Appendix J
NW Natural's Additional Revised Gasco Sediments Site Dredge and Cover Design, Implementation, Verification, and Closeout Approach Memorandum (June 3, 2019)

6720 SW Macadam Ave, Suite 125
Portland, Oregon 97219
503.670.1108

ANCHOR QEA

Memorandum

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To: Sean Sheldrake and Karl Gustavson, U.S. Environmental Protection Agency

From: Ryan Barth, PE, Anchor QEA, LLC

cc: Bob Wyatt, NW Natural
Patty Dost, Pearl Legal Group
Dana Bayuk, Oregon Department of Environmental Quality
Lance Peterson, CDM Smith
Paul Schroeder, U.S. Army Corps of Engineers
Myron Burr, Siltronic Corporation
Michael Murray, Maul Foster & Alongi

Re: NW Natural's Additional Revised Gasco Sediments Site Dredge and Cover Design, Implementation, Verification, and Closeout Approach

Introduction

NW Natural submitted the *Pre-Remedial Basis of Design Technical Evaluations Work Plan* (Work Plan; Anchor QEA 2017) to the U.S. Environmental Protection Agency (EPA) in July 2017 to support remedial design evaluations at the Gasco Sediments Site in accordance with the *Record of Decision – Portland Harbor Superfund Site* (ROD; EPA 2017). EPA provided comments on the Work Plan on October 18, 2017. NW Natural and EPA held meetings with EPA on October 31 and November 14, 2017, to discuss the Work Plan comments. NW Natural and EPA subsequently held meetings on January 10 and February 22, 2018, to discuss the EPA comments regarding characterization and management of dredge residuals. After these meetings, the following sequence of communications and deliverables were completed to facilitate EPA approval of the Gasco Sediments Site dredge and cover design, implementation, verification, and closeout approach:

- EPA provided written comments on NW Natural's approach in a letter dated April 2, 2018 (Attachment A).
- NW Natural submitted a written verification and closeout approach on May 7, 2018, to address EPA's April 2 comments.
- During a teleconference on July 12, 2018, NW Natural and EPA discussed the May 7 approach, and NW Natural agreed to incorporate some additional revisions to the approach, which were incorporated into a revised memorandum dated July 24, 2018.
- NW Natural and EPA held a meeting on September 5, 2018, to discuss the July 24 revised memorandum, and EPA subsequently provided conditional approval of the revised memorandum in a letter dated September 21, 2018.

- NW Natural and EPA held a teleconference on September 27, 2018, to discuss the terms of the conditional approval, and NW Natural submitted a subsequent memorandum dated September 28, 2018, that summarized NW Natural's interpretations of the conditional approval and requested some final clarifications.
- EPA submitted a response to NW Natural's interpretations and request for clarifications in a letter dated October 22, 2018.
- NW Natural and EPA exchanged electronic email communications on October 25 and 30, 2018, respectively, to further discuss EPA's response to NW Natural's interpretations and request for clarifications, and NW Natural confirmed collective agreement on the EPA-approved approach on October 31, 2018.

This additional revised dredge and cover design, implementation, verification, and closeout approach memorandum presents the collaboratively developed approach that resulted from the above coordination between EPA, EPA's partners, and NW Natural, and this memorandum specifically addresses General Comment 4 and Specific Comments 1 through 4, 9 through 15, 18 and 19, 23, 25 and 26, and 30 and 31 in EPA's comment letter dated October 22, 2018.

Summary of Dredge and Cover Design, Implementation, Verification, and Closeout Approach

The EPA-approved dredge and cover design, implementation, verification, and closeout approach was developed to achieve the following overarching goals:

- Establish a clear framework for the post-dredge and post-dredge cover activities that will be performed to identify when dredging and cover placement is deemed complete and when additional actions are necessary.
- Assess and address potential remedial action level (RAL) exceedances or the presence of principal threat waste nonaqueous phase liquid (PTW-NAPL) existing below the dredge prism not identified during the pre-remedial design characterization.
- Minimize dredge residuals generation and migration during both a single construction season and across multiple construction seasons.
- Maximize the probability of a single dredge pass in each cleanup area.
- Minimize the time prior to the placement of residual management cover.
- Eliminate the potential for removal and disposal of residual management cover material following placement.
- Incorporation of adaptive management during construction based on lessons learned during previous construction season implementation, verification, and closeout activities.

To achieve these goals, the dredge and cover design, implementation, verification, and closeout approach includes the following elements:

- Dredge design
  - Pre-remedial design investigations will be conducted to further define the lateral and vertical extent of contamination exceeding RALs or containing PTW-NAPL. These data, together with existing site data, will be used to develop a 3D dredge prism to be approved by EPA in the remedial design documents.
  - Site-specific factors will be used to divide the 3D dredge prism into smaller operational dredge management units (DMUs) to balance an efficient pace of dredge work against short-term risks associated with dredge residuals. The DMUs will be approved by EPA in the final remedial design documents.
- Dredging implementation
  - Dredging techniques and equipment, to be defined during remedial design, will be selected to minimize residual generation and dispersal.
  - Best management practices (BMPs), to be defined during remedial design, will be employed to contain and manage residuals.
- Post-dredge verification
  - At the conclusion of dredging each DMU, the DMU will be surveyed to verify the 3D dredge prism elevations/thicknesses have been achieved.
  - Immediately after verification that dredge prism elevations/thicknesses have been achieved in a DMU, two or more sediment cores will be collected in the DMU.
  - The entirety of each core will be visually observed for the presence of PTW-NAPL.
  - The top 6-inch interval will represent the operationally defined 6-inch residual layer.
  - Samples will be collected at 6-inch intervals from each core below the operationally defined residuals layer. Samples from each interval from each core will be composited into a single sample from each interval in the DMU if the samples do not contain visible observations of tar. If tar is identified in a 6-inch interval, a discrete sample from that interval will also be retained for potential analysis. Cores will be advanced to approximately 6 feet below the post-dredge surface.
  - Samples from each operationally defined 6-inch residuals layer interval from each core will be composited into a single sample in the DMU and submitted for laboratory analysis.
  - The composited sample of the first two 6-inch intervals below the 6-inch residual layer in each DMU and any discrete samples containing tar from these intervals will be analyzed immediately to verify material exceeding the RALs or containing PTW-NAPL does not exist below the dredge prism. All deeper samples will be archived.
  - If the initial composite or discrete (if applicable) sample concentrations from the first two 6-inch intervals do not exceed RALs or contain PTW-NAPL, and none of the

underlying core intervals contain PTW-NAPL, EPA will approve dredging closeout in the DMU, the dredge will move to the next DMU scheduled in the dredge season, and residual management cover (RMC) will be placed as soon as practicable in the DMU.
  - If the initial deeper composite or discrete sample exceeds RALs or contains PTW-NAPL, or any of the deeper core intervals contain PTW-NAPL, additional successively deeper composite samples will be analyzed until the distribution and depth of contamination (DOC) is determined. EPA and NW Natural will evaluate whether additional measures are appropriate based on the nature and extent of remaining contamination. Once those measures are determined (and any associated dredging, to the extent appropriate, has been completed), EPA will approve dredging closeout in the DMU, and the dredge will move to the next DMU in the season.
- DMU construction completion
  - After EPA has approved dredging closeout in a DMU, the operationally defined 6-inch residual concentrations will be reviewed to determine whether placement of 12 inches of overlying RMC will be sufficient to achieve the cleanup level identified in the ROD (EPA 2017) for protection of benthic invertebrates.
  - If the 12-inch RMC layer will be sufficient, NW Natural will place the first 6-inch layer of RMC within the DMU to manage the residuals. If the 12-inch RMC layer will be insufficient, NW Natural will either increase the thickness of the first RMC layer above 6 inches or incorporate active amendments into the first 6-inch RMC layer.
  - At the end of each dredging season, NW Natural will place a second 6-inch layer of RMC across all DMUs closed out that season. EPA will then confirm that cover closeout is achieved at all DMUs worked during the season.
- Final cover
  - At the conclusion of all dredging and capping activities, NW Natural will place a final/third 6-inch layer of RMC across the entire dredge prism and immediately surrounding area.
  - After placement of the final cover, EPA will confirm that cover closeout is achieved throughout the dredge prism.
- At the conclusion of all remedial measures, NW Natural will commence post-construction baseline and long-term monitoring.

A summary of this stepwise approach is provided in Figure 1. Specific procedures, details, and engineering evaluations for this approach will be developed for EPA approval in the remedial design documents. A high-level summary of the basis and rationale for the approach is presented in the following section.

Summary of Pre-Remedial Design Activities to Support the Post-Dredge and Cover Verification and Closeout Approach

Summary of Pre-Remedial Design Sediment Characterization

NW Natural will perform additional pre-remedial design surface and subsurface sediment characterization within the Gasco Sediments Site Project Area (Project Area) to identify the lateral and vertical extents of chemical concentrations exceeding the RALs for the focused contaminants of concern (COCs) (i.e., total polycyclic aromatic hydrocarbons [TPAHs], polychlorinated biphenyls [PCBs], pesticides [DDx], and dioxin/furans [D/F]).[1] The Project Area lateral extents will be determined using the technical evaluations detailed in Section 3 of the Work Plan. Consistent with comparable sediment sites (Patmont et al. 2018), the Project Area vertical extents of contamination will be determined through subsurface sediment cores spaced approximately 100 feet apart to account for spatial heterogeneities. To the extent possible, the cores will be advanced to a target depth of 20 feet below mudline or until refusal is encountered using a vibracore.

The pre-remedial design surface and subsurface sediment sampling locations will supplement the dataset that currently exists for the Project Area (Figure 2). The bottom DOC in each core will be defined as the deepest depth that contains exceedances of the focused COC RALs or the presence of PTW-NAPL.[2] For existing cores where the DOC is unknown, an additional pre-remedial design core will be collected in the vicinity and subsampled for chemical analysis in 12-inch depth intervals below the current deepest RAL exceedance or presence of PTW-NAPL. For new core locations, the subsampling depths and analyses will be informed by existing adjacent core data. The specific sampling depths, analytes, methods, and sequencing will be detailed in the forthcoming *Pre-Remedial Design Data Gaps Work Plan*. Chemical analysis will be performed until the first encountered 12-inch depth interval below mudline that does not contain a RAL exceedance or presence of PTW-NAPL.

NW Natural recognizes there may be cores where the DOC cannot be determined "below the feasible depth limit of excavation technology" referenced in the ROD. Any contamination requiring cleanup deeper than the depth limit of excavation technology will require dredging followed by capping. This memorandum does not address this capping scenario.

Development of 3D Dredge Prism

The pre-remedial design sediment characterization dataset will be used to develop a 3D dredge prism throughout the required dredge footprint in the Project Area. The 3D dredge prism will be

[1] Pre-design investigations will also address other objectives, such as waste suitability characterization, not relevant to this memorandum.

[2] PTW-NAPL will be defined as any layer or seam of product, regardless of thickness, that is clearly defined as liquid NAPL that is also mobile (i.e., "oozes" or "drips" out of the core during core observations). See Section 3.6.2.1 of NW Natural's *Statement of Work – Gasco Sediments Site* (EPA 2009).

defined by lateral and vertical RAL exceedances and the presence of PTW-NAPL. The detailed methodologies used to develop the 3D dredge prism will be described in the remedial design documents.

Dredge Management Unit Boundary Development

Following completion of the pre-remedial design sediment characterization and development of the 3D dredge prism, the full extents of the dredge prism will be subdivided into constructible DMUs to facilitate field verification that the dredge design elevations/thicknesses are achieved in discrete subareas and to allow for placement of RMC in these subareas as soon as practicable to manage dredge residuals. The DMU configurations will attempt to balance the need to maintain an efficient pace of dredge work against short-term risks associated with dredge residuals. The DMU boundaries and sizes will be developed based on evaluation of the following multiple lines of evidence during the remedial design process:

- Design dredge elevation/thickness
- Waste disposal suitability determinations
- Presence of functional and temporary structures
- Location of federal navigation channel boundary
- Presence of PTW-NAPL
- Presence of Siltronic Corporation chlorinated solvents sediment contamination
- Proximity to the shoreline riverbank
- Nature of dredge materials (e.g., riprap and debris)
- Location of installed dredging water quality BMPs (e.g., silt curtains)
- Dredging boundaries for each construction season
- The capacity of disposal facilities to receive, handle, and manage dredge material during project construction timeframes

For planning purposes, NW Natural has performed initial evaluations in coordination with a marine contractor to determine the length of time it is anticipated to take to dredge a range of areas to a variety of DOCs using an assumed average 700 cubic yards per day dredging production rate (subject to change based on remedial design evaluations). The ROD-identified dredging footprint within the Project Area is approximately 14.5 acres, and the existing distribution of DOCs within that area is identified in Figure 3, ranging from 2 feet to greater than 12 feet. The majority of the existing sediment cores have RAL exceedances or PTW-NAPL in the bottom sampled depth, so the DOC is vertically unbounded at those locations; therefore, the distributions in Figure 3 are biased toward deeper DOCs and anticipated to change (i.e., larger percentage of the Project Area will have deeper DOCs) following the pre-remedial design sediment characterization. Based on this planning level evaluation, NW Natural believes the DMU sizes will range from approximately 0.25 to 1.0 acre and vary in size throughout the dredge prism to achieve the placement of RMC approximately every 10

to 14 days. This frequency of RMC placement would minimize the overall time to complete dredging (especially if in-water work proceeds during the short 4-month construction window) while limiting the duration of dredge residual production and dispersal to the water column. This frequency would also maintain initial RMC placement footprints in each DMU that are large enough to be feasibly constructible (e.g., a DMU with a DOC of 15 feet would result in an RMC placement footprint of only approximately 43 feet by 43 feet when accounting for engineering factors [side slopes, overdredge tolerance, etc.] at a dredging production rate of 700 cubic yards per day for 10 days).

Dredging Performance Criteria and Best Management Practices

Short-term risks from contaminant concentrations in the river water column and sediment bed caused by dredging operations will be further mitigated through the development of dredging performance criteria and the implementation of BMPs. NW Natural recommends the following dredging performance criteria:

- **Generated Residuals:** Remove the targeted sediment using dredging methods specifically designed to limit the formation of dredging-generated residuals on the bed of the river, thereby limiting sediment resuspension and release to the water column.
- **Water Quality:** Remove the targeted sediment using dredging methods and BMPs specifically designed to limit suspension of sediments into the water column, thereby reducing impacts to water quality during the removal action.
- **Productivity:** Remove the targeted sediment in an efficient manner that is compatible with the site-specific constraints, limits excess removal of non-target sediments, produces a material that is compatible with delivery by truck and/or rail to a permitted landfill, and maintains removal productivity rates that allow the dredging to be completed in a timely fashion.

To achieve the dredge performance criteria, at a minimum NW Natural will implement the following BMPs during dredging:

- **Depth of Contamination:** Use the results of robust pre-remedial design sediment characterization, in combination with geospatial analysis, to develop an accurate DOC to be removed and improve the degree of confidence of the dredge plan.
- **Design Dredge Elevation/Thickness:** Use the DOC findings, plus an allowance for dredge accuracy and tolerance, to develop an accurate design for dredge elevations/thicknesses.
- **Single Dredge Event and Sequencing:** Perform dredging to the design elevation in a single dredge event, as verified by periodic bathymetric surveys, to facilitate expeditious placement of RMC. Sequence dredging from upriver to downriver.
- **Expeditious Residual Management Cover Placement with Minimal Mixing:** As soon as practicable following verification that dredging closeout is achieved in a DMU (see below), place an initial layer of RMC to cover any generated residuals. The RMC will be placed using

equipment and procedures to minimize mixing of the residuals and RMC. Experience at the Ashtabula River Superfund Site, Lower Fox River Superfund Site, Hudson River Superfund Site, and Esquimalt Harbour environmental dredging projects has shown that quick placement of RMC does a much better job of reducing generated residual migration as compared to allowing residuals to remain uncovered while additional evaluations or additional dredge events are performed. Patmont et al. (2018) reported for each of these sites, "Sand covers have been demonstrated to be a very effective residual management option; post-dredging placement of 10- to 15-cm [centimeters; 4- to 6-inches]-thick layers of clean sand was used extensively," protectively limiting the potential for resuspension and transport of generated residuals. Patmont et al. (2018) also reports, "Even if the sand ultimately mixes into underlying sediments, thin covers have been demonstrated to protectively address generated residuals that are up to 10-fold higher than remedial action levels."

- **Dredging Equipment:** Use dredging equipment that has been shown on other environmental dredging projects to minimize the development and transport of dredge residuals when applied to appropriate site conditions. The specific equipment to be used will be evaluated and selected during remedial design based on site-specific characteristics (e.g., softness of sediments, presence of debris, interfering structures, current velocities, and water depth).
- **Dredge Bucket Positioning:** Use on-board real-time kinematic digital global positioning system equipment capable of displaying the location of the dredge bucket within 4 to 6 inches horizontally and vertically, which helps to assure the target material is captured by the dredge bucket.
- **Dredge Bucket Descension/Ascension:** Lower and raise the dredge bucket with a controlled rate of speed to minimize the creation of turbidity in the water column during dredging.
- **Dredge Cuts on Slopes and Flat Areas:** Implement stair-step dredge cuts for steeper slopes to reduce sloughing of sediment, and sequence dredging from the top of the slope downward. In flat areas, implement dredge cuts to avoid leaving ridges or windrows of sediment between adjacent cuts.
- **Debris Removal:** Debris will be removed prior to dredging (where debris is identifiable and can be removed in a manner that does not excessively suspend material).
- **Piling Removal:** Piling will be removed in a manner that minimizes the release of sediment. Piling removal will require conventional marine construction equipment, such as a derrick configured with pile-pulling and heavy lifting equipment. If individual pilings cannot be removed, they will be cut off at the design removal elevation/thickness or at least 3 feet below the final grade, whichever is deeper.
- **Dredge Water Management:** Prohibit direct overflow of water in sediment haul barges back to the river without prior processing and management as necessary to maintain compliance with the applicable water quality criteria. The specific water management methods and

associated equipment to be used will be evaluated and selected during remedial design based on site-specific characteristics.

- **Water Quality Engineering Controls:** Evaluate the use of water quality engineering controls (e.g., silt curtains and rigid containment) during remedial design based on site-specific characteristics.
- **Expeditious Dredging Verification Testing:** Expeditiously collect post-dredge verification sediment cores and perform expedited laboratory turnaround time chemical analyses to limit the time between verification testing and placement of the initial RMC layer.

Dredging of sediments cannot completely avoid the resuspension of sediments, but these and other BMPs that may be evaluated and further developed during remedial design have been demonstrated at the Portland Harbor Superfund Site, Lower Duwamish Waterway Superfund Site, Lower Fox River Superfund Site, Hudson River Superfund Site, and similar other large-scale sediment cleanup sites to effectively control resuspension and transport of residuals during dredging to the extent practical while still completing dredge work within a reasonable timeframe.

Post-Dredge Verification and Closeout Approach

The post-dredge verification and closeout approach is based on the following two verification metrics:

- Attainment of the dredge design elevations/thicknesses
- Absence of RAL exceedances or the presence of PTW-NAPL below the dredge prism (no "missed inventory")

The ROD specifies that dredge design elevations/thicknesses will be achieved via a single dredge event for each DMU to minimize potential project delays and water quality impacts associated with multiple dredge events (EPA 2017). Additional dredge events would only be performed following achievement of the dredge design elevations/thicknesses if post-dredge verification sampling identifies subsurface sediments beneath the post-dredge surface and generated residual layer that exceed the RALs or contain PTW-NAPL. Once it is verified that the design dredge prism has been achieved and there is no underlying remaining missed inventory, no additional dredge events will be required.

Post-dredge verification and closeout will be determined through the following steps:

- **Post-Dredge Step 1:** Perform post-dredge bathymetry surveys to verify whether the design dredge prism elevations/thicknesses have been achieved on a DMU basis. If the elevations/ thicknesses are achieved, proceed to Post-Dredge Step 2. If not, perform additional dredging to remove high spots and confirm the required elevations/thicknesses are achieved through additional bathymetry surveys.

- **Post-Dredge Step 2:** As quickly as practicable following completion of Post-Dredge Step 1, collect post-dredge cores and perform expedited laboratory chemical analyses within the completed DMU to verify whether there is any missed inventory (i.e., RAL exceedances or the presence of PTW-NAPL). (See missed inventory discussion in the following section for more details on the vertical aspects of the coring approach.) If missed inventory is identified based on composite samples in a DMU, perform chemical analysis on each discrete sample in the DMU and proceed to Post-Dredge Step 3. Similarly, if missed inventory is identified based on discrete samples (only applicable if tar is present in composite sample interval), proceed to Post-Dredge Step 3. If no missed inventory is identified, proceed to Post-Dredge Step 4.
- **Post-Dredge Step 3:** If missed inventory is identified, perform expedited, real-time (i.e., during construction) post-dredge engineering evaluations to determine the most appropriate additional measures, if any, to maintain construction progress and avoid project delays. If the additional measures evaluation determines no additional dredge pass is warranted or following the completion of a single additional dredge pass, proceed to Post-Dredge Step 4.
- **Post-Dredge Step 4:** Following Post-Dredge Step 2 or 3, as appropriate, EPA will confirm dredging closeout is achieved in the DMU.
- **Post-Dredge Step 5:** Expeditiously proceed to Cover Step 1.

Figure 1 depicts the post-dredge verification approach on a DMU basis and season-by-season basis. The subsections that follow provide detail on and rationale for these post-dredge verification steps.

Post-Dredge Missed Inventory Verification Approach

Missed inventory is defined as sediments beneath the post-dredge surface *and* generated residual layer that contain RAL exceedances or the presence of PTW-NAPL. Figure 4 provides a simple schematic that details the approach for assessing missed inventory.

Post-Dredge Operationally Defined Generated Residuals Thickness

Based on findings from other environmental dredging projects (Bridges et al. 2010; Patmont et al. 2018), the generated residual layer thickness is anticipated to be less than 6 inches. The previously described BMPs during dredging are expected to minimize any residual layer thickness. Therefore, consistent with the Lower Fox River Superfund Site, for convenience and consistency during project planning, and as discussed during the development meetings with EPA, the generated residual layer thickness will be operationally defined as 6 inches below the post-dredge surface. NW Natural will perform missed inventory sampling beneath that depth to avoid the generated residual layer.[3] During dredging, EPA and NW Natural will perform periodic monitoring of the encountered

[3] See section titled "Cover Verification and Closeout Approach" for discussion of sampling of the residual layer during cover verification.

generated residuals thickness to confirm that the operational definition is appropriate. This monitoring will be performed by the field coring personnel based on visual observations of the distance between the post-construction surface and underlying undisturbed sediment. Details of the residual thickness monitoring approach will be developed during remedial design. If the monitored thickness is observed to be consistently thicker than 6 inches, NW Natural will coordinate with EPA to determine if the operationally defined RMC thickness and deeper missed inventory subsampling intervals need to be adjusted.

Post-Dredge Verification Dredge Management Unit Sampling Density and Locations

As soon as practicable following the Post-Dredge Step 1, NW Natural will advance a minimum of two cores in the DMU to verify whether missed inventory is present beneath the generated residual layer. Cores will be advanced to approximately 6 feet below the post-dredge surface.

The coring density in each DMU will be dependent on the size (area) of the DMU. Consistent with the post-dredge characterization approach taken on the Lower Fox River Superfund Site, NW Natural recommends the collection of five sediment cores per acre. Each of the cores will be advanced at stratified random locations to provide a representative sample of the DMU. Each DMU will be subdivided into X equal area polygons, where X is the number of cores in the DMU. A single core will be randomly positioned within each polygon to account for spatial heterogeneities.

Similarly, consistent with the Lower Fox River Superfund Site, for DMUs less than 1 acre, samples will be collected at the following pro-rated density of five cores per acre:

- 0.75 to less than 1 acre: four cores
- 0.5 to less than 0.75 acre: three cores
- Less than 0.5 acre: two cores

Post-Dredge Stepwise Remedial Action Level Chemical Sampling and Analysis

Samples will be collected and submitted for expedited laboratory chemical analysis at 6-inch intervals below the post-dredge surface, as shown in Figures 4 and 5. As discussed with EPA during the January 10 and July 12, 2018 meetings, chemical analyses for the generated residuals and underlying missed inventory will be limited to TPAHs if the following criteria are met based on the pre-remedial design sediment characterization:

- TPAH RAL exceedances are located at the DOC in each pre-remedial design core.
- There are consistently no PCB, DDx, or D/F RAL exceedances in subsurface sediment samples collected within the Project Area that are not co-located with TPAH RAL exceedances.
- The subsurface sediment TPAH RAL exceedance factors (calculated as the measured TPAH concentration divided by the TPAH RAL) are consistently higher than the co-located PCB, DDx, or D/F exceedance factors.

Limiting the analyses to TPAHs will ensure that dredge areas can be covered with RMC as soon as practicable after dredging is complete. However, if the criteria are not achieved, limited (i.e., less than 10 percent of the samples) chemical analysis may be performed for additional focused COCs as indicated by evaluations using the comprehensive pre-remedial design data.

As shown in Figure 4, chemical analysis of the 6-inch intervals will be performed in a stepwise fashion. Consistent with the Lower Fox River Superfund Site, to minimize the influence of sample variability on false positive and false negative determinations of RAL exceedances, multi-point composite samples will be used to support dredge verification assessments for individual DMUs. Chemical analyses will be performed on a physical composite of all subsamples collected from the same depth interval below mudline in a DMU (herein termed "DMU-composite"). For example, in a 1-acre DMU, five samples of equal volume collected from the 6- to 12-inch core interval will be composited and homogenized into a single sample. The individual subsamples from each depth interval in each core (herein termed "core-discrete") will be archived in the laboratory for potential future analysis if TPAH RAL exceedances are identified in the associated composite sample. In addition, per EPA's request, a 6-inch core-discrete sample will be archived in the laboratory for potential future analysis if visible tar is present.

Initially, the DMU-composite upper 6-inch generated residual sample and first two successive underlying individual DMU-composite 6-inch depth intervals (6 to 12 inches and 12 to 18 inches below mudline) will be submitted for chemical analysis for TPAHs. If either of the first two successive 6-inch depth intervals contain visible tar, then a core-discrete sample will also be submitted for chemical analysis for TPAHs. The generated residual concentrations will be used to define residual management requirements, as described in Cover Step 1. If the 6- to 12-inch DMU-composite or core-discrete (if tar is visible) contains TPAH RAL exceedances but the 12- to 18-inch DMU-composite or discrete (if tar is visible) does not, no additional chemical analysis will be performed at deeper depths to assess RAL exceedances. If the 12- to 18-inch DMU-composite or core-discrete (if tar is visible) contains TPAH RAL exceedances, the next successive deeper (18 to 24 inches) DMU-composite or core-discrete (if tar is visible) samples will be submitted for TPAH analysis. This stepwise sampling and analysis will continue for successively deeper 6-inch DMU-composites or core-discretes (if tar is visible) until the first encountered 6-inch DMU-composite or core-discrete (if tar is visible) containing no TPAH RAL exceedances.

For any 6-inch intervals where DMU-composite TPAH RAL exceedances are identified, NW Natural will trigger TPAH analysis of each of the archived core-discrete subsamples from that depth. Any required additional measures will be applied to the polygon area representing the core-discrete subsamples containing TPAH RAL exceedances, rather than the entire DMU.

NW Natural will identify realistic, expedited laboratory turnaround times for all required chemicals in the remedial design documents. If the selected laboratories are unable to consistently achieve these

turnaround times during the post-dredge verification, EPA and NW Natural will evaluate the need for placement of the initial 6-inch RMC layer prior to receipt of the missed inventory laboratory data.

Post-Dredge Stepwise PTW-NAPL Visual Observations and Chemical Sampling and Analysis

Visual observations of PTW-NAPL will be performed on each individual core within a DMU throughout the full penetration depth. If PTW-NAPL is observed at any depth(s) in any core, the 6-inch core-discrete subsample from that specific core depth(s) (without compositing as performed for assessing RAL exceedances) will be submitted for TPAH analysis to evaluate RAL exceedances. If RAL exceedances are identified in the 6-inch subsample(s), successively deeper discrete depth intervals from the same core will be analyzed for the TPAHs until the first encountered 6-inch DMU-composite containing no TPAH RAL exceedances. Additional chemicals beyond TPAHs may also be analyzed if necessary to support cap or reactive amendment RMC protectiveness evaluations (to be detailed in the remedial design documents).

Post-Dredge Additional Measures

Comment 6 in EPA's April 2, 2018 letter (Attachment A) states, "The EPA also requests that NW Natural illustrate the use of averaged and/or composited results for purposes of missed inventory verification and final RMC layer placement by including examples based on a range of reasonably likely dredging and capping scenarios." We agree that having an agreed approach for using these results is crucial; however, attempting to provide specific examples of how the core-discrete results will trigger likely dredging and capping measures until the pre-remedial design sediment characterization is performed and site-specific remedial design evaluations are completed would be speculative. We recommend instead that these measures be selected in consultation with EPA with full consideration of several site-specific factors that will be better defined after the pre-remedial design sediment characterization and remedial design evaluations are available. These factors include, but are not limited to, the nature and extent of RAL exceedances, presence or absence of PTW-NAPL, proximity to structures and the shoreline riverbank, and depth below mudline.

Although not linked to specific scenarios, additional measures we believe should be included in this approach are the placement of additional RMC beyond that identified in the remedial design, incorporation of reactive amendments into the RMC (e.g., activated carbon or organoclay), placement of a cap, and performance of a single additional dredge pass. In some DMUs, additional dredging below the dredge design elevation/thickness may not be feasible regardless of the missed inventory RAL exceedance(s) or presence of PTW-NAPL because additional removal would cause adverse impacts to structures and/or the riverbank. Therefore, capping may be the most appropriate additional measure. Alternatively, RMC with or without reactive amendments may be the most feasible additional measure if only slight RAL exceedances are limited to the 6- to 12-inch interval.

Finally, the presence of PTW-NAPL will trigger the need to incorporate reactive amendments into the RMC or cap materials. NW Natural's future remedial design documents will use the complete remedial design dataset to evaluate and describe what additional measures may be performed for the range of anticipated missed inventory verification results and the expedited real-time approach for selecting the most appropriate additional measure(s) during construction.

Post-Dredge Closeout

Dredging closeout in each DMU will be achieved following completion of Post-Dredge Step 2 (where no missed inventory is identified) or Post-Dredge Step 3 (where missed inventory is identified). If missed inventory is identified and site-specific evaluations determine that additional dredging would be the most appropriate additional measure, only a single additional dredge pass will be performed in the impacted portion of the DMU, as determined by the core-discrete results. If a single additional dredge pass is performed in a DMU, only Post-Dredge Step 1 will be performed following the re-dredging. No additional missed inventory verification will be performed. Consistent with the ROD (EPA 2017), no additional dredging events will be required.

Cover Verification and Closeout Approach

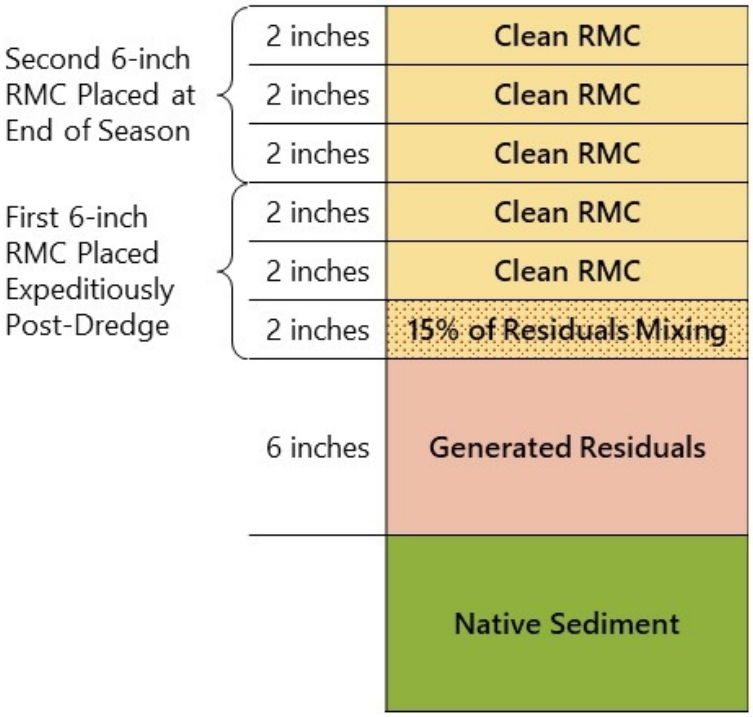
During the January 10 and February 22, 2018 meetings, EPA requested that post-dredge verification samples be collected to characterize the concentrations in the generated residuals layer and ensure the placement of RMC is protective following the completion of each season of construction and following the completion of all construction activities.

This type of sampling has been performed at other sediment sites, where it was generally used to determine if placement of RMC was required following dredging based on the measured generated residual concentrations. The ROD (EPA 2017) requires the placement of 12 inches of RMC in all dredging areas regardless of the residual concentrations and specifies that in areas with complete removal of RAL exceedances and PTW, that thickness "would eliminate the need for additional dredge passes and ensures that the leave surface is clean." During the July 12, 2018 meeting, EPA requested that the TPAH residuals concentrations be measured and used to confirm that 12 inches of overlying RMC will be sufficient to achieve the ROD Remedial Action Objective (RAO) 5 TPAH surface sediment cleanup level (CUL; 23,000 parts per billion [ppb]).

EPA released a memorandum titled *Review and Recommendations on Dredge Releases and Residuals Calculations from the Portland Harbor Draft Feasibility Study* dated May 24, 2013, that identified the anticipated mixing depth of the residual layer and overlying 6-inch RMC layer and concentration of the residual layer based on data from multiple, recent sediment cleanup projects. Specifically, the memorandum states, "The residuals cover contaminant profile should reflect mixing in only the bottom 1 to 2 inches of the 6-inch cover." The memorandum also states, "The concentration in the

mixed zone is likely to range from 5 to 20% of the contaminant concentration of the residuals generated from the cleanup pass, as described above. A value of 15% is likely to be conservative."

NW Natural agrees with this approach. The following schematic describes how the threshold concentration for generated residuals that is sufficient to achieve the TPAH RAO 5 CUL following placement of the ROD-required 12 inches of RMC at the Gasco Sediments Site is calculated:



Calculations:

0.15 * (2/12) * [RAO 5 Protective Concentration] = 23,000 ppb TPAH

[RAO 5 Protective Concentration] = 920,000 ppb TPAH

NW Natural proposes to place the ROD-required 12 inches of RMC in two 6-inch lifts at different times during the construction process to minimize residuals migration throughout each construction season. The first 6-inch layer (or modified thickness, as discussed below) will be placed following dredging closeout and confirmation that no missed inventory remains. Following dredging closeout of all DMUs in a single construction season, a second 6-inch layer of RMC will be placed on top of the first 6-inch layer. Finally, as an added protective measure, NW Natural will place a third 6-inch layer of RMC following the completion of all dredging in all construction seasons. NW Natural considers the third layer to be appropriate because the entire dredging project is expected to take multiple seasons. At sites where work can be completed in a single season, the final layer may not be warranted. This cover is, therefore, three times thicker than the RMC layer placed at the Lower Fox River Superfund Site and is placed regardless of the measured generated residuals concentrations. Therefore, the final post-construction surface, which will serve as the Time 0 surface for baseline long-term monitoring, will contain concentrations equivalent to the RMC source material "clean" concentrations.

NW Natural's cover verification and closeout stepwise approach is as follows:

- **Cover Step 1:** Following achievement of dredging closeout in each DMU, the DMU-composite samples of the operationally defined 6-inch generated residuals layer analyzed during Post-Dredge Step 2 will be compared to the RAO 5 CUL Protective Threshold Concentration (i.e., 920,000 ppb TPAH). If an exceedance is identified, each discrete composite sample in the DMU will be analyzed and the evaluation will proceed to Cover Step 2. If no exceedance is identified, place the initial 6-inch RMC layer and proceed to Cover Step 3.
- **Cover Step 2:** Perform expedited, real-time (i.e., during construction) cover engineering evaluations to determine the most appropriate additional measures, if any, to address the identified RAO 5 CUL Protective Threshold Concentration exceedance in the core-discrete sample. Complete the appropriate additional measure for the initial RMC layer.
- **Cover Step 3:** At the conclusion of the dredging season, place a second 6-inch layer of RMC over all DMUs dredged during that season.
- **Cover Step 4:** Following Cover Step 3, EPA will confirm that cover closeout is achieved in each DMU completed that season.

Figure 1 depicts the post-dredge verification approach on a DMU basis and season-by-season basis. The subsections below provide detail on and rationale for these cover verification steps.

Pre-Cover Verification Analysis

After dredge closeout is achieved in each DMU, a composite sample of the operationally defined 6-inch generated residuals layer will be analyzed concurrently with the underlying 6- to 12-inch and 12- to 18-inch missed inventory samples. The generated residual analytical results will be compared to the RAO 5 CUL Protective Threshold Concentration.

As described above, the samples representing generated residuals will be collected from each core in a DMU. These samples will be termed core-discrete. Equal volumes of the core-discrete samples from each core will also be composited and homogenized to create a single sample representative of the entire DMU (termed DMU-composite). Samples of core-discrete residuals will be collected from each core and archived. Chemical analyses will be performed on the DMU-composite for TPAHs. If the RAO 5 CUL Protective Threshold Concentration is not exceeded in the DMU-composite, the first 6-inch layer of RMC will be placed. If the RAO 5 CUL Protective Threshold Concentration is exceeded in a DMU-composite, the archived core-discrete samples from each core in that DMU will be analyzed. If additional measures are necessary due to a RAO 5 CUL Protective Threshold Concentration exceedance, they will be applied to individual polygon areas represented by the associated core-discrete sample, rather than the entire DMU.

Cover PTW-NAPL Visual Observations and Chemical Sampling and Analysis

Visual observations of PTW-NAPL will be performed on each individual core within a DMU throughout the operationally defined 6-inch generated residual thickness. Any observations of PTW-NAPL will be used to support the additional measures evaluations described in the next subsection of this memorandum.

Initial-Cover Additional Measures Approach

Consistent with the post-dredge verification additional measures discussion above, NW Natural cannot currently provide specific examples of how the core-discrete results will trigger additional measures until the pre-remedial design sediment characterization is performed and site-specific remedial design evaluations are completed. These measures will be dependent on several site-specific factors, including, but not limited to, the nature and extent of RAO 5 CUL Protective Threshold Concentration exceedances and the presence or absence of PTW-NAPL.

As discussed during the working sessions with EPA, once dredging has been deemed complete based on the missed inventory verification, the presence of RAO 5 CUL Protective Threshold Concentration exceedances during cover verification will not trigger the requirement for additional dredge events or placement of a cap. Instead, potential additional measures will include the placement of additional RMC beyond that identified in the remedial design and/or incorporation of reactive amendments into the initial layer of RMC (e.g., activated carbon or organoclay), designed to be protective of the RAO 5 CUL Protective Threshold Concentration exceedances. Consistent with the ROD (EPA 2017), the presence of any PTW-NAPL remaining in place following the completion of dredging will trigger the need to incorporate reactive amendments into the RMC. NW Natural anticipates that significant exceedances of the RAO CUL Protective Threshold Concentration would also lead to the need to incorporate reactive amendments into the RMC. NW Natural's future remedial design documents will detail what additional measures may be performed for the range of cover verification results and the expedited real-time approach for selecting the most appropriate additional measure(s) during construction.

Cover Closeout

Cover closeout will be achieved on a season-by-season basis after the completion of any additional measures following completion of the Cover Step 3. This approach will facilitate closeout of cover placement activities for all DMUs completed in a single season.

Post-Construction Final Cover Placement

After EPA has confirmed post-dredge and cover closeout at all DMUs and completion of all capping activities outside the dredge footprint, NW Natural will place a final 6-inch layer of RMC over the entire dredge footprint and perimeter area.

Long-Term Monitoring

Achievement of long-term sediment cleanup levels and RAOs following construction completion will be evaluated as part of long-term monitoring and the 5-year review process, as described in Sections 14.2.7 and 14.2.8 of the ROD (EPA 2017). EPA has proposed to evaluate upriver background sediment concentrations entering the Portland Harbor Superfund Site using an equivalency analysis as part of long-term monitoring. NW Natural agrees with this approach and anticipates incorporating it into the proposed long-term monitoring approach to be developed during remedial design. NW Natural also agrees with EPA that the sampling spatial density for long-term monitoring should be consistent with the metrics developed for the harbor-wide pre-construction baseline monitoring process.

References

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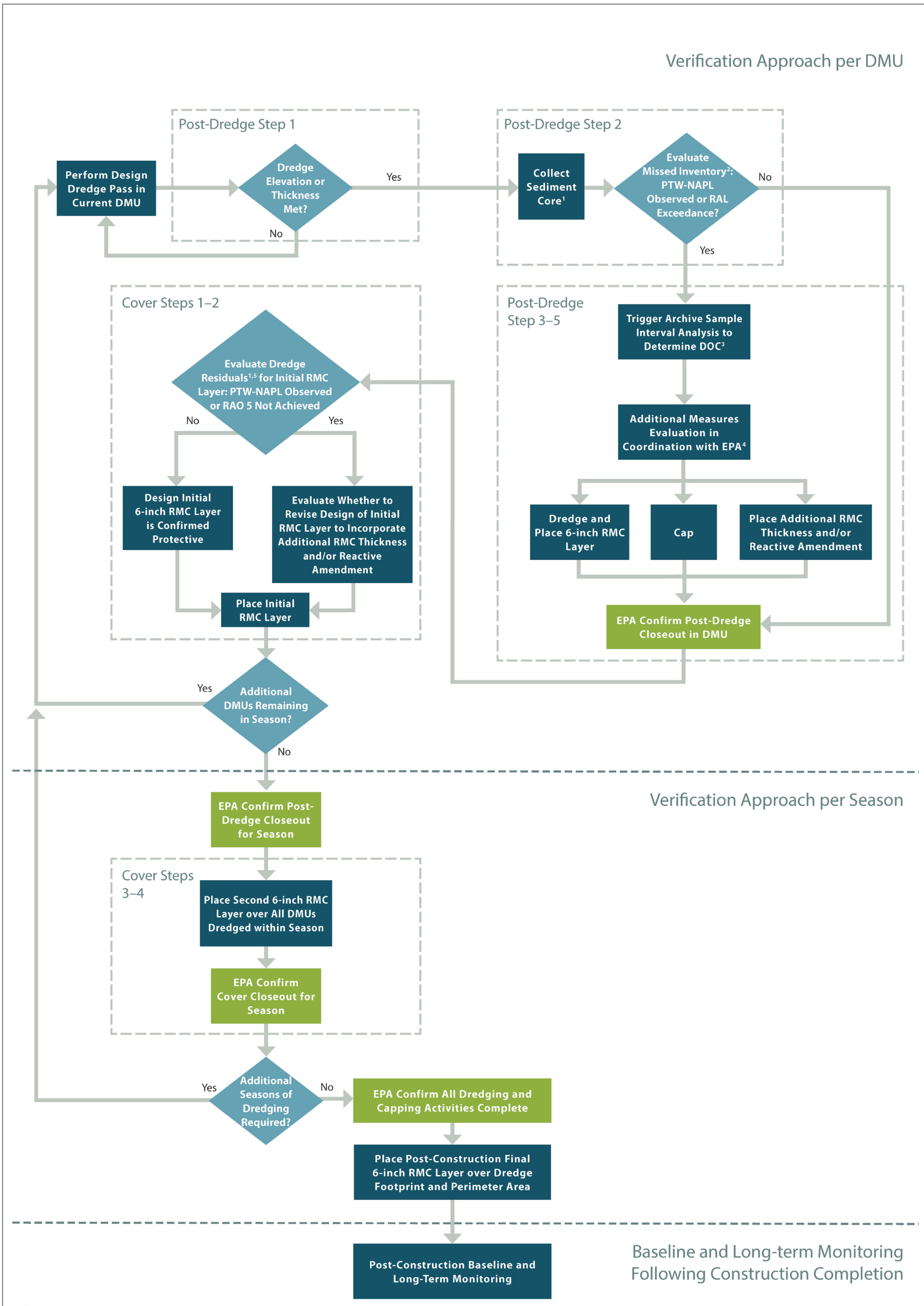
Bridges, T.S., K.E. Gustavson, P. Schroeder, S.J. Ells, D. Hayes, S.C. Nadeau, M.R. Palermo, C. Patmont, 2010. "Dredging Processes and Remedy Effectiveness: Relationship to the 4 Rs of Environmental Dredging." *Integrated Environmental Assessment Management* 6(4):619–630.

EPA (U.S. Environmental Protection Agency), 2009. *Statement of Work – Gasco Sediments Site*. U.S. Environmental Protection Agency Region 10. September 9, 2009.

EPA, 2017. *Record of Decision.* Portland Harbor Superfund Site, Portland, Oregon. U.S. Environmental Protection Agency Region 10. January 2017.

Patmont C., P. LaRosa, R. Narayanan, and C. Forrest, 2018. "Environmental Dredging Residual Generation and Management." *Integrated Environmental Assessment and Management*.

Figures



Notes:

1. Sediment core advanced to approximately 6 feet below the post-dredge surface.
2. The operational definition of residuals thickness is 6 inches below the mudline; therefore, missed inventory sample intervals will begin 6 inches below the post-dredge surface. The 6-12 inches and 12-18 inches missed inventory sample intervals will be submitted for TPAH analysis(or other focused COCs if necessary based on pre-remedial design data), and the remainder of the deeper core (18 inches to the bottom of the core) will be archived in 6-inch intervals pending future analyses, if necessary. In addition to chemical analyses, missed inventory core intervals will be visually observed for PTW-NAPL. NW Natural will identify realistic laboratory turnaround times for all COCs. If during the post-dredge evaluation process the turnaround times cannot be achieved, then EPA and NW Natural will evaluate the need for placement of the initial 6-inch RMC layer prior to receipt of the missing laboratory data.
3. Archive analyses will occur until the first encountered deeper 6-inch interval without TPAH RAL exceedances and no visually observed PTW-NAPL.
4. Additional measures will range from performance of a single additional dredge pass, placement of a cap, or placement of additional RMC thickness and/or incorporation of reactive amendment based on site-specific evaluations. Additional dredging, if necessary, will be located in the portion of the DMU causing the TPAH RAL exceedance or containing visually observed PTW-NAPL.
5. Sample is composed of dredge residuals operationally defined as 6 inches below the post-dredge surface.

COC – Contaminant of Concern
DOC – Depth of Contamination
DMU – Dredge Management Unit
EPA – U.S. Environmental Protection Agency
NAPL – Non-Aqueous Phase Liquid
PTW – Principal Threat Waste
RAL – Remedial Action Level
RMC – Residuals Management Cover
TPAH – Total Polycyclic Aromatic Hydrocarbons

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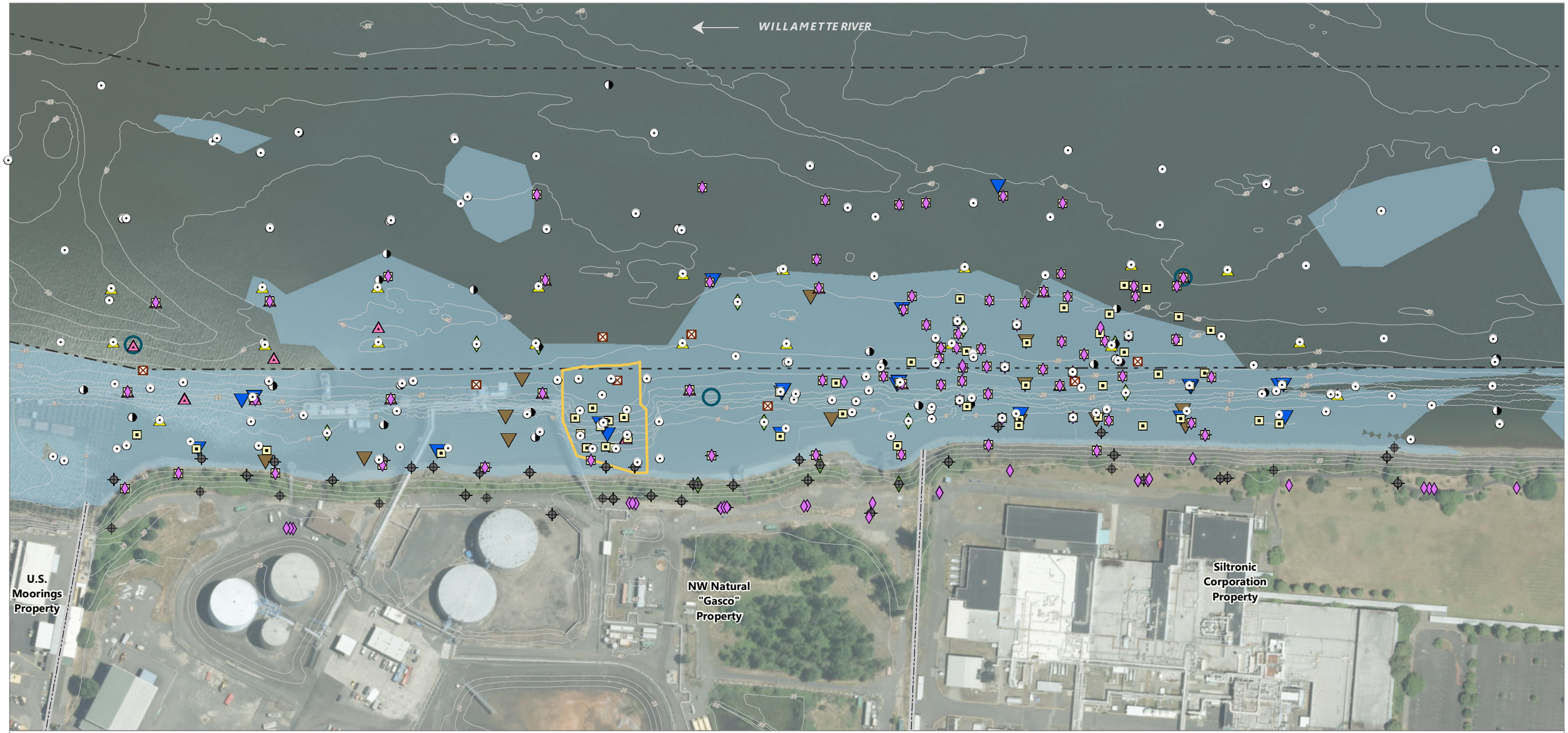
ANCHOR QEA

Figure 1

Stepwise Post-Dredge and Cover Verification and Closeout Stepwise Approaches

Gasco Sediments Site Post-Dredge and Cover Verification and Closeout Approach
Gasco Sediments Cleanup Action

GASCO0067464



LEGEND:

- Surface Water
- Groundwater
- Surface Sediment
- Subsurface Sediment
- Soil
- TZW
- Sediment Trap
- TCLP Locations
- Bioassay Stations
- Seepage Meter Locations
- LWG Seepage Meter Locations
- Acoustic Doppler Measurements
- Tar Body Removal Action Area (RAPP; Anchor 2005)
- Alt F Mod SMAs (USEPA ROD 2017)
- Bathymetry/Topography (feet COP, 2009)
- Navigation Channel
- Property Line

NOTES:
1. Arrow indicates direction of flow of river.
2. Horizontal datum is NAD83 Oregon State Plane North, International Feet.
3. Vertical datum is City of Portland, Feet.
4. Aerial imagery from City of Portland 2016.
5. Bathymetry surveyed by LWG 2009.
6. Topography surveyed by Spencer B. Gross, Inc 2006.

0 200
Feet

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ANCHOR QEA

Figure 2
Summary of Existing Riverbank and Offshore Sample Media Locations at Gasco Sediments Site
Gasco Sediments Site Post-Dredge and Cover Verification and Closeout Approach
Gasco Sediments Cleanup Action
GASCO0067465

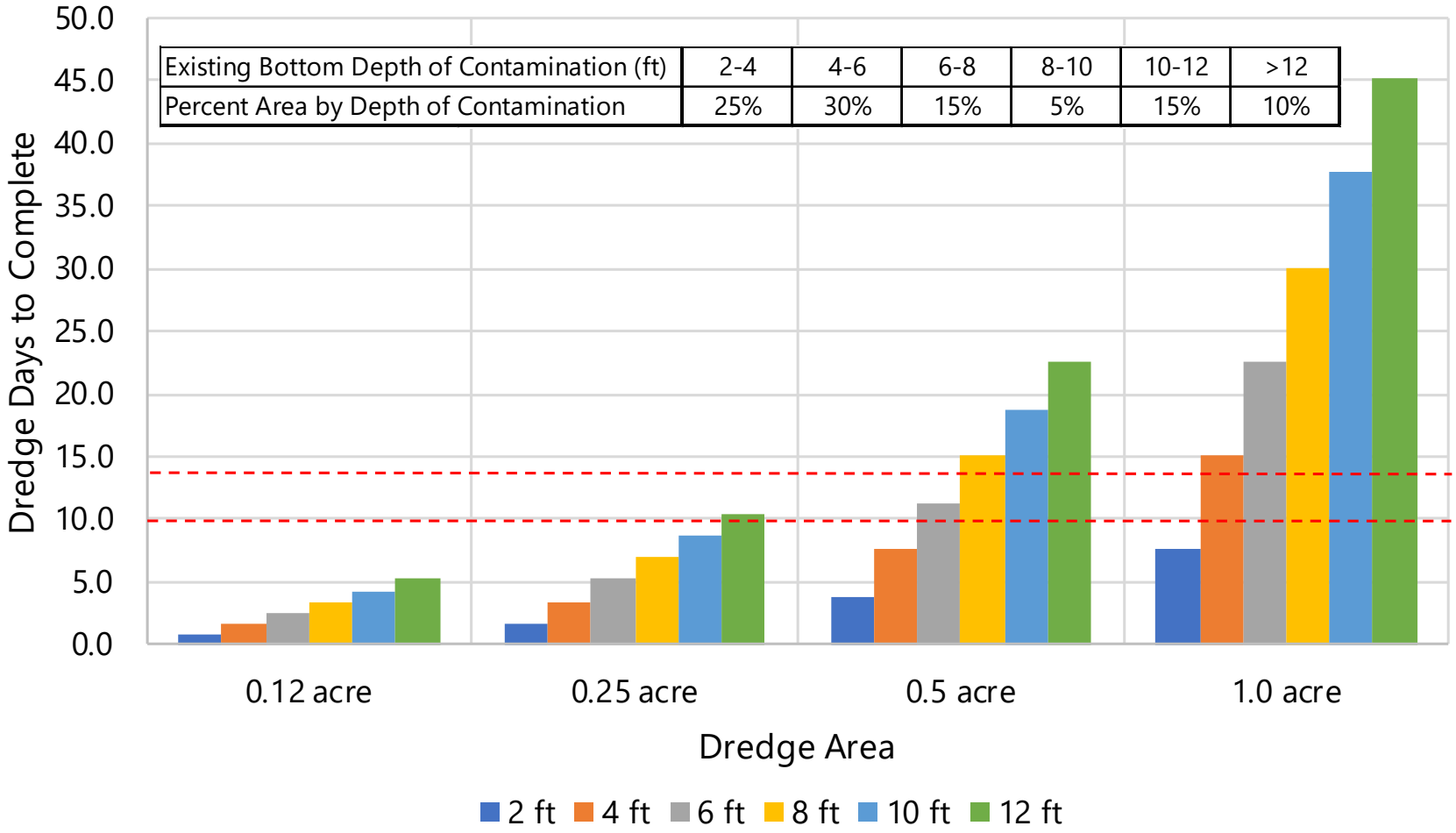

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Figure 3

Planning Level Dredging Durations for Variety of DMU Areas and DOCs

Gasco Sediments Site Post-Dredge and Cover Verification and Closeout Approach
Gasco Sediments Cleanup Action

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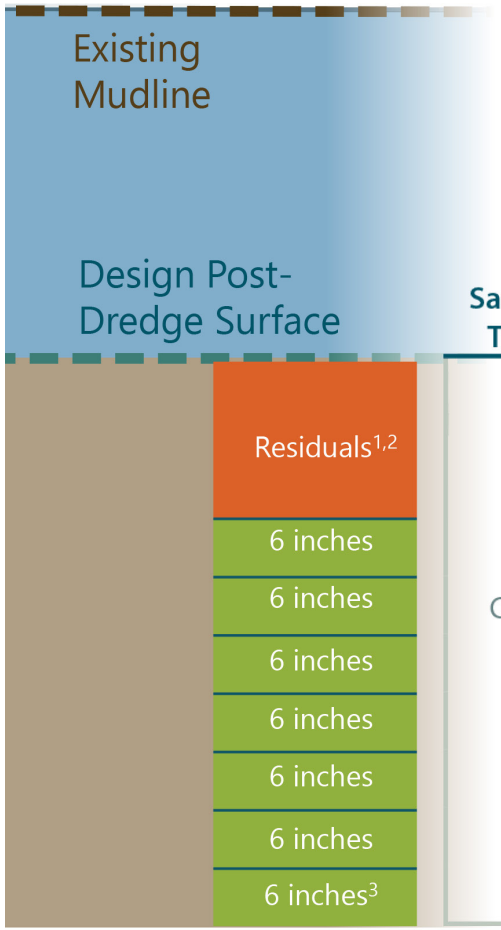

Sample Type	Sampling Sequence	Objective	Analytes	Verification Metric	Spatial	Additional Measures
Core	1	Support Initial RMC Layer Placement	TPAH[7]	Less Than 920,000 ppb TPAH	DMU Composite[6]	Revisions to First 6-inch Layer of RMC Thickness or Incorporate Amendment[5]
	1	Subsurface Sediments Missed Inventory Verification	TPAHs[7]	Less Than RAL	DMU Composite[6] or Core Discrete[8]	To Be Determined Based On Site-Specific Remedial Design Evaluations[4]
	1					
	2 (archive)					
	3 (archive)					
	4 (archive)					
	5 (archive)					
	6 (archive)					

[1]Residuals thickness not shown to scale with other thicknesses.
[2]Assumed operational definition of residuals thickness is 6 inches below the mudline interface consistent with the Fox River Superfund Site. NW Natural will perform periodic field monitoring of the encountered generated residuals thickness to inform whether the operational definition is appropriate.
[3]Core advanced to approximately 6 feet below the post-dredge surface.
[4]Additional measures may include a single additional dredge pass.
[5]Additional measures will not include additional dredging.
[6]All cores within a DMU will be composited for the intervals shown in the sampling sequence.
[7]Analytes will be limited to TPAHs dependent on multiple lines of evidence evaluation using complete data set. Otherwise, the full focused COCs will be analyzed.
[8]If the required sample interval contains visible tar, then a core-discrete sample will also be submitted for chemical analysis for TPAHs.

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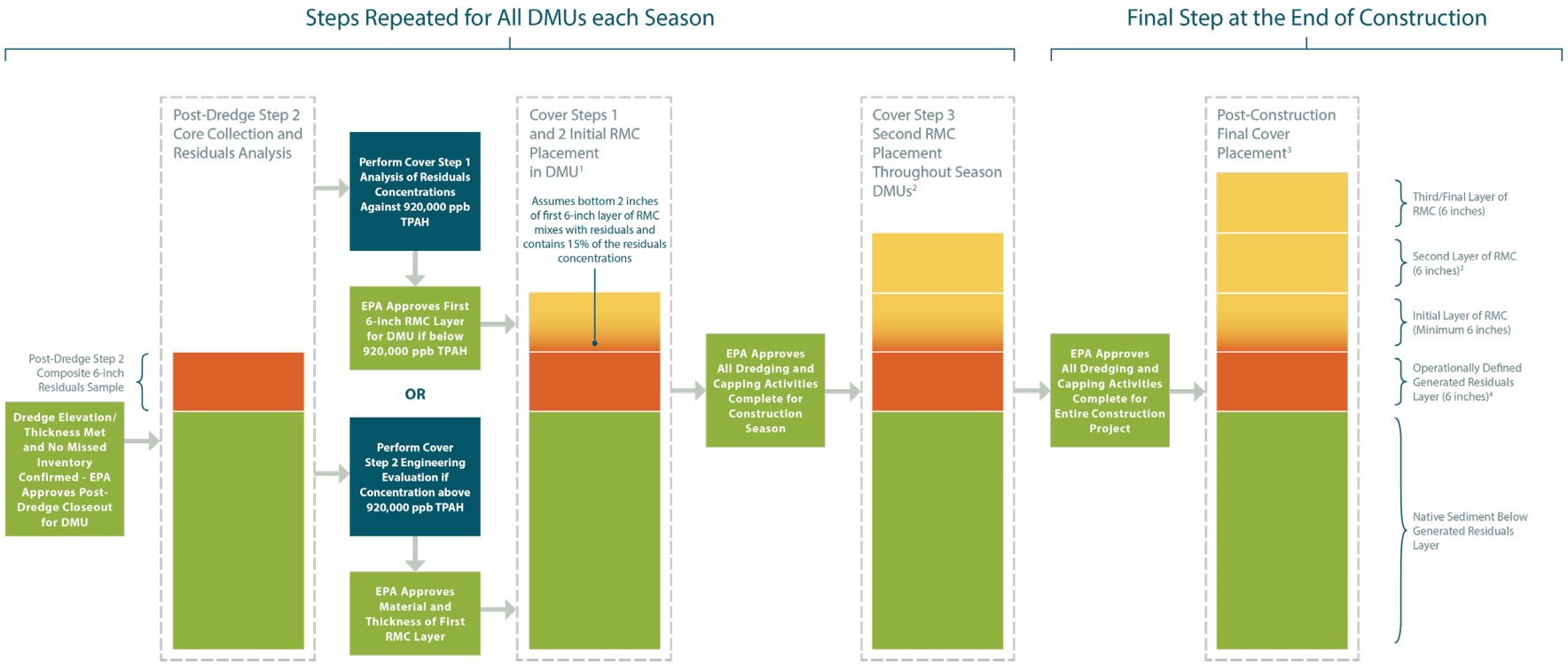
ANCHOR QEA

Figure 4
Post-Dredge Missed Inventory Field Verification Framework
Gasco Sediments Site Post-Dredge and Cover Verification and Closeout Approach
Gasco Sediments Cleanup Action



Notes:

1. Initial layer of RMC placed throughout a DMU following achievement of the target dredge design elevations/thicknesses determined via bathymetry surveys, completion of missed inventory evaluation and any associated additional measures, and comparison of the generated residuals concentrations to the 920,000 ppb TPAH benthic cleanup level protective threshold concentration, which was calculated using EPA's dredge residuals calculations from the Portland Harbor Draft Feasibility Study (EPA, 2013).

2. Second 6-inch layer of RMC placed throughout all DMUs where work performed that season following completion of all dredging and initial RMC placement.

3. Third/final 6-inch layer of RMC placed throughout the entire Project Area dredge footprint following completion of the last season of all dredging and placement of initial and second layer of RMC.

4. The dredge residual thickness is operationally defined as 6 inches below the post-construction surface. NW Natural will perform periodic field monitoring of the encountered generated residuals thickness to inform whether this operational definition is appropriate.

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ANCHOR QEA

Figure 5

Cover Placement Sequencing and Cover Verification Approach

Gasco Sediments Site Post-Dredge and Cover Verification and Closeout Approach
Gasco Sediments Cleanup Action

GASCO0067468

Attachment A
EPA Comments on NW Natural's Proposed Verification and Closeout Approach for Gasco Sediments Site

Review Comments
Dredging and Cover Closeout Approaches – Gasco Sediments Site
Presentation by NW Natural and Anchor QEA
Dated February 27, 2018

Review Comments dated April 2, 2018

Following are the United States Environmental Protection Agency's (EPA's) comments on the presentation titled *Dredging and Cover Closeout Approaches – Gasco Sediments Site*. The presentation was conveyed to EPA and the Technical Coordinating Team (TCT) in a February 27, 2018 meeting. Comments on the presentation were also received from the Oregon Department of Environmental Quality (DEQ) and the Five Tribes[1]and incorporated into the EPA comments. The presentation contains NW Natural's current thoughts regarding post-dredge closeout, dredge management unit cover closeout and post-project area construction closeout for the Gasco Sediments Site. The post-project area construction closeout discussion introduces the RAL Multiplier concept. NW Natural agreed in the February 27th meeting to produce a memorandum that will describe the derivation and application of the RAL multiplier. The following comments contain topics that EPA requests be incorporated into the memorandum.

1. The subsurface sediments missed inventory sampling should use the complete pre-design dataset and include analytical testing on other remedial action level (RAL) contaminants in addition to polycyclic aromatic hydrocarbons (PAHs), at least on a portion of the samples to confirm the assumption that PAHs are consistently the analytical driver for determining the need for active cleanup. NW Natural's proposal for a subset of full RAL list sampling should be provided in the upcoming memorandum.

2. NW Natural uses an operationally defined thickness of 6-inches for the post-dredge residual layer. The EPA supports using an operationally defined residuals layer for convenience and consistency during project planning. That said, we recommend that residuals thickness monitoring during dredging be included as a component of construction quality assurance. Periodic monitoring will provide data on the thickness of post-dredge residuals during construction and provide a basis for modifying the operational definition as appropriate.

3. A discussion of sampling density (how many cores to collect per dredge management unit [DMU]) should be included in the upcoming memorandum.

4. The protocol for setting the boundaries of DMUs is important and is relevant to dredging and cover closeout approaches, as samples are proposed to be composited across each DMU. Thus, this concept should be described in the upcoming memorandum.

5. Section 14.2.7 of the Portland Harbor Superfund Site (PHSS) Record of Decision (ROD) specifies that baseline data will be evaluated at spatial scales appropriate for the remedial action objectives (RAOs), implying that t=0 (i.e., immediately following construction) and long-term monitoring data will also be evaluated over these same spatial scales. It is not clear how the proposed t=0 sampling design and DMU-specific analyses will relate to the RAO-appropriate spatial scales.

[1] The five tribes are the Confederated Tribes of the Grand Ronde Community of Oregon, the Nez Perce Tribe, the Confederated Tribes of Siletz Indians, the Confederated Tribes of the Umatilla Indian Reservation, and the Confederated Tribes of the Warm Springs Reservation of Oregon.

6. The EPA believes that significant consideration should be given to the spatial element of the verification metric for attaining the RAOs identified in the ROD. NW Natural's presentation indicates the verification metric (i.e., the RAL) will be compared with a "dredge management unit average composite" for the missed inventory verification, and with a "spatial composite" for the final RMC layer placement. The EPA requests that NW Natural's next memorandum fully define these terms and document that comparing RALs with averaged and/or composted results will achieve RAOs. The EPA also requests that NW Natural illustrate the use of averaged and/or composited results for purposes of missed inventory verification and final RMC layer placement by including examples based on a range of reasonably likely dredging and capping scenarios.

7. A discussion of NW Natural's vision for defining the dredge prism during remedial design would be appreciated for upcoming memorandum. The density of cores, compositing scheme, and procedure to define the horizontal and vertical extent of the prism are important decisions that will directly affect the amount of "missed inventory" found after dredging.

8. Another topic that would be ideal to touch on in the upcoming memorandum is the topic of implementing best dredging practices, including practices to minimize residuals. Because Gasco is within a stretch of the Willamette River characterized by little deposition, as described in the ROD and illustrated in Figure 3.6-2a of the PHSS Feasibility Study, the residuals management cover may not be as effective at containing residuals at this site compared to more depositional areas. Thus, residuals must be minimized to the maximum extent practicable.

9. The post-dredge missing inventory approach assumes sufficient pre-design data are available to identify the depth of contamination for removal, and limit the occurrence of missed inventory. DEQ understands that sediment data gaps sampling scheduled for this year will supplement pre-design data. NW Natural has yet to submit the scope of work for data gaps sampling, and DEQ notes that the results of this work may indicate that modifying the post-dredge verification approach is warranted.

6720 SW Macadam Avenue, Suite 125
Portland, Oregon 97219
503.670.1108

ANCHOR QEA

Memorandum

May 7, 2018

To: Sean Sheldrake and Karl Gustavson, U.S. Environmental Protection Agency

From: Ryan Barth, PE, Anchor QEA, LLC

cc: Bob Wyatt, NW Natural
Patty Dost, Pearl Legal Group
Dana Bayuk, Oregon Department of Environmental Quality
Lance Pederson, CDM Smith
Paul Schroeder, U.S. Army Corps of Engineers
Myron Burr, Siltronic Corporation
Michael Murray, Maul Foster & Alongi

Re: NW Natural Response to EPA Review Comments on the Proposed Post-Dredge and Post-Cover Verification and Closeout Approaches – Gasco Sediments Site

NW Natural and Anchor QEA presented proposed post-dredge and post-cover verification and closeout approaches for the Gasco Sediments Site to the U.S. Environmental Protection Agency (EPA) and Technical Coordinating Team (TCT) during meetings on January 10 and February 22, 2018. EPA provided comments on these presentations to NW Natural in a letter dated April 2, 2018. This memorandum serves as NW Natural's responses to EPA's comments. Concurrent with these responses, NW Natural is submitting a memorandum entitled *Summary of NW Natural's Gasco Sediments Site Proposed Post-Dredge and Post-Cover Verification and Closeout Approaches* (Post-Dredge/Cover Memorandum) that incorporates the responses included herein.

EPA Comments

EPA Comment 1

The subsurface sediments missed inventory sampling should use the complete pre-design dataset and include analytical testing on other remedial action level (RAL) contaminants in addition to polycyclic aromatic hydrocarbons (PAHs), at least on a portion of the samples to confirm the assumption that PAHs are consistently the analytical driver for determining the need for active cleanup. NW Natural's proposal for a subset of full RAL list sampling should be provided in the upcoming memorandum.

NW Natural Response

Agreed. As described in the section "Post-Dredge Stepwise Remedial Action Level Chemical Sampling and Analysis" in the Post-Dredge/Cover Memorandum, NW Natural agrees to perform periodic sampling and analysis for additional focused contaminants of concern

(i.e., polychlorinated biphenyls, pesticides, and dioxins/furans) on a portion of the subsurface sediments during post-dredge missed inventory verification. The density and analytes will be developed in coordination with EPA during remedial design.

EPA Comment 2

NW Natural uses an operationally defined thickness of 6-inches for the post-dredge residual layer. The EPA supports using an operationally defined residuals layer for convenience and consistency during project planning. That said, we recommend that residuals thickness monitoring during dredging be included as a component of construction quality assurance. Periodic monitoring will provide data on the thickness of post-dredge residuals during construction and provide a basis for modifying the operational definition as appropriate.

NW Natural Response

Agreed. As described in the section "Post-Dredge Operationally Defined RMC Thickness" in the Post-Dredge/Cover Memorandum, NW Natural will perform periodic monitoring of the encountered generated residuals thickness to inform whether the operational definition is appropriate. The frequency of monitoring will be developed in coordination with EPA during remedial design.

EPA Comment 3

A discussion of sampling density (how many cores to collect per dredge management unit [DMU]) should be included in the upcoming memorandum.

NW Natural Response

Agreed. A discussion of sampling density is included in the section "Post-Dredge Verification Dredge Management Unit Sampling Density and Locations" in the Post-Dredge/Cover Memorandum.

EPA Comment 4

The protocol for setting the boundaries of DMUs is important and is relevant to dredging and cover closeout approaches, as samples are proposed to be composited across each DMU. Thus, this concept should be described in the upcoming memorandum.

NW Natural Response

Agreed. A discussion of the DMU boundaries is included in the section "Dredge Management Unit Boundary Development" in the Post-Dredge/Cover Memorandum.

EPA Comment 5

Section 14.2.7 of the Portland Harbor Superfund Site (PHSS) Record of Decision (ROD) specifies that baseline data will be evaluated at spatial scales appropriate for the remedial action objectives (RAOs),

implying that t=0 (i.e., immediately following construction) and long-term monitoring data will also be evaluated over these same spatial scales. It is not clear how the proposed t=0 sampling design and DMU-specific analyses will relate to the RAO-appropriate spatial scales.

NW Natural Response

The DMU-specific analyses described in the Post-Dredge/Cover Memorandum are solely for the purpose of closing out construction activities in active remediation areas defined by RALs. Baseline data at Time 0 to evaluate attainment of RAOs will be a separate effort following completion of all construction activities as part of long-term monitoring. The long-term monitoring objectives and associated spatial scales will be developed during remedial design. Therefore, the Post-Dredge/Cover Memorandum does not include any Time 0 sampling of the final post-construction surface. NW Natural agrees with EPA that the sampling spatial density for long-term monitoring should be consistent with the metrics developed for the harbor-wide baseline monitoring process.

EPA Comment 6

The EPA believes that significant consideration should be given to the spatial element of the verification metric for attaining the RAOs identified in the ROD. NW Natural's presentation indicates the verification metric (i.e., the RAL) will be compared with a "dredge management unit average composite" for the missed inventory verification, and with a "spatial composite" for the final RMC layer placement. The EPA requests that NW Natural's next memorandum fully define these terms and document that comparing RALs with averaged and/or composted results will achieve RAOs. The EPA also requests that NW Natural illustrate the use of averaged and/or composited results for purposes of missed inventory verification and final RMC layer placement by including examples based on a range of reasonably likely dredging and capping scenarios.

NW Natural Response

The use of composite and discrete subsamples to support the missed inventory verification approach is described in the section "Post-Dredge Stepwise Remedial Action Level Chemical Sampling and Analysis" in the Post-Dredge/Cover Memorandum. Because the ROD uses RALs to define areas of active remediation, the sampling approach described in the Post-Dredge/Cover Memorandum will use RALs to evaluate whether active remediation is complete. As described in the section "Post-Dredge Additional Measures Approach" in the Post-Dredge/Cover Memorandum, NW Natural cannot provide specific examples of how the DMU-discrete results will trigger likely dredging and capping measures until the pre-remedial design sediment characterization is performed and site-specific remedial design evaluations are completed. However, anticipated triggers for these measures are included. The measures will be developed collaboratively with EPA during the design process.

Attainment of RAOs will be measured through post-construction baseline and long-term monitoring. This is a separate task that will be developed during remedial design.

EPA Comment 7

A discussion of NW Natural's vision for defining the dredge prism during remedial design would be appreciated for upcoming memorandum. The density of cores, compositing scheme, and procedure to define the horizontal and vertical extent of the prism are important decisions that will directly affect the amount of "missed inventory" found after dredging.

NW Natural Response

A description of the process is included in the section "Summary of Pre-Remedial Design Sediment Characterization" in the Post-Dredge/Cover Memorandum. Details and design procedures will be collaboratively determined with EPA during the development of the pre-remedial design data gaps sampling scope of work.

EPA Comment 8

Another topic that would be ideal to touch on in the upcoming memorandum is the topic of implementing best dredging practices, including practices to minimize residuals. Because Gasco is within a stretch of the Willamette River characterized by little deposition, as described in the ROD and illustrated in Figure 3.6-2a of the PHSS Feasibility Study, the residuals management cover may not be as effective at containing residuals at this site compared to more depositional areas. Thus, residuals must be minimized to the maximum extent practicable.

NW Natural Response

Agreed. This information is included in the section "Dredging Performance Criteria and Best Management Practices" in the Post-Dredge/Cover Memorandum.

EPA Comment 9

The post-dredge missing inventory approach assumes sufficient pre-design data are available to identify the depth of contamination for removal, and limit the occurrence of missed inventory. DEQ understands that sediment data gaps sampling scheduled for this year will supplement pre-design data. NW Natural has yet to submit the scope of work for data gaps sampling, and DEQ notes that the results of this work may indicate that modifying the post-dredge verification approach is warranted.

NW Natural Response

Understood. The scope of the data gaps investigation will be developed in coordination with EPA to ensure it meets the objectives of the dredge, post-dredge, and post-cover process, when approved.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 Sixth Avenue, Suite 900
Seattle, WA 98101-3140

OFFICE OF
ENVIRONMENTAL CLEANUP

September 21, 2018

Mr. Bob Wyatt
NW Natural
220 NW 2nd Avenue
Portland, Oregon 97209

sent via email only

Mr. Myron Burr
Siltronic Corporation
7200 NW Front Avenue, M/S 20
Portland, Oregon 97210-3676

Re: Conditional Approval of NW Natural's Revised Gasco Sediments Site Dredge and Cover Design, Implementation, Verification, and Closeout Approach Memorandum

Dear Sirs:

The Environmental Protection Agency (EPA) reviewed the document titled *NW Natural's Revised Gasco Sediments Site Dredge and Cover Design, Implementation, Verification, and Closeout Approach Memorandum* (Memorandum), dated July 24, 2018 and prepared by Anchor QEA on behalf of Northwest Natural (NW Natural). EPA's comments on the document are attached. The EPA also received comments on the document from its partners, including the Oregon Department of Environmental Quality, the Five Tribes[1] and the Yakama Nation, which have been incorporated in the EPA comments.

The Memorandum presents NW Natural's stepwise approach to determine when dredging will be deemed complete during the planned in-water cleanup of the Gasco Sediments Site as well as a process to evaluate and manage dredge residuals. The July 2018 version of the Memorandum represents the culmination of numerous discussions between EPA, its partners and respondents over the course of 2018. EPA believes the Memorandum, if revised as requested, will provide respondents with the certainty needed to move forward with the data gaps development for pre-design investigation activities while allowing for certain aspect of the approach (e.g. dredge management unit size, contaminant of concern drivers, and feasible laboratory turn-around-times, specific dredging equipment and best management practices used) to be further developed during the remedial design process.

There are two types of comments in the attachment, those that need to be addressed in the final Memorandum and others which can be addressed in future documents. The Memorandum is conditionally approved with the changes requested in the attachment. EPA understands the final Memorandum will become an appendix to the Pre-Remedial Basis of Design Technical Evaluations Work Plan when that document is finalized.

[1] The Five Tribes are the Confederated Tribes of the Grand Ronde Community of Oregon, the Nez Perce Tribe, the Confederated Tribes of Siletz Indians of Oregon, the Confederated Tribes of the Umatilla Indian Reservation, and the Confederated Tribes of the Warm Springs Reservation of Oregon.

Please let me know if you have any questions or concerns at (206) 553-1220 or via email at sheldrake.sean@epa.gov.

Sincerely,

Sean Sheldrake, RPM

Cc: Dana Bayuk, DEQ *via email only*
Lance Peterson, CDM
TCT

Enclosures

Enclosure

EPA Comments on
NW Natural's Revised Gasco Sediments Site Dredge and Cover Design, Implementation, Verification, and Closeout Approach
Gasco Sediments Site
Dated July 24, 2018

Comments dated September 17, 2018

The following are U.S. Environmental Protection Agency (EPA) comments on the *NW Natural's Revised Gasco Sediments Site Dredge and Cover Design, Implementation, Verification, and Closeout Approach Memorandum* (Memorandum), dated July 24, 2018 and prepared by Anchor QEA on behalf of Northwest Natural (NW Natural).

General Comments

1. EPA would like to communicate key overarching remedial design construction objectives that are important to consider during development of select elements of the design and construction. Gasco Sediment Management Area (SMA) design and post-construction technical elements have so far been submitted as presentations and in memoranda. To date, there has been limited opportunity to discuss and provide review comments on the overall ("big picture") remedial approach. EPA recommends that the final Pre-Remedial Basis of Design Technical Evaluations Work Plan (work plan) explicitly identify "guiding principles" for the remedy to ground the project planning process and provide context for evaluating the more detailed technical elements of the project. The guiding principles should be refined to reflect the status of the project as the design process moves forward. In the absence of guiding principles, EPA is proposing expectations for consideration and incorporation into future design documents.

   Given the size of the SMA and magnitude of sediment contamination, EPA's primary expectation is that the remedial design maximizes certainty to the extent possible to limit the need for contingency decision making during construction. Specifically:

   - **Pre-dredge SMA data gaps sampling design should produce a robust data set that maximizes the certainty that remedial action level (RAL) exceedance and principal threat waste (PTW) presence are delineated.** EPA's general impression of the Revised Post-Dredge Approach is that NW Natural is proposing a decision process that relies on substantial post-dredge data collection and analysis, and multiple iterative steps. EPA agrees that the revised Memorandum indicates that advancing cores every 100 feet during pre-design sampling may be an appropriate rule-of-thumb for data density. However, this may be refined following further analyses and the actual density of data gaps samples, including location and depth interval. Sampling density should be developed using an appropriate three-dimensional model of existing data that evaluates SMA and contaminant of concern (COC)-specific heterogeneity; identifies sample locations needed to delineate the margins of the three-dimensional (3-D) dredge prism; and establishes the basis for dredge design elevations throughout the SMA. Please note, EPA also requests more information on how vertical delineation will be accomplished.

- **Sediment remedy design should strive to limit the need for additional dredge cleanup passes to the extent practicable.** Triggering additional dredging during construction represents an undesirable outcome for the project. Additional dredge passes have the potential to adversely impact the environment and ultimately result in a less effective remedy by, for example, extending the period of time highly contaminated sediments could enter the water column and/or be transported to other areas of the Portland Harbor. The overall goal for dredging, including equipment selection, methods, and other best management practices, should be to minimize residuals generation.

- **Gasco SMA remedy design should address key Gasco upland COCs in addition to Portland Harbor Record of Decision (ROD) Table 17 constituents.** Inclusion of uplands Gasco COCs in the planning process should be done to ensure the remedy design fully addresses site-specific contamination within the SMA. The assertion that total polycyclic aromatic hydrocarbons (TPAHs) are the primary COC will need verification after completion of pre-design sampling work. In addition, all Table 17 constituents will need to be evaluated for any cap modeling and design.

EPA requests that these expectations be incorporated as "guiding principles" into the final work plan, the "Pre-Remedial Design Data Gaps Work Plan and Sampling and Analysis Plan" (Data Gaps Sampling Plan), and other forthcoming design documents, as appropriate.

2. EPA expects the remedial design to be consistent with the ROD. This Memorandum focuses in part on residuals, but future discussions and documents should include the aspects of design described in the following excerpts from the ROD:

    a) Section 14.2.3. Intermediate Region, 108: "In this region, avoiding or minimizing impacts to the aquatic environment and floodway need to be considered and evaluated to meet CWA (Section 404) and federal floodway requirements as well as climate change impacts."

    "The elevation of the top of the cap will be no higher than the pre-design elevation to avoid impacts to the floodway."

    b) Section 14.2.4. Shallow Region, page 109: "Under any scenario, the elevation of the top of the cap or residual layer will be no higher than the pre-design elevation to avoid loss of submerged aquatic habitat, preserve slope stability, and negate adverse impacts to the floodway. In the shallow regions, a habitat layer such as beach mix will be used for the final layer of clean cover in both residual management areas and capped areas to bring the surface back to the original (pre-dredge) elevation and in order to maintain the natural habitat."

    c) Section 14.2.9.1. Capping, page 113: "In habitat areas, currently defined by NMFS as those areas above -15 ft CRD, post-remedy surfaces will be maintained at their current depth and backfilled or capped with suitable habitat materials."

    d) Section 14.2.9.2. Dredging, page 114: "In the shallow region, residual management will consist of capping or backfilling to grade to prevent exposure above cleanup levels and

to minimize adverse effects on in-river and riparian habitat, including the loss of shallow water habitat."

3. The success of the described approach specifically and remedial dredging and cover placement in general is dependent on three important factors:

    a) The dredge prism must be accurately and precisely defined during remedial design. The density of cores, compositing scheme, and procedure to define the horizontal and vertical extent of the prism are important decisions that will directly affect the amount of "missed inventory" found after dredging. EPA appreciates the language describing the process to define the dredge prism included in the Memorandum. EPA will continue to evaluate approaches to define to dredge prism as they are refined during pre-remedial and remedial design.

    b) Best dredging practices must be implemented to accurately dredge the defined dredge prism and to minimize residuals. Residuals must be minimized to the greatest extent practicable. EPA appreciates the language describing dredging best practices included in the Memorandum. EPA will continue to evaluate anticipated dredging approaches as equipment choices and best practices are refined.

    c) The placement of the residuals management cover (RMC) must be achieved using equipment that will minimize the disturbance of the underlying sediment and maximize the accuracy of placement of a layer of the desired thickness. In addition, the thickness of each RMC layer must be verified using bathymetry or some other relevant method.

    NW Natural should ensure that forthcoming design documents include an assessment of these factors.

4. The *Summary of Dredge and Cover Design, Implementation, Verification, and Closeout Approach* section should be revised in the final Memorandum to include over-arching goals to guide the design, implementation and verification of dredging activities (e.g., minimize missed inventory, minimize residuals generation, minimize time prior to placement of residual management layer, minimize additional dredge passes, and minimize the removal and disposal of residual management material following placement).

    It may also be useful to consider an adaptive management step during implementation – for example, it may be advantageous to redefine the operationally defined residual layer based on observations or adjust the target dredge depth based on interpretation of core data if there is a systematic difference between pre-design depth of contamination (DOC) estimates and actual DOC based on confirmation samples following dredging.

5. NW Natural should plan dredge management Units (DMUs) in a manner that prevents any DMU being left incomplete and open at the end of a construction period within a season. This should be clarified in future design documents.

Specific Comments

1. **Summary of Dredge and Cover Design, Implementation, Verification, and Closeout Approach, Dredging Implementation, page 2, 3rd item:** The item in this bullet point should be moved to *Post-dredge verification* in the final Memorandum.

2. **Summary of Dredge and Cover Design, Implementation, Verification, and Closeout Approach, Post-dredge verification, page 2, 4th item:** In the final Memorandum the text in this item point should state the expected core depth.

3. **Summary of Dredge and Cover Design, Implementation, Verification, and Closeout Approach, Post-dredge verification, page 2, 5th item:** In the final Memorandum the text in this item should state that the sample from the residual layer will be a composite sample.

4. **Summary of Dredge and Cover Design, Implementation, Verification, and Closeout Approach, Post-dredge verification, page 2, 7th item:** The text in the final Memorandum should clarify the timing of the RMC layer.

5. **Summary of Pre-Remedial Design Activities to Support the Post-Dredge and Cover Verification and Closeout Approach, Summary of Pre-Remedial Design Sediment Characterization, page 3-4:** The possibility of the presence of an active non-aqueous phase liquid (NAPL)/groundwater plume emanating from the upland/river bank that will be intersected by the dredging should be discussed. If such a plume is possible, then information on how it will be addressed should be presented in future design documents including how Gasco groundwater plumes will affect dredging, capping, and closeout decisions.

6. **Summary of Pre-Remedial Design Activities to Support the Post-Dredge and Cover Verification and Closeout Approach, Summary of Pre-Remedial Design Sediment Characterization, page 3-4:** EPA expects to see the following information in the upcoming Data Gaps Sampling Plan:

    a) Specifics regarding the sediment sampling scope of work should be presented and be based on evaluations of previous sampling locations and compilations of the existing data. Data presentations based on this information (e.g., plan-view figures, cross-sections, a fence diagram) that illustrate the extent of sediment contamination, the sediment sampling grid, and preliminary dredge prism will support identification of data gaps.

    b) NW Natural should give careful consideration to selecting a data interpolation algorithm(s) that, in conjunction with current understandings of site heterogeneity, will support decisions regarding requisite data gaps sampling locations and data density. The objective of this analysis should be to identify sampling locations where data is needed to constrain anomalous and/or significantly heterogeneous results.

    c) The number and depth of cores collected during the pre-design sediment characterization should be sufficient to delineate a 3D dredge prism, establish the DOC for removal, and identify the basis for identifying target dredge elevations with an appropriate level of confidence. Given the majority of the existing sediment cores within the 14.5-acre

dredging footprint have RAL exceedances or PTW-NAPL in the bottom sampled depth (i.e., DOC is unbounded at most core locations), the depth of coring will be an especially important factor in developing the pre-design data gaps sampling scope of work. Based on this information, if the intent of the effort is to define the DOC, the projected depth of pre-design cores and sample collection (20-feet below mudline) will likely need to be extended downward to meet project needs.

d) In terms of contamination, EPA expects the Data Gaps Sampling Plan scope of work to include sampling and analysis of Gasco upland COCs and that this data be used to inform evaluations of the 3-D dredge prism. EPA acknowledges that the upland and sediment remedies cannot be combined because the current schedule shows upland remedy implementation occurring after the in-water remedy; however, care should be taken to ensure that the shared objectives of both EPA and the Oregon Department of Environmental Quality are being met.

7. **Summary of Pre-Remedial Design Activities to Support the Post-Dredge and Cover Verification and Closeout Approach, Summary of Pre-Remedial Design Sediment Characterization, page 4, 2nd paragraph:** Definitions used for identifying PTW-NAPL must be clarified and must meet ROD requirements. First, the term PTW-NAPL appears only to mean NAPL so a distinction should be made between PTW and NAPL. Second, NAPL is only defined as "mobile" material, so that a substantial deposit of tar that is sorbed to or mixed in with sediments would not qualify. Future design documents should clarify how immobile product will be addressed if encountered and how the mobility of NAPL will be determined.

8. **Summary of Pre-Remedial Design Activities to Support the Post-Dredge and Cover Verification and Closeout Approach, Dredge Management Unit Boundary Development, page 4:** Future design documents need to clarify how extensively the dredge prism may overlap with nearshore sediments, beaches and riverbanks and if/how this verification and closeout approach will vary for these areas.

9. **Summary of Pre-Remedial Design Activities to Support the Post-Dredge and Cover Verification and Closeout Approach, Dredge Management Unit Boundary Development, page 5:** In the final Memorandum the list of lines of evidence should include the capacity of disposal facilities to receive, handle, and manage dredge material during project construction timeframes. In the same way dredging boundaries must consider time of construction, potential operational constraints at receiving facilities (e.g., volume limitations) should be factors for project planning. Future design documents should take these factors into consideration.

10. **Summary of Pre-Remedial Design Activities to Support the Post-Dredge and Cover Verification and Closeout Approach, Dredging Performance Criteria and Best Management Practices, page 6:** The list of BMPs should be revised in the final Memorandum to include a BMP focused on expeditious collection of sediment cores and rapid turn-around chemical analysis to limit the time between verification of target sample depth and placement of the RMC layer.

11. **Post-Dredge Verification and Closeout Approach, page 8:** The Revised Post-Dredge Approach is acceptable to EPA if the turn-around-time (TAT) for analytical data does not result

in unacceptable exposure to and migration of residuals prior to placement of the first 6-inch RMC layer. As noted in the Memorandum, specific procedures, details, and engineering evaluations for this approach will be developed for EPA approval in the remedial design documents. Further refinement of the approach should in part be based on the results of sediment sampling and analysis and the lay-out of the DMUs (sizes, numbers, depths), which are things that will be informed by the data gaps sampling work. A priority for planning the dredging work is to minimize to the maximum extent practicable the time between achieving the design elevation and placement of the initial RMC layer. NW Natural should identify realistic laboratory TATs for all analytes. If during the post-dredge evaluation process the TATs cannot be achieved, then EPA and NW Natural will evaluate the need for placement of the initial 6-inch RMC layer prior to receipt of the missing laboratory data. Additionally, the current approach will need to be made compatible with any areas where existing or data gaps sampling information indicate that TPAHs are not the primary COC and analysis of other COCs is necessitated, prolonging the analysis time. EPA requests updating the footnotes in the Figure 1 flow chart in the final Memorandum to document these contingencies.

12. **Post-Dredge Verification and Closeout Approach, page 8, 1st paragraph:** According to this section, the basis for the post-dredge verification and closeout approach is two criteria: 1) attainment of the dredge design elevations/thicknesses; and 2) absence of RAL exceedances or the presence of PTW-NAPL below the dredge prism (no "missed inventory"). As indicated in a previous comment on Summary of Pre-Remedial Design Activities to Support the Post-Dredge and Cover Verification and Closeout Approach, Summary of Pre-Remedial Design Sediment Characterization (page 3-4), the DOC is vertically unbounded at the majority of previous core locations. Consequently, dredging may not be able to achieve the full DOC. The post-dredge approach should acknowledge and address this case in the final Memorandum.

13. **Post-Dredge Verification and Closeout Approach, Post-Dredge Operationally Defined Generated Residuals Thickness, page 9:** It should be noted in the final Memorandum that BMPs are expected to further minimize residuals generation.

14. **Post-Dredge Verification and Closeout Approach, Post-Dredge Stepwise Remedial Action Level Chemical Sampling and Analysis, page 10, 1st paragraph:** After the bulleted list, it may be useful to provide in the final Memorandum an example to clarify the number of samples to be included in each composite sample e.g., for a 1-acre DMU, 5 samples of equal volume collected from the 6-12 inch depth interval will be composited into a single sample.

15. **Post-Dredge Verification and Closeout Approach, Post-Dredge Stepwise Remedial Action Level Chemical Sampling and Analysis, page 10, 3rd paragraph:** The sentence regarding the use of generated residual concentrations should be revised in the final Memorandum to read: "The generated residual concentrations will be used to define residual management requirements as described in Cover Step 1".

16. **Post-Dredge Verification and Closeout Approach, Post-Dredge Stepwise Remedial Action Level Chemical Sampling and Analysis, and Post-Dredge Additional Measure Approach, pages 10 and 11:** These sections of the Memorandum indicate that samples within a DMU will be composited and compared to the RAL to evaluate whether active remediation is complete. NW Natural estimates DMU sizes based on a planning level evaluation to range from

approximately 0.25 to 1.0-acre. EPA requests that in future design documents NW Natural present a proposal for the lay-out of DMUs with pre-design data before DMU boundaries and/or any associated sampling and compositing scheme are finalized. EPA acknowledges and accepts NW Natural's recommendation to present a reasonable range of dredging and capping scenarios subsequent to completion of pre-remedial design sediment characterization.

17. **Post-Dredge Verification and Closeout Approach, Post-Dredge Stepwise PTW-NAPL Visual Observations and Chemical Sampling and Analysis, page 11:** Any sample showing obvious signs of contamination upon core inspection should be analyzed separately. Information on the approach that will be adopted if obvious heavy contamination is observed at depth in a core but not in the surface/shallow layers should be provided during design.

18. **Post-Dredge Verification and Closeout Approach, Post-Dredge Additional Measures, page 11, 2nd paragraph:** The text should be revised in the final Memorandum to clarify what is meant by a single additional dredge event. For example, whether this implies a single pass or something more extensive.

19. **Post-Dredge Verification and Closeout Approach, Post-Dredge Additional Measures, page 11, 2nd paragraph:** The sentence that states additional dredging below the dredge design elevation/thickness may not be possible should be revised in the final Memorandum to read: "In some DMUs, additional dredging below the dredge design elevation/thickness may not be feasible…"

20. **Post-Dredge Verification and Closeout Approach, Post-Dredge Closeout, page 12:** The approach will result in adjacent DMUs being dredged after dredging at a DMU is completed. It is possible/likely that there will be some residuals spreading carryover from the dredging of adjacent DMUs. The design should consider DMU dredging order to minimize residuals spreading, for example, removing the most contaminated areas first.

21. **Cover Verification and Closeout Approach, page 12:** The text implies that an 18-inch thick clean sand cover will be protective for the Gasco in-river cleanup. Future design documents should include evaluation of the effectiveness and long-term integrity of the sand cover. The design should also consider any erosive forces that the cover will be subjected to.

22. **Cover Verification and Closeout Approach, page 12:** Future design documents should discuss what the requirements are for final sediment elevations since the dredge activities may extend to depths of 10 to 20 or more feet. Future design documents should also discuss how the dredge/cover verification and closeout approach will be modified in areas where extensive dredging is required, and how final cover surfaces will be compatible with habitat-friendly goals described in the ROD.

23. **Cover Verification and Closeout Approach, page 12, 2nd paragraph:** The third sentence should be revised in the final Memorandum to read: "….EPA requested that the TPAH residuals concentrations be measured and used to confirm that 12 inches of overlying RMC will be sufficient to achieve the ROD remedial action objective (RAO) 5 TPAH surface sediment cleanup level…."

24. **Cover Verification and Closeout Approach, page 13, figure:** The figure nested in this page indicates the proposed approach anticipates generation of up to 6-inches of residuals. As discussed in previous comments, all efforts should be made to minimize generation of dredge residuals and this should be considered in future design documents.

25. **Cover Verification and Closeout Approach, page 13, 3rd paragraph:** The sentence that reads: "Finally as an added protective measure, NW Natural will place a third 6-inch layer of RMC following the completion of all construction seasons." should be revised in the final Memorandum to note that this is following completion of all dredging in all construction seasons.

26. **Cover Verification and Closeout Approach, Pre-Cover Verification Analysis, Cover Step 1, page 14:** The second sentence should be revised in the final Memorandum to note that the comparison to the RAO5 CUL Protective Threshold Concentration is only for the generated residuals.

    The evaluation of individual residual samples to identify additional measures should also include constructability considerations - for example if 4 out of 5 or 3 out of 5 of samples exceed the threshold, the additional measures may be applied to the entire DMU. Future design documents should include these considerations.

27. **Cover Verification and Closeout Approach, Pre-Cover Verification Analysis, Cover Step 4, page 14:** Verification is needed to confirm that the cover layer(s) are correctly placed. Future design documents should discuss how RMC thickness will be verified and that the resolution capabilities for the bathymetry equipment can achieve verification of a 6-inch RMC.

28. **Cover Verification and Closeout Approach, Initial-Cover Additional Measures Approach, page 15, 2nd paragraph:** NW Natural proposes that if PTW-NAPL is observed in missed inventory cores, this will trigger the need to incorporate amendments into the sand or cap materials. This appears to be inconsistent with the ROD, which states that NAPL should be dredged, "unless it is present below the feasible depth limit of excavation technology, in which case it will be capped..." Dredging PTW is also indicated in the ROD Figure 28, Technology Application Decision Tree. Future design documents should be consistent with the ROD.

29. **Long-Term Monitoring, page 16**: This section implies that following construction, evaluations of RAOs will rely on site-wide long-term monitoring and equivalency monitoring. For clarification, NW Natural should develop SMA-specific performance standards to demonstrate remedy effectiveness, particularly for capped portions of the site. Analyses should include ROD Table 17 constituents and key uplands Gasco COCs not included in ROD Table 17. These factors should be considered in future design documents.

30. **Figure 1:** The first additional measures under "Post-Dredge Step 3-5" should read "Dredge and Place 6-inch RMC Layer".

31. **Figure 1:** The first decision point for "Cover Step 1-2" should be revised in the final Memorandum to read, "Evaluate Dredge Residuals for initial RMC Layer: PTW-NAPL Observed or RAO 5 not Achieved?"

32. **Figure 2:** The Revised Post-Dredge Approach does not identify the sources and/or discuss the basis for the sampling locations shown in the figure. The Data Gaps Sampling Plan should fully document this information.

6720 SW Macadam Avenue, Suite 125
Portland, Oregon 97219
503.670.1108

ANCHOR QEA

Memorandum

September 28, 2018

To: Sean Sheldrake and Karl Gustavson, U.S. Environmental Protection Agency

From: Ryan Barth, PE, Anchor QEA, LLC

cc: Bob Wyatt, NW Natural
Patty Dost, Pearl Legal Group
Dana Bayuk, Oregon Department of Environmental Quality
Lance Peterson, CDM Smith
Paul Schroeder, U.S. Army Corps of Engineers
Myron Burr, Siltronic Corporation

Re: NW Natural Interpretations and Request for Clarifications – EPA Conditional Approval Proposed Post-Dredge and Post-Cover Verification and Closeout Approaches – Gasco Sediments Site

NW Natural submitted a memorandum entitled *NW Natural's Revised Gasco Sediments Site Dredge and Cover Design, Implementation, Verification, and Closeout Approach Memorandum* (Memorandum), dated July 24, 2018, and prepared by Anchor QEA, LLC. The Memorandum presents NW Natural's stepwise approach to determine how dredging and cover placement closeout will be field verified and deemed complete during construction of the in-water cleanup of the Gasco Sediments Site as well as a process to evaluate and manage generated dredge residuals. The Memorandum represents the culmination of numerous discussions between NW Natural, the U.S. Environmental Protection Agency (EPA), and its partners throughout 2018. EPA provided its *Conditional Approval of NW Natural's Revised Gasco Sediments Site Dredge and Cover Design, Implementation, Verification, and Closeout Approach* on September 21, 2018. The EPA conditional approval states that it contains two types of comments, "…those that need to be addressed in the final Memorandum and others which can be addressed in future documents." The conditional approval also states that "EPA believes the Memorandum, if revised as requested, will provide respondents with the certainty needed to move forward with the data gaps development for pre-design investigation activities while allowing for certain aspect of the approach (e.g. dredge management unit size, contaminant of concern drivers, and feasible laboratory turn-around-times, specific dredging equipment and best management practices used) to be further developed during the remedial design process."

The purposes of this memorandum are as follows: 1) confirm the EPA comments to be addressed in the final Memorandum; and 2) confirm our understanding of or seek clarification on several of those comments related to development of the comprehensive pre-design investigation data gaps sampling program. Upon EPA confirmation, NW Natural will finalize and submit the revised

Pre-Remedial Basis of Design Technical Evaluation Work Plan, which will include the final Memorandum as an appendix. Concurrently, NW Natural will work with EPA to further understand and reach a path-forward agreement on EPA's comments on the Memorandum regarding data gaps sampling. Following that agreement, NW Natural will schedule a technical briefing to summarize NW Natural's proposed comprehensive data gaps sampling approach.

The remainder of EPA's comments—those that can be addressed in future documents—will be discussed as necessary with EPA in the context of those future documents, including the data gaps sampling program.

Comments to be Addressed in Final Memorandum

NW Natural requests confirmation from EPA that the following comments are those that must be addressed in the final Memorandum: General Comment 4 and Specific Comments 1 through 5, 7, 9 through 15, 17 through 19, 23, 25 through 26, and 30 through 32.

Comment Interpretations and Clarifications

Please confirm our understanding of or provide clarification on the following specific comments.

Specific Comment 11: What is EPA's defined duration for "unacceptable exposure to and migration of residuals prior to placement of the first 6-inch RMC [residuals management cover] layer?" Based on discussions with Apex Laboratories, Inc., located out of Tigard, Oregon, we identified the following range of expedited laboratory turnaround times for the Record of Decision (ROD) Table 21 focused contaminants of concern (COCs): 2 to 3 days for polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), and pesticides and 4 to 5 days for dioxins/furans. Are these durations acceptable to EPA?

Specific Comment 12: NW Natural recognizes that there may be cores where the depth of contamination (DOC) cannot be determined "below the feasible depth limit of excavation technology" referenced in the ROD. Any contamination requiring cleanup deeper than the depth limit of excavation technology will require dredging followed by capping. The final Memorandum will be revised to more clearly state that any portion of the Project Area that is capped is not addressed by the Memorandum. Is this acceptable to EPA?

Specific Comment 17: We interpret "obvious signs of contamination" to mean principal threat waste—nonaqueous phase liquid (PTW-NAPL) using the Gasco Sediments Site-specific definition. Consistent with the comment, the current Memorandum requires subsampling of any PTW-NAPL observed throughout the full penetration depth of the missed inventory cores and analyzing for total PAHs in the discrete core interval (i.e., without compositing other consistent depth intervals below mudline within the dredge management unit as is performed for remedial action level exceedances). The final Memorandum will also be revised to include analyses of the PTW "Additional

Contaminants" identified in ROD Table 21. Please note the analytical turnaround times for these additional PTW contaminants (i.e., 2,3,7,8-TCDF and 1,2,3,4,6,7,8-HxCDF) typically range from 4 to 5 days, several days longer than total PAH analytical turnaround times. Consistent with the previous request for Specific Comment 11, please confirm whether these durations are acceptable to EPA. Consistent with the previous request for Specific Comment 11, please confirm whether these durations are acceptable to EPA. Consistent with the current Figure 1 decision tree in the Memorandum, the PTW-NAPL concentrations will be used to perform the missed inventory additional measures evaluation shown in Post-Dredge Steps 3 through 5 to determine whether to dredge and place a 6-inch RMC layer, cap, or place additional RMC thickness and/or reactive amendment. This menu of additional measures is consistent with the ROD, which states that "NAPL or PTW that cannot be reliably contained" will not be dredged "unless it is present below the feasible depth limit of excavation technology, in which case it will be capped." Is this acceptable to EPA?

Specific Comment 22: EPA commented, "Future design documents should also discuss how the dredge/cover verification and closeout approach will be modified in areas where extensive dredging is required." The currently proposed approach is applicable to cleanup using all available remedial technologies, including where extensive dredging is performed. Consistent with our interpretation of Specific Comment 12, if the DOC in an area with extensive dredging that is "below the feasible depth limit of excavation technology," than the area will be capped and the Memorandum approach is not applicable. Therefore, no modification to the approach is necessary where extensive dredging is performed. Is this acceptable to EPA?

Specific Comment 28: EPA commented that PTW-NAPL identified during missed inventory sampling should be dredged even though the referenced section is applicable to residuals sampling. NW Natural's interpretation for Specific Comment 17 regarding the collection of discrete PTW-NAPL sample concentrations and performance of the additional measures evaluation shown in Post-Dredge Steps 3 through 5 is applicable to both missed inventory and generated residuals sampling. Is this acceptable to EPA?

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 Sixth Avenue, Suite 900
Seattle, WA 98101-3140

OFFICE OF
ENVIRONMENTAL CLEANUP

October 22, 2018

Mr. Bob Wyatt
NW Natural
220 NW 2nd Avenue
Portland, Oregon 97209

sent via email only

Mr. Myron Burr
Siltronic Corporation
7200 NW Front Avenue, M/S 20
Portland, Oregon 97210-3676

Re: NW Natural Interpretations and Request for Clarifications – EPA Conditional Approval, Proposed Post-Dredge and Post-Cover Verification and Closeout Approaches – Gasco Sediments Site

Dear Sirs:

The Environmental Protection Agency (EPA) reviewed the memorandum titled *NW Natural Interpretations and Request for Clarifications – EPA Conditional Approval, Proposed Post-Dredge and Post-Cover Verification and Closeout Approaches – Gasco Sediments Site* (September Memorandum), dated September 28, 2018 and prepared by Anchor QEA on behalf of Northwest Natural (NW Natural).

The September Memorandum presents several questions regarding EPA's September 21, 2018 conditional approval letter of NW Natural's Revised Gasco Sediments Site Dredge and Cover Design, Implementation, Verification, and Closeout Approach. Specifically, the September Memorandum requests the following: 1) confirmation regarding the EPA comments to be addressed in the final *NW Natural's Revised Gasco Sediments Site Dredge and Cover Design, Implementation, Verification, and Closeout Approach Memorandum* (Memorandum) and 2) confirmation regarding NW Natural's understanding of or requested clarification on several of those comments related to development of the comprehensive pre-design investigation data gaps sampling program.

Comments to be Addressed in Final Memorandum

EPA requests the following comments be addressed in the final Memorandum: General Comment 4 and Specific Comments 1 through 4, 9 through 15, 18 and 19, 23, 25 and 26, and 30 and 31.

Comment Interpretations and Clarifications

Text requesting comment interpretations/clarifications in the September Memorandum is copied below followed by EPA's response.

Specific Comment 11: What is EPA's defined duration for "unacceptable exposure to and migration of residuals prior to placement of the first 6-inch RMC [residuals management cover]

layer?" Based on discussions with Apex Laboratories, Inc., located out of Tigard, Oregon, we identified the following range of expedited laboratory turnaround times for the Record of Decision (ROD) Table 21 focused contaminants of concern (COCs): 2 to 3 days for polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), and pesticides and 4 to 5 days for dioxins/furans. Are these durations acceptable to EPA?

EPA Response: *A turnaround time of 2 to 3 days for PAHs, PCBs and pesticides and 4 to 5 days for dioxins/furans is acceptable to EPA. As the the state of the art evolves, we of course will revisit this with the respondents, as needed.*

Specific Comment 12: NW Natural recognizes that there may be cores where the depth of contamination (DOC) cannot be determined "below the feasible depth limit of excavation technology" referenced in the ROD. Any contamination requiring cleanup deeper than the depth limit of excavation technology will require dredging followed by capping. The final Memorandum will be revised to more clearly state that any portion of the Project Area that is capped is not addressed by the Memorandum. Is this acceptable to EPA?

EPA Response: *EPA agrees that the Memorandum approach is not applicable to areas where capping is the selected remedy. In areas where contamination requiring cleanup is deeper than the depth limit of excavation, particularly areas where NAPL or PTW that cannot be reliably contained is present below the feasible dredging depth limit, the final Pre-Remedial Basis of Design Technical Evaluations Work Plan should identify the information that will be used to establish target dredging depths and to develop input parameters for cap design. In addition, consideration should be given to placement of an RMC layer to stabilize and cover the dredged surface prior to "capping" based on the timing of the work and/or the dredging occurring in surrounding DMUs.*

Specific Comment 17: We interpret "obvious signs of contamination" to mean principal threat waste—nonaqueous phase liquid (PTW-NAPL) using the Gasco Sediments Site-specific definition. Consistent with the comment, the current Memorandum requires subsampling of any PTW-NAPL observed throughout the full penetration depth of the missed inventory cores and analyzing for total PAHs in the discrete core interval (i.e., without compositing other consistent depth intervals below mudline within the dredge management unit as is performed for remedial action level exceedances). The final Memorandum will also be revised to include analyses of the PTW "Additional Contaminants" identified in ROD Table 21. Please note the analytical turnaround times for these additional PTW contaminants (i.e., 2,3,7,8-TCDF and 1,2,3,4,6,7,8-HxCDF) typically range from 4 to 5 days, several days longer than total PAH analytical turnaround times. Consistent with the previous request for Specific Comment 11, please confirm whether these durations are acceptable to EPA. Consistent with the previous request for Specific Comment 11, please confirm whether these durations are acceptable to EPA. Consistent with the current Figure 1 decision tree in the Memorandum, the PTW-NAPL concentrations will be used to perform the missed inventory additional measures evaluation shown in Post-Dredge Steps 3 through 5 to determine whether to dredge and place a 6-inch RMC layer, cap, or place additional RMC thickness and/or reactive amendment. This menu of additional measures is consistent with the ROD, which states that "NAPL or PTW that cannot be reliably contained" will not be dredged "unless it is present below the feasible depth limit of excavation technology, in which case it will be capped." Is this acceptable to EPA?

EPA Response: *Obvious signs of contamination include NAPL as defined by the site-specific definition and any visible observations of product (e.g. tar) and sheen. Core intervals showing such contamination should not be composited with the rest of the core as stated in NW Natural's*

response and should instead trigger discrete TPAH laboratory analysis. See EPA's response to Comment 11 regarding analytical turnaround times. However, to reduce the time that a DMU is open, the need to assess PTW/RAL exceedances of dioxins/furans in deeper core intervals may be evaluated based on the analytical results from samples obtained to implement the Pre-Remedial Design Data Gaps Work Plan and Sampling and Analysis Plan (Data Gaps Sampling Plan).

According to the ROD: "PTW was identified based on a 10^{-3} cancer risk (highly toxic) or NAPL within the sediment bed (source material) and on an evaluation of mobility of contaminants in the sediment." The definition provided in NW Natural's Statement of Work states that "PTW-NAPL will be defined as any layer or seam of product, regardless of thickness, that is clearly defined as liquid NAPL that is also mobile (i.e., "oozes" or "drips" out of the core during core observations)." Since these definitions are based on mobile NAPL, future design documents should clarify how an immobile deposit of tar will be addressed if encountered. EPA does not expect the definition of PTW-NAPL to be expanded, however, NW Natural should provide clarity on how the mobility of NAPL will be assessed.

Please note that the ROD states that: "NAPL or PTW that cannot be reliably contained ***will be*** *dredged unless it is present below the feasible depth limit of excavation technology, in which case it will be capped". This has been slightly mis-stated in NW Natural's response. If NAPL or PTW exists at depths that are not below depth limits of excavation technology, it will have to be dredged unless an obstruction prevents its removal.*

Specific Comment 22: EPA commented, "Future design documents should also discuss how the dredge/cover verification and closeout approach will be modified in areas where extensive dredging is required." The currently proposed approach is applicable to cleanup using all available remedial technologies, including where extensive dredging is performed. Consistent with our interpretation of Specific Comment 12, if the DOC in an area with extensive dredging that is "below the feasible depth limit of excavation technology," than the area will be capped and the Memorandum approach is not applicable. Therefore, no modification to the approach is necessary where extensive dredging is performed. Is this acceptable to EPA?

EPA Response: *EPA agrees that the Memorandum approach is not applicable to areas where capping is the selected remedy (see also EPA's Response to Comment 12).*

Specific Comment 28: EPA commented that PTW-NAPL identified during missed inventory sampling should be dredged even though the referenced section is applicable to residuals sampling. NW Natural's interpretation for Specific Comment 17 regarding the collection of discrete PTW-NAPL sample concentrations and performance of the additional measures evaluation shown in Post-Dredge Steps 3 through 5 is applicable to both missed inventory and generated residuals sampling. Is this acceptable to EPA?

EPA Response: *The response is acceptable to EPA. See also EPA's response to Specific Comment 17.*

EPA also provides clarification on the following comments from the September 21, 2018 Conditional Approval Memo:

> **General Comment 1, first bullet point: Pre-dredge SMA data gaps sampling design should produce a robust data set that maximizes the certainty that remedial action level (RAL) exceedance and principal threat waste (PTW) presence are delineated.** EPA's general impression of the Revised Post-Dredge Approach is that NW Natural is proposing a decision process that relies on substantial post-dredge data collection and analysis, and multiple iterative steps. EPA agrees that the revised Memorandum

indicates that advancing cores every 100 feet during pre-design sampling may be an appropriate rule-of-thumb for data density. However, this may be refined following further analyses and the actual density of data gaps samples, including location and depth interval. Sampling density should be developed using an appropriate three-dimensional model of existing data that evaluates SMA and contaminant of concern (COC)-specific heterogeneity; identifies sample locations needed to delineate the margins of the three-dimensional (3-D) dredge prism; and establishes the basis for dredge design elevations throughout the SMA. Please note, EPA also requests more information on how vertical delineation will be accomplished.

EPA Clarification: *Application of a three-dimensional model can be performed after data agreed to in the Data Gaps Sampling Plan are collected.*

Specific Comment 6 (c): The number and depth of cores collected during the pre-design sediment characterization should be sufficient to delineate a 3D dredge prism, establish the DOC for removal, and identify the basis for identifying target dredge elevations with an appropriate level of confidence. Given the majority of the existing sediment cores within the 14.5-acre dredging footprint have RAL exceedances or PTW-NAPL in the bottom sampled depth (i.e., DOC is unbounded at most core locations), the depth of coring will be an especially important factor in developing the pre-design data gaps sampling scope of work. Based on this information, if the intent of the effort is to define the DOC, the projected depth of pre-design cores and sample collection (20-feet below mudline) will likely need to be extended downward to meet project needs.

EPA Clarification: *EPA requires cores to be advanced to depth of contamination (DOC), but given the high density proposed, EPA may accept a subset of cores that go well beyond the 20-foot range. The Data Gaps Sampling Plan should identify the locations of the subset of cores deeper than 20-feet.*

General Comment 1, third bullet point: Gasco SMA remedy design should address key Gasco upland COCs in addition to Portland Harbor Record of Decision (ROD) Table 17 constituents. Inclusion of uplands Gasco COCs in the planning process should be done to ensure the remedy design fully addresses site-specific contamination within the SMA. The assertion that total polycyclic aromatic hydrocarbons (TPAHs) are the primary COC will need verification after completion of pre-design sampling work. In addition, all Table 17 constituents will need to be evaluated for any cap modeling and design.

Specific Comment 6 (d): In terms of contamination, EPA expects the Data Gaps Sampling Plan scope of work to include sampling and analysis of Gasco upland COCs and that this data be used to inform evaluations of the 3-D dredge prism. EPA acknowledges that the upland and sediment remedies cannot be combined because the current schedule shows upland remedy implementation occurring after the in-water remedy; however, care should be taken to ensure that the shared objectives of both EPA and the Oregon Department of Environmental Quality are being met.

Specific Comment 29: This section implies that following construction, evaluations of RAOs will rely on site-wide long-term monitoring and equivalency monitoring. For clarification, NW Natural should develop SMA-specific performance standards to demonstrate remedy effectiveness, particularly for capped portions of the site. Analyses should include ROD Table 17 constituents and key uplands Gasco COCs not included in ROD Table 17. These factors should be considered in future design documents.

EPA Clarification: *The request for Gasco COCs is a courtesy request for efficiency on behalf of DEQ and if NW Natural does not collect this information under EPA efforts DEQ may require NW Natural to collect that data independently. EPA and DEQ can discuss with NW Natural the approach for incorporating uplands COCs into sediment remedy planning and design, if needed.*

Please let me know if you have any questions or concerns at (206) 553-1220 or via email at sheldrake.sean@epa.gov.

Sincerely,

Sean Sheldrake, RPM

Cc: Dana Bayuk, DEQ *via email only*
Lance Peterson, CDM
TCT

From:	Sheldrake, Sean
To:	Jen Mott; Patricia Dost; Ryan Barth; Bob Wyatt
Cc:	liverman.alex@deq.state.or.us; Dana Bayuk; brandy.humphreys@grandronde.org; callie@ridolfi.com; Scott Coffey; Cora, Lori; Courtney Johnson (courtney@crag.org); Zhen, Davis; Deirdre F. Donahue (deirdre.donahue@sol.doi.gov); dexb@yakamafish-nsn.gov; Ebright, Stephanie; DeMaria, Eva; Gail Fricano (gfricano@indecon.com); Genevieve Angle - NOAA-NMFS (Genevieve.Angle@noaa.gov); Gustavson, Karl; holly.partridge@grandronde.org; Young, Hunter; jennifer.graham@ctwsbnr.org; Jennifer Hart (jhart@indecon.com); Jeremy_Buck@fws.gov; Joe Pitt (joepitt@ctuir.org); Clark, Josie; jweis@hk-law.com; Kevin Parrett; Knudsen, Laura; kristin@ridolfi.com; Peterson, Lance; shil@yakamafish-nsn.gov; Madi Novak (novak.madi@deq.state.or.us); Mairs, Stephanie; Matt Johnson - JD Law Umatilla rep. (MatthewJohnson@ctuir.org); mcclincy.matt@deq.state.or.us; tosm@yakamafish-nsn.gov; Michael.karnosh@grandronde.org; Michel L. Wigney (MLW@karnopp.com); NaomiStacy@ctuir.org; paul.seidel@state.or.us; Rachel DelVecchio (rdelvecchio@indecon.com); rcabral@indecon.com; Robert Brunoe (robert.brunoe@ctwsbnr.org); Robert.Neely@noaa.gov; rose@yakamafish-nsn.gov; greenfield.sarah@deq.state.or.us; SCHATZ Jeff; Sean Sheldrake; Skadowski, Suzanne; Buerger, Ted; tomd@ctsi.nsn.us; David.Rabbino@jordanramis.com; mmurray@maulfoster.com; myron.burr@siltronic.com
Subject:	FW: [External]Data gaps meeting gasco sf2
Date:	Tuesday, October 30, 2018 1:31:37 PM
Attachments:	Fig_4_Gasco Sediments Post-Dredge_Cover Memo_07-24-2018.pdf

Hello Bob, the EPA has reviewed your email and agrees with the clarification provided for Specific Comment 6(c).

Regarding the first bullet provided for the Specific Comment 17 clarification, EPA seeks confirmation and clarification on a couple items. We understand NW Natural is not proposing to collect and analyze samples of tar using the same approach as for NAPL ("…observations of NAPL at any depth in any missed inventory core automatically triggers discrete sampling in the 6-inch interval containing the NAPL."). For tar NW Natural indicates that, "We agree if tar is visually observed within the interval of a core being composited for laboratory analysis that we will split the sample from that core. One split will be composited with the other samples from that interval for the DMU, and the other split will be analyzed discretely." Based on Figure 4 of the July 24, 2018 version of the Memorandum (see attached), please confirm you are agreeing to the following:

- If tar is observed in one or both of the two 6-inch intervals of the core beneath the residuals layer, tar-containing intervals will be split with half going into the composite of same intervals within the DMU, and half being analyzed separately.
- The 1st bullet above applies to the next 6-inch interval (i.e. the 18"-24" interval) if analytical results from the 12"-18" interval indicate further testing is necessary (i.e. there is a RAL exceedance) and so on successively for deeper 6-inch intervals until there is no RAL exceedance.
- If either the DMU composite or the interval analyzed separately exceed RALs, the remedial design will include an approach for addressing the situation consistent with the Final Memorandum.

If this understanding is correct, EPA concurs with this approach with the clarification that NW Natural should account for the tar-containing split sample in the composite sample results. For example, the results would be biased low if there were 3 cores in a DMU and only one of the 6-inch intervals contained tar. In this case half the core interval with tar will be removed for discrete analysis which will lead to biasing the composite sample result on the low side.

Regarding the second bullet provided for the Specific Comment 17 clarification, EPA agrees with the plan to not collect discrete samples of sheen for analysis; however, we disagree that sheen is not an indicator of site contamination. Overall, observations of sheen in sediments offshore of Gasco can be attributed to MGP contamination. This is consistent with DEQ's uplands determinations.

Let me know if you have any questions, and hopefully we can move forward to planning a data gaps

presentation soon. I have time 11/15 (Wednesday), if that works for your team.

Thank you.

S

Sean Sheldrake RPM, Unit Diver Officer
U.S. Environmental Protection Agency
1200 Sixth Avenue, Suite 155, M/S DOC-01
Seattle, WA 98101
206.553.1220 desk
206.225.6528 cell
https://www.epa.gov/scientific-diving
https://www.facebook.com/EPADivers
https://www.epa.gov/superfund/portland-harbor

From: Wyatt, Robert <rjw@nwnatural.com>
Sent: Thursday, October 25, 2018 12:46 AM
To: Sheldrake, Sean <sheldrake.sean@epa.gov>
Cc: rbarth@anchorqea.com; jmott@anchorqea.com; Peterson, Lance <PetersonLE@cdmsmith.com>; dana.bayuk@state.or.us
Subject: Re: [External]Data gaps meeting gasco sf

Thanks very much for following up, Sean.

We are looking forward to being able to prepare for the data gaps meeting, and getting it scheduled. We just completed our review of your team's responses to our requested clarifications and interpretations on EPA's conditional approval letter. There are only a couple of remaining issues we need resolved in order to develop our data gaps technical briefing materials. Once these are resolved we can evaluate how much time we will need to develop the data gaps materials and be able to schedule the meeting. We are excited to be close to an end on this memo and being able to move into the pre-remedial design characterization phase of the project.

Your conditional approval letter was broken up into two parts: a summary of the comments that need to be addressed in the Final Post-Dredge/Cover Verification and Closeout Approach Memorandum (Memorandum) and responses to NW Natural's comment interpretations and clarifications. We agree with the identified comments that need to be addressed in the Final Memorandum and your responses to Specific Comments 11, 12, 22, and 28. We also appreciate and agree with your additional provided clarifications on General Comment 1 and Specific Comments 6(d) and 29. The only remaining issues we seek to resolve are associated with your responses to Specific Comment 17 and clarification on Specific Comment 6(c):

- **Specific Comment 6(c)**: We understand the intent of your comment regarding the collection

of deeper cores. We believe a phased data collection approach (e.g., the collection of initial 20-foot cores followed the determination of the potential need for deeper cores based on the 20-foot core data) is the most efficient means to address this clarification. We propose to include a stepwise decision framework in the Data Gaps Work Plan and SAP that will determine when and where additional cores may be required to support the remedial design process (e.g. capping demonstrations).

- **Specific Comment 17**: The only portion of this comment that requires resolution is the required discrete sampling within missed inventory core intervals if "NAPL as defined by the site-specific definition and any visible observations of product (e.g. tar) and sheen" is visually observed. There are two parts of this comment that we'd like to clarify:
    - First, the missed inventory samples will be collected in the stepwise sequence identified in the Memorandum. As previously discussed, these samples will be composited for each DMU. Your response incorporates an additional requirement for individual sample analyses if we identify observations of tar and sheen. NAPL is already addressed in the Memorandum, because observations of NAPL at any depth in any missed inventory core automatically triggers discrete sampling in the 6-inch interval containing the NAPL. We agree that if tar is visually observed within the interval of a core being composited for laboratory analysis that we will split the sample from that core. One split will be composited with the other samples from that interval for the DMU, and the other split will be analyzed discretely. If the composite or discrete sample exceed the RALs, the remedial design will include the evaluation framework to determine any appropriate additional measures, consistent with the current Memorandum.
    - Second, we do not believe it is appropriate to also include observations of sheen as a trigger for discrete sampling because sheens are not an indicator of elevated contamination or sources from the site (e.g., wood degradation sheens have been identified in sediments at the site).

We also want you to know that, consistent with your responses to Specific Comment 17 which support reducing the time a DMU is maintained open prior to placement of residual management cover, we agree to evaluate the results of the dioxin/furan results collected as part of our pre-design characterization to determine whether these chemicals should be analyzed in the missed inventory cores. In addition, we agree that our design documents will discuss how any identified immobile deposit of tar will be addressed if encountered. Lastly, we understand the intent of the last portion of the comment regarding dredging of PTW-NAPL and note that the requirement to dredge is governed by the ROD technology application decision tree, which also allows capping under some conditions (e.g., under functional structures and where the PTW-NAPL can be reliably contained).

Pleaselet us know if you agree with these clarifications and agreements or if you'd like to discuss any of them further.

Thanks again,

Bob

From: Sheldrake, Sean <sheldrake.sean@epa.gov>
Sent: Wednesday, October 24, 2018 2:19 PM
To: Wyatt, Robert
Cc: rbarth@anchorqea.com; jmott@anchorqea.com; Peterson, Lance; dana.bayuk@state.or.us
Subject: [External]Data gaps meeting gasco sf

Hello Bob, what are your thoughts on meeting dates to follow up on data gaps?

Thanks
S

Sean Sheldrake, RPM
Unit Diving Officer
206.225.6528
Sent from my iPhone

Sample Type	Sampling Sequence	Objective	Analytes	Verification Metric	Spatial	Additional Measures
	1	Support Initial RMC Layer Placement	TPAH[7]	Less Than 920,000 ppb TPAH	DMU Composite[6]	Revisions to First 6-inch Layer of RMC Thickness or Incorporate Amendment[5]
Core	1	Subsurface Sediments Missed Inventory Verification	TPAHs[7]	Less Than RAL	DMU Composite[6]	To Be Determined Based On Site-Specific Remedial Design Evaluations[4]
	1					
	2 (archive)					
	3 (archive)					
	4 (archive)					
	5 (archive)					
	6 (archive)					

[1]Residuals thickness not shown to scale with other thicknesses.
[2]Assumed operational definition of residuals thickness is 6 inches below the mudline interface consistent with the Fox River Superfund Site. NW Natural will perform periodic field monitoring of the encountered generated residuals thickness to inform whether the operational definition is appropriate.
[3]Core collected to approximately 6 feet below the post-dredge surface.
[4]Additional measures may include a single additional dredge pass.
[5]Additional measures will not include additional dredging.
[6]All cores within a DMU will be composited for the intervals shown in the sampling sequence.
[7]Analytes will be limited to TPAHs dependent on multiple lines of evidence evaluation using complete data set. Otherwise, the full focused COCs will be analyzed.

Filepath: \\fuji\anchor\Projects\NW Natural\Gasco\Sediments\Sediments New Action\New Early Action Eval\Pre-design Evaluations\Residuals Analysis\Post-Dredge_Cover Memo_April 2018\Revised July 2018 Memo\Figures\Figure 4.docxMarketing\BusinessDevelopment\Miscellaneous\2018\GascoPostDredgeVerificationTablesandOblique

ANCHOR QEA

Figure 4
Post-Dredge Missed Inventory Field Verification Framework
Gasco Sediments Site Post-Dredge and Cover Verification and Closeout Approach
Gasco Sediments Cleanup Action

From:	Wyatt, Robert
To:	Sean Sheldrake; Jen Mott; Patricia Dost; Ryan Barth
Cc:	liverman.alex@deq.state.or.us; Dana Bayuk; brandy.humphreys@grandronde.org; callie@ridolfi.com; Scott Coffey; Cora, Lori; Courtney Johnson (courtney@crag.org); Zhen, Davis; Deirdre F. Donahue (deirdre.donahue@sol.doi.gov); dexb@yakamafish-nsn.gov; Ebright, Stephanie; DeMaria, Eva; Gail Fricano (gfricano@indecon.com); Genevieve Angle - NOAA-NMFS (Genevieve.Angle@noaa.gov); Gustavson, Karl; holly.partridge@grandronde.org; Young, Hunter; jennifer.graham@ctwsbnr.org; Jennifer Hart (jhart@indecon.com); Jeremy_Buck@fws.gov; Joe Pitt (joepitt@ctuir.org); Clark, Josie; jweis@hk-law.com; Kevin Parrett; Knudsen, Laura; kristin@ridolfi.com; Peterson, Lance; shil@yakamafish-nsn.gov; Madi Novak (novak.madi@deq.state.or.us); Mairs, Stephanie; Matt Johnson - JD Law Umatilla rep. (MatthewJohnson@ctuir.org); mcclincy.matt@deq.state.or.us; tosm@yakamafish-nsn.gov; Michael.karnosh@grandronde.org; Michel L. Wigney (MLW@karnopp.com); NaomiStacy@ctuir.org; paul.seidel@state.or.us; Rachel DelVecchio (rdelvecchio@indecon.com); rcabral@indecon.com; Robert Brunoe (robert.brunoe@ctwsbnr.org); Robert.Neely@noaa.gov; rose@yakamafish-nsn.gov; greenfield.sarah@deq.state.or.us; SCHATZ Jeff; Skadowski, Suzanne; Buerger, Ted; tomd@ctsi.nsn.us; David.Rabbino@jordanramis.com; mmurray@maulfoster.com; myron.burr@siltronic.com
Subject:	Re: [External]Data gaps meeting gasco sf2
Date:	Wednesday, October 31, 2018 1:08:46 PM

Thank you, Sean.

We agree with your understanding of the first bullet of our Specific Comment 17 clarifications, and appreciate EPA's agreement that discrete samples of intervals with sheen do not need to be collected for analysis. With closure of these last issues on the Post-Dredge Approach memo we can complete our work on the data gaps design materials for our next meeting.

We understand the date your team is available for the roll out is November 27th. That works for our team, although we were really hoping to meet sooner than that. I will ask Jen to coordinate with you to see if there might be an option for us to meet sooner.

Bob

From: Sheldrake, Sean <sheldrake.sean@epa.gov>
Sent: Tuesday, October 30, 2018 10:30 AM
To: jmott@anchorqea.com; pdost@pearllegalgroup.com; rbarth@anchorenv.com; Wyatt, Robert
Cc: liverman.alex@deq.state.or.us; bayuk.dana@deq.state.or.us; brandy.humphreys@grandronde.org; callie@ridolfi.com; Scott Coffey; Cora, Lori; Courtney Johnson (courtney@crag.org); Zhen, Davis; Deirdre F. Donahue (deirdre.donahue@sol.doi.gov); dexb@yakamafish-nsn.gov; Ebright, Stephanie; DeMaria, Eva; Gail Fricano (gfricano@indecon.com); Genevieve Angle - NOAA-NMFS (Genevieve.Angle@noaa.gov); Gustavson, Karl; holly.partridge@grandronde.org; Young, Hunter; jennifer.graham@ctwsbnr.org; Jennifer Hart (jhart@indecon.com); Jeremy_Buck@fws.gov; Joe Pitt (joepitt@ctuir.org); Clark, Josie; jweis@hk-law.com; Kevin Parrett; Knudsen, Laura; kristin@ridolfi.com; Peterson, Lance; shil@yakamafish-nsn.gov; Madi Novak (novak.madi@deq.state.or.us); Mairs, Stephanie; Matt Johnson - JD Law Umatilla rep. (MatthewJohnson@ctuir.org); mcclincy.matt@deq.state.or.us; tosm@yakamafish-nsn.gov; Michael.karnosh@grandronde.org; Michel L. Wigney (MLW@karnopp.com); NaomiStacy@ctuir.org; paul.seidel@state.or.us; Rachel DelVecchio (rdelvecchio@indecon.com); rcabral@indecon.com; Robert Brunoe (robert.brunoe@ctwsbnr.org); Robert.Neely@noaa.gov; rose@yakamafish-nsn.gov; greenfield.sarah@deq.state.or.us; SCHATZ Jeff; Sheldrake, Sean;

Skadowski, Suzanne; Buerger, Ted; tomd@ctsi.nsn.us; David.Rabbino@jordanramis.com; mmurray@maulfoster.com; myron.burr@siltronic.com
Subject: FW: [External]Data gaps meeting gasco sf2

Hello Bob, the EPA has reviewed your email and agrees with the clarification provided for Specific Comment 6(c).

Regarding the first bullet provided for the Specific Comment 17 clarification, EPA seeks confirmation and clarification on a couple items. We understand NW Natural is not proposing to collect and analyze samples of tar using the same approach as for NAPL ("…observations of NAPL at any depth in any missed inventory core automatically triggers discrete sampling in the 6-inch interval containing the NAPL."). For tar NW Natural indicates that, "We agree if tar is visually observed within the interval of a core being composited for laboratory analysis that we will split the sample from that core. One split will be composited with the other samples from that interval for the DMU, and the other split will be analyzed discretely." Based on Figure 4 of the July 24, 2018 version of the Memorandum (see attached), please confirm you are agreeing to the following:

- If tar is observed in one or both of the two 6-inch intervals of the core beneath the residuals layer, tar-containing intervals will be split with half going into the composite of same intervals within the DMU, and half being analyzed separately.
- The 1st bullet above applies to the next 6-inch interval (i.e. the 18"-24" interval) if analytical results from the 12"-18" interval indicate further testing is necessary (i.e. there is a RAL exceedance) and so on successively for deeper 6-inch intervals until there is no RAL exceedance.
- If either the DMU composite or the interval analyzed separately exceed RALs, the remedial design will include an approach for addressing the situation consistent with the Final Memorandum.

If this understanding is correct, EPA concurs with this approach with the clarification that NW Natural should account for the tar-containing split sample in the composite sample results. For example, the results would be biased low if there were 3 cores in a DMU and only one of the 6-inch intervals contained tar. In this case half the core interval with tar will be removed for discrete analysis which will lead to biasing the composite sample result on the low side.

Regarding the second bullet provided for the Specific Comment 17 clarification, EPA agrees with the plan to not collect discrete samples of sheen for analysis; however, we disagree that sheen is not an indicator of site contamination. Overall, observations of sheen in sediments offshore of Gasco can be attributed to MGP contamination. This is consistent with DEQ's uplands determinations.

Let me know if you have any questions, and hopefully we can move forward to planning a data gaps presentation soon. I have time 11/15 (Wednesday), if that works for your team.

Thank you.

S

Sean Sheldrake RPM, Unit Diver Officer

U.S. Environmental Protection Agency
1200 Sixth Avenue, Suite 155, M/S DOC-01
Seattle, WA 98101
206.553.1220 desk
206.225.6528 cell
https://www.epa.gov/scientific-diving
https://www.facebook.com/EPADivers
https://www.epa.gov/superfund/portland-harbor

From: Wyatt, Robert <rjw@nwnatural.com>
Sent: Thursday, October 25, 2018 12:46 AM
To: Sheldrake, Sean <sheldrake.sean@epa.gov>
Cc: rbarth@anchorqea.com; jmott@anchorqea.com; Peterson, Lance <PetersonLE@cdmsmith.com>; dana.bayuk@state.or.us
Subject: Re: [External]Data gaps meeting gasco sf

Thanks very much for following up, Sean.

We are looking forward to being able to prepare for the data gaps meeting, and getting it scheduled. We just completed our review of your team's responses to our requested clarifications and interpretations on EPA's conditional approval letter. There are only a couple of remaining issues we need resolved in order to develop our data gaps technical briefing materials. Once these are resolved we can evaluate how much time we will need to develop the data gaps materials and be able to schedule the meeting. We are excited to be close to an end on this memo and being able to move into the pre-remedial design characterization phase of the project.

Your conditional approval letter was broken up into two parts: a summary of the comments that need to be addressed in the Final Post-Dredge/Cover Verification and Closeout Approach Memorandum (Memorandum) and responses to NW Natural's comment interpretations and clarifications. We agree with the identified comments that need to be addressed in the Final Memorandum and your responses to Specific Comments 11, 12, 22, and 28. We also appreciate and agree with your additional provided clarifications on General Comment 1 and Specific Comments 6(d) and 29. The only remaining issues we seek to resolve are associated with your responses to Specific Comment 17 and clarification on Specific Comment 6(c):

- **Specific Comment 6(c)**: We understand the intent of your comment regarding the collection of deeper cores. We believe a phased data collection approach (e.g., the collection of initial 20-foot cores followed the determination of the potential need for deeper cores based on the 20-foot core data) is the most efficient means to address this clarification. We propose to include a stepwise decision framework in the Data Gaps Work Plan and SAP that will determine when and where additional cores may be required to support the remedial design process (e.g. capping demonstrations).

- **Specific Comment 17**: The only portion of this comment that requires resolution is the

required discrete sampling within missed inventory core intervals if "NAPL as defined by the site-specific definition and any visible observations of product (e.g. tar) and sheen" is visually observed. There are two parts of this comment that we'd like to clarify:

- First, the missed inventory samples will be collected in the stepwise sequence identified in the Memorandum. As previously discussed, these samples will be composited for each DMU. Your response incorporates an additional requirement for individual sample analyses if we identify observations of tar and sheen. NAPL is already addressed in the Memorandum, because observations of NAPL at any depth in any missed inventory core automatically triggers discrete sampling in the 6-inch interval containing the NAPL. We agree that if tar is visually observed within the interval of a core being composited for laboratory analysis that we will split the sample from that core. One split will be composited with the other samples from that interval for the DMU, and the other split will be analyzed discretely. If the composite or discrete sample exceed the RALs, the remedial design will include the evaluation framework to determine any appropriate additional measures, consistent with the current Memorandum.
- Second, we do not believe it is appropriate to also include observations of sheen as a trigger for discrete sampling because sheens are not an indicator of elevated contamination or sources from the site (e.g., wood degradation sheens have been identified in sediments at the site).

We also want you to know that, consistent with your responses to Specific Comment 17 which support reducing the time a DMU is maintained open prior to placement of residual management cover, we agree to evaluate the results of the dioxin/furan results collected as part of our pre-design characterization to determine whether these chemicals should be analyzed in the missed inventory cores. In addition, we agree that our design documents will discuss how any identified immobile deposit of tar will be addressed if encountered. Lastly, we understand the intent of the last portion of the comment regarding dredging of PTW-NAPL and note that the requirement to dredge is governed by the ROD technology application decision tree, which also allows capping under some conditions (e.g., under functional structures and where the PTW-NAPL can be reliably contained).

Pleaselet us know if you agree with these clarifications and agreements or if you'd like to discuss any of them further.

Thanks again,

Bob

From: Sheldrake, Sean <sheldrake.sean@epa.gov>
Sent: Wednesday, October 24, 2018 2:19 PM
To: Wyatt, Robert
Cc: rbarth@anchorqea.com; jmott@anchorqea.com; Peterson, Lance; dana.bayuk@state.or.us
Subject: [External]Data gaps meeting gasco sf

Hello Bob, what are your thoughts on meeting dates to follow up on data gaps?

Thanks
S
Sean Sheldrake, RPM
Unit Diving Officer
206.225.6528
Sent from my iPhone