23:45	12.4	1:45	4.2	3:45	13.4	12:16	8.6	14:16	-0.8	16:16	9.1
5/10/2013	4:17	23:34	0:26	12.7	2:26	5.0	4:26	14.6	12:55	8.1	14:55	-0.4	16:55	9.9
5/11/2013	4:13	23:37	1:05	12.6	3:05	5.7	5:05	15.6	13:33	7.5	15:33	0.0	17:33	10.6
5/12/2013	4:10	23:41	1:42	12.3	3:42	6.2	5:42	16.1	14:08	6.8	16:08	0.4	18:08	10.9
5/13/2013	4:06	23:45	2:18	11.7	4:18	6.3	6:18	16.1	14:42	6.1	16:42	0.8	18:42	10.8
5/14/2013	4:02	23:49	2:54	11.3	4:54	6.4	6:54	15.4	15:16	5.9	17:16	1.4	19:16	10.3
5/15/2013	3:58	23:53	3:32	11.1	5:32	6.5	7:32	14.6	15:52	6.3	17:52	2.1	19:52	9.8
5/16/2013	3:54	23:56	4:17	11.0	6:17	6.8	8:17	13.9	16:35	7.0	18:35	3.2	20:35	9.7
5/17/2013	3:51	0:00	5:14	10.8	7:14	7.2	9:14	13.8	17:32	7.7	19:32	4.5	21:32	10.6
5/18/2013	3:47	0:04	6:23	10.5	8:23	7.2	10:23	13.9	18:41	8.4	20:41	5.4	22:41	12.1
5/19/2013	3:43	0:08	7:33	10.3	9:33	6.3	11:33	13.3	19:49	9.2	21:49	5.8	23:49	13.1
5/20/2013	3:39	0:12	8:36	9.8	10:36	4.6	12:36	12.1	20:50	10.0	22:50	5.6	0:50	13.6
5/21/2013	3:35	0:16					0:50	13.6	9:33	8.9	11:33	2.7	13:33	11.1
5/22/2013	3:31	0:21					1:45	14.2	10:25	7.8	12:25	0.7	14:25	10.3
5/23/2013	3:27	0:25	22:36	11.0	0:36	5.0	2:36	14.7	11:14	6.9	13:14	-0.9	15:14	9.7
5/24/2013	3:23	0:29	23:26	11.3	1:26	4.7	3:26	15.4	12:02	6.0	14:02	-2.3	16:02	9.5
5/25/2013	3:19	0:34	0:14	11.4	2:14	4.3	4:14	15.8	12:48	5.5	14:48	-3.2	16:48	9.2
5/26/2013	3:14	0:38	1:02	11.4	3:02	3.9	5:02	16.0	13:35	5.0	15:35	-3.8	17:35	9.2
5/27/2013	3:10	0:43	1:50	11.2	3:50	3.4	5:50	15.9	14:21	4.9	16:21	-3.8	18:21	9.2
5/28/2013	3:06	0:47	2:38	11.0	4:38	3.1	6:38	15.4	15:07	5.1	17:07	-3.2	19:07	9.2
5/29/2013	3:01	0:52	3:28	10.8	5:28	3.1	7:28	14.7	15:56	5.6	17:56	-2.0	19:56	9.6
5/30/2013	2:56	0:57	4:22	10.6	6:22	3.5	8:22	14.1	16:49	6.5	18:49	-0.2	20:49	10.3
5/31/2013	2:51	1:02	5:21	10.6	7:21	3.9	9:21	13.2	17:46	7.8	19:46	1.7	21:46	10.9

Date	2 Hours Before		Actual Low Tide		2 Hours After		Unrestricted Work Window 1			Unrestricted Work Window 2			Unrestricted Work Window 3			Hourly Totals		
	Time	MLLW	Time	MLLW	Time	MLLW	Start	End	Hours	Start	End	Hours	Start	End	Hours	Daily	Monthly	Yearly
5/1/2013							8:36	17:12	8.6	21:12	23:02	1.9				10.5	10.5	354.2
5/2/2013							4:47	5:40	0.0	9:40	18:16	8.6	22:16	23:05	0.0	10.3	20.8	364.6
5/3/2013							4:43	6:50	2.1	10:50	19:22	8.5				10.7	31.5	375.2
5/4/2013							4:39	7:59	3.3	11:59	20:25	8.4				11.8	43.3	387.0
5/5/2013	21:23	10.8	23:23	2.7	1:23	10.7	4:36	9:02	4.4	13:02	21:23	8.4				12.8	56.1	399.9
5/6/2013	22:15	11.4					4:32	9:58	5.4	13:58	22:15	8.3				13.7	69.9	413.6
5/7/2013	23:02	11.9					4:28	10:48	6.3	14:48	23:02	8.2				14.6	84.5	428.2
5/8/2013	23:45	12.4					4:25	11:33	7.1	15:33	23:26	7.9				15.0	99.5	443.3
5/9/2013							4:21	12:16	7.9	16:16	23:30	7.3				15.2	114.7	458.4
5/10/2013							4:26	12:55	8.5	16:55	23:34	6.7				15.2	129.9	473.6
5/11/2013							5:05	13:33	8.5	17:33	23:37	6.1				14.6	144.4	488.2
5/12/2013							5:42	14:08	8.4	18:08	23:41	5.6				14.0	158.5	502.2
5/13/2013							6:18	14:42	8.4	18:42	23:45	5.1				13.5	171.9	515.7
5/14/2013							6:54	15:16	8.4	19:16	23:49	4.6				12.9	184.9	528.6
5/15/2013							7:32	15:52	8.3	19:52	23:53	4.0				12.4	197.3	541.0
5/16/2013							3:54	4:17	0.0	8:17	16:36	8.3	20:35	23:56	3.4	12.1	209.4	553.1
5/17/2013							3:51	5:14	1.4	9:14	17:32	8.3	21:32	23:59	2.5	12.2	221.5	565.3
5/18/2013							3:47	6:23	2.6	10:23	18:41	8.3	22:41	23:59	1.3	12.2	233.8	577.5
5/19/2013							3:43	7:33	3.8	11:33	19:49	8.3	23:49	23:59	0.0	12.3	246.1	589.8
5/20/2013							3:39	8:36	5.0	12:36	20:50	8.2				13.2	259.3	603.1
5/21/2013	21:45	10.6	23:45	5.3	1:45	14.2	3:35	9:33	6.0	13:33	21:45	8.2				14.2	273.5	617.3
5/22/2013	22:36	11.0					3:31	10:25	6.9	14:25	22:36	8.2				15.1	288.6	632.4
5/23/2013	23:26	11.3					3:27	11:14	7.8	15:14	23:26	8.2				16.0	304.7	648.4
5/24/2013							3:26	12:02	8.6	16:02	23:59	8.0				16.6	321.2	665.0
5/25/2013							4:14	12:48	8.6	16:48	23:59	7.2				15.8	337.0	680.8
5/26/2013							5:02	13:35	8.6	17:35	23:59	6.4				15.0	352.0	695.7
5/27/2013							5:50	14:21	8.5	18:21	23:59	5.7				14.2	366.2	709.9
5/28/2013							6:38	15:07	8.5	19:07	23:59	4.9				13.4	379.6	723.3
5/29/2013							3:01	3:28	0.0	7:28	15:56	8.5	19:56	23:59	4.1	13.0	392.6	736.3
5/30/2013							2:56	4:22	1.4	8:22	16:49	8.5	20:49	23:59	3.2	13.1	405.7	749.4
5/31/2013							2:51	5:21	2.5	9:21	17:46	8.4	21:46	23:59	2.2	13.2	418.9	762.6



TYPICAL SECTION D-D

Represents the low tide window for June 12, 2013



Civil Twilight window

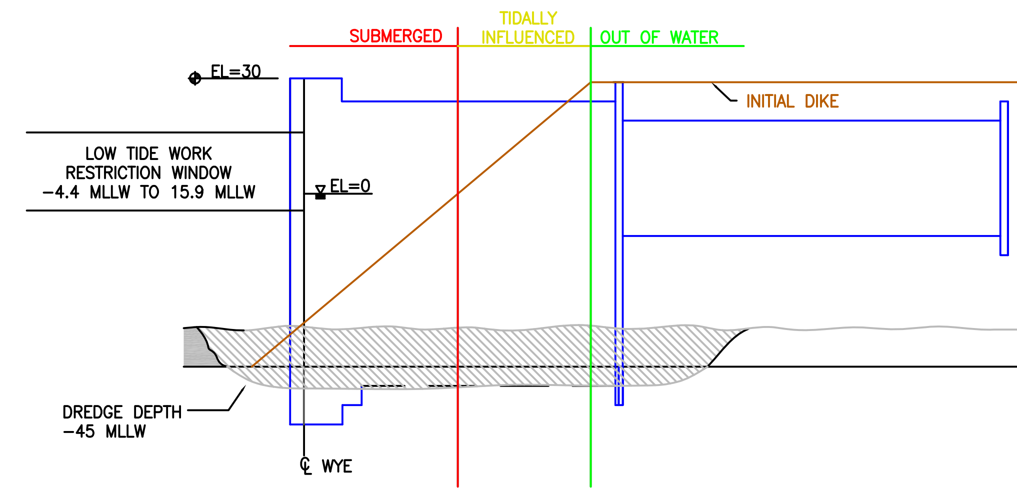
Low Tide window

Unrestricted Work window

Submerged Piledriving

Tidally Influenced Piledriving

Out of Water Piledriving

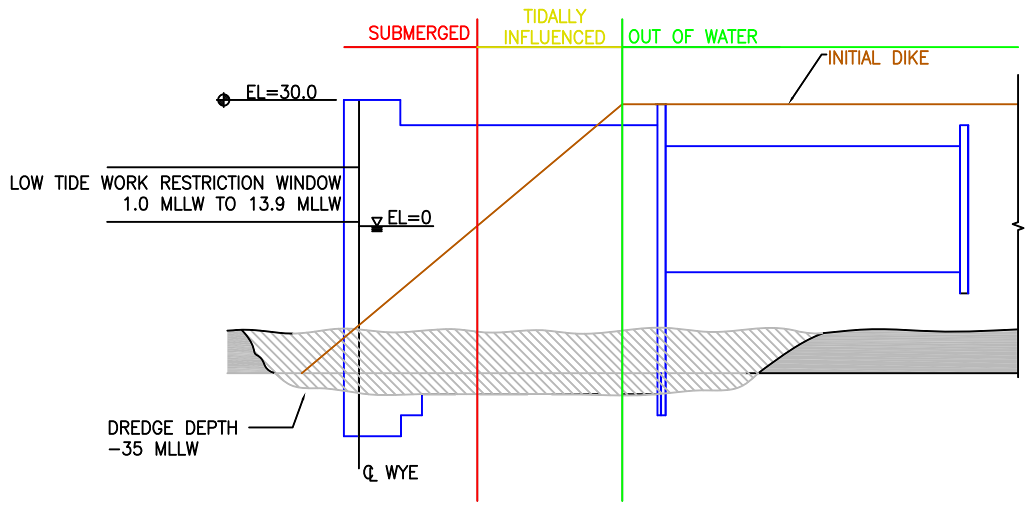


TYPICAL SECTION E-E

Represents the low tidal range for the entire month of June 2013

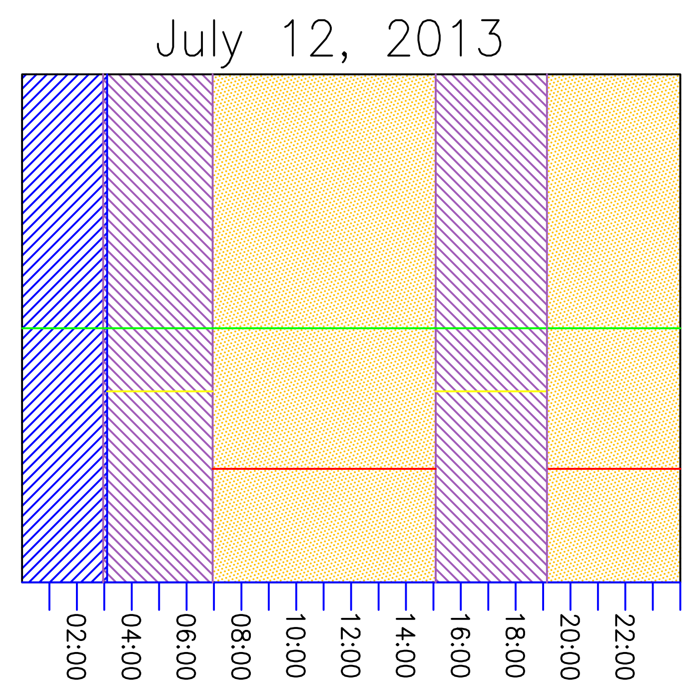
Ship Creek smolt releases, during which time no piledriving may be performed, typically occur during the third week of June.

Date	Civil Twilight		2 Hours Before		Actual Low Tide		2 Hours After		2 Hours Before		Actual Low Tide		2 hours After		2 Hours Before		Actual Low Tide		2 Hours After		Unrestricted Work Window 1			Unrestricted Work Window 2			Unrestricted Work Window 3			Hourly Totals		
	Begin	End	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Start	End	Hours	Start	End	Hours	Start	End	Hours	Daily	Monthly	Yearly
6/1/2013	2:46	1:08	6:25	10.7	8:25	3.9	10:25	12.0	18:48	9.3	20:48	3.3	22:48	11.5							2:46	6:25	3.7	10:25	18:48	8.4	22:48	23:59	1.2	13.2	13.3	775.9
6/2/2013	2:41	1:13	7:31	10.6	9:31	3.3	11:31	10.5	19:50	10.7	21:50	4.3	23:50	11.7							2:41	7:31	4.8	11:31	19:50	8.3	23:50	23:59	0.0	13.3	26.6	789.2
6/3/2013	2:35	1:20	8:34	10.2	10:34	2.0	12:34	9.0	20:50	11.7	22:50	4.7	0:50	12.0							2:35	8:34	6.0	12:34	20:50	8.3				14.3	40.9	803.5
6/4/2013	2:28	1:27					0:50	12.0	9:32	9.5	11:32	0.7	13:32	8.1	21:44	12.4	23:44	5.0	1:44	12.4	2:28	9:32	7.1	13:32	21:44	8.2				15.3	56.2	818.8
6/5/2013	2:20	1:35					1:44	12.4	10:23	8.9	12:23	-0.3	14:23	7.6	22:34	12.9					2:20	10:23	8.1	14:23	22:34	8.2				16.2	72.5	835.1
6/6/2013	2:08	1:48	22:34	12.9	0:34	5.3	2:34	13.0	11:09	8.5	13:09	-0.7	15:09	7.7	23:20	13.2					2:34	11:09	8.6	15:09	23:20	8.2				16.8	89.3	851.9
6/7/2013	1:58	1:58	23:20	13.2	1:20	5.7	3:20	13.9	11:52	8.2	13:52	-0.7	15:52	8.3							3:20	11:52	8.5	15:52	23:59	8.1				16.7	106.0	868.6
6/8/2013	1:58	1:58	0:03	13.3	2:03	6.0	4:03	14.7	12:32	7.9	14:32	-0.5	16:32	9.1							4:03	12:32	8.5	16:32	23:59	7.5				16.0	121.9	884.5
6/9/2013	1:58	1:58	0:44	13.1	2:44	6.2	4:44	15.5	13:11	7.3	15:11	-0.2	17:11	10.0							4:44	13:11	8.5	17:11	23:59	6.8				15.3	137.2	899.8
6/10/2013	1:59	1:59	1:23	12.6	3:23	6.2	5:23	15.9	13:47	6.7	15:47	0.0	17:47	10.5							5:23	13:47	8.4	17:47	23:59	6.2				14.6	151.8	914.4
6/11/2013	1:59	1:59	2:01	11.9	4:01	5.9	6:01	15.9	14:21	6.2	16:21	0.3	18:21	10.6							1:59	2:01	0.0	6:01	14:21	8.3	18:21	23:59	5.7	14.0	165.9	928.5
6/12/2013	1:59	1:59	2:38	11.1	4:38	5.6	6:38	15.4	14:54	5.9	16:54	0.6	18:54	10.3							1:59	2:38	0.0	6:38	14:54	8.3	18:54	23:59	5.1	14.0	179.9	942.5
6/13/2013	1:59	1:59	3:15	10.5	5:15	5.3	7:15	14.5	15:27	6.1	17:27	1.2	19:27	9.8							1:59	3:15	1.3	7:15	15:27	8.2	19:27	23:59	4.6	14.0	194.0	956.6
6/14/2013	1:59	1:59	3:56	10.1	5:56	5.3	7:56	13.6	16:03	6.8	18:03	2.2	20:03	9.5							1:59	3:56	2.0	7:56	16:03	8.1	20:03	23:59	4.0	14.0	208.0	970.6
6/15/2013	2:00	2:00	4:43	9.7	6:43	5.5	8:43	12.9	16:46	7.8	18:46	3.5	20:46	9.7							2:00	4:43	2.7	8:43	16:46	8.1	20:46	23:59	3.2	14.0	222.1	984.7
6/16/2013	2:00	2:00	5:42	9.3	7:42	5.7	9:42	12.7	17:44	8.6	19:44	5.1	21:44	11.0							2:00	5:42	3.7	9:42	17:44	8.0	21:44	23:59	2.3	14.0	236.1	998.7
6/17/2013	2:00	2:00	6:50	8.9	8:50	5.3	10:50	12.5	18:56	9.2	20:56	6.3	22:56	13.0							2:00	6:50	4.8	10:50	18:56	8.1	22:56	23:59	1.1	14.0	250.1	1012.7
6/18/2013	2:00	2:00	7:58	8.4	9:58	4.1	11:58	11.8	20:06	10.2	22:06	6.7	0:06	14.4							2:00	7:58	6.0	11:58	20:06	8.1				14.1	264.3	1026.9
6/19/2013	2:01	2:01					0:06	14.4	9:00	7.8	11:00	2.3	13:00	10.7	21:10	11.0	23:10	6.6	1:10	15.1	2:01	9:00	7.0	13:00	21:10	8.2				15.2	279.5	1042.1
6/20/2013	2:01	2:01					1:10	15.1	9:57	7.0	11:57	0.4	13:57	9.7	22:08	11.5					2:01	9:57	7.9	13:57	22:08	8.2				16.1	295.6	1058.2
6/21/2013	2:01	2:01	22:08	11.5	0:08	6.0	2:08	15.5	10:50	6.2	12:50	-1.4	14:50	9.0	23:03	11.7					2:08	10:50	8.7	14:50	23:03	8.2				16.9	312.6	1075.2
6/22/2013	2:01	2:01	23:03	11.7	1:03	5.2	3:03	15.7	11:40	5.7	13:40	-2.9	15:40	8.5	23:55	11.7					3:03	11:40	8.6	15:40	23:55	8.3				16.9	329.5	1092.1
6/23/2013	2:01	2:01	23:55	11.7	1:55	4.3	3:55	15.7	12:29	5.3	14:29	-3.9	16:29	8.4							3:55	12:29	8.6	16:29	23:59	7.5				16.1	345.6	1108.2
6/24/2013	2:02	2:02	0:45	11.6	2:45	3.4	4:45	15.4	13:17	5.1	15:17	-4.4	17:17	8.6							4:45	13:17	8.5	17:17	23:59	6.7				15.3	360.8	1123.4
6/25/2013	2:02	2:02	1:35	11.2	3:35	2.5	5:35	15.1	14:03	5.2	16:03	-4.3	18:03	8.8							5:35	14:03	8.5	18:03	23:59	6.0				14.4	375.3	1137.9
6/26/2013	2:02	2:02	2:23	10.7	4:23	1.8	6:23	14.4	14:48	5.6	16:48	-3.6	18:48	9.2							2:02	2:23	0.0	6:23	14:48	8.4	18:48	23:59	5.2	14.0	389.3	1151.9
6/27/2013	2:02	2:02	3:12	10.2	5:12	1.6	7:12	13.7	15:34	6.1	17:34	-2.2	19:34	9.9							2:02	3:12	1.2	7:12	15:34	8.4	19:34	23:59	4.4	14.0	403.3	1165.9
6/28/2013	2:02	2:02	4:02	9.9	6:02	1.9	8:02	12.9	16:21	7.0	18:21	-0.2	20:21	10.6							2:02	4:02	2.0	8:02	16:21	8.3	20:21	23:59	3.7	14.0	417.3	1179.9
6/29/2013	2:03	2:03	4:56	9.7	6:56	2.5	8:56	12.2	17:12	8.2	19:12	2.2	21:12	11.6							2:03	4:56	2.9	8:56	17:12	8.3	21:12	23:59	2.8	14.0	431.2	1193.8
6/30/2013	2:03	2:03	5:55	9.7	7:55	3.1	9:55	11.5	18:09	9.6	20:09	4.4	22:09	12.5							2:03	5:55	3.9	9:55	18:09	8.2	22:09	23:59	1.9	14.0	445.2	1207.8



TYPICAL SECTION D-D

Represents the low tide window for July 12, 2013



Civil Twilight window

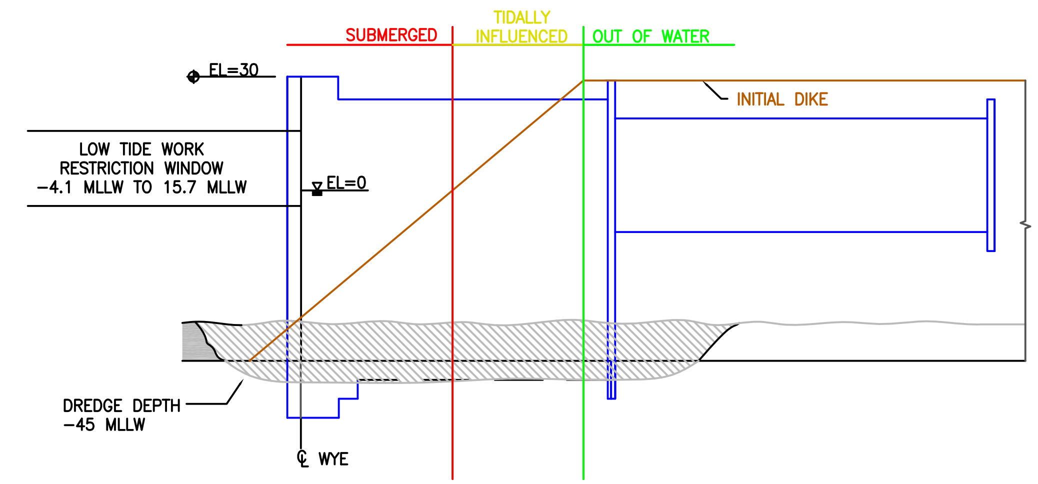
Low Tide window

Unrestricted Work window

Submerged Piledriving

Tidally Influenced Piledriving

Out of Water Piledriving

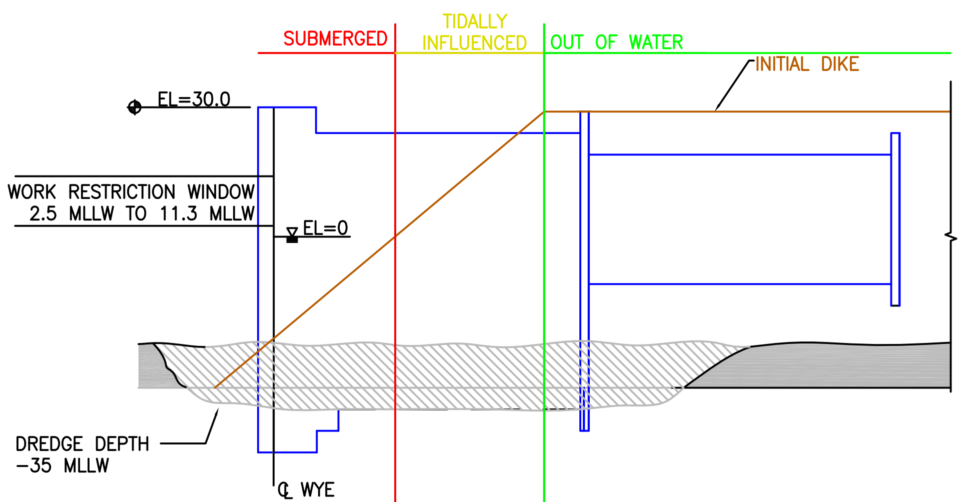


TYPICAL SECTION E-E

Represents the low tidal range for the entire month of July 2013

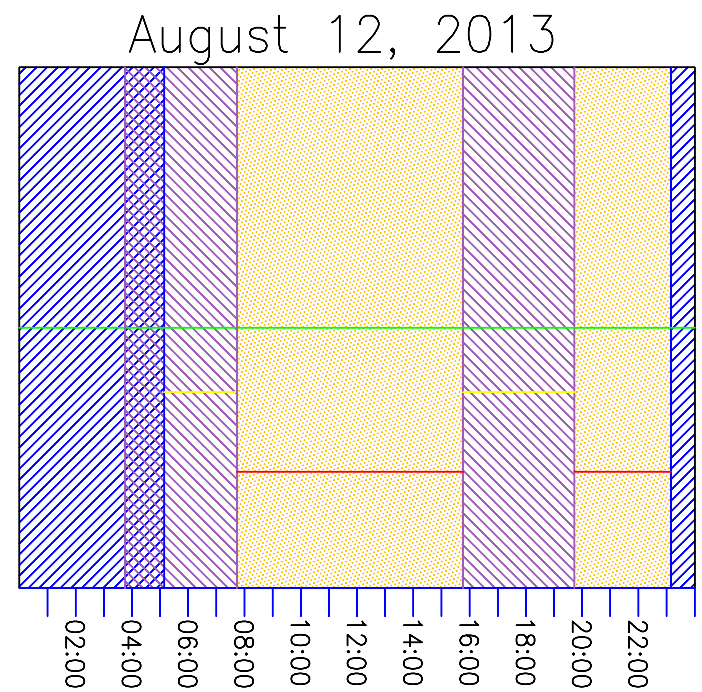
Date	Civil Twilight		2 Hours Before		Actual Low Tide		2 Hours After		2 Hours Before		Actual Low Tide		2 hours After	
	Begin	End	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW
7/1/2013	2:03	2:03	6:58	9.8	8:58	3.2	10:58	10.4	19:11	11.1	21:11	6.0	23:11	13.2
7/2/2013	2:03	2:03	8:02	9.7	10:02	2.7	12:02	9.3	20:14	12.3	22:14	6.7	0:14	13.4
7/3/2013	2:03	2:03					0:14	13.4	9:02	9.2	11:02	1.7	13:02	8.3
7/4/2013	2:04	2:04					1:13	13.4	9:55	8.8	11:55	0.7	13:55	7.6
7/5/2013	2:20	1:48	22:06	13.4	0:06	6.6	2:06	13.4	10:43	8.4	12:43	-0.1	14:43	7.5
7/6/2013	2:30	1:38	22:55	13.4	0:55	6.3	2:55	13.7	11:28	8.0	13:28	-0.5	15:28	8.0
7/7/2013	2:38	1:30	23:40	13.3	1:40	5.9	3:40	14.0	12:09	7.8	14:09	-0.5	16:09	8.6
7/8/2013	2:44	1:24	0:23	12.9	2:23	5.6	4:23	14.5	12:48	7.5	14:48	-0.4	16:48	9.5
7/9/2013	2:50	1:18	1:03	12.3	3:03	5.2	5:03	14.9	13:25	7.0	15:25	-0.2	17:25	10.3
7/10/2013	2:56	1:13	1:42	11.5	3:42	4.7	5:42	15.0	13:59	6.6	15:59	0.0	17:59	10.8
7/11/2013	3:01	1:08	2:19	10.6	4:19	4.3	6:19	14.7	14:32	6.3	16:32	0.4	18:32	10.9
7/12/2013	3:06	1:03	2:55	9.8	4:55	3.9	6:55	13.9	15:04	6.4	17:04	1.0	19:04	10.7
7/13/2013	3:11	0:59	3:33	9.0	5:33	3.8	7:33	13.0	15:36	7.0	17:36	1.9	19:36	10.2
7/14/2013	3:16	0:54	4:14	8.6	6:14	3.9	8:14	12.0	16:12	8.2	18:12	3.2	20:12	10.0
7/15/2013	3:20	0:50	5:04	8.2	7:04	4.2	9:04	11.4	17:00	9.3	19:00	5.0	21:00	10.7
7/16/2013	3:25	0:46	6:10	7.7	8:10	4.4	10:10	11.6	18:08	9.9	20:08	6.7	22:08	12.7
7/17/2013	3:29	0:41	7:22	7.5	9:22	3.8	11:22	11.4	19:29	10.6	21:29	7.7	23:29	14.9
7/18/2013	3:33	0:37	8:30	7.3	10:30	2.3	12:30	10.5	20:42	11.5	22:42	7.4	0:42	15.7
7/19/2013	3:38	0:33					0:42	15.7	9:32	6.9	11:32	0.4	13:32	9.5
7/20/2013	3:42	0:29					1:45	15.5	10:28	6.4	12:28	-1.5	14:28	8.6
7/21/2013	3:46	0:25	22:43	12.0	0:43	5.0	2:43	15.0	11:20	6.1	13:20	-2.9	15:20	8.1
7/22/2013	3:50	0:21	23:37	11.7	1:37	3.5	3:37	14.6	12:10	5.9	14:10	-3.9	16:10	8.2
7/23/2013	3:54	0:17	0:28	11.3	2:28	2.2	4:28	14.1	12:57	5.9	14:57	-4.1	16:57	8.6
7/24/2013	3:58	0:13	1:17	10.8	3:17	1.1	5:17	13.6	13:42	6.2	15:42	-3.8	17:42	9.2
7/25/2013	4:02	0:09	2:04	10.2	4:04	0.5	6:04	13.0	14:26	6.5	16:26	-2.8	18:26	10.1
7/26/2013	4:06	0:06	2:51	9.6	4:51	0.4	6:51	12.6	15:08	7.2	17:08	-1.2	19:08	10.9
7/27/2013	4:09	0:02	3:38	9.1	5:38	0.9	7:38	12.2	15:51	7.9	17:51	1.0	19:51	11.9
7/28/2013	4:13	23:58	4:26	8.9	6:26	1.8	8:26	11.8	16:36	8.9	18:36	3.4	20:36	12.8
7/29/2013	4:17	23:54	5:20	8.9	7:20	2.9	9:20	11.5	17:28	10.1	19:28	5.8	21:28	13.8
7/30/2013	4:21	23:50	6:19	9.2	8:19	3.8	10:19	11.0	18:29	11.5	20:29	7.6	22:29	14.5
7/31/2013	4:24	23:47	7:23	9.5	9:23	3.9	11:23	10.2	19:35	12.7	21:35	8.5	23:35	14.6

Date	2 Hours Before		Actual Low Tide		2 Hours After		Unrestricted Work Window 1			Unrestricted Work Window 2			Unrestricted Work Window 3			Hourly Totals		
	Time	MLLW	Time	MLLW	Time	MLLW	Start	End	Hours	Start	End	Hours	Start	End	Hours	Daily	Monthly	Yearly
7/1/2013							2:03	6:58	4.9	10:58	19:11	8.2	23:11	23:59	0.0	14.0	14.0	1221.8
7/2/2013							2:03	8:02	6.0	12:02	20:14	8.2				14.2	28.2	1236.0
7/3/2013	21:13	13.0	23:13	6.8	1:13	13.4	2:03	9:02	7.0	13:02	21:13	8.2				15.2	43.4	1251.2
7/4/2013	22:06	13.4					2:04	9:55	7.9	13:55	22:06	8.2				16.0	59.5	1267.3
7/5/2013	22:55	13.4					2:20	10:43	8.4	14:43	22:55	8.2				16.6	76.1	1283.9
7/6/2013	23:40	13.3					2:55	11:28	8.6	15:28	23:40	8.2				16.8	92.9	1300.7
7/7/2013							3:40	12:09	8.5	16:09	23:59	7.9				16.3	109.2	1317.0
7/8/2013							4:23	12:48	8.4	16:48	23:59	7.2				15.6	124.9	1332.7
7/9/2013							5:03	13:25	8.4	17:25	23:59	6.6				15.0	139.8	1347.6
7/10/2013							5:42	13:59	8.3	17:59	23:59	6.0				14.3	154.1	1362.0
7/11/2013							6:19	14:32	8.2	18:32	23:59	5.5				13.7	167.8	1375.7
7/12/2013							6:55	15:04	8.2	19:04	23:59	4.9				13.1	180.9	1388.8
7/13/2013							3:11	3:33	0.0	7:33	15:36	8.1	19:36	23:59	4.4	12.8	193.8	1401.6
7/14/2013							3:16	4:14	1.0	8:14	16:12	8.0	20:12	23:59	3.8	12.7	206.6	1414.4
7/15/2013							3:20	5:04	1.7	9:04	17:00	7.9	21:00	23:59	3.0	12.7	219.3	1427.1
7/16/2013							3:25	6:10	2.8	10:10	18:08	8.0	22:08	23:59	1.9	12.6	231.9	1439.7
7/17/2013							3:29	7:22	3.9	11:22	19:29	8.1	23:29	23:59	0.0	12.5	244.4	1452.2
7/18/2013							3:33	8:30	5.0	12:30	20:42	8.2				13.2	257.6	1465.4
7/19/2013	21:45	12.0	23:45	6.4	1:45	15.5	3:38	9:32	5.9	13:32	21:45	8.2				14.1	271.8	1479.6
7/20/2013	22:43	12.0					3:42	10:28	6.8	14:28	22:43	8.3				15.0	286.8	1494.6
7/21/2013	23:37	11.7					3:46	11:20	7.6	15:20	23:37	8.3				15.9	302.7	1510.5
7/22/2013							3:50	12:10	8.3	16:10	23:59	7.8				16.2	318.9	1526.7
7/23/2013							4:28	12:57	8.5	16:57	23:59	7.1				15.5	334.4	1542.2
7/24/2013							5:17	13:42	8.4	17:42	23:59	6.3				14.7	349.2	1557.0
7/25/2013							6:04	14:26	8.4	18:26	23:59	5.6				13.9	363.1	1570.9
7/26/2013							6:51	15:08	8.3	19:08	23:59	4.9				13.2	376.3	1584.1
7/27/2013							7:38	15:51	8.2	19:51	23:59	4.2				12.4	388.7	1596.5
7/28/2013							4:13	4:26	0.0	8:26	16:36	8.2	20:36	23:58	3.4	11.8	400.5	1608.3
7/29/2013							4:17	5:20	1.1	9:20	17:28	8.1	21:28	23:54	2.5	11.6	412.1	1619.9
7/30/2013							4:21	6:19	2.0	10:19	18:29	8.2	22:29	23:50	1.4	11.5	423.7	1631.5
7/31/2013							4:24	7:23	3.0	11:23	19:35	8.2	23:35	23:47	0.0	11.4	435.1	1642.9



TYPICAL SECTION D-D

Represents the low tide window for August 12, 2013



Civil Twilight window

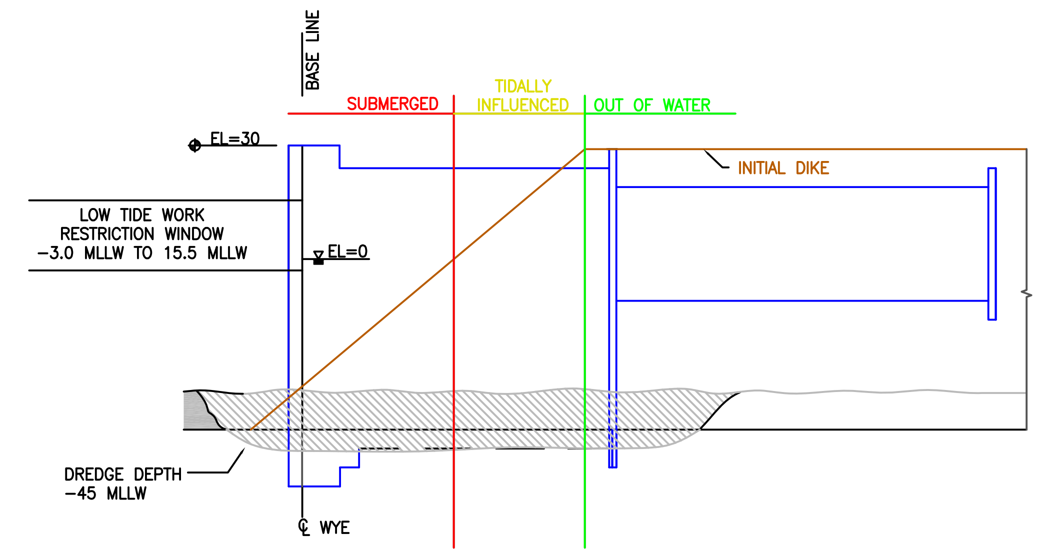
Low Tide window

Unrestricted Work window

Submerged Piledriving

Tidally Influenced Piledriving

Out of Water Piledriving

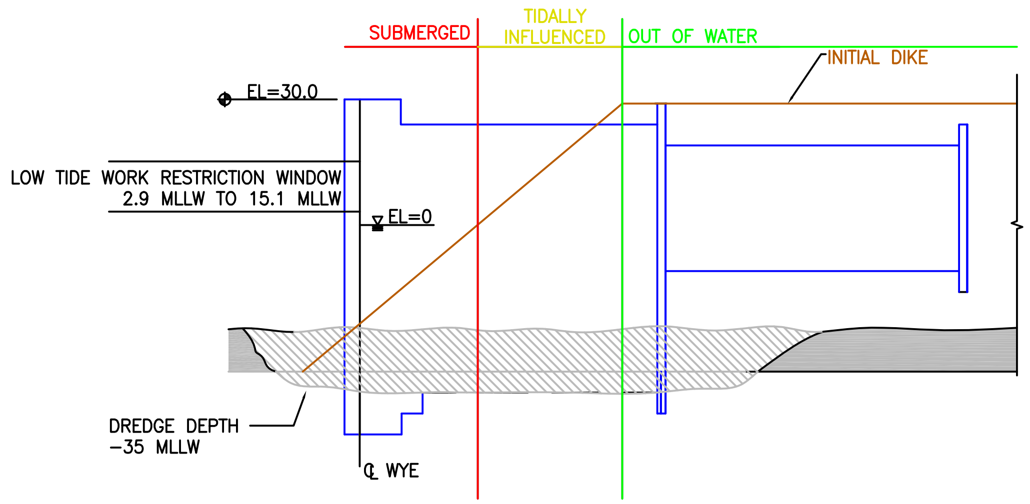


TYPICAL SECTION E-E

Represents the low tidal range for the entire month of August 2013

Date	Civil Twilight		2 Hours Before		Actual Low Tide		2 Hours After		2 Hours Before		Actual Low Tide		2 hours After	
	Begin	End	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW
8/1/2013	4:28	23:43	8:26	9.5	10:26	3.2	12:26	9.2	20:40	13.4	22:40	8.2	0:40	14.1
8/2/2013	4:31	23:39					0:40	14.1	9:24	9.2	11:24	2.1	13:24	8.4
8/3/2013	4:35	23:35					1:38	13.5	10:15	8.7	12:15	1.0	14:15	8.0
8/4/2013	4:38	23:32	22:29	13.2	0:29	6.2	2:29	13.0	11:01	8.4	13:01	0.2	15:01	8.2
8/5/2013	4:42	23:28	23:16	12.8	1:16	5.2	3:16	13.0	11:43	8.2	13:43	-0.2	15:43	8.7
8/6/2013	4:45	23:24	0:00	12.2	2:00	4.4	4:00	13.3	12:23	7.9	14:23	-0.2	16:23	9.7
8/7/2013	4:49	23:21	0:41	11.6	2:41	3.7	4:41	13.6	13:00	7.7	15:00	0.0	17:00	10.7
8/8/2013	4:52	23:17	1:20	10.8	3:20	3.2	5:20	13.9	13:35	7.5	15:35	0.4	17:35	11.6
8/9/2013	4:56	23:13	1:57	9.8	3:57	2.8	5:57	13.8	14:08	7.3	16:08	0.9	18:08	12.0
8/10/2013	4:59	23:10	2:34	8.8	4:34	2.5	6:34	13.4	14:40	7.4	16:40	1.6	18:40	12.0
8/11/2013	5:02	23:06	3:10	8.0	5:10	2.3	7:10	12.4	15:12	7.9	17:12	2.5	19:12	11.6
8/12/2013	5:05	23:03	3:48	7.5	5:48	2.5	7:48	11.3	15:47	9.0	17:47	3.9	19:47	11.3
8/13/2013	5:09	22:59	4:35	7.2	6:35	3.0	8:35	10.7	16:32	10.1	18:32	5.6	20:32	11.7
8/14/2013	5:12	22:55	5:37	7.0	7:37	3.6	9:37	10.9	17:39	10.8	19:39	7.4	21:39	13.5
8/15/2013	5:15	22:52	6:52	7.2	8:52	3.6	10:52	11.3	19:05	11.4	21:05	8.3	23:05	15.7
8/16/2013	5:18	22:48	8:05	7.5	10:05	2.6	12:05	10.7	20:22	12.2	22:22	7.7	0:22	15.8
8/17/2013	5:21	22:45					0:22	15.8	9:09	7.6	11:09	0.8	13:09	9.5
8/18/2013	5:24	22:41					1:28	14.9	10:07	7.3	12:07	-1.0	14:07	8.6
8/19/2013	5:28	22:38	22:27	11.9	0:27	4.0	2:27	13.9	11:00	7.1	13:00	-2.4	15:00	8.4
8/20/2013	5:31	22:34	23:21	11.3	1:21	2.2	3:21	13.1	11:49	7.1	13:49	-3.0	15:49	8.7
8/21/2013	5:34	22:30	0:11	10.7	2:11	0.8	4:11	12.5	12:35	7.4	14:35	-2.9	16:35	9.4
8/22/2013	5:37	22:27	0:58	10.1	2:58	-0.1	4:58	12.1	13:19	7.8	15:19	-2.1	17:19	10.6
8/23/2013	5:40	22:23	1:44	9.5	3:44	-0.5	5:44	12.0	14:01	8.2	16:01	-0.8	18:01	11.8
8/24/2013	5:43	22:20	2:27	9.0	4:27	-0.2	6:27	11.8	14:41	8.7	16:41	0.9	18:41	12.8
8/25/2013	5:46	22:16	3:10	8.5	5:10	0.6	7:10	11.8	15:20	9.3	17:20	2.9	19:20	13.6
8/26/2013	5:48	22:13	3:54	8.2	5:54	1.7	7:54	11.8	16:00	10.0	18:00	5.0	20:00	14.1
8/27/2013	5:51	22:09	4:41	8.2	6:41	3.1	8:41	11.7	16:46	10.9	18:46	7.1	20:46	14.7
8/28/2013	5:54	22:06	5:36	8.5	7:36	4.4	9:36	11.7	17:44	11.9	19:44	8.8	21:44	15.3
8/29/2013	5:57	22:02	6:39	9.1	8:39	5.1	10:39	11.4	18:55	12.8	20:55	9.6	22:55	15.5
8/30/2013	6:00	21:59	7:46	9.6	9:46	4.8	11:46	10.7	20:05	13.4	22:05	9.1	0:05	14.7
8/31/2013	6:03	21:56					0:05	14.7	8:48	9.6	10:48	3.8	12:48	9.7

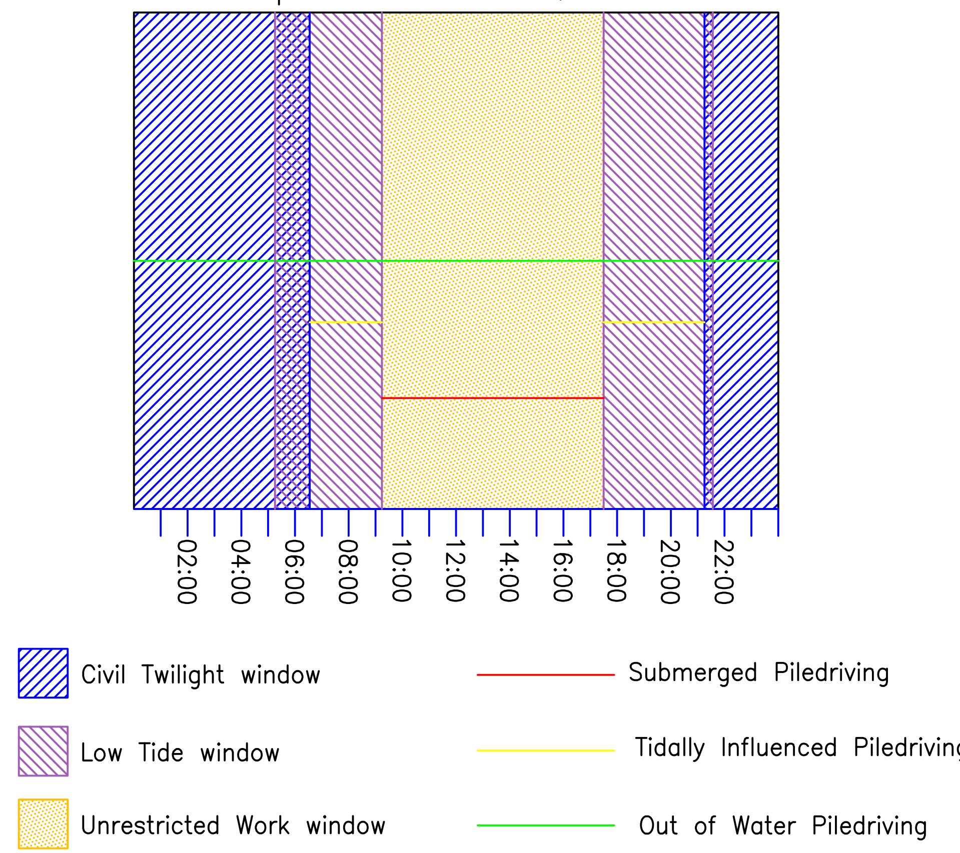
Date	2 Hours Before		Actual Low Tide		2 Hours After		Unrestricted Work Window 1			Unrestricted Work Window 2			Unrestricted Work Window 3			Hourly Totals		
	Time	MLLW	Time	MLLW	Time	MLLW	Start	End	Hours	Start	End	Hours	Start	End	Hours	Daily	Monthly	Yearly
8/1/2013							4:28	8:26	4.0	12:26	20:40	8.2				12.2	12.2	1655.1
8/2/2013	21:38	13.5	23:38	7.3	1:38	13.5	4:31	9:24	4.9	13:24	21:38	8.2				13.1	25.4	1668.3
8/3/2013	22:29	13.2					4:35	10:15	5.7	14:15	22:29	8.2				13.9	39.3	1682.2
8/4/2013	23:16	12.8					4:38	11:01	6.4	15:01	23:16	8.3				14.6	54.0	1696.9
8/5/2013							4:42	11:43	7.0	15:43	23:28	7.8				14.8	68.8	1711.7
8/6/2013							4:45	12:23	7.6	16:23	23:24	7.0				14.7	83.5	1726.4
8/7/2013							4:49	13:00	8.2	17:00	23:21	6.4				14.6	98.0	1740.9
8/8/2013							5:20	13:35	8.3	17:35	23:17	5.7				14.0	112.0	1754.9
8/9/2013							5:57	14:08	8.2	18:08	23:13	5.1				13.3	125.3	1768.2
8/10/2013							6:34	14:40	8.1	18:40	23:10	4.5				12.6	138.0	1780.9
8/11/2013							7:10	15:12	8.0	19:12	23:06	3.9				12.0	149.9	1792.8
8/12/2013							7:48	15:47	8.0	19:47	23:03	3.3				11.3	161.2	1804.1
8/13/2013							8:35	16:32	8.0	20:32	22:59	2.5				10.4	171.6	1814.5
8/14/2013							5:12	5:37	0.0	9:37	17:39	8.0	21:39	22:55	1.3	9.7	181.4	1824.3
8/15/2013							5:15	6:52	1.6	10:52	19:05	8.2				9.8	191.3	1834.2
8/16/2013							5:18	8:05	2.8	12:05	20:22	8.3				11.1	202.4	1845.3
8/17/2013	21:28	12.4	23:28	6.0	1:28	14.9	5:21	9:09	3.8	13:09	21:28	8.3				12.1	214.5	1857.4
8/18/2013	22:27	11.9					5:24	10:07	4.7	14:07	22:27	8.3				13.1	227.6	1870.5
8/19/2013	23:21	11.3					5:28	11:00	5.5	15:00	22:38	7.7				13.2	240.8	1883.7
8/20/2013							5:31	11:49	6.3	15:49	22:34	6.8				13.1	253.9	1896.8
8/21/2013							5:34	12:35	7.0	16:35	22:30	5.9				13.0	266.9	1909.8
8/22/2013							5:37	13:19	7.7	17:19	22:27	5.2				12.9	279.7	1922.6
8/23/2013							5:44	14:01	8.3	18:01	22:23	4.4				12.7	292.4	1935.3
8/24/2013							6:27	14:41	8.2	18:41	22:20	3.7				11.9	304.3	1947.2
8/25/2013							7:10	15:20	8.2	19:20	22:16	3.0				11.1	315.5	1958.4
8/26/2013							7:54	16:00	8.1	20:00	22:13	2.2				10.3	325.8	1968.7
8/27/2013							8:41	16:46	8.1	20:46	22:09	1.4				9.5	335.3	1978.2
8/28/2013							9:36	17:44	8.1	21:44	22:06	0.0				8.5	343.8	1986.7
8/29/2013							5:57	6:39	0.0	10:39	18:55	8.3				9.0	352.8	1995.7
8/30/2013							6:00	7:46	1.8	11:46	20:05	8.3				10.1	363.0	2005.9
8/31/2013	21:07	13.4	23:07	7.6	1:07	13.4	6:03	8:48	2.8	12:48	21:07	8.3				11.1	374.1	2017.0

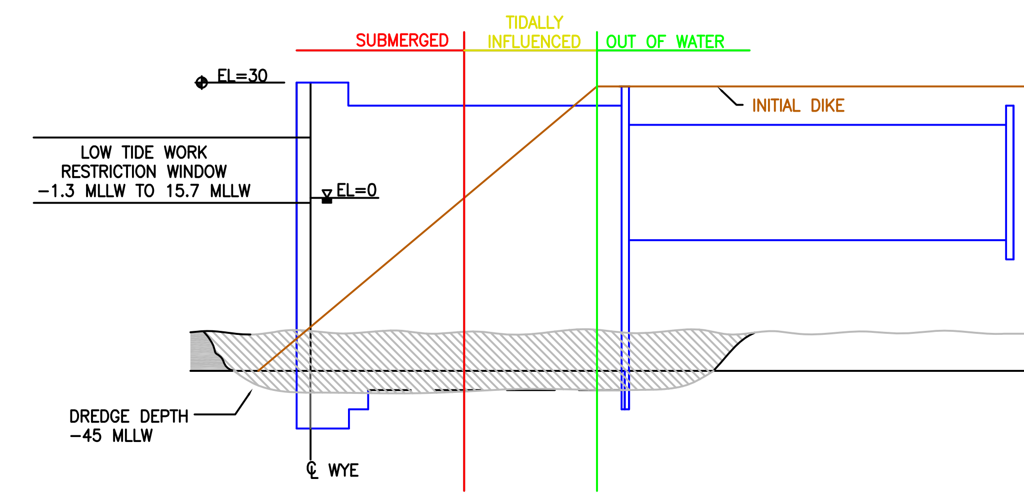


TYPICAL SECTION D-D

Represents the low tide window for September 12, 2013

September 12, 2013

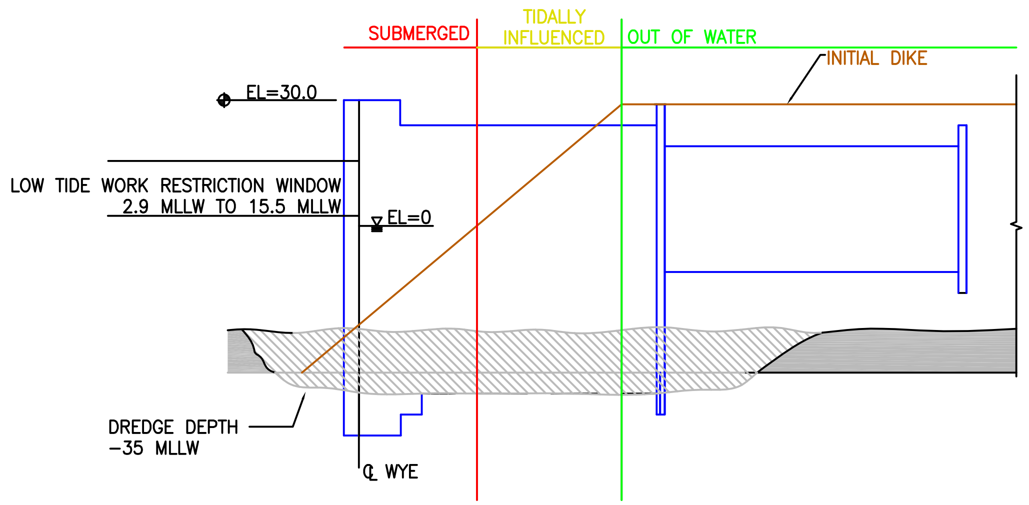




TYPICAL SECTION E-E

Represents the low tidal range for the entire month of September 2013

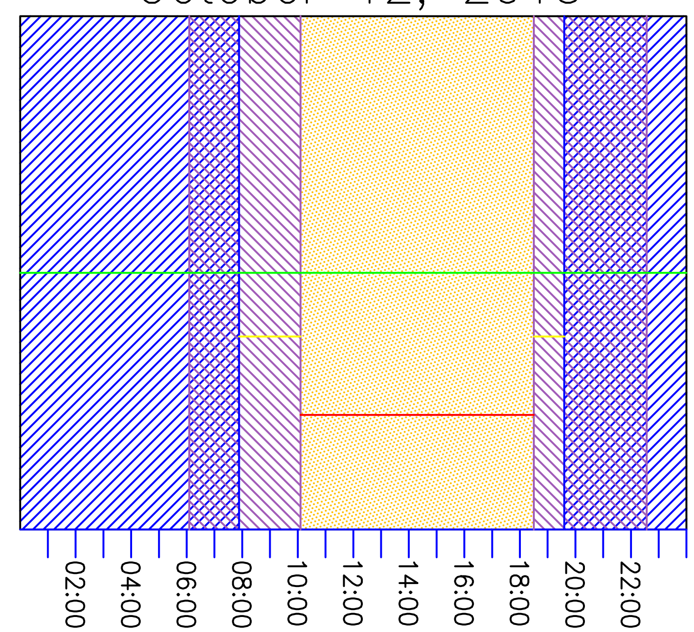
Date	Civil Twilight		2 Hours Before		Actual Low Tide		2 Hours After		2 Hours Before		Actual Low Tide		2 hours After		2 Hours Before		Actual Low Tide		2 Hours After		Unrestricted Work Window 1			Unrestricted Work Window 2			Unrestricted Work Window 3			Hourly Totals		
	Begin	End	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Start	End	Hours	Start	End	Hours	Start	End	Hours	Daily	Monthly	Yearly
9/1/2013	6:06	21:52					1:07	13.4	9:42	9.4	11:42	2.4	13:42	9.1	22:01	12.8					6:06	9:42	3.6	13:42	21:52	8.2				11.8	11.8	2028.8
9/2/2013	6:08	21:49	22:01	12.8	0:01	5.8	2:01	12.5	10:30	9.1	12:30	1.4	14:30	9.1	22:50	12.0					6:08	10:30	4.4	14:30	21:49	7.3				11.7	23.5	2040.5
9/3/2013	6:11	21:45	22:50	12.0	0:50	4.2	2:50	12.1	11:13	8.9	13:13	0.8	15:13	9.6	23:34	11.3					6:11	11:13	5.0	15:13	21:45	6.6				11.6	35.1	2052.1
9/4/2013	6:14	21:42	23:34	11.3	1:34	3.1	3:34	12.1	11:54	8.8	13:54	0.7	15:54	10.6							6:14	11:54	5.7	15:54	21:42	5.8				11.5	46.6	2063.6
9/5/2013	6:17	21:38	0:16	10.6	2:16	2.3	4:16	12.5	12:32	8.8	14:32	1.0	16:32	11.8							6:17	12:32	6.3	16:32	21:38	5.1				11.4	58.0	2075.0
9/6/2013	6:19	21:35	0:56	9.7	2:56	1.7	4:56	12.8	13:09	8.7	15:09	1.5	17:09	13.0							6:19	13:09	6.8	17:09	21:35	4.5				11.3	69.3	2086.3
9/7/2013	6:22	21:32	1:34	8.8	3:34	1.3	5:34	12.9	13:44	8.7	15:44	2.1	17:44	13.7							6:22	13:44	7.4	17:44	21:32	3.8				11.2	80.5	2097.5
9/8/2013	6:25	21:28	2:11	7.8	4:11	1.1	6:11	12.5	14:18	8.8	16:18	2.8	18:18	13.9							6:25	14:18	7.9	18:18	21:28	3.2				11.1	91.6	2108.5
9/9/2013	6:28	21:25	2:48	7.0	4:48	1.0	6:48	11.8	14:52	9.3	16:52	3.7	18:52	13.5							6:48	14:52	8.1	18:52	21:25	2.6				10.6	102.2	2119.2
9/10/2013	6:30	21:21	3:28	6.5	5:28	1.3	7:28	11.0	15:31	10.0	17:31	4.9	19:31	13.4							7:28	15:31	8.1	19:31	21:21	1.9				9.9	112.2	2129.1
9/11/2013	6:33	21:18	4:14	6.5	6:14	2.0	8:14	10.5	16:20	10.7	18:20	6.4	20:20	13.8							8:14	16:20	8.1	20:20	21:18	1.0				9.1	121.3	2138.2
9/12/2013	6:36	21:15	5:14	6.7	7:14	2.9	9:14	10.8	17:28	11.3	19:28	7.9	21:28	15.1							9:14	17:28	8.2							8.2	129.5	2146.5
9/13/2013	6:38	21:11	6:28	7.3	8:28	3.4	10:28	11.4	18:50	12.0	20:50	8.4	22:50	16.1							10:28	18:50	8.4							8.4	137.9	2154.8
9/14/2013	6:41	21:08	7:41	8.1	9:41	2.9	11:41	10.9	20:06	12.6	22:06	7.3	0:06	15.3							6:41	7:41	1.0	11:41	20:06	8.4				9.4	147.3	2164.3
9/15/2013	6:43	21:05					0:06	15.3	8:47	8.5	10:47	1.4	12:47	9.9	21:12	12.4	23:12	5.1	1:12	13.6	6:43	8:47	2.1	12:47	21:05	8.3				10.4	157.7	2174.7
9/16/2013	6:46	21:01					1:12	13.6	9:46	8.5	11:46	-0.1	13:46	9.3	22:10	11.6					6:46	9:46	3.0	13:46	21:01	7.3				10.3	168.0	2185.0
9/17/2013	6:49	20:58	22:10	11.6	0:10	2.7	2:10	12.1	10:38	8.6	12:38	-1.1	14:38	9.1	23:03	10.7					6:49	10:38	3.8	14:38	20:58	6.4				10.2	178.2	2195.2
9/18/2013	6:51	20:55	23:03	10.7	1:03	0.7	3:03	11.2	11:27	8.7	13:27	-1.3	15:27	9.8	23:52	10.0					6:51	11:27	4.6	15:27	20:55	5.5				10.1	188.3	2205.3
9/19/2013	6:54	20:51	23:52	10.0	1:52	-0.5	3:52	10.8	12:12	9.2	14:12	-0.8	16:12	10.9							6:54	12:12	5.3	16:12	20:51	4.7				10.0	198.3	2215.2
9/20/2013	6:56	20:48	0:38	9.5	2:38	-1.0	4:38	10.8	12:55	9.7	14:55	0.3	16:55	12.3							6:56	12:55	6.0	16:55	20:48	3.9				9.9	208.2	2225.1
9/21/2013	6:59	20:45	1:22	8.9	3:22	-0.9	5:22	11.2	13:35	10.2	15:35	1.8	17:35	13.6							6:59	13:35	6.6	17:35	20:45	3.2				9.8	218.0	2234.9
9/22/2013	7:02	20:42	2:03	8.5	4:03	-0.3	6:03	11.5	14:13	10.5	16:13	3.3	18:13	14.6							7:02	14:13	7.2	18:13	20:42	2.5				9.7	227.7	2244.6
9/23/2013	7:04	20:38	2:43	8.0	4:43	0.6	6:43	11.8	14:50	10.8	16:50	4.9	18:50	15.2							7:04	14:50	7.8	18:50	20:38	1.8				9.6	237.3	2254.2
9/24/2013	7:07	20:35	3:22	7.6	5:22	1.8	7:22	11.8	15:28	11.1	17:28	6.4	19:28	15.4							7:22	15:28	8.1	19:28	20:35	1.1				9.2	246.5	2263.5
9/25/2013	7:09	20:32	4:03	7.5	6:03	3.1	8:03	11.8	16:09	11.6	18:09	7.9	20:09	15.3							8:03	16:09	8.1	20:09	20:32	0.0				8.5	255.1	2272.0
9/26/2013	7:12	20:29	4:50	7.8	6:50	4.4	8:50	11.7	17:02	12.2	19:02	9.1	21:02	15.5							8:50	17:02	8.2							8.2	263.3	2280.2
9/27/2013	7:14	20:25	5:49	8.5	7:49	5.5	9:49	11.9	18:12	12.6	20:12	9.8	22:12	15.7							9:49	18:12	8.4							8.4	271.7	2288.6
9/28/2013	7:17	20:22	6:58	9.2	8:58	5.8	10:58	11.9	19:26	13.0	21:26	9.2	23:26	14.9							10:58	19:26	8.5							8.5	280.2	2297.1
9/29/2013	7:19	20:19	8:04	9.8	10:04	5.2	12:04	11.2	20:33	12.8	22:33	7.6	0:33	13.5							7:19	8:04	0.0	12:04	20:19	8.3				9.0	289.2	2306.1
9/30/2013	7:22	20:16					0:33	13.5	9:03	9.9	11:03	4.0	13:03	10.7	21:30	12.1	23:30	5.5	1:30	12.2	7:22	9:03	1.7	13:03	20:16	7.2				8.9	298.1	2315.1



TYPICAL SECTION D-D

Represents the low tide window for October 12, 2013

October 12, 2013



Civil Twilight window

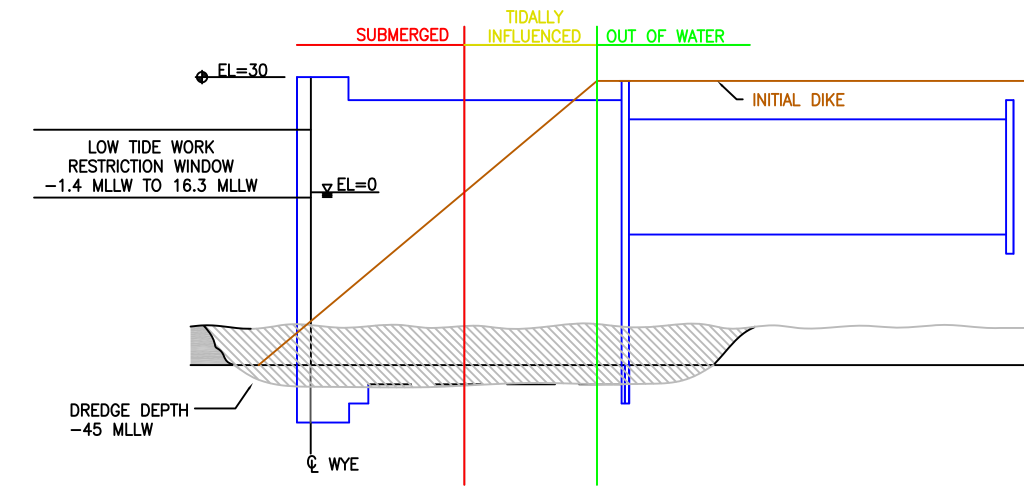
Low Tide window

Unrestricted Work window

Submerged Piledriving

Tidally Influenced Piledriving

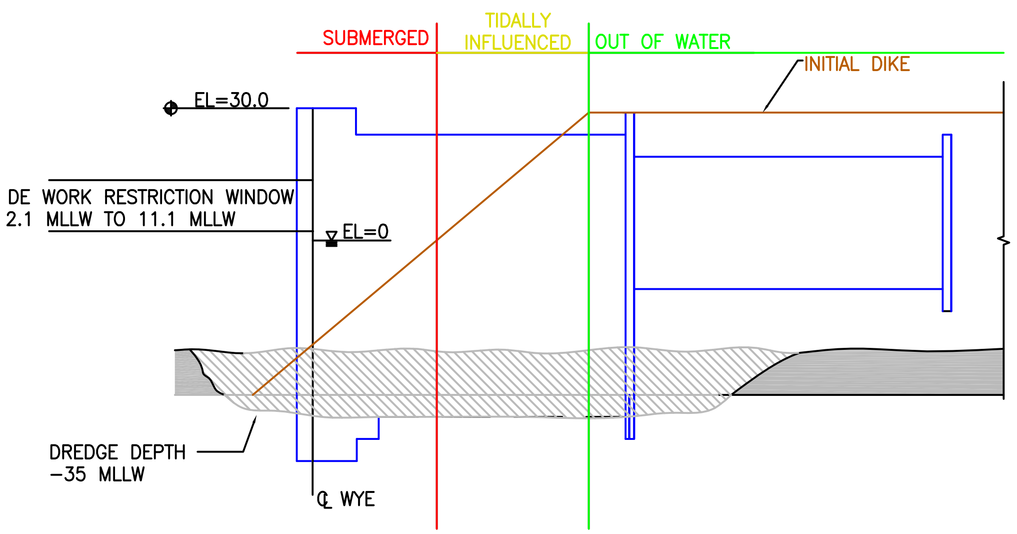
Out of Water Piledriving



TYPICAL SECTION E-E

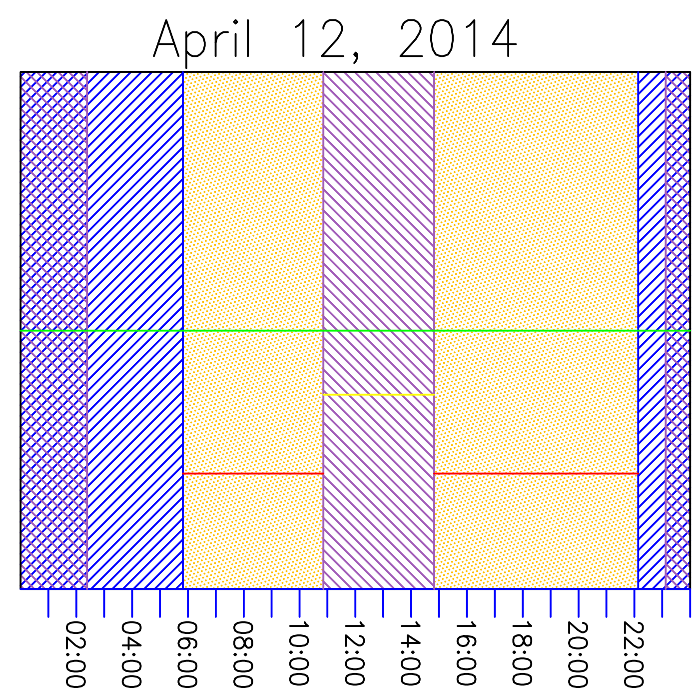
Represents the low tidal range for the entire month of October 2013

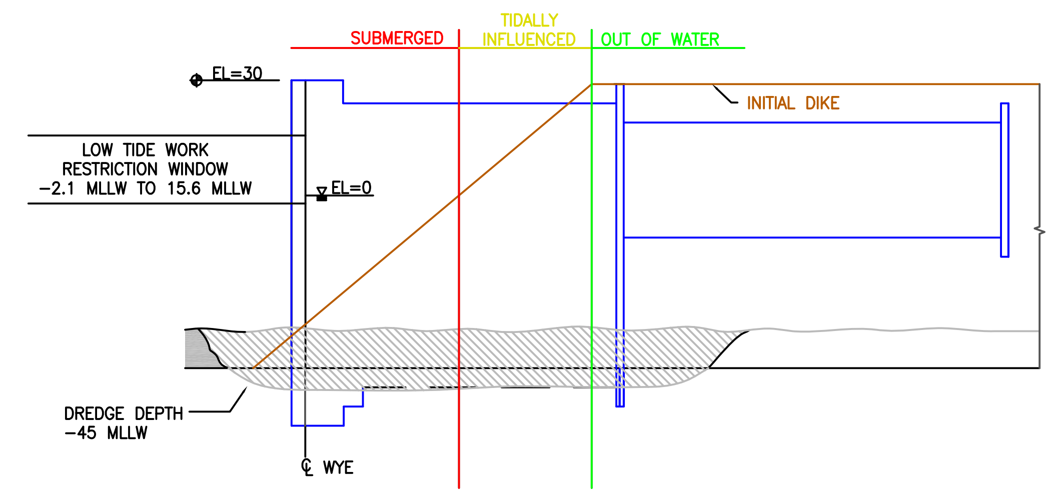
Date	Civil Twilight		2 Hours Before		Actual Low Tide		2 Hours After		2 Hours Before		Actual Low Tide		2 hours After		2 Hours Before		Actual Low Tide		2 Hours After		Unrestricted Work Window 1			Unrestricted Work Window 2			Unrestricted Work Window 3			Hourly Totals		
	Begin	End	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Start	End	Hours	Start	End	Hours	Start	End	Hours	Daily	Monthly	Yearly
10/1/2013	7:24	20:13					1:30	12.2	9:54	9.8	11:54	3.0	13:54	10.6	22:20	11.2					7:24	9:54	2.5	13:54	20:13	6.3				8.8	8.9	2323.9
10/2/2013	7:27	20:10	22:20	11.2	0:20	3.6	2:20	11.5	10:40	9.8	12:40	2.4	14:40	11.1	23:06	10.3					7:27	10:40	3.2	14:40	20:10	5.5				8.7	17.6	2332.7
10/3/2013	7:29	20:06	23:06	10.3	1:06	2.1	3:06	11.3	11:22	9.9	13:22	2.3	15:22	12.1	23:49	9.4					7:29	11:22	3.9	15:22	20:06	4.8				8.6	26.3	2341.3
10/4/2013	7:32	20:03	23:49	9.4	1:49	1.1	3:49	11.4	12:03	10.0	14:03	2.6	16:03	13.4							7:32	12:03	4.5	16:03	20:03	4.0				8.5	34.8	2349.9
10/5/2013	7:34	20:00	0:30	8.6	2:30	0.4	4:30	11.6	12:42	10.1	14:42	3.0	16:42	14.5							7:34	12:42	5.1	16:42	20:00	3.3				8.5	43.3	2358.3
10/6/2013	7:37	19:57	1:10	7.7	3:10	-0.1	5:10	11.8	13:20	10.2	15:20	3.6	17:20	15.3							7:37	13:20	5.7	17:20	19:57	2.6				8.4	51.6	2366.7
10/7/2013	7:39	19:54	1:50	6.7	3:50	-0.4	5:50	11.7	13:58	10.3	15:58	4.1	17:58	15.5							7:39	13:58	6.3	17:58	19:54	2.0				8.3	59.9	2375.0
10/8/2013	7:42	19:51	2:29	6.1	4:29	-0.4	6:29	11.2	14:38	10.4	16:38	4.7	18:38	15.5							7:42	14:38	6.9	18:38	19:51	1.2				8.2	68.1	2383.2
10/9/2013	7:44	19:48	3:12	5.7	5:12	-0.1	7:12	10.8	15:22	10.8	17:22	5.5	19:22	15.3							7:44	15:22	7.6	19:22	19:48	0.0				8.1	76.2	2391.3
10/10/2013	7:47	19:45	3:59	5.9	5:59	0.8	7:59	10.5	16:14	11.2	18:14	6.6	20:14	15.4							7:59	16:14	8.3							8.3	84.5	2399.5
10/11/2013	7:49	19:42	4:57	6.5	6:57	1.9	8:57	10.9	17:20	11.7	19:20	7.5	21:20	15.8							8:57	17:20	8.4							8.4	92.9	2407.9
10/12/2013	7:52	19:39	6:05	7.5	8:05	2.9	10:05	11.4	18:35	12.2	20:35	7.5	22:35	15.5							10:05	18:35	8.5							8.5	101.4	2416.5
10/13/2013	7:54	19:36	7:16	8.6	9:16	2.9	11:16	11.2	19:48	12.4	21:48	6.1	23:48	13.9							11:16	19:36	8.4							8.4	109.7	2424.8
10/14/2013	7:57	19:33	8:22	9.4	10:22	2.2	12:22	10.5	20:54	11.9	22:54	3.8	0:54	12.0							7:57	8:22	0.0	12:22	19:33	7.2				7.6	117.4	2432.4
10/15/2013	7:59	19:30					0:54	12.0	9:21	9.8	11:21	1.3	13:21	10.1	21:52	10.9	23:52	1.4	1:52	10.3	7:59	9:21	1.4	13:21	19:30	6.2				7.5	124.9	2440.0
10/16/2013	8:02	19:27					1:52	10.3	10:14	10.1	12:14	0.8	14:14	10.3	22:45	9.9					8:02	10:14	2.2	14:14	19:27	5.2				7.4	132.4	2447.4
10/17/2013	8:04	19:24	22:45	9.9	0:45	-0.3	2:45	9.5	11:03	10.5	13:03	0.9	15:03	11.1	23:33	9.3					8:04	11:03	3.0	15:03	19:24	4.4				7.4	139.7	2454.8
10/18/2013	8:07	19:22	23:33	9.3	1:33	-1.3	3:33	9.3	11:48	11.1	13:48	1.7	15:48	12.4							8:07	11:48	3.7	15:48	19:22	3.6				7.3	147.0	2462.1
10/19/2013	8:09	19:19	0:17	8.9	2:17	-1.4	4:17	9.6	12:31	11.6	14:31	2.9	16:31	13.9							8:09	12:31	4.4	16:31	19:19	2.8				7.2	154.2	2469.3
10/20/2013	8:12	19:16	1:00	8.5	3:00	-1.0	5:00	10.4	13:11	11.9	15:11	4.2	17:11	15.2							8:12	13:11	5.0	17:11	19:16	2.1				7.1	161.3	2476.4
10/21/2013	8:14	19:13	1:39	8.1	3:39	-0.3	5:39	11.0	13:49	12.0	15:49	5.4	17:49	16.1							8:14	13:49	5.6	17:49	19:13	1.4				7.0	168.3	2483.4
10/22/2013	8:17	19:10	2:17	7.6	4:17	0.6	6:17	11.5	14:25	11.9	16:25	6.3	18:25	16.3							8:17	14:25	6.1	18:25	19:10	0.0				6.9	175.3	2490.3
10/23/2013	8:19	19:08	2:53	7.1	4:53	1.6	6:53	11.6	15:01	11.8	17:01	7.1	19:01	16.1							8:19	15:01	6.7	19:01	19:08	0.0				6.8	182.1	2497.2
10/24/2013	8:22	19:05	3:29	6.9	5:29	2.6	7:29	11.4	15:40	11.8	17:40	7.8	19:40	15.5							8:22	15:40	7.3							7.3	189.4	2504.5
10/25/2013	8:24	19:02	4:08	7.2	6:08	3.6	8:08	11.0	16:28	12.0	18:28	8.5	20:28	15.2							8:24	16:28	8.1							8.1	197.5	2512.6
10/26/2013	8:27	18:59	4:59	7.7	6:59	4.8	8:59	11.3	17:31	12.0	19:31	9.0	21:31	15.2							8:59	17:31	8.5							8.5	206.1	2521.1
10/27/2013	8:29	18:57	6:04	8.4	8:04	5.8	10:04	12.1	18:44	12.1	20:44	8.7	22:44	14.8							10:04	18:44	8.7							8.7	214.7	2529.8
10/28/2013	8:31	18:54	7:13	9.3	9:13	6.0	11:13	12.4	19:53	11.9	21:53	7.3	23:53	13.6							11:13	18:54	7.7							7.7	222.4	2537.5
10/29/2013	8:34	18:52	8:17	10.0	10:17	5.5	12:17	12.4	20:54	11.3	22:54	5.3	0:54	12.2							12:17	18:52	6.6							6.6	229.0	2544.1
10/30/2013	8:36	18:49					0:54	12.2	9:12	10.5	11:12	4.8	13:12	12.4	21:48	10.3	23:48	3.3	1:48	11.2	8:36	9:12	0.0	13:12	18:49	5.6				6.2	235.3	2550.4
10/31/2013	8:39	18:46					1:48	11.2	10:02	10.7	12:02	4.3	14:02	12.8	22:36	9.3					8:39	10:02	1.4	14:02	18:46	4.8				6.1	241.4	2556.5



TYPICAL SECTION D-D

Represents the low tide window for April 12, 2014





TYPICAL SECTION E-E

Represents the low tidal range for the entire month of April 2014

Civil Twilight window

Low Tide window

Unrestricted Work window

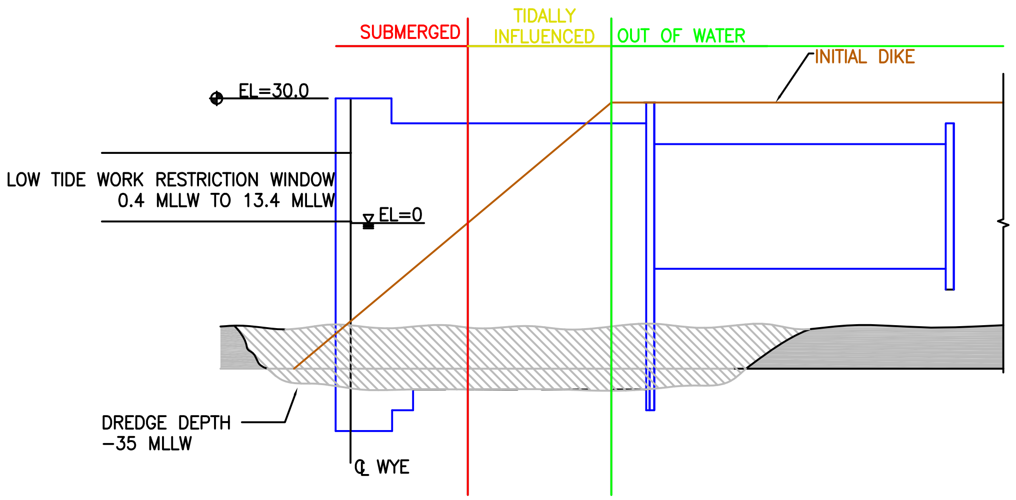
Submerged Piledriving

Tidally Influenced Piledriving

Out of Water Piledriving

Date	Civil Twilight		2 Hours Before		Actual Low Tide		2 Hours After		2 Hours Before		Actual Low Tide		2 hours After	
	Begin	End	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW
4/1/2014	6:36	21:30	1:18	9.8	3:18	0.5	5:18	12.9	13:47	8.0	15:47	-1.8	17:47	10.7
4/2/2014	6:32	21:33	1:59	10.2	3:59	1.9	5:59	13.9	14:28	7.6	16:28	-1.0	18:28	10.9
4/3/2014	6:29	21:35	2:39	10.4	4:39	3.4	6:39	14.8	15:09	7.3	17:09	0.2	19:09	11.2
4/4/2014	6:26	21:38	3:18	10.7	5:18	5.0	7:18	15.1	15:50	7.2	17:50	1.6	19:50	11.4
4/5/2014	6:22	21:41	3:59	11.1	5:59	6.5	7:59	15.1	16:34	7.4	18:34	3.2	20:34	11.4
4/6/2014	6:19	21:44	4:47	11.5	6:47	7.9	8:47	15.2	17:28	7.9	19:28	4.7	21:28	11.8
4/7/2014	6:15	21:47	5:49	12.0	7:49	8.9	9:49	15.3	18:31	8.8	20:31	5.6	22:31	11.9
4/8/2014	6:12	21:50	7:01	12.4	9:01	8.9	11:01	14.8	19:38	9.7	21:38	5.6	23:38	11.6
4/9/2014	6:09	21:52	8:09	12.5	10:09	7.7	12:09	13.4	20:40	10.1	22:40	4.8	0:40	11.1
4/10/2014	6:05	21:55					0:40	11.1	9:10	12.0	11:10	5.7	13:10	12.0
4/11/2014	6:02	21:58					1:34	10.8	10:03	11.1	12:03	3.7	14:03	11.0
4/12/2014	5:58	22:01	22:23	10.2	0:23	3.1	2:23	11.1	10:51	10.2	12:51	2.1	14:51	10.6
4/13/2014	5:55	22:04	23:07	10.3	1:07	2.8	3:07	11.8	11:35	9.4	13:35	1.0	15:35	10.6
4/14/2014	5:51	22:07	23:49	10.5	1:49	3.0	3:49	13.0	12:17	8.6	14:17	0.2	16:17	10.9
4/15/2014	5:48	22:10	0:29	10.6	2:29	3.4	4:29	14.2	12:57	7.8	14:57	-0.2	16:57	11.2
4/16/2014	5:44	22:13	1:07	10.7	3:07	3.8	5:07	15.1	13:36	6.9	15:36	-0.6	17:36	11.3
4/17/2014	5:41	22:16	1:45	10.6	3:45	4.1	5:45	15.6	14:15	6.0	16:15	-0.7	18:15	11.2
4/18/2014	5:37	22:19	2:23	10.5	4:23	4.5	6:23	15.5	14:54	5.4	16:54	-0.6	18:54	10.6
4/19/2014	5:34	22:22	3:04	10.5	5:04	4.9	7:04	15.3	15:36	5.3	17:36	-0.2	19:36	10.1
4/20/2014	5:30	22:25	3:49	10.7	5:49	5.6	7:49	14.8	16:25	5.6	18:25	0.8	20:25	10.0
4/21/2014	5:27	22:29	4:46	10.9	6:46	6.5	8:46	15.0	17:26	6.2	19:26	1.9	21:26	10.6
4/22/2014	5:23	22:32	5:55	11.2	7:55	6.9	9:55	15.2	18:35	7.2	20:35	2.6	22:35	11.2
4/23/2014	5:20	22:35	7:10	11.4	9:10	6.3	11:10	14.6	19:44	8.3	21:44	2.4	23:44	11.1
4/24/2014	5:16	22:38	8:19	11.3	10:19	4.5	12:19	12.8	20:48	9.0	22:48	1.8	0:48	10.7
4/25/2014	5:13	22:41					0:48	10.7	9:22	10.6	11:22	2.1	13:22	11.0
4/26/2014	5:09	22:45					1:45	10.6	10:18	9.7	12:18	0.0	14:18	9.7
4/27/2014	5:06	22:48	22:37	10.1	0:37	0.9	2:37	11.0	11:10	8.9	13:10	-1.5	15:10	9.1
4/28/2014	5:02	22:51	23:26	10.6	1:26	1.2	3:26	11.9	11:58	8.4	13:58	-2.1	15:58	9.1
4/29/2014	4:58	22:54	0:12	11.2	2:12	2.1	4:12	13.1	12:43	8.1	14:43	-2.1	16:43	9.5
4/30/2014	4:55	22:58	0:55	11.7	2:55	3.1	4:56	14.2	13:25	7.9	15:25	-1.5	17:25	10.0

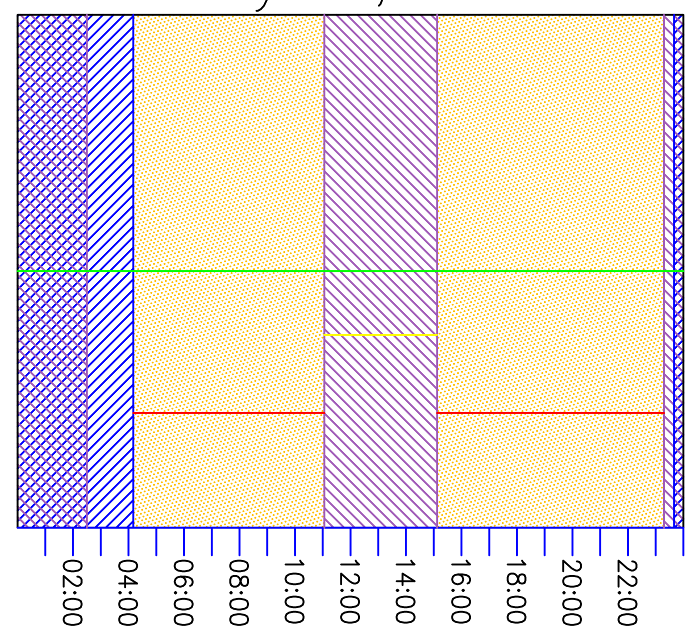
Date	2 Hours Before		Actual Low Tide		2 Hours After		Unrestricted Work Window 1			Unrestricted Work Window 2			Unrestricted Work Window 3			Hourly Totals		
	Time	MLLW	Time	MLLW	Time	MLLW	Start	End	Hours	Start	End	Hours	Start	End	Hours	Daily	Monthly	Yearly
4/1/2014							6:36	13:47	7.2	17:47	21:30	3.7				10.9	10.9	10.9
4/2/2014							6:32	14:28	7.9	18:28	21:33	3.1				11.0	22.0	22.0
4/3/2014							6:39	15:09	8.5	19:09	21:35	2.5				11.0	33.0	33.0
4/4/2014							7:18	15:50	8.5	19:50	21:38	1.8				10.4	43.3	43.3
4/5/2014							7:59	16:34	8.6	20:34	21:41	1.1				9.7	53.1	53.1
4/6/2014							8:47	17:28	8.7	21:28	21:44	0.0				9.0	62.0	62.0
4/7/2014							9:49	18:31	8.7							8.7	70.8	70.8
4/8/2014							6:12	7:01	0.0	11:01	19:38	8.6				9.4	80.2	80.2
4/9/2014							6:09	8:09	2.0	12:09	20:40	8.5				10.5	90.8	90.8
4/10/2014	21:34	10.2	23:34	3.8	1:34	10.8	6:05	9:10	3.1	13:10	21:34	8.4				11.5	102.3	102.3
4/11/2014	22:23	10.2					6:02	10:03	4.0	14:03	21:58	7.9				12.0	114.3	114.3
4/12/2014	23:07	10.3					5:58	10:51	4.9	14:51	22:01	7.2				12.1	126.3	126.3
4/13/2014	23:49	10.5					5:55	11:35	5.7	15:35	22:04	6.5				12.2	138.5	138.5
4/14/2014							5:51	12:17	6.4	16:17	22:07	5.9				12.3	150.8	150.8
4/15/2014							5:48	12:57	7.2	16:57	22:10	5.2				12.4	163.2	163.2
4/16/2014							5:44	13:36	7.9	17:36	22:13	4.6				12.5	175.7	175.7
4/17/2014							5:45	14:15	8.5	18:15	22:16	4.0				12.5	188.3	188.3
4/18/2014							6:23	14:54	8.5	18:54	22:19	3.4				12.0	200.3	200.3
4/19/2014							7:04	15:36	8.5	19:36	22:22	2.8				11.3	211.6	211.6
4/20/2014							7:49	16:25	8.6	20:25	22:25	2.0				10.6	222.2	222.2
4/21/2014							8:46	17:26	8.7	21:26	22:29	1.1				9.7	232.0	232.0
4/22/2014							5:23	5:55	0.0	9:55	18:35	8.7				9.2	241.2	241.2
4/23/2014							5:20	7:10	1.8	11:10	19:44	8.6				10.4	251.6	251.6
4/24/2014							5:16	8:19	3.1	12:19	20:48	8.5				11.5	263.2	263.2
4/25/2014	21:45	9.5	23:45	1.1	1:45	10.6	5:13	9:22	4.2	13:22	21:45	8.4				12.5	275.8	275.8
4/26/2014	22:37	10.1					5:09	10:18	5.2	14:18	22:37	8.3				13.5	289.3	289.3
4/27/2014	23:26	10.6					5:05	11:10	6.1	15:10	22:48	7.7				13.7	303.0	303.0
4/28/2014							5:02	11:58	6.9	15:58	22:51	6.9				13.8	316.9	316.9
4/29/2014							4:58	12:43	7.8	16:43	22:54	6.2				14.0	330.8	330.8
4/30/2014							4:55	13:25	8.5	17:25	22:58	5.6				14.1	344.9	344.9

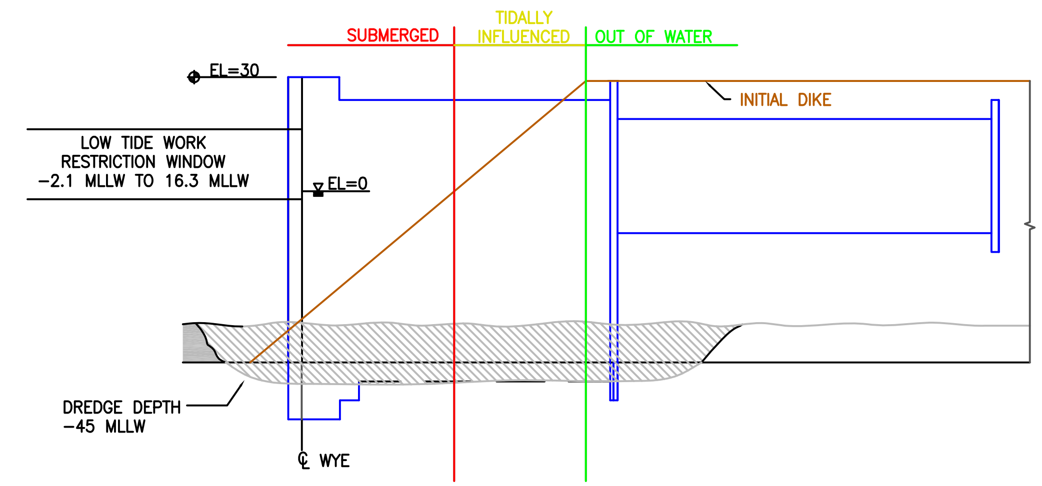


TYPICAL SECTION D-D

Represents the low tide window for May 12, 2014

May 12, 2014





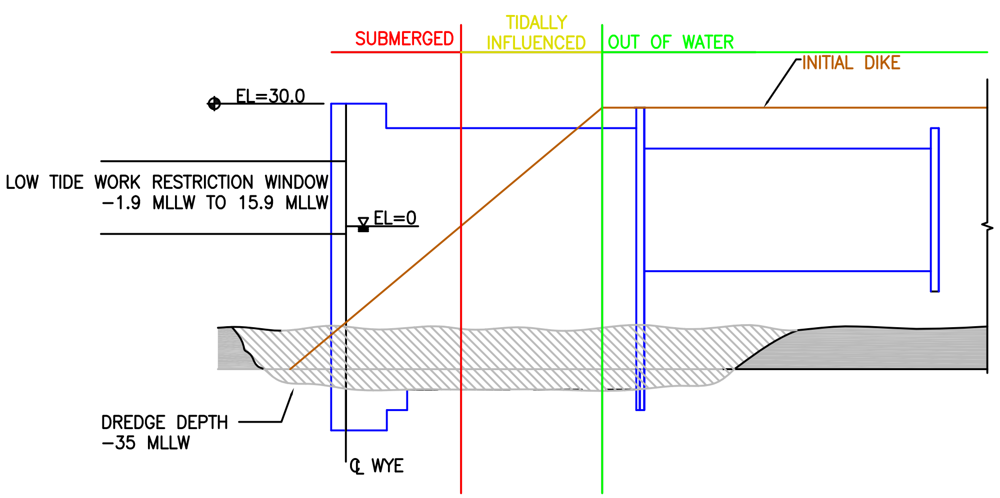
TYPICAL SECTION E-E

Represents the low tidal range for the entire month of May 2014

- Civil Twilight window
- Low Tide window
- Unrestricted Work window
- Submerged Piledriving
- Tidally Influenced Piledriving
- Out of Water Piledriving

Ship Creek smolt releases, during which time no piledriving may be performed, typically occur during the second week of May.

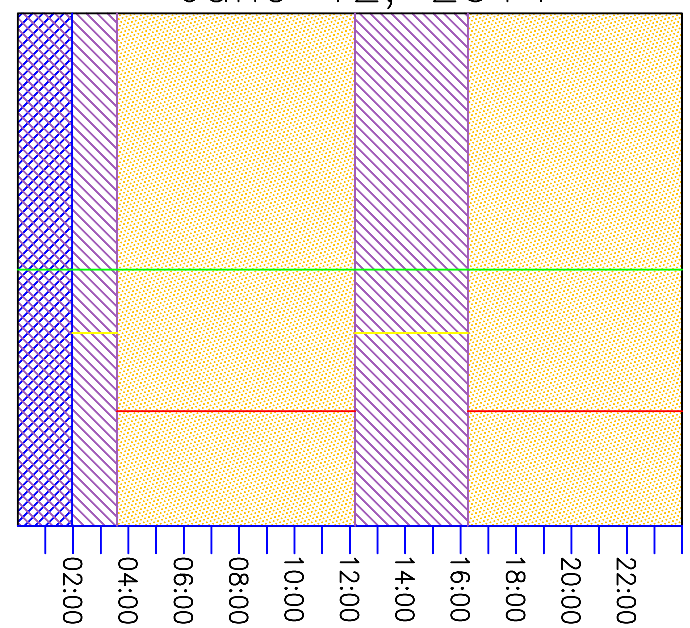
Date	Civil Twilight		2 Hours Before		Actual Low Tide		2 Hours After		2 Hours Before		Actual Low Tide		2 hours After		2 Hours Before		Actual Low Tide		2 Hours After		Unrestricted Work Window 1			Unrestricted Work Window 2			Unrestricted Work Window 3			Hourly Totals		
	Begin	End	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Start	End	Hours	Start	End	Hours	Start	End	Hours	Daily	Monthly	Yearly
5/1/2014	4:51	23:01	1:37	11.8	3:37	4.2	5:37	15.3	14:05	7.5	16:05	-0.7	18:05	10.6							5:37	14:05	8.5	18:05	23:01	5.0				13.4	13.4	358.4
5/2/2014	4:47	23:05	2:16	11.8	4:16	5.1	6:16	15.8	14:43	7.1	16:43	0.3	18:43	11.0							6:16	14:43	8.5	18:43	23:05	4.4				12.8	26.3	371.2
5/3/2014	4:44	23:08	2:54	11.6	4:54	5.9	6:54	15.8	15:21	6.7	17:21	1.4	19:21	11.2							6:54	15:21	8.5	19:21	23:08	3.8				12.3	38.6	383.5
5/4/2014	4:40	23:11	3:33	11.4	5:33	6.6	7:33	15.4	15:59	6.7	17:59	2.5	19:59	11.0							7:33	15:59	8.4	19:59	23:11	3.2				11.7	50.2	395.1
5/5/2014	4:37	23:15	4:17	11.3	6:17	7.3	8:17	14.9	16:43	7.1	18:43	3.7	20:43	11.0							8:17	16:43	8.4	20:43	23:15	2.6				11.0	61.2	406.1
5/6/2014	4:33	23:18	5:11	11.3	7:11	7.8	9:11	14.6	17:39	7.8	19:39	4.9	21:39	11.6							4:33	5:11	0.0	9:11	17:39	8.5	21:39	23:18	1.7	10.8	72.0	416.9
5/7/2014	4:29	23:22	6:18	11.2	8:18	7.8	10:18	14.3	18:45	8.6	20:45	5.6	22:45	12.2							4:29	6:18	1.8	10:18	18:45	8.5	22:45	23:22	0.0	10.9	83.0	427.9
5/8/2014	4:26	23:26	7:27	11.2	9:27	7.0	11:27	13.3	19:50	9.5	21:50	5.6	23:50	12.4							4:26	7:27	3.0	11:27	19:50	8.4				11.4	94.4	439.3
5/9/2014	4:22	23:29	8:31	10.8	10:31	5.3	12:31	11.9	20:49	10.2	22:49	5.2	0:49	12.4							4:22	8:31	4.2	12:31	20:49	8.3				12.5	106.9	451.8
5/10/2014	4:18	23:33					0:49	12.4	9:27	10.0	11:27	3.4	13:27	10.7	21:43	10.6	23:43	4.8	1:43	12.8	4:18	9:27	5.2	13:27	21:43	8.3				13.4	120.3	465.2
5/11/2014	4:14	23:37					1:43	12.8	10:18	9.2	12:18	1.7	14:18	10.0	22:31	11.1					4:14	10:18	6.1	14:18	22:31	8.2				14.3	134.6	479.6
5/12/2014	4:11	23:40	22:31	11.1	0:31	4.6	2:31	13.4	11:05	8.4	13:05	0.4	15:05	9.8	23:17	11.4					4:11	11:05	6.9	15:05	23:17	8.2				15.1	149.8	494.7
5/13/2014	4:07	23:44	23:17	11.4	1:17	4.7	3:17	14.3	11:50	7.6	13:50	-0.5	15:50	10.0							4:07	11:50	7.7	15:50	23:44	7.9				15.6	165.4	510.3
5/14/2014	4:03	23:48	0:01	11.6	2:01	4.8	4:01	15.3	12:33	6.8	14:33	-1.1	16:33	10.2							4:03	12:33	8.5	16:33	23:48	7.3				15.8	181.2	526.1
5/15/2014	3:59	23:52	0:44	11.7	2:44	4.9	4:44	16.0	13:15	6.1	15:15	-1.7	17:15	10.4							4:44	13:15	8.5	17:15	23:52	6.6				15.2	196.4	541.3
5/16/2014	3:55	23:55	1:26	11.5	3:26	4.8	5:26	16.3	13:56	5.5	15:56	-2.0	17:56	10.2							5:26	13:56	8.5	17:56	23:55	6.0				14.5	210.9	555.8
5/17/2014	3:52	23:59	2:09	11.2	4:09	4.6	6:09	16.2	14:38	5.0	16:38	-2.1	18:38	10.0							6:09	14:38	8.5	18:38	23:59	5.4				13.9	224.8	569.7
5/18/2014	3:48	0:03	2:54	10.8	4:54	4.4	6:54	15.8	15:23	4.8	17:23	-1.7	19:23	9.9							6:54	15:23	8.5	19:23	23:59	4.6				13.1	237.9	582.8
5/19/2014	3:44	0:07	3:42	10.6	5:42	4.5	7:42	15.2	16:11	5.2	18:11	-0.8	20:11	9.9							7:42	16:11	8.5	20:11	23:59	3.8				12.3	250.2	595.1
5/20/2014	3:40	0:11	4:37	10.5	6:37	4.7	8:37	14.7	17:07	5.9	19:07	0.5	21:07	10.4							3:40	4:37	1.0	8:37	17:07	8.5	21:07	23:59	2.9	12.3	262.6	607.5
5/21/2014	3:36	0:15	5:41	10.4	7:41	4.9	9:41	14.1	18:09	7.1	20:09	1.7	22:09	11.0							3:36	5:41	2.1	9:41	18:09	8.5	22:09	23:59	1.9	12.4	275.0	619.9
5/22/2014	3:32	0:20	6:49	10.5	8:49	4.3	10:49	12.9	19:15	8.5	21:15	2.5	23:15	11.4							3:32	6:49	3.3	10:49	19:15	8.4	23:15	23:59	0.0	12.5	287.5	632.4
5/23/2014	3:28	0:24	7:57	10.3	9:57	2.9	11:57	11.2	20:19	9.7	22:19	2.8	0:19	11.5							3:28	7:57	4.5	11:57	20:19	8.4				12.9	300.4	645.3
5/24/2014	3:24	0:28					0:19	11.5	9:00	9.8	11:00	1.1	13:00	9.5	21:18	10.6	23:18	2.8	1:18	11.6	3:24	9:00	5.6	13:00	21:18	8.3				13.9	314.3	659.2
5/25/2014	3:20	0:33					1:18	11.6	9:58	8.9	11:58	-0.6	13:58	8.4	22:13	11.3					3:20	9:58	6.6	13:58	22:13	8.3				14.9	329.2	674.1
5/26/2014	3:15	0:37	22:13	11.3	0:13	2.9	2:13	12.1	10:50	8.4	12:50	-1.7	14:50	7.9	23:03	12.0					3:15	10:50	7.6	14:50	23:03	8.2				15.8	345.1	690.0
5/27/2014	3:11	0:41	23:03	12.0	1:03	3.4	3:03	12.8	11:37	8.2	13:37	-2.0	15:37	8.0	23:50	12.5					3:11	11:37	8.4	15:37	23:50	8.2				16.7	361.7	706.7
5/28/2014	3:07	0:46	23:50	12.5	1:50	4.1	3:50	13.8	12:22	8.0	14:22	-1.7	16:22	8.7							3:50	12:22	8.5	16:22	23:59	7.6				16.2	377.9	722.8
5/29/2014	3:02	0:51	0:34	12.9	2:34	4.9	4:34	14.8	13:04	7.8	15:04	-1.1	17:04	9.6							4:34	13:04	8.5	17:04	23:59	6.9				15.4	393.4	738.3
5/30/2014	2:57	0:56	1:16	12.8	3:16	5.5	5:16	15.6	13:43	7.5	15:43	-0.4	17:43	10.4							5:16	13:43	8.5	17:43	23:59	6.3				14.7	408.1	753.0
5/31/2014	2:53	1:01	1:55	12.4	3:55	5.8	5:56	16.0	14:19	7.0	16:19	0.3	18:19	10.8							5:55	14:19	8.4	18:19	23:59	5.7				14.1	422.2	767.1



TYPICAL SECTION D-D

Represents the low tide window for June 12, 2014

June 12, 2014



Civil Twilight window

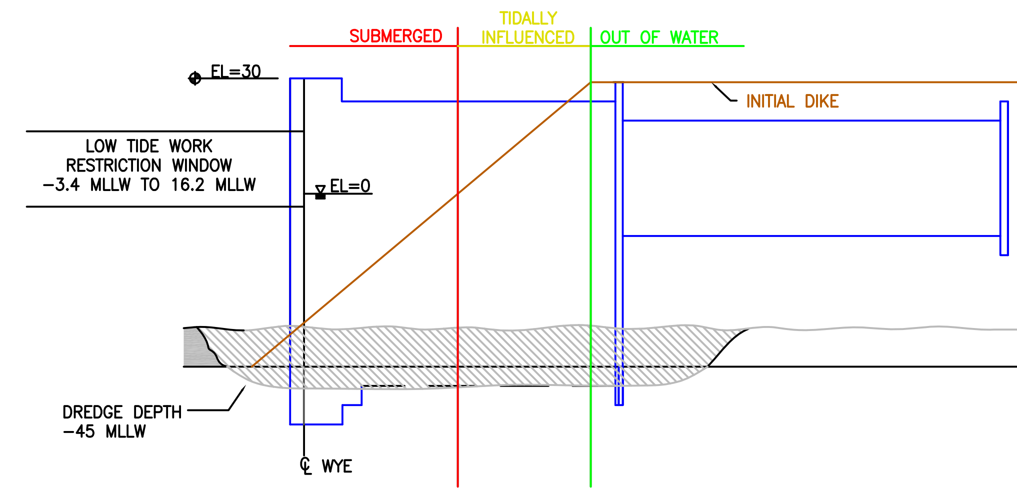
Low Tide window

Unrestricted Work window

Submerged Piledriving

Tidally Influenced Piledriving

Out of Water Piledriving

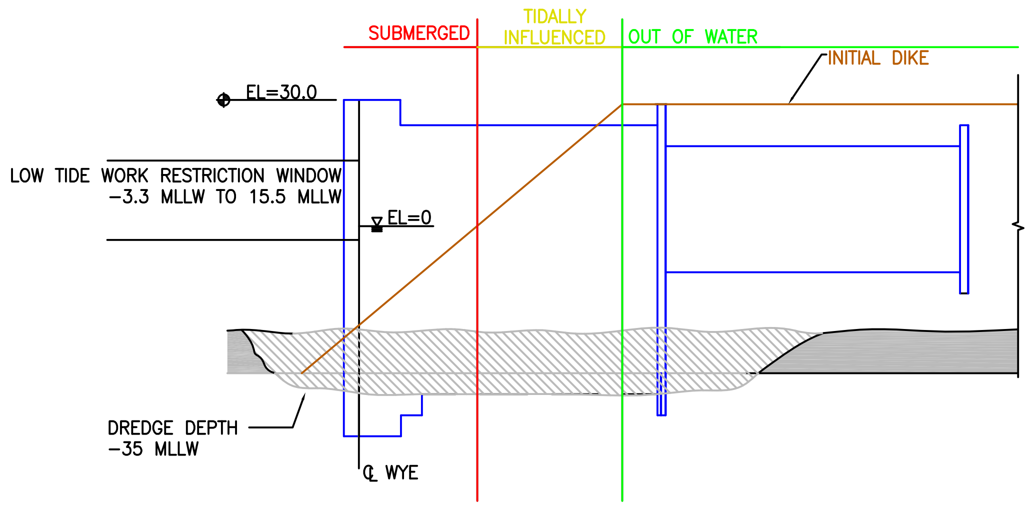


TYPICAL SECTION E-E

Represents the low tidal range for the entire month of June 2014

Ship Creek smolt releases, during which time no piledriving may be performed, typically occur during the third week of June.

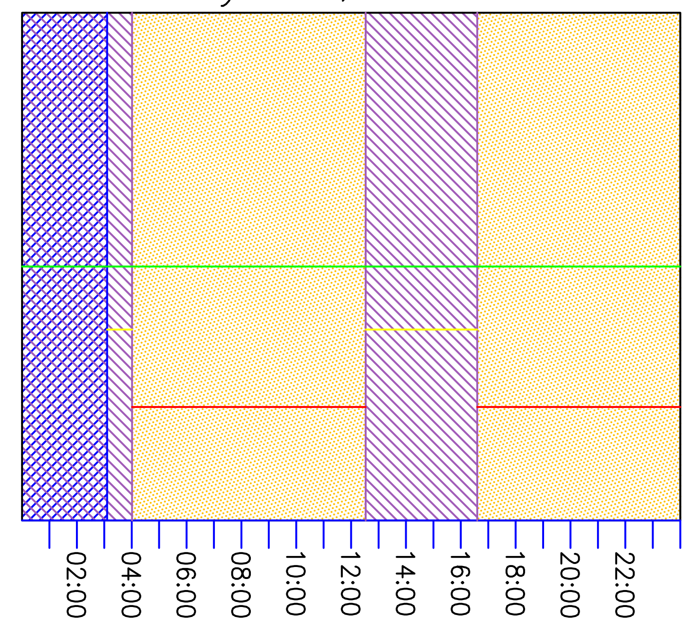
Date	Civil Twilight		2 Hours Before		Actual Low Tide		2 Hours After		2 Hours Before		Actual Low Tide		2 hours After		2 Hours Before		Actual Low Tide		2 Hours After		Unrestricted Work Window 1			Unrestricted Work Window 2			Unrestricted Work Window 3			Hourly Totals		
	Begin	End	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Start	End	Hours	Start	End	Hours	Start	End	Hours	Daily	Monthly	Yearly
6/1/2014	2:48	1:06	2:33	11.8	4:33	6.0	6:33	15.9	14:54	6.5	16:54	1.0	18:54	11.0							6:33	14:54	8.4	18:54	23:59	5.1				13.5	13.5	780.6
6/2/2014	2:42	1:12	3:11	11.1	5:11	6.0	7:11	15.3	15:29	6.2	17:29	1.6	19:29	10.8							2:42	3:11	0.0	7:11	15:29	8.3	19:29	23:59	4.5	13.3	26.8	793.9
6/3/2014	2:36	1:18	3:51	10.6	5:51	6.0	7:51	14.4	16:05	6.6	18:05	2.5	20:05	10.3							2:36	3:51	1.3	7:51	16:05	8.2	20:05	23:59	3.9	13.4	40.2	807.4
6/4/2014	2:30	1:25	4:37	10.3	6:37	6.2	8:37	13.6	16:49	7.3	18:49	3.7	20:49	10.4							2:30	4:37	2.1	8:37	16:49	8.2	20:49	23:59	3.2	13.5	53.8	820.9
6/5/2014	2:22	1:33	5:35	9.9	7:35	6.3	9:35	13.2	17:46	8.1	19:46	5.0	21:46	11.4							2:22	5:35	3.2	9:35	17:46	8.2	21:46	23:59	2.2	13.6	67.4	834.6
6/6/2014	2:12	1:44	6:42	9.7	8:42	6.0	10:42	12.8	18:54	9.0	20:54	6.0	22:54	12.7							2:12	6:42	4.5	10:42	18:54	8.2	22:54	23:59	1.1	13.8	81.3	848.4
6/7/2014	1:58	1:58	7:48	9.5	9:48	5.0	11:48	11.9	20:00	10.0	22:00	6.4	0:00	13.6							1:58	7:48	5.8	11:48	20:00	8.2				14.0	95.3	862.5
6/8/2014	1:58	1:58					0:00	13.6	8:50	8.9	10:50	3.5	12:50	10.9	21:00	10.9	23:00	6.4	1:00	14.1	1:58	8:50	6.9	12:50	21:00	8.2				15.0	110.4	877.5
6/9/2014	1:58	1:58					1:00	14.1	9:44	8.3	11:44	1.8	13:44	9.9	21:55	11.5	23:55	6.2	1:55	14.7	1:58	9:44	7.8	13:44	21:55	8.2				16.0	126.4	893.5
6/10/2014	1:59	1:59					1:55	14.7	10:35	7.5	12:35	0.3	14:35	9.5	22:46	11.9					1:59	10:35	8.6	14:35	22:46	8.2				16.8	143.2	910.3
6/11/2014	1:59	1:59	22:46	11.9	0:46	6.0	2:46	15.2	11:23	6.8	13:23	-0.9	15:23	9.3	23:35	12.1					2:46	11:23	8.6	15:23	23:35	8.2				16.8	160.1	927.2
6/12/2014	1:59	1:59	23:35	12.1	1:35	5.6	3:35	15.9	12:09	6.1	14:09	-1.9	16:09	9.4							3:35	12:09	8.6	16:09	23:59	7.9				16.4	176.5	943.6
6/13/2014	1:59	1:59	0:22	12.0	2:22	5.1	4:22	16.2	12:54	5.5	14:54	-2.7	16:54	9.5							4:22	12:54	8.5	16:54	23:59	7.1				15.6	192.1	959.3
6/14/2014	1:59	1:59	1:08	11.7	3:08	4.4	5:08	16.2	13:38	5.1	15:38	-3.2	17:38	9.5							5:08	13:38	8.5	17:38	23:59	6.4				14.9	207.0	974.2
6/15/2014	2:00	2:00	1:54	11.2	3:54	3.6	5:54	15.8	14:21	4.9	16:21	-3.4	18:21	9.4							5:54	14:21	8.5	18:21	23:59	5.7				14.1	221.1	988.3
6/16/2014	2:00	2:00	2:41	10.6	4:41	2.9	6:41	15.2	15:06	4.8	17:06	-3.0	19:06	9.5							2:00	2:41	0.0	6:41	15:06	8.4	19:06	23:59	4.9	14.0	235.2	1002.3
6/17/2014	2:00	2:00	3:29	10.1	5:29	2.5	7:29	14.2	15:53	5.2	17:53	-2.0	19:53	9.8							2:00	3:29	1.5	7:29	15:53	8.4	19:53	23:59	4.1	14.0	249.2	1016.3
6/18/2014	2:00	2:00	4:22	9.6	6:22	2.5	8:22	13.4	16:44	6.1	18:44	-0.4	20:44	10.4							2:00	4:22	2.4	8:22	16:44	8.4	20:44	23:59	3.3	14.0	263.2	1030.4
6/19/2014	2:00	2:00	5:21	9.5	7:21	2.7	9:21	12.6	17:41	7.4	19:41	1.5	21:41	11.2							2:00	5:21	3.4	9:21	17:41	8.3	21:41	23:59	2.3	14.0	277.3	1044.4
6/20/2014	2:01	2:01	6:26	9.4	8:26	2.7	10:26	11.6	18:44	8.9	20:44	3.1	22:44	12.0							2:01	6:26	4.4	10:26	18:44	8.3	22:44	23:59	1.3	14.0	291.3	1058.4
6/21/2014	2:01	2:01	7:32	9.5	9:32	2.1	11:32	10.1	19:49	10.4	21:49	4.2	23:49	12.4							2:01	7:32	5.5	11:32	19:49	8.3	23:49	23:59	0.0	14.0	305.3	1072.4
6/22/2014	2:01	2:01	8:36	9.3	10:36	0.9	12:36	8.7	20:51	11.6	22:51	4.6	0:51	12.6							2:01	8:36	6.6	12:36	20:51	8.3				14.8	320.2	1087.3
6/23/2014	2:01	2:01					0:51	12.6	9:35	8.8	11:35	-0.3	13:35	7.6	21:48	12.4	23:48	4.8	1:48	12.7	2:01	9:35	7.6	13:35	21:48	8.2				15.8	336.0	1103.1
6/24/2014	2:02	2:02					1:48	12.7	10:28	8.5	12:28	-1.1	14:28	7.2	22:41	12.9					2:02	10:28	8.4	14:28	22:41	8.2				16.7	352.7	1119.8
6/25/2014	2:02	2:02	22:41	12.9	0:41	4.9	2:41	13.1	11:17	8.2	13:17	-1.4	15:17	7.5	23:29	13.2					2:41	11:17	8.6	15:17	23:29	8.2				16.8	369.5	1136.6
6/26/2014	2:02	2:02	23:29	13.2	1:29	5.2	3:29	13.7	12:01	8.2	14:01	-1.2	16:01	8.2							3:29	12:01	8.5	16:01	23:59	8.0				16.5	386.0	1153.2
6/27/2014	2:02	2:02	0:13	13.3	2:13	5.4	4:13	14.3	12:42	8.0	14:42	-0.7	16:42	9.2							4:13	12:42	8.5	16:42	23:59	7.3				15.8	401.8	1169.0
6/28/2014	2:02	2:02	0:55	13.0	2:55	5.5	4:55	15.0	13:20	7.7	15:20	-0.2	17:20	10.1							4:55	13:20	8.4	17:20	23:59	6.7				15.1	416.9	1184.1
6/29/2014	2:03	2:03	1:34	12.4	3:34	5.4	5:34	15.3	13:56	7.1	15:56	0.2	17:56	10.8							5:34	13:56	8.4	17:56	23:59	6.1				14.4	431.4	1198.5
6/30/2014	2:03	2:03	2:12	11.4	4:12	5.1	6:12	15.2	14:29	6.6	16:29	0.6	18:29	11.0							2:03	2:12	0.0	6:12	14:29	8.3	18:29	23:59	5.5	14.0	445.4	1212.5

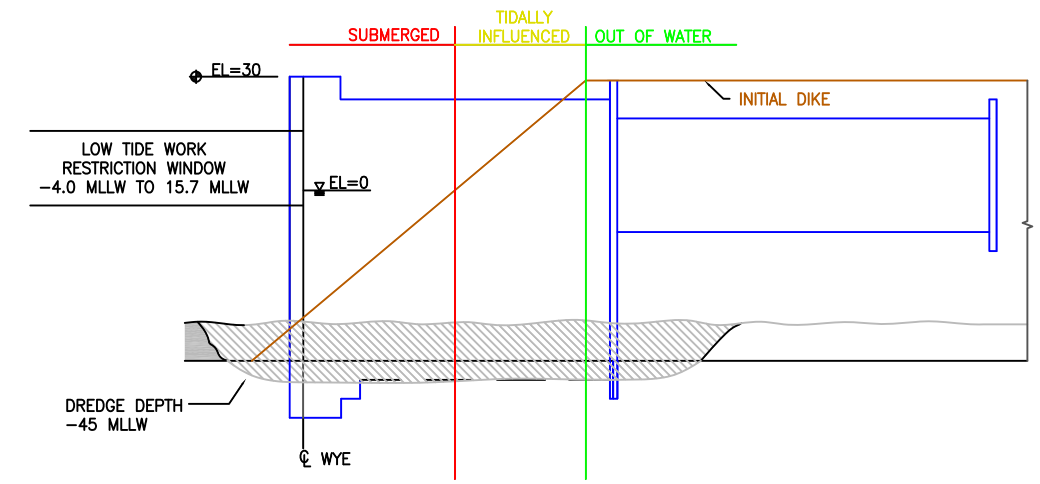


TYPICAL SECTION D-D

Represents the low tide window for July 12, 2014

July 12, 2014





TYPICAL SECTION E-E

Represents the low tidal range for the entire month of July 2014

Civil Twilight window

Low Tide window

Unrestricted Work window

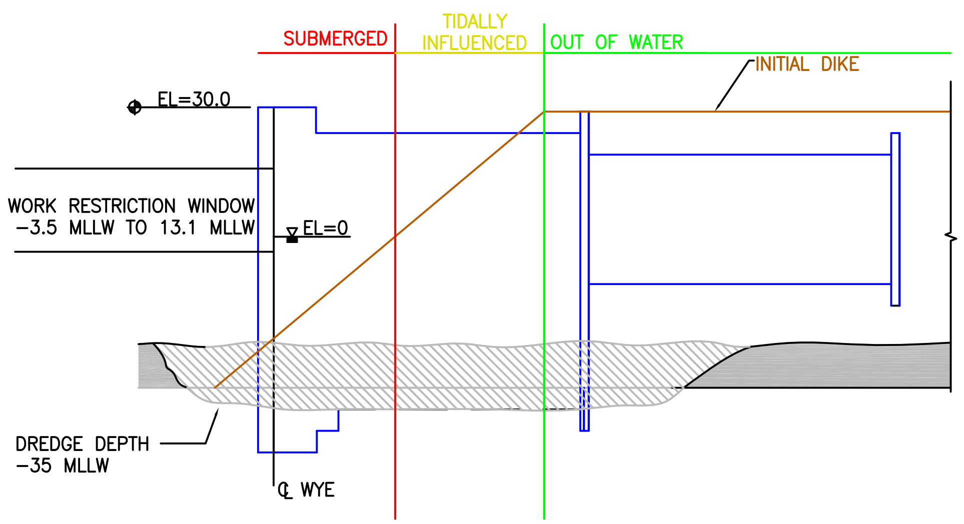
Submerged Piledriving

Tidally Influenced Piledriving

Out of Water Piledriving

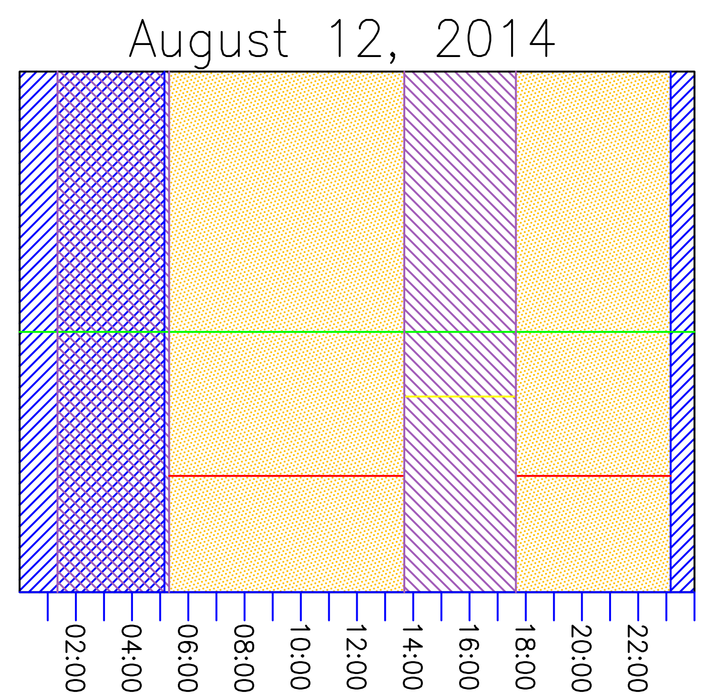
Date	Civil Twilight		2 Hours Before		Actual Low Tide		2 Hours After		2 Hours Before		Actual Low Tide		2 hours After	
	Begin	End	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW
7/1/2014	2:03	2:03	2:48	10.5	4:48	4.7	6:48	14.5	15:01	6.3	17:01	1.1	19:01	10.8
7/2/2014	2:03	2:03	3:26	9.6	5:26	4.5	7:26	13.7	15:33	6.6	17:33	1.8	19:33	10.3
7/3/2014	2:03	2:03	4:06	9.2	6:06	4.5	8:06	12.7	16:08	7.5	18:08	2.9	20:08	9.9
7/4/2014	2:04	2:04	4:54	8.8	6:54	4.8	8:54	12.0	16:52	8.6	18:52	4.5	20:52	10.3
7/5/2014	2:16	1:51	5:54	8.5	7:54	5.1	9:54	11.9	17:53	9.4	19:53	6.2	21:53	11.9
7/6/2014	2:28	1:40	7:03	8.3	9:03	4.8	11:03	11.8	19:08	10.2	21:08	7.4	23:08	14.0
7/7/2014	2:36	1:32	8:10	8.1	10:10	3.8	12:10	11.1	20:19	11.1	22:19	7.8	0:19	15.2
7/8/2014	2:43	1:26					0:19	15.2	9:11	7.7	11:11	2.3	13:11	10.2
7/9/2014	2:49	1:20					1:21	15.5	10:06	7.1	12:06	0.6	14:06	9.5
7/10/2014	2:55	1:14	22:18	12.2	0:18	6.6	2:18	15.6	10:57	6.5	12:57	-1.0	14:57	9.0
7/11/2014	3:00	1:09	23:11	12.1	1:11	5.6	3:11	15.7	11:45	6.0	13:45	-2.3	15:45	8.8
7/12/2014	3:05	1:05	0:01	11.8	2:01	4.4	4:01	15.5	12:32	5.5	14:32	-3.3	16:32	8.9
7/13/2014	3:10	1:00	0:50	11.2	2:50	3.1	4:50	15.3	13:17	5.3	15:17	-3.9	17:17	9.0
7/14/2014	3:15	0:55	1:37	10.6	3:37	1.9	5:37	14.6	14:02	5.2	16:02	-4.0	18:02	9.4
7/15/2014	3:19	0:51	2:24	9.8	4:24	0.9	6:24	13.8	14:46	5.4	16:46	-3.5	18:46	9.7
7/16/2014	3:24	0:47	3:12	9.1	5:12	0.5	7:12	13.0	15:31	5.9	17:31	-2.2	19:31	10.3
7/17/2014	3:28	0:42	4:03	8.6	6:03	0.6	8:03	12.3	16:19	6.9	18:19	-0.2	20:19	11.1
7/18/2014	3:32	0:38	4:57	8.6	6:57	1.3	8:57	11.5	17:12	8.2	19:12	2.2	21:12	12.1
7/19/2014	3:37	0:34	5:58	8.8	7:58	2.0	9:58	10.9	18:12	9.8	20:12	4.4	22:12	13.0
7/20/2014	3:41	0:30	7:04	9.1	9:04	2.2	11:04	10.0	19:18	11.4	21:18	5.9	23:18	13.6
7/21/2014	3:45	0:26	8:09	9.3	10:09	1.8	12:09	8.8	20:23	12.6	22:23	6.5	0:23	13.4
7/22/2014	3:49	0:22					0:23	13.4	9:10	9.2	11:10	0.9	13:10	7.8
7/23/2014	3:53	0:18					1:24	13.0	10:05	8.9	12:05	0.1	14:05	7.4
7/24/2014	3:57	0:14	22:18	13.5	0:18	5.8	2:18	12.8	10:54	8.7	12:54	-0.4	14:54	7.6
7/25/2014	4:01	0:10	23:07	13.3	1:07	5.3	3:07	12.9	11:38	8.5	13:38	-0.5	15:38	8.2
7/26/2014	4:05	0:06	23:52	13.0	1:52	4.9	3:52	13.3	12:18	8.4	14:18	-0.3	16:18	9.1
7/27/2014	4:09	0:03	0:33	12.5	2:33	4.6	4:33	13.7	12:55	8.2	14:55	0.1	16:55	10.1
7/28/2014	4:12	23:59	1:12	11.8	3:12	4.2	5:12	14.1	13:31	7.7	15:31	0.4	17:31	11.1
7/29/2014	4:16	23:55	1:50	10.7	3:50	3.7	5:50	14.2	14:04	7.2	16:04	0.8	18:04	11.6
7/30/2014	4:20	23:51	2:26	9.6	4:26	3.4	6:26	13.9	14:35	7.0	16:35	1.3	18:35	11.6
7/31/2014	4:23	23:47	3:01	8.8	5:01	3.1	7:01	13.0	15:05	7.3	17:05	2.0	19:05	11.2

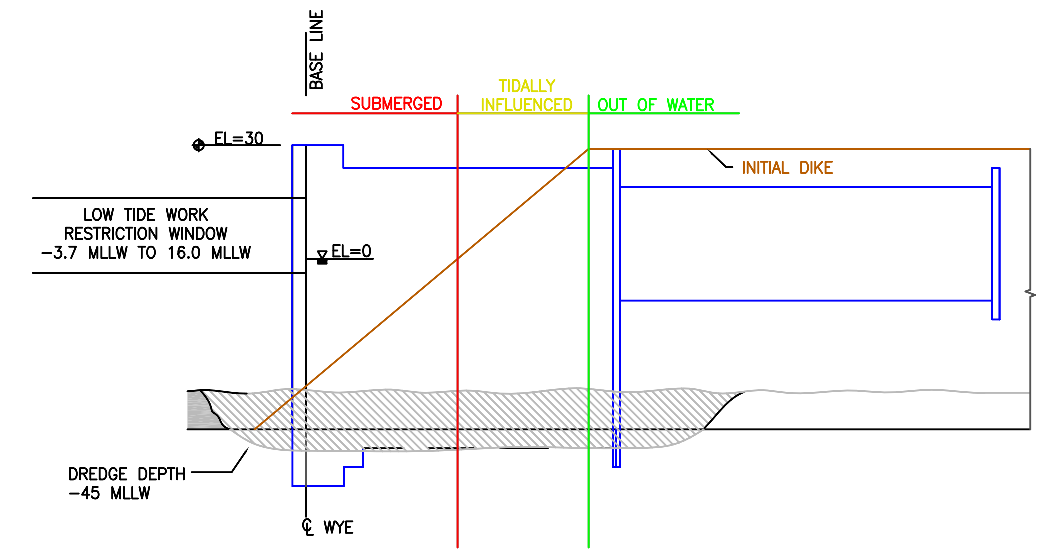
Date	2 Hours Before		Actual Low Tide		2 Hours After		Unrestricted Work Window 1			Unrestricted Work Window 2			Unrestricted Work Window 3			Hourly Totals		
	Time	MLLW	Time	MLLW	Time	MLLW	Start	End	Hours	Start	End	Hours	Start	End	Hours	Daily	Monthly	Yearly
7/1/2014							2:03	2:48	0.0	6:48	15:01	8.2	19:01	23:59	5.0	14.0	14.0	1226.5
7/2/2014							2:03	3:26	1.4	7:26	15:33	8.1	19:33	23:59	4.5	14.0	28.0	1240.5
7/3/2014							2:03	4:06	2.1	8:06	16:08	8.0	20:08	23:59	3.9	14.0	42.0	1254.5
7/4/2014							2:04	4:54	2.8	8:54	16:52	8.0	20:52	23:59	3.1	13.9	55.9	1268.4
7/5/2014							2:16	5:54	3.6	9:54	17:53	8.0	21:53	23:59	2.1	13.7	69.7	1282.2
7/6/2014							2:28	7:03	4.6	11:03	19:08	8.1	23:08	23:59	0.0	13.5	83.3	1295.8
7/7/2014							2:36	8:10	5.6	12:10	20:19	8.2				13.7	97.0	1309.5
7/8/2014	21:21	11.9	23:21	7.4	1:21	15.5	2:43	9:11	6.5	13:11	21:21	8.2				14.6	111.7	1324.2
7/9/2014	22:18	12.2					2:49	10:06	7.3	14:06	22:18	8.2				15.5	127.2	1339.7
7/10/2014	23:11	12.1					2:56	10:57	8.0	14:57	23:11	8.2				16.3	143.5	1356.0
7/11/2014							3:11	11:45	8.6	15:45	23:59	8.3				16.8	160.3	1372.8
7/12/2014							4:01	12:32	8.5	16:32	23:59	7.5				16.0	176.3	1388.8
7/13/2014							4:50	13:17	8.5	17:17	23:59	6.7				15.2	191.5	1404.0
7/14/2014							5:37	14:02	8.4	18:02	23:59	6.0				14.4	205.9	1418.4
7/15/2014							6:24	14:46	8.4	18:46	23:59	5.2				13.6	219.5	1432.0
7/16/2014							7:12	15:31	8.3	19:31	23:59	4.5				12.8	232.3	1444.8
7/17/2014							3:28	4:03	0.0	8:03	16:19	8.3	20:19	23:59	3.7	12.5	244.9	1457.4
7/18/2014							3:32	4:57	1.4	8:57	17:12	8.3	21:12	23:59	2.8	12.5	257.4	1469.9
7/19/2014							3:37	5:58	2.4	9:58	18:12	8.2	22:12	23:59	1.8	12.4	269.8	1482.3
7/20/2014							3:41	7:04	3.4	11:04	19:18	8.2	23:18	23:59	0.0	12.3	282.2	1494.7
7/21/2014							3:45	8:09	4.4	12:09	20:23	8.2				12.6	294.8	1507.3
7/22/2014	21:24	13.2	23:24	6.3	1:24	13.0	3:49	9:10	5.4	13:10	21:24	8.2				13.6	308.5	1521.0
7/23/2014	22:18	13.5					3:53	10:05	6.2	14:05	22:18	8.2				14.4	322.9	1535.4
7/24/2014	23:07	13.3					3:57	10:54	7.0	14:54	23:07	8.2				15.2	338.1	1550.6
7/25/2014	23:52	13.0					4:01	11:38	7.6	15:38	23:52	8.2				15.9	354.0	1566.5
7/26/2014							4:05	12:18	8.2	16:18	23:59	7.7				15.9	369.9	1582.4
7/27/2014							4:33	12:55	8.4	16:55	23:59	7.1				15.5	385.4	1597.9
7/28/2014							5:12	13:31	8.3	17:31	23:59	6.5				14.8	400.2	1612.7
7/29/2014							5:50	14:04	8.2	18:04	23:56	5.9				14.1	414.3	1626.8
7/30/2014							6:26	14:35	8.2	18:35	23:51	5.3				13.4	427.8	1640.3
7/31/2014							7:01	15:05	8.1	19:05	23:47	4.7				12.8	440.6	1653.1



TYPICAL SECTION D-D

Represents the low tide window for August 12, 2014





TYPICAL SECTION E-E

Represents the low tidal range for the entire month of August 2014

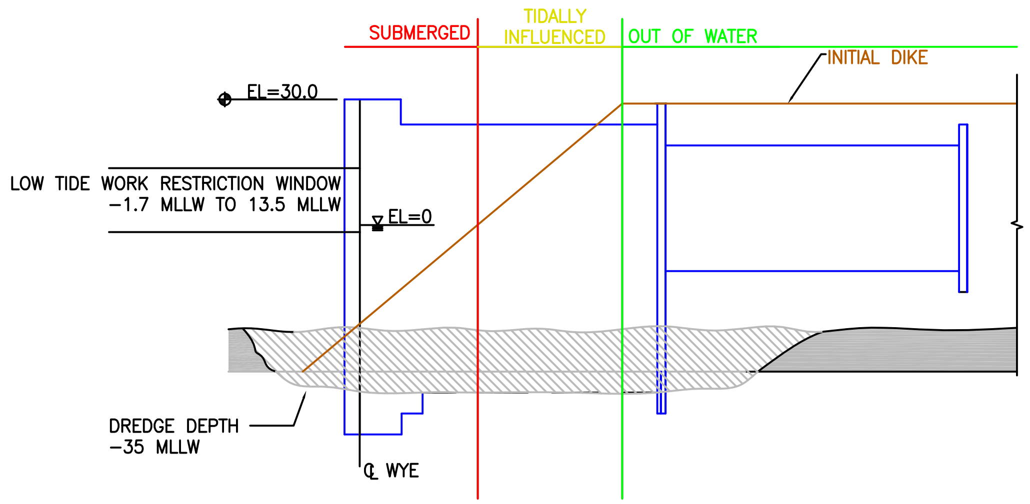
Civil Twilight window — Submerged Piledriving

Low Tide window — Tidally Influenced Piledriving

Unrestricted Work window — Out of Water Piledriving

Date	Civil Twilight		2 Hours Before		Actual Low Tide		2 Hours After		2 Hours Before		Actual Low Tide		2 hours After		2 Hours Before		Actual Low Tide		2 Hours After	
	Begin	End	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW
8/1/2014	4:27	23:44	3:37	8.2	5:37	3.2	7:37	12.0	15:36	8.2	17:36	3.1	19:36	10.6						
8/2/2014	4:31	23:40	4:18	7.9	6:18	3.6	8:18	11.2	16:13	9.5	18:13	4.6	20:13	10.7						
8/3/2014	4:34	23:36	5:09	7.8	7:09	4.2	9:09	10.9	17:02	10.7	19:02	6.5	21:02	11.5						
8/4/2014	4:38	23:33	6:17	7.6	8:17	4.7	10:17	11.4	18:18	11.0	20:18	8.2	22:18	13.8						
8/5/2014	4:41	23:29	7:31	7.7	9:31	4.3	11:31	11.5	19:42	11.6	21:42	8.7	23:42	15.7						
8/6/2014	4:45	23:25	8:38	7.7	10:38	2.9	12:38	10.7	20:53	12.2	22:53	8.0	0:53	16.0						
8/7/2014	4:48	23:22					0:53	16.0	9:38	7.3	11:38	1.1	13:38	9.8	21:54	12.3	23:54	6.5	1:54	15.5
8/8/2014	4:51	23:18					1:54	15.5	10:32	6.8	12:32	-0.8	14:32	9.2	22:49	11.9				
8/9/2014	4:55	23:14	22:49	11.9	0:49	4.7	2:49	14.9	11:22	6.3	13:22	-2.3	15:22	9.0	23:41	11.2				
8/10/2014	4:58	23:11	23:41	11.2	1:41	2.9	3:41	14.3	12:10	6.0	14:10	-3.3	16:10	9.2						
8/11/2014	5:01	23:07	0:31	10.4	2:31	1.3	4:31	13.8	12:56	6.0	14:56	-3.7	16:56	9.7						
8/12/2014	5:05	23:03	1:18	9.6	3:18	0.0	5:18	13.1	13:40	6.2	15:40	-3.5	17:40	10.2						
8/13/2014	5:08	23:00	2:05	8.9	4:05	-0.8	6:05	12.5	14:24	6.6	16:24	-2.6	18:24	10.9						
8/14/2014	5:11	22:56	2:52	8.3	4:52	-1.0	6:52	11.9	15:08	7.2	17:08	-1.0	19:08	11.8						
8/15/2014	5:14	22:53	3:40	8.0	5:40	-0.4	7:40	11.5	15:53	8.2	17:53	1.2	19:53	12.6						
8/16/2014	5:17	22:49	4:31	8.0	6:31	0.7	8:31	11.2	16:42	9.5	18:42	3.7	20:42	13.4						
8/17/2014	5:21	22:46	5:27	8.5	7:27	2.2	9:27	11.0	17:40	10.8	19:40	6.0	21:40	14.4						
8/18/2014	5:24	22:42	6:31	9.2	8:31	3.2	10:31	10.7	18:45	12.3	20:45	7.7	22:45	14.6						
8/19/2014	5:27	22:38	7:37	9.8	9:37	3.4	11:37	9.8	19:54	13.4	21:54	8.0	23:54	14.1						
8/20/2014	5:30	22:35	8:41	9.9	10:41	2.8	12:41	8.9	20:58	13.7	22:58	7.3	0:58	13.2						
8/21/2014	5:33	22:31					0:58	13.2	9:37	9.7	11:37	1.8	13:37	8.3	21:54	13.4	23:54	6.0	1:54	12.4
8/22/2014	5:36	22:28					1:54	12.4	10:27	9.4	12:27	0.9	14:27	8.2	22:44	12.8				
8/23/2014	5:39	22:24	22:44	12.8	0:44	4.8	2:44	12.1	11:11	9.2	13:11	0.5	15:11	8.7	23:28	12.3				
8/24/2014	5:42	22:21	23:28	12.3	1:28	3.8	3:28	12.1	11:51	9.1	13:51	0.4	15:51	9.6						
8/25/2014	5:45	22:17	0:10	11.5	2:10	3.1	4:10	12.5	12:29	8.9	14:29	0.7	16:29	10.8						
8/26/2014	5:48	22:14	0:49	10.8	2:49	2.7	4:49	12.8	13:05	8.6	15:05	1.2	17:05	12.0						
8/27/2014	5:51	22:10	1:26	9.9	3:26	2.3	5:26	13.0	13:38	8.4	15:38	1.7	17:38	12.7						
8/28/2014	5:54	22:07	2:03	8.8	4:03	2.1	6:03	13.1	14:10	8.3	16:10	2.4	18:10	13.1						
8/29/2014	5:56	22:03	2:37	8.0	4:37	2.0	6:37	12.5	14:41	8.6	16:41	3.1	18:41	12.9						
8/30/2014	5:59	22:00	3:12	7.3	5:12	2.2	7:12	11.7	15:11	9.4	17:11	4.2	19:11	12.3						
8/31/2014	6:02	21:56	3:48	7.2	5:48	2.7	7:48	10.7	15:46	10.5	17:46	5.5	19:46	12.0						

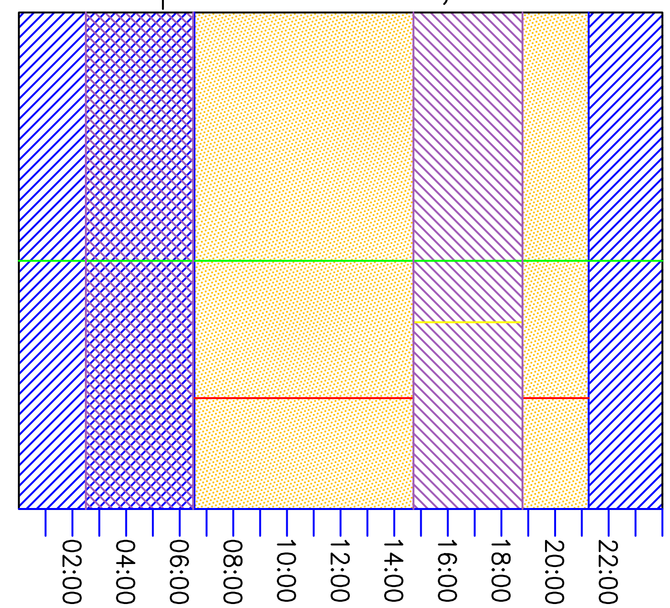
Date	Unrestricted Work Window 1			Unrestricted Work Window 2			Unrestricted Work Window 3			Hourly Totals		
	Start	End	Hours	Start	End	Hours	Start	End	Hours	Daily	Monthly	Yearly
8/1/2014	7:37	15:36	8.0	19:36	23:44	4.2				12.1	12.2	1665.2
8/2/2014	8:18	16:13	7.9	20:13	23:40	3.5				11.4	23.6	1676.6
8/3/2014	4:34	5:09	0.0	9:09	17:02	7.9	21:02	23:36	2.6	11.1	34.6	1687.7
8/4/2014	4:38	6:17	1.7	10:17	18:18	8.0	22:18	23:33	1.3	10.9	45.6	1698.7
8/5/2014	4:41	7:31	2.8	11:31	19:42	8.2				11.0	56.7	1709.7
8/6/2014	4:45	8:38	3.9	12:38	20:53	8.3				12.1	68.8	1721.9
8/7/2014	4:48	9:38	4.8	13:38	21:54	8.3				13.1	82.0	1735.0
8/8/2014	4:51	10:32	5.7	14:32	22:49	8.3				14.0	96.0	1749.0
8/9/2014	4:55	11:22	6.5	15:22	23:14	7.9				14.3	110.3	1763.4
8/10/2014	4:58	12:10	7.2	16:10	23:11	7.0				14.2	124.6	1777.6
8/11/2014	5:01	12:56	7.9	16:56	23:07	6.2				14.1	138.7	1791.8
8/12/2014	5:18	13:40	8.4	17:40	23:03	5.4				13.8	152.5	1805.5
8/13/2014	6:05	14:24	8.3	18:24	23:00	4.6				12.9	165.4	1818.5
8/14/2014	6:52	15:08	8.3	19:08	22:56	3.8				12.1	177.5	1830.6
8/15/2014	7:40	15:53	8.2	19:53	22:53	3.0				11.2	188.8	1841.8
8/16/2014	8:31	16:42	8.2	20:42	22:49	2.1				10.3	199.1	1852.2
8/17/2014	5:21	5:27	0.0	9:27	17:40	8.2	21:40	22:46	1.1	9.4	208.6	1861.6
8/18/2014	5:24	6:31	1.1	10:31	18:45	8.2				9.4	218.0	1871.0
8/19/2014	5:27	7:37	2.2	11:37	19:54	8.3				10.5	228.4	1881.5
8/20/2014	5:30	8:41	3.2	12:41	20:58	8.3				11.5	239.9	1893.0
8/21/2014	5:33	9:37	4.1	13:37	21:54	8.3				12.4	252.3	1905.4
8/22/2014	5:36	10:27	4.9	14:27	22:28	8.0				12.9	265.2	1918.3
8/23/2014	5:39	11:11	5.5	15:11	22:24	7.2				12.8	278.0	1931.1
8/24/2014	5:42	11:51	6.2	15:51	22:21	6.5				12.7	290.7	1943.8
8/25/2014	5:45	12:29	6.7	16:29	22:17	5.8				12.6	303.3	1956.3
8/26/2014	5:48	13:05	7.3	17:05	22:14	5.2				12.5	315.7	1968.8
8/27/2014	5:51	13:38	7.8	17:38	22:10	4.6				12.3	328.1	1981.1
8/28/2014	6:03	14:10	8.1	18:10	22:07	4.0				12.1	340.2	1993.2
8/29/2014	6:37	14:41	8.1	18:41	22:03	3.4				11.5	351.6	2004.7
8/30/2014	7:12	15:11	8.0	19:11	22:00	2.8				10.8	362.5	2015.5
8/31/2014	7:48	15:46	8.0	19:46	21:56	2.2				10.2	372.6	2025.7

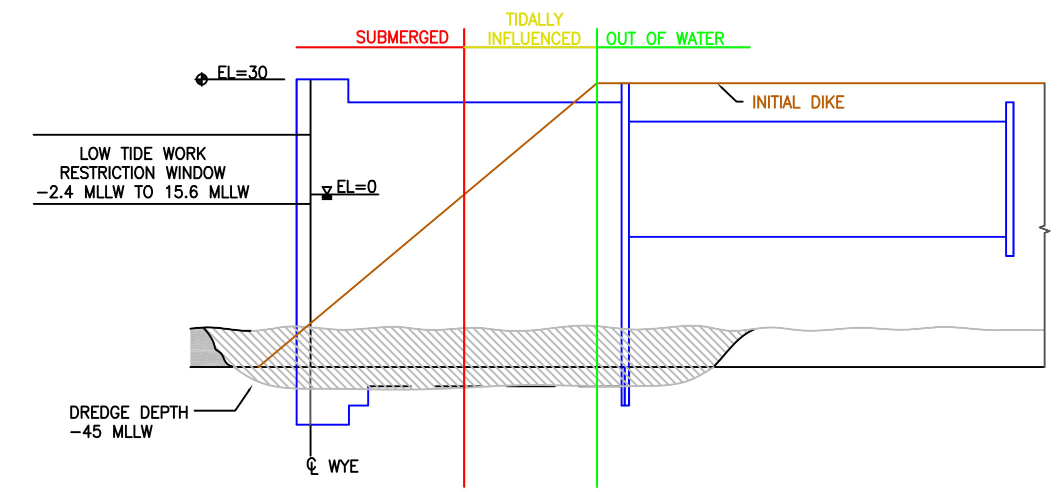


TYPICAL SECTION D-D

Represents the low tide window for September 12, 2014

September 12, 2014





TYPICAL SECTION E-E

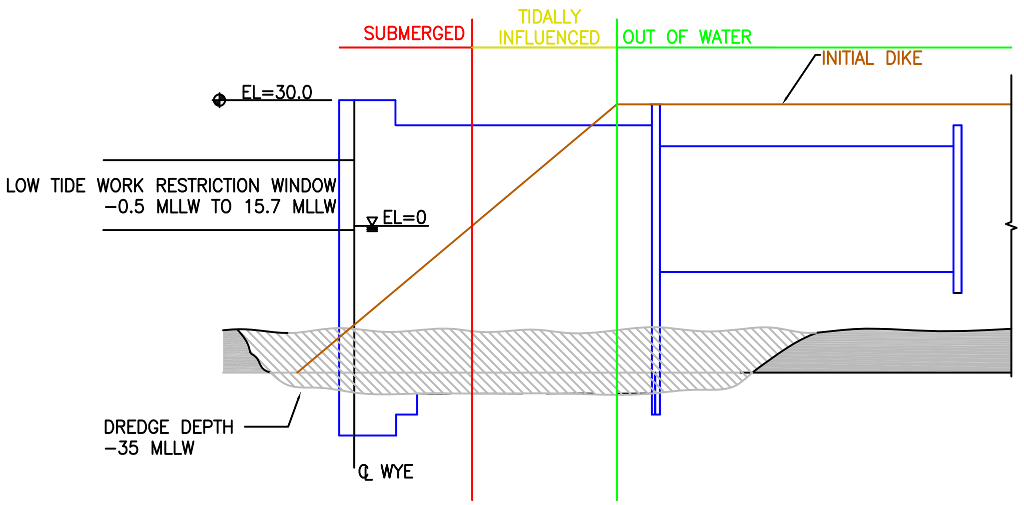
Represents the low tidal range for the entire month of September 2014

Civil Twilight window — Submerged Piledriving

Low Tide window — Tidally Influenced Piledriving

Unrestricted Work window — Out of Water Piledriving

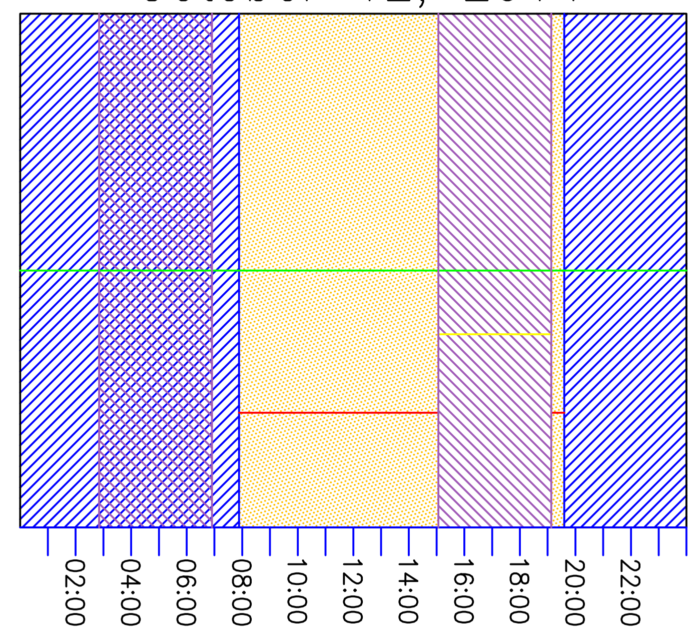
Date	Civil Twilight		2 Hours Before		Actual Low Tide		2 Hours After		2 Hours Before		Actual Low Tide		2 hours After		2 Hours Before		Actual Low Tide		2 Hours After		Unrestricted Work Window 1			Unrestricted Work Window 2			Unrestricted Work Window 3			Hourly Totals		
	Begin	End	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Start	End	Hours	Start	End	Hours	Start	End	Hours	Daily	Monthly	Yearly
9/1/2014	6:05	21:53	4:33	7.3	6:33	3.5	8:33	10.2	16:33	11.5	18:33	7.2	20:33	12.5							8:33	16:33	8.0	20:33	21:53	1.4				9.4	9.4	2035.1
9/2/2014	6:08	21:49	5:37	7.2	7:37	4.4	9:37	10.9	17:46	11.7	19:46	8.8	21:46	14.3							9:37	17:46	8.2	21:46	21:49	0.0				8.2	17.6	2043.3
9/3/2014	6:11	21:46	6:55	7.5	8:55	4.5	10:55	11.7	19:15	12.0	21:15	9.2	23:15	16.2							6:11	6:55	0.0	10:55	19:15	8.3				9.1	26.7	2052.4
9/4/2014	6:13	21:43	8:07	7.9	10:07	3.5	12:07	11.2	20:30	12.4	22:30	7.9	0:30	15.9							6:13	8:07	1.9	12:07	20:30	8.4				10.3	37.0	2062.7
9/5/2014	6:16	21:39					0:30	15.9	9:11	7.8	11:11	1.7	13:11	10.4	21:33	12.1	23:33	5.8	1:33	14.7	6:16	9:11	2.9	13:11	21:33	8.4				11.3	48.3	2074.0
9/6/2014	6:19	21:36					1:33	14.7	10:06	7.6	12:06	-0.2	14:06	9.7	22:29	11.3					6:19	10:06	3.8	14:06	21:36	7.5				11.3	59.7	2085.4
9/7/2014	6:22	21:32	22:29	11.3	0:29	3.4	2:29	13.6	10:58	7.3	12:58	-1.6	14:58	9.6	23:21	10.4					6:22	10:58	4.6	14:58	21:32	6.6				11.2	70.9	2096.6
9/8/2014	6:24	21:29	23:21	10.4	1:21	1.2	3:21	12.7	11:46	7.3	13:46	-2.3	15:46	10.0							6:24	11:46	5.4	15:46	21:29	5.7				11.1	82.0	2107.7
9/9/2014	6:27	21:26	0:11	9.4	2:11	-0.5	4:11	12.1	12:32	7.5	14:32	-2.4	16:32	10.7							6:27	12:32	6.1	16:32	21:26	4.9				11.0	93.0	2118.7
9/10/2014	6:30	21:22	0:58	8.7	2:58	-1.6	4:58	11.6	13:17	7.9	15:17	-1.8	17:17	11.7							6:30	13:17	6.8	17:17	21:22	4.1				10.9	103.9	2129.6
9/11/2014	6:32	21:19	1:45	8.1	3:45	-2.0	5:45	11.4	14:00	8.5	16:00	-0.6	18:00	12.6							6:32	14:00	7.5	18:00	21:19	3.3				10.8	114.7	2140.4
9/12/2014	6:35	21:15	2:30	7.7	4:30	-1.7	6:30	11.2	14:43	9.2	16:43	1.1	18:43	13.5							6:35	14:43	8.1	18:43	21:15	2.6				10.7	125.4	2151.1
9/13/2014	6:38	21:12	3:16	7.5	5:16	-0.7	7:16	11.3	15:27	9.9	17:27	3.1	19:27	14.3							7:16	15:27	8.2	19:27	21:12	1.8				10.0	135.4	2161.1
9/14/2014	6:40	21:09	4:03	7.7	6:03	0.9	8:03	11.4	16:13	10.8	18:13	5.4	20:13	14.9							8:03	16:13	8.2	20:13	21:09	1.0				9.1	144.5	2170.2
9/15/2014	6:43	21:05	4:54	8.3	6:54	2.7	8:54	11.5	17:07	11.8	19:07	7.5	21:07	15.4							8:54	17:07	8.2							8.2	152.7	2178.4
9/16/2014	6:45	21:02	5:53	9.1	7:53	4.2	9:53	11.6	18:11	12.8	20:11	8.9	22:11	15.6							9:53	18:11	8.3							8.3	161.1	2186.8
9/17/2014	6:48	20:59	6:59	9.9	8:59	5.0	10:59	11.3	19:21	13.6	21:21	9.0	23:21	14.8							6:48	6:59	0.0	10:59	19:21	8.4				8.6	169.6	2195.3
9/18/2014	6:51	20:55	8:04	10.5	10:04	4.6	12:04	10.4	20:27	13.7	22:27	7.8	0:27	13.3							6:51	8:04	1.2	12:04	20:27	8.4				9.6	179.3	2205.0
9/19/2014	6:53	20:52					0:27	13.3	9:03	10.4	11:03	3.6	13:03	9.7	21:26	13.1	23:26	6.0	1:25	12.0	6:53	9:03	2.2	13:03	20:52	7.8				10.0	189.3	2215.0
9/20/2014	6:56	20:49					1:25	12.0	9:54	10.2	11:54	2.6	13:54	9.5	22:16	12.1					6:56	9:54	3.0	13:54	20:49	6.9				9.9	199.2	2224.9
9/21/2014	6:58	20:46	22:16	12.1	0:16	4.2	2:16	11.2	10:39	10.0	12:39	1.8	14:39	9.8	23:01	11.3					6:58	10:39	3.7	14:39	20:46	6.1				9.8	209.0	2234.7
9/22/2014	7:01	20:42	23:01	11.3	1:01	2.7	3:01	10.9	11:21	9.9	13:21	1.6	15:21	10.6	23:44	10.4					7:01	11:21	4.3	15:21	20:42	5.4				9.7	218.8	2244.5
9/23/2014	7:03	20:39	23:44	10.4	1:44	1.8	3:44	11.2	12:00	9.9	14:00	1.9	16:00	11.8							7:03	12:00	5.0	16:00	20:39	4.7				9.6	228.4	2254.1
9/24/2014	7:06	20:36	0:24	9.7	2:24	1.2	4:24	11.6	12:37	9.9	14:37	2.4	16:37	13.1							7:06	12:37	5.5	16:37	20:36	4.0				9.5	237.9	2263.6
9/25/2014	7:09	20:33	1:03	8.8	3:03	1.0	5:03	12.1	13:13	9.9	15:13	3.1	17:13	14.2							7:09	13:13	6.1	17:13	20:33	3.4				9.4	247.4	2273.1
9/26/2014	7:11	20:29	1:40	8.0	3:40	0.9	5:40	12.4	13:47	9.9	15:47	3.8	17:47	14.8							7:11	13:47	6.6	17:47	20:29	2.7				9.3	256.7	2282.4
9/27/2014	7:14	20:26	2:15	7.2	4:15	1.0	6:15	12.1	14:20	10.1	16:20	4.6	18:20	14.8							7:14	14:20	7.1	18:20	20:26	2.1				9.2	265.9	2291.6
9/28/2014	7:16	20:23	2:50	6.7	4:50	1.3	6:50	11.5	14:54	10.5	16:54	5.4	18:54	14.4							7:16	14:54	7.6	18:54	20:23	1.5				9.1	275.1	2300.8
9/29/2014	7:19	20:20	3:27	6.4	5:27	1.8	7:27	10.7	15:32	11.1	17:32	6.4	19:32	14.0							7:27	15:32	8.1	19:32	20:20	0.0				8.9	284.0	2309.7
9/30/2014	7:21	20:17	4:10	6.7	6:10	2.7	8:10	10.1	16:20	11.8	18:20	7.7	20:20	14.0							8:10	16:20	8.2							8.2	292.2	2317.9

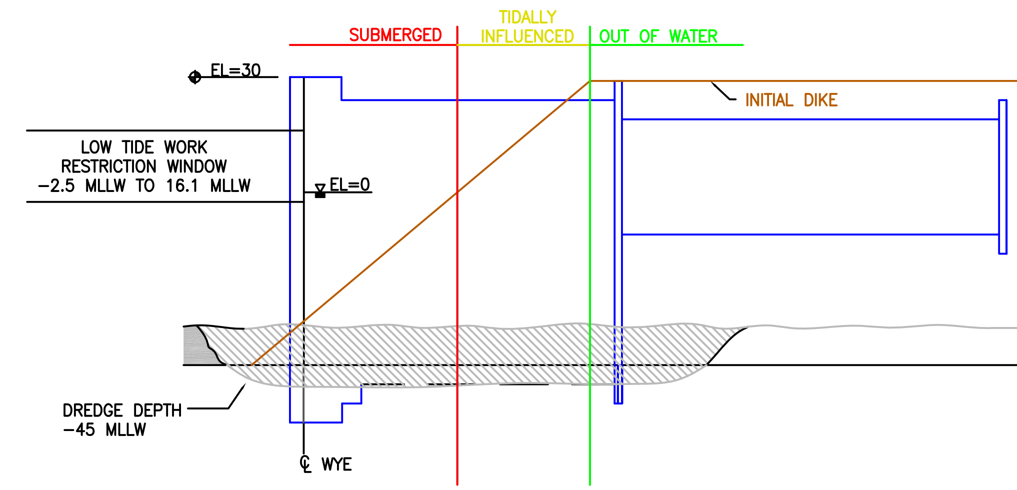


TYPICAL SECTION D-D

Represents the low tide window for October 12, 2014

October 12, 2014





TYPICAL SECTION E-E

Represents the low tidal range for the entire month of October 2014

Civil Twilight window

Low Tide window

Unrestricted Work window

Submerged Piledriving

Tidally Influenced Piledriving

Out of Water Piledriving

Date	Civil Twilight		2 Hours Before		Actual Low Tide		2 Hours After		2 Hours Before		Actual Low Tide		2 hours After		2 Hours Before		Actual Low Tide		2 Hours After		Unrestricted Work Window 1			Unrestricted Work Window 2			Unrestricted Work Window 3			Hourly Totals		
	Begin	End	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Time	MLLW	Start	End	Hours	Start	End	Hours	Start	End	Hours	Daily	Monthly	Yearly
10/1/2014	7:24	20:14	5:10	6.9	7:10	3.7	9:10	10.8	17:32	11.9	19:32	8.8	21:32	15.4							9:10	17:32	8.4							8.4	8.4	2326.3
10/2/2014	7:26	20:10	6:24	7.4	8:24	4.2	10:24	11.7	18:54	12.2	20:54	8.7	22:54	16.1							10:24	18:54	8.5							8.5	16.9	2334.8
10/3/2014	7:29	20:07	7:38	8.1	9:38	3.6	11:38	11.7	20:08	12.2	22:08	7.0	0:08	15.1							7:29	7:38	0.0	11:38	20:07	8.5				8.7	25.6	2343.4
10/4/2014	7:31	20:04					0:08	15.1	8:43	8.5	10:43	2.2	12:43	11.0	21:13	11.6	23:13	4.5	1:13	13.5	7:31	8:43	1.2	12:43	20:04	7.4				8.6	34.2	2352.0
10/5/2014	7:34	20:01					1:13	13.5	9:41	8.5	11:41	0.7	13:41	10.6	22:10	10.5					7:34	9:41	2.1	13:41	20:01	6.4				8.5	42.6	2360.5
10/6/2014	7:36	19:58	22:10	10.5	0:10	1.8	2:10	12.0	10:33	8.6	12:33	-0.3	14:33	10.6	23:02	9.5					7:36	10:33	3.0	14:33	19:58	5.4				8.4	51.0	2368.9
10/7/2014	7:39	19:55	23:02	9.5	1:02	-0.4	3:02	10.9	11:22	8.9	13:22	-0.7	15:22	11.1	23:51	8.6					7:39	11:22	3.7	15:22	19:55	4.6				8.3	59.3	2377.2
10/8/2014	7:41	19:52	23:51	8.6	1:51	-1.8	3:51	10.3	12:09	9.3	14:09	-0.3	16:09	12.1							7:41	12:09	4.5	16:09	19:52	3.7				8.2	67.6	2385.4
10/9/2014	7:44	19:49	0:39	8.0	2:39	-2.5	4:39	10.3	12:54	9.9	14:54	0.6	16:54	13.3							7:44	12:54	5.2	16:54	19:49	2.9				8.1	75.7	2393.5
10/10/2014	7:46	19:46	1:24	7.7	3:24	-2.4	5:24	10.4	13:37	10.5	15:37	1.9	17:37	14.3							7:46	13:37	5.9	17:37	19:46	2.2				8.0	83.7	2401.6
10/11/2014	7:49	19:43	2:08	7.5	4:08	-1.7	6:08	10.8	14:20	10.9	16:20	3.4	18:20	15.2							7:49	14:20	6.5	18:20	19:43	1.4				7.9	91.6	2409.5
10/12/2014	7:51	19:40	2:51	7.4	4:51	-0.5	6:51	11.1	15:02	11.4	17:02	5.0	19:02	15.7							7:51	15:02	7.2	19:02	19:40	0.0				7.8	99.5	2417.4
10/13/2014	7:54	19:37	3:34	7.5	5:34	1.1	7:34	11.5	15:46	11.7	17:46	6.6	19:46	15.9							7:54	15:46	7.9							7.9	107.4	2425.2
10/14/2014	7:56	19:34	4:20	7.9	6:20	2.9	8:20	11.8	16:35	12.2	18:35	8.0	20:35	16.0							8:20	16:35	8.3							8.3	115.6	2433.5
10/15/2014	7:59	19:31	5:12	8.5	7:12	4.5	9:12	12.1	17:34	12.6	19:34	9.0	21:34	15.8							9:12	17:34	8.4							8.4	124.0	2441.9
10/16/2014	8:01	19:28	6:13	9.4	8:13	5.7	10:13	12.3	18:42	13.0	20:42	9.1	22:42	15.0							10:13	18:42	8.5							8.5	132.5	2450.4
10/17/2014	8:04	19:25	7:17	10.2	9:17	5.9	11:17	11.9	19:50	13.0	21:50	7.9	23:50	13.5							11:17	19:25	8.2							8.2	140.7	2458.5
10/18/2014	8:06	19:22	8:19	10.7	10:19	5.3	12:19	11.4	20:51	12.3	22:51	5.9	0:51	11.9							8:06	8:19	0.0	12:19	19:22	7.1				7.3	148.0	2465.8
10/19/2014	8:09	19:19					0:51	11.9	9:14	10.7	11:14	4.3	13:14	11.1	21:44	11.3	23:44	3.8	1:44	10.7	8:09	9:14	1.1	13:14	19:19	6.1				7.2	155.2	2473.0
10/20/2014	8:11	19:17					1:44	10.7	10:03	10.7	12:03	3.6	14:03	11.3	22:32	10.2					8:11	10:03	1.9	14:03	19:17	5.3				7.1	162.3	2480.2
10/21/2014	8:14	19:14	22:32	10.2	0:32	2.0	2:32	10.2	10:48	10.7	12:48	3.3	14:48	12.0	23:16	9.4					8:14	10:48	2.6	14:48	19:14	4.5				7.0	169.3	2487.2
10/22/2014	8:16	19:11	23:16	9.4	1:16	0.8	3:16	10.1	11:29	11.0	13:29	3.5	15:29	13.0	23:58	8.6					8:16	11:29	3.2	15:29	19:11	3.7				6.9	176.3	2494.2
10/23/2014	8:19	19:08	23:58	8.6	1:58	0.2	3:58	10.5	12:10	11.1	14:10	4.0	16:10	14.4							8:19	12:10	3.9	16:10	19:08	3.0				6.8	183.1	2501.0
10/24/2014	8:21	19:05	0:38	8.0	2:38	-0.1	4:38	10.9	12:48	11.3	14:48	4.5	16:48	15.4							8:21	12:48	4.5	16:48	19:05	2.3				6.8	189.9	2507.8
10/25/2014	8:23	19:03	1:17	7.3	3:17	-0.1	5:17	11.4	13:26	11.3	15:26	5.1	17:26	16.1							8:23	13:26	5.1	17:26	19:03	1.6				6.7	196.6	2514.5
10/26/2014	8:26	19:00	1:55	6.5	3:55	-0.1	5:55	11.5	14:04	11.3	16:04	5.5	18:04	16.4							8:26	14:04	5.6	18:04	19:00	1.0				6.6	203.2	2521.1
10/27/2014	8:28	18:57	2:32	6.0	4:32	0.2	6:32	11.1	14:42	11.3	16:42	5.9	18:42	16.0							8:28	14:42	6.2	18:42	18:57	0.0				6.5	209.7	2527.6
10/28/2014	8:31	18:55	3:12	5.7	5:12	0.6	7:12	10.7	15:24	11.4	17:24	6.5	19:24	15.5							8:31	15:24	6.9							6.9	216.6	2534.5
10/29/2014	8:33	18:52	3:56	5.9	5:56	1.3	7:56	10.4	16:16	11.5	18:16	7.1	20:16	15.4							8:33	16:16	7.7							7.7	224.4	2542.2
10/30/2014	8:36	18:50	4:51	6.4	6:51	2.4	8:51	10.8	17:21	11.5	19:21	7.6	21:21	15.6							8:51	17:21	8.5							8.5	232.9	2550.7
10/31/2014	8:38	18:47	5:58	7.2	7:58	3.3	9:58	11.6	18:35	11.6	20:35	7.2	22:35	15.3							9:58	18:35	8.6							8.6	241.5	2559.4

APPENDIX E
2008 POA Marine Mammal Monitoring Summary Tables

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MARINE MAMMAL OBSERVATION AND PROJECT ACTIVITIES SUMMARY: PORT OF ANCHORAGE MARINE TERMINAL REDEVELOPMENT PROJECT CONSTRUCTION-SITE MONITORING LOCATION — JULY 2008

Date	24 July[1]
Project Activity at Time of Marine Mammal Sighting	No in-water work
Sighting Number[2]	#1 (of 1)
No. of Marine Mammals	7 beluga whales
Group Composition[3]	7 adults
Behavior	Traveling close, one body-length apart
Reaction[4]	No observable reaction
No. of Animals in 200-Meter (m) Safety Zone	7
No. of Animals in Harassment Zones[5]	0
Shutdown? (Y/N) Time of Shutdown	No
Takes[6]	0

No marine mammal sightings 25-31 July.

1 First day of in-water work: 2008 field season.
2 #1= first marine mammal sighting of the day; #2= second marine mammal sighting of the day, etc.
3 Distribution of adults, juveniles, and calves.
4 Reaction of marine mammals to project construction activities and other activities in the Port.
5 Shutdown Criteria: 50 m from other in-water project activities; 200 m from either vibratory or impact pile driving; 350 m from impact pile driving, but only if 5 or more marine mammals are seen or if a calf/calves present; 800 m from vibratory pile driving, but only if 5 or more (group) marine mammals are seen or if calf/calves present.
6 Per sighting: total number of animals observed within safety or harassment zones during in-water pile driving.
7 In order of occurrence.

MARINE MAMMAL OBSERVATIONS AND PROJECT ACTIVITIES SUMMARY: AUGUST 2008
CONSTRUCTION OBSERVERS–PORT OF ANCHORAGE MARINE TERMINAL REDEVELOPMENT PROJECT

Date	Project Activity at time of marine mammal sighting	Sighting Number[1]	No. of Beluga Whales[2]	Group Composition[3]	No. of Animals in 200-m Safety Zone[4]	No. of Animals in Harassment Zone[4]	Initial Heading and Behavior[5]	Reaction[6]	Shutdown (Y/N) Time of shutdown	Takes[7]	No. of Hours: In-Water Project Work[8]
1 Aug.	N/A	No marine mammal sightings	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	5.00
2 Aug.	N/A	No marine mammal sightings	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	5.50
3 Aug.	Sunday - no work.									0	
4 Aug.	N/A	No marine mammal sightings	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	5.75
5 Aug.	N/A	No marine mammal sightings	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	6.00
6 Aug.	N/A	No marine mammal sightings	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	7.00
7 Aug.	N/A	No marine mammal sightings	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	4.50
8 Aug.	N/A	No marine mammal sightings	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	4.50
9 Aug.	N/A	No marine mammal sightings	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	4.50
10 Aug.	Sunday - no work.									0	
11 Aug.	N/A	No marine mammal sightings	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	4.50
12 Aug.	N/A	No marine mammal sightings	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	5.25
13 Aug.	N/A	No marine mammal sightings	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	8.00
14 Aug.	No in-water work at time of initial sighting.	#1	9	6 adults; 3 juveniles	0	0	Traveling NW	N/A	No	0	5.75
	In-water vibratory pile driving.	#2	16	8 adults; 5 juveniles; 3 calves	0	0	Traveling S, whales about 50 meters apart	No observable reaction.	Yes: 10:40 - 11:06 AM; Group first sighted 1200 m outside the 800-m harassment zone-work shut down before group reached the 800-m harassment zone.	0	
15 Aug.	No in-water work at time of initial sighting.	#1	4	2 adults; 1 juvenile; 1 calf	0	4	Traveling S to W; slow surfacing; diving	No observable reaction.	No	0	4.50
	No in-water work at time of initial sighting.	#2	4	2 adults; 1 juvenile; 1 calf	0	4	Swimming N; diving	No observable reaction.	No	0	
16 Aug.	No in-water work at time of initial sighting.	#1	16	13 adults; 3 juveniles	0	16	Traveling S; slow surfacing; juveniles in rear	No observable reaction.	No	0	7.00
17 Aug.	Sunday - no work.										
18 Aug.	No in-water work at time of initial sighting.	#1	4	4 adults	0	4	Traveling N ; swimming; diving	No observable reaction.	No	0	6.00

1 #1= first marine mammal sighting of the day; #2= second marine mammal sighting of the day, etc.
2 Beluga whales were the only marine mammal species sighted by the observers during August.
3 Distribution of adults, juveniles, and calves.
4 Shutdown criteria. 50 meters from other in-water non-pile-driving activities; 200 m from either impact or vibratory pile driving; 350 m from impact pile driving if 5 or more animals seen or if a calf/calves are present; 800 meters from vibratory hammer if 5 or more animals seen or if calf/calves present.
5 In order of occurrence.
6 Reaction of marine mammals to construction activities.
7 Per sighting: Total number of animals in safety or harassment zones during in-water pile driving activities.
8 During August, only total in-water hours were recorded. In September, at the request of NMFS, hours of in-water impact pile driving, hours of in-water vibratory pile driving, and hours of in-water stabbing will be recorded separately.

MARINE MAMMAL OBSERVATIONS AND PROJECT ACTIVITIES SUMMARY: AUGUST 2008
CONSTRUCTION OBSERVERS–PORT OF ANCHORAGE MARINE TERMINAL REDEVELOPMENT PROJECT

Date	Project Activity at time of marine mammal sighting	Sighting Number[1]	No. of Beluga Whales[2]	Group Composition[3]	No. of Animals in 200-m Safety Zone[4]	No. of Animals in Harassment Zone[4]	Initial Heading and Behavior[5]	Reaction[6]	Shutdown (Y/N) Time of shutdown	Takes[7]	No. of Hours: In-Water Project Work[8]
18 Aug. *Continued*	No in-water work at time of initial sighting.	#2	11	7 adults; 1 juvenile; 3 calves	0	11	Swimming S, close together; calves close to mothers; diving; swimming diving	Whales split into two groups because of barge in area.	No	0	
	Out-of-water stabbing.	#3	4	4 adults	0	4	Swimming S; diving; slow surfacing	No observable reaction.	Yes: 10:52 - 11:30 AM	0	
	Out-of-water stabbing.	#4	6	4 adults; 2 juveniles	0	6	Traveling S; swimming	Group did not dive when near observers.	Yes: 10:52 - 11:30 AM	0	
	No in-water work at time of initial sighting.	#5	9	6 adults; 2 juveniles; 1 calf	0	0	Swimming NE; diving; very slow surfacing	No observable reaction.	No	0	
	No in-water work at time of initial sighting.	#6	9	7 adults; 2 juveniles	0	0	Traveling N; swimming	Group split up when boat approached.	No	0	
	No in-water work at time of initial sighting.	#7	4	3 adults; 1 juvenile	0	4	Traveling N; swimming; milling; feeding	No observable reaction.	No	0	
	No in-water work at time of initial sighting.	#8	3	3 adults	0	0	Traveling NW; slow surfacing (loosely grouped); milling; 2 dives; suspected feeding	No observable reaction.	No	0	
19 Aug.	In-water work, but no vibratory or impact pile driving.	#1	14	9 adults; 3 juveniles; 2 calves	0	14	Traveling S; swimming; slow surfacing; subgroups of 4, then 1, then 1, then 8	Animals went right past both areas of construction seemingly unaffected.	Yes: 9:57 - 10:21 AM	0	6.50
	Fill placement.	#2	9	7 adults; 1 juvenile ; 1 calf	0	0	Traveling N; swimming; diving; slow surfacing; moving in different directions; milling	Seemed unaffected by any noise in the Port.	No	0	
	No in-water work at time of initial sighting.	#3	12	7 adults; 3 juveniles; 2 calves	0	0	Traveling S; milling and feeding W & SW of Port docks	May have reacted to Port dredging barge-split into groups.	No	0	
20 Aug.	Stabbing.	#1	3	2 adults; 1 calf	0	0	Traveling NW. Calf swam close to 1 adult; other adult stayed close by	No observed response to any noise in Port.	No (whales did not enter safety or harassment zones)	0	8.50
	Out-of-water stabbing.	#2	6	4 adults; 1 juvenile; 1 calf	0	6	Traveling S, 1 adult swimming in a different pattern than rest of group	No observable reaction.	Yes: 10:40 - 11:00 AM	0	
	No in-water work at time of initial sighting.	#3	6	6 adults	0	0	Traveling S; swimming; milling; surfacing; feeding	No observable reaction.	No	0	
21 Aug.	Out-of-water stabbing.	#1	45	30 adults; 5 juveniles; 10 calves	0	0	Traveling SW; feeding	Leader was 100 yards ahead of rest of group. Mammals seemed to pay no attention to work going on.	Yes: 11:30 - 11:40 AM	0	8.50

1 #1= first marine mammal sighting of the day; #2= second marine mammal sighting of the day, etc.
2 Beluga whales were the only marine mammal species sighted by the observers during August.
3 Distribution of adults, juveniles, and calves.
4 Shutdown criteria. 50 meters from other in-water non-pile-driving activities; 200 m from either impact or vibratory pile driving; 350 m from impact pile driving if 5 or more animals seen or if a calf/calves are present; 800 meters from vibratory hammer if 5 or more animals seen or if calf/calves present.
5 In order of occurrence.
6 Reaction of marine mammals to construction activities.
7 Per sighting: Total number of animals in safety or harassment zones during in-water pile driving activities.
8 During August, only total in-water hours were recorded. In September, at the request of NMFS, hours of in-water impact pile driving, hours of in-water vibratory pile driving, and hours of in-water stabbing will be recorded separately.

MARINE MAMMAL OBSERVATIONS AND PROJECT ACTIVITIES SUMMARY: AUGUST 2008
CONSTRUCTION OBSERVERS–PORT OF ANCHORAGE MARINE TERMINAL REDEVELOPMENT PROJECT

Date	Project Activity at Time of Marine Mammal Sighting	Sighting Number[1]	No. of Beluga Whales[2]	Group Composition[3]	No. of Animals in 200-m Safety Zone[4]	No. of Animals in Harassment Zone[4]	Initial Heading and Behavior[5]	Reaction[6]	Shutdown (Y/N) Time of Shutdown	Takes[7]	No. of Hours: In-Water Project Work[8]
21 Aug. *Continued*	No in-water work at time of initial sighting.	#2	4	1 adult; 3 juveniles	4	0	Traveling SW; feeding	No observable reaction.	No	0	
	No in-water work at time of initial sighting.	#3	30	30 unknown		0	Traveling NE	No observable reaction.	No	0	
22 Aug.	No in-water work at time of initial sighting.	#1	2	1 adult; 1 calf	0	2	Traveling N	No observable reaction.	No	0	7.50
	No in-water work at time of initial sighting.	#2	2	1 adult; 1 juvenile	0	2	Traveling N	No observable reaction.	No	0	
	No in-water work at time of initial sighting.	#3	1	1 adult	0	1	Traveling N	No observable reaction.	No	0	
	No in-water work at time of initial sighting.	#4	1	1 adult	0	0	Traveling NW	No observable reaction.	No	0	
	Out-of-water stabbing.	#5	8	8 unknown	0	8	Traveling S	No observable reaction.	No	0	
23 Aug.	Out-of-water stabbing.	#1	5	5 juveniles	0	5	Traveling N	No observable reaction.	No	0	7.00
24 Aug.	Sunday-no work.										
25 Aug.	No in-water work at time of initial sighting.	#1	3	1 adult; 2 juveniles	3	0	Traveling N; diving; swimming; feeding	No observable reaction.	No	0	4.00
26 Aug.	No in-water work at time of initial sighting.	#1	3	2 adults; 1 juvenile	3	0	Traveling S fast in tight formation	No observable reaction.	No	0	4.00
	No in-water work at time of initial sighting.	#2	1	1 adult	0	0	Traveling S: diving & surfacing twice	No observable reaction.	No	0	
27 Aug.	N/A	No marine mammal sightings	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	3.00
28 Aug.	No in-water work at time of initial sighting.	#1	3	3 adults	0	3	Traveling S, close together	No observable reaction.	No	0	7.00
29 Aug.	No in-water work at time of initial sighting.	#1	3	3 adults	0	0	Traveling N	No observable reaction.	No	0	8.00
	No in-water work at time of initial sighting.	#2	2	2 adults	0	2	Traveling N; swimming	No observable reaction.	No	0	
30 Aug.	Labor Day Weekend - no work.										
31 Aug.	Sunday - no work.										
	AUGUST TOTALS	34 sightings	262 beluga whales	151 adults 46 juveniles 27 calves 38 age unknown	10 belugas in safety zone	96 belugas in harassment zones	N/A	N/A	6 shutdowns	0 Takes	147.75 total hours of in-water work

1 #1= first marine mammal sighting of the day; #2= second marine mammal sighting of the day, etc.
2 Beluga whales were the only marine mammal species sighted by the observers during August.
3 Distribution of adults, juveniles, and calves.
4 Shutdown criteria. 50 meters from other in-water non-pile-driving activities; 200 m from either impact or vibratory pile driving; 350 m from impact pile driving if 5 or more animals seen or if a calf/calves are present; 800 meters from vibratory hammer if 5 or more animals seen or if calf/calves present.
5 In order of occurrence.
6 Reaction of marine mammals to construction activities.
7 Per sighting: Total number of animals in safety or harassment zones during in-water pile driving activities.
8 During August, only total in-water hours were recorded. In September, at the request of NMFS, hours of in-water impact pile driving, hours of in-water vibratory pile driving, and hours of in-water stabbing will be recorded separately.

Marine Mammal Observation and Project Activities Summary: September 2008
Construction-Site Monitoring Location–Port of Anchorage Marine Terminal Redevelopment Project

Date	Project Activity at Time of Sighting	Sighting Number[1]	No. of Marine Mammals Sighted	Group Composition[2]	No. of Animals in 200-meter (m) Safety Zone[3]	No. of Animals in Harassment Zones[3]	Initial Heading & Behavior[4]	Reaction[5]	Shutdown? (Y/N) Time of shutdown	Takes[6]	No. of Hours: Impact Pile Driving - in Water	No. of Hours: Vibratory Pile Driving - in Water	No. of Hours Stabbing – in Water
1 Sept.	Labor Day – no work												
2 Sept.	No in-water work at time of sighting.	#1 (of 1)	2 beluga whales	1 adult 1 juvenile	0	2	Traveling north; swimming close together	No observable reaction.	No	0	0	8.0	0
3 Sept.	N/A	No marine mammals sighted.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	1.0	1.0
4 Sept.	No in-water work at time of sighting.	#1 (of 1)	4 beluga whales	4 adults	0	4	Traveling south. Milling; swimming; diving; Drifted apart in pairs for awhile, then came together.	No observable reaction.	No	0	0	5.25	0
5 Sept.	No in-water work at time of sighting.	#1 (of 1)	6 beluga whales	4 adults 2 juveniles	0	0	Feeding	No observable reaction.	No	0	0	6.25	0
6 Sept.	No in-water work at time of sighting.	#1 (of 1)	7 beluga whales	4 adults 3 juveniles	7	0	Swimming slowly south	No observable reaction.	No	0	0	8.5	0
7 Sept.	Sunday – no work												
8 Sept.	No in-water work at time of sighting.	#1 (of 1)	4 beluga whales	4 unknown age[7]	0	0	Traveling northwest; swimming	No observable reaction.	No	0	0	0	0
9 Sept.	N/A	No marine mammals sighted.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	5.5	0	0
10 Sept.	N/A	No marine mammals sighted.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	4.0	0	0
11 Sept.	N/A	No marine mammals sighted.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2.5	0	0
12 Sept.	N/A	No marine mammals sighted.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3.75	0	0
13 Sept.	No in-water work at time of sighting.	#1 (of 4)	1 harbor seal	N/A	0	1	Traveling north; diving 3-4 min. at a time; swimming	No reaction.	No	0	0	0	7.5
	Stabbing: out of water	#2 (of 4)	4 beluga whales	4 unknown age[7]	0	0	Traveling north; swimming	No observable reaction.	No	0			
	Stabbing: out of water	#3 (of 4)	5 beluga whales	5 unknown age[7]	0	0	Traveling north; swimming diving	No observable reaction.	No	0			
	Pile driving with vibratory hammer	#4 (of 4)	5 beluga whales	5 unknown age[7]	0	0	Traveling north; swimming; diving; feeding suspected	No observable reaction.	No (no marine mammals nearing or within safety or harassment or zones)	0			
14 Sept.	Sunday – no work												

1 #1= first marine mammal sighting of the day; #2= second marine mammal sighting of the day, etc.
2 Distribution of adults, juveniles, and calves.
3 Shutdown Criteria: 50 m from other in-water project activities; 200 m from either vibratory or impact pile driving; 350 m from impact pile driving, but only if 5 or more marine mammals are seen or if a calf/calves present; 800 m from vibratory pile driving, but only if 5 or more (group) marine mammals are seen or if calf/calves present.
4 In order of occurrence.
5 Reaction of marine mammals to project construction activities.
6 Per sighting: Total number of animals observed within safety or harassment zones during in-water pile driving activities.
7 Age of whales was not able to be determined due to sighting distance: 3.22 kilometers from Project footprint.

Marine Mammal Observation and Project Activities Summary: September 2008
Construction-Site Monitoring Location–Port of Anchorage Marine Terminal Redevelopment Project

Date	Project Activity at Time of Sighting	Sighting Number[1]	No. of Marine Mammals Sighted	Group Composition[2]	Animals in 200-meter (m) Safety Zone[3]	Animals in Harassment Zones[3]	Initial Heading & Behavior[4]	Reaction[5]	Shutdown? (Y/N) Time of Shutdown	Takes[6]	No. of Hours: Impact Pile Driving - in Water	No. of Hours: Vibratory Pile Driving in Water	No. of Hours: Stabbing –in Water
15 Sept.	No in-water work at time of sighting.	#1 (of 2)	6 beluga whales	6 juveniles	0	6	Traveling south; swimming	No observable reaction.	No	0	1.5	4.0	3.5
	No in-water work at time of sighting.	#2 (of 2)	6 beluga whales	6 juveniles	0	6	Traveling north	No observable reaction.	No	0			
16 Sept.	N/A	No marine mammals sighted.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3.0	5.0	0
17 Sept.	N/A	No marine mammals sighted.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	5.0	0
18 Sept.	N/A	No marine mammals sighted.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	4.0	0	0
19 Sept.	N/A	No marine mammals sighted.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0
20 Sept.	N/A	No marine mammals sighted.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	0	8.0
21 Sept.	Sunday – no work												
22 Sept.	N/A	No marine mammals sighted.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	12.0	0
23 Sept.	N/A	No marine mammals sighted.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	7.5	0
24 Sept.	N/A	No marine mammals sighted.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0
25 Sept.	N/A	No marine mammals sighted.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	5.0	0	0
26 Sept.	N/A	No marine mammals sighted.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	0	2.5
27 Sept.	N/A	No marine mammals sighted.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	5.0	0
28 Sept.	Sunday – no work												
29 Sept.	Vibratory pile driving	#1 (of 1)	1 beluga whale	1 adult	0	0	Traveling southwest; diving	No observable reaction.	No (whale was not in safety or harassment zones)	0	0	3.0	0
30 Sept.	N/A	No marine mammals sighted.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3.5	0	0
	SEPTEMBER TOTALS	12 marine mammal sightings	51 marine mammals sighted	1 harbor seal 14 adult whales 18 juvenile whales 0 whale calves 18 whales of unknown age[7]	7 whales entered the Safety Zone	1 harbor seal & 18 whales entered the Harassment Zones	N/A	N/A	No shutdowns during September	No takes during September	Total hours in-water pile driving with impact hammer: 32.75 Total days in-water pile driving with impact hammer: 9	Total hours in-water pile driving with vibratory hammer: 70.5 Total days in-water pile driving with vibratory hammer: 12	Total hours in-water stabbing: 22.5 Total days in-water stabbing: 5

1 #1= first marine mammal sighting of the day; #2= second marine mammal sighting of the day, etc.
2 Distribution of adults, juveniles, and calves.
3 Shutdown Criteria: 50 m from other in-water project activities; 200 m from either vibratory or impact pile driving; 350 m from impact pile driving, but only if 5 or more marine mammals are seen or if a calf/calves present; 800 m from vibratory pile driving, but only if 5 or more (group) marine mammals are seen or if calf/calves present.
4 In order of occurrence.
5 Reaction of marine mammals to project construction activities.
6 Per sighting: Total number of animals observed within safety or harassment zones during in-water pile driving activities.
7 Age of whales was not able to be determined due to sighting distance: 3.22 kilometers from Project footprint.

Marine Mammal Observation and Project Activities Summary: October 2008
Construction-Site Monitoring Location--Port of Anchorage Marine Terminal Redevelopment Project

Date	Project Activity at Time of Marine Mammal Sighting	Sighting Number[1]	No. of Marine Mammals	Group Composition[2]	No. of Animals in 200-Meter (m) Safety Zone[3]	No. of Animals in Harassment Zones[3]	Initial Heading & Behavior[4]	Reaction[5]	Shutdown? (Y/N) Time of Shutdown	Takes[6]	No. of Hours: Impact Pile Driving – In Water	No. of Hours: Vibratory Pile Driving – In Water	No. of Hours: Stabbing – In Water
1 Oct.	In-water pile driving with vibratory hammer	#1 (of 1)	3 beluga whales	3 adults	0	3	Traveling north as a cohesive group	No observable reaction	Yes: 9:55 – 10:16 a.m.	3	1 Oct. = 1.0	1 Oct. = 2.0	1 Oct. = 0
2 Oct. – 4 Oct.	N/A	No marine mammals sighted.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2 Oct. = 0 3 Oct. = 0 4 Oct. = 0	2 Oct. = 0 3 Oct. = 4.5 4 Oct. = 0	2 Oct. = 0 3 Oct. = 0 4 Oct. = 0
5 Oct.	Sunday – no work[7]												
6 Oct. – 8 Oct.	N/A	No marine mammals sighted.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	6 Oct. = 6.0 7 Oct. = 8.5 8 Oct. = 1.0	6 Oct. = 1.0 7 Oct. = 0 8 Oct. = 1.0	6 Oct. = 5.0 7 Oct. = 8.0 8 Oct. = 2.0
9 Oct.	N/A	No marine mammals sighted.	N/A	N/A	N/A	N/A	N/A	N/A	Yes: 12:57 – 2:00 p.m.; poor visibility due to snow & fog[8] Yes: 3:00 – 3:45 p.m.; poor visibility due to snow	N/A	9 Oct. = 5.0	9 Oct. = 2.0	9 Oct. = 0
10 Oct. – 15 Oct.	N/A	No marine mammals sighted.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	10 Oct. = 5.5 11 Oct. = 2.0 12 Oct. = 0 13 Oct. = 4.0 14 Oct. = 5.0 15 Oct. = 5.0	10 Oct. = 0 11 Oct. = 0 12 Oct. = 0 13 Oct. = 3.0 14 Oct. = 5.0 15 Oct. = 0	10 Oct. = 0 11 Oct. = 0.5 12 Oct. = 6.0 13 Oct. = 0 14 Oct. = 0 15 Oct. = 5.0
16 Oct.	N/A	No marine mammals sighted.	N/A	N/A	N/A	N/A	N/A	N/A	Yes: 10:30 a.m. – 12:30 p.m.; poor visibility due to fog	N/A	16 Oct. = 4.0	16 Oct. = 0	16 Oct. = 4.0
17 Oct. – 27 Oct.	N/A	No marine mammals sighted.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	17 Oct. = 4.0 18 Oct. = 3.0 19 Oct. = 0 20 Oct. = 3.0 21 Oct.=10.0 22 Oct. = 9.0 23 Oct. = 8.5 24 Oct. = 0 25 Oct. = 4.5 26 Oct. = 6.0 27 Oct. = 3.0	17 Oct. = 3.5 18 Oct. = 0 19 Oct. = 6.0 20 Oct. = 0 21 Oct. = 4.0 22 Oct. = 0 23 Oct. = 4.0 24 Oct. = 0 25 Oct. = 0 26 Oct. = 6.0 27 Oct. = 0	17 Oct. = 1.0 18 Oct. = 2.0 19 Oct. = 0 20 Oct. = 4.5 21 Oct. = 0 22 Oct. = 0 23 Oct. = 2.5 24 Oct. = 0 25 Oct. = 4.5 26 Oct. = 0 27 Oct. = 0
28 Oct.	No in-water construction	#1 (of 1)	6 beluga whales	2 adults 2 juveniles 2 calves	6	6	Swimming south: milling, suspected feeding, & diving	none	No	N/A	28 Oct. = 0	28 Oct. = 0	28 Oct. = 4.0
29 Oct. – 30 Oct.	N/A	No marine mammals sighted.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	29 Oct. = 0 30 Oct. = 6.0	29 Oct. = 5.0 30 Oct. = 6.0	29 Oct. = 0 30 Oct. = 0
31 Oct.	No in-water construction	#1 (of 1)	1 beluga whale	1 adult	0	0	Traveling northwest	No observable reaction	No	N/A	31 Oct. = 0	31 Oct. = 2.0	31 Oct. = 1.0
	OCTOBER TOTALS	3 marine mammal sightings	10 beluga whales sighted	6 adults 2 juveniles 2 calves	6 whales entered Safety Zone	9 whales entered Harassment Zones	N/A	N/A	4 shutdowns	3 takes	Total hours in-water impact pile driving: 104 Total days in-water impact pile driving: 21	Total hours in-water vibratory pile driving: 55 Total days in-water vibratory pile driving: 15	Total hours in-water stabbing: 50 Total days in-water stabbing: 14

1 #1= first marine mammal sighting of the day; #2= second marine mammal sighting of the day, etc.
2 Distribution of adults, juveniles, and calves.
3 Shutdown Criteria: 50 m from other in-water project activities; 200 m from either vibratory or impact pile driving; 350 m from impact pile driving, but only if 5 or more marine mammals are seen or if a calf/calves present; 800 m from vibratory pile driving, but only if 5 or more (group) marine mammals are seen or if calf/calves present.
4 In order of occurrence.
5 Reaction of marine mammals to project construction activities and other activities in the Port.
6 Per sighting: total number of animals observed within safety or harassment zones during in-water pile driving activities.
7 This was the only Sunday in Oct. that project activities were not conducted: 7-day/week work schedule for remainder of the month.
8 As required by stipulation 5(c)(3) of the 2008 Incidental Harassment Authorization.

Cumulative Summary of Pile-Driving Duration and Construction Observers Marine Mammal Observations: July – October 2008
Port of Anchorage Marine Terminal Redevelopment Project

Month	Total Sightings	No. & Species of Marine Mammals	Ages	Number of Animals in 200-m Safety Zone	Number of Animals in Harassment Zone[1]	Shutdowns[2]	Takes	Total Days: In-Water Pile Driving[3]	Total Hours: In-Water Pile Driving[4]	Total Hours: In-Water Pile Driving with Impact Hammer[5]	Total Hours: In-Water Pile Driving with Vibratory Hammer[6]	Total Hours: In-Water Stabbing[7]
July	1	7 beluga whales	7 adults	7	0	0	0	7 maximum (7/24 – 7/31)	Unknown	Unknown	Unknown	Unknown
August	34	262 beluga whales	151 adults 46 juveniles 27 calves 38 age unknown	10	97	6	0	25	147.75	Unknown	Unknown	Unknown
September	12	1 harbor seal 50 beluga whales	14 adults 18 juveniles 0 calves 18 whales: age unknown 1 harbor seal: age unknown	7	19	0	0	22	125.75	32.75	70.5	22.5
October	3	10 beluga whales	6 adults 2 juveniles 2 calves	6	9	4	3	27	209.0	104.0	55.0	50.0
Cumulative Totals	50	329 beluga whales 1 harbor seal	178 adults 66 juveniles 29 calves 36 whales: age unknown 1 harbor seal: age unknown	30	125	10	3	81	482.50	136.75	125.50	72.50

1 Includes some marine mammals that also entered the safety zone.
2 Includes shutdowns because of poor visibility.
3 Total days of in-water pile driving not tracked in July; at the request of National Marine Fisheries Service (NMFS), tracking of total days of in-water pile-driving days began in August.
4 Total hours of in-water pile driving not tracked in July; at the request of National Marine Fisheries Service (NMFS), daily tracking of in-water pile-driving hours began in August.
5 Total hours of in-water pile driving with impact hammer not tracked in July or August; at the request of National Marine Fisheries Service (NMFS), tracking daily hours of in-water pile-driving with impact hammer began in September.
6 Total hours of in-water pile driving with vibratory hammer not tracked in July or August; at the request of National Marine Fisheries Service (NMFS), tracking daily hours of in-water pile-driving with vibratory hammer began in September.
7 Total hours of in-water stabbing not tracked in July or August; at the request of National Marine Fisheries Service (NMFS), tracking daily hours of in-water stabbing began in September.

APPENDIX F
Underwater Noise Survey 2008

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Underwater Noise Survey Plan 2008

Port of Anchorage
Marine Terminal Redevelopment Project

AUGUST 2008

Prepared for:

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Underwater Noise Survey Plan 2008

Port of Anchorage
Marine Terminal Redevelopment Project

Table of Contents

1. Introduction

The Port of Anchorage (Port) serves 80 percent of Alaska's population and transports 90 percent of the consumer goods in Alaska. It is the major gateway for Alaska's water-borne commerce and a vital element of the regional economy, generating more than $750 million each year. To keep pace with the future trends in the shipping industry, the Port is undergoing construction to accommodate larger ships, develop larger barge berths, and improve and expand cruise ship facilities. As part of the Marine Terminal Redevelopment Project (Project), construction is planned for the next several years. To prevent and minimize adverse impacts to marine mammals, underwater noise surveys and beluga whale monitoring are required during in-water Port construction activities, including pile driving, dredging, vessel traffic and dockside activities.

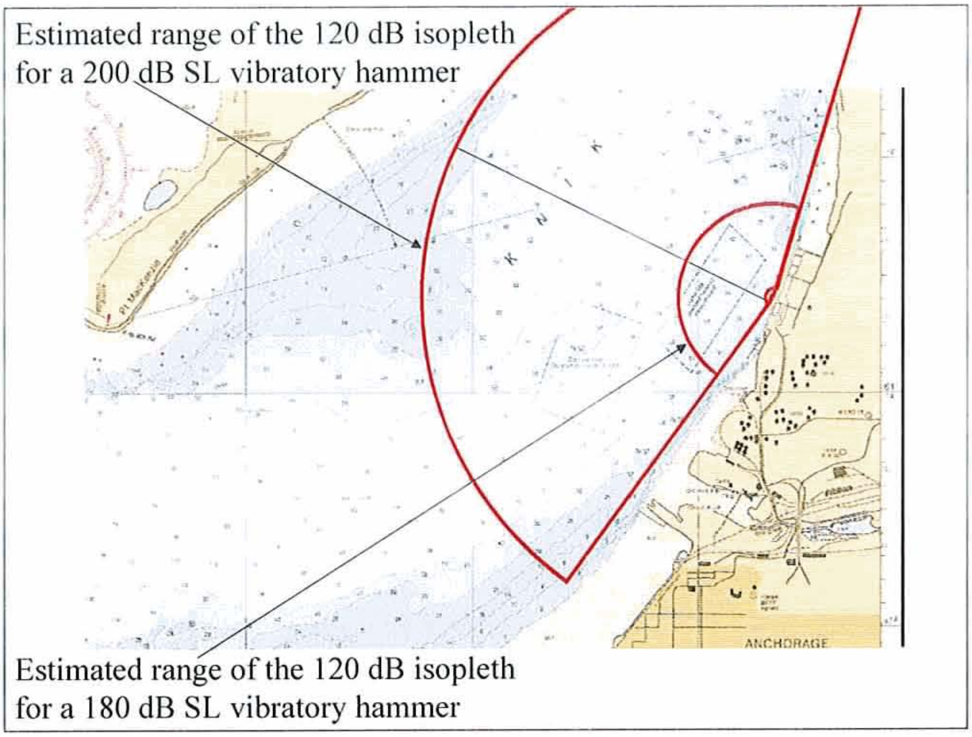
Representatives of the Port of Anchorage (POA) have received an Incidental Harassment Authorization (IHA) permit from the National Marine Fisheries Service (NMFS) dated July 15, 2008 for the 2008 construction season for small take authorizations under the Marine Mammal Protection Act (MMPA) for incidental taking of Cook Inlet Beluga Whales. The POA must comply with the terms of the IHA as well as the mitigation measures stipulated in the US Army Corps of Engineers (USACE) permit number POA-2003-502-N (August 10, 2007). Specific permit conditions will be discussed in Section 1.1.

Integrated Concepts and Research Corporation (ICRC) procured the services of Alaska Native Technologies, LLC (ANT) to develop this Noise Survey Plan (Plan). The Plan is written in accordance with the IHA and USACE permits and details procedures for conducting the noise survey during pile driving activities, and coordination with beluga whale observers, construction crews, and other Port operations personnel. Implementation of the Plan will occur only after NMFS approval.

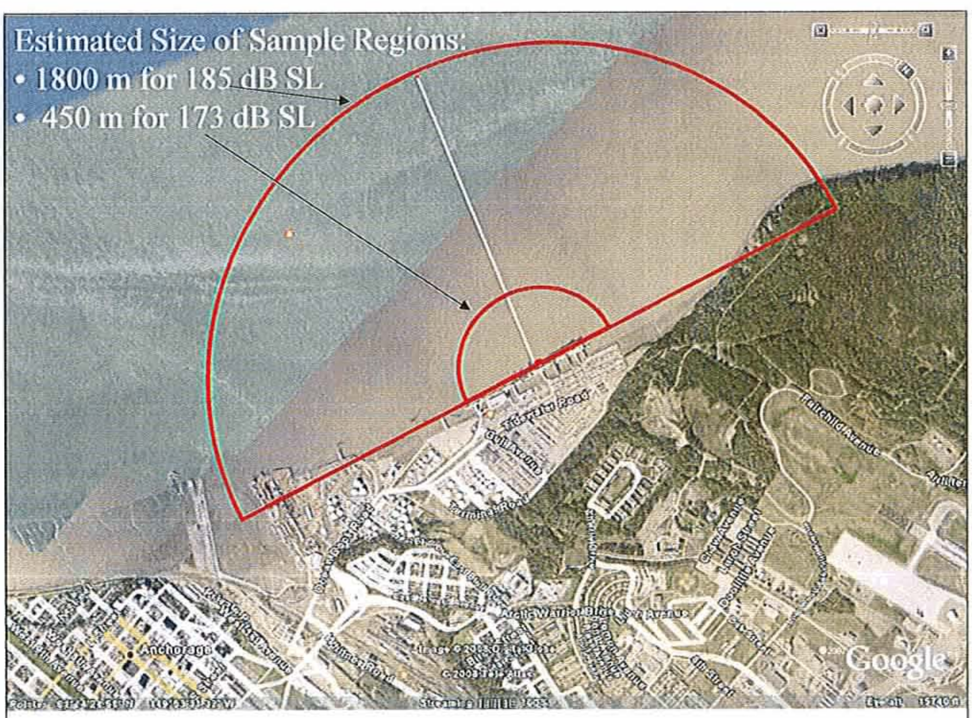
1.1 Permit Requirements

The following conditions specified in the NMFS and USACE permits are applicable to this Underwater Noise Survey Plan:

- Carry out a one-time acoustic monitoring study upon commencement of in-water pile driving. The study will confirm or identify harassment isopleths for all types of piles used, including open-cell sheet piles and 36-inch steel piles, and the "stabbing" process. The acoustic study proposal shall be approved by NMFS prior to the start of seasonal in-water pile driving.
- Collaborate with the concurrent beluga whale monitoring program to correlate construction noise with beluga whale presence, absence, or change in behavior.
- Conduct underwater noise surveys to verify the 190, 180, and 160 dB re 1 microPascal (μPa) root mean square (RMS) isopleths from pile driving activities, and determine the 120 dB isopleth for vibratory pile driving.
- Prior to the start of seasonal pile driving activities, the Port of Anchorage shall require construction supervisors and crews, the marine mammal monitoring team, the acoustical monitoring team, and all project managers to attend a briefing on



Projected sample area based on estimated transmission loss for 180 and 200 dB SL vibratory hammers



Projected sample area based on estimated transmission loss for 173 and 185 dB SL vibratory hammers responsibilities of each party, defining chains of command, discussing communication procedures, providing overview of monitoring purposes, and reviewing operational procedures regarding beluga whales.

- A "*soft start*" technique shall be used at the beginning of each day's in-water pile driving activities or if pile driving has ceased for more than one hour to allow any marine mammal that may be in the immediate area to leave before pile driving reaches full energy. The soft start requires subcontractors to initiate noise from vibratory hammers for 15 seconds at reduced energy followed by a one-minute waiting period. The procedure will be repeated two additional times. If an impact hammer is used, contractors will be required to provide an initial set of three strikes from the impact hammer at 40 percent energy, followed by a one-minute waiting period, then two subsequent three strike sets.
- If marine mammals are sighted within or approaching the safety or harassment zones prior to commencement of pile driving, operations shall be delayed until the animals move outside the zones in order to avoid take exceedence.
- Pile driving shall not occur when weather conditions restrict clear, visible detection of all waters within harassment zones. Such conditions that can impair sightability include, but are not limited to, fog and rough sea state.
- Develop a *Sound Index* to accurately represent noise levels from pile driving and other Port operations, including dockside activities, vessel traffic, dredging, and docking. The evaluation shall characterize current baseline operations noise levels at the Port of Anchorage and develop an engineering report that identifies structural and operational noise reduction measures, if necessary, to minimize the baseline operational noise levels at the expanded Port to the maximum extent practicable.

1.2 Underwater Sound Descriptors

Sound is a physical phenomenon consisting of minute vibrations that travel through a medium, such as air or water. Sound is generally characterized by several variables, including frequency and intensity. Frequency describes the sound's pitch and is measured in Hertz (Hz), while intensity describes the sound's loudness and is measured in decibels (dB). Decibels are measured using a logarithmic scale.

The method commonly used to quantify airborne sounds consists of evaluating all frequencies of a sound according to a weighting system which reflects that human hearing is less sensitive at low frequencies and extremely high frequencies than at the mid-range frequencies. This is called A-weighting, and the decibel level measured is called the A-weighted sound level (dBA). A filtering method to reflect hearing of marine mammals such as whales has not been developed for regulatory purposes. Therefore, sound levels underwater are not weighted and measure the entire frequency range of interest. In the case of marine construction work, the frequency range of interest is 10 to 10,000 Hz.

Several descriptors are used to describe underwater sounds. Two common descriptors are the instantaneous peak sound pressure level (dB PEAK) and the Root Mean Square (dB RMS) pressure level during the pulse or over a defined averaging period. The peak pressure is the instantaneous maximum or minimum overpressure observed during each pulse or sound event and is presented in Pascals (Pa) or decibels (dB) referenced to a pressure of 1 micro Pascal (μPa).

The RMS level is the square root of the energy divided by a defined time period. The duration of a single pulse will be defined as the averaging period for impact pile driving. The RMS or sound pressure level (SPL) average period is not sensitive to continuous sounds from vibratory pile installation, so a period of about 1/8 of a second will be appropriate for evaluating impacts to marine mammals. Other researchers have used longer periods for vibratory driving, but offered no justification. The "impulse" setting of a sound level meter uses 35-millisecond (ms) time averaging. This provides a good approximation of the RMS averaged over the duration of a pulse, since most pile driving impact pulses last about 40 to 60 ms. This proposed monitoring plan will provide RMS levels for various pulse durations to ensure the appropriate levels are used to assess impacts to marine mammals.

Transmission loss (TL) under water is the decrease in acoustic intensity as an acoustic pressure wave propagates out from a source. Transmission loss parameters vary with frequency, temperature, sea conditions, source and receiver depth, water chemistry, and bottom composition and topography. For this survey, TL will be calculated based on results of underwater sound measurements for several hydrophone positions both close and distant from the pile installation activity.

2. Project Objectives

To prevent and minimize adverse impacts to marine mammals, underwater noise surveys and beluga whale monitoring are required during MTR Project activities, including pile driving, pile stabbing, construction, dockside activities, vessel traffic, and dredging. The noise survey is to be conducted over a period of approximately five to seven days in order to appropriately capture representative noise measurements of pile driving test and existing Port operations. The survey is expected to begin mid-September 2008, in coordination with the MTR Project construction subcontractor, QAP, and their schedule for in-water pile driving.

3. Methodology

To successfully implement an Underwater Noise Survey Plan, it is necessary to have the following:

- A sampling strategy that provides sufficient coverage within the MTR Project footprint (See Section 4);
- Sensors that can sufficiently provide the acoustic, bathymetric, thermal, and location accuracy needed to provide the data that will be used to provide a sound index;
- Personnel that have field experience for hydro-acoustic data collection;
- Analysis tools to properly analyze and graphically report the sound index;
- Coordination with both the pile-driving and whale observation activities, including the ability to immediately communicate with both groups; and
- Maritime support sufficient to provide rapid response of sensors.

3.1 Briefing

Prior to beginning activities, ANT will coordinate with ICRC's Construction Group to attend the weekly subcontractors meeting.

During the underwater noise survey, ANT personnel will attend the subcontractor's daily safety meeting. All personnel involved in the daily activities will coordinate survey operations with QAP's and ICRC's Safety Managers.

Depending on the tide schedule at the survey site, ANT personnel will launch the boat and arrive at the survey site at least one hour prior to high tide to prepare for monitoring.

3.2 Coordination

Coordination between the noise survey vessel, construction crew, POA personnel, marine mammal observers, and ICRC staff will be conducted using hand-held radios. It is imperative that the noise survey vessel remain in constant contact with the construction crew or ICRC personnel to be apprised of the start and stop times of the pile driving, types of pile, depths of pile, and location.

ANT will have one technician on the noise survey vessel who will operate the hydro-acoustic recording devices and other necessary equipment, and coordinate with the on-shore personnel, vessel operators, and marine mammal observers. The boat will be operated by Terrasond, a company with extensive experience in working in the arduous conditions associated with Knik Arm.

3.3 Equipment

ANT will provide all equipment required for the noise survey, as described in the following sections.

3.3.1 Boat

Terrasond has two vessels available for rapid response: the M/V Jella Sea and the MV Hick Up. Each vessel can be transported by trailer on surface streets and deployed directly from the Port. These vessels have been used previously in the Upper Cook Inlet for data collection activities and have proven to be safe and reliable in this environment. Acoustic sampling will be conducted by two people aboard each vessel: the vessel operator and the acoustician.

Each vessel provides a Differential GPS with NMEA port and a depth sounder. These vessels also provide 110 VAC power through DC to AC invertors. The acoustic equipment will be located in an enclosed cabin so that data collection will not be hampered by rain. Both vessels have VHF radios to provide communications with the pile driving crew on shore.

3.3.2 Recording

The passive hydro-acoustic monitoring equipment that has been selected for this survey is consistent with the acoustic equipment used during prior beluga whale noise studies (Blackwell & Greene, 2002; NMFS, 2007). The following acoustic sampling equipment will be used:

- Calibrated hydrophone capable of recording from 1 Hz to 25 kHz (Reson TC4034)
- Signal amplifier, providing up to 94 dB additional signal strength (Stanford Research Model SR560)

- Data collection system that provides the capability of 14-bit samples up to 2,000,000 samples per second and stores the data in 10 second intervals in time-stamped files (Adlink DAQ-2010)
- Nautical charting software to provide immediate reference of the sensor during data collection and assist with sensor positioning and localization of additional noise sources such as vessel traffic in the sample region
- Matlab data analysis software for quick-look analysis on the water to confirm system operation and provide immediate noise levels

The hydrophone will be attached to a weight between 5 and 20 pounds, and manually lowered into the water. ANT will have several different weights, so that adjustments in the field can be made if necessary. Hydrophone depth will be set at 10 m, unless the water is too shallow, in which case the hydrophone will be placed at half the available depth. A depth reading will be taken with the recording vessel's depth sounder before all sound-generating devices (engine, generator, depth sounder) on the vessel are turned off and the vessel begins its drift. Power on the vessel will be 110 VAC provided through power inversion from 12V marine-grade batteries.

During the data collection operation, range information from all known noise sources will be stored in a log file. The log file provides time-stamped entries that identify acoustic events as they are occurring. At a minimum, the start and stop of pile-driving activities will be noted, as well as the location, name, and size of any vessels passing through the area. A range finder will be used to determine the distance between the data collection vessels and vessels passing through the area. Annotations on the electronic chart will also be made and this data will be stored with the log files through screen captures.

3.3.3 Differential GPS

A differential GPS is installed on each vessel proposed for maritime support. Either the Trimble DSM-212 or the CSI MBX-3 Beacon Receiver will be used to provide D-GPS data. Both of these devices provide an NMEA output for the nautical charting software. The GPS will be used to reset the clock on the data collection system prior to data collection each day, in order to mitigate clock drift.

3.3.4 Depth Sounder

Depth information will be collected and monitored using Raymarine Model L365 depth sounder.

3.3.5 Water Temperature

Temperature data will be continuously collected using an Applied Microsystems CTD (conductivity-temperature-depth) sensor deployed to the same depth as the acoustic sensor. Data is time-stamped as it is collected.

The internal clock will be synchronized with the GPS at the beginning of each day to mitigate clock drift.

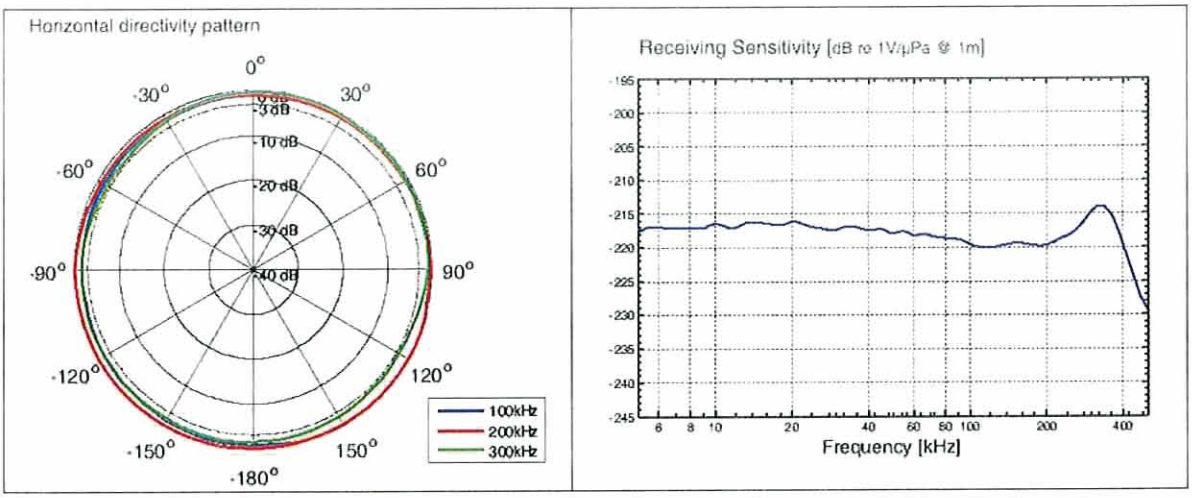
3.3.6 Laser Range Finder

To determine the range from the data collection vessel to other passing vessels and other surface-borne acoustic sources, a Bushnell Yardage Pro Trophy Laser Rangefinder will be used. This rangefinder provides distance accuracy of 1 m to 800 m.

3.3.7 Sensor Calibration

All hydro-acoustic sensors were individually calibrated from the manufacturers in a well-controlled environment. Additional calibration is not necessary to perform the noise survey. The directivity pattern and the receiving sensitivity of Reson hydrophone TC4034 are shown in the figure below.

Reson Hydrophone TS4034 Directivity and Sensitivity Curves



4. Sampling Protocol and Techniques

To create the required sound-index and the associated acoustic isopleths, passive acoustic measurements will need to be taken during a variety of activities, including pile driving, dockside activities, vessel traffic in the channel, dredging, and docking activities. Furthermore, sampling must be done for each type of piling and pile installation technique.

Sampling must be done at multiple locations to produce the required 190, 180, 160, and 120 dB isopleths. Sampling will occur from a drifting vessel, utilizing the tides and currents to move through the sample area. The sample area for each isopleth will be determined based on the estimated Source Level (SL) of each pile driving method. The SPL measured at the receiver is affected by the TL from spherical spreading (20 log R) and attenuation from absorption loss (NA), related using the equation

$$SPL = SL - TL$$

$$TL = 20 \log R - NA$$

For example, assuming an SL of the vibratory hammer equals to 185 dB, the distance to 160 dB isopleth could be approximately estimated at 18 m. Hence the sample area for 160 dB isopleth for vibratory hammer will be located approximately between 15~20 meters distance from the pile. Note that in this example the SL of the vibratory hammer is less then 190 dB, so the 190 dB isopleths for this operation would not be applicable. Furthermore, the 180 dB isopleth will be located approximately 2 m from the source. Measuring sound pressure level at this distance might be inappropriate due to various factors (acoustic far-field restrictions, equipment deployment complexity, safety requirements). In such case the theoretical location of 180 dB isopleth could be empirically derived from the SPL data recorded at larger distances based on estimated TL values.

According to the IHA and USACE permits, impact pile driving may not take place within two hours on either side of low tide; therefore, ANT will measure other Port operation activities (docking, dredging, vessel activities, other construction activities) and ambient noise levels during low tides. Since the existing underwater noise in Knik Arm is often higher then 120 dB (URS Report, Underwater Noise Survey During Test Pile Driving, 2007), it might be difficult to determine the location of the 120 dB isopleth for any pile driving operation. Again, the theoretical location of 120 dB isopleth could be empirically derived from the SPL data recorded at smaller distances from the source.

Each day that the pile driving noise is sampled, a hydrophone that is acoustically isolated from the survey vessel will be deployed at mid-water depth and the vessel will be shut down and allowed to drift past the MTR Project site at various ranges from shore within the sample region. The minimum range to the pile driving activity will be 10 meters to provide a safety zone near the pile-driving activity. The drift rate will depend on the tides and currents. Appendix A provides estimates of currentes in the sampling region for September 2008 (http://tidesand**currents**.noaa.gov/**currents**08). A differential GPS will be used to acquire position information. Acoustic data will be collected at 10-second intervals and each 10-second file will be tagged with GPS-synchronized time and location for later isopleth creation. The peak pressure and sound pressure level (RMS) will be calculated from recorded data using custom-developed signal processing Matlab scripts. Nautical chart software on the vessel will be used to track the vessel position and assist with positioning so that the sample region will be optimally sampled. Isopleth will be created daily and compared with prior isopleth to determine variability. Isopleths will be created from samples collected during a complete sample interval.

All noise sources will be catalogued during collection. A laser rangefinder will be used to measure distance to vessels that pass through the sample area. The isopleths produced each day will be transmitted to the pile-driving subcontractor (QAP) and their marine mammal observers (FROG) and reviewed by an ANT marine mammal expert. The sampling strategy will be optimized each day using the results from the prior acoustic measurements.

4.1 Stabbing

Due to the short duration of the pile driving "stabbing" process and due to unknown SL values, creating isopleths for this operation would require multiple repetition of "stabbing" with each individual pile. Since this approach is not feasible, the first two recordings of pile "stabbing" will be used to estimate corresponding SL. Based on the calculated SL values ANT will estimate the theoretical distance to each isopleth. Estimated isopleth distances will be then used to determine recording locations for the consecutive pile "stabbing" operations. The recorded SPL values at these locations will be used to verify the estimated isopleths distances.

Since "stabbing" operations are performed at reduced vibratory hammer energy, it is estimated that the SL for this operation may be less then 190 dB. In this case only 180 dB, 160 dB, and 120 dB isopleths would be determined for "stabbing" operation.

4.2 Vibratory Pile Driving

The SL for vibratory hammers can range from 173 dB to 185 dB re 1 micro Pascal (μPa) RMS, depending on the pile driving equipment being used (Hawkins, 2006; Illingworth & Rodkin, 2001; Abbott & Bing-Sawyer, 2002). Given the TL values provided above, a 120 dB isopleths for a 185 dB SL vibratory hammer would be 1800 m from the source. If the SL of the vibratory hammer is 173 dB, then the 120 dB isopleths are approximately 450 m from the source. This estimate is also affected by sediment load, salinity, bathymetry, water temperature, and other ambient noise sources in the region. Much of Upper Cook Inlet is generally a poor acoustic environment because of its shallow depth, sand/mud bottoms, and high background noise from currents and glacier silt (Blackwell and Green, 2002). It is expected that the sample region required to meet the 190 dB, 180 dB, 160 dB, and 120 dB isopleths is closer to smaller than the ranges mentioned above.

Vibratory pile installation produces continuous sounds, which are not sensitive to the RMS averaging time window selected, unlike impulse sounds. The 1/8 second average tie will be used to measure the RMS for vibratory pile driving.

4.3 Impact Pile Driving

Underwater sound levels from impact pile driving are much higher in amplitude and shorter in duration than vibratory sound levels. For this reason, safety zones will be greater and will require considerably more measurements to establish.

Impact pile driving generates transient noise events of varying duration. For this reason, the "impulse" setting that utilizes a 35-milliseconds (ms) time average will be used for describing sound pressure levels for this type of pile driving. Duration of pile driving sounds is typically 50 to 100 ms, with most energy contained within about 50 ms. The RMS measured with the impulse setting will closely approximate this pulse over the duration.

5.0 Data Analysis

The peak pressure and sound pressure level (RMS) will be measured in real time using an SLM and recorded on a datasheet. Sampled calibrated tap recordings will be analyzed using Real Time Analyzers (RTA) to provide detailed acoustical analyses of selected pile installation sounds. Waveforms (time pressure analysis), frequency spectra (narrow band and 1/3 octave band), and accumulation of sound energy can be provided from this type of analysis.

6.0 Reporting

Preliminary noise survey data consisting of peak and RMS sound pressure levels will be made available verbally at the end of each measurement day. Following approval by ICRC, ANT will produce a report documenting the results of the noise surveys for pile driving and other Port activities. ANT will also include any beluga whale activities observed in the MTR Project footprint during the noise surveys.

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Appendix A

Cook Inlet Currents – Anchorage Shipdock – September 2008

	Slack Water	Maximum Current		Slack Water	Maximum Current		Slack Water	Maximum Current		Slack Water	Maximum Current		Slack Water	Maximum Current	
	Time h.m.	Time h.m.	Veloc knots	Time h.m.	Time h.m.	Veloc knots	Time h.m.	Time h.m.	Veloc knots	Time h.m.	Time h.m.	Veloc knots	Time h.m.	Time h.m.	Veloc knots
1	420	630	5.5	1014	1152	-5.6	1639	1842	5.7	2232					
2		10	-5.8	501	700	5.6	1054	1227	-5.4	1719	1913	5.6	2308		
3		45	-5.7	542	734	5.5	1134	1303	-5.1	1758	1947	5.3	2343		
4		120	-5.4	623	811	5.1	1213	1340	-4.6	1838	2025	4.8			
5	17	158	-5	706	851	4.6	1254	1419	-4.1	1920	2106	4.1			
6	53	239	-4.5	753	935	3.9	1338	1503	-3.4	2009	2152	3.3			
7	133	327	-3.8	850	1025	3.1	1433	1554	-2.7	2112	2244	2.6			
8	225	420	-3.2	958	1120	2.4	1544	1651	-2.2	2225	2340	2.1			
9	342	519	-2.8	1108	1220	2.1	1702	1756	-1.8		1933	-1.4		2047	-1.7
10	503	628	-2.6		800	-2.4		901	-2.5	1211	1331	2		1418	2
11		152	1.9	613	944	-3	1306	1623	2.8	1907	2214	-2.9			
12	130	429	2.5	711	1013	-3.5	1354	1656	3.4	1953	2238	-3.4			
13	215	421	3.2	801	941	-4.1	1436	1647	4	2032	2203	-4.1			
14	256	446	4	844	1017	-4.6	1515	1707	4.5	2107	2237	-4.7			
15	334	524	4.8	924	1055	-5	1552	1742	5	2140	2314	-5.4			
16	411	603	5.4	1002	1134	-5.3	1628	1820	5.4	2212	2352	-5.8			
17	448	644	5.8	1040	1213	-5.4	1704	1900	5.6	2245					
18		31	-6	527	725	5.9	1120	1253	-5.2	1742	1940	5.5	2319		
19		112	-5.9	609	808	5.7	1203	1335	-4.9	1823	2024	5.1	2358		
20		155	-5.6	657	854	5.1	1251	1421	-4.2	1911	2111	4.5			
21	43	244	-5	753	945	4.4	1347	1514	-3.6	2012	2204	3.8			
22	140	341	-4.4	901	1043	3.7	1456	1615	-3	2128	2304	3.1			
23	256	444	-3.8	1015	1146	3.1	1614	1723	-2.7	2246					
24		9	2.7	423	556	-3.5	1125	1303	3	1727	2039	-2.9	2355		
25		133	2.7	540	853	-3.7	1227	1538	3.6	1830	2128	-3.8			
26	55	358	3.6	646	942	-4.3	1322	1625	4.3	1923	2207	-4.5			
27	147	444	4.4	743	1019	-4.8	1410	1704	4.8	2008	2236	-5			
28	233	524	5	831	1041	-5	1453	1735	5	2048	2244	-5.4			
29	315	553	5.3	914	1058	-5.2	1534	1747	5.2	2125	2308	-5.6			
30	355	608	5.5	953	1126	-5.2	1612	1809	5.2	2200	2339	-5.8			

APPENDIX G
Take Calculations

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Table G-1
Pile Driving Duration Calculations

				HAIRPIN				SHEET PILES						TEMPORARY PILES (vib only)			FENDER PILES					GRAND TOTALS			
Year	Location of Activity	Type of Pile Installation	Length of Bulkhead Wall	Number of Sheet Piles	Number of Hairpin Uses	Number of Hours	Number of Hours with 2 crews, 75% work time	Length of Submerged Wall	Lengh of Tidally Influenced Wall	Number of Hours Pile Driving	Number of Hours Pile Driving with 2 crews, 75% work time	Number of Hours Vibratory Driving	Number of Hours Impact Driving	Number of Piles	Number of Hours Vibratory Pile Driving	Number of Hours Pile Driving with 2 crews, 75% work time	Number of Piles	Number of Hours Pile Driving	Number of Hours Pile Driving with 2 crews, 75% work time	Number of Hours Vibratory Driving	Number of Hours Impact Driving	Vibratory Driving	Impact Driving	Total Driving	Year
Description						4 min per pile		all wall considered in-water	half wall considered in-water	30 ft of wall in 10 hour period				4 temporary piles per template (27.5 ft of dock face)	10 min per pile		2 piles for every 55 ft of dock face	2 hours per pile							
Formula					number piles*34%	use *4min/60min/hr				submerged/30*10+tidally/30*10/2	Hours/2*.75	75 percent	25 percent	length/27.5*4	# piles*10/60	hours/2*.75	length/55*2	# piles*2	hours/2	75 percent	25 percent				
		OCSP	0		0	0	0	0	0	0	0	0	0									0	0	0	
	Barge Berths	Temporary	0											0	0	0						0	0	0	
		Fender	360														14	28	11	8	3	8	3	11	
2009																						0	0	0	2009
		OCSP	1,840	4,106	1,396	93	70	3,920	2,739	1,763	661	496	165									496	235	731	
	North Extension	Temporary	1,840											268	45	17						17	0	17	
		Fender	0														0	0	0	0	0	0	0	0	
TOTAL							**70**			**1,763**	**661**	**496**	**165**	**268**	**45**	**17**	**14**	**28**	**11**	**8**	**3**	**520**	**238**	**758**	
		OCSP	1,000	1,831	623	42	31	1,554	1,506	769	288	216	72									216	103	320	
	South Extension	Temporary	1,000											145	24	9						9	0	9	
		Fender	1,000														36	73	27	20	7	20	7	27	
2010																						0	0	0	2010
		OCSP	0		0	0	0	0	0	0	0	0	0									0	0	0	
	North Extension	Temporary	0											0	0	0						0	0	0	
		Fender	1,840														82	164	62	46	15	46	15	62	
TOTAL							**31**			**769**	**288**	**216**	**72**	**145**	**24**	**9**	**118**	**237**	**89**	**67**	**22**	**292**	**125**	**417**	
		OCSP	1,000	2,718	924	62	46	2,756	1,429	1,157	434	325	108									325	155	480	
	North Replacement	Temporary	1,000											145	24	9						9	0	9	
		Fender	0														0	0	0	0	0	0	0	0	
2011																						0	0	0	2011
		OCSP	0		0	0	0	0	0	0	0	0	0									0	0	0	
	South Extension	Temporary	0											0	0	0						0	0	0	
		Fender	0														0	0	0	0	0	0	0	0	
TOTAL							**46**			**1,157**	**434**	**325**	**108**	**145**	**24**	**9**	**0**	**0**	**0**	**0**	**0**	**334**	**155**	**489**	
		OCSP	1,000	2,718	924	62	46	2,756	1,429	1,157	434	325	108									325	155	480	
	North Replacement	Temporary	1,000											145	24	9						9	0	9	
		Fender	0														0	0	0	0	0	0	0	0	
2012																						0	0	0	2012
		OCSP	1,118	3,034	1,032	69	52	3,071	1,661	1,301	488	366	122									366	173	539	
	South Replacement	Temporary	1,118											163	27	10						10	0	10	
		Fender	0														0	0	0	0	0	0	0	0	
TOTAL							**98**			**2,457**	**922**	**691**	**230**	**308**	**51**	**19**	**0**	**0**	**0**	**0**	**0**	**710**	**328**	**1,039**	
		OCSP	0		0	0	0	0	0	0	0	0	0									0	0	0	
	North Replacement	Temporary	0											0	0	0						0	0	0	
		Fender	2,000														94	188	71	53	18	53	18	71	
2013																						0	0	0	2013
		OCSP	1,118	3,034	1,032	69	52	3,071	1,661	1,301	488	366	122									366	173	539	
	South Replacement	Temporary	1,118											163	27	10						10	0	10	
		Fender	0														0	0	0	0	0	0	0	0	
TOTAL							**52**			**1,301**	**488**	**366**	**122**	**163**	**27**	**10**	**94**	**188**	**71**	**53**	**18**	**429**	**191**	**620**	
		OCSP	0		0	0	0	0	0	0	0	0	0									0	0	0	
Before July 15, 2014	South Replacement	Temporary	0											0	0	0						0	0	0	Before July 15, 2014
		Fender	1,118														41	81	30	23	8	23	8	30	
TOTAL							**0**			**0**	**0**	**0**	**0**	**0**	**0**	**0**	**41**	**81**	**30**	**23**	**8**	**23**	**8**	**30**	
		OCSP	0		0	0	0	0	0	0	0	0	0									0	0	0	
After July 15, 2014	South Replacement	Temporary	0											0	0	0						0	0	0	After July 15, 2014
		Fender	1,118														41	81	30	23	8	23	8	30	
TOTAL							**0**			**0**	**0**	**0**	**0**	**0**	**0**	**0**	**41**	**81**	**30**	**23**	**8**	**23**	**8**	**30**	
		GRAND TOTALS					**296**	**17,128**	**10,425**	**7,447**	**2,793**	**2,094**	**698**	**1,029**	**172**	**64**	**308**	**615**	**231**	**173**	**58**	**2,332**	**1,052**	**3,384**	

Table G-2
Pile Driving Hours by Month Calculations

Year	Month	HAIRPIN Impact	SHEET PILE Vibratory	SHEET PILE Impact	TEMPORARY Vibratory	FENDER PILE Vibratory	FENDER PILE Impact	GRAND TOTALS Vibratory	GRAND TOTALS Impact	GRAND TOTALS Total
2009	**Total**	**69.8**	**495.9**	**165.3**	**16.7**	**7.9**	**2.6**	**520.5**	**237.7**	**758.2**
	April	10.9	77.5	25.8	2.6	1.2	0.4	81.3	37.1	118.5
	May	7.6	54.2	18.1	1.8	0.9	0.3	56.9	26.0	82.9
	June	7.6	54.2	18.1	1.8	0.9	0.3	56.9	26.0	82.9
	July	10.9	77.5	25.8	2.6	1.2	0.4	81.3	37.1	118.5
	August	10.9	77.5	25.8	2.6	1.2	0.4	81.3	37.1	118.5
	September	10.9	77.5	25.8	2.6	1.2	0.4	81.3	37.1	118.5
	October	10.9	77.5	25.8	2.6	1.2	0.4	81.3	37.1	118.5
2010	**Total**	**31.1**	**216.3**	**72.1**	**9.1**	**66.6**	**22.2**	**292.0**	**125.4**	**417.4**
	April	4.9	33.8	11.3	1.4	10.4	3.5	45.6	19.6	65.2
	May	3.4	23.7	7.9	1.0	7.3	2.4	31.9	13.7	45.6
	June	3.4	23.7	7.9	1.0	7.3	2.4	31.9	13.7	45.6
	July	4.9	33.8	11.3	1.4	10.4	3.5	45.6	19.6	65.2
	August	4.9	33.8	11.3	1.4	10.4	3.5	45.6	19.6	65.2
	September	4.9	33.8	11.3	1.4	10.4	3.5	45.6	19.6	65.2
	October	4.9	33.8	11.3	1.4	10.4	3.5	45.6	19.6	65.2
2011	**Total**	**46.2**	**325.4**	**108.5**	**9.1**	**0.0**	**0.0**	**334.5**	**154.7**	**489.1**
	April	7.2	50.8	16.9	1.4	0.0	0.0	52.3	24.2	76.4
	May	5.1	35.6	11.9	1.0	0.0	0.0	36.6	16.9	53.5
	June	5.1	35.6	11.9	1.0	0.0	0.0	36.6	16.9	53.5
	July	7.2	50.8	16.9	1.4	0.0	0.0	52.3	24.2	76.4
	August	7.2	50.8	16.9	1.4	0.0	0.0	52.3	24.2	76.4
	September	7.2	50.8	16.9	1.4	0.0	0.0	52.3	24.2	76.4
	October	7.2	50.8	16.9	1.4	0.0	0.0	52.3	24.2	76.4
2012	**Total**	**97.8**	**691.1**	**230.4**	**19.3**	**0.0**	**0.0**	**710.4**	**328.2**	**1,038.5**
	April	15.3	108.0	36.0	3.0	0.0	0.0	111.0	51.3	162.3
	May	10.7	75.6	25.2	2.1	0.0	0.0	77.7	35.9	113.6
	June	10.7	75.6	25.2	2.1	0.0	0.0	77.7	35.9	113.6
	July	15.3	108.0	36.0	3.0	0.0	0.0	111.0	51.3	162.3
	August	15.3	108.0	36.0	3.0	0.0	0.0	111.0	51.3	162.3
	September	15.3	108.0	36.0	3.0	0.0	0.0	111.0	51.3	162.3
	October	15.3	108.0	36.0	3.0	0.0	0.0	111.0	51.3	162.3
2013	**Total**	**51.6**	**365.8**	**121.9**	**10.2**	**52.9**	**17.6**	**428.8**	**191.1**	**619.9**
	April	8.1	57.2	19.1	1.6	8.3	2.8	67.0	29.9	96.9
	May	5.6	40.0	13.3	1.1	5.8	1.9	46.9	20.9	67.8
	June	5.6	40.0	13.3	1.1	5.8	1.9	46.9	20.9	67.8
	July	8.1	57.2	19.1	1.6	8.3	2.8	67.0	29.9	96.9
	August	8.1	57.2	19.1	1.6	8.3	2.8	67.0	29.9	96.9
	September	8.1	57.2	19.1	1.6	8.3	2.8	67.0	29.9	96.9
	October	8.1	57.2	19.1	1.6	8.3	2.8	67.0	29.9	96.9
Before July 15, 2014	**Total**	**0.0**	**0.0**	**0.0**	**0.0**	**22.9**	**7.6**	**22.9**	**7.6**	**30.5**
	April	0.0	0.0	0.0	0.0	8.2	2.7	8.2	2.7	10.9
	May	0.0	0.0	0.0	0.0	3.3	1.1	3.3	1.1	4.4
	June	0.0	0.0	0.0	0.0	3.3	1.1	3.3	1.1	4.4
	July	0.0	0.0	0.0	0.0	8.2	2.7	8.2	2.7	10.9
After July 15, 2014	**Total**	**0.0**	**0.0**	**0.0**	**0.0**	**22.9**	**7.6**	**22.9**	**7.6**	**30.5**
	August	0.0	0.0	0.0	0.0	7.6	2.5	7.6	2.5	10.2
	September	0.0	0.0	0.0	0.0	7.6	2.5	7.6	2.5	10.2
	October	0.0	0.0	0.0	0.0	7.6	2.5	7.6	2.5	10.2

0

Distribution description for 2009 - 2013

5x + 2y = z; y = 0.7 x
x = number of hours in apr, jul-oct
y = number of hours in may, jun
z = total number of hours per year
Solve:
z = 5x + 2(0.7x)
z = 5x + 1.4x
z = 6.4x

so apr, jul-oct = z / 6.4
may, jun = number of hours / 6.4 * 0.7

Distribution description for Before July 14, 2014

2x + 2y = z; y = 0.4x
x = number of hours in apr & jul
y = number of hours in may, jun
z = total number of hours per year
Solve:
z = 2x + 2(0.4x)
z = 2x + .8x
z = 2.8x

so apr * jul = z / 2.8
may, jun = number of hours / 2.8 * 0.4

After July 14, 2014

total number of hours / 3

Table G-3
Estimated Number of Beluga Whales Potentially Exposed to Noise

Hairpin

Distance to 160 dB (km): 0.205 | 0.205 | 0.205
Area of 160 dB (km2): 0.066 | 0.066 | 0.066

Year	Month	Average Beluga Whale Density	Number of Hours	Take within 500 m for 80%	Take within 1000 m for 10%	Take in Arm for 10%	Total Take	Round Up
2009	April	0.014	10.9	0.008	0.001	0.001	0.010	1
	May	0.006	7.6	0.002	0.000	0.000	0.003	1
	June	0.012	7.6	0.005	0.001	0.001	0.006	1
	July	0.004	10.9	0.002	0.000	0.000	0.003	1
	Aug	0.062	10.9	0.036	0.004	0.004	0.045	1
	Sept	0.043	10.9	0.025	0.003	0.003	0.031	1
	Oct	0.020	10.9	0.012	0.001	0.001	0.015	1
	TOTAL		**69.8**	**0.090**	**0.011**	**0.011**	**0.113**	**7**
	Low tide							
2010	April	0.014	4.9	0.004	0.000	0.000	0.004	1
	May	0.006	3.4	0.001	0.000	0.000	0.001	1
	June	0.012	3.4	0.002	0.000	0.000	0.003	1
	July	0.004	4.9	0.001	0.000	0.000	0.001	1
	August	0.062	4.9	0.016	0.002	0.002	0.020	1
	September	0.043	4.9	0.011	0.001	0.001	0.014	1
	October	0.020	4.9	0.005	0.001	0.001	0.006	1
	TOTAL		**31.1**	**0.040**	**0.005**	**0.005**	**0.050**	**7**
	Low tide							
2011	April	0.014	7.2	0.005	0.001	0.001	0.007	1
	May	0.006	5.1	0.001	0.000	0.000	0.002	1
	June	0.012	5.1	0.003	0.000	0.000	0.004	1
	July	0.004	7.2	0.002	0.000	0.000	0.002	1
	August	0.062	7.2	0.024	0.003	0.003	0.030	1
	September	0.043	7.2	0.017	0.002	0.002	0.021	1
	October	0.020	7.2	0.008	0.001	0.001	0.010	1
	TOTAL		**46.2**	**0.060**	**0.007**	**0.007**	**0.074**	**7**
	Low tide							
2012	April	0.014	15.3	0.011	0.001	0.001	0.014	1
	May	0.006	10.7	0.003	0.000	0.000	0.004	1
	June	0.012	10.7	0.007	0.001	0.001	0.009	1
	July	0.004	15.3	0.003	0.000	0.000	0.004	1
	August	0.062	15.3	0.050	0.006	0.006	0.063	1
	September	0.043	15.3	0.035	0.004	0.004	0.044	1
	October	0.020	15.3	0.016	0.002	0.002	0.020	1
	TOTAL		**97.8**	**0.126**	**0.016**	**0.016**	**0.158**	**7**
	Low tide							
2013	April	0.014	8.1	0.006	0.001	0.001	0.007	1
	May	0.006	5.6	0.002	0.000	0.000	0.002	1
	June	0.012	5.6	0.004	0.000	0.000	0.005	1
	July	0.004	8.1	0.002	0.000	0.000	0.002	1
	August	0.062	8.1	0.027	0.003	0.003	0.033	1
	September	0.043	8.1	0.018	0.002	0.002	0.023	1
	October	0.020	8.1	0.009	0.001	0.001	0.011	1
	TOTAL		**51.6**	**0.067**	**0.008**	**0.008**	**0.083**	**7**
	Low tide							
Before July 15, 2014	April	0.014	0.0	0.000	0.000	0.000	0.000	0
	May	0.006	0.0	0.000	0.000	0.000	0.000	0
	June	0.012	0.0	0.000	0.000	0.000	0.000	0
	July	0.004	0.0	0.000	0.000	0.000	0.000	0
	TOTAL		**0.0**	**0.000**	**0.000**	**0.000**	**0.000**	**0**
	Low tide							
After July 15, 2014	August	0.062	0.0	0.000	0.000	0.000	0.000	0
	September	0.043	0.0	0.000	0.000	0.000	0.000	0
	October	0.020	0.0	0.000	0.000	0.000	0.000	0
	TOTAL		**0.0**	**0.000**	**0.000**	**0.000**	**0.000**	**0**
	Low tide							
GRAND TOTALS			**296.5**	**0.382**	**0.048**	**0.048**	**0.478**	**35**
Low tide								

VIBRATORY SHEET PILE

Distance to 120 (km): 0.500 | 1.000 | 4.698
Area of 120 dB (km2): 0.393 | 1.570 | 34.652

Year	Month	Number of Hours	Take within 500 m for 80%	Take within 1000 m for 10%	Take in Arm for 10%	Total Take	Round Up
2009	April	77.5	0.338	0.169	3.729	4.236	5
	May	54.2	0.095	0.047	1.044	1.186	2
	June	54.2	0.210	0.105	2.320	2.636	3
	July	77.5	0.097	0.048	1.065	1.210	2
	Aug	77.5	1.517	0.758	16.737	19.011	20
	Sept	77.5	1.056	0.528	11.653	13.237	14
	Oct	77.5	0.492	0.246	5.434	6.172	7
	TOTAL	**495.9**	**3.804**	**1.902**	**41.983**	**47.689**	**53**
	Low tide						
2010	April	33.8	0.147	0.074	1.626	1.847	2
	May	23.7	0.041	0.021	0.455	0.517	1
	June	23.7	0.092	0.046	1.012	1.150	2
	July	33.8	0.042	0.021	0.465	0.528	1
	August	33.8	0.661	0.331	7.300	8.292	9
	September	33.8	0.461	0.230	5.083	5.773	6
	October	33.8	0.215	0.107	2.370	2.692	3
	TOTAL	**216.3**	**1.659**	**0.830**	**18.311**	**20.799**	**24**
	Low tide						
2011	April	50.8	0.222	0.111	2.447	2.779	3
	May	35.6	0.062	0.031	0.685	0.778	1
	June	35.6	0.138	0.069	1.522	1.729	2
	July	50.8	0.063	0.032	0.699	0.794	1
	August	50.8	0.995	0.498	10.981	12.474	13
	September	50.8	0.693	0.346	7.646	8.685	9
	October	50.8	0.323	0.162	3.565	4.050	5
	TOTAL	**325.4**	**2.496**	**1.248**	**27.545**	**31.289**	**34**
	Low tide						
2012	April	108.0	0.471	0.235	5.197	5.904	6
	May	75.6	0.132	0.066	1.455	1.653	2
	June	75.6	0.293	0.147	3.234	3.673	4
	July	108.0	0.135	0.067	1.485	1.687	2
	August	108.0	2.114	1.057	23.326	26.496	27
	September	108.0	1.472	0.736	16.241	18.449	19
	October	108.0	0.686	0.343	7.573	8.603	9
	TOTAL	**691.1**	**5.302**	**2.651**	**58.511**	**66.464**	**69**
	Low tide						
2013	April	57.2	0.249	0.125	2.751	3.124	4
	May	40.0	0.070	0.035	0.770	0.875	1
	June	40.0	0.155	0.078	1.711	1.944	2
	July	57.2	0.071	0.036	0.786	0.893	1
	August	57.2	1.119	0.559	12.345	14.023	15
	September	57.2	0.779	0.389	8.595	9.764	10
	October	57.2	0.363	0.182	4.008	4.553	5
	TOTAL	**365.8**	**2.806**	**1.403**	**30.966**	**35.175**	**38**
	Low tide						
Before July 15, 2014	April	0.0	0.000	0.000	0.000	0.000	0
	May	0.0	0.000	0.000	0.000	0.000	0
	June	0.0	0.000	0.000	0.000	0.000	0
	July	0.0	0.000	0.000	0.000	0.000	0
	TOTAL	**0.0**	**0.000**	**0.000**	**0.000**	**0.000**	**0**
	Low tide						
After July 15, 2014	August	0.0	0.000	0.000	0.000	0.000	0
	September	0.0	0.000	0.000	0.000	0.000	0
	October	0.0	0.000	0.000	0.000	0.000	0
	TOTAL	**0.0**	**0.000**	**0.000**	**0.000**	**0.000**	**0**
	Low tide						
GRAND TOTALS		**2094.4**	**16.068**	**8.034**	**177.316**	**201.417**	**218**
Low tide							

IMPACT SHEET PILE

Distance to 160 dB (km): 0.500 | 0.740 | 0.740
Area of 160 dB (km2): 0.393 | 0.860 | 0.860

Year	Month	Number of Hours	Take within 500 m for 80%	Take within 1000 m for 10%	Take in Arm for 10%	Total Take	Round Up
2009	April	25.8	0.113	0.031	0.031	0.174	1
	May	18.1	0.032	0.009	0.009	0.049	1
	June	18.1	0.070	0.019	0.019	0.108	1
	July	25.8	0.032	0.009	0.009	0.050	1
	Aug	25.8	0.506	0.138	0.138	0.782	1
	Sept	25.8	0.352	0.096	0.096	0.545	1
	Oct	25.8	0.164	0.045	0.045	0.254	1
	TOTAL	**165.3**	**1.268**	**0.347**	**0.347**	**1.963**	**7**
	Low tide					**0.589**	**2**
2010	April	11.3	0.049	0.013	0.013	0.076	1
	May	7.9	0.014	0.004	0.004	0.021	1
	June	7.9	0.031	0.008	0.008	0.047	1
	July	11.3	0.014	0.004	0.004	0.022	1
	August	11.3	0.220	0.060	0.060	0.341	1
	September	11.3	0.154	0.042	0.042	0.238	1
	October	11.3	0.072	0.020	0.020	0.111	1
	TOTAL	**72.1**	**0.553**	**0.151**	**0.151**	**0.856**	**7**
	Low tide					**0.257**	**2**
2011	April	16.9	0.074	0.020	0.020	0.114	1
	May	11.9	0.021	0.006	0.006	0.032	1
	June	11.9	0.046	0.013	0.013	0.071	1
	July	16.9	0.021	0.006	0.006	0.033	1
	August	16.9	0.332	0.091	0.091	0.513	1
	September	16.9	0.231	0.063	0.063	0.357	1
	October	16.9	0.108	0.029	0.029	0.167	1
	TOTAL	**108.5**	**0.832**	**0.228**	**0.228**	**1.288**	**7**
	Low tide					0.387	2
2012	April	36.0	0.157	0.043	0.043	0.243	1
	May	25.2	0.044	0.012	0.012	0.068	1
	June	25.2	0.098	0.027	0.027	0.151	1
	July	36.0	0.045	0.012	0.012	0.069	1
	August	36.0	0.705	0.193	0.193	1.090	2
	September	36.0	0.491	0.134	0.134	0.759	1
	October	36.0	0.229	0.063	0.063	0.354	1
	TOTAL	**230.4**	**1.767**	**0.484**	**0.484**	**2.735**	**8**
	Low tide					**0.821**	**2**
2013	April	19.1	0.083	0.023	0.023	0.129	1
	May		0.000	0.000	0.000	0.000	0
	June	13.3	0.052	0.014	0.014	0.080	1
	July	19.1	0.024	0.006	0.006	0.037	1
	August	19.1	0.373	0.102	0.102	0.577	1
	September	19.1	0.260	0.071	0.071	0.402	1
	October	19.1	0.121	0.033	0.033	0.187	1
	TOTAL	**108.6**	**0.912**	**0.250**	**0.250**	**1.412**	**6**
	Low tide					**0.424**	**2**
Before July 15, 2014	April	0.0	0.000	0.000	0.000	0.000	0
	May	0.0	0.000	0.000	0.000	0.000	0
	June	0.0	0.000	0.000	0.000	0.000	0
	July	0.0	0.000	0.000	0.000	0.000	0
	TOTAL	**0.0**	**0.000**	**0.000**	**0.000**	**0.000**	**0**
	Low tide					**0.000**	**0**
After July 15, 2014	August	0.0	0.000	0.000	0.000	0.000	0
	September	0.0	0.000	0.000	0.000	0.000	0
	October	0.0	0.000	0.000	0.000	0.000	0
	TOTAL	**0.0**	**0.000**	**0.000**	**0.000**	**0.000**	**0**
	Low tide					**0.000**	**0**
GRAND TOTALS		**684.8**	**5.333**	**1.460**	**1.460**	**8.253**	**35**
Low tide						**2.478**	**11**

VIBRATORY TEMPORARY PILE

Distance to 120 (km): 0.312 | 0.312 | 0.312
Area of 120 dB (km2): 0.153 | 0.153 | 0.153

Year	Month	Number of Hours	Take within 500 m for 80%	Take within 1000 m for 10%	Take in Arm for 10%	Total Take	Round Up
2009	April	2.6	0.004	0.001	0.001	0.006	1
	May	1.8	0.001	0.000	0.000	0.002	1
	June	1.8	0.003	0.000	0.000	0.003	1
	July	2.6	0.001	0.000	0.000	0.002	1
	Aug	2.6	0.020	0.002	0.002	0.025	1
	Sept	2.6	0.014	0.002	0.002	0.017	1
	Oct	2.6	0.006	0.001	0.001	0.008	1
	TOTAL	**16.7**	**0.050**	**0.006**	**0.006**	**0.062**	**7**
	Low tide						
2010	April	1.4	0.002	0.000	0.000	0.003	1
	May	1.0	0.001	0.000	0.000	0.001	1
	June	1.0	0.002	0.000	0.000	0.002	1
	July	1.4	0.001	0.000	0.000	0.001	1
	August	1.4	0.011	0.001	0.001	0.014	1
	September	1.4	0.008	0.001	0.001	0.009	1
	October	1.4	0.004	0.000	0.000	0.004	1
	TOTAL	**9.1**	**0.027**	**0.003**	**0.003**	**0.034**	**7**
	Low tide						
2011	April	1.4	0.002	0.000	0.000	0.003	1
	May	1.0	0.001	0.000	0.000	0.001	1
	June	1.0	0.002	0.000	0.000	0.002	1
	July	1.4	0.001	0.000	0.000	0.001	1
	August	1.4	0.011	0.001	0.001	0.014	1
	September	1.4	0.008	0.001	0.001	0.009	1
	October	1.4	0.004	0.000	0.000	0.004	1
	TOTAL	**9.1**	**0.027**	**0.003**	**0.003**	**0.034**	**7**
	Low tide						
2012	April	3.0	0.005	0.001	0.001	0.006	1
	May	2.1	0.001	0.000	0.000	0.002	1
	June	2.1	0.003	0.000	0.000	0.004	1
	July	3.0	0.001	0.000	0.000	0.002	1
	August	3.0	0.023	0.003	0.003	0.029	1
	September	3.0	0.016	0.002	0.002	0.020	1
	October	3.0	0.007	0.001	0.001	0.009	1
	TOTAL	**19.3**	**0.058**	**0.007**	**0.007**	**0.072**	**7**
	Low tide						
2013	April	1.6	0.003	0.000	0.000	0.003	1
	May	1.1	0.001	0.000	0.000	0.001	1
	June	1.1	0.002	0.000	0.000	0.002	1
	July	1.6	0.001	0.000	0.000	0.001	1
	August	1.6	0.012	0.002	0.002	0.015	1
	September	1.6	0.008	0.001	0.001	0.011	1
	October	1.6	0.004	0.000	0.000	0.005	1
	TOTAL	**10.2**	**0.030**	**0.004**	**0.004**	**0.038**	**7**
	Low tide						
Before July 15, 2014	April	0.0	0.000	0.000	0.000	0.000	0
	May	0.0	0.000	0.000	0.000	0.000	0
	June	0.0	0.000	0.000	0.000	0.000	0
	July	0.0	0.000	0.000	0.000	0.000	0
	TOTAL	**0.0**	**0.000**	**0.000**	**0.000**	**0.000**	**0**
	Low tide						
After July 15, 2014	August	0.0	0.000	0.000	0.000	0.000	0
	September	0.0	0.000	0.000	0.000	0.000	0
	October	0.0	0.000	0.000	0.000	0.000	0
	TOTAL	**0.0**	**0.000**	**0.000**	**0.000**	**0.000**	**0**
	Low tide						
GRAND TOTALS		**64.3**	**0.192**	**0.024**	**0.024**	**0.240**	**35**
Low tide							

VIBRATORY FENDER PILE

Distance to 120 (km): 0.500 | 1.000 | 4.991
Area of 120 dB (km2): 0.393 | 1.570 | 39.109

Year	Month	Number of Hours	Take within 500 m for 80%	Take within 1000 m for 10%	Take in Arm for 10%	Total Take	Round Up
2009	April	1.2	0.005	0.003	0.067	0.075	1
	May	0.9	0.002	0.001	0.019	0.021	1
	June	0.9	0.003	0.002	0.042	0.047	1
	July	1.2	0.002	0.001	0.019	0.021	1
	Aug	1.2	0.024	0.012	0.300	0.336	1
	Sept	1.2	0.017	0.008	0.209	0.234	1
	Oct	1.2	0.008	0.004	0.097	0.109	1
	TOTAL	**7.9**	**0.060**	**0.030**	**0.752**	**0.843**	**7**
	Low tide						
2010	April	10.4	0.045	0.023	0.565	0.633	1
	May	7.3	0.013	0.006	0.158	0.177	1
	June	7.3	0.028	0.014	0.352	0.394	1
	July	10.4	0.013	0.006	0.161	0.181	1
	August	10.4	0.204	0.102	2.536	2.842	3
	September	10.4	0.142	0.071	1.766	1.979	2
	October	10.4	0.066	0.033	0.823	0.923	1
	TOTAL	**66.6**	**0.511**	**0.255**	**6.362**	**7.128**	**10**
	Low tide						
2011	April	0.0	0.000	0.000	0.000	0.000	0
	May	0.0	0.000	0.000	0.000	0.000	0
	June	0.0	0.000	0.000	0.000	0.000	0
	July	0.0	0.000	0.000	0.000	0.000	0
	August	0.0	0.000	0.000	0.000	0.000	0
	September	0.0	0.000	0.000	0.000	0.000	0
	October	0.0	0.000	0.000	0.000	0.000	0
	TOTAL	**0.0**	**0.000**	**0.000**	**0.000**	**0.000**	**0**
	Low tide						
2012	April	0.0	0.000	0.000	0.000	0.000	0
	May	0.0	0.000	0.000	0.000	0.000	0
	June	0.0	0.000	0.000	0.000	0.000	0
	July	0.0	0.000	0.000	0.000	0.000	0
	August	0.0	0.000	0.000	0.000	0.000	0
	September	0.0	0.000	0.000	0.000	0.000	0
	October	0.0	0.000	0.000	0.000	0.000	0
	TOTAL	**0.0**	**0.000**	**0.000**	**0.000**	**0.000**	**0**
	Low tide						
2013	April	8.3	0.036	0.018	0.449	0.503	1
	May	5.8	0.010	0.005	0.126	0.141	1
	June	5.8	0.022	0.011	0.279	0.313	1
	July	8.3	0.010	0.005	0.128	0.144	1
	August	8.3	0.162	0.081	2.014	2.257	3
	September	8.3	0.113	0.056	1.402	1.571	2
	October	8.3	0.053	0.026	0.654	0.733	1
	TOTAL	**52.9**	**0.406**	**0.203**	**5.052**	**5.661**	**10**
	Low tide						
Before July 15, 2014	April	8.2	0.036	0.018	0.444	0.497	1
	May	3.3	0.006	0.003	0.071	0.080	1
	June	3.3	0.013	0.006	0.158	0.177	1
	July	8.2	0.010	0.005	0.127	0.142	1
	TOTAL	**22.9**	**0.064**	**0.032**	**0.799**	**0.895**	**4**
	Low tide						
After July 15, 2014	August	7.6	0.149	0.075	1.858	2.082	3
	September	7.6	0.104	0.052	1.294	1.450	2
	October	7.6	0.048	0.024	0.603	0.676	1
	TOTAL	**22.9**	**0.302**	**0.151**	**3.756**	**4.208**	**6**
	Low tide						
GRAND TOTALS		**173.1**	**1.343**	**0.671**	**16.721**	**18.735**	**37**
Low tide							

IMPACT FENDER PILE

Distance to 160 dB (km): 0.500 | 1.000 | 1.961
Area of 160 dB (km2): 0.393 | 1.570 | 6.037

Year	Month	Number of Hours	Take within 500 m for 80%	Take within 1000 m for 10%	Take in Arm for 10%	Total Take	Round Up
2009	April	0.4	0.002	0.001	0.003	0.006	1
	May	0.3	0.001	0.000	0.001	0.002	1
	June	0.3	0.001	0.001	0.002	0.004	1
	July	0.4	0.001	0.000	0.001	0.002	1
	Aug	0.4	0.008	0.004	0.015	0.027	1
	Sept	0.4	0.006	0.003	0.011	0.019	1
	Oct	0.4	0.003	0.001	0.005	0.009	1
	TOTAL	**2.6**	**0.020**	**0.010**	**0.039**	**0.069**	**7**
	Low tide					**0.021**	**2**
2010	April	3.5	0.015	0.008	0.029	0.052	1
	May	2.4	0.004	0.002	0.008	0.014	1
	June	2.4	0.009	0.005	0.018	0.032	1
	July	3.5	0.004	0.002	0.008	0.015	1
	August	3.5	0.068	0.034	0.131	0.232	1
	September	3.5	0.047	0.024	0.091	0.162	1
	October	3.5	0.022	0.011	0.042	0.075	1
	TOTAL	**0.0**	**0.170**	**0.085**	**0.327**	**0.583**	**7**
	Low tide					**0.175**	**2**
2011	April	0.0	0.000	0.000	0.000	0.000	0
	May	0.0	0.000	0.000	0.000	0.000	0
	June	0.0	0.000	0.000	0.000	0.000	0
	July	0.0	0.000	0.000	0.000	0.000	0
	August	0.0	0.000	0.000	0.000	0.000	0
	September	0.0	0.000	0.000	0.000	0.000	0
	October	0.0	0.000	0.000	0.000	0.000	0
	TOTAL	**0.0**	**0.000**	**0.000**	**0.000**	**0.000**	**0**
	Low tide					0.000	0
2012	April	0.0	0.000	0.000	0.000	0.000	0
	May	0.0	0.000	0.000	0.000	0.000	0
	June	0.0	0.000	0.000	0.000	0.000	0
	July	0.0	0.000	0.000	0.000	0.000	0
	August	0.0	0.000	0.000	0.000	0.000	0
	September	0.0	0.000	0.000	0.000	0.000	0
	October	0.0	0.000	0.000	0.000	0.000	0
	TOTAL	**0.0**	**0.000**	**0.000**	**0.000**	**0.000**	**0**
	Low tide					**0.000**	**0**
2013	April	2.8	0.012	0.006	0.023	0.041	1
	May	1.9	0.003	0.002	0.006	0.012	1
	June	1.9	0.007	0.004	0.014	0.026	1
	July	2.8	0.003	0.002	0.007	0.012	1
	August	2.8	0.054	0.027	0.104	0.184	1
	September	2.8	0.038	0.019	0.072	0.128	1
	October	2.8	0.018	0.009	0.034	0.060	1
	TOTAL	**17.6**	**0.135**	**0.068**	**0.260**	**0.463**	**7**
	Low tide					**0.139**	**2**
Before July 15, 2014	April	2.7	0.012	0.006	0.023	0.041	1
	May	1.1	0.002	0.001	0.004	0.007	1
	June	1.1	0.004	0.002	0.008	0.014	1
	July	2.7	0.003	0.002	0.007	0.012	1
	TOTAL	**7.6**	**0.021**	**0.011**	**0.041**	**0.073**	**4**
	Low tide					**0.022**	**1**
After July 15, 2014	August	2.5	0.050	0.025	0.096	0.170	1
	September	2.5	0.035	0.017	0.067	0.119	1
	October	2.5	0.016	0.008	0.031	0.055	1
	TOTAL	**7.6**	**0.101**	**0.050**	**0.193**	**0.344**	**3**
	Low tide					**0.103**	**1**
GRAND TOTALS		**35.5**	**0.448**	**0.224**	**0.860**	**1.532**	**28**
Low tide						**0.460**	**8**

GRAND TOTALS

Year	Month	TOTAL TAKES	Taken by Vibratory	Taken by Impact
2009	April	10	7	3
	May	7	4	3
	June	8	5	3
	July	7	4	3
	Aug	25	22	3
	Sept	19	16	3
	Oct	12	9	3
	TOTAL	88	67	21
	Low tide	4	0	4
2010	April	7	4	3
	May	6	3	3
	June	7	4	3
	July	6	3	3
	August	16	13	3
	September	12	9	3
	October	8	5	3
	TOTAL	62	41	21
	Low tide	4	0	4
2011	April	6	4	2
	May	4	2	2
	June	5	3	2
	July	4	2	2
	August	16	14	2
	September	12	10	2
	October	8	6	2
	TOTAL	55	41	14
	Low tide	2	0	2
2012	April	9	7	2
	May	5	3	2
	June	7	5	2
	July	5	3	2
	August	31	28	3
	September	22	20	2
	October	12	10	2
	TOTAL	91	76	15
	Low tide	2	0	2
2013	April	9	6	3
	May	5	3	2
	June	7	4	3
	July	6	3	3
	August	22	19	3
	September	16	13	3
	October	10	7	3
	TOTAL	75	55	20
	Low tide	4	0	4
Before July 15, 2014	April	2	1	1
	May	2	1	1
	June	2	1	1
	July	2	1	1
	TOTAL	8	4	4
	Low tide	1	0	1
After July 15, 2014	August	4	3	1
	September	3	2	1
	October	2	1	1
	TOTAL	9	6	3
	Low tide	1	0	1
GRAND TOTALS		**388**	290	98
Low tide		**19**	0	19

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APPENDIX H
Construction Joints

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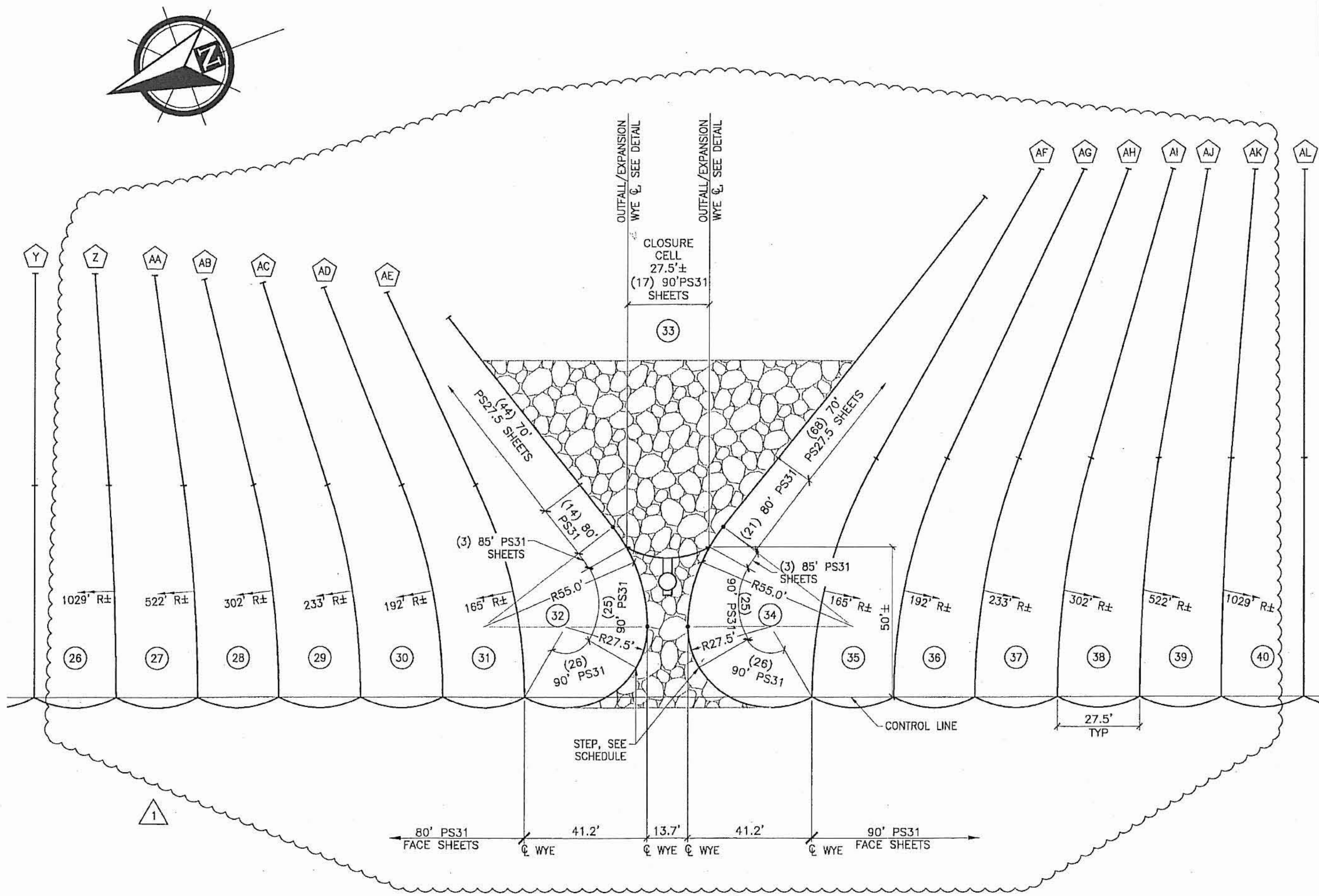
LEGEND	
(#)	CELL DESIGNATION
(LTR)	TAIL WALL DESIGNATION

SYMBOLS IN THIS LEGEND APPLY TO THIS SHEET.



OUTFALL B PLAN

NTS

OPEN CELL PATENT #6,715,694

ICRC

421 West First Avenue, Suite 200
Anchorage, Alaska 99501
(907) 561-4272
www.icrcsolutions.com

Anchorage Port Expansion Team

REV	DATE	DESCRIPTION
1	1-25-08	OUTFALL UPDATES & NOTES PER ICRC

DATE:

STATE OF ALASKA
49TH
D. Nottingham
No. 1204-CE
REGISTERED PROFESSIONAL ENGINEER

DATE: 1/25/2008

1506 West 36th Avenue
Anchorage, Alaska 99503
Phone: 907.561.1011
Fax: 907.563.4220
www.pndengineers.com

P N D
ENGINEERS, INC.

PROJECT:
PORT OF ANCHORAGE EXPANSION PROJECT

TITLE:
NORTH EXTENSION OUTFALL B PLAN

DESIGNED BY:	GH	DATE:	1/25/08	SHEET NO: 21B of 38
CHECKED BY:	DN	PROJECT NO:	61028	

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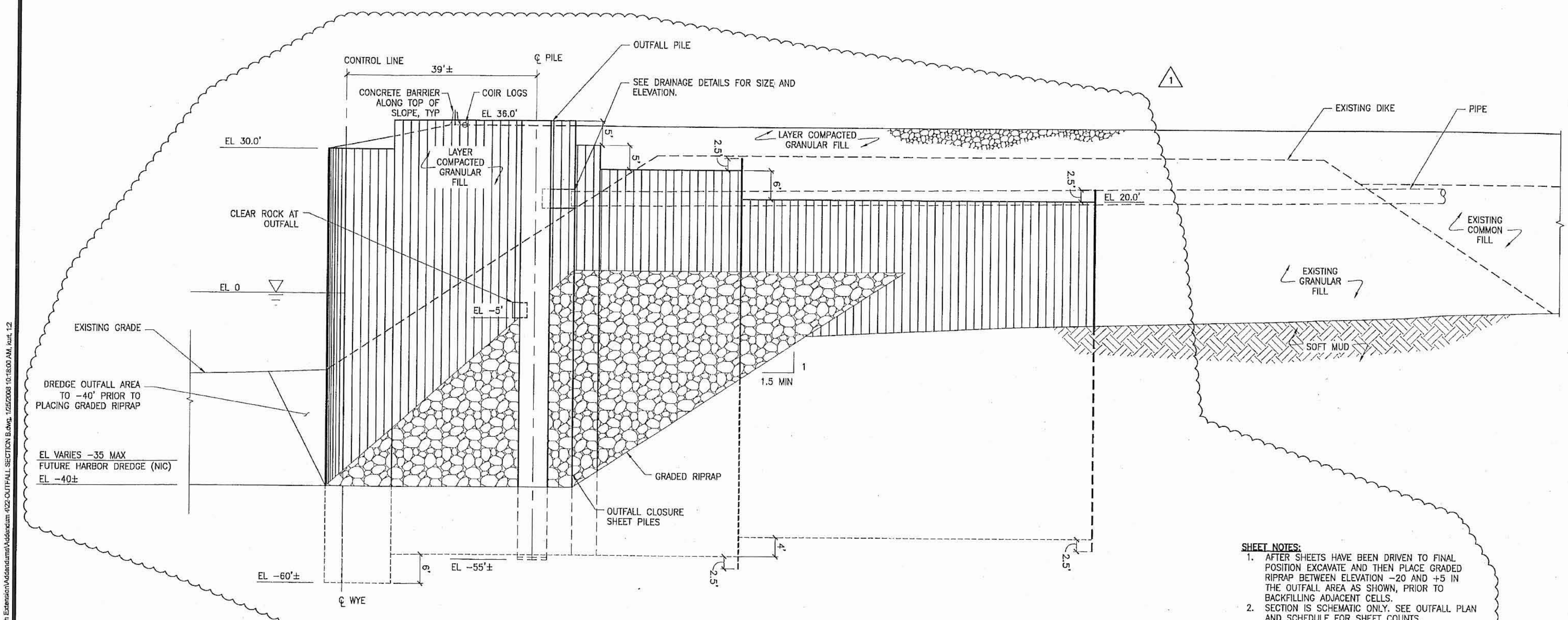

OUTFALL B SECTION

FOR OUTFALLS A AND C GEOMETRY IS SIMILAR, SEE NOTES

SHEET NOTES:

1. AFTER SHEETS HAVE BEEN DRIVEN TO FINAL POSITION EXCAVATE AND THEN PLACE GRADED RIPRAP BETWEEN ELEVATION -20 AND +5 IN THE OUTFALL AREA AS SHOWN, PRIOR TO BACKFILLING ADJACENT CELLS.
2. SECTION IS SCHEMATIC ONLY. SEE OUTFALL PLAN AND SCHEDULE FOR SHEET COUNTS.
3. FOR OUTFALLS "A" AND "C", OUTFALL PIPE, CLOSURE CELL, DREDGING AND RIPRAP ARE NOT PROVIDED UNDER THIS NORTH EXTENSION ADDENDUM.

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OPEN CELL PATENT #6,715,694

ICRC

421 West First Avenue, Suite 250
Anchorage, Alaska 99501
(907) 561-4272
www.icrcsolutions.com

Anchorage Port Expansion Team

REV	DATE	DESCRIPTION
1	1-25-08	OUTFALL UPDATES & NOTES PER ICRC

Stamp applies to cathodic protection only.

DATE:

STATE OF ALASKA — 49TH — D. Nottingham No. 1204-CE — REGISTERED PROFESSIONAL ENGINEER

DATE: 1/25/2008

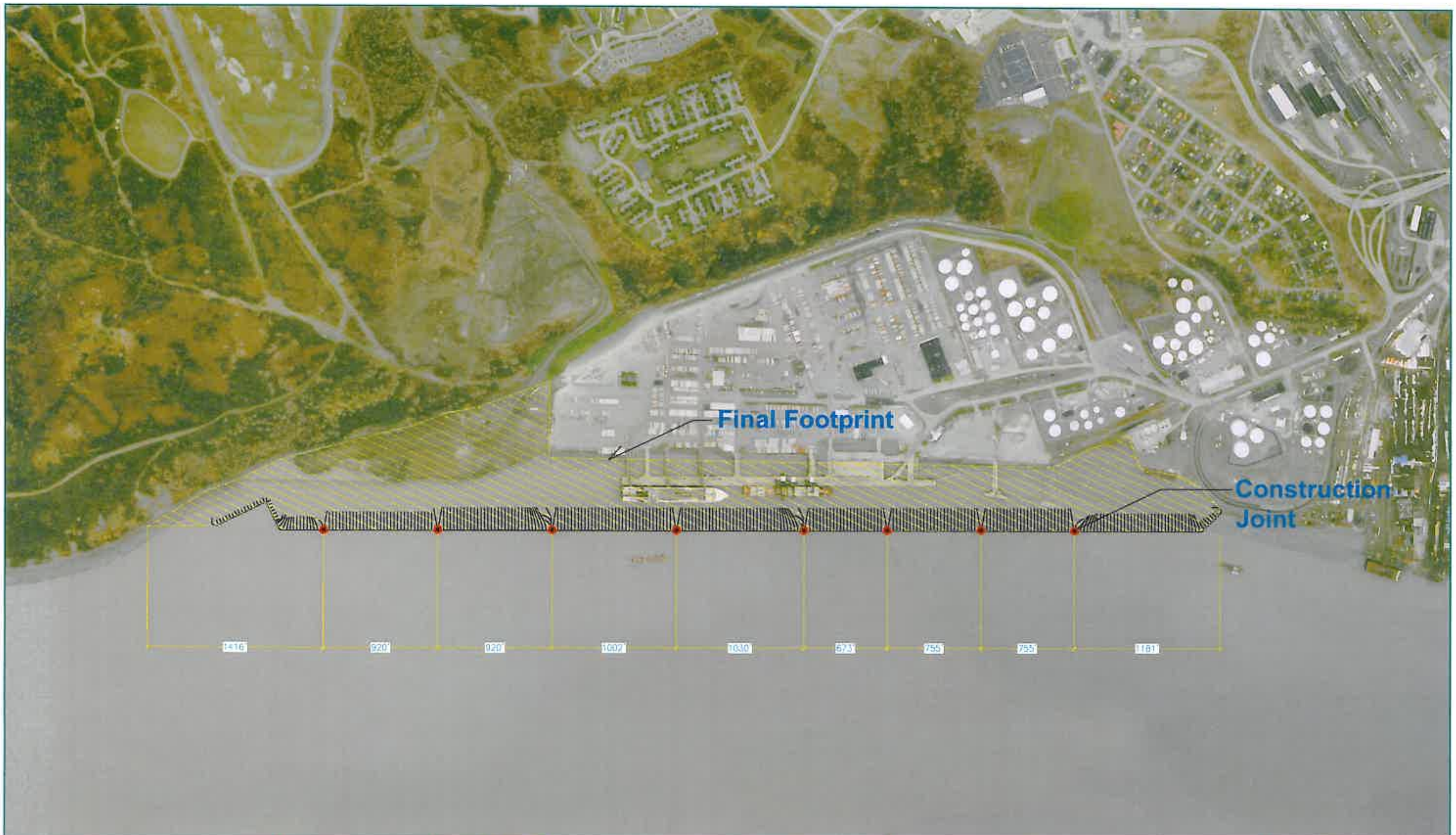
1506 West 36th Avenue
Anchorage, Alaska 99503
Phone: 907.561.1011
Fax: 907.563.4220
www.pndengineers.com

P N D ENGINEERS, INC.

PROJECT: PORT OF ANCHORAGE EXPANSION PROJECT

TITLE: NORTH EXTENSION OUTFALL B SECTION

DESIGNED BY:	GH	DATE:	1/25/08
CHECKED BY:	DN	PROJECT NO:	61028



Anchorage Port Expansion Team

PORT OF ANCHORAGE
We've got the goods.

ICRC
421 West First Avenue, Suite 200
Anchorage, Alaska 99501
(907) 861-4372
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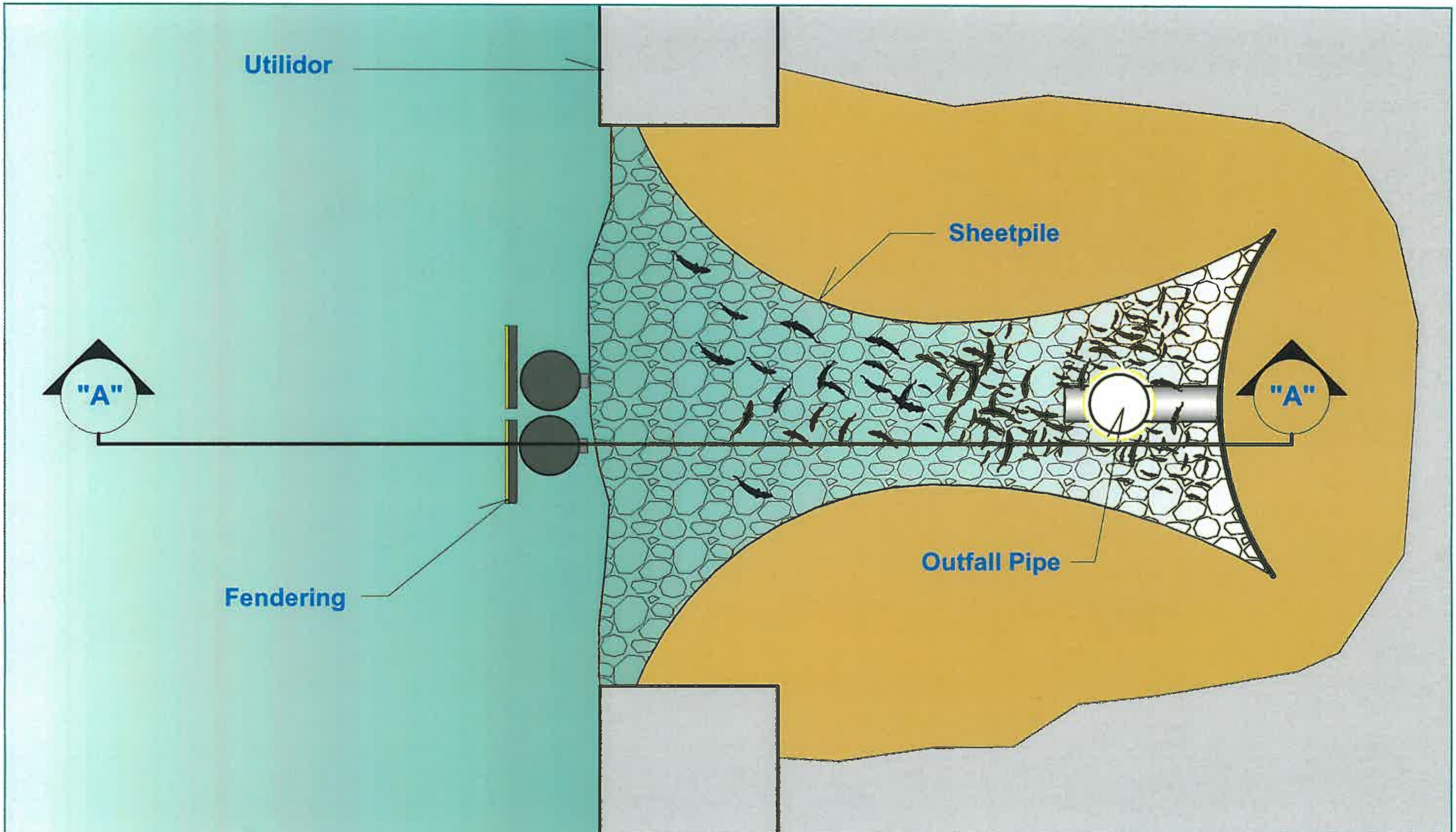
Port of Anchorage Intermodal Expansion Project

Construction Joints

SHEET: 1 OF 4

4-14-08



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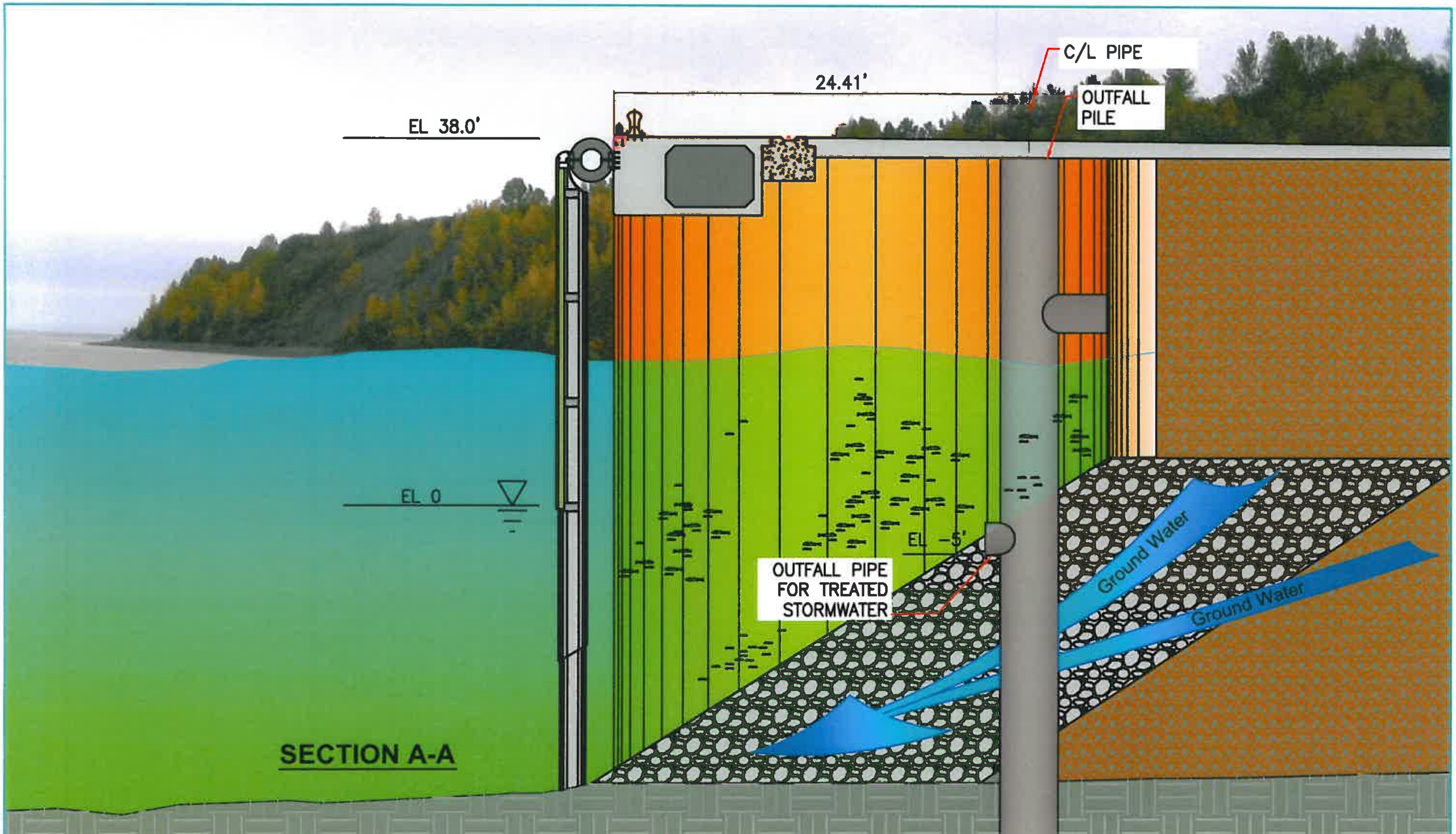
	Construction Joint	4-14-08



Anchorage Port Expansion Team

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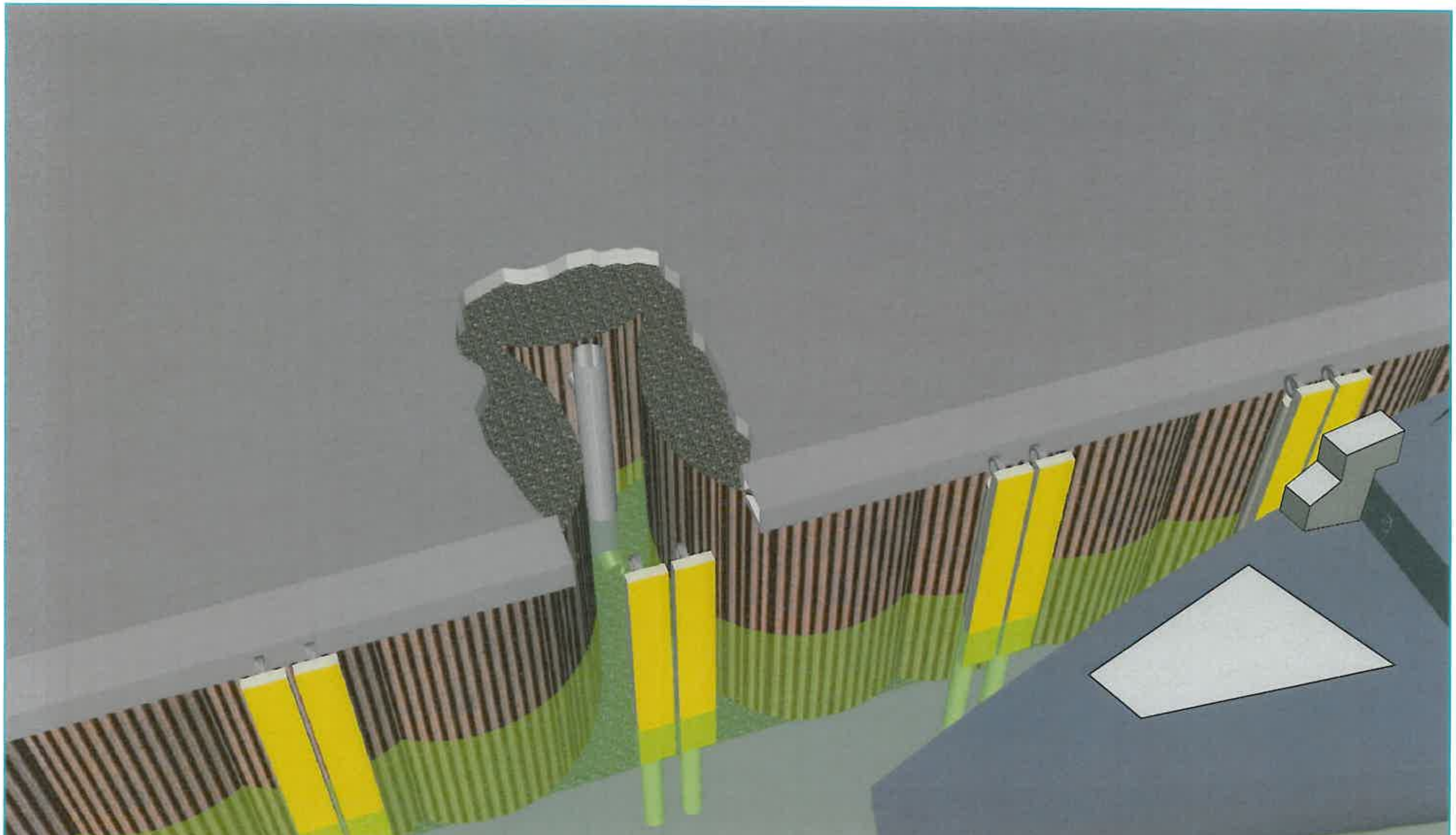
Port of Anchorage Intermodal Expansion Project

Construction Joint

Sheet 3 of 4

4-14-08



Anchorage Port Expansion Team	PORT OF ANCHORAGE We're got the goods.	ICRC	Port of Anchorage Intermodal Expansion Project	Sheet 4 of 4
			Perspective	4-14-08

APPENDIX I
Marine Mammal Sighting Forms
Approved by NMFS

a) **Construction Monitoring Program – Marine Mammal Sighting Form, Marine Terminal Redevelopment Construction**

b) **Scientific Monitoring Program - APU Marine Mammal Sighting Form**

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APPENDIX I
Marine Mammal Sighting Forms

a) **Construction Monitoring – Marine Mammal Sighting Form , Marine Terminal Redevelopment Construction**

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Project Construction Subcontractor – Marine Mammal Sighting Form
Marine Terminal Redevelopment Construction 2008

Date of Observation: ____________________ **Name & Affiliation of Observer:** _______________________

Location of Observation Station: **Sighting #:** ______ (1st sighting of the day is Sighting # 1)

Time of Initial Sighting ↓	Time of Last Sighting ↓	Harassment Zones in View (circle) ↓	Species (circle) ↓	No. of Marine Mammals Sighted ↓		How Many ↓	Initial Heading (circle) ↓	Final Heading (circle) ↓
		None Some (< 50%) Most (> 50 %) All (100 %)	beluga whale harbor seal harbor porpoise killer whale other ________	Inside harassment zones	Outside harassment zones	Adults ____ Juveniles __ Calves ____	N NE E SE S SW W NW	N NE E SE S SW W NW

Tidal stage at time of sighting (circle): low slack low ebb low flood high slack high ebb high flood

Distances of marine mammal(s) from in-water noise source (meters):

Initial Distance = _______ Closest Distance = _______ Final Distance = _______

In-water Project activities at time of sighting. Check boxes that apply: ☐ no in-water activity ☐ soft start

☐ vibratory hammer ☐ impact hammer ☐ stabbing with vibratory/impact hammer ☐ stabbing without vibratory/impact hammer

SHUT DOWN DURING IN-WATER CONSTRUCTION ACTIVITIES

- When marine mammals are sighted approaching the project site **OR**
- When marine mammals are sighted within the following established harassment zones (from point of in-water noise source):
  - **50 meters** from **other in-water Project activities** (non pile-driving work)
  - **200 meters** from either **vibratory or impact pile driving**
  - **350 meters** from **impact pile driving,** but only if 5 or more (Group) marine mammals are seen
  - **800 meters** from **vibratory pile driving**, but only if 5 or more (Group) marine mammals are seen
  - When a **beluga calf or calves** are sighted approaching the Project site or are sighted within any of the harassment zones.
- Project activities were shut down from _________ to _________ (time).
- Project activities were NOT shut down. **EXPLANATION REQUIRED Use Notes section on page two.**

Failure to shut down in-water construction activities **before** a marine mammal has been sighted within harassment zones under the circumstances listed above constitutes a "TAKE." THERE ARE NO EXCEPTIONS. You MUST keep an accurate "take" count of marine mammals sighted within harassment zones during in-water pile driving (including pile driving during the stabbing process) and submit this total take count to your supervisor. Count "one take" per each mammal (six beluga whales seen within harassment zones in one sighting during in-water pile driving = six takes).

TAKE COUNT THIS SIGHTING: ______

To the best of your ability mark your location and the approximate location of marine mammal (mammals) on the attached map.

BEHAVIOR OF MARINE MAMMAL: 1= initial behavior 2= a change in behavior

( ) traveling	( ) diving	( ) resting	( ) milling
( ) swimming	( ) swimming toward construction	( ) swimming away from construction	( ) fleeing
( ) feeding observed	( ) feeding suspected	( ) mating	( ) other

Describe any behavior patterns:____

Describe initial group cohesion (orientation; how far apart): ____________________________________

Describe end group cohesion:____

ADDITIONAL INFORMATION:

- Animal behavior ____
- Distance to in-water noise source ____
- Describe in-water stabbing phases____
- Locations in relation to the port and to the sound source during observation period ____________________

  ____

  ____
- Note the time and the construction activity taking place during the change in marine mammal behavior _________

  ____

Notes:

Map is page three.


POA Expansion Observation Grid
0
1
2
3
4
5
6
7
8
9
S
R
Q
P
O
N
M
L
K
J
I
H
G
F
E
D
C
B
A
Z
Y
X
W
V
U
T
800m (2,625 ft)
350m (1,148 ft)
200m (656 ft)
50m (162 ft)
N
Meters
0
500
1,000
1,500
Feet
0
2,000
4,000
6,000

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APPENDIX I
Marine Mammal Sighting Forms

b) Scientific Monitoring Program - APU Marine Mammal Sighting Form

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POA Land-Based Surveys of Marine Mammals: Environmental Conditions

Alaska Pacific University

Station:	Date (dd/mm/yy):	Observer(s):	Pg___of___

Verified____________
Entered by___________
Sheet #_________________

Time (hh:mm)	Air Temp. (°C)	Precip Code 00-none 01-fog 02- rain 03-snow	Wind Dir. (99 if null)	Wind Speed (km/hr, nearest whole number)	Cloud Cover (%)	Vis. Dis. (km)	See Far Shore	Glare	Central Glare Bearing 001-360°	Swell (ht in m)	Sea State (Beaufort)	White Caps	Sea Ice Concentration (tenths 00-10)	Overall Conditions	# of vessels (hourly)	Comments	Comments on Reverse
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							☐	☐				☐					☐
							☐	☐				☐					☐
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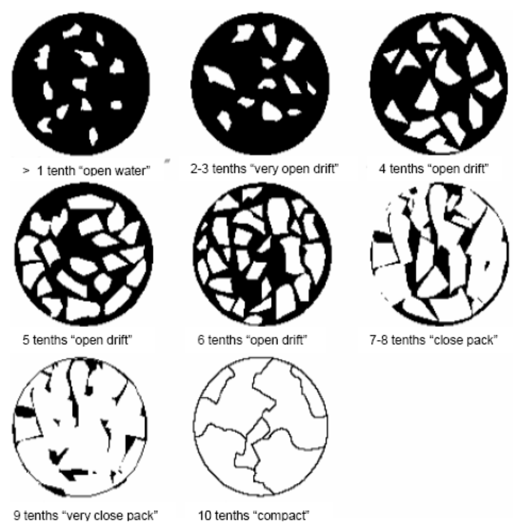
Sea State	Description
0	Sea like mirror
1	Ripples but without foam crests
2	Small wavelets
3	Large wavelets, perhaps scattered white horses
4	Small wavelets, fairly frequent white horses

Sea Ice Concentration (tenths 00-10)



Types of Vessels	
Ship	Skiff
Tug boat	Dredge
Barge	Coast Guard
Tug & barge	Other
Dredge	

Overall Conditions	
1	Poor
2	Moderate
3	Excellent

POA Land-Based Surveys of Marine Mammals: Beluga whales (*Delphinapterus leucas*)

Alaska Pacific University

Station:	Date (dd/mm/yy):	Observer(s):	Pg __ of ___
Shift Start Time (hh:mm):	Shift End Time (hh:mm):	Optic:	

Verified_________
Entered by_______
Sheet #_______________

Sampling Round	Best Sample ☐	Time (hh:mm)	Count				Harbor Seal	Harbor Porpoise	Steller Sea Lion	Killer Whale	Other	Magnetic Compass Bearing 001-360°	Grid Cell	Group #	Group Code	Activity		Direction	Previously Counted Y/N/U		In-water Construction Activity		Start/End/Arrive/Leave (S/E/A/L)		Comments	Comments on the Reverse ☐
			Adults	Sub-Adults	Calves	Unk										1	2		You	Other	1	2	CON 1	CON 2	Write additional comments on the reverse side of this sheet. Be sure to identify which record additional comments are associated with.	
	☐						☐	☐	☐	☐	☐															☐
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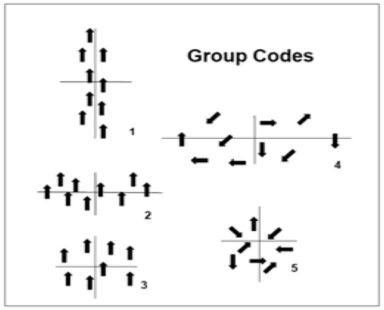
	☐						☐	☐	☐	☐	☐															☐

Note the time at the first and last sighting of each whale/group. Identify EACH grid cell the whales move through and note the time they enter each cell!!
Continue to count whales throughout the time the whales are in the area, until you get an accurate count (Best Sample)



Activity Code	
1	Traveling/Moving
2	Diving
3	Motionless on surface
4	Spyhopping
5	Breaching
6	Feeding Observed
7	Feeding Suspected
8	Milling

Activity Code	
9	Startled effect
10	Approaches then leaves
11	Change in swimming speed
12	Abrupt change in direction
13	Abrupt dives
14	Disperse
99	Other

In-water Construction Activities	
0	No construction
1	Soft-start
2	Impact sheet pile driving (PD)
3	Vibratory sheet PD
4	Impact pipe PD
5	Vibratory pipe PD
6	Dredging
7	In-water fill
99	Other

Additional Comments (reverse side)

Time	Comments

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