EPA Region 10 Responses to NRRB Comments

Since meeting with the National Remedy Review Board (Board) in July 2010, Region 10 has accepted a variety of recommendations from the Board. For instance, the Region has selected a preferred cleanup remedy, Alternative 3C Plus (a modification of the alternative presented to the Board), had additional discussions with property owners and Stakeholders regarding future land use, and has conducted a seismic evaluation. Although the Board recommended an interim cleanup at the Lockheed West Seattle Superfund Site (Site), the Region has decided to implement a final remedy. The Region continues its coordination with the Lower Duwamish Waterway (LDW) Superfund Site team because the LDW Site is "upstream" from this Site. Below are the Region's responses to the Board's comments.

Preferred Alternative 3C Plus:

The Preferred Alternative includes the following elements:

- Dredge the northeastern and eastern shoreline bank to mean higher high water (MHHW) and all intertidal sediment to remove sediments with contaminants of concern (COCs) at levels in excess of Washington State Sediment Management Standards (SMS) (*Washington Administrative Code* [WAC] Chapter 173-204) Sediment Quality Standards (SQS) and backfill to grade with a layer of habitat restoration "fish mix" material.
- Place habitat substrate and fish mix on the northern shoreline bank, where large riprap currently supports the Terminal 5 bank, to provide a more habitat-friendly environment.
- Dredge the former shipway area (westernmost portion of the Site) to remove sediments with COC concentrations in excess of the SQS levels and place a thin layer (6 to 9 inches) of clean material to cover dredge residuals.
- Dredge the former Dry Docks 1 through 3 area and other localized areas throughout the Site to remove sediments with COC concentrations that exceed SMS cleanup screening levels (CSL), and place a thin layer (6 to 9 inches) of clean material over dredge residuals.
- Dredge the Navigation Channel in the West Waterway to remove sediments with COC concentrations that exceed SQS, and place a thin layer (6 to 9 inches) of clean material to cover dredge residuals.
- Dispose of dredged sediments and other related remediation materials by truck or rail transport to an appropriate offsite upland facility permitted to accept these materials.
- Remove debris, riprap, failing wooden bulkheads, and pilings as necessary or directed by EPA, and dispose of them offsite.
- Place a thin layer (6 to 9 inches) of clean sand and gravel material to promote enhanced natural recovery (ENR) over the remainder of the Site where concentrations of most risk-driver COCs are between the SQS and CSL and concentrations of other COCs are no greater than two times the SQS.
- Place institutional controls (ICs) in the form of a proprietary control that runs with the land and that requires coordination with EPA and management of any residual contamination that is disturbed or encountered in the event of future excavation or dredging within the boundaries of the Site. It is EPA's expectation that the state Uniform Environmental Covenant Act (UECA) will be used. The ICs will not affect or restrict Tribal fishing rights in this area nor will they restrict pile installation, anchoring, or water-based commerce. The Lockheed Martin Corporation will secure appropriate restrictive covenants from the Port of Seattle (Port) and the Washington State Department of Natural Resources (DNR). In addition, Elliott Bay fish consumption advisories, established by the Washington State Department of Health, to reduce human exposure from ingestion of contaminated seafood will be posted at the Site.
- Conduct post-remedial confirmation sampling.

- Conduct long-term monitoring at the Site in the event of a major storm (with high winds from the north at 30 miles per hour or greater, that persist for more than 4 hours), or an earthquake of significance. If those events occur, bathymetric monitoring will be implemented to determine whether one or more components of the selected remedy are affected.
- Conduct 5-year reviews (with scopes limited to bathymetric surveys to ensure that the ENR areas remain in place), file reviews, and interviews with the landowner pertaining to any development that has occurred at the Site since remediation was completed.

The overall size of the site is approximately 40 acres. Implementation of the Preferred Alternative will encompass the entire site and involve removal and/or addition of the following quantities of materials:

- Dredging—13.6 acres total (167,450 cubic yards [yd3]) derived from the following areas:
  - Shoreline/intertidal area – 1.2 acres (9,300 yd3)
  - Former shipway area – 0.8 acre (6,500 yd3)
  - Area below -10 feet (ft) mean lower low water (MLLW) – 11.6 acres (151,650 yd3)
- Backfill/capping of dredged areas—2.2 acres total in the following areas:
  - Shoreline/intertidal area – 1.2 acres (13,100 yd^3 of habitat mix, 1,900 yd^3 of riprap)
  - Former shipway area – 1 acre (9,850 yd^3 of habitat mix)
- ENR—28.6 acres total over the remaining (nondredged) area below -10 ft MLLW to the limits of the Site boundary (45,900 yd3)

The total capital cost to construct the preferred alternatives is estimated to be $48.1 million. The present value of the total cost of construction plus operations and maintenance is $47.7 million. This is because IC costs are minimal, there are no cap replacement costs, and no O&M costs will be incurred because the remedy will meet the RAOs at the end of construction. Construction will be completed in one or two construction seasons and will be determined during design.

Site Characterization

Comment: *Throughout the presentation to the Board, a number of issues and potential data gaps became evident. These issues center on the need for additional site specific data and re-assessment of the assumptions used in the cleanup level risk calculations. These issues/gaps include: 1) designation of future land use; 2) contaminant distribution (e.g. dioxins); 3) site specific contaminant bioaccumulation data (e.g. site fish tissue collection); 4) chemical speciation in exposure media (e.g. arsenic (As) in fish tissue) which can impact the toxicity assessment; 5) reassessment of exposure assumptions (e.g. relative risk calculations/relative source contributions or additional risk for PCBs, or ingestion rates); 6) consideration of sedimentation rates and background levels from the neighboring Pacific Sound Resources Superfund Site (PSR); 7) associated recontamination potential from groundwater and Elliot Bay; and 8) the potential effects of seismic activity. In addition to ensuring an adequate administrative record to support the Region's cleanup approach for this site, this information could have a substantial influence on alternative approaches, conclusions on current risk, and remedy protectiveness for the final remedy cleanup decisions made by the Region. The Board recommends the Region consider addressing all the issues above and document the Region's data and findings in the administrative record and decision documents.*

The Regional responses to these issues/gaps are provided numerically below:

1. Designation of future land use.

Since the Board met, EPA and Lockheed Martin continued to meet with project Stakeholders including the Port of Seattle (the Port), the Washington State Department of Natural Resources (DNR) and the Suquamish Tribe and Muckleshoot Tribe (the Tribes). A portion of the Tribes' Usual and Accustomed fishing area is included within the Site. As a result of EPA's conversations with these Stakeholders, three FS alternatives were re-evaluated and modified to take into account future land use issues. The future land use issues the Region considered included the Port's request to the Water Resources Development Authority to congressionally authorize deepening the

navigational channel in West Waterway (from -42 feet Mean Lower Low Water (mllw) to -50 ft mllw). The Region also considered the Port's, DNR's and the Tribes' preference to minimize contamination remaining on the Site after remediation, and to minimize areas of capping. In addition, the Region addressed the Stakeholders' preference to clean up the entire site footprint and reduce the need for institutional controls because (1) the Tribes believe ICs could infringe on tribal treaty rights; (2) under Washington state law, sediment caps and related ICs are not considered a "water dependent use" on state owned aquatic lands; and (3) the Port and DNR are concerned that contaminants left on Site may impede or complicate future land use.

The three FS alternatives were modified to include dredging the navigational channel to the Model Toxics Control Act Sediment Quality Standards (MTCA SQS). This modification addresses the Port's land use issues by taking into consideration the depth of the channel needed for navigational clearance if this is congressionally authorized in the future. Additional modifications to FS alternatives include removing the most contaminated sediments at the Site in the dry dock areas and shipway and placing ENR material in the less contaminated areas (the remainder of the Site). Removing the most contaminated sediment and placing a thin layer of clean material to enhance natural recovery in the rest of the Site, including in the dredged areas, minimizes the need for ICs, thereby taking into consideration stakeholders' land use preference for unrestricted use. Even with this more conservative approach, IC's will still be required in the form of a state UECA covenant and an Elliott Bay fish advisory.

2. Contaminant distribution (e.g., dioxins).

Extensive sampling has been conducted at this Site in and prior to 2007. Since it was a former shipyard, the emphasis of sample collections was surface and subsurface metals, PAHs and PCBs. Dioxins/furans were sampled at that time, but it was decided these samples should be archived and not analyzed. Dioxins/furans sampling was done as part of the Lower Duwamish Waterway investigations and the contaminant was found to be present throughout much of the Waterway. In the LDW, the spatially-weighted average concentration of dioxin is 25.6 nanograms Toxicity Equivalent Quotient (TEQ) per kilogram (ng/kg) dry weight (dw). Concentrations range from 0.3 to 2,100 ng/kg dw in LDW (AECOM 2010, Draft Final Feasibility Study, Lower Duwamish Waterway (LDW)). Since water and suspended sediments from the Lower Duwamish Waterway flows into Elliott Bay, dioxins/furans contamination has the potential for being deposited in Elliott Bay and potentially at the Site. For comparison, a risk-based exposure concentration for direct contact of 13 ng/kg dw was chosen for the LDW Site based on values presented in the LDW Draft Final FS for site-wide and intertidal tribal clamming scenarios. Based on this information, EPA directed Lockheed Martin to include dioxins/furans as one of the risk-drivers for the Site. Lockheed Martin did not object to the inclusion of these contaminants in the list of COCs for the Site. Clam sampling discussed below was done after dioxins/furans were included as a Site COC. It was during that sampling event that dioxins/furans were sampled and analyzed in site sediments and clams from the intertidal portion of the Site.

The PSR site adjacent to the Lockheed West Site was a potential source of dioxins/furans. These contaminants are commonly found at wood treatment sites and were identified as being associated with wood processing and related industrial chemicals released from historical operations in the PSR Upland Unit (EPA Second Five-Year Review Report 2009). Dioxins/furans were also previously identified as a PSR site-related contaminant of concern in EPA's 1999 Record of Decision. Detected dioxin concentrations in surface sediment samples from the PSR site ranged from 1.97 – 156 ng/kg dw, as reported in the 1998 Remedial Investigation prepared for EPA by Roy F. Weston, Inc. Intertidal portions of the PSR site were capped in 2005 and remedial control measures were implemented to address historical upland contaminant releases.

To support the assumptions used in the HHRA and the ERA, clam tissue samples were collected at the Site as part of the RI sampling in 2008 to determine if the proposed BSAFs for tissue modeling in the HHRA and ERA were sufficiently conservative. In conjunction with clam tissue sample collection, composite surface sediment samples were collected from the areas from which the clams were collected in both intertidal and subtidal sediments.

The composite surface sediment samples in the three subtidal areas for dioxin TEQ concentrations ranged from 2.41 to 13.8 ng/kg dw and in the one intertidal area the concentration was 0.687 ng/kg-dw. The background value for sediment concentrations is 2 ng/kg-dw. The three clam tissue concentrations ranged from 0.0677 -

0.154 mg/kg-wet weight) These results define the dioxin/furan distribution sufficiently to address this COC within the facilities boundaries.

3. Site specific contaminant bioaccumulation data (e.g., site fish tissue collection).

The quantity of site-specific contaminant bioaccumulation data collected at this Site is sufficient to support the proposed remedial alternative. This determination was made in light of the fact that prior to conducting the risk assessments, the PRP proposed an acceptable expedited and complete site cleanup to the Region. Consequently, easily implemented biota sediment accumulation factor (BSAF) approaches that did not require large quantities of tissue monitoring data and health protective exposure assumptions were utilized to demonstrate unacceptable site risk. The exposure assumptions used reflect the fact that the Lockheed West site is part of Puget Sound, and that it is the desire of the Region that individual site risks within Puget Sound be evaluated with the objective of improving the environmental quality of Puget Sound as a whole.

Biota data collected from the Site consisted of tissue concentrations of contaminants in *Macoma balthica*. Intertidal *M. balthica* and sediment data were used to compute empirical BSAFs. BSAFs selected from the literature and used to compute site risks were in all instances greater than empirical BSAFs, with the exception of chromium. Use of literature BSAFs thus generally resulted in a health protective estimate of risks posed by consumption of intertidal shellfish.

In addition to the clam survey described below, and further discussed in Section 4.7 of the RI/FS report, Pacific staghorn sculpin and English sole were identified as site-wide receptors of concern. The Ecological Risk Assessment (ERA) focused on receptor species that have the highest potential exposures to site-related chemicals and that serve to represent other species or groups of organisms that may also be exposed. The English sole and Pacific staghorn sculpin were chosen to evaluate exposures to higher trophic fish through bioaccumulation. (Note: Salmon were not selected as they are migrating fish and are not at this Site long enough for the fish tissue to accurately reflect site conditions).

Fish exposure data consisted of (1) estimated concentrations in fish tissue for contaminants evaluated using toxicity data related to whole body tissue concentrations, and (2) estimated concentrations in prey that fish consume for contaminants with toxicity data related to dietary exposures. Concentrations of COPCs in tissues of receptors of concern (ROC) and their prey were modeled from concentrations in site sediments. Modeling was performed in two ways- through the use of numerical BSAFs and regression equations. Both methods represent the relationship between a chemical concentration in sediment and its concentration in tissue of the ROC or its prey.

For crabs, fish and sandpiper, effects data were identified for COPC concentrations in receptor tissue or as doses to the organism that were associated with the most sensitive endpoint that could affect populations of the organism. Both the NOAEL and LOAEL values were identified as toxicity reference values (TRVs). TRVs were used as the toxicity criteria in the characterization of risks to crabs, fish and sandpiper. In conclusion, given the initial understanding between EPA and the PRPs that the cleanup at Lockheed would be comprehensive, health protective risk assessment methods that did not require collection of vast amounts of site specific data were employed to assess risks and develop risk based cleanup values.

When the Site is cleaned up, the risk levels for the human health and ecological exposure pathways identified in the RAOs will be: RAO 1 – $2\text{-}2.8\times10^{-4}$, RAO 2 -- $<1\times10^{-5}$, RAO 3 – meets SQS and HI<1 and RAO 4 – HQ<1. A fish advisory is identified as an institutional control in order to further decrease the human health risk at the Site due to consumption of fish.

4. Chemical speciation in exposure media (e.g., arsenic (As) in fish tissue), which can impact the toxicity assessment.

A BSAF approach was used to model total arsenic in tissues of biota. Total and inorganic arsenic concentration data from the nearby LDW were available for all of the tissue types utilized in assessing human health risk. The percent inorganic arsenic data from LDW were used to compute inorganic concentrations for the Lockheed West Site based on Lockheed West Site total arsenic data. The LDW bivalve inorganic arsenic data came from *Mya*

arenaria, the eastern softshell clam. *Mya arenaria* from the LDW were found to have 40% inorganic arsenic, higher than that which is usually found in bivalves. Use of the *Mya arenaria* percent inorganic arsenic value will likely result in a health-protective estimate of arsenic risk.

5. Reassessment of exposure assumptions (e.g., relative risk calculations/relative source contributions or additional risk for PCBs, or ingestion rates).

Potential sources to the Site were evaluated in the Source Control Information and Data Gap Report (2009) and the Source Control Evaluation Report (2009). The conclusion of these reports is that Elliott Bay is a large water body with many potential contaminant sources that could potentially migrate to the Site. EPA did not perform a risk analysis regarding potential risk from contaminants that have migrated to the Site since the shipyard was shutdown in 1987 because the elevated concentrations of contaminants at the Site far outweigh the contaminant concentrations in the Bay. The risk assessment for all the exposure pathways from the Site, including ingestion, was based on the contaminant concentrations found at the Site during the sampling rounds during and prior to 2007 and the clam reconnaissance survey in 2008. This is appropriate because the Site is not a pronounced depositional or erosional environment. Superfund sites adjacent to the Lockheed West site that were capped in 2005 have not exceeded the state SQS concentrations based on long term monitoring .In addition, any elevated concentrations of contaminants identified on the surface of the caps at these cleaned up sites are not from "cap failure" (e.g., contaminants moving through the cap designed for containment) but rather are likely from the urban environment (i.e., Elliott Bay) that these sites are located within.

Because this Site is located within Puget Sound, it cannot be addressed in isolation. The fact remains that the Site receives some amount of contaminated sediments and surface water from the larger Elliott Bay. Therefore, the Region has used exposure assumptions that recognize the relationship between the Site, Elliott Bay (and Puget Sound), and the Lower Duwamish Waterway, that are likely to be protective of the Site and the contiguous water body.

6. Consideration of sedimentation rates and background levels from the neighboring Pacific Sound Resources Superfund Site (PSR).

EPA completed the cleanup of PSR in 2005. A cap was placed throughout this Site in the intertidal and subtidal areas. Two Five-Year Reviews have been conducted and bathymetric data was collected prior to the second Five-Year Review (2009) in order to determine that the cap is still in place. PSR cap thickness measured by bathymetric survey indicated that the cap is remaining physically stable, but more detailed information on sediment deposition was not included. The second Five-Year review concluded that the extent of some erosion and accretion of material noted along the adjacent intertidal shoreline was not large enough to suggest that the intertidal cap function has been degraded (the intertidal cap is five feet thick). The cleanup standard for PSR was the state SQS. No re-contamination above these concentrations that are protective of benthic invertebrates has been detected since the completion of cleanup.

7. Associated recontamination potential from groundwater and Elliott Bay.

The RI and supporting studies investigated the potential for recontamination from several potential off-site sources. These sources included surface water and suspended sediment, groundwater, spills and unauthorized releases, permitted wastewater discharges, and combined sewer outfall bypasses. Although Elliott Bay as a whole is currently not identified as an active federal or state cleanup area, urban pollutant influences from many sources affect sediment quality on a bay-wide basis and cause contaminants to be elevated above natural background. Based on the counter-clockwise flow of water in the Bay and tidal influences, the surface water and sediments are not stagnant. Sediment transport and surface water circulation studies for Elliott Bay, information from the Harbor Island area Superfund sites and bathymetric data from the adjacent PSR site suggest that the Lockheed West Site will be impacted by Elliott Bay, but overall it is an area characterized by a low sedimentation rate. The Site is subject to receiving sediments transported from adjacent in-water sources such as the West Waterway and Elliott Bay due to wave and current action. After cleanup, transport and deposition of sediments containing contaminants onto the Site are expected to maintain sediment contaminant concentrations at or below levels comparable to vicinity background, but above natural background due to the above referenced factors.

Groundwater monitoring wells were placed in the upland area known as Remediation Area #5 that is part of a state cleanup site for the adjacent uplands. These wells were located near the edge of the upland site in order to monitor the effectiveness of the asphalt cap for reducing contaminants to the groundwater. Review of the groundwater monitoring data from 2011 and previous monitoring events did not identify concerns for potential impacts to groundwater or to surface water. In particular, metals concentrations were not detected at concentrations that would be expected to be of concern for partitioning into sediment. There was also no indication that residual NAPL in the adjacent PSR Site uplands is migrating toward the Lockheed West Site.

In addition, there are several facilities in the Site vicinity with general industrial NPDES stormwater permits as described in the Source Control Information and Data Gap Report and Source Control Evaluation Report. The closest of these facilities is Eagle Marine Services at Terminal 5. There are four major stormwater conveyances at Terminal 5. The closest of these outfalls is the SW Florida Street Outfall that borders the southern portion of the Lockheed West Site. The remedy recontamination potential for the SW Florida Street Outfall was further evaluated as part of the Source Control Evaluation Report. The SW Florida Street Outfall represents a relatively low ongoing recontamination potential for the Lockheed West Site remedy, provided that Port operations in the vicinity of the drainage system do not significantly change. The following observations regarding the SW Florida Street Outfall were provided:

- A shoreline survey of the Terminal 5 frontage was performed during April 2009 in an effort to reconcile details regarding the layout of the current and former stormwater drainage system and as verification of an earlier shoreline inspection that was performed as part of the remedial investigation and summarized in the RI Data Report. Based on the inspection, the current stormwater drainage system at the former shipyard uplands drains to the SW Florida Street Outfall. The previous shoreline survey (Tetra Tech, 2008b) and Phoinix (2006) stormwater inspection noted the presence of miscellaneous piping along the shoreline. The piping found during the previous shoreline survey was consistent with observations made during the April 2009 survey. The observed piping did not appear to represent storm sewer piping based on construction and location. Only one of the miscellaneous pipes observed along the shoreline was draining a small trickle of water during the April 2009 site shoreline survey that likely represented seawater drainage during low tide.
- Sediment data were collected from near the SW Florida Street Outfall during the remedial investigation and were evaluated to assess whether historical discharges have resulted in a discernible contamination hotspot. Based on a comparison with the remedial investigation data, a contaminant hotspot could not be identified. Due to changes in configuration and current regulation of stormwater discharges, future releases to the drainage system will likely be significantly less than historical releases.
- The Stormwater Pollution Prevention Plan for Terminal 5 does not include ongoing chemical monitoring of the SW Florida Street Outfall. Recent water quality results (January 2006 through the present) for Eagle Marine Services at the Terminal 5 Outfall show that zinc (maximum of 780 micrograms per liter [µg/L] during July 2008) consistently exceeded the benchmark screening value (117 µg/L) specified in the Stormwater Pollution Prevention Plan. However, this monitored outfall is about ½ mile from the Lockheed West Site and is too far away to represent a high likelihood of remedy recontamination for the Lockheed West Site.
- Information from the RI and supporting studies further indicated that other sources associated with historical spills and combined sewer outfall discharges do not represent a significant direct source of contamination to the Site (outfalls are not located on the Site). However, the culmination of discharges from permitted outfalls (CSO's, industrial permits, etc.) do have an overall effect on the contaminant concentrations in Elliott Bay which currently impacts the Site and will continue to do so after cleanup is completed.

The Region recognizes the potential for recontamination from Elliott Bay; however, cleaning up the contamination that is associated with the Site's historical operations reduces exposure to contaminants at the Site, and reduces the overall contaminant load being transported among the contiguous water bodies. Regardless of the contaminants being transported to the Site from other areas, it is important and beneficial to the environment to take the step to address the contamination at this Site.

8. The potential effects of seismic activity.

In fall 2012, EPA directed Lockheed Martin to conduct a seismic evaluation of the Site. An evaluation was conducted of the seismic stability and liquefaction potential of three remediation alternatives at the Site—Alternatives 2A2a (cap and ENR only), 3A1 (dredge, cap and ENR) and 3C (dredge and ENR only). The conclusions of the liquefaction potential and seismic stability evaluation of the remedial alternatives are:

- The upper 50 feet of site sediments are considered susceptible to liquefaction initiated by a 100-, 500, and 2,500-year seismic events.
- Earthquake-induced displacement/lateral spreading was predicted to be up to 9 feet and up to 4 feet, respectively, for the 2,500-year event using the most conservative strength estimates predicted by WSliq for the analyzed seismic events. These estimates indicate that sediments associated with a seismically induced displacement are likely to remain within or in the near vicinity of the dry dock 1 area. The liquefaction-induced hazard potential is estimated to be less for Alternative 3C due to removal of the top 15 feet of liquefiable layer within the remedial action area.
- Based on the liquefaction-induced deformation analysis, there exists a risk of potential upwelling, exposure, and spreading of contaminated sediments beneath the capped areas due to the liquefaction; however, the hazard is expected to be localized and remain within the dry dock hot spot area. Such an event may cause short-term disruption to the benthic community in the affected zone but could be repaired by placement of additional cap material.
- Slope stability analysis for the post remediation profiles shows stable slopes for static conditions for 100-year event and potential failure for 500-year and 2,500-year events. The 2,500-year event is likely to affect the stability of contaminated sediment under the dry dock 1 hot spot area. The proposed alternatives have a minor effect on the existing topography and stratigraphy; therefore, the slope stability conditions do not differ significantly among the alternatives. This conclusion is applicable to all the FS alternatives.
- A stable capping slope will be determined during design. Stability of locally steeper slopes such as the berms under piers, former dredge cuts with a typical side slope 2H: 1V or flatter are not considered critical. If local slope stability failure of those capped berms or former dredge cuts occur, such failure would be localized and easily repaired by placing additional cap material.
- A potential for a flow slide may exist due to vary low residual strength conditions after liquefaction. Although under the conservative assumptions, the analysis suggest that a large-scale flow slide could occur on the relatively flat upper portion of the deltaic sediments (e.g., in the vicinity of the former dry dock areas), these types of flow slides tend to occur on the steeper forefront of the deltaic deposits and relatively close to the slope break. Alternatives 2A2a and 3A1, which include a cap layer over a 6- to 10-acre area and where the outer edge of the cap is 400 feet from the delta shelf slope at a slope of 8 degrees, is well below the 15 degree delta shelf slope assumed by Palmer (1999). Thus, the current analysis does not suggest occurrence of a large-scale flow slide that may affect the stability of contaminated sediments.
- During the 2001 Nisqually earthquake, a PGA of 0.22 was measured at Harbor Island. Such magnitude of PGA is expected to affect this site similar to the 100- and 500-year events analyzed. However, post-earthquake bathymetry surveys in the vicinity of the Lockheed West Site do not indicate any recognizable effect of liquefaction, slope failure, or flow slides.
- The findings of these analyses for nominal 100-year and 500-year events do not suggest a large-scale failure. Any earthquake-induced damage on the sediment cap will require repair or full replacement of the cap as part of the long-term operation and maintenance plan of the remedy.

Comment: *In addition, the Board recommends that the Region consider proceeding with an interim remedial action for this site at this time. For example, an interim action could provide for the limited dredging and related actions at the former shipyard area (e.g. 10,000 cubic yards plus some additional dredging and/or capping in selected areas with higher contamination levels) while additional studies and monitoring are conducted to better characterize the site and reduce as much as possible the uncertainties resulting from current data gaps.*

The Regional response to these issues/gaps is provided below:

The Region is proposing a final remedial action. The Region has taken several steps to address the Board's concerns and feels certain that data not discussed at the time Region 10 met with the Board, additional information and analyses obtained since the Board met, and the modification and enhancement of the FS alternatives since the Board's review, support Alternative 3C Plus as a final remedial action. The Region does not believe that additional studies and monitoring are needed to support the selection of the proposed alternative 3CPlus as a final remedy.

The FS alternatives presented in the draft RI/FS (April 2011) have been modified as a result of several factors, including the seismic evaluation, the additional discussions regarding future land use, and Lockheed Martin's preference to conduct a remedy at this Site that would allow for minimal long term O&M and institutional controls. All of the FS remedies under consideration could be performed as final remedies and meet the site RAOs and cleanup levels upon completion of the remediation. Therefore, the Region is proceeding with a final remedy at this Site.

EPA's ROD Guidance document, "A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents," discusses the situations when an interim remedy, rather than a final remedy, is appropriate:

- "During scoping, or at other points in the RI/FS, the lead agency may determine that an interim remedial action is appropriate. An interim action is limited in scope and only addresses areas/media that also will be addressed by a final site/operable unit ROD. Reasons for taking an interim action could include the need to:
  - Take quick action to protect human health and the environment from an imminent threat in the short term, while a final remedial solution is being developed; or
  - Institute temporary measures to stabilize the site or operable unit and/or prevent further migration of contaminants or further environmental degradation. (p. 8-2)"

An interim ROD would not be appropriate at this Site because the preferred cleanup alternative is comprehensive in scope for the contamination stemming from historical operations at the Site. Based on the information currently available, EPA believes the preferred alternative meets the threshold criteria and provides the best balance of tradeoffs among the other alternatives with respect to the balancing criteria. EPA expects the preferred alternative to satisfy the requirements of CERCLA §121(b). ARARs will be met, except for the Clean Water Act, Ambient Water Quality Criteria that will be waived. (See, discussion of ARARs below) Also the preliminary remediation goals ("cleanup goals"), which become remediation goals in the ROD, will also be met at the completion of site cleanup.

Comment. *Furthermore, the review package shows that the site has significant bathymetric relief with peaks, valleys and steep slopes. There are also significant pilings and debris. Before any remedy is implemented, the Region indicated that the pilings and debris would be removed and leveling may be needed. The Board recommends that the Region evaluate the effect of sediment re-suspension, redistribution of contamination, and accompanying risk. There may be an effect on the implementability and cost of capping. The Region should consider if this will make dredging more comparable to capping. If so, the comparative analysis of alternatives should be revised.*

The Regional response to these issues/gaps is provided below:

It is well established that dredging creates dredge residuals (USACE 2008 Technical Guidelines for Environmental Dredging of Contaminated Sediments). Dredge residuals are contaminated sediments remaining in or adjacent to

the dredging footprint after completion of the removal/dredging operation. There are numerous potential causes for residual sediment contamination, but dredge residuals generally include either undisturbed contaminated sediments not fully removed or suspended material generated during dredging. There are a number of operational, engineering and containment measures that incorporate best management practices (BMPs) to minimize and control residuals. The BMPs include adjusting the dredge rate cycle (i.e., rate the bucket is brought to the surface of the water), the type of dredging bucket, dredging accuracy, timing of dredging with tide and wind conditions, use of silt curtains or enclosures, and placement of clean cover material over the dredge prism to settle suspended solids. For remedies with dredge components the details about the use of these BMPs will be determined during the design phase. During remediation, water quality parameters will be monitored at the edge of the mixing zone. Also sediment samples at the dredge perimeter and potentially beyond the dredge area will be sampled after dredging. Finally, dredge residuals will be covered with the same ENR material placed in the remainder of the Site upon completion of the dredging operations.

Waste Characterization and Possible Principal Threat Waste.

Comment. *The package presented to the Board did not contain information to support the identification of dioxins and furans as contaminants of concern (COCs). Information should be collected and presented in the administrative record and decision documents to support this identification. Depending on the concentrations of these contaminants in the sediment some of this material may be considered a principal threat waste (PTW). The Board recommends that the Region include within the decision documents sufficient explanation regarding how COC's are identified and whether any of the contaminated media constitute principal threat waste consistent with the NCP (e.g., 40 CFR 300.430(b) and (d)), Office of Solid Waste and Emergency Response (OSWER) Directive No. 9355.3-01, October 1988, Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA, Interim Final (e.g., Chapter 3.4), EPA guidance 540/1-89/002, December 1989, Risk Assessment Guidance for Superfund, Volume 1, Human Health Evaluation Manual (Part A), Interim Final (e.g., Chapter 4); and OSWER Directive No.9380.3-06FS, November 1991, A Guide to Principal Threat and Low Level Threat Wastes. The Board recommends that in its decision documents, the Region more thoroughly explain how its reading of Agency guidance and its approach to treatment at this site are consistent with CERCLA and the NCP.*

The Regional response to these issues/gaps is provided below:

The information presented to the Board did not include the dioxins/furans data available from the Clam Reconnaissance study. This additional information is provided in "Site Characterization, #2" above. At the concentrations detected in the inter- and subtidal sediments, this contaminant, and the other site contaminants, are not considered a Principal Threat Waste since it is not significantly above the natural background concentrations (i.e., 13 ng/kg-dw highest sediment concentration; 2 ng/kg–dw background concentration). As stated previously, the PSR site is a potential nearby source of dioxins/furans but these sources have been controlled following remediation (by an intertidal and subtidal cap).

For intertidal and subtidal surface sediments at the Site, PCBs range from 4.2-3,000 micrograms per kilogram (ug/kg)-dw with the average concentration of 420 ug/kg-dw. The cleanup value based on natural background is 2 ug/kg OC normalized and SQS is 130 ug/kg-dw equivalent (assuming 1.5 percent organic carbon). Copper ranges from 28.2 to1900 mg/kg with the mean at 266 mg/kg. Natural background for copper is 24.9 mg/kg and SQS is 390 mg/kg. The mercury range is 0.02 to 2.94 mg/kg with the mean at 0.47 mg/kg. Natural background for mercury is 0.11 mg/kg and the SQS is 0.41 mg/kg. The arsenic range is 4.56 mg/kg to 330 mg/kg with the mean at 42 mg/kg. Natural background for arsenic is 7 mg/kg and the SQS is 57 mg/kg. The range for lead is 15.9 mg/kg to 1,420 mg/kg with the mean at 145 mg/kg. Natural background for lead is 11 mg/kg and the SQS is 450 mg/kg. The maximum for dioxins/furans is 13.8 ppt TEQ. Natural background for dioxins/furans is 2 ppt TEQ. At the detected concentrations listed for these constituents, none would be expected to a principal threat waste. There are no identified sources of non-aqueous phase liquids (NAPL), nor do PAH levels present a concern for the presence of principal threat wastes.

The NCP establishes the expectation that treatment will be used to address the principal threats posed by a site whenever practicable, in accordance with federal regulations (40 Code of Federal Regulations [CFR] 300.430[a] [1]

[iii] [A]). In general, principal threat wastes are those source materials considered to be highly toxic or highly mobile that generally cannot be contained in a reliable manner. Contaminants identified at the Site are considered low-level threats and are not highly mobile or highly toxic. Metals concentrations also do not trigger principal threat waste issues, and no Resource Conservation and Recovery Act of 1976 (RCRA)-listed hazardous wastes will be generated during Site remediation.

Future Land Use/Institutional Controls.

Comment. *The review package indicated and the presentation confirmed that the key stakeholders who control land use at the site have not reached a consensus or decided on future land use for the site. The Board recommends that the Region work with all interested stakeholders, including the DNR, Port of Seattle, tribes and community, to ensure the Region is using correct assumptions with regard to the reasonably anticipated future land use at this site. The Region then should be better able to consider reasonably anticipated future land use when making the remedy selection in accordance with OSWER Directive No. 9355.7-06P, June 2001, Reuse Assessments: A Tool To Implement The Superfund Land Use Directive.*

The Regional response to these issues/gaps is provided below:

See response for "Site Characterization #1" above. The Region has applied the principals in EPA's Reasonably Anticipated Land Use guidance at this Site. Based on the information obtained through letters or meetings from the Stakeholders, three FS alternatives were modified (from the initial 16 alternatives in the draft FS) for further consideration. All of the modified alternatives and the complete dredge Alternatives (4A-4C) provide the greatest amount of site cleanup and minimize future land use restrictions and required the fewest ICs.

While the Site is not currently used for Port-related or other commercial activities, the Port envisions expanding Terminal 5 to include pier structures as a multi-modal container in the future. Container ships use the navigational channel and offload in West Waterway at Terminal 5. Waterway Resource District Act (WRDA) authorization to dredge the navigation channel to -50 ft MLLW has been requested by the Port in 2010 and 2011. The Port described potential future development in letters to EPA in November 2010, and in May and September 2011. All of the modified FS alternatives include dredging the navigational channel to the state SQS cleanup standards which would result in clean sediments to -50 feet and allow for navigation of deep draft container vessels without any additional cleanup.

The Site and adjacent aquatic areas are designated as Tribal Usual and Accustomed (U&A) fishing areas. The Tribe has stated that if a cap were chosen as part of the remedy, it cannot conflict with, or restrict, Tribal treaty fishing rights or other treaty-protected rights. In addition, the Tribes requested that the use of IC's be minimized. The preferred alternative meets the Tribe's future land use needs because it does not include a cap, maximizes the removal of the highest contaminant concentrations, allows for unrestricted anchoring and use of the site for clamming and fishing, and requires minimal IC's.

DNR has stated that it would like the selected remedy to take into account the Port's future land use needs as it is the lessor to the Port, as well as limit the use of sediment capping as a remedial option. DNR believes that caps may restrict public access and damage natural resources, and is not an inherent water-dependent use. The Site has restricted access due to Homeland Security designation, and therefore is not a major recreational resource compared to other water bodies in the area. Public access is available at Jack Block Park to the west of the Site bordering the PSR Site.

Comment. *The information presented to the Board indicates that active remediation at this site will not by itself achieve a remedy that is protective of human health and the environment, so that institutional controls (ICs) will be needed to help ensure protectiveness. The Board recommends that the Region clarify in the decision documents the role of ICs that may be selected and implemented, including the potential role of fish consumption restrictions for subsistence fishermen and limitations on commercial fishing.*

The Regional response to these issues/gaps is provided below:

Active remediation with institutional controls will achieve a remedy that is protective of human health and the environment at the completion of the cleanup. At that time, all of the RAOs and site remediation goals will be achieved. EPA's 1995 Land Use Directive states, "In general, remedial action objectives should be developed in order to develop alternatives that would achieve cleanup levels associated with the reasonably anticipated future land use over as much of the site as possible." (p. 7). The RAOs for the Site considered future land use and is protective of those potential uses.

Meeting the preliminary remediation goal (or remediation goal that will be established in the ROD) for PCBs (2 ug/kg-dw) is based on natural background concentrations. At this concentration, site-wide risk for PCBs 2x10-4. The risk-based threshold concentration for PCBs is lower than the natural background concentration; therefore as per guidance the natural background concentration is selected. Due to this risk level, it is necessary to also include a health protective fish-advisory as an institutional control at this Site to further protect subsistence and recreational fishers. EPA has identified this as part of its Preferred Alternative in the Proposed Plan. The fish advisory that is recommended is one that is already in place for fish in Elliott Bay, the larger water body that this Site resides within.

The Region has determined that two ICs necessary at the Site will be a state UECA and posting of the Elliott Bay fish advisory which already exists in the Bay. The reason for the state UECA IC is to ensure that appropriate BMPs are identified for future development activities that may take place in sediments with contaminant concentrations between natural background (protective of human health) and the state SQS (protective of benthic invertebrates) concentrations. No restrictions are necessary on anchoring by tribal members exercising their tribal treaty rights as such activity would not compromise the effectiveness of the remedy. In addition, the fish advisory that is currently in effect for Elliott Bay (with fish consumption restrictions and limitations on commercial fishing) will also be posted at the Lockheed West site; however, this fish advisory is not specific to the Site, but rather takes into account the contaminant levels throughout the bay. Based on the fish advisory, the Tribal governments have a process the use to determine the amount of fishing they do in this area (i.e., larger than the Lockheed West Site) for subsistence, commercial and ceremonial purposes.

Human Health/Ecological Risk

Comment. *In the presentation to the Board, the Region focused on the difficult issues related to human health exposure, the potential for site recontamination from non site-related sources, and the challenges associated with the ability to achieve protectiveness within the dietary exposure pathway (fish consumption). The Board notes that there are other substantive and significant site related risks identified by the Region, both human health and ecological, from multiple contaminants (e.g. tributyltin, copper, arsenic) and exposure pathways (e.g. human health direct contact and incidental sediment ingestion). The Board recommends that the Region clearly and prominently articulate these risks in the decision documents, and explain how the preferred site remedy would achieve protectiveness, as well as explain how these risks provide a basis for action. The Region also should explain how the site cleanup is designed to achieve protectiveness with regard to non-site related fish bioaccumulation of certain contaminants with the help of ICs. Furthermore, the Board believes it may be appropriate for the Region to highlight the accomplishment of mass removal of contaminants from the Elliot Bay system, which may lead to the long-term reduction in fish contaminant levels in the future.*

The Regional response to these issues/gaps is provided below:

The RI/FS and the Proposed Plan identify the human health and ecological site risks (contaminants) and exposure pathways. In addition, the Proposed Plan discusses how these site risks and pathways are eliminated or reduced by Alternative 3C Plus.

There may be an overall impact of site cleanup on "non-site related fish bioaccumulation", but this is not likely to be measurable as per the discussion below in "Remedial Action Objectives," nor is it the objective (or responsibility) of this cleanup project to "achieve protectiveness with regard to non-site related fish bioaccumulation of certain contaminants with the help of (site specific) ICs." The Elliott Bay fish advisory will be

posted at the Site, but a site-specific fish advisory will not be developed because the advisory used throughout the Bay addresses the same aquatic species that are also found at or near the Site. This is because the Site is too small to be a home range for resident fish, and any fish exposed to Site contaminants will also be exposed to contamination outside the Site.

Because natural background concentrations for PCBs are higher than the risk-based threshold concentrations, a fish advisory institutional control will also be a component of the remedy at the Site to ensure that people don't eat unlimited fish.

Remedial Action Objectives

Comment. *In the package provided to the Board, remedial action objective (RAO) 1 states that an objective of the remedy is to reduce human health risks associated with the consumption of resident site seafood by reducing sediment and surface water concentrations of COCs to protective levels. The Board recommends defining the protective levels referenced in the RAO (i.e. based on number of fish meals) and clarifying what is meant by "reduce human health risks." In addition, baseline concentrations in seafood should be collected and documented so that the post-remediation reductions can be measured against pre-remediation levels. Providing more detail to the RAO will allow the Region to document when this RAO is achieved.*

The Regional response to these issues/gaps is provided below:

The resident fish at the Lockheed West site, English Sole and Pacific staghorn sculpin, do not strictly stay within the 40 acres of this site even though they are characterized as "resident fish." Therefore, although site cleanup will incrementally improve the overall habitat for fish and other aquatic life in Elliott Bay, it is not certain that fish tissue concentrations will dramatically improve after this action given that the fish move throughout Elliott Bay. By the same token, it is hard to quantify the reduction, if any, in human health risks. Therefore, the Region revised RAO 1 to state "Reduce human exposure from ingestion of on-site seafood contaminated with COCs from Site sediments to levels that are protective of recreational or subsistence fishing". This RAO will be met by using a site-wide average sediment concentration for COCs in the top 45 centimeters (cm) for intertidal sediments for clamming and beach play and top 10 cm for subtidal sediments. RAO 1 is met when RBTCs or natural background concentrations for human health exposure pathways for the applicable COCs are achieved. This RAO will be achieved at the completion of remedial action. The Site risks calculated after clean up are—RAO 1 -- 2-2.8 x 10^{-4}, RAO 2 -- <1x10^{-5}, RAO 3 meets SQS and HQ <1 and RAO 4 –HQ <1.

Comment. *The package presented to the Board includes RAOs 1 and 4 that call for reduction of human health risks and reduction of risks to crabs, fish, birds, and mammals to "protective levels" but specify that "no active remediation of surface water will be conducted." The Board recommends that the Region more clearly specify what "protective levels" means (in light of the various descriptions used in the package and during the presentation for ultimate site cleanup numbers) when it includes RAOs in its decision documents. The Board also recommends that the parenthetical notes connected with RAOs 1 and 4 be deleted; if surface water (and potential ground water contamination from the upland area) is not being addressed through this remedial action, the decision documents should explain how that will affect the Region's proposed approach to site cleanup*.

The Regional response to these issues/gaps is provided below:

The SQS and CSL concentrations identified in the Washington state SMS are the cleanup levels in the Preferred Alternative 3C Plus considered at this Site. These SQS and CSL concentrations are identified in the Proposed Plan. Figures 7-1 and 7-2 demonstrate the extent the Site exceeds these concentrations in the surface and subsurface sediments.

The RAOs, PRGs, and RALs address risk in the following ways:

- **RAO 1**—using a site-wide average sediment concentration for COCs in the top 45 centimeters (cm) for intertidal sediments for clamming and beach play and top 10 cm for subtidal sediments, RAO 1 is met when RBTCs or natural background for human health exposure pathways for the applicable COCs are achieved. This RAO will be achieved at the completion of remedial action.

- **RAO 2—** using a site-wide average sediment concentration for COCs, RAO 2 is met using the most stringent PRG for the subtidal direct contact exposure scenarios (netfishing and tribal clamming). RAO 2 will be achieved at the completion of remedial action.
- **RAO 3—** using point-by-point sediment concentrations for COCs in the top 10 cm in the intertidal and subtidal sediments, RAO 3 is met based on meeting the SMS SQS, which is the protective chemical concentration for benthic invertebrates. This RAO will be achieved at the completion of remedial action.
- **RAO 4—**using a site-wide average sediment concentration for COCs, RAO 4 is met when the PRGs for ecological risk are met in the top 10 cm of intertidal and subtidal sediments. This RAO will be achieved at the completion of remedial action.

Remedy Performance

Comment. *The package provided information on the physical location of the site in relation to the Lower Duwamish Waterway, Todd Shipyard Sediment Operable Unit, Lockheed Shipyard No. 1 Sediment Operable Unit, West Waterway Operable Unit and Pacific Sound Resources Marine Sediment Unit. While several of these external sources have undergone response measures, other sources of contamination to the immediate area are in the investigation phase. The Board is concerned with the timing of the cleanup in relation to completion of all external source cleanups. Thus the Board recommends, based on the proximity to other sites and the site characterization issues mentioned above, that an interim action may be warranted at this time.*

The Regional response to these issues/gaps is provided below:

Active remediation for the Todd Shipyard Sediment Operable Unit, Lockheed Shipyard No. 1 Sediment Operable Unit, and Pacific Sound Resources (PSR) Marine Sediment Unit is complete and these sites are in the post-construction monitoring phases. Collectively these sites are the nearest aquatic remediation projects to the Lockheed West Site, and the West Waterway is a “no action area”. Contaminant sources associated with these sites are controlled, and post-construction monitoring results have not identified potential concerns for migratory contaminants that would be expected to affect the Lockheed West Site. Remedies at the Todd, Lockheed Shipyard No. 1, and PSR sites are performing as designed, which include sediment containment caps.

The construction schedule for the Lower Duwamish Waterway has not been established but could extend years into the future following cleanup at the Lockheed West Site. While short-term water quality impacts may occur during dredging for the Lower Duwamish project, construction will include best management practices to limit potential for downstream impacts. Potential impacts are more likely closer to the points of dredging, with diminishing affects downstream toward the Lockheed West Site and neighboring aquatic cleanup projects. There is currently no indication that remediated portions of the Lockheed West Site will be adversely impacted from Lower Duwamish remediation activities, or that an interim cleanup status is warranted.

Although dredge, cap, and/or ENR surfaces at the Lockheed West Site may unavoidably re-equilibrate to levels above natural background over the longer term, remediation goals (including natural background levels) will be met following construction. Achievement of these remediation goals will constitute a final remedy.

Comment. *Furthermore, if the Region proceeds with a final remedy at this time, the Board notes that the Region is proposing to use urban (not site-specific) background as the basis for PCB cleanup levels in sediments. The urban background concentration is 119 parts per billion (ppb). However, a higher sediment cleanup level was employed at two nearby Superfund sites in Elliott Bay (i.e. Todd Shipyard and PSR). The Board is concerned that residual contaminant levels at these two sites will impact any remedial action and potentially recontaminate the Lockheed West site. This is further supported by the Region’s belief that active remediation at the Lockheed site will not by itself result in a protective remedy from a fish consumption perspective (e.g., ICs will be needed to help ensure protectiveness). The Board recommends that the Region clarify its basis for the PCB sediment cleanup level in the context of the location of the Lockheed West site in a commercial harbor setting with other nearby and upstream sources of contamination (e.g., Lower Duwamish Waterway).*

The Regional response to these issues/gaps is provided below:

Review of post-construction monitoring data from Todd, Lockheed Shipyard No. 1, and PSR indicates that remedial components including sediment caps are performing as intended at these sites. With few exceptions, sediment quality monitoring data show compliance with SQS criteria for PCBs and other contaminants. Where elevated concentrations were detected, these are attributable to urban background conditions rather than residual contaminants at the Superfund sites in question.

In 2006 and 2007, the U.S. Army Corps of Engineers coordinated surface sediment sampling and chemical testing to evaluate the performance of remedial caps placed at the PSR Superfund site in 2005 (Science Applications International Corporation [SAIC], 2008). The PSR site is located immediately west of the Lockheed West Seattle Superfund Site. Post-cap sediment sampling and chemical testing were conducted as part of the site monitoring program supporting EPA's Five-Year Review Report for PSR (EPA, 2009b). The PSR sediment sample testing results also provide general information regarding equilibration of sediment COCs to Elliott Bay background conditions following placement of the PSR capping materials. A number of the sediment samples collected from the PSR capping areas contained concentrations of metals above natural background levels established for Puget Sound by the Bold Study . For example, 11 of the 12 sediment samples collected in 2006 had concentrations of mercury in excess of the natural background concentration of 0.101 mg/kg- dw, and 9 of the samples had lead concentrations in excess of the background concentration of 11 mg/kg-dw. Concentrations of certain metals also exceeded the Elliott Bay urban background levels. For example, arsenic concentrations in 5 of the 7 seven samples with natural background exceedances also exceeded the urban background concentration. In addition, concentrations of cPAHs and PCBs in the 2007 PSR surface sediment data set also exceeded natural background levels. For example, detected concentrations of cPAHs in the 25 samples ranged from 10.48 to 242 ug/kg-dw TEQ and all 25 results exceeded the natural background concentration for cPAHs at 9 ug/kg TEQ dw. However, none of the cPAH results exceeded the urban background level of 757 ug/kg dw TEQ. Detected concentrations of total PCBs ranged from 2 to 317 ug/kg dw, in comparison to a natural background concentration of 2 ug/kg dw (24 of 25 samples exceeded the value, 1 equaled it). Concentrations of total PCBs in 2 of the samples also exceed the urban background concentration of 119 ug/ kg dw. With regard to projected post-remediation surface sediment quality at the Lockheed West site, the PSR results indicate that COC concentrations may equilibrate to concentrations above background over time.

These findings indicate that potential post-construction re-equilibration at the Site may occur because of its urban setting in Elliott Bay and the West Waterway, rather than impacts from residual contaminants from neighboring Superfund sites. Regardless, the Lockheed West Site will meet remediation goals for site contaminants including natural background levels or RBTCs for the COCs following Site remediation. Achievement of remediation goals will constitute a final remedy.

Active remediation and institutional controls at the Lockheed West Site will achieve protective levels for fish consumption at this Site. However, Site cleanup is not expected to result in safe fin- or shell-fish consumption for fish throughout Elliott Bay. This is because the Site is small and, therefore, the cleanup will not have as large an impact on fishery habitat as does the larger Elliott Bay. Because Elliott Bay has contamination from numerous urban impacts, the fish consumption advisory used in Elliott Bay will also be posted at the Site. Institutional Controls for fish consumption at the Lockheed West Site will be an extension of existing and future Elliott Bay-wide fish consumption advisories, and are not related to Site specific contaminant concentrations following cleanup. The Region is taking action to clean up the sediments to the maximum extent practicable, which we believe is protective and meets the State ARAR for protection of ecological resources and is as much as can be done through active remediation to address human risks. Additionally to protect human health we are relying on the Elliott Bay Fish Advisory to limit human exposure to and risk from contaminated seafood.

Comment. *The information presented to the Board was not clear about whether the region is using a site-wide averaging approach or surface-area weighted averaging when setting a cleanup level. The Board recommends that the Region's decision documents explain its approach and how it is consistent with the NCP and existing Superfund program guidance (e.g., OSWER Directive No. 9285.6-10, December 2002, Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites. For large commercial/industrial areas, the*

Board recommends that the Region consider breaking the site or the individual OUs into small sub areas and meeting the cleanup criteria for each individual sub area.

The Regional response to these issues/gaps is provided below:

Based on the size of this site (40 acres), the Region doesn't believe there is any reason to divide the site into operable units (OU) in order to meet the cleanup criteria for sub areas. Cleanup criteria can be met throughout the site without using OUs. Furthermore, due to the small area of the site and the selection of a remedy that addresses the entirety of the Site, it doesn't matter whether a site-wide averaging approach or a surface-area weighted averaging approach is used. The site will be dredged in the dry dock areas, after which a thin-layer cap will be placed in areas with concentrations no greater than twice the SQS throughout the site to enhance natural recovery. Therefore, regardless of the sampling approached used for post-construction verification monitoring, the material sampled will all be below the PRGs.

Comment. *The Board notes that the presentation and review materials described the cleanup levels in terms of preliminary remediation goals (PRGs), remedial action levels (RALs), sediment management standards to include cleanup screening levels (CSLs) and sediment quality standards (SQSs), natural background and urban background. Each of these goals, standards, and levels is presented using a different unit of measure. The Board recommends that consistent with the NCP, the decision documents clarify what are the PRGs and cleanup levels, the areas where they apply, and the basis for the selected PRGs and cleanup levels. In addition, to ensure transparency and a meaningful opportunity for informed public participation, the decision documents should include standardized concentrations (i.e. same unit of measure) for all of the contaminant concentrations and PRGs.*

The Regional response to these issues/gaps is provided below:

The units of measure for these various cleanup levels and goals are standardized in the RI/FS and the Proposed Plan. Definitions for the PRGs, cleanup levels and remedial action levels, the basis for them and the areas where they apply is more thoroughly described in these documents as well.

Applicable or Relevant and Appropriate Requirements

Comment. *The information presented to the Board indicated that surface water quality ARARs are not appropriate for use in developing numerical PRGs. At the same time, the package identified federal ambient water quality standards as applicable or relevant and appropriate requirements (ARARs) for the site. The Board recommends that the Region ensure that the decision documents clearly identify all appropriate ARARs and how they are being used in the remedy selection process. Furthermore, the Board recommends that the decision document clearly state if an ARAR waiver is being invoked, identify the data in the administrative record supporting a waiver determination, and explain the basis for any potential ARAR waiver.*

The Regional response to these issues/gaps is provided below:

The Region has modified the RAOs to delete the objective of reducing contamination in surface water and limiting the objectives to remediation of sediments. Since the Site includes the aerial extent of contamination, it would be a fiction to say that surface water with elevated levels of COCs are not part of the Site. Complication arises as a result of the fact that this Site is a parcel within the area of influence of other contaminated areas. As such, the surface water overlying the sediments at the Site will continue to be impacted by the flow of surface water in Elliott Bay and the Lower Duwamish Waterway.

The Region's approach at this Site is to limit the RAOs to reduction of contaminants in sediment, instead of including the objective of addressing surface water contamination. It is expected that improvements to surface water quality will be achieved through the remediation of Site sediment; however, it is not expected that there will be a measurable reduction in levels of surface water contaminants resulting solely from remediation of sediments at this Site due to the size of Elliott Bay relative to the area that will be remediated. It would also be impracticable to treat the surface water at the Site, given that it is part of Elliott Bay, a large water body that has been impacted by many other sources.

Since surface water is necessarily part of the Site, federal ambient water quality standards are ARARs. As stated earlier, given the size of Elliott Bay, it is not the goal of this action to clean up that large water body. Region 10 is still discussing whether it believes the AWQC are an ARAR for this Site. If the Region determines that it is, then the Region will waive the ARAR.