U.S. Army Corps of Engineers
Walla Walla District

Lower Snake River Programmatic Sediment Management Plan, Final Environmental Impact Statement

Appendix J - Current Immediate Need Navigation Maintenance Monitoring Plan

August 2014

CONTENTS

FIGURES

1 INTRODUCTION

The Walla Walla District of the U.S. Army Corps of Engineers (Corps) proposes to perform federal navigation channel maintenance dredging at two locations and ancillary/related port berthing maintenance dredging at two locations in the lower Snake River and lower Clearwater River in Washington and Idaho. The dredging would occur during the winter in-water work window, which is currently identified as December 15 through March 1, in the first window available following completion of the Lower Snake River Programmatic Sediment Management Plan Environmental Impact Statement (PSMP EIS). This action is consistent with the preferred alternative described in the PSMP EIS. The purpose of the federal channel maintenance activities is to re-establish the congressionally-authorized dimensions of the navigation channel. Dredging would occur in the federal navigation channel at the confluence of the Snake and Clearwater Rivers and at the downstream approach to the Ice Harbor Dam navigation lock. The proposed dredging also includes ancillary/related maintenance actions by the Ports of Lewiston and Clarkston to restore the dimensions of berthing areas adjacent to the federal navigation channel in Lower Granite reservoir. The Ports are responsible for maintaining their respective berthing areas.
The Ports and Corps have signed an agreement under which the Corps would include the Ports ancillary/related berthing area maintenance dredging and disposal in the Corps' federal navigation channel maintenance dredging contract, pending completion of environmental reviews. The proposed disposal for all four dredging areas would be in-water on a mid-depth underwater bench immediately upstream of Knoxway Canyon at river mile (RM) 116 in Lower Granite reservoir. The dredged material would be used to create shallow-water rearing habitat for juvenile salmonids.

This monitoring plan for the maintenance dredging evaluates several issues associated with the proposed dredging and disposal. These issues include water quality, biological impacts, and structural stability of the disposed material. The Corps has consulted with National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS) in recent years to assess potential impacts of dredging and disposal on fish use [Endangered Species Act (ESA)-listed salmonids and bull trout in particular] in the lower Snake and Clearwater Rivers, and this plan addresses those issues as well. This plan includes water quality monitoring that has been historically required for maintenance dredging projects in the lower Snake River as well as addressing concerns raised in previous ESA consultations. These concerns include viability of fish habitat and stability of the disposal embankment. Additional monitoring requirements may be identified in the Section 401 Water Quality Certification the Corps is requesting from Washington Department of Ecology, the short term activity exemption the Corps is requesting from Idaho Department of Environmental Quality, and the ESA consultation the Corps is currently performing with NMFS and USFWS. These more specific requirements would be incorporated into any future work plans of contracts associated with the dredging and disposal project.

This monitoring plan describes monitoring activities conducted during three different time periods: pre-dredging, during dredging and disposal, and post-dredging and disposal. Some of the monitoring has already occurred and was used to plan the proposed dredging and disposal activities. Some monitoring would occur within the 10 years following final shaping of the disposal site. The Corps intends to issue one or more reports presenting the results of the monitoring. All the Corps' monitoring activities described in this plan may be conducted either by the Corps or its contractors, based on the availability of funds.

2 PURPOSE

The purpose of the monitoring of the dredging and disposal is to:

- Address concerns and comply with the terms and conditions related to ESA consultation with NMFS and USFWS and their respective Biological Opinions for the current immediate need maintenance dredging action.
- Comply with the terms and conditions of the Clean Water Act, Section 401 Water Quality Certification that the Corps is requesting from Washington Department of Ecology, as well as the short term activity exemption the Corps is requesting from Idaho Department of Environmental Quality.
- Gather information for adaptive management in planning any future dredging and disposal activities, and for mainstem habitat-related activities.

3 MONITORING

3.1 Pre-dredging

The Corps identified a need to perform biological monitoring prior to the start of any dredging or disposal activities. Some of this monitoring has already occurred and was used in designing the proposed dredging and disposal activities. Some of the monitoring would not occur until shortly before dredging begins. Descriptions of these monitoring efforts are below.

3.1.1 Redd Surveys

The Corps would perform redd surveys within the total boundary of the proposed dredging template for Ice Harbor navigation lock approach in the fall (November through mid-December) just prior to dredging to determine if any fall Chinook (*Oncorhynchus tshawytscha*) spawning has occurred in the navigation lock approach. Threatened Snake River fall Chinook salmon are known to spawn in the mainstem river using the type of cobble and large gravel substrate routinely found in dam tailwaters when other appropriate conditions are available. Following a thorough literature review and decades of experience surveying redds in the productive Hanford Reach of the Columbia River, Dauble et al. (1994) defined preferred ocean-type (sub-yearling) or fall Chinook salmon spawning criteria as:

- 0-25 feet depth,
- 0-20 degrees slope,
- unconsolidated large gravel, cobble, or boulder substrate,
- 2-6 feet per second water velocities.

Upon further study of refining preferred salmon spawning habitat criteria for use in predictive habitat models used for larger mainstem river reaches, Dauble et al. (2003) included hyporheic upwelling flow as an important correlative criteria required for successful redd production and increasing the probability of researchers locating redd aggregations. Fall Chinook usually spawn in the Snake River in late-November and early December. Redd surveys have been performed several times since 1993 in the tailwaters of lower Snake River dams proposed for dredging.

In 1993, the first year in which comprehensive surveys were conducted, a total of 18 redds were found, accounting for approximately 7.5% of all redds found in the Snake River basin. Additional surveys were conducted at Lower Granite and Lower Monumental dams in association with in-river dredging in 2002, 2004, and 2005 (Mueller 2003, 2006; Mueller and Duberstein 2005). These surveys were limited to only likely spawning regions (e.g., near the fish return outfall pipes) and resulted in the finding of a single redd downstream of the fish return outfall pipe at Lower Granite Dam in 2004 (Mueller and Duberstein 2005).

Dauble et al. (1994, 1995) found that while suitable spawning habitat criteria does not occur downriver of the navigation locks at Lower Granite and Lower Monumental dams, such criteria does occur downriver of the navigation locks at Little Goose and Ice Harbor dams. Mueller and Coleman (2007, 2008) and Mueller 2009 found potentially suitable spawning substrate within the immediate vicinity of proposed template at Ice Harbor Dam. However, based on the multiple years of surveys, no redds have been found within the navigation lock approaches of any of the lower Snake River projects since surveys began in 1993.

Starting in 2006, USACE Walla Walla District conducted a three year study to determine if fall Chinook salmon spawn within the immediate tailrace regions of Lower Granite, Little Goose, Lower Monumental, and Ice Harbor dams as part of developing the PSMP for the lower Snake River. As part of this comprehensive evaluation, zones were established downstream of all four lower Snake River dams in which habitat criteria met the requirements for fall Chinook salmon spawning (Mueller and Coleman 2007, 2008; Mueller 2009). In 2006, Mueller and Coleman (2007) confirmed one redd in the tailwaters below Lower Granite Dam and two redds in the tailwaters below Little Goose Dam during comprehensive deepwater video surveys. In 2007, six redds were found in the tailrace regions of two of the four dams—four at Lower Granite Dam and two at Ice Harbor Dam (Mueller and Coleman 2008). In 2008, surveys showed a total of 15 redds in the tailrace regions of two of the four dams – eight redds downstream of Lower Granite Dam; seven redds in the tailrace region of Lower Monumental Dam (Mueller 2009).

Since potential spawning habitat exists within the footprint of the proposed dredging area of the Ice Harbor Dam tailrace, the proposed action may have the potential to disturb and/or harm eggs and alevins in redds if found to be present immediately prior to or during the proposed dredging activities. In an effort to avoid disturbing or harming fall Chinook redds, the Corps would conduct underwater surveys of the proposed dredging site at the Ice Harbor navigation lock in November and the first 2 weeks of December prior to commencing dredging. Techniques similar to those used by Battelle from 1993 to 2008 (Dauble et al. 1994-1998; Mueller 2005, 2009; Mueller and Coleman 2007, 2008) would be employed. This technique has used a combination of a boat mounted underwater video camera tracking system to look at the bottom of the river to identify redds. On at least 2 separate sampling periods (one in November when spawning activity is active and one in December when spawning activity is complete or near-complete), a one-pass search pattern would be conducted throughout a consistent transecting grid of the navigation lock approach template using a systematic tracking method employing a Global Positioning System (GPS) to determine both location of the redds on the river bottom and the position of the boat as it navigated through its search pattern. Results of the surveys would be transferred to the Corps within 2 days of the survey dates for compilation prior to December 15, at which time the Corps can communicate results to NMFS for appropriate action. If no redds are located, then the Corps would proceed with proposed dredging within the boundaries of the surveyed template. If one or more redds are located within the proposed dredging template and such redds are verified with video, the Corps would coordinate with NMFS to determine the appropriate avoidance and protection actions to take prior to dredging the affected location.

3.1.2 Rearing Habitat and Site Use Surveys

The Corps has conducted multiple years of biological surveys within the lower Snake River including at the proposed RM 116 disposal site to determine current usage by juvenile salmonids, potential usage as rearing habitat by fall Chinook, and the efficacy of in-water disposal of dredged material for creating juvenile fall Chinook resting and rearing habitat in the lower Snake River reservoirs. These surveys have been conducted by Corps and their contractors as part of follow-up surveys associated with previous dredging actions and for planning purposes associated with potential future dredging and disposal actions. The results of this research have shown that the use of dredged material to create shallow-water habitat has not adversely impacted salmonid species, and after stabilization provides suitable salmonid rearing and shallow habitat functions (Arntzen et al, 2012; Gottfried et el, 2011; Tiffan and Conner 2012). These newly built shallow water areas were found to be at least as productive for invertebrates as compared to reference sites, provide beneficial shallow water habitat for natural subyearlings during the spring and summer (i.e., rearing fall Chinook), minimized the presence of predators at that site, and in general made the reservoir environment more hospitable for the Chinook salmon using it (Arntzen et al, 2012; Gottfried et el, 2011; Tiffan and Conner, 2012).

The proposed action at Knoxway Canyon (RM 116) is to create an elongated block of shallow water habitat (<6 feet deep) composed of sand/silt substrate for resting/rearing habitat area for juvenile fall Chinook salmon on the mid-depth bench located immediately downstream of where dredged materials were deposited at the Knoxway Bench Lower (i.e., the lower half of the Knoxway Bench complex and location of the 2005/06 dredged materials) as part of the 2005/06 dredging action. This location is approximately 0.25 to 0.5 mile upriver of the Knoxway Canyon reference site and immediately downstream of Knoxway Bench Upper reference sites (i.e., the upper half of the Knoxway Bench complex) (see Arntzen et al, 2012; Tiffan and Conner 2012 for reference). Previous monitoring of this bench, prior to placement of dredged material in 2005/06, indicated none to low salmonid use, moderate predator use, and low macroinvertebrate species composition and abundance (Bennett et al. 1992-1997; Curet 1993). Recent monitoring indicates use of the Knoxway Bench Lower area by natural subyearling Chinook in higher densities, with longer residency times at the as compared to the Knoxway Bench Upper site (Tiffan and Conner, 2012). The Knoxway Bench Upper site has a steep lateral bed slope that is not preferred by subyearlings (Tiffan et al. 2006) whereas the shoreline of Knoxway Bench Lower site has a suitable lateral bed slope. This difference in lateral bed slopes likely explains the density of subyearlings being nearly twice as high in the area of dredged material deposition as compared to the upper half of the site (Tiffan and Connor, 2012). Based on recent habitat modeling efforts in the Lower Granite pool (Tiffan and Hatten, 2012), construction of additional salmonid rearing habitat in this area and in near proximity to a moderately suitable reference backwater site that has been shown to be used by rearing Snake River fall Chinook salmon (Arntzen et al, 2012), should result in increased benefits to Snake River fall Chinook salmon production and survival at the cohort and population levels attributable to both sites.

Due to concerns regarding potential impacts to juvenile Pacific lamprey as part of the proposed dredging action, a minimally obtrusive electroshocking sled with an optical camera was developed to survey for presence/absence of juvenile Pacific lamprey. In order to assess presence/absence of juvenile Pacific lamprey in the lower Snake River that may be impacted by potential dredging actions Arntzen et al. (2012) conducted surveys at 24 sample sites within the lower Snake River to determine presence of juvenile Pacific lamprey including at potential dredge locations (Clarkston Upper and Lower, RM 138), past dredged material disposal sites, and reference sites. No lamprey were observed at any of the 24 sample sites during either of the two sample periods in late July and September 2011. It is plausible that juvenile lamprey were present but not observed with this electroshocking sled as it was recently developed for this specific objective and had a limited testing period prior to deployment. However, while juvenile lamprey are often found in silt/sand substrate (Arntzen et al, 2012), it is unlikely that juveniles are present in moderate or high numbers in the proposed templates. Juvenile lamprey typically have a patchy distribution related to other environmental variables such as water depth and velocity, light level, organic content, chlorophyll concentration, proximity to spawning area and riparian canopy (Moser et al. 2007).

Biological and physical parameters measured for pre-dredging monitoring associated with rearing habitat and habitat site use have mimicked those measured under Bennett (2003) and Bennett and Seybold (2005). This is so consistency can be maintained for correlation analyses used to estimate effectiveness of the action for benefit to salmonid production and reservoir survival. A wide suite of parameters were measured at the Knoxway Bench (RM 116) disposal site (newly constructed habitat), the Knoxway Canyon reference site (backwater transect site of previous monitoring efforts), and as well as at several other sites in the Lower Granite Reservoir (Gottfried et el, 2011; Tiffan and Connor, 2012) and within the four lower Snake River reservoirs (Arntzen et al, 2012) These were sampled at a frequency of up to biweekly during March through November and have generally included:

Surface sediment/substrate composition and grain size of the habitat, including percent organic or organic content.

- Presence and abundance of macrophyte plants.
- Predator species composition and abundance [catch-per-unit-effort defined as 5 minutes of electrofishing and one seine haul (CPUE)].
- Juvenile salmonid abundance and habitat usage (CPUE).
- Macroinvertebrate species composition, species richness/diversity, periodicity or seasonality, and abundance on both soft and hard substrates, including crayfish.
- Water temperature.
- Bathymetry used to verify designed slope, depth, and acreage.
- Dissolved oxygen.
- Water velocity.
- Secchi depth and surface water elevation.
- Chlorophyll *a*.
- Photo record of shoreline substrate composition, landform, and riparian species composition.

3.2 During Dredging and Disposal Activities

The Corps proposes to perform water quality and biological monitoring during the dredging and disposal activities. This monitoring would be to ensure the Corps is meeting environmental compliance requirements.

3.2.1 Water Quality Monitoring

The Corps, through its dredging contractor, would conduct water quality monitoring during dredging and disposal activities to ensure it is meeting applicable state water quality standards while performing these activities. Depth and turbidity would be monitored before, during, and after all in-river work at each active dredging site and at the disposal site. Additional water samples would be collected for laboratory analyses of 4-methylphenol, total suspended solids, and turbidity during the first two weeks of dredging in the lower Snake River near Clarkston, Washington.

The water quality monitoring equipment used would meet industry standard sensitivity and accuracy levels available at the time the dredging and disposal takes place. The equipment would have the capability to transmit turbidity data via satellite/cell phone telemetry rather than downloading manually at each station in the field.

All of the equipment would be calibrated prior to use according to the manufacturer's specifications using recognized industry standards. Cleaning and recalibration would occur according to the manufacturer's recommendation, or whenever there is any indication that the equipment is not performing properly.

Turbidity data would be measured by sondes (i.e., multi-parameter probes) and would be verified periodically in the field. This verification would consist of collecting water samples when the sondes are calibrated, and when questionable values appear in the data set. Grab sample turbidity would be measured using a portable, calibrated turbidimeter.

Monitoring locations for all parameters would follow the specifications in the Washington Administrative Code (WAC) 173-201A, Idaho Administrative code (IDAPA) 58.01.02, the requirements in the 401 certification the Corps is requesting from the Washington Department of Ecology, and the requirements in the current ESA consultations with NMFS and USFWS. Monitoring would be performed at several points to evaluate water quality, but will generally include:

- All active dredging and in-water disposal areas (Figures J-1 and J-2).
    - A monitoring zone approximately 800-ft long and 600-ft wide would be created around the dredging and in-water disposal areas. The width at the in-water disposal site would be measured from the shoreline.

- A background station would be placed a minimum of 300-ft upstream of each monitoring zone.
- One early warning station would be located 300-ft downstream of the monitoring zone. This station would be located in the main direction of the river flow using the best professional judgment of the monitoring crew to place it in the direct path of the plume. The data from this array would be used for informational purposes as described in Section 4.2. The station at the in-water disposal site would only be operational during the sediment re-shaping phase of the project.
- A compliance monitoring station would be located 900-ft downstream of the monitoring zone, also using the best professional judgment of the monitoring crew to place it in the direct path of the plume.
- When all dredging and disposal is completed inside the zone a new monitoring zone would be defined and the monitoring network repositioned. The actual GPS coordinates of all monitoring locations would be recorded in the field documentation and entered into a database.
- Measurements would be taken *in situ* at two depths in the water column. Each floating platform would include two multi-parameter probes. One probe would be located 3 feet below the surface and the second one would be situated approximately 3 feet above the sediment.

The timing of sampling would be as follows:

- Pre-activity levels would be measured for 1 hour prior to commencing work at each dredging site and at the disposal site.
- During all dredging and in-river disposal activities, real-time water quality measurements would occur at 15-minute intervals. This data would be transmitted via telemetry to a website where they can be monitored by the contractor, Corps and regulatory/ cooperating agencies.
- Post-activity turbidity levels would be measured at 15-minute intervals at the early warning station at each dredging site and at the disposal site following re-shaping until levels return to applicable state standards.

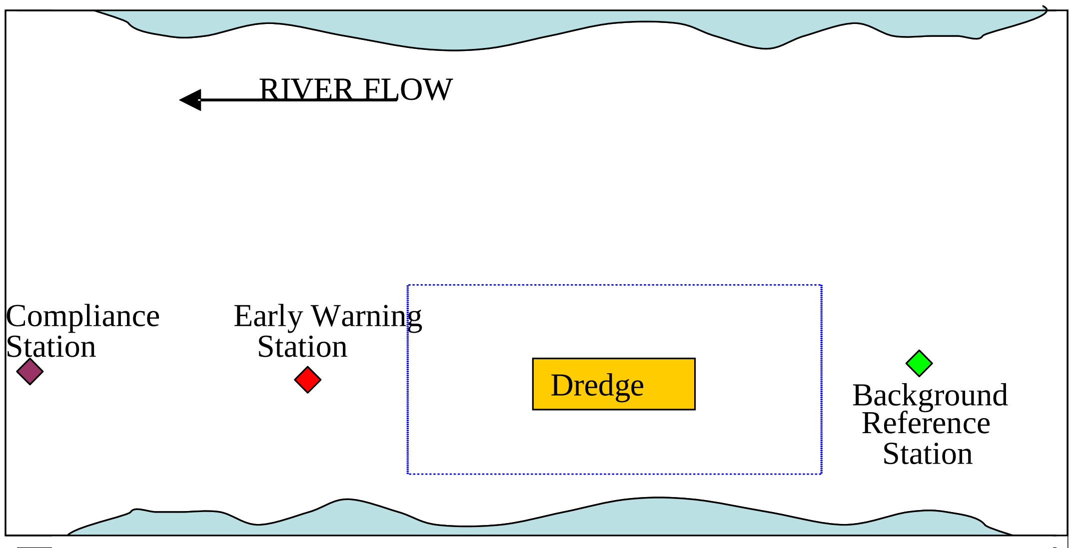

Figure J-1. Conceptual Plan of Monitoring Station Locations during Dredging Activities Relative to the Dredging Monitoring Zone
(not to scale)

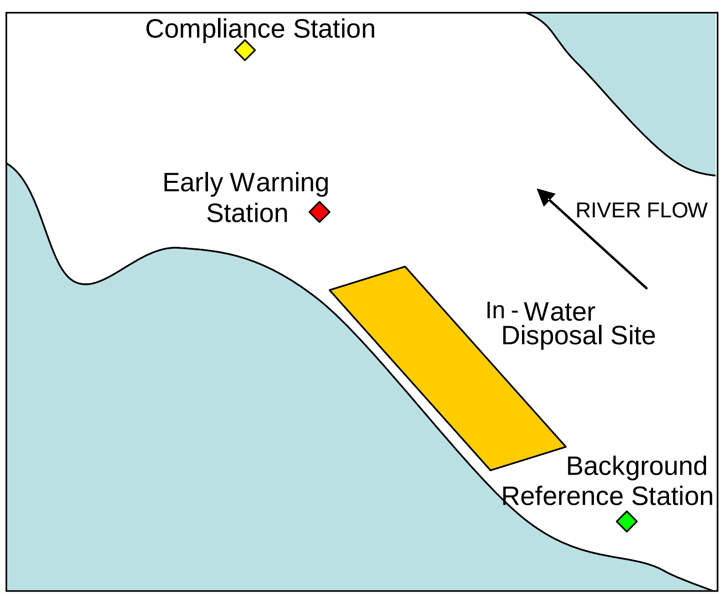

Figure J-2. Conceptual Plan for Monitoring Station Locations at the In-water Disposal Site
(not to scale)

3.2.2 Biological Monitoring

Fish Monitoring

During dredging and disposal activities, the Corps would monitor for sick, injured, or dead fish. The Corps would continuously visually monitor the waters surrounding the dredging and disposal activities . If a sick, injured, or dead specimen is encountered, it would be placed in a container of cold river water until it could be determined if it was a species listed under the ESA. If it is a listed species, the Corps would then contact the Vancouver Field Office of NOAA Fisheries Law Enforcement and the USFWS Division of Law Enforcement in Redmond, Washington, as soon as possible for further instructions. If a healthy fish has been entrained by the dredging operations, the Corps would make every reasonable attempt to return the specimen safely back to the river.

3.3 Post-dredging and Disposal

Monitoring performed at the disposal area following completion of disposal activities would consist of hydrographic surveys and biological surveys. The hydrographic surveys would be performed at least twice, if funding is available, to determine if the embankment has sloughed, settled, or moved, and to verify that the desired physical structure determining rearing habitat suitability have been achieved and maintained. The Corps would use the information from these efforts to assess the stability of the embankment in the short-term and long-term to determine if changes need to be made in grain size composition of construction methods for any future in-water disposal of dredged material. Biological surveys would be performed twice over 10 years, if funding is available, to assess the use of the disposal area by target fish species and to document changes in several parameters such as use by juvenile salmonids, sediment grain size, food organisms, and water temperature.

3.3.1 Hydrographic Surveys

The Corps would perform a series of hydrographic surveys of the disposal site. The Corps would perform hydrographic surveys for both the pre- and post-disposal condition of the disposal area. The Corps would provide survey control to be utilized, a horizontal alignment with stationing, and a drawing representing the required area to be surveyed. The cross sections would be required to be surveyed at specific 25-foot interval spacing for both the pre and post condition surveys performed. The Corps would perform a follow up survey after the first spring runoff (July-September time frame) following disposal utilizing the same control, alignment, and interval requirements. The Corps proposes to replicate the survey one year later if funding is available.

The results obtained would provide the following data:

1. Dredged material disposal site bathymetry before material placement.
2. Bathymetry of the disposal site after embankment construction (accepted configuration).
3. Embankment bathymetry after first runoff season is complete. Comparing (2) and (3) would identify any erosion and/or settlement that have occurred.
4. Bathymetry of the embankment after second runoff season is complete (if funding is available). Comparing (2) and (4) would identify the overall settlement of the embankment, and any additional erosion that may have occurred. Comparing (2), (3) and (4) would also provide curves that could be used for predicting settlement rate and erosion rate for any future in-water disposal sites.

This information would provide a good picture of the embankment performance regarding its shape and final geometry.

3.3.2 Biological Monitoring

To evaluate use of the newly created habitat area by juvenile salmonids and food organisms, the Corps would repeat all monitoring tasks under protocols and study designs of tasks outlined above in Section 3.1.2 Fish Habitat and Habitat Site Use Surveys for at least post-construction years 2 and 10, subject to the availability of funding. However, the Corps has modified the sampling timing so the sites would be sampled at a frequency of biweekly

during April through July and December and January, and at least monthly during August through November and February through March during biological study years. The Corps would compile draft reports detailing multi-year comparison of research results and would make these available to regulatory agencies and all interested parties for their review and comment prior to the production of a final biological monitoring report.

4 MONITORING CRITERIA AND SUBSEQUENT ACTIONS

4.1 Biological

4.1.1 Redd Surveys

The Corps would discuss the results of the pre-dredging research with NMFS personnel prior to initiating dredging. If a redd is found in the proposed dredging footprint, the Corps would coordinate with NMFS under Section 7 of the ESA consultation to determine what the appropriate avoidance and protection actions would be prior to dredging the affected location. This potentially would include modifying the dredging footprint to avoid the redd and/or postponing dredging in that footprint to a later date after emergence of young fish from the redd in the spring.

4.1.2 Fish Habitat

The Corps, in conjunction with USGS, has conducted a comprehensive modeling effort of juvenile rearing habitat in the Lower Granite Reservoir, where creation of new shallow water habitat appears to be most beneficial (Tiffan and Hatten, 2012). As part of this modeling effort, USGS has estimated the amount of current rearing habitat available in Lower Granite Reservoir at five different flows using a statistical rearing model and a spatially explicit analysis that incorporated river bathymetry and outputs (i.e., depth and velocity) from a hydrodynamic model. Results indicate that Lower Granite Reservoir contains about 255 ha of rearing habitat at a flow of 143 kcfs, which equates to about 7% of the reservoir area when a 20-ft shallow water depth criterion is used. Most available rearing habitat is located in the upper half (i.e., upstream of Centennial Island) of the reservoir and little exists in the lower half due to steep lateral bed slopes and unsuitable substrate along the shorelines. The largest habitat areas were associated with known shallow-water locations such as at Silcott Island (~85 ha) and the area near Steptoe Canyon (~32 ha). Reducing the criterion to define shallow water from <20 ft (the COE's current definition) to <6 ft (based on recent habitat use data) resulted in a significant reduction in available habitat but spatial trends remained consistent. Because of the shoreline orientation of subyearling fall Chinook salmon and their transient rearing strategy, creating new habitat in the lower portion of Lower Granite Reservoir in bands along the shoreline appears as though it may provide the greatest potential benefit from creation of additional shallow water habitat.

As a result of this modeling effort, recent biological monitoring and evaluation of previous and potential future disposal areas, and other engineering considerations, the proposed disposal area at RM 116 was selected for disposal of dredged material as part of the proposed action. In addition, as a result of recent habitat sampling efforts showing rearing/resting juvenile fall Chinook appear to utilize shallow water habitat <2 meters (about 6 feet) in depth in higher frequency (Tiffan and Connor, 2012) and a general paucity of available shallow water habitat in the lower portion of the Lower Granite Pool (Tiffan and Hatten, 2012) as described above, the Corps will attempt to create shallow water habitat that is primarily less than 6 feet in depth instead of 20 feet in depth as traditionally done in the past.

Habitat surveys conducted after final shaping of the proposed disposal site would be used to evaluate future use of in-water disposal to create resting/rearing habitat for juvenile salmonids with particular emphasis on evaluating whether the creation of shallow water habitat in a <6 and <20 foot deep band along the shoreline results in increased habitat utilization as expected. These surveys would be used to document several parameters such as trends in usage by juvenile salmonids, changes in food organism composition, and changes in substrate over time as described in previous sections. If the surveys indicated a need to take corrective action at the disposal area, such as possible modifying the contours to reduce predation on juvenile salmonids, the Corps would consider taking this action pending availability of funds.

In addition, the Corps would use numbers of ESA-listed salmonid species or stocks present during critical seasons and life stages compared to presence and extent of critical habitat parameters at that proposed site versus ESA-listed species presence and abundance compared to critical habitat parameters and juxtaposition at alternative reference sites to determine whether or not the proposed criteria for selecting disposal sites and disposal methods would still be acceptable for potential future actions. If the surveys indicated a minimal number of ESA-listed juvenile salmonids were currently using potential future disposal sites, but the habitat suitability index of the site could be substantially increased effectively, the Corps would consider using the proposed site(s) for disposal with the intent to design to an optimal habitat suitability. The Corps will continue to coordinate with NMFS to determine the continued suitability of the currently proposed site and other potential disposal areas are still acceptable as continued and/or future disposal site(s).

4.1.2.1 Water Quality

Turbidity created by in-river activities and measured in nephelometric turbidity units (NTU) would be maintained below the following standards at the locations described in 3.2.1.

- **Washington**
  - 5 NTUs above background when background levels are 50 NTUs or less.
  - Maximum 10 percent increase when the background is more than 50 NTUs.

- **Idaho**
  - Shall not exceed the background by more than 50 NTU instantaneously below the compliance boundary or by more than 25 NTU for more than 10 consecutive days.

Measured turbidity data would be evaluated using 15-minute intervals. The contractor's monitoring crew would compare individual readings from the early warning station and the compliance zone boundary with the readings from the background sample location, taking into consideration the estimated amount of time it takes for the water to travel from the background station to the monitoring station (hereafter referred to as travel time) to determine compliance with the water quality standards. For example, the deep compliance boundary sample would be compared to the deep background sample, and the shallow compliance boundary sample would be compared to the shallow background sample. The 300-ft early warning readings would similarly be compared to the background measurements.

4.1.2.2 Active Dredging Site

Early Warning Station

The intent of the early-warning station would be to provide the contractor with information that can be used to adjust the dredging operation to mitigate elevated readings at the compliance boundary downstream. As such, actions triggered by elevated turbidity readings at this station may be modified using adaptive management, with the goal being no turbidity exceedances at the point of compliance.

The data acquisition system would be programmed (e.g., use of red, yellow, green color coding or an audible alarm) to notify field managers when the turbidity at one of the sensors is greater than the NTU over background criteria. An elevated value would initiate the following sequence of responses:

1. If a calculated value surpasses the water quality criteria for two consecutive 15-minute instances the monitoring crew would:
    a. Verify that the sonde is functioning correctly,
    b. Visually assess the station vicinity for potential outside influences such as malfunctioning dredging equipment or turbidity produced by a tug boat propeller, wake, barge, or wind if conditions permit, and
    c. Evaluate the data at the Compliance Boundary, taking into consideration the water travel time from one station to the other (see Compliance Boundary Station section).
2. If the monitoring crew determines that the elevated turbidity is attributed to the dredging, then:
    a. If there are signs of elevated turbidity at the point of compliance (i.e. turbidity is above background - even if it is below the standard) the monitoring crew would notify the contractor's dredge operator. The contractor would assess the current work methodology and implement best management practices (BMPs) to reduce turbidity. The monitoring crew would wait at least 30 minutes to 1 hour after implementing any additional BMPs and re-evaluate the Early Warning measurements.
    b. If turbidity at the point of compliance is equal to or less than background, then no further action is required.
    c. If repeated elevated turbidity at the Early Warning point is not associated with either elevated turbidity or turbidity exceedances at the point of compliance, then the turbidity trigger for BMPs may be re-assessed for the Early Warning point. The contractor must meet with Corps and Ecology to modify the Early Warning point turbidity trigger.
3. Special sampling for 4-methylphenol would be required in the Snake River when dredging occurs between river miles 138 and 139.5. If a calculated turbidity value surpasses the water quality criteria for two consecutive 15-minute intervals, a 1-liter water sample would be collected with a van Dorn, Niskin, or equivalent sampler. Samples would be collected up to three times per day for the first two weeks. The

samples would be collected over as broad of range of turbidity values as practical. The water samples would be forwarded to a certified laboratory to be analyzed for 4-methylphenol (EPA Method 8270D), total suspended solids, and turbidity. The results of these analyses would be made available to the Corps when they have been received by the contractor. Samples taken during the first day would have an expedited processing time of no more than one week. All subsequent sample analyses would be subject to normal laboratory turnaround time. Due to the anticipated time lag between sample collection and receipt of the results, the analytical data would only be used for informational purposes. However, if the concentration of 4-methylphenol exceeds 2.8 mg/L, the Corps would contact Ecology, NMFS, and USFWS to discuss what actions to take, if any.

Compliance Boundary Station

The 15-minute data from the compliance boundary location would also be set-up with an alarm system to alert the monitoring crew if the compliance station data, allowing for estimated water travel time between stations and sensor accuracy, exceeds the applicable NTU level.

1 If a 15-minute calculated value from either of the turbidity sensors exceeds the applicable NTU level, the monitoring crew would:
   a. Verify that the sonde is functioning correctly,
   b. Visually assess the station vicinity for potential outside influences such as malfunctioning dredging equipment or turbidity produced by a tug boat propeller, wake, barge, or wind if conditions permit.
   c. Determine if there is a correlation to a similar event at the Early Warning station, taking into consideration the estimated water travel time between stations, and
   d. Determine if the elevated turbidity is confirmed by a consecutive reading above the turbidity criteria.

2. If a turbidity exceedance is confirmed by the evaluations listed above, the monitoring crew would notify the dredge contractor. In addition,
   a. The contractor would take appropriate corrective action (beyond those taken to modify the work activity for the elevated measurements at the Early Warning station) as necessary in order to meet turbidity standards and would submit its contingency response action(s) to the Corps immediately.
   b. The monitoring crew would wait one hour after the dredge operator has implemented its contingency response actions to allow time for the changes to take effect, and then evaluate the 15-minute data again.
   c. The monitoring crew would also take one or more turbidity readings downstream of the Compliance Boundary station twice per day during daylight hours for the first two weeks of dredging when turbidity is greater than the criteria. The purpose of the readings would be to determine the downstream extent of the turbidity plume. The first reading would be taken at 1,200 feet downstream from the monitoring zone along the anticipated path of the plume and at the same relative depth (i.e., 3.3-ft below the surface or 3.3-ft above the

sediment) as the Compliance Boundary sonde recording the exceedance. If turbidity exceeds criteria at this location, a second reading would be taken 1,500 feet downstream from the monitoring zone and at the same relative depth as the first reading. Additional readings would be taken every 300 feet at the same relative depth until turbidity has returned to background levels, taking into consideration the estimated water travel time between monitoring locations. GPS coordinates would be recorded for each of the additional locations beyond the 900-ft Compliance Boundary where turbidity levels are evaluated.

3. In the event that the contractor's contingency response actions do not achieve compliance with the water quality criteria, or in case or repeated exceedances at the point of compliance, the contractor would:
   a. Discontinue any additional in-water work until the problem is resolved
   b. Meet with the Corps and Ecology to discuss the water quality monitoring observations and contingency response actions taken by the contractor, and to identify additional contingency response actions that the contractor could implement to comply with the water quality criteria.

4.1.2.3 In-Water Disposal Site

Water quality monitoring at the in-water disposal site would follow a protocol similar to the one presented for the active dredging site. However, since the discharge from the bottom-dump barge is episodic (approximately three events per 24-hour period) compared to the near-continuous activity at the dredging site, the bottom-dump phase of the monitoring would be modified. Monitoring during re-shaping activity would be performed in the same manner as the active dredging site monitoring since re-shaping is also a near-continuous activity.

4.1.2.4 In-Water Disposal

The Early Warning station will not be operational when only in-water disposal is occurring. The 15-minute data from the Compliance Boundary station will be used to assess whether turbidity is produced by the bottom-dump barge operation. Since the scow would have completed its bottom-dump action by the time any increase in turbidity is registered at the monitoring station, real-time management is not practical. However, if the resulting turbidity at the Compliance Boundary is greater than the water quality criterion, the feasibility of increasing the rate of discharge from subsequent barges to minimize turbidity effects will be assessed.

4.1.2.5 Re-Shaping

Early Warning Station

Water quality monitoring during re-shaping would follow the same protocols as presented in the Active Dredging Site/Early Warning Station section, with the exception of sample collection for 4-methylphenol analyses, which would not be required for re-shaping.

4.2 Hydrographic Surveys

The results of the hydrographic surveys of the disposal site would be used to assess slope stability and long-term structural stability of the disposal area. Changes in elevations would indicate movement of material. The Corps would compare pre-dredging sediment sampling records to the locations of material movement to evaluate the composition of the dredged material (e.g., percent sand vs. percent silt) disposed at that location. Based on the results of the comparison, the Corps may modify its disposal plans for future dredging. Modifications could include altering the percent of silt in in-water disposal areas, or constructing a berm of sand or cobble at the toe of the disposal area slope.

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