6 PREPARING THE SAMPLING AND ANALYSIS PLAN (SAP)

Once the required numbers of DMMUs and field samples have been calculated and a dredging plan conceived, a sampling plan must be developed. The DMMUs and field samples must be distributed within the actual dredging prism in a manner consistent with the definition of a DMMU and any project-specific constraints. It is not necessary or always desirable to restrict the volumes characterized by each individual sample or DMMU in the field to the maximums from **Table 5-7** and **Table 5-8**. Best professional judgment is necessary in the allocation of DMMUs and the development of a sampling and compositing plan.

In dividing the proposed dredging volume into DMMUs, it is important to ensure that the DMMUs be fully reflective of the dredging plan, i.e., ***that the management units be truly "dredgeable."*** If an individual DMMU (represented by one or more field samples) is found unsuitable for unconfined open-water disposal, then that DMMU must be capable of being dredged independently from adjacent sediment. Additional DMMUs--beyond the minimum number--may be required to achieve an appropriate dredging plan (e.g., where different sediment types or physically separated areas warrant separate DMMUs).

Steps followed in developing characterization requirements in Chapter 5 must be documented in the sampling and analysis plan developed for review by the agencies.

A well-designed sampling and analysis plan (SAP) is essential when evaluating the potential impact of dredged material discharge upon the aquatic environment. The SAP is submitted to the DMMO for coordinated review and approval by regulatory agencies before any sampling is initiated, as shown in **Figure 3-1**. This coordination, including full and open disclosure of information, reduces the chance of having to repeat costly procedures and assists in keeping projects on schedule.

The SAP should contain the information outlined in the following sections in enough detail to allow the agencies to determine the adequacy of the sampling and analysis program.

6.1 PROJECT OVERVIEW

1. maps of vicinity and project area and plan view of site
2. project description, recent bathymetric survey data, one or more cross-sections of the dredging prism, dredging depth (MLLW) including overdepth, side-slope ratios, and proposed disposal site
3. project volume, including sideslopes and overdepth, and contingency factor used in volume calculations (see DMMP 1996, Dredged Material Volume Estimates)
4. project schedule
5. personnel involved with the project and their respective responsibilities, including project planning and coordination, field sampling, chemical and biological testing labs, QA management, data validation and final report preparation
6. signature page for subcontractors

6.2 TIER 1 EVALUATION

1. Site history, including past characterization data, past and current site use, identification of potential sources of contamination, and past permitting (including NPDES permits as well as dredging) – see Chapter 4.

2. The project location must be checked for the presence of the invasive New Zealand mud snail using the following Ecology website:

   http://www.ecy.wa.gov/programs/eap/InvasiveSpecies/AIS-PublicVersion.html

   The result of this check must be documented in the SAP. If the project is located within an area known or suspected of harboring the New Zealand mud snail, standard operating procedures for minimizing the spread of this invasive species must be included in the SAP.

6.3 CHARACTERIZATION PLAN

1. project rank and justification
2. computation of DMMP sampling and analysis requirements based on surface (0-4 feet) and subsurface (> 4 feet) volumes,
3. conceptual dredging plan, if necessary, to justify the design of the DMMUs
4. map/s of project area with DMMU outlines(including sideslopes) and target sampling locations; cross sections if necessary
5. table with DMMU identification, DMMU volume, designation as surface or subsurface DMMU, and number of samples for each DMMU
6. compositing plan, including sampling depths relative to both mudline and MLLW
7. Z-sample plan

6.4 SAMPLING

1. sampling equipment and capability
2. table of sampling locations including coordinates, mudline elevation (MLLW), design depth, overdepth, Z-depth, and preliminary determination of required core lengths to be assigned to DMMUs and Z-samples
3. horizontal datum – NAD83, HPGN83, HARN83 or WGS84
4. anticipated mudline elevations at the target sampling stations
5. horizontal positioning system and accuracy of sampling stations (must be $<\pm$ 3 meters); if GPS is used, include the make and model of the GPS unit and indicate the differential signal and station that will be used.
6. method for determining real-time water depths at sampling stations
7. method for real-time determination of tide levels (e.g. Hazen gauge or tide board), including procedure for establishing or verifying vertical control
8. sample acceptance criteria (e.g. penetration and recovery criteria for cores)
9. description of the use of water depths, tide elevations, penetration and recovery data to determine the actual core lengths to be assigned to DMMUs and Z-samples
10. location where sample processing will occur (i.e. on-board vessel, onshore, laboratory)
11. decontamination procedures

12. table of analytical groups (e.g. semivolatiles, metals, bioassays) with planned sample volumes, container sizes and type, holding times and conditions; this table should also include archived samples
13. sulfides sampling procedure
14. description of entries that will be made in field/sampling logs
15. description of core logging
16. chain-of-custody procedures
17. proposed sampling schedule

6.5 CHEMICAL ANALYSIS

1. plans for physical and chemical laboratory testing, including grain-size analysis, sediment conventionals and chemicals-of-concern
2. table(s) of current chemicals of concern, with relevant regulatory limits (DMMP and SMS, marine and/or freshwater) clearly indicated (with correct units of measure), including extraction/digestion methods, analytical methods, method reporting limits and method detection limits for all COCs
3. table(s) of QA parameters, frequency of analysis, and acceptance guidelines
4. use of the Puget Sound Sediment Reference Material for dioxin and PCBs; including PS-SRM request procedure and acceptance ranges for Aroclors and congeners, as needed; see http://www.nws.usace.army.mil/Missions/CivilWorks/Dredging/SRM.aspx
5. identification of SRMs to be used for semivolatiles, pesticides and metals, including the SRM certificates and the acceptance ranges the lab plans to use for quality control
6. dioxin quality assurance and interpretation guidelines, if necessary
7. validation stage for each analytical group
8. statement indicating that reporting limits or sample reporting limits must be at or below SLs to avoid bioassays
9. chemistry lab reporting requirements, including case narrative describing analytical problems

6.6 BIOLOGICAL ANALYSIS

1. selection of tiered or concurrent bioassays
2. bioassays to be used, species-selection rationale and a brief description of the protocols
3. decision-making process for determining amphipod species vis-a-vis grain size and clay content (i.e. if clay content is greater than 20%, use *Ampelisca abdita*)
4. decision-making process for determining whether to purge for ammonia or sulfides and/or run an LC_{50} test for ammonia
5. decision-making process for determining whether to use the larval resuspension protocol
6. statement that larval test will be aerated
7. water quality monitoring parameters, schedule and acceptance limits

8. proposed collection location of reference sediments and how reference sediments will be matched to test sediments; the wet-sieving protocol should be included
9. table with bioassay interpretation and reference/control performance standards
10. list of data to be provided to DMMO in the event that bioassays are needed: grain-size and sediment conventional data (especially ammonia and sulfides) for DMMUs to be tested
11. bioassay lab reporting requirements

6.7 REPORTING REQUIREMENTS

All of the following are required elements of a sediment characterization report and should be listed in the SAP:

1. explanations of any deviations from approved SAP
2. sampling equipment and protocols used
3. methods used to locate sampling positions
4. table with coordinates of actual sampling locations, measured water depth at each location, tidal stage at the time of sampling each station, and mudline elevations (tide-corrected to MLLW)
5. figure showing target and actual sampling locations with DMMU outlines
6. penetration and recovery data
7. compositing scheme with actual core lengths and depths (referenced to both MLLW and the mudline)
8. table of analyzed concentrations for all DMMP COCs, lab and validation qualifiers, method reporting limits and method detection limits, with DMMP guideline exceedances highlighted
9. table of analyzed concentrations for all SMS COCs, lab and validation qualifiers, method reporting limits and method detection limits, with SMS guideline exceedances highlighted
10. table comparing PS-SRM results to acceptance ranges for PCBs and dioxins, if analyzed
11. chemistry QA review and validation results
12. summary table/s of bioassay results, QA data and interpretation
13. sampling/field log as an appendix
14. core logs as an appendix, including any relevant photos
15. chemistry data report (including a case narrative) as an appendix
16. bioassay report as an appendix
17. validation report as an appendix
18. EIM-ready data to be submitted to the Corps for QA review (electronic submittal only)
19. QA2 data for Ecology (electronic submittal only)
20. chain-of-custody forms as an appendix

6.8 HEALTH AND SAFETY PLAN

A site-specific health and safety plan (HASP) must be included as an appendix in the sampling and analysis plan. The HASP must include the following at a minimum:

1. activity hazard analysis
2. safety procedures
3. emergency procedures