STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

In the Matter of Remedial Action by:	FIRST AMENDMENT TO AGREED ORDER
The Port of Seattle	No. DE 8938

TO: Port of Seattle
Attention: Ted J. Fick
P.O. Box 1209
Seattle, Washington 98111

EXHIBITS

EXHIBIT G	Regrading Area Diagrams
EXHIBIT H	Discarded Military Munitions Management Plan (AECOM, Aug. 2015)

I. INTRODUCTION

The State of Washington, Department of Ecology (Ecology) and Port of Seattle (the Port) entered into Agreed Order No. DE 8938 on April 10, 2012, as modified by the Minor Change to Agreed Order No. DE 8938 (March 28, 2013) (Order). The Order requires the Port to implement the Cleanup Action Plan (CAP), including the installation of certain remedial actions and the completion of compliance monitoring within either the Upland or the Tank Farm Affected Area. The Order also requires the Port to address contamination in the Upland Area of the Terminal 91 Facility, including any units newly identified during implementation of the CAP.

The Order applies to the "Terminal 91 Facility," defined in relevant part by the Order as "the real property owned by the Port of Seattle encompassing approximately 216 acres and located at 2001 West Garfield Street, Seattle, Washington, as depicted in Exhibit B." Order No. DE 8938 at 5, § IV.14. All capitalized terms used but not otherwise defined herein shall have the meaning provided to them by the Order.

Pursuant to Section VIII.L of the Order, Ecology and the Port hereby stipulate to amend the Order. Ecology deems the remedial actions included within this amendment as "substantial" (*see* Order Section VIII.L), and as such those actions must be authorized through an amendment to the Order.

This amendment to the Order shall be referred to as the First Amendment to Agreed Order No. DE 8938 (First Amendment). The First Amendment authorizes the Port to conduct remedial actions as part of a seafloor regrading project in parts of the Submerged Lands Area, and requires the Port to undertake specified interim actions to support evaluation of the need for further remedial actions in the Submerged Lands Area more generally. By this First Amendment to the Order, the Port will perform activities that constitute an interim remedial action at a facility where there has been a release or threatened release of hazardous substances.

Regrading and Preliminary Site Investigation Project (the Project). The Project consists of two separate actions: 1) Regrade accumulated shoal material along the southeast portion of Pier 91 in the Submerged Lands Area to increase water depths (the Regrade Project), and 2) Investigate potentially contaminated sediments in the area.

The Project would occur within the Terminal 91 Facility, an area subject to the Order. The Order specified remedial actions to be carried out in the Uplands, most of which have been implemented by the time of this First Amendment, but deferred any remedial actions for the Submerged Lands Area until such time, no later than April 10, 2022, by when the necessity and practicability of such actions for the Submerged Lands Area could be evaluated.

1. **The Regrade Project.** The proposed regrading will correct a potential problem in the Pier 91 marine sediments, and therefore it constitutes an interim remedial action. This action is necessary to provide sufficient depths for the safe berthing of cruise ships that dock at Pier 91. The remedial action must be carried out if the Port implements the Regrade Project, and the timing requirements for its completion are

imposed in relation to the schedule by which that portion of the Project is actually implemented.

2. **Submerged Lands Preliminary Investigation.** During sediment sampling for a maintenance dredging project, the Port detected elevated levels of PCBs within the proposed dredging area on the east side of Pier 90 as well as some exceedances of mercury and PAHs. Because the Submerged Lands Area is subject to corrective action requirements under the Permit and the Order, the Port must evaluate whether releases of hazardous substances have occurred within the Submerged Lands Area that present an unacceptable risk to human health or the environment. The Order deferred remedial action with respect to the Submerged Lands Area, but Ecology and the Port have agreed that the Port shall pursue additional remedial investigation to document environmental information related to the Submerged Lands Area, to develop a sampling and analysis plan to address potential releases, and to implement that plan and document its results. The resulting report will furnish a basis to identify whether further remedial actions shall be required, as well as preliminary indications of historic and current sources of contamination and identification of potentially responsible parties.

This amendment does not attempt to recite all of the provisions of the Order. Provisions of the Order not specifically changed in this amendment remain in full force and effect.

VI. ECOLOGY DETERMINATIONS

The following shall be added as a new subsection to section VI. of the Order:

8. Under WAC 173-340-430, an interim action is a remedial action that is technically necessary to reduce a threat to human health or the environment by eliminating or substantially reducing one or more pathways for exposure to a hazardous substance at a facility, that corrects a problem that may become substantially worse or cost substantially more to address if the remedial action is delayed, or that is technically necessary to provide for

completion of a site hazard assessment, RI/FS study or design of a cleanup action. Based on the circumstances, Ecology has determined that an interim action is warranted under WAC 173-340-430. Either party may propose an additional interim action under this First Amendment. If the Parties are in agreement concerning the additional interim action, the Parties will follow the process in Section VII.H. If the Parties are not in agreement, Ecology reserves its authority to require additional interim action(s) under a separate order or other enforcement action under RCW 70.105D, or to undertake the interim action(s) itself.

VII. WORK TO BE PERFORMED

The following shall be substituted for subsection VII.B of the Order:

B. Preliminary Site Investigation in the Submerged Lands Area

The Port shall perform the Preliminary Site Investigation for the Submerged Lands, which shall include: (1) preparation of a Historical Review Report; (2) preparation of a Sampling and Analysis Plan (SAP), based upon the findings of the Historical Review Report; and (3) implementation of the SAP, in accordance with the following schedule.

Schedule for task deliverables

Task	**Deliverable**	**Schedule in Calendar Days**
Task 1	Draft Historical Review Report	Ninety (90) days after approval of Port/Contractor Service Directive
	Final Historical Review Report	Thirty (30) days after receipt of Ecology comments
Task 2	Draft SAP	Ninety (90) days after Task 1 finalized
	Final SAP	Thirty (30) days after receipt of Ecology comments
Task 3	Implement SAP	Following approved schedule in work plan to be initiated thirty (30) days after signing of Contractor Service

		Directive
	Draft Sampling Report	Forty-five (45) days after receipt of validated data
	Final Sampling Report	Thirty (30) days after receipt of Ecology comments

The following shall be added as a new subsection H to Section VII of the Order:

H. Regrade Project in the Submerged Lands Area

The Regrade Project will be conducted using a clamshell digging bucket. The open bucket will be lowered to the bottom, closed onto the shoal material, lifted to clear the bottom, and moved into position over designated relocation area, opened to release the material, closed and moved across the bottom over area where material has been relocated to knock down any material above -37 feet mean lower low water (MLLW). The regrading bucket will not be lifted into the water column any further than required to clear the bottom while swinging the bucket (< three feet). The regrading volume is calculated to be 280 cubic yards (CY), which includes -35.00 feet MLLW required depth (project depth), anticipated infill from slopes, allowable two feet potential overdepth and 15 percent allowance for infill since last survey in 2014. Regraded material will be placed below -37 feet MLLW. The proposed regrading will take place in the area shown on Exhibit G. The regrading will avoid all areas which have been determined to be susceptible to prop wash and scour.

As part of the implementation of the Regrade Project, the Port shall submit to Ecology the specified deliverables in accordance with the following schedule.

Deliverable	**Due Date**
Completed JARPA	Thirty (30) days prior to the start of construction
Completed SEPA checklist	Thirty (30) days prior to the start of construction

Water Quality Plan	Thirty (30) days prior to the start of construction
Contractor Work Plan	Thirty (30) days prior to the start of construction
Post-regrading Sampling and Analysis Plan (draft)	Thirty (30) days prior to the start of construction
Post-regrading Sampling and Analysis Plan (final)	Ten (10) days after delivery of approved draft
Regrading Construction Report	Thirty (30) days after data verification is completed for sediment sampling analysis

The PLP shall not conduct the Regrade Project until Ecology approves the Contractor Work Plan. Upon approval by Ecology, the Contractor Work Plan and the other deliverables found in the foregoing schedule become integral and enforceable parts of this First Amendment, and the Port is required to conduct the action in accordance with that schedule.

The Port shall implement the Regrade Project consistent with the Discarded Military Munitions Management Plan (AECOM, Aug. 2015) (Exhibit H), which is hereby approved as an enforceable part of this First Amendment. Accordingly, in the event that Discarded Military Munitions (DMM) are encountered in the performance of the Regrade Project, the Port shall not collect or remove any such DMM as part of the Regrade Project construction. Any movement of DMMs present within the regrade material shall not be considered "generation, storage, treatment or disposal" of solid waste in accordance with U.S. EPA guidance, including Sylvia Lawrence (Director, U.S. EPA Office of Solid Waste) letter to Douglas Green, June 11, 1992. Instead, the Port shall leave in place any DMMs within the Regrade Project area for later removal by the U.S. Army Corps of Engineers or the Seattle Port Police Department's regular inspection dives.

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VIII. TERMS AND CONDITIONS OF ORDER

The following shall be substituted for subsection VIII.D of the Order:

D. Designated Project Coordinators

The project coordinator for Ecology is:

Name: Greg Caron
Address: Department of Ecology-CRO
1250 West Alder Street
Union Gap, WA 98903-0009
Phone: (509) 454-7893
Email: grca461@ecy.wa.gov

The project coordinator for the Port is:

Name: Susan Roth
Address: Roth Consulting
3937 SW 109th Street
Seattle, WA 98146-1653
Phone: (206) 617-2176
Email: susanjroth@comcast.net

Each project coordinator shall be responsible for overseeing the implementation of this First Amendment. Ecology's project coordinator will be Ecology's designated representative for the Site. To the maximum extent possible, communications between Ecology and the Port, and all documents, including reports, approvals, and other correspondence concerning the activities performed pursuant to the terms and conditions of this First Amendment shall be directed through the project coordinators. The project coordinators may designate, in writing, working level staff contacts for all or portions of the implementation of the work to be performed required by this First Amendment.

Any party may change its respective project coordinator. Written notification shall be given to the other party at least ten (10) calendar days prior to the change.

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Effective date of this First Amendment: _____

PORT OF SEATTLE

_____

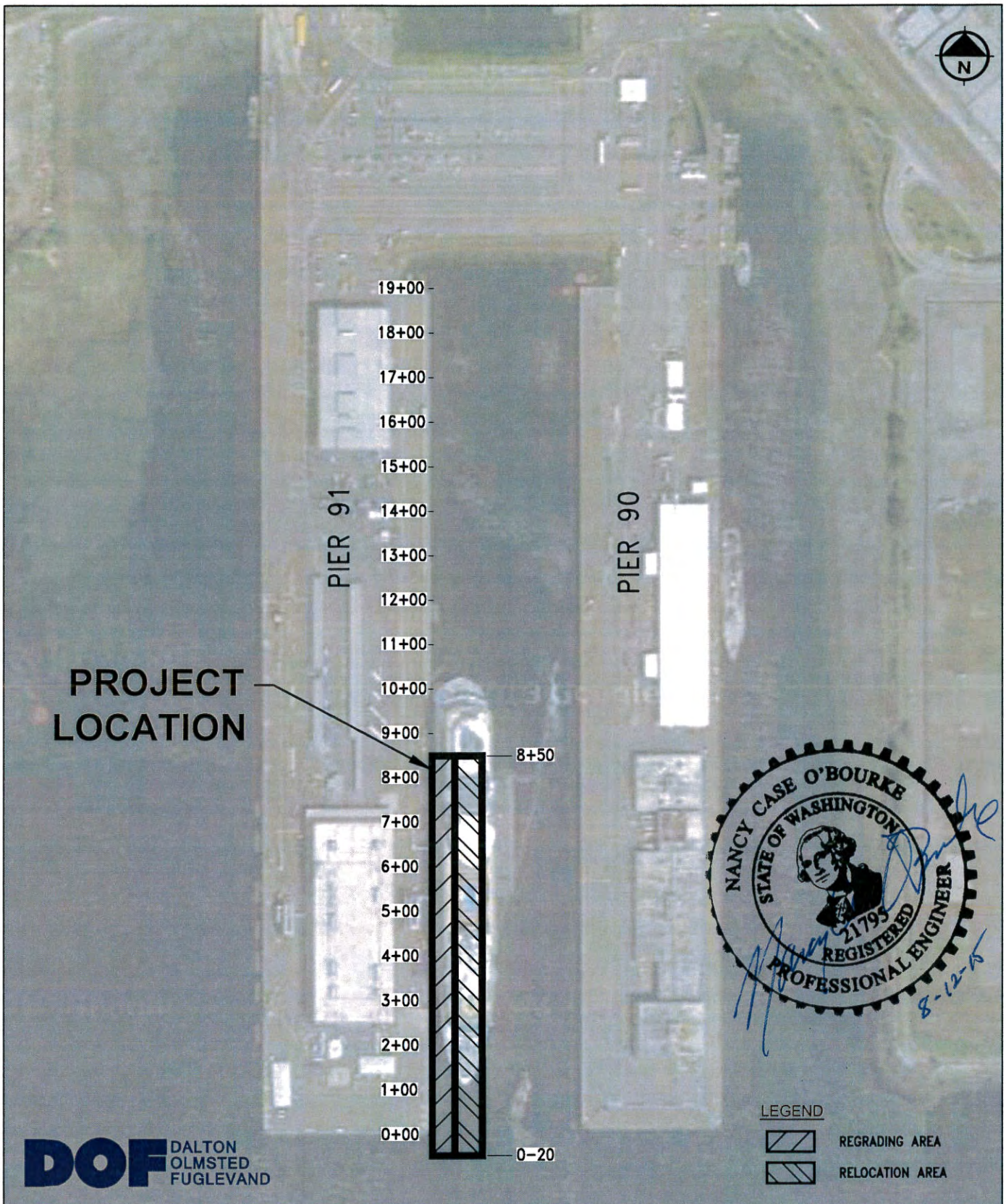
Ted E. Fick
Chief Executive Officer
Port of Seattle
Telephone: (206) 787-3000

STATE OF WASHINGTON, DEPARTMENT OF ECOLOGY

_____

Raman Iyer
Section Manager
Hazardous Waste Toxics Reduction Program
Northwest Regional Office
Telephone: (425) 649-7053

Exhibit G

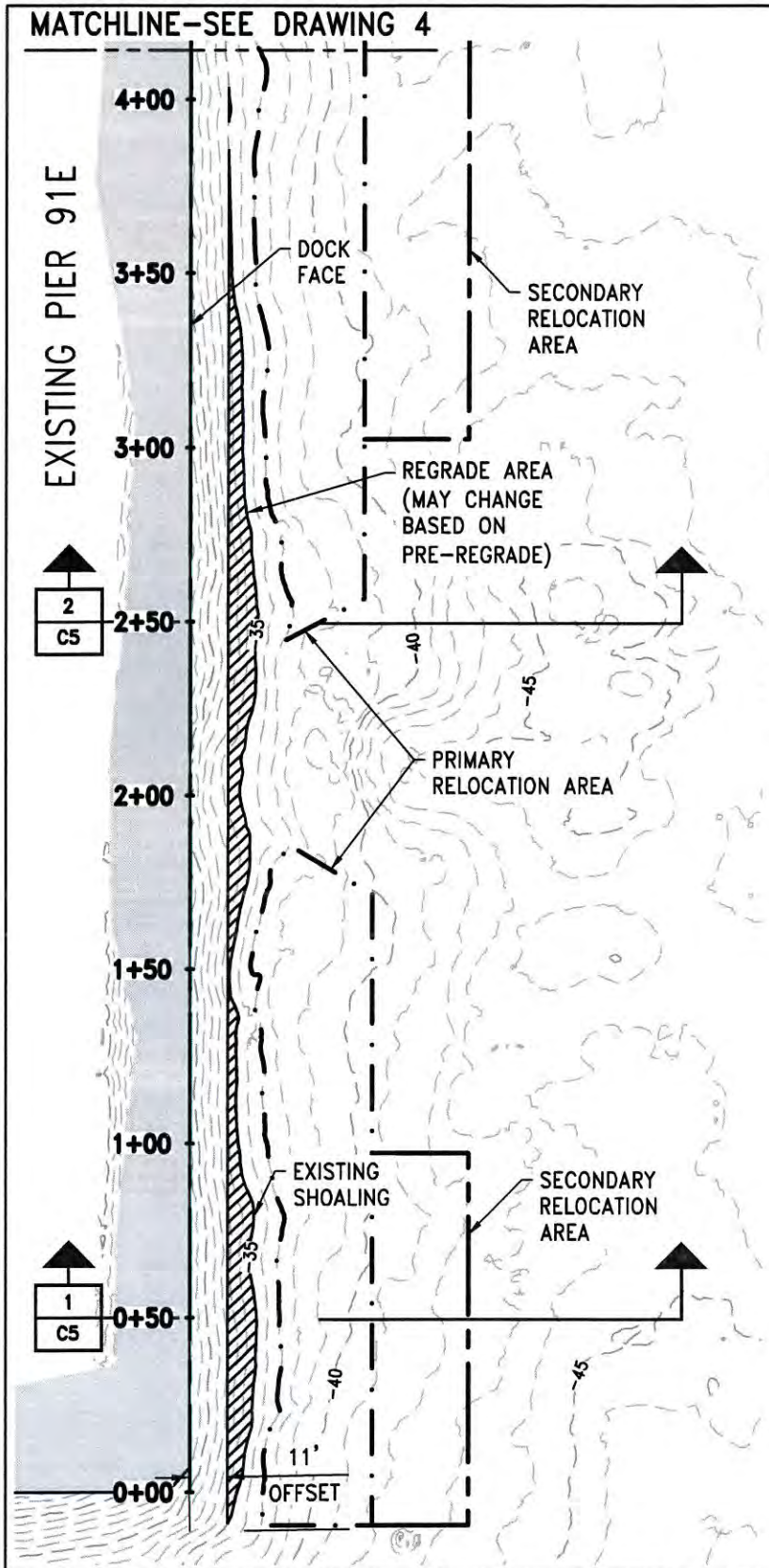


REFERENCE: POS 91-1501
APPLICANT: PORT OF SEATTLE
ADJACENT PROPERTY OWNERS:
PORT OF SEATTLE

TERMINAL 91 P91E -
UNDERWATER REGRADING
PROJECT AREA PLAN VIEW
LOCATION: ELLIOT BAY
LAT/LONG: 47°37'39"/-112°22'55"
DRAWING 2 **OF** 7
DATE:
AUGUST 5, 2015

PROPOSED: PERFORM UNDERWATER REGRADING AT P91E
NEAR/AT: SEATTLE
IN: ELLIOT BAY
COUNTY:KING
STATE: WA

PLOT TIME: 8/5/2015 12:17 PM MOD TIME: 8/5/2015 12:16 PM USER: Steven Rasmussen DWG: D:\Projects\POS T5-T18\T-91\Cad\Figures\2015-08\JARPA\JARPA 20150805.dwg



GENERAL NOTES:

VERTICAL DATUM: ELEVATIONS ARE EXPRESSED IN FEET AND REFER TO THE PLANE OF MEAN LOWER LOW WATER (MLLW), EPOCH 1983 – 2001.

HORIZONTAL DATUM: HORIZONTAL CONTROL BASED ON THE LAMBERT CONFORMAL CONIC PROJECTION FOR THE WASHINGTON STATE PLANE COORDINATE SYSTEM, NORTH ZONE, NAD 83/91.

SURVEY: MULTIBEAM BATHYMETRIC SOUNDINGS COLLECTED BY NORTHWEST HYDRO INC. ON SEPTEMBER 15, 2014.

LEGEND

- REGRADING AREA EXISTING SHOALING TO –35 FEET MLLW FROM SEPTEMBER 15, 2014 SURVEY
- –40 — EXISTING CONTOUR MAJOR (DESIGN SURVEY DATED SEPTEMBER 15, 2014)
- EXISTING CONTOUR MINOR (DESIGN SURVEY DATED SEPTEMBER 15, 2014)
- PRIMARY RELOCATION AREA LIMITS
- SECONDARY RELOCATION AREA LIMITS
- Cx — CROSS SECTION

1"=50'–0" Scale: 25 0 25 50 Feet

NANCY CASE O'BOURKE
STATE OF WASHINGTON
21795
REGISTERED
PROFESSIONAL ENGINEER
8/12/15

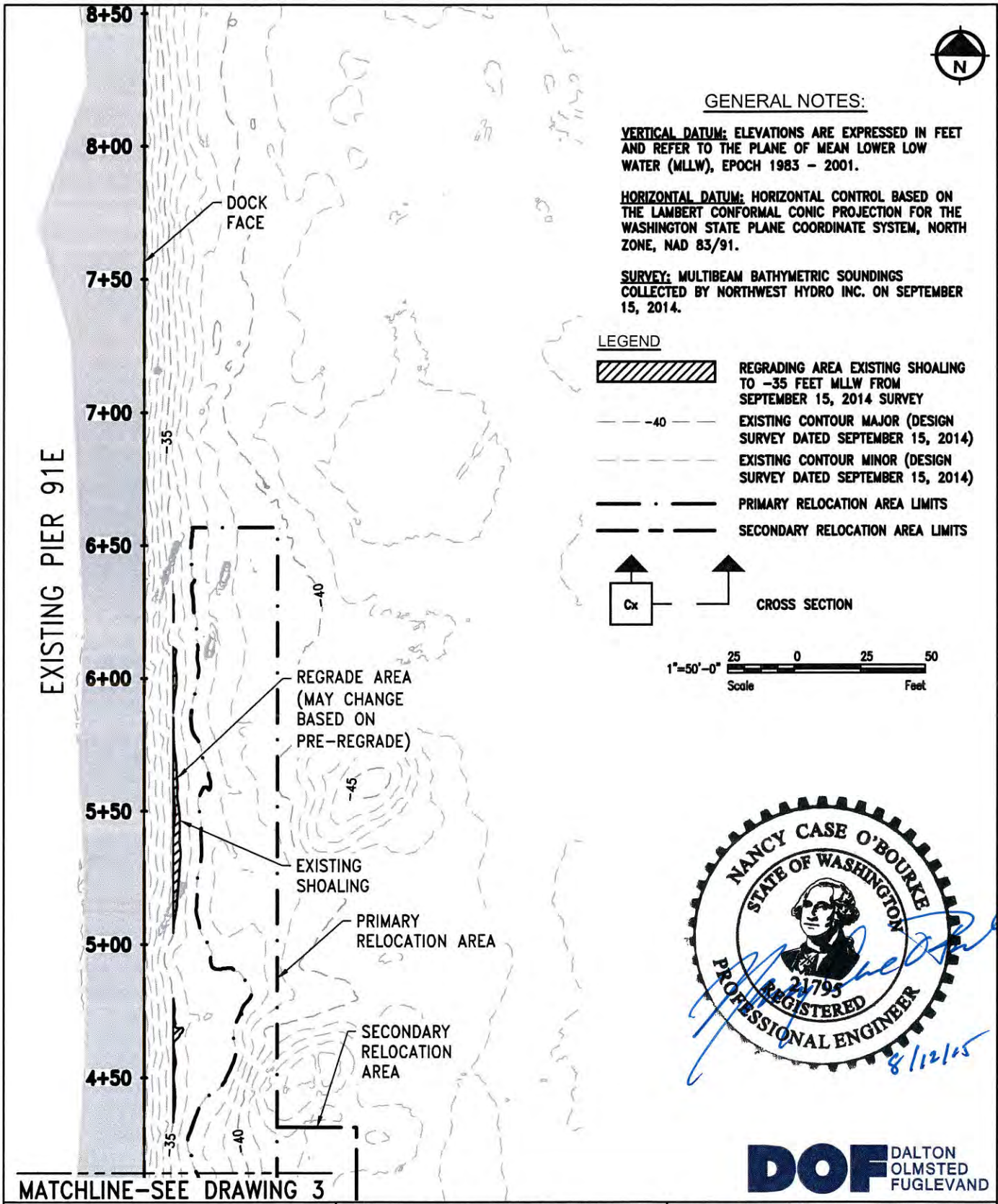
DOF DALTON OLMSTED FUGLEVAND

REFERENCE: POS 91-1501
APPLICANT: PORT OF SEATTLE
ADJACENT PROPERTY OWNERS: PORT OF SEATTLE

TERMINAL 91 P91E - UNDERWATER REGRADING
REGRADING PLAN VIEW
LOCATION: ELLIOT BAY
LAT/LONG: 47°37'39"/-112°22'55"
DRAWING 3 OF 7
DATE: AUGUST 5, 2015

PROPOSED: PERFORM UNDERWATER REGRADING AT P91E
NEAR/AT: SEATTLE
IN: ELLIOT BAY
COUNTY: KING
STATE: WA

PLOT TIME: 8/5/2015 12:17 PM MOD TIME: 8/5/2015 12:16 PM USER: Steven Rasmussen DWG: D:\Projects\POS T5-T18\T-91\Cad\Figures\2015-08\JARPA\JARPA 20150805.dwg



REFERENCE: POS 91-1501
APPLICANT: PORT OF SEATTLE
ADJACENT PROPERTY OWNERS:
PORT OF SEATTLE

TERMINAL 91 P91E - UNDERWATER REGRADING
REGRADING PLAN VIEW
LOCATION: ELLIOT BAY
LAT/LONG: 47°37'39"/-112°22'55"
DRAWING 4 **OF** 7
DATE: AUGUST 5, 2015

PROPOSED: PERFORM UNDERWATER REGRADING AT P91E
NEAR/AT: SEATTLE
IN: ELLIOT BAY
COUNTY:KING
STATE: WA

PLOT TIME: 8/5/2015 12:17 PM MOD TIME: 8/5/2015 12:16 PM USER: Steven Rasmussen DWG: D:\Projects\POS T5-T18\T-91\Cad\Figures\2015-08\JARPA\JARPA 20150805.dwg

Exhibit H

Discarded Military Munitions Management Plan

TERMINAL 91: SEDIMENT REGRADING

Prepared for:

Port of Seattle
PO Box 1209
2711 Alaskan Way (Pier 69)
Seattle, WA 98111-1209

August 2015

Prepared by

AECOM

List of Tables

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1.0 INTRODUCTION

The Port of Seattle's Terminal 91 (T-91), Pier 91 requires sediment regrading in order to maintain navigational access (Figure 1). The last dredging event in 2008 at Pier 91 addressed the western berth. A portion of the eastern berth of Pier 91 is currently proposed for sediment regrading by the Port of Seattle (Port).

Sediment regrading is proposed for this area based on complications that make traditional dredging impractical. T-91 was an active U.S. Department of the Navy supply terminal during World War II. As a result of former Naval operations, discarded military munitions (DMM) have been identified in the vicinity of Pier 91 East by the U.S. Army Corps of Engineers (USACE 2013). The potential presence of DMM in sediment complicates dredging and disposal options. The current plan involves repositioning shoal material a short distance to adjacent downslope areas (DOF 2015).

This DMM Management Plan assesses the hazards of encountering DMM during the underwater regrading project, as well as how any DMM that are identified during post-project dive inspections will be managed. Contents of this plan were prepared following Department of Defense (DoD) and USACE safety requirements, similar to an Explosives Safety Submission (ESS) for the DoD (DoD 2010, USACE 2008, USACE 2014).

Site Information:

- Facility Name: Port of Seattle
- Site Name: Terminal 91, Pier 91 East
- Location: Smith Cove, northern end of Elliott Bay
- State: Washington
- Project: Sediment regrading activities

2.0 ANTICIPATED START DATE

The anticipated start date for the underwater regarding activities is December 2015.

3.0 PURPOSE

The purpose of the project is to maintain safe navigational access in the east berth of Pier 91 by relocating (i.e., regrading) between 250 and 500 cubic yards (cy) of shoaled material consisting primarily of shell hash, fractured rock, and cobble. A small portion of the nearshore area is shoaled above water depths needed for berthing (Figure 2). Following regrading, the project area will be inspected for DMM that may be visible at the surface.[1] DMM are defined as "Military munitions that have been abandoned without proper disposal or removed from storage in a

[1] Sediment sampling activities completed prior to regrading did not require a DMM Management Plan. Activities were completed using anomaly avoidance protocols.

military magazine or other storage area for the purpose of disposal" (10 United States Code 2710(e)(2)).

4.0 SITE BACKGROUND AND CURRENT CONDITIONS

T-91 is located at the north end of Elliott Bay at 2001 West Garfield Street, in Seattle, Washington. T-91 includes Piers 90 and 91, about 35 acres of adjacent water area, and about 72 acres of yard area north of the Magnolia Bridge.

T-91 supports marine uses such as a cruise ship terminal; cargo handling facilities for high-value, high-employment commodities (e.g., fish products); a factory trawler homeport and support facility; major cold storage warehouses, distribution, and a seafood processing plant; and short- and long-term moorage for tugs, barges, and other large vessels.

Shoaled sediment requires regrading and relocation in support of cruise ship terminal operations. Underwater regrading work using derrick and clamshell equipment will relocate infilled material (shoals) to adjacent deeper water in order to provide navigational access at the project elevation of -35 feet Mean Lower Low Water (MLLW).

The Required Regrade Area at T-91, Pier 91E (STA 0-20 to STA 8+50) includes a shoal length of approximately 370 feet (STA 0-20 to 3+50) and a second smaller shoal of 20 feet in length (STA 5+50) offset 11 feet from the face of the fender pile system. The shoals are of varying width up to approximately 10 to 15 feet. The primary and secondary relocation areas (Figure 3) are adjacent to the shoaled areas. The post-regrade slope may be vertical based on the geometry of the clamshell bucket. The Work Area may be adjusted, based on shoal conditions in the pre-regrade survey.

A Remedial Investigation (RI) (USACE 2013) completed for the T-91 area identified 20 millimeter (mm), 40 mm, 3-inch, and 5-inch projectiles, all of which were DMM. The 5-inch projectile was the largest DMM item identified for the site, so it is used as the munition with the greatest fragmentation distance (MGFD). DMM items were identified as having Explosive D filler, a relatively insensitive high explosive. Chapter 8 of the RI included an assessment of potential hazards of DMM to various receptors at T-91, including "topside construction workers" such as those who would be employed to conduct the regrading project. The risk is reported as "N/A" because there is no exposure pathway.

Field investigations and removal actions undertaken as part of the RI in 2010 and 2011 removed 25 pieces of DMM that were at or near the surface of the seabed. With the exception of one shell casing, the DMM items were located well outside of the shoal area at Pier 91. Based on the size of the project area, the volume of material being moved, and the nature of the shoal material, it is unlikely that DMM items will be encountered during regrading.

5.0 EXECUTING AGENCIES

a. Port of Seattle – Facility owner/operator

b. Washington State Department of Ecology – Regulatory lead

c. United States Environmental Protection Agency – Additional regulatory support

d. Dalton Olmsted Fuglevand (DOF) – Sediment regrading design contractor

e. AECOM – DMM/unexploded ordnance (UXO) contractor

6.0 SCOPE OF INVESTIGATIVE ACTION

a. Regrading/Relocation of Sediment (Construction) – Following the sediment regrading and relocation activities, Port of Seattle police divers will inspect the project area for surficial evidence of DMM. The Port Police Department Dive Unit routinely performs thorough surveys of both the east and west berths at Pier 91, including inspection of the seabed, piling, and underpier area for security purposes. These dives occur in early April before the summer cruise season begins. The Dive Unit is aware of the potential to discover DMM items in the berths and has a standard operating procedure (SOP) in place should any be discovered. In the past, discovered DMM items have been removed in accordance with their SOP, which includes coordination with explosive ordnance disposal personnel at Joint Base Lewis-McChord (JBLM) for transport and disposal at their permitted facility. If the regrading project were to expose DMM items, they would likewise be identified and removed by the Port's Dive Unit during their pre-cruise security dives and transferred to JBLM personnel. However, as referenced above, based on the nature, location, and volume of the shoal material, it is extremely unlikely that DMM items would be exposed by the regrading.

b. Table 6-1 identifies the different areas to be investigated within this project location. Figures 1 through 7 in the *Underwater Regrading Plan* (DOF 2015) show the areal extent of the proposed regrading and relocation areas for sediment.

TABLE 6-1. REGRADING AND RELOCATION AREAS

Proposed Sediment Area	Description	Total Acreage of Area
Shoaled Regrading Area	Area of shoaling approximately 390 feet long, 10 to15 feet wide, and 1.25 feet thick along eastern edge of Pier 91E.	0.045 ac
Relocation Area	Deposition area located approximately 27 to 82 feet east of Pier 91E (primary and secondary).	0.55 ac

7.0 SAFETY CRITERIA

Characteristics of the munition with the greatest fragmentation distance (MGFD) (i.e., 5-inch projectile) selected for this project are shown in Table 7-1. The MGFD was based on available historical information and findings during previous projects (see Appendix A for Fragmentation Data Review Form). The minimum separation distances (MSDs) for surface workers are also

listed in Table 7-1. However, assuming a depth of at least 22 feet of water cover during the regrading activities, the effects of over-pressurization and fragmentation will be mitigated by the presence of the water column. As shown in Table 7-2, in accordance with the underwater component of buried explosion module (BEM) listed in the DoD Explosives Safety Board (DDESB) Technical Paper (TP) 16 Chapter 6, BEM Procedures (DDESB 2012), there is no fragmentation or blast withdrawal hazard below 22 feet MLLW (see Appendix A for the BEM output form). However, as an additional safety measure, a default MSD of 100 feet will be established for non-essential personnel during regrading activities.

TABLE 7-1. MINIMUM SEPARATION DISTANCES

DMM	Minimum Separation Distance (feet)			
	Unintentional Detonations		Intentional Detonations	
	HFD	Team Separation Distance (K40)	Without Engineering Controls (MFD-H)	Using Sandbag Mitigation
5-inch 54 Caliber Mark (Mk) 81, 82, and 83	343[a]	84	2,652	Not Permitted

Notes:
See Appendix A for fragmentation data review forms.
Source: DDESB 2004.
[a] Hazardous fragment distance (HFD) will be based on the 5-inch 38 Caliber Mk 35 projectile.
K40 – Inhabited Building Distance (1.2 pounds per square inch).
MFD-H – Maximum Fragment Distance, Horizontal.
Intentional Detonation – planned explosive demolition (not anticipated at T-91).
Unintentional Detonation– interaction with the material (i.e., handling) causes it to function.

TABLE 7-2. BURIED EXPLOSION MODULE SUMMARY

Depth of Water (feet)	MFD-H (feet of water cover)
	5-inch Mark (Mk) 28 (Explosive D filled)
22	20.1[a]

Notes:
See Appendix A for Buried Explosion Module (BEM) output form.
[a] Maximum Fragment Distance, Horizontal (MFD-H) will be based on the 5-inch Mk 28 (Explosive D filled) projectile.

8.0 METHODS OF DISPOSAL

The contractor will not conduct disposal operations. The Port of Seattle Bomb Disposal Unit will take custody of any DMM discovered during the pre-cruise dive inspection. Custody of DMM will then be transferred to JBLM for disposal and final disposition at their permitted site. This DoD military installation is located approximately 9 miles southwest of Tacoma, Washington and operates under the jurisdiction of the United States Army Joint Base Garrison. DMM will be transported in accordance with applicable local, state, and federal regulations (i.e., bracing, blocking, segregation of incompatible explosives, and appropriate notifications).

9.0 REFERENCES

DDESB, 2004. *Technical Paper (TP) 18. Minimum Qualifications for Unexploded Ordnance (UXO) Technicians and Personnel.* December 20.

DDESB, 2012. *Technical Paper (TP) 16. Methodologies for Calculating Primary Fragment Characteristics. Revision 4*. August.

DoD, 2010. DoD Manual (DoDM) 6055.09-M, *Ammunition and Explosives Safety Standards*. Prepared by the U.S. Department of Defense. August 4.

DOF, 2015. *Terminal 91 – Pier 91E Underwater Regrading Plan 201, Draft Figures*. Prepared for the Port of Seattle. Prepared by Dalton Olmstead Fuglevand, Seattle, WA.

USACE, 2008. *Explosives Safety and Health Requirements Manual.* EM 385-1-97 (including Errata 1 through 6 dated June and July 2009, April 2010, and May 2013, and Change 1 dated June 2013). Prepared by the U.S. Army Corps of Engineers. Last revision dated June 2013.

USACE, 2013. *Draft Final Remedial Investigation Report, Former Seattle Naval Supply Depot, Piers 90 and 91, Port of Seattle*. Formerly Used Defense Site #F10WA012501. Prepared by the U.S. Army Corps of Engineers, Seattle, WA. September.

USACE, 2014. *Safety and Health Requirements Manual.* EM 385-1-1. Prepared by the U.S. Army Corps of Engineers. November.

Port of Seattle Proposed T91 P91E Regrading Project	DALTON OLMSTED FUGLEVAND
VICINITY MAP	**FIGURE 1** February 19, 2015

T-91 Project Elevations

Begin STA	End STA	Project Elevation (ft MLLW)	Allowance for Cover (ft)	Required Regrading Elevation (ft MLLW)	Allowable Overdepth (ft)	Allowable Regrade Overdepth (ft MLLW)	Post-Regrading Sand and Gravel Cover Thickness (ft)
-0+20	8+50	-35	1.3	-36.3	2	-38.3	0.5

T-91 Project Quantities

Station		Estimated Material Quantity (CY)			
Begin	End	A	B	C	A+B+C
-0+20	8+50	120	180	150	450

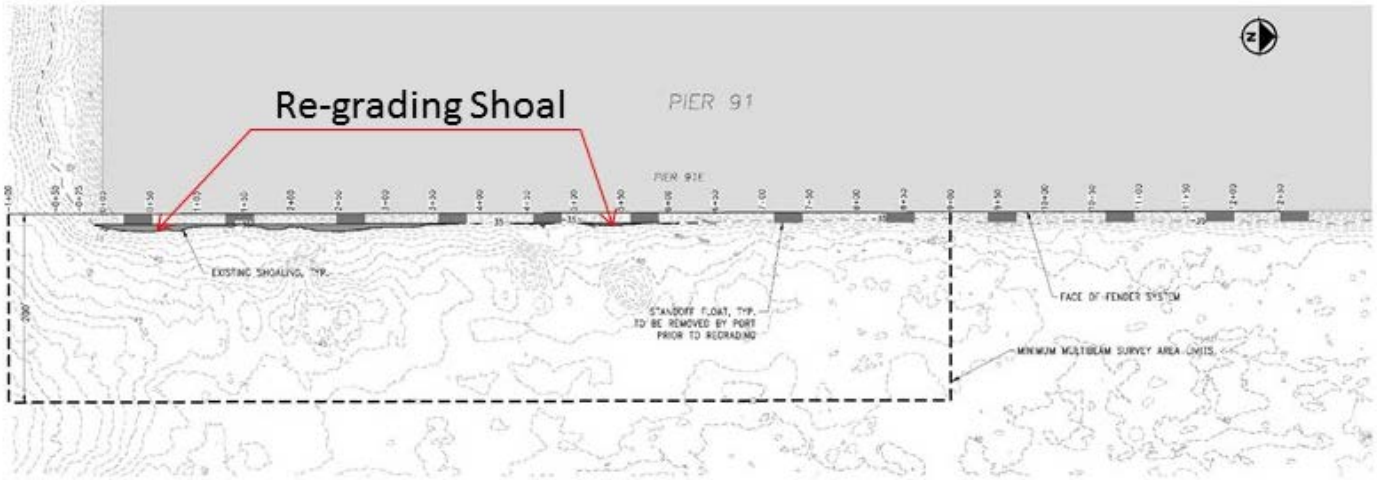
NOTES:
1. SEE SHEET G03 FOR DEFINITIONS OF A, B & C MATERIAL TYPES.
2. VOLUMES SHOWN ABOVE ARE ESTIMATES BASED ON CONDITIONS AT THE TIME OF THE SURVEY AND MAY CHANGE DURING THE PERIOD PRIOR TO COMMENCING WORK. A CONDITION SURVEY WILL BE PERFORMED PRIOR TO COMMENCEMENT OF WORK AS STATED IN THE SPECIFICATIONS.
3. NUMBERS ARE ROUNDED UP TO THE NEAREST 10 CY.

FOR REVIEW ONLY

THESE DRAWINGS HAVE BEEN PREPARED PRIOR TO PROJECT PERMITS BEING ISSUED. DRAWINGS MAY REQUIRE SUBSEQUENT REVISIONS IN ORDER TO BE CONSISTENT WITH ISSUED PERMITS.

GENERAL NOTE:

1. SEE NOTES ON SHEET G02.



CALL 2 DAYS BEFORE YOU DIG 1-800-424-5555

NOTE: THIS PLAN SET IS FORMATTED TO BE PRINTED AT FULL SCALE (22"x34").

SITE MAP

SCALE: 1" = 50'

DALTON OLMSTED FUGLEVAND

Port of Seattle

TERMINAL 91 - PIER 91E UNDERWATER REGRADING 2014

T-01 REGRADING CALCULATION PLAN

100% REVIEW SET

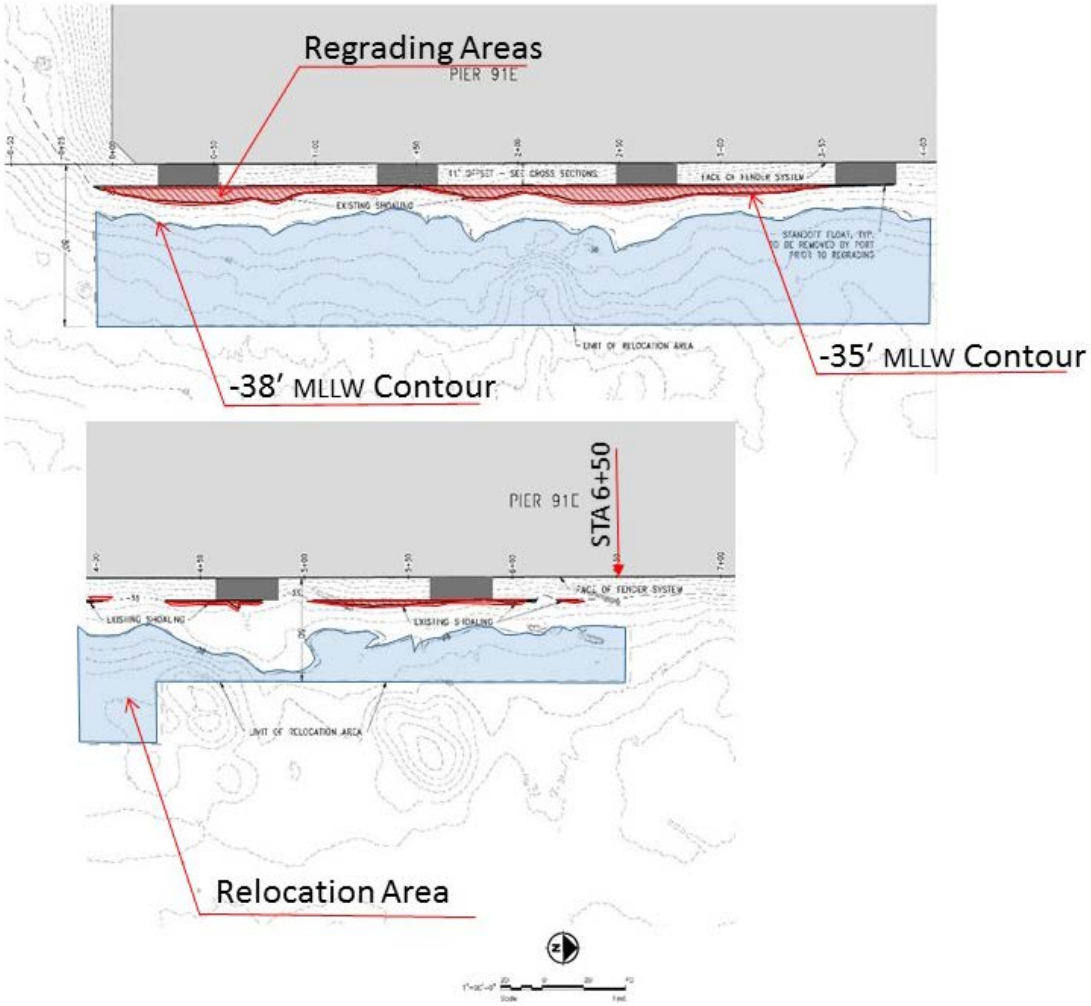
Port of Seattle Proposed T91 P91E Regrading Project

PROPOSED REGRADING PROJECT

DALTON OLMSTED FUGLEVAND

FIGURE 2

February 19, 2015



Port of Seattle Proposed T91 P91E Regrading Project

PROPOSED REGRADING & RELOCATION AREAS

DALTON OLMSTED FUGLEVAND

FIGURE 3

February 19, 2015

Fragmentation Data Review Forms
Buried Explosion Module (BEM) Output Form

Fragmentation Data Review Form

Database Revision Date 8/21/2014

Category:	Surface-Launched HE Rounds
Munition:	5 in 38 Caliber Mk 35
Case Material:	Steel, Mild
Fragmentation Method:	Naturally Fragmenting
Secondary Database Category:	Projectile
Munition Case Classification:	Robust

DODIC:	
Date Record Created:	1/11/2008
Record Created By:	MC
Last Date Record Updated:	9/14/2011
Individual Last Updated Record:	SDH
Date Record Retired:	

Munition Information and Fragmentation Characteristics

Explosive Type:	Explosive D
Explosive Weight (lb):	7.55
Diameter (in):	5.0000
Cylindrical Case Weight (lb):	29.81237
Maximum Fragment Weight (Intentional) (lb):	0.3380
Design Fragment Weight (95%) (Unintentional) (lb):	0.0667
Critical Fragment Velocity (fps):	3409

Sandbag and Water Mitigation Options

TNT Equivalent (Impulse):	0.81
TNT Equivalent Weight - Impulse (lbs):	6.116
Kinetic Energy 10^6 (lb-ft²/s²):	1.9634

Single Sandbag Mitigation

Required Wall & Roof Thickness (in)	36
Expected Max. Throw Distance (ft):	220
Minimum Separation Distance (ft):	220

Double Sandbag Mitigation

Required Wall & Roof Thickness (in)	Not Permitted
Expected Max. Throw Distance (ft):	Not Permitted
Minimum Separation Distance (ft):	Not Permitted

Water Mitigation

Minimum Separation Distance (ft):	275
Water Containment System:	1100 gal tank

Note: Use Sandbag and Water Mitigation in accordance with all applicable documents and guidance. If a donor charge larger than 32 grams is utilized, the above mitigation options are no longer applicable. Subject matter experts may be contacted to develop site specific mitigation options.

Theoretical Calculated Fragment Distances

HFD [Hazardous Fragment Distance: distance to no more than 1 hazardous fragment per 600 square feet] (ft):	343
MFD-H [Maximum Fragment Distance, Horizontal] (ft):	2131
MFD-V [Maximum Fragment Distance, Vertical] (ft):	1613

Overpressure Distances

TNT Equivalent (Pressure):	0.85
TNT Equivalent Weight - Pressure (lbs):	6.418
Unbarricaded Intraline Distance (3.5 psi), K18 Distance:	33
Public Traffic Route Distance (2.3 psi); K24 Distance:	45
Inhabited Building Distance (1.2 psi), K40 Distance:	74
Intentional MSD (0.0655 psi), K328 Distance:	610

Note: Per V5.E3.2.2.1 of DoD 6055.09-M the minimum sited K328 distance may be no smaller than 200 ft.

Minimum Thickness to Prevent Perforation

	Intentional	Unintentional
4000 psi Concrete (Prevent Spall):	8.80	4.49
Mild Steel:	1.71	0.87
Hard Steel:	1.40	0.71
Aluminum:	3.37	1.79
LEXAN:	8.19	5.49
Plexi-glass:	6.62	3.89
Bullet Resist Glass:	5.85	3.26

Item Notes

Distribution authorized to the Department of Defense and U.S. DoD contractors only for Administrative-Operational Use (17 October 2002). Other requests shall be referred to the Chairman, Department of Defense Explosives Safety Board, Room 856C, Hoffman Building I, 2461 Eisenhower Avenue, Alexandria, VA 22331-0600.

Fragmentation Data Review Form

Database Revision Date 8/21/2014

Category:	Surface-Launched HE Rounds
Munition:	5 in 54 Caliber Mk 81, 82, and 83
Case Material:	Steel, Mild
Fragmentation Method:	Naturally Fragmenting
Secondary Database Category:	Projectile
Munition Case Classification:	Robust

DODIC:	D340, D343, D346
Date Record Created:	10/14/2011
Record Created By:	SDH
Last Date Record Updated:	4/15/2013
Individual Last Updated Record:	SDH
Date Record Retired:	

Munition Information and Fragmentation Characteristics

Explosive Type:	PBXN-106
Explosive Weight (lb):	6.25
Diameter (in):	5.0000
Cylindrical Case Weight (lb):	46.75802
Maximum Fragment Weight (Intentional) (lb):	0.6690
Design Fragment Weight (95%) (Unintentional) (lb):	0.1825
Critical Fragment Velocity (fps):	3933

Sandbag and Water Mitigation Options

TNT Equivalent (Impulse):	1.3
TNT Equivalent Weight - Impulse (lbs):	8.125
Kinetic Energy 10^6 (lb-ft²/s²):	4.8135

Single Sandbag Mitigation

Required Wall & Roof Thickness (in)	36
Expected Max. Throw Distance (ft):	220
Minimum Separation Distance (ft):	220

Double Sandbag Mitigation

Required Wall & Roof Thickness (in)	Not Permitted
Expected Max. Throw Distance (ft):	Not Permitted
Minimum Separation Distance (ft):	Not Permitted

Water Mitigation

Minimum Separation Distance (ft):	275
Water Containment System:	1100 gal tank

Note: Use Sandbag and Water Mitigation in accordance with all applicable documents and guidance. If a donor charge larger than 32 grams is utilized, the above mitigation options are no longer applicable. Subject matter experts may be contacted to develop site specific mitigation options.

Theoretical Calculated Fragment Distances

HFD [Hazardous Fragment Distance: distance to no more than 1 hazardous fragment per 600 square feet] (ft):	326
MFD-H [Maximum Fragment Distance, Horizontal] (ft):	2652
MFD-V [Maximum Fragment Distance, Vertical] (ft):	2024

Overpressure Distances

TNT Equivalent (Pressure):	1.46
TNT Equivalent Weight - Pressure (lbs):	9.125
Unbarricaded Intraline Distance (3.5 psi), K18 Distance:	38
Public Traffic Route Distance (2.3 psi); K24 Distance:	50
Inhabited Building Distance (1.2 psi), K40 Distance:	84
Intentional MSD (0.0655 psi), K328 Distance:	685

Note: Per V5.E3.2.2.1 of DoD 6055.09-M the minimum sited K328 distance may be no smaller than 200 ft.

Minimum Thickness to Prevent Perforation

	Intentional	Unintentional
4000 psi Concrete (Prevent Spall):	12.71	6.81
Mild Steel:	2.46	1.33
Hard Steel:	2.02	1.09
Aluminum:	4.74	2.65
LEXAN:	10.24	7.00
Plexi-glass:	8.91	5.38
Bullet Resist Glass:	8.12	4.64

Item Notes

Corrected values utilized for determining sandbag and water mitigation requirements resulted sandbag and water mitigation being permitted for use with this item.

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BURIED EXPLOSION MODULE

(Version 6.3.1)

Based on DDESB Technical Paper 16 Revision 4, EARTHEX software, and NSWCDD/TR-92/196

(ENGLISH UNITS)

SELECT BURIAL MEDIUM	Water	SELECT ITEM DESCRIPTION	5 in Mk 28 (Explosive D filled)
If underwater, ignore soil type	Dry Sand		

USER INPUTS

ENTER TOTAL NUMBER OF ITEMS	1
ENTER TOTAL WEIGHT OF ALL DONOR CHARGES (lbs)	0.10
ENTER DONOR CHARGE EXPLOSIVE TYPE	Explosive D

VALUES USED IN BEM CALCULATIONS

SINGLE ITEM NEW (lbs)	7.33
ITEM DIAMETER (in)	4.930
SINGLE ITEM MAXIMUM FRAGMENT WEIGHT (lbs)	0.3955
FRAGMENT WEIGHT USED IN CALCULATIONS (lbs)	0.3955
SINGLE ITEM MAXIMUM FRAGMENT VELOCITY (ft/s)	3,031
FRAGMENT VELOCITY USED IN CALCULATIONS (ft/s)	3,031
TOTAL TNT WEIGHT USED (lbs)	6.32
WEIGHT USED IN UNDEX WEIGHT CALCULATIONS (lbs)	7.58
WEIGHT USED IN UNDEX VELOCITY CALCULATIONS (lbs)	5.61

USER INPUTS

ENTER DEPTH OF WATER (ft)	22.00
ENTER HORIZONTAL RANGE (for pressure calculation) (ft)	100

BURIED EXPLOSION MODULE OUTPUTS

UNDERWATER

NO CRATER

0

FRAGMENT EXIT VELOCITY (ft/s)	0.0	MIN. FRAGMENT LAUNCH ANGLE (°)	90.0
MAXIMUM FRAGMENT DISTANCE - HORIZONTAL (ft)	0.0		

Distance at which pressure is 0.066 psi = Blast Withdrawal Distance (buried/undex) (ft)			20.1	
Open Air Withdrawal Distance, K328 (ft)	606.3	Fragment Hazard Distance (ft)	0.0	See Note 2
		Pressure at Fragment Hazard Distance (psi)	-N/A-	See Note 3
		Pressure at Fragment Hazard Distance (dB)	-N/A-	See Note 3
		Fragment Hazard Distance = max (MFD-H, Soil Ejecta Distance)		
		Pressure at Range Entered (psi)	0.0000	See Note 4
		Pressure at Range Entered (dB)	0.0	See Note 4

Note 2: Water too deep--no fragments expected

Note 3: No overpressure is produced at this depth

Note 4: No overpressure is produced at this depth