LOWER PASSAIC RIVER RESTORATION PROJECT

QUALITY ASSURANCE PROJECT PLAN

SURFACE SEDIMENT CHEMICAL ANALYSES AND BENTHIC INVERTEBRATE TOXICITY AND BIOACCUMULATION TESTING

FINAL

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ES 1 Introduction

The following serves as an executive summary of the surface sediment chemical analyses and benthic invertebrate toxicity and bioaccumulation testing quality assurance project plan (QAPP) for the Lower Passaic River Study Area (LPRSA). The data collected during this Surface Sediment Chemical Analyses and Benthic Invertebrate Toxicity and Bioaccumulation Testing will be used by the Cooperating Parties Group (CPG), US Environmental Protection Agency (USEPA), and its Partner Agencies (PA)[1] for Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)-related decisions for the LPRSA. Specifically, these include the ecological risk assessment (ERA), the human health risk assessment (HHRA), and other purposes, including activities supporting the Water Resources Development Act (WRDA) study, such as restoration planning.

The data collected during this sampling effort, in conjunction with data collected from other sampling efforts, will be used to support the ERA and HHRA. This sampling effort addresses the following assessment objectives related to benthic invertebrates as outlined in the 2006 Field Sampling Plan Volume 2 (FSP2) prepared by Malcolm Pirnie et al. (2006) for the USEPA/PA:

1. Determine if exposure to site-related contaminants in the LPRSA sediment poses unacceptable risks to the benthic invertebrate community
2. Determine if the consumption of benthic invertebrates (represented by laboratory-exposed bioaccumulation test and field-collected crab and crayfish tissue results for representative invertebrate species) poses unacceptable risks to ecological receptors
3. Determine if exposure to surface sediments in the LPRSA poses unacceptable risks to human receptors

Data collected from other sampling efforts will also be used (in conjunction with the data collected under this QAPP) to support the ERA and HHRA. Fish and decapod crustacean tissue data collected as part of the tissue sampling effort (presented in the Fish and Decapod Crustacean Tissue Collection for Chemical Analysis and Fish Community Survey QAPP, hereafter referred to as the Fish/Decapod QAPP (Windward 2009) will be used in the ERA and HHRA. Surface water data collected as part of the 2010 surface water monitoring program to be developed by CPG will be used to support both risk assessments. Existing data that have been collected from the LPRSA will also be used in the HHRA and ERA. Seasonal bird surveys and potential additional habitat surveys will also be conducted, primarily to support WRDA activities, such as restoration planning, and also to support the risk assessments as appropriate.

ES 2 Data Use

The primary sample type that will be collected as part of this sampling event is surface sediment, which will be from the top 6 inches (15 cm) of sediment, from the LPRSA. Surface sediment will be used for chemical analysis, toxicity testing, and benthic community analysis in order to perform a sediment quality triad (SQT) assessment. Surface sediment will also be used for bioaccumulation testing of selected benthic invertebrate species. Benthic invertebrate

[1] The Partner Agencies include the US Army Corps of Engineers (USACE), the New Jersey Department of Environmental Protection (NJDEP), the New Jersey Department of Transportation (NJDOT), National Oceanic and Atmospheric Administration (NOAA), and US Fish and Wildlife Service (USFWS).

community data will be collected during three seasonal benthic community surveys – the first of which will be implemented as part of this program and the second and third conducted in spring and summer 2010. The protocols for the conduct of the benthic community surveys are included in this QAPP.

ES 3 Ecological Risk Assessment

The data collected under this QAPP will be used to support the ERA in evaluating the assessment endpoints of the benthic invertebrate community and fish, bird, and aquatic mammal populations as presented in the Problem Formulation Document (PFD) (Windward and AECOM 2009) and summarized below.

Assessment Endpoint No. 2 – "Protection and maintenance (i.e., survival, growth, and reproduction) of the benthic invertebrate community both as an environmental resource in itself and as one that serves as a forage base for fish and wildlife populations."

Benthic community, toxicity testing, bioaccumulation testing, and surface sediment chemistry data collected as part of this sampling event will be used evaluate potential risks to benthic invertebrates in order to answer the following questions:

- **Are benthic communities different from those found in similar nearby water bodies where chemical concentrations are at regional background levels?** Benthic invertebrate organisms will be collected from the LPRSA, and the benthic community structure will be assessed using community-level metrics (e.g., total abundance, species richness, and abundance of species or specific taxonomic groups) as well as comparisons to benthic community structure information from appropriate regional background datasets using diversity indices, multivariate, and spatial statistical techniques.
- **Are chemical of potential concern (COPC) residues in benthic invertebrate tissues from the LPRSA at levels that might cause an adverse effect on survival, growth, and/or reproduction of infaunal invertebrates?** This question will be addressed with one measurement endpoint. Chemical concentrations in laboratory-exposed benthic infaunal invertebrate tissues will be compared to tissue-residue toxicity reference values (TRVs). Because the field collection of sufficient biomass (e.g., polychaetes or oligochaetes) will not be possible in the LPRSA, laboratory bioaccumulation tests will be used to generate surrogate tissue concentration information. The test organisms will be a polychaete worm (*Neanthes virens*) for the estuarine portion of the LPRSA and an oligochaete worm (*Lumbriculus variegatus*) for the freshwater portion of the LPRSA. LPRSA surface sediment will be used to conduct the 28-day bioaccumulation tests, and whole-body benthic invertebrate tissue from the tests will be chemically analyzed. The methodology and sampling design for the caged bivalve study will be provided as an addendum to this QAPP.
- **Are COPC concentrations in LPRSA sediments from the biologically active zone at levels that might cause an adverse effect on survival, growth, and/or reproduction of the benthic invertebrate community?** This question will be addressed with two measurement endpoints based on surface sediment that will be collected from the biologically active zone, which is estimated to be the top 6 inches, throughout the LPRSA:

- Surface sediment from the biologically active zone will be chemically analyzed. Chemical concentrations in sediment will be compared to literature-derived toxicity-based sediment quality values that are specific to benthic invertebrates.
- Surface sediment from the biologically active zone will be used to conduct laboratory toxicity tests (i.e., 28-day survival and growth of *Hyalella azteca* throughout the LPRSA, 10-day survival and growth of *Chironomus dilutus* in the freshwater portion, and 10-day survival of *Ampelisca abdita* in the estuarine portions). The results of the toxicity tests will be statistically compared to toxicity tests conducted with control sediment and also compared to existing urban regional background data.

Surface sediment chemistry data along with conventional sediment parameters (such as grain size) will be used in conjunction with the benthic community analysis to develop benthic community metrics. The community metric line of evidence will be part of the SQT approach, which is a sediment assessment technique that incorporates information about sediment chemistry and toxicity in conjunction with benthic community metrics.

Assessment Endpoints No. 5, No. 6, and No. 7 – "Protection and maintenance (i.e., survival, growth, and reproduction) of omnivorous, invertivorous, and piscivorous fish populations that serve as a forage base for fish and wildlife populations and of fish populations that serve as a base for sports fishery;" "Protection and maintenance (i.e., survival, growth, and reproduction) of herbivorous, omnivorous, sediment-probing, and piscivorous bird populations;" and "Protection and maintenance (i.e., survival, growth, and reproduction) of aquatic mammal populations."

Sediment chemistry and tissue chemistry data from laboratory-exposed benthic invertebrates collected as part of this sampling event will be used (along with surface water chemistry data and fish and decapod tissue chemistry data) in a dietary model to estimate dietary intakes for selected fish, bird, and mammal receptors. Modeled dietary dose concentrations will be compared to dietary dose TRVs to answer the following risk question: **"Are modeled dietary doses of COPCs based on LPRSA biota, sediment, and surface water at levels that might cause an adverse effect on survival, growth, and/or reproduction of fish, bird, or aquatic mammal populations that use the LPRSA?"**

Table ES-1 presents a summary of how the benthic invertebrate data will be used in the ERA.

Table ES-1. Proposed use of sediment data in the ERA

Data Type	ERA Data Use	Receptor Group	Assessment Endpoint Number
Benthic community structure data	SQT approach	benthic invertebrates	2
	benthic invertebrate community analysis	benthic invertebrates	2
Bioaccumulation tissue chemistry	tissue-residue evaluation of benthic invertebrates	benthic invertebrates	2
	dietary evaluation	fish	5
	dietary evaluation	birds	6
Surface sediment chemistry	SQT approach	benthic invertebrates	2
	dietary evaluation	fish	5
	dietary evaluation	birds	6
	dietary evaluation	mammals	7

DATA TYPE	ERA DATA USE	RECEPTOR GROUP	ASSESSMENT ENDPOINT NUMBER
Surface sediment toxicity	SQT approach	benthic invertebrates	2

ERA – ecological risk assessment

SQT – sediment quality triad

ES 4 Human Health Risk Assessment

The data collected during this sampling effort will also be used to support the HHRA in evaluating the following risk question: **"What are the potential adverse effects of river chemicals on human health via exposure to surface sediment from the LPRSA?"** As defined in the PFD (Windward and AECOM 2009), the data use objective for this endpoint is to estimate potential human exposures and assess the potential impact of chemicals on human health via dermal contact with, incidental ingestion of, and/or inhalation of volatile organic compounds (VOCs) from surface sediment, primarily intertidal mudflats and sand/gravel/cobble flats, of the LPRSA. Potential surface sediment exposure scenarios are presented in the preliminary human health conceptual site model (CSM) included in the PFD (Windward and AECOM 2009).

ES 5 Overview of Sampling Design and Locations

Per the agreements resulting from the January 14-15, 2009, meetings between the USEPA/PA and the CPG, the general sampling design divides the LPRSA into two zones according to surface water salinity: the estuarine zone and the freshwater zone. Consistent with the preliminary salinity reaches referenced in the PFD (Windward and AECOM 2009), the estuarine zone includes both the brackish (Lower River Segment River Mile [RM] 0 to RM 6) and transition (Middle River Segment RM 6 to 10) river segments from approximately RM 0 to RM 10, and the freshwater zone includes the freshwater river segment from approximately RM 10 to RM 17.4 (Dundee Dam) (Figure 1). It should be noted the exact RM designations are not definitive and are subject to variation. A final determination of these zones is dependent on data being collected as part of the Remedial Investigation.

For the SQT sampling effort (i.e., collection of surface sediment for chemistry, toxicity test, and benthic invertebrate community analyses), these two zones will be subdivided into 16 1-mile segments and 1 1.4-mile segment (which will span from RM 16 to RM 17.4) for a total of 17 segments to ensure adequate spatial allocation of samples throughout the LPRSA. Sampling locations will be distributed within each segment between two depth ranges, shallow nearshore areas (-2 ft MLW and shallower[2]) and subtidal areas (deeper than -2 ft MLW), and two grain size ranges, fine (≥ 60% fines, defined as the sum of clay and silt particles having a diameter less than 63 µm based on the evaluation of historical grain-size data) and coarse (< 60% fines)-grained sediment,[3] within the two depth ranges, to the degree that these habitat features are present in a river mile.

To be consistent with the FSP2 sampling approach, surface sediment samples will be collected at up to 97 sampling locations in the LPRSA between RM 0 and RM 16 and, if possible (i.e., where grain-size is appropriate for chemical and biological analyses), at up to

[2] Bathymetry layer is from 2004 Rogers Surveying for USACE, RM 0 to Dundee Dam.

[3] Aqua Survey Inc., 2005 Geophysical Survey for LPRRP. Technical Report, geophysical survey, Lower Passaic River Restoration Project. New Jersey Department of Transportation, Office of Maritime Resources. The geophysical survey was conducted between April 21, 2005, and June 16, 2005.

5 sampling locations between RM 16 and the Dundee Dam (RM 17.4), for a total of 102 possible sampling locations in the LPRSA for the SQT assessment (i.e., chemistry analysis, toxicity testing, and benthic community analysis) (Figure 1). The 102 SQT sampling locations were allocated as follows:

- Twenty-seven of the SQT sampling locations were placed to be co-located with the mummichog and darter/killifish sampling locations (described in the Fish/Decapod QAPP (Windward 2009)) to support the fish tissue-residue line of evidence and the wildlife assessment in the ERA. All of the sediment samples co-located with tissue sampling locations will target samples in the shallow, nearshore areas (mostly shallow mudflat areas) between RM 0 and RM 16, except for and one, which is located between RM 16 and the Dundee Dam (RM 17.4). The collection of 27 sediment samples to be co-located with locations where mummichog/darter/killifish will have been collected will be deferred until these fish have been caught (26 of these are identified in Worksheet No. 18). Additional sediment sampling locations to be co-located with blue crab composite samples collected in traps will also be sampled once blue crab compositing locations have been selected and approved by USEPA.

- Sediment will be collected from 20 of the SQT sampling locations for bioaccumulation testing. These sampling locations were selected to represent a range of contaminants and chemical concentrations throughout the LPRSA and on the basis of the frequency of detection. The selected chemicals were polychlorinated dibenzo-*p*-dioxins (PCDDs)/ polychlorinated dibenzofurans (PCDFs), polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), pesticides (dieldrin, chlordane and total dichlorodiphenyltrichloroethanes [DDTs]), phthalates, copper, lead, and mercury.

- The remaining 51 sampling locations were placed randomly (using a random number grid[4] generated using a geographic information system [GIS]) within the four depth-range and grain-size habitat types described above.

In addition to sediment collected at the SQT locations described above, up to fourteen human health exposure samples will also be collected for sediment chemistry only. Nine of these samples have targeted locations at certain shallow nearshore locations for the HHRA surface sediment sampling and up to five additional "floater" locations of potential human exposure interest may be identified while in the field (e.g., boat clubs, docks, and other locations of human activity such as fishing that are not currently identified for sampling).

If samples are collected at all possible locations described above, a total of 116 sediment locations will be sampled (102 SQT sampling locations and 14 human health exposure sampling locations). Decision-making regarding the 2009 data interpretation will be documented in a series of memoranda prior to the start of the 2010 sampling effort, and any changes to the field collection program as a result will be incorporated into a revised/amended QAPP. Additional data will be collected if data gaps are identified after evaluation of the data collected in fall 2009. The rationale of each location is specified on Worksheet No. 18, the number of stations is summarized in Table ES-2, and all locations are presented on Figure 1.

[4] A random point generator tool in ArcGIS was used to derive Xs and Ys from a random number stream, constrained by the boundaries of a feature layer (built on a combination of river mile, depth, and % fines).

Table ES-2. Summary of Proposed Sampling Stations

River Mile	Number of SQT Sampling Stations per Habitat[a]				Number of Co-Located Bioaccumulation Stations[b]	Number of Co-Located Mummichog/ Darter/Killifish/ Stations[c]	Number of Human Health Exposure Stations[d]
	Fine Shallow	Coarse Shallow	Fine Deep	Coarse Deep			
0 – 1	3	1	2	1	2	3	0
1 – 2	2	1	2	1	1	2	0
2 – 3	2	1	3	0	0	2	0
3 – 4	2	1	2	1	1	2	0
4 – 5	2	1	2	1	0	2	1
5 – 6	2	1	2	1	1	1	0
6 – 7	2	0	2	1	1	1	1
7 – 8	1	1	3	1	3	1	0
8 – 9	1	1	3	2	0	3	1
9 – 10	1	1	2	1	1	0	0
10 – 11	3	2	2	0	2	3	1
11 – 12	1	1	2	1	1	0	1
12 – 13	1	2	3	1	4	2	1
13 – 14	1	2	3	0	1	1	0
14 – 15	2	1	2	1	0	1	0
15 – 16	0	4	0	2	2	2	2
16 – 17.4	0	5	0	0	0	1	1
Total	**26**	**26**	**35**	**15**	**[20][b]**	**[27][c]**	**9[f]**

[a] Five to seven sampling locations were allocated among the four sampling habitat types (fine shallow, course shallow, fine deep, and course deep) for each RM segment, to the degree that these habitat features are present. These sampling locations represent SQT samples and will be analyzed for chemistry, toxicity, and benthic community data.

[b] Bioaccumulation sampling stations are co-located with SQT sampling stations.

[c] Mummichog/darter/killifish tissue sampling stations are co-located with SQT sampling stations. Sediment collection at stations intended for co-location with small forage fish (i.e., mummichog and darters/killifish) collection will be deferred, as appropriate, to a time subsequent to when the fish are caught. Station coordinates will be determined in conjunction with fish sampling. Additional sediment locations to be co-located with blue crab will also be sampled once blue crab compositing locations are selected and approved by USEPA.

[d] Human health exposure stations will be analyzed for sediment chemistry only.

[e] No habitat data are available for sampling stations between RM 16 and RM 17.4; course substrate in shallow nearshore areas is expected based on visual observation.

[f] Up to 5 additional locations may be added throughout the LPRSA as “floater” stations for the HHRA for a total of 14 human health exposure locations. “Floater” locations will be identified during the field effort based on observations of human access and use.

ES 6 Biological Analyses

Two toxicity tests will be performed on each of the SQT surface sediment samples collected (between 97 and 102, depending upon grain size in the uppermost 1.4 miles of the river) for the SQT. The 28-day *Hyalella azteca* growth and mortality test will be conducted on all sediment samples, whereas the 10-day *Chironomus dilutus* growth and mortality test will be performed on freshwater sediment samples, and the 10-day *Ampelisca abdita* mortality test will be conducted on the estuarine sediment samples. The decision of which of the two toxicity tests to perform will be based on the interstitial salinity measured in the laboratory from the samples submitted for testing (sediment with salinity measures of < 5 parts per thousand [ppt] will be tested with *Chironomus* and ≥ 5 ppt with *Ampelisca*).

Benthic community samples will be collected at each of the SQT sediment sampling locations (between 97 and 102, depending upon grain size in the upper 1.4 miles of the river). If feasible, four replicates will be collected and analyzed separately per location of which three will be analyzed separately per location and one will be archived. The invertebrates will be identified to the lowest practical taxonomic level (generally genus or species level). Table11-1 in Worksheet No. 11 summarizes the taxonomic level identified in other surveys in New Jersey. The invertebrates will be identified to this taxonomic level unless the condition of the organisms (damaged or fragmented) and the age (juvenile) precludes this taxonomic level. Benthic community samples will be taken as part of the sediment collection effort planned for fall of 2009. A subset of the SQT assessment locations sampled will be revisited as part of the second and third community surveys, which will take place in spring and summer of 2010 (all dates are tentative and subject to approvals by the USEPA). The targeted locations to be sampled during the second survey will be selected following the first sampling event.

Two bioaccumulation tests will be performed on surface sediment samples collected at up to 20 sampling locations (locations selected as specified in Attachment J); the specific test species will depend on the interstitial salinity of the sediment, as measured in the laboratory from the sample submitted for testing. The freshwater bioaccumulation test (for sediments with interstitial salinity < 5 ppt) will be the 28-day *Lumbriculus variegatus* test, and the estuarine bioaccumulation test (for interstitial salinity ≥ 5 ppt) will be the 28-day *Neanthes virens* test. Detected concentrations of neutral organic chemicals of interest in lab-exposed worm (*Lumbriculus* and *Neanthes*) tissue will be adjusted to estimate steady-state concentrations using the process based on McFarland (1995) and described in the US Army Corps of Engineers (USACE) inland testing manual (USEPA and USACE 1998).

ES 7 Chemical Analyses

The analyte list as outlined in the Fish/Decapod QAPP (Windward 2009) was used to develop the proposed chemistry analyte list for the benthic invertebrate bioaccumulation tissue and sediment sampling effort. Table ES-3 provides a summary of the chemical groups that are proposed for analysis in fish and decapod tissue and identifies the analytical groups that are proposed for benthic invertebrate bioaccumulation tissue and sediment chemistry analyses.

Table ES-3. Analyte groups for chemistry analysis

Analyte Group	Proposed for Analysis in Fish/Decapod Tissue and Benthic Bioaccumulation Tissue?	Proposed for Analysis in Sediment?
Metals	Yes (inorganic arsenic in fish/decapod tissue only)	Yes (excluding inorganic arsenic)
Mercury and methylmercury	yes	yes
Butyltins	yes	yes
SVOCs	yes[a]	yes
VOCs	no	yes[b]
PAHs (excluding alkylated compounds)	yes	yes
Alkylated PAHs	yes	yes
PCB congeners[c] and homologs	yes	yes
PCB Aroclors	yes	yes
PCDDs/PCDFs	yes	yes
Organochlorine pesticides (excluding toxaphene)	yes	yes
Herbicides	no[d]	yes
TPH (extractable, purgeable, and alkanes)	no	yes
General chemistry – total sulfide, ammonia-N, total Kjeldahl nitrogen, total phosphorus, AVS/SEM	no	yes
Cyanide	no	yes
Lipids	yes	no
Percent moisture	yes	yes
TOC	no	yes
Grain size	no	yes

[a] 1,2,4,5-tetrachlorobenzene and 2,3,4,6-tetrachrophenol will not be included in tissue analysis.
[b] VOCs will be analyzed at all human health exposure and shallow SQT sampling locations.
[c] Up to 209 PCB congeners will be analyzed.
[d] Per agreement between USEPA and CPG, herbicides will be analyzed only in sediment and are not included for analysis in tissue for the following reasons: 1) there are no published methods for herbicides in tissue, 2) herbicides are infrequently detected in tissue in recent studies, 3) the likely levels of detection are below levels to be toxic to wildlife, and the bioaccumulation potential is low.

AVS/SEM – acid volatile sulfur/simultaneously extracted metals
CPG – Cooperating Parties Group
PAH – polycyclic aromatic hydrocarbon
PCB – polychlorinated biphenyl
PCDD – polychlorinated dibenzo-*p*-dioxins
PCDF – polychlorinated dibenzofuran
SVOC – semivolatile organic compound
TOC – total organic carbon
TPH – total petroleum hydrocarbons
USEPA – US Environmental Protection Agency
VOC – volatile organic compound

TABLE OF CONTENTS

Introduction

This document presents the Sediment Chemical Analyses and Benthic Invertebrate Toxicity and Bioaccumulation Testing quality assurance project plan (QAPP) proposed sediment collection effort to support of the benthic invertebrate sediment quality triad (SQT) assessment (i.e., through chemical analysis, toxicity testing, and benthic invertebrate community analysis) and for benthic invertebrate bioaccumulation testing for the Lower Passaic River Study Area (LPRSA). Per the agreements resulting from the January 14-15, 2009, meetings between US Environmental Protection Agency (USEPA), its Partner Agencies (PA),[5] and the Cooperating Parties Group (CPG) to discuss the elements of the 2006 Field Sampling Plan Volume 2 (FSP2) (Malcolm Pirnie et al. 2006), this QAPP was developed to address these main sampling objectives:

1. Determine if exposure to site-related contaminants in the LPRSA sediment poses unacceptable risks to the benthic invertebrate community
2. Determine if the consumption of benthic invertebrates (represented by laboratory-exposed bioaccumulation test and field-collected crab and crayfish tissue results for representative invertebrate species) poses unacceptable risks to ecological receptors
3. Determine if exposure to surface sediments in the LPRSA poses unacceptable risks to human receptors

The sediment collection event is scheduled for fall 2009. The purpose of the sediment sampling effort is three-fold: 1) to collect benthic community survey data in LPRSA (two subsequent survey events are currently planned to evaluate potential seasonal changes, 2) to conduct toxicity tests to assess adverse effects of LPRSA chemicals in sediment on benthic invertebrates, and 3) to conduct a tissue-residue analysis to understand which chemicals may be bioaccumulating in benthic invertebrate species. The benthic community, toxicity test, and sediment chemistry data will be used in the SQT assessment to evaluate potential risks to benthic invertebrates in the ecological risk assessment (ERA). Benthic infaunal invertebrate tissue chemistry data from bioaccumulation testing will also be used in the ERA. Sediment chemistry data will be used in the ERA in the evaluation of dietary exposure to ecological receptors and in the human health risk assessment (HHRA) in the evaluation of exposure via multiple exposure pathways.

Background Information

The LPRSA is an operable unit of the Diamond Alkali Superfund Site. In 1984, the Diamond Alkali Superfund Site was placed on the National Priorities List because of past industrial operations at the Diamond Alkali plant (80-120 Lister Avenue in Newark, New Jersey), which resulted in the release of hazardous substances, such as polychlorinated dibenzo-*p*-dioxins (PCDDs) and pesticides. Sampling in Passaic River sediments conducted during the remedial investigation/feasibility study (RI/FS) for the Diamond Alkali plant revealed many organic and inorganic chemical substances including, but not limited to, PCDDs and polychlorinated dibenzofurans (PCDFs), pesticides, polychlorinated biphenyls (PCBs), polycyclic aromatic

[5] The Partner Agencies include the US Army Corps of Engineers (USACE), the New Jersey Department of Environmental Protection (NJDEP), the New Jersey Department of Transportation (NJDOT), National Oceanic and Atmospheric Administration (NOAA), and US Fish and Wildlife Service (USFWS).

hydrocarbons (PAHs), and metals. In 1994, an investigation of a 6-mile stretch of the Passaic River centered on the Diamond Alkali plant was begun. Extensive sampling showed that the evaluation of a larger area was necessary because sediments contaminated with similar organic chemical substances, and other potential sources of hazardous substances were present along at least the entire 17.4-mile tidal stretch of the Passaic River and were further dispersed by the tidal nature of the Lower Passaic River (LPR). As a result, in 2001, USEPA expanded the scope of the Superfund study to encompass the 17.4-mile tidal stretch of the LPR and to include other potentially responsible parties. Currently 73 companies are part of the CPG that have agreed to help fund this study.

The USEPA, the US Army Corps of Engineers (USACE), the New Jersey Department of Environmental Protection (NJDEP), the New Jersey Department of Transportation (NJDOT), National Oceanic and Atmospheric Administration (NOAA), and US Fish and Wildlife Service (USFWS) have partnered to conduct a comprehensive study of the LPR and its tributaries. The Lower Passaic River Restoration Project (LPRRP) is an integrated, joint effort among state and federal agencies to evaluate environmental conditions within the LPRSA and identify remediation and restoration options as part of a program to restore human use and ecological functions in the LPR that have been lost as a result of more than 200 years of urbanization and industrialization. The LPRRP is governed by the:

- CERCLA: RI/FS, and natural resource damage assessment and restoration (NRDAR) program
- Water Resources Development Act (WRDA): study and FS

Initial scoping and investigative activities have been performed by contractors retained by members of the government partnership. However, as of May 8, 2007, the LPRSA CPG, an unincorporated group of companies that has entered into an Administrative Settlement Agreement and Order on Consent (Settlement Agreement) with the USEPA Region 2 (USEPA 2007), assumed the role of scoping and executing remaining activities to be performed as part of the LPRRP CERCLA RI/FS. This work will be performed under the Settlement Agreement with oversight provided by USEPA and its government parties.

The LPRSA has been identified as one area within the New York/New Jersey Harbor complex requiring investigation and evaluation. The LPRSA encompasses the 17.4-mile tidal reach of the Passaic River below the Dundee Dam to the mouth of the Passaic River at Newark Bay, its tributaries (e.g., Saddle River, Second River, and Third River), and the surrounding watershed below the Dundee Dam. Information from investigations conducted by other parties, both within the LPRSA and in major physically connected water bodies, including the upper Passaic River, Hackensack River, Newark Bay, the Arthur Kill, and the Kill van Kull may also be utilized in completing the RI/FS. Additional background information on the LPRSA is provided in the *LPRSA Human Health and Ecological Risk Assessment Streamlined 2009 Problem Formulation* document (PFD) (Windward and AECOM 2009).

Document Organization

This document was prepared using the Uniform Federal Policy for Quality Assurance Project Plans (UFP-QAPPs) guidance (USEPA et al. 2005). Worksheet No. 2 identifies the location of each element of this QAPP. A brief summary of the information provided in this document is presented below.

Information on personnel and project organization related specifically to this QAPP, including personnel responsibilities, qualifications, and special training, and project organization, distribution, and communications pathways, is presented in Worksheet Nos. 3 through 8. A summary of the scoping session conducted for the development of this QAPP (i.e., the FSP2 meeting held on January 14-15, 2009, in Newark, New Jersey) is presented in Worksheet No. 9.

The problem definition, project quality objectives (PQO), a summary of project tasks, and the project schedule and timeline for this QAPP are summarized in Worksheet Nos. 10, 11, 14, and 16, respectively. A summary of secondary data that may be used for the completion of this QAPP is provided in Worksheet No. 13. The field sampling design and rationale and a list of proposed sampling locations are provided in Worksheet Nos. 17 and 18.

Information related to laboratory analyses, including performance criteria; reference limits and evaluations; analytical standard operating procedure (SOP) requirements; field quality control (QC) samples; SOP references; instrument calibration, maintenance, testing, and inspection; QC samples; and analytical services, is presented in Worksheet Nos. 12, 15, 19, 23, 24, 25, 28, and 30, respectively.

Field QC samples are summarized in Worksheet No. 20. Field sampling SOPs are presented in Attachments B through I of this document, and the location of each SOP is identified in Worksheet No. 21. Procedures for the calibration and maintenance of field equipment are presented in Worksheet No. 22. Field sample handling and custody procedures are provided in Worksheet Nos. 26 and 27, respectively.

A summary of the documents and records associated with this QAPP, from field sampling effort to the delivery of the data report, is presented in Worksheet No. 29. Internal and external assessments of the field activities, map production, laboratory analytical method compliance, data usability, and document review are described in Worksheet No. 31, and types of findings and corrective action responses are outlined in Worksheet No. 32. A summary of quality assurance (QA) management reports for this QAPP is provided in Worksheet No. 33. Verification of field sampling data, validation of laboratory analytical data, and an assessment of data usability are presented in Worksheet Nos. 34 through 37.

QAPP Worksheet No. 1. Title and Approval Page

Quality Assurance Project Plan for Surface Sediment Chemical Analyses and Toxicity and Bioaccumulation Testing of the LPRSA

Document Title

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Signature

Bill Potter, de maximis, inc., Date

Printed Name/Organization/Date

QAPP Worksheet No. 1. Title and Approval Page (cont.)

Signature

Robert Law, de maximis, inc., Date

Printed Name/Organization/Date

Approval Signatures:

USEPA Project Managers
Approval Authority

Signature

Alice Yeh, USEPA, Date

Printed Name/Title/Date

Signature

Stephanie Vaughn, USEPA, Date

Printed Name/Title/Date

USEPA Project QA Officer
Approval Authority

Signature

William Sy, USEPA, Date

Printed Name/Title/Date

QAPP Worksheet No. 2. QAPP Identifying Information

1. Identify guidance used to prepare QAPP:

   Uniform Federal Policy for Quality Assurance Project Plans. (USEPA et al. 2005) Evaluating, Assessing, and Documenting Environmental Data Collection and Use Programs. Part 1: UFP-QAPP Manual. Final Version 1. March 2005. Intergovernmental Data Quality Task Force (USEPA, US Department of Defense, US Department of Energy). EPA 505-B-04-900A.

2. Identify regulatory program: CERCLA

3. Identify approval entity: USEPA Region 2

4. Indicate whether the QAPP is a ~~generic~~ or a project-specific QAPP

5. List dates of scoping sessions that were held: January 14-15, 2009

6. List dates and titles of QAPP documents written for previous site work, if applicable:

Title
Tierra Solutions. 1999. *Passaic River Study Area Ecological Sampling Plan. Quality Assurance Project Plan.* Volume 2 of 6. Tierra Solutions, Inc., Newark, NJ.
Malcolm Pirnie. 2005. *Lower Passaic River Restoration Project. Quality Assurance Project Plan*. Prepared for USEPA and USACE. Malcolm Pirnie, Inc., White Plains, NY.
Aqua Survey. 2005. *Taxonomic Identification of Benthic Invertebrates from Sediment Collected in the Lower 17 Miles of the LPR in Support of the LPRRP for NJDOT/OMR*. Flemington, NJ.
Germano & Associates. 2005. *Sediment Profile Imaging Survey of Sediment and Benthic Habitat Characteristics of the Lower Passaic River.* Bellevue, WA.
Malcolm Pirnie, Earth Tech, Battelle. 2006. *Lower Passaic River Restoration Project. Draft Field Sampling Plan.* Volume 2. Prepared for USEPA, USACE, and NJDOT/Office of Maritime Resources. Malcolm Pirnie, Inc., White Plains, NY; Earth Tech, Inc., Bloomfield, NJ; Battelle, Stony Brook, NY.
Malcolm Pirnie. 2007. *Lower Passaic River Restoration Project*. *Quality Assurance Project Plan/Field Sampling Plan Addendum for Lower Passaic River Restoration Project Empirical Mass Balance Evaluation*. Prepared for USEPA and USACE. Malcolm Pirnie, Inc., White Plains, NY.
ENSR, AECOM, Windward. 2008. *Lower Passaic River Restoration Project*. *Quality Assurance Project Plan: RI Low Resolution Coring/Sediment Sampling.* Revision 4. Prepared for CPG. ENSR AECOM, Newark, NJ.

7. List organizational partners (stakeholders) and connection with lead organization:

   USEPA, USACE, NJDOT, NJDEP, NOAA, and USFWS have partnered to conduct a comprehensive study of the LPR and its tributaries.

   As of May 8, 2007, the LPRSA CPG has entered into an Administrative Order on Consent (Settlement Agreement) with USEPA Region 2 (USEPA 2007) and assumed the role of scoping and executing remaining activities to be performed as part of the LPRRP CERCLA RI/FS. This work will be performed under the Settlement Agreement with oversight conducted by USEPA and its government partners. de maximis, inc. (acting as project

QAPP Worksheet No. 2. QAPP Identifying Information (cont.)

coordinator for the CPG), Windward, and its subcontractors, are conducting the work on behalf of the CPG.

8. List data users:

   All entities identified in Item 7 above are considered to be data users.

Required QAPP Element(s) and Corresponding QAPP Section(s)	QAPP Worksheet Number	Required Information
Project Management and Objectives		
2.1 Title and Approval Page	1	Title and Approval Page
2.2 Document Format and Table of Contents	2	Table of Contents QAPP Identifying Information
2.2.1 Document Control Format 2.2.2 Document Control Numbering System 2.2.3 Table of Contents 2.2.4 QAPP Identifying Information		
2.3 Distribution List and Project Personnel Sign-Off Sheet		
2.3.1 Distribution List	3	Distribution List
2.3.2 Project Personnel Sign-Off Sheet	4	Project Personnel Sign-Off Sheet
2.4 Project Organization		
2.4.1 Project Organizational Chart	5	Project Organizational Chart
2.4.2 Communication Pathways	6	Communication Pathways
2.4.3 Personnel Responsibilities and Qualifications	7	Personnel Responsibilities and Qualifications Table
2.4.4 Special Training Requirements and Certification	8	Special Personnel Training Requirements Table
2.5 Project Planning/Problem Definition		Project Planning Session Documentation (including Data Needs tables)
2.5.1 Project Planning (Scoping)	9	Project Scoping Session Participants Sheet
2.5.2 Problem Definition, Site History, and Background	10	Problem Definition, Site History, and Background Site Maps (historical and present)
2.6 Project Quality Objectives and Measurement Performance Criteria	11	Site-Specific PQOs
	12	Measurement Performance Criteria Table
2.6.1 Development of Project Quality Objectives Using the Systematic Planning Process 2.6.2 Measurement Performance Criteria		
2.7 Secondary Data Evaluation	13	Sources of Secondary Data and Information Secondary Data Criteria and Limitations Table
2.8 Project Overview and Schedule	14	Summary of Project Tasks
2.8.1 Project Overview	15	Reference Limits and Evaluation Table

QAPP Worksheet No. 2. QAPP Identifying Information (cont.)

Required QAPP Element(s) and Corresponding QAPP Section(s)		QAPP Worksheet Number	Required Information
	2.8.2 Project Schedule	16	Project Schedule/Timeline Table
Measurement/Data Acquisition			
3.1 Sampling Tasks			
	3.1.1 Sampling Process Design and Rationale	17	Sampling Design and Rationale Sample Location Map
	3.1.2 Sampling Procedures and Requirements	18	Sampling Locations and Methods/ SOP Requirements Table
	3.1.2.1 Sampling Collection Procedures	19	Analytical Methods/SOP Requirements Table
	3.1.2.2 Sample Containers, Volume, and Preservation	20	Field QC Sample Summary Table Sampling SOPs
	3.1.2.3 Equipment/Sample Containers Cleaning and Decontamination Procedures	21	Project Sampling SOP References Table
	3.1.2.4 Field Equipment Calibration, Maintenance, Testing, and Inspection Procedures	22	Field Equipment Calibration, Maintenance, Testing, and Inspection Table
	3.1.2.5 Supply Inspection and Acceptance Procedures		
	3.1.2.6 Field Documentation Procedures		
3.2 Analytical Tasks			
	3.2.1 Analytical SOPs	23	Analytical SOP References Table
	3.2.2 Analytical Instrument Calibration Procedures	24	Analytical Instrument Calibration Table
	3.2.3 Analytical Instrument and Equipment Maintenance, Testing, and Inspection Procedures	25	Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table
	3.2.4 Analytical Supply Inspection and Acceptance Procedures		
3.3 Sample Collection Documentation, Handling, Tracking, and Custody Procedures		26	Sample Collection Documentation Handling, Tracking, and Custody SOPs Sample Container Identification
	3.3.1 Sample Collection Documentation 3.3.2 Sample Handling and Tracking System 3.3.3 Sample Custody	27	Sample Handling Flow Diagram Example Chain-of-Custody Form and Seal
3.4 QC Samples		28	QC Samples Table Screening/Confirmatory Analysis Decision Tree
	3.4.1 Sampling QC Samples 3.4.2 Analytical Quality Control Samples		

QAPP Worksheet No. 2. QAPP Identifying Information (cont.)

Required QAPP Element(s) and Corresponding QAPP Section(s)	QAPP Worksheet Number	Required Information
3.5 Data Management Tasks	29	Project Documents and Records Table
3.5.1 Project Documentation and Records 3.5.2 Data Package Deliverables 3.5.3 Data Reporting Formats 3.5.4 Data Handling and Management 3.5.5 Data Tracking and Control	30	Analytical Services Table Data Management SOPs
Assessment/Oversight		
4.1 Assessments and Response Actions	31	Assessments and Response Actions
4.1.1 Planned Assessments 4.1.2 Assessment Findings and Corrective Action Responses	32	Planned Project Assessments Table Audit Checklists Assessment Findings and Corrective Action Responses Table
4.2 QA Management Reports	33	QA Management Reports Table
4.3 Final Project Report		
Data Review		
5.1 Overview		
5.2 Data Review Steps		
5.2.1 Step I: Verification	34	Verification (Step I) Process Table
5.2.2 Step II: Validation 5.2.2.1 Step IIa Validation Activities 5.2.2.2 Step IIb Validation Activities	35	Validation (Steps IIa and IIb) Process Table
5.2.3 Step III: Usability Assessment 5.2.3.1 Data Limitations and Actions from Usability Assessment 5.2.3.2 Activities	36	Validation (Steps IIa and IIb) Summary Table
5.3 Streamlining Data Review		
5.3.1 Data Review Steps To Be Streamlined 5.3.2 Criteria for Streamlining Data Review 5.3.3 Amounts and Types of Data Appropriate for Streamlining	37	Usability Assessment

QAPP Worksheet No. 3. Distribution List

QAPP Recipients	Title	Organization	Telephone Number	E-mail Address
Lisa Saban	Investigative Organization Project Manager	Windward	206.812.5429	lisas@windwardenv.com
Mike Johns	Technical Advisory Team member	Windward	206.812.5418	mikej@windwardenv.com
Tad Deshler	Investigative Organization Task QA/QC Manager	Windward	206.812.5406	tad@windwardenv.com
Susan McGroddy	Investigative Organization Project Chemist	Windward	206.812.5421	susanm@windwardenv.com
Kimberley Goffman	Investigative Organization Information Manager	Windward	206.812.5414	kimg@windwardenv.com
Jennifer Parker	Investigative Organization Data Validation Coordinator	Windward	206.812.5442	jenniferp@windwardenv.com
Thai Do	Field Coordinator/Site Safety and Health Officer	Windward	206.812.5407	thaid@windwardenv.com
Angelita Rodriquez	Field Coordinator/Site Safety and Health Officer (alternate)	Windward	206.812.5428	angelitar@windwardenv.com
Helle Andersen	Field Personnel/ Biological Laboratory Coordinator	Windward	206.812.5402	hellea@windwardenv.com

QAPP Worksheet No. 3. Distribution List (cont.)

QAPP Recipients	Title	Organization	Telephone Number	E-mail Address
Joanna Florer	Field Personnel	Windward	206.812.5438	joannaf@windwardenv.com
Suzanne Replinger	Field Personnel	Windward	206.812.5435	suzanner@windwardenv.com
Rick Berg	Field Personnel	Windward	206.812.5428	rickb@windwardenv.com
Daniel Diedrich	Field Personnel	Windward	206.812.5441	danield@windwardenv.com
Chelsea Lorenz	Field Personnel	Windward	206.812.5436	chelseal@windwardenv.com
Sarah Fowler	Field Personnel	Windward	206.812.5440	sarahf@windwardenv.com
Bill Potter/Robert Law	Project Coordinators	de maximis, inc.	908.735.9315	otto@demaximis.com rlaw@demaximis.com
William Hyatt	Coordinating Counsel	K&L Gates	973.848.4045	william.hyatt@klgates.com
Eric Parker	Boat Operator Contact	Research Support Services, Inc.	206.550.5202	eparker@rssincorporated.com
Tom Dolce	Boat Operator Contact (alternate)	Aqua Survey, Inc.	908.303.8326	dolce@aquasurvey.com
Polly Newbold	CPG QA Coordinator	de maximis Data Management Solutions, Inc.	908.479.1975	pnewbold@ddmsinc.com
Denise Shepperd	Third-party independent validator	Trillium	302.992.9737	dshepperd@trilliuminc.com
Paul Dinnel	Third-party independent validator	Dinnel Marine Resources	360. 299.8468	padinnel@aol.com
Ken Simons	Biological Laboratory Project Manager	EnviroSystem Inc.	603.926.3345, ext. 213	ksimon@envirosystems.com
Dave Langill	Biological Laboratory Project Manager	EcoAnalysts, Inc.	208.882.2588, ext. 71	DLangill@ecoanalysts.com

QAPP Worksheet No. 3. Distribution List (cont.)

QAPP Recipients	Title	Organization	Telephone Number	E-mail Address
Peter Henriksen	Laboratory Project Manager	Alpha Analytical	508.844.4113	phenriks@alphalab.com
Kimberly Mace	Laboratory Project Manager	Analytical Perspectives	910.794.1613, ext. 102	kmace@ultratrace.com
Misty Kennard-Mayer	Laboratory Project Manager	Brooks Rand Labs	206.753.6125	Misty@brooksrand.com
Lynda Huckestein	Laboratory Project Manager	Columbia Analytical Services, Inc.	360.430.7733	LHuckestein@caslab.com
Mike Challis	Laboratory Project Manager	Maxxam Analytics	800.563.6266, ext. 5790	mike.challis@maxxamanalytics.com
Alice Yeh	USEPA Project Manager	USEPA Region 2	212.637.4427	yeh.alice@epa.gov
Stephanie Vaughn	USEPA Project Manager	USEPA Region 2	212.637.3914	vaughn.stephanie@epamail.epa.gov
William Sy	USEPA Project QA Officer	USEPA Region 2	732.632.4766	sy.william@epa.gov
Lisa Baron	Project Manager	USACE	917.790.8306	Lisa.A.Baron@usace.army.mil
Janine MacGregor	Project Coordinator	NJDEP	609.633.0784	Janine.MacGregor@dep.state.nj.us
Timothy Kubiak	Assistant Supervisor of Environmental Contaminants	USFWS	609.646.9310, ext. 26	tim_kubiak@fws.gov
Reyhan Mehran	Coastal Resource Coordinator	NOAA	212.637.3257	reyhan.mehran@noaa.gov

QAPP Worksheet No. 4. Project Personnel Sign-Off Sheet

Project Personnel	Title	Telephone Number	Signature	Date QAPP Read E-mail Receipt
Lisa Saban	Investigative Organization Project Manager, Windward	206.812.5429		
Tad Deshler	Investigative Organization Task QA/QC Manager, Windward	206.812.5406		
Thai Do	Field Coordinator/Site Safety and Health Officer, Windward	206.812.5407		
Angelita Rodriquez	Field Coordinator/Site Safety and Health Officer (alternate), Windward	206.812.5428		
Helle Andersen	Biological Laboratory Coordinator, Windward	206.812.5402		
Susan McGroddy	Investigative Organization Project Chemist, Windward	206.812.5421		
Kimberley Goffman	Investigative Organization Information Manager, Windward	206.812.5414		
Jennifer Parker	Investigative Organization Data Validation Coordinator, Windward	206.812.5442		
Joanna Florer	Field Personnel, Windward	206.812.5438		
Suzanne Replinger	Field Personnel, Windward	206.812.5435		

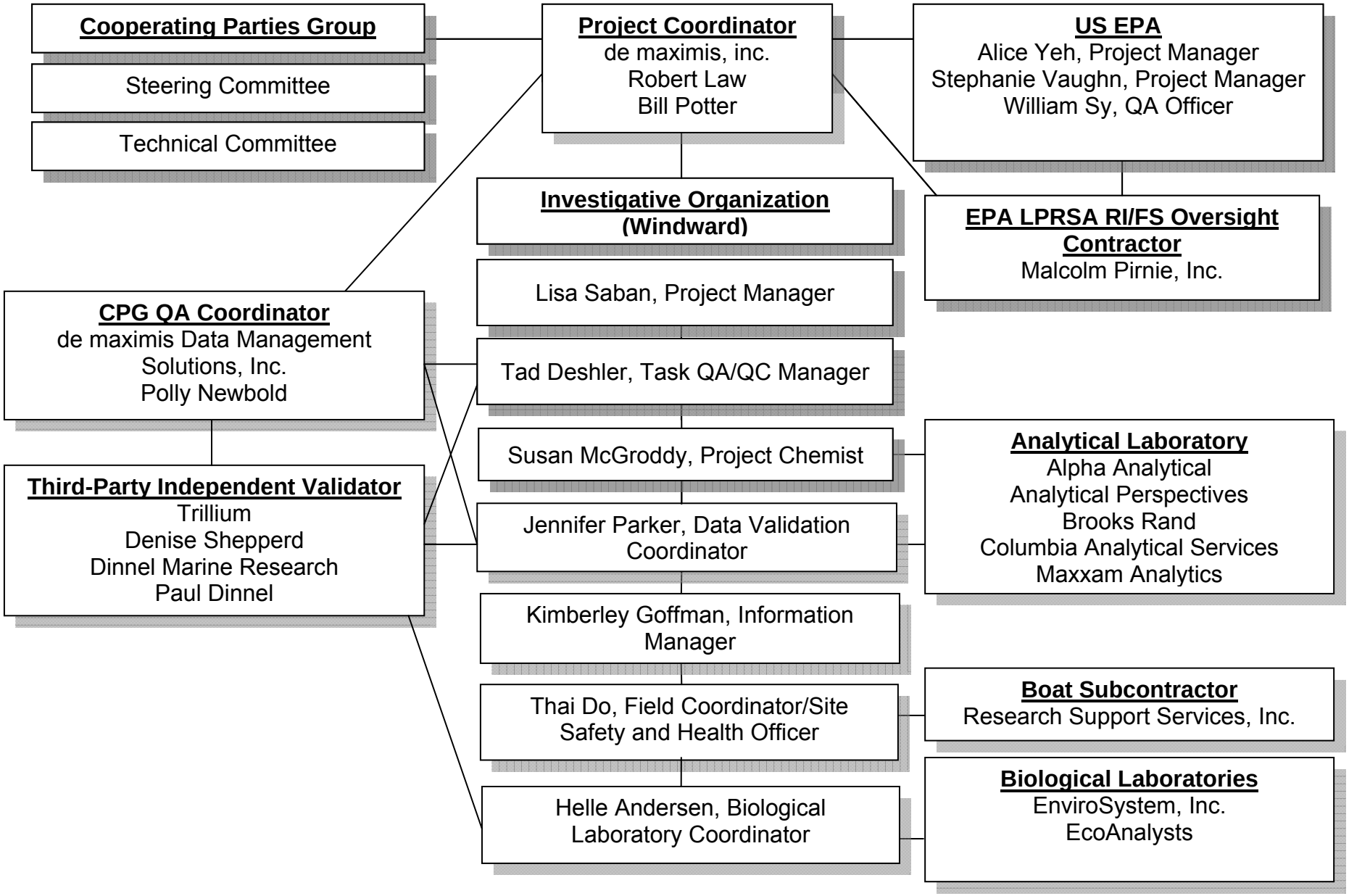
QAPP Worksheet No. 4. Project Personnel Sign-Off Sheet (cont.)

Project Personnel	Title	Telephone Number	Signature	Date QAPP Read E-mail Receipt
Rick Berg	Field Personnel, Windward	206.812.5428		
Daniel Diedrich	Field Personnel, Windward	206.812.5441		
Chelsea Lorenz	Field Personnel, Windward	206.812.5436		
Sarah Fowler	Field Personnel, Windward	206.812.5440		
Bill Potter/Robert Law	Project Coordinators, dmi	908.735.9315		
Eric Parker	Boat Operator, Research Support Services, Inc.	206.550.5202		
Ken Simons	Laboratory PM, EnviroSystem Inc.	603.926.3345, ext. 213		
Dave Langill	Laboratory PM, EcoAnalysts, Inc.	208.882.2588, ext. 71		
Peter Henriksen	Laboratory PM, Alpha Analytical	508.844.4113		
Kimberly Mace	Laboratory PM, Analytical Perspectives	910.794.1613, ext. 102		
Misty Kennard-Mayer	Laboratory PM, Brooks Rand Labs	206.753.6125		
Lynda Huckestein	Laboratory PM, Columbia Analytical Services, Inc.	360.430.7733		
Mike Challis	Laboratory PM, Maxxam Analytics	800.563.6266, ext. 5790		

QAPP Worksheet No. 4. Project Personnel Sign-Off Sheet (cont.)

Project Personnel	Title	Telephone Number	Signature	Date QAPP Read E-mail Receipt
Polly Newbold	CPG QA Coordinator, de maximis Data Management Solutions, Inc.	908.479.1975		
Denise Shepperd	Third-Party Independent validator, Trillium	302.992.9737		
Paul Dinnel	Third-Party Independent validator, Dinnel Marine Resources	360.299.8468		

QAPP Worksheet No. 5. Project Organizational Chart



QAPP Worksheet No. 6. Communication Pathways

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (timing, pathways, etc.)
Field sampling communications	Field Coordinator	Thai Do	206.812.5407	Communicate daily, or as needed, with field personnel, subcontractors, and Investigative Organization Project Manager and Task QA/QC Manager directly, or via e-mail or phone.
Communications with Investigative Organization Project Manager				
Communications with Investigative Organization Task QA/QC Manager				
Health and safety briefing	Site Safety and Health Officer			Communicate daily, or as needed, with field personnel directly, or via e-mail or phone, on matters regarding health and safety
Communications with Project Coordinator	Investigative Organization Project Manager	Lisa Saban	206.812.5427	Communicate as needed with Project Coordinator via e-mail or phone.
	Investigative Organization Data Validation Coordinator	Jennifer Parker	206.812.5442	
	Investigative Organization Task QA/QC Manager	Tad Deshler	206.812.5406	

QAPP Worksheet No. 6. Communication Pathways (cont.)

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (timing, pathways, etc.)
Communications with analytical laboratories	Investigative Organization Project Chemist	Susan McGroddy	206.812.5421	Communicate with FC, Project Managers, and laboratory Project Manager as needed via phone or e-mail, regarding laboratory- and chemical analysis-related issues.
	Investigative Organization Data Validation Coordinator	Jennifer Parker	206.812.5442	Communicate with Project Managers and laboratory Project Manager as needed via phone or e-mail, regarding laboratory- and chemical analysis-related issues.
	Investigative Organization Biological Laboratory Coordinator	Helle Andersen	206.812.5402	Communicate with FC, Project Managers, and laboratory Project Manager as needed via phone or e-mail, regarding biological laboratory-related issues (e.g., toxicity tests).
	Investigative Organization Information Manager	Kim Goffman	206.812.5414	Communicate with FC, Project Managers, and laboratory Project Manager as needed via phone or e-mail, regarding chemical and biological data management.
Communications with USEPA	Project Coordinators	Bill Potter/ Robert Law (de maximis, inc.)	908.735.9315	Communicate with USEPA Project Manager as needed via e-mail or phone.
	Investigative Organization Project Manager	Lisa Saban	206.812.5427	Communicate with USEPA Project Manager as needed via e-mail or phone.
Quality status and issues	CPG QA Coordinator	Polly Newbold	908.479.1975	Communicate with CPG Project Coordinator as needed via e-mail or phone.

QAPP Worksheet No. 6. Communication Pathways (cont.)

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (timing, pathways, etc.)
Sampling vessel operations	Boat subcontractor	Eric Parker (Research Support Services, Inc.)	206.550.5202	Communicate daily, or as needed, with FC directly. The sampling vessel captain has the ultimate authority for stopping work while working on water. The vessel captain, in consultation with the Site Safety and Health Officer, will follow guidelines documented in the site-specific health and safety plan (Attachment L). In addition, standard safe boating practices related to weather conditions and vessel operations will also apply, even if not specifically addressed in the health and safety plan (Attachment L).

QAPP Worksheet No. 7. Personnel Responsibilities and Qualifications Table

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications
Lisa Saban	Investigative Organization Project Manager	Windward	Oversight of performance by investigative organization	MS, Aquatic Toxicology and Ecology, 22 yrs. exp.
Mike Johns	Technical Advisory Team Member	Windward	Implementation strategy and guidance	PhD, Oceanography, 30 yrs. exp.
Tad Deshler	Investigative Organization Task QA/QC Manager	Windward	Coordinate QAPP production; oversee implementation of QA/QC procedures; senior review of deliverables	MS, Animal Science, 23 yrs. exp.
Susan McGroddy	Investigative Organization Project Chemist	Windward	Coordinate with the FC and analytical testing laboratories to ensure that QAPP chemistry requirements are followed	PhD, Environmental Science, 16 yrs. exp.
Jennifer Parker	Investigative Organization Data Validation Coordinator	Windward	Manage data validation tasks, ensure that validation is conducted and documented according to the QAPP, and interact with laboratories to resolve any issue	MS, Soil Chemistry, 9 yrs. exp
Kimberley Goffman	Investigative Organization Information Manager	Windward	Oversees import and export of chemistry data to and from project database	BS, Geology, 17 yrs. exp.
Helle Andersen	Investigative Organization Biological Laboratory Coordinator/Field Personnel	Windward	Coordinate with the FC and analytical testing laboratories to ensure that QAPP biological testing requirements are followed	MS, Toxicology and Marine Biology, 22 yrs. exp.
Thai Do	Investigative Organization Field Coordinator/Site Safety and Health Officer	Windward	Manager of field sampling efforts; daily and site health and safety briefings with field staff; communications with project management; HSP and report preparation	MS, Tropical Biology, 6 yrs. exp.

QAPP Worksheet No. 7. Personnel Responsibilities and Qualifications Table (cont.)

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications
Angelita Rodriquez	Investigative Organization Field Coordinator/Site Safety and Health Officer (alternate)	Windward	Manager of field sampling efforts; daily and site health and safety briefings with field staff; communications with project management; HSP and report preparation	BS, Environmental Science, 5 yrs. exp.
Joanna Florer	Investigative Organization Field Personnel	Windward	Implementation of QAPP in field collection of samples, as directed by the FC	BS, Environmental Science, 7 yrs. exp.
Suzanne Replinger	Investigative Organization Field Personnel	Windward	Implementation of QAPP in field laboratory processing, as directed by the FC	BS, Environmental Science, 2 yrs. exp.
Rick Berg	Investigative Organization Field Personnel	Windward	Implementation of QAPP in field laboratory processing, as directed by the FC	MS, Earth Sciences, 1 yr. exp.
Daniel Diedrich (alternate)	Investigative Organization Field Personnel	Windward	Implementation of QAPP in field collection of samples, as directed by the FC	MS, Environmental Science/Toxicology, 4 yrs. exp.
Chelsea Lorenz (alternate)	Investigative Organization Field Personnel	Windward	Implementation of QAPP in field laboratory processing, as directed by the FC	BS, Aquatic and Fishery Sciences, 1 yr. exp.
Sarah Fowler (alternate)	Investigative Organization Field Personnel	Windward	Implementation of QAPP in field laboratory processing, as directed by the FC	BS, Environmental Science/Toxicology, 2 yrs. exp.
Linda Marsh	Investigative Organization GIS database management	Windward	Management of GIS database; verify field-collected GPS coordinates	BA, Zoology; GIS certificate, 5 yrs. exp.
Bill Potter	CPG Project Coordinator	de maximis, inc.	Coordination of delivery of task products to USEPA	BS, Chemical Engineering, 38 yrs. exp.

QAPP Worksheet No. 7. Personnel Responsibilities and Qualifications Table (cont.)

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications
Robert Law	CPG Project Coordinator	de maximis, inc.	Coordination of delivery of task products to USEPA	PhD, Geology, 28 yrs. exp.
Polly Newbold	CPG QA Coordinator	ddms, inc.	Oversight of project QA/QC. Periodically review and audit operations to ensure that QAPP/FSP Addendum QA/QC procedures are being followed.	BS, Textile Science, 26 yrs. exp.
Denise Shepperd	Third-Party Independent Validator	Trillium	Third-party independent validation of chemistry data	BS, Environmental Science, 32 yrs. exp.
Paul Dinnel	Third-Party Independent Validator	Dinnel Marine Resources	Third-party independent validation of biological data	PhD, Fisheries, 25 yrs. exp.
Eric Parker	Boat Operator	Research Support Services, Inc.	Safe vessel operation in accordance with project objectives and site-specific HSP	USCG Master License, 13 yrs. exp.
Peter Henriksen	Laboratory Project Manager	Alpha Analytical	Execute sample management and analysis consistent with prescribed analyses	BS, Environmental Science, 15 yrs. exp.
Kimberly Mace	Laboratory Project Manager	Analytical Perspectives	Execute sample management and analysis consistent with prescribed analyses	PhD, Chemical Oceanography, 15 yrs. exp.
Misty Kennard-Mayer	Laboratory Project Manager	Brooks Rand Labs	Execute sample management and analysis consistent with prescribed analyses	BS, Environmental Sciences, 10 yrs. exp.
Lynda Huckestein	Laboratory Project Manager	Columbia Analytical Services, Inc.	Execute sample management and analysis consistent with prescribed analyses	BS, 19 yrs. exp.
Mike Challis	Laboratory Project Manager	Maxxam Analytics	Execute sample management and analysis consistent with prescribed analyses	BS, Chemistry, 21 yrs. exp.

QAPP Worksheet No. 7. Personnel Responsibilities and Qualifications Table (cont.)

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications
Ken Simon	Laboratory Project Manager	EnviroSystem, Inc.	Execute sample management and toxicity test and bioaccumulation analyses consistent with prescribed analyses	MS, Marine Biology, 26 yrs. exp.
Dave Langill	Laboratory Project Manager	EcoAnalysts	Execute sample management and taxonomic analyses consistent with prescribed analyses	BS, Biology, 7 yrs. exp.

FC – Field Coordinator
GIS – geographic information system
GPS – global positioning system
HSP – health and safety plan
QAPP – quality assurance project plan
QA/QC – quality assurance/quality control
USCG – US Coast Guard
USEPA – US Environmental Protection Agency

QAPP Worksheet No. 8. Special Personnel Training Requirements Table

Project Function	Specialized Training by Title or Description of Course	Training Provider	Training Date	Personnel/Groups Receiving Training	Personnel Titles/ Organizational Affiliation	Location of Training Records/Certificates[a]
Field Coordinator/Site Safety and Health Officer	40-hr HAZWOPER	Prezant Associates, Inc.	11/21/03	Thai Do	Environmental Scientist/Windward	Windward: certificates available on request
	HAZWOPER 8-hr Refresher	Advance Online	1/2/09			
	OSHA 8-hr Training for Supervisors	Association of Bay Area Governments	1/6/07			
	Adult CPR	American Red Cross	7/1/09			
	First Aid	American Red Cross	7/1/08			
Field Coordinator/Site Safety and Health Officer (alternate)	40 hour HAZWOPER	Compliance Solutions	5/19/04	Angelita Rodriquez	Environmental Scientist/Windward	Windward: certificates available on request
	HAZWOPER 8-hr Refresher	Advance Online	10/13/08			
	OSHA 8-hr Training for Supervisors	Association of Bay Area Governments	3/20/07			
	Adult CPR	American Red Cross	7/17/09			
	First Aid	American Red Cross	7/1/08			

QAPP Worksheet No. 8. Special Personnel Training Requirements Table (cont.)

Project Function	Specialized Training by Title or Description of Course	Training Provider	Training Date	Personnel/Groups Receiving Training	Personnel Titles/ Organizational Affiliation	Location of Training Records/Certificates[a]
Windward Field Personnel/ Biological Laboratory Coordinator	40 hour HAZWOPER	Prezant Associates, Inc.	08/0/03	Helle Andersen	Benthic Ecologist/Windward	Windward: certificates available on request
	HAZWOPER 8-hr Refresher	Advance Online	04/30/09			
	Adult CPR	American Red Cross	7/1/09			
	First Aid	American Red Cross	7/1/08			
Windward Field Personnel	40-hr HAZWOPER	Prezant Associates, Inc.	12/15/00	Joanna Florer	Environmental Scientist/Windward	Windward: certificates available on request
	HAZWOPER 8-hr Refresher	Advance Online	11/3/08			
	Adult CPR	American Red Cross	7/1/09			
	First Aid	American Red Cross	7/1/08			
Windward Field Personnel	40-hr HAZWOPER	Compliance Solutions	1/13/06	Suzanne Replinger	Environmental Scientist/Windward	Windward: certificates available on request
	HAZWOPER 8-hr Refresher	Advance Online	2/20/09			
	Adult CPR	American Red Cross	7/1/09			
	First Aid	Medic First Aid	6/7/08			

QAPP Worksheet No. 8. Special Personnel Training Requirements Table (cont.)

Project Function	Specialized Training by Title or Description of Course	Training Provider	Training Date	Personnel/Groups Receiving Training	Personnel Titles/ Organizational Affiliation	Location of Training Records/Certificates[a]
Windward Field Personnel	40-hr HAZWOPER	Compliance Solutions	6/20/09	Rick Berg	Environmental Scientist/Windward	Windward: certificates available on request
	Adult CPR	American Red Cross	7/1/09			
	First Aid	American Red Cross	7/22/08			
Windward Field Personnel (alternate)	40-hr HAZWOPER	Compliance Solutions	11/10/06	Daniel Diedrich	Environmental Scientist/Windward	Windward: certificates available on request
	HAZWOPER 8-hr Refresher	Advance Online	1/2/09			
	Adult CPR	American Red Cross	7/1/09			
	First Aid	American Red Cross	7/22/08			
Windward Field Personnel (alternate)	40-hr HAZWOPER	Compliance Solutions	8/24/07	Chelsea Lorenz	Environmental Scientist/Windward	Windward: certificates available on request
	HAZWOPER 8-hr Refresher	Advance Online	9/5/08			
	Adult CPR	American Red Cross	7/1/09			
	First Aid	American Red Cross	7/22/08			

QAPP Worksheet No. 8. Special Personnel Training Requirements Table (cont.)

Project Function	Specialized Training by Title or Description of Course	Training Provider	Training Date	Personnel/Groups Receiving Training	Personnel Titles/ Organizational Affiliation	Location of Training Records/Certificates[a]
Windward Field Personnel (alternate)	40-hr HAZWOPER	Compliance Solutions	9/15/06	Sarah Fowler	Environmental Scientist/Windward	Windward: certificates available on request
	HAZWOPER 8-hr Refresher	Advance Online	10/2/08			
	Adult CPR	American Red Cross	7/1/09			
	First Aid	American Red Cross	7/22/08			
Boat operator	40-hr HAZWOPER	TCB Industrial	01/99	Eric Parker	President and Operator/ Environmental Scientist, Research Support Services, Inc.	Research Support Services: certificates available upon request
	HAZWOPER 8-hr Refresher	TCB Industrial	(current)			
	First Aid	American Red Cross	1997 (current)			
	Adult CPR	American Red Cross	1997 (current)			
	Master License	US Coast Guard	1996			

[a] If training records and/or certificates are on file elsewhere, document their location in this column. If training records and/or certificates do not exist or are not available, then this should be noted.

CPR – cardiopulmonary resuscitation
HAZWOPER – Hazardous Waste Operations and Emergency Response
OSHA – Occupational Safety and Health Administration

QAPP Worksheet No. 9. Project Scoping Session Participants Sheet

Project Name:	LPRRP Ecological and Human Health Risk Assessment
Site Name:	LPRSA
Projected Date(s) of Sampling:	August - October 2009; Spring 2010, Summer 2010
Site Location:	LPRSA
Project Managers:	Bill Potter/Robert Law, de maximis, inc.
Date of Session:	January 14 and 15, 2009
Scoping Session Purpose:	Workshop to discuss the ERA, the HHRA, and the implementation of FSP2 in 2009.

Participants: USEPA, PA (NOAA, USFWS, NJDEP, NJDOT, USACE), CPG, dmi, AECOM, Windward (presented in alphabetical order)

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QAPP Worksheet No. 9. Project Scoping Session Participants Sheet (cont.)

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January 2009 Risk Assessment and FSP2 Field Sampling Program Goals Meeting	
Comments/Decisions:	The meeting to discuss the ERA, HHRA, and FSP2 was held January 14 and 15, 2009, at K&L Gates in Newark, New Jersey. The purpose of this meeting was to address the components of the ERA and HHRA and to discuss the goals of 2009 FSP2 field sampling program.

QAPP Worksheet No. 9. Project Scoping Session Participants Sheet (cont.)

January 2009 Risk Assessment and FSP2 Field Sampling Program Goals Meeting	
Action Items: **(Retrospective Summary)**	• CPG to provide USEPA the detailed timeframe and milestones to conduct field sampling by August 2009. • USEPA/PA to provide data use objectives (DUOs), test species and standard American Society for Testing and Materials (ASTM)/USEPA protocol reference for freshwater and estuarine bivalve larval toxicity test. • USEPA/PA to provide DUOs, test species, standard ASTM/USEPA protocol reference, and practical application of data for use of caged bivalve test in the LPRSA. • Both USEPA/PA and CPG to evaluate the practicality and issues/uncertainties of using *Hyalella* in higher salinity regimes (> 10 parts per thousand [ppt]) of the LPRSA. USEPA to provide protocols, examples, and evidence of technical success of where salinity has been adjusted at Superfund sites above 10 ppt. CPG to review sites where this test has been applied. • NOAA to review the grass shrimp data from the Tierra Solutions PRSA 6-mile study. • CPG to provide one-page briefing document on benthic community sampling approach. • USEPA/PA and CPG agreed to look into feasibility of using upstream of Dundee Dam as freshwater reference. In addition, specific freshwater candidate reference sites proposed by USACE include the Passaic River at Scherman-Hoffman Wildlife Sanctuary (upstream of dam on LPR) and Rancocas Creek, a tidal freshwater creek in the Delaware River watershed. • USEPA/PA agreed to provide the supporting materials (including criteria) for use of Mullica River as an estuarine reference location. • USEPA/PA and CPG agreed to review Mullica River data collected by Tierra Solutions under USEPA Region 2-approved work plans to see if these data are acceptable for use as the estuarine reference (i.e., no new data collection needed). • USEPA/PA and CPG to determine how to incorporate a regional background approach into the risk characterization.

QAPP Worksheet No. 9. Project Scoping Session Participants Sheet (cont.)

January 2009 Risk Assessment and FSP2 Field Sampling Program Goals Meeting	
Consensus Decisions:	• CPG agreed to re-write the risk hypotheses presented in the Endpoint Assessment Table into risk questions. • USEPA/PA and CPG agreed to use a SQT approach consisting of multiple lines of evidence to assess benthic risk. • USEPA/PA and CPG agreed to collect benthic community data as part of the benthic invertebrate assessment, using replication, and seasonal sampling. • USEPA/PA and CPG agreed to conduct benthic toxicity tests with select species in freshwater and estuarine portions of the LPRSA. The specific species have not yet been agreed upon. • USEPA/PA and CPG agreed to attempt to collect blue crab and crayfish tissue data from the LPRSA. • USEPA/PA and CPG agreed to conduct laboratory bioaccumulation tests (freshwater and estuarine) to support dietary exposure models for upper-trophic-level endpoints *in lieu* of field-collected benthic infauna. The test organisms will be a polychaete worm (i.e., *Neanthes* sp.) in the saline portion of the LPR and an oligochaete worm (i.e., *Lumbricus* sp.) in the freshwater/brackish portion of the LPR. • USEPA/PA and CPG agreed to conduct ammonia and sulfide tests on the interstitial water of the sediment samples as part of the data collection for interpretation of benthic community risks. • USEPA/PA and CPG agreed surface sediment will be collected at each benthic sample location. • USEPA/PA and CPG agreed Mullica River is an appropriate estuarine reference location (due to extensive, USEPA Region 2-approved, previous work). *NOTE: This consensus decision is superseded by March/April 2009 teleconference meetings (see summary table below).* • USEPA/PA and CPG agreed a regional background approach is needed per USEPA guidance for risk characterization and for use in FS process. • USEPA/PA and CPG agreed to use reference areas for toxicity tests, tissue analyses (as stated above, a regional background approach is also needed per USEPA (2002) guidance for risk characterization), bioaccumulation tests, and benthic community surveys. *NOTE: This consensus decision regarding the use of reference is superseded by March/April 2009 teleconference meetings (see summary table below).*

QAPP Worksheet No. 9. Project Scoping Session Participants Sheet (cont.)

Project Name:	LPRRP Ecological and Human Health Risk Assessment
Site Name:	LPRSA
Projected Date(s) of Sampling:	August - October 2009; Spring 2010, Summer 2010
Site Location:	LPRSA
Project Manager:	Bill Potter/Robert Law, de maximis, inc.
Date of Sessions:	March 25, March 26, April 2, and April 6, 2009
Scoping Session Purpose:	Conference calls to discuss Agency comments on the draft PFD and January 14/15 Field Sampling Plan Volume 2 Workshop Agreements Comments.

Participants: USEPA, dmi, AECOM, Windward

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March/April 2009 Risk Assessment and FSP2 Field Sampling Program Goals Teleconference Meetings	
Comments/Decisions:	Four teleconference meetings were held on March 25, March 26, April 2, and April 6, 2009 to discuss Agency comments on the draft PFD and January 14-15 Field Sampling Plan Volume 2 Workshop Agreements Comments. The purpose of these meetings was to address additional components of the risk assessments and goals of 2009 FSP2 field sampling program.

QAPP Worksheet No. 9. Project Scoping Session Participants Sheet (cont.)

March/April 2009 Risk Assessment and FSP2 Field Sampling Program Goals Teleconference Meetings	
Action Items: **(Retrospective Summary)**	• CPG to provide in the QAPPs the conservative toxicity reference values (TRVs) upon which the analytical detection limits are based. • CPG to document the decision process that was used to determine whether or not to measure each of the assessment endpoints listed in the 2005 Baseline Ecological Risk Assessment (BERA) workshop notes. • USEPA agreed to discuss with the PA the option of conducting laboratory bivalve bioaccumulation studies in place of both worm laboratory bioaccumulation studies and in situ caged mussel studies.
Consensus Decisions:	• USEPA will not be requiring the collection of multiple benthic invertebrates. CPG will collect crab and crayfish as originally proposed. • USEPA are comfortable with dropping the request for comparison to "reference" and instead determine toxicity using laboratory-provided clean sediments as negative control for benthic toxicity tests. The issue of "risk to the benthic community" will be addressed in risk characterization using a regional background approach. They are also willing to evaluate CPG's proposal for a regional background determination (to be documented by CPG in a separate memo). If CPG and USEPA/PA are not able to agree to a regional background level, then we will default back to the negative control (and would still need to determine what constitutes "risk" in risk characterization). • USEPA and CPG discussed performing toxicity testing on *Hyalella* over the entire stretch, *Ampelisca* for the estuarine section, and chironomid species for the fresh-water section. USEPA believes *Hyalella* will provide consistency over the whole river and *Ampelisca* will provide a check if problems with salinity are encountered with *Hyalella* in estuarine waters. CPG reserved the right to evaluate the performance of *Hyalella* and USEPA agreed language could be inserted in the QAPP outlining what types of evaluations will be performed to determine if the *Hyalella* test is performing adequately. • USEPA agreed that bivalve larval toxicity tests would not be conducted. However, CPG to add language to the PFD that makes it clear that the benthic testing being conducted will be used to represent all benthic organisms, not just amphipods. In addition, CPG to include a discussion in the PFD of the sensitivity of amphipods/other invertebrates as representative invertebrate species. • USEPA recommends retaining all of the proposed laboratory bioaccumulation tests (freshwater and saltwater bivalves as well as freshwater and saltwater polychaetes) given the number of bioaccumulative contaminants of potential ecological concern (COPECs) in the study area.

QAPP Worksheet No. 9. Project Scoping Session Participants Sheet (cont.)

Project Name:	LPRRP Ecological and Human Health Risk Assessment
Site Name:	LPRSA
Projected Date(s) of Sampling:	August - October 2009; Spring 2010, Summer 2010
Site Location:	LPRSA
Project Manager:	Bill Potter/Robert Law, de maximis, inc.
Date of Session:	August 12, 2009
Scoping Session Purpose:	Conference call to resolve remaining USEPA comments on the Benthic QAPP

Participants: USEPA, USCOE, Malcolm Pirnie, Inc., Battelle, dmi, AECOM, Windward

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QAPP Worksheet No. 9. Project Scoping Session Participants Sheet (cont.)

Benthic QAPP Field Sampling Program Goals Meeting	
Comments/Decisions:	A conference call to discuss the Benthic QAPP was held August 12, 2009. The purpose of the call was to provide an opportunity for clarification and discussion of issues on the sampling program based on USEPA's comments on the draft Benthic QAPP, received July 23, 2009.
Action Items: **(Retrospective Summary)**	• CPG asked if a power grab could be used to collect sediments USEPA requested pictures and documentation of the equipment to aid in their decision. • CPG asked for a discussion on the wording used to describe the level of identification used for the benthic community analysis. USEPA had requested changing "lowest practical level" to "lowest possible level." CPG explained that typically the taxonomist strives to identify organisms to as low a level as possible but juveniles and damaged organisms can be difficult to identify. Identifying to the lowest practical level provides a reasonable timeframe for the effort. USEPA said that would get back to CPG with a decision. • The study area of the river contains both estuarine and freshwater segments and, therefore, CPG asked for clarification on the appropriate method to use to collect and sieve sediments to obtain benthic organisms for the benthic community analysis. CPG recommended using the marine method (1-mm sieve) in the estuarine portions of the river and the freshwater method (0.5-mm sieve) in the freshwater portion of the river and recommended using a salinity of 5 ppt as the guide to change methods. USEPA said they would get back to CPG with a decision • One comment from USEPA requested that all sediment for SQT be press sieved to 2 mm. CPG explained that this is typically not performed anymore and cited recent USEPA guidance. USEPA asked for the citation and said that would get back to CPG with a decision. • CPG asked USEPA why they were requesting inorganic arsenic in sediment and the benthic tissue. USEPA said they would get back to CPG with a decision. • CPG clarified the difference between positive and negative controls in toxicity testing and said that positive controls would not be used to determine test acceptability. As is typical, negative controls would be used to determine test acceptability. Positive controls will be used to show how sensitive the organisms are compared to other laboratories. USEPA agreed with this approach. • CPG asked what water quality measurements USEPA expected to be measured in the field. USEPA said they would get back to CPG with a decision. • USEPA had a comment asking for wetlands to be sampled during the benthic fall 2009 field program. CPG explained the objective of the pending fall sampling is to conduct the benthic triad approach in submerged waters. USEPA said they would get back to CPG, but tentatively agreed that wetland sampling might be too much to add on to the program for this fall. • There was a general discussion about what salinity to use in the *Hyalella* toxicity test. CPG and USEPA agreed that *Hyalella* could be tested at 0 ppt when salinity in the sediments are ≤ 5 ppt and at 10 ppt when salinity in the sediments are > 5 ppt. The test organisms used at

QAPP Worksheet No. 9. Project Scoping Session Participants Sheet (cont.)

	a salinity of 10 ppt will be acclimated to 10 ppt for 6 weeks prior to initiating the test. The laboratory conducting the *Hyalella* toxicity test will provide their SOP for USEPA to review prior to resubmittal of the Benthic QAPP. • CPG asked why porewater was being requested and USEPA said the comment was a mistake and should be disregarded. • There was general discussion about the number of grab samples to include in a sediment composite sample. CPG recommended the composite include at least three grab samples. USEPA said they would get back to CPG. • CPG asked if some of the processing could be conducted on the boat. USEPA said they would get back to CPG. • CPG stated that they would prefer to address comments on data use, DQO, background, and BSAF in memos to be consistent with the Tissue QAPP and as outlined in the PFD. USEPA stated they would get back to CPG.
Consensus Decisions:	• CPG sent information on the power grab to USEPA on August 12, 2009. USEPA agreed that use of a power grab is acceptable in an e-mail sent August 28, 2009, • CPG sent the USEPA 2001 citation on methods for collection, storage and manipulation of sediments to USEPA on August 12, 2009 to aid their decision on press sieving the sediments. • CPG sent the SOP from EcoAnalysts to USEPA as a separate document so they could review the methods used to establish taxonomy. • In an e-mail sent August 21, 2009, USEPA requested the following water quality parameters be measured in the field: temperature, dissolved oxygen, salinity, conductivity, and pH. • In an e-mail sent August 21, 2009, USEPA agreed that wetland areas do not need to be sampled during the fall 2009 effort. They requested that all wetland areas that are attached hydraulically to the river be identified on a map during the field work so that these areas can be targeted during future sampling events. • In an e-mail sent August 21, 2009, USEPA agreed that it is acceptable to use three sediment grab samples per composite. • In an e-mail sent August 21, 2009, USEPA requested that CPG develop a table of the expected/known species that inhabit the Passaic River using previously obtained data, and then ensure that the taxonomist can identify each specific species. The table can include text indicating to what level each expected species should be indentified and the catch-all phrase of "lowest practicable level" can be used for unexpected/unknown species and recommended using the previously conducted benthic work in Newark Bay. CPG developed a chart that will be included in the Benthic QAPP.

QAPP Worksheet No. 9. Project Scoping Session Participants Sheet (cont.)

Project Name:	LPRRP Ecological and Human Health Risk Assessment
Site Name:	LPRSA
Projected Date(s) of Sampling:	August - October 2009; Spring 2010, Summer 2010
Site Location:	LPRSA
Project Manager:	Bill Potter/Robert Law, de maximis, inc.
Date of Session:	August 31, 2009
Scoping Session Purpose:	Conference call to resolve remaining USEPA comments on the Benthic QAPP

Participants: USEPA, Battelle, AECOM, Windward

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Benthic QAPP Field Sampling Program Goals Meeting	
Comments/Decisions:	A conference call was held on August 31, 2009, to discuss resolution on the few remaining issues based on USEPA's comments on the draft Benthic QAPP, received July 23, 2009.
Action Items: (Retrospective Summary)	• The analysis of inorganic arsenic in tissue and sediment was discussed, and the exclusion of inorganic arsenic from benthic tissue and sediment as presented in Table ES-3 in the Benthic QAPP was clarified. CPG explained that both inorganic and total arsenic will be analyzed in fish tissue only. Total arsenic is being measured in sediment and benthic tissue (polychaetes and freshwater worms) but CPG explained that inorganic arsenic is not being analyzed in sediment because most of the arsenic in sediment is inorganic and, therefore, analysis of total arsenic also captures the inorganic form. Inorganic arsenic is not being analyzed in benthic tissue (polychaetes and freshwater worms) because the data will not be used for the HHRA and only total arsenic is needed for the ERA. USEPA agreed with the approach and does not need inorganic arsenic analyzed in sediments or polychaetes/freshwater worms • CPG and USEPA continued discussion on which methods are appropriate (marine or freshwater) to collect and sieve sediments for benthic organisms for the benthic community analysis. Norm Richardson of Battelle said he looked at the ASI 2005 survey and it

QAPP Worksheet No. 9. Project Scoping Session Participants Sheet (cont.)

	looks like the community changes between station B1 (RM 7) and B26 (he wasn't sure what RM). He said to use this as the primary means to determine when to change methods, rather than use salinity as the primary means. Since salinity was measured during the ASI survey, it can be used as a secondary guideline. CPG agreed that using the ASI report as a guide was a good approach. • Data use and TRV questions were discussed. USEPA agreed data use questions can be discussed later in memos similar to the approach used to resolve Fish Tissue QAPP data use questions. Stephanie Vaughn of USEPA would like the memos identified in the PFD to be delivered soon. Marian Olson of USEPA would like RAGS part D format in the memo for HHRA assumptions and also requested that the memos be similar to the PAR. CPG agreed that the memos would contain the next level of detail from the PFD, specifically the TRVs, background, data use, as well as exposure assumptions and calculation methods. The memos would not be a SLERA. USEPA seemed satisfied with the content. CPG also explained that USEPA will be getting the TRV/data quality level (DQL) comparison memo for fish tissue and a similar memo will be prepared for the benthic effort. USEPA wants any memo that may affect sampling to be given priority. • USEPA asked to review the SOP for the *Hyalella* toxicity test and CPG agreed to check on the status of the SOP and send it as soon as possible. CPG also confirmed with USEPA that the method will follow USEPA's suggested option for *Hyalella* testing as discussed in the August 12, 2009, call and that the acclimation of *Hyalella* has started in order to get in the field this fall. • Marian Olsen of USEPA would like more information on the HHRA mudflat samples. Betsy Ruffle of AECOM will add in more explanation to Worksheet No. 18. USEPA would like Worksheet No. 18 early, if possible. • The group then discussed schedule. The document will be delivered to dmi on September 10, and delivered to USEPA on September 16, 2009. USEPA agreed to the schedule but noted that the timing coincides with the end of their fiscal year and they may be busy. The target date for fieldwork is October 1 or 5, and it was agreed that it might be better to start on Monday, October 5. • The issue of press sieving all the sediment was discussed and USEPA noted they are still discussing it internally and will get back to CPG soon on whether or not to sieve all the sediments.

QAPP Worksheet No. 9. Project Scoping Session Participants Sheet (cont.)

Consensus Decisions:	• USEPA agreed that inorganic arsenic does not need to be analyzed in sediments or in tissue from polychaetes/freshwater worms. • Freshwater taxonomy methods will be used in the freshwater zone and marine taxonomy methods in the estuarine zone. The primary means to determine when to change methods will be based on community rather than salinity. Salinity will be a secondary guideline. • Data use and TRVs will be discussed in future memos. • The *Hyalella* SOP was sent to USEPA on September 2, 2009. Based on comments received from USEPA on September 9, 2009, a project-specific revised draft SOP was prepared by EnviroSystems. In a call on September 14, 2009, between USEPA and CPG, final decisions on the test method were made. The final SOP is in revision and will be provided as soon as it is ready. • In an e-mail sent September 15, 2009, Stephanie Vaughn of USEPA informed the CPG that press sieving all the sediments will not be required. Sediment sieving for benthic taxonomy sample collection will be conducted as described in the QAPP.

QAPP Worksheet No. 10. Problem Definition

The problem to be addressed by the project:

A better understanding of the potential adverse effects to ecological and human receptors caused by exposure to surface sediments from the LPRSA is needed to effectively complete the ERA. In addition, a better understanding of benthic infaunal tissue-residue concentrations in the LPRSA is needed to support the ERA. Because previous biological investigations focused primarily on the lower 6 miles (River Mile [RM] 1 to RM 7) of the LPRSA (Tierra Solutions 2003, 2002a), there are limited data available for the remainder of the LPRSA (RM 0 to RM 1 and approximately RM 7 to RM 17.4). The present effort will address this uncertainty by collecting surface sediment samples throughout the LPRSA for chemistry analysis, toxicity testing, and benthic community analysis to perform a SQT assessment and for bioaccumulation testing. This information will also be compared to validated results previously reported for RM 1 to RM 7 of the LPRSA.

The environmental questions being asked:

The following questions are defined for this effort:

1. Are benthic communities of the LPRSA different from those found in similar nearby water bodies where chemical concentrations are at regional background levels?
2. Are chemical of potential concern (COPC) residues in benthic invertebrate tissues from the LPRSA at levels that cause an adverse effect on survival, growth, and/or reproduction of infaunal invertebrates?
3. Are COPC concentrations in LPRSA sediments from the biologically active zone at levels that cause an adverse effect on survival, growth, and/or reproduction of the benthic invertebrate community?
4. Are modeled dietary doses of COPCs based on LPRSA biota, sediment, and surface water at levels that cause an adverse effect on survival, growth, and/or reproduction of fish, bird, or aquatic mammal populations that use the LPRSA?
5. What are the potential adverse effects of river chemicals to human health via exposure to surface sediment from the LPRSA?

These questions were presented as part of the ERA and HHRA approaches in the Problem Formulation Document (PFD) (Windward and AECOM 2009); further detail on how the data will be used is presented on Worksheet No. 11.

Observations from any site reconnaissance reports:

A site reconnaissance survey has not been performed to support this effort.

A synopsis of secondary data or information from site reports:

Benthic community, toxicity, and invertebrate tissue-residue data have been collected in the LPRSA over the past 19 years, but there are very limited data from the upper 11 miles of the LPRSA (substantial data exist for RM 1 to RM 7).

QAPP Worksheet No. 10. Problem Definition (cont.)

Benthic Community Survey

Taxonomic identification of benthic Invertebrates was conducted by Aqua Survey for NJDOT/Office of Maritime Resources (OMR) in summer 2005 (Aqua Survey 2005). The survey of the benthic community was performed at 28 locations in the lower 16 miles of the LPR in support of the LPRRP. A subset of 100 organisms was subsampled from each sample, counted, and identified to the lowest practical taxonomic level (family, in most cases).

The RI ecological sampling plan (ESP) benthic invertebrate community survey was conducted by Tierra Solutions in fall 1999 and spring 2000 (Tierra Solutions 2002a). Evaluation of the structure and composition of the benthic invertebrate community was performed at 15 locations between RM 1 and RM 7 and compared to the benthic community at three locations in Mullica River (reference area). The community results were included in an SQT assessment (Iannuzzi et al. 2008).

As part of the USEPA Environmental Monitoring and Assessment Program (EMAP) within the National Coastal Assessment – Northeast/New Jersey Coast, benthic community data, including biomass, were collected at three stations in the LPRSA and one station in Newark Bay near the mouth of the river in 2000 and 2002 (USEPA REMAP 2002c).

In 1992, the Ambient Biomonitoring Network (AMNET) Program was initiated to provide NJDEP with benthic community baseline data in support of watershed management. Three surveys were conducted (in 1993, 1998, and 2006) and included one station in LPRSA (at Dundee Dam) and six stations in tributaries to the Passaic River (e.g., Second River, Third River and Saddle River). The surveys used USEPA's Rapid Bioassessment Protocol II guidelines. The benthic community results were based on 100 organism subsamples and scoring criteria validated for family-level taxonomy. The stations were given one of three final rating categories (non-impaired, moderately impaired, and severely impaired) (NJDEP 2000).

As part of the USEPA Regional Environmental Monitoring and Assessment Program (REMAP), Region 2, within the National Coastal Assessment, benthic community data, including biomass, were collected at one station in LPRSA and one station in Newark Bay near the mouth of the river in 1998 and 1999 (USEPA REMAP 1999).

As part of a study of the benthic macrofauna and associated hydrographic observations in Newark Bay by the Northeast Fisheries Science Center, benthic community data were collected at two stations in Newark Bay near the mouth of the river in 1993 and 1994 (Stehlik et al. 2005).

As part of the USEPA EMAP within the National Coastal Assessment – Virginian Province, benthic community data, including biomass, were collected at two stations in the LPRSA in 1990 and 1993 (USEPA REMAP 1993b).

Toxicity Testing

As part of the USEPA EMAP within the National Coastal Assessment – Northeast/New Jersey Coast, sediment toxicity testing using the amphipod *Ampelisca abdita* was conducted at three stations in the LPRSA and one station in Newark Bay near the mouth of the river in 2000 and 2002 (USEPA REMAP 2002b).

The Phase 1 Toxicity Identification Evaluation was conducted by Tierra Solutions in 1999 (Tierra Solutions 2003; Kay et al. 2008).

QAPP Worksheet No. 10. Problem Definition (cont.)

Sediment toxicity to benthic invertebrates was assessed at five locations between RM 1 and RM 7 by performing the sediment and porewater toxicity test with the amphipod *Ampelisca abdita.*

The SQT analysis was conducted by Tierra Solutions (Iannuzzi et al. 2008). Sediment toxicity to benthic invertebrates was assessed at 15 locations between RM 1 and RM 7 in the LPRSA by performing the toxicity tests with *Ampelisca abdita* and *Neanthes arenaceodentata.*

As part of the USEPA REMAP, Region 2, within the National Coastal Assessment, sediment toxicity testing using the amphipod *Ampelisca abdita* was conducted at one station in the LPRSA and one station in Newark Bay near the mouth of the river in 1998 (USEPA REMAP 1998).

As part of the USEPA EMAP within the National Coastal Assessment – Virginian Province, sediment toxicity testing using the amphipod *Ampelisca abdita* was conducted at two stations in the LPRSA in 1990 and 1993 (USEPA REMAP 1993a).

Tissue Chemistry

As part of the USEPA EMAP within the National Coastal Assessment – Northeast/New Jersey Coast, crab tissue chemistry data were collected at two stations in the LPRSA and one station in Newark Bay near the mouth of the river in 2000 and 2002 (USEPA REMAP 2002a). Tissue samples were analyzed for metals, dichlorodiphenyltrichloroethanes (DDTs), PCBs, and pesticides.

As part of the Contaminant Assessment and Reduction Program (CARP) (http://www.carpweb.org/main.html), invertebrate tissue data were collected from 1999 to 2004. The invertebrate tissue samples included four species (i.e., blue crab, opossum shrimp, ribbed mussel, and seven spine bay shrimp) at RM 2.6 in the LPRSA. Tissue samples were analyzed for PCDDs/PCDFs, metals, PAHs, PCBs, and pesticides.

As part of the PRSA ESP Biota Sampling Program by Tierra Solutions (Tierra Solutions 1999), blue crab tissue chemistry data were collected in a portion of the LPRSA (RM 1 to RM 7) in autumn 1999, spring 2000, and late summer 2001. Tissue samples were analyzed for PCDD/PCDFs, herbicides, metals, PAHs, PCBs, pesticides, SVOCs, and organometals.

The PREmis database (available at ourpassaic.org) includes blue crab tissue chemistry data from two surveys. The Passaic 1995 Biological Sampling Program collected blue crab at locations in the estuarine zone (RM 1.1 to RM 4.5). Tissue samples were analyzed for PCDD/PCDFs, metals, PAHs, PCBs, pesticides, semivolatile organic compounds (SVOCs), organometals, cyanide, and total petroleum hydrocarbons (TPH). The New York State Department of Environmental Conservation (NYSDEC) collected blue crab at one location near the mouth of the LPR (RM 0.1) in 1993. Tissue samples were analyzed for PCDD/PCDFs, metals, PCBs, pesticides, and lipids.

The caged bivalve study with ribbed mussel (*Geukensia demissus*) was conducted by Tierra Solutions in 1999 (Tierra Solutions 2003). Caged bivalves were exposed to LPRSA sediments at 15 stations between approximately RM 1 and RM 7. Tissue samples were analyzed for organotins, PAHs, PCDDs/PCDFs, coplanar PCBs, herbicides, PCB congeners, metals, PCB/pesticides, percent moisture, percent lipid, and SVOCs.

QAPP Worksheet No. 10. Problem Definition (cont.)

The possible classes of contaminants and the affected matrices:
There are several different classes of organic and inorganic contaminants in the LPRSA, which may accumulate in benthic invertebrates. Whole-body invertebrate tissue samples generated in the bioaccumulation tests will be analyzed for the following analytes: PCB congeners (and homologs), PCB Aroclors, PCDDs/PCDFs**,** organochlorine pesticides, PAHs, alkylated PAHs, metals (including total mercury, methylmercury, and butyltins), SVOCs (including phthalates), lipid content, and percent moisture (Worksheet No. 15 lists the specific analytes in each of these chemical classes that will be analyzed). Although volatile organic compounds (VOCs) were identified as contaminants of potential ecological concern in sediment in the pathways analysis report (Battelle 2005), they were not identified as bioaccumulative chemicals by USEPA (2000a); therefore, VOCs will not be analyzed in tissue samples. Only surface sediments included to assess human health exposure as well as the shallow SQT sampling locations will be analyzed for VOCs to address the potential human health risks associated with potential exposure to intertidal sediments. Surface sediment samples will be analyzed for PCB congeners (and homologs), PCB Aroclors, PCDDs/PCDFs, organochlorine pesticides, PAHs, alkylated PAHs, metals (including total mercury, methylmercury, and butyltins), SVOCs (including phthalates), VOCs (in human health exposure and SQT shallow sampling locations only), TPH (extractable, purgeable, and alkanes), herbicides, sulfide, ammonia-N, cyanide, total phosphorus, total Kjeldahl nitrogen, acid volatile sulfur/simultaneously extracted metals (AVS/SEM), percent moisture, grain size, and total organic carbon (TOC). Both tissue and sediment samples collected during this program may be highly complex analytically. Therefore, analytical laboratories may experience matrix interferences while conducting the chemical analyses. Sample cleanup procedures will be employed when appropriate, and over-dilution will not be used.
The rationale for inclusion of chemical and non-chemical analyses:
The surface sediment concentrations will provide information on the chemical exposure in the LPRSA to be used in the sediment SQT assessment. Invertebrate tissue-residue concentrations will provide information on the chemical exposure in the LPRSA to be compared with toxicity reference values (TRVs) in a tissue-residue evaluation for benthic invertebrates. The benthic infaunal invertebrate tissue-residue concentrations will also provide information on the chemical exposure of fish and wildlife via the diet. Sediment chemistry data collected during this sampling effort will also be used to evaluate exposure to ecological receptors (via dietary exposure) and to human receptors. Total arsenic will be analyzed in both sediment and benthic invertebrate tissue samples. The TRV for human health is based on inorganic arsenic, which is typically only a relatively small fraction of total arsenic. Such a speciation method is not appropriate for sediment and benthic invertebrate tissue because virtually all arsenic in sediment is inorganic, so speciation methods are unnecessary, and benthic invertebrate tissue data will not be used in the HHRA. Inorganic arsenic will be analyzed in fish and decapods tissue only (see the Fish/Decapod QAPP (Windward 2009)). Per agreement between USEPA and CPG, herbicide analysis will only be conducted on sediment. Herbicides are not included for

QAPP Worksheet No. 10. Problem Definition (cont.)

analysis in tissues for the following reasons: 1) there are no published methods for herbicides in tissue, 2) herbicides have been infrequently detected in tissue in recent studies, 3) the likely levels of detection are below levels considered to be toxic to wildlife, and the bioaccumulation potential is low. Windward drafted a memorandum explaining the above points in more detail for USEPA. Consistent with the Fish/Decapod QAPP (Windward 2009), VOCs will not be analyzed in tissue. VOCs will only be analyzed in the human health exposure and shallow SQT sampling locations because the sediment from these locations has the greatest potential to be exposed to air.

Information concerning various environmental indicators:

The sediment sampling effort is designed to collect information for future use in the project, including the surface sediment conditions throughout the LPRSA. There is very limited benthic toxicity information available for RM 0 to RM 1 and none from RM 7 to RM 17.4; the results can be compared to results previously reported for RM 1 to RM 7 of the LPRSA.

Project decision conditions:

The conditions for project decisions (i.e., those decisions that may require communication between CPG and USEPA during the field event or sampling analysis) include the prioritization of chemical analysis if insufficient tissue is available following bioaccumulation testing and the need to relocate sampling locations.

A pre-homogenization minimum tissue mass of 115 g (a post-homogenization mass 105 g) is needed, per sample, for analysis of all proposed chemical groups. The 10-g difference between pre-and post-homogenization mass accounts for the estimated mass of tissue lost during processing and homogenization. The minimum mass requirements per chemical group are provided in the priority list below. Mass requirements have been optimized with each analytical laboratory such that they are the lowest required to achieve the detection limits presented in Worksheet No. 15. The minimum mass does not include enough mass for re-extractions or matrix-specific quality control samples. If a post-homogenization minimum mass of 105 g is not obtained, the following priority list (consistent with the Fish/Decapod QAPP [Windward 2009]) for the chemical analysis of tissue samples will be considered in conjunction with available sediment chemistry data collected:

1. PCDDs/PCDFs (10-g minimum mass)
2. PCB congeners (10-g minimum mass)
3. Total and methylmercury (10-g minimum mass)
4. Organochlorine pesticides (10-g minimum mass)
5. Lipids (5-g minimum mass)
6. Metals (including butyltins; 15-g minimum mass
7. PAHs (10-g minimum mass)
8. SVOCs (including phthalates; 10-g minimum mass)

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9. Percent moisture (5-g minimum mass)
10. PCB Aroclors(10-g minimum mass)
11. Alkylated PAHs (10-g minimum mass)

If acceptable grabs cannot be obtained at targeted sampling locations after five attempts following the procedures described in Attachment D, sampling locations may be re-located within 30 m of the target location. See Attachment O for the field sampling flowcharts.

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Who will use the data?

The data collected under this QAPP will be used by CPG and USEPA for CERCLA-related decisions, specifically for the ERA and the HHRA, and planning the ERA and by other interested parties (e.g., USACE, NJDEP, USFWS, NJDOT, and NOAA) for other purposes, including WRDA activities, such as restoration planning.

What will the data be used for?

The data collected during this sampling effort will be used in risk-based decision-making for the RI/FS at the LPRSA. Specifically, the data will be used to estimate potential human health and ecological risks to receptors that may be exposed to chemicals in the LPRSA. The results of the baseline risk assessments will be used to inform remedial decision-making under CERLA/National Contingency Plan and other appropriate regulations and future restoration planning.

Risks to the benthic invertebrate community will be evaluated using multiple lines of evidence, including: 1) the SQT assessment, which integrates benthic community structure data, toxicity results, and sediment chemistry, 2) tissue chemistry, 3) surface water chemistry (not addressed in this QAPP). As part of the risk evaluation of the benthic invertebrate community, benthic toxicity results will be compared to regional background pending USEPA approval of this approach. The approach for establishing regional background will be developed between USEPA/PA and CPG prior to the risk assessments. Data collected during this sampling effort will also be used to evaluate dietary risks to ecological receptors as well as risks to human receptors based on exposure to surface sediments.

ERA Assessment Endpoints

The data collected will be used to support the ERA in evaluating the assessment endpoints of the health of the benthic invertebrate community and fish, bird, and aquatic mammal populations presented in the PFD (Windward and AECOM 2009) and summarized below:

Assessment Endpoint No. 2 – "Protection and maintenance (i.e., survival, growth, and reproduction) of the benthic invertebrate community both as an environmental resource in itself and as one that serves as a forage base for fish and wildlife populations."

Benthic community, toxicity testing, bioaccumulation testing, and surface sediment chemistry data collected as part of this sampling event will be used evaluate potential risks to benthic invertebrates in order to answer the following questions:

- **Are benthic communities different from those found in similar nearby water bodies where chemical concentrations are at regional background levels?** Benthic invertebrate organisms will be collected from the LPRSA and the benthic community structure will be assessed using community-level metrics (e.g., total abundance, species richness, and abundance of species or specific taxonomic groups) as well as comparisons to benthic community structure information from appropriate regional background datasets using diversity indices, multivariate, and spatial statistical techniques.
- **Are COPC residues in benthic invertebrate tissues from the LPRSA at levels that might cause an adverse effect on**

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survival, growth, and/or reproduction of infaunal invertebrates? This question will be addressed with one measurement endpoint. Chemical concentrations in laboratory-exposed benthic infaunal invertebrate tissues will be compared to tissue residue TRVs. Because the field collection of sufficient biomass (e.g., polychaetes or oligochaetes) will not be possible in the LPRSA, laboratory bioaccumulation tests will be used to generate surrogate tissue concentration information. The test organisms will be a polychaete worm (*Neanthes* virens) for the estuarine portion of the LPRSA and an oligochaete worm (*Lumbriculus variegatus*) for the freshwater portion of the LPRSA. LPRSA surface sediment will be used to conduct the 28-day bioaccumulation tests, and whole-body benthic invertebrate tissue from the tests will be chemically analyzed. The methodology and sampling design for the caged bivalve study will be provided as an addendum to this QAPP.

- **Are COPC concentrations in LPRSA sediments from the biologically active zone at levels that might cause an adverse effect on survival, growth, and/or reproduction of the benthic invertebrate community?** This question will be addressed with two measurement endpoints based on surface sediment that will be collected from the biologically active zone, which is estimated to be the top 6 inches, throughout the LPRSA:
  - Surface sediment from the biologically active zone will be chemically analyzed. Chemical concentrations in sediment will be compared to literature-derived toxicity-based sediment quality values that are specific to benthic invertebrates.
  - Surface sediment from the biologically active zone will be used to conduct laboratory toxicity tests (i.e., 28-day survival and growth of *Hyalella azteca* throughout the LPRSA, 10-day survival and growth of *Chironomus dilutus* in the freshwater portion, and 10-day survival of *Ampelisca abdita* in the estuarine portions). The results of the toxicity tests will be statistically compared to comparable tests conducted with control sediment and also compared to existing urban regional background data.

  Surface sediment chemistry data along with conventional sediment parameters (such as grain size) will be used in conjunction with the benthic community analysis to develop benthic community metrics. The community metric line of evidence will be part of the SQT approach, which is a sediment assessment technique that incorporates information about sediment chemistry and toxicity in conjunction with benthic community metrics.

Assessment Endpoints No. 5, No. 6, and No. 7 – "Protection and maintenance (i.e., survival, growth, and reproduction) of omnivorous, invertivorous, and piscivorous fish populations that serve as a forage base for fish and wildlife populations and of fish populations that serve as a base for sports fishery;" "Protection and maintenance (i.e., survival, growth, and reproduction) of herbivorous, omnivorous, sediment-probing, and piscivorous bird populations;" and "Protection and maintenance (i.e., survival, growth, and reproduction) of aquatic mammal populations."

Sediment chemistry and tissue chemistry data from laboratory-exposed benthic invertebrates collected as part of this sampling event will be used (along with surface water chemistry data and fish and decapod tissue chemistry data) in a dietary model to estimate dietary intakes for selected fish, bird, and mammal receptors. Modeled dietary dose concentrations will be compared to dietary dose TRVs to answer the following risk question: ***"Are modeled dietary doses of COPCs based on LPRSA biota, sediment, and surface water at levels that might cause an adverse effect on survival, growth, and/or reproduction of fish, bird, or aquatic***

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mammal populations that use the LPRSA?"

HHRA Assessment Endpoints

The data collected during this sampling effort will also be used to support the HHRA in evaluating the following risk question: **"What are the potential adverse effects of river chemicals to human health via exposure to surface sediment from the LPRSA?"** As defined in the PFD (Windward and AECOM 2009), the data use objective for this endpoint is to estimate potential human exposures and assess the potential impact of chemicals on human health via dermal contact with, incidental ingestion of, and/or inhalation of VOCs from surface sediment of the LPRSA. Potential surface sediment exposure scenarios are presented in the human health conceptual site model (CSM) included in the PFD (Windward and AECOM 2009).

What types of data are needed (matrix, target analytes, analytical groups, field screening, on-site analytical or off-site laboratory techniques, sampling techniques)?

For the SQT assessment, surface sediment samples will be collected for chemistry, toxicity testing, and benthic community analyses at up to 97 stations in the LPRSA between RM 0 and RM 16 and, if sediment sampling and sampling access are possible (see response to "Where, when, and how should the data be collected/generated?"), at up to 5 stations between RM 16 and the Dundee Dam, for a total of 102 SQT possible stations in the LPRSA (sampling locations are further described below in response to "Where, when, and how should the data be collected/generated?" and presented on Worksheet No. 18). The SQT assessment will include three components:

1. Surface sediment samples from all of the SQT sampling locations will be analyzed for PCBs congeners (and homologs), PCB Aroclors, PCDDs/PCDFs, organochlorine pesticides, PAHs, alkylated PAHs, metals (including total mercury, methylmercury, and butyltins), SVOCs (including phthalates), VOCs (in human health exposure and shallow SQT sampling locations only), TPH (extractable, purgeable, and alkanes), herbicides, sulfide, ammonia-N, cyanide, total phosphorus, total Kjeldahl nitrogen, AVS/SEM, percent moisture, grain size, and TOC.
2. Three toxicity tests will be performed: the 28-day *Hyalella azteca* growth and mortality test, the 10-day *Chironomus dilutus* growth and mortality test, and the 10-day *Ampelisca abdita* mortality test. The *Hyalella* test will be conducted on all sediment samples, whereas the *Chironomus* test will be performed on freshwater sediment samples, and the *Ampelisca* test will be conducted on the estuarine sediment samples. The decision of which of the two toxicity tests to perform will be based on the interstitial salinity (< 5 ppt *Chironomus* and ≥ 5 ppt *Ampelisca*). Interstitial salinity will be measured first in the field for the purpose of determining the appropriate volume of sediment needed for bioaccumulation sampling. Interstitial salinity will also be measured in the laboratory for the final determination of which test organism to use.[6]
3. Benthic community samples will also be collected all of the SQT sampling locations. Four replicates will be collected, and

[6] The laboratory will be prepared with sufficient numbers of organisms for all tests (e.g., if salinity is higher than expected).

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three of these will be analyzed separately per location for the benthic community analysis. The fourth replicate will be archived and only analyzed if one of the three replicates is damaged or lost. The benthic community samples in the estuarine portion of the river will be collected from a 0.1-m^2 area and sieved through a 1-mm sieve, and the benthic community samples in the freshwater portion will be collected from a 0.5-m^2 area and sieved through a 0.5-mm sieve. The switch from the estuarine methods to the freshwater methods will occur at RM 8.5 (between stations LPRT09B and LPRT09C) based on recommendations from USEPA to use the absence of polychaetes in the benthic community survey data by Aqua Survey (2005) to define the boundary between estuarine and fresh water. Following standard practice, all invertebrates in the estuarine samples will be identified, and 300 invertebrates will be identified in the freshwater samples (Barbour et al. 1999). As stated in the *Rapid Bioassessment Protocols for Use in Streams in Wadeable Rivers* (Barbour et al. 1999), the subsampling reduces the effort required for the sorting and identification aspects of marcroinvertebrate surveys and provides a more accurate estimate of time expenditure. The protocol is based on a 200-organism subsample, but it could be used for any subsample size (e.g., 100, 300, 500). A subsample of 300 invertebrates was chosen for this program. The invertebrates will be identified to lowest practical taxonomic level; generally genus or species level unless the organisms are damaged, incomplete, or juveniles, which may preclude identification to this level. The taxonomic level will adhere to the level presented in Table 11-1, which is based on other benthic surveys in New Jersey. A subset of SQT sampling locations will be resampled for benthic community analysis in three subsequent surveys.

In addition to the sediment that will be collected for the SQT assessment, surface sediments will be collected from up to 20 sampling locations (co-located with SQT sampling locations), and two bioaccumulation tests will be performed on these surface sediment samples based on the interstitial salinity. For sediments with interstitial salinity < 5 ppt (as measured in samples submitted to the laboratory), the 28-day *Lumbriculus variegatus* bioaccumulation test will be performed. For sediments with interstitial salinity ≥ 5 ppt (as measured in samples submitted to the laboratory), the 28-day *Neanthes virens* bioaccumulation test will be performed. Interstitial salinity will be measured in the laboratory. The whole-body tissue samples will be analyzed for PCB congeners (and homologs), PCB Aroclors, PCDDs/PCDFs, organochlorine pesticides, PAHs, alkylated PAHs, metals (including total mercury, methylmercury, and butyltins), SVOCs (including phthalates), lipid content, and percent moisture For use in the ERA, detected concentrations of neutral organic chemicals of interest in the laboratory-exposed worm tissue will be adjusted to estimate steady-state concentrations using the process based on McFarland (1995) and described in the USACE inland testing manual (USEPA and USACE 1998).

Up to fourteen human health exposure sediment samples will also be collected for sediment chemistry only. Nine of these samples have targeted locations at certain shallow nearshore locations for the HHRA surface sediment sampling and up to five additional “floater” locations of potential human exposure interest may be identified while in the field (e.g., boat clubs, docks, and other locations of human activity such as fishing that are not currently identified for sampling). These samples will be analyzed for the following analytes: PCB congeners (and homologs), PCB Aroclors, PCDDs/PCDFs, organochlorine pesticides, PAHs, alkylated PAHs, metals (including total mercury, methylmercury, and butyltins), SVOCs (including phthalates), VOCs (in human health exposure and shallow SQT sampling locations only), TPH (extractable, purgeable, and alkanes), herbicides, sulfide, ammonia-N,

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cyanide, total phosphorus, total Kjeldahl nitrogen, AVS/SEM, percent moisture, grain size, and TOC.

The following water quality parameters will be measured in the field at all sediment sampling stations (up to 116 locations – 102 SQT locations and 14 human health exposure locations): temperature, dissolved oxygen, salinity, conductivity, and pH (see Attachment P for water quality sampling methods).

Matrix

Chemical analysis will be conducted on surface sediment samples and on whole-body invertebrate tissue samples generated from the sediment bioaccumulation tests. Toxicity testing and benthic community assessment will also be conducted on surface sediment samples.

How "good" do the data need to be in order to support the environmental decision?

The data will be used to support decisions about the magnitude and spatial distribution of risks to human and ecological receptors. The data will be used to better define risk decisions for discrete endpoints. The data may also be used to support initial investigations of potential remedial options. Consequently, the data need to be collected using a design that specifically addresses the questions that are being posed (see above section entitled "What will the data be used for?"). Decision-making regarding the 2009 data interpretation will be documented in a series of memoranda prior to the start of the 2010 sampling effort, and any changes to the field collection program as a result will be incorporated into a revised/amended QAPP.

With respect to data quality, the chemistry laboratories should achieve the project quantitation limit (PQL) goals established for these analyses (see Worksheet No. 15). If these goals are met, the resulting risk analyses will have much lower uncertainties compared to analyses conducted on data that did not meet the PQL goals. Other analytical performance criteria, such as precision, accuracy, and completeness requirements, for the chemical analyses are presented in Worksheet Nos. 12 and 28.

The toxicity tests must meet the performance standards for these tests provided by American Society for Testing and Materials (ASTM) and USEPA (see Table 11-2). A negative control will be used to evaluate toxicity test acceptability. If a negative control for a given batch of LPRSA sediment samples does not meet the acceptability criteria that batch of sediment samples will be re-tested (sufficient sediment will be collected at each location for re-testing). Positive controls will be used to evaluate the sensitivity of the organisms used in the tests compared with other laboratories and will not be used to determine test acceptability. Per the request of USEPA, *Hyalella* toxicity tests will be conducted on sediments from both the freshwater and estuarine zones. The interstitial salinity of each sediment sample will be measured in the laboratory upon receipt. Samples with interstitial salinity of 0 to 5 ppt will be tested at overlying-water salinity of 0 ppt (i.e., freshwater at 100 ppm of water hardness) using *Hyalella azteca* acclimated to freshwater. Samples with interstitial salinity > 5 ppt will be tested at overlying-water salinity of 10 ppt using *Hyalella azteca* acclimated to water with a salinity of 10 ppt. There is concern regarding the usability of *Hyalella* toxicity data from the estuarine portion, specifically where salinity levels are > 15 ppt. Therefore the CPG will evaluate the *Hyalella* toxicity test results from the estuarine portion by comparing to the results of the negative control, evaluating variability in growth, and evaluating mortality data in determining whether these data

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will be used in the risk assessment.

The bioaccumulation tests must meet the performance standards for these tests provided by ASTM and USEPA (Table 11-3).

How much data are needed (number of samples for each analytical group, matrix, and concentration)?

Benthic community, toxicity test, and surface sediment chemistry data will be collected from up to SQT 102 locations in the LPRSA (97 locations between RM 0 and RM 16 and, if possible, at 5 stations between RM 16 and RM 17.4) to provide adequate information and spatial coverage to perform the SQT assessment. Surface sediments (for sediment chemistry only) will also be collected from up to 14 human health exposure sampling locations: 9 targeted shallow nearshore human health exposure sampling locations and up to 5 additional locations that may be added as "floater" stations for the HHRA that will be identified during the field effort based on observations of human access and use (see response to "Where, when, and how should the data be collected/generated?" for further description of sample locations).

Additional sediment will be collected from 20 of the SQT sampling locations for the bioaccumulation testing of two benthic invertebrate species: polychaete worm (*Neanthes virens*) for the estuarine portion, and an oligochaete worm (*Lumbriculus variegatus*) for the freshwater portion. These 20 locations were selected to represent a range of chemical concentrations present in the estuarine and freshwater zone of the LPRSA (see Attachment J for details on how locations were selected). Tissue samples generated from the bioaccumulation tests will be analyzed for chemistry to provide data for evaluating risk to benthic organisms by comparing tissue residue to TRVs and to provide data to estimate prey concentrations in the fish and wildlife dietary exposure models. The sediment chemistry data (from the co-located SQT locations) will be used with the laboratory exposed bioaccumulation tissue chemistry data to evaluate the relationship between benthic invertebrate tissue chemistry and sediment chemistry.

Where, when, and how should the data be collected/generated?

Per the agreements that resulted from the January 14-15, 2009, FSP2 meetings between USEPA and the CPG, the general sampling design divides the LPRSA into two major zones: the estuarine zone, and the freshwater zone. Consistent with the preliminary salinity reaches defined in the PFD (Windward and AECOM 2009), the estuarine zone includes both the brackish and transition river segments from RM 0 to RM 10, and the freshwater zone includes the freshwater river segment from RM 10 to RM 17.4 (Figure 1). The river mile where this transition occurs may be revised based on past data and data being collected as part of the RI.

For the placement of sampling locations for both the SQT assessment (i.e., the collection of surface sediment for chemistry, toxicity test, and community analyses) and the bioaccumulation testing effort, the LPRSA was subdivided into 16 1-mile segments and 1 1.4-mile segment (the 17th segment spans from RM 16 to RM 17.4) to allow for spatial allocation of samples throughout the study

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area. Sampling locations within each of the 17 segments were selected to represent four general habitat strata based on water depth and grain size.[7]

- Two depth zones, consisting of shallow nearshore areas (to 2 ft MLW and shallower) and subtidal areas (deeper than to 2 ft MLW)
- Two grain size categories, consisting of fine-grained sediment (≥ 60% fines, defined as the sum of clay and silt particles that have a diameter less than 63 µm based on the evaluation of historical grain-size data) and coarse-grained sediment (< 60% fines)

To be consistent with the FSP2 sampling approach, surface sediment samples will be collected at up to 97 sampling locations in the LPRSA between RM 0 and RM 16 and, if possible (i.e., where grain-size is appropriate for chemical and biological analyses), at up to 5 sampling locations between RM 16 and the Dundee Dam (RM 17.4), for a total of 102 possible sampling locations in the LPRSA for the SQT assessment (i.e., chemistry analysis, toxicity testing, and benthic community analysis) (Figure 1). The location of the 102 SQT sampling locations were allocated as follows:

- Twenty-seven of the SQT sampling locations were placed to be co-located with the mummichog and darter/killifish sampling locations (described in the Fish/Decapod QAPP (Windward 2009)) to support the fish tissue-residue line of evidence and the wildlife assessment in the ERA. All of the sediment samples co-located with tissue sampling locations target samples in shallow, nearshore areas (mostly shallow mudflat areas) between RM 0 and 16, except for one, which is located between RM 16 and the Dundee Dam (RM 17.4). The collection of 27 sediment samples to be co-located with locations where mummichog/darter/killifish will have been collected will be deferred until these fish have been caught (26 of these are identified in Worksheet No. 18). Additional sediment sampling locations to be co-located with blue crab composite samples collected in traps will also be sampled once blue crab compositing locations have been selected and approved by USEPA.
- Sediment will be collected from 20 of the SQT sampling locations for bioaccumulation testing. For the bioaccumulation testing effort, bioaccumulation sample locations were selected from the locations in the LPRSA that were characterized in the recent low-resolution core (LRC) sediment sampling program. The chemistry surface sediment (0 to 0.5 ft) samples from the LRC cores were reviewed to identify locations that represent the range of chemical concentrations. A subset of the chemicals analyzed in the LRC sediments was selected for analysis to represent a range of contaminants and on the basis of the frequency of detection (PCDDs and PCDFs, PCBs, PAHs, pesticides [dieldrin, chlordane and total DDTs], phthalates, copper, lead and mercury). For each chemical, cumulative frequency plots were created for the estuarine zone (RM 0 to RM 10) and the freshwater zone (RM 10 to RM 17.4). Twenty sample locations (ten in the estuarine zone and ten in the freshwater zone) were selected to represent the range of chemical concentrations present throughout the site (see Attachment J for further

[7] If a particular habitat stratum was not present in a given 1-mile segment (e.g., the shallow, coarse-grained stratum in RM 1 to RM 2 or deep, fine-grained stratum in RM 16 to RM 17.4), then sampling locations were not identified for that stratum in that 1-mile segment.

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description of the selection of bioaccumulation test sample locations).

- The remaining 51 station locations were be placed randomly (using a random number grid[8] generated using a geographic information system [GIS]) within the four depth range and grain size habitat types described above. Up to five additional locations may be sampled by hand above RM 16 (for a total of up to 102 SQT samples); however, the sampling of these locations will depend on access agreement, safety of the field crew, and accessibility of sediment locations. Based on the above, a total of up to 97 sample locations were identified between RM 0 to RM 16 of the LPRSA. The decision criteria for the sampling process are depicted in flow charts (Attachment O).

In addition to sediment collected at the SQT locations described above, up to fourteen human health exposure samples will also be collected for sediment chemistry only. Nine of these samples have targeted locations at certain shallow nearshore HHRA locations and up to five additional "floater" locations of potential human exposure interest may be identified while in the field (e.g., boat clubs, docks, and other locations of human activity such as fishing that are not currently identified for sampling).

If samples are collected at all possible locations described above, a total of 116 sediment locations will be sampled (102 SQT sampling locations and 14 human health exposure sampling locations). The rationale of each location is specified on Worksheet No. 18 and all locations are presented on Figure 1. Adequate surface sediment will be collected at each sampling location from the top 6 inches (15 cm) to support benthic community characterization (enumeration and taxonomic characterization), sediment toxicity testing, and sediment chemistry.

Attachment O presents the flow charts for sampling sediment in the field. From RM 0 to RM 16, at each SQT sampling location, a minimum of four sediment samples will be taken with a power grab, van Veen (0.2 m^2), or other sediment grab sampler to obtain the four replicate samples for benthic community characterization. The four benthic community allocations (0.1 m^2 for estuarine samples and 0.5 m^2 for freshwater samples) will be kept separate to provide four replicates per location. A minimum of three grab samples will be collected to provide sufficient sediment for sediment chemistry analysis and toxicity and bioaccumulation testing (for the 20 bioaccumulation stations). The sediment will be transferred into containers that have Teflon® liners for transport to the field facility, where they will be transferred to a stainless steel container, thoroughly homogenized, and apportioned into sample containers for chemistry analysis, toxicity testing, or bioaccumulation testing. Excess sample sediment will be containerized and stored in drums at the field facility for offsite disposal (Attachment F).

For human health exposure sampling locations, power grabs will be taken until sufficient sediment is obtained for chemistry analysis. A minimum of three grab samples will be composited for each human health exposure sampling station (i.e., chemistry only station, no toxicity testing and no benthic community samples). Above RM 16, up to five locations may be sampled by hand depending on access agreement and safety of the field crew, and if sediment sampling and sampling access are possible. If sampling is possible, the station locations will be documented using a hand-held differential global positioning system (DGPS) (see Attachment B). The

[8] A random point generator tool in ArcGIS was used to derive Xs and Ys from a random number stream, constrained by the boundaries of a feature layer (built on a combination of river mile, depth, and % fines).

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sediment will be collected by a hand-held grab sampler (e.g., Ponar) or, if necessary, by scooping sediment from a depth of 15 cm with a dedicated, clean, large stainless steel serving spoon, until sufficient sediment is obtained for SQT analysis.

Subsamples of sediment for volatile analytes (VOCs, AVS/SEM, ammonia, sulfides, TPH-purgeables) will be distributed to the appropriate sample containers immediately after collection. At locations where VOCs are designated for collection (at all human heath exposure and SQT shallow sampling locations), the grab sample collected closest to shore will be analyzed for VOCs, to the extent possible, because it represents the location with the greatest potential to be exposed to air.

The *Hyalella* test will be conducted on all sediment samples. The interstitial salinity in the sediment samples will be measured in the laboratory (see SOP M41 Worksheet No. 23) upon receipt. Samples with interstitial salinity of 0 to 5 ppt will be tested at overlying-water salinity of 0 ppt (i.e., freshwater at 100 ppm of water hardness) using *Hyalella azteca* acclimated to freshwater. Samples with interstitial salinity > 5 ppt will be tested at overlying-water salinity of 10 ppt using *Hyalella azteca* acclimated to water with a salinity of 10 ppt. There is concern regarding the usability of *Hyalella* toxicity data from the estuarine portion, specifically where salinity levels are > 15 ppt. Therefore the CPG will evaluate the *Hyalella* toxicity test results from the estuarine portion by comparing to the results of the negative control, evaluating variability in growth, and evaluating mortality data in determining whether these data will be used in the risk assessment. For further details see Attachment M. The *Chironomus* test and the *Ampelisca* test will be selected based on the interstitial salinity; the 10-day *Chironomus dilutus* tests will be performed on freshwater sediments (< 5 ppt salinity) and the 10-day *Ampelisca abdita* tests will be performed on the estuarine sediments (≥ 5 ppt salinity). The planned 97 (or 102) sampling locations in the LPRSA are presented in Figure 1.

At the 20 SQT locations targeted for bioaccumulation sampling, surface sediment samples will be collected. Each sediment sample will be a composite sample composed of a minimum of four grabs. The bioaccumulation sediment will be homogenized with the toxicity and chemistry sediment collected at the same station. The bioaccumulation test for each sample will be selected at the laboratory based on the interstitial salinity (regardless of which zone because the estuarine and freshwater zones are preliminarily defined based on available salinity data; however, the estuarine and freshwater boundary will likely vary); the 28-day *Lumbriculus variegatus* test will be performed on freshwater sediments (interstitial salinity < 5 ppt) and the 28-day *Neanthes virens* test will be performed on the estuarine sediments (interstitial salinity ≥ 5 ppt).

A total of 8 L (2 gallons) and 5.7 L (1.5 gallons) are needed for the toxicity testing and chemistry analyses, respectively. For the bioaccumulation test with *Neanthes virens* 30 L (8 gallons) of sediment is needed. Because the generated tissue mass using the *Lumbriculus variegatus* is dependent on the TOC in the sediments, the analyte list (Worksheet No. 15) will require a large volume of sediment to be collected at each station (according to ASTM (2007a) protocol, the ratio between tissue dry weight to TOC is 1:50). Based on the analyte tissue requirement of 115 g (pre-homogenization) and an average TOC of 6% in the LPRSA (based on preliminary LRC surface sediment data) 64.3 L (17 gallons) of sediments will be collected at each freshwater station for the *Lumbriculus* test. At stations with lower TOC this bioaccumulation test may produce less than 115 g (pre-homogenization) of tissue and the analyses will be prioritized as stated in Worksheet No. 10. The 20 locations planned in the LPRSA for this task are presented in Figure 1.

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Benthic community samples will be taken as part of the sediment collection effort in fall of 2009 (depending on timely approval from the USEPA). A subset of the SQT assessment locations sampled will be revisited as part of the second and third community surveys, which will take place in spring and summer 2010. The targeted locations to be sampled during the second and third surveys will be selected following the first sampling event. All dates are tentative and dependent on approvals from the USEPA.

During benthic sampling, field crew will document any qualitative observations of the presence of wetlands and/or low marsh habitat along the LPRSA.

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Who will collect and generate the data?
As described in Worksheet No. 7, Windward will provide the field sampling coordination and most of the field personnel required to conduct the tissue collection efforts and provide laboratory coordination and support. If necessary, additional field personnel may be provided by de maximis, inc., Research Support Services, Inc. or Aqua Survey, Inc.
How will the data be reported?
Daily updates of locations and sample collection progress will be communicated (e.g., telephone conversation, e-mail) to CPG and USEPA Project Managers and Project Coordinators. Data reports summarizing the toxicity test results, the invertebrate taxonomy results, and chemistry analysis results will be provided within 90 days after receipt of validated toxicity test, taxonomy, and chemistry data. In addition, these reports will include a map that presents the final locations from the sampling effort and summarize any modifications to the proposed sampling plan as outlined in this QAPP. An electronic database that includes the coordinates of sediment sampling locations and sediment sample characteristics will be provided. The electronic database will be provided at the end of the sampling effort. Preliminary data will be available upon request. A data report summarizing the tissue chemistry results from bioaccumulation testing will be provided 90 days after receipt of validated tissue chemistry data.
How will the data be archived?
Data records, forms, and notes, will be scanned and stored electronically in a project file. Hard copies will be archived by Windward's main office in Seattle, Washington. Data will be provided to USEPA in data reports and other acceptable electronic deliverables. The data reports will be issued and then archived electronically and as a hard copy.

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Table 11-1. Taxonomic Names of Benthic Invertebrates Identified in New Jersey Waters

Latin Name	Data Group	Sampling Year
Acanthohaustorius millsi	REMAP Region 2 1998	1998
Acari	REMAP Region 2 1998	1998
Acteocina canaliculata	REMAP Region 2 1998	1998
Actiniaria	REMAP Region 2 1998	1998
Actiniaria	REMAP Region 2 1998	1999
Aeginellidae	REMAP Region 2 1998	1999
Aeginellidae	REMAP Region 2 1998	1998
Ampelisca	REMAP Region 2 1998	1999
Ampelisca	REMAP Region 2 1998	1998
Ampelisca abdita	REMAP Region 2 1998	1998
Ampelisca abdita	REMAP Region 2 1998	1999
Ampelisca vadorum	National Coastal Assessment – Northeast/New Jersey Coast	2002
Ampeliscidae	REMAP Region 2 1998	1999
Ampeliscidae	REMAP Region 2 1998	1998
Ampharete finmarchica	REMAP Region 2 1998	1998
Ampharetidae	Aqua Survey Inc., Benthic Survey	2005
Ampharetidae	REMAP Region 2 1998	1998
Ampharetidae	REMAP Region 2 1998	1999
Amphicteis floridus	EMAP Virginian Province	1990
Amphipoda	REMAP Region 2 1998	1999
Amphipoda	REMAP Region 2 1998	1999
Amphipoda	REMAP Region 2 1998	1998
Amphitrite ornata	REMAP Region 2 1998	1998
Anadara transversa	REMAP Region 2 1998	1998

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Latin Name	Data Group	Sampling Year
Ancistrosyllis hartmanae	REMAP Region 2 1998	1998
Aoridae	REMAP Region 2 1998	1999
Aoridae	REMAP Region 2 1998	1998
Arabella mutans	REMAP Region 2 1998	1998
Aricidea	REMAP Region 2 1998	1998
Aricidea catherinae	REMAP Region 2 1998	1998
Arrenuridae	ABN, New Jersey Department of Environmental Protection	1998
Asabellides oculata	REMAP Region 2 1998	1998
Asabellides oculata	REMAP Region 2 1998	1999
Ascidiacea	REMAP Region 2 1998	1998
Ascidiacea	REMAP Region 2 1998	1999
Asellidae	ABN, New Jersey Department of Environmental Protection	1998
Asellus sp.	Aqua Survey Inc., Benthic Survey	2005
Astacidae	ABN, New Jersey Department of Environmental Protection	1998
Asterias forbesi	REMAP Region 2 1998	1998
Asteroidea	REMAP Region 2 1998	1998
Athericidae	ABN, New Jersey Department of Environmental Protection	1998
Autolytus sp.	REMAP Region 2 1998	1998
Autolytus sp.	REMAP Region 2 1998	1998
Baetidae	ABN, New Jersey Department of Environmental Protection	1998
Balanoglossus	REMAP Region 2 1998	1998
Batea catharinensis	REMAP Region 2 1998	1998
Bathyporeia parkeri	REMAP Region 2 1998	1998
Bivalvia	National Coastal Assessment – Northeast/New Jersey Coast	2000
Bivalvia	REMAP Region 2 1998	1998
Bivalvia	REMAP Region 2 1998	1999

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Latin Name	Data Group	Sampling Year
BloodRed Chironomidae	ABN, New Jersey Department of Environmental Protection	1998
Brachycentridae	ABN, New Jersey Department of Environmental Protection	1998
Brania wellfleetensis	REMAP Region 2 1998	1998
Bryozoa	REMAP Region 2 1998	1999
Caenidae	ABN, New Jersey Department of Environmental Protection	1998
Callinectes sapidus	Tierra Solutions Benthic Survey	1999/2000
Calopterygidae	ABN, New Jersey Department of Environmental Protection	1998
Calyptraeidae	REMAP Region 2 1998	1998
Calyptraeidae	REMAP Region 2 1998	1998
Cambaridae	ABN, New Jersey Department of Environmental Protection	1998
Cancer irroratus	REMAP Region 2 1998	1998
Capitella capitata	REMAP Region 2 1998	1998
Capitella sp. e	REMAP Region 2 1998	1998
Capitellidae	Aqua Survey Inc., Benthic Survey	2005
Capitellidae	REMAP Region 2 1998	1998
Capitellidae	REMAP Region 2 1998	1999
Capniidae	ABN, New Jersey Department of Environmental Protection	1998
Caprella penantis	REMAP Region 2 1998	1998
Cardiidae	REMAP Region 2 1998	1998
Cardiidae	REMAP Region 2 1998	1998
Caulleriella sp. j	REMAP Region 2 1998	1998
Ceratopogon sp.	Tierra Solutions Benthic Survey	1999/2000
Ceratopogonidae	ABN, New Jersey Department of Environmental Protection	1998
Cerebratulus lacteus	Tierra Solutions Benthic Survey	1999/2000
Chaetopteridae	REMAP Region 2 1998	1998
Chione	REMAP Region 2 1998	1998

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Latin Name	Data Group	Sampling Year
Chiridotea almyra	EMAP Virginian Province	1990
Chiridotea coeca	Tierra Solutions Benthic Survey	1999/2000
Chiridotea sp.	Aqua Survey Inc., Benthic Survey	2005
Chironomidae	National Coastal Assessment – Northeast/New Jersey Coast	2000
Chironomidae	Aqua Survey Inc., Benthic Survey	2005
Chironomidae	ABN, New Jersey Department of Environmental Protection	1998
Chironomus spp.	National Coastal Assessment – Northeast/New Jersey Coast	2000
Chloroperlidae	ABN, New Jersey Department of Environmental Protection	1998
Chydoridae	ABN, New Jersey Department of Environmental Protection	1998
Cirratulidae	REMAP Region 2 1998	1998
Cirratulidae	REMAP Region 2 1998	1999
Cirriformia grandis	REMAP Region 2 1998	1998
Clinocardium ciliatum	REMAP Region 2 1998	1998
Clymenella	REMAP Region 2 1998	1998
Clymenella torquata	REMAP Region 2 1998	1998
Coenagrionidae	ABN, New Jersey Department of Environmental Protection	1998
Corbiculidae	ABN, New Jersey Department of Environmental Protection	1998
Corixidae	ABN, New Jersey Department of Environmental Protection	1998
Corophiidae	REMAP Region 2 1998	1998
Corophiidae	REMAP Region 2 1998	1999
Corophium	REMAP Region 2 1998	1998
Corophium	REMAP Region 2 1998	1999
Corophium acherusicum	REMAP Region 2 1998	1998
Corophium acherusicum	REMAP Region 2 1998	1998
Corophium acherusicum	REMAP Region 2 1998	1999
Corophium acutum	REMAP Region 2 1998	1998

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Latin Name	Data Group	Sampling Year
Corophium acutum	REMAP Region 2 1998	1999
Corophium insidiosum	REMAP Region 2 1998	1998
Corophium tuberculatum	National Coastal Assessment – Northeast/New Jersey Coast	2002
Corophium tuberculatum	REMAP Region 2 1998	1998
Corophium tuberculatum	REMAP Region 2 1998	1999
Corydalidae	ABN, New Jersey Department of Environmental Protection	1998
Cossura delta	REMAP Region 2 1998	1998
Crangon septemspinosa	Aqua Survey Inc., Benthic Survey	2005
Crangon septemspinosa	REMAP Region 2 1998	1998
Crangon septemspinosa	REMAP Region 2 1998	1999
Crangon septemspinosa	Tierra Solutions Benthic Survey	1999/2000
Crangonidae	REMAP Region 2 1998	1998
Crepidula	REMAP Region 2 1998	1998
Crepidula	REMAP Region 2 1998	1999
Crepidula fornicata	REMAP Region 2 1998	1998
Crepidula fornicata	REMAP Region 2 1998	1999
Crepidula plana	REMAP Region 2 1998	1998
Crepidula plana	REMAP Region 2 1998	1999
Cryptochironomus spp.	National Coastal Assessment – Northeast/New Jersey Coast	2000
Culicidae	Aqua Survey Inc., Benthic Survey	2005
Culicidae	ABN, New Jersey Department of Environmental Protection	1998
Cumacea	Aqua Survey Inc., Benthic Survey	2005
Curculionidae	ABN , New Jersey Department of Environmental Protection	1998
Cyathura	REMAP Region 2 1998	1999
Cyathura	REMAP Region 2 1998	1998
Cyathura burbancki	REMAP Region 2 1998	1998

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Latin Name	Data Group	Sampling Year
Cyathura polita	Aqua Survey Inc., Benthic Survey	2005
Cyathura polita	National Coastal Assessment – Northeast/New Jersey Coast	2002
Cyathura polita	EMAP Virginian Province	1990
Cyathura polita	REMAP Region 2 1998	1998
Cyathura polita	REMAP Region 2 1998	1999
Cyathura polita	Tierra Solutions Benthic Survey	1999/2000
Cyclopidae	ABN, New Jersey Department of Environmental Protection	1998
Cypridae	ABN, New Jersey Department of Environmental Protection	1998
Daphnidae	ABN, New Jersey Department of Environmental Protection	1998
Decapoda	REMAP Region 2 1998	1998
Decapoda	REMAP Region 2 1998	1999
Decapoda	REMAP Region 2 1998	1998
Demonax	REMAP Region 2 1998	1999
Demonax microphthalmus	REMAP Region 2 1998	1998
Demonax microphthalmus	REMAP Region 2 1998	1999
Dendrocoelidae	ABN, New Jersey Department of Environmental Protection	1998
Deutella incerta	REMAP Region 2 1998	1999
Deutella incerta	REMAP Region 2 1998	1998
Diastylidae	REMAP Region 2 1998	1998
Diastylidae	REMAP Region 2 1998	1999
Dinophilus	REMAP Region 2 1998	1999
Diopatra cuprea	REMAP Region 2 1998	1998
Diopatra cuprea	REMAP Region 2 1998	1999
Dipolydora socialis	REMAP Region 2 1998	1998
Diptera (pupae)	Aqua Survey Inc., Benthic Survey	2005
Doridella obscura	REMAP Region 2 1998	1998

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Latin Name	Data Group	Sampling Year
Doridella obscura	REMAP Region 2 1998	1999
Drilonereis longa	REMAP Region 2 1998	1998
Echinarachnius parma	REMAP Region 2 1998	1998
Echinoidea	REMAP Region 2 1998	1998
Edotea triloba	National Coastal Assessment – Northeast/New Jersey Coast	2002
Edotea triloba	EMAP Virginian Province	1993
Edotia triloba	REMAP Region 2 1998	1998
Edotia triloba	REMAP Region 2 1998	1999
Elasmopus	REMAP Region 2 1998	1999
Elasmopus	REMAP Region 2 1998	1998
Elasmopus levis	REMAP Region 2 1998	1998
Elasmopus levis	REMAP Region 2 1998	1999
Elmidae	ABN, New Jersey Department of Environmental Protection	1998
Empididae	ABN, New Jersey Department of Environmental Protection	1998
Enchytraeidae	ABN, New Jersey Department of Environmental Protection	1998
Ensis directus	REMAP Region 2 1998	1998
Eobrolgus spinosus	REMAP Region 2 1998	1998
Ephemerellidae	ABN, New Jersey Department of Environmental Protection	1998
Erichthonius brasiliensis	REMAP Region 2 1998	1998
Erichthonius brasiliensis	REMAP Region 2 1998	1998
Erichthonius brasiliensis	REMAP Region 2 1998	1999
Erpobdellidae	ABN, New Jersey Department of Environmental Protection	1998
Eteone heteropoda	Tierra Solutions Benthic Survey	1999/2000
Eteone sp.	Aqua Survey Inc., Benthic Survey	2005
Eumida sanguinea	REMAP Region 2 1998	1998
Eumida sanguinea	REMAP Region 2 1998	1999

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Latin Name	Data Group	Sampling Year
Eumida sanguinea	REMAP Region 2 1998	1998
Eunicidae	REMAP Region 2 1998	1998
Eupleura caudata	REMAP Region 2 1998	1998
Eurypanopeus depressus	REMAP Region 2 1998	1998
Eurypanopeus depressus	REMAP Region 2 1998	1999
Eusarsiella zostericola	REMAP Region 2 1998	1998
Eusarsiella zostericola	REMAP Region 2 1998	1999
Exogone	REMAP Region 2 1998	1998
Exogone dispar	REMAP Region 2 1998	1998
Flabelligeridae	REMAP Region 2 1998	1998
Fredericellidae	ABN, New Jersey Department of Environmental Protection	1998
Gammaridae	EMAP Virginian Province	1990
Gammaridae	REMAP Region 2 1998	1998
Gammaridae	ABN, New Jersey Department of Environmental Protection	1998
Gammarus	National Coastal Assessment – Northeast/New Jersey Coast	2002
Gammarus annulatus	REMAP Region 2 1998	1998
Gammarus annulatus	REMAP Region 2 1998	1999
Gammarus daiberi	EMAP Virginian Province	1990
Gammarus mucronatus	Tierra Solutions Benthic Survey	1999/2000
Gammarus palustris	National Coastal Assessment – Northeast/New Jersey Coast	2000
Gammarus sp.	Aqua Survey Inc., Benthic Survey	2005
Gammarus sp.	Tierra Solutions Benthic Survey	1999/2000
Gastropoda	National Coastal Assessment – Northeast/New Jersey Coast	2000
Gastropoda	EMAP Virginian Province	1990
Gastropoda	REMAP Region 2 1998	1998
Gastropoda	REMAP Region 2 1998	1999

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Latin Name	Data Group	Sampling Year
Gemma gemma	REMAP Region 2 1998	1998
Gerridae	ABN, New Jersey Department of Environmental Protection	1998
Glossiphoniidae	ABN, New Jersey Department of Environmental Protection	1998
Glossosomatidae	ABN, New Jersey Department of Environmental Protection	1998
Glycera	REMAP Region 2 1998	1998
Glycera americana	REMAP Region 2 1998	1998
Glycera americana	REMAP Region 2 1998	1999
Glycera dibranchiata	REMAP Region 2 1998	1999
Glycera dibranchiata	REMAP Region 2 1998	1999
Glycera dibranchiata	REMAP Region 2 1998	1998
Glycera sp.	Aqua Survey Inc., Benthic Survey	2005
Glyceridae	REMAP Region 2 1998	1998
Glycinde solitaria	Tierra Solutions Benthic Survey	1999/2000
Gomphidae	ABN, New Jersey Department of Environmental Protection	1998
Goniadidae	REMAP Region 2 1998	1998
Gyrinidae	ABN, New Jersey Department of Environmental Protection	1998
Haliplidae	ABN, New Jersey Department of Environmental Protection	1998
Harmothoe	REMAP Region 2 1998	1998
Harmothoe	REMAP Region 2 1998	1999
Harmothoe imbricata	REMAP Region 2 1998	1998
Harmothoe imbricata	REMAP Region 2 1998	1999
Harnischia spp.	National Coastal Assessment – Northeast/New Jersey Coast	2000
Haustoriidae	REMAP Region 2 1998	1998
Helicopsychidae	ABN, New Jersey Department of Environmental Protection	1998
Heptagenidae	ABN, New Jersey Department of Environmental Protection	1998
Heptageniidae	ABN, New Jersey Department of Environmental Protection	1998

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Latin Name	Data Group	Sampling Year
Hesionidae	REMAP Region 2 1998	1998
Heteromastus filiformis	REMAP Region 2 1998	1998
Heteromastus filiformis	REMAP Region 2 1998	1999
Heteromastus filiformis	Tierra Solutions Benthic Survey	1999/2000
Heteromysis formosa	REMAP Region 2 1998	1998
Hobsonia florida (= Hypaniola grayi)	Aqua Survey Inc., Benthic Survey	2005
Hydra sp.	Aqua Survey Inc., Benthic Survey	2005
Hydridae	ABN, New Jersey Department of Environmental Protection	1998
Hydrobia	REMAP Region 2 1998	1998
Hydrobia	REMAP Region 2 1998	1999
Hydrobiidae	REMAP Region 2 1998	1998
Hydrobiidae	REMAP Region 2 1998	1999
Hydrobiidae	ABN, New Jersey Department of Environmental Protection	1998
Hydroides	REMAP Region 2 1998	1998
Hydroides dianthus	REMAP Region 2 1998	1998
Hydrophilidae	ABN, New Jersey Department of Environmental Protection	1998
Hydropsychidae	ABN, New Jersey Department of Environmental Protection	1998
Hydroptilidae	ABN, New Jersey Department of Environmental Protection	1998
Hydrozoa	REMAP Region 2 1998	1998
Hydrozoa	REMAP Region 2 1998	1999
Hygrobatidae	ABN, New Jersey Department of Environmental Protection	1998
Hypereteone heteropoda	REMAP Region 2 1998	1998
Hypereteone heteropoda	REMAP Region 2 1998	1999
Idotea phosphorea	Aqua Survey Inc., Benthic Survey	2005
Ilyanassa obsoleta	REMAP Region 2 1998	1998
Ilyanassa trivittata	REMAP Region 2 1998	1998

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Latin Name	Data Group	Sampling Year
Ilyanassa trivittata	REMAP Region 2 1998	1999
Ilyodrilus templetoni	Tierra Solutions Benthic Survey	1999/2000
imm. Tub. with hair chaetae	Tierra Solutions Benthic Survey	1999/2000
Isotomidae	ABN, New Jersey Department of Environmental Protection	1998
Jassa falcata	REMAP Region 2 1998	1998
Laeonereis culveri	Tierra Solutions Benthic Survey	1999/2000
Lebertiidae	ABN, New Jersey Department of Environmental Protection	1998
Leitoscoloplos	REMAP Region 2 1998	1998
Leitoscoloplos	REMAP Region 2 1998	1999
Leitoscoloplos acutus	REMAP Region 2 1998	1998
Leitoscoloplos acutus	REMAP Region 2 1998	1999
Leitoscoloplos fragilis	REMAP Region 2 1998	1998
Leitoscoloplos fragilis	Tierra Solutions Benthic Survey	1999/2000
Leitoscoloplos robustus	REMAP Region 2 1998	1998
Leitoscoloplos robustus	REMAP Region 2 1998	1999
Lepidonotus	REMAP Region 2 1998	1998
Lepidonotus sublevis	REMAP Region 2 1998	1998
Lepidonotus sublevis	REMAP Region 2 1998	1999
Lepidostomatidae	ABN, New Jersey Department of Environmental Protection	1998
Leptoceridae	ABN, New Jersey Department of Environmental Protection	1998
Leptocheirus plumulosus	Tierra Solutions Benthic Survey	1999/2000
Leptophlebiidae	ABN, New Jersey Department of Environmental Protection	1998
Leucon americanus	EMAP Virginian Province	1990
Leucon americanus	REMAP Region 2 1998	1999
Leucon americanus	REMAP Region 2 1998	1998
Leuctridae	ABN, New Jersey Department of Environmental Protection	1998

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Latin Name	Data Group	Sampling Year
Libinia dubia	REMAP Region 2 1998	1998
Limnephilidae	ABN, New Jersey Department of Environmental Protection	1998
Limnodrilus hoffmeisteri	National Coastal Assessment – Northeast/New Jersey Coast	2000
Limnodrilus sp.	Tierra Solutions Benthic Survey	1999/2000
Limulus polyphemus	REMAP Region 2 1998	1998
Lineidae	REMAP Region 2 1998	1998
Lineidae	REMAP Region 2 1998	1999
Littoridinops tenuipes	EMAP Virginian Province	1990
Lumbricidae	ABN, New Jersey Department of Environmental Protection	1998
Lumbriculidae	ABN, New Jersey Department of Environmental Protection	1998
Lumbriculidae	ABN, New Jersey Department of Environmental Protection	1998
Lymnaeidae	ABN, New Jersey Department of Environmental Protection	1998
Lyonsia hyalina hyalina	REMAP Region 2 1998	1999
Lyonsia hyalina hyalina	REMAP Region 2 1998	1998
Lysianassidae	REMAP Region 2 1998	1998
Lysianopsis alba	REMAP Region 2 1998	1998
Macoma	REMAP Region 2 1998	1999
Macoma balthica	REMAP Region 2 1998	1999
Macoma balthica	REMAP Region 2 1998	1998
Macoma baltica	EMAP Virginian Province	1993
Macoma sp.	Tierra Solutions Benthic Survey	1999/2000
Mactridae	REMAP Region 2 1998	1998
Magelona papillicornis	REMAP Region 2 1998	1998
Majidae	REMAP Region 2 1998	1998
Maldanidae	REMAP Region 2 1998	1998
Manayunkia speciosa	Aqua Survey Inc., Benthic Survey	2005

QAPP Worksheet No. 11. Project Quality Objectives/Systematic Planning Process Statements (cont.)

Latin Name	Data Group	Sampling Year
Marenzellaria viridis	REMAP Region 2 1998	1998
Marenzelleria (Scolecolepidis) viridis	Aqua Survey Inc., Benthic Survey	2005
Marenzelleria viridis	National Coastal Assessment – Northeast/New Jersey Coast	2002
Marenzelleria viridis	EMAP Virginian Province	1990
Marenzelleria viridis	EMAP Virginian Province	1993
Marenzelleria viridis	Tierra Solutions Benthic Survey	1999/2000
Mediomastus ambiseta	EMAP Virginian Province	1990
Mediomastus ambiseta	EMAP Virginian Province	1993
Mediomastus ambiseta	REMAP Region 2 1998	1998
Mediomastus ambiseta	REMAP Region 2 1998	1999
Mediomastus sp.	REMAP Region 2 1998	1998
Mediomastus sp.	REMAP Region 2 1998	1999
Melita	REMAP Region 2 1998	1998
Melita nitida	REMAP Region 2 1998	1998
Melita nitida	REMAP Region 2 1998	1999
Melitidae	REMAP Region 2 1998	1998
Melitidae	REMAP Region 2 1998	1999
Mercenaria mercenaria	REMAP Region 2 1998	1998
Mercenaria mercenaria	REMAP Region 2 1998	1999
Microdeutopus	REMAP Region 2 1998	1998
Microdeutopus	REMAP Region 2 1998	1999
Microdeutopus anomalus	REMAP Region 2 1998	1998
Microdeutopus gryllotalpa	REMAP Region 2 1998	1998
Microphthalmus	REMAP Region 2 1998	1998
Microphthalmus	REMAP Region 2 1998	1999
Microphthalmus sczelkowii	REMAP Region 2 1998	1998

QAPP Worksheet No. 11. Project Quality Objectives/Systematic Planning Process Statements (cont.)

Latin Name	Data Group	Sampling Year
Microphthalmus similis	REMAP Region 2 1998	1998
Molannidae	ABN, New Jersey Department of Environmental Protection	1998
Monoculodes sp. g	REMAP Region 2 1998	1998
Mulinia lateralis	Aqua Survey Inc., Benthic Survey	2005
Mulinia lateralis	REMAP Region 2 1998	1998
Mulinia lateralis	REMAP Region 2 1998	1999
Muricidae	REMAP Region 2 1998	1998
Mya	REMAP Region 2 1998	1998
Mya arenaria	REMAP Region 2 1998	1998
Mya arenaria	REMAP Region 2 1998	1999
Mya arenaria	Tierra Solutions Benthic Survey	1999/2000
Mysidacea	Aqua Survey Inc., Benthic Survey	2005
Mysidacea	REMAP Region 2 1998	1998
Mysidae	REMAP Region 2 1998	1998
Mysidae	REMAP Region 2 1998	1999
Mysidopsis	REMAP Region 2 1998	1999
Mytilus edulis	REMAP Region 2 1998	1998
Mytilus edulis	REMAP Region 2 1998	1999
Naididae	Aqua Survey Inc., Benthic Survey	2005
Naididae	ABN, New Jersey Department of Environmental Protection	1998
Naididae	Tierra Solutions Benthic Survey	1999/2000
Nassarius vibex	REMAP Region 2 1998	1998
Naucoridae	ABN, New Jersey Department of Environmental Protection	1998
Neanthese sp.	Tierra Solutions Benthic Survey	1999/2000
Nematoda	EMAP Virginian Province	1990
Nematoda	ABN, New Jersey Department of Environmental Protection	1998

QAPP Worksheet No. 11. Project Quality Objectives/Systematic Planning Process Statements (cont.)

Latin Name	Data Group	Sampling Year
Nematonereis hebes	REMAP Region 2 1998	1998
Nemouridae	ABN, New Jersey Department of Environmental Protection	1998
Neomysis americana	REMAP Region 2 1998	1998
Neomysis americana	REMAP Region 2 1998	1999
Neomysis americana	Tierra Solutions Benthic Survey	1999/2000
Neopanope sayi	REMAP Region 2 1998	1998
Nephtyidae	REMAP Region 2 1998	1998
Nephtys	REMAP Region 2 1998	1998
Nephtys incisa	REMAP Region 2 1998	1998
Nephtys picta	REMAP Region 2 1998	1998
Nereidae	REMAP Region 2 1998	1998
Nereidae	REMAP Region 2 1998	1999
Nereis	REMAP Region 2 1998	1998
Nereis	REMAP Region 2 1998	1999
Nereis acuminata	REMAP Region 2 1998	1998
Nereis succinea	REMAP Region 2 1998	1998
Nereis succinea	REMAP Region 2 1998	1999
Neverita duplicata	REMAP Region 2 1998	1998
Notonectidae	ABN, New Jersey Department of Environmental Protection	1998
Nucula proxima	REMAP Region 2 1998	1998
Nudibranchia	REMAP Region 2 1998	1999
Odontoceridae	ABN, New Jersey Department of Environmental Protection	1998
Odostomia	REMAP Region 2 1998	1998
Odostomia trifida	REMAP Region 2 1998	1998
Oligochaeta	EMAP Virginian Province	1990
Oligochaeta	EMAP Virginian Province	1993

QAPP Worksheet No. 11. Project Quality Objectives/Systematic Planning Process Statements (cont.)

Latin Name	Data Group	Sampling Year
Oligochaeta	REMAP Region 2 1998	1998
Oligochaeta	REMAP Region 2 1998	1999
Oligoneuriidae	ABN, New Jersey Department of Environmental Protection	1998
Oniscidae	ABN, New Jersey Department of Environmental Protection	1998
Onuphidae	REMAP Region 2 1998	1999
Ophelia sp.	Aqua Survey Inc., Benthic Survey	2005
Ophiuroidea	REMAP Region 2 1998	1998
Orbinia americana	REMAP Region 2 1998	1998
Ostracoda	REMAP Region 2 1998	1998
Ovalipes	REMAP Region 2 1998	1998
Ovalipes ocellatus	REMAP Region 2 1998	1998
Oxyurostylis smithi	REMAP Region 2 1998	1999
Oxyurostylis smithi	REMAP Region 2 1998	1998
Paguridae	REMAP Region 2 1998	1998
Paguridae	REMAP Region 2 1998	1999
Paguridae	REMAP Region 2 1998	1998
Pagurus	REMAP Region 2 1998	1998
Pagurus	REMAP Region 2 1998	1999
Pagurus acadianus	REMAP Region 2 1998	1998
Pagurus longicarpus	REMAP Region 2 1998	1998
Pagurus politus	REMAP Region 2 1998	1998
Palaemonetes	REMAP Region 2 1998	1998
Palaemonetes pugio	REMAP Region 2 1998	1998
Palaemonetes pugio	REMAP Region 2 1998	1999
Paludicellidae	ABN, New Jersey Department of Environmental Protection	1998
Panopeus herbstii	REMAP Region 2 1998	1998

QAPP Worksheet No. 11. Project Quality Objectives/Systematic Planning Process Statements (cont.)

Latin Name	Data Group	Sampling Year
Paracaprella tenuis	REMAP Region 2 1998	1999
Paracaprella tenuis	REMAP Region 2 1998	1998
Paracaprella tenuis	REMAP Region 2 1998	1998
Parametopella cypris	REMAP Region 2 1998	1999
Parametopella cypris	REMAP Region 2 1998	1998
Paranaitis speciosa	REMAP Region 2 1998	1998
Paraonidae	REMAP Region 2 1998	1998
Paraonis fulgens	REMAP Region 2 1998	1998
Parapionosyllis longicirrata	REMAP Region 2 1998	1998
Parasterope pollex	REMAP Region 2 1998	1998
Pectinaria gouldii	REMAP Region 2 1998	1998
Pectinaria gouldii	REMAP Region 2 1998	1999
Pectinaria sp.	REMAP Region 2 1998	1998
Pectinidae	REMAP Region 2 1998	1998
Peltoperlidae	ABN, New Jersey Department of Environmental Protection	1998
Perlidae	ABN, New Jersey Department of Environmental Protection	1998
Perlodidae	ABN, New Jersey Department of Environmental Protection	1998
Petricola pholadiformis	REMAP Region 2 1998	1998
Petricola pholadiformis	REMAP Region 2 1998	1999
Pettiboneia duofurca	REMAP Region 2 1998	1998
Pherusa	REMAP Region 2 1998	1998
Pherusa affinis	REMAP Region 2 1998	1998
Philopotamidae	ABN, New Jersey Department of Environmental Protection	1998
Philopotamidae	ABN, New Jersey Department of Environmental Protection	1998
Phoxocephalidae	REMAP Region 2 1998	1998
Phoxocephalus holbolli	REMAP Region 2 1998	1998

QAPP Worksheet No. 11. Project Quality Objectives/Systematic Planning Process Statements (cont.)

Latin Name	Data Group	Sampling Year
Phyllodoce arenae	REMAP Region 2 1998	1998
Phyllodoce sp.	REMAP Region 2 1998	1998
Phyllodocidae	REMAP Region 2 1998	1999
Physidae	ABN, New Jersey Department of Environmental Protection	1998
Physidae	ABN, New Jersey Department of Environmental Protection	1998
Pinnixa	REMAP Region 2 1998	1998
Pionosyllis	REMAP Region 2 1998	1998
Pisidum sp.	Aqua Survey Inc., Benthic Survey	2005
Pitar morrhuanus	REMAP Region 2 1998	1998
Placobdella sp.	Aqua Survey Inc., Benthic Survey	2005
Plagiostomidae	ABN, New Jersey Department of Environmental Protection	1998
Planariidae	ABN, New Jersey Department of Environmental Protection	1998
Planorbidae	ABN, New Jersey Department of Environmental Protection	1998
Pleuroceridae	ABN, New Jersey Department of Environmental Protection	1998
Pleustidae	REMAP Region 2 1998	1998
Pleustidae	REMAP Region 2 1998	1999
Pleustidae	REMAP Region 2 1998	1998
Pleusymtes glaber	REMAP Region 2 1998	1999
Pleusymtes glaber	REMAP Region 2 1998	1998
Podarke obscura	REMAP Region 2 1998	1998
Podarkeopsis levifuscina	REMAP Region 2 1998	1998
Podarkeopsis levifuscina	REMAP Region 2 1998	1999
Podarkeopsis levifuscina	REMAP Region 2 1998	1998
Polycentropodidae	ABN, New Jersey Department of Environmental Protection	1998
Polychaeta – unidentified/fragments	EMAP Virginian Province	1990
Polycirrus	REMAP Region 2 1998	1998

QAPP Worksheet No. 11. Project Quality Objectives/Systematic Planning Process Statements (cont.)

Latin Name	Data Group	Sampling Year
Polycirrus eximius	REMAP Region 2 1998	1998
Polydora cornuta	REMAP Region 2 1998	1998
Polydora cornuta	REMAP Region 2 1998	1999
Polydora sp.	Aqua Survey Inc., Benthic Survey	2005
Polygordius	REMAP Region 2 1998	1998
Polynoidae	REMAP Region 2 1998	1999
Polynoidae	REMAP Region 2 1998	1999
Polypedilum illinoense group	National Coastal Assessment – Northeast/New Jersey Coast	2000
Polypedilum scalaenum group	National Coastal Assessment – Northeast/New Jersey Coast	2000
Polypedilum simulans group	National Coastal Assessment – Northeast/New Jersey Coast	2000
Polypedilum spp.	National Coastal Assessment – Northeast/New Jersey Coast	2000
Pontogeneia inermis	REMAP Region 2 1998	1998
Portunidae	REMAP Region 2 1998	1998
Portunidae	REMAP Region 2 1998	1999
poss. Enchytraeus sp.	Tierra Solutions Benthic Survey	1999/2000
Prionospio sp.	REMAP Region 2 1998	1998
Procladius sp.	Tierra Solutions Benthic Survey	1999/2000
Protohaustorius wigleyi	REMAP Region 2 1998	1998
Psephenidae	ABN, New Jersey Department of Environmental Protection	1998
Pseudopolydora	REMAP Region 2 1998	1998
Psychoda sp.	Tierra Solutions Benthic Survey	1999/2000
Psychomyiidae	ABN, New Jersey Department of Environmental Protection	1998
Pteronarcidae	ABN, New Jersey Department of Environmental Protection	1998
Pyralidae	ABN, New Jersey Department of Environmental Protection	1998
Pyramidella	REMAP Region 2 1998	1998
Pyramidellidae	REMAP Region 2 1998	1998

QAPP Worksheet No. 11. Project Quality Objectives/Systematic Planning Process Statements (cont.)

Latin Name	Data Group	Sampling Year
Quistadrilus multisetosus	Tierra Solutions Benthic Survey	1999/2000
Rhepoxynius hudsoni	REMAP Region 2 1998	1998
Rhepoxynius hudsoni	REMAP Region 2 1998	1998
Rhithropanopeus harrisi	EMAP Virginian Province	1993
Rhithropanopeus harrisii	REMAP Region 2 1998	1998
Rhithropanopeus harrisii	REMAP Region 2 1998	1999
Rhyacophilidae	ABN, New Jersey Department of Environmental Protection	1998
Rhynchocoela	REMAP Region 2 1998	1998
Rhynchocoela	REMAP Region 2 1998	1999
Rictaxis punctostriatus	REMAP Region 2 1998	1998
Rictaxis punctostriatus	REMAP Region 2 1998	1999
Sabellaria vulgaris	REMAP Region 2 1998	1998
Sabellaria vulgaris	REMAP Region 2 1998	1999
Sabellariidae	REMAP Region 2 1998	1998
Sabellidae	REMAP Region 2 1998	1998
Sabellidae	REMAP Region 2 1998	1999
Schistomeringos rudolphi	REMAP Region 2 1998	1998
Scolelepis	REMAP Region 2 1998	1998
Scolelepis squamata	REMAP Region 2 1998	1998
Scolelepis texana	REMAP Region 2 1998	1998
Scoletoma acicularum	REMAP Region 2 1998	1998
Scoloplos sp.	Aqua Survey Inc., Benthic Survey	2005
Serpulidae	REMAP Region 2 1998	1998
Sialidae	ABN, New Jersey Department of Environmental Protection	1998
Siliqua costata	REMAP Region 2 1998	1998
Simuliidae	ABN, New Jersey Department of Environmental Protection	1998

QAPP Worksheet No. 11. Project Quality Objectives/Systematic Planning Process Statements (cont.)

Latin Name	Data Group	Sampling Year
Siphlonuridae	ABN, New Jersey Department of Environmental Protection	1998
Solenidae	REMAP Region 2 1998	1998
Sphaeriidae	National Coastal Assessment – Northeast/New Jersey Coast	2000
Sphaeriidae	Aqua Survey Inc., Benthic Survey	2005
Sphaeriidae	ABN, New Jersey Department of Environmental Protection	1998
Sphaerium	Aqua Survey Inc., Benthic Survey	2005
Spio	REMAP Region 2 1998	1998
Spio filicornis	REMAP Region 2 1998	1998
Spio filicornis	REMAP Region 2 1998	1999
Spio setosa	REMAP Region 2 1998	1999
Spio setosa	REMAP Region 2 1998	1998
Spiochaetopterus oculatus	REMAP Region 2 1998	1999
Spiochaetopterus oculatus	REMAP Region 2 1998	1998
Spionidae	REMAP Region 2 1998	1998
Spionidae	REMAP Region 2 1998	1999
Spiophanes bombyx	REMAP Region 2 1998	1998
Spisula	REMAP Region 2 1998	1998
Spisula solidissima	REMAP Region 2 1998	1998
Spongillidae	ABN, New Jersey Department of Environmental Protection	1998
Stenothoidae	REMAP Region 2 1998	1998
Sthenelais boa	REMAP Region 2 1998	1998
Streblospio benedicti	National Coastal Assessment – Northeast/New Jersey Coast	2002
Streblospio benedicti	EMAP Virginian Province	1993
Streblospio benedicti	Aqua Survey Inc., Benthic Survey	2005
Streblospio benedicti	REMAP Region 2 1998	1998
Streblospio benedicti	REMAP Region 2 1998	1999

QAPP Worksheet No. 11. Project Quality Objectives/Systematic Planning Process Statements (cont.)

Latin Name	Data Group	Sampling Year
Streptoblospio benedicti	Tierra Solutions Benthic Survey	1999/2000
Streptosyllis arenae	REMAP Region 2 1998	1998
Streptosyllis pettiboneae	REMAP Region 2 1998	1998
Streptosyllis pettiboneae	REMAP Region 2 1998	1999
Syllidae	REMAP Region 2 1998	1998
Syllis gracilis	REMAP Region 2 1998	1998
Synidotea sp. e	REMAP Region 2 1998	1998
Synidotea sp. e	REMAP Region 2 1998	1999
Tabanidae	ABN, New Jersey Department of Environmental Protection	1998
Taeniopterygidae	ABN, New Jersey Department of Environmental Protection	1998
Talitridae	ABN, New Jersey Department of Environmental Protection	1998
Tanaissus psammophilus	REMAP Region 2 1998	1998
Tectonatica pusilla	REMAP Region 2 1998	1998
Tellina	REMAP Region 2 1998	1998
Tellina	REMAP Region 2 1998	1999
Tellina agilis	REMAP Region 2 1998	1998
Tellina agilis	REMAP Region 2 1998	1999
Tellinidae	REMAP Region 2 1998	1998
Terebellidae	REMAP Region 2 1998	1998
Terebellidae	REMAP Region 2 1998	1998
Tetrastemmatidae	ABN, New Jersey Department of Environmental Protection	1998
Tharyx	REMAP Region 2 1998	1998
Tharyx acutus	REMAP Region 2 1998	1998
Tharyx acutus	REMAP Region 2 1998	1999
Thienemannimyia group	Tierra Solutions Benthic Survey	1999/2000
Tipulidae	ABN, New Jersey Department of Environmental Protection	1998

QAPP Worksheet No. 11. Project Quality Objectives/Systematic Planning Process Statements (cont.)

Latin Name	Data Group	Sampling Year
Travisia carnea	Aqua Survey Inc., Benthic Survey	2005
Travisia parva	REMAP Region 2 1998	1998
Tricorythidae	ABN, New Jersey Department of Environmental Protection	1998
Tubificidae	National Coastal Assessment – Northeast/New Jersey Coast	2000
Tubificidae	National Coastal Assessment – Northeast/New Jersey Coast	2002
Tubificidae	ABN, New Jersey Department of Environmental Protection	1998
Tubificoides heterochaetus	Tierra Solutions Benthic Survey	1999/2000
Tubulanus	REMAP Region 2 1998	1999
Tubulanus	REMAP Region 2 1998	1998
Turbellaria	REMAP Region 2 1998	1998
Turbellaria	REMAP Region 2 1998	1999
Turbonilla	REMAP Region 2 1998	1998
Turbonilla	REMAP Region 2 1998	1998
Turbonilla	REMAP Region 2 1998	1998
Turbonilla interrupta	REMAP Region 2 1998	1998
Unciola	REMAP Region 2 1998	1998
Unciola	REMAP Region 2 1998	1999
Unciola dissimilis	REMAP Region 2 1998	1998
Unciola irrorata	REMAP Region 2 1998	1998
Unciola irrorata	REMAP Region 2 1998	1998
Unciola serrata	REMAP Region 2 1998	1998
Unciola serrata	REMAP Region 2 1998	1999
Urnatellidae	ABN, New Jersey Department of Environmental Protection	1998
Urosalpinx cinera	REMAP Region 2 1998	1998
Veliidae	ABN, New Jersey Department of Environmental Protection	1998
Veneridae	REMAP Region 2 1998	1998

QAPP Worksheet No. 11. Project Quality Objectives/Systematic Planning Process Statements (cont.)

Latin Name	Data Group	Sampling Year
Viviparidae	ABN, New Jersey Department of Environmental Protection	1998
Xanthidae	EMAP Virginian Province	1993
Xanthidae	REMAP Region 2 1998	1998
Xanthidae	REMAP Region 2 1998	1999
Yoldia limatula	REMAP Region 2 1998	1998

Sources: Aqua Survey (2005), NJDEP (2000); Tierra Solutions (2002a); USEPA REMAP (1993b, 1999, 2002c)
ABN – ambient biomonitoring network
EMAP – Environmental Monitoring and Assessment Program
REMAP – Regional Environmental Monitoring and Assessment Program

QAPP Worksheet No. 11. Project Quality Objectives/Systematic Planning Process Statements (cont.)

Table 11-2. Quality Indicators for Toxicity Tests Based on ASTM and USEPA Protocols

Test	Quality Indicators
10-day *Chironomus dilutus* test[9]	• Minimum control survival of 70%; mean weight of surviving control organisms 0.48 mg ash-free dry weight. • All organisms in a test must be from the same source. • Tests must be started with second- to third-instar larvae. • Test organisms must be cultured and tested at 23°C (± 1°C). • All test chambers should be identical and should contain the same amount of sediment and overlying water. • Hardness, alkalinity, and ammonia in the overlying water typically should not vary by more than 50% during the test, and dissolved oxygen should be maintained above 2.5 mg/L in the overlying water. • The daily mean test temperature must be within 1°C of 23°C. The instantaneous temperature must always be within 3°C of 23°C. • The LC50 for a positive control test should be within the mean LC50 ± 2 standard deviations of the control chart. • Natural physico-chemical characteristics of test sediment collected from the field should be within the tolerance limits of the test organisms. • Storage of sediment collected in the field should be ≤ 8 weeks, preferably ≤14 days. • Storage of sediments for toxicity testing should be at 4 ^{o}C.
28-day *Hyalella azteca* test	• Minimum negative control survival of 80%. • All organisms in a test must be from the same source. • Age of *H. azteca* at the start of the test must be between 7 to 14 days old. • Test organisms must be cultured and tested at 23°C (± 1°C). • All test chambers should be identical and should contain the same amount of sediment and overlying water. • Hardness, alkalinity, and ammonia of overlying water typically should not vary by more than 50% during the test, and dissolved oxygen should be maintained above 2.5 mg/L in the overlying water. • The daily mean test temperature must be within ± 1°C of 23°C. The instantaneous temperature must always be within ± 3°C of 23°C. • Natural physico-chemical characteristics of test sediment collected from the field should be within the tolerance limits of the test organisms. • The LC50 for a positive control test should be within the mean LC50 ± 2 standard deviations of the control chart for the lab conducting the test. • Storage of sediment collected in the field should be ≤ 8 weeks, preferably ≤ 14 days. • Storage of sediments for toxicity testing should be at 4 ^{o}C.

[9] *Chironomus dilutus* is also *Chironomus tentans.*

QAPP Worksheet No. 11. Project Quality Objectives/Systematic Planning Process Statements (cont.)

Test	Quality Indicators
10-day *Ampelisca abdita* test	• Mean mortality in the negative control ≦ 10%, individual replicate mortality should not exceed 20%. • All organisms in a test must be from the same source. • The mean of the daily test temperature must be within ± 1°C of 15°C. • Test conducted under continuous light. • Dissolved oxygen, pH, and salinity within the acceptable ranges established by the protocol. • All test chambers should be identical and should contain the same amount of sediment and overlying water. • The LC50 for a positive control test should be within the mean LC50 ± 2 standard deviations of the control chart for the lab conducting the test. • Storage of sediment collected in the field should be ≤ 8 weeks, preferably ≤ 14 days. • Storage of sediments for toxicity testing should be at 4 ^{o}C.

QAPP Worksheet No. 11. Project Quality Objectives/Systematic Planning Process Statements (cont.)

Table 11-3. Quality Indicators for Bioaccumulation Tests Based on ASTM and USEPA Protocols

Test	Quality Indicators
28-day *Lumbriculus variegatus* test:	• Negative-control sediment must be included. • All organisms in a test must be from the same source. • Number of *L. variegatus* in a 4-day toxicity screening test should not be significantly reduced in the test sediment relative to the control sediment. • Test organisms should burrow into the sediment. Avoidance of test sediment by *L. variegatus* may decrease bioaccumulation. • Test organisms must be cultured at 23°C (± 3°C) and tested at 23°C (± 1°C). • The mean of the daily test temperature must be within ± 1°C of 23°C. The instantaneous temperature must always be within ± 3°C of 23°C. • All test chambers should be identical and should contain the same amount of sediment and overlying water. • Hardness, alkalinity, and ammonia in the overlying water typically should not vary more than 50% during the sediment exposure, and dissolved oxygen should be maintained above 2.5 mg/L in the overlying water. • Natural physico-chemical characteristics of sediment collected from the field should be within tolerance limits of the test organisms. • Storage of sediment collected in the field should be ≤ 8 weeks, preferably ≤14 days. • Storage of sediments for toxicity testing should be at 4 ^{o}C.
28-day *Neanthes virens* test	• 90% survival in negative control. • All organisms in a test must be from the same source. • Daily mean temperature of 12-16°C, within ± 2°C of target, with no readings beyond ±3°C. • Aeration is provided to all test chambers and the dissolved oxygen is maintained at least 60% saturation. • All test chambers should be identical and should contain the same amount of sediment and overlying water. • Natural physico-chemical characteristics of sediment collected from the field should be within tolerance limits of the test organisms. • Storage of sediment collected in the field should be ≤ 8 weeks, preferably ≤14 days. • Storage of sediments for toxicity testing should be at 4 ^{o}C.

QAPP Worksheet No. 12. Measurement Performance Criteria Table

Matrix	Tissue and Sediment
Analytical Group[a]	PCBs – Congeners
Concentration Level	Low

Sampling Procedure[b]	Analytical Method/SOP[b]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analysis (A) or Both (S & A)
Tissue: M39, M40, M41[c] Sediment: Attachment D	USEPA 1668A/ M2	Accuracy/bias – contamination	a) When detected, the concentration should be less than the reporting limit or < 10 times the highest concentration found in the batch of samples; b) signal to noise ratio should be > 10 for the extraction standard; c) detection level should be ≤ 4 times the limit of detection; d) recoveries of the extraction standard should be 25% minimum or meet c and d.	Method blank	A
	USEPA 1668A/ M2	Accuracy/bias – contamination	Signal to noise should be > 2.5:1 for the 1 pg/μL selected PCB congeners peak to verify absence of bad injection. To verify absence of carryover, there should be no target analyte peak with signal to noise ratio > 2.5:1 or if above, the response should be less than 1% of the target analyte in the batch control spike.	Spiked solvent blank	A

QAPP Worksheet No. 12. Measurement Performance Criteria Table (cont.)

Matrix	Tissue and Sediment
Analytical Group[a]	PCBs – Congeners
Concentration Level	Low

Sampling Procedure[b]	Analytical Method/SOP[b]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analysis (A) or Both (S & A)
Tissue: M39, M40, M41[c] Sediment: Attachment D (cont.)	USEPA 1668A/ M2	Accuracy/bias – contamination	a) When detected, the concentration should be less than the reporting limit or < 10 times the highest concentration found in the batch of samples; b) signal to noise ratio > 10 for the extraction standard; c) detection level ≤ 4 times the limit of detection; d) recoveries of the extraction standard should be 25% minimum or meet c and d.	Equipment rinsate blanks[d]	S & A
	USEPA 1668A/ M2	Accuracy/bias, precision	PD between the relative response factor of the batch control spike and the initial calibration should be ≤ 20% for target species and ≤ 30% for extraction standard/cleanup standard; RPD between the beginning and ending batch control spike should be ≤ 10% for target species and ≤ 20% for extraction standard/cleanup standard.	Batch control spike	A
	USEPA 1668A/ M2	Accuracy/bias	Percent recovery = 30 – 140%	Extraction standard	A

QAPP Worksheet No. 12. Measurement Performance Criteria Table (cont.)

Matrix	Tissue and Sediment
Analytical Group[a]	PCBs – Congeners
Concentration Level	Low

Sampling Procedure[b]	Analytical Method/SOP[b]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analysis (A) or Both (S & A)
Tissue: M39, M40, M41[c] Sediment: Attachment D (cont.)	USEPA 1668A/ M2	Accuracy/bias	PD of certified target analytes within 25% of reference values when within the ICAL.	CRM	A
	USEPA 1668A/ M2	Precision	RPD should be ≤ 20% when within the calibration curve and the sample is a true laboratory duplicate	MD	S & A
	USEPA 1668A/ M2	Precision	RPD ≤ 50% if both samples are > 5 x QL.	Field duplicate[e]	S & A
	USEPA 1668A/ M2	Completeness	≥ 90%	Data completeness check	S & A

[a] Refer to QAPP Worksheet No. 15 for a complete list of analytes for each analytical group.
[b] Reference number from QAPP Worksheet No. 23 for analytical SOPs and tissue sampling.
[c] Benthic invertebrate tissue will not be collected from the field for chemical analysis as part of this QAPP. Tissues in organisms that undergo sediment toxicity testing in the laboratory will be analyzed.
[d] Rinsate blank will be created from the homogenization equipment.
[e] Field duplicates apply to sediments only.

CRM – certified reference material
ICAL – initial calibration
MD – matrix duplicate
PCB – polychlorinated biphenyl
PD – percent difference
QAPP – quality assurance project plan
QC – quality control
QL – quantitation limit
RPD – relative percent difference
RSD – relative standard deviation
SOP – standard operating procedure
USEPA – US Environmental Protection Agency

QAPP Worksheet No. 12. Measurement Performance Criteria Table (cont.)

Matrix	Tissue and Sediment
Analytical Group[a]	PCBs – Aroclors
Concentration Level	Low

Sampling Procedure[b]	Analytical Method/SOP[b]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analysis (A) or Both (S & A)
Tissue: M39, M40[c] Sediment: Attachment D	USEPA SW-846 8082/ M35	Accuracy/bias – contamination	No target compound > QL	Method blank/instrument blank	A
	USEPA SW-846 8082/ M35	Accuracy/bias – contamination	No target compound > QL	Equipment rinsate blanks[d]	S & A
	USEPA SW-846 8082/ M35	Accuracy/bias	Compound-specific (see SOP)	LCS	A
	USEPA SW-846 8082/ M35	Accuracy/bias, precision	Percent recovery is compound-specific (see SOP), RPD ≤ 50%	MS/MSD	S & A
	USEPA SW-846 8082/ M35	Precision	RPD ≤ 50%for target compounds > 5 x QL	MD	S & A
	USEPA SW-846 8082/ M35	Precision	RPD ≤ 50% for target compounds > 5 x QL.	Field duplicate[e]	S & A
	USEPA SW-846 8082/ M35	Completeness	≥ 90%	Data completeness check	S & A

[a] Refer to QAPP Worksheet No. 15 for a complete list of analytes for each analytical group.
[b] Reference number from QAPP Worksheet No. 23 for analytical SOPs and tissue sampling.
[c] Benthic invertebrate tissue will not be collected from the field for chemical analysis as part of this QAPP. Tissues in organisms that undergo sediment toxicity testing in the laboratory will be analyzed.
[d] Rinsate blank will be created from the homogenization equipment.
[e] Field duplicates apply to sediments only.

LCS – laboratory control sample
MD – matrix duplicate
MS – matrix spike
MSD – matrix spike duplicate
PCB – polychlorinated biphenyl
QAPP – quality assurance project plan
QC – quality control
QL – quantitation limit
RPD – relative percent difference
SOP – standard operating procedure
USEPA – US Environmental Protection Agency

QAPP Worksheet No. 12. Measurement Performance Criteria Table (cont.)

Matrix	Tissue and Sediment
Analytical Group[a]	PCDDs/PCDFs
Concentration Level	Low

Sampling Procedure[b]	Analytical Method/SOP[b]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analysis (A) or Both (S & A)
Tissue: M39, M40[c] Sediment: Attachment D	USEPA 1613B/ M3	Accuracy/bias – contamination	a) No target compound should be detected above signal to noise ratio > 2.5:1; b) when detected, the concentration should be less than the reporting limit or <10 times the highest concentration found in the batch of samples; c) signal to noise should be > 10:1 for extraction standard (isotopically labeled standard added before extraction); d) detection level should be ≤ 4 times limit of detection; e) recoveries of the extraction standard should be 40% minimum or meet c and d.	Method blank	A
	USEPA 1613B/ M3	Accuracy/bias – contamination	No target analyte peak should have a signal-to-noise ratio > 2.5:1 or if above 2.5:1, the response should be < 1% of the target analyte in the batch control spike.	Spiked solvent blank	A
	USEPA 1613B/ M3	Accuracy/bias – contamination	No target compound should be detected above signal to noise ratio > 2.5:1; when detected, the concentration should be less than the reporting limit or <10 times the highest concentration found in the batch of samples.	Equipment rinsate blank[d]	S & A
	USEPA 1613B/ M3	Accuracy/bias, precision	PD between the relative response factor of the batch control spike and the initial calibration should be ≤ 20% for target species and ≤ 30% for extraction standard/cleanup standard; RPD between the beginning and ending batch control spike should be ≤ 10% for target species and ≤	Batch control spike	A

QAPP Worksheet No. 12. Measurement Performance Criteria Table (cont.)

Matrix	Tissue and Sediment				
Analytical Group[a]	PCDDs/PCDFs				
Concentration Level	Low				
Sampling Procedure[b]	**Analytical Method/SOP**[b]	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analysis (A) or Both (S & A)**
			20% for extraction standard/cleanup standard.		
	USEPA 1613B/ M3	Accuracy/bias	PD of certified target analytes should be within 25% consensus values when within the ICAL.	CRM	A
	USEPA 1613B/ M3	Precision	RPD <20% when within the calibration curve and the sample is a true laboratory duplicate.	MD	S & A
	USEPA 1613B/ M3	Precision	RPD ≤ 50% if both samples are > 5 x QL.	Field duplicate[e]	S & A
	USEPA 1613B/ M3	Completeness	≥ 90%	Data completeness check	S & A

[a] Refer to QAPP Worksheet No. 15 for a complete list of analytes for each analytical group.
[b] Reference number from QAPP Worksheet No. 23 for analytical SOPs and tissue sampling.
[c] Benthic invertebrate tissue will not be collected from the field for chemical analysis as part of this QAPP. Tissues in organisms that undergo sediment toxicity testing in the laboratory will be analyzed.
[d] Rinsate blank will be created from the homogenization equipment.
[e] Field duplicates apply to sediments only.

CDD – chlorinated dibenzo-*p*-dioxin
CDF – chlorinated dibenzofuran
CRM – certified reference material
ICAL – initial calibration
LCS – laboratory control sample
MD – matrix duplicate
MS – matrix spike
PCDD – polychlorinated dibenzo-*p*-dioxin
PCDF – polychlorinated dibenzofuran
PD – percent difference
QAPP – quality assurance project plan
QC – quality control
QL– quantitation limit
RPD – relative percent difference
RSD – relative standard deviation
SOP – standard operating procedure
USEPA – US Environmental Protection Agency

QAPP Worksheet No. 12. Measurement Performance Criteria Table (cont.)

Matrix	Tissue and Sediment
Analytical Group[a]	PAHs
Concentration Level	Low

Sampling Procedure[b]	Analytical Method/SOP[b]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S & A)
Tissue: M39, M40[c] Sediment: Attachment D	CARB 429 Modified/M4	Accuracy/bias – contamination	No target compound > EML	Method blank/ instrument blank	A
	CARB 429 Modified/M4	Accuracy/bias – contamination	No target compound > EML	Equipment rinsate blank[d]	S & A
	CARB 429 Modified/M4	Accuracy/bias	50 – 150%	LCS	A
	CARB 429 Modified/M4	Accuracy/bias	Recovery within limits set by CRM manufacturer	CRM	A
	CARB 429 Modified/M4	Accuracy/bias	Compound-specific (see SOP)	Pre-extraction internal standards	A
	CARB 429 Modified/M4	Precision	RPD ≤ 50% if both samples are > 5 x QL	MD	S & A
	CARB 429 Modified/M4	Precision	RPD ≤ 50% if both samples are > 5 x QL	Field duplicate[e]	S & A
	CARB 429 Modified/M4	Completeness	≥ 90%	Data completeness check	S & A

[a] Refer to QAPP Worksheet No. 15 for a complete list of analytes for each analytical group.
[b] Reference number from QAPP Worksheet No. 23 for analytical SOPs and tissue sampling.
[c] Benthic invertebrate tissue will not be collected from the field for chemical analysis as part of this QAPP. Tissues in organisms that undergo sediment toxicity testing in the laboratory will be analyzed.
[d] Rinsate blank will be created from the homogenization equipment.
[e] Field duplicates apply to sediments only.

CRM – certified reference material
EML – estimated minimum level
LCS – laboratory control sample
MD – matrix duplicate
PAH – polycyclic aromatic hydrocarbon
QAPP – quality assurance project plan
QC – quality control
QL – quantitation limit
RPD – relative percent difference
SOP – standard operating procedure

QAPP Worksheet No. 12. Measurement Performance Criteria Table (cont.)

Matrix	Tissue and Sediment
Analytical Group[a]	Alkylated PAHs
Concentration Level	Low

Sampling Procedure[b]	Analytical Method/SOP[b]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S & A)
Tissue: M39, M40[c] Sediment: Attachment D	USEPA SW-846 8270D/M43, M46	Accuracy/bias – contamination	No target compound > QL	Method blank/ instrument blank	A
	USEPA SW-846 8270D/M43, M46	Accuracy/bias – contamination	No target compound > QL	Equipment rinsate blank[d]	S & A
	USEPA SW-846 8270D/M43, M46	Accuracy/bias	Percent recovery = 50 – 150%	LCS	A
	USEPA SW-846 8270D/M43, M46	Precision	RPD ≤ 30% for target compound > 5 x QL	MD[e]	S & A
	USEPA SW-846 8270D/M43, M46	Accuracy/bias, precision	Percent recovery = 50 – 150%, RPD ≤ 30%	MS/MSD	S & A
	USEPA SW-846 8270D/M43, M46	Accuracy/bias	50 – 200% of the daily CCV area for the internal standards	Pre-extraction internal standards	A
	USEPA SW-846 8270D/M43, M46	Precision	RPD ≤ 50% if both samples are > 5 x QL	Field duplicate[e]	S & A
	USEPA SW-846 8270D/M43, M46	Completeness	≥ 90%	Data completeness check	S & A

[a] Refer to QAPP Worksheet No. 15 for a complete list of analytes for each analytical group.
[b] Reference number from QAPP Worksheet No. 23 for analytical SOPs and tissue sampling.
[c] Benthic invertebrate tissue will not be collected from the field for chemical analysis as part of this QAPP. Tissues in organisms that undergo sediment toxicity testing in the laboratory will be analyzed.
[d] Rinsate blank will be created from the homogenization equipment.
[e] Field duplicates apply to sediments only.

CCV – continuing calibration verification
CRM – certified reference material
LCS – laboratory control sample
MD – matrix duplicate
MS – matrix spike
MSD – matrix spike duplicate
PAH – polycyclic aromatic hydrocarbon
QAPP – quality assurance project plan
QC – quality control
QL – quantitation limit
RPD – relative percent difference
SOP – standard operating procedure
USEPA – US Environmental Protection Agency

QAPP Worksheet No. 12. Measurement Performance Criteria Table (cont.)

Matrix	Tissue and Sediment
Analytical Group[a]	Organochlorine Pesticides
Concentration Level	Low

Sampling Procedure[b]	Analytical Method/SOP[b]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analysis (A) or Both (S & A)
Tissue: M39, M40[c] Sediment: Attachment D	USEPA 1699 Modified (NYSDEC HRMS-2)/ M5, M6, M7	Accuracy/bias – contamination	No target compound > QL	Method blank	A
	USEPA 1699 Modified (NYSDEC HRMS-2)/ M5, M6, M7	Accuracy/bias – contamination	No target compound > QL	Equipment rinsate blanks[d]	S & A
	USEPA 1699 Modified (NYSDEC HRMS-2)/ M5, M6, M7	Accuracy/bias	Compound-specific (see SOP)	Ongoing precision and recovery sample (or LCS)	A
	USEPA 1699 Modified (NYSDEC HRMS-2)/ M5, M6, M7	Accuracy/bias	Recovery within limits set by CRM manufacturer	CRM	A
	USEPA 1699 Modified (NYSDEC HRMS-2)/ M5, M6, M7	Precision	RPD ≤ 25% if both samples are > 5 x QL	MD	S & A
	USEPA 1699 Modified (NYSDEC HRMS-2)/ M5, M6, M7	Accuracy/bias	Recovery 10 – 200% per laboratory SOP	Pre-extraction internal standard	A
	USEPA 1699 Modified (NYSDEC HRMS-2)/ M5, M6, M7	Precision	RPD ≤ 50% if both samples are > 5 x QL	Field duplicate[e]	S & A
	USEPA 1699 Modified (NYSDEC HRMS-2)/ M5, M6, M7	Completeness	≥ 90%	Data completeness check	S & A

[a] Refer to QAPP Worksheet No. 15 for a complete list of analytes for each analytical group.
[b] Reference number from QAPP Worksheet No. 23 for analytical SOPs and tissue sampling.
[c] Benthic invertebrate tissue will not be collected from the field for chemical analysis as part of this QAPP. Tissues in organisms that undergo

QAPP Worksheet No. 12. Measurement Performance Criteria Table (cont.)

Matrix	Tissue and Sediment
Analytical Group[a]	Organochlorine Pesticides
Concentration Level	Low

Sampling Procedure[b]	Analytical Method/SOP[b]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analysis (A) or Both (S & A)

sediment toxicity testing in the laboratory will be analyzed.

[d] Rinsate blank will be created from the homogenization equipment.

[e] Field duplicates apply to sediments only.

CRM – certified reference material
HRMS – high-resolution mass spectrometry
LCS – laboratory control sample
MD – matrix duplicate
NYSDEC – New York State Department of Environmental Conservation
QAPP – quality assurance project plan
QC – quality control
QL – quantitation limit
RPD – relative percent difference
SOP – standard operating procedure
USEPA – US Environmental Protection Agency

QAPP Worksheet No. 12. Measurement Performance Criteria Table (cont.)

Matrix	Tissue and Sediment
Analytical Group[a]	Metals (ICP/MS)
Concentration Level	Low

Sampling Procedure[b]	Analytical Method/SOP[b]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analysis (A) or Both (S & A)
Tissue: M39, M40[c] Sediment: Attachment D	USEPA SW-846 6020/ M8, M9, M10	Accuracy/bias – contamination	No target compound > QL	Method blank	A
	USEPA SW-846 6020/ M8, M9, M10	Accuracy/bias – contamination	No target compound > QL	Equipment rinsate blanks[d]	S & A
	USEPA SW-846 6020/ M8, M9, M10	Accuracy/bias	Percent recovery = 75 – 125%	LCS	A
	USEPA SW-846 6020/ M8, M9, M10	Accuracy/bias	Percent recovery = 75 – 125%	MS	S & A
	USEPA SW-846 6020/ M8, M9, M10	Accuracy/bias	Percent recovery = 70 – 130%	CRM	A
	USEPA SW-846 6020/ M8, M9, M10	Precision	RPD ≤ 30%	MD	S & A
	USEPA SW-846 6020/ M8, M9, M10	Precision	RPD ≤ 50% if both samples are > 5 x QL	Field duplicate[e]	S & A
	USEPA SW-846 6020/ M8, M9, M10	Completeness	≥ 90%	Data completeness check	S & A

[a] Refer to QAPP Worksheet No. 15 for a complete list of analytes for each analytical group.
[b] Reference number from QAPP Worksheet No. 23 for analytical SOPs and tissue sampling.
[c] Benthic invertebrate tissue will not be collected from the field for chemical analysis as part of this QAPP. Tissues in organisms that undergo sediment toxicity testing in the laboratory will be analyzed.
[d] Rinsate blank will be created from the homogenization equipment.
[e] Field duplicates apply to sediments only.

CRM – certified reference material
ICP/MS – inductively coupled plasma/mass spectrometry
LCS – laboratory control sample
MD – matrix duplicate
MS – matrix spike
QAPP – quality assurance project plan
QC – quality control
QL – quantitation limit
RPD – relative percent difference
SOP – standard operating procedure
USEPA – US Environmental Protection Agency

QAPP Worksheet No. 12. Measurement Performance Criteria Table (cont.)

Matrix	Tissue and Sediment
Analytical Group[a]	Metals (ICP)
Concentration Level	Low

Sampling Procedure[b]	Analytical Method/SOP[b]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analysis (A) or Both (S & A)
Tissue: M39, M40[c] Sediment: Attachment D	USEPA SW-846 6010B/ M8, M9, M11	Accuracy/bias – contamination	No target compound > QL	Method blank	A
	USEPA SW-846 6010B/ M8, M9, M11	Accuracy/bias – contamination	No target compound > QL	Equipment rinsate blanks[d]	S & A
	USEPA SW-846 6010B/ M8, M9, M11	Accuracy/bias	Percent recovery = 75 – 125%	LCS	A
	USEPA SW-846 6010B/ M8, M9, M11	Accuracy/bias	Percent recovery = 70 – 130%	MS	S & A
	USEPA SW-846 6010B/ M8, M9, M11	Accuracy/bias	Recovery within limits set by CRM manufacturer	CRM	A
	USEPA SW-846 6010B/ M8,M9, M11	Precision	RPD ≤ 30%	MD	S & A
	USEPA SW-846 6010B/ M8,M9, M11	Precision	RPD ≤ 50% if both samples are > 5 x QL	Field duplicate[e]	S & A
	USEPA SW-846 6010B/ M8, M9, M11	Completeness	≥ 90%	Data completeness check	S & A

[a] Refer to QAPP Worksheet No. 15 for a complete list of analytes for each analytical group.
[b] Reference number from QAPP Worksheet No. 23 for analytical SOPs and tissue sampling.
[c] Benthic invertebrate tissue will not be collected from the field for chemical analysis as part of this QAPP. Tissues in organisms that undergo sediment toxicity testing in the laboratory will be analyzed.
[d] Rinsate blank will be created from the homogenization equipment.
[e] Field duplicates apply to sediments only.

CRM – certified reference material
ICP – inductively coupled plasma
LCS – laboratory control sample
MD – matrix duplicate
MS – matrix spike
QAPP – quality assurance project plan
QC – quality control
QL – quantitation limit
RPD – relative percent difference
SOP – standard operating procedure
USEPA – US Environmental Protection Agency

QAPP Worksheet No. 12. Measurement Performance Criteria Table (cont.)

Matrix	Tissue and Sediment
Analytical Group[a]	Metals (Selenium)
Concentration Level	Low

Sampling Procedure[b]	Analytical Method/SOP[b]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analysis (A) or Both (S & A)
Tissue: M39, M40[c] Sediment: Attachment D	USEPA SW-846 7742/ M8, M9, M12	Accuracy/bias – contamination	No target compound > QL	Method blank	A
	USEPA SW-846 7742/ M8, M9, M12	Accuracy/bias – contamination	No target compound > QL	Equipment rinsate blanks[d]	S & A
	USEPA SW-846 7742/ M8, M9, M12	Accuracy/bias	Percent recovery = 75 – 125%%	LCS	A
	USEPA SW-846 7742/ M8, M9, M12	Accuracy/bias	Percent recovery = 60 – 130%	MS[e]	S & A
	USEPA SW-846 7742/ M8, M9, M12	Accuracy/bias	Recovery within limits set by CRM manufacturer	CRM	A
	USEPA SW-846 7742/ M8, M9, M12	Precision	RPD ≤ 30%	MD	S & A
	USEPA SW-846 7742/ M8, M9, M12	Precision	RPD ≤ 50% if both samples are > 5 x QL	Field duplicate[e]	S & A
	USEPA SW-846 7742/ M8, M9, M12	Completeness	≥ 90%	Data completeness check	S & A

[a] Refer to QAPP Worksheet No. 15 for a complete list of analytes for each analytical group.
[b] Reference number from QAPP Worksheet No. 23 for analytical SOPs and tissue sampling.
[c] Benthic invertebrate tissue will not be collected from the field for chemical analysis as part of this QAPP. Tissues in organisms that undergo sediment toxicity testing in the laboratory will be analyzed.
[d] Rinsate blank will be created from the homogenization equipment.
[e] Field duplicates apply to sediments only.

CRM – certified reference material
LCS – laboratory control sample
MD – matrix duplicate
MS – matrix spike
QAPP – quality assurance project plan
QC – quality control
QL – quantitation limit
RPD – relative percent difference
SOP – standard operating procedure
USEPA – US Environmental Protection Agency

QAPP Worksheet No. 12. Measurement Performance Criteria Table (cont.)

Matrix	Tissue and Sediment
Analytical Group[a]	Total Mercury
Concentration Level	Low

Sampling Procedure[b]	Analytical Method/SOP[b]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analysis (A) or Both (S & A)
Tissue: M39, M40[c] Sediment: Attachment D	USEPA 1631/ M14, M15	Accuracy/bias – contamination	Average MB < 2 x MDL and standard deviation < 0.67 x MDL or < 0.1 x the concentration of project samples	Method blank	A
	USEPA 1631/ M14, M15	Accuracy/bias – contamination	No target compound > QL	Equipment rinsate blanks[d]	S & A
	USEPA 1631/ M14, M15	Accuracy/bias	Percent recovery = 75 –125%	CRM	A
	USEPA 1631/ M14, M15	Accuracy/bias, precision	Percent recovery = 70 – 130%	MS/MSD	S & A
	USEPA 1631/ M14, M15	Precision	RPD ≤ 30%	MD	S & A
	USEPA 1631/ M14, M15	Precision	RPD ≤ 50% if both samples are > 5 x QL	Field duplicate[e]	S &A
	USEPA 1631/ M14, M15	Completeness	≥ 90%	Data completeness check	S & A

[a] Refer to QAPP Worksheet No. 15 for a complete list of analytes for each analytical group.
[b] Reference number from QAPP Worksheet No. 23 for analytical SOPs and tissue sampling.
[c] Benthic invertebrate tissue will not be collected from the field for chemical analysis as part of this QAPP. Tissues in organisms that undergo sediment toxicity testing in the laboratory will be analyzed.
[d] Rinsate blank will be created from the homogenization equipment.
[e] Field duplicates apply to sediments only.

CRM – certified reference material
MB – method blank
MD – matrix duplicate
MDL – method detection limit
MS – matrix spike
MSD – matrix spike duplicate
QAPP – quality assurance project plan
QC – quality control
QL – quantitation limit
RPD – relative percent difference
SOP – standard operating procedure
USEPA – US Environmental Protection Agency

QAPP Worksheet No. 12. Measurement Performance Criteria Table (cont.)

Matrix	Tissue and Sediment
Analytical Group[a]	Methylmercury
Concentration Level	Low

Sampling Procedure[b]	Analytical Method/SOP[b]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analysis (A) or Both (S & A)
Tissue: M39, M40[c] Sediment: Attachment D	USEPA 1630/M16	Accuracy/bias – contamination	MB ≤ 2 x MDL, standard deviation ≤ 2/3 MDL or 1/10 of associated samples	Method blank	A
	USEPA 1630/ M16	Accuracy/bias – contamination	No target compound > QL	Equipment rinsate blanks[d]	S & A
	USEPA 1630/ M16	Accuracy/bias	Percent recovery = 65 – 135%	CRM	A
	USEPA 1630/ M16	Accuracy/bias, precision	Percent recovery = 65 – 135%; RPD ≤ 35%	MS/MSD	S & A
	USEPA 1630/ M 16	Precision	RPD ≤ 35% or±2 x MRL if samples < 5 x MRL	MD	S & A
	USEPA 1630/ M16	Precision	RPD ≤ 50% if both samples are > 5 x QL	Field duplicate[e]	S & A
	USEPA 1630/ M16	Completeness	≥ 90%	Data completeness check	S & A

[a] Refer to QAPP Worksheet No. 15 for a complete list of analytes for each analytical group.
[b] Reference number from QAPP Worksheet No. 23 for analytical SOPs and tissue sampling.
[c] Benthic invertebrate tissue will not be collected from the field for chemical analysis as part of this QAPP. Tissues in organisms that undergo sediment toxicity testing in the laboratory will be analyzed.
[d] Rinsate blank will be created from the homogenization equipment.
[e] Field duplicates apply to sediments only.

CRM – certified reference material
MB – method blank
MD – matrix duplicate
MDL – method detection limit
MRL – method reporting limit
MS – matrix spike
MSD – matrix spike duplicate
QAPP – quality assurance project plan
QC – quality control
QL – quantitation limit
RPD – relative percent difference
SOP – standard operating procedure
USEPA – US Environmental Protection Agency

QAPP Worksheet No. 12. Measurement Performance Criteria Table (cont.)

Matrix	Tissue and Sediment
Analytical Group[a]	SVOCs
Concentration Level	Low

Sampling Procedure[b]	Analytical Method/SOP[b]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S & A)
Tissue: M39, M40[c] Sediment: Attachment D	USEPA SW-846 8270C/ M17, M18, M19, M20	Accuracy/bias – contamination	No target compound > QL, no common lab contaminants > 5 x QL	Method blank/ instrument blank	A
	USEPA SW-846 8270C/ M17, M18, M19, M20	Accuracy/bias – contamination	No target compound > QL, no common lab contaminants > 5 x QL	Equipment rinsate blanks[d]	S & A
	USEPA SW-846 8270C/ M17, M18, M19, M20	Accuracy/bias	Compound-specific (see SOP)	LCS	A
	USEPA SW-846 8270C/ M17, M18, M19, M20	Accuracy/bias, precision	Compound-specific (see SOP)	MS/MSD	S & A
	USEPA SW-846 8270C/ R17, R18, R19, R20	Accuracy/bias	Percent recovery = 40 – 140%	CRM (sediment only)	A
	USEPA SW-846 8270C/ M17, M18, M19, M20	Accuracy/bias	Compound-specific (see SOP)	Surrogates	A
	USEPA SW-846 8270C/ M17, M18, M19, M20	Precision	Compound-specific (see SOP)	MD	
	USEPA SW-846 8270C/ M17, M18, M19, M20	Precision	RPD ≤ 50% if both samples are > 5 x QL	Field duplicate[e]	S & A
	USEPA SW-846 8270C/ M17, M18, M19, M20	Completeness	≥ 90%	Data completeness check	S & A

[a] Refer to QAPP Worksheet No. 15 for a complete list of analytes for each analytical group.
[b] Reference number from QAPP Worksheet No. 23 for analytical SOPs and tissue sampling.
[c] Benthic invertebrate tissue will not be collected from the field for chemical analysis as part of this QAPP. Tissues in organisms that undergo sediment toxicity testing in the laboratory will be analyzed.
[d] Rinsate blank will be created from the homogenization equipment.
[e] Field duplicates apply to sediments only.

CRM – certified reference material MSD – matrix spike duplicate RPD – relative percent difference

QAPP Worksheet No. 12. Measurement Performance Criteria Table (cont.)

Matrix	Tissue and Sediment
Analytical Group[a]	SVOCs
Concentration Level	Low

Sampling Procedure[b]	Analytical Method/SOP[b]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S & A)

LCS – laboratory control sample
MD – matrix duplicate
MS – matrix spike
QAPP – quality assurance project plan
QC – quality control
QL – quantitation limit
SOP – standard operating procedure
SVOC – semivolatile organic compound
USEPA – US Environmental Protection Agency

QAPP Worksheet No. 12. Measurement Performance Criteria Table (cont.)

Matrix	Tissue and Sediment
Analytical Group[a]	Butyltins
Concentration Level	Low

Sampling Procedure[b]	Analytical Method/SOP[b]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analysis (A) or Both (S & A)
Tissue: M39, M40[c] Sediment: Attachment D	Krone et al. (1989)/ M21, M22	Accuracy/bias – contamination	No target compound >QL	Method blank	A
	Krone et al. (1989)/ M21, M22	Accuracy/bias – contamination	No target compound >QL	Equipment rinsate blanks[d]	S & A
	Krone et al. (1989)/ M21, M22	Accuracy/bias	Compound-specific (see SOP)	LCS	A
	Krone et al. (1989)/ M21, M22	Accuracy/bias, precision	Recovery is compound-specific (see SOP), RPD ≤ 40%	MS/MSD	S & A
	Krone et al. (1989)/ M21, M22	Precision	RPD ≤ 40%	MD	S & A
	Krone et al. (1989)/ M21, M22	Precision	RPD ≤ 50% if both samples are > 5 x QL	Laboratory duplicate[e]	S & A
	Krone et al. (1989)/ M21, M22	Completeness	≥ 90%	Data completeness check	S & A

[a] Refer to QAPP Worksheet No. 15 for a complete list of analytes for each analytical group.
[b] Reference number from QAPP Worksheet No. 23 for analytical SOPs and tissue sampling.
[c] Benthic invertebrate tissue will not be collected from the field for chemical analysis as part of this QAPP. Tissues in organisms that undergo sediment toxicity testing in the laboratory will be analyzed.
[d] Rinsate blank will be created from the homogenization equipment.
[e] Field duplicates apply to sediments only.

LCS – laboratory control sample
MD – matrix duplicate
MS – matrix spike
MSD – matrix spike duplicate
QAPP – quality assurance project plan
QC – quality control
QL – quantitation limit
RPD – relative percent difference
SOP – standard operating procedure

QAPP Worksheet No. 12. Measurement Performance Criteria Table (cont.)

Matrix	Tissue
Analytical Group[a]	General Chemistry – Lipids
Concentration Level	Low

Sampling Procedure[b]	Analytical Method/SOP[b]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analysis (A) or Both (S & A)
M39, M40[c]	Bligh-Dyer/M23	Precision	RPD ≤ 20%	MD	S & A
	Bligh-Dyer/M23	Contamination	≤ QL	Method blank	A
	Bligh-Dyer/M23	Accuracy	Recovery within limits set by CRM manufacturer	CRM	A
	Bligh-Dyer/M23	Completeness	> 90%	Data completeness check	S & A

[a] Refer to QAPP Worksheet No. 15 for a complete list of analytes for each analytical group.

[b] Reference number from QAPP Worksheet No. 23.

[c] Benthic invertebrate tissue will not be collected from the field for chemical analysis as part of this QAPP. Tissues in organisms that undergo sediment toxicity testing in the laboratory will be analyzed.

CRM – certified reference material
MD – matrix duplicate
QAPP – quality assurance project plan
QC – quality control
QL – quantitation limit
RPD – relative percent difference
SM – standard method
SOP – standard operating procedure

QAPP Worksheet No. 12. Measurement Performance Criteria Table (cont.)

Matrix	Tissue and Sediment
Analytical Group[a]	General Chemistry – Percent Moisture
Concentration Level	Not Applicable

Sampling Procedure[b]	Analytical Method/SOP[b]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analysis (A) or Both (S & A)
Tissue:M39, M40[c] Sediment: Attachment D	SM2540G Modified/M24	Precision	RPD ≤ 20%	MD	A
	SM2540G Modified/M24	Precision	RPD ≤ 50% if both samples are > 5 x QL	Field duplicate[d]	S & A
	SM2540G Modified/M24	Completeness	> 90%	Data completeness check	S & A

[a] Refer to QAPP Worksheet No. 15 for a complete list of analytes for each analytical group.
[b] Reference number from QAPP Worksheet No. 23 for analytical SOPs and tissue sampling. Reference number from QAPP Worksheet No 21 for sediments sampling.
[c] Benthic invertebrate tissue will not be collected from the field for chemical analysis as part of this QAPP. Tissues in organisms that undergo sediment toxicity testing in the laboratory will be analyzed.
[d] Field duplicates apply to sediments only.

MD – matrix duplicate
MRL – method reporting limit
PCB – polychlorinated biphenyl
QAPP – quality assurance project plan
QC – quality control
QL – quantitation limit
RPD – relative percent difference
SOP – standard operating procedure

QAPP Worksheet No. 12. Measurement Performance Criteria Table (cont.)

Matrix	Sediment
Analytical Group[a]	Herbicides
Concentration Level	Low

Sampling Procedure[b]	SOP[c]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analysis (A) or Both (S & A)
3	USEPA SW 846 8151A/M45	Accuracy/bias – contamination	No target compound > QL	Method blank	A
	USEPA SW 846 8151A/M45	Accuracy/bias – contamination	No target compound > QL	Equipment rinsate blank[d]	S & A
	USEPA SW 846 8151A/M45	Accuracy/bias	Percent recovery = 30 – 150%	LCS	A
	USEPA SW 846 8151A/M45	Accuracy/bias, precision	Percent recovery = 30 – 150%, RPD ≤ 30%	MS/MSD	S & A
	USEPA SW 846 8151A/M45	Precision	RPD ≤30%	MD	S & A
	USEPA SW 846 8151A/M45	Precision	RPD ≤ 50% if both samples are > 5 x QL	Field duplicate	S & A
	USEPA SW 846 8151A/M45	Completeness	≥ 90%	Data completeness check	S & A

[a] Refer to QAPP Worksheet No. 15 for a complete list of analytes for each analytical group.
[b] Reference number from QAPP Worksheet No. 21.
[c] Reference number from QAPP Worksheet No. 23.
[d] Rinsate blank will be created from the homogenization equipment.

LCS – laboratory control sample
MD – matrix duplicate
MS – matrix spike
MSD – matrix spike duplicate
QAPP – quality assurance project plan
QC – quality control
QL – quantitation limit
RPD – relative percent difference
SOP – standard operating procedure
USEPA – US Environmental Protection Agency

QAPP Worksheet No. 12. Measurement Performance Criteria Table (cont.)

Matrix	Sediment
Analytical Group[a]	VOCs
Concentration Level	Low

Sampling Procedure[b]	Analytical Method/SOP[c]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S & A)
3	USEPA SW-846 5035A/8260B/M44	Accuracy/bias – contamination	No target compound > QL, no common lab contaminants > 5 x QL	Method blank/ instrument blank	A
	USEPA SW-846 5035A/8260B/M44	Accuracy/bias – contamination	No target compound > QL, no common lab contaminants > 5 x QL	Trip blank	S & A
	USEPA SW-846 5035A/8260B/M44	Accuracy/bias	Compound-specific (see SOP)	LCS	A
	USEPA SW-846 5035A/8260B/M44	Accuracy/bias, precision	Compound-specific (see SOP)	MS/MSD	S & A
	USEPA SW-846 5035A/8260B/M44	Accuracy/bias	Compound-specific (see SOP)	Surrogates	A
	USEPA SW-846 5035A/8260B/M44	Precision	RPD ≤ 50% if both samples are > 5 x QL	Field duplicate	S & A
	USEPA SW-846 5035A/8260B/M44	Completeness	≥ 90%	Data completeness check	S & A

[a] Refer to QAPP Worksheet No. 15 for a complete list of analytes for each analytical group.
[b] Reference number from QAPP Worksheet No. 21.
[c] Reference number from QAPP Worksheet No. 23.

LCS – laboratory control sample
MS – matrix spike
MSD – matrix spike duplicate
QAPP – quality assurance project plan
QC – quality control
QL – quantitation limit
RPD – relative percent difference
SOP – standard operating procedure
VOC – volatile organic carbon
USEPA – US Environmental Protection Agency

QAPP Worksheet No. 12. Measurement Performance Criteria Table (cont.)

Matrix	Sediment
Analytical Group[a]	General Chemistry – TOC
Concentration Level	Low

Sampling Procedure[b]	Analytical Method/SOP[c]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S & A)
3	Lloyd Kahn/ M25	Accuracy/bias – contamination	No target compound > QL	Method blank/instrument blank	A
	Lloyd Kahn/ M25	Accuracy/bias	Percent recovery = 75 – 125%	LCS	A
	Lloyd Kahn/ M25	Accuracy/bias – contamination	No target compound > QL	Equipment rinsate blank[d]	S & A
	Lloyd Kahn/ M25	Accuracy/bias	Percent recovery =75 – 125%	MS	S & A
	Lloyd Kahn/ M25	Precision	RPD ≤ 25%	MD	S &A
	Lloyd Kahn/ M25	Precision	RPD ≤ 50% if both samples are > 5 x QL	Field duplicate	S & A
	Lloyd Kahn/ M25	Completeness	≥ 90%	Data completeness check	S & A

[a] Refer to QAPP Worksheet No. 15 for a complete list of analytes for each analytical group.
[b] Reference number from QAPP Worksheet No. 21.
[c] Reference number from QAPP Worksheet No. 23.
[d] Rinsate blank will be created from the homogenization equipment.

LCS – laboratory control sample
MD – matrix duplicate
MS – matrix spike
QAPP – quality assurance project plan
QC – quality control
QL – quantitation limit
RPD – relative percent difference
SOP – standard operating procedure
TOC – total organic carbon

QAPP Worksheet No. 12. Measurement Performance Criteria Table (cont.)

Matrix	Sediment
Analytical Group[a]	Grain Size
Concentration Level	Not Applicable

Sampling Procedure[b]	Analytical Method/SOP[c]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analysis (A) or Both (S & A)
3	ASTM D422/M26	Precision	RPD ≤ 20%	MD	S & A
	ASTM D422/M26	Completeness	≥ 90%	Data completeness check	S & A
	ASTM D422/M26	Precision	RPD ≤ 50% if both samples are > 5 x QL	Field duplicate	S & A

[a] Refer to QAPP Worksheet No. 15 for a complete list of analytes for each analytical group.
[b] Reference number from QAPP Worksheet No. 21.
[c] Reference number from QAPP Worksheet No. 23.

ASTM – American Society for Testing and Materials
MD – matrix duplicate
NA – not applicable
QAPP – quality assurance project plan
QC – quality control
RPD – relative percent difference
SOP – standard operating procedure

QAPP Worksheet No. 12. Measurement Performance Criteria Table (cont.)

Matrix	Sediment
Analytical Group[a]	General Chemistry – Total Sulfide
Concentration Level	Low

Sampling Procedure[b]	Analytical Method/SOP[c]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analysis (A) or Both (S & A)
3	USEPA SW-846 9030M/M32	Contamination	No target compounds > QL	Method blank	A
	USEPA SW-846 9030M/M32	Accuracy/bias	Percent recovery = 51 – 125%	LCS	A
	USEPA SW-846 9030M/M32	Accuracy/bias	Percent recovery = 46 – 144%	MS	S & A
	USEPA SW-846 9030M/M32	Precision	RPD ≤ 43%	MD	S &A
	USEPA SW-846 9030M/M32	Precision	RPD ≤ 50% if both samples are > 5 x QL	Field duplicate	S & A
	USEPA SW-846 9030M/M32	Completeness	≥ 90%	Data completeness check	S & A

[a] Refer to QAPP Worksheet No. 15 for a complete list of analytes for each analytical group.
[b] Reference number from QAPP Worksheet No. 21.
[c] Reference number from QAPP Worksheet No. 23.

LCS – laboratory control sample
MD – matrix duplicate
MS – matrix spike
QAPP – quality assurance project plan QC – quality control
QL – quantitation limit
RPD – relative percent difference
SOP – standard operating procedure
USEPA – US Environmental Protection Agency

QAPP Worksheet No. 12. Measurement Performance Criteria Table (cont.)

Matrix	Sediment
Analytical Group[a]	General Chemistry – Cyanide
Concentration Level	Low

Sampling Procedure[b]	Analytical Method/SOP[c]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analysis (A) or Both (S & A)
3	USEPA SW-846 9012A/M28, M29	Contamination	No target compounds > QL	Method blank	A
	USEPA SW-846 9012A/M28, M29	Accuracy/bias – contamination	No target compounds > QL	Equipment rinsate blank[d]	S & A
	USEPA SW-846 9012A/M28, M29	Accuracy/bias	Percent recovery = 85 – 115%	LCS	A
	USEPA SW-846 9012A/M28, M29	Accuracy/bias	Percent recovery = 75 – 125%	MS	S & A
	USEPA SW-846 9012A/M28, M29	Precision	RPD ≤ 20%	MD	S &A
	USEPA SW-846 9012A/M28, M29	Precision	RPD ≤ 50% if both samples are > 5 x QL	Field duplicate	S & A
	USEPA SW-846 9012A/M28, M29	Completeness	≥ 90%	Data completeness check	S & A

[a] Refer to QAPP Worksheet No. 15 for a complete list of analytes for each analytical group.
[b] Reference number from QAPP Worksheet No. 21.
[c] Reference number from QAPP Worksheet No. 23.
[d] Rinsate blank will be created from the homogenization equipment.

LCS – laboratory control sample
MD – matrix duplicate
MS – matrix spike
QAPP – quality assurance project plan
QC – quality control
QL – quantitation limit
RPD – relative percent difference
SOP – standard operating procedure
USEPA – US Environmental Protection Agency

QAPP Worksheet No. 12. Measurement Performance Criteria Table (cont.)

Matrix	Sediment
Analytical Group[a]	General Chemistry – Total Phosphorus
Concentration Level	Low

Sampling Procedure[b]	SOP[c]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analysis (A) or Both (S & A)
3	USEPA 365.3 Modified/M31	Contamination	No target compounds > QL	Method blank	A
	USEPA 365.3 Modified/M31	Accuracy/bias – contamination	No target compounds > QL	Equipment rinsate blank[d]	S & A
	USEPA 365.3 Modified/M31	Accuracy/bias	Percent recovery = 85 – 115%	LCS	A
	USEPA 365.3 Modified/M31	Accuracy/bias	Percent recovery = 75 – 125%	MS	S & A
	USEPA 365.3 Modified/M31	Precision	RPD ≤ 20%	MD	S &A
	USEPA 365.3 Modified/M31	Precision	≤ 50% if both samples are > 5 x QL	Field duplicate	S & A
	USEPA 365.3 Modified/M31	Completeness	≤ 90%	Data completeness check	S & A

[a] Refer to QAPP Worksheet No. 15 for a complete list of analytes for each analytical group.
[b] Reference number from QAPP Worksheet No. 21.
[c] Reference number from QAPP Worksheet No. 23.
[d] Rinsate blank will be created from the homogenization equipment.

LCS – laboratory control sample
MD – matrix duplicate
MS – matrix spike
QAPP – quality assurance project plan
QC – quality control
QL – quantitation limit
RPD – relative percent difference
SOP – standard operating procedure
USEPA – US Environmental Protection Agency

QAPP Worksheet No. 12. Measurement Performance Criteria Table (cont.)

Matrix	Sediment
Analytical Group[a]	General Chemistry – Total Kjeldahl Nitrogen
Concentration Level	Low

Sampling Procedure[b]	Analytical Method/SOP[c]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analysis (A) or Both (S & A)
3	ASTM D3590-89-02/ M30	Contamination	No target compounds > QL	Method blank	A
	ASTM D3590-89-02/ M30	Accuracy/bias – contamination	No target compounds > QL	Equipment rinsate blank[d]	S & A
	ASTM D3590-89-02/ M30	Accuracy/bias	Percent recovery = 70 – 108%	LCS	A
	ASTM D3590-89-02/ M30	Accuracy/bias	Percent recovery = 38 – 138%	MS	S & A
	ASTM D3590-89-02/ M30	Precision	RPD ≤ 20%	MD	S &A
	ASTM D3590-89-02/ M30	Precision	≤ 50% if both samples are > 5 x QL	Field duplicate	S & A
	ASTM D3590-89-02/ M30	Completeness	≤ 90%	Data completeness check	S & A

[a] Refer to QAPP Worksheet No. 15 for a complete list of analytes for each analytical group.
[b] Reference number from QAPP Worksheet No. 21.
[c] Reference number from QAPP Worksheet No. 23.
[d] Rinsate blank will be created from the homogenization equipment.

ASTM – American Society for Testing and Materials
LCS – laboratory control sample
MD – matrix duplicate
MS – matrix spike
QAPP – quality assurance project plan
QC – quality control
QL – quantitation limit
RPD – relative percent difference
SOP – standard operating procedure

QAPP Worksheet No. 12. Measurement Performance Criteria Table (cont.)

Matrix	Sediment
Analytical Group[a]	General Chemistry – AVS/SEM
Concentration Level	Low

Sampling Procedure[b]	SOP[c]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analysis (A) or Both (S & A)
3	USEPA 821R91100, SW-846 610C/6020/M13	Accuracy/bias – contamination	No target compound >QL	Method blank	A
	USEPA 821R91100, SW-846 610C/6020/M13	Accuracy/bias	Percent recovery = 62 – 109% for AVS; compound-specific (see SOP for metals)	LCS	A
	USEPA 821R91100, SW-846 610C/6020/M13	Accuracy/bias	Percent recovery = 66 – 117% for AVS; compound-specific (see SOP)	MS	S & A
	USEPA 821R91100, SW-846 610C/6020/M13	Precision	RPD ≤ 45% for AVS; RPD ≤ 30% for metals	MD	S &A
	USEPA 821R91100, SW-846 610C/6020/M13	Precision	RPD ≤ 50% if both samples are > 5 x QL	Field duplicate	S & A
	USEPA 821R91100, SW-846 610C/6020/M13	Completeness	≥ 90%	Data completeness check	S & A

[a] Refer to QAPP Worksheet No. 15 for a complete list of analytes for each analytical group.
[b] Reference number from QAPP Worksheet No. 21.
[c] Reference number from QAPP Worksheet No. 23.

AVS – acid volatile sulfide
LCS – laboratory control sample
MD – matrix duplicate
MS – matrix spike
QAPP – quality assurance project plan
QC – quality control
QL – quantitation limit
RPD – relative percent difference
SEM – simultaneously extracted metals
SOP – standard operating procedure
USEPA – US Environmental Protection Agency

QAPP Worksheet No. 12. Measurement Performance Criteria Table (cont.)

Matrix	Sediment
Analytical Group[a]	General Chemistry – Ammonia-N
Concentration Level	Low

Sampling Procedure[b]	Analytical Method/SOP[c]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analysis (A) or Both (S & A)
3	USEPA 350.1 Modified/M27	Contamination	No target compounds > QL	Method blank	A
	USEPA 350.1 Modified/M27	Accuracy/bias	Percent recovery = 58 – 131%	LCS	A
	USEPA 350.1 Modified/M27	Accuracy/bias	Percent recovery = 66-127%	MS	S & A
	USEPA 350.1 Modified/M27	Precision	RPD ≤ 32%	MD	S &A
	USEPA 350.1 Modified/M27	Precision	RPD ≤ 50% if both samples are > 5 x QL	Field duplicate	S & A
	USEPA 350.1 Modified/M27	Completeness	> 90%	Data completeness check	S & A

[a] Refer to QAPP Worksheet No. 15 for a complete list of analytes for each analytical group.
[b] Reference number from QAPP Worksheet No. 21.
[c] Reference number from QAPP Worksheet No. 23.

LCS – laboratory control sample
MD – matrix duplicate
MS – matrix spike
QAPP – quality assurance project plan
QC – quality control
QL – quantitation limit
RPD – relative percent difference
SOP – standard operating procedure
USEPA – US Environmental Protection Agency

QAPP Worksheet No. 12. Measurement Performance Criteria Table (cont.)

Matrix	Sediment
Analytical Group[a]	TPH – Extractables
Concentration Level	Low

Sampling Procedure[b]	Analytical Method/SOP[c]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analysis (A) or Both (S & A)
3	OQA-QAM-025-02/08/ M33	Accuracy/bias – contamination	No target compound >QL (5 x MDL)	Method blank/ instrument blank	A
	OQA-QAM-025-02/08/ M33	Accuracy/bias – contamination	No target compound >QL (5 x MDL)	Equipment rinsate blanks[d]	S & A
	OQA-QAM-025-02/08/ M33	Accuracy/bias	Percent recovery = 70 – 120%	LCS	A
	OQA-QAM-025-02/08/ M33	Accuracy/bias	Percent recovery = 60 – 120%	Surrogates	A
	OQA-QAM-025-02/08/ M33	Accuracy/bias, precision	Percent recovery = 70 – 130%, RPD ≤ 30 %	MS/MSD	S & A
	OQA-QAM-025-02/08/ M33	Precision	RPD ≤ 50% if both samples are > 5 x QL	MD	A
	OQA-QAM-025-02/08/ M33	Precision	RPD ≤ 50% if both samples are > 5 x QL	Field duplicate	S & A
	OQA-QAM-025-02/08/ M33	Completeness	≥ 90%	Data completeness check	S & A

[a] Refer to QAPP Worksheet No. 15 for a complete list of analytes for each analytical group.
[b] Reference number from QAPP Worksheet No. 21.
[c] Reference number from QAPP Worksheet No. 23.
[d] Rinsate blank will be created from the homogenization equipment.

LCS – laboratory control sample
MD – matrix duplicate
MDL – method detection limit
MS – matrix spike
MSD – matrix spike duplicate
OQA – Office of Quality Assurance
QAM – quality assurance manual
QAPP – quality assurance project plan
QC – quality control
QL – quantitation limit
RPD – relative percent difference
SOP – standard operating procedure
TPH – total petroleum hydrocarbons

QAPP Worksheet No. 12. Measurement Performance Criteria Table (cont.)

Matrix	Sediment
Analytical Group[a]	TPH – Purgeables
Concentration Level	Low

Sampling Procedure[b]	Analytical Method/SOP[c]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analysis (A) or Both (S & A)
3	USEPA SW-846 8015B Modified and Maine Method 4.2.17/M34	Accuracy/bias – contamination	No target compound > QL	Method blank/instrument blank/trip blank	S & A
	USEPA SW-846 8015B Modified. and Maine Method 4.2.17/M34	Accuracy/bias	Percent recovery = 70 – 120%	LCS	A
	USEPA SW-846 8015B Modified and Maine Method 4.2.17/M34	Accuracy/bias	Percent recovery = 70 – 130%	Surrogates	A
	USEPA SW-846 8015B Modified and Maine Method 4.2.17/M34	Accuracy/bias, precision	Percent recovery = 80 – 120%, RPD ≤ 30%	MS/MSD	S & A
	USEPA SW-846 8015B Modified and Maine Method 4.2.17/M34	Precision	RPD ≤ 50% if both samples are > 5 x QL	Field duplicate	S & A
	USEPA SW-846 8015B Modified and Maine Method 4.2.17/M34	Completeness	≥ 90%	Data completeness check	S & A

[a] Refer to QAPP Worksheet No. 15 for a complete list of analytes for each analytical group.
[b] Reference number from QAPP Worksheet No. 21.
[c] Reference number from QAPP Worksheet No. 23.

LCS – laboratory control sample
MS – matrix spike
MSD – matrix spike duplicate
QAPP – quality assurance project plan
QC – quality control
QL – quantitation limit
RPD – relative percent difference
SOP – standard operating procedure
TPH – total petroleum hydrocarbons
USEPA – US Environmental Protection Agency

QAPP Worksheet No. 12. Measurement Performance Criteria Table (cont.)

Matrix	Sediment
Analytical Group[a]	TPH – Alkanes
Concentration Level	Low

Sampling Procedure[b]	Analytical Method/SOP[c]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analysis (A) or Both (S & A)
3	USEPA SW-846 8015D/M46, M47, M48	Accuracy/bias – contamination	No target compound >QL (5 x MDL) or > 10% of any sample result for the same compound	Method blank/ instrument blank	A
	USEPA SW-846 8015D/M46, M47, M48	Accuracy/bias – contamination	No target compound >QL (5 x MDL) or > 10% of any sample result for the same compound	Equipment rinsate blanks[d]	S & A
	USEPA SW-846 8015D/M46, M47, M48	Accuracy/bias	Percent recovery = 50 – 130%	LCS	A
	USEPA SW-846 8015D/M46, M47, M48	Accuracy/bias	Percent recovery = 50 – 130%	Surrogates	A
	USEPA SW-846 8015D/M46, M47, M48	Accuracy/bias, precision	Percent recovery = 50 – 150%, RPD ≤ 30%	MS/MSD	S & A
	USEPA SW-846 8015D/M46, M47, M48	Precision	RPD ≤ 30% if both samples are > 5 x QL	MD	A
	USEPA SW-846 8015D/M46, M47, M48	Precision	RPD ≤ 50% if both samples are > 5 x QL	Field duplicate	S & A
	USEPA SW-846 8015D/M46, M47, M48	Completeness	≥ 90%	Data completeness check	S & A

[a] Refer to QAPP Worksheet No. 15 for a complete list of analytes for each analytical group.
[b] Reference number from QAPP Worksheet No. 21.
[c] Reference number from QAPP Worksheet No. 23.
[d] Rinsate blank will be created from the homogenization equipment.

LCS – laboratory control sample
MD – matrix duplicate
MDL – method detection limit
MS – matrix spike
MSD – matrix spike duplicate
QAPP – quality assurance project plan
QC – quality control
QL – quantitation limit
RPD – relative percent difference
SOP – standard operating procedure
TPH – total petroleum hydrocarbons
USEPA – US Environmental Protection Agency

QAPP Worksheet No. 13. Secondary Data Criteria and Limitations Table

Secondary Data	Data Source (originating organization, report title and date)	Data Generator(s) (originating organization, data types, data generation/collection dates)	How Data Will Be Used	Limitations on Data Use
Benthic community data	Taxonomic Identification of benthic invertebrates in the LPR in support of the LPRRP, Aqua Survey for NJDOT/OMR. September 2005	Aqua Survey (2005) Taxonomic identification of benthic invertebrates from sediment collected in the lower 17.4 miles of the LPR in support of the LPRRP. June/July 2005	The benthic community data will be incorporated into the data collected in the current sampling effort to increase the understanding of the benthic community in the LPRSA.	Identification was performed on a subsampled of approximately 100 organisms.
	USEPA EMAP within the National Coastal Assessment – Northeast/New Jersey Coast, available online at http://www.epa.gov/emap/nca/html/about.html).	USEPA and EMAP. Taxonomic identification and biomass of benthic invertebrates from numerous stations along New Jersey coast. 2000, 2002.		Benthic community data is limited to three stations in the LPRSA and one station in Newark Bay near the mouth of the Passaic River. These data were available on the USEPA EMAP Website; however, an associated report outlining study methods was not identified.
	RI ESP Benthic Invertebrate Community Survey, Tierra Solutions (2002a).	Tierra Solutions. Evaluation of structure and composition of benthic invertebrate community in LPRSA, and comparison to Mullica River (reference area). Fall 1999 and spring 2000.		Tierra Solutions benthic community survey in the LPRSA is limited to approximately RM 1 to RM 7.
	NJDEP (2007) ambient biomonitoring network	NJDEP. Taxonomic identification of benthic invertebrates from one station in LPRSA (at Dundee Dam) and six stations in tributaries to the Passaic River (e.g., Second River, Third River, and Saddle River). 2006.		NJDEP assemblage data for the LPRSA is limited to one station in LPRSA and six stations in three tributaries. Identification was performed on a subsampled of approximately 100 organisms (all organisms selected for identification

QAPP Worksheet No. 13. Secondary Data Criteria and Limitations Table (cont.)

Secondary Data	Data Source (originating organization, report title and date)	Data Generator(s) (originating organization, data types, data generation/collection dates)	How Data Will Be Used	Limitations on Data Use
				were > or = 2 mm in size).
Benthic community data (cont.)	NJDEP (2000) ambient biomonitoring network	NJDEP. Taxonomic identification of benthic invertebrates from one station in LPRSA (at Dundee Dam) and six stations in tributaries to the Passaic River (e.g., Second River, Third River, and Saddle River). 1998.		NJDEP assemblage data for the LPRSA is limited to one station in LPRSA and six stations in three tributaries. Identification was performed on a subsampled of approximately 100 organisms.
	NJDEP (1994) ambient biomonitoring network	NJDEP. Taxonomic identification of benthic invertebrates from one station in LPRSA (at Dundee Dam) and six stations in tributaries to the Passaic River (e.g., Second River, Third River, and Saddle River). 1993.		NJDEP assemblage data for the LPRSA is limited to one station in LPRSA and six stations in three tributaries. Identification was performed on a subsampled of approximately 100 organisms.
	USEPA REMAP, Region 2, within National Coastal Assessment available online at http://www.epa.gov/emap/nca/html/about.html)	USEPA and REMAP, Region 2. Taxonomic identification and biomass of benthic invertebrates from numerous stations in Region 2. 1998, 1999.		Benthic community data is limited to one station in LPRSA and one station in Newark Bay near the mouth of the river. These data were available on the USEPA REMAP website, however an associated report outlining study methods was not identified.

QAPP Worksheet No. 13. Secondary Data Criteria and Limitations Table (cont.)

Secondary Data	Data Source (originating organization, report title and date)	Data Generator(s) (originating organization, data types, data generation/collection dates)	How Data Will Be Used	Limitations on Data Use
Benthic community data (cont.)	Northeast Fisheries Science Center (2005). Benthic Macrofauna and Associated Hydrographic Observations Collected in Newark Bay, New Jersey, between June 1993 and March 1994	Northeast Fisheries Science Center (Stehlik et al. 2005). Taxonomic identification of benthic invertebrates from numerous stations in Newark Bay 1993, 1994.		Benthic community data is limited to two stations in Newark Bay near the mouth of the river.
	USEPA EMAP within the National Coastal Assessment – Northeast/New Jersey Coast, available online at http://www.epa.gov/emap/nca/html/about.html).	USEPA and EMAP. Taxonomic identification and biomass of benthic invertebrates from numerous stations in Virginian Province. 1990, 1993		Benthic community data is limited to two stations in the LPRSA. These data were available on the USEPA EMAP Website; however, an associated report outlining study methods was not identified.

QAPP Worksheet No. 13. Secondary Data Criteria and Limitations Table (cont.)

Secondary Data	Data Source (originating organization, report title and date)	Data Generator(s) (originating organization, data types, data generation/collection dates)	How Data Will Be Used	Limitations on Data Use
Toxicity test data	USEPA EMAP within the National Coastal Assessment – Northeast/New Jersey Coast, available online at http://www.epa.gov/emap/nca/html/about.html). 2000, 2002	USEPA and EMAP. Sediment toxicity tests using amphipod, *Ampelisca abdita.* 2000, 2002	The toxicity data will be incorporated into the data collected in the current sampling effort to increase the understanding of adverse effects to benthic invertebrate associated with exposure to sediments in the LPRSA.	Toxicity testing data with *Ampelisca abdita* at three stations in the LPRSA and one station in Newark Bay near the mouth of the river These data were available on the USEPA EMAP Website; however, an associated report outlining study methods was not identified.
	Phase 1 Toxicity Identification Evaluation, Tierra Solutions (Tierra Solutions 2002b; Kay et al. 2008)	Tierra Solutions. Investigation of sediment toxicity to benthic invertebrates in the LPRSA. Sediment and porewater toxicity tests using amphipod, *Ampelisca abdita.* July 2000.		Toxicity testing was performed at 5locations in the lower reach of the LPRSA (approximately RM 1 to RM 7).
	Sediment Quality Triad Analysis, Tierra Solutions (Iannuzzi et al. 2008)	Tierra Solutions. Investigation of sediment toxicity to benthic invertebrates in the LPRSA. Sediment toxicity tests using amphipod, *Ampelisca abdita* and polychaete, *Neanthes arenaceodentata.* 1999		Toxicity testing was performed at 12 locations in the lower reach of the LPRSA (approximately RM 1 to RM 7).
	USEPA REMAP, Region 2, within National Coastal Assessment available online at http://www.epa.gov/emap/nca/html/about.html)	USEPA and REMAP, Region 2. Sediment toxicity tests using amphipod, *Ampelisca abdita.*1998		Toxicity testing data with *Ampelisca abdita* is limited to one station in LPRSA and one station in Newark Bay near the mouth of the river.

QAPP Worksheet No. 13. Secondary Data Criteria and Limitations Table (cont.)

Secondary Data	Data Source (originating organization, report title and date)	Data Generator(s) (originating organization, data types, data generation/collection dates)	How Data Will Be Used	Limitations on Data Use
Toxicity test data (cont.)	USEPA EMAP within the National Coastal Assessment – Northeast/New Jersey Coast, available online at http://www.epa.gov/emap/nca/html/about.html).	USEPA and EMAP, Virginian Province Coast. Sediment toxicity tests using amphipod, *Ampelisca abdita.* 1990, 1993		Toxicity testing data with *Ampelisca abdita* is limited to two stations in the LPRSA
Tissue-residue/ bioaccumulation data	USEPA EMAP within the National Coastal Assessment – Northeast/New Jersey Coast, available online at http://www.epa.gov/emap/nca/html/about.html).	USEPA and EMAP. Crab and lobster tissue data. 2000, 2002	The tissue residue data will be incorporated into the data collected in the current sampling effort to increase the understanding of bioaccumulation in benthic invertebrate exposed to sediments in the LPRSA.	Crab tissue chemistry data available at two stations in the LPRSA and one station in Newark Bay near the mouth of the Passaic River. Samples were only analyzed for PAHs, PCB Aroclors, one PCB congener, metals, and pesticides
	CARP. Available online at (http://www.carpweb.org/main.html)	CARP. Invertebrate tissue data collection from 1999 to 2004.		CARP only collected invertebrate tissue for four species (i.e., blue crab, opossum shrimp, ribbed mussel and seven spine bay shrimp) at RM 2.6 in the LPRSA. Samples were only analyzed for PCDDs/PCDFs, PAHs, PCBs (Aroclors and congeners), metals, and pesticides.

QAPP Worksheet No. 13. Secondary Data Criteria and Limitations Table (cont.)

Secondary Data	Data Source (originating organization, report title and date)	Data Generator(s) (originating organization, data types, data generation/collection dates)	How Data Will Be Used	Limitations on Data Use
Tissue-residue/ bioaccumulation data (cont.)	Tierra Solutions. Passaic River Study Area ESP Biota Sampling Program, 1999- 2001. (PREmis project database created January 21, 2006)	Tierra Solutions. Passaic River Study Area ESP Biota Sampling Program. Data were collected in autumn 1999, spring 2000, and late summer 2001.		Tierra Solutions Biota Sampling Program collected blue crabs only from RM 1 to RM 7. Samples were analyzed for PCDDs/PCDFs, PAHs, PCBs (Aroclors and congeners), metals, SVOCs, herbicides, and pesticides.
	PREmis database (created January 21, 2006; available online at http://ourpassaic.org)	NYSDEC, fish and invertebrate tissue, 1993 (data queried from PREmis database)		Limited to blue crab at one location near the mouth of the LPR (RM 0.1). Sample was analyzed for PCDDs/ PCDFs, PCBs (Aroclors), metals, and pesticides.
		Tierra Solutions, Inc., Passaic 1995 Biological Sampling Program (data queried from PREmis database)		Limited to blue crab at locations in the estuarine zone only (RM 1.1 to RM 4.5). Samples were analyzed for PCDDs/ PCDFs, PAHs, PCBs (Aroclors and congeners), metals, SVOCs, TPH, and pesticides.
	Caged bivalve study, Tierra Solutions (2003).	Tierra Solutions. Caged bivalve (*Geukensia demissus)* study in LPRSA, and in reference areas. Summer and fall 1999.		28-day caged bivalve study at 15 station in LPRSA approximately RM 1 to RM7. Samples were analyzed for PCDDs/ PCDFs, PAHs, PCBs (Aroclors and congeners), metals, SVOCs, herbicides, and pesticides.

QAPP Worksheet No. 13. Secondary Data Criteria and Limitations Table (cont.)

Secondary Data	Data Source (originating organization, report title and date)	Data Generator(s) (originating organization, data types, data generation/collection dates)	How Data Will Be Used	Limitations on Data Use
Tissue-residue/ bioaccumulation data (cont.)	NJDEP, PCBs, chlordane, and DDTs in selected fish and shellfish from New Jersey waters, 1986 – 1987: results from New Jersey's Toxics in Biota Monitoring Program (NJDEP 1990); NJDEP, PCBs, chlordane, and DDTs in selected fish and shellfish from New Jersey waters, 1988 – 1991: Results from New Jersey's Toxics in Biota Monitoring Program (NJDEP 1993); NJDEP, A study of 2, 3, 7, 8-tetrachlorodibenzo-p-dioxin contamination in select finfish, crustaceans and sediments of New Jersey waterways (Belton et al. 1985); Final report: routine monitoring program for toxics in fish (Horwitz et al. 2005); 2004 monitoring program for chemical contaminants in fish from the State of New Jersey: second year of routine monitoring program, final report. No. 06-04F (Horwitz et al. 2006); NJDEP 2004 Routine Monitoring Program for Toxics in Fish: Year 2 – Estuarine and Marine Waters (crab data), available online at (http://www.state.nj.us/dep/dsr/2004data.htm).	NJDEP, fish and crab tissue data. Data were collected from 1986 to 2004.		NJDEP collected tissue for blue crab at limited locations in the LPRSA (Newark Bay and Monroe Street Bridge [RM 16]). Detection limits not known. No sample coordinates. Unknown if data was validated. Samples were analyzed for PCDDs/ PCDFs, PCBs (Aroclors and congeners), and pesticides.

QAPP Worksheet No. 13. Secondary Data Criteria and Limitations Table (cont.)

Secondary Data	Data Source (originating organization, report title and date)	Data Generator(s) (originating organization, data types, data generation/collection dates)	How Data Will Be Used	Limitations on Data Use
Sediment image profile survey	Sediment Profile Imaging (SPI) survey of the LPR, Germano & Associates (2005)	Germano & Associates. Sediment Profile Imaging (SPI) survey of Sediment and Benthic Habitat Characteristics of the lower 16 river miles of the LPR. July 2005.	The SPI data will be used to identify areas with fine-grained and coarse-grained sediments.	None
Predicted tide tables	NOAA online tide data available at (http://tidesandcurrents.noaa.gov/tides09/)	NOAA, tide predictions, 2009	Tide predictions will be used to determine when stations can be accessed by boat.	Raw tidal elevation data obtained from the NOAA website have not been subjected to the National Ocean Service's QC or QA procedures and do not meet the criteria and standards of official National Ocean Service data. They are released for limited public use as preliminary data to be used only with appropriate caution.
Sediment texture maps	Malcolm Pirnie. 2006. LPRRP. Draft geochemical evaluation (step 2). Prepared for USEPA Region 2 and USACE. Malcolm Pirnie, Inc., White Plains, NY (Malcolm Pirnie 2006).	Aqua Survey. Vector digital data, April 21, 2005 to June 16, 2005, as cited in Malcolm Pirnie (2006)	Sediment texture maps will be used to identify areas with fine-grained and coarse-grained sediments.	Side scan sonar survey data is limited to general grain size characterization. Sediment texture map coverage ends at ~RM 16.1.
Bathymetry maps	Malcolm Pirnie. 2006. LPRRP. Draft geochemical evaluation (step 2). Prepared for USEPA Region 2 and USACE. Malcolm Pirnie, Inc., White Plains, NY (Malcolm Pirnie 2006).	Aqua Survey. Vector digital data, April 21, 2005, to June 16, 2005, as cited in Malcolm Pirnie (2006)	Bathymetry maps will be used to help identify areas with fine-grained and coarse-grained sediments.	Multi-beam bathymetric data may be incomplete in places at shoreline and near structures.

QAPP Worksheet No. 14. Summary of Project Tasks

Project Area: LPRSA	
Sampling Tasks:	**Sediment Collection for SQT (Benthic Community, Sediment Chemistry, and Sediment Toxicity):** Sampling locations will be distributed throughout the LPRSA for the SQT as described on Worksheet No. 11. Locations within a given segment will be selected to represent shallow nearshore areas (- 2 ft MLW and shallower) and subtidal areas (deeper than - 2 ft MLW), and fine (≥ 60% fines)- and coarse (< 60% fines)-grained sediment within these depth zones to the degree that these habitat features are present in a river mile segment. Twenty-seven sediment samples in the nearshore areas were co-located with mummichog and darter/killifish sampling locations[10] to support the fish tissue-residue line of evidence and the wildlife assessment in the ERA. The sediment sampling at these stations will be coordinated with the fish tissue effort. Twenty SQT sampling locations were co-located with the bioaccumulation test locations and the remaining 51 SQT station locations were placed randomly within the four habitat types described above. Sampling design and locations are further described on Worksheet No. 11 and No. 18 and presented on Figure 1. At each of the 97 selected locations between RM 0 and RM 16, a minimum of four replicates (0.2 m^2) will be collected within a radius of 10 m and the biological active zone (0-15 cm) will be sampled for SQT analyses. A 0.1 m^2 portion from the center of each grab will be allocated to benthic community analysis at the estuarine stations and a 0.5 m^2 portion will be allocated to benthic community analysis at the freshwater stations. The remaining sediment (0-15 cm) will be homogenized and then apportioned into appropriate containers for toxicity tests and chemistry analysis. A minimum of 8 L (2 gallons) and 5.7 L (1.5 gallons) per sample is needed for the toxicity tests and chemistry analysis, respectively. Additional grabs will be collected if the first four grabs provide insufficient sediment to meet the toxicity and chemistry requirements. The four benthic community allocations will be kept separate to provide 4 replicates per location. The estuarine benthic community samples will be collected from a 0.1-m^2 area and sieved in the field laboratory using a 1.0-mm sieve, and the freshwater benthic community samples will be collected from a 0.5-m^2 area and sieved through a 0.5-mm sieve. The remaining contents will be transferred into appropriate containers and preserved with buffered formalin (final concentration about 10%). Up to five additional locations may be sampled by hand above RM 16. The sampling of these locations will depend on access agreement, safety of the field crew, and accessibility of sediment locations. If sampling is possible, the stations will be recorded using a hand-held GPS (see Attachment B). The sediment will be collected by a hand-held grab sampler (e.g., Ponar) or, if necessary, by scooping sediment from a depth of 15 cm with a dedicated, clean,

[10] Co-located nearshore sediments will be co-located with mummichog, darter/killifish, and decapods, as appropriate, based on species caught during the fish/decapod sampling effort. A field modification will be prepared, if necessary, once the fish/decapod tissue collection effort is completed documenting the specific locations to be co-located with sediment sampling.

QAPP Worksheet No. 14. Summary of Project Tasks (cont.)

Sampling Tasks (cont.):	large stainless steel serving spoon. The sediment will be placed into a pre-cleaned stainless steel bowl and homogenized as described in Attachment D. Any large non-sediment items such as rocks, shells, wood chips, or organisms (e.g., clams) will be removed (i.e., scraped off any surface) prior to homogenization. Homogenized sediment will then be split into the appropriate sample containers as described in Attachment E. **Sediment Collection for Bioaccumulation Testing:** For the bioaccumulation testing, it is expected that sufficient sediment will be collected at 20 of the SQT stations. Further details on selection process for the bioaccumulation stations are presented in Attachment J. At each location a minimum of 4 power grab replicates (0.2 m^2) will be collected, if feasible, within a radius of 10 m. A total of 64.3 L (17 gallons) and 30 L (8 gallons) will be collected at the freshwater and estuarine stations, respectively, based on a tissue requirement of 115 g (pre-homogenization) and the following sediment volumes: • *Neanthes virens* 30 L of estuarine surface sediment per sample The sediment volume for the bioaccumulation test with *Lumbriculus variegatus* depends on the TOC contents of the sample. The protocol for the *Lumbriculus* bioaccumulation test requires 50:1 ratio between TOC in sediment and dry weight of worms in each replicate. Based on the tissue mass requirement of 115 g (pre-homogenization) and an average TOC of 6% in the LPRSA (based on preliminary LRC surface sediment data) 64.3 L (17 gallons) of surface sediments will be collected at each freshwater station for the *Lumbriculus* test. At stations with lower TOC this bioaccumulation test may produce less than 115 g (pre-homogenization) of tissue because according to protocol (ASTM 2007a), the ratio between tissue dry weight to TOC is 1:50. **Sediment Collection for Human Health Exposure:** In addition to the SQT locations described above, sediment will be collected from up to 14 additional locations will also be sampled for sediment chemistry only. Nine of these samples have targeted locations at certain shallow nearshore locations for the HHRA ("Human Exposure Locations" presented on Figure 1) and up to five additional "floater" locations of potential human exposure interest may be identified while in the field (e.g., boat clubs, docks, and other locations of human activity such as fishing that are not currently identified for sampling).

QAPP Worksheet No. 14. Summary of Project Tasks (cont.)

Analysis Tasks:	At each sampling location, coordinates and water depth will be recorded. Following collection, the sediment samples will be homogenized in the field laboratory and the sediment samples will be shipped to the analytical laboratory for chemical analysis and to the toxicity testing laboratory for toxicity or bioaccumulation testing. The benthic community samples will be shipped to the taxonomy laboratory. Tissue samples derived from the bioaccumulation tests and sediment samples will be analyzed for the chemicals listed in Worksheet No. 10. The benthic community samples will be identified to lowest practical taxonomic level and in concordance with the taxonomic level from other surveys in New Jersey (Worksheet No. 11, Table 11-1) following the rapid bioassessment protocols (Barbour et al. 1999). The toxicity tests will be conducted according to USEPA and ASTM protocols (ASTM 2004, 2007b; USEPA 2000b) (quality indicators are presented in Table 11-2). The *Hyalella* test will be conducted on both freshwater and estuarine sediment samples. The interstitial salinity in each sediment sample will be measured in the laboratory upon receipt. Samples with interstitial salinity of 0 to 5 ppt will be tested at overlying-water salinity of 0 ppt (i.e., freshwater at 100 ppm of water hardness) using *Hyalella azteca* acclimated to freshwater. Samples with interstitial salinity >5 ppt will be tested at overlying-water salinity of 10 ppt using *Hyalella azteca* acclimated to water with a salinity of 10 ppt. For further details, including the three toxicity test SOPs, see Attachment M. The bioaccumulation test will be conducted according to USEPA and ASTM protocols (ASTM 2007a; ODEQ 1999; USEPA and USACE 1998; USEPA 1993, 2000b) (quality indicators are presented in Table 11-3). The four bioaccumulation test SOPs are included in Attachment M.
QC Tasks:	All field notes and forms completed during the field sampling task will be checked daily by the Field Coordinator (FC). The FC will also communicate daily with the Task QA/QC Manager to confirm PQOs are being met. Electronic sampling equipment (e.g., GPS units) will be calibrated, maintained, tested and inspected according to manufacturers' specifications as necessary to ensure they are functioning properly (refer to Worksheet No. 22). The analytical laboratories will follow QC procedures outlined in this QAPP (see Worksheet Nos. 19, 24, and 25), their SOPs for the analytical methods being conducted (see Worksheet No. 23), and their quality management plan. Chemical data will be validated according to procedures outlined in this QAPP (see Worksheet Nos. 35 and 36). The biological laboratories will follow QC procedures outlined in this QAPP (see Worksheet No.14), their SOPs for the toxicity and bioaccumulation tests being conducted (see Attachment M), and their quality management plan.

QAPP Worksheet No. 14. Summary of Project Tasks (cont.)

Secondary Data:	Other community and chemistry data that are summarized in Worksheet Nos. 10 and 13 will also be reviewed and potentially used to accomplish project objectives.
Data Management Tasks:	The data management task will include keeping accurate records of field activities and observations so that project team members using the data will have accurate and appropriate documentation. Data management activities will be conducted in accordance with the project data management plan using the Technical Committee (TC) data rules. The overall project data management plans will be developed by the data management contractor in collaboration with Windward. As part of the transition of performance of the RI/FS to the CPG, an overall data management plan will be developed prior to the initiation of data collection. This plan will detail internal data management protocols as well as procedures for submitting the multimedia electronic data deliverable (MEDD) to USEPA in Region 2. Data transfer to USEPA will include a multi-media EDD that conforms to the 2007 USEPA Region 2 MEDD format. The MEDD will include all qualified and rejected data (including the reported, numerical value for rejected data). Field data will be stored in its native format and in the project sampling database. GPS data will also be downloaded and stored electronically in a project file. Laboratory analytical data will be loaded into the project sampling database, verified against the laboratory reports, merged with corresponding field data, and updated based on validation. Subsequently, the spatial data will be mapped for the data report.

QAPP Worksheet No. 14. Summary of Project Tasks (cont.)

Documentation and Records:	It is important that field activities be documented in an organized, chronologic, and accurate manner. All field activities will be recorded in a field logbook maintained by the FC. The field logbook is intended to provide sufficient data and observations to enable participants to reconstruct events that occurred during the sampling period. Procedures for documentation are presented in Attachment H. All relevant forms and records are presented on Worksheet No. 29. In general, the following information must be recorded: • The identities and affiliation of the personnel conducting field activities. • Model numbers and serial numbers of instruments and/or equipment being used, will, to the extent available, be recorded in the field log. • A description of the type of field work being conducted and the equipment used • The date and time the field activities were initiated and completed, with specific temporal information for each task (e.g., record the time activities commenced at each individual location, if applicable) • The site where the field activities were conducted and also any locations within that site where work was performed (e.g., specific sampling sites, coordinates, and depths) • The general methodology used to conduct the activities • Communications with project managers and personnel regarding field activities • Field collected data (e.g., GPS measurements) • Daily health and safety briefings • Deviations from QAPP, SOP, or project health and safety plan (HSP) (Attachment L), reason for change, and any corrective actions taken. Corrective actions will be electronically documented on the Protocol Modification Form (Attachment A) All entries must be made in language that is objective, factual, and free of personal feelings or other terminology that might prove inappropriate. The Surface Sediment Collection Form (Attachment D) will be filled out electronically to document sediment sampling location information. A record of all personnel briefed on the HSP will be maintained by the FC, Site Safety and Health Officer, or designee. The record will be archived at Windward's Seattle office upon completion of the sampling efforts.
Assessment/Audit Tasks	The FC will also communicate frequently with the Investigative Organization Task QA/QC Manager to confirm PQOs are being met. Assessment/audit tasks will be conducted, as summarized in Worksheet No. 31. Reviews of field activities/sampling method compliance and laboratory method compliance will be conducted periodically.
Data Review Tasks:	All field records will be reviewed by the FC for completeness and accuracy, and verified by the Task QA/QC Manager or a designee. All data will be presented in a data report. In addition, the data report will also undergo a senior and peer review process before the final draft is submitted to USEPA (see Worksheet Nos. 34 through 37 for relevant procedures).

QAPP Worksheet No. 14. Summary of Project Tasks (cont.)

Deliverables:	A field operations report summarizing the sampling efforts will be provided to USEPA within 90 days after completion of the effort. A map illustrating the actual sampling locations will also be prepared. Data reports will be prepared once the sediment chemistry, toxicity testing, and community results have been validated. These data reports will be provided to USEPA within 90 days of receipt of data from the laboratories or the data validator. A tissue chemistry data report will be prepared once the tissue chemistry results have been validated. This data report will be provided to USEPA within 90 days of receipt of validated data and will include validation results.

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation

Matrix: Tissue

Analytical Group, Method, and Laboratory: PCBs – Congeners, USEPA 1668A, Analytical Perspectives, Wilmington, NC

SOP from Worksheet 23: M2

Concentration Level: Low

Analyte	CAS Number	DQL (mg/kg ww)[a]	Project Quantitation Limit Goal (mg/kg ww)	Analytical Method[b]		Achievable Laboratory Limits (11 ±2-g sample)[c]		Achievable Laboratory Limits (1 g-sample)[c]	
				MDL (mg/kg ww)	Method QL (mg/kg ww)	MDL (mg/kg ww)	QL (mg/kg ww)	MDL (mg/kg ww)	QL (mg/kg ww)
PCBs by Congeners									
PCB 1	2051-60-7	0.0231[d]	4.63E-05	8.0E-06	2.0E-05	1.59E-06	4.20E-06	1.75E-05	4.63E-05
PCB 2	2051-61-8	0.0231[d]	4.46E-05	4.0E-07	1.0E-06	1.56E-06	4.05E-06	1.72E-05	4.46E-05
PCB 3	2051-62-9	0.0231[d]	4.46E-05	9.0E-06	2.0E-05	1.56E-06	4.05E-06	1.71E-05	4.46E-05
PCB 4	13029-08-8	0.0231[d]	7.93E-05	1.7E-05	5.0E-05	2.85E-06	7.21E-06	3.13E-05	7.93E-05
PCB 5	16605-91-7	0.0231[d]	8.75E-05	1.E-06	5.E-06	3.02E-06	7.95E-06	3.33E-05	8.75E-05
PCB 6	25569-80-6	0.0231[d]	9.02E-05	1.E-06	5.E-06	3.12E-06	8.20E-06	3.43E-05	9.02E-05
PCB 7	33284-50-3	0.0231[d]	8.60E-05	2.E-06	5.E-06	2.97E-06	7.82E-06	3.27E-05	8.60E-05
PCB 8	34883-43-7	0.0231[d]	8.98E-05	1.2E-05	5.0E-05	3.10E-06	8.16E-06	3.41E-05	8.98E-05
PCB 9	34883-39-1	0.0231[d]	8.95E-05	2.E-06	5.E-06	3.09E-06	8.14E-06	3.40E-05	8.95E-05
PCB 10	33146-45-1	0.0231[d]	8.39E-05	2.E-06	5.E-06	2.88E-06	7.63E-06	3.17E-05	8.39E-05
PCB 11	2050-67-1	0.0231[d]	9.20E-05	1.0E-05	2.0E-05	3.16E-06	8.36E-06	3.48E-05	9.20E-05
PCB 12	2974-92-7	0.0231[d]	9.28E-05	3.E-06	1.0E-05	3.19E-06	8.43E-06	3.51E-05	9.28E-05
PCB 13	2974-90-5	0.0231[d]	9.28E-05	3.E-06	1.0E-05	3.19E-06	8.43E-06	3.51E-05	9.28E-05
PCB 14	34883-41-5	0.0231[d]	8.60E-05	3.E-06	1.0E-05	2.97E-06	7.82E-06	3.27E-05	8.60E-05
PCB 15	2050-68-2	0.0231[d]	8.97E-05	1.8E-05	5.0E-05	3.11E-06	8.16E-06	3.42E-05	8.97E-05
PCB 16	38444-78-9	0.0231[d]	4.05E-05	4.E-06	1.0E-05	1.48E-06	3.68E-06	1.63E-05	4.05E-05
PCB 17	37680-66-3	0.0231[d]	4.20E-05	9.E-06	2.0E-05	1.49E-06	3.81E-06	1.64E-05	4.20E-05
PCB 18	37680-65-2	0.0231[d]	4.20E-05	1.7E-05	5.0E-05	1.49E-06	3.82E-06	1.64E-05	4.20E-05
PCB 19	38444-73-4	0.0231[d]	4.10E-05	4.E-06	1.0E-05	1.48E-06	3.73E-06	1.63E-05	4.10E-05
PCB 20	38444-84-7	0.0231[d]	5.92E-05	1.9E-05	5.0E-05	2.08E-06	5.39E-06	2.29E-05	5.92E-05

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Analyte	CAS Number	DQL (mg/kg ww)[a]	Project Quantitation Limit Goal (mg/kg ww)	Analytical Method[b]		Achievable Laboratory Limits (11 ±2-g sample)[c]		Achievable Laboratory Limits (1 g-sample)[c]	
				MDL (mg/kg ww)	Method QL (mg/kg ww)	MDL (mg/kg ww)	QL (mg/kg ww)	MDL (mg/kg ww)	QL (mg/kg ww)
PCB 21	55702-46-0	0.0231[d]	6.04E-05	5.E-06	2.0E-05	2.10E-06	5.49E-06	2.31E-05	6.04E-05
PCB 22	38444-85-8	0.0231[d]	5.90E-05	9.E-06	2.0E-05	2.08E-06	5.37E-06	2.29E-05	5.90E-05
PCB 23	55720-44-0	0.0231[d]	5.94E-05	5.E-06	2.0E-05	2.08E-06	5.40E-06	2.29E-05	5.94E-05
PCB 24	55702-45-9	0.0231[d]	4.34E-05	5.E-06	2.0E-05	1.51E-06	3.95E-06	1.66E-05	4.34E-05
PCB 25	55712-37-3	0.0231[d]	6.00E-05	5.E-06	2.0E-05	2.09E-06	5.45E-06	2.30E-05	6.00E-05
PCB 26	38444-81-4	0.0231[d]	5.99E-05	8.E-06	2.0E-05	2.09E-06	5.44E-06	2.30E-05	5.99E-05
PCB 27	38444-76-7	0.0231[d]	4.27E-04	6.E-06	2.0E-05	1.50E-06	3.89E-06	1.65E-05	4.27E-04
PCB 28	7012-37-5	0.0231[d]	5.92E-05	1.9E-05	5.0E-05	2.08E-06	5.39E-06	2.29E-05	5.92E-05
PCB 29	15862-07-4	0.0231[d]	5.99E-05	8.E-06	2.0E-05	2.09E-06	5.44E-06	2.30E-05	5.99E-05
PCB 30	35693-92-6	0.0231[d]	4.20E-05	1.7E-05	5.0E-05	1.49E-06	3.82E-06	1.64E-05	4.20E-05
PCB 31	16606-02-3	0.0231[d]	6.07E-05	1.5E-05	5.0E-05	2.10E-06	5.51E-06	2.31E-05	6.07E-05
PCB 32	38444-77-8	0.0231[d]	4.38E-05	8.E-06	2.0E-05	1.52E-06	3.98E-06	1.67E-05	4.38E-05
PCB 33	38444-86-9	0.0231[d]	6.04E-05	5.E-06	2.0E-05	2.10E-06	5.49E-06	2.31E-05	6.04E-05
PCB 34	37680-68-5	0.0231[d]	5.89E-05	7.E-06	2.0E-05	2.08E-06	5.36E-06	2.28E-05	5.89E-05
PCB 35	37680-69-6	0.0231[d]	5.84E-05	8.E-06	2.0E-05	2.07E-06	5.31E-06	2.28E-05	5.84E-05
PCB 36	38444-87-0	0.0231[d]	5.98E-05	8.E-06	2.0E-05	2.09E-06	5.43E-06	2.30E-05	5.98E-05
PCB 37	38444-90-5	0.0231[d]	5.82E-05	1.3E-05	5.0E-05	2.07E-06	5.29E-06	2.27E-05	5.82E-05
PCB 38	53555-66-1	0.0231[d]	5.96E-05	8.E-06	2.0E-05	2.09E-06	5.42E-06	2.30E-05	5.96E-05
PCB 39	38444-88-1	0.0231[d]	5.97E-05	9.E-06	2.0E-05	2.09E-06	5.42E-06	2.30E-05	5.97E-05
PCB 40	38444-93-8	0.0231[d]	1.69E-05	1.2E-05	5.0E-05	0.64E-06	1.53E-06	7.00E-06	1.69E-05
PCB 41	52663-59-9	0.0231[d]	1.70E-05	1.2E-05	5.0E-05	0.65E-06	1.54E-06	7.13E-06	1.70E-05
PCB 42	36559-22-5	0.0231[d]	1.71E-05	6.E-06	2.0E-05	0.65E-06	1.55E-06	7.20E-06	1.71E-05
PCB 43	70362-46-8	0.0231[d]	1.76E-05	9.E-06	2.0E-05	0.68E-06	1.60E-06	7.45E-06	1.76E-05
PCB 44	41464-39-5	0.0231[d]	1.70E-05	1.9E-05	5.0E-05	0.64E-06	1.54E-06	6.99E-06	1.70E-05
PCB 45	70362-45-7	0.0231[d]	1.65E-05	5.E-06	2.0E-05	0.62E-06	1.50E-06	6.81E-06	1.65E-05
PCB 46	41464-47-5	0.0231[d]	1.65E-05	1.0E-05	2.0E-05	0.63E-06	1.50E-06	6.88E-06	1.65E-05

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Analyte	CAS Number	DQL (mg/kg ww)[a]	Project Quantitation Limit Goal (mg/kg ww)	Analytical Method[b]		Achievable Laboratory Limits (11 ±2-g sample)[c]		Achievable Laboratory Limits (1 g-sample)[c]	
				MDL (mg/kg ww)	Method QL (mg/kg ww)	MDL (mg/kg ww)	QL (mg/kg ww)	MDL (mg/kg ww)	QL (mg/kg ww)
PCB 47	2437-79-8	0.0231[d]	1.70E-05	1.9E-05	5.0E-05	0.64E-06	1.54E-06	6.99E-06	1.70E-05
PCB 48	70362-47-9	0.0231[d]	1.69E-05	8.E-06	2.0E-05	0.63E-06	1.54E-06	6.97E-06	1.69E-05
PCB 49	41464-40-8	0.0231[d]	1.71E-05	1.1E-05	5.0E-05	0.63E-06	1.55E-06	6.93E-06	1.71E-05
PCB 50	62796-65-0	0.0231[d]	1.64E-05	6.E-06	2.0E-05	0.61E-06	1.49E-06	6.74E-06	1.64E-05
PCB 51	68194-04-7	0.0231[d]	1.63E-05	5.E-06	2.0E-05	0.61E-06	1.48E-06	6.76E-06	1.63E-05
PCB 52	35693-99-3	0.0231[d]	1.69E-05	1.9E-05	5.0E-05	0.64E-06	1.54E-06	7.04E-06	1.69E-05
PCB 53	41464-41-9	0.0231[d]	1.64E-05	6.E-06	2.0E-05	0.61E-06	1.49E-06	6.74E-06	1.64E-05
PCB 54	15968-05-5	0.0231[d]	1.29E-05	1.2E-05	5.0E-05	0.48E-06	1.17E-06	5.23E-06	1.29E-05
PCB 55	74338-24-2	0.0231[d]	2.97E-05	1.2E-05	5.0E-05	1.11E-06	2.7E-06	1.22E-05	2.97E-05
PCB 56	41464-43-1	0.0231[d]	3.00E-05	1.0E-05	2.0E-05	1.11E-06	2.73E-06	1.22E-05	3.00E-05
PCB 57	70424-67-8	0.0231[d]	3.04E-05	1.2E-05	5.0E-05	1.11E-06	2.77E-06	1.22E-05	3.04E-05
PCB 58	41464-49-7	0.0231[d]	2.98E-05	1.3E-05	5.0E-05	1.11E-06	2.71E-06	1.22E-05	2.98E-05
PCB 59	74472-33-6	0.0231[d]	1.73E-05	6.E-06	2.0E-05	0.63E-06	1.58E-06	6.94E-06	1.73E-05
PCB 60	33025-41-1	0.0231[d]	3.04E-05	1.3E-05	5.0E-05	1.11E-06	2.77E-06	1.23E-05	3.04E-05
PCB 61	33284-53-6	0.0231[d]	3.02E-05	1.7E-05	5.0E-05	1.11E-06	2.75E-06	1.22E-05	3.02E-05
PCB 62	54230-22-7	0.0231[d]	1.73E-05	6.E-06	2.0E-05	0.63E-06	1.58E-06	6.94E-06	1.73E-05
PCB 63	74472-34-7	0.0231[d]	3.10E-05	1.4E-05	5.0E-05	1.12E-06	2.82E-06	1.23E-05	3.10E-05
PCB 64	52663-58-8	0.0231[d]	1.77E-05	7.E-06	2.0E-05	0.63E-06	1.61E-06	6.97E-06	1.77E-05
PCB 65	33284-54-7	0.0231[d]	1.70E-05	1.9E-05	5.0E-05	0.64E-06	1.54E-06	6.99E-06	1.70E-05
PCB 66	32598-10-0	0.0231[d]	3.00E-05	1.6E-05	5.0E-05	1.11E-06	2.73E-06	1.22E-05	3.00E-05
PCB 67	73575-53-8	0.0231[d]	3.03E-05	1.5E-05	5.0E-05	1.11E-06	2.76E-06	1.22E-05	3.03E-05
PCB 68	73575-52-7	0.0231[d]	3.04E-05	1.5E-05	5.0E-05	1.11E-06	2.76E-06	1.22E-05	3.04E-05
PCB 69	60233-24-1	0.0231[d]	1.71E-05	1.1E-05	5.0E-05	0.63E-06	1.55E-06	6.93E-06	1.71E-05
PCB 70	32598-11-1	0.0231[d]	3.02E-05	1.7E-05	5.0E-05	1.11E-06	2.75E-06	1.22E-05	3.02E-05
PCB 71	41464-46-4	0.0231[d]	1.69E-05	1.2E-05	5.0E-05	0.64E-06	1.53E-06	7.00E-06	1.69E-05
PCB 72	41464-42-0	0.0231[d]	3.03E-05	1.6E-05	5.0E-05	1.11E-06	2.75E-06	1.22E-05	3.03E-05

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Analyte	CAS Number	DQL (mg/kg ww)[a]	Project Quantitation Limit Goal (mg/kg ww)	Analytical Method[b]		Achievable Laboratory Limits (11 ±2-g sample)[c]		Achievable Laboratory Limits (1 g-sample)[c]	
				MDL (mg/kg ww)	Method QL (mg/kg ww)	MDL (mg/kg ww)	QL (mg/kg ww)	MDL (mg/kg ww)	QL (mg/kg ww)
PCB 73	74338-23-1	0.0231[d]	1.72E-05	1.6E-05	5.0E-05	0.63E-06	1.56E-06	6.94E-06	1.72E-05
PCB 74	32690-93-0	0.0231[d]	3.02E-05	1.7E-05	5.0E-05	1.11E-06	2.75E-06	1.22E-05	3.02E-05
PCB 75	32598-12-2	0.0231[d]	1.73E-05	6.E-06	2.0E-05	0.63E-06	1.58E-06	6.94E-06	1.73E-05
PCB 76	70362-48-0	0.0231[d]	3.02E-05	1.7E-05	5.0E-05	1.11E-06	2.75E-06	1.22E-05	3.02E-05
PCB 77	32598-13-3	2.4E-04[e]	2.95E-05	1.7E-05	5.0E-05	1.11E-06	2.68E-06	1.11E-05	2.95E-05
PCB 78	70362-49-1	0.0231[d]	2.99E-05	1.7E-05	5.0E-05	1.12E-06	2.72E-06	1.23E-05	2.99E-05
PCB 79	41464-48-6	0.0231[d]	3.05E-05	1.7E-05	5.0E-05	1.11E-06	2.77E-06	1.23E-05	3.05E-05
PCB 80	33284-52-5	0.0231[d]	3.03E-05	1.8E-05	5.0E-05	1.11E-06	2.76E-06	1.22E-05	3.03E-05
PCB 81	70362-50-4	1.2E-04[e]	2.97E-05	1.8E-05	5.0E-05	1.11E-06	2.7E-06	1.22E-05	2.97E-05
PCB 82	52663-62-4	0.0231[d]	2.06E-05	1.3E-05	5.0E-05	0.8E-06	1.87E-06	8.85E-06	2.06E-05
PCB 83	60145-20-2	0.0231[d]	1.99E-05	2.2E-05	5.0E-05	0.77E-06	1.81E-06	8.46E-06	1.99E-05
PCB 84	52663-60-2	0.0231[d]	2.00E-05	1.2E-05	5.0E-05	0.77E-06	1.82E-06	8.47E-06	2.00E-05
PCB 85	65510-45-4	0.0231[d]	1.98E-05	1.0E-05	2.0E-05	0.75E-06	1.80E-06	8.21E-06	1.98E-05
PCB 86	55312-69-1	0.0231[d]	1.99E-05	1.5E-05	5.0E-05	0.75E-06	1.81E-06	8.27E-06	1.99E-05
PCB 87	38380-02-8	0.0231[d]	1.99E-05	1.5E-05	5.0E-05	0.75E-06	1.81E-06	8.27E-06	1.99E-05
PCB 88	55215-17-3	0.0231[d]	1.99E-05	1.2E-05	5.0E-05	0.77E-06	1.81E-06	8.46E-06	1.99E-05
PCB 89	73575-57-2	0.0231[d]	2.00E-05	1.9E-05	5.0E-05	0.77E-06	1.82E-06	8.49E-06	2.00E-05
PCB 90	68194-07-0	0.0231[d]	1.98E-05	2.4E-05	1.0E-04	0.75E-06	1.80E-06	8.27E-06	1.98E-05
PCB 91	68194-05-8	0.0231[d]	2.01E-05	1.2E-05	5.0E-05	0.75E-06	1.83E-06	8.27E-06	2.01E-05
PCB 92	52663-61-3	0.0231[d]	2.01E-05	1.2E-05	5.0E-05	0.78E-06	1.83E-06	8.55E-06	2.01E-05
PCB 93	73575-56-1	0.0231[d]	1.98E-05	2.2E-05	5.0E-05	0.76E-06	1.80E-06	8.36E-06	1.98E-05
PCB 94	73575-55-0	0.0231[d]	1.99E-05	1.2E-05	5.0E-05	0.77E-06	1.81E-06	8.48E-06	1.99E-05
PCB 95	38379-99-6	0.0231[d]	1.99E-05	2.2E-05	5.0E-05	0.75E-06	1.81E-06	8.28E-06	1.99E-05
PCB 96	73575-54-9	0.0231[d]	1.11E-05	2.1E-05	5.0E-05	0.42E-06	1.01E-06	4.64E-06	1.11E-05
PCB 97	41464-51-1	0.0231[d]	1.99E-05	1.5E-05	5.0E-05	0.75E-06	1.81E-06	8.27E-06	1.99E-05
PCB 98	60233-25-2	0.0231[d]	2.02E-05	2.2E-05	5.0E-05	0.78E-06	1.84E-06	8.55E-06	2.02E-05

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Analyte	CAS Number	DQL (mg/kg ww)[a]	Project Quantitation Limit Goal (mg/kg ww)	Analytical Method[b]		Achievable Laboratory Limits (11 ±2-g sample)[c]		Achievable Laboratory Limits (1 g-sample)[c]	
				MDL (mg/kg ww)	Method QL (mg/kg ww)	MDL (mg/kg ww)	QL (mg/kg ww)	MDL (mg/kg ww)	QL (mg/kg ww)
PCB 99	38380-01-7	0.0231[d]	1.99E-05	2.2E-05	5.0E-05	0.75E-06	1.80E-06	8.30E-06	1.99E-05
PCB 100	39485-83-1	0.0231[d]	1.98E-05	2.2E-05	5.0E-05	0.76E-06	1.80E-06	8.36E-06	1.98E-05
PCB 101	37680-73-2	0.0231[d]	1.98E-05	2.4E-05	1.0E-04	0.75E-06	1.80E-06	8.27E-06	1.98E-05
PCB 102	68194-06-9	0.0231[d]	1.99E-05	2.2E-05	5.0E-05	0.75E-06	1.81E-06	8.22E-06	1.99E-05
PCB 103	60145-21-3	0.0231[d]	2.00E-05	2.3E-05	5.0E-05	0.75E-06	1.82E-06	8.25E-06	2.00E-05
PCB 104	56558-16-8	0.0231[d]	1.11E-05	2.3E-05	5.0E-05	0.42E-06	1.01E-06	4.60E-06	1.11E-05
PCB 105	32598-14-4	0.092[e]	1.94E-06	1.1E-05	2.0E-06	0.73E-06	1.76E-06	8.06E-06	1.94E-06
PCB 106	70424-69-0	0.0231[d]	1.99E-05	1.4E-05	5.0E-05	0.75E-06	1.81E-06	8.22E-06	1.99E-05
PCB 107	70424-68-9	0.0231[d]	1.20E-05	2.7E-05	1.0E-04	0.75E-06	1.81E-06	8.24E-06	1.20E-05
PCB 108	70362-41-3	0.0231[d]	1.99E-05	1.5E-05	5.0E-05	0.75E-06	1.81E-06	8.27E-06	1.99E-05
PCB 109	74472-35-8	0.0231[d]	2.05E-05	1.0E-05	2.0E-05	0.75E-06	1.86E-06	8.25E-06	2.05E-05
PCB 110	38380-03-9	0.0231[d]	1.99E-05	2.4E-05	1.0E-04	0.75E-06	1.81E-06	8.20E-06	1.99E-05
PCB 111	39635-32-0	0.0231[d]	2.02E-06	2.4E-05	1.0E-04	0.75E-06	1.83E-06	8.24E-06	2.02E-06
PCB 112	74472-36-9	0.0231[d]	1.98E-05	2.5E-05	1.0E-04	0.75E-06	1.80E-06	8.22E-06	1.98E-05
PCB 113	68194-10-5	0.0231[d]	1.98E-05	2.4E-05	1.0E-04	0.75E-06	1.80E-06	8.27E-06	1.98E-05
PCB 114	74472-37-0	0.092[e]	1.88E-05	1.2E-05	5.0E-05	0.72E-06	1.71E-06	7.87E-06	1.88E-05
PCB 115	74472-38-1	0.0231[d]	2.06E-05	2.4E-05	1.0E-04	0.76E-06	1.87E-06	8.31E-06	2.06E-05
PCB 116	18259-05-7	0.0231[d]	1.98E-05	1.0E-05	2.0E-05	0.75E-06	1.80E-06	8.21E-06	1.98E-05
PCB 117	68194-11-6	0.0231[d]	2.03E-05	1.0E-05	2.0E-05	0.76E-06	1.85E-06	8.33E-06	2.03E-05
PCB 118	31508-00-6	0.092[e]	1.82E-05	1.9E-05	5.0E-05	0.69E-06	1.65E-06	7.57E-06	1.82E-05
PCB 119	56558-17-9	0.0231[d]	1.99E-05	1.5E-05	5.0E-05	0.75E-06	1.81E-06	8.27E-06	1.99E-05
PCB 120	68194-12-7	0.0231[d]	1.99E-05	1.5E-05	5.0E-05	0.75E-06	1.81E-06	8.23E-06	1.99E-05
PCB 121	56558-18-0	0.0231[d]	2.02E-05	2.1E-05	5.0E-05	0.75E-06	1.84E-06	8.25E-06	2.02E-05
PCB 122	76842-07-4	0.0231[d]	1.89E-05	1.2E-05	5.0E-05	0.72E-06	1.72E-06	7.96E-06	1.89E-05
PCB 123	65510-44-3	0.092[e]	1.97E-05	1.5E-05	5.0E-05	0.74E-06	1.79E-06	8.19E-06	1.97E-05
PCB 124	70424-70-3	0.0231[d]	1.20E-05	2.7E-05	1.0E-04	0.75E-06	1.81E-06	8.24E-06	1.20E-05

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Analyte	CAS Number	DQL (mg/kg ww)[a]	Project Quantitation Limit Goal (mg/kg ww)	Analytical Method[b]		Achievable Laboratory Limits (11 ±2-g sample)[c]		Achievable Laboratory Limits (1 g-sample)[c]	
				MDL (mg/kg ww)	Method QL (mg/kg ww)	MDL (mg/kg ww)	QL (mg/kg ww)	MDL (mg/kg ww)	QL (mg/kg ww)
PCB 125	74472-39-2	0.0231[d]	1.99E-05	1.5E-05	5.0E-05	0.75E-06	1.81E-06	8.27E-06	1.99E-05
PCB 126	57465-28-8	2.7E-05[e]	**4.02E-05**	1.4E-05	5.0E-05	1.43E-06	3.66E-06	1.57E-05	**4.02E-05**
PCB 127	39635-33-1	0.0231[d]	1.96E-05	2.8E-05	1.0E-04	0.73E-06	1.78E-06	8.05E-06	1.96E-05
PCB 128	38380-07-3	0.0231[d]	3.59E-05	1.2E-05	5.0E-05	1.26E-06	3.26E-06	1.39E-05	3.59E-05
PCB 129	55215-18-4	0.0231[d]	1.24E-05	2.1E-05	5.0E-05	0.45E-06	1.12E-06	5.00E-06	1.24E-05
PCB 130	52663-66-8	0.0231[d]	1.31E-05	1.4E-05	5.0E-05	0.49E-06	1.19E-06	5.35E-06	1.31E-05
PCB 131	61798-70-7	0.0231[d]	1.23E-05	1.2E-05	5.0E-05	0.45E-06	1.12E-06	5.00E-06	1.23E-05
PCB 132	38380-05-1	0.0231[d]	1.23E-05	1.2E-05	5.0E-05	0.45E-06	1.12E-06	4.99E-06	1.23E-05
PCB 133	35694-04-3	0.0231[d]	1.23E-05	1.7E-05	5.0E-05	0.45E-06	1.12E-06	4.99E-06	1.23E-05
PCB 134	52704-70-8	0.0231[d]	1.34E-05	1.3E-05	5.0E-05	0.5E-06	1.22E-06	5.48E-06	1.34E-05
PCB 135	52744-13-5	0.0231[d]	1.22E-05	1.1E-05	5.0E-05	0.45E-06	1.11E-06	4.97E-06	1.22E-05
PCB 136	38411-22-2	0.0231[d]	9.95E-06	9.E-06	2.0E-05	0.37E-06	0.90E-06	4.06E-06	9.95E-06
PCB 137	35694-06-5	0.0231[d]	1.22E-05	3.0E-05	1.0E-04	0.45E-06	1.11E-06	4.92E-06	1.22E-05
PCB 138	35065-28-2	0.0231[d]	1.24E-05	2.1E-05	5.0E-05	0.45E-06	1.12E-06	5.00E-06	1.24E-05
PCB 139	56030-56-9	0.0231[d]	1.22E-05	2.0E-05	5.0E-05	0.45E-06	1.11E-06	4.93E-06	1.22E-05
PCB 140	59291-64-4	0.0231[d]	1.22E-05	2.0E-05	5.0E-05	0.45E-06	1.11E-06	4.93E-06	1.22E-05
PCB 141	52712-04-6	0.0231[d]	1.23E-05	9.E-06	2.0E-05	0.45E-06	1.12E-06	4.98E-06	1.23E-05
PCB 142	41411-61-4	0.0231[d]	1.27E-05	3.1E-05	1.0E-04	0.47E-06	1.16E-06	5.19E-06	1.27E-05
PCB 143	68194-15-0	0.0231[d]	1.23E-05	1.3E-05	5.0E-05	0.46E-06	1.12E-06	5.03E-06	1.23E-05
PCB 144	68194-14-9	0.0231[d]	1.25E-05	1.7E-05	5.0E-05	0.46E-06	1.13E-06	5.07E-06	1.25E-05
PCB 145	74472-40-5	0.0231[d]	9.45E-06	3.2E-05	1.0E-04	0.35E-06	0.86E-06	3.84E-06	9.45E-06
PCB 146	51908-16-8	0.0231[d]	1.23E-05	1.8E-05	5.0E-05	0.45E-06	1.12E-06	4.98E-06	1.23E-05
PCB 147	68194-13-8	0.0231[d]	1.22E-05	1.8E-05	5.0E-05	0.45E-06	1.11E-06	4.94E-06	1.22E-05
PCB 148	74472-41-6	0.0231[d]	1.22E-05	3.2E-05	1.0E-04	0.45E-06	1.11E-06	4.97E-06	1.22E-05
PCB 149	38380-04-0	0.0231[d]	1.22E-05	1.8E-05	5.0E-05	0.45E-06	1.11E-06	4.94E-06	1.22E-05
PCB 150	68194-08-1	0.0231[d]	9.58E-06	3.3E-05	1.0E-04	0.35E-06	0.87E-06	3.90E-06	9.58E-06

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Analyte	CAS Number	DQL (mg/kg ww)[a]	Project Quantitation Limit Goal (mg/kg ww)	Analytical Method[b]		Achievable Laboratory Limits (11 ±2-g sample)[c]		Achievable Laboratory Limits (1 g-sample)[c]	
				MDL (mg/kg ww)	Method QL (mg/kg ww)	MDL (mg/kg ww)	QL (mg/kg ww)	MDL (mg/kg ww)	QL (mg/kg ww)
PCB 151	52663-63-5	0.0231[d]	1.22E-05	1.1E-05	5.0E-05	0.45E-06	1.11E-06	4.97E-06	1.22E-05
PCB 152	68194-09-2	0.0231[d]	9.50E-06	2.4E-05	1.0E-04	0.35E-06	0.86E-06	3.86E-06	9.50E-06
PCB 153	35065-27-1	0.0231[d]	1.21E-05	1.3E-05	5.0E-05	0.44E-06	1.10E-06	4.85E-06	1.21E-05
PCB 154	60145-22-4	0.0231[d]	1.21E-05	1.1E-05	5.0E-05	0.44E-06	1.10E-06	4.89E-06	1.21E-05
PCB 155	33979-03-2	0.0231[d]	9.55E-06	3.4E-05	1.0E-04	0.35E-06	0.87E-06	3.88E-06	9.55E-06
PCB 156	38380-08-4	0.092[e]	4.95E-05	1.3E-05	5.0E-05	1.74E-06	4.50E-06	1.91E-05	4.95E-05
PCB 157	69782-90-7	0.092[e]	4.95E-05	1.3E-05	5.0E-05	1.74E-06	4.50E-06	1.91E-05	4.95E-05
PCB 158	74472-42-7	0.0231[d]	1.22E-05	1.1E-05	2.0E-05	0.44E-06	1.11E-06	4.88E-06	1.22E-05
PCB 159	39635-35-3	0.0231[d]	3.62E-05	3.5E-05	1.0E-04	1.27E-06	3.29E-06	1.39E-05	3.62E-05
PCB 160	41411-62-5	0.0231[d]	1.22E-05	2.1E-05	5.0E-05	0.45E-06	1.11E-06	4.91E-06	1.22E-05
PCB 161	74472-43-8	0.0231[d]	1.22E-05	3.5E-05	1.0E-04	0.44E-06	1.10E-06	4.82E-06	1.22E-05
PCB 162	39635-34-2	0.0231[d]	3.66E-05	3.5E-05	1.0E-04	1.27E-06	3.33E-06	1.40E-05	3.66E-05
PCB 163	74472-44-9	0.0231[d]	1.24E-05	2.1E-05	5.0E-05	0.45E-06	1.12E-06	5.00E-06	1.24E-05
PCB 164	74472-45-0	0.0231[d]	1.22E-05	1.4E-05	5.0E-05	0.44E-06	1.11E-06	4.82E-06	1.22E-05
PCB 165	74472-46-1	0.0231[d]	1.22E-05	3.6E-05	1.0E-04	0.45E-06	1.11E-06	4.90E-06	1.22E-05
PCB 166	41411-63-6	0.0231[d]	3.59E-05	1.2E-05	5.0E-05	1.26E-06	3.26E-06	1.39E-05	3.59E-05
PCB 167	52663-72-6	0.092	3.92E-05	1.1E-05	5.0E-05	1.27E-06	3.29E-06	1.39E-05	3.92E-05
PCB 168	59291-65-5	0.0231[d]	1.21E-05	1.3E-05	5.0E-05	0.44E-06	1.10E-06	4.85E-06	1.21E-05
PCB 169	32774-16-6	9.2E-05[e]	5.28E-05	1.6E-05	5.0E-05	1.82E-06	4.80E-06	2.01E-05	5.28E-05
PCB 170	35065-30-6	0.0231[d]	3.49E-05	1.6E-05	5.0E-05	1.28E-06	3.18E-06	1.41E-05	3.49E-05
PCB 171	52663-71-5	0.0231[d]	2.96E-05	3.7E-05	1.0E-04	1.1E-06	2.69E-06	1.21E-05	2.96E-05
PCB 172	52663-74-8	0.0231[d]	2.93E-05	3.8E-05	1.0E-04	1.1E-06	2.67E-06	1.20E-05	2.93E-05
PCB 173	68194-16-1	0.0231[d]	2.96E-05	3.7E-05	1.0E-04	1.1E-06	2.69E-06	1.21E-05	2.96E-05
PCB 174	38411-25-5	0.0231[d]	2.96E-05	1.9E-05	5.0E-05	1.1E-06	2.69E-06	1.21E-05	2.96E-05
PCB 175	40186-70-7	0.0231[d]	2.97E-05	3.8E-05	1.0E-04	1.1E-06	2.70E-06	1.21E-05	2.97E-05
PCB 176	52663-65-7	0.0231[d]	9.93E-06	3.9E-05	1.0E-04	0.37E-06	0.90E-06	4.10E-06	9.93E-06

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Analyte	CAS Number	DQL (mg/kg ww)[a]	Project Quantitation Limit Goal (mg/kg ww)	Analytical Method[b]		Achievable Laboratory Limits (11 ±2-g sample)[c]		Achievable Laboratory Limits (1 g-sample)[c]	
				MDL (mg/kg ww)	Method QL (mg/kg ww)	MDL (mg/kg ww)	QL (mg/kg ww)	MDL (mg/kg ww)	QL (mg/kg ww)
PCB 177	52663-70-4	0.0231[d]	2.94E-05	1.4E-05	5.0E-05	1.10E-06	2.67E-06	1.22E-05	2.94E-05
PCB 178	52663-67-9	0.0231[d]	1.32E-05	2.2E-05	5.0E-05	0.48E-06	1.20E-06	5.31E-06	1.32E-05
PCB 179	52663-64-6	0.0231[d]	1.15E-05	2.3E-05	5.0E-05	0.43E-06	1.04E-06	4.68E-06	1.15E-05
PCB 180	35065-29-3	0.0231[d]	3.04E-05	1.4E-05	5.0E-05	1.11E-06	2.76E-06	1.22E-05	3.04E-05
PCB 181	74472-47-2	0.0231[d]	3.03E-05	4.0E-05	1.0E-04	1.11E-06	2.75E-06	1.22E-05	3.03E-05
PCB 182	60145-23-5	0.0231[d]	3.02E-05	4.0E-05	1.0E-04	1.11E-06	2.74E-06	1.22E-05	3.02E-05
PCB 183	52663-69-1	0.0231[d]	3.10E-05	4.0E-05	1.0E-04	1.12E-06	2.81E-06	1.23E-05	3.10E-05
PCB 184	74472-48-3	0.0231[d]	1.14E-05	4.0E-05	1.0E-04	0.42E-06	1.04E-06	4.66E-06	1.14E-05
PCB 185	52712-05-7	0.0231[d]	3.06E-05	4.0E-05	1.0E-04	1.11E-06	2.78E-06	1.22E-05	3.06E-05
PCB 186	74472-49-4	0.0231[d]	1.23E-05	4.1E-05	1.0E-04	0.45E-06	1.11E-06	4.97E-06	1.23E-05
PCB 187	52663-68-0	0.0231[d]	3.01E-05	1.9E-05	5.0E-05	1.11E-06	2.73E-06	1.22E-05	3.01E-05
PCB 188	74487-85-7	0.0231[d]	1.05E-05	2.3E-05	5.0E-05	0.39E-06	0.95E-06	4.32E-06	1.05E-05
PCB 189	39635-31-9	0.092[e]	1.92E-05	1.8E-05	5.0E-05	0.75E-06	1.75E-06	8.29E-06	1.92E-05
PCB 190	41411-64-7	0.0231[d]	3.60E-05	2.3E-05	5.0E-05	1.29E-06	3.27E-06	1.42E-05	3.60E-05
PCB 191	74472-50-7	0.0231[d]	3.01E-05	4.2E-05	1.0E-04	1.10E-06	2.73E-06	1.21E-05	3.01E-05
PCB 192	74472-51-8	0.0231[d]	2.96E-05	4.2E-05	1.0E-04	1.10E-06	2.69E-06	1.21E-05	2.96E-05
PCB 193	69782-91-8	0.0231[d]	3.04E-05	1.4E-05	5.0E-05	1.11E-06	2.76E-06	1.22E-05	3.04E-05
PCB 194	35694-08-7	0.0231[d]	1.86E-05	1.7E-05	5.0E-05	0.73E-06	1.69E-06	8.01E-06	1.86E-05
PCB 195	52663-78-2	0.0231[d]	1.87E-05	4.3E-05	1.0E-04	0.73E-06	1.70E-06	8.08E-06	1.87E-05
PCB 196	42740-50-1	0.0231[d]	9.11E-06	4.3E-05	1.0E-04	0.36E-06	0.83E-06	3.95E-06	9.11E-06
PCB 197	33091-17-7	0.0231[d]	9.57E-06	2.5E-05	1.0E-04	0.36E-06	0.87E-06	3.95E-06	9.57E-06
PCB 198	68194-17-2	0.0231[d]	9.18E-06	2.0E-05	1.0E-04	0.37E-06	0.83E-06	4.08E-06	9.18E-06
PCB 199	52663-75-9	0.0231[d]	9.18E-06	2.0E-05	1.0E-04	0.37E-06	0.83E-06	4.08E-06	9.18E-06
PCB 200	52663-73-7	0.0231[d]	9.25E-06	2.5E-05	1.0E-04	0.36E-06	0.84E-06	3.94E-06	9.25E-06
PCB 201	40186-71-8	0.0231[d]	9.32E-06	4.4E-05	1.0E-04	0.36E-06	0.85E-06	3.94E-06	9.32E-06
PCB 202	2136-99-4	0.0231[d]	9.20E-06	4.4E-05	1.0E-04	0.35E-06	0.84E-06	3.90E-06	9.20E-06

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Analyte	CAS Number	DQL (mg/kg ww)[a]	Project Quantitation Limit Goal (mg/kg ww)	Analytical Method[b]		Achievable Laboratory Limits (11 ±2-g sample)[c]		Achievable Laboratory Limits (1 g-sample)[c]	
				MDL (mg/kg ww)	Method QL (mg/kg ww)	MDL (mg/kg ww)	QL (mg/kg ww)	MDL (mg/kg ww)	QL (mg/kg ww)
PCB 203	52663-76-0	0.0231[d]	9.10E-06	4.4E-05	1.0E-04	0.36E-06	0.83E-06	3.99E-06	9.10E-06
PCB 204	74472-52-9	0.0231[d]	9.29E-06	4.5E-05	1.0E-04	0.36E-06	0.84E-06	3.94E-06	9.29E-06
PCB 205	74472-53-0	0.0231[d]	1.78E-05	4.5E-05	1.0E-04	0.69E-06	1.62E-06	7.60E-06	1.78E-05
PCB 206	40186-72-9	0.0231[d]	3.84E-05	4.5E-05	1.0E-04	1.55E-06	3.49E-06	1.71E-05	3.84E-05
PCB 207	52663-79-3	0.0231[d]	3.04E-05	4.5E-05	1.0E-04	1.19E-06	2.77E-06	1.31E-05	3.04E-05
PCB 208	52663-77-1	0.0231[d]	3.00E-05	4.6E-05	1.0E-04	1.19E-06	2.73E-06	1.31E-05	3.00E-05
PCB 209	2051-24-3	0.0231[d]	1.25E-06	1.5E-05	5.0E-05	0.48E-06	1.13E-06	5.31E-06	1.25E-06

Note: Project data will be reported in units appropriate to the analytical method.

[a] DQLs have not been approved by USEPA. DQLs based on the lowest available ecological tissue thresholds based on tissue-residue TRVs (if available) including TRVs derived for the protection of benthos and fish as well as dietary TRVs for the protection of wildlife receptors. See Attachment K for benthos, fish, and wildlife thresholds used to derive DQLs. DQLs (including ecological thresholds presented in Attachment K) are very conservative, generic analytical goals used solely for the purpose of evaluating laboratory analytical methods and achievable laboratory limits; these are not project-specific screening levels or PRGs. These values will be developed in subsequent phases of the project.

[b] Analytical MDLs and QLs are those documented in validated methods.

[c] Achievable MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method. Actual MDLs and QLs will vary based on sample-specific factors. For PCBs, the MDL and QL are based on extraction of 11 ±2-g samples. The MDLs and QLs for the 1-g samples were determined by multiplying the MDLs and QLs for the 11 ± 2-g samples by a factor of 11. The laboratory detection limit will be based on the sample specific EDL. Actual EDLs will vary based on sample-specific factors, including sample mass.

[d] The DQL was based on risk for total PCBs. DQLs have not been approved by USEPA.

[e] DQLs for the twelve dioxin-like PCB congeners calculated by dividing the 2,3,7,8-TCDD DQL by its respective mammal or bird toxic equivalence factor as cited in Van den Berg et al (1998) and (2006), respectively. DQLs have not been approved by USEPA.

CAS – Chemical Abstract Service
DQL – data quality level
EDL – estimated detection limit
MDL – method detection limit
PCB – polychlorinated biphenyl
PRG – preliminary remediation goal
QL – quantitation limit
TRV – toxicity reference value
USEPA – US Environmental Protection Agency
ww – wet weight

Bold indicates chemicals for which the achievable laboratory limits exceed the DQL.

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Matrix: Tissue

Analytical Group, Method, and Laboratory: PCBs – Aroclors, USEPA SW-846 8082, Alpha Analytical, Mansfield, MA

SOP from Worksheet 23: M35

Concentration Level: Low

Analyte	CAS Number	DQL (mg/kg ww)[a]	Project Quantitation Limit Goal (mg/kg ww)	Analytical Method[b]		Achievable Laboratory Limits[c]	
				MDL (mg/kg ww)	Method QL (mg/kg ww)	MDL (mg/kg)	QL (mg/kg)
Aroclor 1016	12674-11-2	0.0231[d]	0.004	NA	NA	0.001	0.004
Aroclor 1221	11104-28-2	0.0231[d]	0.004	NA	NA	0.002	0.004
Aroclor 1232	11141-16-5	0.0231[d]	0.004	NA	NA	0.002	0.004
Aroclor 1242	53469-21-9	0.0231[d]	0.004	NA	NA	0.001	0.004
Aroclor 1248	12672-29-6	0.0231[d]	0.004	NA	NA	0.001	0.004
Aroclor 1254	11097-69-1	0.0231[d]	0.004	NA	NA	0.001	0.004
Aroclor 1260	11096-82-5	0.0231[d]	0.004	NA	NA	0.002	0.004
Aroclor 1262	37324-23-5	0.0231[d]	0.004	NA	NA	0.002	0.004
Aroclor 1268	11100-14-4	0.0231[d]	0.004	NA	NA	0.002	0.004

Note: Project data will be reported in units appropriate to the analytical method.

[a] DQLs have not been approved by USEPA. DQLs based on the lowest available ecological tissue thresholds based on tissue-residue TRVs (if available) including TRVs derived for the protection of benthos and fish as well as dietary TRVs for the protection of wildlife receptors. See Attachment K for benthos, fish, and wildlife thresholds used to derive DQLs. DQLs (including ecological thresholds presented in Attachment K) are very conservative, generic analytical goals used solely for the purpose of evaluating laboratory analytical methods and achievable laboratory limits; these are not project-specific screening levels or PRGs. These values will be developed in subsequent phases of the project.

[b] Analytical MDLs and QLs are those documented in validated methods. When the method did not publish a value for either the MDL or QL, the value was determined to be NA.

[c] Achievable MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method. Actual MDLs and QLs will vary based on sample-specific factors, including sample mass. Tissue QL and MDL is based on sediment QL and MDL. The laboratory conducts MDL studies with spikes that go through the extraction and analytical process; therefore, dry weight or wet weight units do not apply.

[d] The DQL was based on risk for total PCBs. DQLs have not been approved by USEPA.

CAS – Chemical Abstract Service
DQL – data quality level
PCB – polychlorinated biphenyl
PRG – preliminary remediation goal
USEPA – US Environmental Protection Agency
ww – wet weight

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Analyte	CAS Number	DQL (mg/kg ww)[a]	Project Quantitation Limit Goal (mg/kg ww)	Analytical Method[b]		Achievable Laboratory Limits[c]	
				MDL (mg/kg ww)	Method QL (mg/kg ww)	MDL (mg/kg)	QL (mg/kg)

MDL – method detection limit
NA – not available
QL – quantitation limit
TRV – toxicity reference value

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Matrix: Tissue

Analytical Group, Method, and Laboratory: PCDDs/PCDFs, USEPA 1613B, Analytical Perspectives, Wilmington, NC

SOP from Worksheet 23: M3

Concentration Level: Low

Analyte	CAS Number	DQL (mg/kg ww)[a]	Project Quantitation Limit Goal (mg/kg ww)	Analytical Method[b]		Achievable Laboratory Limits[c]	
				MDL (mg/kg ww)	Method QL (mg/kg ww)	MDLs (mg/kg ww)	QLs (mg/kg ww)
1,2,3,4,6,7,8-HpCDD	35822-46-9	2.75E-04[d]	5.70E-07	NA	5.00E-06	2.10E-07	5.70E-07
1,2,3,4,6,7,8-HpCDF	67562-39-4	1.95E-04[d]	2.10E-07	NA	5.00E-06	8.70E-08	2.10E-07
1,2,3,4,7,8-HxCDD	39227-28-6	1.95E-06[d]	6.60E-07	NA	5.00E-06	2.73E-07	6.60E-07
1,2,3,4,7,8-HxCDF	70648-26-9	1.95E-05[d]	1.89E-07	NA	5.00E-06	7.80E-08	1.89E-07
1,2,3,4,7,8,9-HpCDF	55673-89-7	1.95E-04[d]	3.00E-07	NA	5.00E-06	1.26E-07	3.00E-07
1,2,3,6,7,8-HxCDD	57653-85-7	2.75E-05[d]	6.60E-07	NA	5.00E-06	2.73E-07	6.60E-07
1,2,3,6,7,8-HxCDF	57117-44-9	1.95E-05[d]	1.80E-07	NA	5.00E-06	7.50E-08	1.80E-07
1,2,3,7,8,9-HxCDD	19408-74-3	2.75E-05[d]	6.90E-07	NA	5.00E-06	2.82E-07	6.90E-07
1,2,3,7,8,9-HxCDF	72918-21-9	1.95E-05[d]	2.31E-07	NA	5.00E-06	9.60E-08	2.31E-07
1,2,3,7,8-PeCDD	40321-76-4	1.95E-06[d]	5.31E-07	NA	5.00E-06	2.19E-07	5.31E-07
1,2,3,7,8-PeCDF	57117-41-6	3.9E-05[d]	4.89E-07	NA	5.00E-06	1.98E-07	4.89E-07
2,3,4,6,7,8-HxCDF	60851-34-5	1.95E-05[d]	2.01E-07	NA	5.00E-06	8.10E-08	2.01E-07
2,3,4,7,8-PeCDF	57117-31-4	3.9E-06[d]	4.41E-07	NA	5.00E-06	1.77E-07	4.41E-07
2,3,7,8-TCDD	1746-01-6	1.95E-06	2.10E-07	NA	1.00E-06	9.90E-08	2.10E-07
2,3,7,8-TCDF	51207-31-9	1.2E-05[d]	2.94E-07	NA	1.00E-06	1.20E-07	2.94E-07
OCDD	3268-87-9	9.16E-03[d]	9.60E-07	NA	1.00E-05	3.60E-07	9.60E-07
OCDF	39001-02-0	9.2E-03[d]	9.00E-07	NA	1.00E-05	3.60E-07	9.00E-07

Note: Project data will be reported in units appropriate to the analytical method.

[a] DQLs have not been approved by USEPA. DQLs based on the lowest available ecological tissue thresholds based on tissue-residue TRVs (if available) including TRVs derived for the protection of benthos and fish as well as dietary TRVs for the protection of wildlife receptors. See Attachment K for benthos, fish, and wildlife thresholds used to derive DQLs. DQLs (including ecological thresholds presented in Attachment K) are very conservative, generic analytical goals used solely for the purpose of evaluating laboratory analytical methods and achievable laboratory limits; these are not project-specific screening levels or PRGs. These values will be developed in subsequent phases of the project.

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Analyte	CAS Number	DQL (mg/kg ww)[a]	Project Quantitation Limit Goal (mg/kg ww)	Analytical Method[b]		Achievable Laboratory Limits[c]	
				MDL (mg/kg ww)	Method QL (mg/kg ww)	MDLs (mg/kg ww)	QLs (mg/kg ww)

[b] Analytical MDLs and QLs are those documented in validated methods. When the method did not publish a value for either the MDL or QL, the value was determined to be NA.

[c] Achievable MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method. Actual MDLs and QLs will vary based on sample-specific factors, including sample mass. For PCDDs/PCDFs, the MDL and QL are based on extraction of 10 grams/sample. The laboratory detection limit will be based on the sample specific EDL. Actual EDLs will vary based on sample-specific factors, including sample mass.

[d] DQLs for individual PCDDs/ PCDFs calculated by dividing the 2,3,7,8-TCDD DQL by its respective mammal or bird toxic equivalence factor as cited in Van den Berg et al. (1998) and (2006), respectively. DQLs have not been approved by USEPA.

CAS – Chemical Abstract Service
DQL – data quality level
EDL – estimated detection limit
HpCDD – heptachlorodibenzo-*p*-dioxin
HpCDF – heptachlorodibenzofuran
HxCDD – hexachlorodibenzo-*p*-dioxin
HxCDF – hexachlorodibenzofuran
MDL – method detection limit
NA – not available
OCDD – octachlorodibenzo-*p*-dioxin
OCDF – octachlorodibenzofuran
PCDD – polychlorinated dibenzo-*p*-dioxin
PCDF – polychlorinated dibenzofuran
PeCDD – pentachlorodibenzo-*p*-dioxin
PeCDF – pentachlorodibenzofuran
PRG – preliminary remediation goal
QL – quantitation limit
TCDD – tetrachlorodibenzo-*p*-dioxin
TCDF – tetrachlorodibenzofuran
TRV – toxicity reference value
USEPA – US Environmental Protection Agency
ww – wet weight

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Matrix: Tissue

Analytical Group, Method, and Laboratory: PAHs, CARB 429 Modified, Maxxam Analytics, Mississauga, ON

SOP from Worksheet 23: M4

Concentration Level: Low

Analyte	CAS Number	DQL (mg/kg ww)[a]	Project Quantitation Limit Goal (mg/kg ww)	Analytical Method[b]		Achievable Laboratory Limits[c]	
				MDL (mg/kg ww)	Method QL (mg/kg ww)	MDL (mg/kg ww)	QL (mg/kg ww)
2-Methylnaphthalene	91-57-6	337	0.001	NA	NA	0.0001216	0.001
Acenaphthene	83-32-9	0.24[d]	0.001	NA	NA	0.0001186	0.001
Acenaphthylene	208-96-8	0.24[d]	0.001	NA	NA	0.0001331	0.001
Anthracene	120-12-7	0.24	0.001	NA	NA	0.0000792	0.001
Fluorene	86-73-7	0.24[d]	0.001	NA	NA	0.0003043	0.001
Naphthalene	91-20-3	0.24[d]	0.001	NA	NA	0.0001165	0.001
Phenanthrene	85-01-8	0.24[d]	0.001	NA	NA	0.0001246	0.001
Benzo[a]anthracene	56-55-3	0.24[d]	0.001	NA	NA	0.0001307	0.001
Benzo[a]pyrene	50-32-8	0.24[d]	0.001	NA	NA	0.0002381	0.001
Benzo[b]fluoranthene	205-99-2	0.24[d]	0.001	NA	NA	0.0002573	0.001
Benzo[e]pyrene	192-97-2	NA[e]	0.001	NA	NA	0.0000994	0.001
Benzo[g,h,i]perylene	191-24-2	0.24[d]	0.001	NA	NA	0.0001359	0.001
Benzo[k]fluoranthene[f]	207-08-9	0.24[d]	0.001	NA	NA	0.0001935	0.001
Chrysene	218-01-9	0.24[d]	0.001	NA	NA	0.0002475	0.001
Dibenzo[a,h]anthracene	53-70-3	0.24[d]	0.001	NA	NA	0.0001729	0.001
Fluoranthene	206-44-0	0.24[d]	0.001	NA	NA	0.0003043	0.001
Indeno-[1,2,3c,d]pyrene	193-39-5	0.24[d]	0.001	NA	NA	0.0002026	0.001
Perylene	198-55-0	NA[e]	0.001	NA	NA	0.0001281	0.001
1-Methylnaphthalene	90-12-0	937	0.001	NA	NA	0.0001152	0.001
1-Methylphenanthrene	832-69-9	NA[e]	0.001	NA	NA	0.0000721	0.001
2,3,5-Trimethylnaphthalene	2245-38-7	NA[e]	0.001	NA	NA	0.0001275	0.001
2,6-Dimethylnaphthalene	581-42-0	NA[e]	0.001	NA	NA	0.0001006	0.001
Dibenzothiophene	132-65-0	293	0.001	NA	NA	0.0001031	0.001

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Analyte	CAS Number	DQL (mg/kg ww)[a]	Project Quantitation Limit Goal (mg/kg ww)	Analytical Method[b]		Achievable Laboratory Limits[c]	
				MDL (mg/kg ww)	Method QL (mg/kg ww)	MDL (mg/kg ww)	QL (mg/kg ww)
Pyrene	129-00-0	0.24[d]	0.001	NA	NA	0.0002738	0.001

Note: Project data will be reported in units appropriate to the analytical method.

[a] DQLs have not been approved by USEPA. DQLs based on the lowest available ecological tissue thresholds based on tissue-residue TRVs (if available) including TRVs derived for the protection of benthos and fish as well as dietary TRVs for the protection of wildlife receptors. See Attachment K for benthos, fish, and wildlife thresholds used to derive DQLs. DQLs (including ecological thresholds presented in Attachment K) are very conservative, generic analytical goals used solely for the purpose of evaluating laboratory analytical methods and achievable laboratory limits; these are not project-specific screening levels or PRGs. These values will be developed in subsequent phases of the project.

[b] Analytical MDLs and QLs are those documented in validated methods. When the method did not publish a value for either the MDL or QL, the value was determined to be NA.

[c] Achievable MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method. Actual MDLs and QLs will vary based on sample-specific factors, including sample mass. Tissue RL and MDL is based on sediment RL and MDL.

[d] The DQL for this analyte was based on the DQL for anthracene. DQLs have not been approved by USEPA.

[e] A DQL or project quantitation limit goal could not be established because no toxicity thresholds were available.

[f] Benzo[k]fluoranthene will be reported by the laboratory with a C-qualifier, indicating that it co-elutes with benzo[j]fluoranthene.

CARB – California Air Resources Board
CAS – Chemical Abstract Service
DQL – data quality level
MDL – method detection limit
NA – not available
PAH – polycyclic aromatic hydrocarbon
PRG – preliminary remediation goal
QL – quantitation limit
RL – reporting limit
TRV – toxicity reference value
ww – wet weight

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Matrix: Tissue

Analytical Group, Method, and Laboratory: Alkylated PAHs, USEPA SW-846 8270D, Alpha Analytical, Mansfield, MA

SOP from Worksheet 23: M43, M46

Concentration Level: Low

Analyte	CAS Number	DQL (mg/kg ww)[a]	Project Quantitation Limit Goal (mg/kg ww)	Analytical Method[b]		Achievable Laboratory Limits[c]	
				MDL (mg/kg ww)	Method QL (mg/kg ww)	MDL (mg/kg)	QL (mg/kg)
C2-Alkylnaphthalenes	NA	0.24	0.001	NA	NA	0.00009	0.001
C3-Alkylnaphthalenes	NA	0.24	0.001	NA	NA	0.00009	0.001
C1-Benzanthracene/chrysenes	NA	0.24	0.001	NA	NA	0.00016	0.001
C1-Dibenzothiophenes	NA	0.24	0.001	NA	NA	0.00016	0.001
C1-Fluorenes	NA	0.24	0.001	NA	NA	0.00008	0.001
C1-Phenanthrene/anthracenes	NA	0.24	0.001	NA	NA	0.00012	0.001
C1-Pyrene/fluoranthenes	NA	0.24	0.001	NA	NA	0.00017	0.001
C2-Benzanthracene/chrysenes	NA	0.24	0.001	NA	NA	0.00016	0.001
C2-Dibenzothiophenes	NA	293	0.001	NA	NA	0.00006	0.001
C2-Fluorenes	NA	0.24	0.001	NA	NA	0.00008	0.001
C2-Naphthalenes	NA	0.24	0.001	NA	NA	0.00016	0.001
C2-Phenanthrene/anthracenes	NA	0.24	0.001	NA	NA	0.00016	0.001
C3-Benzanthracene/chrysenes	NA	0.24	0.001	NA	NA	0.00016	0.001
C3-Dibenzothiophenes	NA	293	0.001	NA	NA	0.00016	0.001
C3-Fluorenes	NA	0.24	0.001	NA	NA	0.00008	0.001
C3-Naphthalenes	NA	0.24	0.001	NA	NA	0.00016	0.001
C3-Phenanthrene/anthracenes	NA	0.24	0.001	NA	NA	0.00012	0.001
C4-Benzanthracene/chrysenes	NA	0.24	0.001	NA	NA	0.00016	0.001
C4-Dibenzothiophenes	NA	293	0.001	NA	NA	0.00016	0.001
C4-Naphthalenes	NA	0.24	0.001	NA	NA	0.00016	0.001
C4-Phenanthrenes/anthracenes	NA	0.24	0.001	NA	NA	0.00016	0.001

Note: Project data will be reported in units appropriate to the analytical method

[a] DQLs have not been approved by USEPA. DQLs based on the lowest available ecological tissue thresholds based on tissue-residue TRVs

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Analyte	CAS Number	DQL (mg/kg ww)[a]	Project Quantitation Limit Goal (mg/kg ww)	Analytical Method[b]		Achievable Laboratory Limits[c]	
				MDL (mg/kg ww)	Method QL (mg/kg ww)	MDL (mg/kg)	QL (mg/kg)

(if available) including TRVs derived for the protection of benthos and fish as well as dietary TRVs for the protection of wildlife receptors. See Attachment K for benthos, fish, and wildlife thresholds used to derive DQLs. DQLs (including ecological thresholds presented in Attachment K) are very conservative, generic analytical goals used solely for the purpose of evaluating laboratory analytical methods and achievable laboratory limits; these are not project-specific screening levels or PRGs. These values will be developed in subsequent phases of the project. DQLs for alkylated PAHs were based on the DQLs presented for the parent PAH, using the lowest of the two parents when two were present.

[b] Analytical MDLs and QLs are those documented in validated methods. When the method did not publish a value for either the MDL or QL, the value was determined to be NA.

[c] Achievable MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method. Actual MDLs and QLs will vary based on sample-specific factors. The MDL and QLs are the MDLs and QLs for the parent compound. Tissue MDLs and QLs are based on sediment MDLs and QLs. The laboratory conducts MDL studies with spikes that go through the extraction and analytical process; therefore, dry weight or wet weight units do not apply.

CAS – Chemical Abstract Service
DQL – data quality level
dw – dry weight
MDL – method detection limit
NA – not available
PAH – polycyclic aromatic hydrocarbon
PRG – preliminary remediation goal
QL – quantitation limit
TRV – toxicity reference value
USEPA – US Environmental Protection Agency
ww – wet weight

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Matrix: Tissue

Analytical Group, Method, and Laboratory: Organochlorine Pesticides, USEPA 1699 Modified (NYSDEC HRMS-2), Maxxam Analytics, Mississauga, ON

SOP from Worksheet 23: M5, M6, M7

Concentration Level: Low

Analyte	CAS Number	DQL (mg/kg ww)[a]	Project Quantitation Limit Goal (mg/kg ww)	Analytical Method[b]		Achievable Laboratory Limits[c]	
				MDL (mg/kg ww)	Method QL (mg/kg ww)	MDLs (mg/kg ww)	QLs (mg/kg ww)
2,4'-DDD	53-19-0	0.046	0.0001	NA	NA	0.0000604	0.0001
2,4'-DDE	3424-82-6	0.046	0.0001	NA	NA	0.0000376	0.0001
2,4'-DDT	789-02-6	0.026	0.0001	NA	NA	0.0000113	0.0001
4,4'-DDD	72-54-8	0.046	0.0001	NA	NA	0.0000197	0.0001
4,4'-DDE	72-55-9	0.046	0.0001	NA	NA	0.0000200	0.0001
4,4'-DDT	50-29-3	0.026	0.0001	NA	NA	0.0000156	0.0001
Aldrin	309-00-2	0.0069	0.0001	NA	NA	0.0000151	0.0001
alpha-BHC	319-84-6	1.37	0.0001	NA	NA	0.0000152	0.0001
beta-BHC	319-85-7	1.37[d]	0.0001	NA	NA	0.0000177	0.0001
cis-Chlordane	5103-71-9	0.49[e]	0.0001	NA	NA	0.0000525	0.0001
cis-Nonachlor	5103-73-1	0.49	0.0001	NA	NA	0.0000655	0.0001
delta-BHC	319-86-8	1.37[d]	0.0001	NA	NA	0.0000221	0.0001
Dieldrin	60-57-1	0.057	0.0001	NA	NA	0.0000338	0.0001
Endosulfan I	959-98-8	0.031	0.0001	NA	NA	0.0000939	0.0001
Endosufan II	33213-65-9	0.031[f]	0.0002	NA	NA	0.0000661	0.0002
Endosulfan sulfate	1031-07-8	0.031[f]	0.0001	NA	NA	0.0000170	0.0001
Endrin	72-20-8	0.010	0.0001	NA	NA	0.0000307	0.0001
Endrin aldehyde	7421-93-4	0.010[g]	0.0001	NA	NA	0.0000531	0.0001
Endrin ketone	53494-70-5	0.010[g]	0.0001	NA	NA	0.0000296	0.0001
gamma-BHC (Lindane)	58-89-9	1.37[d]	0.0001	NA	NA	0.0000123	0.0001
Hexachlorobenzene	118-74-1	0.16	0.0001	NA	NA	0.0000049	0.0001
Heptachlor	76-44-8	0.086[h]	0.0001	NA	NA	0.0000124	0.0001

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Analyte	CAS Number	DQL (mg/kg ww)[a]	Project Quantitation Limit Goal (mg/kg ww)	Analytical Method[b]		Achievable Laboratory Limits[c]	
				MDL (mg/kg ww)	Method QL (mg/kg ww)	MDLs (mg/kg ww)	QLs (mg/kg ww)
Heptachlor epoxide	1024-57-3	0.086	0.0001	NA	NA	0.0000267	0.0001
Methoxychlor	72-43-5	0.05	0.0001	NA	NA	0.0005619	0.0001
Oxychlordane	27304-13-8	0.49	0.0001	NA	NA	0.0000190	0.0001
trans-Chlordane	5103-74-2	0.49[e]	0.0001	NA	NA	0.0000283	0.0001
trans-Nonachlor	3734-49-4	0.49	0.0001	NA	NA	0.0000409	0.0001

Note: Project data will be reported in units appropriate to the analytical method.

[a] DQLs have not been approved by USEPA. DQLs based on the lowest available ecological tissue thresholds based on tissue-residue TRVs (if available) including TRVs derived for the protection of benthos and fish as well as dietary TRVs for the protection of wildlife receptors. See Attachment K for benthos, fish, and wildlife thresholds used to derive DQLs. DQLs (including ecological thresholds presented in Attachment K) are very conservative, generic analytical goals used solely for the purpose of evaluating laboratory analytical methods and achievable laboratory limits; these are not project-specific screening levels or PRGs. These values will be developed in subsequent phases of the project.

[b] Analytical MDLs and QLs are those documented in validated methods. When the method did not publish a value for either the MDL or QL, the value was determined to be NA.

[c] Achievable MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method. Actual MDLs and QLs will vary based on sample-specific factors, including sample mass.

[d] The DQL for this analyte was based on the DQL for gamma-BHC. DQLs have not been approved by USEPA.

[e] The DQL for this analyte was based on the DQL for total chlordane. DQLs have not been approved by USEPA.

[f] The DQL for this analyte was based on the DQL for endosulfan. DQLs have not been approved by USEPA.

[g] The DQL for this analyte was based on the DQL for endrin. DQLs have not been approved by USEPA.

[h] The DQL for this analyte was based on the DQL for heptachlor epoxide. DQLs have not been approved by USEPA.

BHC – benzene hexachloride
CAS – Chemical Abstract Service
DDD – dichlorodiphenyldichloroethane
DDE – dichlorodiphenyldichloroethylene
DDT – dichlorodiphenyltrichloroethane
DQL – data quality level
HRMS – high resolution mass spectrometry
MDL – method detection limit
NA – not available
NYSDEC – New York State Department of Environmental Conservation
PRG – preliminary remediation goal
QL – quantitation limit
TRV – toxicity reference value
USEPA – US Environmental Protection Agency
ww – wet weight

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Matrix: Tissue

Analytical Group, Method, and Laboratory: Metals (ICP/MS), USEPA SW-846 6020, CAS, Kelso, WA

SOP from Worksheet 23: M9, M10

Concentration Level: Low

Analyte	CAS Number	DQL (mg/kg ww)[a]	Project Quantitation Limit Goal (mg/kg ww)	Analytical Method[b]		Achievable Laboratory Limits[c]	
				MDL (mg/kg ww)	Method QL (mg/kg ww)	MDL (mg/kg ww)	QL (mg/kg ww)
Aluminum	7429-90-5	NA[d]	2	NA	NA	0.2	2
Antimony	7440-36-0	9,297	0.05	NA	NA	0.02	0.05
Arsenic (total)	7440-38-2	1.15[e]	0.5	NA	NA	0.08	0.5
Barium	7440-39-3	31.6	0.05	NA	NA	0.03	0.05
Beryllium	7440-41-7	4.12	0.02	NA	NA	0.007	0.02
Cadmium	7440-43-9	0.63	0.02	NA	NA	0.02	0.02
Cobalt	7440-48-4	0.62	0.02	NA	NA	0.003	0.02
Copper	7440-50-8	34	0.1	NA	NA	0.08	0.1
Lead	7439-92-1	1.72	0.02	NA	NA	0.008	0.02
Manganese	7439-96-5	549	0.05	NA	NA	0.006	0.05
Nickel	7440-02-0	52.6	0.2	NA	NA	0.04	0.2
Silver	7440-22-4	NA[e]	0.02	NA	NA	0.008	0.02
Thallium	7440-28-0	0.41	0.02	NA	NA	0.005	0.02
Titanium	7440-32-6	NA[d]	2	NA	NA	0.7	2
Zinc	7440-66-6	12.7	0.5	NA	NA	0.09	0.5

Note: Project data will be reported in units appropriate to the analytical method.

[a] DQLs have not been approved by USEPA. DQLs based on the lowest available ecological tissue thresholds based on tissue-residue TRVs (if available) including TRVs derived for the protection of benthos and fish as well as dietary TRVs for the protection of wildlife receptors. See Attachment K for benthos, fish, and wildlife thresholds used to derive DQLs. DQLs (including ecological thresholds presented in Attachment K) are very conservative, generic analytical goals used solely for the purpose of evaluating laboratory analytical methods and achievable laboratory limits; these are not project-specific screening levels or PRGs. These values will be developed in subsequent phases of the project.

[b] Analytical MDLs and QLs are those documented in validated methods.

[c] Achievable MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method. Actual MDLs

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Analyte	CAS Number	DQL (mg/kg ww)[a]	Project Quantitation Limit Goal (mg/kg ww)	Analytical Method[b]		Achievable Laboratory Limits[c]	
				MDL (mg/kg ww)	Method QL (mg/kg ww)	MDL (mg/kg ww)	QL (mg/kg ww)

and QLs will vary based on sample-specific factors, including sample mass.

[d] A DQL or project quantitation limit goal could not be established because no toxicity thresholds were available.

[e] The DQL for this analyte is based on the inorganic arsenic DQL. DQLs have not been approved by USEPA.

CAS – Chemical Abstract Service
DQL – data quality level
ICP/MS – inductively coupled plasma/mass spectrometer
MDL – method detection limit
NA – not available
PRG – preliminary remediation goal
QL – quantitation limit
TRV – toxicity reference value
USEPA – US Environmental Protection Agency
ww – wet weight

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Matrix: Tissue

Analytical Group, Method, and Laboratory: Metals (ICP), USEPA SW-846 6010B, CAS, Kelso, WA

SOP from Worksheet 23: M9, M11

Concentration Level: Low

Analyte	CAS Number	DQL (mg/kg ww)[a]	Project Quantitation Limit Goal (mg/kg ww)	Analytical Method[b]		Achievable Laboratory Limits[c]	
				MDL (mg/kg ww)	Method QL (mg/kg ww	MDL (mg/kg ww)	QL (mg/kg ww)
Calcium	7440-70-2	NA[d, e]	10	NA	NA	3	10
Chromium	7440-47-3	0.86	0.2	NA	NA	0.07	0.2
Iron	7439-89-6	NA[e]	2	NA	NA	0.7	2
Magnesium	7439-95-4	NA[d, e]	2	NA	NA	0.9	2
Potassium	7440-09-7	NA[d, e]	30	NA	NA	10	30
Sodium	7440-23-5	NA[d, e]	20	NA	NA	5	20
Vanadium	7440-62-2	1.03	0.3	NA	NA	0.09	0.3

Note: Project data will be reported in units appropriate to the analytical method.

[a] DQLs have not been approved by USEPA. DQLs based on the lowest available ecological tissue thresholds based on tissue-residue TRVs (if available) including TRVs derived for the protection of benthos and fish as well as dietary TRVs for the protection of wildlife receptors. See Attachment K for benthos, fish, and wildlife thresholds used to derive DQLs. DQLs (including ecological thresholds presented in Attachment K) are very conservative, generic analytical goals used solely for the purpose of evaluating laboratory analytical methods and achievable laboratory limits; these are not project-specific screening levels or PRGs. These values will be developed in subsequent phases of the project.

[b] Analytical MDLs and QLs are those documented in validated methods. When the method did not publish a value for either the MDL or QL, the value was determined to be NA.

[c] Achievable MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method. Actual MDLs and QLs will vary based on sample-specific factors, including sample mass.

[d] Essential nutrient.

[e] A DQL or project quantitation limit goal could not be established because no toxicity thresholds were available.

CAS – Chemical Abstract Service
DQL – data quality level
ICP – inductively coupled plasma
MDL – method detection limit
NA – not available
PRG – preliminary remediation goal
QL – quantitation limit
TRV – toxicity reference value
USEPA – US Environmental Protection Agency
ww – wet weight

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Matrix: Tissue

Analytical Group, Method, and Laboratory: Metals (Selenium), USEPA SW-846-7742, CAS, Kelso, WA

SOP from Worksheet 23: M9, M12

Concentration Level: Low

Analyte	CAS Number	DQL (mg/kg ww)[a]	Project Quantitation Limit Goal (mg/kg ww)	Analytical Method[b]		Achievable Laboratory Limits[c]	
				MDL (mg/kg ww)	Method QL (mg/kg ww)	MDL (mg/kg ww)	QL (mg/kg ww)
Selenium	7782-49-2	0.34	0.1	NA	NA	0.02	0.1

Note: Project data will be reported in units appropriate to the analytical method.

[a] DQLs have not been approved by USEPA. DQLs based on the lowest available ecological tissue thresholds based on tissue-residue TRVs (if available) including TRVs derived for the protection of benthos and fish as well as dietary TRVs for the protection of wildlife receptors. See Attachment K for benthos, fish, and wildlife thresholds used to derive DQLs. DQLs (including ecological thresholds presented in Attachment K) are very conservative, generic analytical goals used solely for the purpose of evaluating laboratory analytical methods and achievable laboratory limits; these are not project-specific screening levels or PRGs. These values will be developed in subsequent phases of the project.

[b] Analytical MDLs and QLs are those documented in validated methods. When the method did not publish a value for either the MDL or QL, the value was determined to be NA.

[c] Achievable MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method. Actual MDLs and QLs will vary based on sample-specific factors, including sample mass.

CAS – Chemical Abstract Service
DQL – data quality level
MDL – method detection limit
NA – not available
PRG – preliminary remediation goal
QL – quantitation limit
TRV – toxicity reference value
USEPA – US Environmental Protection Agency
ww – wet weight

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Matrix: Tissue

Analytical Group, Method, and Laboratory: Methylmercury, USEPA 1630, Brooks Rand Labs, Seattle, WA

SOP from Worksheet 23: M16

Concentration Level: Low

Analyte	CAS Number	DQL (mg/kg ww)[a]	Project Quantitation Limit Goal (mg/kg ww)	Analytical Method[b]		Achievable Laboratory Limits[c]	
				MDL (mg/kg ww)	Method QL (mg/kg ww)	MDL (mg/kg ww)	QL (mg/kg ww)
Methylmercury	22967-92-6	0.0086	0.003	NA	NA	0.001	0.003

Note: Project data will be reported in units appropriate to the analytical method.

[a] DQLs have not been approved by USEPA. DQLs based on the lowest available ecological tissue thresholds based on tissue-residue TRVs (if available) including TRVs derived for the protection of benthos and fish as well as dietary TRVs for the protection of wildlife receptors. See Attachment K for benthos, fish, and wildlife thresholds used to derive DQLs. DQLs (including ecological thresholds presented in Attachment K) are very conservative, generic analytical goals used solely for the purpose of evaluating laboratory analytical methods and achievable laboratory limits; these are not project-specific screening levels or PRGs. These values will be developed in subsequent phases of the project.

[b] Analytical MDLs and QLs are those documented in validated methods. When the method did not publish a value for either the MDL or QL, the value was determined to be not NA.

[c] Achievable MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method. Actual MDLs and QLs will vary based on sample-specific factors, including sample mass. Project data will be reported data in ng/g to maintain precision.

CAS – Chemical Abstract Service
DQL – data quality level
MDL – method detection limit
NA – not available
PRG – preliminary remediation goal
QL – quantitation limit
TRV – toxicity reference value
USEPA – US Environmental Protection Agency
ww – wet weight

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Matrix: Tissue

Analytical Group, Method, and Laboratory: Total Mercury, USEPA 1631, Brooks Rand Labs, LLC, Seattle, WA

SOP from Worksheet 23: M14, M15

Concentration Level: Low

Analyte	CAS Number	DQL (mg/kg ww)[a]	Project Quantitation Limit Goal (mg/kg ww)	Analytical Method[b]		Achievable Laboratory Limits[c]	
				MDL (mg/kg ww)	Method QL (mg/kg ww)	MDL (mg/kg ww)	QL (mg/kg ww)
Mercury	7439-97-6	0.0086	0.0001	NA	NA	0.00004	0.0001

Note: Project data will be reported in units appropriate to the analytical method.

[a] DQLs have not been approved by USEPA. DQLs based on the lowest available ecological tissue thresholds based on tissue-residue TRVs (if available) including TRVs derived for the protection of benthos and fish as well as dietary TRVs for the protection of wildlife receptors. See Attachment K for benthos, fish, and wildlife thresholds used to derive DQLs. DQLs (including ecological thresholds presented in Attachment K) are very conservative, generic analytical goals used solely for the purpose of evaluating laboratory analytical methods and achievable laboratory limits; these are not project-specific screening levels or PRGs. These values will be developed in subsequent phases of the project.

[b] Analytical MDLs and QLs are those documented in validated methods. When the method did not publish a value for either the MDL or QL, the value was determined to be NA.

[c] Achievable MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method. Actual MDLs and QLs will vary based on sample-specific factors, including sample mass.

CAS – Chemical Abstract Service
DQL – data quality level
MDL – method detection limit
NA – not available
PRG – preliminary remediation goal
QL – quantitation limit
TRV – toxicity reference value
USEPA – US Environmental Protection Agency
ww – wet weight

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Matrix: Tissue

Analytical Group, Method, and Laboratory: SVOCs, USEPA SW-846 8270C, Alpha Analytical, Mansfield, MA

SOP from Worksheet 23: M17, M18, M19, M20

Concentration Level: Low

Analyte	CAS Number	DQL (mg/kg ww)[a]	Project Quantitation Limit Goal (mg/kg ww)	Analytical Method[b]		Achievable Laboratory Limit[c]	
				MDL (mg/kg ww)	Method QL (mg/kg ww)	MDL (mg/kg)	QL (mg/kg)
1,1'-Biphenyl	92-52-4	NA[d]	0.4	NA	NA	0.2	0.4
2,2'-Oxybis (1-Chloropropane)	108-60-1	NA[d]	0.4	NA	0.66	0.2	0.4
2,4,5-Trichlorophenol	95-95-4	NA[d]	0.4	NA	0.66	0.2	0.4
2,4,6-Trichlorophenol	88-06-2	NA[d]	0.4	NA	0.66	0.2	0.4
2,4-Dichlorophenol	120-83-2	NA[d]	0.8	NA	0.66	0.4	0.8
2,4-Dimethylphenol	105-67-9	37.5	0.4	NA	0.66	0.2	0.4
2,4-Dinitrophenol	51-28-5	NA[d]	1.6	NA	3.3	0.8	1.6
2,4-Dinitrotoluene	121-14-2	NA[d]	0.4	NA	0.66	0.2	0.4
2,6-Dinitrotoluene	606-20-2	NA[d]	0.4	NA	0.66	0.2	0.4
2-Chloronaphthalene	91-58-7	NA[d]	0.4	NA	0.66	0.2	0.4
2-Chlorophenol	95-57-8	NA[d]	0.4	NA	0.66	0.2	0.4
2-Methylnaphthalene[e]	91-57-6	337	0.4	NA	0.66	0.2	0.4
2-Methylphenol	95-48-7	NA[d]	0.4	NA	0.66	0.2	0.4
2-Nitroaniline	88-74-4	NA[d]	0.4	NA	3.30	0.2	0.4
2-Nitrophenol	88-75-5	NA[d]	0.4	NA	0.66	0.2	0.4
3,3'-Dichlorobenzidine	91-94-1	NA[d]	0.4	NA	1.30	0.2	0.4
3-Nitroaniline	99-09-2	NA[d]	0.4	NA	3.3	0.2	0.4
4,6-Dinitro-2-methylphenol	534-52-1	NA[d]	1.6	NA	3.3	0.8	1.6
4-Bromophenyl-phenylether	101-55-3	NA[d]	0.4	NA	0.66	0.2	0.4
4-Chloro-3-methylphenol	59-50-7	NA[d]	0.4	NA	1.3	0.2	0.4
4-Chloroaniline	106-47-8	NA[d]	0.4	NA	1.3	0.2	0.4
4-Chlorophenyl-phenyl ether	7005-72-3	NA[d]	0.4	NA	0.66	0.2	0.4
4-Methylphenol	106-44-5	76.5	0.4	NA	0.66	0.2	0.4

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Analyte	CAS Number	DQL (mg/kg ww)[a]	Project Quantitation Limit Goal (mg/kg ww)	Analytical Method[b]		Achievable Laboratory Limit[c]	
				MDL (mg/kg ww)	Method QL (mg/kg ww)	MDL (mg/kg)	QL (mg/kg)
4-Nitroaniline	100-01-6	NA[d]	0.4	NA	NA	0.2	0.4
4-Nitrophenol	100-02-7	NA[d]	0.8	NA	3.3	0.4	0.8
Acenaphthene[e]	83-32-9	0.24[d]	**0.4**	NA	0.66	0.2	**0.4**
Acenaphthylene[e]	208-96-8	0.24[d]	**0.4**	NA	0.66	0.2	**0.4**
Acetophenone	98-86-2	NA[d]	0.4	NA	NA	0.2	0.4
Anthracene[e]	120-12-7	0.24	**0.4**	NA	0.66	0.2	**0.4**
Atrazine	1912-24-9	NA[d]	0.4	NA	NA	0.2	0.4
Benzaldehyde	100-52-7	NA[d]	0.4	NA	NA	0.2	0.4
Benzo(a)anthracene[e]	56-55-3	0.24[f]	**0.4**	NA	0.66	0.2	**0.4**
Benzo(a)pyrene[e]	50-32-8	0.24[f]	**0.4**	NA	0.66	0.2	**0.4**
Benzo(b)fluoranthene[e]	205-99-2	0.24[f]	**0.4**	NA	0.66	0.2	**0.4**
Benzo(g,h,i)perylene[e]	191-24-2	0.24[f]	**0.4**	NA	0.66	0.2	**0.4**
Benzo(k)fluoranthene[e]	207-08-9	0.24[f]	**0.4**	NA	0.66	0.2	**0.4**
bis-(2-Chloroethoxy)methane	111-91-1	NA[d]	0.4	NA	0.66	0.2	0.4
bis-(2-Chloroethyl)ether	111-44-4	NA[d]	**0.4**	NA	0.66	0.2	0.4
bis(2-Ethylhexyl) phthalate	117-81-7	0.39	0.4	NA	0.66	0.2	**0.4**
Butylbenzylphthalate	85-68-7	1.24[g]	0.4	NA	0.66	0.2	0.4
Caprolactam	105-60-2	NA[d]	0.4	NA	NA	0.2	0.4
Carbazole	86-74-8	NA[d]	0.4	NA	NA	0.2	0.4
Chrysene[e]	218-01-9	0.24[f]	**0.4**	NA	0.66	0.2	**0.4**
Dibenzo(a,h)-anthracene[e]	53-70-3	0.24[f]	**0.4**	NA	0.66	0.2	**0.4**
Dibenzofuran	132-64-9	NA[d]	0.4	NA	0.66	0.2	0.4
Diethylphthalate	84-66-2	1.24[g]	0.4	NA	0.66	0.2	0.4
Dimethylphthalate	131-11-3	1.24[g]	0.4	NA	0.66	0.2	0.4
Di-n-butylphthalate	84-74-2	0.5	0.4	NA	NA	0.2	0.4
Di-n-octylphthalate	117-84-0	1.24[g]	0.4	NA	0.66	0.2	0.4
Fluoranthene[e]	206-44-0	0.24[f]	**0.4**	NA	0.66	0.2	**0.4**
Fluorene[e]	86-73-7	0.24[f]	**0.4**	NA	0.66	0.2	**0.4**

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Analyte	CAS Number	DQL (mg/kg ww)[a]	Project Quantitation Limit Goal (mg/kg ww)	Analytical Method[b]		Achievable Laboratory Limit[c]	
				MDL (mg/kg ww)	Method QL (mg/kg ww)	MDL (mg/kg)	QL (mg/kg)
Hexachlorobenzene[h]	118-74-1	0.16	**0.4**	NA	0.66	**0.2**	**0.4**
Hexachlorobutadiene	87-68-3	1.46	0.4	NA	0.66	0.2	0.4
Hexachloroethane	67-72-1	624	0.4	NA	0.66	0.2	0.4
Hexchlorocyclopentadiene	77-47-4	NA[d]	0.4	NA	0.66	0.2	0.4
Indeno(1,2,3-cd)-pyrene[e]	193-39-5	0.24[f]	**0.4**	NA	0.66	0.2	**0.4**
Isophorone	78-59-1	NA[d]	0.4	NA	0.66	0.2	0.4
Naphthalene[e]	91-20-3	0.24[f]	0.4	NA	0.66	0.2	**0.4**
Nitrobenzene	98-95-3	NA[d]	0.4	NA	0.66	0.2	0.4
n-Nitroso-di-n-propylamine	621-64-7	NA[d]	0.4	NA	0.66	0.2	0.4
n-Nitrosodiphenylamine	86-30-6	NA[d]	0.4	NA	0.66	0.2	0.4
Pentachlorophenol	87-86-5	18.9	0.8	NA	3.30	0.4	0.8
Phenanthrene[e]	85-01-8	0.24[f]	**0.4**	NA	0.66	0.2	**0.4**
Phenol	108-95-2	375	0.4	NA	0.66	0.2	0.4
Pyrene[e]	129-00-0	0.24[f]	**0.4**	NA	0.66	0.2	**0.4**

Note: Project data will be reported in units appropriate to the analytical method.

[a] DQLs have not been approved by USEPA. DQLs based on the lowest available ecological tissue thresholds based on tissue-residue TRVs (if available) including TRVs derived for the protection of benthos and fish as well as dietary TRVs for the protection of wildlife receptors. See Attachment K for benthos, fish, and wildlife thresholds used to derive DQLs. DQLs (including ecological thresholds presented in Attachment K) are very conservative, generic analytical goals used solely for the purpose of evaluating laboratory analytical methods and achievable laboratory limits; these are not project-specific screening levels or PRGs. These values will be developed in subsequent phases of the project.

[b] Analytical MDLs and QLs are those documented in validated methods. When the method did not publish a value for either the MDL or QL, the value was determined to be NA.

[c] Achievable MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method. Actual MDLs and QLs will vary based on sample-specific factors, including sample mass. The laboratory conducts MDL studies with spikes that go through the extraction and analytical process; therefore, dry weight or wet weight units do not apply.

[d] A DQL or project quantitation limit goal could not be established because no toxicity thresholds were available.

[e] Analyte will also be reported from the PAH HRGC/HRMS method, the results from the HRGC/HRMS will take precedence over these results. The analytes 1-methylnaphthalene, 1-methylphenanthrene, 2,3,5-trimethylnaphthalene, 2,6-dimethylnaphthalene, benzo(e)pyrene, dibenzothiophene, and perylene, originally listed under this method, will be reported by the PAH HRGC/HRMS method only.

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Analyte	CAS Number	DQL (mg/kg ww)[a]	Project Quantitation Limit Goal (mg/kg ww)	Analytical Method[b]		Achievable Laboratory Limit[c]	
				MDL (mg/kg ww)	Method QL (mg/kg ww)	MDL (mg/kg)	QL (mg/kg)

[f] The DQL for this analyte was based on the DQL for anthracene. DQLs have not been approved by USEPA.

[g] The DQL for this analyte was based on the DQL di-n-butyl phthalate. DQLs have not been approved by USEPA.

[h] Analyte will also be reported from the organochlorine pesticide HRGC/HRMS method, the results from the HRGC/HRMS will take precedence over these results.

CAS – Chemical Abstract Service
DQL – data quality level
HRGC – high-resolution gas chromatography
HRMS – high-resolution mass spectrometry
MDL – method detection limit
NA – not available
PAH – polycyclic aromatic hydrocarbon
PRG – preliminary remediation goal
QL – quantitation limit
SVOC – semivolatile organic compound
TRV – toxicity reference value
USEPA – US Environmental Protection Agency
ww – wet weight

Bold indicates chemicals for which the achievable laboratory limits exceed the DQL.

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Matrix: Tissue

Analytical Group, Method, and Laboratory: Butyltins, Krone et al. (1989), Columbia Analytical Services, Inc., Kelso, WA

SOP from Worksheet 23: M21, M22

Concentration Level: Low

Analyte	CAS Number	DQL (mg/kg ww)[a]	Project Quantitation Limit Goal (mg/kg ww)	Analytical Method[b]		Achievable Laboratory Limit[c]	
				MDL (mg/kg ww)	Method QL (mg/kg ww)	MDL (mg/kg ww)	QL (mg/kg ww)
Dibutyltin	14488-53-0	0.22[d]	0.001	NA	NA	0.000091	0.001
Monobuyltin	78763-54-9	0.22[d]	0.001	NA	NA	0.00020	0.001
Tetrabutyltin	1461-25-2	0.22[d]	0.001	NA	NA	0.00018	0.001
Tributyltin	36643-28-4	0.22	0.001	NA	NA	0.00033	0.001

Note: Project data will be reported in units appropriate to the analytical method.

[a] DQLs have not been approved by USEPA. DQLs based on the lowest available ecological tissue thresholds based on tissue-residue TRVs (if available) including TRVs derived for the protection of benthos and fish as well as dietary TRVs for the protection of wildlife receptors. See Attachment K for benthos, fish, and wildlife thresholds used to derive DQLs. DQLs (including ecological thresholds presented in Attachment K) are very conservative, generic analytical goals used solely for the purpose of evaluating laboratory analytical methods and achievable laboratory limits; these are not project-specific screening levels or PRGs. These values will be developed in subsequent phases of the project.

[b] Analytical MDLs and QLs are those documented in validated methods. When the method did not publish a value for either the MDL or QL, the value was determined to be NA.

[c] Achievable MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method. Actual MDLs and QLs will vary based on sample-specific factors, including sample mass.

[d] The DQL for this analyte was based on the DQL for tributyltin. DQLs have not been approved by USEPA.

CAS – Chemical Abstract Service
DQL – data quality level
MDL – method detection limit
NA – not available
PRG – preliminary remediation goal
QL – quantitation limit
TRV – toxicity reference value
ww – wet weight

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Matrix: Tissue

Analytical Group, Method, and Laboratory: General Chemistry – Percent Moisture, SM2540G Modified, Alpha Analytical, Mansfield, MA

SOP from Worksheet 23: M24

Concentration Level: Low

Analyte	CAS Number	DQL (%)[a]	Project Quantitation Limit Goal (%)	Analytical Method[b]		Achievable Laboratory Limit[c]	
				MDL (%)	Method QL (%)	MDL (%)	QL (%)
Percent moisture	NA	NA[d]	NA[d]	NA	NA	NA	NA

Note: Project data will be reported in units appropriate to the analytical method.

[a] DQLs have not been approved by USEPA. DQLs based on the lowest available ecological tissue thresholds based on tissue-residue TRVs (if available) including TRVs derived for the protection of benthos and fish as well as dietary TRVs for the protection of wildlife receptors. See Attachment K for benthos, fish, and wildlife thresholds used to derive DQLs. DQLs (including ecological thresholds presented in Attachment K) are very conservative, generic analytical goals used solely for the purpose of evaluating laboratory analytical methods and achievable laboratory limits; these are not project-specific screening levels or PRGs. These values will be developed in subsequent phases of the project.

[b] Analytical MDLs and QLs are those documented in validated methods. When the method did not publish a value for either the MDL or QL, the value was determined to be NA.

[c] Achievable MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method. Actual MDLs and QLs will vary based on sample-specific factors, including sample mass. When MDLs are not conducted for this analysis, the MDL and QL value was determined to be NA. Although no MDLs and QLs are provided, the laboratory will use a 5-point (0.0001 g) analytical balance for this procedure.

[d] A DQL or project quantitation limit goal could not be established because percent moisture is not a chemical stressor.

CAS – Chemical Abstract Service
DQL – data quality level
MDL – method detection limit
NA – not available
PRG – preliminary remediation goal
QL – quantitation limit
TRV – toxicity reference value

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Matrix: Tissue

Analytical Group: General Chemistry – Lipids, Bligh-Dyer, Columbia Analytical Services, Kelso, WA **SOP from Worksheet 23:** M23

Concentration Level: Low

Analyte	CAS Number	DQL (%)[a]	Project Quantitation Limit Goal (%)	Analytical Method[b]		Achievable Laboratory Limit[c]	
				MDL (%)	Method QL (%)	MDL (%)	QL (%)
Lipids	NA	NA[d]	NA[d]	NA	NA	NA	NA

Note: Project data will be reported in units appropriate to the analytical method.

[a] DQLs have not been approved by USEPA. DQLs based on the lowest available ecological tissue thresholds based on tissue-residue TRVs (if available) including TRVs derived for the protection of benthos and fish as well as dietary TRVs for the protection of wildlife receptors. See Attachment K for benthos, fish, and wildlife thresholds used to derive DQLs. DQLs (including ecological thresholds presented in Attachment K) are very conservative, generic analytical goals used solely for the purpose of evaluating laboratory analytical methods and achievable laboratory limits; these are not project-specific screening levels or PRGs. These values will be developed in subsequent phases of the project.

[b] Analytical MDLs and QLs are those documented in validated methods. When the method did not publish a value for either the MDL or QL, the value was determined to be NA.

[c] Achievable MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method. Actual MDLs and QLs will vary based on sample-specific factors, including sample mass. When MDLs are not conducted for this analysis, the MDL and QL value was determined to be NA. Although no MDLs and QLs are provided, the laboratory will use a 5-point (0.0001 g) analytical balance for this procedure.

[d] A DQL or project quantitation limit goal could not be established because percent lipids is not a chemical stressor.

CAS – Chemical Abstract Service
DQL – data quality level
MDL – method detection limit
NA – not available
PRG – preliminary remediation goal
QL – quantitation limit
TRV – toxicity reference value

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Matrix: Sediment

Analytical Group, Method, and Laboratory: PCBs – Congeners, USEPA1668A, Analytical Perspectives, Wilmington, NC

SOP from Worksheet 23: M2

Concentration Level: Low

Analyte	CAS Number	DQL (mg/kg dw)[a, b]	Project Quantitation Limit Goal (mg/kg dw)	Analytical Method[c]		Achievable Laboratory Limits (10-g sample)[d]		Achievable Laboratory Limits (1-g sample)[d]	
				MDL (mg/kg dw)	Method QL (mg/kg dw)	MDL (mg/kg dw)	QL (mg/kg dw)	MDL (mg/kg dw)	QL (mg/kg dw)
PCBs by Congeners									
PCB 1	2051-60-7	0.0227	4.36E-05	8.0E-06	2.0E-05	1.61E-06	4.36E-06	1.61E-05	4.36E-05
PCB 2	2051-61-8	0.0227	3.33E-05	4.0E-07	1.0E-06	1.28E-06	3.33E-06	1.28E-05	3.33E-05
PCB 3	2051-62-9	0.0227	3.28E-05	9.0E-06	2.0E-05	1.25E-06	3.28E-06	1.25E-05	3.28E-05
PCB 4	13029-08-8	0.0227	1.09E-04	1.7E-05	5.0E-05	4.09E-06	1.09E-05	4.09E-05	1.09E-04
PCB 5	16605-91-7	0.0227	7.59E-05	1.E-06	5.E-06	2.86E-06	7.59E-06	2.86E-05	7.59E-05
PCB 6	25569-80-6	0.0227	8.22E-05	1.E-06	5.E-06	3.09E-06	8.22E-06	3.09E-05	8.22E-05
PCB 7	33284-50-3	0.0227	7.23E-05	2.E-06	5.E-06	2.73E-06	7.23E-06	2.73E-05	7.23E-05
PCB 8	34883-43-7	0.0227	8.07E-05	1.2E-05	5.0E-05	3.03E-06	8.07E-06	3.03E-05	8.07E-05
PCB 9	34883-39-1	0.0227	8.10E-05	2.E-06	5.E-06	3.04E-06	8.10E-06	3.04E-05	8.10E-05
PCB 10	33146-45-1	0.0227	6.27E-05	2.E-06	5.E-06	2.35E-06	6.27E-06	2.35E-05	6.27E-05
PCB 11	2050-67-1	0.0227	7.87E-05	1.0E-05	2.0E-05	2.96E-06	7.87E-06	2.96E-05	7.87E-05
PCB 12	2974-92-7	0.0227	8.05E-05	3.E-06	1.0E-05	3.02E-06	8.05E-06	3.02E-05	8.05E-05
PCB 13	2974-90-5	0.0227	8.05E-05	3.E-06	1.0E-05	3.02E-06	8.05E-06	3.02E-05	8.05E-05
PCB 14	34883-41-5	0.0227	7.14E-05	3.E-06	1.0E-05	2.68E-06	7.14E-06	2.68E-05	7.14E-05
PCB 15	2050-68-2	0.0227	8.50E-05	1.8E-05	5.0E-05	3.18E-06	8.50E-06	3.18E-05	8.50E-05
PCB 16	38444-78-9	0.0227	8.42E-05	4.E-06	1.0E-05	3.19E-06	8.42E-06	3.19E-05	8.42E-05
PCB 17	37680-66-3	0.0227	6.25E-05	9.E-06	2.0E-05	2.36E-06	6.25E-06	2.36E-05	6.25E-05
PCB 18	37680-65-2	0.0227	6.23E-05	1.7E-05	5.0E-05	2.35E-06	6.23E-06	2.35E-05	6.23E-05
PCB 19	38444-73-4	0.0227	7.18E-05	4.E-06	1.0E-05	2.72E-06	7.18E-06	2.72E-05	7.18E-05

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Analyte	CAS Number	DQL (mg/kg dw)[a, b]	Project Quantitation Limit Goal (mg/kg dw)	Analytical Method[c]		Achievable Laboratory Limits (10-g sample)[d]		Achievable Laboratory Limits (1-g sample)[d]	
				MDL (mg/kg dw)	Method QL (mg/kg dw)	MDL (mg/kg dw)	QL (mg/kg dw)	MDL (mg/kg dw)	QL (mg/kg dw)
PCB 20	38444-84-7	0.0227	9.08E-05	1.9E-05	5.0E-05	3.35E-06	9.08E-06	3.35E-05	9.08E-05
PCB 21	55702-46-0	0.0227	8.10E-05	5.E-06	2.0E-05	2.99E-06	8.10E-06	2.99E-05	8.10E-05
PCB 22	38444-85-8	0.0227	9.27E-05	9.E-06	2.0E-05	3.42E-06	9.27E-06	3.42E-05	9.27E-05
PCB 23	55720-44-0	0.0227	9.12E-05	5.E-06	2.0E-05	3.36E-06	9.12E-06	3.36E-05	9.12E-05
PCB 24	55702-45-9	0.0227	4.91E-05	5.E-06	2.0E-05	1.85E-06	4.91E-06	1.85E-05	4.91E-05
PCB 25	55712-37-3	0.0227	8.41E-05	5.E-06	2.0E-05	3.11E-06	8.41E-06	3.11E-05	8.41E-05
PCB 26	38444-81-4	0.0227	8.59E-05	8.E-06	2.0E-05	3.17E-06	8.59E-06	3.17E-05	8.59E-05
PCB 27	38444-76-7	0.0227	5.44E-05	6.E-06	2.0E-05	2.05E-06	5.44E-06	2.05E-05	5.44E-05
PCB 28	7012-37-5	0.0227	9.08E-05	1.9E-05	5.0E-05	3.35E-06	9.08E-06	3.35E-05	9.08E-05
PCB 29	15862-07-4	0.0227	8.59E-05	8.E-06	2.0E-05	3.17E-06	8.59E-06	3.17E-05	8.59E-05
PCB 30	35693-92-6	0.0227	6.23E-05	1.7E-05	5.0E-05	2.35E-06	6.23E-06	2.35E-05	6.23E-05
PCB 31	16606-02-3	0.0227	7.79E-05	1.5E-05	5.0E-05	2.88E-06	7.79E-06	2.88E-05	7.79E-05
PCB 32	38444-77-8	0.0227	4.49E-05	8.E-06	2.0E-05	1.70E-06	4.49E-06	1.70E-05	4.49E-05
PCB 33	38444-86-9	0.0227	8.10E-05	5.E-06	2.0E-05	2.99E-06	8.10E-06	2.99E-05	8.10E-05
PCB 34	37680-68-5	0.0227	9.48E-05	7.E-06	2.0E-05	3.50E-06	9.48E-06	3.50E-05	9.48E-05
PCB 35	37680-69-6	0.0227	9.64E-05	8.E-06	2.0E-05	3.56E-06	9.64E-06	3.56E-05	9.64E-05
PCB 36	38444-87-0	0.0227	8.55E-05	8.E-06	2.0E-05	3.16E-06	8.55E-06	3.16E-05	8.55E-05
PCB 37	38444-90-5	0.0227	1.02E-04	1.3E-05	5.0E-05	3.77E-06	1.02E-05	3.77E-05	1.02E-04
PCB 38	53555-66-1	0.0227	8.80E-05	8.E-06	2.0E-05	3.25E-06	8.80E-06	3.25E-05	8.80E-05
PCB 39	38444-88-1	0.0227	8.54E-05	9.E-06	2.0E-05	3.16E-06	8.54E-06	3.16E-05	8.54E-05
PCB 40	38444-93-8	0.0227	4.22E-05	1.2E-05	5.0E-05	1.63E-06	4.22E-06	1.63E-05	4.22E-05
PCB 41	52663-59-9	0.0227	4.73E-05	1.2E-05	5.0E-05	1.82E-06	4.73E-06	1.82E-05	4.73E-05
PCB 42	36559-22-5	0.0227	4.92E-05	6.E-06	2.0E-05	1.90E-06	4.92E-06	1.90E-05	4.92E-05
PCB 43	70362-46-8	0.0227	5.53E-05	9.E-06	2.0E-05	2.14E-06	5.53E-06	2.14E-05	5.53E-05
PCB 44	41464-39-5	0.0227	4.03E-05	1.9E-05	5.0E-05	1.56E-06	4.03E-06	1.56E-05	4.03E-05

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Analyte	CAS Number	DQL (mg/kg dw)[a, b]	Project Quantitation Limit Goal (mg/kg dw)	Analytical Method[c]		Achievable Laboratory Limits (10-g sample)[d]		Achievable Laboratory Limits (1-g sample)[d]	
				MDL (mg/kg dw)	Method QL (mg/kg dw)	MDL (mg/kg dw)	QL (mg/kg dw)	MDL (mg/kg dw)	QL (mg/kg dw)
PCB 45	70362-45-7	0.0227	4.47E-05	5.E-06	2.0E-05	1.72E-06	4.47E-06	1.72E-05	4.47E-05
PCB 46	41464-47-5	0.0227	4.77E-05	1.0E-05	2.0E-05	1.83E-06	4.77E-06	1.83E-05	4.77E-05
PCB 47	2437-79-8	0.0227	4.03E-05	1.9E-05	5.0E-05	1.56E-06	4.03E-06	1.56E-05	4.03E-05
PCB 48	70362-47-9	0.0227	3.96E-05	8.E-06	2.0E-05	1.53E-06	3.96E-06	1.53E-05	3.96E-05
PCB 49	41464-40-8	0.0227	3.54E-05	1.1E-05	5.0E-05	1.37E-06	3.54E-06	1.37E-05	3.54E-05
PCB 50	62796-65-0	0.0227	4.09E-05	6.E-06	2.0E-05	1.58E-06	4.09E-06	1.58E-05	4.09E-05
PCB 51	68194-04-7	0.0227	4.15E-05	5.E-06	2.0E-05	1.61E-06	4.15E-06	1.61E-05	4.15E-05
PCB 52	35693-99-3	0.0227	4.27E-05	1.9E-05	5.0E-05	1.65E-06	4.27E-06	1.65E-05	4.27E-05
PCB 53	41464-41-9	0.0227	4.09E-05	6.E-06	2.0E-05	1.58E-06	4.09E-06	1.58E-05	4.09E-05
PCB 54	15968-05-5	0.0227	2.63E-05	1.2E-05	5.0E-05	1.01E-06	2.63E-06	1.01E-05	2.63E-05
PCB 55	74338-24-2	0.0227	2.57E-05	1.2E-05	5.0E-05	9.11E-06	2.57E-05	9.11E-05	2.57E-05
PCB 56	41464-43-1	0.0227	2.42E-04	1.0E-05	2.0E-05	8.57E-06	2.42E-05	8.57E-05	2.42E-04
PCB 57	70424-67-8	0.0227	2.18E-04	1.2E-05	5.0E-05	7.73E-06	2.18E-05	7.73E-05	2.18E-04
PCB 58	41464-49-7	0.0227	2.46E-04	1.3E-05	5.0E-05	8.72E-06	2.46E-05	8.72E-05	2.46E-04
PCB 59	74472-33-6	0.0227	3.10E-05	6.E-06	2.0E-05	1.20E-06	3.10E-06	1.20E-05	3.10E-05
PCB 60	33025-41-1	0.0227	2.22E-04	1.3E-05	5.0E-05	7.84E-06[e]	2.22E-05	7.84E-05[e]	2.22E-04
PCB 61	33284-53-6	0.0227	2.21E-04	1.7E-05	5.0E-05	7.84E-06	2.21E-05	7.84E-05	2.21E-04
PCB 62	54230-22-7	0.0227	3.10E-05	6.E-06	2.0E-05	1.20E-06	3.10E-06	1.20E-05	3.10E-05
PCB 63	74472-34-7	0.0227	1.93E-05	1.4E-05	5.0E-05	6.83E-06	1.93E-06	6.83E-05	1.93E-05
PCB 64	52663-58-8	0.0227	2.73E-05	7.E-06	2.0E-05	1.05E-06	2.73E-06	1.05E-05	2.73E-05
PCB 65	33284-54-7	0.0227	4.03E-05	1.9E-05	5.0E-05	1.56E-06	4.03E-06	1.56E-05	4.03E-05
PCB 66	32598-10-0	0.0227	2.29E-04	1.6E-05	5.0E-05	8.14E-06	2.29E-05	8.14E-05	2.29E-04
PCB 67	73575-53-8	0.0227	2.20E-04	1.5E-05	5.0E-05	7.79E-06	2.20E-05	7.79E-05	2.20E-04
PCB 68	73575-52-7	0.0227	2.17E-04	1.5E-05	5.0E-05	7.68E-06	2.17E-05	7.68E-05	2.17E-04
PCB 69	60233-24-1	0.0227	3.54E-05	1.1E-05	5.0E-05	1.37E-06	3.54E-06	1.37E-05	3.54E-05

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Analyte	CAS Number	DQL (mg/kg dw)[a, b]	Project Quantitation Limit Goal (mg/kg dw)	Analytical Method[c]		Achievable Laboratory Limits (10-g sample)[d]		Achievable Laboratory Limits (1-g sample)[d]	
				MDL (mg/kg dw)	Method QL (mg/kg dw)	MDL (mg/kg dw)	QL (mg/kg dw)	MDL (mg/kg dw)	QL (mg/kg dw)
PCB 70	32598-11-1	0.0227	2.21E-04	1.7E-05	5.0E-05	7.84E-06	2.21E-05	7.84E-05	2.21E-04
PCB 71	41464-46-4	0.0227	4.22E-05	1.2E-05	5.0E-05	1.63E-06	4.22E-06	1.63E-05	4.22E-05
PCB 72	41464-42-0	0.0227	2.20E-04	1.6E-05	5.0E-05	7.80E-06	2.20E-05	7.80E-05	2.20E-04
PCB 73	74338-23-1	0.0227	3.37E-05	1.6E-05	5.0E-05	1.30E-06	3.37E-06	1.30E-05	3.37E-05
PCB 74	32690-93-0	0.0227	2.21E-04	1.7E-05	5.0E-05	7.84E-06	2.21E-05	7.84E-05	2.21E-04
PCB 75	32598-12-2	0.0227	3.10E-05	6.E-06	2.0E-05	1.20E-06	3.10E-06	1.20E-05	3.10E-05
PCB 76	70362-48-0	0.0227	2.21E-04	1.7E-05	5.0E-05	7.84E-06	2.21E-05	7.84E-05	2.21E-04
PCB 77	32598-13-3	0.0089[e]	2.53E-04	1.7E-05	5.0E-05	8.93E-06	2.53E-05	8.93E-05	2.53E-04
PCB 78	70362-49-1	0.0227	2.45E-04	1.7E-05	5.0E-05	8.68E-06	2.45E-05	8.68E-05	2.45E-04
PCB 79	41464-48-6	0.0227	2.08E-04	1.7E-05	5.0E-05	7.37E-06	2.08E-05	7.37E-05	2.08E-04
PCB 80	33284-52-5	0.0227	2.15E-04	1.8E-05	5.0E-05	7.61E-06	2.15E-05	7.61E-05	2.15E-04
PCB 81	70362-50-4	0.0044[e]	2.32E-04	1.8E-05	5.0E-05	8.25E-06	2.32E-05	8.25E-05	2.32E-04
PCB 82	52663-62-4	0.0227	2.44E-04	1.3E-05	5.0E-05	8.31E-06	2.44E-05	8.31E-05	2.44E-04
PCB 83	60145-20-2	0.0227	2.19E-04	2.2E-05	5.0E-05	7.46E-06	2.19E-05	7.46E-05	2.19E-04
PCB 84	52663-60-2	0.0227	2.11E-04	1.2E-05	5.0E-05	7.16E-06	2.11E-05	7.16E-05	2.11E-04
PCB 85	65510-45-4	0.0227	1.70E-04	1.0E-05	2.0E-05	5.78E-06	1.70E-05	5.78E-05	1.70E-04
PCB 86	55312-69-1	0.0227	1.80E-04	1.5E-05	5.0E-05	6.12E-06	1.80E-05	6.12E-05	1.80E-04
PCB 87	38380-02-8	0.0227	1.80E-04	1.5E-05	5.0E-05	6.12E-06	1.80E-05	6.12E-05	1.80E-04
PCB 88	55215-17-3	0.0227	2.34E-04	1.2E-05	5.0E-05	7.92E-06	2.34E-05	7.92E-05	2.34E-04
PCB 89	73575-57-2	0.0227	2.16E-04	1.9E-05	5.0E-05	7.32E-06	2.16E-05	7.32E-05	2.16E-04
PCB 90	68194-07-0	0.0227	1.81E-04	2.4E-05	1.0E-04	6.14E-06	1.81E-05	6.14E-05	1.81E-04
PCB 91	68194-05-8	0.0227	1.63E-04	1.2E-05	5.0E-05	5.53E-06	1.63E-05	5.53E-05	1.63E-04
PCB 92	52663-61-3	0.0227	2.22E-04	1.2E-05	5.0E-05	7.55E-06	2.22E-05	7.55E-05	2.22E-04
PCB 93	73575-56-1	0.0227	2.09E-04	2.2E-05	5.0E-05	7.08E-06	2.09E-05	7.08E-05	2.09E-04

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Analyte	CAS Number	DQL (mg/kg dw)[a, b]	Project Quantitation Limit Goal (mg/kg dw)	Analytical Method[c]		Achievable Laboratory Limits (10-g sample)[d]		Achievable Laboratory Limits (1-g sample)[d]	
				MDL (mg/kg dw)	Method QL (mg/kg dw)	MDL (mg/kg dw)	QL (mg/kg dw)	MDL (mg/kg dw)	QL (mg/kg dw)
PCB 94	73575-55-0	0.0227	2.22E-04	1.2E-05	5.0E-05	7.51E-06	2.22E-05	7.51E-05	2.22E-04
PCB 95	38379-99-6	0.0227	1.85E-04	2.2E-05	5.0E-05	6.29E-06	1.85E-05	6.29E-05	1.85E-04
PCB 96	73575-54-9	0.0227	3.20E-05	2.1E-05	5.0E-05	1.22E-06	3.20E-06	1.22E-05	3.20E-05
PCB 97	41464-51-1	0.0227	1.80E-04	1.5E-05	5.0E-05	6.12E-06	1.80E-05	6.12E-05	1.80E-04
PCB 98	60233-25-2	0.0227	2.11E-04	2.2E-05	5.0E-05	7.16E-06	2.11E-05	7.16E-05	2.11E-04
PCB 99	38380-01-7	0.0227	1.87E-04	2.2E-05	5.0E-05	6.35E-06	1.87E-05	6.35E-05	1.87E-04
PCB 100	39485-83-1	0.0227	2.09E-04	2.2E-05	5.0E-05	7.08E-06	2.09E-05	7.08E-05	2.09E-04
PCB 101	37680-73-2	0.0227	1.81E-04	2.4E-05	1.0E-04	6.14E-06	1.81E-05	6.14E-05	1.81E-04
PCB 102	68194-06-9	0.0227	1.74E-04	2.2E-05	5.0E-05	5.92E-06	1.74E-05	5.92E-05	1.74E-04
PCB 103	60145-21-3	0.0227	1.72E-04	2.3E-05	5.0E-05	5.83E-06	1.72E-05	5.83E-05	1.72E-04
PCB 104	56558-16-8	0.0227	2.80E-05	2.3E-05	5.0E-05	1.07E-06	2.80E-06	1.07E-05	2.80E-05
PCB 105	32598-14-4	0.0227	1.67E-04	1.1E-05	2.0E-06	5.65E-06	1.67E-05	5.65E-05	1.67E-04
PCB 106	70424-69-0	0.0227	1.61E-04	1.4E-05	5.0E-05	5.48E-06	1.61E-05	5.48E-05	1.61E-04
PCB 107	70424-68-9	0.0227	1.65E-04	2.7E-05	1.0E-04	5.59E-06	1.65E-05	5.59E-05	1.65E-04
PCB 108	70362-41-3	0.0227	1.80E-04	1.5E-05	5.0E-05	6.12E-06	1.80E-05	6.12E-05	1.80E-04
PCB 109	74472-35-8	0.0227	1.35E-04	1.0E-05	2.0E-05	4.59E-06	1.35E-05	4.59E-05	1.35E-04
PCB 110	38380-03-9	0.0227	1.62E-04	2.4E-05	1.0E-04	5.49E-06	1.62E-05	5.49E-05	1.62E-04
PCB 111	39635-32-0	0.0227	1.53E-04	2.4E-05	1.0E-04	5.19E-06	1.53E-05	5.19E-05	1.53E-04
PCB 112	74472-36-9	0.0227	1.75E-04	2.5E-05	1.0E-04	5.93E-06	1.75E-05	5.93E-05	1.75E-04
PCB 113	68194-10-5	0.0227	1.81E-04	2.4E-05	1.0E-04	6.14E-06	1.81E-05	6.14E-05	1.81E-04
PCB 114	74472-37-0	0.00068[e]	1.63E-04	1.2E-05	5.0E-05	5.54E-06	1.63E-05	5.54E-05	1.63E-04
PCB 115	74472-38-1	0.0227	1.41E-04	2.4E-05	1.0E-04	4.79E-06	1.41E-05	4.79E-05	1.41E-04
PCB 116	18259-05-7	0.0227	1.70E-04	1.0E-05	2.0E-05	5.78E-06	1.70E-05	5.78E-05	1.70E-04
PCB 117	68194-11-6	0.0227	1.75E-04	1.0E-05	2.0E-05	5.91E-06	1.75E-05	5.91E-05	1.75E-04
PCB 118	31508-00-6	0.0227	1.53E-04	1.9E-05	5.0E-05	5.19E-06	1.53E-05	5.19E-05	1.53E-04

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Analyte	CAS Number	DQL (mg/kg dw)[a, b]	Project Quantitation Limit Goal (mg/kg dw)	Analytical Method[c]		Achievable Laboratory Limits (10-g sample)[d]		Achievable Laboratory Limits (1-g sample)[d]	
				MDL (mg/kg dw)	Method QL (mg/kg dw)	MDL (mg/kg dw)	QL (mg/kg dw)	MDL (mg/kg dw)	QL (mg/kg dw)
PCB 119	56558-17-9	0.0227	1.80E-04	1.5E-05	5.0E-05	6.12E-06	1.80E-05	6.12E-05	1.80E-04
PCB 120	68194-12-7	0.0227	1.65E-04	1.5E-05	5.0E-05	5.61E-06	1.65E-05	5.61E-05	1.65E-04
PCB 121	56558-18-0	0.0227	1.56E-04	2.1E-05	5.0E-05	5.29E-06	1.56E-05	5.29E-05	1.56E-04
PCB 122	76842-07-4	0.0227	1.80E-04	1.2E-05	5.0E-05	6.11E-06	1.80E-05	6.11E-05	1.80E-04
PCB 123	65510-44-3	0.0227	1.61E-04	1.5E-05	5.0E-05	5.46E-06	1.61E-05	5.46E-05	1.61E-04
PCB 124	70424-70-3	0.0227	1.65E-04	2.7E-05	1.0E-04	5.59E-06	1.65E-05	5.59E-05	1.65E-04
PCB 125	74472-39-2	0.0227	1.80E-04	1.5E-05	5.0E-05	6.12E-06	1.80E-05	6.12E-05	1.80E-04
PCB 126	57465-28-8	0.000034[e]	**3.28E-04**	1.4E-05	5.0E-05	1.15E-05	3.28E-05	**1.15E-04**	**3.28E-04**
PCB 127	39635-33-1	0.0227	1.53E-04	2.8E-05	1.0E-04	5.19E-06	1.53E-05	5.19E-05	1.53E-04
PCB 128	38380-07-3	0.0227	8.98E-04	1.2E-05	5.0E-05	3.07E-05	8.98E-05	3.07E-04	8.98E-04
PCB 129	55215-18-4	0.0227	5.16E-05	2.1E-05	5.0E-05	1.89E-06	5.16E-06	1.89E-05	5.16E-05
PCB 130	52663-66-8	0.0227	6.69E-05	1.4E-05	5.0E-05	2.45E-06	6.69E-06	2.45E-05	6.69E-05
PCB 131	61798-70-7	0.0227	6.16E-05	1.2E-05	5.0E-05	2.23E-06	6.16E-06	2.23E-05	6.16E-05
PCB 132	38380-05-1	0.0227	5.69E-05	1.2E-05	5.0E-05	2.16E-06	5.69E-06	2.16E-05	5.69E-05
PCB 133	35694-04-3	0.0227	5.87E-05	1.7E-05	5.0E-05	2.13E-06	5.87E-06	2.13E-05	5.87E-05
PCB 134	52704-70-8	0.0227	7.11E-05	1.3E-05	5.0E-05	2.61E-06	7.11E-06	2.61E-05	7.11E-05
PCB 135	52744-13-5	0.0227	5.85E-05	1.1E-05	5.0E-05	2.13E-06	5.85E-06	2.13E-05	5.85E-05
PCB 136	38411-22-2	0.0227	3.72E-05	9.E-06	2.0E-05	1.40E-06	3.72E-06	1.40E-05	3.72E-05
PCB 137	35694-06-5	0.0227	5.22E-05	3.0E-05	1.0E-04	1.89E-06	5.22E-06	1.89E-05	5.22E-05
PCB 138	35065-28-2	0.0227	5.16E-05	2.1E-05	5.0E-05	1.89E-06	5.16E-06	1.89E-05	5.16E-05
PCB 139	56030-56-9	0.0227	5.61E-05	2.0E-05	5.0E-05	2.04E-06	5.61E-06	2.04E-05	5.61E-05
PCB 140	59291-64-4	0.0227	5.61E-05	2.0E-05	5.0E-05	2.04E-06	5.61E-06	2.04E-05	5.61E-05
PCB 141	52712-04-6	0.0227	5.46E-05	9.E-06	2.0E-05	1.99E-06	5.46E-06	1.99E-05	5.46E-05
PCB 142	41411-61-4	0.0227	6.38E-05	3.1E-05	1.0E-04	2.33E-06	6.38E-06	2.33E-05	6.38E-05
PCB 143	68194-15-0	0.0227	5.97E-05	1.3E-05	5.0E-05	2.18E-06	5.97E-06	2.18E-05	5.97E-05

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Analyte	CAS Number	DQL (mg/kg dw)[a, b]	Project Quantitation Limit Goal (mg/kg dw)	Analytical Method[c]		Achievable Laboratory Limits (10-g sample)[d]		Achievable Laboratory Limits (1-g sample)[d]	
				MDL (mg/kg dw)	Method QL (mg/kg dw)	MDL (mg/kg dw)	QL (mg/kg dw)	MDL (mg/kg dw)	QL (mg/kg dw)
PCB 144	68194-14-9	0.0227	5.84E-05	1.7E-05	5.0E-05	2.14E-06	5.84E-06	2.14E-05	5.84E-05
PCB 145	74472-40-5	0.0227	3.55E-05	3.2E-05	1.0E-04	1.31E-06	3.55E-06	1.31E-05	3.55E-05
PCB 146	51908-16-8	0.0227	5.38E-05	1.8E-05	5.0E-05	1.97E-06	5.38E-06	1.97E-05	5.38E-05
PCB 147	68194-13-8	0.0227	5.49E-05	1.8E-05	5.0E-05	1.99E-06	5.49E-06	1.99E-05	5.49E-05
PCB 148	74472-41-6	0.0227	5.90E-05	3.2E-05	1.0E-04	2.15E-06	5.90E-06	2.15E-05	5.90E-05
PCB 149	38380-04-0	0.0227	5.49E-05	1.8E-05	5.0E-05	1.99E-06	5.49E-06	1.99E-05	5.49E-05
PCB 150	68194-08-1	0.0227	3.47E-05	3.3E-05	1.0E-04	1.30E-06	3.47E-06	1.30E-05	3.47E-05
PCB 151	52663-63-5	0.0227	5.85E-05	1.1E-05	5.0E-05	2.13E-06	5.85E-06	2.13E-05	5.85E-05
PCB 152	68194-09-2	0.0227	3.38E-05	2.4E-05	1.0E-04	1.26E-06	3.38E-06	1.26E-05	3.38E-05
PCB 153	35065-27-1	0.0227	4.41E-05	1.3E-05	5.0E-05	1.62E-06	4.41E-06	1.62E-05	4.41E-05
PCB 154	60145-22-4	0.0227	5.23E-05	1.1E-05	5.0E-05	1.91E-06	5.23E-06	1.91E-05	5.23E-05
PCB 155	33979-03-2	0.0227	3.31E-05	3.4E-05	1.0E-04	1.24E-06	3.31E-06	1.24E-05	3.31E-05
PCB 156	38380-08-4	0.00068[e]	1.05E-03	**1.3E-05**	5.0E-05	3.61E-05	1.05E-04	3.61E-04	**1.05E-03**
PCB 157	69782-90-7	0.00068[e]	1.05E-03	**1.3E-05**	5.0E-05	3.61E-05	1.05E-04	3.61E-04	**1.05E-03**
PCB 158	74472-42-7	0.0227	4.08E-05	1.1E-05	2.0E-05	1.51E-06	4.08E-06	1.51E-05	4.08E-05
PCB 159	39635-35-3	0.0227	8.49E-04	3.5E-05	1.0E-04	2.90E-05	8.49E-05	2.90E-04	8.49E-04
PCB 160	41411-62-5	0.0227	4.54E-05	2.1E-05	5.0E-05	1.67E-06	4.54E-06	1.67E-05	4.54E-05
PCB 161	74472-43-8	0.0227	4.25E-05	3.5E-05	1.0E-04	1.55E-06	4.25E-06	1.55E-05	4.25E-05
PCB 162	39635-34-2	0.0227	7.90E-04	3.5E-05	1.0E-04	2.70E-05	7.90E-05	2.70E-04	7.90E-04
PCB 163	74472-44-9	0.0227	5.16E-05	2.1E-05	5.0E-05	1.89E-06	5.16E-06	1.89E-05	5.16E-05
PCB 164	74472-45-0	0.0227	4.13E-05	1.4E-05	5.0E-05	1.51E-06	4.13E-06	1.51E-05	4.13E-05
PCB 165	74472-46-1	0.0227	4.72E-05	3.6E-05	1.0E-04	1.74E-06	4.72E-06	1.74E-05	4.72E-05
PCB 166	41411-63-6	0.0227	8.98E-04	1.2E-05	5.0E-05	3.07E-05	8.98E-05	3.07E-04	8.98E-04
PCB 167	52663-72-6	0.0227[e]	7.90E-04	1.1E-05	5.0E-05	2.70E-05	7.90E-05	2.70E-04	7.90E-04
PCB 168	59291-65-5	0.0227	4.41E-05	1.3E-05	5.0E-05	1.62E-06	4.41E-06	1.62E-05	4.41E-05

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Analyte	CAS Number	DQL (mg/kg dw)[a, b]	Project Quantitation Limit Goal (mg/kg dw)	Analytical Method[c]		Achievable Laboratory Limits (10-g sample)[d]		Achievable Laboratory Limits (1-g sample)[d]	
				MDL (mg/kg dw)	Method QL (mg/kg dw)	MDL (mg/kg dw)	QL (mg/kg dw)	MDL (mg/kg dw)	QL (mg/kg dw)
PCB 169	32774-16-6	0.0227[e]	8.67E-04	1.6E-05	5.0E-05	2.98E-05	8.67E-05	2.98E-04	8.67E-04
PCB 170	35065-30-6	0.0227	1.55E-03	1.6E-05	5.0E-05	5.24E-05	1.55E-04	5.24E-04	1.55E-03
PCB 171	52663-71-5	0.0227	1.59E-03	3.7E-05	1.0E-04	5.36E-05	1.59E-04	5.36E-04	1.59E-03
PCB 172	52663-74-8	0.0227	1.50E-03	3.8E-05	1.0E-04	5.05E-05	1.50E-04	5.05E-04	1.50E-03
PCB 173	68194-16-1	0.0227	1.59E-03	3.7E-05	1.0E-04	5.36E-05	1.59E-04	5.36E-04	1.59E-03
PCB 174	38411-25-5	0.0227	1.56E-03	1.9E-05	5.0E-05	5.28E-05	1.56E-04	5.28E-04	1.56E-03
PCB 175	40186-70-7	0.0227	1.54E-03	3.8E-05	1.0E-04	5.18E-05	1.54E-04	5.18E-04	1.54E-03
PCB 176	52663-65-7	0.0227	3.90E-05	3.9E-05	1.0E-04	1.44E-06	3.90E-06	1.44E-05	3.90E-05
PCB 177	52663-70-4	0.0227	1.66E-03	1.4E-05	5.0E-05	5.60E-05	1.66E-04	5.60E-04	1.66E-03
PCB 178	52663-67-9	0.0227	5.53E-05	2.2E-05	5.0E-05	2.04E-06	5.53E-06	2.04E-05	5.53E-05
PCB 179	52663-64-6	0.0227	4.43E-05	2.3E-05	5.0E-05	1.65E-06	4.43E-06	1.65E-04	4.43E-05
PCB 180	35065-29-3	0.0227	1.30E-03	1.4E-05	5.0E-05	4.38E-05	1.30E-04	4.38E-04	1.30E-03
PCB 181	74472-47-2	0.0227	1.38E-03	4.0E-05	1.0E-04	4.70E-05	1.38E-04	4.70E-04	1.38E-03
PCB 182	60145-23-5	0.0227	1.42E-03	4.0E-05	1.0E-04	4.81E-05	1.42E-04	4.81E-04	1.42E-03
PCB 183	52663-69-1	0.0227	1.27E-03	4.0E-05	1.0E-04	4.28E-05	1.27E-04	4.28E-04	1.27E-03
PCB 184	74472-48-3	0.0227	4.50E-05	4.0E-05	1.0E-04	1.68E-06	4.50E-06	1.68E-03	4.50E-05
PCB 185	52712-05-7	0.0227	1.33E-03	4.0E-05	1.0E-04	4.49E-05	1.33E-04	4.49E-04	1.33E-03
PCB 186	74472-49-4	0.0227	4.55E-05	4.1E-05	1.0E-04	1.71E-06	4.55E-06	1.71E-05	4.55E-05
PCB 187	52663-68-0	0.0227	1.46E-03	1.9E-05	5.0E-05	4.93E-05	1.46E-04	4.93E-04	1.46E-03
PCB 188	74487-85-7	0.0227	3.92E-05	2.3E-05	5.0E-05	1.46E-06	3.92E-06	1.46E-05	3.92E-05
PCB 189	39635-31-9	0.0227[e]	2.16E-04	1.8E-05	5.0E-05	7.64E-06	2.16E-05	7.64E-05	2.16E-04
PCB 190	41411-64-7	0.0227	1.33E-03	2.3E-05	5.0E-05	4.49E-05	1.33E-04	4.49E-04	1.33E-03
PCB 191	74472-50-7	0.0227	1.32E-03	4.2E-05	1.0E-04	4.45E-05	1.32E-04	4.45E-04	1.32E-03
PCB 192	74472-51-8	0.0227	1.43E-03	4.2E-05	1.0E-04	4.84E-05	1.43E-04	4.84E-04	1.43E-03
PCB 193	69782-91-8	0.0227	1.30E-03	1.4E-05	5.0E-05	4.38E-05	1.30E-04	4.38E-04	1.30E-03

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Analyte	CAS Number	DQL (mg/kg dw)[a, b]	Project Quantitation Limit Goal (mg/kg dw)	Analytical Method[c]		Achievable Laboratory Limits (10-g sample)[d]		Achievable Laboratory Limits (1-g sample)[d]	
				MDL (mg/kg dw)	Method QL (mg/kg dw)	MDL (mg/kg dw)	QL (mg/kg dw)	MDL (mg/kg dw)	QL (mg/kg dw)
PCB 194	35694-08-7	0.0227	5.70E-04	1.7E-05	5.0E-05	1.95E-05	5.70E-05	1.95E-04	5.70E-04
PCB 195	52663-78-2	0.0227	5.84E-04	4.3E-05	1.0E-04	2.00E-05	5.84E-05	2.00E-04	5.84E-04
PCB 196	42740-50-1	0.0227	2.00E-04	4.3E-05	1.0E-04	7.02E-06	2.00E-05	7.02E-05	2.00E-04
PCB 197	33091-17-7	0.0227	1.45E-04	2.5E-05	1.0E-04	5.10E-06	1.45E-05	5.10E-05	1.45E-04
PCB 198	68194-17-2	0.0227	2.25E-04	2.0E-05	1.0E-04	7.96E-06	2.25E-05	7.96E-05	2.25E-04
PCB 199	52663-75-9	0.0227	2.25E-04	2.0E-05	1.0E-04	7.96E-06	2.25E-05	7.96E-05	2.25E-04
PCB 200	52663-73-7	0.0227	1.72E-04	2.5E-05	1.0E-04	6.08E-06	1.72E-05	6.08E-05	1.72E-04
PCB 201	40186-71-8	0.0227	1.61E-04	4.4E-05	1.0E-04	5.70E-06	1.61E-05	5.70E-05	1.61E-04
PCB 202	2136-99-4	0.0227	1.52E-04	4.4E-05	1.0E-04	5.38E-06	1.52E-05	5.38E-05	1.52E-04
PCB 203	52663-76-0	0.0227	2.02E-04	4.4E-05	1.0E-04	7.14E-06	2.02E-05	7.14E-05	2.02E-04
PCB 204	74472-52-9	0.0227	1.69E-04	4.5E-05	1.0E-04	5.96E-06	1.69E-05	5.96E-05	1.69E-04
PCB 205	74472-53-0	0.0227	4.47E-04	4.5E-05	1.0E-04	1.53E-05	4.47E-05	1.53E-04	4.47E-04
PCB 206	40186-72-9	0.0227	5.04E-04	4.5E-05	1.0E-04	1.72E-05	5.04E-05	1.72E-04	5.04E-04
PCB 207	52663-79-3	0.0227	3.91E-04	4.5E-05	1.0E-04	1.35E-05	3.91E-05	1.35E-04	3.91E-04
PCB 208	52663-77-1	0.0227	3.93E-04	4.6E-05	1.0E-04	1.35E-05	3.93E-05	1.35E-04	3.93E-04
PCB 209	2051-24-3	0.0227	1.64E-04	1.5E-05	5.0E-05	5.69E-06	1.64E-05	5.69E-05	1.64E-04

Note: Project data will be reported in units appropriate to the analytical method.

[a] DQLs have not been approved by USEPA. DQLs based on the lower of: 1) NJDEP Soil Remediation Standards for Residential Soil, June 2008, 2) USEPA RSLs for residential soil, April 2009, and 3) applicable ecological thresholds based on NOAELs, TRVs, AETs, ERLs, and TELs (if available). RSLs for non-carcinogenic compounds were divided by a factor of 10 to adjust for a hazard index of 0.1 to account for potential additive effects. See Attachment K for ecological and human health thresholds. DQLs (including ecological and human health thresholds presented in Attachment K) are analytical goals listed solely for the purpose of evaluating laboratory analytical methods and achievable laboratory limits; these are not project-specific screening levels or PRGs and are not approved by the USEPA as the appropriate risk assessment criteria for this project. These values will be developed in subsequent phases of the project.

[b] DQLs for individual PCB congeners based on the total PCB DQL. For dioxin-like PCB congeners, DQL based on the lower of the total PCB DQL and the individual PCB congener DQL. DQLs have not been approved by USEPA.

[c] Analytical MDLs and QLs are those documented in validated methods. When the method did not publish a value for either the MDL or QL, the

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Analyte	CAS Number	DQL (mg/kg dw)[a, b]	Project Quantitation Limit Goal (mg/kg dw)	Analytical Method[c]		Achievable Laboratory Limits (10-g sample)[d]		Achievable Laboratory Limits (1-g sample)[d]	
				MDL (mg/kg dw)	Method QL (mg/kg dw)	MDL (mg/kg dw)	QL (mg/kg dw)	MDL (mg/kg dw)	QL (mg/kg dw)

value was determined to be NA.

[d] Achievable MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method. Actual MDLs and QLs will vary based on sample-specific factors. For PCBs, the MDL and QL are based on extraction of 10-g samples. The MDLs and QLs for the 1-g samples were determined by multiplying the MDLs and QLs for the 10-g samples by a factor of 10. The laboratory detection limit will be based on the sample specific EDLs. Actual EDLs will vary based on sample specific factors.

[e] DQLs for the individual dioxin-like PCB congeners calculated by dividing the 2,3,7,8-TCDD DQL by its respective mammal or bird toxic equivalence factor as cited in Van den Berg et al (1998) and (2006), respectively. DQLs have not been approved by USEPA.

AET – apparent effects threshold
CAS – Chemical Abstract Service
DQL – data quality level
dw – dry weight
EDL – estimated detection limit
ERL – effects range – low
MDL – method detection limit
NA – not available
NJDEP – New Jersey Department of Environmental Protection
NOAEL – no-observed-adverse-effect level
PCB – polychlorinated biphenyl
PRG – preliminary remediation goal
QL – quantitation limit
RSL – regional screening level
TCDD – tetrachlorodibenzo-*p*-dioxin
TEL – threshold effects level
TRV – toxicity reference value
USEPA – US Environmental Protection Agency

Bold indicates chemicals for which the achievable laboratory limits exceed the DQL.

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Matrix: Sediment

Analytical Group, Method, and Laboratory: PCB – Aroclors, USEPA SW-846 8082, Alpha Analytical, Mansfield, MA

SOP from Worksheet 23: M35

Concentration Level: Low

Analyte	CAS Number	DQL (mg/kg dw)[a]	Project Quantitation Limit Goal (mg/kg dw)	Analytical Method[b]		Achievable Laboratory Limits[c]	
				MDL (mg/kg dw)	Method QL (mg/kg dw)	MDL (mg/kg)	QL (mg/kg)
Aroclor 1016	12674-11-2	0.0227	0.004	NA	NA	0.001	0.004
Aroclor 1221	11104-28-2	0.0227	0.004	NA	NA	0.002	0.004
Aroclor 1232	11141-16-5	0.0227	0.004	NA	NA	0.002	0.004
Aroclor 1242	53469-21-9	0.0227	0.004	NA	NA	0.001	0.004
Aroclor 1248	12672-29-6	0.0227	0.004	NA	NA	0.001	0.004
Aroclor 1254	11097-69-1	0.0227	0.004	NA	NA	0.001	0.004
Aroclor 1260	11096-82-5	0.0227	0.004	NA	NA	0.002	0.004
Aroclor 1262	37324-23-5	0.0227	0.004	NA	NA	0.002	0.004
Aroclor 1268	11100-14-4	0.0227	0.004	NA	NA	0.002	0.004

Note: Project data will be reported in units appropriate to the analytical method.

[a] DQLs have not been approved by USEPA. DQLs based on the lower of: 1) NJDEP Soil Remediation Standards for Residential Soil, June 2008, 2) USEPA RSLs for residential soil, April 2009, and 3) applicable ecological thresholds based on NOAELs, TRVs, AETs, ERLs, and TELs (if available). RSLs for non-carcinogenic compounds were divided by a factor of 10 to adjust for a hazard index of 0.1 to account for potential additive effects. See Attachment K for ecological and human health thresholds. DQLs (including ecological and human health thresholds presented in Attachment K) are analytical goals listed solely for the purpose of evaluating laboratory analytical methods and achievable laboratory limits; these are not project-specific screening levels or PRGs and are not approved by the USEPA as the appropriate risk assessment criteria for this project. These values will be developed in subsequent phases of the project.

[b] Analytical MDLs and QLs are those documented in validated methods. When the method did not publish a value for either the MDL or QL, the value was determined to be NA.

[c] Achievable MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method. Actual MDLs and QLs will vary based specific estimated detection limits rather than QLs on sample-specific factors. The laboratory conducts MDL studies with spikes that go through the extraction and analytical process; therefore, dry weight or wet weight units do not apply.

AET – apparent effects threshold
CAS – Chemical Abstract Service
DQL – data quality level
dw – dry weight
NA – not available
NJDEP – New Jersey Department of Environmental Protection
NOAEL – no-observed-adverse-effect level
QL – quantitation limit
RSL – regional screening level
TEL – threshold effects level
TRV – toxicity reference value

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Analyte	CAS Number	DQL (mg/kg dw)[a]	Project Quantitation Limit Goal (mg/kg dw)	Analytical Method[b]		Achievable Laboratory Limits[c]	
				MDL (mg/kg dw)	Method QL (mg/kg dw)	MDL (mg/kg)	QL (mg/kg)

ERL – effects range – low
MDL – method detection limit
PCB – polychlorinated biphenyl
PRG – preliminary remediation goal
USEPA – US Environmental Protection Agency

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Matrix: Sediment

Analytical Group, Method, and Laboratory: PCDDs/PCDFs, USEPA 1613B, Analytical Perspectives, Wilmington, NC

SOP from Worksheet 23: M3

Concentration Level: Low

Analyte	CAS Number	DQL (mg/kg dw)[a]	Project Quantitation Limit Goal (mg/kg dw)	Analytical Method[b]		Achievable Laboratory Limits[c]	
				MDL (mg/kg dw)	Method QL (mg/kg dw)	MDLs (mg/kg dw)	QLs (mg/kg dw)
1,2,3,4,6,7,8-HpCDD	35822-46-9	0.00045[d]	5.79E-06	NA	5.00E-06	2.05E-06	5.79E-06
1,2,3,4,6,7,8-HpCDF	67562-39-4	0.00045[d]	1.77E-06	NA	5.00E-06	6.4E-07	1.77E-06
1,2,3,4,7,8-HxCDD	39227-28-6	0.000045[d]	1.43E-06	NA	5.00E-06	6.2E-07	1.43E-06
1,2,3,4,7,8-HxCDF	70648-26-9	0.000045[d]	7.0E-07	NA	5.00E-06	2.9E-07	7.0E-07
1,2,3,4,7,8,9-HpCDF	55673-89-7	0.00045[d]	2.43E-06	NA	5.00E-06	8.8E-07	2.43E-06
1,2,3,6,7,8-HxCDD	57653-85-7	0.000045[d]	1.35E-06	NA	5.00E-06	5.9E-07	1.35E-06
1,2,3,6,7,8-HxCDF	57117-44-9	0.000045[d]	7.0E-07	NA	5.00E-06	2.9E-07	7.0E-07
1,2,3,7,8,9-HxCDD	19408-74-3	0.000045[d]	1.49E-06	NA	5.00E-06	6.5E-07	1.49E-06
1,2,3,7,8,9-HxCDF	72918-21-9	0.000045[d]	8.1E-07	NA	5.00E-06	3.4E-07	8.1E-07
1,2,3,7,8-PeCDD	40321-76-4	0.0000045[d]	7.6E-07	NA	5.00E-06	3.5E-07	7.6E-07
1,2,3,7,8-PeCDF	57117-41-6	0.00015[d]	7.4E-07	NA	5.00E-06	3.3E-07	7.4E-07
2,3,4,6,7,8-HxCDF	60851-34-5	0.000045[d]	7.5E-07	NA	5.00E-06	3.1E-07	7.5E-07
2,3,4,7,8-PeCDF	57117-31-4	0.000015[d]	6.3E-07	NA	5.00E-06	2.8E-07	6.3E-07
2,3,7,8-TCDD	1746-01-6	0.00000012	**4.9E-07**	NA	1.00E-06	**2.3E-07**	**4.9E-07**
2,3,7,8-TCDF	51207-31-9	0.000045[d]	3.7E-07	NA	1.00E-06	1.8E-07	3.7E-07
OCDD	3268-87-9	0.015[d]	2.74E-06	NA	1.00E-05	1.10E-06	2.74E-06
OCDF	39001-02-0	0.015[d]	2.13E-06	NA	1.00E-05	9.1E-07	2.13E-06

Note: Project data will be reported in units appropriate to the analytical method.

[a] DQLs have not been approved by USEPA. DQLs based on the lower of: 1) NJDEP Soil Remediation Standards for Residential Soil, June 2008, 2) USEPA RSLs for residential soil, April 2009, and 3) applicable ecological thresholds based on NOAELs, TRVs, AETs, ERLs, and TELs (if available). RSLs for non-carcinogenic compounds were divided by a factor of 10 to adjust for a hazard index of 0.1 to account for potential additive effects. See Attachment K for ecological and human health thresholds. DQLs (including ecological and human health thresholds presented in Attachment K) are analytical goals listed solely for the purpose of evaluating laboratory analytical methods and achievable laboratory limits; these are not project-specific screening levels or PRGs and are not approved by the USEPA as the appropriate

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Analyte	CAS Number	DQL (mg/kg dw)[a]	Project Quantitation Limit Goal (mg/kg dw)	Analytical Method[b]		Achievable Laboratory Limits[c]	
				MDL (mg/kg dw)	Method QL (mg/kg dw)	MDLs (mg/kg dw)	QLs (mg/kg dw)

risk assessment criteria for this project. These values will be developed in subsequent phases of the project.

[b] Analytical MDLs and QLs are those documented in validated methods. When the method did not publish a value for either the MDL or QL, the value was determined to be NA.

[c] Achievable MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method. Actual MDLs and QLs will vary based on sample-specific factors. For PCDDs/PCDFs, the MDL and QL are based on extraction of 10 grams/sample. The laboratory reporting limit will be based on the sample specific EDL. Actual EDLs will vary based on sample-specific factors, including sample mass.

[d] DQLs for individual PCDDs/ PCDFs calculated by dividing the 2,3,7,8-TCDD DQL by its respective mammal or bird toxic equivalence factor as cited in Van den Berg et al (1998) and (2006), respectively. DQLs have not been approved by USEPA.

AET – apparent effects threshold
CAS – Chemical Abstract Service
DQL – data quality level
dw – dry weight
EDL – estimated detection limit
ERL – effects range – low
HpCDD – heptachlorodibenzo-*p*-dioxin
HpCDF – heptachlorodibenzofuran
HxCDD – hexachlorodibenzo-*p*-dioxin
HxCDF – hexachlorodibenzofuran
MDL – method detection limit
NA – not available
NJDEP – New Jersey Department of Environmental Protection
NOAEL – no-observed-adverse-effect level
OCDD – octachlorodibenzo-*p*-dioxin
OCDF – octachlorodibenzofuran
PCDD – polychlorinated dibenzo-*p*-dioxin
PCDF – polychlorinated dibenzofuran
PeCDD – pentachlorodibenzo-*p*-dioxin
PeCDF – pentachlorodibenzofuran
PRG – preliminary remediation goal
QL – quantitation limit
RSL – regional screening level
TCDD – tetrachlorodibenzo-*p*-dioxin
TCDF – tetrachlorodibenzofuran
TEL – threshold effects level
TRV – toxicity reference value
USEPA – US Environmental Protection Agency

Bold indicates chemicals for which the achievable laboratory limits exceed the project quantitation limit goal.

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Matrix: Sediment

Analytical Group, Method, and Laboratory: PAHs, CARB 429 Modified, Maxxam Analytics, Mississauga, ON

SOP from Worksheet 23: M4

Concentration Level: Low

Analyte	CAS Number	DQL (mg/kg dw)[a]	Project Quantitation Limit Goal (mg/kg dw)	Analytical Method[b]		Achievable Laboratory Limits[c]	
				MDL (mg/kg dw)	Method QL (mg/kg dw)	MDL (mg/kg dw)	QL (mg/kg dw)
2-Methylnaphthalene	91-57-6	0.0202	0.001	NA	NA	0.0000992	0.001
Acenaphthene	83-32-9	0.00671	0.001	NA	NA	0.0001316	0.001
Acenaphthylene	208-96-8	0.00587	0.001[d]	NA	NA	0.001316	0.001[d]
Anthracene	120-12-7	0.0469	0.001	NA	NA	0.000093	0.001
Fluorene	86-73-7	0.019	0.001	NA	NA	0.0000957	0.001
Naphthalene	91-20-3	0.0346	0.001	NA	NA	0.0001661	0.001
Phenanthrene	85-01-8	0.0419	0.001	NA	NA	0.0001225	0.001
Benzo[a]anthracene	56-55-3	0.0317	0.001d	NA	NA	0.0002016	0.001d
Benzo[a]pyrene	50-32-8	0.015	0.001	NA	NA	0.0001677	0.001
Benzo[b]fluoranthene	205-99-2	0.15	0.001	NA	NA	0.0003726	0.001
Benzo[e]pyrene	192-97-2	170	0.001	NA	NA	0.0001677	0.001
Benzo[g,h,i]perylene	191-24-2	0.17	0.001	NA	NA	0.0002390	0.001
Benzo[k]fluoranthene[e]	207-08-9	0.24	0.001	NA	NA	0.0002101	0.001
Chrysene	218-01-9	0.0571	0.001	NA	NA	0.0001409	0.001
Dibenzo[a,h]anthracene	53-70-3	0.00622	0.001	NA	NA	0.0002348	0.001
Fluoranthene	206-44-0	0.111	0.001	NA	NA	0.0001775	0.001
Indeno-[1,2,3c,d]pyrene	193-39-5	0.15	0.001	NA	NA	0.0002784	0.001
Perylene	198-55-0	170	0.001	NA	NA	0.0001740	0.001
Pyrene	129-00-0	0.053	0.001	NA	NA	0.0001027	0.001
1-Methylnaphthalene	90-12-0	22	0.001	NA	NA	0.0001593	0.001
1-Methylphenanthrene	832-69-9	1700	0.001	NA	NA	0.0001451	0.001
2,3,5-Trimethylnaphthalene	2245-38-7	3.9	0.001	NA	NA	0.0002091	0.001
2,6-Dimethylnaphthalene	581-42-0	3.9	0.001	NA	NA	0.0002405	0.001

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Analyte	CAS Number	DQL (mg/kg dw)[a]	Project Quantitation Limit Goal (mg/kg dw)	Analytical Method[b]		Achievable Laboratory Limits[c]	
				MDL (mg/kg dw)	Method QL (mg/kg dw)	MDL (mg/kg dw)	QL (mg/kg dw)
Dibenzothiophene	132-65-0	NA[f]	0.001	NA	NA	0.0000940	0.001

Note: Project data will be reported in units appropriate to the analytical method.

[a] DQLs have not been approved by USEPA. DQLs based on the lower of: 1) NJDEP Soil Remediation Standards for Residential Soil, June 2008, 2) USEPA RSLs for residential soil, April 2009, and 3) applicable ecological thresholds based on NOAELs, TRVs, AETs, ERLs, and TELs (if available). RSLs for non-carcinogenic compounds were divided by a factor of 10 to adjust for a hazard index of 0.1 to account for potential additive effects. See Attachment K for ecological and human health thresholds. DQLs (including ecological and human health thresholds presented in Attachment K) are analytical goals listed solely for the purpose of evaluating laboratory analytical methods and achievable laboratory limits; these are not project-specific screening levels or PRGs and are not approved by the USEPA as the appropriate risk assessment criteria for this project. These values will be developed in subsequent phases of the project.

[b] Analytical MDLs and QLs are those documented in validated methods. When the method did not publish a value for either the MDL or QL, the value was determined to be NA.

[c] Achievable MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method. Actual MDLs and QLs will vary based on sample-specific factors. Tissue RL and MDL is based on sediment RL and MDL.

[d] MDL studies to be conducted by June 2009.

[e] Benzo[k]fluoranthene will be reported by the laboratory with a "C" qualifier, indicating that it co-elutes with benzo[j]fluoranthene.

[f] A DQL or project quantitation limit goal could not be established because no toxicity thresholds were available.

AET – apparent effects threshold
CARB – California Air Resources Board
CAS – Chemical Abstract Service
DQL – data quality level
dw – dry weight
ERL – effects range – low
MDL – method detection limit
NA – not available
NJDEP – New Jersey Department of Environmental Protection
NOAEL – no-observed-adverse-effect level
PAH – polycyclic aromatic hydrocarbon
PRG – preliminary remediation goal
QL – quantitation limit
RL – reporting limit
RSL – regional screening level
TEL – threshold effects level
TRV – toxicity reference value
USEPA – US Environmental Protection Agency

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Matrix: Sediment

Analytical Group, Method, and Laboratory: Alkylated PAHs, USEPA SW-846 8270D, Alpha Analytical, Mansfield, MA

SOP from Worksheet 23: M43, M46

Concentration Level: Low

Analyte	CAS Number	DQL (mg/kg dw)[a, b]	Project Quantitation Limit Goal (mg/kg dw)	Analytical Method[c]		Achievable Laboratory Limits[d]	
				MDL (mg/kg dw)	Method QL (mg/kg dw)	MDL (mg/kg)	QL (mg/kg)
C2-Alkylnaphthalenes	NA	0.0346	0.001	NA	NA	0.00009	0.001
C3-Alkylnaphthalenes	NA	0.0346	0.001	NA	NA	0.00009	0.001
C1-Benzanthracene/chrysenes	NA	0.0317	0.001	NA	NA	0.00016	0.001
C1-Dibenzothiophenes	NA	NA[e]	0.001	NA	NA	0.00016	0.001
C1-Fluorenes	NA	0.019	0.001	NA	NA	0.00008	0.001
C1-Phenanthrene/anthracenes	NA	0.0419	0.001	NA	NA	0.00012	0.001
C1-Pyrene/fluoranthenes	NA	0.053	0.001	NA	NA	0.00017	0.001
C2-Benzanthracene/chrysenes	NA	0.0317	0.001	NA	NA	0.00016	0.001
C2-Dibenzothiophenes	NA	NA[e]	0.001	NA	NA	0.00006	0.001
C2-Fluorenes	NA	0.019	0.001	NA	NA	0.00008	0.001
C2-Naphthalenes	NA	0.0346	0.001	NA	NA	0.00016	0.001
C2-Phenanthrene/anthracenes	NA	0.0419	0.001	NA	NA	0.00016	0.001
C3-Benzanthracene/chrysenes	NA	0.0317	0.001	NA	NA	0.00016	0.001
C3-Dibenzothiophenes	NA	NA[e]	0.001	NA	NA	0.00016	0.001
C3-Fluorenes	NA	0.019	0.001	NA	NA	0.00008	0.001
C3-Naphthalenes	NA	0.0346	0.001	NA	NA	0.00016	0.001
C3-Phenanthrene/anthracenes	NA	0.0419	0.001	NA	NA	0.00012	0.001
C4-Benzanthracene/chrysenes	NA	0.0317	0.001	NA	NA	0.00016	0.001
C4-Dibenzothiophenes	NA	NA[e]	0.001	NA	NA	0.00016	0.001
C4-Naphthalenes	NA	0.0346	0.001	NA	NA	0.00016	0.001
C4-Phenanthrenes/anthracenes	NA	0.0419	0.001	NA	NA	0.00016	0.001

Note: Project data will be reported in units appropriate to the analytical method.

[a] DQLs have not been approved by USEPA. DQLs based on the lower of: 1) NJDEP Soil Remediation Standards for Residential Soil, June

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Analyte	CAS Number	DQL (mg/kg dw)[a, b]	Project Quantitation Limit Goal (mg/kg dw)	Analytical Method[c]		Achievable Laboratory Limits[d]	
				MDL (mg/kg dw)	Method QL (mg/kg dw)	MDL (mg/kg)	QL (mg/kg)

2008, 2) USEPA RSLs for residential soil, April 2009, and 3) applicable ecological thresholds based on NOAELs, TRVs, AETs, ERLs, and TELs (if available). RSLs for non-carcinogenic compounds were divided by a factor of 10 to adjust for a hazard index of 0.1 to account for potential additive effects. See Attachment K for ecological and human health thresholds. DQLs (including ecological and human health thresholds presented in Attachment K) are analytical goals listed solely for the purpose of evaluating laboratory analytical methods and achievable laboratory limits; these are not project-specific screening levels or PRGs and are not approved by the USEPA as the appropriate risk assessment criteria for this project. These values will be developed in subsequent phases of the project.

[b] DQLs for alkylated PAHs based on DQLs for individual PAHs (see Attachment K). DQLs have not been approved by USEPA.

[c] Analytical MDLs and QLs are those documented in validated methods. When the method did not publish a value for either the MDL or QL, the value was determined to be NA.

[d] Achievable MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method. Actual MDLs and QLs will vary based on sample-specific factors. The MDL and QLs are the MDLs and QLs for the parent compound. The laboratory conducts MDL studies with spikes that go through the extraction and analytical process; therefore, dry weight or wet weight units do not apply.

[e] A DQL or project quantitation limit goal could not be established because no toxicity thresholds were available.

AET – apparent effects threshold
CAS – Chemical Abstract Service
DQL – data quality level
dw – dry weight
ERL – effects range – low
MDL – method detection limit
NA – not available
NJDEP – New Jersey Department of Environmental Protection
NOAEL – no-observed-adverse-effect level
PAH – polycyclic aromatic hydrocarbon
PRG – preliminary remediation goal
QL – quantitation limit
RSL – regional screening level
TEL – threshold effects level
TRV – toxicity reference value
USEPA – US Environmental Protection Agency

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Matrix: Sediment

Analytical Group, Method, and Laboratory: Organochlorine Pesticides, USEPA 1699 Modified (NYSDEC HRMS-2), Maxxam Analytics, Mississauga, ON

SOP from Worksheet 23: M5, M6, M7

Concentration Level: Low

Analyte	CAS Number	DQL (mg/kg dw)[a]	Project Quantitation Limit Goal (mg/kg dw)	Analytical Method[b]		Achievable Laboratory Limits[c]	
				MDL (mg/kg dw)	Method QL (mg/kg dw)	MDLs (mg/kg dw)	QLs (mg/kg dw)
2,4'-DDD	53-19-0	0.0020	0.0001	NA	NA	0.0000081	0.0001
2,4'-DDE	3424-82-6	0.00142	0.0001	NA	NA	0.0000101	0.0001
2,4'-DDT	789-02-6	0.001	0.0001	NA	NA	0.0000111	0.0001
4,4'-DDD	72-54-8	0.001	0.0001	NA	NA	0.0000143	0.0001
4,4'-DDE	72-55-9	0.00142	0.0001	NA	NA	0.0000167	0.0001
4,4'-DDT	50-29-3	0.001	0.0001	NA	NA	0.0000071	0.0001
Aldrin	309-00-2	0.002	0.0001	NA	NA	0.0000079	0.0001
alpha-BHC	319-84-6	0.00094	0.0001	NA	NA	0.0000200	0.0001
beta-BHC	319-85-7	0.00094[d]	0.0001	NA	NA	0.0000200	0.0001
cis-Chlordane	5103-71-9	0.00002[e]	**0.0001**	NA	NA	**0.0000342**	**0.0001**
cis-Nonachlor	5103-73-1	0.20	0.0001	NA	NA	0.0000277	0.0001
delta-BHC	319-86-8	0.00094[d]	0.0001	NA	NA	0.0001532	0.0001
Dieldrin	60-57-1	0.00002	**0.0001**	NA	NA	0.0000113	**0.0001**
Endosulfan I	959-98-8	37[f]	0.0001	NA	NA	0.0000396	0.0001
Endosufan II	33213-65-9	37[f]	0.0001	NA	NA	0.0001951	0.0001
Endosulfan sulfate	1031-07-8	37	0.0001	NA	NA	0.0000197	0.0001
Endrin	72-20-8	0.00222	0.0001	NA	NA	0.000377	0.0001
Endrin aldehyde	7421-93-4	0.00267[g]	0.0001	NA	NA	0.0000254	0.0001
Endrin ketone	53494-70-5	0.00267[g]	0.0001	NA	NA	0.0000148	0.0001
gamma-BHC (Lindane)	58-89-9	0.00094	0.0001	NA	NA	0.0000179	0.0001
Hexachlorobenzene	118-74-1	0.002	0.0001	NA	NA	0.0000111	0.0001

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Analyte	CAS Number	DQL (mg/kg dw)[a]	Project Quantitation Limit Goal (mg/kg dw)	Analytical Method[b]		Achievable Laboratory Limits[c]	
				MDL (mg/kg dw)	Method QL (mg/kg dw)	MDLs (mg/kg dw)	QLs (mg/kg dw)
Heptachlor	76-44-8	0.0003[h]	0.0001	NA	NA	0.0000106	0.0001
Heptachlor epoxide	1024-57-3	0.0006	0.0001	NA	NA	0.0000137	0.0001
Methoxychlor	72-43-5	0.006	0.0001	NA	NA	0.0000119	0.0001
Oxychlordane	27304-13-8	0.20	0.0001	NA	NA	0.0000104	0.0001
trans-Chlordane	5103-74-2	0.00002[d]	**0.0001**	NA	NA	0.0000194	**0.0001**
trans-Nonachlor	3734-49-4	0.20	0.0001	NA	NA	0.0000146	0.0001

Note: Project data will be reported in units appropriate to the analytical method.

[a] DQLs based on the lower of: 1) NJDEP Soil Remediation Standards for Residential Soil, June 2008, 2) USEPA RSLs for residential soil, April 2009, and 3) applicable ecological thresholds based on NOAELs, TRVs, AETs, ERLs, and TELs (if available). RSLs for non-carcinogenic compounds were divided by a factor of 10 to adjust for a hazard index of 0.1 to account for potential additive effects. See Attachment K for ecological and human health thresholds. DQLs (including ecological and human health thresholds presented in Attachment K) are analytical goals listed solely for the purpose of evaluating laboratory analytical methods and achievable laboratory limits; these are not project-specific screening levels or PRGs and are not approved by the USEPA as the appropriate risk assessment criteria for this project. These values will be developed in subsequent phases of the project. DQLs have not been approved by USEPA.

[b] Analytical MDLs and QLs are those documented in validated methods. When the method did not publish a value for either the MDL or QL, the value was determined to be NA.

[c] Achievable MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method. Actual MDLs and QLs will vary based on sample-specific factors.

[d] The DQL for this analyte was based on the DQL for alpha-BHC. DQLs have not been approved by USEPA.

[e] The DQL for this analyte was based on the DQL for chlordane. DQLs have not been approved by USEPA.

[f] The DQL for this analyte was based on the DQL for endosulfan. DQLs have not been approved by USEPA.

[g] The DQL for this analyte was based on the DQL for endrin. DQLs have not been approved by USEPA.

[h] The DQL for this analyte was based on the DQL for heptachlor epoxide. DQLs have not been approved by USEPA.

AET – apparent effects threshold
BHC – benzene hexachloride
CAS – Chemical Abstract Service
DDD – dichlorodiphenyldichloroethane
DDE – dichlorodiphenyldichloroethylene
DDT – dichlorodiphenyltrichloroethane
DQL – data quality level
dw – dry weight
HRMS – high-resolution mass spectrometry
MDL – method detection limit
NA – not available
NJDEP – New Jersey Department of Environmental Protection
NOAEL – no-observed-adverse-effect level
NYSDEC – New York State Department of Environmental Conservation
QL – quantitation limit
RSL – regional screening level
TBD – to be determined
TEL – threshold effects level
TRV – toxicity reference value
USEPA – US Environmental Protection Agency

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Analyte	CAS Number	DQL (mg/kg dw)[a]	Project Quantitation Limit Goal (mg/kg dw)	Analytical Method[b]		Achievable Laboratory Limits[c]	
				MDL (mg/kg dw)	Method QL (mg/kg dw)	MDLs (mg/kg dw)	QLs (mg/kg dw)

ERL – effects range – low PRG – preliminary remediation goal

Bold indicates chemicals for which the achievable laboratory limits exceed the DQL.

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Matrix: Sediment

Analytical Group, Method, and Laboratory: Herbicides, USEPA SW-846 8151A, Alpha Analytical, Mansfield, MA

SOP from Worksheet 23: M45

Concentration Level: Low

Analyte	CAS Number	DQL (mg/kg dw)[a]	Project Quantitation Limit Goal (mg/kg dw)	Analytical Method[b]		Achievable Laboratory Limits[c]	
				MDL (mg/kg dw)	Method QL (mg/kg dw)	MDLs (mg/kg)	QLs (mg/kg)
2,4-D	94-75-7	69	0.033	NA	NA	0.017	0.033
2,4-DB	94-82-6	49	0.033	NA	NA	0.017	0.033
2,4,5-T	93-76-5	12.3	0.033	NA	NA	0.017	0.033
2,4,5-TP (Silvex)	93-72-1	0.675	0.033	NA	NA	0.017	0.033

Note: Project data will be reported in units appropriate to the analytical method.

[a] DQLs have not been approved by USEPA. DQLs based on the lower of: 1) NJDEP Soil Remediation Standards for Residential Soil, June 2008, 2) USEPA RSLs for residential soil, April 2009, and 3) applicable ecological thresholds based on NOAELs, TRVs, AETs, ERLs, and TELs (if available). RSLs for non-carcinogenic compounds were divided by a factor of 10 to adjust for a hazard index of 0.1 to account for potential additive effects. See Attachment K for ecological and human health thresholds. DQLs (including ecological and human health thresholds presented in Attachment K) are analytical goals listed solely for the purpose of evaluating laboratory analytical methods and achievable laboratory limits; these are not project-specific screening levels or PRGs and are not approved by the USEPA as the appropriate risk assessment criteria for this project. These values will be developed in subsequent phases of the project.

[b] Analytical MDLs and QLs are those documented in validated methods. When the method did not publish a value for either the MDL or QL, the value was determined to be NA.

[c] Achievable MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method. Actual MDLs and QLs will vary based on sample-specific factors. The laboratory conducts MDL studies with spikes that go through the extraction and analytical process; therefore, dw or ww units do not apply.

AET – apparent effects threshold
CAS – Chemical Abstract Service
DQL – data quality level
dw – dry weight
ERL – effects range – low
MDL – method detection limit
NA – not available
NJDEP – New Jersey Department of Environmental Protection
NOAEL – no-observed-adverse-effect level
PRG – preliminary remediation goal
QL – quantitation limit
RSL – regional screening level
TEL – threshold effects level
TRV – toxicity reference value
USEPA – US Environmental Protection Agency
ww – wet weight

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Matrix: Sediment

Analytical Group, Method, and Laboratory: Metals (ICP), USEPA SW-846 6010B, CAS, Kelso WA

SOP from Worksheet 23: M8, M11

Concentration Level: Low

Analyte	CAS Number	DQL (mg/kg dw)[a]	Project Quantitation Limit Goal (mg/kg dw)	Analytical Method[b]		Achievable Laboratory Limits[c]	
				MDL (mg/kg dw)	Method QL (mg/kg dw)	MDL (mg/kg dw)	QL (mg/kg dw)
Calcium	7440-70-2	NA[d,e]	10	NA	NA	3	10
Chromium	7440-47-3	26	1.0	NA	NA	0.4	1.0
Iron	7439-89-6	5,500	2	NA	NA	0.7	2
Magnesium	7439-95-4	NA[d,e]	3	NA	NA	0.9	3
Potassium	7440-09-7	NA[d,e]	30	NA	NA	10	30
Sodium	7440-23-5	NA[d,e]	60	NA	NA	20	60
Vanadium	7440-62-2	38.1	0.6	NA	NA	0.2	0.6

Note: Project data will be reported in units appropriate to the analytical method.

[a] DQLs have not been approved by USEPA. DQLs based on the lower of: 1) NJDEP Soil Remediation Standards for Residential Soil, June 2008, 2) USEPA RSLs for residential soil, April 2009, and 3) applicable ecological thresholds based on NOAELs, TRVs, AETs, ERLs, and TELs (if available). RSLs for non-carcinogenic compounds were divided by a factor of 10 to adjust for a hazard index of 0.1 to account for potential additive effects. See Attachment K for ecological and human health thresholds. DQLs (including ecological and human health thresholds presented in Attachment K) are analytical goals listed solely for the purpose of evaluating laboratory analytical methods and achievable laboratory limits; these are not project-specific screening levels or PRGs and are not approved by the USEPA as the appropriate risk assessment criteria for this project. These values will be developed in subsequent phases of the project.

[b] Analytical MDLs and QLs are those documented in validated methods. When the method did not publish a value for either the MDL or QL, the value was determined to be NA.

[c] Achievable MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method. Actual MDLs and QLs will vary based on sample-specific factors.

[d] Essential nutrient.

[e] A DQL or project quantitation limit goal could not be established because no toxicity thresholds were available.

AET – apparent effects threshold
BHC – benzene hexachloride
CAS – Chemical Abstract Service
DQL – data quality level
dw – dry weight
ERL – effects range – low
ICP – inductively coupled plasma
NA – not available
MDL – method detection limit
NA – not available
NJDEP – New Jersey Department of Environmental Protection
NOAEL – no-observed-adverse-effect level
PRG – preliminary remediation goal
QL – quantitation limit
RSL – regional screening level
TBD – to be determined
TEL – threshold effects level
TRV – toxicity reference value
USEPA – US Environmental Protection Agency

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Matrix: Sediment

Analytical Group, Method, and Laboratory: Metals (ICP/MS), USEPA SW-846 6020, CAS, Kelso WA

SOP from Worksheet 23: M8, M10

Concentration Level: Low

Analyte	CAS Number	DQL (mg/kg dw)[a]	Project Quantitation Limit Goal (mg/kg dw)	Analytical Method[b]		Achievable Laboratory Limits[c]	
				MDL (mg/kg dw)	Method QL (mg/kg dw)	MDL (mg/kg dw)	QL (mg/kg dw)
Aluminum	7429-90-5	7,700	2	NA	NA	0.2	2
Antimony	7440-36-0	2.0	0.05	NA	NA	0.02	0.05
Arsenic (total)	7440-38-2	0.39[d]	**0.5**	NA	NA	0.08	**0.5**
Barium	7440-39-3	1,500	0.05	NA	NA	0.03	0.05
Beryllium	7440-41-7	16	0.02	NA	NA	0.007	0.02
Cadmium	7440-43-9	0.60	0.02	NA	NA	0.01	0.02
Cobalt	7440-48-4	2.3	0.02	NA	NA	0.003	0.02
Copper	7440-50-8	16	0.1	NA	NA	0.08	0.1
Lead	7439-92-1	31	0.02	NA	NA	0.008	0.02
Manganese	7439-96-5	260	0.05	NA	NA	0.006	0.05
Nickel	7440-02-0	16	0.2	NA	NA	0.04	0.2
Silver	7440-22-4	0.5	0.02	NA	NA	0.008	0.02
Thallium	7440-28-0	0.51	0.02	NA	NA	0.005	0.02
Titanium	7440-32-6	100,000	0.2	NA	NA	0.06	0.2
Zinc	7440-66-6	120	0.5	NA	NA	0.09	0.5

Note: Project data will be reported in units appropriate to the analytical method.

[a] DQLs have not been approved by USEPA. DQLs based on the lower of: 1) NJDEP Soil Remediation Standards for Residential Soil, June 2008, 2) USEPA RSLs for residential soil, April 2009, and 3) applicable ecological thresholds based on NOAELs, TRVs, AETs, ERLs, and TELs (if available). RSLs for non-carcinogenic compounds were divided by a factor of 10 to adjust for a hazard index of 0.1 to account for potential additive effects. See Attachment K for ecological and human health thresholds. DQLs (including ecological and human health thresholds presented in Attachment K) are analytical goals listed solely for the purpose of evaluating laboratory analytical methods and achievable laboratory limits; these are not project-specific screening levels or PRGs and are not approved by the USEPA as the appropriate risk assessment criteria for this project. These values will be developed in subsequent phases of the project.

[b] Analytical MDLs and QLs are those documented in validated methods. When the method did not publish a value for either the MDL or QL,

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Analyte	CAS Number	DQL (mg/kg dw)[a]	Project Quantitation Limit Goal (mg/kg dw)	Analytical Method[b]		Achievable Laboratory Limits[c]	
				MDL (mg/kg dw)	Method QL (mg/kg dw)	MDL (mg/kg dw)	QL (mg/kg dw)

the value was determined to be NA.

[c] Achievable MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method. Actual MDLs and QLs will vary based on sample-specific factors.

[d] The DQL for this analyte is based on the inorganic arsenic DQL.DQLs have not been approved by USEPA.

AET – apparent effects threshold
CAS – Chemical Abstract Service
DQL – data quality level
dw – dry weight
ERL – effects range – low
ICP/MS – inductively coupled plasma
MDL – method detection limit
NA – not available
NJDEP – New Jersey Department of Environmental Protection
NOAEL – no-observed-adverse-effect level
PRG – preliminary remediation goal
QL – quantitation limit
RSL – regional screening level
TEL – threshold effects level
TRV – toxicity reference value
USEPA – US Environmental Protection Agency

Bold indicates chemicals for which the achievable laboratory limits exceed the DQL.

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Matrix: Sediment

Analytical Group, Method, and Laboratory: Metals (Selenium), USEPA SW-846 7742, CAS, Kelso WA

SOP from Worksheet 23: M8, M12

Concentration Level: Low

Analyte	CAS Number	DQL (mg/kg dw)[a]	Project Quantitation Limit Goal (mg/kg dw)	Analytical Method[b]		Achievable Laboratory Limits[c]	
				MDL (mg/kg dw)	Method QL (mg/kg dw)	MDL (mg/kg dw)	QL (mg/kg dw)
Selenium	7782-49-2	1.0	0.1	NA	NA	0.02	0.1

Note: Project data will be reported in units appropriate to the analytical method.

[a] DQLs have not been approved by USEPA. DQLs based on the lower of: 1) NJDEP Soil Remediation Standards for Residential Soil, June 2008, 2) USEPA RSLs for residential soil, April 2009, and 3) applicable ecological thresholds based on NOAELs, TRVs, AETs, ERLs, and TELs (if available). RSLs for non-carcinogenic compounds were divided by a factor of 10 to adjust for a hazard index of 0.1 to account for potential additive effects. See Attachment K for ecological and human health thresholds. DQLs (including ecological and human health thresholds presented in Attachment K) are analytical goals listed solely for the purpose of evaluating laboratory analytical methods and achievable laboratory limits; these are not project-specific screening levels or PRGs and are not approved by the USEPA as the appropriate risk assessment criteria for this project. These values will be developed in subsequent phases of the project.

[b] Analytical MDLs and QLs are those documented in validated methods. When the method did not publish a value for either the MDL or QL, the value was determined to be NA.

[c] Achievable MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method. Actual MDLs and QLs will vary based on sample-specific factors.

AET – apparent effects threshold
CAS – Chemical Abstract Service
DQL – data quality level
dw – dry weight
ERL – effects range – low
MDL – method detection limit
NA – not available
NJDEP – New Jersey Department of Environmental Protection
NOAEL – no-observed-adverse-effect level
PRG – preliminary remediation goal
QL – quantitation limit
RSL – regional screening level
TEL – threshold effects level
TRV – toxicity reference value
USEPA – US Environmental Protection Agency

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Matrix: Sediment

Analytical Group, Method, and Laboratory: Methylmercury, USEPA 1630, Brooks Rand Labs, Seattle, WA

SOP from Worksheet 23: M16

Concentration Level: Low

Analyte	CAS Number	DQL (mg/kg dw))[a]	Project Quantitation Limit Goal (mg/kg dw)	Analytical Method[b]		Achievable Laboratory Limits[c]	
				MDL (mg/kg dw)	Method QL (mg/kg dw)	MDL (mg/kg dw)	QL (mg/kg dw)
Methylmercury	22967-92-6	0.15	2.5E-08	NA	NA	8.E-09	2.5E-08

Note: Project data will be reported in units appropriate to the analytical method.

[a] DQLs have not been approved by USEPA. DQLs based on the lower of: 1) NJDEP Soil Remediation Standards for Residential Soil, June 2008, 2) USEPA RSLs for residential soil, April 2009, and 3) applicable ecological thresholds based on NOAELs, TRVs, AETs, ERLs, and TELs (if available). RSLs for non-carcinogenic compounds were divided by a factor of 10 to adjust for a hazard index of 0.1 to account for potential additive effects. See Attachment K for ecological and human health thresholds. DQLs (including ecological and human health thresholds presented in Attachment K) are analytical goals listed solely for the purpose of evaluating laboratory analytical methods and achievable laboratory limits; these are not project-specific screening levels or PRGs and are not approved by the USEPA as the appropriate risk assessment criteria for this project. These values will be developed in subsequent phases of the project.

[b] Analytical MDLs and QLs are those documented in validated methods. When the method did not publish a value for either the MDL or QL, the value was determined to be NA.

[c] Achievable MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method. Actual MDLs and QLs will vary based on sample-specific factors.

AET – apparent effects threshold
CAS – Chemical Abstract Service
DQL – data quality level
dw – dry weight
ERL – effects range – low
MDL – method detection limit
NA – not available
NJDEP – New Jersey Department of Environmental Protection
NOAEL – no-observed-adverse-effect level
PRG – preliminary remediation goal
QL – quantitation limit
RSL – regional screening level
TEL – threshold effects level
TRV – toxicity reference value
USEPA – US Environmental Protection Agency

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Matrix: Sediment

Analytical Group, Method, and Laboratory: Total Mercury, USEPA 1631, Brooks Rand Labs, Seattle, WA

SOP from Worksheet 23: M14, M15

Concentration Level: Low

Analyte	CAS Number	DQL (mg/kg dw)[a]	Project Quantitation Limit Goal (mg/kg dw)	Analytical Method[b]		Achievable Laboratory Limits[c]	
				MDL (mg/kg dw)	Method QL (mg/kg dw)	MDL (mg/kg dw)	QL (mg/kg dw)
Mercury	7439-97-6	0.15	1.5E-07	NA	NA	5.E-08	1.5E-07

Note: Project data will be reported in units appropriate to the analytical method.

[a] DQLs have not been approved by USEPA. DQLs based on the lower of: 1) NJDEP Soil Remediation Standards for Residential Soil, June 2008, 2) USEPA RSLs for residential soil, April 2009, and 3) applicable ecological thresholds based on NOAELs, TRVs, AETs, ERLs, and TELs (if available). RSLs for non-carcinogenic compounds were divided by a factor of 10 to adjust for a hazard index of 0.1 to account for potential additive effects. See Attachment K for ecological and human health thresholds. DQLs (including ecological and human health thresholds presented in Attachment K) are analytical goals listed solely for the purpose of evaluating laboratory analytical methods and achievable laboratory limits; these are not project-specific screening levels or PRGs and are not approved by the USEPA as the appropriate risk assessment criteria for this project. These values will be developed in subsequent phases of the project.

[b] Analytical MDLs and QLs are those documented in validated methods. When the method did not publish a value for either the MDL or QL, the value was determined to be NA.

[c] Achievable MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method. Actual MDLs and QLs will vary based on sample-specific factors.

AET – apparent effects threshold
CAS – Chemical Abstract Service
DQL – data quality level
dw – dry weight
ERL – effects range – low
MDL – method detection limit
NA – not available
NJDEP – New Jersey Department of Environmental Protection
NOAEL – no-observed-adverse-effect level
PRG – preliminary remediation goal
QL – quantitation limit
RSL – regional screening level
TEL – threshold effects level
TRV – toxicity reference value
USEPA – US Environmental Protection Agency

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Matrix: Sediment

Analytical Group, Method, and Laboratory: SVOCs, USEPA SW-846 8270C, Alpha Analytical, Mansfield, MA

SOP from Worksheet 23: M17, M18, M19, M20

Concentration Level: Low

Analyte	CAS Number	DQL (mg/kg dw)[a]	Project Quantitation Limit Goal (mg/kg dw)	Analytical Method[b]		Achievable Laboratory Limit[c]	
				MDL (mg/kg dw)	Method QL (mg/kg dw)	MDL (mg/kg)	QL (mg/kg)
1,1'-Biphenyl	92-52-4	262	0.4	NA	NA	0.2	0.4
2,2'-Oxybis (1-Chloropropane)	108-60-1	3.5	0.4	NA	0.66	0.2	0.4
2,4,5-Trichlorophenol	95-95-4	0.003	**0.4**	NA	0.66	**0.2**	**0.4**
2,4,6-Trichlorophenol	88-06-2	0.006	**0.4**	NA	0.66	**0.2**	**0.4**
2,4-Dichlorophenol	120-83-2	0.005	**0.8**	NA	0.66	**0.4**	**0.8**
2,4-Dimethylphenol	105-67-9	0.304	**0.4**	NA	0.66	0.2	**0.4**
2,4-Dinitrophenol	51-28-5	0.00621	**1.6**	NA	3.3	**0.8**	**1.6**
2,4-Dinitrotoluene	121-14-2	0.0144	**0.4**	NA	0.66	**0.2**	**0.4**
2,6-Dinitrotoluene	606-20-2	0.70	0.4	NA	0.66	0.2	0.4
2-Chloronaphthalene	91-58-7	0.417	0.4	NA	0.66	0.2	0.4
2-Chlorophenol	95-57-8	0.008	**0.4**	NA	0.66	**0.2**	**0.4**
2-Methylnaphthalene[d]	91-57-6	0.0202	**0.4**	NA	0.66	**0.2**	**0.4**
2-Methylphenol	95-48-7	310	0.4	NA	0.66	0.2	0.4
2-Nitroaniline	88-74-4	18	0.4	NA	3.3	0.2	0.4
2-Nitrophenol	88-75-5	1,800[e]	0.4	NA	0.66	0.2	0.4
3,3'-Dichlorobenzidine	91-94-1	0.127	**0.4**	NA	1.3	**0.2**	**0.4**
3-Nitroaniline	99-09-2	18	0.4	NA	3.3	0.2	0.4
4,6-Dinitro-2-methylphenol	534-52-1	0.61	**1.6**	NA	3.3	**0.8**	**1.6**
4-Bromophenyl-phenylether	101-55-3	NA[f]	0.4	NA	0.66	0.2	0.4
4-Chloro-3-methylphenol	59-50-7	NA	0.4	NA	1.3	0.2	0.4
4-Chloroaniline	106-47-8	2.4	0.4	NA	1.3	0.2	0.4
4-Chlorophenyl-phenyl ether	7005-72-3	NA[f]	0.4	NA	0.66	0.2	0.4

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Analyte	CAS Number	DQL (mg/kg dw)[a]	Project Quantitation Limit Goal (mg/kg dw)	Analytical Method[b]		Achievable Laboratory Limit[c]	
				MDL (mg/kg dw)	Method QL (mg/kg dw)	MDL (mg/kg)	QL (mg/kg)
4-Methylphenol	106-44-5	31	0.4	NA	0.66	0.2	0.4
4-Nitroaniline	100-01-6	24	0.4	NA	NA	0.2	0.4
4-Nitrophenol	100-02-7	0.0133	**0.8**	NA	3.3	**0.4**	**0.8**
Acenaphthene[d]	83-32-9	0.00671	**0.4**	NA	0.66	**0.2**	**0.4**
Acenaphthylene[d]	208-96-8	0.00587	**0.4**	NA	0.66	**0.2**	**0.4**
Acetophenone	98-86-2	2.0	0.4	NA	NA	0.2	0.4
Anthracene[d]	120-12-7	0.0469	**0.4**	NA	0.66	**0.2**	**0.4**
Atrazine	1912-24-9	2.1	0.4	NA	NA	0.2	0.4
Benzaldehyde	100-52-7	780	0.4	NA	NA	0.2	0.4
Benzo(a)anthracene[d]	56-55-3	0.0317	**0.4**	NA	0.66	**0.2**	**0.4**
Benzo(a)pyrene[d]	50-32-8	0.015	**0.4**	NA	0.66	**0.2**	**0.4**
Benzo(b)fluoranthene[d]	205-99-2	0.15	0.4	NA	0.66	0.2	0.4
Benzo(g,h,i)perylene[d]	191-24-2	0.17	**0.4**	NA	0.66	**0.2**	**0.4**
Benzo(k)fluoranthene[d]	207-08-9	0.24	**0.4**	NA	0.66	0.2	**0.4**
bis-(2-Chloroethoxy)methane	111-91-1	18	0.4	NA	0.66	0.2	0.4
bis-(2-Chloroethyl)ether	111-44-4	0.19	**0.4**	NA	0.66	**0.2**	**0.4**
bis(2-Ethylhexyl) phthalate	117-81-7	0.182	**0.4**	NA	0.66	**0.2**	**0.4**
Butylbenzylphthalate	85-68-7	0.063	**0.4**	NA	0.66	**0.2**	**0.4**
Caprolactam	105-60-2	3,100	0.4	NA	NA	0.2	0.4
Carbazole	86-74-8	24	0.4	NA	NA	0.2	0.4
Chrysene[d]	218-01-9	0.0571	**0.4**	NA	0.66	**0.2**	**0.4**
Dibenzo(a,h)-anthracene[d]	53-70-3	0.00622	**0.4**	NA	0.66	**0.2**	**0.4**
Dibenzofuran	132-64-9	NA[f]	0.4	NA	0.66	0.2	0.4
Diethylphthalate	84-66-2	0.006	**0.4**	NA	0.66	**0.2**	**0.4**
Dimethylphthalate	131-11-3	46[g]	0.4	NA	0.66	0.2	0.4
Di-n-butylphthalate	84-74-2	0.058	**0.4**	NA	NA	**0.2**	**0.4**
Di-n-octylphthalate	117-84-0	46[g]	0.4	NA	0.66	0.2	0.4

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Analyte	CAS Number	DQL (mg/kg dw)[a]	Project Quantitation Limit Goal (mg/kg dw)	Analytical Method[b]		Achievable Laboratory Limit[c]	
				MDL (mg/kg dw)	Method QL (mg/kg dw)	MDL (mg/kg)	QL (mg/kg)
Fluoranthene[d]	206-44-0	0.111	**0.4**	NA	0.66	**0.2**	**0.4**
Fluorene[d]	86-73-7	0.019	**0.4**	NA	0.66	**0.2**	**0.4**
Hexachlorobenzene[h]	118-74-1	0.002	**0.4**	NA	0.66	**0.2**	**0.4**
Hexachlorobutadiene	87-68-3	0.0013	**0.4**	NA	0.66	**0.2**	**0.4**
Hexachloroethane	67-72-1	0.073	**0.4**	NA	0.66	**0.2**	**0.4**
Hexchlorocyclopentadiene	77-47-4	0.007	**0.4**	NA	0.66	**0.2**	**0.4**
Indeno(1,2,3-cd)-pyrene[d]	193-39-5	0.15	**0.4**	NA	0.66	**0.2**	**0.4**
Isophorone	78-59-1	0.432	0.4	NA	0.66	0.2	0.4
Naphthalene[d]	91-20-3	0.0346	**0.4**	NA	0.66	**0.2**	**0.4**
Nitrobenzene	98-95-3	0.145	**0.4**	NA	0.66	**0.2**	**0.4**
n-Nitroso-di-n-propylamine	621-64-7	0.069	**0.4**	NA	0.66	**0.2**	**0.4**
n-Nitrosodiphenylamine	86-30-6	99	0.4	NA	0.66	0.2	0.4
Pentachlorophenol	87-86-5	0.017	**0.4**	NA	3.3	**0.2**	**0.4**
Phenanthrene	85-01-8	0.0419	**0.4**	NA	0.66	**0.2**	**0.4**
Phenol	108-95-2	0.0491	**0.4**	NA	0.66	**0.2**	**0.4**
Pyrene[d]	129-00-0	0.053	**0.4**	NA	0.66	**0.2**	**0.4**

Note: Project data will be reported in units appropriate to the analytical method.

[a] DQLs have not been approved by USEPA. DQLs based on the lower of: 1) NJDEP Soil Remediation Standards for Residential Soil, June 2008, 2) USEPA RSLs for residential soil, April 2009, and 3) applicable ecological thresholds based on NOAELs, TRVs, AETs, ERLs, and TELs (if available). RSLs for non-carcinogenic compounds were divided by a factor of 10 to adjust for a hazard index of 0.1 to account for potential additive effects. See Attachment K for ecological and human health thresholds. DQLs (including ecological and human health thresholds presented in Attachment K) are analytical goals listed solely for the purpose of evaluating laboratory analytical methods and achievable laboratory limits; these are not project-specific screening levels or PRGs and are not approved by the USEPA as the appropriate risk assessment criteria for this project. These values will be developed in subsequent phases of the project.

[b] Analytical MDLs and QLs are those documented in validated methods. When the method did not publish a value for either the MDL or QL, the value was determined to be NA.

[c] Achievable MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method. Actual MDLs and QLs will vary based on sample-specific factors. The laboratory conducts MDL studies with spikes that go through the extraction and analytical process; therefore, dry weight or wet weight units do not apply.

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Analyte	CAS Number	DQL (mg/kg dw)[a]	Project Quantitation Limit Goal (mg/kg dw)	Analytical Method[b]		Achievable Laboratory Limit[c]	
				MDL (mg/kg dw)	Method QL (mg/kg dw)	MDL (mg/kg)	QL (mg/kg)

[d] Analyte will also be reported from the PAH HRGC/HRMS method and the HRGC/HRMS method results will take precedence over these. The analytes 1-methylnaphthalene, 1-methylphenanthrene, 2,3,5-trimethylnaphthalene, 2,6-dimethylnaphthalene, benzo(e)pyrene, dibenzothiophene, and perylene, originally listed under this method, will be reported by the PAH HRGC/HRMS method only.

[e] The DQL for this analyte was based on the DQL for phenol. DQLs have not been approved by USEPA.

[f] A DQL or project quantitation limit goal could not be established because no toxicity thresholds were available.

[g] The DQL for this analyte was based on the DQL for di-n-butyl phthalate. DQLs have not been approved by USEPA.

[h] Analyte will also be reported from the organochlorine pesticide HRGC/HRMS method, the results from the HRGC/HRMS will take precedence over these results.

AET – apparent effects threshold
CAS – Chemical Abstract Service
DQL – data quality level
dw – dry weight
ERL – effects range – low
HRGC – high-resolution gas chromatography
HRMS – high-resolution mass spectrometry
MDL – method detection limit
NA – not available
NJDEP – New Jersey Department of Environmental Protection
NOAEL – no-observed-adverse-effect level
PAH – polycyclic aromatic hydrocarbon
PRG – preliminary remediation goal
QL – quantitation limit
RSL – regional screening level
SVOC – semivolatile organic compound
TEL – threshold effects level
TRV – toxicity reference value
USEPA – US Environmental Protection Agency

Bold indicates chemicals for which the achievable laboratory limits exceed the DQL.

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Matrix: Sediment

Analytical Group, Method, and Laboratory: VOCs, USEPA SW-846 5035A/8260B , Alpha Analytical, Mansfield, MA

SOP from Worksheet 23: M44

Concentration Level: Low

Analyte	CAS Number	DQL (mg/kg dw)[a]	Project Quantitation Limit Goal (mg/kg dw)	Analytical Method[b]		Achievable Laboratory Limit[c]	
				MDL (mg/kg dw)	Method QL (mg/kg dw)	MDL (mg/kg)	QL (mg/kg)
1,1,1-Trichloroethane	71-55-6	0.213	0.002	NA	0.0050	0.0001	0.002
1,1,2,2-Tetrachloroethane	75-34-3	0.59	0.002	NA	0.0050	0.0003	0.002
1,1,2-Trichloro-1,2,2-trifluoroethane	75-35-4	940	0.005	NA	0.0050	0.0003	0.005
1,1,2-Trichloroethane	79-34-5	0.518	0.002	NA	0.0050	0.0003	0.002
1,1-Dichloroethane	76-13-1	3.4	0.002	NA	0.0050	0.0002	0.002
1,1-Dichloroethene	79-00-5	0.0194	0.002	NA	0.0050	0.0002	0.002
1,2,3-Trichlorobenzene	96-12-8	8.7	0.002	NA	0.0050	0.0002	0.002
1,2,4-Trichlorobenzene	106-93-4	0.0048	0.002	NA	0.0050	0.0005	0.002
1,2-Dibromo-3-chloropropane	95-50-1	0.0056	0.002	NA	0.0050	0.0003	0.002
1,2-Dibromoethane	107-06-2	0.0080	0.002	NA	0.0050	0.0003	0.002
1,2-Dichlorobenzene	78-87-5	0.333	0.002	NA	0.0050	0.0002	0.002
1,2-Dichloroethane	87-61-6	0.260	0.002	NA	0.0050	0.0001	0.002
1,2-Dichloropropane	120-82-1	0.93	0.002	NA	0.0050	0.0002	0.002
1,3-Dichlorobenzene	541-73-1	0.12	0.002	NA	0.0050	0.0003	0.002
1,4-Dichlorobenzene	106-46-7	0.110	0.002	NA	0.0050	0.0002	0.002
1,4-Dioxane	123-91-1	44	0.05	NA	0.0050	0.0182	0.05
2-Butanone	78-93-3	2,800	0.05	NA	0.0050	0.0022	0.05
2-Hexanone	591-78-6	NA[d]	0.05	NA	0.0050	0.0010	0.05
4-Methyl-2-pentanone	108-10-1	530	0.002	NA	0.0050	0.0005	0.002
Acetone	67-64-1	6,100	0.05	NA	0.0050	0.0015	0.05
Benzene	71-43-2	0.142	0.002	NA	0.0050	0.0002	0.002
Bromochloromethane	74-97-5	0.28	0.002	NA	0.0050	0.0003	0.002
Bromodichloromethane	75-27-4	0.28	0.002	NA	0.0050	0.0003	0.002

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Analyte	CAS Number	DQL (mg/kg dw)[a]	Project Quantitation Limit Goal (mg/kg dw)	Analytical Method[b]		Achievable Laboratory Limit[c]	
				MDL (mg/kg dw)	Method QL (mg/kg dw)	MDL (mg/kg)	QL (mg/kg)
Bromoform	75-25-2	0.492	0.002	NA	0.0050	0.0003	0.002
Bromomethane	74-83-9	0.00137	**0.002**	NA	0.0050	0.0003	**0.002**
Carbon disulfide	75-15-0	67	0.002	NA	0.0050	0.0002	0.002
Carbon tetrachloride	56-23-5	0.25	0.002	NA	0.0050	0.0002	0.002
Chlorobenzene	75-00-3	0.035	0.002	NA	0.0050	0.0002	0.002
Chloroethane	74-87-3	220	0.002	NA	0.0050	0.0005	0.002
Chloroform	156-59-2	0.121	0.002	NA	0.0050	0.0002	0.002
Chloromethane	10061-01-5	4.0	0.002	NA	0.0050	0.0002	0.002
cis-1,2-Dichloroethene	108-90-7	78	0.002	NA	0.0050	0.0002	0.002
cis-1,3-Dichloropropene	67-66-3	1.7	0.002	NA	0.0050	0.0002	0.002
Cyclohexane	110-82-7	120	0.005	NA	0.0050	0.0003	0.005
Dibromochloromethane	124-48-1	0.70	0.002	NA	0.0050	0.0003	0.002
Dichorodifluoromethane	75-71-8	19	0.002	NA	0.0050	0.0005	0.002
Ethylbenzene	100-41-4	0.064	0.002	NA	0.0050	0.0001	0.002
Isopropylbenzene	98-82-8	220	0.002	NA	0.0050	0.0002	0.002
m, p-Xylene	79-20-9	0.12	0.002	NA	0.0050	0.0003	0.002
Methyl acetate	108-87-2	7,800	0.005	NA	0.0050	0.0004	0.005
Methyl tert-butyl ether	75-09-2	39	0.002	NA	0.0050	0.0002	0.002
Methylcyclohexane	1634-04-4	NA[d]	0.005	NA	0.0050	0.0003	0.005
Methylene chloride	100-42-5	0.159	0.002	NA	0.0050	0.0004	0.002
o-Xylene	127-18-4	0.12	0.002	NA	0.0050	0.0002	0.002
Styrene	108-88-3	0.254	0.002	NA	0.0050	0.0002	0.002
Tetrachloroethene	156-60-5	0.45	0.002	NA	0.0050	0.0003	0.002
Toluene	10061-02-6	0.45	0.002	NA	0.0050	0.0004	0.002
Trans-1,2-Dichloroethene	79-01-6	0.654	0.002	NA	0.0050	0.0002	0.002
Trans-1,3-Dichloropropene	75-69-4	1.7	0.002	NA	0.0050	0.0002	0.002
Trichloroethene	179601-23-1	0.122	0.002	NA	0.0050	0.0002	0.002
Trichlorofluoromethane	95-47-6	80	0.002	NA	0.0050	0.0004	0.002

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Analyte	CAS Number	DQL (mg/kg dw)[a]	Project Quantitation Limit Goal (mg/kg dw)	Analytical Method[b]		Achievable Laboratory Limit[c]	
				MDL (mg/kg dw)	Method QL (mg/kg dw)	MDL (mg/kg)	QL (mg/kg)
Vinyl chloride	75-01-4	0.060	0.002	NA	0.0050	0.0003	0.002

Note: Project data will be reported in units appropriate to the analytical method.

[a] DQLs have not been approved by USEPA. DQLs based on the lower of: 1) NJDEP Soil Remediation Standards for Residential Soil, June 2008, 2) USEPA RSLs for residential soil, April 2009, and 3) applicable ecological thresholds based on NOAELs, TRVs, AETs, ERLs, and TELs (if available). RSLs for non-carcinogenic compounds were divided by a factor of 10 to adjust for a hazard index of 0.1 to account for potential additive effects. See Attachment K for ecological and human health thresholds. DQLs (including ecological and human health thresholds presented in Attachment K) are analytical goals listed solely for the purpose of evaluating laboratory analytical methods and achievable laboratory limits; these are not project-specific screening levels or PRGs and are not approved by the USEPA as the appropriate risk assessment criteria for this project. These values will be developed in subsequent phases of the project.

[b] Analytical MDLs and QLs are those documented in validated methods. When the method did not publish a value for either the MDL or QL, the value was determined to be NA.

[c] Achievable MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method. Actual MDLs and QLs will vary based on sample-specific factors.

[d] A DQL or project quantitation limit goal could not be established because no toxicity thresholds were available. The laboratory conducts MDL studies with spikes that go through the extraction and analytical process; therefore, dry weight or wet weight units do not apply.

AET – apparent effects threshold
CAS – Chemical Abstract Service
DQL – data quality level
dw – dry weight
ERL – effects range – low
MDL – method detection limit
NA – not available
NJDEP – New Jersey Department of Environmental Protection
NOAEL – no-observed-adverse-effect level
PRG – preliminary remediation goal
QL – quantitation limit
RSL – regional screening level
TEL – threshold effects level
TRV – toxicity reference value
USEPA – US Environmental Protection Agency
VOC – volatile organic compound

Bold indicates chemicals for which the achievable laboratory limits exceed the DQL.

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Matrix: Sediment

Analytical Group, Method, and Laboratory: Butyltins, Krone et al. (1989), CAS, Kelso, WA

SOP from Worksheet 23: M21, M22

Concentration Level: Low

Analyte	CAS Number	DQL (mg/kg dw)[a]	Project Quantitation Limit Goal (mg/kg dw)	Analytical Method[b]		Achievable Laboratory Limit[c]	
				MDL (mg/kg dw)	Method QL (mg/kg dw	MDL (mg/kg dw)	QL (mg/kg dw)
Dibutyltin	14488-53-0	1.8[d]	0.001	NA	NA	0.00024	0.001
Monobuyltin	78763-54-9	1.8[d]	0.001	NA	NA	0.00021	0.001
Tetrabutyltin	1461-25-2	1.8[d]	0.001	NA	NA	0.00047	0.001
Tributyltin	36643-28-4	1.8	0.001	NA	NA	0.0003	0.001

Note: Project data will be reported in units appropriate to the analytical method.

[a] DQLs have not been approved by USEPA. DQLs based on the lower of: 1) NJDEP Soil Remediation Standards for Residential Soil, June 2008, 2) USEPA RSLs for residential soil, April 2009, and 3) applicable ecological thresholds based on NOAELs, TRVs, AETs, ERLs, and TELs (if available). RSLs for non-carcinogenic compounds were divided by a factor of 10 to adjust for a hazard index of 0.1 to account for potential additive effects. See Attachment K for ecological and human health thresholds. DQLs (including ecological and human health thresholds presented in Attachment K) are analytical goals listed solely for the purpose of evaluating laboratory analytical methods and achievable laboratory limits; these are not project-specific screening levels or PRGs and are not approved by the USEPA as the appropriate risk assessment criteria for this project. These values will be developed in subsequent phases of the project.

[b] Analytical MDLs and QLs are those documented in validated methods. When the method did not publish a value for either the MDL or QL, the value was determined to be NA)

[c] Achievable MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method. Actual MDLs and QLs will vary based on sample-specific factors.

[d] The DQL for this analyte was based on the DQL for tributyltin. DQLs have not been approved by USEPA.

AET – apparent effects threshold
CAS – Chemical Abstract Service
DQL – data quality level
dw – dry weight
ERL – effects range – low
MDL – method detection limit
NA – not available
NJDEP – New Jersey Department of Environmental Protection
NOAEL – no-observed-adverse-effect level
PRG – preliminary remediation goal
QL – quantitation limit
RSL – regional screening level
TEL – threshold effects level
TRV – toxicity reference value
USEPA – US Environmental Protection Agency

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Matrix: Sediment

Analytical Group, Method, and Laboratory: TPH – Extractables, OQA-QAM-025-02/08, Alpha Analytical, Mansfield, MA

SOP from Worksheet 23: M33

Concentration Level: Low

Analyte	CAS Number	DQL (mg/kg dw)[a]	Project Quantitation Limit Goal (mg/kg dw)	Analytical Method[b]		Achievable Laboratory Limit[c]	
				MDL (mg/kg dw)	Method QL (mg/kg dw)	MDL (mg/kg)	QL (mg/kg)
TPH – extractable	NA	NA[d]	10	10	30	3.0	10

Note: Project data will be reported in units appropriate to the analytical method.

[a] DQLs have not been approved by USEPA. DQLs based on the lower of: 1) NJDEP Soil Remediation Standards for Residential Soil, June 2008, 2) USEPA RSLs for residential soil, April 2009, and 3) applicable ecological thresholds based on NOAELs, TRVs, AETs, ERLs, and TELs (if available). RSLs for non-carcinogenic compounds were divided by a factor of 10 to adjust for a hazard index of 0.1 to account for potential additive effects. See Attachment K for ecological and human health thresholds. DQLs (including ecological and human health thresholds presented in Attachment K) are analytical goals listed solely for the purpose of evaluating laboratory analytical methods and achievable laboratory limits; these are not project-specific screening levels or PRGs and are not approved by the USEPA as the appropriate risk assessment criteria for this project. These values will be developed in subsequent phases of the project.

[b] Analytical MDLs and QLs are those documented in validated methods.

[c] Achievable MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method. Actual MDLs and QLs will vary based on sample-specific factors. The laboratory conducts MDL studies with spikes that go through the extraction and analytical; therefore, dry weight or wet weight units do not apply.

[d] A DQL or project quantitation limit goal could not be established because no toxicity thresholds were available.

AET – apparent effects threshold
CAS – Chemical Abstract Service
DQL – data quality level
dw – dry weight
ERL – effects range – low
MDL – method detection limit
NA – not available
NJDEP – New Jersey Department of Environmental Protection
NOAEL – no-observed-adverse-effect level
OQA – Office of Quality Assurance
PRG – preliminary remediation goal
QAM – quality assurance manual
QL – quantitation limit
RSL – regional screening level
TEL – threshold effects level
TPH – total petroleum hydrocarbons
TRV – toxicity reference value
USEPA – US Environmental Protection Agency

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Matrix: Sediment

Analytical Group: TPH – Purgeables, USEPA SW-846 8015B Modified and Maine Method 4.2.17, Alpha Analytical, Mansfield, MA

SOP from Worksheet 23: M34

Concentration Level: Low

Analyte	CAS Number	DQL (mg/kg dw)[a]	Project Quantitation Limit Goal (mg/kg dw)	Analytical Method[b]		Achievable Laboratory Limit[c]	
				MDL (mg/kg dw)	Method QL (mg/kg dw)	MDL (mg/kg)	QL (mg/kg)
TPH – purgeable	NA	NA[d]	2.5	NA	NA	0.048	2.5

Note: Project data will be reported in units appropriate to the analytical method.

[a] DQLs have not been approved by USEPA. DQLs based on the lower of: 1) NJDEP Soil Remediation Standards for Residential Soil, June 2008, 2) USEPA RSLs for residential soil, April 2009, and 3) applicable ecological thresholds based on NOAELs, TRVs, AETs, ERLs, and TELs (if available). RSLs for non-carcinogenic compounds were divided by a factor of 10 to adjust for a hazard index of 0.1 to account for potential additive effects. See Attachment K for ecological and human health thresholds. DQLs (including ecological and human health thresholds presented in Attachment K) are analytical goals listed solely for the purpose of evaluating laboratory analytical methods and achievable laboratory limits; these are not project-specific screening levels or PRGs and are not approved by the USEPA as the appropriate risk assessment criteria for this project. These values will be developed in subsequent phases of the project.

[b] Analytical MDLs and QLs are those documented in validated methods. When the method did not publish a value for either the MDL or QL, the value was determined to be NA.

[c] Achievable MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method. Actual MDLs and QLs will vary based on sample-specific factors. The laboratory conducts MDL studies with spikes that go through the extraction and analytical process; therefore, dw or ww units do not apply.

[d] A DQL or project quantitation limit goal could not be established because no toxicity thresholds were available.

AET – apparent effects threshold
CAS – Chemical Abstract Service
DQL – data quality level
dw – dry weight
ERL – effects range – low
MDL – method detection limit
NA – not available
NJDEP – New Jersey Department of Environmental Protection
NOAEL – no-observed-adverse-effect level
PRG – preliminary remediation goal
QL – quantitation limit
RSL – regional screening level
TEL – threshold effects level
TPH – total petroleum hydrocarbons
TRV – toxicity reference value
USEPA – US Environmental Protection Agency
ww – wet weight

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Matrix: Sediment

Analytical Group: TPH – Alkanes, USEPA SW-846-8015D, Alpha Analytical, Mansfield, MA

SOP from Worksheet 23: M46, M47, M48

Concentration Level: Low

Analyte	CAS Number	DQL (mg/kg dw)[a]	Project Quantitation Limit Goal (mg/kg dw)	Analytical Method[b]		Achievable Laboratory Limit[c]	
				MDL (mg/kg dw)	Method QL (mg/kg dw)	MDL (mg/kg)	QL (mg/kg)
n-Octane (C8)	111-65-9	NA[d]	0.0667	NA	NA	0.0156	0.0667
n-Nonane (C9)	111-84-2	NA[d]	0.0667	NA	NA	0.00644	0.0667
n-Decane (C10)	124-18-5	NA[d]	0.0667	NA	NA	0.00707	0.0667
n-Undecane (C11)	1120-21-4	NA[d]	0.0667	NA	NA	0.00728	0.0667
n-Dodecane (C12)	112-40-3	NA[d]	0.0667	NA	NA	0.00939	0.0667
n-Tridecane (C13)	629-50-5	NA[d]	0.0667	NA	NA	0.0389	0.0667
n-Tetradecane (C14)	629-59-4	NA[d]	0.0667	NA	NA	0.00696	0.0667
n-Pentadecane (C15)	629-92-9	NA[d]	0.0667	NA	NA	0.0166	0.0667
n-Hexadecane (C16)	629-73-2	NA	0.0667	NA[d]	NA	0.00639	0.0667
n-Heptadecane (C17)	629-78-7	NA	0.0667	NA[d]	NA	0.00808	0.0667
Pristane	1921-70-6	NA	0.0667	NA[d]	NA	0.0108	0.0667
n-Octadecane (C18)	593-45-3	NA	0.0667	NA[d]	NA	0.00535	0.0667
Phytane	638-36-8	NA	0.0667	NA[d]	NA	0.0056	0.0667
n-Nonadecane (C19)	629-92-5	NA	0.0667	NA[d]	NA	0.00541	0.0667
n-Eicosane (C20)	112-95-8	NA	0.0667	NA[d]	NA	0.00371	0.0667
n-Heneicosane (C21)	629-94-7	NA	0.0667	NA[d]	NA	0.00448	0.0667
n-Docosane (C22)	629-97-0	NA	0.0667	NA[d]	NA	0.00288	0.0667
n-Tricosane (C23)	638-67-5	NA[d]	0.0667	NA	NA	0.00397	0.0667
n-Tetracosane (C24)	646-31-1	NA[d]	0.0667	NA	NA	0.00619	0.0667
n-Pentacosane (C25)	629-99-2	NA[d]	0.0667	NA	NA	0.0391	0.0667
n-Hexacosane (C26)	630-01-3	NA[d]	0.0667	NA	NA	0.00733	0.0667

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Analyte	CAS Number	DQL (mg/kg dw)[a]	Project Quantitation Limit Goal (mg/kg dw)	Analytical Method[b]		Achievable Laboratory Limit[c]	
				MDL (mg/kg dw)	Method QL (mg/kg dw)	MDL (mg/kg)	QL (mg/kg)
n-Heptacosane (C27)	593-49-7	NA[d]	0.0667	NA	NA	0.00522	0.0667
n-Octacosane (C28)	630-02-4	NA[d]	0.0667	NA	NA	0.0233	0.0667
n-Nonacosane (C29)	630-03-5	NA[d]	0.0667	NA	NA	0.00628	0.0667
n-Triacontane (C30)	638-68-6	NA[d]	0.0667	NA	NA	0.00665	0.0667
n-Hentriacontane (C31)	630-04-6	NA[d]	0.0667	NA	NA	0.00712	0.0667
n-Dotriacontane (C32)	544-85-4	NA[d]	0.0667	NA	NA	0.00740	0.0667
n-Tritriacontane (C33)	630-05-7	NA[d]	0.0667	NA	NA	0.00735	0.0667
n-Tetratriacontane (C34)	14167-59-0	NA[d]	0.0667	NA	NA	0.00892	0.0667
n-Pentatriacontane (C35)	630-07-9	NA[d]	0.0667	NA	NA	0.00733	0.0667
n-Hexatriacontane (C36)	630-06-8	NA[d]	0.0667	NA	NA	0.00692	0.0667
n-Heptatriacontane (C37)	7194-84-5	NA[d]	0.0667	NA	NA	0.011	0.0667
n-Octatriacontane (C38)	7194-85-6	NA[d]	0.0667	NA	NA	0.010	0.0667
n-Tetracontane (C40)	4181-95-7	NA[d]	0.0667	NA	NA	0.012	0.0667

Note: Project data will be reported in units appropriate to the analytical method.

[a] DQLs have not been approved by USEPA. DQLs based on the lower of: 1) NJDEP Soil Remediation Standards for Residential Soil, June 2008, 2) USEPA RSLs for residential soil, April 2009, and 3) applicable ecological thresholds based on NOAELs, TRVs, AETs, ERLs, and TELs (if available). RSLs for non-carcinogenic compounds were divided by a factor of 10 to adjust for a hazard index of 0.1 to account for potential additive effects. See Attachment K for ecological and human health thresholds. DQLs (including ecological and human health thresholds presented in Attachment K) are analytical goals listed solely for the purpose of evaluating laboratory analytical methods and achievable laboratory limits; these are not project-specific screening levels or PRGs and are not approved by the USEPA as the appropriate risk assessment criteria for this project. These values will be developed in subsequent phases of the project.

[b] Analytical MDLs and QLs are those documented in validated methods. When the method did not publish a value for either the MDL or QL, the value was determined to be NA.

[c] Achievable MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method. Actual MDLs and QLs will vary based on sample-specific factors. The laboratory conducts MDL studies with spikes that go through the extraction and analytical process; therefore, dry weight or wet weight units do not apply.

[d] A DQL or project quantitation limit goal could not be established because no toxicity thresholds were available.

AET – apparent effects threshold
CAS – Chemical Abstract Service
DQL – data quality level
ERL – effects range – low
MDL – method detection limit
NJDEP – New Jersey Department of Environmental Protection
NA – not available
NOAEL – no-observed-adverse-effect level
PRG – preliminary remediation goal
QL – quantitation limit
RSL – regional screening level
TEL – threshold effects level
TPH – total petroleum hydrocarbons
TRV – toxicity reference value
USEPA – US Environmental Protection Agency

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Matrix: Sediment

Analytical Group, Method, and Laboratory: General Chemistry – Ammonia-N, USEPA 350.1 Modified, Columbia Analytical Services, Inc., Kelso, WA

SOP from Worksheet 23: M27

Concentration Level: Low

Analyte	CAS Number	DQL (mg/kg dw)[a]	Project QL Goal (mg/kg dw)	Analytical Method[b]		Achievable Laboratory Limit[c]	
				MDL (mg/kg dw)	Method QL (mg/kg dw)	MDL (mg/kg dw)	QL (mg/kg dw)
Ammonia-N	7664-41-7	NA[d]	0.50	NA	NA	0.04	0.50

Note: Project data will be reported in units appropriate to the analytical method.

[a] DQLs have not been approved by USEPA. DQLs based on the lower of: 1) NJDEP Soil Remediation Standards for Residential Soil, June 2008, 2) USEPA RSLs for residential soil, April 2009, and 3) applicable ecological thresholds based on NOAELs, TRVs, AETs, ERLs, and TELs (if available). RSLs for non-carcinogenic compounds were divided by a factor of 10 to adjust for a hazard index of 0.1 to account for potential additive effects. See Attachment K for ecological and human health thresholds. DQLs (including ecological and human health thresholds presented in Attachment K) are analytical goals listed solely for the purpose of evaluating laboratory analytical methods and achievable laboratory limits; these are not project-specific screening levels or PRGs and are not approved by the USEPA as the appropriate risk assessment criteria for this project. These values will be developed in subsequent phases of the project.

[b] Analytical MDLs and QLs are those documented in validated methods. When the method did not publish a value for either the MDL or QL, the value was determined to be NA.

[c] Achievable MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method. Actual MDLs and QLs will vary based on sample-specific factors.

[d] A DQL or project quantitation limit goal could not be established because no toxicity thresholds were available.

AET – apparent effects threshold
CAS – Chemical Abstract Service
DQL – data quality level
dw – dry weight
ERL – effects range – low
MDL – method detection limit
NA – not available
NJDEP – New Jersey Department of Environmental Protection
NOAEL – no-observed-adverse-effect level
PRG – preliminary remediation goal
QL – quantitation limit
RSL – regional screening level
TEL – threshold effects level
TRV – toxicity reference value
USEPA – US Environmental Protection Agency

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Matrix: Sediment

Analytical Group, Method, and Laboratory: General Chemistry – Cyanide, USEPA SW-846 9012A, Columbia Analytical Services Inc., Kelso, WA

SOP from Worksheet 23: M28, M29

Concentration Level: Low

Analyte	CAS Number	DQL (mg/kg dw)[a]	Project QL Goal (mg/kg dw)	Analytical Method[b]		Achievable Laboratory Limit[c]	
				MDL (mg/kg dw)	Method QL (mg/kg dw)	MDL (mg/kg dw)	QL (mg/kg dw)
Cyanide	57-12-5	0.0001	**0.20**	NA	NA	**0.10**	**0.20**

Note: Project data will be reported in units appropriate to the analytical method.

[a] DQLs have not been approved by USEPA. DQLs based on the lower of: 1) NJDEP Soil Remediation Standards for Residential Soil, June 2008, 2) USEPA RSLs for residential soil, April 2009, and 3) applicable ecological thresholds based on NOAELs, TRVs, AETs, ERLs, and TELs (if available). RSLs for non-carcinogenic compounds were divided by a factor of 10 to adjust for a hazard index of 0.1 to account for potential additive effects. See Attachment K for ecological and human health thresholds. DQLs (including ecological and human health thresholds presented in Attachment K) are analytical goals listed solely for the purpose of evaluating laboratory analytical methods and achievable laboratory limits; these are not project-specific screening levels or PRGs and are not approved by the USEPA as the appropriate risk assessment criteria for this project. These values will be developed in subsequent phases of the project.

[b] Analytical MDLs and QLs are those documented in validated methods. When the method did not publish a value for either the MDL or QL, the value was determined to be NA.

[c] Achievable MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method. Actual MDLs and QLs will vary based on sample-specific factors.

AET – apparent effects threshold
CAS – Chemical Abstract Service
DQL – data quality level
dw – dry weight
ERL – effects range – low
MDL – method detection limit
NA – not available
NJDEP – New Jersey Department of Environmental Protection
NOAEL – no-observed-adverse-effect level
PRG – preliminary remediation goal
QL – quantitation limit
RSL – regional screening level
TEL – threshold effects level
TRV – toxicity reference value
USEPA – US Environmental Protection Agency

Bold indicates chemicals for which the achievable laboratory limits exceed the DQL.

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Matrix: Sediment

Analytical Group, Method, and Laboratory: General Chemistry – Total Phosphorus, USEPA 365.3 Modified, Columbia Analytical Services, Inc., Kelso, WA

SOP from Worksheet 23: M31

Concentration Level: Low

Analyte	CAS Number	DQL (mg/kg dw)[a]	Project QL Goal (mg/kg dw)	Analytical Method[b]		Achievable Laboratory Limit[c]	
				MDL (mg/kg dw)	Method QL (mg/kg dw)	MDL (mg/kg dw)	QL (mg/kg dw)
Total phosphorus	14265-44-2	NA[d]	0.10	NA	NA	NA	0.10

Note: Project data will be reported in units appropriate to the analytical method.

[a] DQLs have not been approved by USEPA. DQLs based on the lower of: 1) NJDEP Soil Remediation Standards for Residential Soil, June 2008, 2) USEPA RSLs for residential soil, April 2009, and 3) applicable ecological thresholds based on NOAELs, TRVs, AETs, ERLs, and TELs (if available). RSLs for non-carcinogenic compounds were divided by a factor of 10 to adjust for a hazard index of 0.1 to account for potential additive effects. See Attachment K for ecological and human health thresholds. DQLs (including ecological and human health thresholds presented in Attachment K) are analytical goals listed solely for the purpose of evaluating laboratory analytical methods and achievable laboratory limits; these are not project-specific screening levels or PRGs and are not approved by the USEPA as the appropriate risk assessment criteria for this project. These values will be developed in subsequent phases of the project.

[b] Analytical MDLs and QLs are those documented in validated methods. When the method did not publish a value for either the MDL or QL, the value was determined to be NA.

[c] Achievable MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method. Actual MDLs and QLs will vary based on sample-specific factors.

[d] A DQL or project quantitation limit goal could not be established because no toxicity thresholds were available.

AET – apparent effects threshold
CAS – Chemical Abstract Service
DQL – data quality level
dw – dry weight
ERL – effects range – low
MDL – method detection limit
NA – not available
NJDEP – New Jersey Department of Environmental Protection
NOAEL – no-observed-adverse-effect level
PRG – preliminary remediation goal
QL – quantitation limit
RSL – regional screening level
TEL – threshold effects level
TRV – toxicity reference value
USEPA – US Environmental Protection Agency

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Matrix: Sediment

Analytical Group, Method, and Laboratory: General Chemistry – Total Kjeldahl Nitrogen, ASTM D3590-89-02, Columbia Analytical Services, Inc., Kelso, WA

SOP from Worksheet 23: M30

Concentration Level: Low

Analyte	CAS Number	DQL (mg/kg dw)[a]	Project QL Goal (mg/kg dw)	Analytical Method[b]		Achievable Laboratory Limit[c]	
				MDL (mg/kg dw)	Method QL (mg/kg dw)	MDL (mg/kg dw)	QL (mg/kg dw)
Total Kjeldahl nitrogen	7727-37-9	NA[d]	20	NA	NA	8.0	20

Note: Project data will be reported in units appropriate to the analytical method.

[a] DQLs have not been approved by USEPA. DQLs based on the lower of: 1) NJDEP Soil Remediation Standards for Residential Soil, June 2008, 2) USEPA RSLs for residential soil, April 2009, and 3) applicable ecological thresholds based on NOAELs, TRVs, AETs, ERLs, and TELs (if available). RSLs for non-carcinogenic compounds were divided by a factor of 10 to adjust for a hazard index of 0.1 to account for potential additive effects. See Attachment K for ecological and human health thresholds. DQLs (including ecological and human health thresholds presented in Attachment K) are analytical goals listed solely for the purpose of evaluating laboratory analytical methods and achievable laboratory limits; these are not project-specific screening levels or PRGs and are not approved by the USEPA as the appropriate risk assessment criteria for this project. These values will be developed in subsequent phases of the project.

[b] Analytical MDLs and QLs are those documented in validated methods. When the method did not publish a value for either the MDL or QL, the value was determined to be NA.

[c] Achievable MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method. Actual MDLs and QLs will vary based on sample-specific factors.

[d] A DQL or project quantitation limit goal could not be established because no toxicity thresholds were available.

AET – apparent effects threshold
ASTM – American Society for Testing and Materials
CAS – Chemical Abstract Service
DQL – data quality level
dw – dry weight
ERL – effects range – low
MDL – method detection limit
NA – not available
NJDEP – New Jersey Department of Environmental Protection
NOAEL – no-observed-adverse-effect level
PRG – preliminary remediation goal
QL – quantitation limit
RSL – regional screening level
TEL – threshold effects level
TRV – toxicity reference value
USEPA – US Environmental Protection Agency

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Matrix: Sediment

Analytical Group, Method, and Laboratory: General Chemistry – TOC, Lloyd Kahn, Alpha Analytical, Mansfield, MA

SOP from Worksheet 23: M25

Concentration Level: Low

Analyte	CAS Number	DQL (%)[a]	Project QL Goal (%)	Analytical Method[b]		Achievable Laboratory Limit[c]	
				MDL (%)	Method QL (%)	MDL (%)	QL (%)
TOC	D3590-89-02	NA[d]	0.01	NA	NA	0.003	0.01

Note: Project data will be reported in units appropriate to the analytical method.

[a] DQLs have not been approved by USEPA. DQLs based on the lower of: 1) NJDEP Soil Remediation Standards for Residential Soil, June 2008, 2) USEPA RSLs for residential soil, April 2009, and 3) applicable ecological thresholds based on NOAELs, TRVs, AETs, ERLs, and TELs (if available). RSLs for non-carcinogenic compounds were divided by a factor of 10 to adjust for a hazard index of 0.1 to account for potential additive effects. See Attachment K for ecological and human health thresholds. DQLs (including ecological and human health thresholds presented in Attachment K) are analytical goals listed solely for the purpose of evaluating laboratory analytical methods and achievable laboratory limits; these are not project-specific screening levels or PRGs and are not approved by the USEPA as the appropriate risk assessment criteria for this project. These values will be developed in subsequent phases of the project.

[b] Analytical MDLs and QLs are those documented in validated methods. When the method did not publish a value for either the MDL or QL, the value was determined to be NA.

[c] Achievable MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method. Actual MDLs and QLs will vary based on sample-specific factors.

[d] A DQL or project quantitation limit goal could not be established because no toxicity thresholds were available.

AET – apparent effects threshold
CAS – Chemical Abstract Service
DQL – data quality level
ERL – effects range – low
MDL – method detection limit
NA – not available
NJDEP – New Jersey Department of Environmental Protection
NOAEL – no-observed-adverse-effect level
PRG – preliminary remediation goal
QL – quantitation limit
RSL – regional screening level
TEL – threshold effects level
TOC – total organic carbon
TRV – toxicity reference value
USEPA – US Environmental Protection Agency

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Matrix: Sediment

Analytical Group Method, and Laboratory: General Chemistry – Total Sulfide, USEPA SW-846 9030M, Columbia Analytical Services, Inc., Kelso, WA

SOP from Worksheet 23: M32

Concentration Level: Low

Analyte	CAS Number	DQL (mg/kg dw)[a]	Project QL Goal (mg/kg dw)	Analytical Method[b]		Achievable Laboratory Limit[c]	
				MDL (mg/kg dw)	Method QL (mg/kg dw)	MDL (mg/kg dw)	QL (mg/kg dw)
Total sulfide	7440-44-0	NA[d]	0.50	NA	0.20	0.2	0.50

Note: Project data will be reported in units appropriate to the analytical method.

[a] DQLs have not been approved by USEPA. DQLs based on the lower of: 1) NJDEP Soil Remediation Standards for Residential Soil, June 2008, 2) USEPA RSLs for residential soil, April 2009, and 3) applicable ecological thresholds based on NOAELs, TRVs, AETs, ERLs, and TELs (if available). RSLs for non-carcinogenic compounds were divided by a factor of 10 to adjust for a hazard index of 0.1 to account for potential additive effects. See Attachment K for ecological and human health thresholds. DQLs (including ecological and human health thresholds presented in Attachment K) are analytical goals listed solely for the purpose of evaluating laboratory analytical methods and achievable laboratory limits; these are not project-specific screening levels or PRGs and are not approved by the USEPA as the appropriate risk assessment criteria for this project. These values will be developed in subsequent phases of the project.

[b] Analytical MDLs and QLs are those documented in validated methods. When the method did not publish a value for either the MDL or QL, the value was determined to be NA.

[c] Achievable MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method. Actual MDLs and QLs will vary based on sample-specific factors.

[d] A DQL or project quantitation limit goal could not be established because no toxicity thresholds were available.

AET – apparent effects threshold
CAS – Chemical Abstract Service
DQL – data quality level
dw – dry weight
ERL – effects range – low
MDL – method detection limit
NA – not available
NJDEP – New Jersey Department of Environmental Protection
NOAEL – no-observed-adverse-effect level
PRG – preliminary remediation goal
QL – quantitation limit
RSL – regional screening level
TEL – threshold effects level
TRV – toxicity reference value
USEPA – US Environmental Protection Agency

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Matrix: Sediment

Analytical Group, Method, and Laboratory: General Chemistry – AVS/SEM, USEPA 821R91100, SW-846 6010C/6020, Columbia Analytical Services, Inc., Kelso, WA

SOP from Worksheet 23: M13

Concentration Level: Low

Analyte	CAS Number	DQL (µmoles/g dw)[a]	Project QL Goal (µmoles/g dw)	Analytical Method[b]		Achievable Laboratory Limit[c]	
				MDL (µmoles/g dw)	Method QL (µmoles/g dw)	MDL (µmoles/g dw)	QL (µmoles/g dw)
AVS/SEM	18496-25-8	NA[d]	0.016	NA	NA	NA	0.016
SEM – cadmium	7440-43-9	0.60	0.0018	NA	NA	NA	0.0018
SEM – copper	7440-50-8	16	0.0063	NA	NA	NA	0.0063
SEM – lead	7439-92-1	31	0.0145	NA	NA	NA	0.0145
SEM – silver	7440-22-4	0.5	0.0019	NA	NA	NA	0.0019
SEM – nickel	7440-02-0	16	0.0085	NA	NA	NA	0.0085
SEM – zinc	7440-66-6	120	0.0061	NA	NA	NA	0.0061

Note: Project data will be reported in units appropriate to the analytical method.

[a] DQLs have not been approved by USEPA. DQLs based on the lower of: 1) NJDEP Soil Remediation Standards for Residential Soil, June 2008, 2) USEPA RSLs for residential soil, April 2009, and 3) applicable ecological thresholds based on NOAELs, TRVs, AETs, ERLs, and TELs (if available). RSLs for non-carcinogenic compounds were divided by a factor of 10 to adjust for a hazard index of 0.1 to account for potential additive effects. See Attachment K for ecological and human health thresholds. DQLs (including ecological and human health thresholds presented in Attachment K) are analytical goals listed solely for the purpose of evaluating laboratory analytical methods and achievable laboratory limits; these are not project-specific screening levels or PRGs and are not approved by the USEPA as the appropriate risk assessment criteria for this project. These values will be developed in subsequent phases of the project.

[b] Analytical MDLs and QLs are those documented in validated methods. When the method did not publish a value for either the MDL or QL, the value was determined to be NA.

[c] Achievable MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method. Actual MDLs and QLs will vary based on sample-specific factors.

[d] A DQL or project quantitation limit goal could not be established because no toxicity thresholds were available.

AET – apparent effects threshold
AVS – acid volatile sulfur
CAS – Chemical Abstract Service
DQL – data quality level
dw – dry weight
NA – not available
ERL – effects range – low
MDL – method detection limit
NA – not available
NJDEP – New Jersey Department of Environmental Protection
NOAEL – no-observed-adverse-effect level
PRG – preliminary remediation goal
QL – quantitation limit
RSL – regional screening level
SEM – simultaneously extracted metals
TEL – threshold effects level
TRV – toxicity reference value
USEPA – US Environmental Protection Agency

QAPP Worksheet No. 15. Data Quality Levels and Analytical Methods Evaluation (cont.)

Matrix: Sediment

Analytical Group, Method, and Laboratory: General Chemistry – Percent Moisture, SM2540G Modified, Alpha Analytical, Mansfield, MA

SOP from Worksheet 23: M24

Concentration Level: Low

Analyte	CAS Number	DQL (%)[a]	Project Quantitation Limit Goal (%)	Analytical Method[b]		Achievable Laboratory Limit[c]	
				MDL (%)	Method QL (%)	MDL (%)	QL (%)
Percent moisture	NA	NA[d]	NA[d]	NA	NA	NA	NA

Note: Project data will be reported in units appropriate to the analytical method.

[a] DQLs have not been approved by USEPA. DQLs based on the lower of: 1) NJDEP Soil Remediation Standards for Residential Soil, June 2008, 2) USEPA RSLs for residential soil, April 2009, and 3) applicable ecological thresholds based on NOAELs, TRVs, AETs, ERLs, and TELs (if available). RSLs for non-carcinogenic compounds were divided by a factor of 10 to adjust for a hazard index of 0.1 to account for potential additive effects. See Attachment K for ecological and human health thresholds. DQLs (including ecological and human health thresholds presented in Attachment K) are analytical goals listed solely for the purpose of evaluating laboratory analytical methods and achievable laboratory limits; these are not project-specific screening levels or PRGs and are not approved by the USEPA as the appropriate risk assessment criteria for this project. These values will be developed in subsequent phases of the project.

[b] Analytical MDLs and QLs are those documented in validated methods. When the method did not publish a value for either the MDL or QL, the value was determined to be NA.

[c] Achievable MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method. Actual MDLs and QLs will vary based on sample-specific factors. When the laboratory does not conduct MDL studies the associated laboratory MDL and QL value was determined to be NA.

[d] A DQL or project quantitation limit goal could not be established because percent moisture is not a chemical stressor.

AET – apparent effects threshold
CAS – Chemical Abstract Service
DQL – data quality level
ERL – effects range – low
MDL – method detection limit
NA – not available
NJDEP – New Jersey Department of Environmental Protection
NOAEL – no-observed-adverse-effect level
PRG – preliminary remediation goal
QL – quantitation limit
RSL – regional screening level
TEL – threshold effects level
TRV – toxicity reference value
USEPA – US Environmental Protection Agency

QAPP Worksheet No. 16. Project Schedule/Timeline Table

Activities	Organization	Date (MM/DD/YY)		Deliverable	Deliverable Due Date
		Anticipated Date of Initiation	Anticipated Date of Completion		
QAPP preparation and delivery to USEPA	Windward	3/15/09	5/22/09	QAPP	5/22/09
Surface sediment collection	Windward	10/7/09	12/1/09	See below for data report deliverables.	See below
Benthic community surveys	Windward	10/7/09; spring and summer 2010	12/1/09; spring and summer 2010 (approximately 15 business days following start of event)	See below for data report deliverables.	See below
Toxicity testing (performed in batches of 20 to 30 sediment samples)	EnviroSystem	Within 8 weeks of the earliest sediment collection date in a given batch	Maximum of 32 days after test initial of each batch of sediment samples	Draft toxicity test reports within 30 days of test completion	Final toxicity test reports 30 days after validation
Bioaccumulation testing (performed in batches of 5 to 10 sediment samples)	EnviroSystem	Within 8 weeks of the earliest sediment collection date in a given batch	Maximum of 30 days after test initial of each batch of sediment samples	Draft bioaccumulation test reports within 30 days of test completion	Final bioaccumulation test reports 30 days after validation
Validation of toxicity and bioaccumulation reports	Dinnel Marine Resources	Upon receipt of draft toxicity and bioaccumulation reports	30 days after receipt of toxicity and bioaccumulation reports	One final validation report	Final toxicity testing validation report 30 days after validation of last batch of tests Final bioaccumulation validation report 30 days after validation of last batch of tests

QAPP Worksheet No. 16. Project Schedule/Timeline Table (cont.)

Activities	Organization	Date (MM/DD/YY)		Deliverable	Deliverable Due Date
		Anticipated Date of Initiation	Anticipated Date of Completion		
Benthic community data	EcoAnalysts	Upon receipt of samples from the field	6 weeks after receipt of last benthic community samples	Benthic community data and QA/QC report	30 days after identification of invertebrates in last samples received
Surface sediment chemical analyses	Alpha Analytical, Analytical Perspectives, Brooks Rand Labs, CAS, Kelso, and Maxxam Analytics	Upon receipt of samples from the field	9 weeks after receipt of last sediment samples	Final laboratory data reports and EDD	9 weeks after receipt of last sediment samples
Validation of surface sediment	Trillium	Upon receipt of final laboratory data reports and EDDs	45 days after receipt of final laboratory data report	Final validation report	45 days after receipt of laboratory data reports and EDDs
Homogenization of bioaccumulation tissue for chemical analysis	Alpha Analytical	Upon receipt of bioaccumulation tissue from EnviroSystem	3 weeks after receipt of last bioaccumulation tissue samples	Homogenized bioaccumulation tissue	Homogenized tissue available for analysis and sent to other chemistry laboratories
Bioaccumulation tissue for chemical analysis	Alpha Analytical, Analytical Perspectives, Brooks Rand Labs, CAS, Kelso, and Maxxam Analytics	Upon receipt of samples from the field	9 weeks after receipt of last sediment samples	Final laboratory data reports and EDD	9 weeks after receipt of last sediment samples

QAPP Worksheet No. 16. Project Schedule/Timeline Table (cont.)

Activities	Organization	Date (MM/DD/YY)		Deliverable	Deliverable Due Date
		Anticipated Date of Initiation	Anticipated Date of Completion		
Validation of bioaccumulation tissue for chemical analysis	Trillium	Upon receipt of final laboratory data reports	45 days after receipt of final laboratory data report	Final validation report	Final validation report 45 days after receipt of validated data
Preparation and delivery of the benthic community data report to USEPA	Windward	Upon receipt of validated data	90 days after receipt of validated data	Benthic community data report	90 days after receipt of validated data
Preparation and delivery of the toxicity test data report to USEPA	Windward	Upon receipt of validated data	90 days after receipt of validated data	Toxicity test data report	90 days after receipt of validated data
Preparation and delivery of the tissue chemistry data report to USEPA	Windward	Upon receipt of validated data	90 days after receipt of validated data	Tissue chemistry data report	90 days after receipt of validated data
Preparation and delivery of the sediment chemistry data report to USEPA	Windward	Upon receipt of validated data	90 days after receipt of validated data	Sediment chemistry data report	90 days after receipt of validated data

EDD – electronic data deliverable

HRMS – high-resolution mass spectrometry

QA/QC – quality assurance/quality control

USEPA – US Environmental protection Agency

QAPP Worksheet No. 17. Sampling Design and Rationale

Describe and provide a rationale for choosing the sampling approach (e.g., grid system, biased statistical approach):

This sampling effort addresses the following assessment objectives related to benthic invertebrates as outlined in FSP2 (Malcolm Pirnie et al. 2006) for the USEPA/PA:

1. Determine if exposure to site-related contaminants in the LPRSA poses unacceptable risks to the benthic invertebrate community.
2. Determine if the consumption of benthic invertebrates (represented by laboratory-exposed bioaccumulation test results for representative invertebrate species) poses unacceptable risks to ecological receptors.
3. Determine if exposure to surface sediments in the LPRSA poses unacceptable risks to human receptors.

Risks to the benthic invertebrate community will be evaluated using multiple lines of evidence, including: 1) the SQT assessment, which integrates benthic community data, toxicity test data, and sediment chemistry data, 2) tissue chemistry, and 3) surface water chemistry (this line of evidence is not addressed in this QAPP). The sampling design presented in this QAPP addresses the first two lines of evidence and the two objectives are to:

- Collect surface sediments for benthic community analysis, toxicity test, and chemistry analysis throughout the LPRSA to perform the SQT assessment.
- Collect surface sediments for bioaccumulation testing; tissues generated from bioaccumulation tests will undergo chemical analyses.

The results of the proposed SQT assessment and bioaccumulation testing sampling effort will be used to support the ERA and HHRA, specifically to address the assessment and measurement endpoints described in Worksheet No. 11 and outlined in the PFD (Windward and AECOM 2009). A description of the sampling approach is provided in Worksheet No. 11 (see section entitled “Where, when, and how should the data be collected/generated?”). Additional data will be collected if data gaps are identified after evaluation of data collected in fall 2009.

Twenty-seven of the shallow nearshore area SQT samples were co-located[11] with mummichog and darter/killifish sampling locations (presented in the Fish and Decapod Crustacean Tissue Collection for Chemical Analysis and Fish Community Survey QAPP (Windward 2009)). The sediment sampling at these stations will be coordinated with the fish tissue collection effort and will be deferred until these fish are caught (26 of these are identified in the Worksheet 18 with a footnote that says the collection of sediments will be deferred until these fish are caught). Additional sediment locations to be co-located with blue crab will also be sampled once blue crab compositing locations are selected and approved by USEPA.

Twenty SQT sampling locations were co-located with the bioaccumulation test locations, which were selected to represent a range of chemical concentrations throughout the estuarine and freshwater zones of the LPRSA (see Attachment J for details on how bioaccumulation locations were selected). The sediment chemistry data (from the co-located SQT locations) will be used with the laboratory exposed bioaccumulation tissue chemistry data to evaluate the relationship between benthic invertebrate tissue chemistry and sediment chemistry. The remaining 51 station locations were placed randomly within the four habitat strata within each segment for a total of up to 97 sample locations between RM 0 to RM 16

[11] The target co-located sediment locations will be represented as the centroid of all the locations where individual mummichog or darter/killifish selected for a single tissue composite were collected.

QAPP Worksheet No. 17. Sampling Design and Rationale (cont.)

of the LPRSA. In addition to the targeted 97 locations, up five more locations may be sampled by hand above RM 16 (for a total of up to 102 SQT samples); however, the sampling of these locations will depend on access agreement, safety of the field crew, and accessibility of sediment locations.

In addition to the SQT locations described above, up to fourteen human health exposure samples will also be collected for sediment chemistry only. Nine of these samples have targeted locations at certain shallow nearshore locations for the HHRA and up to five additional "floater" locations of potential human exposure interest may be identified while in the field (e.g., boat clubs, docks, and other locations of human activity such as fishing that are not currently identified for sampling).

If samples are collected at all possible locations described above, a total of 116 sediment locations will be sampled (102 SQT sampling locations and 14 human health exposure sampling locations).

Describe the sampling design and rationale in terms of what matrices will be sampled, what analytical groups will be analyzed and at what concentration levels, the sampling locations (including QC, critical, and background samples), the number of samples to be taken, and the sampling frequency (including seasonal considerations):

The rationale and description of the sampling design is provided in the above section entitled "Describe and provide a rationale for choosing the sampling approach"). The information presented here is primarily focused on the sampling protocol and methods that will be used throughout the LPRSA. Sampling locations, and the rationale for each location, are presented in Worksheet No. 18.

The following protocols will be implemented, as practicable, for conducting the field sampling effort and laboratory testing, as described in further detail in Worksheet No. 21 and Attachment M. Surface sediment samples will be collected in a consistent, repeatable manner with a stainless-steel, 0.2-m^2 hydraulic power-grab or a van Veen sampler and must also meet the acceptability criteria (described in Attachment D). Five SQT locations may be sampled by hand above RM 16. The sampling of these locations will depend on access agreement and safety of the field crew, and if sediment sampling and sampling access are possible. If sampling is possible, the stations will be recorded using a hand-held GPS (see Attachment B). The sediment will be collected by a hand-held grab sampler (e.g., Ponar) or, if necessary, by scooping sediment to a depth of 15 cm with a dedicated, clean, large stainless steel serving spoon. Samples for VOC, AVS/SEM, ammonia, sulfide, and TPH-purgeable analyses will be subsampled as discrete, non-homogenized samples immediately after collection on the boat. The sediment will then be placed into a pre-cleaned stainless steel or food-grade plastic container, tightly covered and transported to the field facility where it will be transferred to a pre-cleaned stainless steel container and homogenized as described in Attachment D. Any large non-sediment items such as rocks, shells, wood chips, or organisms (e.g., clams) will be removed prior to homogenization; the surface of these items will be scraped to remove any invertebrates, which will be homogenized with the rest of the sample. Homogenized sediment will then be split into the appropriate sample containers as described in Attachment E. Excess sample sediment will be containerized and stored in drums at the field facility for off-site disposal (Attachment F). For decontamination procedures between collection activities, see Attachment E.

Benthic community samples will be taken as part of the sediment collection effort in fall of 2009. A subset of the SQT assessment locations sampled will be revisited as part of the second and third community surveys, which will take place spring and summer 2010. The targeted locations to be sampled during the subsequent surveys will be selected following the first sampling event. During benthic sampling, field crew will document any qualitative observations of the presence of wetlands and/or low marsh habitat along the LPRSA.

QAPP Worksheet No. 18. Proposed Sampling Locations and Methods/SOP Requirements Table

Sampling Location/ID Number[a]	Easting (X)[b]	Northing (Y)[b]	Substrate[c]	Water Depth[d]	Method	Analyses	Number of Samples (identify field duplicates)	Sampling SOP Reference	Rationale for Sampling Location
LPRT01A	597077	683255	Fine	Deep subtidal	Grab sampler	Toxicity test, sediment chemistry, taxonomy, bioaccumulation	One for toxicity test and chemistry, four replicates for taxonomy	1-8	Co-location with bioaccumulation testing, LRC ID CLRC-004
LPRT01B	596562	685877	Coarse	Deep subtidal	Grab sampler	Toxicity test, sediment chemistry, taxonomy	One for toxicity test and chemistry, four replicates for taxonomy	1-8	Random location within river mile and habitat[e]
LPRT01C[f]	598967[i]	685963[i]	Fine	Shallow nearshore	Grab sampler	Toxicity test, sediment chemistry, taxonomy, mummichog	One for toxicity test and chemistry, four replicates for taxonomy	1-8	Co-location with mummichog or darter/killifish; sampling location to be determined when fish are collected[i]
LPRT01D[f]	598171[i]	686194[i]	Fine	Shallow nearshore	Grab sampler	Toxicity test, sediment chemistry, taxonomy, mummichog	One for toxicity test and chemistry, four replicates for taxonomy	1-8	Co-location with mummichog or darter/killifish; sampling location to be determined when fish are collected[i]
LPRT01E[f]	598171[i]	686217[i]	Fine	Shallow nearshore	Grab sampler	Toxicity test, sediment chemistry, taxonomy, mummichog	One for toxicity test and chemistry, four replicates for taxonomy	1-8	Co-location with mummichog or darter/killifish; sampling location to be determined when fish are collected[i]

QAPP Worksheet No. 18. Proposed Sampling Locations and Methods/SOP Requirements Table (cont.)

Sampling Location/ID Number[a]	Easting (X)[b]	Northing (Y)[b]	Substrate[c]	Water Depth[d]	Method	Analyses	Number of Samples (identify field duplicates)	Sampling SOP Reference	Rationale for Sampling Location
LPRT01F	596986	687014	Fine	Deep subtidal	Grab sampler	Toxicity test, sediment chemistry, taxonomy, bioaccumulation	One for toxicity test, bioaccumulation and chemistry, four replicates for taxonomy.	1-8	Co-location with bioaccumulation testing, LRC ID CLRC-010
LPRT01G	596830	688278	Coarse	Shallow nearshore	Grab sampler	Toxicity test, sediment chemistry, taxonomy	One for toxicity test and chemistry, four replicates for taxonomy	1-8	Random location within river mile and habitat[e]
LPRT02A	597060	689120	Coarse	Deep subtidal	Grab sampler	Toxicity test, sediment chemistry, taxonomy	One for toxicity test and chemistry, four replicates for taxonomy	1-8	Random location within river mile and habitat[e]
LPRT02B	597839	690166	Fine	Deep subtidal	Grab sampler	Toxicity test, sediment chemistry, taxonomy	One for toxicity test and chemistry, four replicates for taxonomy	1-8	Random location within river mile and habitat[e]
LPRT02C[f]	597388[i]	690363[i]	Fine	Shallow nearshore	Grab sampler	Toxicity test, sediment chemistry, taxonomy, mummichog	One for toxicity test and chemistry, four replicates for taxonomy	1-8	Co-location with mummichog or darter/killifish; sampling location to be determined when fish are collected[i]
LPRT02D[f]	597404[i]	690424[i]	Fine	Shallow nearshore	Grab sampler	Toxicity test, sediment chemistry, taxonomy, mummichog	One for toxicity test and chemistry, four replicates for taxonomy.	1-8	Co-location with mummichog or darter/killifish; sampling location to be determined when fish are collected[i]

QAPP Worksheet No. 18. Proposed Sampling Locations and Methods/SOP Requirements Table (cont.)

Sampling Location/ID Number[a]	Easting (X)[b]	Northing (Y)[b]	Substrate[c]	Water Depth[d]	Method	Analyses	Number of Samples (identify field duplicates)	Sampling SOP Reference	Rationale for Sampling Location
LPRT02E	597966	691370	Fine	Deep subtidal	Grab sampler	Toxicity test, sediment chemistry, taxonomy, bioaccumulation	One for toxicity test, bioaccumulation, and chemistry, four replicates for taxonomy	1-8	Co-location with bioaccumulation testing, LRC ID CLRC-019
LPRT02F	597790	692091	Coarse	Shallow nearshore	Grab sampler	Toxicity test, sediment chemistry, taxonomy	One for toxicity test and chemistry, four replicates for taxonomy	1-8	Random location within river mile and habitat[e]
LPRT03A	597875	694195	Coarse	Shallow nearshore	Grab sampler	Toxicity test, sediment chemistry, taxonomy	One for toxicity test and chemistry, four replicates for taxonomy	1-8	Random location within river mile and habitat[e]
LPRT03B	597907	694724	Fine	Deep subtidal	Grab sampler	Toxicity test, sediment chemistry, taxonomy	One for toxicity test and chemistry, four replicates for taxonomy	1-8	Random location within river mile and habitat[e]
LPRT03C[f]	596589[i]	695173[i]	Fine	Shallow nearshore	Grab sampler	Toxicity test, sediment chemistry, taxonomy, mummichog	One for toxicity test and chemistry, four replicates for taxonomy	1-8	Co-location with mummichog or darter/killifish; sampling location to be determined when fish are collected[i]
LPRT03D	594769	695713	Fine	Deep subtidal	Grab sampler	Toxicity test, sediment chemistry, taxonomy	One for toxicity test and chemistry, four replicates for taxonomy	1-8	Random location within river mile and habitat[e]
LPRT03E	594660	695497	Fine	Deep subtidal	Grab sampler	Toxicity test, sediment chemistry, taxonomy	One for toxicity test and chemistry, four replicates for taxonomy	1-8	Random location within river mile and habitat[e]

QAPP Worksheet No. 18. Proposed Sampling Locations and Methods/SOP Requirements Table (cont.)

Sampling Location/ID Number[a]	Easting (X)[b]	Northing (Y)[b]	Substrate[c]	Water Depth[d]	Method	Analyses	Number of Samples (identify field duplicates)	Sampling SOP Reference	Rationale for Sampling Location
LPRT03F[f]	594533[i]	695241[i]	Fine	Shallow nearshore	Grab sampler	Toxicity test, sediment chemistry, taxonomy, mummichog	One for toxicity test and chemistry, four replicates for taxonomy	1-8	Co-location with mummichog or darter/killifish; sampling location to be determined when fish are collected[i]
LPRT04A	591552	694967	Fine	Shallow nearshore	Grab sampler	Toxicity test, sediment chemistry, taxonomy	One for toxicity test and chemistry, four replicates for taxonomy	1-8	Random location within river mile and habitat[e]
LPRT04B	591048	694267	Fine	Deep subtidal	Grab sampler	Toxicity test, sediment chemistry, taxonomy, bioaccumulation	One for toxicity test, bioaccumulation, and chemistry, four replicates for taxonomy	1-8	Co-location with bioaccumulation testing, LRC ID CLRC-029
LPRT04C	590753	693144	Coarse	Deep subtidal	Grab sampler	Toxicity test, sediment chemistry, taxonomy	One for toxicity test and chemistry, four replicates for taxonomy.	1-8	Random location within river mile and habitat[e]
LPRT04D[f]	590350[i]	693005[i]	Fine	Deep subtidal	Grab sampler	Toxicity test, sediment chemistry, taxonomy, mummichog	One for toxicity test and chemistry, three replicates for taxonomy	1-8	Co-location with mummichog or darter/killifish; sampling location to be determined when fish are collected[i]

QAPP Worksheet No. 18. Proposed Sampling Locations and Methods/SOP Requirements Table (cont.)

Sampling Location/ID Number[a]	Easting (X)[b]	Northing (Y)[b]	Substrate[c]	Water Depth[d]	Method	Analyses	Number of Samples (identify field duplicates)	Sampling SOP Reference	Rationale for Sampling Location
LPRT04E[f]	590175[i]	692915[i]	Fine	Shallow nearshore	Grab sampler	Toxicity test, sediment chemistry, taxonomy, mummichog	One for toxicity test and chemistry, four replicates for taxonomy	1-8	Co-location with mummichog or darter/killifish; sampling location to be determined when fish are collected[i]
LPRT04F	589906	692314	Coarse	Shallow nearshore	Grab sampler	Toxicity test, sediment chemistry, taxonomy	One for toxicity test and chemistry, four replicates for taxonomy	1-8	Random location within river mile and habitat[e], eastern end of Riverbank Park
LPRT05A	588919	692185	Coarse	Shallow nearshore	Grab sampler	Toxicity test, sediment chemistry, taxonomy	One for toxicity test and chemistry, four replicates for taxonomy	1-8	Random location within river mile and habitat[e], adjacent to Riverbank Park
LPRT05B	588807	692290	Fine	Deep subtidal	Grab sampler	Toxicity test, sediment chemistry, taxonomy	One for toxicity test and chemistry, four replicates for taxonomy	1-8	Random location within river mile and habitat[e]
LPRT05C[f]	588550[i]	692663[i]	Fine	Shallow nearshore	Grab sampler	Toxicity test, sediment chemistry, taxonomy, mummichog	One for toxicity test and chemistry, four replicates for taxonomy	1-8	Co-location with mummichog or darter/killifish; sampling location to be determined when fish are collected[i]
LPRT05D	587574	692212	Fine	Deep subtidal	Grab sampler	Toxicity test, sediment chemistry, taxonomy	One for toxicity test and chemistry, three replicates for taxonomy	1-8	Random location within river mile and habitat[e]

QAPP Worksheet No. 18. Proposed Sampling Locations and Methods/SOP Requirements Table (cont.)

Sampling Location/ID Number[a]	Easting (X)[b]	Northing (Y)[b]	Substrate[c]	Water Depth[d]	Method	Analyses	Number of Samples (identify field duplicates)	Sampling SOP Reference	Rationale for Sampling Location
LPRT05E	585609	693327	Coarse	Deep subtidal	Grab sampler	Toxicity test, sediment chemistry, taxonomy	One for toxicity test and chemistry, four replicates for taxonomy	1-8	Random location within river mile and habitat[e]
LPRT05F[f]	585651[i]	694256[i]	Fine	Shallow nearshore	Grab sampler	Toxicity test, sediment chemistry, taxonomy, mummichog	One for toxicity test and chemistry, four replicates for taxonomy	1-8	Co-location with mummichog or darter/killifish; sampling location to be determined when fish are collected[i]
LPRH05A	587783	692173	No data	Shallow nearshore	Grab sampler	Sediment chemistry	One for chemistry	1-8	Western end of Riverbank Park and vicinity of homeless camp
LPRT06A	585118	694422	Fine	Shallow nearshore	Grab sampler	Toxicity test, sediment chemistry, taxonomy	One for toxicity test and chemistry, four replicates for taxonomy	1-8	Random location within river mile and habitat[e]; vicinity of homeless camp
LPRT06B[f]	585116[i]	694436[i]	Fine	Shallow nearshore	Grab sampler	Toxicity test, sediment chemistry, taxonomy, mummichog	One for toxicity test and chemistry, four replicates for taxonomy	1-8	Co-location with mummichog or darter/killifish; sampling location to be determined when fish are collected[i]; vicinity of homeless camp

QAPP Worksheet No. 18. Proposed Sampling Locations and Methods/SOP Requirements Table (cont.)

Sampling Location/ID Number[a]	Easting (X)[b]	Northing (Y)[b]	Substrate[c]	Water Depth[d]	Method	Analyses	Number of Samples (identify field duplicates)	Sampling SOP Reference	Rationale for Sampling Location
LPRT06C	584808	697059	Fine	Deep subtidal	Grab sampler	Toxicity test, sediment chemistry, taxonomy, bioaccumulation	One for toxicity test, bioaccumulation, and chemistry, four replicates for taxonomy	1-8	Co-location with bioaccumulation testing, LRC ID CLRC-037
LPRT06D	584604	697313	Coarse	Deep subtidal	Grab sampler	Toxicity test, sediment chemistry, taxonomy	One for toxicity test and chemistry, four replicates for taxonomy	1-8	Random location within river mile and habitat[e]
LPRT06E	584936	698755	Fine	Deep subtidal	Grab sampler	Toxicity test, sediment chemistry, taxonomy	One for toxicity test and chemistry, four replicates for taxonomy	1-8	Random location within river mile and habitat[e]
LPRT06F	585142	699496	Coarse	Shallow nearshore	Grab sampler	Toxicity test, sediment chemistry, taxonomy	One for toxicity test and chemistry, four replicates for taxonomy.	1-8	Random location within river mile and habitat[e]
LPRT07A	584913	699733	Fine	Deep subtidal	Grab sampler	Toxicity test, sediment chemistry, taxonomy	One for toxicity test and chemistry, four replicates for taxonomy	1-8	Random location within river mile and habitat[e]
LPRT07B	585517	702182	Fine	Deep subtidal	Grab sampler	Toxicity test, sediment chemistry, taxonomy, bioaccumulation	One for toxicity test, bioaccumulation, and chemistry, four replicates for taxonomy	1-8	Co-location with bioaccumulation testing, LRC ID CLRC-040
LPRT07C	585851	702894	Fine	Shallow nearshore	Grab sampler	Toxicity test, sediment chemistry, taxonomy	One for toxicity test and chemistry, four replicates for taxonomy	1-8	Random location within river mile and habitat[e]
LPRT07D	586606	703488	Coarse	Deep subtidal	Grab sampler	Toxicity test, sediment chemistry, taxonomy	One for toxicity test and chemistry, four replicates for taxonomy	1-8	Random location within river mile and habitat[e]

QAPP Worksheet No. 18. Proposed Sampling Locations and Methods/SOP Requirements Table (cont.)

Sampling Location/ID Number[a]	Easting (X)[b]	Northing (Y)[b]	Substrate[c]	Water Depth[d]	Method	Analyses	Number of Samples (identify field duplicates)	Sampling SOP Reference	Rationale for Sampling Location
LPRT07E[f]	586707[i]	704111[i]	Fine	Shallow nearshore	Grab sampler	Toxicity test, sediment chemistry, taxonomy, mummichog	One for toxicity test and chemistry, four replicates for taxonomy	1-8	Co-location with mummichog or darter/killifish; sampling location to be determined when fish are collected[i]
LPRH07A	586627	703394	Coarse	Shallow nearshore	Grab sampler	Sediment chemistry	One for chemistry	1-8	Southern end of Riverbank Park and in vicinity of Kearny boat launch
LPRT08A	586935	704618	Coarse	Shallow nearshore	Grab sampler	Toxicity test, sediment chemistry, taxonomy	One for toxicity test and chemistry, four replicates for taxonomy.	1-8	Random location within river mile and habitat[e]
LPRT08B	587530	705785	Fine	Shallow nearshore	Grab sampler	Toxicity test, sediment chemistry, taxonomy	One for toxicity test and chemistry, four replicates for taxonomy	1-8	Random location within river mile and habitat[e]; adjacent to Riverbank Park
LPRT08C[f]	587977[i]	706324[i]	Fine	Deep subtidal	Grab sampler	Toxicity test, sediment chemistry, taxonomy	One for toxicity test and chemistry, four replicates for taxonomy	1-8	Co-location with mummichog or darter/killifish; sampling location to be determined when fish are collected[i]
LPRT08D	587826	706608	Fine	Deep subtidal	Grab sampler	Toxicity test, sediment chemistry, taxonomy, bioaccumulation	One for toxicity test, bioaccumulation, and chemistry, four replicates for taxonomy	1-8	Co-location with bioaccumulation testing LRC ID CLRC-047

QAPP Worksheet No. 18. Proposed Sampling Locations and Methods/SOP Requirements Table (cont.)

Sampling Location/ID Number[a]	Easting (X)[b]	Northing (Y)[b]	Substrate[c]	Water Depth[d]	Method	Analyses	Number of Samples (identify field duplicates)	Sampling SOP Reference	Rationale for Sampling Location
LPRT08E	589181	708327	Fine	Deep subtidal	Grab sampler	Toxicity test, sediment chemistry, taxonomy, bioaccumulation	One for toxicity test, bioaccumulation, and chemistry, four replicates for taxonomy	1-8	Co-location with bioaccumulation testing, LRC ID CLRC-049
LPRT08F	589594	708728	Coarse	Deep subtidal	Grab sampler	Toxicity test, sediment chemistry, taxonomy, bioaccumulation	One for toxicity test, bioaccumulation, and chemistry, four replicates for taxonomy	1-8	Co-location with bioaccumulation testing LRC ID CLRC-052
LPRT09A	589402	709079	Coarse	Shallow nearshore	Grab sampler	Toxicity test, sediment chemistry, taxonomy	One for toxicity test and chemistry, four replicates for taxonomy	1-8	Random location within river mile and habitat[e]
LPRT09B[f]	589428[i]	709262[i]	Coarse	Deep subtidal	Grab sampler	Toxicity test, sediment chemistry, taxonomy, mummichog	One for toxicity test and chemistry, four replicates for taxonomy	1-8	Co-location with mummichog or darter/killifish; sampling location to be determined when fish are collected[i]
LPRT09C	590080	712136	Fine	Deep subtidal	Grab sampler	Toxicity test, sediment chemistry, taxonomy	One for toxicity test and chemistry, four replicates for taxonomy	1-8	Random location within river mile and habitat[e]
LPRT9D[f]	590238[i]	712388[i]	Fine	Deep subtidal	Grab sampler	Toxicity test, sediment chemistry, taxonomy, mummichog	One for toxicity test and chemistry, four replicates for taxonomy	1-8	Co-location with mummichog or darter/killifish; sampling location to be determined when fish are collected[i]

QAPP Worksheet No. 18. Proposed Sampling Locations and Methods/SOP Requirements Table (cont.)

Sampling Location/ID Number[a]	Easting (X)[b]	Northing (Y)[b]	Substrate[c]	Water Depth[d]	Method	Analyses	Number of Samples (identify field duplicates)	Sampling SOP Reference	Rationale for Sampling Location
LPRT09E	590353	712630	Fine	Deep subtidal	Grab sampler	Toxicity test, sediment chemistry, taxonomy	One for toxicity test and chemistry, four replicates for taxonomy. \	1-8	Random location within river mile and habitat[e]
LPRT09F[f]	590289[i]	712991[i]	Coarse	Deep subtidal	Grab sampler	Toxicity test, sediment chemistry, taxonomy, mummichog	One for toxicity test and chemistry, four replicates for taxonomy	1-8	Co-location with mummichog or darter/killifish; sampling location to be determined when fish are collected[i]
LPRT09G	590735	713144	Fine	Shallow nearshore	Grab sampler	Toxicity test, sediment chemistry, taxonomy	One for toxicity test and chemistry, four replicates for taxonomy	1-8	Random location within river mile and habitat[e]
LPRH09A	589759	711291	Shallow nearshore	No data	Grab sampler	Sediment chemistry	One for chemistry	1-8	Vicinity of Kearny High School boathouse/dock
LPRT10A	591131	714097	Fine	Deep subtidal	Grab sampler	Toxicity test, sediment chemistry, taxonomy	One for toxicity test and chemistry, four replicates for taxonomy	1-8	Random location within river mile and habitat[e]
LPRT10B	591545	714536	Coarse	Deep subtidal	Grab sampler	Toxicity test, sediment chemistry, taxonomy	One for toxicity test and chemistry, four replicates for taxonomy	1-8	Random location within river mile and habitat[e]
LPRT10C	592367	716576	Fine	Deep subtidal	Grab sampler	Toxicity test, sediment chemistry, taxonomy	One for toxicity test and chemistry, four replicates for taxonomy	1-8	Random location within river mile and habitat[e]

QAPP Worksheet No. 18. Proposed Sampling Locations and Methods/SOP Requirements Table (cont.)

Sampling Location/ID Number[a]	Easting (X)[b]	Northing (Y)[b]	Substrate[c]	Water Depth[d]	Method	Analyses	Number of Samples (identify field duplicates)	Sampling SOP Reference	Rationale for Sampling Location
LPRT10D	592680	716756	Coarse	Shallow nearshore	Grab sampler	Toxicity test, sediment chemistry, taxonomy, bioaccumulation	One for toxicity test, bioaccumulation, and chemistry, four replicates for taxonomy	1-8	Co-location with bioaccumulation testing, LRC ID CLRC-114; southern end of Riverside County Park South
LPRT10E	591962	718186	Fine	Shallow nearshore	Grab sampler	Toxicity test, sediment chemistry, taxonomy	One for toxicity test and chemistry, four replicates for taxonomy	1-8	Random location within river mile and habitat[e]; adjacent to Riverside County Park South and in vicinity of PRRA boathouse/dock
LPRT11A	592227	721505	Fine	Deep subtidal	Grab sampler	Toxicity test, sediment chemistry, taxonomy, bioaccumulation	One for toxicity test, bioaccumulation, and chemistry, four replicates for taxonomy	1-8	Co-location with bioaccumulation testing, LRC ID CLRC-064
LPRT11B	592138	721715	Coarse	Shallow nearshore	Grab sampler	Toxicity test, sediment chemistry, taxonomy	One for toxicity test and chemistry, four replicates for taxonomy	1-8	Random location within river mile and habitat[e]
LPRT11C	592337	721785	Fine	Deep subtidal	Grab sampler	Toxicity test, sediment chemistry, taxonomy	One for toxicity test and chemistry, four replicates for taxonomy	1-8	Random location within river mile and habitat[e]

QAPP Worksheet No. 18. Proposed Sampling Locations and Methods/SOP Requirements Table (cont.)

Sampling Location/ID Number[a]	Easting (X)[b]	Northing (Y)[b]	Substrate[c]	Water Depth[d]	Method	Analyses	Number of Samples (identify field duplicates)	Sampling SOP Reference	Rationale for Sampling Location
LPRT11D[f]	592538[i]	722401[i]	Fine	Shallow nearshore	Grab sampler	Toxicity test, sediment chemistry, taxonomy, mummichog	One for toxicity test and chemistry, four replicates for taxonomy	1-8	Co-location with mummichog or darter/killifish; sampling location to be determined when fish are collected[i]; adjacent to Riverside County Park North
LPRT11E	592963	723067	Fine	Shallow nearshore	Grab sampler	Toxicity test, sediment chemistry, taxonomy, bioaccumulation	One for toxicity test, bioaccumulation, and chemistry, four replicates for taxonomy.	1-8	Co-location with bioaccumulation testing, LRC ID CLRC-067; adjacent to Riverside County Park North
LPRT11F[f]	593254[i]	723575[i]	Coarse	Shallow nearshore	Grab sampler	Toxicity test, sediment chemistry, taxonomy, mummichog	One for toxicity test and chemistry, four replicates for taxonomy	1-8	Co-location with mummichog or darter/killifish; sampling location to be determined when fish are collected[i, g]

QAPP Worksheet No. 18. Proposed Sampling Locations and Methods/SOP Requirements Table (cont.)

Sampling Location/ID Number[a]	Easting (X)[b]	Northing (Y)[b]	Substrate[c]	Water Depth[d]	Method	Analyses	Number of Samples (identify field duplicates)	Sampling SOP Reference	Rationale for Sampling Location
LPRT11G[f]	593386[i]	723300[i]	Fine	Shallow nearshore	Grab sampler	Toxicity test, sediment chemistry, taxonomy, mummichog	One for toxicity test and chemistry, four replicates for taxonomy	1-8	Co-location with mummichog or darter/killifish; sampling location to be determined when fish are collected[i]; adjacent to Riverside County Park North and boat launch
LPRH11A	592043	720726	No data	Shallow nearshore	Grab sampler	Sediment chemistry	One for chemistry	1-8	Vicinity of Nutley boat launch
LPRT12A	594082	723590	Coarse	Deep subtidal	Grab sampler	Toxicity test, sediment chemistry, taxonomy	One for toxicity test and chemistry, four replicates for taxonomy.	1-8	Random location within river mile and habitat[e]
LPRT12B	595198	724082	Fine	Deep subtidal	Grab sampler	Toxicity test, sediment chemistry, taxonomy	One for toxicity test and chemistry, four replicates for taxonomy	1-8	Random location within river mile and habitat[e]
LPRT12C	595821	724485	Fine	Deep subtidal	Grab sampler	Toxicity test, sediment chemistry, taxonomy, bioaccumulation	One for toxicity test, bioaccumulation, and chemistry, four replicates for taxonomy	1-8	Co-location with bioaccumulation testing, LRC ID CLRC-069
LPRT12D	596040	724906	Fine	Shallow nearshore	Grab sampler	Toxicity test, sediment chemistry, taxonomy	One for toxicity test and chemistry, four replicates for taxonomy	1-8	Random location within river mile and habitat[e]

QAPP Worksheet No. 18. Proposed Sampling Locations and Methods/SOP Requirements Table (cont.)

Sampling Location/ID Number[a]	Easting (X)[b]	Northing (Y)[b]	Substrate[c]	Water Depth[d]	Method	Analyses	Number of Samples (identify field duplicates)	Sampling SOP Reference	Rationale for Sampling Location
LPRT12E	596564	725373	Coarse	Shallow nearshore	Grab sampler	Toxicity test, sediment chemistry, taxonomy	One for toxicity test and chemistry, four replicates for taxonomy	1-8	Random location within river mile and habitat[e]; vicinity of Montclair College boathouse/dock
LPRH12A	594501	723958	No data	Shallow nearshore	Grab sampler	Sediment chemistry	One for chemistry	1-8	Small mudflat with lawn chair at confluence with Third River where fishing has been observed
LPRT13A	596925	726950	Coarse	Deep subtidal	Grab sampler	Toxicity test, sediment chemistry, taxonomy, bioaccumulation	One for toxicity test, bioaccumulation, and chemistry, four replicates for taxonomy	1-8	Co-location with bioaccumulation testing, LRC ID CLRC-072
LPRT13B	596922	728180	Fine	Shallow nearshore	Grab sampler	Toxicity test, sediment chemistry, taxonomy	One for toxicity test and chemistry, four replicates for taxonomy	1-8	Random location within river mile and habitat[e]
LPRT13C[f]	596742[i]	728831[i]	Fine	Deep subtidal	Grab sampler	Toxicity test, sediment chemistry, taxonomy, mummichog	One for toxicity test and chemistry, four replicates for taxonomy.	1-8	Co-location with mummichog or darter/killifish; sampling location to be determined when fish are collected[i]

QAPP Worksheet No. 18. Proposed Sampling Locations and Methods/SOP Requirements Table (cont.)

Sampling Location/ID Number[a]	Easting (X)[b]	Northing (Y)[b]	Substrate[c]	Water Depth[d]	Method	Analyses	Number of Samples (identify field duplicates)	Sampling SOP Reference	Rationale for Sampling Location
LPRT13D[f]	596711[i]	729278[i]	Coarse	Shallow nearshore	Grab sampler	Toxicity test, sediment chemistry, taxonomy, mummichog	One for toxicity test and chemistry, four replicates for taxonomy	1-8	Co-location with mummichog or darter/killifish; sampling location to be determined when fish are collected[i]
LPRT13E	596403	729620	Coarse	Shallow nearshore	Grab sampler	Toxicity test, sediment chemistry, taxonomy, bioaccumulation	One for toxicity test, bioaccumulation, and chemistry, four replicates for taxonomy	1-8	Co-location with bioaccumulation testing, LRC ID CLRC-074
LPRT13F	596107	730759	Fine	Deep subtidal	Grab sampler	Toxicity test, sediment chemistry, taxonomy, bioaccumulation	One for toxicity test, bioaccumulation, and chemistry, four replicates for taxonomy	1-8	Co-location with bioaccumulation testing, LRC ID CLRC-076
LPRT13G	596232	731021	Fine	Deep subtidal	Grab sampler	Toxicity test, sediment chemistry, taxonomy, bioaccumulation	One for toxicity test, bioaccumulation, and chemistry, four replicates for taxonomy	1-8	Co-location with bioaccumulation testing, LRC ID CLRC-077
LPRH13A	596037	731057	No data	Shallow nearshore	Grab sampler	Sediment chemistry	One for chemistry	1-8	Rope swing downriver of stormwater outfall structures; fishing observed
LPRT14A	596917	733007	Fine	Shallow nearshore	Grab sampler	Toxicity test, sediment chemistry, taxonomy	One for toxicity test and chemistry, four replicates for taxonomy	1-8	Random location within river mile and habitat[e]; adjacent to Rutherford Memorial Park

QAPP Worksheet No. 18. Proposed Sampling Locations and Methods/SOP Requirements Table (cont.)

Sampling Location/ID Number[a]	Easting (X)[b]	Northing (Y)[b]	Substrate[c]	Water Depth[d]	Method	Analyses	Number of Samples (identify field duplicates)	Sampling SOP Reference	Rationale for Sampling Location
LPRT14B	597076	734487	Coarse	Shallow nearshore	Grab sampler	Toxicity test, sediment chemistry, taxonomy	One for toxicity test and chemistry, four replicates for taxonomy	1-8	Random location within river mile and habitat[e]
LPRT14C	597248	734738	Fine	Deep subtidal	Grab sampler	Toxicity test, sediment chemistry, taxonomy, bioaccumulation	One for toxicity test, bioaccumulation, and chemistry, four replicates for taxonomy	1-8	Co-location with bioaccumulation testing, LRC ID CLRC-079
LPRT14D	597276	735062	Coarse	Shallow nearshore	Grab sampler	Toxicity test, sediment chemistry, taxonomy	One for toxicity test and chemistry, four replicates for taxonomy	1-8	Random location within river mile and habitat[e]
LPRT14E[f]	597339[i]	735270[i]	Fine	Deep subtidal	Grab sampler	Toxicity test, sediment chemistry, taxonomy, mummichog	One for toxicity test and chemistry, four replicates for taxonomy	1-8	Co-location with mummichog or darter/killifish; sampling location to be determined when fish are collected[i]
LPRT14F	597395	736224	Fine	Deep subtidal	Grab sampler	Toxicity test, sediment chemistry, taxonomy	One for toxicity test and chemistry, four replicates for taxonomy	1-8	Random location within river mile and habitat[e]
LPRT15A	597368	737068	Fine	Deep subtidal	Grab sampler	Toxicity test, sediment chemistry, taxonomy	One for toxicity test and chemistry, four replicates for taxonomy	1-8	Random location within river mile and habitat[e]
LPRT15B	597411	737203	Fine	Shallow nearshore	Grab sampler	Toxicity test, sediment chemistry, taxonomy	One for toxicity test and chemistry, four replicates for taxonomy	1-8	Random location within river mile and habitat[e]

QAPP Worksheet No. 18. Proposed Sampling Locations and Methods/SOP Requirements Table (cont.)

Sampling Location/ID Number[a]	Easting (X)[b]	Northing (Y)[b]	Substrate[c]	Water Depth[d]	Method	Analyses	Number of Samples (identify field duplicates)	Sampling SOP Reference	Rationale for Sampling Location
LPRT15C	597342	737846	Coarse	Shallow nearshore	Grab sampler	Toxicity test, sediment chemistry, taxonomy	One for toxicity test and chemistry, four replicates for taxonomy	1-8	Random location within river mile and habitat[e]
LPRT15D[f]	597542[i]	737926[i]	Fine	Shallow nearshore	Grab sampler	Toxicity test, sediment chemistry, taxonomy, mummichog	One for toxicity test and chemistry, four replicates for taxonomy	1-8	Co-location with mummichog or darter/killifish; sampling location to be determined when fish are collected[i]; vicinity of boat launch
LPRT15E	598704	738397	Fine	Deep subtidal	Grab sampler	Toxicity test, sediment chemistry, taxonomy	One for toxicity test and chemistry, four replicates for taxonomy	1-8	Random location within river mile and habitat[e]
LPRT15F	599283	737132	Coarse	Deep subtidal	Grab sampler	Toxicity test, sediment chemistry, taxonomy	One for toxicity test and chemistry, four replicates for taxonomy	1-8	Random location within river mile and habitat[e]
LPRT16A	600626	737041	Coarse	Shallow nearshore	Grab sampler	Toxicity test, sediment chemistry, taxonomy, bioaccumulation	One for toxicity test, bioaccumulation, and chemistry, four replicates for taxonomy	1-8	Co-location with bioaccumulation testing, LRC ID CLRC-087
LPRT16B	600498	737268	Coarse	Deep subtidal	Grab sampler	Toxicity test, sediment chemistry, taxonomy	One for toxicity test and chemistry, four replicates for taxonomy	1-8	Random location within river mile and habitat[e]

QAPP Worksheet No. 18. Proposed Sampling Locations and Methods/SOP Requirements Table (cont.)

Sampling Location/ID Number[a]	Easting (X)[b]	Northing (Y)[b]	Substrate[c]	Water Depth[d]	Method	Analyses	Number of Samples (identify field duplicates)	Sampling SOP Reference	Rationale for Sampling Location
LPRT16C[f]	600909[i]	737821[i]	Coarse	Shallow nearshore	Grab sampler	Toxicity test, sediment chemistry, taxonomy	One for toxicity test and chemistry, four replicates for taxonomy	1-8	Co-location with mummichog or darter/killifish; sampling location to be determined when fish are collected[i]
LPRT16D	600861	739278	Coarse	Shallow nearshore	Grab sampler	Toxicity test, sediment chemistry, taxonomy, bioaccumulation	One for toxicity test, bioaccumulation, and chemistry, four replicates for taxonomy	1-8	Co-location with bioaccumulation testing, LRC ID CLRC-089
LPRT16E[f]	600574[i]	739432[i]	Coarse	Shallow nearshore	Grab sampler	Toxicity test, sediment chemistry, taxonomy, mummichog	One for toxicity test and chemistry, four replicates for taxonomy	1-8	Co-location with mummichog or darter/killifish; sampling location to be determined when fish are collected[i]
LPRT16F	600125	740066	Coarse	Deep subtidal	Grab sampler	Toxicity test, sediment chemistry, taxonomy	One for toxicity test and chemistry, four replicates for taxonomy	1-8	Random location within river mile and habitat[e]
LPRH16A	600722	739749	Coarse	Shallow nearshore	Grab sampler	Sediment chemistry	One for chemistry	1-8	North of confluence with Saddle River where fishing has been observed
LPRH16B	599584	740329	Coarse	Shallow nearshore	Grab sampler	Sediment chemistry	One for chemistry	1-8	Pulaski Park boat launch

QAPP Worksheet No. 18. Proposed Sampling Locations and Methods/SOP Requirements Table (cont.)

Sampling Location/ID Number[a]	Easting (X)[b]	Northing (Y)[b]	Substrate[c]	Water Depth[d]	Method	Analyses	Number of Samples (identify field duplicates)	Sampling SOP Reference	Rationale for Sampling Location
LPRT17A[g]	No data	No data	No data	No data	Grab sampler or hand-collection	Toxicity test, sediment chemistry, taxonomy	One for toxicity test and chemistry, four replicates for taxonomy	1-8	No grain size and depth data available. Five stations will be surveyed in this RM for suitable substrate. If no suitable grain size for chemistry and Toxicity tests is available benthic community samples will be collected according to the SOP (Attachment I).
LPRT17B[g]	No data	No data	No data	No data	Grab sampler or hand-collection	Toxicity test, sediment chemistry, taxonomy	One for toxicity test and chemistry, four replicates for taxonomy	1-8	
LPRT17C[g]	No data	No data	No data	No data	Grab sampler or hand-collection	Toxicity test, sediment chemistry, taxonomy	One for toxicity test and chemistry, four replicates for taxonomy	1-8	
LPRT17D[g]	No data	No data	No data	No data	Grab sampler or hand-collection	Toxicity test, sediment chemistry, taxonomy	One for toxicity test and chemistry, four replicates for taxonomy	1-8	
LPRT17E[g]	No data	No data	No data	No data	Grab sampler or hand-collection	Toxicity test, sediment chemistry, taxonomy	One for toxicity test and chemistry, four replicates for taxonomy	1-8	
LPRH17A	595803	746885	No data	No data	Grab sampler or hand-collection	Sediment chemistry	One for chemistry	1-8	Shallow area below Dundee Dam where fishing has been observed
LPRHXXX[h]	No data	No data	No data	No data	Grab sampler or hand-collection	Sediment chemistry	One for chemistry	1-8	Floater station for human exposure
LPRHXXX[h]	No data	No data	No data	No data	Grab sampler or hand-collection	Sediment chemistry	One for chemistry	1-8	Floater station for human exposure
LPRHXXX[h]	No data	No data	No data	No data	Grab sampler or hand-collection	Sediment chemistry	One for chemistry	1-8	Floater station for human exposure

QAPP Worksheet No. 18. Proposed Sampling Locations and Methods/SOP Requirements Table (cont.)

Sampling Location/ID Number[a]	Easting (X)[b]	Northing (Y)[b]	Substrate[c]	Water Depth[d]	Method	Analyses	Number of Samples (identify field duplicates)	Sampling SOP Reference	Rationale for Sampling Location
LPRHXXX[h]	No data	No data	No data	No data	Grab sampler or hand-collection	Sediment chemistry	One for chemistry	1-8	Floater station for human exposure
LPRHXXX[h]	No data	No data	No data	No data	Grab sampler or hand-collection	Sediment chemistry	One for chemistry	1-8	Floater station for human exposure

Note: Refer to Project Sampling SOP References table (Worksheet No. 21). Sample locations are also illustrated on Figure 1.

[a] Key to sampling location ID numbers: LPR = lower Passaic River; TD = SQT assessment; HH = Human Health exposure locations; 01 = river mile (1 – 17); 1, 2, 3 = sample number per river mile.

[b] New Jersey State Plane (US survey ft).

[c] Fine substrate refers to fine-grained sediment (≥ 60% fines, defined as the sum of clay and silt particles having a diameter less than 63 µm based on the evaluation of historical grain-size data), and coarse substrate refers to coarse-grained sediment (< 60% fines) based on historical grain-size distribution data.

[d] Shallow nearshore water depth refers to shallow nearshore areas that are - 2 ft and shallower, and deep subtidal water depth refers to subtidal areas deeper than - 2 ft. Shallow nearshore samples will also be used for the HHRA. Samples have been located at points where potential for human exposure is anticipated to occur (e.g., proximity to boat launch, boathouse/dock, park, observed homeless camp, areas where fishing has been observed).

[e] If the habitat requirements (i.e., coarse or fine sediments, shallow nearshore or deep subtidal) are not present at the sampling location, sampling will be conducted within 10 m of the station. If the requirements are still not met another random station will be selected within that river mile and habitat.

[f] SQT sampling location is subject to change based on where small forage fish (i.e., mummichog and darters/killifish) and/or decapods with sufficient mass for chemistry analysis are collected during the fish and decapod sampling effort (as outlined in the Fish/Decapod QAPP(Windward 2009)). The target co-located sediment locations will be represented as the centroid of all the locations where individual mummichog or darter/killifish selected for a single tissue composite were collected. If any sampling locations of mummichog and darters/killifish change (thus changing the co-located SQT location), the sampling location will still be selected to be representative of the shallow-fine grained stratum. Sediment collection at stations intended for co-location with mummichog/darter killifish collection will be deferred, as appropriate, to the time when fish are caught. Station coordinates will be determined in conjunction with fish sampling.

[g] These five additional locations may be sampled by hand depending on access agreement and safety of the field crew, and if sediment sampling and sampling access are possible (see Worksheet No. 11 for details). Sampling ID will be determined in field if sample is taken. One of these five sampling locations will be targeted to be co-located with a mummichog/darter/killifish tissue sampling location.

[h] Up to five additional “floater” locations of potential human exposure interest may be identified while in the field (e.g., boat clubs, docks, and other locations of human activity such as fishing that are not currently identified for sampling) for sediment chemistry only. Sampling location/ identification number will be determined at the time of sampling.

[i] The sediment samples to be co-located with locations where mummichog/darter/killifish will have been collected will be deferred until these fish have been caught. Additional sediment sampling locations to be co-located with blue crab composite samples will also be sampled once blue crab compositing locations have been selected and approved by USEPA. The actual coordinates for these stations will be determined once tissue collection and compositing decisions are finalized. The coordinates will be documented in a field modification form.

QAPP Worksheet No. 19. Analytical SOP Requirements Table

Matrix	Analytical Group	Concentration Level	Analytical Laboratory/ SOP Reference	Sample Size[a]	Containers (number, size, and type)[b]	Preservation Requirements (chemical, temperature, light protected)[c]	Maximum Holding Time (preparation/ analysis)[d]
Tissue	PCBs – Congeners	Low	Analytical Perspectives/ Attachment M2	10 g minimum	One 4-oz WM clear or amber glass jar	Frozen in the dark at <0 °C until analysis at laboratory and during shipment	1 year if frozen
Tissue	PCDDs/PCDFs	Low	Analytical Perspectives/ Attachment M3	10 g minimum			
Tissue	PAHs	Low	Maxxam Analytics/ Attachment M4	10 g minimum	One 2-oz WM clear or amber glass jar	Frozen in the dark at < 0°C until analysis at laboratory and during shipment	1 year to prep if frozen, 40 days to analysis
Tissue	Organochlorine pesticides	Low	Maxxam Analytics/ Attachment M5, M6, M7	10 g minimum	One 2-oz WM clear or amber glass jar	Frozen in the dark at < 0 0°C until analysis at laboratory and during shipment	1 year to prep if frozen, 40 days to analysis
Tissue	Metals	Low	CAS, Kelso/ Attachment M9, M10, M11, M12	10 g minimum	One 4-oz WM clear or amber glass jar	Frozen in the dark at < 0°C until analysis in laboratory and during shipment	1 year if frozen
Tissue	Butyltins	Low	CAS, Kelso/ Attachment M21, M22	5 g minimum			1 year to extract if frozen, 40 days to analysis
Tissue	General chemistry – lipids	Low	CAS, Kelso/ Attachment M23	5 g minimum			1 year if frozen
Tissue	Total mercury	Low	Brooks Rand Labs/ Attachment M14, M15	5 g minimum	One 2-oz WM glass or plastic jar, clear or amber	Frozen in the dark at < 0 °C until analysis in laboratory and during shipment	1 year if frozen
Tissue	Methylmercury	Low	Brooks Rand Labs/ Attachment M16	5 g minimum			

QAPP Worksheet No. 19. Analytical SOP Requirements Table (cont.)

Matrix	Analytical Group	Concentration Level	Analytical Laboratory/ SOP Reference	Sample Size[a]	Containers (number, size, and type)[b]	Preservation Requirements (chemical, temperature, light protected)[c]	Maximum Holding Time (preparation/ analysis)[d]
Tissue	SVOCs	Low	Alpha Analytical/ Attachment M17, M18, M19, M20	10 g minimum	One 8-oz WM amber glass jar	Frozen in the dark at < 0°C until analysis and during shipment	1 year to extract if frozen, 40 days to analysis
Tissue	PCBs – Aroclors	Low	Alpha Analytical/ Attachment M35	10 g minimum			1 year to extract if frozen, 40 days to analysis
Tissue	Alkylated PAHs	Low	Alpha Analytical/ Attachment M43, M46	10 g minimum			1 year to extract if frozen, 40 days to analysis
Tissue	General chemistry – percent moisture	Low	Alpha Analytical/ Attachment M24	5 g minimum			1 year if frozen
Sediment	PCBs – congeners	Low	Analytical Perspectives/ Attachment M2	10 g minimum	One 16-oz WM clear or amber glass jar	0 – 6 °C and dark until analysis at laboratory and during shipment	None established
Sediment	PCDDs/PCDFs	Low	Analytical Perspectives/ Attachment M3	10 g minimum			
Sediment	PAHs	Low	Maxxam Analytics/ Attachment M4	10 g minimum	One 8-oz WM clear or amber glass jar	Frozen in the dark at < 0°C until analysis at laboratory and during shipment	100 days to prep if frozen, 40 days to analysis
Sediment	Organochlorine pesticides	Low	Maxxam Analytics/ Attachment M5, M6, M7	10 g minimum	One 8-oz WM clear or amber glass jar	Frozen in the dark at < 0°C until analysis at laboratory and during shipment	299 days to prep if frozen, 40 days to analysis
Sediment	SVOCs	Low	Alpha Analytical/ Attachment M17, M18, M19, M20	10 g minimum	One 8-oz WM amber glass jar	Frozen in the dark at < 0°C until analysis at laboratory and during shipment	6 months to extract if frozen, 14 days to extract if refrigerated, 40 days to analysis once extracted

QAPP Worksheet No. 19. Analytical SOP Requirements Table (cont.)

Matrix	Analytical Group	Concentration Level	Analytical Laboratory/ SOP Reference	Sample Size[a]	Containers (number, size, and type)[b]	Preservation Requirements (chemical, temperature, light protected)[c]	Maximum Holding Time (preparation/ analysis)[d]
Sediment	VOCs	Low	Alpha Analytical/ Attachment M44	4 x 5 g minimum	Two 40-mL VOA vial (MeOH) collected for VOCs and TPH-purgeables, two 40-mL VOA vials (deionized water) collected for VOCs, and one vial (unpreserved) collected for % solids	0 – 6°C at laboratory and during shipment; store in the dark, deionized water vials frozen at < 0°C until analysis at laboratory	Field preservation upon collection (MeOH); 48 hours to freezing deionized water vials; 14 calendar days for preparation and analysis
Sediment	TPH – purgeables	Low	Alpha Analytical/ Attachment M34	20 g minimum			Field preservation upon collection (MeOH); 14 calendar days for preparation and analysis
Sediment	TPH – extractables	Low	Alpha Analytical/ Attachment M33	100 g minimum	One 8-oz WM amber glass jar	0 – 6°C at laboratory and during shipment; store in the dark	14 calendar days to preparation; 40 calendar days from preparation to analysis
Sediment	Herbicides	Low	Alpha Analytical/ Attachment M45	50 g minimum			
Sediment	Alkylated PAHs	Low	Alpha Analytical/ Attachment M43, M46	10 g minimum	One 8-oz WM amber glass jar	Frozen in the dark at < 0°C until analysis at laboratory and during shipment	100 days to prep if frozen, 40 days to analysis
Sediment	General chemistry – TOC	Low	Alpha Analytical/ Attachment M25	20 g minimum	One 8-oz WM amber jar with Teflon	0 – 6°C and dark until extraction at laboratory and during shipment	14 calendar days to analysis
Sediment	General chemistry – percent moisture	Low	Alpha Analytical/ Attachment M24	5 g minimum			14 calendar days to analysis
Sediment	PCBs – Aroclors	Low	Alpha Analytical/ Attachment M35	10 g minimum			None established

QAPP Worksheet No. 19. Analytical SOP Requirements Table (cont.)

Matrix	Analytical Group	Concentration Level	Analytical Laboratory/ SOP Reference	Sample Size[a]	Containers (number, size, and type)[b]	Preservation Requirements (chemical, temperature, light protected)[c]	Maximum Holding Time (preparation/ analysis)[d]
Sediment	TPH – alkanes	Low	Alpha Analytical/ Attachment M46, M47, M48	30 g minimum			14 calendar day to extraction, 40 calendar days from extraction to analysis
Sediment	Grain size	Not applicable	Alpha Analytical/ Attachment M26	250 g minimum	One 16-oz WM glass jar	0 – 6°C at laboratory and during shipment	6 months
Sediment	Total mercury	Low	Brooks Rand Labs/ Attachment M14, M15	10 g minimum	One 4-oz WM glass or plastic jar, clear or amber	< 0°C until analysis at laboratory and during shipment	6 months if frozen
Sediment	Methylmercury	Low	Brooks Rand Labs/ Attachment M16	10 g minimum			
Sediment	Metals	Low	CAS, Kelso/ Attachment M8, M10, M11, M12	10 g minimum	One 8-oz WM glass or plastic jar, clear or amber	0 – 6°C during shipment, 0 – 6°C at the laboratory or frozen at < 0°C	1 year if frozen, 180 calendar days if refrigerated
Sediment	General chemistry – total sulfide	Low-high	CAS, Kelso/ Attachment M32	20 g minimum	One 4-oz WM glass jar	Fill jar completely with sediment; pour 10 mL NaOH/zinc acetate solution over the top of the sample; 0 – 6°C at laboratory and during shipment	7 calendar days to analysis
Sediment	General chemistry – AVS/SEM	Low	CAS, Kelso/ Attachment M13	20 g minimum	One 4-oz WM glass jar	0 – 6°C at laboratory and during shipment, minimize headspace	AVS: evolution within 14 calendar days; analysis within 24 hours of evolution; SEM: analysis within 14 calendar days of extraction

QAPP Worksheet No. 19. Analytical SOP Requirements Table (cont.)

Matrix	Analytical Group	Concentration Level	Analytical Laboratory/ SOP Reference	Sample Size[a]	Containers (number, size, and type)[b]	Preservation Requirements (chemical, temperature, light protected)[c]	Maximum Holding Time (preparation/ analysis)[d]
Sediment	General chemistry – ammonia-N	Low	CAS, Kelso/ Attachment M27	20 g minimum			7 calendar days to extraction; extracts preserved by lab with sulfuric acid; 28 calendar days to analysis
Sediment	General chemistry – cyanide	Low	CAS, Kelso/ Attachment M28, M29	20 g minimum	One 8-oz WM glass jar	0 – 6°C at laboratory and during shipment	14 calendar days to analysis
Sediment	Butyltins	Low	CAS, Kelso/ Attachment M21, M22	5 g minimum			1 year to extract if frozen, 40 days to analysis, 14 calendar days to extraction if refrigerated, 40 days to analysis
Sediment	General chemistry – total Kjeldahl nitrogen	Low	CAS, Kelso/ Attachment M30	20 g minimum			None established for soils/sediments
Sediment	General chemistry – total phosphorus	Low	CAS, Kelso/ Attachment M31	20 g minimum			28 calendar days to analysis
Sediment	Toxicity tests[e]	Not applicable	EnviroSystems/ Attachment M36, M37, M39	2 gallons	Two 2-gallon food-grade plastic buckets with Teflon liners	0 – 4°C at laboratory and during shipment,; store in the dark without headspace or with nitrogen headspace	8 weeks (56 days) upon collection

QAPP Worksheet No. 19. Analytical SOP Requirements Table (cont.)

Matrix	Analytical Group	Concentration Level	Analytical Laboratory/ SOP Reference	Sample Size[a]	Containers (number, size, and type)[b]	Preservation Requirements (chemical, temperature, light protected)[c]	Maximum Holding Time (preparation/ analysis)[d]
Sediment	Bioaccumulation tests[e]	Not applicable	EnviroSystems/ Attachment M39, M40	18 gallons of freshwater sediments and 8 gallons of marine sediments	Two to four 5-gallon food-grade plastic buckets with Teflon liners	0 – 4°C at laboratory and during shipment,; store in the dark without headspace or with nitrogen headspace	8 weeks (56 days) upon collection
Benthic invertebrates	Taxonomy[f]	Not applicable	EcoAnalysts/ Attachment M42	0.5 – 4 L	Appropriate size plastic jar (0.5 to 4 L)	10% buffered formalin	Years upon preservation

[a] The minimum mass indicated may not allow for re-extractions if necessary, or required batch QC samples. If tissue mass does not meet the minimum mass requirement, refer to the priority list presented in Worksheet No. 10 (project condition decision).

[b] Container size may be modified by the laboratory, particularly for tissue samples that will have a small sample mass. The smallest container size should be selected; however, volume increases due to expansion of water upon freezing must be accounted for to avoid breaking the container upon freezing.

[c] Tissue samples for chemical analyses will be frozen upon collection and shipped from the biological laboratories to the appropriate analytical laboratories. Tissues will remain frozen until extraction/preparation for analysis. Sediment samples will be either refrigerated or frozen after collection depending on preservation requirements. When frozen samples for chemical analysis are couriered and the transit time is guaranteed to be less than 24 hours, wet ice or ice packs may be used as a preservative. Frozen samples shipped via overnight delivery will be packed with a combination of dry ice with wet ice or ice packs.

[d] Holding times are in calendar days. Any remaining sample mass will be archived frozen. When frozen samples are allowed to thaw, the cumulative time the sample is removed from the freezer is considered the holding time at 0 to 4 °C.

[e] The toxicity and bioaccumulation samples will be hand-delivered to EnviroSystems in a refrigerated truck on a weekly basis.

[f] The taxonomy samples will be shipped to EcoAnalysts using a commercial carrier.

AVS – acid volatile sulfide
CAS – Columbia Analytical Services, Inc.
CPG – Cooperating Parties Group
MeOH – methanol
NaOH – sodium hydroxide
PAH – polycyclic aromatic hydrocarbon
PCB – polychlorinated biphenyl
PCDD – polychlorinated dibenzo-*p*-dioxin
PCDF – polychlorinated dibenzofuran
QC – quality control
SEM – simultaneously extracted metals
SOP – standard operating procedure
SVOC – semivolatile organic compound
TOC – total organic carbon
TPH – total petroleum hydrocarbons
VOA – volatile organic analysis
VOC – volatile organic compound
USEPA – US Environmental Protection Agency
WM – wide mouth

QAPP Worksheet No. 20. Field Quality Control Sample Summary Table

Matrix	Analytical Group	Conc. Level	SOP Reference[a]	No. of Sampling Locations	No. of Field Duplicates[b]	No. of Rinsate Blanks/ Trip Blanks[c]	No. of CRMs[d]	No. of MD/MS/MSD	Total No. of Samples[e]
Tissue	PCBs – congeners	Low	M2	20	0	1	1	2/0/0	24
Tissue	PCBs – Aroclors	Low	M35	20	0	1	0	2/2/2	27
Tissue	PCDDs/PCDFs	Low	M3	20	0	1	1	2/0/0	24
Tissue	Butyltins	Low	M21, M22	20	0	1	0	2/2/2	27
Tissue	PAHs	Low	M4	20	0	1	1	2/0/0	24
Tissue	Alkylated PAHs	Low	M43, M46	20	0	1	0	2/2/2	27
Tissue	SVOCs	Low	M17, M18, M19, M20	20	0	1	0	2/2/2	27
Tissue	Metals	Low	M9, M10, M11, M12	20	0	1	1	2/2/0	26
Tissue	Methylmercury	Low	M16	20	0	1	1	2/2/2	28
Tissue	Total mercury	Low	M14, M15	20	0	1	1	2/2/2/	28
Tissue	Organochlorine pesticides	Low	M5, M6, M7	20	0	1	1	2/0/0	24
Tissue	General chemistry – lipids	NA	M23	20	0	0	1	1/0/0	22
Tissue	General chemistry – percent moisture	NA	M24	20	0	0	0	2/0/0	22
Sediment	PCB – congeners	Low	M2	116	6	6	6	6/0/0	140
Sediment	PCB – Aroclors	Low	M35	116	6	6	0	6/6/6	146
Sediment	PCDDs/PCDFs	Low	M3	116	6	6	6	6/0/0	140
Sediment	Butyltins	Low	M21, M22	116	6	6	0	6/6/6	146

QAPP Worksheet No. 20. Field Quality Control Sample Summary Table (cont.)

Matrix	Analytical Group	Conc. Level	SOP Reference[a]	No. of Sampling Locations	No. of Field Duplicates[b]	No. of Rinsate Blanks/ Trip Blanks[c]	No. of CRMs[d]	No. of MD/MS/MSD	Total No. of Samples[e]
Sediment	PAHs	Low	M4	116	6	6/0	6	6/0/0	140
Sediment	Alkylated PAHs	Low	M43, M46	116	6	6/0	0	6/6/6	146
Sediment	SVOCs	Low	M17, M18, M19, M20	116	6	6/0	6	6/6/6	152
Sediment	VOCs	Low	M44	66	4	0/20	0	0/4/4	98
Sediment	Metals	Low	M8, M10, M11, M12	116	6	6/0	6	6/6/0	146
Sediment	Methylmercury	Low	M16	116	6	6/0	6	12/12/12	170
Sediment	Total mercury	Low	M14, M15	116	6	6/0	6	12/12/12	170
Sediment	Organochlorine pesticides	Low	M5, M6, M7	116	6	6/0	6	6/0/0	140
Sediment	Herbicides	Low	M45	116	6	6/0	0	6/6/6	146
Sediment	General chemistry – TOC	Low	M25	116	6	6/0	0	6/6/0	140
Sediment	Grain size	NA	M26	116	6	0/0	0	6/0/0	128
Sediment	General chemistry – percent moisture	NA	M24	116	6	0/0	0	6/0/0	128
Sediment	General chemistry – AVS/SEM	Low	M13	116	6	0/0	0	6/6/0	134
Sediment	General chemistry – ammonia-N	Low	M27	116	6	0/0	0	6/6/0	134
Sediment	General chemistry – cyanide	Low	M28, M29	116	6	6/0	0	6/6/0	140
Sediment	General chemistry –	Low	M30	116	6	6/0	0	6/6/0	140

QAPP Worksheet No. 20. Field Quality Control Sample Summary Table (cont.)

Matrix	Analytical Group	Conc. Level	SOP Reference[a]	No. of Sampling Locations	No. of Field Duplicates[b]	No. of Rinsate Blanks/ Trip Blanks[c]	No. of CRMs[d]	No. of MD/MS/MSD	Total No. of Samples[e]
	total Kjeldahl nitrogen								
Sediment	General chemistry – total phosphorus	Low	M31	116	6	6/0	0	6/6/0	140
Sediment	General chemistry – total sulfide	Low – high	M32	116	6	0/0	0	6/6/0	134
Sediment	TPH – extractables	Low	M33	116	6	6/0	0	6/6/6	146
Sediment	TPH – purgeables	Low	M34	116	6	0/20	0	0/6/6	154
Sediment	TPH – alkanes	Low	M46, M47, M48	116	6	6/0	0	6/6/6	146

[a] Refer to Worksheet No. 23 for SOP titles.

[b] Field duplicate will be collected at a rate of one per 20 samples, and consist of a thoroughly homogenized sample collected from one location that has been split between two sets of containers and labeled as representing two separate sampling locations. Samples for VOC, AVS/SEM, ammonia, sulfide, and TPH-purgeable analyses will be collected as discrete, non-homogenized samples. Field duplicates for VOC, AVS/SEM, ammonia, sulfide, and TPH analyses will be collected from the same grab sample as the parent sample and will not be homogenized.

[c] Rinsate blanks will include a deionized water rinse of decontaminated equipment used to homogenize sediment and tissue samples. The number provided for the trip blanks is an estimate, one trip blank per analysis will be included in each cooler transporting sediment samples for VOC and TPH-purgeable analysis sent to Alpha Analytical, the laboratory conducting both of the analyses.

[d] See Attachment Q.

[e] Additional containers will not be collected for laboratory duplicate, matrix spike, and matrix spike duplicate samples, the aliquot for matrix duplicate, matrix spike, and matrix spike duplicates will be taken from the same container as the parent sample with the exception of VOCs and TPH-purgeables. Separate containers will be collected for matrix spike and matrix spike duplicate samples for VOC and TPH-purgeable analyses.

AVS – acid volatile sulfide
CRM – certified reference material
HRGC – high-resolution gas chromatography
MD – matrix duplicate
MS – matrix spike
MSD – matrix spike duplicate
NA – not applicable
PAH – polycyclic aromatic hydrocarbon
PCB – polychlorinated biphenyl
PCDD – polychlorinated dibenzo-*p*-dioxin
PCDF – polychlorinated dibenzofuran
SEM – simultaneously extracted metals
SOP – standard operating procedure
SVOC – semivolatile organic compound
TOC – total organic carbon
TPH – total petroleum hydrocarbons
VOC – volatile organic compound

QAPP Worksheet No. 21. Project Sampling SOP References Table

Reference Number	Title, Revision Date and/or Number	Originating Organization	Equipment Type	Modified for Project Work? (Y/N)	Comments
1	Locating Sample Points Using a Hand-held Global Positioning System (GPS) SOP, (July 2007), Revision 0	Windward	Hand-held GPS unit	N	Attachment B; for use with backpack electrofishing gear and boat operations
2	Locating Sample Points Using a Boat-Mounted Global Positioning System (GPS) (July 2007), Revision 0	Windward	Trimble (or similar boat-mounted GPS unit) with related cable and power supply	N	Attachment C; for use with boat-based operations
3	Collection and Processing of Sediment Grab Samples SOP (April 2009), Revision 0	Windward	Sediment grab samplers and fathometer (or weighted demarcated line)	N	Attachment D; for collection of surface sediment samples and benthic invertebrate samples
4	Procedure to Decontaminate Sediment Sampling Equipment SOP (July 2007), Revision 0	Windward	Sediment grab samplers, spoons, mixing pots and bowls, and any equipment that comes into contact with sediment	N	Attachment E
5	Management and Disposal of Investigation-Derived Waste SOP (July 2007), Revision 0	Windward	open-top drums, storage racks, and insulated coolers	N	Attachment F
6	Chain-of-Custody (COC) Tracking and Sample Packaging SOP (July 2007), Revision 0	Windward	COC forms, custody seals, sample containers, packaging supplies and coolers	N	Attachment G
7	Documenting Field Activities SOP (March 2009), Revision 0	Windward	Computer, camera	N	Attachment H

QAPP Worksheet No. 21. Project Sampling SOP References Table (cont.)

Reference Number	Title, Revision Date and/or Number	Originating Organization	Equipment Type	Modified for Project Work? (Y/N)	Comments
8	Benthic Macroinvertebrate Sampling SOP (April 2009), Revision 0	Windward	Kick net, D-frame dip net, and sieve bucket	N	Attachment I
9	Measuring Interstitial Salinity Using a Refractometer SOP (September 2009), Revision 0	Windward	Refractometer	N	Attachment N
10	Measuring Water Quality Parameters Using a Handheld Multi-Probe Meter (September 2009), Revision 0	Windward	Handheld multi-probe YSI meter	N	Attachment P

QAPP Worksheet No. 22. Field Equipment Calibration, Maintenance, Testing, and Inspection Table

Field Equipment	Calibration Activity	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Resp. Person	SOP Attachment[a]
GPS receiver	The GPS receiver is calibrated automatically, using satellite signals, each time it is powered on.	Keep one set of fresh batteries available at all times. Keep dirt and dust away from GPS receiver.	Vessel will be stationed at the check point to verify GPS position with known land-survey coordinates. Testing results will be logged in the daily field notes.	Confirm there are no cracks in the unit and that the antenna has not been damaged.	Each time unit is powered on	GPS receiver is suitable for use if it is reporting coordinates, indicating it is receiving signals from three independent GPS satellites, and that test coordinates are confirmed during testing activities.	If unit will not obtain a coordinate lock, move to an unobstructed location. If no unobstructed location is available, consider recording position at nearby unobstructed location and measuring horizontal offset which can be used to correct the measured position later.	FC or designee	F, G (reference numbers 5 and 6)
Sediment grab samplers	NA	Decontami-nation	Not applicable	Inspect for physical damage that may compromise effectiveness of sampler	Daily, prior to use	Sampler is undamaged	Repair damage, if possible, or replace trap as necessary	FC or designee	D (reference number 3)
Fathometer (or weighted demarcated line)	Fathometer will be calibrated automatically when it is powered on.	Keep instrument clear of debris while in use to prevent reading interferences	Fathometer depth reading will be checked against depth reading from a weighted demarcated line. Test results will be logged in the daily field notes.	Inspect for physical damage that may compromise effectiveness of fathometer (or weighted demarcated line)	Daily, prior to use	Fathometer (or weighted demarcated line) is undamaged	Repair damage, if possible, or replace as necessary	FC or designee	D (reference number 3)

QAPP Worksheet No. 22. Field Equipment Calibration, Maintenance, Testing, and Inspection Table (cont.)

Field Equipment	Calibration Activity	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Resp. Person	SOP Attachment[a]
Kick net and D-frame dip net	NA	Decontami-nation	Not applicable	Inspect for physical damage that may compromise effectiveness of nets	Daily, prior to use	Nets are undamaged	Repair damage, if possible, or replace as necessary	FC or designee	I (reference number 8)
YSI 556 multi-probe meter	The YSI 556 meter is calibrated daily when in use	Keep one set of fresh batteries available at all times. Protect probes from damage.	Calibrate against known standards	Confirm that the o-ring is installed and in good condition.	Daily, prior to use	Meter is undamaged and has no error messages	Recalibrate, repair, and replace as necessary	FC or designee	P (reference number 10)

[a] Refer to Project Sampling SOP References table (Worksheet No. 21).

FC – Field Coordinator NA – not applicable SOP – standard operating procedure
GPS – global positioning system

QAPP Worksheet No. 23. Analytical and Biological SOP References Table

Reference Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
M1	SOP No. OP-003, Tissue Preparation and Homogenization, Revision 0.0, 4/25/02	NA	NA	Glass or polyethylene cutting board; Black & Decker food processor with titanium small blade; Osterizer® blender with large stainless steel blades; ceramic, stainless steel, or titanium knives; Omni-GLH grinding unit with stainless steel or titanium saw tooth probes; Janke & Kunkel IKA tissuemizer	Alpha Analytical	N
M2	SOP No. AP-CM-7, High Resolution Mass Spectrometry, Method 1668A for Solid/Air/Aqueous/Tissue Matrices, Revision 7, 2/14/05	Definitive	PCBs – congeners	Micromass Autospec Ultima High Resolution Mass Spectrometers	Analytical Perspectives	N
M3	SOP No. AP-CM-5, Polychlorinated dibenzo dioxin/furans, USEPA Methods 8290, 1613, 23, 0023A, & TO-9A, Revision 12-5, 1/7/09	Definitive	PCDDs/PCDFs	Micromass Autospec Ultima High Resolution Mass Spectrometers	Analytical Perspectives	N
M4	SOP No. BRL-00423, PAH Compounds by HRGC HRMS in Food Products, Sediment and Water, 4/13/09 Technical Summary in reference to SOP Version 4, 7/15/09	Definitive	PAHs	VG Autospec Hi-Resolution Mass Spectrometer or Autospec Ultima Hewlett Packard 5890 Series II Gas Chromatograph or HP 6890 Gas Chromatograph Autosampler	Maxxam Analytics	N

QAPP Worksheet No. 23. Analytical and Biological SOP References Table (cont.)

Reference Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
M5	SOP No BRL-00003, Cleanup of Sample Extract Using Gel Permeation Chromatography, 4/13/09 Technical Summary in reference to SOP GPC Cleanup, Version 1, 7/17/06	Definitive	Organochlorine pesticides	Gel Permeation Chromatograph Autoprep and Model 1002B or J2Scientific AccuPrep MPS GPC System	Maxxam Analytics	N
M6	SOP No BRL-00010, Extraction Organochlorine Pesticides from Liquids and Solids, 4/13/09 Technical Summary in reference to SOP Version 1, 7/17/06	Definitive	Organochlorine pesticides	Cal-Glass LG-6900 Soxhlet (or equivalent), Cal-Glass LG-6901-122 thimble, and 500 mL round-bottom flask	Maxxam Analytics	N
M7	SOP No BRL-00415, OC Pesticides by HRMS, 4/13/09 Technical Summary in reference to SOP Version 3, 7/15/09	Definitive	Organochlorine pesticides	Hewlett Packard high-resolution gas chromatograph, Model: 6890A, 6890, 6890D, 6890N, 5690 Series II, or 6890A Plus; with an HR Mass Spectrometer Micromass Autospec Ultima or VG AutoSpec “S”	Maxxam Analytics	N
M8	SOP No. MET-3050, SOP for Metals Digestion, Revision 10, 7/12/07.	Definitive	Metals	NA	CAS, Kelso	N
M9	SOP No. MET-TDIG, SOP for Sample Preparation of Biological Tissue for Metals Analysis by GFAA, ICP-OES, and ICP-MS, Revision 1, 2/27/02	Definitive	Metals	Teflon® closed vessel microwave or conventional oven	CAS, Kelso	N

QAPP Worksheet No. 23. Analytical and Biological SOP References Table (cont.)

Reference Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
M10	SOP No. MET-6020, SOP for Determination of Metals and Trace Elements by Inductively Coupled Plasma-Mass Spectrometry (ICP-MS); USEPA Method 6020, Revision 12, 9/26/08	Definitive	Metals (ICP/MS)	Thermo ICP/MS (VG PQ-S or ExCell or X-Series model)	CAS, Kelso	N
M11	SOP No. MET-ICP, SOP for Determination of Metals and Trace Elements by Inductively Coupled Plasma Atomic Emission Spectrometry (ICP), Revision 20, 9/26/08	Definitive	Metals (ICP)	Thermo Jarrell ash atomic emission spectrometer (ICAP-61 or IRIS model)	CAS, Kelso	N
M12	SOP No. MET-7742, SOP for Selenium by Borohydride Reduction Atomic Absorption, Revision 2, 1/6/06	Definitive	Metals (selenium)	Varian SpectrAA-20 atomic absorption spectrometer	CAS, Kelso	N
M13	SOP No. GEN-AVS, Sulfides, Acid Volatile, Rev. 5, 1/26/05	Definitive	General chemistry – AVS/SEM	Ultraviolet Visible Spectroscopy (UV-Visible) ICP, Cold Vapor Atomic Adsorption Spectrometry	CAS, Kelso	N
M14	SOP No. BR-0002, BRL Procedure for USEPA Method 1631, Appendix: Total Mercury in Tissue, Sludge, Sediment, and Soil by Acid Digestion and BrCl Oxidation by Cold Vapor Atomic Fluorescence Spectrophotometry (CVAFS), Revision 010a, 9/08/08	Definitive	Total mercury	BRL Model III Cold Vapor Atomic Fluorescence Spectrophotometer	Brooks Rand Labs	N

QAPP Worksheet No. 23. Analytical and Biological SOP References Table (cont.)

Reference Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
M15	SOP No. BR-0006, BRL Procedure for USEPA Method 1631, Revision E: Mercury in Water by Oxidation, Purge and Trap, and Cold Vapor Atomic Fluorescence Spectrometry, Revision 004a, 9/08/08	Definitive	Total mercury	BRL Model III Cold Vapor Atomic Fluorescence Spectrophotometer	Brooks Rand Labs	N
M16	SOP No. BR-0011, Determination of Methyl mercury by Aqueous Phase Ethylation, Trap Pre-Collection, Isothermal GC Separation, and CVAFS Detection: BRL Procedure for USEPA Method 1630 (Waters) and USEPA Method 1630, Modified (Solids), Revision 012a, 9/5/08	Definitive	Methylmercury	BRL Model III Cold Vapor Atomic Fluorescence Spectrophotometer	Brooks Rand Labs	N
M17	SOP No. OP-016, Microscale Solvent Extraction (MSE), Revision 2, 2/12/08	Definitive	SVOCs	Custom Tumbler, Kuderna-Danish 10 mL concentrator tubes, 500 mL evaporation flasks, 3-ball macro Snyder columns, Organomations N-EVAP, or Zymark TurboVap	Alpha Analytical	N
M18	SOP No. OP-006, Gel Permeation Chromatography Method 3640A, Revision 1.0, 2/11/08	Definitive	SVOCs	Waters HPLC 600E Controller and Pump, 486 Tunable Absorbance Detector, Auto System, Envirogel GPC Guard and Cleanup Columns, and Phenomonex Guard and Cleanup Columns	Alpha Analytical	N

QAPP Worksheet No. 23. Analytical and Biological SOP References Table (cont.)

Reference Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
M19	SOP No. OP-014, Silica Gel Cleanup Procedure (Automated and Manual), Revision 1.1, 5/2/08	Definitive	SVOCs	Waters HPLC 600E System Controller, 717 Autosampler, and 486 Tunable Absorbance Detector; Waters uPorasil Prep-pak and guard-pak cartridges or Modcol column	Alpha Analytical	N
M20	SOP No. O-006, Method 8270, Semivolatile Organic Compounds by GC/MS, Revision 5, 3/6/09	Definitive	SVOCs	Agilent 6890 GC with Agilent 5973 detector	Alpha Analytical	N
M21	SOP No. SOC-OSWT, Extraction of Organotins in Sediment, Water, and Tissue Matrices, Revision 5, 1/20/06	Definitive	Butyltins	Nitrogen evaporator, centrifuge, Kuderna-Danish apparatus, vacuum pump and manifold, water bath, vortex and tumbler for VOA vials	CAS - Kelso	N
M22	SOP No. SOC-BUTYL, Butyltins, Revision 8, 7/31/07	Definitive	Butyltins	Hewlett Packard 5890 Gas Chromatograph with a flame photometric detector	CAS - Kelso	N
M23	SOP No. SOC-LIPID, Percent Lipids in Tissue, Revision 1, 4/30/07	Definitive	General chemistry – lipids	Analytical balance capable of weighing to the nearest 0.0001 g	CAS, Kelso	N
M24	SOP No. W-001, Percent Solids Determination, Revision 3, 5/4/07	Definitive	Percent moisture	Analytical balance capable of weighing to the nearest 0.0001 g and a top-loading balance capable of weighing to the nearest 0.01 g	Alpha Analytical	N
M25	SOP No. W-028, Total Organic Carbon in Soil, Sediment and Water, Revision 2.0, 1/22/03	Definitive	General chemistry – TOC	Perkin Elmer 2400 Series II CHNS/O Analyzer with Thermal Conductivity Detector	Alpha Analytical	N

QAPP Worksheet No. 23. Analytical and Biological SOP References Table (cont.)

Reference Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
M26	SOP No. W-029, Particle Size Analysis of Soils – With / Without Hydrometer and Liquid Limit, Plastic Limit, and Plasticity Index, Revision 0.0, 7/17/06	Definitive	Grain size	Analytical balance capable of weighing to the nearest 0.0001 g and a top-loading balance capable of weighing to the nearest 0.01 g	Alpha Analytical	N
M27	SOP No. GEN-350.1, Ammonia by Flow Injection Analysis, Revision 7, 5/1/07	Definitive	General chemistry – ammonia-N	Rapid Flow Analyzer Colorimeter	CAS – Kelso	Y, modified to include sulfide cleanup procedures in nitrogen, ammonia, colorimetry, salicylate-hypochlorite automated-segmented flow, United States Geological Survey (USGS) I-6522-90
M28	SOP No. GEN-9013, Cyanide Extraction of Solids and Oils, Revision 0, 7/8/98	Definitive	General chemistry – cyanide	NA	CAS – Kelso	N
M29	SOP No. GEN-335, Total Cyanides and Cyanides Amenable to Chlorination, Revision 12, 4/12/2007	Definitive	General chemistry – cyanide	Lachat Quik-Chem Analyzer	CAS – Kelso	N
M30	SOP No. GEN-TKN, Nitrogen, Total and Soluble Kjeldahl, Revision10, 1/7/08	Definitive	General chemistry – total Kjeldahl nitrogen	Ion selective electrode	CAS – Kelso	N

QAPP Worksheet No. 23. Analytical and Biological SOP References Table (cont.)

Reference Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
M31	SOP No. GEN-365.3, Phosphorus Determination Using Colorimetric Procedure, Revision 10, 8/28/08 (includes sample preparation)	Definitive	General chemistry – total phosphorus	UV-VIS	CAS – Kelso	N
M32	SOP No. GEN-9030M, Total Sulfides by Methylene Blue Determination, Revision 8, 1/5/06 (includes sample preparation)	Definitive	General chemistry – total sulfide	UV-VIS	CAS – Kelso	N
M33	SOP No. 04-20 Quantification of Semivolatile Petroleum Products in Water, Soil, Sediment and Sludge, Revision 1, 3/12/09 (NJDEP OQA-QAM-025-02/08 Rev.7)	Definitive	TPH – extractables	GC/FID	Alpha Analytical	N
M34	SOP No. 04-13, TPH-Gasoline Range Organics, Revision 3, 7/4/07	Definitive	TPH – purgeables	GC/FID	Alpha Analytical	N
M35	SOP No. O-012, Determination of Polychlorinated Biphenyls (PCBs) as Aroclors or Congeners By Gas Chromatography/Electron Capture Detection (GC-ECD), Revision 2.0, 2/11/08	Definitive	PCBs – Aroclors	Hewlett Packard HP 5890 Series II Gas Chromatograph, HP 6890 Plus or similar, HP 6890 series autosampler with controller or equivalent	Alpha Analytical	N
M36	SOP No. QA-1407, Acute Toxicity of Sediments To Midge Larvae, *Chironomus dilutus,* Revision 12, 01/09	Definitive	Benthic invertebrates	Toxicity testing equipment	EnviroSystem	N

QAPP Worksheet No. 23. Analytical and Biological SOP References Table (cont.)

Reference Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
M37	SOP No. QA-1467, Assessment Toxicity (28-Day) of Sediments To The Amphipod, *Hyalella azteca* based on Survival and Growth – Project-Specific Document, Revision 0, 08/09 (Draft document – final to be provided as an addendum to the Benthic QAPP)	Definitive	Benthic invertebrates	Toxicity testing equipment	EnviroSystem	N
M38	SOP No. QA-1426. Acute Toxicity of Sediments to the Marine Amphipod, *Ampelisca abdita.* Revision 8, 4/09	Definitive	Benthic invertebrates	Toxicity testing equipment	EnviroSystem	N
M39	SOP No. QA-1435. Marine Sediment Bioaccumulation Evaluation with the Polychaete, *Neanthes virens,* Revision 8, 1/09	Definitive	Benthic invertebrates	Bioaccumulation testing equipment	EnviroSystem	N
M40	SOP No. QA-1445. Assessment of Bioaccumulative Potential of Sediments to the Freshwater Oligochaete, *Lumbriculus variegatus*. Revision No. 4, 4/09	Definitive	Benthic invertebrates	Bioaccumulation testing equipment	EnviroSystem	N
M41	SOP No. QA-1373 Pore Water Salinity Adjustment from EnviroSystem. Revision 0, 4/09	Definitive	Salinity	Refractometer or salinometer	EnviroSystem	N
M42	EcoAnalysts Macroinvertebrate Laboratory QA Plan	Definitive	Benthic invertebrates	Taxonomic identification of benthic invertebrates	EcoAnalysts	N

QAPP Worksheet No. 23. Analytical and Biological SOP References Table (cont.)

Reference Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
M43	SOP No. O-008. Analysis of Parent and Alkylated Polynuclear Aromatic Hydrocarbons, Selected Heterocyclic Compounds, Steranes, Triterpanes, and Triaromatic Steroids by GC/MS – SIM, Revision 4, 10/08/08	Definitive	Alkylated PAHs	GC Model Agilent/HP6890 or equivalent, Mass spectrometer Agilent/HP5973 or equivalent	Alpha Analytical	N
M44	SOP No. O-004. Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry , Revision 6.2, 6/27/08	Definitive	VOCs	GC Hewlett Packard 5890 or 6890, Mass spectrometer Hewlett Packard 6890 mass selective detector	Alpha Analytical	N
M45	SOP No. 04-16. Chlorinated Herbicides by GC Using Methylation Derivatization, Revision 4.0, 7/2/09	Definitive	Herbicides	GC/ECD	Alpha Analytical	N
M46	SOP No. OP-009. Alumina Column Cleanup of Organic Extracts, Revision 1.0 4/17/08	Definitive	Alkylated PAHs, TPH – alkanes	Glass preparation column, muffle furnace, and a top-loading balance capable of weighing to the nearest 0.01 g	Alpha Analytical	N
M47	SOP No. O-003, Total Petroleum and Saturated Hydrocarbons by Gas Chromatography/Flame Ionization Detector, Revision 4.0, 10/28/08	Definitive	TPH – alkanes	GC Model Agilent/HP6890 or equivalent, auto sampler HP6890 with a GC autosampler controller or equivalent	Alpha Analytical	N
M48	SOP No OP-013. Shaker Table Extraction, Revision 2.0, 10/22/08	Definitive	TPH – alkanes	New Brunswick Scientific shaker table and drying oven capable of maintaining 105 ºC and 400 ºC	Alpha Analytical	N

QAPP Worksheet No. 23. Analytical and Biological SOP References Table (cont.)

Reference Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
M49	SOP No. G-003, Balance Calibration and Maintenance, Revision 2.0, 1/31/08	Definitive	Percent moisture, grain size	Analytical balance capable of weighing to the nearest 0.0001 g and a top-loading balance capable of weighing to the nearest 0.01 g	Alpha Analytical	N

AVS/SEM – acid volatile sulfide/ simultaneously extracted metals
BRL – Brooks Rand Labs
BrCl – bromine monochloride
CAS – Columbia Analytical Services, Inc.
CVAFS – cold vapor atomic fluorescence spectrometer
GC – gas chromatography
GC/ECD – gas chromatograph/electron capture detector
GC/FID – gas chromatograph/flame ionization detector
GFAA – graphite furnace atomic absorption
GLH – general laboratory homogenizer
GPC – gel permeation chromatograph
HPLC – high-performance liquid chromatography
HR – high resolution
HRGC – high-resolution gas chromatography
HRMS – high-resolution mass spectrometry
ICP – inductively coupled plasma
ICP-MS – inductively coupled plasma-mass spectrometry
ICP-OES – inductively coupled plasma-optical emission spectrometry
NA – not applicable
NJDEP – New Jersey Department of Environmental Protection
OC – organic carbon
PAH – polycyclic aromatic hydrocarbon
PCB – polychlorinated biphenyl
PCDD – polychlorinated dibenzo-*p*-dioxin
PCDF – polychlorinated dibenzofuran
QAM – quality assurance manual
QAPP – quality assurance project plan
SOP – standard operating procedure
SVOC – semivolatile organic compound
TOC – total organic carbon
TPH – total petroleum hydrocarbons
USEPA – US Environmental Protection Agency
USGS – US Geological Survey
UV-VIS – ultraviolet-visible spectrophotometry
VOA – volatile organic analysis
VOC – volatile organic carbon

QAPP Worksheet No. 24. Analytical Instrument Calibration Table

Instrument – Chemical	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference[a]
HRGC/HRMS – PCBs – congeners	Refer to Analytical Perspectives SOP No. AP-CM-7.	Initial calibration after instrument set up, after major instrument changes and when continuing calibration criteria are not met; CCV daily at beginning of 12-hour analytical batch	ICAL: %RSD ≤ 20% for target analytes calculated by isotope dilution or ≤ 35% for target analytes calculated by internal standard. CCV: ≤ 20% drift for toxic congeners or ≤ 50% drift for non-toxic congeners	Inspect system, correct problem, rerun calibration and affected samples.	Analyst or Bryan Vining, Analytical Perspectives	M2
GC/ECD – PCBs – Aroclors	Refer to Alpha Analytical SOP No. O-012.	Initial calibration after instrument set up, after major instrument changes and when continuing calibration criteria are not met; CCV daily at beginning of 12-hour analytical batch	ICAL: %RSD ≤ 20% CCV: ≤15% drift	Inspect system, correct problem, rerun calibration and affected samples.	Analyst or Cindy McQueen or Jolanta Scieglinska, Alpha Analytical	M35
HRGC/HRMS – PCDDs/PCDFs	Refer to Analytical Perspectives SOP No. AP-CM-5.	Initial calibration after instrument set up, after major instrument changes and when continuing calibration criteria are not met; CCVs daily at beginning and end of 12-hour analytical batch	ICAL: %RSD $\leq$ 10% for native standards or $\leq$ 20% for extraction standards CCV: Refer to Method 1613	Inspect system, correct problem, rerun calibration and affected samples.	Analyst or Bryan Vining, Analytical Perspectives	M3
HRGC/HRMS – PAHs	Refer to Maxxam Analytics SOP No. BRL 00423.	Initial calibration after instrument set up, after major instrument changes and when continuing calibration criteria are not met; CCV daily at beginning of 24-hour analytical batch	ICAL: %RSD ≤ 30% for unlabeled standards and internal standards CCV: ≤ 30% drift	Inspect system, correct problem, rerun calibration and affected samples.	Analyst or Owen Cosby, Maxxam Analytics	M4

QAPP Worksheet No. 24. Analytical Instrument Calibration Table (cont.)

Instrument – Chemical	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference[a]
GC/MS-SIM – alkylated PAHs	Refer to Alpha Analytical SOP No. O-008.	Initial calibration before analysis of sample extracts, initial calibration check standard (CCC) following calibration curve; CCV at the beginning and end of every analytical sequence and every 24 hours within the sequence	ICAL: 25% RSD for 90% of all target compounds, with the exception for 10% between 25% RSD and 25% RSD CCC: ± 20% of true values CCV: Compare the CCV resulting response against the average response for the initial calibration for each calibrated PAH; the percent difference for each calibrated PAH must be < 25%, with no more than 10% of all compounds > 25% but < 35%	Inspect system, correct problem, rerun calibration and affected samples.	Analyst or Susan O'Neil or Andrew Cram, Alpha Analytical	M43
HRGC/HRMS – organochlorine pesticides	Refer to Maxxam SOP No. BRL 00415.	Initial calibration after instrument set up, after major instrument changes and when continuing calibration criteria are not met; CCV daily at beginning of 12 hour analytical batch	ICAL: %RSD ≤ 35% CCV: ≤ 50% drift	Inspect system, correct problem, rerun calibration and affected samples.	Analyst or Owen Cosby, Maxxam Analytics	M7
ICP/MS –metals	Refer to CAS-Kelso SOP No. MET-6020.	Calibration and ICV daily; CCV at beginning and end of analytical batch and once every 10 samples	CRA: % recovery ±100% ICV: 90 – 110% recovery CCV: 90 – 110% recovery	Inspect system, correct problem, re-run calibration and affected samples.	Analyst or Jeff Coronado, CAS Kelso	M10
ICP – metals	Refer to CAS-Kelso SOP No. MET-ICP.	Calibration and ICV daily; CCV at beginning and end of analytical batch and once every 10 samples	CRA: % recovery ±100% ICV: 90 – 110% recovery CCV: 90 – 110% recovery	Inspect system, correct problem, rerun calibration and affected samples.	Analyst or Jeff Coronado, CAS Kelso	M11
AAS – metals (selenium)	Refer to CAS-Kelso SOP No. MET-7742.	Calibration and ICV daily; CCV at beginning and end of analytical batch and once every 10 samples	Correlation coefficient of standard curve $\geq$ 0.995 ICV: 90 – 110% recovery CCV: 90 – 110% recovery	Inspect system, correct problem, rerun calibration and affected samples.	Analyst or Jeff Coronado, CAS Kelso	M12

QAPP Worksheet No. 24. Analytical Instrument Calibration Table (cont.)

Instrument – Chemical	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference[a]
CVAFS – total mercury and methylmercury	Refer to Brooks Rand Labs SOP Nos. BR-0002, BR-0006, and BR-0011.	Calibration and ICV daily; CCV at beginning and end of analytical batch and once every 10 samples for methylmercury only	ICAL: RSD of response factors ≤15%; low standard % recovery 75 – 125% for total mercury or 65 – 135% for methylmercury. ICV: 85 – 115% recovery for total mercury or 80 – 120% recovery for methylmercury. CCV: 77 – 123% recovery for total mercury or 67 – 133% recovery for methylmercury	Inspect system, correct problem. Recalibrate and rerun affected samples.	Analyst or Annie Carter, Brooks Rand Labs	M14, M15 M16
GC/MS – SVOCs	Refer to Alpha Analytical SOP No. O-006.	Initial calibration after instrument set up, after major instrument changes and when continuing calibration criteria are not met	ICAL: ≤ 15% RSD for all target analytes or linear/quadratic curve r ≥ 0.990, ≤ 30% for CCC's (allowed 20% of remaining compounds > 30% and the average of 15% for all compounds except CCCs). ICV: ±20% recovery of the true values. Sporadic marginal failures accepted CCV: ≤ 30%D for target analytes, ≤ 20% for CCCs; SPCC minimum avg. RF.	Inspect system, correct problem, rerun calibration and affected samples.	Analyst or Susan O'Neil or Julie DeSousa, Alpha Analytical	M20
GC/MS – VOCs	Refer to Alpha Analytical SOP No. O-004.	Initial calibration after instrument set up, after major instrument changes and when continuing calibration criteria are not met	ICAL: ≤30%RSD for CCCs; non-CCC compounds <15% or linear curve r≥ 0.995, or quadratic curve r^2>0.990 CCV: ≤20% difference for CCCs; SPCC minimum average RF	Inspect system, correct problem, rerun calibration and affected samples.	Analyst or Bethany Silvio or Maria Raposo	M44

QAPP Worksheet No. 24. Analytical Instrument Calibration Table (cont.)

Instrument – Chemical	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference[a]
GC/FPD – butyltins	Refer to CAS SOP No. SOC-BUTYL.	Initial calibration and ICV daily; CCV at beginning of analytical batch (unless ICAL begins 12 hour analytical batch), every 12 hours, and/or every 10 samples, whichever is more frequent; closing CCV required when butyltins are detected in project samples	ICAL: ≤ 20% RSD for all target analytes or linear/quadratic curve r ≥ 0.990 ICV: ±25% recovery of the true values CCV: ±25% drift for target analytes	Inspect system, correct problem, rerun calibration and affected samples.	Analyst or Jeff Grindstaff, CAS Kelso	M22
Analytical balance –percent moisture and grain size	Refer to Alpha Analytical SOP Nos. OP-003, W-001, and W-029.	Calibrate monthly, check calibration daily.	0.1% of true value.	Clean, level, and tare the balance; repeat procedure; if acceptance criteria is not met, balance must not be used for project samples; correct problem in consultation with laboratory QA staff.	Analyst or Nancy Rose, Alpha Analytical	M1, M24, M26
CHNS/O analyzer – TOC	Refer to Alpha Analytical SOP No. W-028.	Calibration and ICV daily.	Correlation coefficient of the initial calibration curve must be ≥ 0.995. The slope of the line should be ±10% of historical curves.	Repeat analyses to see if an error has occurred. If acceptance criteria are not met, recalibrate and reanalyze ICV and affected samples.	Analyst or Nancy Rose, Alpha Analytical	M25
Analytical balance – lipids	Refer to CAS SOP No. SOC-LIPID	Calibration checks are performed daily for each day analyses are performed.	0.1% of true value	Clean, level, and tare the balance; repeat procedure; if acceptance criteria is not met, balance must not be used for project samples; correct problem in consultation with laboratory QA staff	Greg Salata (or alternate analyst), CAS Kelso	M23

QAPP Worksheet No. 24. Analytical Instrument Calibration Table (cont.)

Instrument – Chemical	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference[a]
GC/FID – TPH	Refer to Alpha Analytical SOP Nos. 04-20, 04-13, and O-003.	Initial calibration after instrument set up, after major instrument changes and when continuing calibration criteria are not met. CCV verified on each working day.	Initial calibration %RSD ≤ 20%; continuing calibration ±20%	Inspect system, correct problem rerun calibration and affected samples.	Analyst or Nancy Rose or Elizabeth Porta, Alpha Analytical	M33, M34, M47
UV-VIS – total sulfide, AVS	Refer to CAS-Kelso SOP No. GEN-AVS and GEN-9030M.	Allow spectrophotometer to warm up for 30 minutes. External calibration prior to each use, r ≥ 0.995; CCB, CCV every 10 samples.	ICV, CCV ± 10% of true value	Inspect system, correct problem rerun calibration and affected samples.	Analyst or Jeff Coronado, CAS Kelso	M13, M32
Rapid-flow analyzer colorimeter—ammonia-N	Refer to CAS-Kelso SOP No. GEN-350.1.	Determine linear calibration range at initial calibration and verify at least every 6 months using a blank and 3 standards; r ≥ 0.995; CCB, CCV every 10 samples.	Linearity check must be within ± 10% of original values; ICV, CCV ± 10% of true value.	Inspect system, correct problem rerun calibration and affected samples.	Analyst or Jeff Coronado, CAS Kelso	M27
Rapid-flow analyzer colorimeter – cyanide	Refer to CAS-Kelso SOP No. GEN-335.	Determine linear calibration range at initial calibration and verify at least every 6 months using a blank and 3 standards; r ≥ 0.995; CCB, CCV every 10 samples.	Linearity check must be within ± 10% of original values; ICV, CCV ± 10% of true value.	Inspect system, correct problem rerun calibration and affected samples.	Analyst or Jeff Coronado, CAS Kelso	M29
Ion selective electrode – Total Kjeldahl Nitrogen	Refer to CAS-Kelso SOP No. GEN-TKN.	Calibrate daily, ICV, CCV every 10 samples.	ICV, CCV ± 10% of true value	Inspect system, correct problem rerun calibration and affected samples.	Analyst or Jeff Coronado, CAS Kelso	M30
UV-VIS – total phosphorus	Refer to CAS-Kelso SOP No. GEN-365.3.	External calibration prior to each use, r ≥ 0.995; CCB, CCV every 10 samples.	ICV, CCV ± 10% of true value	Inspect system, correct problem rerun calibration and affected samples.	Analyst or Jeff Coronado, CAS Kelso	M31

QAPP Worksheet No. 24. Analytical Instrument Calibration Table (cont.)

Instrument – Chemical	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference[a]
GC/ECD – herbicides	Refer to Alpha Analytical SOP No. 04-16.	Initial calibration after instrument set up, after major instrument changes and when continuing calibration criteria are not met; CCV daily at beginning of 12-hour analytical batch	ICAL **is** % RSD ≤ 20% when average response factor is used; or a linear curve with a correlation coefficient of R2 ≥ 0.990; CCV is ≤ 15% drift.	Inspect system, correct problem, rerun calibration and affected samples.	Analyst or Justin Benson or Szymon Sus, Alpha Analytical	M45

[a] From Analytical SOP references table (Worksheet No. 23).

AAS – atomic absorption spectrometer
CCC – continuing calibration criteria
CCV – continuing calibration verification
CHNS/O – carbon, hydrogen, nitrogen, sulfur/oxygen
CVAFS – cold vapor atomic fluorescence spectrometer
GC/FID – gas chromatograph/flame ionization detector
GC/FPD – gas chromatograph/flame photometric detection
GC/MS – gas chromatograph/mass spectrometer
HRGC/HRMS – high-resolution gas chromatograph/high-resolution mass spectrometer
ICAL – initial calibration
ICP – inductively coupled plasma
ICV – initial calibration verification
PAH – polycyclic aromatic hydrocarbon
PCB – polychlorinated biphenyl
PCDD – polychlorinated dibenzo-*p*-dioxin
PCDF – polychlorinated dibenzofuran
RF – response factors
RSD – relative standard deviation
SIM – selective ion monitoring
SOP – standard operating procedure
SPCC – system performance check compounds
SVOC – semivolatile organic compound
TKN – total Kjeldahl nitrogen
TOC – total organic carbon
TPH – total petroleum hydrocarbons
UV-VIS – ultraviolet-visible spectrophotometry
VOC – volatile organic carbon

QAPP Worksheet No. 25. Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
HRGC/HRMS	Clean sources; maintain vacuum pumps.	See SOP	Instrument performance and sensitivity	Service vacuum pumps twice per year; other maintenance as needed	See SOP	See SOP	Analyst or Bryan Vining, Analytical Perspectives; Owen Cosby, Maxxam Analytics	M2, M3, M7
GC/MS	Clean sources and quadrupole rods; maintain vacuum pumps.	See SOP	Instrument performance and sensitivity	Service vacuum pumps twice per year; other maintenance as needed	See SOP	See SOP	Analyst or Owen Cosby, Maxxam Analytics	M4
GC/ECD	Change septa, clean injectors, change or trim columns, install new lines.	See SOP	Instrument performance and sensitivity	Daily or as needed	See SOP	See SOP	Cindy McQueen or Jolanta Scieglinska (or alternate analyst), Alpha Analytical	M35
ICP/MS	Remove and clean cone; clean ICP glassware and fittings, clean RF contact strips, clean air and oil mist filters, check rotary pump oil, clean extraction lens and ion lens stack, check electron multiplier.	See SOP	Check connections	Daily or as needed	See SOP	See SOP	Analyst or Jeff Coronado, CAS Kelso	M10
ICP	Clean torch, nebulizer and spray chamber. Clean instrument and water filters.	See SOP	Check connections	Daily or as needed	See SOP	See SOP	Analyst or Jeff Coronado, CAS Kelso	M11
AAS	Clean the nebulizer and burner head, clean the gas liquid separator, inspect hollow cathode and deuterium lamps.	See SOP	Check connections	Daily or as needed	See SOP	See SOP	Analyst or Jeff Coronado, CAS, Kelso	M12

QAPP Worksheet No. 25. Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table (cont.)

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
AAS	Replace disposables, flush lines.	See SOP	Check connections	Daily or as needed	See SOP	See SOP	Analyst or Annie Carter, Brooks Rand Labs	M13
CVAFS	Replace disposables, flush lines.	See SOP	Check connections	Daily or as needed	See SOP	See SOP	Analyst or Annie Carter, Brooks Rand Labs	M14, M15, M16
GC/MS	Clean sources and quadrupole rods; maintain vacuum pumps.	See SOP	Instrument performance and sensitivity	Service vacuum pumps twice per year; other maintenance as needed	See SOP	See SOP	Analyst or Susan O'Neil or Julie DeSousa, Alpha Analytical	M20
GC/MS	Clean sources and quadrupole rods; maintain vacuum pumps.	See SOP	Instrument performance and sensitivity	Service vacuum pumps twice per year; other maintenance as needed	See SOP	See SOP	Analyst or Bethany Silvio or Maria Raposo, Alpha Analytical	M46
GC/MS	Clean sources and quadrupole rods; maintain vacuum pumps.	See SOP	Instrument performance and sensitivity	Service vacuum pumps twice per year; other maintenance as needed	See SOP	See SOP	Analyst or Jeff Grindstaff, CAS, Kelso	M22
GC/MS-SIM	Clean sources and quadrupole rods; maintain vacuum pumps.	See SOP	Instrument performance and sensitivity	Service vacuum pumps twice per year; other maintenance as needed	See SOP	See SOP	Analyst or Susan O'Neil or Andrew Cram, Alpha Analytical	M45, M46
CHNS/O analyzer	Replace disposables, clean system.	See SOP	Instrument performance and sensitivity	Daily or as needed	See SOP	See SOP	Analyst or Susan O'Neil or Julie DeSousa, Alpha Analytical	M25
UV-VIS – total sulfide, AVS	UV-VIS	See SOP	Instrument performance and sensitivity, verify lamp is working	Daily or as needed	See SOP	See SOP	Analyst or Jeff Grindstaff, CAS, Kelso	M13

QAPP Worksheet No. 25. Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table (cont.)

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
Rapid-flow analyzer colorimeter (ammonia-N)	Replace disposables, flush lines.	See SOP	Check connections	Daily or as needed	See SOP	See SOP	Analyst or Jeff Grindstaff, CAS, Kelso	M27
Rapid-flow analyzer – cyanide	Replace disposables, flush lines.	See SOP	Check connections	Daily or as needed	See SOP	See SOP	Analyst or Jeff Grindstaff, CAS, Kelso	M29
Ion selective electrode – TKN	Replace membrane and filling solution.	See SOP	Inspect membrane for signs of failure	Prior to use	See SOP	See SOP	Analyst or Jeff Grindstaff, CAS, Kelso	M30
UV-VIS – total phosphorus	UV-VIS	See SOP	Instrument performance and sensitivity	Verify lamp is working	See SOP	See SOP	Analyst or Jeff Grindstaff, CAS, Kelso	M31
GC-FID – TPH	Change septa, clean injectors, change or trim columns, install new liners.	See SOP	Instrument performance and sensitivity	Daily or as needed	See SOP	See SOP	Analyst or Nancy Rose or Elizabeth Porta, Alpha Analytical	M33, M34, M47
Analytical balance – total solids, and grain size	Calibrate	See SOP	Instrument performance and sensitivity	Calibrate monthly, check calibration daily	See SOP	See SOP	Analyst or Nancy Rose, Alpha Analytical	M1, M24, M26
GC/ECD	Change septa, clean injectors, change or trim columns, install new liners	See SOP	Instrument performance and sensitivity	Daily or as needed	See SOP	See SOP	Analyst or Jeff Grindstaff, CAS, Kelso	M47

AAS – atomic absorption spectrometer
AVS – acid volatile sulfide
CAS – Columbia Analytical Services, Inc.
CHNS/O – carbon, hydrogen, nitrogen, sulfur/oxygen
CVAFS – cold vapor atomic fluorescence spectrometer
GC/ECD – gas chromatograph/electron capture detector
GC-FID– gas chromatograph- flame ionization detector
GC/MS – gas chromatograph/mass spectrometer
HRGC – high-resolution gas chromatograph
HRMS – high-resolution mass spectrometer
ICP – inductively coupled plasma
ICP/MS – inductively coupled plasma/mass spectrometer
SIM – selective ion monitoring
SOP – standard operating procedure
TKN – total Kjeldahl nitrogen
TPH – total petroleum hydrocarbons
UV-VIS – ultraviolet-visible spectrophotometry

QAPP Worksheet No. 26. Sample Handling System

Sample Collection, Packaging, and Shipment	Sediment Samples (for chemistry analysis)	Sediment Samples (for toxicity testing)	Tissue Samples
Sample Collection (Personnel/Organization):	Thai Do or designee/Windward	Thai Do or designee/Windward	Thai Do or designee/Windward
Sample Packaging (Personnel/Organization):	Thai Do or designee/Windward	Thai Do or designee/Windward	Thai Do or designee/Windward
Coordination of Shipment (Personnel/Organization):	Thai Do or designee/Windward	Thai Do or designee/Windward	Thai Do or designee/Windward
Type of Shipment/Carrier:	Overnight carrier (FedEx, UPS or equivalent) to appropriate subcontracted laboratories	Field personnel to hand deliver to EnviroSystem	Overnight carrier (FedEx, UPS or equivalent) from biological laboratory to Alpha Analytical; overnight carrier (FedEx, UPS or equivalent) to other subcontracted analytical laboratories
Sample Receipt and Analysis			
Sample Receipt (Personnel/Organization):	Contact at appropriate laboratory	Contact at appropriate laboratory	Contact at appropriate laboratory
Sample Custody and Storage (Personnel/Organization):	Contact at appropriate laboratory	Contact at appropriate laboratory	Contact at appropriate laboratory
Sample Preparation (Personnel/Organization):	Contact at appropriate laboratory	Contact at appropriate laboratory	Contact at appropriate laboratory
Sample Determinative Analysis (Personnel/Organization):	Contact at appropriate laboratory	Contact at appropriate laboratory	Contact at appropriate laboratory
Sample Archiving			
Field Sample Storage (number of days from sample collection):	Contact at appropriate laboratory	Contact at appropriate laboratory	Contact at appropriate laboratory

QAPP Worksheet No. 26. Sample Handling System (cont.)

Sample Collection, Packaging, and Shipment	Sediment Samples (for chemistry analysis)	Sediment Samples (for toxicity testing)	Tissue Samples
Sample Extract/Digestate Storage (number of days from extraction/digestion):	1 year until Windward authorizes disposal	1 year until Windward authorizes disposal	1 year until Windward authorizes disposal
Biological Sample Storage (number of days from sample collection):	Not applicable	Not applicable	Contact at appropriate laboratory
Sample Disposal			
Personnel/Organization:	Thai Do or designee/Windward	Thai Do or designee/Windward	Susan McGroddy or Helle Andersen/Windward
Number of Days from Analysis:	1 year until Windward authorizes disposal	1 year until Windward authorizes disposal	1 year until Windward authorizes disposal

QAPP Worksheet No. 27. Sample Custody Requirements Table

Field Sample Custody Procedures (sample collection, packaging, shipment, and delivery to laboratory):

Surface sediment samples for chemistry analysis, toxicity tests, and bioaccumulation testing will be collected in the field and packaged for transport to the appropriate laboratories in coolers with ice. Refrigerated samples will be shipped on wet ice. When frozen samples for chemical analysis are couriered and the transit time is guaranteed to be less than 24 hours, wet ice may be used during transit. Frozen samples shipped via overnight delivery will be packed with a combination of dry ice with wet ice or ice packs. The SOPs for collecting and processing the sediment samples are discussed in further detail in Attachment D. The samples will be shipped to the analytical laboratories for chemistry analysis and to the biological laboratories for toxicity or bioaccumulation testing. The original signed chain-of-custody (COC) forms will be placed in a sealable plastic bag, sealed, and taped to the inside lid of the cooler. Fiber tape will be wrapped completely around the cooler. On each side of the cooler a “This Side Up” arrow label will be attached; a “Handle with Care” label will be attached to the top of the cooler, and the cooler will be sealed with a custody seal in two locations. An example COC form and custody seal are provided in Attachment G.

Benthic invertebrate samples will be collected, sieved, and preserved in the field with buffered formalin (final concentration about 10%). The SOPs for collecting and processing the benthic invertebrate samples are discussed in further detail in Attachment D (Worksheet No. 21).The samples will be shipped to the taxonomy laboratory. The original signed COC forms will be placed in a sealable plastic bag, sealed, and taped to the inside lid of the cooler. Fiber tape will be wrapped completely around the cooler. On each side of the cooler a “This Side Up” arrow label will be attached; a “Handle with Care” label will be attached to the top of the cooler, and the cooler will be sealed with a custody seal in two locations. An example COC form and custody seal are provided in Attachment G.

Laboratory Sample Custody Procedures (receipt of samples, archiving, disposal):

Benthic invertebrate tissue samples will be shipped frozen from the biological laboratories to the appropriate analytical laboratories. When frozen samples for chemical analysis are couriered and the transit time is guaranteed to be less than 24 hours, wet ice may be used during transit. Frozen samples shipped via overnight delivery will be packed with a combination of dry ice with wet ice or ice packs. Each contracted laboratory will have a laboratory-specific SOP that details the procedures used to document sample receipt and custody within the laboratory. The following procedures must be addressed in the laboratory custody SOP:

- Each laboratory must have a designated sample custodian who accepts custody of the samples at the time of delivery to the laboratory and verifies that the information on the sample labels matches the information on the COC. The sample custodian must sign and date all appropriate receiving documents and note any discrepancies in sample documentation as well as the condition of the samples at the time of receipt.
- Once the samples have been accepted by the laboratory, checked, and logged in, they must be maintained in accordance with laboratory custody and security requirements as outlined in the laboratory quality management plan (QMP).

QAPP Worksheet No. 27. Sample Custody Requirements Table (cont.)

- To ensure traceability of samples during the analytical process the laboratory will assign a sample identification (ID) number based on procedures outlined in the laboratory QMP or laboratory SOP.
- The following procedures, at a minimum, must be documented by the laboratory:
  - Tissue processing (Alpha Analytical only)
  - Sample extraction/preparation
  - Sample analysis
  - Data reduction
  - Data reporting

Laboratory personnel are responsible for sample custody until the samples are returned to the sample custodian.

When sample analysis and QC procedure are completed, any remaining sample must be stored in accordance with contractual terms. A minimum of 30 days notice must be provided before the disposal of any sample. Data sheets, custody documents, and all other laboratory records must be retained in accordance with contractual agreements.

Final Evidence Files

Laboratory records including all field- and laboratory-initiated COCs and other sample receiving records, sample preparation and analysis records, and the final data package become part of the laboratory final evidence file and must be retained as required by the contractual agreement. An original copy of the data package and associated electronic deliverable must be provided to Windward in accordance with the contractual agreement and will be retained by Windward along with associated field records and other related correspondence.

Sample Identification Procedures:

The SQT samples will be identified with the site name, time, date, sampling location, and field crew initials. Unique alphanumeric ID numbers will be assigned to each sample depending on the analysis. The sample identification schematic is as follows:

- The first four characters will be “LPR” to identify the project area (Lower Passaic River), followed by a character to identify that the sample collected is for either the SQT method (T) or Human Health (H), followed by a two-digit numerical river segment (RM 01 to RM 17), and a unique letter to identify sample location within the river segment.
- For example, an SQT sediment sample collected at location A in RM 9 to RM 10 would be identified as “LPRT10A”.
- For a benthic community sample collected as a subset of the sediment sample, the sample will be identified with the sediment sample ID, in addition to “BC” (benthic community) and a sequentially assigned two-digit number.
- For example, the second benthic community sample collected from sediment sample LPRT10A would be identified as “LPRT10A-BC02.”

QAPP Worksheet No. 27. Sample Custody Requirements Table (cont.)

- For benthic invertebrate tissue samples derived in the bioaccumulation tests, the sample will be identified with the sediment sample ID, in addition to a two-character species code (LV for *Lumbriculus variegatus* –or NV for *Neanthes virens*
- *For example, a Lumbriculus variegatus* tissue sample collected from LPRT10A would be identified as "LPRT10A-LV."

Chain-of-custody Procedures:

COC procedures are documented in detail in Attachment G (Worksheet No. 21) and summarized briefly below. Samples are considered to be in custody if they are: 1) in the custodian's possession or view; 2) in a secured place (under lock) with restricted access; or 3) in a container and secured with an official seal(s) such that the sample cannot be reached without breaking the seal(s). Custody procedures as defined in Attachment G will be used for all samples throughout the collection and transport process. Custody procedures will be initiated during sample collection. An electronic COC form will accompany samples to the analytical laboratory. Each person who has custody of the samples will sign the COC form and ensure that the samples are not left unattended unless properly secured.

The FC will be responsible for all sample tracking and custody procedures for samples in the field. The FC will be responsible for final sample inventory and will maintain sample custody documentation. The FC will also complete COC forms prior to removing samples from the sampling area. At the end of each day, and prior to transfer, COC entries will be made for all samples. Information on the labels will be checked against sample log entries, and samples will be recounted. COC forms will accompany all samples. The COC forms will be signed at each point of transfer. Copies of all COC forms will be retained and included as appendices to QA/QC reports and data reports. Samples will be shipped in sealed coolers.

Windward will ensure that COC forms are properly signed upon receipt of the samples and will note questions or observations concerning sample integrity on the COC forms. Windward will contact the FC and Project Task QA/QC Manager immediately if discrepancies are discovered between the COC forms and the sample shipment upon receipt.

QAPP Worksheet No. 28. QC Samples Table

Matrix	Tissue and Sediment
Analytical Group	PCBs – Congeners
Concentration Level	Low
Sampling SOP[a]	Tissue: M39, M40[b] Sediment: Attachment D
Analytical Method/SOP Reference	USEPA 1668A/M2
Sampler's Name	Windward Field Staff
Field Sampling Organization	Windward Environmental LLC
Analytical Organization	Analytical Perspectives
Number of Sampling Locations	Tissue: 20 Sediment: 116

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method blank	1 per prep batch of 20 samples or fewer	a) When detected, the concentration should be less than the reporting limit or < 10 times the highest concentration found in the batch of samples; b) signal to noise ratio should be > 10 for the extraction standard; c) detection level should be ≤ 4 times the limit of detection; d) recoveries of the extraction standard should be 25% minimum or meet c and d.	Analytical data is accepted (with a data qualifier) if the amount found in the MB is less than one tenth of the level found in the associated samples. Otherwise, the samples are re-extracted and re-analyzed. Use the EMLs in Method 1668A for guidance only. Use the "B" data qualifier when a specific congener is found at a level above the RL or when at a level that is not "significantly" different than the one found in the field sample even if below the RL.	Bryan Vining (or alternate analyst), Analytical Perspectives	Contamination	Laboratory control limits

QAPP Worksheet No. 28. QC Samples Table (cont.)

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Spiked solvent blank	Always follows the analysis of the front-end batch control spike, may also be used before the ending batch control spike sample	Signal to noise should be > 2.5:1 for the 1 pg/μL selected PCB congeners peak to verify absence of bad injection. To verify absence of carryover, there should be no target analyte peak with signal to noise ratio > 2.5:1 or if above, the response should be less than 1% of the target analyte in the batch control spike.	Injector maintenance	Bryan Vining (or alternate analyst), Analytical Perspectives	Accuracy	Laboratory control limits
Extraction standard	Spiked into every sample and QC sample	Percent recovery = 30 – 140%	Refer to SOP for corrective action	Bryan Vining (or alternate analyst), Analytical Perspectives	Accuracy	Laboratory % recovery control limits
MD	1 per 20 samples per matrix type (mass permitting)	RPD should be ≤ 20% when within the curve and the sample is a true laboratory duplicate.	Identify source of variance before implementing corrective action. Assess impact on sample data reliability and consider re-extraction and reanalysis of samples if necessary for generating reliable data as sample mass permits.	Bryan Vining (or alternate analyst), Analytical Perspectives	Precision	Laboratory RPD control limit

QAPP Worksheet No. 28. QC Samples Table (cont.)

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Batch control spike	Minimum 1 per extraction batch, analyzed at the beginning and end of 12-hour analytical sequence	PD between the relative response factor of the batch control spike and the initial calibration should be ≤ 20% for target species and ≤ 30% for extraction standard/cleanup standard; RPD between the beginning and ending batch control spike should be ≤10% for target species and ≤ 20% for extraction standard/cleanup standard.	Refer to SOP for corrective actions	Bryan Vining (or alternate analyst), Analytical Perspectives	Precision/ accuracy	Laboratory RPD control limit and percent drift
CRM	Minimum of 1 per batch of 20 samples	PD of certified target analytes within 25% of reference values when within the ICAL.	Identify source of variance before implementation of corrective action. In all cases. assess impact on sample data reliability and consider re-extraction and reanalysis of samples if necessary for generating reliable data as sample mass permits	Bryan Vining (or alternate analyst), Analytical Perspectives	Accuracy	Laboratory control limits

[a] From Analytical SOP references table (Worksheet No. 23).
[b] Benthic invertebrate tissue will not be collected from the field for chemical analysis as part of this QAPP. Tissues in organisms that undergo sediment toxicity testing in the laboratory will be analyzed.

CRM – certified reference material
DQI – data quality indicator
EML – estimated minimum level
ICAL – initial calibration
PCB – polychlorinated biphenyl
PD – percent difference
QAPP – quality assurance project plan
QC – quality control
RL – reporting limit
RPD – relative percent difference
RSD – relative standard deviation
SOP – standard operating procedure
USEPA – US Environmental Protection Agency

QAPP Worksheet No. 28. QC Samples Table (cont.)

Matrix	Tissue and Sediment
Analytical Group	PCBs – Aroclors
Concentration Level	Low
Sampling SOP[a]	Tissue: M39, M40[b] Sediment: Attachment D
Analytical Method/SOP Reference	USEPA SW-846 8082/M35
Sampler's Name	Windward Field Staff
Field Sampling Organization	Windward Environmental LLC
Analytical Organization	Analytical Perspectives
Number of Sampling Locations	Tissue: 20 Sediment: 116

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method blank/instrument blank	1 per prep batch of 20 samples or fewer	No target compounds > QL	Identify and eliminate source of contamination. Determine extent of contamination and impact on sample data. Report results if sample results > 20 times blank result or sample results ND. Contact project manager and client to determine further corrective action. Corrective action may include re-extraction and reanalysis of sample, if sufficient sample is available and within holding time requirements. If insufficient sample is available, qualify data.	Cindy McQueen or Jolanta Scieglinska (or alternate analyst), Alpha Analytical	Contamination	Laboratory control limits
LCS	1 per prep batch of 20 samples or fewer	Refer to test method for control limits	Reanalyze affected samples. Qualify data as needed.	Cindy McQueen or Jolanta Scieglinska (or alternate analyst), Alpha Analytical	Precision and accuracy	Laboratory RPD control limit and percent drift
MD	1 per 20 samples per matrix type (mass permitting)	RPD ≤ 50% for target compound > 5 x QL	Qualify data as needed.	Cindy McQueen or Jolanta Scieglinska (or alternate analyst), Alpha Analytical	Precision	Laboratory RPD control limit

QAPP Worksheet No. 28. QC Samples Table (cont.)

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
MS/MSD[c]	1 per 20 samples or fewer	Recovery is compound specific (see SOP), RPD ≤ 50%	Flag associated results.	Cindy McQueen or Jolanta Scieglinska (or alternate analyst), Alpha Analytical	Precision and accuracy/bias	Laboratory RPD control limits

[a] From Analytical SOP references table (Worksheet No. 23).

[b] Benthic invertebrate tissue will not be collected from the field for chemical analysis as part of this QAPP. Tissues in organisms that undergo sediment toxicity testing in the laboratory will be analyzed.

DQI – data quality indicator
LCS – laboratory control sample
MD – matrix duplicate
MS – matrix spike
MSD – matrix spike duplicate
ND – not detected
PCB – polychlorinated biphenyl
QAPP – quality assurance project plan
QC – quality control
QL – quantitation limit
RPD – relative percent difference
SOP – standard operating procedure
USEPA – US Environmental Protection Agency

QAPP Worksheet No. 28. QC Samples Table (cont.)

Matrix	Tissue and Sediment
Analytical Group	PCDDs/PCDFs
Concentration Level	Low
Sampling SOP[a]	Tissue: M39, M40[b] Sediment: Attachment D
Analytical Method/SOP Reference	USEPA 1613B/M3
Sampler's Name	Windward Field Staff
Field Sampling Organization	Windward Environmental LLC
Analytical Organization	Analytical Perspectives
Number of Sampling Locations	Tissue: 20 Sediment:116

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method blank	1 per batch of 20 samples	a) No target compound should be detected above signal to noise ratio > 2.5:1; b) when detected, the concentration should be less than the reporting limit or <10 times the highest concentration found in the batch of samples; c) signal to noise should be > 10:1 for extraction standard (isotopically labeled standard added before extraction); d) detection level should be ≤ 4 times limit of detection; e) recoveries of the extraction standard should be 40% minimum or meet c and d.	A B-qualifier is applied to any specific analyte found in the sample when its presence is detected in the laboratory method blank at a concentration above the reporting limit, or the level detected in the blank that is statistically significant relative to that found in the associated sample. An invalid method blank requires re-extraction and reanalysis of the samples.	Bryan Vining (or alternate analyst), Analytical Perspectives	Contamination	Laboratory control limits

QAPP Worksheet No. 28. QC Samples Table (cont.)

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Spiked solvent blank	Always follows the analysis of the front-end batch control spike, can also be used before the ending batch control spike	No target analyte peak should have a signal to noise ratio > 2.5:1 or if above 2.5:1, the response should be < 1% of the target analyte in the batch control spike.	Refer to SOP	Bryan Vining (or alternate analyst), Analytical Perspectives	Contamination	Laboratory control limits
MD	1 per batch of 20 samples per matrix type (mass permitting)	RPD ≤ 20% when within the calibration curve and the sample is a true laboratory duplicate.	Identify the source of variation before implementing corrective action. Assess impact on sample data reliability and consider re-extraction and re-analysis of samples if necessary for generating reliable data as mass permits.	Bryan Vining (or alternate analyst), Analytical Perspectives	Precision and accuracy	Laboratory RPD control limit
CRM	1 per batch of 20 samples	PD of certified target analytes within 25% reference values when within the ICAL.	Identify source of variance before implementation of corrective action. In all cases. assess impact on sample data reliability and consider re-extraction and reanalysis of samples if necessary for generating reliable data as sample mass permits	Bryan Vining (or alternate analyst), Analytical Perspectives	Accuracy	Laboratory control limit

QAPP Worksheet No. 28. QC Samples Table (cont.)

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Batch control spike	A minimum of 1 per extraction batch, analyzed at the beginning and end of the 12-hour analytical period	PD between the relative response factor of the batch control spike and the initial calibration should be ≤ 20% for target species and ≤ 30% for extraction standard/ cleanup standard; RPD between the beginning and ending batch control spike should be ≤ 10% for target species and ≤ 20% for extraction standard/cleanup standard.	Refer to SOP	Bryan Vining (or alternate analyst), Analytical Perspectives	Precision/ accuracy	Laboratory RPD control limit and percent difference

[a] From Analytical SOP references table (Worksheet No. 23).

[b] Benthic invertebrate tissue will not be collected from the field for chemical analysis as part of this QAPP. Tissues in organisms that undergo sediment toxicity testing in the laboratory will be analyzed.

CDD – chlorinated dibenzo-*p*-dioxins
CDF – chlorinated dibenzofurans
CRM – certified reference material
DQI – data quality indicator
ICAL – initial calibration
MD – matrix duplicate
PCDD – polychlorinated dibenzo-*p*-dioxin
PCDF – polychlorinated dibenzofuran
PD – percent difference
QAPP – quality assurance project plan
QC – quality control
RPD – relative percent difference
RSD – relative standard deviation
SOP – standard operating procedure
USEPA – US Environmental Protection Agency

QAPP Worksheet No. 28. QC Samples Table (cont.)

Matrix	Tissue and Sediment
Analytical Group	PAHs
Concentration Level	Low
Sampling SOP[a]	Tissue: M39, M40[b] Sediment: Attachment D
Analytical Method/SOP Reference	CARB 429 Modified/M4
Sampler's Name	Windward Field Staff
Field Sampling Organization	Windward Environmental LLC
Analytical Organization	Maxxam Analytics
Number of Sampling Locations	Tissue: 20 Sediment: 116

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method blank/instrument blank	1 per batch of 20 samples	No target compounds > EML	Determine extent of contamination and impact on sample data. Report results if sample results > 20 times blank result or sample results ND. Contact project manager and client to determine further corrective action. Corrective action may include re-extraction and reanalysis of sample, if sufficient sample is available. If insufficient sample is available qualify data.	Owen Cosby (or alternate analyst), Maxxam Analytics	Contamination	Laboratory control limits
MD	1 per batch of 20 samples per matrix type (mass permitting)	RPD ≤ 50% if samples are > 5 x QL	Flag associated results.	Owen Cosby (or alternate analyst), Maxxam Analytics	Precision	Laboratory RPD control limit
Pre-extraction internal standards	Spiked into every sample and QC sample	Compound-specific (see SOP)	Refer to SOP for corrective action.	Owen Cosby (or alternate analyst), Maxxam Analytics Bryan	Accuracy	Laboratory % recovery control limits

QAPP Worksheet No. 28. QC Samples Table (cont.)

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
LCS	1 for every batch of samples up to a maximum batch size of 20 samples	50 – 150%	Reanalyze affected samples.	Owen Cosby (or alternate analyst), Maxxam Analytics	Precision/ accuracy	Laboratory RPD control limit and percent drift
CRM	1 for every batch of samples up to a maximum batch size of 20 samples	Recovery within limits set by CRM manufacturer	Reanalyze sample to see if an analytical error has occurred. Qualify data as needed. Consider re-extraction and reanalysis of samples if necessary for generating reliable data as sample mass permits.	Owen Cosby (or alternate analyst), Maxxam Analytics	Accuracy	Laboratory % recovery control limits

[a] From Analytical SOP references table (Worksheet No. 23).

[b] Benthic invertebrate tissue will not be collected from the field for chemical analysis as part of this QAPP. Tissues in organisms that undergo sediment toxicity testing in the laboratory will be analyzed.

CARB – California Air Resources Board
CRM – certified reference material
DQI – data quality indicator
EML – estimated minimum level
LCS – laboratory control sample
MD – matrix duplicate
ND – not detected
PAH – polycyclic aromatic hydrocarbon
QAPP – quality assurance project plan
QC – quality control
QL – quantitation limit
RPD – relative percent difference
SOP – standard operating procedure

QAPP Worksheet No. 28. QC Samples Table (cont.)

Matrix	Tissue and Sediment
Analytical Group	Alkylated PAHs
Concentration Level	Low
Sampling SOP[a]	Tissue: M39, M40[b] Sediment: Attachment D
Analytical Method/SOP Reference	USEPA SW-846 8270D/M43, M46
Sampler's Name	Windward Field Staff
Field Sampling Organization	Windward Environmental LLC
Analytical Organization	Alpha Analytical
Number of Sampling Locations	Tissue: 20 Sediment: 116

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method blank/instrument blank	1 per batch of 20 samples	No target compounds > QL	Flag associated results if detected and/or greater than 1/10 of the amount found in samples.	Susan O'Neil (or alternate analyst), Alpha Analytical	Contamination	No target compounds > QL
MS/MSD[c]	1 per batch of 20 samples per matrix type (mass permitting)	Percent recovery = 50 – 150%, RPD ≤ 30%	Flag associated results.	Susan O'Neil (or alternate analyst), Alpha Analytical	Precision	Laboratory recovery and RPD control limit
MD	1 per batch of 20 samples per matrix type (mass permitting)	RPD ≤ 30% if target compounds are > 5 x QL	Flag associated results.	Susan O'Neil (or alternate analyst), Alpha Analytical	Precision	Laboratory recovery and RPD control limit
Pre-extraction internal standard	Added to every sample and QC sample	50 – 200% of the daily CCV area for the internal standards	Refer to SOP for corrective action.	Susan O'Neil (or alternate analyst), Alpha Analytical	Accuracy	Laboratory recovery limits
LCS	At the beginning and end of the 12 hour analytical period	Percent recovery = 50 – 150%	Reanalyze affected samples.	Susan O'Neil (or alternate analyst), Alpha Analytical	Precision/ accuracy	Laboratory RPD control limit and percent drift

[a] From Analytical SOP references table (Worksheet No. 23).

QAPP Worksheet No. 28. QC Samples Table (cont.)

[b] Benthic invertebrate tissue will not be collected from the field for chemical analysis as part of this QAPP. Tissues in organisms that undergo sediment toxicity testing in the laboratory will be analyzed.

CCV –continuing calibration verification
CRM – certified reference material
DQI – data quality indicator
LCS – laboratory control sample
MD – matrix duplicate
MS – matrix spike
MSD – matrix spike duplicate
PAH – polycyclic aromatic hydrocarbon
QAPP – quality assurance project plan
QC – quality control
QL – quantitation limit
RPD – relative percent difference
SOP – standard operating procedure
USEPA – US Environmental Protection Agency

QAPP Worksheet No. 28. QC Samples Table (cont.)

Matrix	Tissue and Sediment
Analytical Group	Organochlorine Pesticides
Concentration Level	Low
Sampling SOP[a]	Tissue: M39, M40[b] Sediment: Attachment D
Analytical Method/SOP Reference	USEPA 1699 Modified (NYSDEC HRMS-2) /M5, M6, M7
Sampler's Name	Windward Field Staff
Field Sampling Organization	Windward Environmental LLC
Analytical Organization	Maxxam Analytics
Number of Sampling Locations	Tissue: 20 Sediment: 116

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method blank	1 per every batch, and a minimum of 1 for every 20 samples	No target compounds> QL	All of the samples must be re-prepared and reanalyzed. If sufficient sample is not available then any positive sample data must be flagged as possibly contaminated to the level found in the method blank.	Owen Cosby (or alternate analyst), Maxxam Analytics	Contamination	Laboratory control limits
LCS	1 for every batch of samples up to a maximum batch size of 20 samples	Percent recovery = 50 – 200%	Check calculations and reanalyze if recoveries are outside of these limits. If the blank spike is outside of limits but the matrix spike is acceptable then the blank spike may have been spiked incorrectly. Review the data with the Team or Group Leader. All data may be accepted but must be flagged as exceeding acceptance criteria. If both the blank spike and the matrix spikes exceed their respective limits re-prepare and reanalyze the samples providing sufficient sample is available. If sufficient sample is not available the data must be flagged.	Owen Cosby (or alternate analyst), Maxxam Analytics	Accuracy/bias	Laboratory % recovery control limits

QAPP Worksheet No. 28. QC Samples Table (cont.)

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
MD	1 for every batch of samples per matrix type (mass permitting)	RPD ≤ 25% if both samples are > 5 x QL	Check calculation for errors. Check solid samples for homogeneity, if not homogeneous, flag data as appropriate. If sample is homogeneous re-prepare and reanalyze sample	Owen Cosby (or alternate analyst), Maxxam Analytics	Precision	Laboratory RPD control limit
Pre-extraction internal standards	Spiked into every sample and QC sample	Recovery = 10 – 200% per laboratory SOP	The data will still be acceptable provided that the signal is equal to or greater than ten times the noise level. This will be flagged in the Case Narrative section of the final report. The extract may be diluted and rerun. Complex matrices may mask or enhance the response of several compounds (Aldrin, methoxychlor, 4,4'-DDT) The sample may be re-extracted if nothing can be found to explain the low or high recoveries and no obvious interference is causing the problem.	Owen Cosby (or alternate analyst), Maxxam Analytics	Accuracy/bias	Laboratory % recovery control limits
CRM	1 for every batch of samples up to a maximum batch size of 20 samples	Recovery within limits set by CRM manufacturer	Reanalyze sample to see if an analytical error has occurred. Qualify data as needed. Consider re-extraction and reanalysis of samples if necessary for generating reliable data as sample mass permits.	Owen Cosby (or alternate analyst), Maxxam Analytics	Accuracy	Laboratory % recovery control limits

[a] From analytical SOP references table (Worksheet No. 23).

[b] Benthic invertebrate tissue will not be collected from the field for chemical analysis as part of this QAPP. Tissues in organisms that undergo sediment toxicity testing in the laboratory will be analyzed.

CRM – certified reference material
DDT – dichlorodiphenyltrichloroethane
DQI – data quality indicator
HRMS – high-resolution mass spectrometry
LCS – laboratory control sample
MD – matrix duplicate
MRL – method reporting limit
NYSDEC – New York State Department of Environmental Conservation
QAPP – quality assurance project plan
QC – quality control
QL – quantitation limit
RPD – relative percent difference
SOP – standard operating procedure
USEPA – US Environmental Protection Agency

QAPP Worksheet No. 28. QC Samples Table (cont.)

Matrix	Tissue and Sediment
Analytical Group	Metals (ICP/MS)
Concentration Level	Low
Sampling SOP[a]	Tissue: M39, M40[b] Sediment: Attachment D
Analytical Method/SOP Reference	USEPA SW-846 6020/M8, M9, M10
Sampler's Name	Windward Field Staff
Field Sampling Organization	Windward Environmental LLC
Analytical Organization	CAS, Kelso
Number of Sampling Locations	Tissue: 20 Sediment: 116

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method blank	Minimum of 1 per batch	Result < QL	All samples associated with contaminated method blanks must be reanalyzed.	Jeff Coronado (or alternate analyst), CAS, Kelso	Contamination	Laboratory control limits
LCS	Minimum of 1 per batch	Percent recovery = 75 – 125%	If recovery is outside of the control limit, then batch must be re-prepared and reanalyzed.	Jeff Coronado (or alternate analyst), CAS, Kelso	Accuracy/bias	Laboratory % recovery control limits
MD	Minimum of 1 per 20 client samples per matrix type (mass permitting)	RPD ≤ 30%	Either redigest the sample batch or flag the results, whichever is appropriate.	Jeff Coronado (or alternate analyst), CAS, Kelso	Precision	Laboratory RPD control limit
MS	Minimum of 1 per 20 client samples per matrix type (mass permitting)	Percent recovery = 75 – 125%	Either redigest the sample batch or flag the results, whichever is appropriate.	Jeff Coronado (or alternate analyst), CAS, Kelso	Accuracy/bias	Laboratory % recovery control limits
CRM	Minimum of 1 per batch	Percent recovery = 70 – 130%	Either redigest the sample batch or flag the results, whichever is appropriate.	Jeff Coronado (or alternate analyst), CAS, Kelso	Accuracy/bias	Laboratory % recovery control limits

[a] From analytical SOP references table (Worksheet No. 23).

QAPP Worksheet No. 28. QC Samples Table (cont.)

[b] Benthic invertebrate tissue will not be collected from the field for chemical analysis as part of this QAPP. Tissues in organisms that undergo sediment toxicity testing in the laboratory will be analyzed.

CAS – Columbia Analytical Services, Inc.
CRM – certified reference material
DQI – data quality indicator
ICP/MS – inductively coupled plasma/mass spectrometer
LCS – laboratory control sample
MD – matrix duplicate
MS – matrix spike
QAPP – quality assurance project plan
QC – quality control QL – quantitation limit
RPD – relative percent difference
SOP – standard operating procedure
USEPA – US Environmental Protection Agency

QAPP Worksheet No. 28. QC Samples Table (cont.)

Matrix	Tissue and Sediment
Analytical Group	Metals (ICP)
Concentration Level	Low
Sampling SOP[a]	Tissue: M39, M40[b] Sediment: Attachment D
Analytical Method/SOP Reference	USEPA SW-846 6010B/M8, M9, M11
Sampler's Name	Windward Field Staff
Field Sampling Organization	Windward Environmental LLC
Analytical Organization	CAS, Kelso
Number of Sampling Locations	Tissue: 20 Sediment: 116

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method blank	Minimum of 1 per batch of 20 samples	Result < QL or < 1/20th sample result	All samples associated with contaminated method blanks must be reanalyzed.	Jeff Coronado (or alternate analyst), CAS, Kelso	Contamination	Laboratory control limits
LCS	Minimum of 1 per batch	Percent recovery = 75 – 125%	If recovery is outside of the control limit, then batch must be re-prepared and reanalyzed.	Jeff Coronado (or alternate analyst), CAS, Kelso	Accuracy/bias	Laboratory % recovery control limits
MD	Minimum of 1 per 20 client samples per matrix type (mass permitting)	RPD ≤ 30%	Either redigest the sample batch or flag the results, whichever is appropriate.	Jeff Coronado (or alternate analyst), CAS, Kelso	Precision	Laboratory RPD control limit
MS	Minimum of 1 per 20 client samples per matrix type (mass permitting)	Percent recovery = 70 – 130%	Either redigest the sample batch or flag the results, whichever is appropriate.	Jeff Coronado (or alternate analyst), CAS, Kelso	Accuracy/bias	Laboratory % recovery control limits
CRM	Minimum of 1 per batch of 20 samples	Recovery within limits set by CRM manufacturer	Either redigest the sample batch or flag the results, whichever is appropriate.	Jeff Coronado (or alternate analyst), CAS, Kelso	Accuracy/bias	Laboratory % recovery control limits

[a] From Analytical SOP references table (Worksheet No. 23).

[b] Benthic invertebrate tissue will not be collected from the field for chemical analysis as part of this QAPP. Tissues in organisms that undergo sediment toxicity testing in the laboratory will be analyzed.

QAPP Worksheet No. 28. QC Samples Table (cont.)

CAS – Columbia Analytical Services, Inc.
CRM – certified reference material
DQI – data quality indicator
ICP – inductively coupled plasma
LCS – laboratory control
MD – matrix duplicate
MS – matrix spike
QAPP – quality assurance project plan
QC – quality control
QL – quantitation limit
RPD – relative percent difference
SOP – standard operating procedure
USEPA – US Environmental Protection Agency

QAPP Worksheet No. 28. QC Samples Table (cont.)

Matrix	Tissue and Sediment
Analytical Group	Metals (Selenium)
Concentration Level	Low
Sampling SOP[a]	Tissue: M39, M40[b] Sediment: Attachment D
Analytical Method/SOP Reference	USEPA SW-846 7742/M8, M9, M12
Sampler's Name	Windward Field Staff
Field Sampling Organization	Windward Environmental LLC
Analytical Organization	CAS, Kelso
Number of Sampling Locations	20

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method blank	Minimum of 1 per batch	Result < QL	All samples associated with contaminated method blanks must be reanalyzed.	Jeff Coronado (or alternate analyst), CAS Kelso	Contamination	No target analytes at MRL
MD	Minimum of 1 per 20 client samples per matrix type (mass permitting)	RPD ≤ 30%	Either redigest the sample batch or flag the results, whichever is appropriate.	Jeff Coronado (or alternate analyst), CAS, Kelso	Precision	Laboratory RPD control limit
MS	Minimum of 1 per 20 client per matrix type (mass permitting) samples	Percent recovery = 60 – 130%	Either redigest the sample batch or flag the results, whichever is appropriate.	Jeff Coronado (or alternate analyst), CAS, Kelso	Accuracy/bias	Laboratory % recovery control limits
LCS	Minimum of 1 per batch	Percent recovery = 75-125%	Either redigest the sample batch or flag the results, whichever is appropriate.	Jeff Coronado (or alternate analyst), CAS, Kelso	Accuracy/bias	Laboratory % recovery control limits
CRM	Minimum of 1 per batch	Recovery within limits set by CRM manufacturer	Either redigest the sample batch or flag the results, whichever is appropriate.	Jeff Coronado (or alternate analyst), CAS, Kelso	Accuracy/bias	Laboratory % recovery control limits

[a] From Analytical SOP references table (Worksheet No. 23).

[b] Benthic invertebrate tissue will not be collected from the field for chemical analysis as part of this QAPP. Tissues in organisms that undergo sediment toxicity testing in the laboratory will be analyzed.

CAS – Columbia Analytical Services, Inc. MRL – method reporting limit RPD – relative percent difference

QAPP Worksheet No. 28. QC Samples Table (cont.)

CRM – certified reference material
DQI – data quality indicator
LCS – Laboratory control sample
MD – matrix duplicate
MS – matrix spike
QAPP – quality assurance project plan
QC – quality control
QL – quantitation limit
SOP – standard operating procedure
USEPA – US Environmental Protection Agency

QAPP Worksheet No. 28. QC Samples Table (cont.)

Matrix	Tissue and Sediment
Analytical Group	Metals (Total Mercury)
Concentration Level	Low
Sampling SOP[a]	Tissue: M39, M40[b] Sediment: Attachment D
Analytical Method/SOP Reference	USEPA 1631/M14, M15
Sampler's Name	Windward Field Staff
Field Sampling Organization	Windward Environmental LLC
Analytical Organization	Brooks Rand Labs
Number of Sampling Locations	Tissue: 20 Sediment: 116

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method blank	3 per batch	Average MB < 2 x method detection limit and standard deviation < 0.67 x MDL or < 0.1 x the concentration of project samples	Correct problem until criteria met. All samples associated with a contaminated method blank must be reanalyzed or qualified accordingly.	Annie Carter (or alternate analyst), Brooks Rand Labs	Contamination	Laboratory control limits
CRM	1 per 20 client samples	Percent recovery = 75 – 125%	Correct problem prior to continuing analysis.	Annie Carter (or alternate analyst), Brooks Rand Labs	Accuracy/bias	Laboratory % recovery control limits
MD[c]	1 per 10 client samples per matrix (mass permitting)	RPD ≤ 30%	If RPD criteria not met, then the system is not in control. Correct problem and reanalyze all associated samples or qualify accordingly.	Annie Carter (or alternate analyst), Brooks Rand Labs	Precision	Laboratory RPD control limit
MS/MSD	1 per 10 client samples (mass permitting)	Percent recovery = 70 – 130%;	If recoveries similar but fail recovery criteria, interference may be present in the sample and the result must be qualified. If RPD criteria not met, then the system is not in control. Correct problem and reanalyze all associated samples.	Annie Carter (or alternate analyst), Brooks Rand Labs	Precision/ accuracy/bias	Laboratory % recovery control limits

[a] From Analytical SOP references table (Worksheet No. 23).

QAPP Worksheet No. 28. QC Samples Table (cont.)

[b] Benthic invertebrate tissue will not be collected from the field for chemical analysis as part of this QAPP. Tissues in organisms that undergo sediment toxicity testing in the laboratory will be analyzed.

CRM – certified reference material
DQI – data quality indicator
MB – method blank
MD – matrix duplicate
MDL – method detection limit
MS – matrix spike
MSD – matrix spike duplicate
QAPP – quality assurance project plan
QC – quality control
RPD – relative percent difference
SOP – standard operating procedure
USEPA – US Environmental Protection Agency

QAPP Worksheet No. 28. QC Samples Table (cont.)

Matrix	Tissue and Sediment
Analytical Group	Metals (Methylmercury)
Concentration Level	Low
Sampling SOP[a]	Tissue: M39, M40[b] Sediment: Attachment D
Analytical Method/SOP Reference	USEPA 1630/M16
Sampler's Name	Windward Field Staff
Field Sampling Organization	Windward Environmental LLC
Analytical Organization	Brooks Rand Labs
Number of Sampling Locations	Tissue: 20 Sediment: 116

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method blank	4 per batch	Average < 2 x MDL St Dev < 2/3 of MDL or < 1/10 of associated samples	Correct problem. All samples associated with a contaminated method blank must be reanalyzed.	Annie Carter (or alternate analyst), Brooks Rand Labs	Contamination	No target analytes at MRL
CRM	1 per 20 client samples	Percent recovery = 65 – 135%	Correct problem prior to continuing analysis.	Annie Carter (or alternate analyst), Brooks Rand Labs	Accuracy/bias	Laboratory % recovery control limits
MD	1 per 10 client samples per matrix type (mass permitting)	RPD ≤ 35% or ± 2 x PQL if sample < 5 x PQL	If RPD criteria not met, then the system is not in control. Correct problem and reanalyze all associated samples.	Annie Carter (or alternate analyst), Brooks Rand Labs	Precision	Laboratory RPD control limit
MS/MSD	1 per 10 client samples per matrix type (mass permitting)	Percent recovery = 65 – 135%, RPD ≤ 35%	If recoveries are similar but fail recovery criteria, an interference is present in the sample and the result must be qualified. If RPD criteria are not met, then the system is not in control. Correct problem and reanalyze all associated samples.	Annie Carter (or alternate analyst), Brooks Rand Labs	Precision/ accuracy/bias	Laboratory % recovery control limits

[a] From Analytical SOP references table (Worksheet No. 23).

QAPP Worksheet No. 28. QC Samples Table (cont.)

[b] Benthic invertebrate tissue will not be collected from the field for chemical analysis as part of this QAPP. Tissues in organisms that undergo sediment toxicity testing in the laboratory will be analyzed.

CRM – certified reference material
DQI – data quality indicator
MD – matrix duplicate
MDL – method detection limit
MRL – method reporting limit
MS – matrix spike
MSD – matrix spike duplicate
PQL – practical quantitation limit
QAPP – quality assurance project plan
QC – quality control
RPD – relative percent difference
SOP – standard operating procedure
USEPA – US Environmental Protection Agency

QAPP Worksheet No. 28. QC Samples Table (cont.)

Matrix	Tissue and Sediment
Analytical Group	SVOCs
Concentration Level	Low
Sampling SOP[a]	Tissue: M39, M40[b] Sediment: Attachment D
Analytical Method/SOP Reference	USEPA SW-846 8270C/M17, M18, M19, M20
Sampler's Name	Windward Field Staff
Field Sampling Organization	Windward Environmental LLC
Analytical Organization	Alpha Analytical
Number of Sampling Locations	Tissue: 20 Sediment: 116

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method blank	1 per extraction batch (20 samples)	No target compounds > QL, no common lab contaminants > 5 x QL	If sufficient sample is available, re-extract and reanalyze samples. If insufficient sample is available, reanalyze extracts. Qualify data as needed. Report results if sample results > 20 times blank result or sample results ND.	Susan O'Neil or Julie DeSousa (or alternate analyst), Alpha Analytical	Accuracy/bias-contamination	Laboratory control limits
Instrument blank	Once per 12 hours if method blank is not run	No target compounds > QL, no common lab contaminants > 5 x QL	Reanalyze extracts. Qualify data as needed. Report results if sample results > 20 times blank result or sample results ND.	Susan O'Neil or Julie DeSousa or alternate analyst), Alpha Analytical	Accuracy/bias-contamination	Laboratory control limits
LCS	1 per extraction batch (20 samples)	Compound-specific (see SOP)	If sufficient sample is available, re-extract and reanalyze samples. If insufficient sample is available, reanalyze extracts. Qualify data as needed.	Susan O'Neil or Julie DeSousa or alternate analyst), Alpha Analytical	Accuracy/bias	Laboratory % recovery control limits

QAPP Worksheet No. 28. QC Samples Table (cont.)

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
CRM (sediment only)	1 per extraction batch (20 samples)	Percent recovery = 40 – 140%	Reanalyze sample, if % recovery still exceeds the control limits and the LCS and MS/MSD pair are compliant, describe potential matrix interferences. Qualify data as needed.	Susan O'Neil or Julie DeSousa (or alternate analyst), Alpha Analytical	Accuracy/bias	Laboratory % recovery control limits
MD	1 per 20 samples per matrix type (mass permitting)	Variable, Compound-specific (see SOP)	Analysis must be repeated once to see if an analytical error has occurred. Qualify data as needed.	Susan O'Neil or Julie DeSousa (or alternate analyst), Alpha	Precision	Laboratory RPD control limits
MS/MSD	1 per 20 samples per matrix type (mass permitting)	Compound-specific (see SOP)	Determine root cause; flag MS/MSD data; discuss in narrative.	Susan O'Neil or Julie DeSousa or alternate analyst), Alpha Analytical	Accuracy/bias, precision	Laboratory % recovery and RPD control limits
Surrogates	Spiked into every sample and QC sample	Compound-specific, see SOP	Check all calculations for error; ensure that instrument performance is acceptable; recalculate the data and/or reanalyze the extract if either of the above checks reveal a problem. Re-prepare and reanalyze the sample or flag the data as "Estimated Concentration" if none of the above resolves the problem. Re-preparation is not necessary if there is obvious chromatographic interference.	Susan O'Neil or Julie DeSousa (or alternate analyst), Alpha Analytical	Accuracy/bias	Laboratory % recovery control limits

[a] From Analytical SOP references table (Worksheet No. 23).
[b] Benthic invertebrate tissue will not be collected from the field for chemical analysis as part of this QAPP. Tissues in organisms that undergo sediment toxicity testing in the laboratory will be analyzed.

CRM – certified reference material
DQI – data quality indicator
LCS – laboratory control sample
MD – matrix duplicate
MS – matrix spike
MSD – matrix spike duplicate
ND – non-detect
QAPP – quality assurance project plan
QC – quality control
QL – quantitation limit
RPD – relative percent difference
SOP – standard operating procedure
SVOC – semivolatile organic compound
USEPA – US Environmental Protection Agency

QAPP Worksheet No. 28. QC Samples Table (cont.)

Matrix	Tissue and Sediment
Analytical Group	Butyltins
Concentration Level	Low
Sampling SOP[a]	Tissue: M39, M40[b] Sediment: Attachment D
Analytical Method/SOP Reference	Krone et al. (1989)/M21, M22
Sampler's Name	Windward Field Staff
Field Sampling Organization	Windward Environmental LLC
Analytical Organization	CAS, Kelso
Number of Sampling Locations	Tissue: 20 Sediment: 116

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method blank	1 per batch of 20 samples	No target analytes at QL	Reanalyze affected samples. Qualify data as needed.	Jeff Grindstaff (or alternate analyst), CAS, Kelso	Contamination	Laboratory control limit
MS/MSD	1 per batch of 20 samples per matrix type (mass permitting)	Compound-specific (see SOP), RPD ≤ 40%	Reanalyze affected samples. Qualify data as needed.	Jeff Grindstaff (or alternate analyst), CAS, Kelso	Accuracy/bias, precision	Laboratory control limits
LCS	1 per batch of 20 samples	Compound-specific (see SOP)	Reanalyze affected samples. Qualify data as needed.	Jeff Grindstaff (or alternate analyst), CAS, Kelso	Accuracy/bias	Laboratory control limits
MD	1 per batch of 20 samples per matrix type (mass permitting)	RPD ≤ 40%	Reanalyze affected samples. Qualify data as needed.	Jeff Grindstaff (or alternate analyst), CAS, Kelso	Precision	Laboratory RPD control limits

[a] From Analytical SOP references table (Worksheet No. 23).

[b] Benthic invertebrate tissue will not be collected from the field for chemical analysis as part of this QAPP. Tissues in organisms that undergo sediment toxicity testing in the laboratory will be analyzed.

CAS – Columbia Analytical Services, Inc.
DQI – data quality indicator
LCS – laboratory control sample
MD – matrix duplicate
MS – matrix spike
MSD – matrix spike duplicate
QAPP – quality assurance project plan
QC – quality control
QL – quantitation limit
RPD – relative percent difference
SOP – standard operating procedure

QAPP Worksheet No. 28. QC Samples Table (cont.)

Matrix	Tissue
Analytical Group	General Chemistry – Lipids
Concentration Level	Low
Sampling SOP[a]	Tissue: M39, M40[b]
Analytical Method/SOP Reference	Bligh-Dyer/M23
Sampler's Name	Windward Field Staff
Field Sampling Organization	Windward Environmental LLC
Analytical Organization	CAS, Kelso
Number of Sampling Locations	20

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method blank	1 per batch of 20 samples	No target analytes at QL	Reanalyze affected samples. Qualify data as needed.	Greg Salata (or alternate analyst), CAS, Kelso	Contamination	Laboratory control limits
MD	1 per batch of 20 samples	RPD ≤ 20%	Reanalyze affected samples. Qualify data as needed.	Greg Salata (or alternate analyst), CAS, Kelso	Precision	Laboratory RPD limits
CRM	1 per batch of 20 samples	Recovery within limits set by CRM manufacturer	Reanalyze and qualify data as needed.	Greg Salata (or alternate analyst), CAS, Kelso	Accuracy	Laboratory % recovery control limits

[a] From Analytical SOP references table (Worksheet No. 23).

[b] Benthic invertebrate tissue will not be collected from the field for chemical analysis as part of this QAPP. Tissues in organisms that undergo sediment toxicity testing in the laboratory will be analyzed.

CRM – certified reference material
DQI – data quality indicator
MD – matrix duplicate
RPD – relative percent difference
QAPP – quality assurance project plan
QC – quality control
QL – quantitation limit
SM – standard method
SOP – standard operating procedure

QAPP Worksheet No. 28. QC Samples Table (cont.)

Matrix	Tissue and Sediment
Analytical Group	General Chemistry – Percent Moisture
Concentration Level	NA
Sampling SOP[a]	Tissue: M39, M40[b] Sediment: Attachment D
Analytical Method/SOP Reference	SM2540G Modified/M24
Sampler's Name	Windward Field Staff
Field Sampling Organization	Windward Environmental LLC
Analytical Organization	Alpha Analytical
Number of Sampling Locations	Tissue: 20 Sediment: 116

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
MD	1 per batch of 20 samples	RPD ≤ 20%	Reanalyze affected samples. Qualify data as needed.	Nancy Rose (or alternate analyst), Alpha Analytical	Precision	Laboratory RPD control limit

[a] From Analytical SOP references table (Worksheet No. 23).

[b] Benthic invertebrate tissue will not be collected from the field for chemical analysis as part of this QAPP. Tissues in organisms that undergo sediment toxicity testing in the laboratory will be analyzed.

DQI – data quality indicator
MD – matrix duplicate
NA – not applicable
QAPP – quality assurance project plan
QC – quality control
RPD – relative percent difference
SM – standard method
SOP – standard operating procedure

QAPP Worksheet No. 28. QC Samples Table (cont.)

Matrix	Sediment
Analytical Group	Herbicides
Concentration Level	Low
Sampling SOP	Attachment D
Analytical Method/SOP Reference	USEPA SW-846 8151A/M45
Sampler's Name	Windward Field Staff
Field Sampling Organization	Windward Environmental LLC
Analytical Organization	Alpha Analytical
Number of Sampling Locations	116

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method blank	One per every batch, and a minimum of one for every 20 samples	No target compounds > QL	Reanalyze samples, locate source of contamination, correct problems, re-extract associated samples if contaminants are present in method blank.	Justin Benson or Szymon Sus (or alternate analyst), Alpha Analytical	Contamination	Laboratory control limits
LCS	One for every batch of samples up to a maximum batch size of 20 samples	Percent recovery = 30 – 150%	Reanalyze affected samples. Qualify data as needed.	Justin Benson or Szymon Sus (or alternate analyst), Alpha Analytical	Accuracy/bias	Laboratory % recovery control limits
MD	One for every batch of samples up to a maximum batch size of 20 samples	RPD ≤ 30%	Check calculations for errors. Flag data and discuss in narrative.	Justin Benson or Szymon Sus (or alternate analyst), Alpha Analytical	Precision	Laboratory RPD control limit
MS/MSD	1 for every batch of samples up to a maximum batch size of 20 samples	Percent recovery = 30 – 150%, RPD ≤ 30%	Check calculations for errors. Flag data and discuss in narrative.	Justin Benson or Szymon Sus (or alternate analyst), Alpha Analytical	Precision, accuracy/bias	Laboratory RPD control limit and laboratory % recovery control limits

DQI – data quality indicator
LCS – laboratory control sample
MD – matrix duplicate
MS – matrix spike
MSD – matrix spike duplicate
QC – quality control
QL – quantitation limit
RPD – relative percent difference
SOP – standard operating procedure
USEPA – US Environmental Protection Agency

QAPP Worksheet No. 28. QC Samples Table (cont.)

Matrix	Sediment
Analytical Group	VOCs
Concentration Level	Low
Sampling SOP	Attachment D
Analytical Method/SOP Reference	USEPA SW-846 5035A/8260B/M44
Sampler's Name	Windward Field Staff
Field Sampling Organization	Windward Environmental LLC
Analytical Organization	Alpha Analytical
Number of Sampling Locations	66

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method blank	One per extraction batch of 20 samples	No target compounds > QL, no common lab contaminants > 5 x QL	Analysis of the method blank and all associated samples must be performed until the method blank is in control. Report results if sample results > 20 x blank result or sample results ND. If not and still out of control and sufficient sample is available, re-extract and reanalyze samples. If insufficient sample is available, qualify data as needed.	Bethany Silvio or Maria Raposo (or alternate analyst), Alpha Analytical	Contamination	Laboratory control limits
Instrument blank	Once per 12 hours if method blank is not run	No target compounds >QL, no common lab contaminants > 5 x QL	Reanalyze extracts. Qualify data as needed. Report results if sample results > 20 x blank result or sample results ND.	Bethany Silvio or Maria Raposo (or alternate analyst), Alpha Analytical	Accuracy/bias-contamination	Laboratory control limits
LCS	One per extraction batch of 20 samples	Compound-specific (see SOP)	If sufficient sample is available, re-extract and reanalyze samples. If insufficient sample is available, reanalyze extracts. Qualify data as needed.	Bethany Silvio or Maria Raposo (or alternate analyst), Alpha Analytical	Accuracy/bias	Laboratory % recovery control limits

QAPP Worksheet No. 28. QC Samples Table (cont.)

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
MS/MSD	One per extraction batch (20 samples)	Compound-specific(see SOP)	Determine root cause; flag MS/MSD data; discuss in narrative.	Bethany Silvio or Maria Raposo (or alternate analyst), Alpha Analytical	Accuracy/bias, precision	Laboratory % recovery/RPD control limits
Surrogates	Spiked into every sample and QC sample	Compound-specific (see SOP)	Check all calculations for error; ensure that instrument performance is acceptable; recalculate the data and/or reanalyze the extract if either of the above checks reveals a problem. Re-prepare and reanalyze the sample or flag the data as "Estimated Concentration" if none of the above resolves the problem. Re-preparation is not necessary if there is obvious chromatographic interference.	Bethany Silvio or Maria Raposo (or alternate analyst), Alpha Analytical	Accuracy/bias	Laboratory % recovery control limits

DQI – data quality indicator
LCS – laboratory control sample
MS – matrix spike
MSD – matrix spike duplicate
ND – not detected
QC – quality control
QL – quantitation limit
RPD – relative percent difference
SOP – standard operating procedure
USEPA – US Environmental Protection Agency
VOCs – volatile organic carbon

QAPP Worksheet No. 28. QC Samples Table (cont.)

Matrix	Sediment
Analytical Group	General Chemistry – TOC
Concentration Level	Low
Analytical Method/Sampling SOP	Attachment D
SOP Reference	Lloyd Kahn/M25
Sampler's Name	Windward Field Staff
Field Sampling Organization	Windward Environmental LLC
Analytical Organization	Alpha Analytical
Number of Sampling Locations	116

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method blank	1 per extraction batch (20 samples)	No target compounds > RL	Reanalyze affected samples. Qualify data as needed.	Nancy Rose (or alternate analyst), Alpha Analytical	Accuracy/bias-contamination	No target compounds > QL
LCS	1 per extraction batch (20 samples)	75 – 125%	Reanalyze affected samples. Qualify data as needed.	Nancy Rose (or alternate analyst), Alpha Analytical	Accuracy/bias	Laboratory % recovery control limits
MD	1 per extraction batch (20 samples)	RPD ≤ 25%	Reanalyze affected samples. Qualify data as needed.	Nancy Rose (or alternate analyst), Alpha Analytical	Precision	Laboratory RPD control limit
MS	1 per extraction batch (20 samples)	75 – 125%	Repeat analysis once, if the recovery and the LCS (blank spike) is compliant, narrate there may be potential matrix effects on the accuracy or precision of the TOCs results.	Nancy Rose (or alternate analyst), Alpha Analytical	Accuracy/bias, precision	Laboratory % recovery

DQI – data quality indicator
LCS – laboratory control sample
MD – matrix duplicate
MS – matrix spike
QC – quality control
QL – quantitation limit
RL – reporting limit
RPD – relative percent difference
SOP – standard operating procedure
TOC – total organic carbon

QAPP Worksheet No. 28. QC Samples Table (cont.)

Matrix	Sediment
Analytical Group	Grain Size
Concentration Level	Not Applicable
Sampling SOP	Attachment D
Analytical Method/SOP Reference	ASTM D422/M26
Sampler's Name	Windward Field Staff
Field Sampling Organization	Windward Environmental LLC
Analytical Organization	Alpha Analytical
Number of Sampling Locations	116

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
MD	1 per batch of 20 samples	RPD ≤ 20%	Check calculation for errors. If no errors found reanalyze batch. Qualify data as needed.	Nancy Rose (or alternate analyst), Alpha Analytical	Precision	Laboratory RPD control limit

ASTM – American Society for Testing and Materials
DQI – data quality indicator
MD – matrix duplicate
QC – quality control
RPD – relative percent difference
SOP – standard operating procedure

QAPP Worksheet No. 28. QC Samples Table (cont.)

Matrix	Sediment
Analytical Group	TPH – Extractables
Concentration Level	Low
Sampling SOP	Attachment D
Analytical Method/SOP Reference	OQA-QAM-025-02/08/M33
Sampler's Name	Windward Field Staff
Field Sampling Organization	Windward Environmental LLC
Analytical Organization	Alpha Analytical
Number of Sampling Locations	116

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method blank/ instrument blank	1 per extraction batch (20 samples)	No target compounds > QL (5 x MDL)	Reanalyze affected samples. Qualify data as needed.	Susan O'Neil or Julie DeSousa (or alternate analyst), Alpha Analytical	Accuracy/bias-contamination	Laboratory control limits
LCS	1 per extraction batch (20 samples)	Percent recovery = 70 – 120%	Reanalyze affected samples. Qualify data as needed.	Susan O'Neil or Julie DeSousa (or alternate analyst), Alpha Analytical	Accuracy/bias	Laboratory % recovery control limits
MD	1 per extraction batch (20 samples)	RPD ≤ 50% if both samples are > 5 x QL	Reanalyze affected samples. Qualify data as needed.	Reanalyze affected samples. Qualify data as needed.	Precision	Laboratory control limits
MS/MSD	1 per extraction batch (20 samples)	Percent recovery = 70 – 130%, RPD ≤ 30%	Determine root cause; flag MS data; discuss in narrative.	Susan O'Neil or Julie DeSousa (or alternate analyst), Alpha Analytical	Accuracy/bias, precision	Laboratory % recovery/RPD control limits
Surrogates	Spiked into every sample and QC sample.	Percent recovery = 60 – 120%	Check all calculations and instrument performance, recalculate, reanalyze.	Susan O'Neil or Julie DeSousa (or alternate analyst), Alpha Analytical	Accuracy/bias	Laboratory % recovery control limits

DQI – data quality indicator
LCS – laboratory control sample
MD –matrix duplicate
MDL – method detection limit
MS – matrix spike
MSD – matrix spike duplicate
OQA – Office of Quality Assurance
QAM – quality assurance manual
QC – quality control
QL – quantitation limit
RPD – relative percent difference
SOP – standard operating procedure
TPH – total petroleum hydrocarbons

QAPP Worksheet No. 28. QC Samples Table (cont.)

Matrix	Sediment
Analytical Group	TPH – Purgeables
Concentration Level	Low
Sampling SOP	Attachment D
Analytical Method/SOP Reference	USEPA SW-846 8015B Modified and Maine Method 4.2.17/M34
Sampler's Name	Windward Field Staff
Field Sampling Organization	Windward Environmental LLC
Analytical Organization	Alpha Analytical
Number of Sampling Locations	116

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method blank	1 per extraction batch (20 samples)	No target compounds > QL	Reanalyze affected samples. Qualify data as needed.	Susan O'Neil or Julie DeSousa (or alternate analyst), Alpha Analytical	Accuracy/bias-contamination	Laboratory control limits
LCS	1 per extraction batch (20 samples)	Percent recovery = 70 – 120%	Reanalyze affected samples. Qualify data as needed.	Susan O'Neil or Julie DeSousa (or alternate analyst), Alpha Analytical	Accuracy/bias	Laboratory % recovery control limits
MS/MSD	1 per extraction batch (20 samples)	Percent recovery = 80 – 120%, RPD ≤ 30%	Determine root cause; flag MS/MSD data; discuss in narrative.	Susan O'Neil or Julie DeSousa (or alternate analyst), Alpha Analytical	Accuracy/bias, precision	Laboratory % recovery/RPD control limits
Surrogates	Spiked into every sample and QC sample.	Percent recovery = 70 – 130%	Check all calculations and instrument performance, recalculate, reanalyze.	Susan O'Neil or Julie DeSousa (or alternate analyst), Alpha Analytical	Accuracy/bias	Laboratory % recovery control limits

DQI – data quality indicator
LCS – laboratory control sample
MS – matrix spike
MSD – matrix spike duplicate
QC – quality control
QL – quantitation limit
RPD – relative percent difference
SOP – standard operating procedure
TPH – total petroleum hydrocarbons
USEPA – US Environmental Protection Agency

QAPP Worksheet No. 28. QC Samples Table (cont.)

Matrix	Sediment
Analytical Group	TPH – Alkanes
Concentration Level	Low
Sampling SOP	Attachment D
Analytical Method/SOP Reference	USEPA SW-846 8015D/M46, M47, M48
Sampler's Name	Windward Field Staff
Field Sampling Organization	Windward Environmental LLC
Analytical Organization	Alpha Analytical
Number of Sampling Locations	116

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method blank	1 per extraction batch (20 samples)	No target compounds > QL (5 x MDL) or > 10% of any sample result for the same compound	Identify and eliminate source of contamination. Reanalyze affected samples. Qualify data as needed.	Norm Laurianno or Devin Pierel (or alternate analyst), Alpha Analytical	Accuracy/bias – contamination	Laboratory control limits
LCS	1 per extraction batch (20 samples)	Percent recovery = 50 – 130%	Reanalyze affected samples. Qualify data as needed.	Norm Laurianno or Devin Pierel (or alternate analyst), Alpha Analytical	Accuracy/bias	Laboratory % recovery control limits
MS/MSD	1 per extraction batch (20 samples)	Percent recovery = 50 – 150%, RPD ≤ 30%	Determine root cause; flag MS/MSD data; discuss in narrative.	Norm Laurianno or Devin Pierel (or alternate analyst), Alpha Analytical	Accuracy/bias, precision	Laboratory % recovery/RPD control limits
MD	1 per extraction batch (20 samples)	RPD ≤ 30% if both samples are > 5 x QL	Reanalyze affected samples; qualify data as needed.	Norm Laurianno or Devin Pierel (or alternate analyst), Alpha Analytical	Precision	Laboratory RPD control limits

QAPP Worksheet No. 28. QC Samples Table (cont.)

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Surrogates	Spiked into every sample and QC sample	Percent recovery = 50 – 130%	Check all calculations and instrument performance, recalculate. If all only surrogate falls below the 50% limit, the exceedance is noted. If all surrogates are recovered below the 50% limit, re-extract sample and report re-extracted results with the original results.	Norm Laurianno or Devin Pierel (or alternate analyst), Alpha Analytical	Accuracy/bias	Laboratory % recovery control limits

DQI – data quality indicator
LCS – laboratory control sample
MD – matrix duplicate
MS – matrix spike
MSD – matrix spike duplicate
MDL – method detection limit
QC – quality control
QL – quantitation limit
RPD – relative percent difference SOP – standard operating procedure
TPH – total petroleum hydrocarbons
USEPA – US Environmental Protection Agency

QAPP Worksheet No. 28. QC Samples Table (cont.)

Matrix	Sediment
Analytical Group	General Chemistry – AVS/SEM
Concentration Level	Low
Sampling SOP	Attachment D
Analytical Method/SOP Reference	USEPA 821R91100, SW-846 6010C/6020/M13
Sampler's Name	Windward Field Staff
Field Sampling Organization	Windward Environmental LLC
Analytical Organization	CAS, Kelso
Number of Sampling Locations	116

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method blank	1 per extraction batch (20 samples)	No target compounds > QL	Reanalyze affected samples; qualify data as needed.	Jeff Grindstaff (or alternate analyst), CAS, Kelso	Accuracy/bias-contamination	Laboratory control limits
LCS	1 per extraction batch (20 samples)	Percent recovery = 62 – 109% for AVS; compound specific (see SOP for metals)	Reanalyze affected samples; qualify data as needed.	Jeff Grindstaff (or alternate analyst), CAS, Kelso	Accuracy/bias	Laboratory % recovery control limits
MD	1 per extraction batch (20 samples)	RPD ≤ 45% for AVS; RPD ≤ 30% for metals	Reanalyze affected samples; qualify data as needed.	Jeff Grindstaff (or alternate analyst), CAS, Kelso	Precision	Laboratory RPD control limit
MS	1 per extraction batch (20 samples)	Percent recovery = 66 – 117% for AVS, compound specific (see SOP for other metals)	Flag data; discuss in narrative.	Jeff Grindstaff (or alternate analyst), CAS, Kelso	Accuracy/bias	Laboratory % recovery

AVS/SEM – acid volatile sulfide/ simultaneously extracted metals
CAS – Columbia Analytical Services, Inc.
DQI – data quality indicator
LCS – laboratory control sample
MD – matrix duplicate
MS – matrix spike
QC – quality control
QL – quantitation limit
RPD – relative percent difference
SOP – standard operating procedure
USEPA – US Environmental Protection Agency

QAPP Worksheet No. 28. QC Samples Table (cont.)

Matrix	Sediment
Analytical Group	General Chemistry – Total Sulfide
Concentration Level	Low
Sampling SOP	Attachment D
Analytical Method/SOP Reference	USEPA SW-846 9030M/M32
Sampler's Name	Windward Field Staff
Field Sampling Organization	Windward Environmental LLC
Analytical Organization	CAS, Kelso
Number of Sampling Locations	116

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method blank	1 per extraction batch (20 samples)	No target compounds > QL	Reanalyze affected samples; qualify data as needed.	Jeff Grindstaff (or alternate analyst), CAS, Kelso	Accuracy/bias – contamination	Laboratory control limits
LCS	1 per extraction batch (20 samples)	Percent recovery = 51 – 125%	Reanalyze affected samples; qualify data as needed.	Jeff Grindstaff (or alternate analyst), CAS, Kelso	Accuracy/bias	Laboratory % recovery control limits
MD	1 per extraction batch (20 samples)	RPD ≤ 43%	Reanalyze affected samples; qualify data as needed.	Jeff Grindstaff (or alternate analyst), CAS, Kelso	Precision	Laboratory RPD control limit
MS	1 per extraction batch (20 samples)	Percent recovery = 46 – 144%	Flag data; discuss in narrative.	Jeff Grindstaff (or alternate analyst), CAS, Kelso	Accuracy/bias	Laboratory % recovery

CAS – Columbia Analytical Services, Inc.
DQI – data quality indicator
LCS – laboratory control sample
MD – matrix duplicate
MS – matrix spike
QC – quality control
QL – quantitation limit
RPD – relative percent difference
SOP – standard operating procedure
USEPA – US Environmental Protection Agency

QAPP Worksheet No. 28. QC Samples Table (cont.)

Matrix	Sediment
Analytical Group	General Chemistry – Ammonia-N
Concentration Level	Low
Sampling SOP	Attachment D
Analytical Method/SOP Reference	USEPA 350.1 Modified/M27
Sampler's Name	Windward Field Staff
Field Sampling Organization	Windward Environmental LLC
Analytical Organization	CAS, Kelso
Number of Sampling Locations	116

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method blank	1 per extraction batch (20 samples)	No target compounds > QL	Reanalyze affected samples. Qualify data as needed.	Jeff Grindstaff (or alternate analyst), CAS, Kelso	Accuracy/bias – contamination	Laboratory control limits
LCS	1 per extraction batch (20 samples)	Percent recovery = 58 – 131%	Reanalyze affected samples. Qualify data as needed.	Jeff Grindstaff (or alternate analyst), CAS, Kelso	Accuracy/bias	Laboratory % recovery control limits
MD	1 per extraction batch (20 samples)	RPD ≤ 32%	Reanalyze affected samples. Qualify data as needed.	Jeff Grindstaff (or alternate analyst), CAS, Kelso	Precision	Laboratory RPD control limit
MS	1 per extraction batch (20 samples)	66 – 127% recovery	Flag data. Discuss in narrative.	Jeff Grindstaff (or alternate analyst), CAS, Kelso	Accuracy/bias	Laboratory % recovery

CAS – Columbia Analytical Services, Inc.
DQI – data quality indicator
LCS – laboratory control sample
MD – matrix duplicate
MS – matrix spike
QC – quality control
QL – quantitation limit
RPD – relative percent difference
SOP – standard operating procedure
USEPA – US Environmental Protection Agency

QAPP Worksheet No. 28. QC Samples Table (cont.)

Matrix	Sediment
Analytical Group	General Chemistry – Cyanide
Concentration Level	Low
Sampling SOP	Attachment D
Analytical Method/SOP Reference	USEPA SW-846 9012A/M28, M29
Sampler's Name	Windward Field Staff
Field Sampling Organization	Windward Environmental LLC
Analytical Organization	CAS, Kelso
Number of Sampling Locations	116

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method blank	1 per extraction batch (20 samples)	No target compounds > QL	Reanalyze affected samples; qualify data as needed.	Jeff Grindstaff (or alternate analyst), CAS, Kelso	Accuracy/bias – contamination	Laboratory control limits
LCS	1 per extraction batch (20 samples)	Percent recovery = 85 – 115%	Reanalyze affected samples; qualify data as needed.	Jeff Grindstaff (or alternate analyst), CAS, Kelso	Accuracy/bias	Laboratory % recovery control limits
MD	1 per extraction batch (20 samples)	RPD ≤ 20%	Reanalyze affected samples; qualify data as needed.	Jeff Grindstaff (or alternate analyst), CAS, Kelso	Precision	Laboratory RPD control limit
MS	1 per extraction batch (20 samples)	Percent recovery = 75 – 125%	Flag data; discuss in narrative.	Jeff Grindstaff (or alternate analyst), CAS, Kelso	Accuracy/bias	Laboratory % recovery

CAS – Columbia Analytical Services, Inc.
DQI – data quality indicator
LCS – laboratory control sample
MD – matrix duplicate
MS – matrix spike
QC – quality control
QL – quantitation limit
RPD – relative percent difference
SOP – standard operating procedure
USEPA – US Environmental Protection Agency

QAPP Worksheet No. 28. QC Samples Table (cont.)

Matrix	Sediment
Analytical Group	General Chemistry – Total Kjeldahl Nitrogen
Concentration Level	Low
Sampling SOP	Attachment D
Analytical Method/SOP Reference	ASTM D3590-89-02/M30
Sampler's Name	Windward Field Staff
Field Sampling Organization	Windward Environmental LLC
Analytical Organization	CAS, Kelso
Number of Sampling Locations	116

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method blank	1 per extraction batch (20 samples)	No target compounds >QL	Reanalyze affected samples. Qualify data as needed.	Jeff Grindstaff (or alternate analyst), CAS, Kelso	Accuracy/bias – contamination	No target compounds > QL
LCS	1 per extraction batch (20 samples)	Percent recovery = 70 – 108%	Reanalyze affected samples. Qualify data as needed.	Jeff Grindstaff (or alternate analyst), CAS, Kelso	Accuracy/bias	Laboratory % recovery control limits
MD	1 per extraction batch (20 samples)	RPD ≤ 20%	Reanalyze affected samples. Qualify data as needed.	Jeff Grindstaff (or alternate analyst), CAS, Kelso	Precision	Laboratory RPD control limit
MS	1 per extraction batch (20 samples)	Percent recovery = 38 – 138%	Flag data; discuss in narrative.	Jeff Grindstaff (or alternate analyst), CAS, Kelso	Accuracy/bias	Laboratory % recovery

ASTM – American Society for Testing and Materials
CAS – Columbia Analytical Services, Inc.
DQI – data quality indicator
LCS – laboratory control sample
MD – matrix duplicate
MS – matrix spike
QC – quality control
QL – quantitation limit
RPD – relative percent difference
SOP – standard operating procedure

QAPP Worksheet No. 28. QC Samples Table (cont.)

Matrix	Sediment
Analytical Group	General Chemistry – Total Phosphorus
Concentration Level	Low
Sampling SOP	Attachment D
Analytical Method/SOP Reference	USEPA 365.3 Modified/M31
Sampler's Name	Windward Field Staff
Field Sampling Organization	Windward Environmental LLC
Analytical Organization	CAS, Kelso
Number of Sampling Locations	116

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method blank	1 per extraction batch (20 samples)	No target compounds > QL	Reanalyze affected samples. Qualify data as needed.	Jeff Grindstaff (or alternate analyst), CAS, Kelso	Accuracy/bias – contamination	Laboratory control limits
LCS	1 per extraction batch (20 samples)	Percent recovery = 85 – 115%	Reanalyze affected samples. Qualify data as needed.	Jeff Grindstaff (or alternate analyst), CAS, Kelso	Accuracy/bias	Laboratory % recovery control limits
MD	1 per extraction batch (20 samples)	RPD ≤ 20%	Reanalyze affected samples. Qualify data as needed.	Jeff Grindstaff (or alternate analyst), CAS, Kelso	Precision	Laboratory RPD control limit
MS	1 per extraction batch (20 samples)	Percent recovery = 75 – 125%	Flag data; discuss in narrative.	Jeff Grindstaff (or alternate analyst), CAS, Kelso	Accuracy/bias	Laboratory % recovery

CAS – Columbia Analytical Services, Inc.
DQI – data quality indicator
LCS – laboratory control sample
MD – matrix duplicate
MS – matrix spike
QC – quality control
QL – quantitation limit
RPD – relative percent difference
SOP – standard operating procedure
USEPA – US Environmental Protection Agency

QAPP Worksheet No. 29. Project Documents and Records Table

Sample Collection Documents and Records
On-Site Analysis Documents and Records
Field logbook entries
Surface Sediment Collection Form
Corrective Action Reports (Protocol Modification Forms)
Progress report, made daily or as scheduled by the FC to Investigative Organization Project Manager and Task QA/QC Manager
Electronic GPS file
Off-Site Analysis Documents and Records
COC record of sample shipment to analytical laboratory
Corrective Action Reports (Protocol Modification Forms)
Progress reports
Electronic Data Deliverables
Laboratory data report and supporting documentation
Data Assessment Documents and Records
Verification of GPS coordinates of surveyed locations by GIS database manager
Data validation reports
Data usability assessment
Deliverables
Benthic community data report
Benthic invertebrate tissue chemistry data report
Toxicity test data report

QAPP Worksheet No. 29. Project Documents and Records Table (cont.)

This section describes the project data management process tracing the data from their generation to final use and/or storage. All project data, communications, and other information must be documented in a format usable by project personnel.

Project Document Control System

Project documents will be controlled by the QA/QC Manager who will maintain and manage hardcopies and electronic copies of all project-related documents. Electronic copies of all information relating to this project will be maintained on the project network files and backed up at least once daily; access to these files will be limited to authorized project personnel. All project data and information must be documented in a standard format that is usable by all project personnel.

Data Recording

Data generated during this project will be captured electronically (refer to Attachment H). Computer-generated laboratory data will be managed using the laboratory information management system used by subcontracted laboratories, as described in their QA documentation.

Data Quality Assurance Procedures

Windward will monitor the progress of sample collection to verify that samples are collected as planned. The sample collection progress will be monitored through the documentation of samples collected and shipped each day. The participating laboratories must maintain a formal QA plan to which they will adhere and address all data-generating aspects of the daily operations. A policy of continuous improvement will allow all data generation processes to be reviewed and modified as necessary to meet project objectives. Periodic audits of field and laboratory operations will ensure that data collection, documentation, and QC procedures are followed.

Laboratory Data Transmittal

Laboratory data will be managed by the laboratories' information management systems beginning with the sample receiving process. Laboratories are required to provide data reports (sample results, QC summary information, and supporting raw data) including electronic data deliverables (EDDs) within the turnaround times specified in Worksheet No. 30. EDDs will be provided as specified in the Data Management Plan. All EDDs will be checked for errors prior to transmittal.

Data Storage and Retrieval

Completed field forms, field logbooks, photographs, data packages, and electronic files will be transmitted regularly to the QA/QC Manager. Each laboratory will maintain copies of all documents generated, as well as backup files of all electronic data relating to the analysis of samples. Raw data and electronic files of all field samples, QC analyses, and blanks must be archived from the date of generation and maintained by each laboratory for a minimum of 5 years in accordance with the terms of the contract between Windward and the laboratory. Project closeout will be conducted in accordance with contractual guidance. As required by the settlement agreement, all data and other project records will be made available to USEPA. Data transfer to USEPA will include a multi-media EDD that conforms to the 2007 USEPA Region 2 MEDD format. The MEDD will include all qualified and rejected data (including the reported, numerical value for rejected data).

QAPP Worksheet No. 30. Laboratory Services Tables

Chemistry Laboratory Services Table

Matrix	Analytical Group	Concentration Level	Sample Locations/ ID Number	Analytical SOP[a]	Data Package Turnaround Time[b]	Laboratory/ Organization (name and address, contact person and telephone number)	Backup Laboratory/ Organization (name and address, contact person and telephone number)
Tissue	Tissue processing and homogenization	NA	All bioaccumulation sampling locations	M1	4 – 6 weeks	Alpha Analytical 320 Forbes Boulevard Mansfield, MA 02048 Peter Henriksen 508.844.4113	CAS 1317 South 13th Ave. Kelso, WA 98626 Lynda Huckestein 360.577.7222
Tissue	PCBs – congeners	Low	All bioaccumulation sampling locations	M2	30 days	Analytical Perspectives 2714 Exchange Drive Wilmington, NC 28405 Kimberly Mace 910.794.1613, ext. 102	Maxxam Analytics 6740 Campobello Rd. Mississauga, ON L5N 2L8 Mike Challis 800.563.6266, ext. 5790 OR Test America 5815 Middlebrook Pike Knoxville, TN 37921 John Reynolds 865.291.3000
Tissue	PCBs – Aroclors	Low	All bioaccumulation sampling locations	M35	30 days	Alpha Analytical 320 Forbes Boulevard Mansfield, MA 02048 Peter Henriksen 508.844.4113	CAS 1317 South 13th Ave. Kelso, WA 98626 Lynda Huckestein 360.577.7222
Tissue	PCDDs/PCDFs	Low	All bioaccumulation sampling locations	M3	30 days	Analytical Perspectives 2714 Exchange Drive Wilmington, NC 28405 Kimberly Mace 910.794.1613, ext. 102	Maxxam Analytics 6740 Campobello Rd. Mississauga, ON L5N 2L8 Mike Challis 800.563.6266, ext. 5790 OR CAS 19408 Park Row, Suite 320 Houston, TX 77084 Jane Freemyer 281.994.2957

QAPP Worksheet No. 30. Laboratory Services Tables (cont.)

Matrix	Analytical Group	Concentration Level	Sample Locations/ ID Number	Analytical SOP[a]	Data Package Turnaround Time[b]	Laboratory/ Organization (name and address, contact person and telephone number)	Backup Laboratory/ Organization (name and address, contact person and telephone number)
Tissue	PAHs	Low	All bioaccumulation sampling locations	M4	30 – 45 days	Maxxam Analytics 6740 Campobello Rd. Mississauga, ON L5N 2L8 Mike Challis 800.563.6266, ext. 5790	Test America 5815 Middlebrook Pike Knoxville, TN 37921 John Reynolds 865.291.3000
Tissues	Alkylated PAHs	Low	All bioaccumulation sampling locations	M43, M46	30 days	Alpha Analytical 320 Forbes Boulevard Mansfield, MA 02048 Peter Henriksen 508.844.4113	CAS 1317 South 13th Ave. Kelso, WA 98626 Lynda Huckestein 360.577.7222
Tissue	Organochlorine pesticides	Low	All bioaccumulation sampling locations	M5, M6, M7	30 – 45 days	Maxxam Analytics 6740 Campobello Rd. Mississauga, ON L5N 2L8 Mike Challis 800.563.6266, ext. 5790	Test America 880 Riverside Parkway West Sacramento, CA 95605 John Reynolds 865.291.3000
Tissue	Metals	Low	All bioaccumulation sampling locations	M9, M10, M11, M12	30 days	CAS 1317 South 13th Ave. Kelso, WA 98626 Lynda Huckestein 360.430.7733	Analytical Resources, Inc. 4611 South 134th Place, Suite 100 Tukwila, WA 98168 Susan Dunnihoo 206.695.6207
Tissue	Total mercury	Low	All bioaccumulation sampling locations	M14, M15	30 days	Brooks Rand Labs, LLC 3958 6th Ave. NW Seattle, WA 98107 Misty Kennard-Mayer 206.753.6125	CAS 1317 South 13th Ave. Kelso, WA 98626 Lynda Huckestein 360.577.7222
Tissue	Methylmercury	Low	All bioaccumulation sampling locations	M16	30 days	Brooks Rand Labs, LLC 3958 6th Ave. NW Seattle, WA 98107 Misty Kennard-Mayer 206.753.6125	CAS 1317 South 13th Ave. Kelso, WA 98626 Lynda Huckestein 360.577.7222
Tissue	SVOCs	Low	All bioaccumulation sampling locations	M17, M18, M19, M20	30 days	Alpha Analytical 320 Forbes Boulevard Mansfield, MA 02048 Peter Henriksen 508.844.4113	CAS 1317 South 13th Ave. Kelso, WA 98626 Lynda Huckestein 360.577.7222

QAPP Worksheet No. 30. Laboratory Services Tables (cont.)

Matrix	Analytical Group	Concentration Level	Sample Locations/ ID Number	Analytical SOP[a]	Data Package Turnaround Time[b]	Laboratory/ Organization (name and address, contact person and telephone number)	Backup Laboratory/ Organization (name and address, contact person and telephone number)
Tissue	Butyltins	Low	All bioaccumulation sampling locations	M21, M22	30 days	CAS 1317 South 13th Ave. Kelso, WA 98626 Lynda Huckestein 360.577.7222	Analytical Resources, Inc. 4611 South 134th Place, Suite 100 Tukwila, WA 98168 Susan Dunnihoo 206.695.6207
Tissue	General chemistry – lipids	Low	All bioaccumulation sampling locations	M23	30 days	CAS 1317 South 13th Ave. Kelso, WA 98626 Lynda Huckestein 360.577.7222	Alpha Analytical 320 Forbes Boulevard Mansfield, MA 02048 Peter Henriksen 508.844.4113
Tissue	General chemistry – percent moisture	Low	All bioaccumulation sampling locations	M24	30 days	Alpha Analytical 320 Forbes Boulevard Mansfield, MA 02048 Peter Henriksen 508.844.4113	CAS 1317 South 13th Ave. Kelso, WA 98626 Lynda Huckestein 360.577.7222
Sediment	PCBs congeners	Low	All bioaccumulation, SQT, and human exposure sampling locations	M2	30 days	Analytical Perspectives 2714 Exchange Drive Wilmington, NC 28405 Kimberly Mace 910.794.1613, ext. 102	Maxxam Analytics 6740 Campobello Rd. Mississauga, ON L5N 2L8 Mike Challis 800.563.6266, ext. 5790 OR Test America 5815 Middlebrook Pike Knoxville, TN 37921 John Reynolds 865.291.3000
Sediment	PCBs – Aroclors	Low	All bioaccumulation, SQT, and human exposure sampling locations	M35	30 days	Alpha Analytical 320 Forbes Boulevard Mansfield, MA 02048 Peter Henriksen 508.844.4113	CAS 1317 South 13th Ave. Kelso, WA 98626 Lynda Huckestein 360.430.7733

QAPP Worksheet No. 30. Laboratory Services Tables (cont.)

Matrix	Analytical Group	Concentration Level	Sample Locations/ ID Number	Analytical SOP[a]	Data Package Turnaround Time[b]	Laboratory/ Organization (name and address, contact person and telephone number)	Backup Laboratory/ Organization (name and address, contact person and telephone number)
Sediment	PCDDs/PCDFs	Low	All bioaccumulation, SQT, and human exposure sampling locations	M3	30 days	Analytical Perspectives 2714 Exchange Drive Wilmington, NC 28405 Kimberly Mace 910.794.1613, ext. 102	Maxxam Analytics 6740 Campobello Rd. Mississauga, ON L5N 2L8 Mike Challis 800.563.6266, ext. 5790 OR CAS 19408 Park Row, Suite 320 Houston, TX 77084 Jane Freemyer 281.994.2957
Sediment	PAHs	Low	All bioaccumulation, SQT, and human exposure sampling locations	M4	30 days	Maxxam Analytics 6740 Campobello Rd. Mississauga, ON L5N 2L8 Mike Challis 800.563.6266, ext. 5790	Test America 5815 Middlebrook Pike Knoxville, TN 37921 John Reynolds 865.291.3000
Sediment	Alkylated PAHs	Low	All bioaccumulation, SQT, and human exposure sampling locations	M43, M46	30 days	Alpha Analytical 320 Forbes Boulevard Mansfield, MA 02048 Peter Henriksen 508.844.4113	CAS 1317 South 13th Ave. Kelso, WA 98626 Lynda Huckestein 360.577.7222
Sediment	Organochlorine pesticides	Low	All bioaccumulation, SQT, and human exposure sampling locations	M5, M6, M7	30 – 45 days	Maxxam Analytics 6740 Campobello Rd. Mississauga, ON L5N 2L8 Mike Challis 800.563.6266, ext. 5790	Test America 880 Riverside Parkway West Sacramento, CA 95605 John Reynolds 865.291.3000
Sediment	Herbicides	Low	All bioaccumulation, SQT, and human exposure sampling locations	M45	30 days	Alpha Analytical 320 Forbes Boulevard Mansfield, MA 02048 Peter Henriksen 508.844.4113	CAS 1317 South 13th Ave. Kelso, WA 98626 Lynda Huckestein 360.577.7222
Sediment	Metals	Low	All bioaccumulation, SQT, and human exposure sampling locations	M8, M10, M11, M12	30 days	CAS 1317 South 13th Ave. Kelso, WA 98626 Lynda Huckestein 360.577.7222	Analytical Resources, Inc. 4611 South 134th Place, Suite 100 Tukwila, WA 98168 Susan Dunnihoo 206 695 6207

QAPP Worksheet No. 30. Laboratory Services Tables (cont.)

Matrix	Analytical Group	Concentration Level	Sample Locations/ ID Number	Analytical SOP[a]	Data Package Turnaround Time[b]	Laboratory/ Organization (name and address, contact person and telephone number)	Backup Laboratory/ Organization (name and address, contact person and telephone number)
Sediment	Total mercury	Low	All bioaccumulation, SQT, and human exposure sampling locations	M14, M15	30 days	Brooks Rand Labs, LLC 3958 6th Ave. NW Seattle, WA 98107 Misty Kennard-Mayer 206.753.6125	CAS 1317 South 13th Ave. Kelso, WA 98626 Lynda Huckestein 360.577.7222
Sediment	Methylmercury	Low	All bioaccumulation, SQT, and human exposure sampling locations	M16	30 days	Brooks Rand Labs, LLC 3958 6th Ave. NW Seattle, WA 98107 Misty Kennard-Mayer 206.753.6125	CAS 1317 South 13th Ave. Kelso, WA 98626 Lynda Huckestein 360.577.7222
Sediment	SVOCs	Low	All bioaccumulation, SQT, and human exposure sampling locations	M17, M18, M19, M20	30 days	Alpha Analytical 320 Forbes Boulevard Mansfield, MA 02048 Peter Henriksen 508.844.4113	CAS 1317 South 13th Ave. Kelso, WA 98626 Lynda Huckestein 360.577.7222
Sediment	VOCs	Low	All human exposure and shallow SQT sampling locations	M44	30 days	Alpha Analytical 320 Forbes Boulevard Mansfield, MA 02048 Peter Henriksen 508.844.4113	CAS 1317 South 13th Ave. Kelso, WA 98626 Lynda Huckestein 360.577.7222
Sediment	Butyltins	Low	All bioaccumulation, SQT, and human exposure sampling locations	M21, M22	30 days	CAS 1317 South 13th Ave. Kelso, WA 98626 Lynda Huckestein 360.577.7222	Analytical Resources, Inc. 4611 South 134th Place, Suite 100 Tukwila, WA 98168 Susan Dunnihoo 206.695.6207
Sediment	General chemistry – percent moisture	Low	All bioaccumulation, SQT, and human exposure sampling locations	M24	30 days	Alpha Analytical 320 Forbes Boulevard Mansfield, MA 02048 Peter Henriksen 508.844.4113	CAS 1317 South 13th Ave. Kelso, WA 98626 Lynda Huckestein 360.577.7222
Sediment	General chemistry – TOC	Low	All bioaccumulation, SQT, and human exposure sampling locations	M25	30 days	Alpha Analytical 320 Forbes Boulevard Mansfield, MA 02048 Peter Henriksen 508.844.4113	CAS 1317 South 13th Ave. Kelso, WA 98626 Lynda Huckestein 360.577.7222

QAPP Worksheet No. 30. Laboratory Services Tables (cont.)

Matrix	Analytical Group	Concentration Level	Sample Locations/ ID Number	Analytical SOP[a]	Data Package Turnaround Time[b]	Laboratory/ Organization (name and address, contact person and telephone number)	Backup Laboratory/ Organization (name and address, contact person and telephone number)
Sediment	Grain size analysis	NA	All bioaccumulation, SQT, and human exposure sampling locations	M26	30 days	Alpha Analytical 320 Forbes Boulevard Mansfield, MA 02048 Peter Henriksen 508.844.4113	CAS 1317 South 13th Ave. Kelso, WA 98626 Lynda Huckestein 360.577.7222
Sediment	General chemistry – AVS/SEM	Low	All bioaccumulation, SQT, and human exposure sampling locations	M13	30 days	CAS 1317 South 13th Ave. Kelso, WA 98626 Lynda Huckestein 360.577.7222	Alpha Analytical 320 Forbes Boulevard Mansfield, MA 02048 Peter Henriksen 508.844.4113
Sediment	General chemistry – ammonia-N	Low	All bioaccumulation, SQT, and human exposure sampling locations	M27	30 days	CAS 1317 South 13th Ave. Kelso, WA 98626 Lynda Huckestein 360.577.7222	Alpha Analytical 320 Forbes Boulevard Mansfield, MA 02048 Peter Henriksen 508.844.4113
Sediment	General chemistry – cyanide	Low	All bioaccumulation, SQT, and human exposure sampling locations	M28, M29	30 days	CAS 1317 South 13th Ave. Kelso, WA 98626 Lynda Huckestein 360.577.7222	Alpha Analytical 320 Forbes Boulevard Mansfield, MA 02048 Peter Henriksen 508.844.4113
Sediment	General chemistry – total Kjeldahl nitrogen	Low	All bioaccumulation, SQT, and human exposure sampling locations	M30	30 days	CAS 1317 South 13th Ave. Kelso, WA 98626 Lynda Huckestein 360.577.7222	Alpha Analytical 320 Forbes Boulevard Mansfield, MA 02048 Peter Henriksen 508.844.4113
Sediment	General chemistry – total phosphorus	Low	All bioaccumulation, SQT, and human exposure sampling locations	M31	30 days	CAS 1317 South 13th Ave. Kelso, WA 98626 Lynda Huckestein 360.577.7222	Alpha Analytical 320 Forbes Boulevard Mansfield, MA 02048 Peter Henriksen 508.844.4113
Sediment	General chemistry – total sulfide	Low – high	All bioaccumulation, SQT, and human exposure sampling locations	M32	30 days	CAS 1317 South 13th Ave. Kelso, WA 98626 Lynda Huckestein 360.577.7222	Alpha Analytical 320 Forbes Boulevard Mansfield, MA 02048 Peter Henriksen 508.844.4113

QAPP Worksheet No. 30. Laboratory Services Tables (cont.)

Matrix	Analytical Group	Concentration Level	Sample Locations/ ID Number	Analytical SOP[a]	Data Package Turnaround Time[b]	Laboratory/ Organization (name and address, contact person and telephone number)	Backup Laboratory/ Organization (name and address, contact person and telephone number)
Sediment	TPH – extractables	Low	All bioaccumulation, SQT, and human exposure sampling locations	M33	30 days	Alpha Analytical 320 Forbes Boulevard Mansfield, MA 02048 Peter Henriksen 508.844.4113	Test America 777 New Durham Road Edison, NJ 08817 Jamie Capad 732.549.3900
Sediment	TPH – purgeables	Low	All bioaccumulation, SQT, and human exposure sampling locations	M34	30 days	Alpha Analytical 320 Forbes Boulevard Mansfield, MA 02048 Peter Henriksen 508.844.4113	Test America 777 New Durham Road Edison, NJ 08817 Jamie Capad 732.549.3900
Sediment	TPH – alkanes	Low	All bioaccumulation, SQT, and human exposure sampling locations	M46, M47, M48	30 days	Alpha Analytical 320 Forbes Boulevard Mansfield, MA 02048 Peter Henriksen 508.844.4113	Test America 777 New Durham Road Edison, NJ 08817 Jamie Capad 732.549.3900

[a] Reference number from Worksheet No. 23.
[b] Business days from sample receipt.

AVS/SEM – acid volatile sulfide/ simultaneously extracted metals
CAS – Columbia Analytical Services, Inc.
ID – identification
NA – not applicable
PAH – polycyclic aromatic hydrocarbon
PCB – polychlorinated biphenyl
PCDD – polychlorinated dibenzo-*p*-dioxin
PCDF – polychlorinated dibenzofuran
SOP – standard operating procedure
SQT – sediment quality triad
SVOC – semivolatile organic compound
TOC – total organic carbon
TPH – total petroleum hydrocarbons
VOC – volatile organic compounds

QAPP Worksheet No. 30. Laboratory Services Tables (cont.)

Biological Laboratory Services Table

Analysis	Sample Locations/ ID Number	Analytical SOP[a]	Data Package Turnaround Time[b]	Laboratory/ Organization (name and address, contact person and telephone number)
28-day *Hyalella azteca* growth and mortality test	All SQT sampling locations	M37	Approximately 2 months	EnviroSystem P.O. Box 778 One Lafayette Road Hampton, NH 03842 Ken Simon 603.926.3345, ext. 213
10-day *Chironomus dilutus* growth and mortality test	All SQT sampling locations in freshwater zone[c]	M36	Approximately 2 months	EnviroSystem P.O. Box 778 One Lafayette Road Hampton, NH 03842 Ken Simon 603.926.3345, ext. 213
10-day *Ampelisca abdita* mortality test	All SQT sampling locations in estuarine zone[c]	M38	Approximately 2 months	EnviroSystem P.O. Box 778 One Lafayette Road Hampton, NH 03842 Ken Simon 603.926.3345, ext. 213
28-day *Lumbriculus variegatus* bioaccumulation test	All bioaccumulation sampling locations in freshwater zone[d]	M40	Approximately 2 months	EnviroSystem P.O. Box 778 One Lafayette Road Hampton, NH 03842 Ken Simon 603.926.3345, ext. 213
28-day *Neanthes virens* bioaccumulation test	All bioaccumulation sampling locations in estuarine zone[e]	M39	Approximately 2 months	EnviroSystem P.O. Box 778 One Lafayette Road Hampton, NH 03842 Ken Simon 603.926.3345, ext. 213

QAPP Worksheet No. 30. Laboratory Services Tables (cont.)

Analysis	Sample Locations/ ID Number	Analytical SOP[a]	Data Package Turnaround Time[b]	Laboratory/ Organization (name and address, contact person and telephone number)
Benthic invertebrate taxonomy	All SQT sampling locations	M44	Approximately 2 months	EcoAnalysts, Inc. 1420 S Blaine St, Suite 14 Moscow, ID 83843 Dave Langill 208.882.2588, ext. 71

[a] Reference number from Worksheet No. 23.
[b] Business days from sample receipt.
[c] The decision of which of the two toxicity tests to perform will be based on the interstitial salinity (< 5 ppt *Chironomus* and ≥ 5 ppt *Ampelisca*). Interstitial salinity will be measured first in the field for the purpose of determining the appropriate volume of sediment needed for bioaccumulation sampling. Interstitial salinity will also be measured in the laboratory for the final determination of which test organism to use.
[d] Sediments with interstitial salinity < 5 ppt.
[e] Sediments with interstitial salinity ≥ 5 ppt.

QAPP Worksheet No. 31. Planned Project Assessments Table

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment (title and organizational affiliation)	Person(s) Responsible for Responding to Assessment Findings (title and organizational affiliation)	Person(s) Responsible for Identifying and Implementing Corrective Actions (CA) (title and organizational affiliation)	Person(s) Responsible for Monitoring Effectiveness of CA (title and organizational affiliation)
Review of field activities/sampling method compliance	Daily or as scheduled	Internal	Windward	**Tad Deshler** (Investigative Organization Task QA/QC Manager, Windward)	**Thai Do** (Field Coordinator, Windward) or designee	**Thai Do** (Field Coordinator, Windward) or designee	**Tad Deshler** (Investigative Organization Task QA/QC Manager, Windward)
Review of analytical laboratory analysis method compliance, audit reports	As necessary	Internal	Windward	**Susan McGroddy** (Investigative Organization Project Chemist, Windward)	**Peter Henriksen**(Laboratory Project Manager, Alpha Analytical), **Kimberly Mace** (Laboratory Project Manager, Analytical Perspectives), **Misty Kennard-Mayer** (Laboratory Project Manager, Brooks Rand Labs), **Lynda Huckestein** (Laboratory Project Manager, Columbia Analytical Services, Inc.), **Mike Challis** (Laboratory Project Manager, Maxxam Analytics)	**Peter Henriksen** (Laboratory Project Manager, Alpha Analytical), **Kimberly Mace** (Laboratory Project Manager, Analytical Perspectives), **Misty Kennard-Mayer** (Laboratory Project Manager, Brooks Rand Labs), **Lynda Huckestein** (Laboratory Project Manager, Columbia Analytical Services, Inc.), **Mike Challis** (Laboratory Project Manager, Maxxam Analytics)	**Susan McGroddy** (Investigative Organization Project Chemist, Windward)

QAPP Worksheet No. 31. Planned Project Assessments Table (cont.)

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment (title and organizational affiliation)	Person(s) Responsible for Responding to Assessment Findings (title and organizational affiliation)	Person(s) Responsible for Identifying and Implementing Corrective Actions (CA) (title and organizational affiliation)	Person(s) Responsible for Monitoring Effectiveness of CA (title and organizational affiliation)
Review of biological laboratory analysis method compliance	As necessary	Internal	Windward	**Helle Andersen** (Investigative Organization Biological Laboratory Coordinator, Windward)	**Ken Simon** (Laboratory Project Manager, EnviroSystem, Inc), **Dave Langill** (Laboratory Project Manager, EcoAnalysts)	**Ken Simon** (Laboratory Project Manager, EnviroSystem, Inc), **Dave Langill** (Laboratory Project Manager, EcoAnalysts)	**Helle Andersen** (Investigative Organization Biological Laboratory Coordinator, Windward)
Data usability	Once, at the end of the field survey	Internal	Windward	**Tad Deshler** (Investigative Organization Task QA/QC Manager, Windward)	**Thai Do** (FC, Windward) or designee	**Thai Do** (FC, Windward) or designee	**Tad Deshler** (Investigative Organization Task QA/QC Manager, Windward)

QAPP Worksheet No. 32. Assessment Findings and Corrective Action Responses

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings (name, title, organization)	Timeframe of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response (name, title, organization)	Timeframe for Response
On-site review of field activities/ sampling method compliance	Deficiencies will be documented in the field logbook	**Thai Do** (FC, Windward); **Lisa Saban** (Investigative Organization Project Manager, Windward); **Tad Deshler** (Investigative Organization Task QA/QC Manager, Windward); **Bill Potter/Robert Law**, (Project Coordinators, de maximis, inc.); **Alice Yeh/Stephanie Vaughn** (USEPA Project Managers); William Sy (USEPA Project QA Officer)	Immediately	Corrective actions will be documented in the field logbook and Protocol Modification Forms (Attachment B)	**Thai Do** (FC, Windward); **Lisa Saban** (Investigative Organization Project Manager, Windward); **Tad Deshler** (Investigative Organization Task QA/QC Manager, Windward); **Bill Potter/Robert Law** (Project Coordinators, de maximis, inc.); **Alice Yeh/Stephanie Vaughn** (USEPA Project Managers); **William Sy** (USEPA Project QA Officer)	By next field day

QAPP Worksheet No. 32. Assessment Findings and Corrective Action Responses (cont.)

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings (name, title, organization)	Timeframe of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response (name, title, organization)	Timeframe for Response
Internal laboratory audits	Deficiencies will be documented as required by laboratory QA manual	**Laboratories** (Alpha Analytical, Analytical Perspectives, Brooks Rand Labs, Maxxam Analytics, CAS, EnviroSystem, EcoAnalysts) as required by laboratory QA manual	As required by laboratory QA manual	As required by laboratory QA manual	**Laboratories** (Alpha Analytical, Analytical Perspectives, Brooks Rand Labs, Maxxam Analytics, CAS, EnviroSystem, EcoAnalysts) as required by laboratory QA manual If project DQOs are affected: **Tad Deshler** (Investigative Organization Task QA/QC Manager, Windward); **Susan McGroddy** (Investigative Organization Project Chemist, Windward); **Helle Andersen** (Investigative Organization Biological Laboratory Coordinator, Windward)	As required by laboratory QA manual
External laboratory audits by Windward and Paul Dinnel, Marine Resources	Written audit report	**Ken Simon** (Laboratory Project Manager, EnviroSystem, Inc	Major deficiencies communicated orally at exit meeting and written report within 3 weeks	Letter with possible re-audit	**Paul Dinnel** (Auditor and Biological Data Validator, DMR); **Helle Andersen** (Investigative Organization Biological Laboratory Coordinator, Windward); **Tad Deshler** (Investigative Organization Task QA/QC Manager, Windward); **Bill Potter/Robert Law** (Project Coordinators, de maximis, inc.)	One month

QAPP Worksheet No. 33. QA Management Reports Table

Type of Report	Frequency (daily, weekly monthly, quarterly, annually, etc.)	Projected Delivery Date(s)	Person(s) Responsible for Report Preparation (title and organizational affiliation)	Report Recipient(s) (title and organizational affiliation)
Progress report	Daily, or as practicable	Daily, beginning the day after the first field sampling day	**Thai Do** (FC, Windward) or designee	**Lisa Saban** (Investigative Organization Project Manager, Windward); **Tad Deshler** (Investigative Organization Task QA/QC Manager, Windward); **Bill Potter/Robert Law** (Project Coordinators, de maximis, inc.); **Susan McGroddy** (Investigative Organization Project Chemist, Windward); **Helle Andersen** (Investigative Organization Biological Laboratory Coordinator, Windward); **Alice Yeh/Stephanie Vaughn** (USEPA Project Managers); **William Sy** (USEPA Project QA Officer)
Corrective Action Reports (Protocol Modification Forms)	Monthly, or as necessary	Monthly, or as necessary	**Thai Do** (FC, Windward) or designee	**Lisa Saban** (Investigative Organization Project Manager, Windward); **Tad Deshler** (Investigative Organization Task QA/QC Manager, Windward); **Bill Potter/Robert Law** (Project Coordinators, de maximis, inc.); **Susan McGroddy** (Investigative Organization Project Chemist, Windward); **Helle Andersen** (Investigative Organization Biological Laboratory Coordinator, Windward); **Alice Yeh/Stephanie Vaughn** (USEPA Project Managers); **William Sy** (USEPA Project QA Officer)
Data usability report	Once, following the field effort	With data report	**Tad Deshler** (Investigative Organization Task QA/QC Manager)	**Lisa Saban** (Investigative Organization Project Manager, Windward); **Bill Potter/Robert Law** (Project Coordinators, de maximis, inc.); **Alice Yeh/Stephanie Vaughn** (USEPA Project Managers); **William Sy** (USEPA Project QA Officer)
Report on chemistry results	Daily, or as necessary	Daily, or as necessary	**Susan McGroddy** (Investigative Organization Project Chemist, Windward);	**Lisa Saban** (Investigative Organization Project Manager, Windward); **Tad Deshler** (Investigative Organization Task QA/QC Manager, Windward); **Bill Potter/Robert Law** (Project Coordinators, de maximis, inc.); **Alice Yeh/Stephanie Vaughn** (USEPA Project Managers); **William Sy** (USEPA Project QA Officer)

QAPP Worksheet No. 34. Verification (Step I) Process Table

Verification Input	Description	Internal/ External	Responsible for Verification (name, organization)
Field-collected coordinates	All field-collected coordinates will be downloaded daily after completion of sampling activities from the GPS receiver and plotted in the GIS to verify they accurately represent locations that were sampled.	Internal	Linda Marsh, Windward
Sample and laboratory QC	Verify the proper packing, shipping, storage and QC procedures for the tissue samples are conducted.	Internal	Jennifer Parker, Windward
Analytical laboratory data packages	Verify 100% of all manual transcriptions from the raw data. Verify calculations from the raw data. Verify that entry of qualifiers was correct and complete, reported analytes conform to target analytes in QAPP, samples were prepared/analyzed within the holding times specified in the QAPP, the measurement criteria specified in the QAPP were met (and, if not, that appropriate corrective action and notification were taken), and project quantitation limits conformed to the QAPP and that deviations were justified.	External	Denise Shepperd, Trillium
Biological laboratory data packages	Data validation review of test and QA/QC data from the testing laboratory including a 100% check of all data transcribed from the raw data bench sheets to the electronic databases. Note any data gaps or items that were out of compliance with the bioassay protocols. Where appropriate, provide guidance regarding the severity of any out-of-compliance items. Recommend retesting where necessary. A formal report of findings will be prepared.	External	Paul Dinnel, DMR

GIS – geographic information system
QA – quality assurance
QAPP – quality assurance project plan

QAPP Worksheet No. 35. Sampling and Analysis Validation Process Tables

Analytical Validation (Steps IIa and IIb) Process Table

Step IIa/IIb	Validation Input	Description	Responsible for Validation (name, organization)
IIa	Analytical data deliverables	Verify that the required deliverables were provided by the laboratory as specified in the contractual documents.	Jennifer Parker, Windward Environmental/Polly Newbold, ddms
IIa	Field SOPs, field records	Verify conformance to approved sampling and field measurement procedures; ensure that activities met performance criteria; and verify that deviations from procedures or criteria were documented.	Jennifer Parker, Windward Environmental/Polly Newbold, ddms
IIa	Field records, database output	Verify transcription of field data from field forms to database.	Thai Do, Windward Environmental/Polly Newbold, ddms
IIa	Custody records, analytical data reports	Review traceability from sample collection through reporting.	Jennifer Parker, Windward Environmental/Polly Newbold, ddms
IIa	Analytical data reports	Verify reported analytes conform to contractual specifications.	Jennifer Parker, Windward Environmental/Polly Newbold, ddms
IIa	Laboratory SOPs, analytical data reports	Verify conformance to approved preparation and analytical procedures; ensure that measurement performance criteria were met; and verify that deviations from procedures or criteria were documented.	Jennifer Parker, Windward Environmental/Polly Newbold, ddms
IIa	Methods, analytical data reports	Verify that samples were prepared and analyzed within method-specific holding times.	Jennifer Parker, Windward Environmental/Polly Newbold, ddms
IIa	Laboratory EDDs	Verify that EDD conforms to USEPA Region 2 MEDD format.	Peter Henriksen, Alpha Analytical/ Kimberly Mace, Analytical Perspectives/Misty Kennard-Mayer, Brooks Rand Labs/Mike Challis, Maxxam Analytics/Lynda Huckestein, Columbia Analytical Services, Inc.
IIa	Laboratory EDDs, analytical data	Verify loading of EDDs into database against hard-copy analytical reports.	Polly Newbold, ddms

QAPP Worksheet No. 35. Sampling and Analysis Validation Process Tables (cont.)

Analytical Validation (Steps IIa and IIb) Process Table

Step IIa/IIb	Validation Input	Description	Responsible for Validation (name, organization)
	reports, database output		
IIa	Analytical data reports	Verify that the qualifiers applied by the laboratory are defined in the analytical report and are in conformance to the contractual requirements.	Jennifer Parker, Windward Environmental/Polly Newbold, ddms
IIa	Laboratory SOPs, analytical data reports	Verify that the measurement criteria were met for all analyses, and, if not, that appropriate corrective action and notification were taken.	Jennifer Parker, Windward Environmental/Polly Newbold, ddms
IIa	Analytical data reports	Verify that project quantitation limits conformed to the contractual specifications and that any deviations were justified.	Jennifer Parker, Windward Environmental/Polly Newbold, ddms
IIa	Analytical data reports, validation guidance	Validate 100% of the analytical data reports according to the method-specific Region 2 validation SOPs (if available). Qualifiers will be applied based on the criteria in the Region 2 validation SOPs or QAPP, whichever are more stringent. Verify 100% all manual transcriptions from the raw data. Verify calculations from the raw data.	Denise Shepperd, Trillium
IIa	Data validation reports, database output	Verify that entry of qualifiers was correct and complete.	Denise Shepperd, Trillium
IIb	Analytical data reports	Verify reported analytes conform to target analytes in QAPP.	Denise Shepperd, Trillium
IIb	QAPP, analytical data reports	Verify that samples were prepared and analyzed within the holding times specified in the QAPP.	Denise Shepperd, Trillium
IIb	QAPP, analytical data reports	Verify that samples were prepared and analyzed according to the procedures specified in the QAPP.	Denise Shepperd, Trillium

QAPP Worksheet No. 35. Sampling and Analysis Validation Process Tables (cont.)

Analytical Validation (Steps IIa and IIb) Process Table

Step IIa/IIb	Validation Input	Description	Responsible for Validation (name, organization)
IIb	QAPP, analytical data reports	Verify that the measurement criteria specified in the QAPP were met for all analyses, and, if not, that appropriate corrective action and notification were taken.	Denise Shepperd, Trillium
IIb	QAPP, analytical data reports	Verify that project quantitation limits conformed to the QAPP and that deviations were justified.	Denise Shepperd, Trillium
IIb	Analytical data reports, validation guidance	Validate 100% of the analytical data reports according to the measurement performance criteria in the QAPP. Qualifiers will be applied based on the criteria in the QAPP or method-specific Region 2 validation SOPs, whichever is more stringent.	Denise Shepperd, Trillium
IIb	QAPP, analytical data reports, validation guidance	Verify that the qualifiers applied during validation were in conformance with the QAPP and specified validation guidance.	Denise Shepperd, Trillium
IIb	QAPP, data validation reports	Verify that data validation was performed in accordance with the QAPP specifications and that all required peer reviews were conducted. If validation actions deviated from the QAPP specifications and/or regional validation guidance based on professional judgment, verify that rationale was documented.	Jennifer Parker, Windward Environmental/Polly Newbold, ddms

ddms – de maximis Data Management Solutions, Inc.

PT – proficiency testing

QAPP – quality assurance project plan

SOP – standard operating procedure

QAPP Worksheet No. 35. Sampling and Analysis Validation Process Tables (cont.)

Biological Validation Process Table		
Validation Input	**Description**	**Responsible for Validation (name, organization)**
Biological data deliverables	Verify that the required deliverables were provided by the laboratory as specified in the contractual documents	Helle Andersen, Windward Environmental/Polly Newbold, ddms
Field SOPs, field records	Verify conformance to approved sampling and field measurement procedures; ensure that activities met performance criteria; and verify that deviations from procedures or criteria were documented.	Helle Andersen, Windward Environmental/ Polly Newbold, ddms
Field records, database output	Verify transcription of field data from field forms to database.	Thai Do, Windward Environmental/ Polly Newbold, ddms
Custody records, analytical data reports	Review traceability from sample collection through reporting.	Helle Andersen, Windward Environmental/ Polly Newbold, ddms
Biological data reports	Verify reported biological data conform to contractual specifications.	Helle Andersen, Windward Environmental/ Polly Newbold, ddms
Laboratory SOPs, analytical data reports	Verify conformance to approved testing procedures; ensure that performance criteria were met; and verify that deviations from procedures or criteria were documented.	Helle Andersen, Windward Environmental/ Polly Newbold, ddms
Methods, analytical data reports	Verify that samples were tested within the required holding times.	Helle Andersen, Windward Environmental/ Polly Newbold, ddms
Laboratory EDDs, biological data reports, database output	Verify loading of EDDs into database against hard-copy analytical reports.	Helle Andersen, Windward Environmental/ Polly Newbold, ddms
Analytical data reports, validation guidance	Data validation review of test and QA/QC data from the testing laboratory including a 100% check of all data transcribed from the raw data bench sheets to the electronic databases. Note any data gaps or items that were out of compliance with the bioassay protocols. Where appropriate, provide guidance regarding the severity of any out-of-compliance items. Recommend retesting where necessary.	Paul Dinnel, Dinnel Marine Resources

QAPP Worksheet No. 35. Sampling and Analysis Validation Process Tables (cont.)

Biological Validation Process Table		
Validation Input	**Description**	**Responsible for Validation (name, organization)**
QAPP, data validation reports	Verify that data validation was performed in accordance with the QAPP specifications and that all required peer reviews were conducted. If validation actions deviated from the QAPP specifications and/or regional validation guidance based on professional judgment, verify that rationale was documented.	Helle Andersen, Windward Environmental/ Polly Newbold, ddms

ddms – de maximis Data Management Solutions, Inc.
EDD – electronic data deliverable
QAPP – quality assurance project plan
QA/QC – quality assurance/quality control
SOP – standard operating procedure

QAPP Worksheet No. 36. Validation Summary

Analytical Validation (Steps IIa and IIb) Summary Table

Step IIa/IIb	Matrix	Analytical Group	Concentration Level	Validation Criteria[a]	Data Validator (title and organizational affiliation)
IIa	Tissue, sediment	PCBs – congeners[b]	Low	Region 2 validation SOP HW-46, modified for method	Denise Shepperd, Principal Validator, Trillium
IIb	Tissue, sediment	PCBs – congeners[b]	Low	QAPP Worksheets 12, 15, 19, and 24	Denise Shepperd, Principal Validator, Trillium
IIa	Tissue, sediment	PCBs – Aroclors[c]	Low	Region 2 validation SOP HW-45	Denise Shepperd, Principal Validator, Trillium
IIb	Tissue, sediment	PCBs – Aroclors[c]	Low	QAPP Worksheets 12, 15, 19, and 24	Denise Shepperd, Principal Validator, Trillium
IIa	Tissue, sediment	PCDDs/PCDFs[b]	Low	Region 2 validation SOP HW-25	Denise Shepperd, Principal Validator, Trillium
IIb	Tissue, sediment	PCDDs/PCDFs[b]	Low	QAPP Worksheets 12, 15, 19, and 24	Denise Shepperd, Principal Validator, Trillium
IIa	Tissue, sediment	Organochlorine pesticides[b]	Low	QAPP Worksheets 12, 15, 19, and 24	Denise Shepperd, Principal Validator, Trillium
IIb	Tissue, sediment	Organochlorine pesticides[b]	Low	QAPP Worksheets 12, 15, 19, and 24	Denise Shepperd, Principal Validator, Trillium
IIa	Sediment	Herbicides[c]	Low	Region 2 validation SOP HW-17	Denise Shepperd, Principal Validator, Trillium
IIb	Sediment	Herbicides[c]	Low	QAPP Worksheets 12, 15, 19, and 24	Denise Shepperd, Principal Validator, Trillium
IIa	Tissue, sediment	PAHs [b]	Low	QAPP Worksheets 12, 15, 19, and 24	Denise Shepperd, Principal Validator, Trillium
IIb	Tissue, sediment	PAHs [b]	Low	QAPP Worksheets 12, 15, 19, and 24	Denise Shepperd, Principal Validator, Trillium
IIa	Tissue, sediment	Alkylated PAHs[c]	Low	QAPP Worksheets 12, 15, 19, and 24	Denise Shepperd, Principal Validator, Trillium
IIb	Tissue, sediment	Alkylated PAHs[c]	Low	QAPP Worksheets 12, 15, 19, and 24	Denise Shepperd, Principal Validator, Trillium

QAPP Worksheet No. 36. Validation Summary (cont.)

Analytical Validation (Steps IIa and IIb) Summary Table

Step IIa/IIb	Matrix	Analytical Group	Concentration Level	Validation Criteria[a]	Data Validator (title and organizational affiliation)
IIa	Tissue, sediment	Metals[c]	Low	Region 2 validation SOP HW-2	Denise Shepperd, Principal Validator, Trillium
IIb	Tissue, sediment	Metals[c]	Low	QAPP Worksheets 12, 15, 19, and 24	Denise Shepperd, Principal Validator, Trillium
IIa	Sediment	TPH[c]	Low	QAPP Worksheets 12, 15, 19, and 24	Denise Shepperd, Principal Validator, Trillium
IIb	Sediment	TPH[c]	Low	QAPP Worksheets 12, 15, 19, and 24	Denise Shepperd, Principal Validator, Trillium
IIa	Sediment	General chemistry[c]	Low	QAPP Worksheets 12, 15, 19, and 24	Denise Shepperd, Principal Validator, Trillium
IIb	Sediment	General chemistry[c]	Low	QAPP Worksheets 12, 15, 19, and 24	Denise Shepperd, Principal Validator, Trillium
IIa	Tissue, sediment	Total mercury[c]	Low	QAPP Worksheets 12, 15, 19, and 24	Denise Shepperd, Principal Validator, Trillium
IIb	Tissue, sediment	Total mercury[c]	Low	QAPP Worksheets 12, 15, 19, and 24	Denise Shepperd, Principal Validator, Trillium
IIa	Tissue, sediment	Methylmercury[c]	Low	QAPP Worksheets 12, 15, 19, and 24	Denise Shepperd, Principal Validator, Trillium
IIb	Tissue, sediment	Methylmercury[c]	Low	QAPP Worksheets 12, 15, 19, and 24	Denise Shepperd, Principal Validator, Trillium
IIa	Tissue, sediment	SVOCs[c]	Low	Region 2 validation SOP HW-22	Denise Shepperd, Principal Validator, Trillium
IIb	Tissue, sediment	SVOCs[c]	Low	QAPP Worksheets 12, 15, 19, and 24	Denise Shepperd, Principal Validator, Trillium
IIa	Sediment	VOCs[c]	Low	Region 2 validation SOP HW-24	Denise Shepperd, Principal Validator, Trillium
IIb	Sediment	VOCs[c]	Low	QAPP Worksheets 12, 15, 19, and 24	Denise Shepperd, Principal Validator, Trillium

QAPP Worksheet No. 36. Validation Summary (cont.)

Analytical Validation (Steps IIa and IIb) Summary Table

Step IIa/IIb	Matrix	Analytical Group	Concentration Level	Validation Criteria[a]	Data Validator (title and organizational affiliation)
IIa	Tissue, sediment	Butyltins[c]	Low	QAPP Worksheets 12, 15, 19, and 24	Denise Shepperd, Principal Validator, Trillium
IIb	Tissue, sediment	Butyltins[c]	Low	QAPP Worksheets 12, 15, 19, and 24	Denise Shepperd, Principal Validator, Trillium
IIa	Sediment	Particle size[c]	NA	QAPP Worksheets 12, 15, 19, and 24	Denise Shepperd, Principal Validator, Trillium
IIb	Sediment	Particle size[c]	NA	QAPP Worksheets 12, 15, 19, and 24	Denise Shepperd, Principal Validator, Trillium
IIa	Tissue	Lipids[c]	Low	QAPP Worksheet Nos. 12, 15, 19, and 24	Denise Shepperd, Principal Validator, Trillium
IIb	Tissue	Lipids[c]	Low	QAPP Worksheet Nos. 12, 15, 19, and 24	Denise Shepperd, Principal Validator, Trillium
IIa	Tissue, sediment	Percent moisture[c]	Low	QAPP Worksheet Nos. 12, 15, 19, and 24	Denise Shepperd, Principal Validator, Trillium
IIb	Tissue, sediment	Percent moisture[c]	Low	QAPP Worksheet Nos. 12, 15, 19, and 24	Denise Shepperd, Principal Validator, Trillium

[a] Validation follows the USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review (USEPA 1999), USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review (USEPA 2002), and Region 2 modifications to the extent they are applicable. Validation includes professional judgment where appropriate and necessary.

[b] All data packages will be submitted for full validation (USEPA Level 4)

[c] One SDG or 20% of the data (whichever is greater) will be submitted for full validation and the remaining SDGs will be submitted for reduced validation (USEPA Level 2).

OC – organic carbon
PAH – polycyclic aromatic hydrocarbon
PCB – polychlorinated biphenyl
QAPP – quality assurance project plan
SDG – sample delivery group
SOP – standard operating procedure
SVOC – semivolatile organic compound
TOC – total organic carbon
USEPA – US Environmental Protection Agency

QAPP Worksheet No. 36. Validation Summary (cont.)

Biological Validation Summary Table

Test	Validation Criteria	Data Validator (title and organizational affiliation)
10-day *Chironomus dilutus* mortality and growth	QAPP Worksheet No. 11 (Table 11-1)	Paul Dinnel, Principal Validator, Dinnel Marine Resources
28-day *Hyalella azteca* mortality and growth	QAPP Worksheet No. 11 (Table 11-1)	Paul Dinnel, Principal Validator, Dinnel Marine Resources
10-day *Ampelisca abdita* mortality	QAPP Worksheet No. 11 (Table 11-1)	Paul Dinnel, Principal Validator, Dinnel Marine Resources
28-day *Neanthes virens* bioaccumulation	QAPP Worksheet No. 11 (Table 11-2)	Paul Dinnel, Principal Validator, Dinnel Marine Resources
28-day *Lumbriculus variegatus* bioaccumulation	QAPP Worksheet No. 11 (Table 11-2)	Paul Dinnel, Principal Validator, Dinnel Marine Resources

QAPP – quality assurance project plan

QAPP Worksheet No. 37. Usability Assessment

Summarize the usability assessment process and all procedures, including interim steps and any statistics, equations, and computer algorithms that will be used:

The benthic invertebrate and surface sediment sampling effort will include chemical analysis of invertebrate tissue and sediment, toxicity testing, and benthic community analysis. All observations made during the field effort will be considered usable as long as they were made according to the methods described in the applicable SOPs (Worksheet No. 21). Any deviations from the SOPs will be documented appropriately in the field logbook and on the Protocol Modification Form (Attachment A) and also approved by USEPA or its authorized representative.

The third-party independent validator will validate all laboratory data in accordance with the protocols described in Worksheet No. 36. The Project QA Manager, in conjunction with the project team, will determine whether the analytical data meet the requirements for use in making decisions related to further actions at the site.

Describe the evaluative procedures used to assess overall measurement error associated with the project:

During the biological and analytical data validation process, the validator will use information confirming sample identification; sample preparation; analysis within holding time; instrument calibration data; and results of QC samples designed to assess blank contamination, analytical precision, and accuracy to identify any limitations in data use and, if known, data bias. The validator will apply qualifiers as needed to reflect any limitations on the use of specific data points and prepare a report detailing the information reviewed, data limitations, and overall usability. Patterns of data use limitations or anomalies that become apparent during the validation process will be reviewed with the Project QA Manager and the appropriate laboratory. Data that do not meet the quality acceptance limits of Worksheet No. 28, quality levels of Worksheet No. 15, analytical performance criteria specified in Worksheet No. 12, or toxicity or bioaccumulation test quality indicators presented on Worksheet No. 14 will be clearly identified in the database so data users are aware of any limitations associated with data usability. Details of the problems identified during data validation and the bias in the data will be provided in the associated validation memorandum.

Identify the personnel responsible for performing the usability assessment:

Data validation will be performed by an independent third-party validator (DMR, Trillium) under the supervision of the Project QA Coordinator. The usability assessment will be performed jointly by the Windward and CPG project teams and will include input by field personnel, QA staff, and project management.

Describe the documentation that will be generated during usability assessment and how usability assessment results will be presented so that they identify trends, relationships (correlations), and anomalies:

The documentation generated during data validation will include a data validation report that describes the information reviewed (as

QAPP Worksheet No. 37. Usability Assessment (cont.)

well as the results of this review) and provides a recommendation on overall data usability and limitations on specific data points. The validation report and associated validation worksheets will provide information on the samples included in the review and the date that were collected, and the condition of samples when received at the laboratory and any discrepancies noted during the receiving process. Additional information specifically pertaining to the analytical data validation will include verification of sample preparation and analysis within the method-specified holding time; instrument calibration information; review of associated QC analyses including blanks, laboratory control samples, matrix spikes, and field and/or laboratory duplicates; and verification of selected reported values from raw data. As a result of this review, standard qualifiers will be entered into the database so that data users can readily identify any limitations associated with a specific data point. Additional information specifically pertaining to the biological data validation will include the toxicity and bioaccumulation test initiations were within the holding time; and the use of standard QA/QC procedures including a negative control, a positive control, and measurement of water quality during testing.

The assessment of analytical data usability will be performed using current USEPA Region 2 data validation guidance and the assessment of biological data usability will be performed using USEPA and ASTM acceptability guidelines. The results of the data usability assessment will be summarized in the final project report. The following items will be assessed and conclusions drawn based on their results:

Holding Time: All sample data will be checked to verify that both sample preparation and analysis were performed within the method-required holding time.

Calibration: Data associated with instrument calibration and verification of calibration will be reviewed to confirm that all data were generated using properly calibrated instrumentation.

Accuracy/Bias Contamination: Results for all field blanks, trip blanks (when relevant), laboratory method blanks, and instrument calibration blanks will be checked against performance criteria specified in Worksheet No. 28; results for analytes that exceed the criteria will be identified, and the impact on field sample data will be assessed. Data will be summarized by type of blank.

Accuracy/Bias Overall: Reported values of laboratory control samples, performance samples, and matrix spikes will be evaluated against the spiked or certified concentration, and the percent recovery will be calculated and compared to the criteria specified in Worksheet No. 28. The percent recovery information will be used to assess the bias associated with the analysis. Recovery for matrix spikes in conjunction with the recovery reported for performance samples and laboratory control samples will provide information on the impact of the sample matrix on specific analyses. Average recoveries will be calculated and reported by analyte for each type of QC sample.

Precision: Results of the relative percent difference (RPD) will be calculated for each analyte in laboratory and field duplicates. These RPDs will be checked against measurement performance criteria presented on Worksheet No. 28; RPDs that exceed the stated criteria will be identified. In addition, the combined RPD of each analyte will be averaged across duplicate pairs for which the original and duplicate values are both greater than the quantitation limit (QL); and a combined overall RPD average will be determined for each analyte in both laboratory and field duplicates. This information will be used to draw conclusions about the precision of the analyses and, for field duplicates, the precision of sampling and analysis. Any limitations on the use of the data will

QAPP Worksheet No. 37. Usability Assessment (cont.)

also be described.

Sensitivity: Reporting limits will be checked against the criteria and QLs presented on Worksheet No. 15. Limitations on the use of the data and conclusions about the sensitivity of the analysis will be reported.

Representativeness: A review of field records will be used to confirm that sample collection and handling was performed in a manner that conformed to the designated SOP. Similarly, laboratory preparation procedures will be reviewed during validation to ensure that a representative sample was selected for analysis. Any deviations or modifications to field or laboratory procedures that might impact the representativeness of the sample will be discussed in the project final report.

Comparability: The sampling and analytical procedures that will be used in this program have been selected to ensure that the resulting data will be comparable to data from similar programs conducted previously or that will be conducted in the future. Any modifications or deviations from stated procedures that might impact data comparability will be addressed in the project final report.

Completeness: Completeness for the analytical program will be calculated as the number of data points that are accepted as usable based on the validation process divided by the total number of data points for each analysis. Completeness will be reported for each analytical category, and an overall value will be reported. As shown in Worksheet No. 12, the analytical completeness goal is ≥ 90%. Completeness for the field program will be calculated as the number of samples successfully collected compared to the total number proposed in this QAPP. The completeness goal for the field sampling program is ≥ 95%. The usability assessment will also evaluate the effects of elevated detection limits, rejected data, and qualified data on the risk assessments.

References

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Attachment A: Protocol Modification Form

Project Name and Number: _____

Material to be Sampled: _____

Measurement Parameter: _____

Standard Procedure for Field Collection & Laboratory Analysis (cite reference):

Reason for Change in Field Procedure or Analysis Variation: _____

Variation from Field or Analytical Procedure: _____

Special Equipment, Materials or Personnel Required: _____

Initiator's Name: _____ Date: _____

Project Manager: _____ Date: _____

QA Manager: _____ Date: _____

USEPA Authority: _____ Date: _____

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Attachment B: SOP—Locating Sample Points Using a Hand-Held Global Positioning System (GPS)

I. Purpose

The purpose of this procedure is to provide reference information regarding the collection and documentation of sample coordinates for the Lower Passaic River Study Area (LPRSA) remedial investigation/feasibility study (RI/FS) using a global positioning system (GPS).

II. Definition

GPS provides navigation and positioning information from a constellation of GPS satellites, operated by the US Department of Defense. The system includes a control station and five monitoring locations that track each satellite. Information received by the monitoring stations is used to calculate satellite orbits and update the information sent to receivers. Satellite signals can be received by any GPS receiver on land or water or in the air. The system incorporates a minimum of 24 satellites, which are positioned around the world such that six satellites are available at a given location, 24 hours a day. The LPRSA RI/FS will use a hand-held GPS unit to collect and record sampling location coordinates. The signals received by the hand-held GPS will produce locations with sub-meter accuracy.

III. Equipment and Supplies

- A hand-held differential global positioning system (DGPS) unit or equivalent model such as the Trimble® ProXH™, with sub-foot accuracy
- An additional DGPS unit with equivalent accuracy as the primary unit (described above) to be carried as a back-up to the Trimble® unit in the case of malfunction or loss (if necessary, the back-up GPS unit will only be used temporarily until the primary unit can be replaced or repaired).
- AA or AAA batteries depending on the device
- USB port cable to download information

IV. Field Procedure

A. Power on the GPS unit and wait several minutes for the GPS to locate the initial position via satellite. Confirm that the date and time are correct.

B. Locate the coordinate system information in the main menu and verify the following settings:

1. Units = Feet
2. Coordinate system = New Jersey State Plane (easting and northing)
3. Map datum = NAD83
4. North reference = Magnetic north (Magnetic north will be used for navigational purposes; however, either magnetic or true north can be used to collect fixed coordinates. The north reference setting will be recorded in the field notebook.)

C. Confirm that the background map is set to North America. Record the date, time, and all relevant coordinate system information in the field notebook.

D. Once the unit has acquired the initial position and has indicated that it is ready, follow directions on the GPS to begin collecting sample coordinates.

E. At each sampling location, allow the GPS to receive satellite data for at least one minute before recording the sampling location. A minimum of three satellites is required for a three-dimensional reading, but four satellites are preferred. Save the location information at each sampling location. Record the date, time, and easting/northing (NAD 83 New Jersey State Plane) in feet for each location in the field notebook. Readings will be stored in the GPS unit for easy downloading and also to reduce error.

F. The manufacturer's user's manual will be reviewed and referenced to address technical difficulties and/or malfunctions with the unit.

V. Quality Control

The GPS has quality control features within the system that maintain reliable readings. The GPS will indicate the number of satellites available, the strength of each satellite signal and will not display coordinates for a given location if there is not a sufficient number of satellites available to take an accurate measurement. The GPS will also make sure that the satellite geometry is able to account for the three-dimensional position. The GPS averages data from satellites over time, thus waiting at least one minute before recording coordinates at each sampling location will provide a more accurate reading. To ensure the accuracy of the navigation system, a checkpoint will be located at a known point, such as a pier face, dock, piling, or similar structure that is accessible by the sampling vessel. At the beginning and end of each day, the vessel will be stationed at the check point, a GPS position reading will be taken, and the reading will be compared with the known land -survey coordinates. The two position readings should agree, within the limits of survey vessel operational mobility, to within 1 ft.

Attachment C: SOP—Locating Sample Points Using a Boat-Mounted Global Positioning System (GPS)

I. Purpose

The purpose of this procedure is to define the Standard Operating Procedure (SOP) for the documentation of sampling locations and for positioning vessels using a global positioning system (GPS) at the Lower Passaic River Restoration Project Superfund Site for boat-based field operations. This is based on Standard Operating Procedure (SOP) 2 of FSP 2 (Malcolm Pirnie et al. 2006). Positioning will be conducted to locate the vessel(s) with sufficient accuracy and precision to meet project objectives during the benthic invertebrate sampling activities.

This SOP describes the equipment, field procedures, materials, and documentation procedures necessary to position fishing vessels. Specific information regarding proposed fish sampling locations is provided in the QAPP.

This SOP may change depending upon field conditions, equipment limitations, or limitations imposed by the procedure. Substantive modification to this SOP shall be approved in advance by the FC, CPG, and the USEPA Remedial Project Manager.

II. Procedures

Unless otherwise indicated, sampling activities described in this QAPP will be conducted from a vessel. In accordance with procedures outlined below, these vessels must be properly positioned and their position recorded before each activity can begin.

A. Equipment List

The following equipment list contains materials which may be needed in carrying out the procedures contained in this SOP. Not all equipment listed below may be necessary for a specific activity. Additional equipment may be required, pending field conditions.

- Personal protective equipment (PPE) and other safety equipment, as required by the health and safety plan (Attachment L)
- Vessel(s) adequate for Newark Bay conditions
- 25 watt marine VHF radio
- Navigation charts and QAPP sampling location figure
- Differential global positioning system (DGPS) receivers (or equivalent model) with an accuracy of +/-1 foot
- DGPS external antennas
- Equipment user manuals
- Table of target sampling location coordinates
- Assorted nautical equipment (e.g., anchors, lines, personal flotation devices)
- Field logbook and field forms
- Electronic wireless recording device (e.g., laptop)
- Permanent marker or grease pencil

B. Positioning Vessel

This section gives the step-by-step procedures for vessel positioning. Observations made during vessel positioning should be recorded on the field forms, and/or logbook, as appropriate.

A DGPS will be used to establish locations during implementation of activities specified in the QAPP. DGPS units will be required: one on board the vessel with a receiving antenna to be aligned with the deployment of the sampling apparatus, and the other at a known fixed location (monument or temporary benchmark) to provide corrections to the standard GPS signal.

While this SOP provides general guidance and procedural steps, personnel performing positioning activities also should follow the appropriate sections of equipment user's manuals and have the manuals available for reference at all times.

The following procedures describe the steps to establish position at a location, as well as the steps to adjust the positioning for collection of additional fish sampling locations.

1. Establishing a Position at a Location

   a. Preliminary Activities

      - Obtain the appropriate field form(s). Complete the field logbook.
      - Obtain the target sampling locations. For the sampling activities, these locations will have been selected prior to commencement of field activities, as described in the QAPP. The location of each target sampling location will be established in the New Jersey State Plane Coordinate System with respect to the North American Datum of 1983 (NAD83).
      - Enter coordinates for the locations into the DGPS unit that will be on board the vessel as a waypoint.

   b. Field Activities

      - Establish a DGPS base station over a shore-based marker prior to sampling operations. The operation and horizontal/vertical accuracy of the vessel mounted DGPS will be verified at another shore-based marker by recording observed horizontal and vertical (XYZ) data and comparing these data to the published XYZ data for a given point. After initial DGPS system verification, a temporary benchmark may be established at a location convenient to the vessel to facilitate daily DGPS system performance verification. DGPS system performance verification will be conducted twice per day and documented in the log book and vessel data logger. The horizontal and vertical accuracy will be compared to shore-based markers to verify performance.
      - Verify receiving antenna is properly aligned with the sampling device.
      - Identify and approach actual sampling locations by using data from the DGPS unit in the navigation mode. The navigation mode provides information on heading, distance remaining, and time remaining. This

information is based on the selected waypoint location and the present location of the vessel.

- Anchor the vessel adjacent to the planned location, if desired.
- Once the vessel is on location and secured, note the coordinates from the DGPS unit and check the coordinates to verify that the vessel is within the pre-determined range of the target location. If not acceptable, adjust the vessel's location, and recheck the position. Repeat this process until the vessel's position is within acceptable range of the target. Record the final coordinates on the appropriate field form.
- Once the coordinates are acceptable, perform activity at the location. Record final location coordinates on the appropriate form. Plot locations onto a master chart or use computer-based, real-time software to verify location.
- At the end of the sampling day, check the data loaded onto the DGPS units to verify the existence of coring locations where data were collected.

III. Calibration, Maintenance and Use of Field Instruments

Prior to use, the DGPS unit will be inspected in accordance with Worksheet No. 22 of this QAPP. DGPS unit will be calibrated in accordance with Worksheet No. 22 of this QAPP, appropriate sections of the equipment user's manual, and as described in of this SOP. Maintenance and use of DGPS units should follow the appropriate sections of the equipment user's manual. Field personnel will have the manual available for reference. Equipment inspection and maintenance will be recorded in the logbook. Despite virtually worldwide, 24-hour coverage, technical difficulties with GPS satellites can still occur. In the event of system-wide or other long-term problems with GPS (e.g., satellite failures), vessel positioning will be achieved using land-based methods. If a land-based method is selected, Attachment B: Locating Sample Points Using a Hand-Held Global Positioning System (GPS) will be used.

IV. Quality Assurance

QA activities for positioning procedures include verification of the sample location by comparing the target coordinates specified in the QAPP with coordinates entered into the DGPS, and by plotting the coordinates on a master chart.

V. Documentation

Detailed positioning data will be recorded on the appropriate field. In addition, the following information will be recorded in a logbook (at a minimum):

- Notes on sampling location;
- Equipment calibration information; and
- Summary of vessel activities.

VI. Reference

Malcolm Pirnie, Earth Tech, Battelle. 2006. Lower Passaic River Restoration Project. Draft field sampling plan. Volume 2. Prepared for US Environmental Protection Agency, US Army Corps of Engineers, and New Jersey Department of Transportation/Office of Maritime Resources. Malcolm Pirnie, Inc., White Plains, NY; Earth Tech, Inc., Bloomfield, NJ; Battelle, Stony Brook, NY.

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Attachment D: SOP—Collection and Processing of Sediment Grab Samples

I. Purpose

A. This standard operating procedure (SOP) describes the collection and processing of sediment grab samples for the Lower Passaic River Restoration Project and is based on SOP 34 of the field sampling plan (Malcolm Pirnie et al. 2006). Grab samples will be collected for chemical, toxicological, and biological (i.e., benthic community) analyses as well as analysis of tissue from laboratory-based bioaccumulation testing.

II. Definitions

A. No specific terms have been identified as requiring definitions.

III. Supplies and Equipment

The following will be needed to collect sediment grab samples:

1. Grab sampler (type will depend on river bottom conditions and sampling needs): a 0.2-m^2 power grab or a 0.5-m^2 Ponar grab (for the upper reaches of the LPRSA). Examples of grab samplers covered by the SOP include: Young-modified van Veen, van Veen, Smith-McIntyre, Eckman, Shipek, and Petersen.
2. Extra weights for the grab sampler
3. Sampling vessel, with a fathometer, capable of deploying grab apparatus with sufficient room for all aspects of grab sampling (e.g., homogenization, sieving, cleaning). Sufficient room must also be available for the storage of collected samples
4. Appropriate winch and cable to deploy grab sampler in deep waters
5. Wooden base or stand for grab sampler
6. Bucket with pour spout
7. 2.54-cm-diameter syringe
8. Sieve table with tube
9. Sieves, mesh size 0.5 mm and 1 mm
10. Sample containers: plastic wide-mouth jars in various sizes for infauna, glass or plastic jars with Teflon®-lined screw caps for chemistry and grain size, or as specified in the quality assurance project plan (QAPP)
11. Squirt bottles
12. Funnels
13. Tape: electrical and Teflon® tape for sealing sample jar lids, and clear packing tape for securing/protecting the computer-generated barcode labels
14. Pencils
15. Plastic ruler
16. Reagents

    37 to 40% solution of formaldehyde (100% formalin)

    Borax (to buffer the formalin)

17. Solvents for cleaning equipment between stations and other sampling equipment as listed in Attachment E: SOP—Procedure to Decontaminate Sampling Equipment (Section III)
18. Personal protective equipment (PPE)
19. Weighted demarcated line
20. Refractometer

IV. Procedures

A. Collection of Benthic Sediment Samples

1. Samples should be collected upstream from the boat's engine or any other machinery that may release exhaust, fumes, or oil into the sample. Once the vessel is at the sampling station, all engines should be turned off. The boat captain, or designee, will determine the depth of the sampling station using a fathometer (or weighted demarcated line). If the sampling stations are located within a short distance of each other, then the most downstream sample, considering the tide, should be collected first to avoid contamination from disturbance and resuspension of sediment due to sampling activities. Sampling in areas of aquatic vegetation, where macrophyte roots or other vegetation might inhibit sample collection, should be avoided. Station coordinates will be manually recorded on the station log. The sampler must be thoroughly washed with Alconox™ prior to use at a station, then rinsed with ambient water to ensure that no sediments remain from the previous station. As stated in Worksheet No. 11, the following water quality parameters will be measured in the field: temperature, dissolved oxygen, salinity, conductivity, and pH (see Attachment P for water quality sampling methods).
2. Attach the sampler to the end of the winch cable with a shackle and tighten the pin.
3. Adjust the weight of the grab sampler according to the substrate (i.e., soft bottom – few/no weights; hard bottom – multiple weights). Set the grab sampler according to the manufacturer's instructions.
4. Once the grab sampler is cocked, it should be lowered into the water column such that travel through the last 5 m is no faster than about 1 m/sec. This minimizes the dispersal of fine material due to a sampler-induced shock wave. Grab samplers should never be allowed to free fall into the substrate. In shallow waters, some grab samplers can be pushed directly into the sediment with a minimum penetration of 3 inches; care must be taken to not overfill the sampling apparatus. For example, 5- and 10-foot extension handles can be attached to Eckman grabs for sampling in shallow waters.
5. When the cable goes slack, the grab sampler is on the bottom. Initiate recovery slowly, until the grab sampler is free from the bottom. After that, retrieve the cable at a steady rate, until the grab sampler is visible near the surface. When the grab sampler is visible, slow the rate of ascent so that it can be steadied as it is brought on board. If an insufficient or improper sample is collected, additional weights should be added to the sampler to allow deeper penetration into the sediment. Set the sampler on the wooden stand, open the lid and inspect the sample for acceptability. An acceptable grab is one that displays the following characteristics:

a. Sampler is not overfilled with sediment, the jaws are fully closed, and the top of the sediment is below the level of the open doors.

b. The overlying water is not excessively turbid.

c. The sampler is at least half full, indicating that the desired penetration has been achieved.

d. The sediment is level on at least one side.

6. In certain locations, slight over-penetration may be acceptable, at the discretion of the field coordinator (FC). The FC will make the final decision regarding acceptability of all grab samples. The overall condition of the grab sample (i.e., "slightly sloped on one side") should be noted in the field application. This information will be the same as the information required on the Surface Sediment Collection Form (Figure 1).

7. Carefully drain overlying water from the grab sample. If the grab sample is used for benthic community analysis, the water must be drained into the container that will receive the sediment to ensure no organisms are lost.

8. All grab samples taken are recorded on the station log. If the grab sample is rejected, record the reasons on the Surface Sediment Collection Form (Figure 1), along with other pertinent station information.

9. If the sample is rejected, empty the grab sampler, placing the discarded sediment into an appropriately labeled waste container (see Attachment F: SOP–Management and Disposal of Investigation-Derived Waste), then wash the grab sampler thoroughly with seawater and re-cock the sampler. Note that decontamination cleaning procedures are not required when the grab sampler is redeployed at the same sampling station. The sampling procedure is repeated until an acceptable grab sample is obtained.

V. Decontamination Cleaning Procedures

A. Sediment collection for non-chemistry (e.g., infaunal) analysis requires that the grab sampler be cleaned with at least soap and water between stations. For samples collected for chemical analyses, follow the cleaning procedures in Attachment E: SOP—Procedure to Decontaminate Sampling Equipment.

Note that all solvents and discarded sediments must be captured and disposed of inappropriately labeled waste containers (see Attachment F: SOP—Management and Disposal Investigation-Derived Waste). All instruments that come into contact with the sample (i.e., syringe, ruler, collection buckets) must be cleaned in the same manner as the grab sampler.

VI. Collection of Sediment Sample from the Grab

A. General

1. Once the grab sample is deemed acceptable, processing can begin. Measure the penetration depth of the grab sampler by inserting a clean ruler into the sediment near the center of the sample. Record the depth and corresponding volume on the Surface Sediment Collection Form (Figure 1). It is important that all sediment be retained if the grab sample is collected for infaunal analysis. If the grab sample is going to be analyzed for infauna, then the ruler should be rinsed over the grab so that all of the adhering sediment washes back into the sample.

2. An estimate of the apparent redox potential discontinuity will be made. Insert a 2.54-cm-diameter syringe into the sediment and withdraw a core. Estimate the distance from the surface of the sediment to the upper portion of the black subsurface sediment (if visible) to the nearest 0.5 cm and record the distance on the Surface Sediment Collection Form (Figure 1). If the grab sample is collected for infaunal analysis, the contents of the syringe and all adhering sediment must be washed back into the sample as described above. For all other analyses, the core may be properly disposed.
3. Measure the interstitial salinity using the procedures described in Attachment N.

B. Chemical, Sediment Toxicity, and Bioaccumulation Samples

1. A subsample from the biological active zone (i.e., the top 15 cm [6 inches]) of the grab is required for samples collected for chemical, sediment toxicity, and bioaccumulation analysis. Once the grab has been deemed acceptable, the following chemistry samples will be collected first as discrete grabs, prior to homogenization by using a contaminant-free utensil: AVS-SEM, volatile organic compounds (VOCs[12]), TPH-purgeables, sulfides, and ammonia. The sample jars must be filled completely, leaving no headspace. For preservation of these samples (see Worksheet Nos. 19 and 20). The samples must be immediately refrigerated at 4 ± 2 °C.
2. Once the chemistry samples have been removed, place the remaining sediment in a clean receptacle. Additional acceptable grab samples will be collected to meet the following sediment volume requirements for the different analyses: toxicity tests 8 L (2 gallons), chemistry 7.6 L (1.5 gallons), freshwater bioaccumulation test 64.3 L (17 gallons), and estuarine bioaccumulation test 30 L (8 gallons). The number of grab samples collected for the composite will be recorded. From each acceptable grab the top 15 cm (6 inches) will be collected and placed in one or more clean receptacles. When sufficient sediment has been collected at a station the receptacles are transported to the field laboratory for processing. Worksheet No. 18 lists the different sampling stations and the analytical requirements.
.3. Upon arrival at the field laboratory combine the contents from each receptacle into one and gently homogenize the sediment for 1 to 2 minutes with a mixer. Following homogenization, partition the sediment into the appropriate sample containers and in the amount specified by the selected laboratory. At the SQT sampling locations, 8 L [2 gallons] are needed for bioassay, and 5.7 L [1.5 gallons] are needed for chemistry; at the bioaccumulation stations, 64.3 L [17 gallons] are needed for the freshwater bioaccumulation test, and 30 L [8 gallons] are needed for the marine bioaccumulation test, based on 115 g of tissue per station. Samples to be analyzed for TOC, organic contaminants, and trace metals can be frozen immediately. Grain size samples should be refrigerated at 4 ±2 °C, not frozen.

C. Infaunal Sample Processing

1. At each location four benthic community replicate samples are collected from four acceptable grabs. At estuarine or freshwater locations a 0.1 m^2 or 0.5 m^2 frame is placed within the power grab and the sediment within the frame is collected to a depth of 15 cm (6 inches). All sediment within the frame must be retained, paying particular attention to organisms visible in overlying water or

[12] VOCs will only be collected from human health and SQT shallow sampling locations.

stuck to the sides of the frame. Transfer the entire frame sample into a clean collection bucket and transport the bucket to the field laboratory for further processing.

2. In the field laboratory place the contents of the bucket in the sieve in the water filled tube on the sieving table. Use a 1 mm sieve for the estuarine samples and a 0.5-mm sieve for the freshwater samples.
3. Gently remove the sediment by moving the sieve up and down in the tube. If the sample volume is large sieve the sample in several rounds by placing a portion of the sediment in the sieve. Continue this process until the bucket is empty. While sieving, it is important to make sure that the remaining sediment in the bucket is covered with water to prevent it from drying out.
4. The portion of the sample remaining on the screen after sieving is retained for analysis. Wash the contents of the screen to one side of the sieve and place a funnel in an appropriately sized sample container (the sample material should ideally fill ½ to ¾ of the container) and carefully wash the sample through the funnel into the sample container with water. Be sure to rinse the funnel and to cap the jar to prevent loss from spilling. Continue this process until the bucket is empty.
5. Once the entire sample has been sieved and collected in the sample jar, add buffered formalin to obtain a final concentration of 10% formalin (e.g., 100 mls of 37% formaldehyde in a 1-L container), and fill the jar to the threads with water. A heaping tablespoon of Borax should be added to the sample to ensure adequate buffering of the slightly acidic formalin. Gently swirl the contents of the jar to ensure complete mixing of the sample and the formalin. Affix the sample label and cover it with clear packing tape. Seal the jar tightly and tape the lid with Teflon® and/or electrical tape to prevent leakage and the escape of fumes during transport.
6. If the sample is made up of heavy material that will not wash through the sieve (i.e., course sand, rocks, and shell hash), it may be necessary to modify the sieving scheme to avoid injuring the organisms. This is accomplished by an elutriation procedure. The contents of the bucket are flooded with site water and gently swirled to encourage the small infaunal organisms to float to the top. The elutrient is then poured off onto the screen. The procedure is repeated until organisms are no longer visible in the elutrient. The portion of the sample retained on the screen is referred to as the light-density fraction; the portion remaining in the bucket is the heavy-density fraction. The two fractions are rinsed into separate, labeled sample jars. Whenever a sample is divided into more than one jar, for any reason, the jar label must reflect the number of jars. The number of jars should also be noted on the chain-of-custody (COC) form.

VII. Quality Control

A. Field duplicates and equipment blanks for chemistry analysis will be collected at the frequencies described in Worksheet No. 20 of the QAPP.

B. Any deviations from this SOP must be documented on the station log in the field logbook. Careful attention to the procedures described in this SOP by trained, qualified personnel will ensure the quality of the samples collected.

C. Interferences that may be encountered during sediment sampling using grab devices should be recorded, and every attempt should be made to minimize their impacts. Such interferences include:

1. Shallow depth of penetration
2. Shock wave and loss of very fine-grained surface deposits
3. Potential for water column contamination and nearby down-current sediment redeposition
4. Loss of depth profile
5. Difficulty of sampling in high current waters
6. Large debris materials such as twigs and stones that may prevent the closure of grab

VIII. References

Malcolm Pirnie, Earth Tech, Battelle. 2006. Lower Passaic River Restoration Project. Draft field sampling plan. Volume 2. Prepared for US Environmental Protection Agency, US Army Corps of Engineers, and New Jersey Department of Transportation/Office of Maritime Resources. Malcolm Pirnie, Inc., White Plains, NY; Earth Tech, Inc., Bloomfield, NJ; Battelle, Stony Brook, NY.

NJDEP. 2005. Field sampling procedures manual. New Jersey Department of Environmental Protection. August 2005.

Ohio EPA. 2001. *Sediment Sampling Guide and Methodologies*. Division of Surface Water, Ohio EPA, Columbus, OH.

Reifsteck, D.R. and C.J. Strobel. 1993. Field Operations and Safety Manual for EMAP- Estuaries 1993 Virginia Province. Environmental Monitoring and Assessment Program, Office of Research and Development. U.S. Environmental Protection Agency. Contract Number 68-C1-0005.

SURFACE SEDIMENT COLLECTION FORM

Project Name: _____ **Project no.:** _____

Date: _____ **Weather:** _____

Sampling Method: _____ **Crew:** _____

GRAB DATA	**Location ID:**				
Latitude/Northing(Y):			**Longitude/Easting(X):**		
Grab time	**Bottom depth (m)**	**Penetration depth (cm)**	**Acceptable grab (Y/N)**	**Benthic Community Subsample ID**	**Comments:**
SAMPLE DATA	**Sample ID:**				
Analyses needed before homogenization (circle): VOC sulfides AVS/SEM Other:					

Sediment type	**Sediment color**	**Sediment odor**		**Comments:** (i.e. redox potential discontinuity, organic matter, wood debris, shell fragments, sheen, fauna, field duplicate, rinsate blank, etc.)
cobble	brown surface	none	H_2S	
gravel	drab olive	slight	petroleum	
sand (F M C)	brown	moderate	other:	
silt	gray	strong		
clay	black			

GRAB DATA	**Location ID:**			
Latitude/Northing(Y):			**Longitude/Easting(X):**	
Grab time	**Bottom depth (m)**	**Penetration depth (cm)**	**Acceptable grab (Y/N)**	**Comments:**
SAMPLE DATA	**Sample ID:**			
Analyses needed before homogenization (circle): VOC sulfides AVS/SEM Other:				

Sediment type	**Sediment color**	**Sediment odor**		**Comments:** (i.e. redox potential discontinuity, organic matter, wood debris, shell fragments, sheen, fauna, field duplicate, rinsate blank, etc.)
cobble	brown surface	none	H_2S	
gravel	drab olive	slight	petroleum	
sand (F M C)	brown	moderate	other:	
silt	gray	strong		
clay	black			

Figure 1: Surface Sediment Collection Form

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Attachment E: SOP—Procedure to Decontaminate Sediment Sampling Equipment

1. Purpose

This procedure describes the methods used to decontaminate soil sampling equipment and tools used at the site and is based on Standard Operating Procedure (SOP) 06 of the field sampling plan (Malcolm Pirnie et al. 2006). The procedures specifically address equipment used to collect sediment samples for chemical analyses.

II. Definitions

PPE – personal protective equipment

III. Equipment and Supplies

The following equipment will be used to decontaminate equipment and tools used to collect sediment and soil samples:

1. De-ionized water for final rinsing of equipment after tap water or solvent rinse
2. Non-phosphate detergent (e.g., Alconox™) for cleaning equipment
3. Dishwashing detergent (e.g., Joy™, which provides suds in seawater) to remove oily or organic residue
4. Nitric acid as a 10% solution for removing metal contaminants from equipment
5. Organic solvent for final cleaning of equipment (e.g., hexane)
6. PPE, including disposable gloves (nitrile preferred), disposable wipes, eye wash system, first aid kit, and waterproof outerwear (if necessary)
7. Resealable buckets approved for waste collection and transportation
8. Squirt bottles for water, alcohol, and solvents
9. Brushes for cleaning equipment
10. Field notebooks, pens, pencils, standardized field data forms (electronic and/or printed copies), hand-held electronic recording device (e.g., laptop) and digital camera to document decontamination procedures

IV. Guidelines

A. The following equipment will be used to collect sediment grab samples and will require decontamination:
   1. Sediment grab sampler (type will depend on river bottom conditions and sampling needs): a 0.2-m^2 power grab or a 0.5-m^2 Ponar grab (for the upper reaches of the LPRSA). Examples of grab samplers covered by the SOP include: Young-modified van Veen, van Veen, Smith-McIntyre, Eckman, Shipek, and Petersen.
   2. Stainless steel scoops, spoons, bowls, and other equipment that come into contact with the sample or are used for homogenization

B. Collection of sediment samples for non-chemical analysis requires that the equipment be cleaned between sampling locations to avoid sample contamination. Generally, the cleaning procedures to be followed between sampling locations are as follows:

1. Rinse each item with site water to remove mud, dirt, or other visually present material.
2. Scrub the item with a brush and soapy water, using non-phosphate detergent such as Alconox™ for non-oily residue, or a detergent (e.g., Joy™) for items with oily or other sticky organic residue.
3. Rinse the item with site water to remove all residual soap.

C. Collection of sediment samples for chemical analysis requires that the equipment be cleaned between sampling locations to avoid sample contamination. Generally, the cleaning procedures to be followed between sampling locations are as follows:

1. Rinse each item with site water to remove mud, dirt, or other visually present material.
2. Scrub the item with a brush and soapy water, using non-phosphate detergent such as Alconox™ for non-oily residue, or a detergent (e.g., Joy™) for items with oily or other sticky organic residue.
3. Rinse the item with site water to remove all residual soap.
4. Rinse the item with 10% nitric acid to remove residual metals.
5. Rinse the item with de-ionized water.
6. Rinse the item with organic solvent (e.g., hexane).
7. Rinse the item with de-ionized or analyte-free water and allow to air dry.
8. Wrap the item(s) in aluminum foil or plastic bag, if necessary, to protect it until it is used.

D. All solvents must be captured and disposed of in appropriate, labeled, aqueous waste containers. All instruments that come into contact with the sample (i.e., syringe, ruler, collection buckets) must be cleaned in the same manner as the sampling device. Liquids collected in the chemical waste container must be discarded in an appropriate waste stream.

E. Staff performing decontamination procedures need to wear appropriate PPE, gloves (e.g., nitrile) and eye protection. Care must be taken during cleaning to not allow the contact of cleaning solutions with clothing as much as possible. If circumstances dictate that contact will occur (e.g., high-pressure washing, splashing, high wind), waterproof outer clothing must be worn (e.g., foul weather gear or rain gear).

F. Decontamination procedures may vary depending on specific work plan specifications and unique contaminants of concern at specific locations. The project work plan may specify the collection of equipment rinse samples to document effectiveness of cleaning.

G. This SOP does not address radioactive decontamination, PPE for radioactive waste, or disposal of radioactive contaminated waste material.

IV. References

American Society for Testing and Materials (ASTM), 1994. Standard Practice for Decontamination of Field Equipment Used at Nonradioactive Waste Sites. Designation: D 5088 – 90.

Malcolm Pirnie, Earth Tech, Battelle. 2006. Lower Passaic River Restoration Project. Draft field sampling plan. Volume 2. Prepared for US Environmental Protection Agency, US Army Corps of Engineers, and New Jersey Department of

Transportation/Office of Maritime Resources. Malcolm Pirnie, Inc., White Plains, NY; Earth Tech, Inc., Bloomfield, NJ; Battelle, Stony Brook, NY.

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Attachment F: SOP—Management and Disposal of Investigation-Derived Waste

I. Purpose

This procedure describes the methods used to manage, store, and dispose of investigation-derived waste (IDW) produced during environmental sampling for the Lower Passaic River Restoration Project. IDW that have come in contact with potentially contaminated materials during this sampling event may include the following: biological waste (e.g., tissue), sediment, water, solvents, personal protective equipment (PPE) and other disposable materials generated during field work at the Lower Passaic River Study Area (LPRSA). These procedures give descriptions of equipment, field procedures, disposal containers and documentation necessary to dispose of waste sediments, water, PPE, and other materials generated during activities at the LPRSA. It also covers the handling of these materials up to the time they are disposed of at an appropriate location.

II. Equipment and Supplies

Equipment to be used during the disposal of residuals may include but is not limited to the following:

- 55-gallon open-top drums (Department of Transportation [DOT] approved)
- 30-gallon (minimum) garbage bags
- Duct tape
- Storage racks
- Insulated coolers
- Large self-contained drum storage facility
- Waterproof marking pens
- Appropriate health and safety equipment

III. Residuals Management and Disposal Procedures

A. Solid and liquid IDW handling will be performed in a well ventilated area. Furthermore, skin and eyes will be protected from accidental exposure by wearing appropriate PPE. Care must be taken during cleaning not to allow contact cleaning solutions with clothing as much as possible.

B. Solids

Solids and residuals that will be generated during the investigation consist primarily of materials generated during the collection and processing of sediment samples, including aluminum foil, paper towels, and PPE (e.g., gloves, Tyvek®, boot covers). In addition, there may be minimal amounts of sediments or biological tissues generated from sample collection or homogenization procedures. These materials will be collected and placed in 55-gallon drums or bulk bags and stored temporarily until disposal either at a municipal solid waste landfill or hazardous waste disposal facility (i.e., if materials meet disposal facility and regulatory requirements). Drums and bags containing solids and residuals will be labeled and handled as described in Section D, below.

C. Liquid Wastes

Wastewater from sampling activities and processing will be collected and returned to the original sampling location. Used solvents and acids generated during the decontamination process will be collected and placed in appropriate containers. These containers will be stored temporarily until recycling or disposal of these liquids at a hazardous waste facility can be arranged.

D. Handling and Tracking of Solid Materials Containers

Solid waste materials will be placed in DOT-tested and approved 55-gallon drums or 30-gallon bags as they are generated during field activities. Solid waste materials that are initially placed in bags may be bulked into 55-gallon drums for storage. The following procedure will be followed for placing solid waste in these drums:

1. A drum number will be assigned to each drum by the field coordinator (FC) or his designee. The drum number will be marked on two sides of the drum before it is used.
2. A log will be kept for each drum, listing the materials placed in the drum.
3. All drums will be closed or covered at the end of the day's work.
4. Collection drums may be reused after emptying.
5. Drums containing solid materials will be stored in a secured temporary facility until proper offsite disposal at the end of the field activities.

E. Samples and Containers Returned from Offsite Laboratories

Upon completion of the required chemical analyses, the remaining sample material will be returned to the processing facility. The returned sample materials are under chain-of-custody (COC) procedures until disposal. Upon receipt of the samples, they will be logged in by designated staff members and the COC form signed. The condition of the containers in which the samples are returned will be checked and recorded on the log.

Samples will be separated into solid (i.e., sediment and tissue) and aqueous sample groups and disposed of according to the procedures described in Section III, Items B and C, respectively. Sample containers will be decontaminated, as appropriate, according to procedures outlined in Attachment E—Procedure to Decontaminate Sediment Sampling Equipment, and placed in 55-gallon drums or bulk bags and stored temporarily until disposal either at a municipal solid waste landfill or hazardous waste disposal facility) as described for solid wastes in Section III, Item D. Hazardous waste disposal facilities must be approved by USEPA prior to their use and again periodically over the length of the project.

IV. Documentation

The CPM or designee will be responsible for documenting the handling or disposal of all containers filled with solids or liquids generated during site activities. Observations and data will be recorded which will include the following at a minimum:

- Responsible person's name
- Date and time of activity

- Information coordinating container numbers for drums or bags with origin of materials.

The information will be reviewed and checked for completeness by the quality assurance/quality control (QA/QC) officer or designee.

V. References

Malcolm Pirnie, Earth Tech, Battelle. 2006. Lower Passaic River Restoration Project. Draft field sampling plan. Volume 2. Prepared for US Environmental Protection Agency, US Army Corps of Engineers, and New Jersey Department of Transportation/Office of Maritime Resources. Malcolm Pirnie, Inc., White Plains, NY; Earth Tech, Inc., Bloomfield, NJ; Battelle, Stony Brook, NY.

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Attachment G: SOP—Procedure for Chain-of-Custody (COC) Tracking and Sample Shipping

I. Introduction

Chain-of-custody (COC) forms will be completed for each tissue sample to serve as a permanent record for the sample collected and retained. This guideline is to provide reference information on COC tracking and sample shipping procedures.

II. Definition

Sample custody is a critical aspect of environmental investigations. Sample possession and handling must be traceable from the time of sample collection, through laboratory and data analysis, to delivery of the sample results to the recipient.

III. Equipment and Supplies

- COC forms
- Custody seals
- Packing tape
- Coolers
- Shipping labels and forms
- Temperature blanks
- Wet ice, dry ice, and/or ice packs
- Bubble wrap or packing peanuts
- Plastic ziplock bags

IV. Procedures

A. Sample Identification

Each sample will be assigned a unique identification. Refer to the corresponding QAPP and/or sampling plan for the sample identification protocol.

B. Sample Labeling

A completed label will be included with each tissue sample. Waterproof labels are preferred. Completion of sample labels will occur at the time of sample collection. When practical, the project identification, sample identification code, sample date, sample time, and sampler initials will be included on the label. For samples that will be placed in containers (e.g., jars), the labels will be protected from moisture with clear packing tape. Labels will be applied to the container, not the lid, whenever possible.

C. COC Tracking

1. Samples are considered to be in custody if they are:
    - In the custodian's possession or view
    - In a secured place (under lock) with restricted access
    - In a container and secured with an official seal(s) (Figure 1), such that the sample cannot be reached without breaking the seal(s)

Figure 1: Example of Custody Seal

2. Custody procedures will be used for all samples throughout collection, transport, and the analytical process.
3. Custody procedures will be initiated during sample collection. A COC form (Figure 2) will accompany the samples at all times during the transportation or shipping to a field facility or analytical laboratory.
4. Each person who has custody of the samples will sign the COC form and ensure that the samples are not left unattended unless properly secured. Minimum documentation of sample handling and custody will include:
   - Sample location, project name, and unique sample identification number
   - Sample collection date and time
   - Sample matrix
   - Page number
   - Laboratory and laboratory contact names
   - Any special notations on sample characteristics or problems
   - Initials of the person collecting the sample
   - Date sample was sent to the laboratory
   - Shipping company name and waybill number
5. The field coordinator (FC) will be responsible for:
   - All sample tracking and custody procedures for samples in the field
   - Final sample inventory
   - Maintaining sample custody documentation
   - Completing COC forms prior to removing samples from the sampling area
6. At the end of each day, and prior to transfer, COC entries will be made for all samples. Information on the labels will be checked against sample log entries, and sample tracking forms and samples will be recounted. COC forms will be enclosed in a sealable plastic bag and accompany all samples. The COC forms will be signed at each point of transfer.
8. Copies of all COC forms will be retained by field personnel and additional copies will be distributed (e.g., faxed or emailed) to the FC or designee, data validator, and lab manager/client service representatives at each laboratory being used. Copies all COCs will be included as appendices to quality assurance/quality control (QA/QC) reports and data reports. Samples will be shipped in sealed coolers to the appropriate facility.
9. The facilities and/or laboratories will be responsible for:
   - Ensuring that COC forms are properly signed upon receipt of the samples

- Noting questions or observations concerning sample integrity on the COC forms, including measuring and recording the temperature of the coolers on the COC form
- Contacting the FC or project QA/QC manager immediately if discrepancies are discovered between the COC forms and the sample shipment upon receipt
- Ensuring that a sample-tracking record follows each sample through all stages of laboratory processing. The analytical laboratories will be responsible for completing the sample tracking records, which will be made available to the FC or project QA/QC manager upon request. The sample-tracking record must contain, at a minimum, the name/initials of individuals responsible for performing the analyses, dates of sample extraction/preparation and analyses, and the types of analyses being performed
- Distributing (e.g., faxing or emailing) a completed copy of the COC form to the FC or designee, data validator, and field office.

V. Sample Shipping

A. Samples will be shipped overnight or couriered in the appropriate containers from the field to a facility or analytical laboratory. Prior to shipping, sample containers will be wrapped in bubble wrap and securely packed inside a container with wet ice, dry ice, and/or ice packs to ensure the integrity of the sample will not be compromised.

1. A temperature blank will be included in each cooler, as required by each analytical laboratory.
2. The original signed COC forms will be placed in a sealable plastic bag, sealed, and taped to the inside lid of the container.
3. Fiber tape will be wrapped completely around the container.
4. On each side of the container a “This Side Up” arrow label will be attached, a “Handle with Care” label will be attached to the top of the container, and the container will be sealed with a custody seal at a minimum of two locations.
5. The temperature inside the container(s) will be checked upon receipt of the samples. The facility or laboratory will specifically note any container that does not contain the appropriate packing material (e.g., ice packs) or that is not sufficiently cold (-20° ± 2°C) upon receipt to ensure the integrity of the samples will not be compromised.
6. All samples will be handled so as to prevent the contamination or loss of any sample.
7. Samples will be assigned a specific storage area within the facility or laboratory, and individual samples will be kept at the appropriate temperature until further instructions (e.g., compositing, homogenizing) are received. After all examinations (e.g., chemical analyses, taxonomic identification) of the samples have been completed, all remaining samples will be disposed of upon receipt of written notification from the project manager.

_____ **of** _____

CHAIN-OF-CUSTODY/TEST REQUEST FORM

Project/Client Name: _____ Ship to: _____

Project Number: _____ Attn: _____ Shipping Date: _____

Contact Name: _____ Shipper: _____ Airbill Number: _____

Sampled By: _____ Form filled out by: _____ Turnaround requested: _____

Sample Collection Date (m/d/y)	Time	Sample Identification	Volume of Sample / # of Containers	Matrix	Test(s) Requested (check test(s) required)							Comments/Instructions [Jar tag number(s)]
Total Number of Containers				Purchase Order/Statement of Work #								

1) Released by:	1) Rec'd by:	2) Released by:	2) Rec'd by:
Print name:		Print name:	
Signature:	Company:	Signature:	Company:
Company:		Company:	
Date/Time:	Date/Time:	Date/Time:	Date/Time:

* Distribution: White copies accompany shipment; yellow retained by consignor.

WindWard environmental LLC

200 West Mercer Street
Suite 401
Seattle, WA 98119
Tel: (206) 378-1364
Fax: (206) 217-9343

To be completed by Laboratory upon sample receipt:

Date of receipt:	Laboratory W.O. #:
Condition upon receipt:	Time of receipt:
Cooler temperature:	Received by:

Figure 2: Example of Chain-of-Custody Form

Attachment H: SOP—Documenting Field Activities

I. Introduction

The purpose of this document is to define the standard operating procedure (SOP) for the documentation of field activities associated with the Lower Passaic River Restoration Project (LPRRP), including sample collection events, field measurements, and site visits. Appropriate documentation of field activities provides an accurate and comprehensive record of the work performed, sufficient for a technical peer to reconstruct the day's activities and determine that necessary requirements were met. Field records also provide evidence and support technical interpretations and judgments. The procedures and systems defined in this SOP help ensure that the records are identifiable (reference the project task/activity), retrievable, and protected from loss or damage.

LPRRP field data will be recorded in field logbook entries, standardized forms, annotated maps, or photos. This SOP provides general guidance on field recordkeeping; additional details for specific procedures (e.g., chain of custody) are provided in the SOPs for the individual task.

It is fully expected that the procedures outlined in this SOP will be followed. Procedural modifications may be warranted depending upon field conditions or limitations imposed by the procedure. Substantive modification to this SOP will be approved in advance by the Quality Assurance (QA) Manager and the Task Manager and communicated to the Cooperating Parties Group (CPG) Project Coordinator and the US Environmental Protection Agency (USEPA) Remedial Project Manager. Deviations from this SOP will be documented in the field records. The ultimate procedure employed will be documented in the report summarizing the results of the sampling event or field activity.

II. Guidelines

The documentation of field activities at uncontrolled hazardous waste sites is governed by a variety of legal guidelines that must be understood prior to the commencement of field activities. It is imperative that the personnel who will be conducting the field activities understand how the overall constitutional, statutory, and evidentiary legal requirements apply to the site inspection documentation and to the rights of potentially responsible parties.

The description of and observations made during field activities often provide the basis for technical site evaluations and other related written reports. All records and notes generated in the field will be considered controlled evidentiary documents and may be subject to scrutiny in litigation. Consequently, it is essential that the Field Coordinator (FC) or designee pay attention to detail and document to the greatest extent practicable every aspect of the inspection.

Personnel designated as responsible for the documentation of field activities must be aware that all notes taken may provide the basis for the preparation of responses to legal interrogatories.

Field documentation must provide sufficient information and data to enable the reconstruction of field activities. A wireless field application using standardized electronic data forms may provide the basic means for documenting field activities.

Control and maintenance of wireless field applications used in the documentation of field activities is the responsibility of the FC, and the transfer of responsibility (e.g., alternate FC) must be documented.

III. Equipment and Materials

The following equipment list contains materials that may be needed in carrying out the procedures contained in this SOP. Not all equipment listed below may be necessary for a specific activity. Additional equipment may be required, pending field conditions.

- Standardized field data forms (electronic and printed copies)
- Site maps (electronic and printed copies)
- Clipboard
- Three-ring binder or equivalent
- Camera
- Time piece
- Hand-held electronic recording device (e.g., laptop)
- Bound field logbook
- Black, ballpoint pen or Sharpie® (or equivalent)

IV. Procedures

A. General Requirements

The field records will contain sufficient detail so that the collection effort can be reconstructed without reliance on the collector's memory.

Pertinent field information will be recorded legibly in field logbook entries and/or in an appropriate standardized form (as described herein).

Logbook entries will be signed and dated. No erasures or obliterations will be made. A single line (i.e., strikeout) will be drawn through incorrect entries and the corrected entry typed next to the original strikeout. Strikeouts are to be initialed and dated by the originator.

The field logbook will be a bound waterproof notebook with entries made in black ballpoint pen (or pencil, as necessary). All logbook entries will be electronically scanned at the end of each day or as frequently as possible and saved in the project files.

Entries will be factual and observational (i.e., no speculation or opinion), and will not contain any personal information or non-project-related entries. Abbreviations and acronyms will be defined.

Field information will be recorded without delay – information recorded significantly after the fact will be dated as such.

Field activities and other events pertinent to the field activities will be documented in chronological order. Times will be recorded using Eastern Standard Time (EST) or Eastern Daylight Savings Time (EDT) notation for each entry.

B. Field Logbook

The field logbook will be a bound waterproof notebook with entries made in black ballpoint pen (or pencil as necessary).

The title page of each logbook entry will contain the following:

- Windward contact, Windward office location, and phone number
- The logbook entry number (corresponding to the number of days in the field event)
- Project name and number
- Start and end date and time of work covered by that logbook entry

A page header will appear on the first page of each logbook entry (i.e., the beginning of notes for each day's events), and activities for each day will be recorded as a new logbook entry. The page header will include:

- Name of author and other personnel on site (and affiliated organization if applicable)
- Date
- Time of arrival (military time)
- Proposed activity (task)
- Current weather and tidal conditions, and weather forecast for the day

An abbreviated header, containing at least the date, will appear at the top of each additional page for the active date. Field forms require similar header information.

The field logbook will provide a chronology of events. At a minimum, documentation in a logbook will include the following (unless documented on a standard form):

- Names of visitor(s), including time of arrival and departure, the visitor's affiliation, and reason for visit
- Summary of project-related communications, including names of people involved and time
- Time daily work commences and ceases
- Start and stop times of new tasks
- Start and stop times of significant stand by time (work interruptions)
- Safety or other monitoring data, including units with each measurement
- Deviations from approved scope of work, including the necessary approvals
- Progress updates
- Problems/delays encountered
- Unusual events
- Initials of author on every page

The logbook will cross-reference the standardized field forms if necessary; however, whenever possible, details recorded on the standardized forms will not be replicated in the logbook.

In the case of equipment malfunction or other unforeseen events, additional bound waterproof field books will be carried by field personnel to serve as back-up documentation methods. LPRRP logbooks will be dedicated to the project and will not be used for any other project or purpose. Separate and dedicated logbooks will be kept for different operations running concurrently (e.g., sampling on board the vessel, processing at the field facility); individual tasks making up each operation will be maintained in the same logbook, if possible. The cover and binding of each logbook will be labeled to identify the operation and dates included with the logbook; each page in the logbook will be consecutively numbered. Pages will not be removed or torn out of the logbook. If there are additional lines on the page at the end of the day's activities, a line will be drawn through the empty space, and initialed and dated, leaving no room for additional entries. Logbook entries will be electronically scanned at the end of each day, or as frequently as possible, and electronically saved as described in Section F.

C. Standardized Forms

Standard forms for field data are provided in this Quality Assurance Project Plan as Attachment A and within Attachment D (Figure 1) and Attachment G (Figure 2). The information collected on any field forms will be collected and/or scanned and stored (if a printed form) electronically (described in Section F).

The following rules apply to the standardized forms:

- Each form will be printed (if electronic), signed, and dated by the person completing the form and stored as described in Section VI.
- There will be no blank spaces on the form – unused spaces will have "not applicable" or "not available" explanations.
- Field forms require similar header information as logbook entries (see Section B of this SOP).
- At the end of each day, or as frequently as possible, all forms completed will be saved as described in Section F.

D. Maps and Drawings

Pre-existing maps and drawings that include notations made in the field (for example, relocating of sample locations) will be referenced in the logbook and, like all field records, include the project/task name and number, site identification, and be signed or initialed and dated by the person who prepared them.

Maps and drawings will include compass orientation and scale. Sketches will include points of reference and distances to the reference points.

If notations are made on electronic map or drawing files, these will be referenced in the logbook as described above and initialed and dated by person who prepared them. Notations made by hand on maps and drawings will be electronically scanned at the end of each day, or as frequently as possible, and electronically saved as described in Section F.

E. Photographs and Other Photo Documentation

Photographs or videos may be taken by the field team to help document site conditions, sampling locations, or sample characteristics. Photographs and videos will be identified in the logbook or on the electronic standard form by a unique numbering system. If photographs are collected using a digital camera, the file number as well as the photograph number will accompany the description of the photograph in the logbook. At a minimum, the date/time the photograph was taken, the general location, a brief description, and the photographer's name will be recorded. Additional information may include differential global positioning system (DGPS) coordinates, direction the photographer was facing, and/or weather conditions. If necessary, an object will be included to indicate the scale of the object in the photograph.

F. Electronic Files

Electronic recording devices may include data logging systems, personal digital assistants (PDAs), laptops, or tablet personal computers (PCs).

Sufficient backup systems will be in place to protect against electronic data loss. Information will be saved to a disk or backed up immediately upon completion. The backup disk or other media (CD, flash drive) will then be stored in a secure location separate from the laptop, tablet, or PDA.

Files will be uniquely identified and will be stored in the project files. File names should include the date, a description of the file contents or a unique title, and a version number. For example, "YYYYMMDD_Name of documentV#." An unedited version of the file will be maintained, and all subsequent manipulations tracked.

V. Quality assurance/quality control

Entries in the field forms will be double-checked by the samplers to verify that the information is correct.

Completed field forms will be reviewed periodically by the FC and/or Project QA Manager or their designees to verify that the requirements are being met. At a minimum, this should occur at the end of each day. When the review is complete, the reviewer will append his/her initials and date to the pages reviewed for documentation purposes.

If information recorded in the field is transcribed to another format, the original record will be retained for comparison purposes.

VI. Data and Records Management

Deviations to the procedures detailed in the SOP will be recorded in the field logbook.

Logbooks, field forms, chain-of-custody forms, and all other records associated with the activities described in this SOP will be ultimately maintained by the investigative organization.

Field logbook entries, field data forms, and chain-of-custody forms will be electronically stored once they have been completed and distributed (if necessary) at the end of each field day or as frequently as possible. Printed copies of these documents will be maintained in labeled three-ring binders or contained in some other organized manner that prevents loss in the field facility. Bound waterproof field logbooks will be electronically scanned and saved in project files at the end of

each day, or as frequently as possible, to mitigate against the loss of historical entries should the logbook be lost in the field.

Distribution of daily forms will be performed according to the needs of the project team and at the direction of the FC or designee.

The FC is responsible for reviewing and approving the field records for accuracy, completeness, and conformance to the procedures in this SOP. The FC is also responsible for ensuring that the field records are distributed to the appropriate personnel during field activities, ensuring that records are maintained properly on site, and for archiving the records upon completion of field activities.

VII. References

ENSR|AECOM. 2008. Standard Operating Procedure, Lower Passaic River Restoration Project: Field Records. Revision 1.

Malcolm Pirnie, Inc. in conjunction with EarthTech, Inc. and Battelle. 2006. Lower Passaic River Restoration Project: Draft Field Sampling Plan Volume 2. Prepared for US Environmental Protection Agency, US Army Corps of Engineers, and New Jersey Department of Transportation/Office of Maritime Resources.

Attachment I: SOP—Benthic Macroinvertebrate Sampling

I. Introduction

This procedure is adapted from USEPA protocols described in *Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates, and Fish* (Barbour et al. 1999), and describes the methods used collect benthic macroinvertebrates where collecting sediment grab samples is not possible (e.g., due to coarse substrate) in the Lower Passaic River Study Area.

II. Equipment and Supplies

Equipment to be used during benthic macroinvertebrate sampling (single habitat and multi-habitat approaches) may include but is not limited to the following:

- Standard kick net, 500 µ opening mesh, 1.0 meter width
- Standard D-frame dip net, 500 opening mesh, 0.3 m width (~ 1.0 ft frame width)
- Sieve bucket, with 500 µ opening mesh
- 95% ethanol
- Sample containers, sample container labels
- Forceps
- Pencils, clipboard

Benthic Macroinvertebrate Field Data Sheet

- First aid kit
- Waders (chest-high or hip boots)
- Gloves
- Camera
- Global positioning system (GPS) unit

III. Equipment Decontamination Procedures

Decontamination of sampling equipment will be performed between samples collected from each location/event in accordance with procedures outlined in the Decontamination of Biological Sampling Equipment SOP E. Personnel decontamination procedures are described separately in the Health and Safety Plan.

IV. Location of Sampling Stations

The position and depth of the sampling station will be established. The positioning procedures are described in SOP B: Locating Sample Points Using a Handheld Global Positioning System (GPS) and SOP C: Locating Sample Points Using a Boat-Mounted Global Positioning System (GPS). The depth of the sampling station will be determined using either a fathometer or weighted demarcated line.

V. Sampling Methods

Two sampling methods may be used in the LPRSA depending on habitat. 1-m kick nets are used to sampled a single habitat, in particular riffles or runs, as a means to standardize assessments among streams having those habitats. This approach is valid, because macroinvertebrate diversity and abundance are usually highest in cobble substrate (riffle/run) habitats. Where cobble substrate is the predominant habitat, this sampling approach provides a representative sample of the stream reach. D-frame dip nets are used to sample a variety of habitat types. This method focuses on a multi-habitat scheme designed to sample major habitats in proportional representation within a sampling reach. Benthic macroinvertebrates are collected systematically from available in-stream habitats by kicking the substrate or jabbing with a D-frame dip net. A total of 20 jabs (or kicks) are taken from a target habitat area resulting in sampling of approximately 3.1 m^2 of habitat. For example, if the habitat in the sampling area is 50% snags, then 50% or 10 jabs should be taken in that habitat. The following habitats may be sampled in the multi-habitat approach to benthic sampling 1) cobble (hard substrate), 2) snags, 3) vegetated banks, and submerged macrophytes. As stated in Worksheet No. 11, the following water quality parameters will be measured in the field: temperature, dissolved oxygen, salinity, conductivity, and pH (see Attachment P for water quality sampling methods).

VI. Field Sampling Procedures the 1-m Kick Net

A. An area that is representative of the characteristics of the target location should be selected. Whenever possible, the area should be upstream from any road or bridge crossing to minimize its effect on stream velocity, depth and overall habitat quality. There should be no major tributaries discharging to the target area.

B. Before sampling, document site description, weather conditions, and land use. Other notes should include in-stream attributes (e.g., riffles, falls, fallen trees, pools, bends, etc.) and important structures, plants, and attributes of the bank and near stream areas. Use a GPS for coordinate determination (i.e., easting/northing) taken at the furthest downstream point of the sampling area.

C. All riffle and run areas within the target area are candidates for sampling macroinvertebrates. A composite sample is generally taken from individual sampling spots in the riffles and runs representing different velocities.

D. Sampling begins at the downstream end of the sampling area and proceeds upstream. Using a 1 m kick net, 2 or 3 kicks are sampled at various velocities in the riffle or series of riffles. A kick is a stationary sampling accomplished by positioning the net and disturbing one square meter upstream of the net. Using the toe or heel of the boot, dislodge the upper layer of cobble or gravel and scrape the underlying bed. Larger substrate particles should be picked up and rubbed by hand to remove attached organisms.

E. After every kick, wash the collected material by running clean stream water through the net two to three times. If clogging does occur, discard the material in the net and redo that portion of the sample in a different location. Remove large debris after rinsing and inspecting it for organisms; place any organisms found into the sample container. Do not spend time inspecting small debris in the field.

F. Transfer the sample from the net to sample container(s) and preserve in enough 95 percent ethanol to cover the sample. Forceps may be needed to remove organisms from the dip net. Place a label indicating the sample identification code or lot number, date, stream name, sampling location, and collector name into the sample container. The outside of the container should include the same information and the words "preservative: 95% ethanol". If more than one container is needed for a sample, each container label should contain all the information for the sample and should be numbered (e.g., 1 of 2, 2 of 2, etc.).

G. Complete the Surface Sediment Collection Form (Attachment D).

H. Record the number of kicks attempted. percentage of each habitat type in the reach. Note the sampling gear used, and comment on conditions of the sampling, e.g., high flows, treacherous rocks, difficult access to stream, or anything that would indicate adverse sampling conditions.

VII. Field Sampling Procedures for the D-frame Dip Net

A. An area that is representative of the characteristics of the target location should be selected. Whenever possible, the area should be upstream from any road or bridge crossing to minimize its effect on stream velocity, depth and overall habitat quality. There should be no major tributaries discharging to the target area.

B. Before sampling, document site description, weather conditions, and land use. Other notes should include in-stream attributes (e.g., riffles, falls, fallen trees, pools, bends, etc.) and important structures, plants, and attributes of the bank and near stream areas. Use a GPS for coordinate determination (i.e., easting/northing) taken at the furthest downstream point of the sampling area.

C. Different types of habitat are to be sampled in approximate proportion to their representation of surface area of the total macroinvertebrate habitat in the target area. For example, if snags comprise 50% of the habitat in an area and riffles comprise 20%, then 10 jabs should be taken in snag material and 4 jabs should be take in riffle areas. The remainder of the jabs (6) would be taken in any remaining habitat type. Habitat types contributing less than 5% of the stable habitat in the target area should not be sampled. In this case, allocate the remaining jabs proportionately among the predominant substrates. The number of jabs taken in each habitat type should be recorded on the field data sheet.

D. Sampling begins at the downstream end of the selected location and proceeds upstream. A total of 20 jabs or kicks will be taken over the length of the target area; a single jab consists of forcefully thrusting the net into a productive habitat for a linear distance of 0.5 m. A kick is a stationary sampling accomplished by positioning the net and disturbing the substrate for a distance of 0.5 m upstream of the net.

E. Every 3 jabs, more often if necessary, wash the collected material by running clean stream water through the net two to three times. If clogging does occur that may hinder obtaining an appropriate sample, discard the material in the net and redo that portion of the sample in the same habitat type but in a different location. Remove large debris after rinsing and inspecting it for organisms; place any organisms found into the sample container. Do not spend time inspecting small debris in the field.

F. Transfer the sample from the net to sample container(s) and preserve in enough 95% ethanol to cover the sample. Forceps may be needed to remove organisms

from the dip net. Place a label indicating the sample identification code or lot number, date, stream name, sampling location, and collector name into the sample container. The outside of the container should include the same information and the words "preservative: 95% ethanol". If more than one container is needed for a sample, each container label should contain all the information for the sample and should be numbered (e.g., 1 of 2, 2 of 2, etc.).

G. Complete the Surface Sediment Collection Form (Attachment D).

H. Record the number of jabs or kicks attempted.

VIII. Quality Control (QC) in the Field

I. Sample labels must be properly completed, including the sample identification code, date, stream name, sampling location, and collector's name and placed into the sample container. The outside of the container should be labeled with the same information. Chain-of-custody forms, if needed, must include the same information as the sample container labels.

J. After sampling has been completed at a given site, all nets, pans, etc. that have come in contact with the sample should be rinsed thoroughly, examined carefully, and picked free of organisms or debris. Any additional organisms found should be placed into the sample containers. The equipment should be examined again prior to use at the next sampling site.

IX. References

Barbour, M.T. et al. 1999. Rapid bioassessment protocols for use in streams and wadeable rivers: periphyton, benthic macroinvertebrates, and fish, Second edition. EPA 841-B-99-002. Office of Water, US Environmental Protection Agency, Washington, DC

Attachment J: Bioaccumulation Sample Location Selection

I. Introduction

The bioaccumulation data will be used for two purposes: the benthic invertebrate tissue data can be used in the assessment of benthic invertebrate risk as well as the dietary exposure of ecological receptors that consume benthic invertebrates, and the data can be used to investigate predictive relationships between sediment chemical concentrations and benthic tissue chemical concentrations. It is important for both of these data uses that the bioaccumulation data represent the range of chemical concentrations throughout the site.

The bioaccumulation sample locations were selected from the locations in the Lower Passaic River Study Area (LPRSA) characterized in the recent low resolution core (LRC) sediment sampling program. The chemistry surface sediment (0 to 0.5 ft) samples from the LRC cores were reviewed to identify locations that represent the range of chemical concentrations present in the site. Ten locations were selected in the estuarine zone and ten locations were selected in the freshwater zone. The selected locations are presented in Table 1.

In order to identify locations that represented the range of chemical concentrations throughout the site, all the LRC surface sediment samples were reviewed. A subset of the chemicals analyzed in the LRC sediments was selected for analysis. The chemicals were selected to represent a range of contaminants and all selected chemicals were detected in greater than 75% of the LRC sediments. All of the analytes for the LRC sediments were reviewed and the chemical concentrations of PCDDs/ PCDFs, PCBs, PAHs, pesticides (dieldrin, chlordane and total DDTs), phthalates, copper, lead and mercury were selected. For each chemical, cumulative frequency plots were created for the LPRSA estuarine zone and the LPRSA freshwater zone. Samples were selected in order to represent the range of chemical concentrations present throughout the site. The cumulative frequency plots with the selected bioaccumulation stations identified are presented in Figures 1 through 14.

For all the selected chemicals, the selected bioaccumulation locations provide a range of concentrations that are representative of the range of concentrations throughout the site.

The only chemical with sediment concentrations consistently above benthic toxicity thresholds was mercury. The upper effects threshold for freshwater sediment for mercury is 560 µg/kg and the effects range medium (ERM) in marine sediments is 710 µg/kg (NOAA 2008). Less than 15% of the sediment locations in the LRC dataset contain concentrations below these toxicity thresholds. The bioaccumulation sediment locations were selected from all sediment locations with surface sediment mercury concentrations less than 5ppm.

Table 1. Summary of selected bioaccumulation locations

Bioaccumulation Location ID	LRC ID	Concentration Expressed as Cumulative Frequency Percentile[a]														
		2,3,7,8-TCDD	Total PCDDs/ PCDFs	Cu	Pb	Hg	Total PCB Aro-clors	Total PCB Con-geners	Total HPAHs	Total LPAHs	Dieldrin	Total Chlor-dane	Total DDTs	BEHP	BBP	DOP
LPRSA Estuarine Zone																
LPRT01A	CLRC-004	36%	69%	21%	10%	66%	41%	19%	15%	13%	15%	11%	10%	16%	5%	42%
LPRT01F	CLRC-010	56%	52%	50%	40%	26%	38%	79%	66%	58%	38%	33%	26%	37%	79%	79%
LPRT02E	CLRC-019	72%	80%	71%	79%	40%	80%	92%	97%	94%	92%	97%	92%	94%	87%	89%
LPRT04B	CLRC-029	97%	97%	60%	53%	82%	89%	97%	74%	84%	39%	38%	31%	87%	53%	52%
LPRT06C	CLRC-037	48%	33%	13%	82%	19%	82%	52%	73%	76%	52%	61%	56%	77%	89%	45%
LPRT07B	CLRC-040	92%	72%	94%	95%	71%	87%	90%	56%	74%	89%	57%	89%	85%	66%	90%
LPRT08D	CLRC-047	62%	39%	45%	66%	39%	90%	87%	95%	95%	98%	98%	93%	56%	94%	95%
LPRT08E	CLRC-049	8%	7%	6%	8%	8%	8%	8%	8%	6%	33%	26%	66%	10%	74%	2%
LPRT08F	CLRC-052	11%	10%	5%	6%	10%	51%	18%	11%	10%	26%	23%	18%	11%	23%	24%
LPRT10D	CLRC-114	85%	36%	34%	55%	69%	26%	29%	29%	35%	93%	85%	85%	2%	27%	27%
LPRSA Freshwater Zone																
LPRT11A	CLRC-064	69%	94%	50%	66%	63%	97%	81%	91%	84%	94%	94%	88%	94%	72%	78%
LPRT11E	CLRC-067	97%	97%	81%	78%	75%	94%	84%	59%	44%	90%	91%	78%	97%	19%	97%
LPRT12C	CLRC-069	94%	78%	91%	91%	84%	50%	69%	31%	34%	77%	72%	91%	66%	69%	47%
LPRT13A	CLRC-072	59%	41%	22%	13%	34%	34%	25%	19%	19%	16%	16%	41%	13%	28%	16%
LPRT13E	CLRC-074	66%	69%	72%	56%	59%	78%	59%	72%	56%	71%	84%	59%	75%	56%	75%
LPRT13F	CLRC-076	78%	81%	44%	28%	81%	75%	97%	94%	91%	97%	97%	94%	28%	34%	19%
LPRT13G	CLRC-077	88%	75%	84%	81%	91%	53%	94%	75%	66%	74%	88%	75%	91%	75%	88%
LPRT14C	CLRC-079	34%	44%	19%	41%	25%	38%	56%	97%	97%	19%	9%	6%	41%	81%	53%
LPRT16D	CLRC-089	22%	53%	31%	19%	13%	44%	47%	34%	31%	65%	53%	28%	38%	3%	31%
LPRT16A	CLRC-087	3%	6%	6%	9%	50%	13%	6%	6%	6%	3%	13%	81%	16%	44%	25%

[a] The cumulative frequency percentile expresses the fraction of the population of concentrations less than or equal to the sample concentration (i.e. A concentration with a cumulative frequency percentile of 3% for copper is greater than or equal to 3% of the copper concentrations reported for surface sediment in the LRC dataset).

BEHP – bis-(2-ethylhexyl) phthalate

BBP – butyl benzyl phthalate

DOP – di-n-octylphthalate

PCDD – polychlorinated dibenzo-*p*-dioxin

PCDF – polychlorinated dibenzofuran

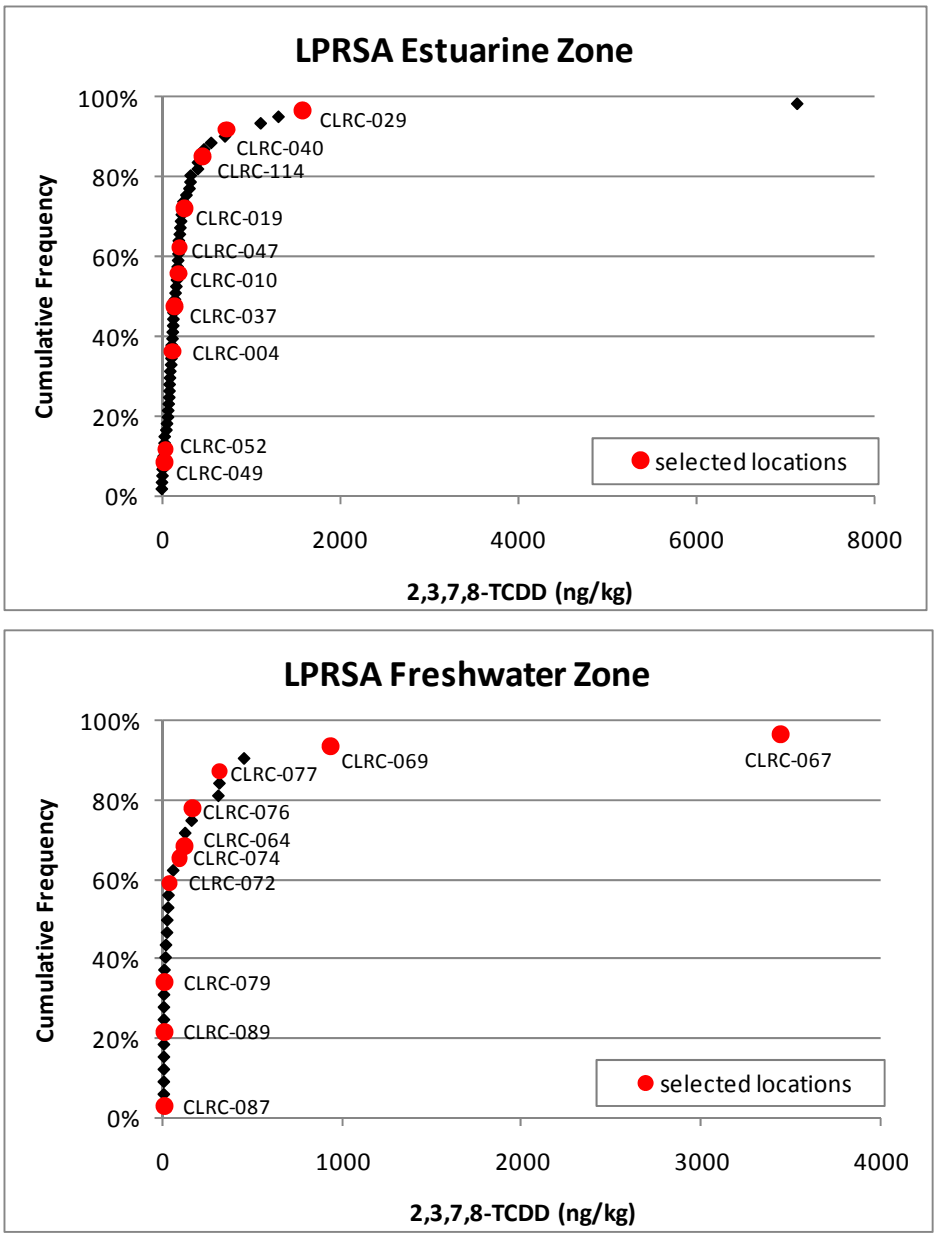


Figure 1: Cumulative frequency of 2,3,7,8-TCDD with selected bioaccumulation locations

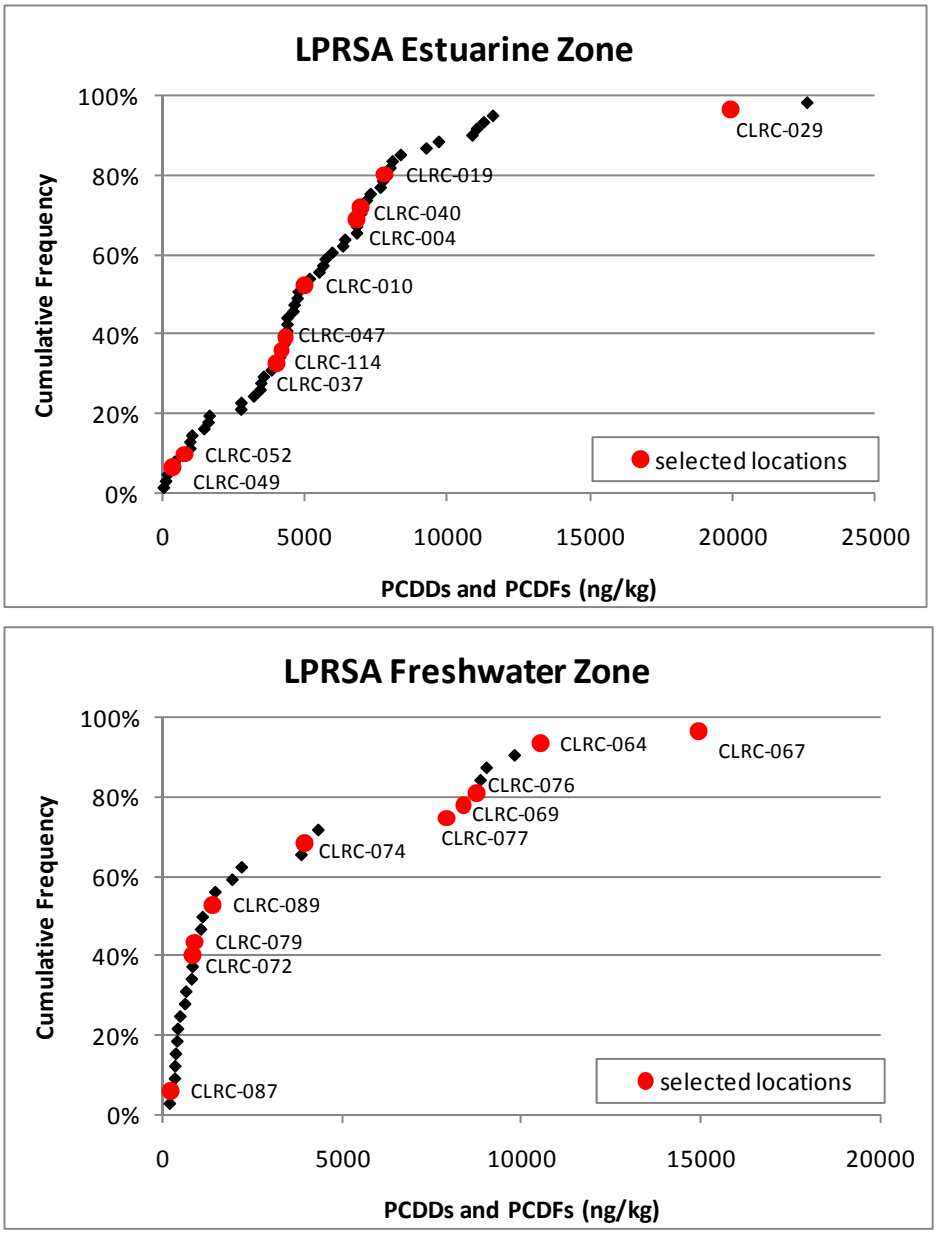
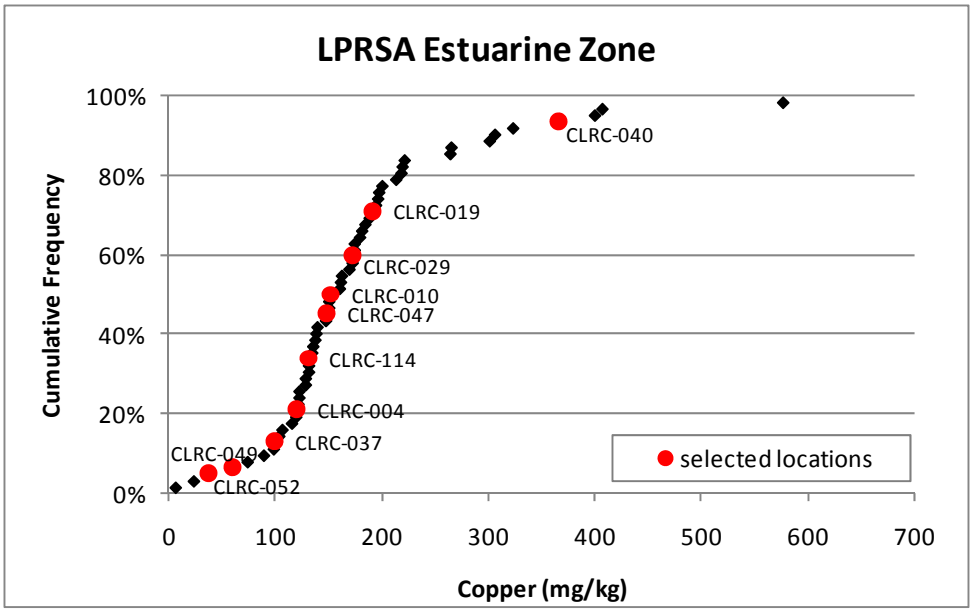


Figure 2: Cumulative frequency of PCDDs and PCDFs with selected bioaccumulation locations



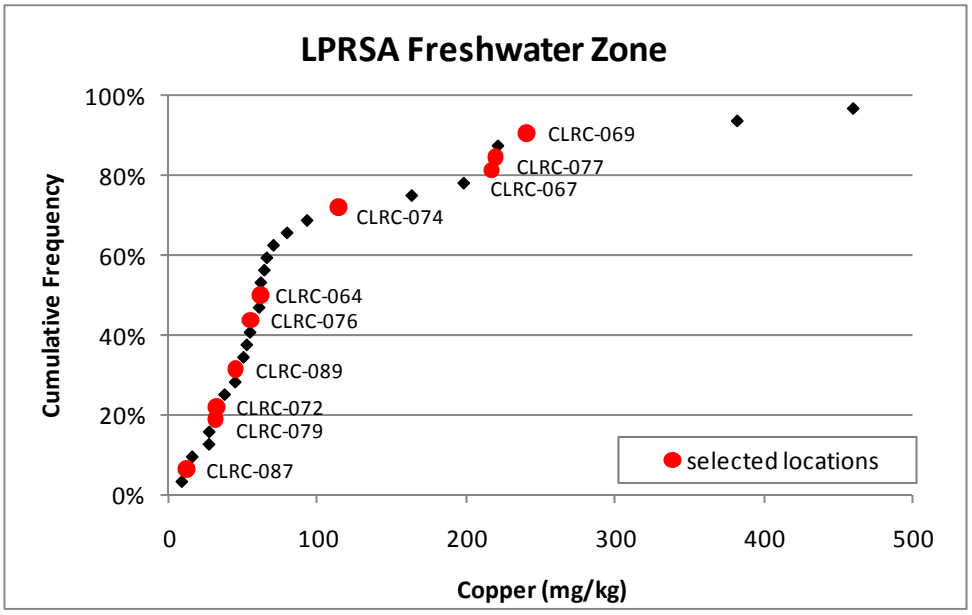


Figure 3.Cumulative frequnecy of copper with selected bioaccumulation locations

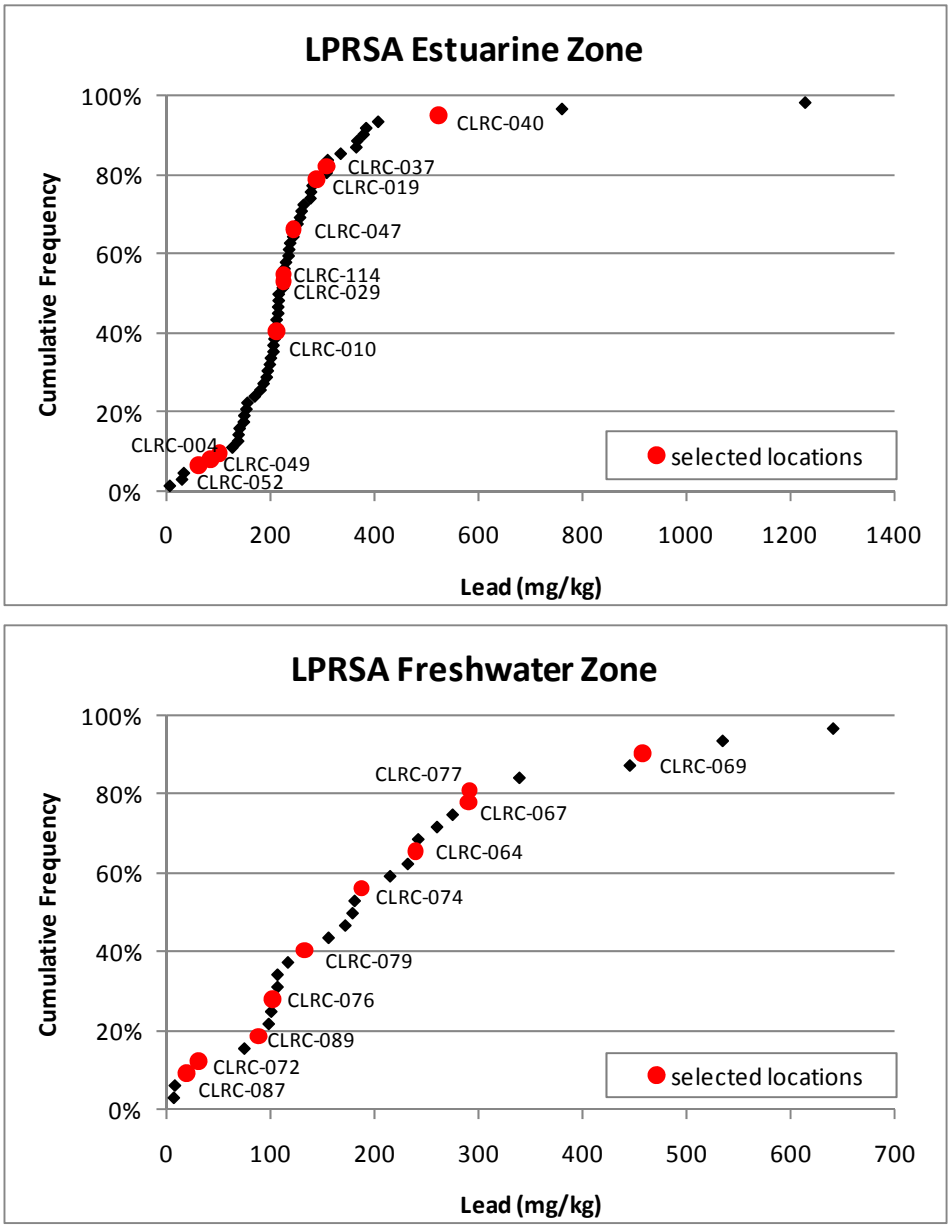


Figure 4. Cumulative frequency of lead with selected bioaccumulation locations

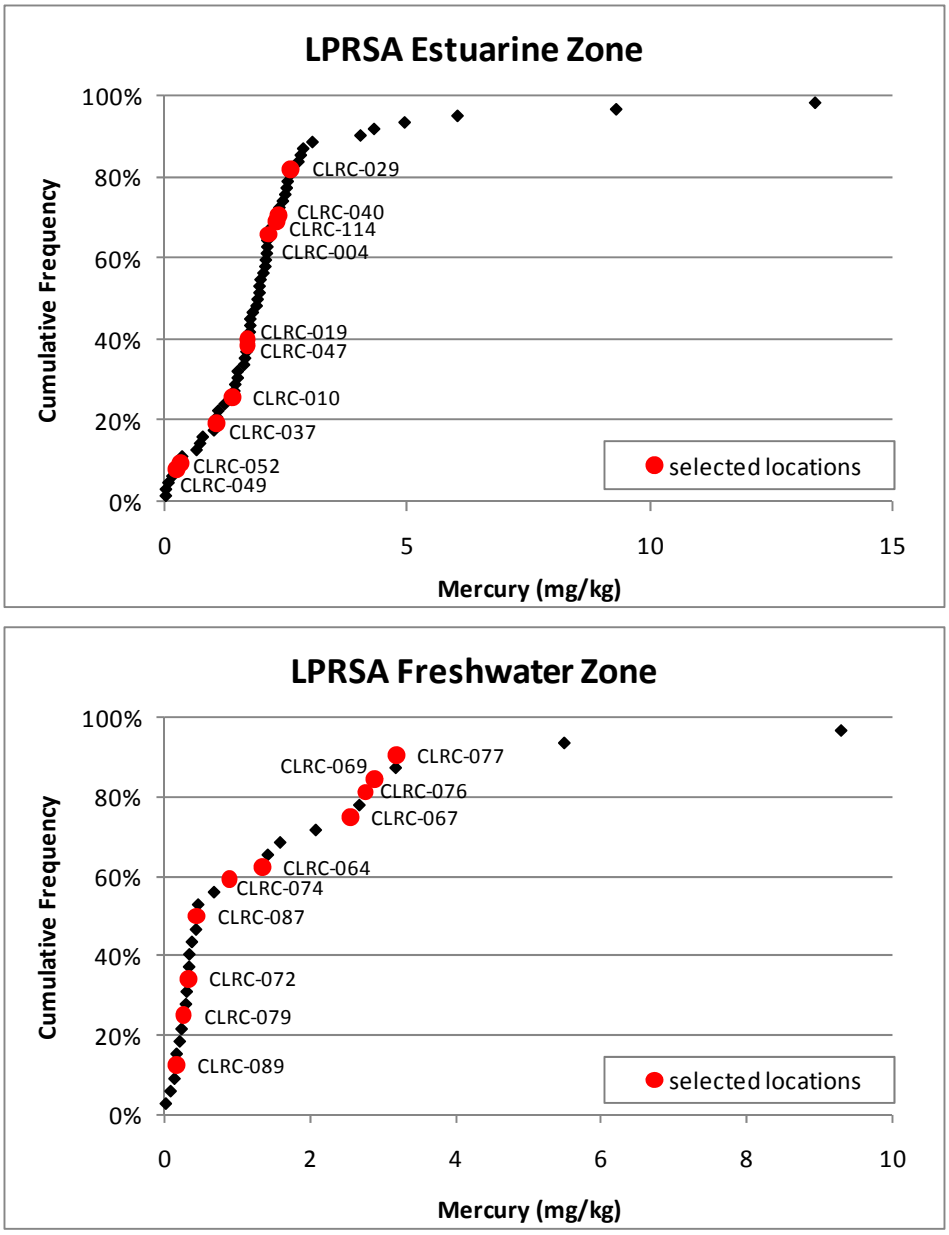


Figure 5. Cumulative frequency of mercury with selected bioaccumulation locations

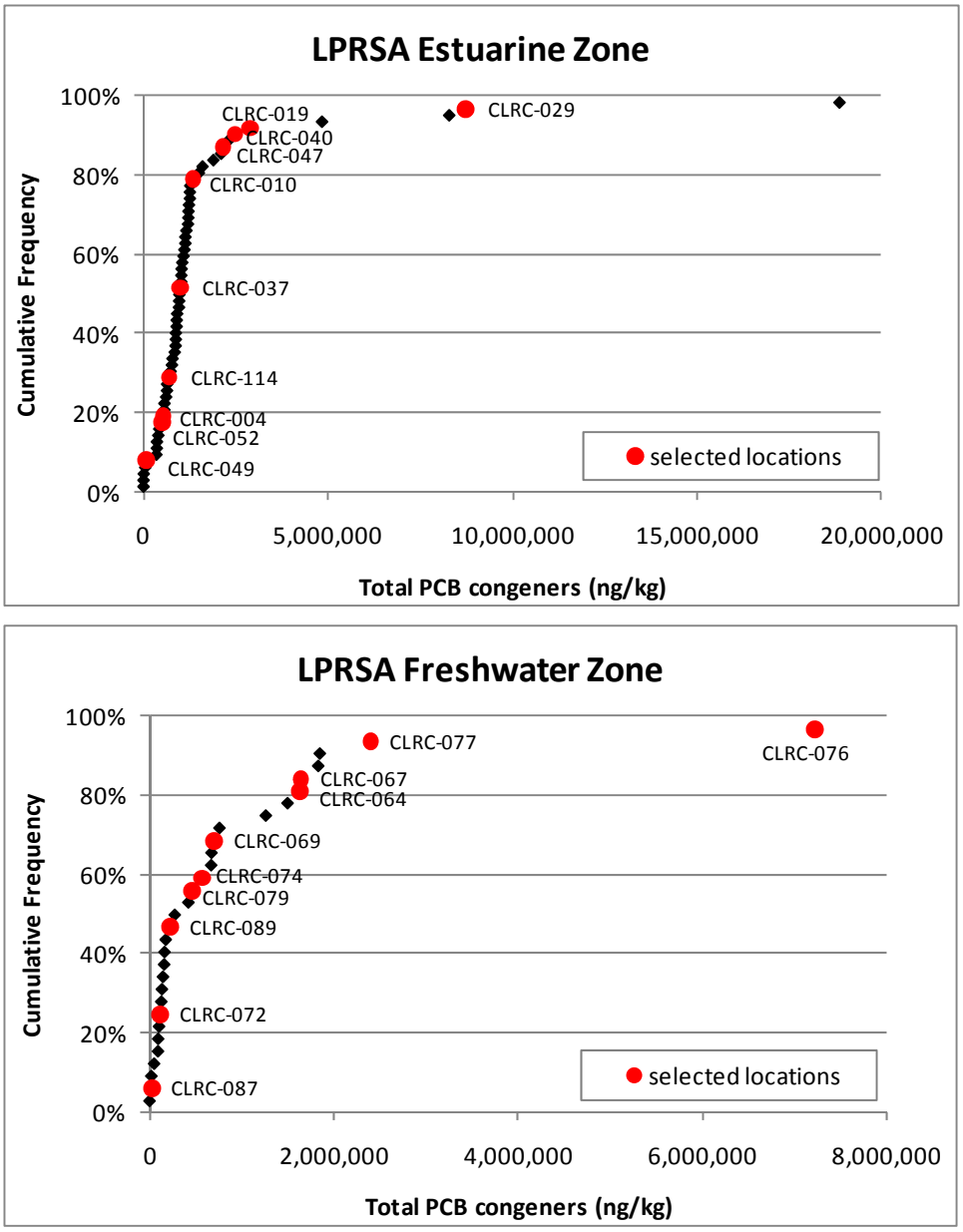


Figure 6. Cumulative frequency of total PCBs (sum of congeners) with selected bioaccumulation locations

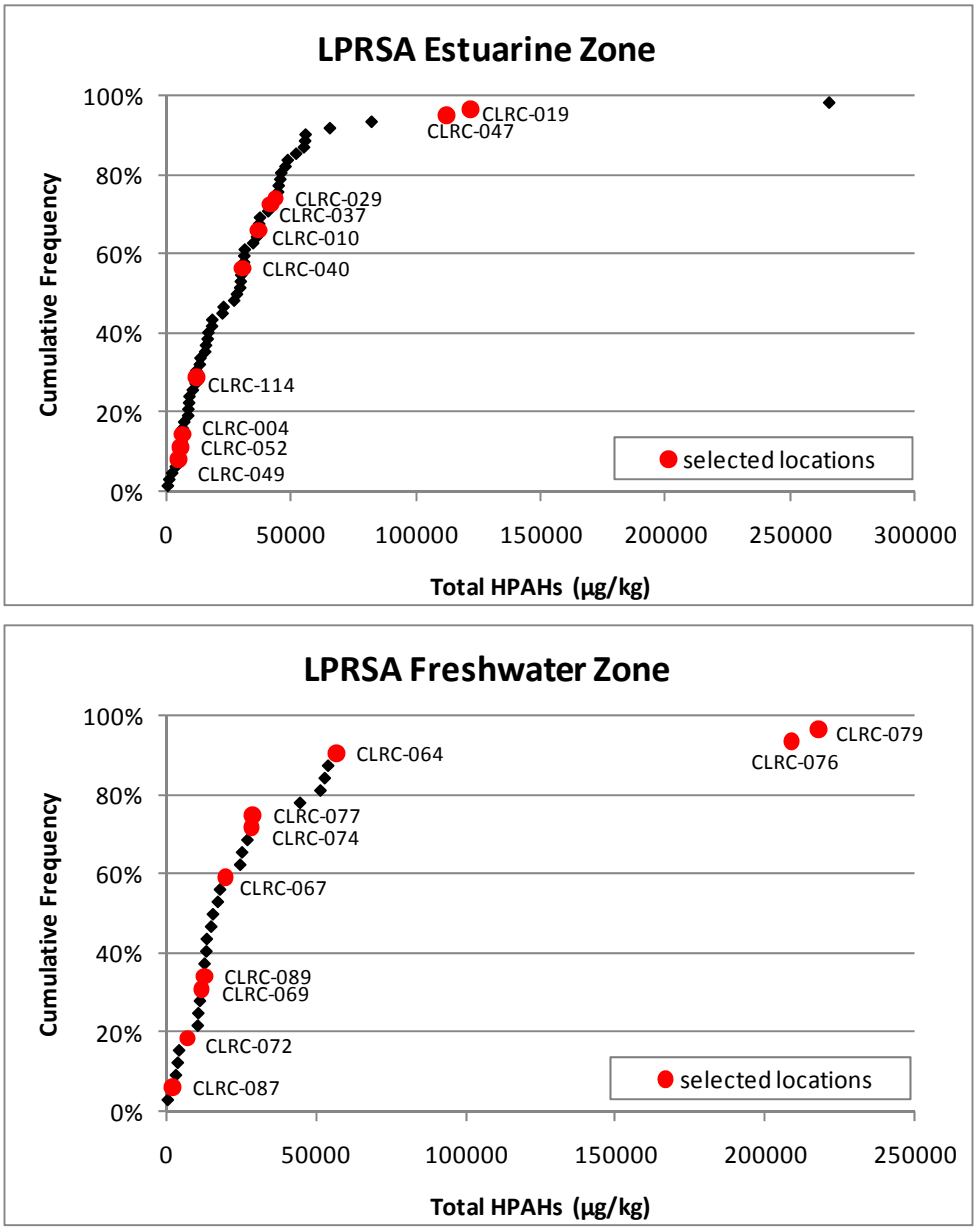


Figure 7. Cumulative frequency of HPAHs with selected bioaccumulation locations

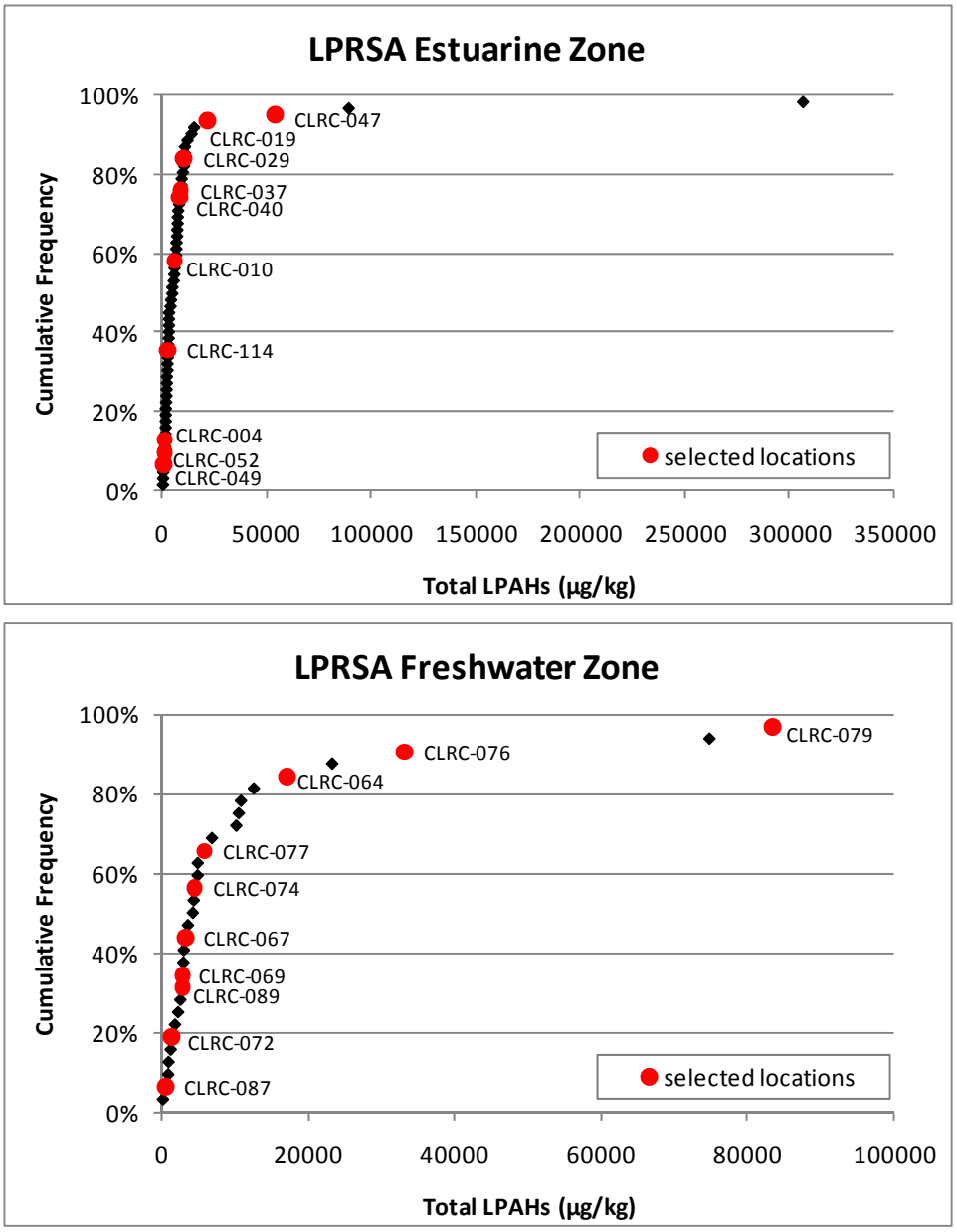
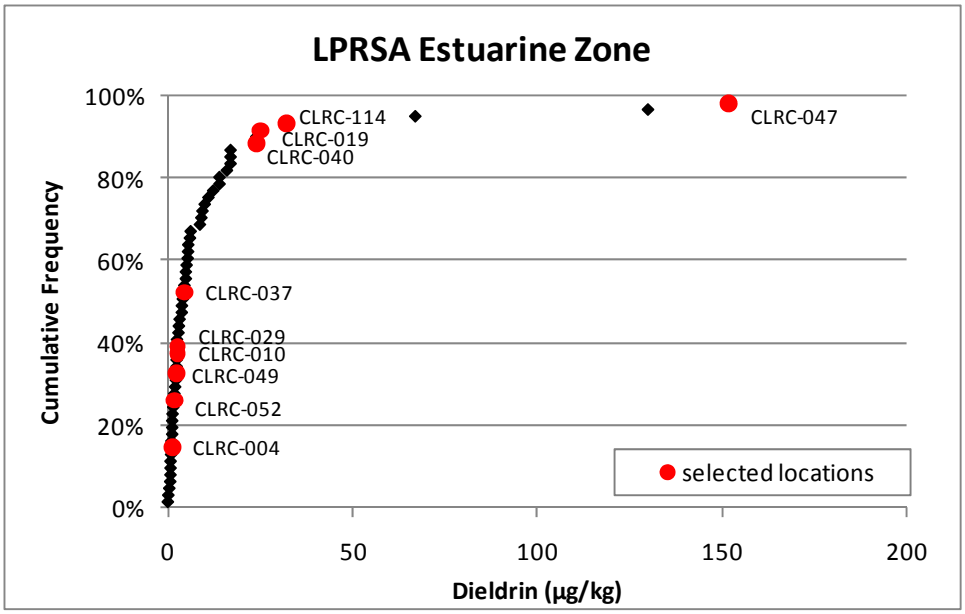


Figure 8. Cumulative frequency of LPAHs with selected bioaccumulation locations



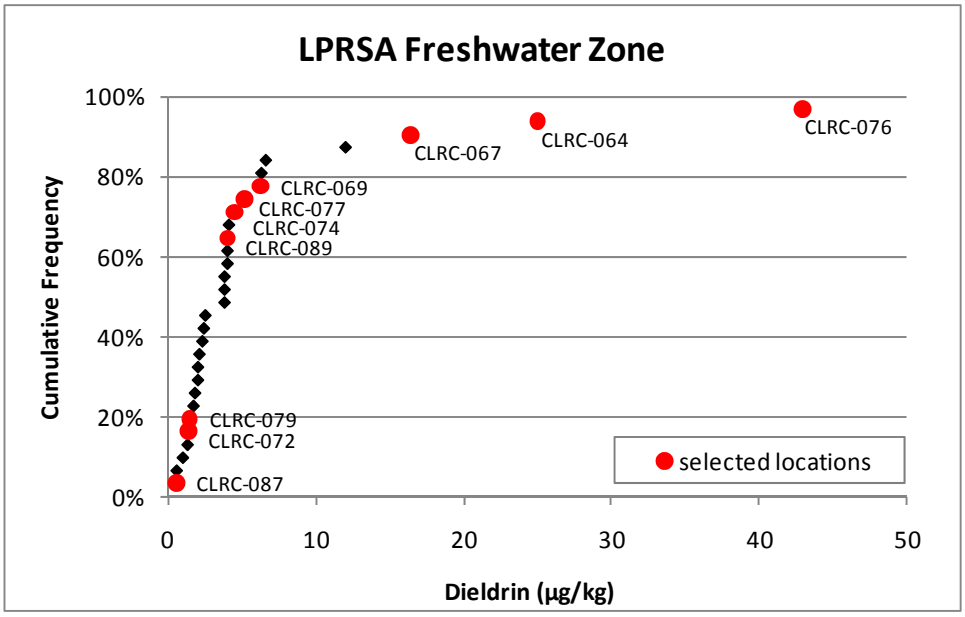


Figure 9. Cumulative frequency of dieldrin with selected bioaccumulation locations

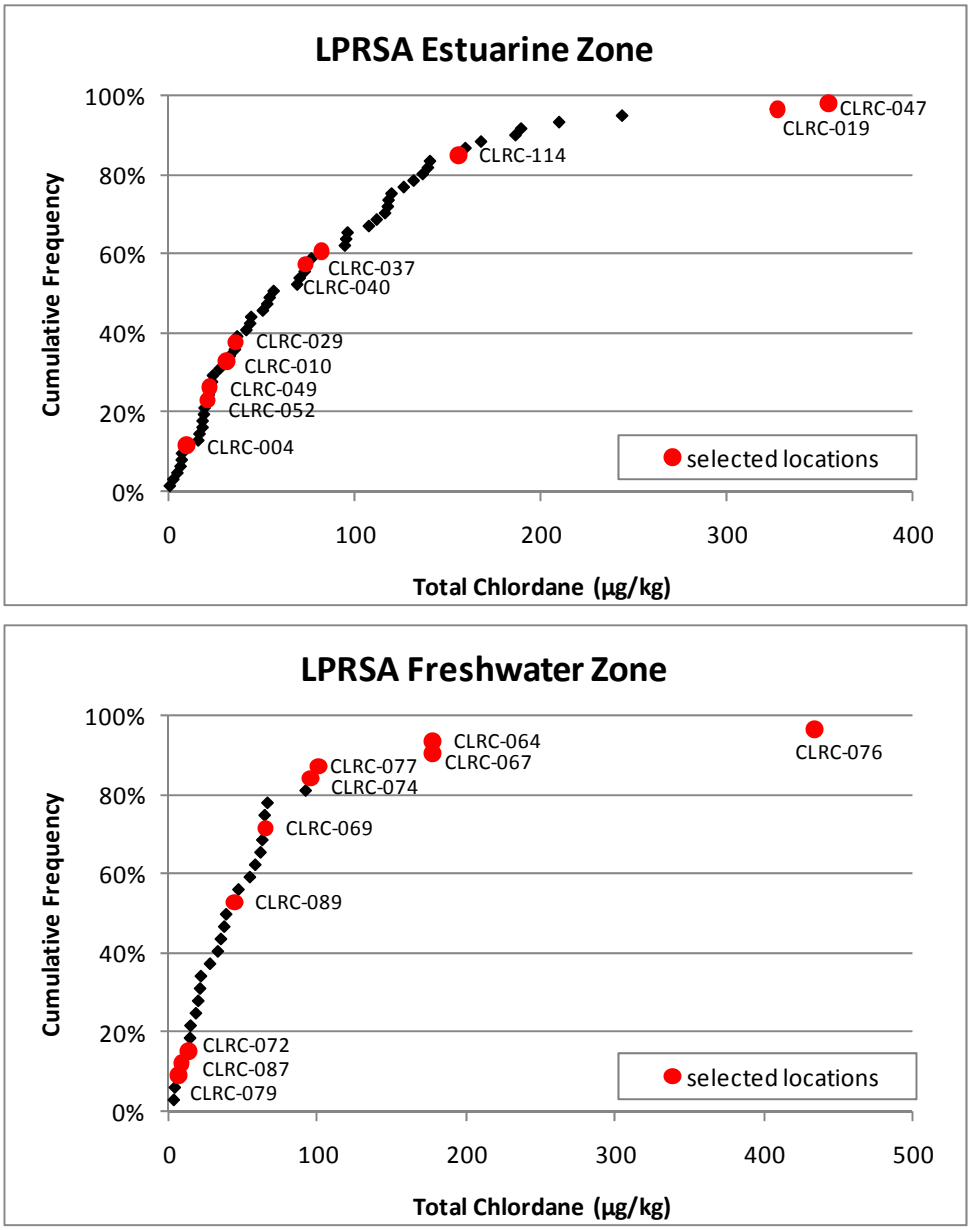


Figure 10. **Cumulative frequency of total chlordane with selected bioaccumulation locations**

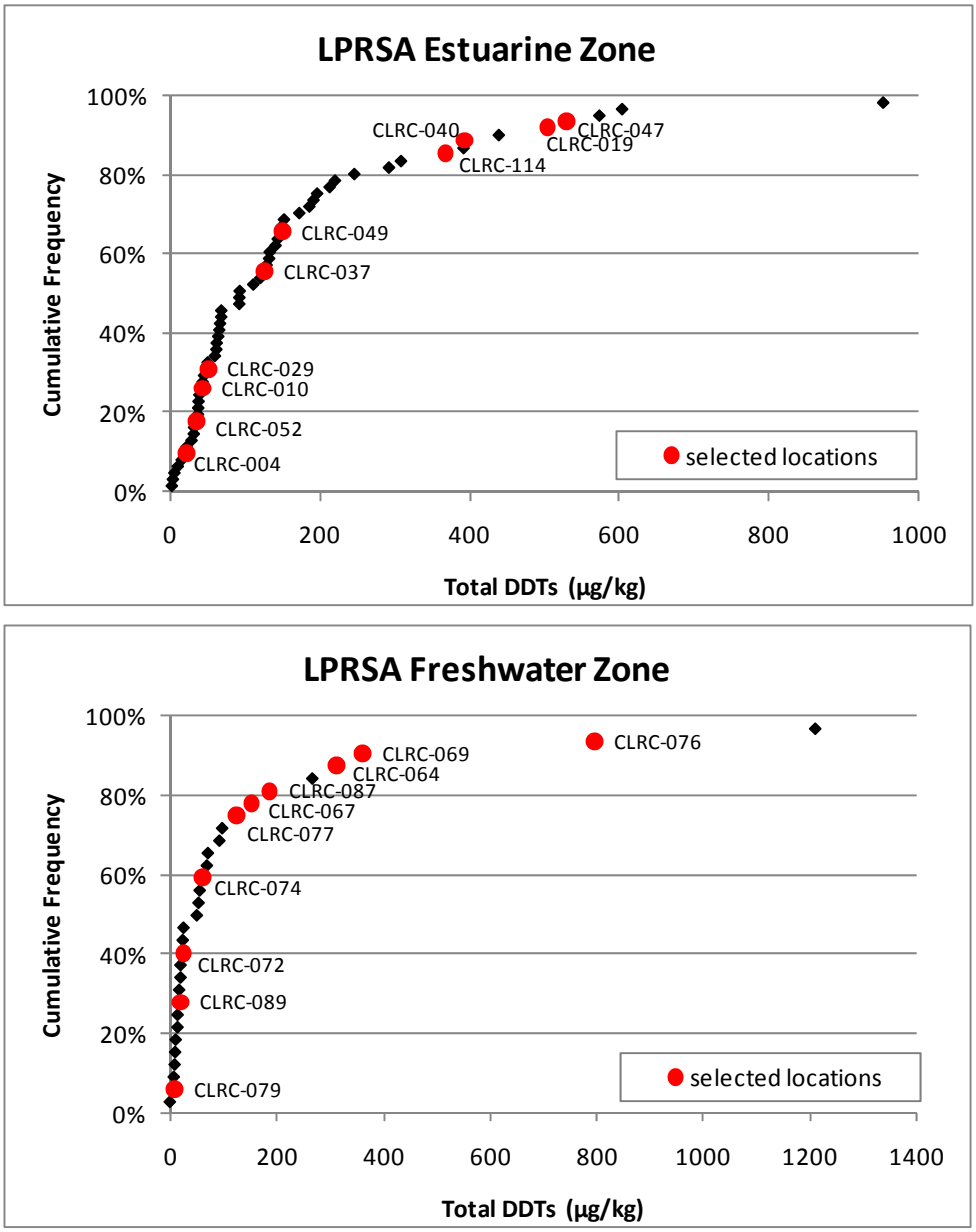
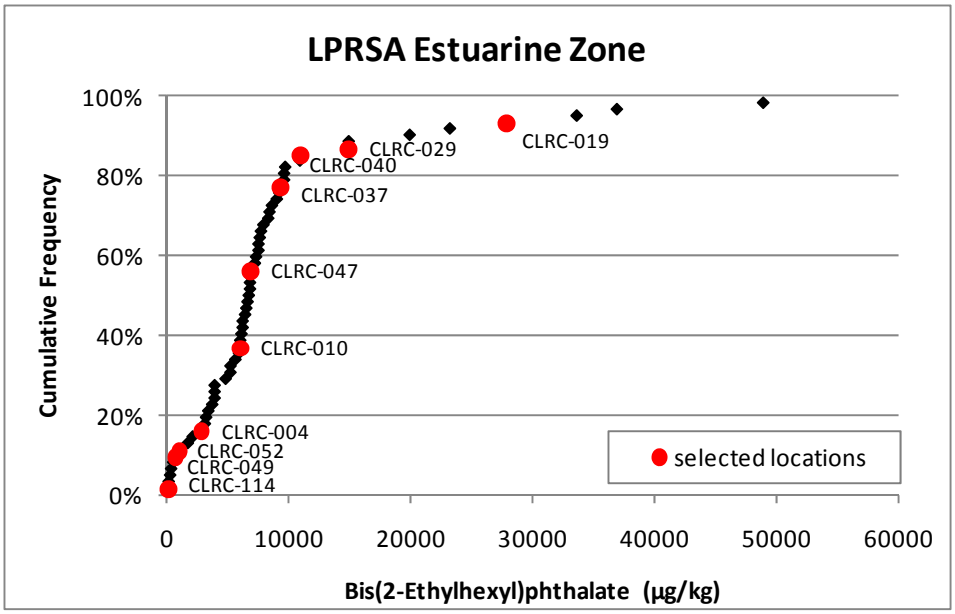


Figure 11. Cumulative frequency of total DDTs with selected bioaccumulation locations



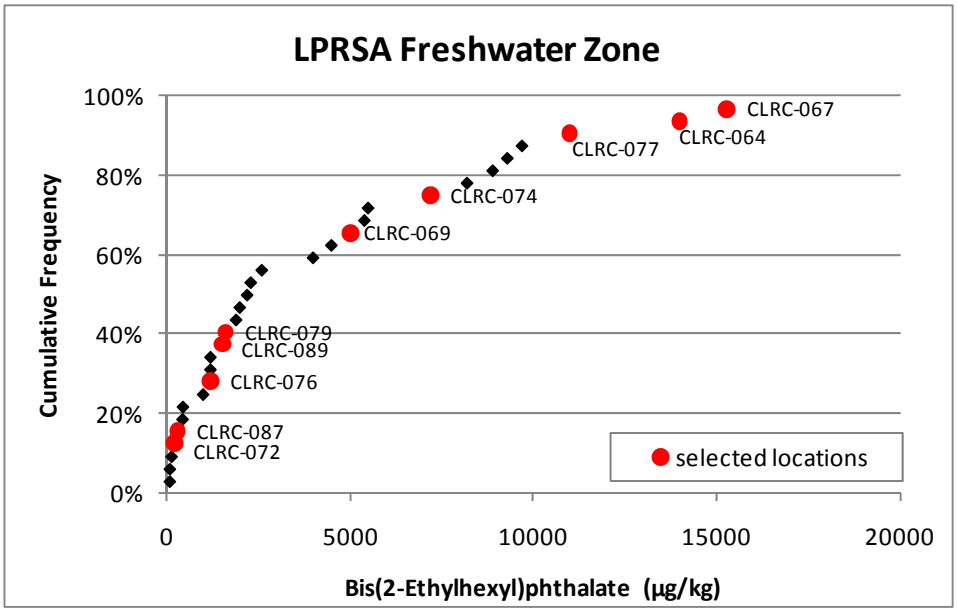


Figure 12. Cumulative frequency of BEHP with selected bioaccumulation locations

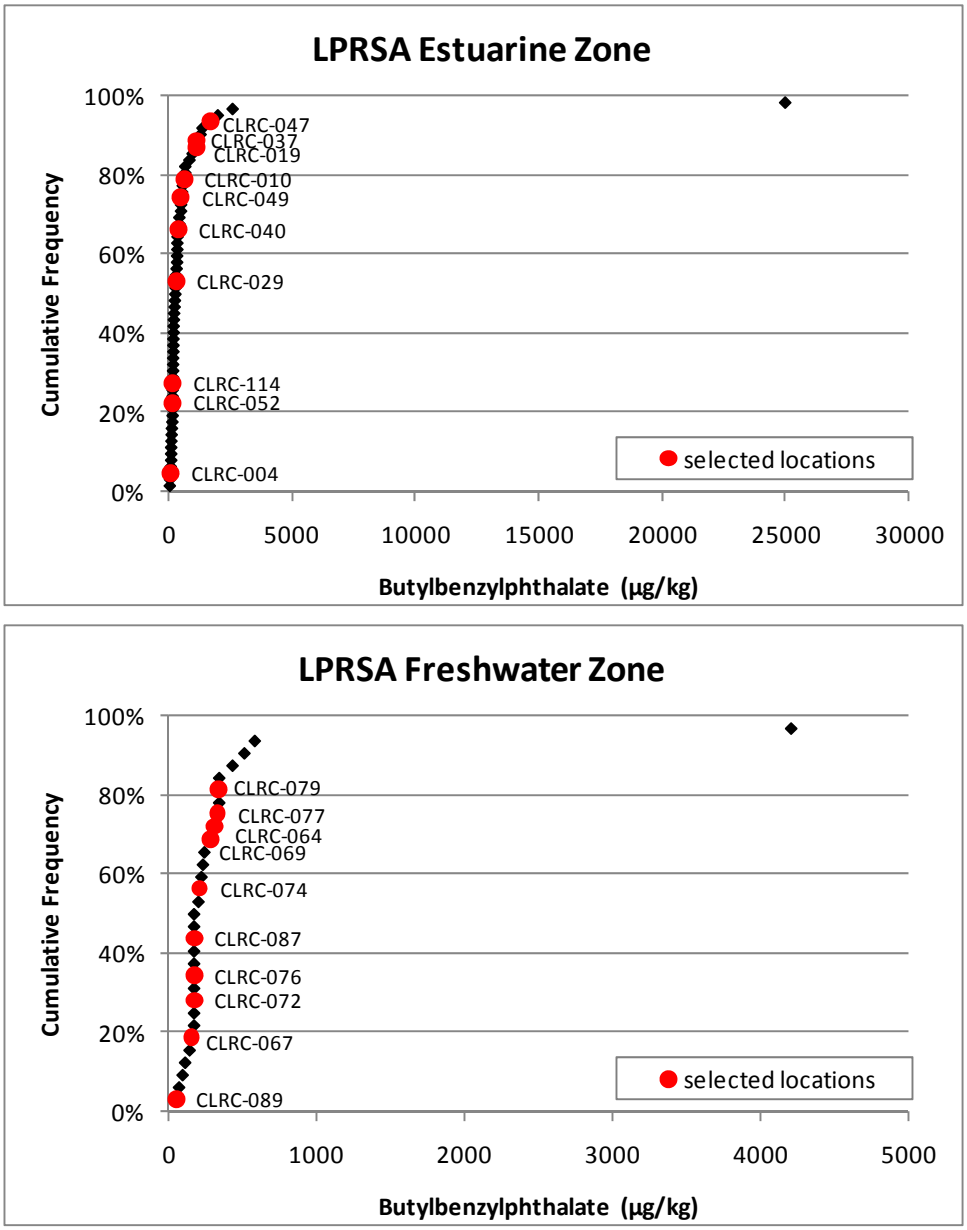


Figure 13. Cumulative frequency of BBP with selected bioaccumulation locations

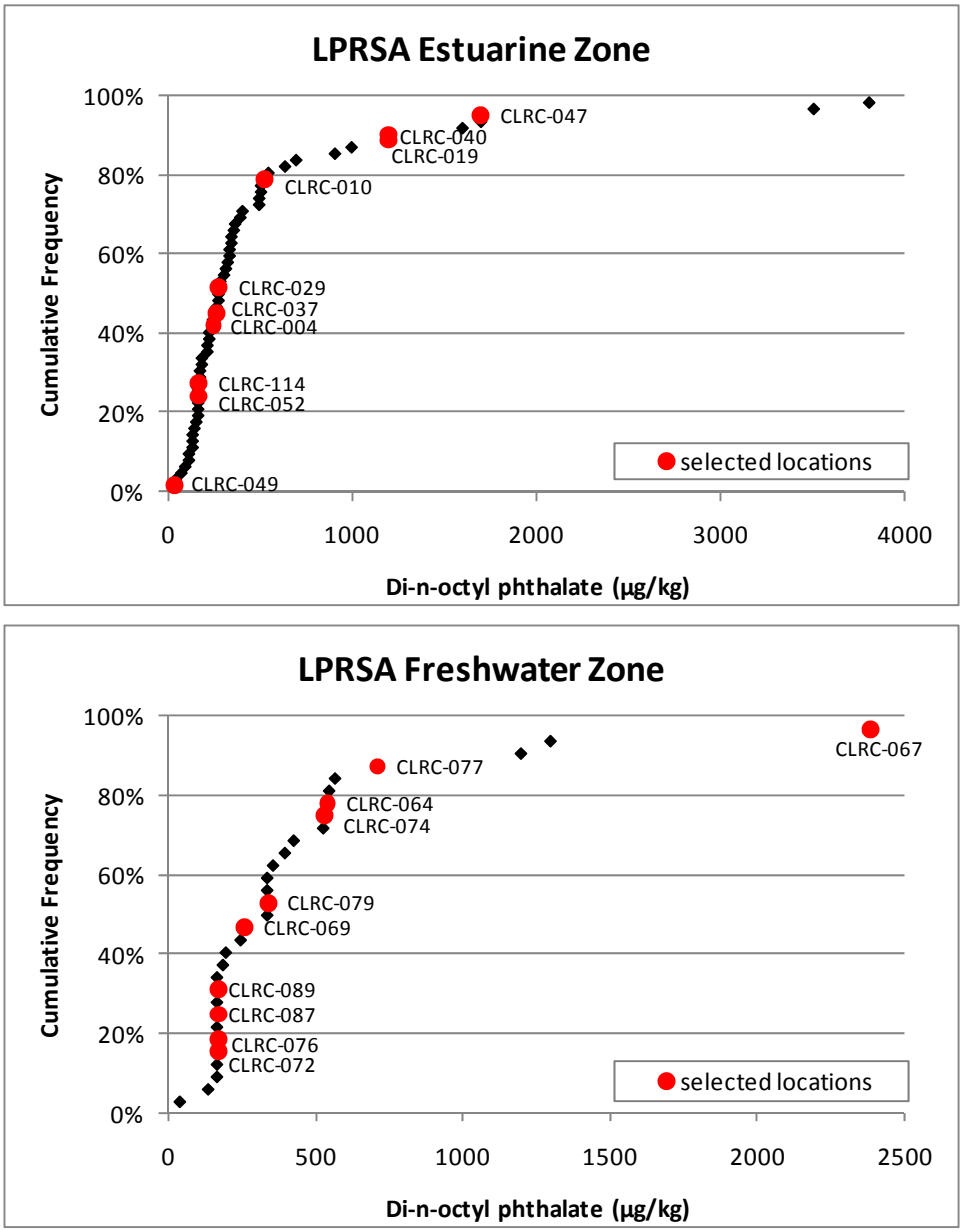


Figure 14. Cumulative frequency of DOP with selected bioaccumulation locations

II. References

NOAA. 2008. Screening quick reference tables. NOAA OR&R report 08-1 [online]. Office of Response and Restoration Division, National Oceanic and Atmospheric Administration, Seattle, WA. [Cited May 15, 2009.] Available from: http://response.restoration.noaa.gov/book_shelf/122_NEW-SQuiRTs.pdf.

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Attachment K: Tissue and Sediment Thresholds Used to Establish Data Quality Levels

The following tables present the ecological data quality levels (DQLs) for tissue and ecological and human health DQLs sediment. It should be noted that these DQLs are not risk assessment numbers and do not represent thresholds that will be used in the baseline ecological risk assessment (ERA) or human health risk assessment (HHRA) but are preliminary screening numbers used to help determine the adequacy and conservative nature of the analytical detection limits being used for tissue and sediment analyses. Thresholds that will be used in the baseline ERA and HHRA will be developed at a later date. The following methods were used to derive ecological and human health DQLs:

- Ecological tissue DQLs were derived by decapod or fish tissue no-observed-apparent-effect level (NOAEL[13]) toxicity reference values (TRVs) and by back-calculating tissue thresholds from literature-based dietary NOAEL TRVs using species-specific exposure parameters (i.e., body weight and food ingestion rate) for multiple avian and mammalian species representing various feeding guilds. NOAEL TRVs derived from toxicity studies were expressed as daily dietary doses normalized for body weight. Ecological tissue DQLs are presented in Table 1.

- Ecological sediment DQLs were based on marine or freshwater sediment thresholds protective of benthic invertebrates directly exposed to sediment and were derived by back-calculating sediment thresholds from literature-based dietary NOAEL TRVs using shorebird-specific exposure parameters (i.e., body weight and sediment ingestion rate). Shorebirds have a relatively high incidental sediment ingestion rate compared to other potential avian or mammal receptors, so sediment DQLs were back-calculated using this receptor. NOAEL TRVs derived from toxicity studies were expressed as daily dietary doses normalized for body weight. DQLs for benthic invertebrates were based on freshwater and marine sediment thresholds presented in the following state and federal regulatory compilations: 1) NOAA effects range-low concentrations (ERLs) (NOAA 2008); 2) New Jersey Department of Environmental Protection sediment quality thresholds (NJDEP 1998); 3) New York Department of Environmental Conservation sediment screening values (NYSDEC 1999); 4) freshwater sediment threshold effects level (TELs) as reported in Smith et al. (1996), or for several PAHs, based on NYSDEC (1994) as cited in CCME (2002); or 5) NJDEP freshwater and marine Ecological Screening Criteria (NJDEP 2009). Ecological sediment DQLs are presented in Table 2.

- Human health sediment DQLs were based on sediment thresholds presented in: 1) USEPA Regional Screening Levels (RSLs) for residential soil from April 2009 (USEPA 2009), and 2) NJDEP Soil Remediation Standards (SRS) for residential soil from June 2008 (NJDEP 2008). RSLs for carcinogenic compounds are based on a target risk level of 1E-06; RSLs for non-carcinogenic compounds have been divided by a factor of 10 to adjust for a hazard index of 0.1 to account for potential additive effects. SRSs for carcinogenic compounds are based on a target risk level of 1E-06; SRSs for non-carcinogenic compounds are based on a hazard index of 1. Human health sediment DQLs are presented in Table 3.

[13] Lowest-observed-apparent-effect levels (LOAELs) were only used in cases where no tissue-residue NOAELs were available from the literature.

The lowest tissue ecological DQL (Table 1) was selected as the tissue DQL for benthic invertebrate tissue. The lowest of the ecological DQL (Table 2) and human health DQL (Table 3) was selected as the sediment DQL (Table 4).

Table 1. Ecological Thresholds Used to Derive Ecological Tissue Data Quality Levels

Analyte	Ecological Tissue Thresholds (mg/kg ww)				Lowest Ecological Tissue DQL[d]	Lowest Ecological Tissue DQL Source
	Decapod Tissue Threshold[a]	Fish Tissue Threshold[a]	Back-Calculated NOAEL Bird Threshold[b]	Back-Calculated NOAEL Mammal Threshold[c]		
Metals						
Aluminum	NA	NA	NA	NA	-	
Antimony	NA	NA	NA	**9,297**	**9,297**	Hext et al. (1999)
Arsenic	**1.15**	NA	1.97	16.4	**1.15**	Lindsay and Sanders (1990)
Barium	NA	NA	179	**31.6**	**31.6**	Perry et al. (1983)[e]
Beryllium	NA	NA	NA	**4.12**	**4.12**	Schroeder and Mitchener (1975)[e]
Cadmium	1.29	NA	**0.63**	21.9	**0.63**	Leach et al. (1979)
Calcium	NA	NA	NA	NA	-	
Chromium	1.0	NA	**0.86**	9154	**0.86**	Haseltine et al. (unpublished)[e]
Chromium VI	NA	NA	NA	NA	-	
Cobalt	NA	NA	1.98	**0.62**	**0.62**	Chetty et al. (1979)
Copper	**34**	NA	40.3	113	**34**	Evans (1980)
Cyanide	NA	NA	NA	**429**	**429**	Tewe and Manor (1981)[e]
Iron	NA	NA	NA	NA	-	
Lead	66	NA	**1.72**	70.4	**1.72**	Edens et al. (1976)
Magnesium	NA	NA	NA	NA	-	
Manganese	NA	NA	838	**549**	**549**	Laskey et al. (1982)[e]
Mercury	1.64	0.2	**0.0086**	0.10	**0.0086**	Heinz (1975; 1979)
Methylmercury	1.64	0.2	**0.0086**	0.10	**0.0086**	Heinz (1975; 1979)
Nickel	NA	NA	66.4	**52.6**	**52.6**	Ambrose et al. (1976)
Potassium	NA	NA	NA	-	-	
Selenium	NA	NA	0.36	**0.34**	**0.34**	Halverson et al. (1966)
Silver	NA	NA	NA	NA	-	
Sodium	NA	NA	NA	NA	-	

Analyte	Ecological Tissue Thresholds (mg/kg ww)				Lowest Ecological Tissue DQL[d]	Lowest Ecological Tissue DQL Source
	Decapod Tissue Threshold[a]	Fish Tissue Threshold[a]	Back-Calculated NOAEL Bird Threshold[b]	Back-Calculated NOAEL Mammal Threshold[c]		
Thallium	NA	NA	**0.41**	4.62	**0.41**	Hudson et al. (1984)
Titanium	NA	NA	NA	NA	**-**	
Vanadium	NA	NA	**1.03**	6.56	**1.03**	Ousterhout and Berg (1981)
Zinc	**12.7**	NA	70.3	998	**12.7**	Mirenda (1986)
VOCs						
1,1,1-Trichloroethane	NA	NA	NA	**6,244**	**6244**	Lane et al. (1982)[e]
1,1-Dichloroethane	NA	NA	NA	NA	**-**	
1,1-Dichloroethene	NA	NA	NA	NA	**-**	
1,1,2,2-Tetrachloroethane	NA	NA	NA	NA	**-**	
1,1,2-Trichloro-1,2,2-trifluoroethane	NA	NA	NA	NA	**-**	
1,1,2-Trichloroethane	NA	NA	NA	NA	**-**	
1,2-Dibromo-3-chloropropane	NA	NA	NA	NA	**-**	
1,2-Dibromoethane	NA	NA	NA	NA	**-**	
1,2-Dichlorobenzene	NA	NA	NA	NA	**-**	
1,2-Dichloroethane	NA	NA	**81.9**	312	**81.9**	Alumot et al. (1976b)[e]
1,2-Dichloropropane	NA	NA	NA	NA	**-**	
1,2,3-Trichlorobenzene	NA	NA	NA	NA	**-**	
1,2,4-Trichlorobenzene	NA	NA	NA	**749**	**749**	Kitchin and Ebron (1983)
1,3-Dichlorobenzene	NA	NA	NA	NA	**-**	
1,4-Dichlorobenzene	212	NA	NA	**33.7**	**33.7**	Lake et al. (1997)
1,4-Dioxane	NA	NA	NA	**3.12**	**3.12**	Giavini et al. (1985)[e]
2-Butanone	NA	NA	NA	**11,057**	**11,057**	Sample et al. (1996)
2-Hexanone	NA	NA	NA	NA	**-**	
4-Methyl-2-pentanone	NA	NA	NA	**11,057**	**11,057**	Sample et al. (1996)
Acetone	NA	NA	**190**	1030	**190**	Hill et al. (1975)
Benzene	NA	NA	NA	**165**	**165**	Nawrot and Staples (1979)[e]

Analyte	Ecological Tissue Thresholds (mg/kg ww)				Lowest Ecological Tissue DQL[d]	Lowest Ecological Tissue DQL Source
	Decapod Tissue Threshold[a]	Fish Tissue Threshold[a]	Back-Calculated NOAEL Bird Threshold[b]	Back-Calculated NOAEL Mammal Threshold[c]		
Bromochloromethane	NA	NA	NA	NA	-	
Bromodichloromethane	NA	NA	NA	NA	-	
Bromoform	NA	NA	NA	NA	-	
Bromomethane	NA	NA	NA	NA	-	
Carbon Disulfide	NA	NA	NA	NA	-	
Carbon Tetrachloride	NA	NA	NA	**99.9**	**99.9**	Alumot et al (1976a)[e]
Chloroethane	NA	NA	NA	NA	-	
Chloromethane	NA	NA	NA	NA	-	
cis-1,2-Dichloroethene	NA	NA	NA	NA	-	
cis-1,3-Dichloropropene	NA	NA	NA	NA	-	
Chlorobenzene	NA	NA	NA	NA	-	
Chloroform	NA	NA	NA	NA	-	
Cyclohexane	NA	NA	NA	NA	-	
Dibromochloromethane	NA	NA	NA	NA	-	
Dichorodifluoromethane	NA	NA	NA	NA	-	
Ethylbenzene	NA	NA	NA	NA	-	
Isopropylbenzene	NA	NA	NA	NA	-	
Methyl acetate	NA	NA	NA	NA	-	
Methylcyclohexane	NA	NA	NA	NA	-	
Methylene Chloride	NA	NA	NA	NA	-	
Methyl tert-Butyl Ether	NA	NA	NA	NA	-	
Styrene	NA	NA	NA	NA	-	
Tetrachloroethene	NA	NA	NA	NA	-	
Toluene	NA	NA	NA	**162**	**162**	Nawrot and Staples (1979)[e]
trans-1,2-Dichloroethene	NA	NA	NA	NA	-	
trans-1,3-Dichloropropene	NA	NA	NA	NA	-	
Trichloroethene	NA	NA	NA	NA	-	
Trichlorofluoromethane	NA	NA	NA	NA	-	

Analyte	Ecological Tissue Thresholds (mg/kg ww)				Lowest Ecological Tissue DQL[d]	Lowest Ecological Tissue DQL Source
	Decapod Tissue Threshold[a]	Fish Tissue Threshold[a]	Back-Calculated NOAEL Bird Threshold[b]	Back-Calculated NOAEL Mammal Threshold[c]		
m, p-Xylene	NA	NA	NA	NA	-	
o-Xylene	NA	NA	NA	NA	-	
Vinyl Chloride	NA	NA	NA	**1.06**	**1.06**	Sample et al. (1996)
SVOCs						
1,1'-Biphenyl	NA	NA	NA	NA	-	
1,2,4,5-Tetrachlorobenzene	NA	NA	NA	NA	-	
1-Methylnaphthalene	NA	NA	NA	**937**	**937**	Murata et al. (1993)
1-Methyl-phenanthrene	NA	NA	NA	NA	-	
2,2'-Oxybis (1-Chloropropane)	NA	NA	NA	NA	-	
2,3,4,6-Tetrachlorophenol	NA	NA	NA	NA	-	
2,3,5-Trimethylnaphthalene	NA	NA	NA	NA	-	
2,4-Dichlorophenol	NA	NA	NA	NA	-	
2,4-Dimethylphenol	NA	NA	NA	**37.5**	**37.5**	Daniel et al. (1993)
2,4-Dinitrophenol	NA	NA	NA	NA	-	
2,4-Dinitrotoluene	NA	NA	NA	NA	-	
2,4,5-Trichlorophenol	NA	NA	NA	NA	-	
2,4,6-Trichlorophenol	NA	NA	NA	NA	-	
2,6-Dimethylnaphthalene	NA	NA	NA	NA	-	
2,6-Dinitrotoluene	NA	NA	NA	NA	-	
2-Chloronaphthalene	NA	NA	NA	NA	-	
2-Chlorophenol	NA	NA	NA	NA	-	
2-Methylnaphthalene	NA	NA	NA	**337**	**337**	Murata et al. (1997)
2-Methylphenol	NA	NA	NA	NA	-	
2-Nitroaniline	NA	NA	NA	NA	-	
2-Nitrophenol	NA	NA	NA	NA	-	
3,3'-Dichlorobenzidine	NA	NA	NA	NA	-	
3-Nitroaniline	NA	NA	NA	NA	-	
4,6-Dinitro-2-methylphenol	NA	NA	NA	NA	-	
4-Bromophenyl-phenylether	NA	NA	NA	NA	-	

Analyte	Ecological Tissue Thresholds (mg/kg ww)				Lowest Ecological Tissue DQL[d]	Lowest Ecological Tissue DQL Source
	Decapod Tissue Threshold[a]	Fish Tissue Threshold[a]	Back-Calculated NOAEL Bird Threshold[b]	Back-Calculated NOAEL Mammal Threshold[c]		
4-Chloro-3-methylphenol	NA	NA	NA	NA	-	
4-Chloroaniline	NA	NA	NA	NA	-	
4-Chlorophenyl-phenyl ether	NA	NA	NA	NA	-	
4-Methylphenol	NA	**76.5**	NA	NA	**76.5**	Kaiser et al. (1984)
4-Nitroaniline	NA	NA	NA	NA	-	
4-Nitrophenol	NA	NA	NA	NA	-	
Acetophenone	NA	NA	NA	NA	-	
Acenaphthene	NA	NA	**0.24**[f]	12.5[f]	**0.24**	Hough et al. (1993)
Acenaphthylene	NA	NA	**0.24**[f]	12.5[f]	**0.24**	Hough et al. (1993)
Anthracene	NA	NA	**0.24**[f]	12.5[f]	**0.24**	Hough et al. (1993)
Atrazine	NA	NA	NA	NA	-	
Benzaldehyde	NA	NA	NA	NA	-	
Benzo(a)anthracene	NA	NA	**0.24**[f]	12.5[f]	**0.24**	Hough et al. (1993)
Benzo(a)pyrene	NA	NA	**0.24**[f]	12.5[f]	**0.24**	Hough et al. (1993)
Benzo(b)fluoranthene	NA	NA	**0.24**[f]	12.5[f]	**0.24**	Hough et al. (1993)
Benzo(e)pyrene	NA	NA	NA	NA	-	
Benzo(g,h,i)perylene	NA	NA	**0.24**[f]	12.5[f]	**0.24**	Hough et al. (1993)
Benzo(k)fluoranthene	NA	NA	**0.24**[f]	12.5[f]	**0.24**	Hough et al. (1993)
bis-(2-Chloroethoxy)methane	NA	NA	NA	NA	-	
bis-(2-Chloroethyl)ether	NA	NA	NA	NA	-	
bis(2-Ethylhexyl) phthalate	NA	**0.39**	1.24	275	**0.39**	Mehrle and Mayer (1976)
Butylbenzylphthalate	NA	NA	**1.24**[g]	5188	**1.24**	Peakall (1974)
Caprolactam	NA	NA	NA	NA	-	
Carbazole	NA	NA	NA	NA	-	
Chrysene	NA	NA	**0.24**[f]	12.5[f]	**0.24**	Hough et al. (1993)
Dibenzo(a,h)-anthracene	NA	NA	**0.24**[f]	12.5[f]	**0.24**	Hough et al. (1993)
Dibenzofuran	NA	NA	NA	NA	-	
Dibenzothiophene	NA	NA	NA	**293**	**293**	Leighton (1989)
Diethylphthalate	NA	NA	**1.24**[g]	11613	**1.24**	Peakall (1974)

Analyte	Ecological Tissue Thresholds (mg/kg ww)				Lowest Ecological Tissue DQL[d]	Lowest Ecological Tissue DQL Source
	Decapod Tissue Threshold[a]	Fish Tissue Threshold[a]	Back-Calculated NOAEL Bird Threshold[b]	Back-Calculated NOAEL Mammal Threshold[c]		
Dimethylphthalate	NA	NA	**1.24**[g]	275	**1.24**	Peakall (1974)
Di-n-butylphthalate	**0.5**	NA	1.24	100	**0.5**	Laughlin et al. (1978)
Di-n-octylphthalate	NA	NA	**1.24**[g]	46827	**1.24**	Peakall (1974)
Fluoranthene	NA	NA	**0.24**[f]	12.5[f]	**0.24**	Hough et al. (1993)
Fluorene	NA	NA	**0.24**[f]	12.5[f]	**0.24**	Hough et al. (1993)
Hexachlorobenzene	NA	468	0.21	**0.16**	**0.16**	Bleavins et al. (1984)
Hexachlorobutadiene	NA	20	**1.46**	12.5[f]	**1.46**	Schwetz et al. (1974)
Hexachloroethane	NA	NA	NA	**624**	**624**	Weeks et al. (1979)
Hexchlorocyclo-pentadiene	NA	NA	NA	NA	**-**	
Indeno(1,2,3-cd)-pyrene	NA	NA	**0.24**[f]	12.5[f]	**0.24**	Hough et al. (1993)
Isophorone	NA	NA	NA	NA	**-**	
Phenanthrene	NA	NA	**0.24**[f]	12.5[f]	**0.24**	Hough et al. (1993)
Pentachlorophenol	NA	NA	**18.9**	25.0	**18.9**	Prescott et al. (1982)
Perylene	NA	NA	NA	NA	**-**	
Petroleum Hydrocarbons (extractable)	NA	NA	NA	NA	**-**	
Petroleum Hydrocarbons (purgeable)	NA	NA	NA	NA	**-**	
Phenol	NA	NA	NA	**375**	**375**	Argus Research Laboratories (1997) as cited in IRIS (USEPA 2006)
Pyrene	NA	NA	**0.24**[f]	12.5[f]	**0.24**	Hough et al. (1993)
Naphthalene	NA	NA	**0.24**[f]	830	**0.24**	Hough et al. (1993)
Nitrobenzene	NA	NA	NA	NA	**-**	
n-Nitroso-di-n-propylamine	NA	NA	NA	NA	**-**	
n-Nitrosodiphenylamine	NA	NA	NA	NA	**-**	
TPH	NA	NA	NA	NA	**-**	
TPH -DRO	NA	NA	NA	NA	**-**	
PCBs						

Analyte	Ecological Tissue Thresholds (mg/kg ww)				Lowest Ecological Tissue DQL[d]	Lowest Ecological Tissue DQL Source
	Decapod Tissue Threshold[a]	Fish Tissue Threshold[a]	Back-Calculated NOAEL Bird Threshold[b]	Back-Calculated NOAEL Mammal Threshold[c]		
Total PCBs	1.1	0.52	0.25	**0.0231**	**0.0231**	Restum et al. (1998)
PCB 077	NA	0.0195	**0.00024**[h]	0.027[h]	**0.00024**	Nosek et al. (1992)
PCB 081	NA	0.0039	**0.00012**[h]	0.0092[h]	**0.00012**	Nosek et al. (1992)
PCB 105	NA	0.39	0.12[h]	**0.092**[h]	**0.092**	Tillitt et al. (1996)
PCB 114	NA	0.39	0.12[h]	**0.092**[h]	**0.092**	Tillitt et al. (1996)
PCB 118	NA	0.39	1.2[h]	**0.092**[h]	**0.092**	Tillitt et al. (1996)
PCB 123	NA	0.39	1.2[h]	**0.092**[h]	**0.092**	Tillitt et al. (1996)
PCB 126	NA	0.00039	0.00012[h]	**0.000027**[h]	**0.000027**	Tillitt et al. (1996)
PCB 156	NA	0.39	0.12[h]	**0.092**[h]	**0.092**	Tillitt et al. (1996)
PCB 157	NA	0.39	0.12[h]	**0.092**[h]	**0.092**	Tillitt et al. (1996)
PCB 167	NA	0.39	1.2[h]	**0.092**[h]	**0.092**	Tillitt et al. (1996)
PCB 169	NA	0.039	0.012[h]	**0.000092**[h]	**0.000092**	Tillitt et al. (1996)
PCB 189	NA	0.39	1.2[h]	**0.092**[h]	**0.092**	Tillitt et al. (1996)
PCDDs/PCDFs						
2,3,7,8-Tetrachlorodibenzo-*p*-dioxin	NA	**0.00000195**	0.000012	0.00000275	**0.00000195**	Giesy et al. (2002)
1,2,3,7,8-Pentachlorodibenzo-*p*-dioxin	NA	**0.00000195**	0.000012[h]	0.00000275[h]	**0.00000195**	Giesy et al. (2002)
1,2,3,4,7,8-Hexachlorodibenzo-*p*-dioxin	NA	**0.00000195**	0.00024[h]	0.0000275[h]	**0.00000195**	Giesy et al. (2002)
1,2,3,6,7,8-Hexachlorodibenzo-*p*-dioxin	NA	0.000195	0.0012[h]	**0.0000275**[h]	**0.0000275**	Tillitt et al. (1996)
1,2,3,7,8,9-Hexachlorodibenzo-*p*-dioxin	NA	0.000195	0.00012[h]	**0.0000275**[h]	**0.0000275**	Tillitt et al. (1996)
1,2,3,4,6,7,8-Heptachlorodibenzo-*p*-dioxin	NA	0.00195	0.012[h]	**0.000275**[h]	**0.000275**	Tillitt et al. (1996)
Octachlorodibenzo-p-dioxin	NA	0.0195	0.12[h]	**0.00916**[h]	**0.00916**	Tillitt et al. (1996)
2,3,7,8-Tetrachlorodibenzofuran	NA	0.000039	**0.000012**[h]	0.000027[h]	**0.000012**	Nosek et al. (1992)
1,2,3,7,8-Pentachlorodibenzofuran	NA	**0.000039**	0.00012[h]	0.000092[h]	**0.000039**	Giesy et al. (2002)
2,3,4,7,8-Pentachlorodibenzofuran	NA	**0.0000039**	0.000012[h]	0.0000092[h]	**0.0000039**	Giesy et al. (2002)

Analyte	Ecological Tissue Thresholds (mg/kg ww)				Lowest Ecological Tissue DQL[d]	Lowest Ecological Tissue DQL Source
	Decapod Tissue Threshold[a]	Fish Tissue Threshold[a]	Back-Calculated NOAEL Bird Threshold[b]	Back-Calculated NOAEL Mammal Threshold[c]		
1,2,3,4,7,8-Hexachlorodibenzofuran	NA	**0.0000195**	0.00012[h]	0.000027[h]	**0.0000195**	Giesy et al. (2002)
1,2,3,6,7,8-Hexachlorodibenzofuran	NA	**0.0000195**	0.00012[h]	0.000027[h]	**0.0000195**	Giesy et al. (2002)
1,2,3,7,8,9-Hexachlorodibenzofuran	NA	**0.0000195**	0.00012[h]	0.000027[h]	**0.0000195**	Giesy et al. (2002)
2,3,4,6,7,8-Hexachlorodibenzofuran	NA	**0.0000195**	0.00012[h]	0.000027[h]	**0.0000195**	Giesy et al. (2002)
1,2,3,4,6,7,8-Heptachlorodibenzofuran	NA	**0.000195**	0.0012[h]	0.00027[h]	**0.000195**	Giesy et al. (2002)
1,2,3,4,7,8,9-Heptachlorodibenzofuran	NA	**0.000195**	0.0012[h]	0.00027[h]	**0.000195**	Giesy et al. (2002)
Octachlorodibenzofuran	NA	0.0195	0.12[h]	**0.0092[h]**	**0.0092**	Tillitt et al. (1996)
PAHs						
1-Methylphenanthrene	NA	NA	NA	NA	**-**	
2,3,5-Trimethylnaphthalene	NA	NA	NA	NA	**-**	
2,6-Dimethylnaphthalene	NA	NA	NA	NA	**-**	
2-Methylnaphthalene	NA	NA	NA	**337**	**337**	Murata et al. (1997)
Acenaphthene	NA	NA	**0.24[f]**	12.5[f]	**0.24**	Hough et al. (1993)
Acenaphthylene	NA	NA	**0.24[f]**	12.5[f]	**0.24**	Hough et al. (1993)
Anthracene	NA	NA	**0.24[f]**	12.5[f]	**0.24**	Hough et al. (1993)
Fluorene	NA	NA	**0.24[f]**	12.5[f]	**0.24**	Hough et al. (1993)
Naphthalene	NA	NA	**0.24[f]**	830	**0.24**	Hough et al. (1993)
Phenanthrene	NA	NA	**0.24[f]**	12.5[f]	**0.24**	Hough et al. (1993)
Benzo[a]anthracene	NA	NA	**0.24[f]**	12.5[f]	**0.24**	Hough et al. (1993)
Benzo[a]pyrene	NA	NA	**0.24[f]**	12.5[f]	**0.24**	Hough et al. (1993)
Benzo[b]fluoranthene	NA	NA	**0.24[f]**	12.5[f]	**0.24**	Hough et al. (1993)
Benzo[e]pyrene	NA	NA	NA	NA	**-**	
Benzo[g,h,i]perylene	NA	NA	**0.24[f]**	12.5[f]	**0.24**	Hough et al. (1993)
Benzo[k]fluoranthene	NA	NA	**0.24[f]**	12.5[f]	**0.24**	Hough et al. (1993)

Analyte	Ecological Tissue Thresholds (mg/kg ww)				Lowest Ecological Tissue DQL[d]	Lowest Ecological Tissue DQL Source
	Decapod Tissue Threshold[a]	Fish Tissue Threshold[a]	Back-Calculated NOAEL Bird Threshold[b]	Back-Calculated NOAEL Mammal Threshold[c]		
Chrysene	NA	NA	**0.24**[f]	12.5[f]	**0.24**	Hough et al. (1993)
Dibenzo[a,h]anthracene	NA	NA	**0.24**[f]	12.5[f]	**0.24**	Hough et al. (1993)
Dibenzothiophene	NA	NA	NA	**293**	**293**	Leighton (1989)
Fluoranthene	NA	NA	**0.24**[f]	12.5[f]	**0.24**	Hough et al. (1993)
Indeno[1,2,3-c,d]-pyrene	NA	NA	**0.24**[f]	12.5[f]	**0.24**	Hough et al. (1993)
Perylene	NA	NA	NA	NA	**-**	
Pyrene	NA	NA	**0.24**[f]	12.5[f]	**0.24**	Hough et al. (1993)
Pesticides						
2,4'-DDD	**0.046**[i]	1.8[i]	0.154	1.62[i]	**0.046**	Nimmo et al. (1970)
2,4'-DDE	**0.046**[i]	1.8[i]	0.055	1.62[i]	**0.046**	Nimmo et al. (1970)
2,4'-DDT	0.046[i]	1.8[i]	**0.026**	1.62[i]	**0.026**	Stickel and Rhodes (1970)
4,4'-DDD	**0.046**[i]	1.8[i]	0.154	1.62[i]	**0.046**	Nimmo et al. (1970)
4,4'-DDE	**0.046**[i]	1.8[i]	0.055	1.62[i]	**0.046**	Nimmo et al. (1970)
4,4'-DDT	0.046[i]	1.8[i]	**0.026**	1.62[i]	**0.026**	Stickel and Rhodes (1970)
Aldrin	NA	5.3	**0.0069**	5.0	**0.0069**	DeWitt (1956)
alpha-Hexachlorocyclohexane	NA	NA	**1.37**[j]	38.1[j]	**1.37**	Chakravarty and Lahiri (1986)
alpha-Chlordane	**0.49**	0.71	NA	NA	**0.49**	Parrish et al. (1976)
beta-Hexachlorocyclohexane	NA	NA	**1.37**[j]	35.6	**1.37**	Chakravarty and Lahiri (1986)
delta-Hexachlorocyclohexane	NA	NA	**1.37**[j]	38.1[j]	**1.37**	Chakravarty and Lahiri (1986)
Dieldrin	NA	0.12	**0.057**	1.12	**0.057**	Mendenhall et al. (1983)
Endosulfan I	0.08[k]	**0.031**[k]	8.58[k]	5.24[k]	**0.031**	Schimmel et al. (1977)
Endosufan II	0.08[k]	**0.031**[k]	8.58[k]	5.24[k]	**0.031**	Schimmel et al. (1977)
Endosulfan sulfate	0.08	**0.031**	8.58	5.24	**0.031**	Schimmel et al. (1977)
Endrin	NA	0.0115	**0.010**	1.12	**0.010**	DeWitt (1956)
Endrin aldehyde	NA	0.0115[l]	**0.010**[l]	1.12[l]	**0.010**	DeWitt (1956)
Endrin ketone	NA	0.0115[l]	**0.010**[l]	1.12[l]	**0.010**	DeWitt (1956)

Analyte	Ecological Tissue Thresholds (mg/kg ww)				Lowest Ecological Tissue DQL[d]	Lowest Ecological Tissue DQL Source
	Decapod Tissue Threshold[a]	Fish Tissue Threshold[a]	Back-Calculated NOAEL Bird Threshold[b]	Back-Calculated NOAEL Mammal Threshold[c]		
gamma-BHC (Lindane)	NA	6.13	**1.37**	38.1	**1.37**	Chakravarty and Lahiri (1986)
gamma-Chlordane	**0.49**[m]	0.71[m]	NA	NA	**0.49**	Parrish et al. (1976)
Heptachlor	NA	1.5	**0.086**	6.24	**0.086**	Hill et al. (1975)
Heptachlor epoxide	NA	0.8	**0.086**[n]	6.24	**0.086**	Hill et al. (1975)
Methoxychlor	<0.1	**0.05**	29.7	106	**0.05**	Oladimeji and Leduc (1975)
Total Chlordane	**0.49**	0.71	0.51	1.12	**0.49**	Parrish et al. (1976)
cis-Nonachlor	**0.49**[m]	0.71[m]	0.51[m]	1.12[m]	**0.49**	Parrish et al. (1976)
trans-Nonachlor	**0.49**[m]	0.71[m]	0.51[m]	1.12[m]	**0.49**	Parrish et al. (1976)
Oxychlordane	**0.49**[m]	0.71[m]	0.51[m]	1.12[m]	**0.49**	Parrish et al. (1976)
Butyltins						
Dibutyl tin	**0.22**[o]	0.26[o]	1.2[o]	23.7	**0.22**	Tsuda et al. (1990)
Monobuyltin	0.22[o]	0.26[o]	1.2[o]	2.5[o]	**0.22**	Tsuda et al. (1990)
Tetrabutyl tin	**0.22**[o]	0.26[o]	1.2[o]	2.5[o]	**0.22**	Tsuda et al. (1990)
Tributyl tin	**0.22**[p]	0.26	1.2	2.5	**0.22**	Tsuda et al. (1990)
Nutrients						
Ammonia as N	NA	NA	NA	NA	-	
Chlorophyll a	NA	NA	NA	NA	-	
Nitrogen (total Kjeldahl)	NA	NA	NA	NA	-	
Phosphate	NA	NA	NA	NA	-	
Total Orthophosphate	NA	NA	NA	NA	-	
Radionuclides						
Beryllium-7 (pCi/g)	NA	NA	NA	NA	-	

[a] Decapod and fish tissue DQLs based on lowest NOAEL or LOAEL TRVs from the literature.

[b] Bird DQLs derived by back-calculating tissue thresholds from literature based dietary NOAEL TRVs using species-specific exposure parameters (i.e., body weight and sediment ingestion rate). Bird DQL is the lowest of back-calculated threshold for shorebirds, eagle, merganser, or osprey. NOAEL TRVs derived from toxicity studies were expressed as daily dietary doses normalized for body weight. To convert these NOAEL TRVs to a concentration in ingested prey tissue, the following equation was used:

C_{Tis} = (Dose x BW) / DFC

where: C_{Tis} = concentration in prey tissue (mg/kg ww)

Dose = NOAEL TRV (mg/kg BW/day)

BW = body weight (kg)

DFC = daily food consumption rate (kg ww/day).

[c] Mammal DQLs derived by back-calculating tissue thresholds from literature based dietary NOAEL TRVs using species-specific exposure parameters (i.e., body weight and sediment ingestion rate). Mammal DQL is the lowest of back-calculated threshold for mink or river otter. NOAEL TRVs derived from toxicity studies were expressed as daily dietary doses normalized for body weight and converted to a concentration in ingested prey tissue using the equation presented in Footnote b.

[d] Selected ecological DQL based on the lowest decapod, fish, bird, or mammal threshold. Ecological DQLs are analytical goals listed solely for the purpose of evaluating laboratory analytical methods and achievable laboratory limits; these are not project-specific screening levels or PRGs and are not approved by the USEPA as the appropriate risk assessment criteria for this project. These values will be developed in subsequent phases of the project.

[e] Reference as cited in Sample et al. (1996).

[f] The DQL for this analyte was based on benzo(a)pyrene.

[g] The DQL for this analyte was based on bis(2-ethylhexyl) phthalate.

[h] Bird and mammal DQLs for individual dioxins, furans, and dioxin-like congeners calculated by dividing the 2,3,7,8-TCDD TRV by the respective bird TEF (Van den berg et al. 1998) or mammal TEF (Van den berg et al. 2006).

[i] The DQL for this analyte was based on total DDT (sum of all DDT metabolites).

[j] The DQL for this analyte was based on gamma-BHC (lindane).

[k] The DQL for this analyte was based on total endosulfan.

[l] The DQL for this analyte was based on endrin.

[m] The DQL for this analyte was based on chlordane.

[n] The DQL for this analyte was based on heptachlor.

[o] The DQL for this analyte was based on tributyltin.

[p] The DQL based on imposex effects in invertebrates (Oehlmann et al. 1996) as cited in EVS Solutions (1999).

CAS – Chemical Abstracts Service
COPEC – compound of potential ecological concern
DRO – diesel-range organic
DQL – data quality level
GRO – gasoline-range organic
LOAEL – lowest-observed-adverse-effect level
NA – not available
NOAEL – no-observed-adverse-effect level
PAH – polycyclic aromatic hydrocarbon
PCB – polychlorinated biphenyl
SVOC – semivolatile organic compound
TEF – toxic equivalency factor
TEQ – toxic equivalent
TPH – total petroleum hydrocarbons
TRV – toxicity reference value
VOC – volatile organic compound

Bold identifies the lowest ecological threshold that was selected as the DQL.

Table 2. Ecological Thresholds Use to Derive Ecological Sediment DQLs

Analyte	Ecological Sediment Thresholds (mg/kg dw)							Lowest Ecological Sediment DQL (mg/kg dw)[f]	Lowest Ecological Sediment DQL Source
	Benthic Invertebrate Thresholds				Back-Calculated NOAEL Shorebird Threshold[e]	NJDEP (1999) Screening Criteria			
	NOAA ER-L (2008)[a]	NJDEP (1998)[b]	NYSDEC (1999)[c]	Freshwater TELs[d]		Fresh-water	Marine		
Metals									
Aluminum	NA	NA	NA	NA	NA	25,500	**18,000**	**18,000**	NJDEP (2009)
Antimony	NA	NA	**2.0**[g]	NA	NA	3	9.3	**2.0**	NYDEC (1999)
Arsenic	8.2	8.2	8.2	**5.9**	73	6	8.2	**5.9**	Smith et al. (1996)
Barium	NA	NA	NA	NA	**6,614**	NA	48	**6,614**	Johnson et al. (1960) as cited in Sample et al.(1996)
Beryllium	NA	NA	NA	NA	NA	NA	NA	**-**	
Cadmium	1.2	1.2	1.2	**0.60**	23	**0.6**	1.2	**0.60**	Smith et al.(1996); NJDEP (2009)
Calcium	NA	NA	NA	NA	NA	NA	NA	**-**	
Chromium	81	81	81	37.3	31.8	**26**	81	**26**	NJDEP (2009)
Chromium VI	NA	NA	NA	NA	NA	NA	NA	**-**	
Cobalt	NA	NA	NA	NA	73	50	**10**	**10**	NJDEP (2009)
Copper	34	34	34	35.7	1491	**16**	34	**16**	NJDEP (2009)
Cyanide	NA	NA	NA	NA	NA	**0.0001**	NA	**0.0001**	NJDEP (2009)
Iron	NA	NA	**20000**[h]	NA	NA	NA	NA	**20,000**	NYDEC (1999)
Lead	46.7	47	46.7	35	63.5	**31**	47	**31**	NJDEP (2009)
Magnesium	NA	NA	NA	NA	NA	NA	NA	**-**	
Manganese	NA	NA	460[h]	NA	31,026	630	**260**	**260**	NJDEP (2009)
Mercury	**0.15**	**0.15**	**0.15**	0.17	0.32	0.174	**0.15**	**0.15**	NOAA (2008); NJDEP (1998); NYDEC (1999); NJDEP (2009)
Methylmercury	**0.15**	**0.15**	**0.15**	0.17	0.32	0.174	**0.15**	**0.15**	NOAA (2008); NJDEP (1998); NYDEC (1999); NJDEP (2009)
Nickel	21	21	21	18	2458	**16**	21	**16**	NJDEP (2009)
Potassium	NA	NA	NA	NA	NA	NA	NA	**-**	

Analyte	Ecological Sediment Thresholds (mg/kg dw)							Lowest Ecological Sediment DQL (mg/kg dw)[f]	Lowest Ecological Sediment DQL Source
	Benthic Invertebrate Thresholds				Back-Calculated NOAEL Shorebird Threshold[e]	NJDEP (1999) Screening Criteria			
	NOAA ER-L (2008)[a]	NJDEP (1998)[b]	NYSDEC (1999)[c]	Freshwater TELs[d]		Fresh-water	Marine		
Selenium	NA	NA	NA	NA	13.2	NA	**1.0**	**1.0**	NJDEP (2009)
Silver	1.0	1.0	1.0	NA	NA	**0.5**	1.0	**0.5**	NJDEP (2009)
Sodium	NA	NA	NA	NA	NA	NA	NA	**-**	
Thallium	NA	NA	NA	NA	**15.2**	NA	NA	**15.2**	Hudson et al. (1984)
Titanium	NA	NA	NA	NA	NA	NA	NA	**-**	
Vanadium	NA	NA	NA	NA	**38.1**	NA	57	**38.1**	Ousterhout and Berg (1981)
Zinc	150	150	150	123	2604	**120**	150	**120**	NJDEP (2009)
VOCs									
1,1,1-Trichloroethane	NA	NA	NA	NA	NA	**0.213**	NA	**0.213**	NJDEP (2009)
1,1-Dichloroethane	NA	NA	NA	NA	NA	NA	NA	**-**	
1,1-Dichloroethene	NA	NA	NA	NA	NA	0.0194	NA	**0.0194**	NJDEP (2009)
1,1,2,2-Tetrachloroethane	NA	NA	NA	NA	NA	**0.850**	NA	**0.850**	NJDEP (2009)
1,1,2-Trichloro-1,2,2-trifluoroethane	NA	NA	NA	NA	NA	NA	NA	**-**	
1,1,2-Trichloroethane	NA	NA	NA	NA	NA	**0.518**	NA	**0.518**	NJDEP (2009)
1,2-Dibromo-3-chloropropane	NA	NA	NA	NA	NA	NA	NA	**-**	
1,2-Dibromoethane	NA	NA	NA	NA	NA	NA	NA	**-**	
1,2-Dichlorobenzene	NA	NA	0.12[i]	NA	NA	0.294	**0.013**	**0.013**	NJDEP (2009)
1,2-Dichloroethane	NA	NA	NA	NA	546	**0.260**	NA	**0.260**	NJDEP (2009)
1,2-Dichloropropane	NA	NA	NA	NA	NA	**0.333**	NA	**0.333**	NJDEP (2009)
1,2,3-Trichlorobenzene	NA	NA	NA	NA	NA	NA	NA	**-**	
1,2,4-Trichlorobenzene	NA	NA	0.91[i]	NA	NA	5.062	**>0.0048**	**0.0048**	NJDEP (2009)
1,3-Dichlorobenzene	NA	NA	**0.12**[i]	NA	NA	1.315	NA	**0.12**	NYDEC (1999)
1,4-Dichlorobenzene	NA	NA	0.12[i]	NA	NA	0.318	**0.110**	**0.110**	NJDEP (2009)
1,4-Dioxane	NA	NA	NA	NA	NA	NA	NA	**-**	
2-Butanone	NA	NA	NA	NA	NA	NA	NA	**-**	

Analyte	Ecological Sediment Thresholds (mg/kg dw)							Lowest Ecological Sediment DQL (mg/kg dw)[f]	Lowest Ecological Sediment DQL Source
	Benthic Invertebrate Thresholds				Back-Calculated NOAEL Shorebird Threshold[e]	NJDEP (1999) Screening Criteria			
	NOAA ER-L (2008)[a]	NJDEP (1998)[b]	NYSDEC (1999)[c]	Freshwater TELs[d]		Fresh-water	Marine		
2-Hexanone	NA	NA	NA	NA	NA	NA	NA	-	
4-Methyl-2-pentanone	NA	NA	NA	NA	NA	NA	NA	-	
Acetone	NA	NA	NA	NA	**7,050**	NA	NA	**7050**	Hill et al. (1975); Heath et al. (1972)
Benzene	NA	0.34[j]	0.26[i]	NA	NA	**0.142**	0.34	**0.142**	NJDEP (2009)
Bromochloromethane	NA	NA	NA	NA	NA	NA	NA	-	
Bromodichloromethane	NA	NA	NA	NA	NA	NA	NA	-	
Bromoform	NA	NA	NA	NA	NA	**0.492**	NA	**0.492**	NJDEP (2009)
Bromomethane	NA	NA	NA	NA	NA	**0.00137**	NA	**0.00137**	NJDEP (2009)
Carbon disulfide	NA	NA	NA	NA	NA	NA	NA	-	
Carbon tetrachloride	NA	NA	NA	NA	NA	**1.450**	NA	**1.450**	NJDEP (2009)
Chloroethane	NA	NA	NA	NA	NA	NA	NA	-	
Chloromethane	NA	NA	NA	NA	NA	NA	NA	-	
cis-1,2-Dichloroethene	NA	NA	NA	NA	NA	NA	NA	-	
cis-1,3-Dichloropropene	NA	NA	NA	NA	NA	NA	NA	-	
Chlorobenzene	NA	NA	**0.035**[i]	NA	NA	0.291	NA	**0.035**	NYDEC (1999)
Chloroform	NA	NA	NA	NA	NA	**0.121**	NA	**0.121**	NJDEP (2009)
Cyclohexane	NA	NA	NA	NA	NA	NA	NA	-	
Dibromochloromethane	NA	NA	NA	NA	NA	NA	NA	-	
Dichorodifluoromethane	NA	NA	NA	NA	NA	NA	NA	-	
Ethylbenzene	NA	1.40[j]	**0.064**[i]	NA	NA	0.175	1.4	**0.064**	NYDEC (1999)
Isopropylbenzene	NA	NA	NA	NA	NA	NA	NA	-	
Methyl acetate	NA	NA	NA	NA	NA	NA	NA	-	
Methylcyclohexane	NA	NA	NA	NA	NA	NA	NA	-	
Methylene chloride	NA	NA	NA	NA	NA	**0.159**	NA	**0.159**	NJDEP (2009)
Methyl tert-butyl ether	NA	NA	NA	NA	NA	NA	NA	-	
Styrene	NA	NA	NA	NA	NA	**0.254**	NA	**0.254**	NJDEP (2009)
Tetrachloroethene	NA	NA	NA	NA	NA	0.990	**0.45**	**0.45**	NJDEP (2009)

Analyte	Ecological Sediment Thresholds (mg/kg dw)							Lowest Ecological Sediment DQL (mg/kg dw)[f]	Lowest Ecological Sediment DQL Source
	Benthic Invertebrate Thresholds				Back-Calculated NOAEL Shorebird Threshold[e]	NJDEP (1999) Screening Criteria			
	NOAA ER-L (2008)[a]	NJDEP (1998)[b]	NYSDEC (1999)[c]	Freshwater TELs[d]		Fresh-water	Marine		
Toluene	NA	2.5[j]	**0.45**[i]	NA	NA	1.220	2.5	**0.45**	NYDEC (1999)
Trans-1,2-Dichloroethene	NA	NA	NA	NA	NA	**0.654**	NA	**0.654**	NJDEP (2009)
Trans-1,3-Dichloropropene	NA	NA	NA	NA	NA	NA	NA	**-**	
Trichloroethene	NA	NA	NA	NA	NA	**0.122**	1.6	**0.122**	NJDEP (2009)
Trichlorofluoromethane	NA	NA	NA	NA	NA	NA	NA	**-**	
m, p-Xylene	NA	NA	NA	NA	NA	0.433	**>0.12**	**0.12**	NJDEP (2009)
o-Xylene	NA	NA	NA	NA	NA	0.433	**>0.12**	**0.12**	NJDEP (2009)
Vinyl Chloride	NA	NA	NA	NA	NA	**0.202**	NA	**0.202**	NJDEP (2009)
SVOCs									
1,1'-Biphenyl	NA	NA	NA	NA	NA	NA	NA	**-**	
1,2,4,5-Tetrachlorobenzene	NA	NA	NA	NA	NA	**1.252**	NA	**1.252**	NJDEP (2009)
1-Methylnaphthalene	NA	NA	NA	NA	NA	NA	NA	**-**	
1-Methyl-phenanthrene	NA	NA	NA	NA	NA	NA	NA	**-**	
2,2'-Oxybis (1-Chloropropane)	NA	NA	NA	NA	NA	NA	NA	**-**	
2,3,4,6-Tetrachlorophenol	NA	NA	NA	NA	NA	NA	NA	**-**	
2,3,5-Trimethylnaphthalene	NA	NA	NA	NA	NA	NA	NA	**-**	
2,4-Dichlorophenol	NA	NA	NA	NA	NA	0.0817	**0.005**	**0.005**	NJDEP (2009)
2,4-Dimethylphenol	NA	NA	NA	NA	NA	**0.304**	NA	**0.304**	NJDEP (2009)
2,4-Dinitrophenol	NA	NA	NA	NA	NA	**0.00621**	NA	**0.00621**	NJDEP (2009)
2,4-Dinitrotoluene	NA	NA	NA	NA	NA	**0.0144**	NA	**0.0144**	NJDEP (2009)
2,4,5-Trichlorophenol	NA	NA	NA	NA	NA	NA	**0.003**	**0.003**	NJDEP (2009)
2,4,6-Trichlorophenol	NA	NA	NA	NA	NA	0.208	**0.006**	**0.006**	NJDEP (2009)
2,6-Dimethylnaphthalene	NA	NA	NA	NA	NA	NA	NA	**-**	
2,6-Dinitrotoluene	NA	NA	NA	NA	NA	NA	NA	**-**	

Analyte	Ecological Sediment Thresholds (mg/kg dw)							Lowest Ecological Sediment DQL (mg/kg dw)[f]	Lowest Ecological Sediment DQL Source
	Benthic Invertebrate Thresholds				Back-Calculated NOAEL Shorebird Threshold[e]	NJDEP (1999) Screening Criteria			
	NOAA ER-L (2008)[a]	NJDEP (1998)[b]	NYSDEC (1999)[c]	Freshwater TELs[d]		Fresh-water	Marine		
2-Chloronaphthalene	NA	NA	NA	NA	NA	**0.417**	NA	**0.417**	NJDEP (2009)
2-Chlorophenol	NA	NA	NA	NA	NA	0.0319	**0.008**	**0.008**	NJDEP (2009)
2-Methylnaphthalene	0.070	0.070	0.070	**0.0202**[k]	NA	**0.0202**	0.070	**0.0202**	CCME (2002); NJDEP (2009)
2-Methylphenol	NA	NA	NA	NA	NA	NA	NA	-	
2-Nitroaniline	NA	NA	NA	NA	NA	NA	NA	-	
2-Nitrophenol	NA	NA	NA	NA	NA	NA	NA	-	
3,3'-Dichlorobenzidine	NA	NA	NA	NA	NA	**0.127**	NA	**0.127**	NJDEP (2009)
3-Nitroaniline	NA	NA	NA	NA	NA	NA	NA	-	
4,6-Dinitro-2-methylphenol	NA	NA	NA	NA	NA	NA	NA	-	
4-Bromophenyl-phenylether	NA	NA	NA	NA	NA	NA	NA	-	
4-Chloro-3-methylphenol	NA	NA	NA	NA	NA	NA	NA	-	
4-Chloroaniline	NA	NA	NA	NA	NA	NA	NA	-	
4-Chlorophenyl-phenyl ether	NA	NA	NA	NA	NA	NA	NA	-	
4-Methylphenol	NA	NA	NA	NA	NA	NA	NA	-	
4-Nitroaniline	NA	NA	NA	NA	NA	NA	NA	-	
4-Nitrophenol	NA	NA	NA	NA	NA	**0.0133**	NA	**0.0133**	NJDEP (2009)
Acetophenone	NA	NA	NA	NA	NA	NA	NA	-	
Acenaphthene	0.016	0.016	0.016	**0.00671**[k]	8.9[l]	**0.00671**	0.016	**0.00671**	CCME (2002); NJDEP (2009)
Acenaphthylene	0.044	0.044	0.044	**0.00587**[k]	8.9[l]	**0.00587**	0.044	**0.00587**	CCME (2002); NJDEP (2009)
Anthracene	0.085	0.085	0.085	**0.0469**[k]	8.9[l]	0.0572	0.085	**0.0469**	CCME (2002)
Atrazine	NA	NA	NA	NA	NA	NA	NA	-	
Benzaldehyde	NA	NA	NA	NA	NA	NA	NA	-	
Benzo(a)anthracene	0.261	0.261	0.261	**0.0317**	8.9[l]	0.108	0.261	**0.0317**	Smith et al.(1996)
Benzo(a)pyrene	0.43	0.43	0.43	**0.0319**	8.9[l]	0.150	0.430	**0.0319**	Smith et al.(1996)

Analyte	Ecological Sediment Thresholds (mg/kg dw)							Lowest Ecological Sediment DQL (mg/kg dw)[f]	Lowest Ecological Sediment DQL Source
	Benthic Invertebrate Thresholds				Back-Calculated NOAEL Shorebird Threshold[e]	NJDEP (1999) Screening Criteria			
	NOAA ER-L (2008)[a]	NJDEP (1998)[b]	NYSDEC (1999)[c]	Freshwater TELs[d]		Fresh-water	Marine		
Benzo(b)fluoranthene	NA	NA	NA	NA	8.9[l]	10.4	**1.800**	**1.8**	NJDEP (2009)
Benzo(e)pyrene	NA	NA	NA	NA	NA	NA	NA	**-**	
Benzo(g,h,i)perylene	NA	**0.17**[h]	NA	NA	8.9[l]	**0.170**	NA	**0.17**	NJDEP (1998); NJDEP (2009)
Benzo(k)fluoranthene	NA	**0.24**[h]	NA	NA	8.9[l]	**0.240**	NA	**0.24**	NJDEP (1998); NJDEP (2009)
bis-(2-Chloroethoxy)methane	NA	NA	NA	NA	NA	NA	NA	**-**	
bis-(2-Chloroethyl)ether	NA	NA	NA	NA	NA	**3.520**	NA	**3.520**	NJDEP (2009)
bis(2-Ethylhexyl) phthalate	NA	NA	1.995[i]	NA	46	**0.182**	0.1821 6	**0.182**	NJDEP (2009)
Butylbenzyl phthalate	NA	NA	NA	NA	46	1.970	**0.063**	**0.063**	NJDEP (2009)
Caprolactam	NA	NA	NA	NA	NA	NA	NA	**-**	
Carbazole	NA	NA	NA	NA	NA	NA	NA	**-**	
Chrysene	0.384	0.384	0.384	**0.0571**	8.9[l]	0.166	0.384	**0.0571**	Smith et al.(1996)
Dibenzo(a,h)-anthracene	0.063	0.063	0.063	**0.00622**[k]	8.9[l]	0.033	0.063	**0.00622**	CCME (2002)
Dibenzofuran	NA	NA	NA	NA	NA	NA	NA	**-**	
Dibenzothiophene	NA	NA	NA	NA	NA	NA	NA	**-**	
Diethylphthalate	NA	NA	NA	NA	46	0.295	**0.006**	**0.006**	NJDEP (2009)
Dimethylphthalate	NA	NA	NA	NA	**46**	NA	NA	**46**	Peakall (1974)
Di-n-butylphthalate	NA	NA	NA	NA	46	0.110	**0.058**	**0.058**	NJDEP (2009)
Di-n-octylphthalate	NA	NA	NA	NA	**46**	NA	NA	**46**	Peakall (1974)
Fluoranthene	0.60	0.60	0.60	**0.111**	8.9[l]	0.423	0.600	**0.111**	Smith et al.(1996);
Fluorene	**0.019**	**0.019**	**0.019**	0.0212[k]	8.9[l]	0.0774	**0.019**	**0.019**	NOAA (2008); NJDEP (1998); NYDEC (1999); NJDEP (2009)
Hexachlorobenzene	NA	**0.002**[h]	0.12[m]	NA	7.6	0.020	NA	**0.002**	NJDEP (1998)
Hexachlorobutadiene	NA	NA	0.016[i]	NA	54	0.0265	**0.0013**	**0.0013**	NJDEP (2009)
Hexachloroethane	NA	NA	NA	NA	NA	0.584	**0.073**	**0.073**	NJDEP (2009)
Hexchlorocyclo-	NA	NA	**0.007**[i]	NA	NA	0.901	NA	**0.007**	NYDEC (1999)

Analyte	Ecological Sediment Thresholds (mg/kg dw)							Lowest Ecological Sediment DQL (mg/kg dw)[f]	Lowest Ecological Sediment DQL Source
	Benthic Invertebrate Thresholds				Back-Calculated NOAEL Shorebird Threshold[e]	NJDEP (1999) Screening Criteria			
	NOAA ER-L (2008)[a]	NJDEP (1998)[b]	NYSDEC (1999)[c]	Freshwater TELs[d]		Fresh-water	Marine		
pentadiene									
Indeno(1,2,3-cd)-pyrene	NA	**0.20**[h]	NA	NA	NA	**0.200**	NA	**0.20**	NJDEP (1998); NJDEP (2009)
Isophorone	NA	NA	NA	NA	8.9[l]	**0.432**	NA	**0.432**	NJDEP (2009)
Phenanthrene	0.24	0.24	0.24	**0.0419**	8.9[l]	0.204	0.24	**0.0419**	Smith et al.(1996)
Pentachlorophenol	NA	NA	0.40[i]	NA	699	23	0.017	**0.017**	NJDEP (2009)
Perylene	NA	NA	NA	NA	NA	NA	NA	-	
Petroleum hydrocarbons (extractable)	NA	NA	NA	NA	NA	NA	NA	-	
Petroleum hydrocarbons (purgeable)	NA	NA	NA	NA	NA	NA	NA	-	
Phenol	NA	NA	NA	NA	NA	**0.0491**	0.130	**0.0491**	NJDEP (2009)
Pyrene	0.665	0.665	0.665	**0.053**	8.9[l]	0.195	0.665	**0.053**	Smith et al.(1996)
Naphthalene	0.16	0.16	0.16	**0.0346**[k]	8.9[l]	0.176	0.16	**0.0346**	CCME (2002)
Nitrobenzene	NA	NA	NA	NA	NA	**0.145**	NA	**0.145**	NJDEP (2009)
n-Nitroso-di-n-propylamine	NA	NA	NA	NA	NA	NA	NA	-	
n-Nitrosodiphenylamine	NA	NA	NA	NA	NA	NA	NA	-	
TPH	NA	NA	NA	NA	NA	NA	NA	-	
TPH – DRO	NA	NA	NA	NA	NA	NA	NA	-	
PCBs									
Total PCBs	**0.0227**	0.023	**0.0227**	0.0341	9.2[n]	0.0598	0.023	**0.0227**	NOAA (2008); NYDEC (1999)
PCB 077	NA	NA	NA	NA	**0.0089**[n]	NA	NA	0.0089	Nosek et al. (1992)
PCB 081	NA	NA	NA	NA	**0.0044**[n]	NA	NA	0.0044	Nosek et al. (1992)
PCB 105	NA	NA	NA	NA	**4.4**[n]	NA	NA	4.4	Nosek et al. (1992)
PCB 114	NA	NA	NA	NA	**4.4**[n]	NA	NA	4.4	Nosek et al. (1992)
PCB 118	NA	NA	NA	NA	**44.5**[n]	NA	NA	44.5	Nosek et al. (1992)
PCB 123	NA	NA	NA	NA	**44.5**[n]	NA	NA	44.5	Nosek et al. (1992)

Analyte	Ecological Sediment Thresholds (mg/kg dw)							Lowest Ecological Sediment DQL (mg/kg dw)[f]	Lowest Ecological Sediment DQL Source
	Benthic Invertebrate Thresholds				Back-Calculated NOAEL Shorebird Threshold[e]	NJDEP (1999) Screening Criteria			
	NOAA ER-L (2008)[a]	NJDEP (1998)[b]	NYSDEC (1999)[c]	Freshwater TELs[d]		Fresh-water	Marine		
PCB 126	NA	NA	NA	NA	**0.0044**[n]	NA	NA	0.0044	Nosek et al. (1992)
PCB 156	NA	NA	NA	NA	**4.4**[n]	NA	NA	4.4	Nosek et al. (1992)
PCB 157	NA	NA	NA	NA	**4.4**[n]	NA	NA	4.4	Nosek et al. (1992)
PCB 167	NA	NA	NA	NA	**44.5**[n]	NA	NA	44.5	Nosek et al. (1992)
PCB 169	NA	NA	NA	NA	**0.44**[n]	NA	NA	0.44	Nosek et al. (1992)
PCB 189	NA	NA	NA	NA	**44.5**[n]	NA	NA	44.5	Nosek et al. (1992)
PCDDs/PCDFs									
2,3,7,8-Tetrachlorodibenzo-*p*-dioxin	0.0000036[o]	NA	0.000020[m]	NA	0.00044[n]	**0.00000012**	0.0000036	**0.00000012**	NJDEP (2009)
1,2,3,7,8-Pentachlorodibenzo-*p*-dioxin	NA	NA	NA	NA	**0.00044**[n]	NA	NA	**0.00044**	Nosek et al. (1992)
1,2,3,4,7,8-Hexachlorodibenzo-*p*-dioxin	NA	NA	NA	NA	**0.0089**[n]	NA	NA	**0.0089**	Nosek et al. (1992)
1,2,3,6,7,8-Hexachlorodibenzo-*p*-dioxin	NA	NA	NA	NA	**0.044**[n]	NA	NA	**0.044**	Nosek et al. (1992)
1,2,3,7,8,9-Hexachlorodibenzo-*p*-dioxin	NA	NA	NA	NA	**0.0044**[n]	NA	NA	**0.0044**	Nosek et al. (1992)
1,2,3,4,6,7,8-Heptachlorodibenzo-*p*-dioxin	NA	NA	NA	NA	**0.44**[n]	NA	NA	**0.44**	Nosek et al. (1992)
Octachlorodibenzo-*p*-dioxin	NA	NA	NA	NA	**4.4**[n]	NA	NA	**4.4**	Nosek et al. (1992)
2,3,7,8-Tetrachlorodibenzofuran	NA	NA	NA	NA	**0.00044**[n]	NA	NA	**0.00044**	Nosek et al. (1992)
1,2,3,7,8-Pentachlorodibenzofuran	NA	NA	NA	NA	**0.0044**[n]	NA	NA	**0.0044**	Nosek et al. (1992)
2,3,4,7,8-	NA	NA	NA	NA	**0.00044**[n]	NA	NA	**0.00044**	Nosek et al. (1992)

Analyte	Ecological Sediment Thresholds (mg/kg dw)							Lowest Ecological Sediment DQL (mg/kg dw)[f]	Lowest Ecological Sediment DQL Source
	Benthic Invertebrate Thresholds				Back-Calculated NOAEL Shorebird Threshold[e]	NJDEP (1999) Screening Criteria			
	NOAA ER-L (2008)[a]	NJDEP (1998)[b]	NYSDEC (1999)[c]	Freshwater TELs[d]		Fresh-water	Marine		
Pentachlorodibenzofuran									
1,2,3,4,7,8-Hexachlorodibenzofuran	NA	NA	NA	NA	**0.0044**[n]	NA	NA	**0.0044**	Nosek et al. (1992)
1,2,3,6,7,8-Hexachlorodibenzofuran	NA	NA	NA	NA	**0.0044**[n]	NA	NA	**0.0044**	Nosek et al. (1992)
1,2,3,7,8,9-Hexachlorodibenzofuran	NA	NA	NA	NA	**0.0044**[n]	NA	NA	**0.0044**	Nosek et al. (1992)
2,3,4,6,7,8-Hexachlorodibenzofuran	NA	NA	NA	NA	**0.0044**[n]	NA	NA	**0.0044**	Nosek et al. (1992)
1,2,3,4,6,7,8-Heptachlorodibenzofuran	NA	NA	NA	NA	**0.044**[n]	NA	NA	**0.044**	Nosek et al. (1992)
1,2,3,4,7,8,9-Heptachlorodibenzofuran	NA	NA	NA	NA	**0.044**[n]	NA	NA	**0.044**	Nosek et al. (1992)
Octachlorodibenzofuran	NA	NA	NA	NA	**4.4**[n]	NA	NA	**4.4**	Nosek et al. (1992)
PAHs									
1-Methylphenanthrene	NA	NA	NA	NA	NA	NA	NA	**-**	
2,3,5-Trimethylnaphthalene	NA	NA	NA	NA	NA	NA	NA	**-**	
2,6-Dimethylnaphthalene	NA	NA	NA	NA	NA	NA	NA	**-**	
2-Methylnaphthalene	0.070	0.070	0.070	**0.0202**[k]	NA	**0.0202**	0.070	**0.0202**	CCME (2002); NJDEP (2009)
Acenaphthene	0.016	0.016	0.016	**0.00671**[k]	8.9[l]	**0.00671**	0.016	**0.00671**	CCME (2002); NJDEP (2009)
Acenaphthylene	0.044	0.044	0.044	**0.00587**[k]	8.9[l]	**0.00587**	0.044	**0.00587**	CCME (2002); NJDEP (2009)
Anthracene	0.085	0.085	0.085	**0.0469**[k]	8.9[l]	0.0572	0.085	**0.0469**	CCME (2002)
Fluorene	**0.019**	**0.019**	**0.019**	0.0212[k]	8.9[l]	0.0774	**0.019**	**0.019**	NOAA (2008); NJDEP (1998); NYDEC (1999); NJDEP (2009)
Naphthalene	0.16	0.16	0.16	**0.0346**[k]	8.9[l]	0.176	0.16	**0.0346**	CCME (2002)

Analyte	Ecological Sediment Thresholds (mg/kg dw)							Lowest Ecological Sediment DQL (mg/kg dw)[f]	Lowest Ecological Sediment DQL Source
	Benthic Invertebrate Thresholds				Back-Calculated NOAEL Shorebird Threshold[e]	NJDEP (1999) Screening Criteria			
	NOAA ER-L (2008)[a]	NJDEP (1998)[b]	NYSDEC (1999)[c]	Freshwater TELs[d]		Fresh-water	Marine		
Phenanthrene	0.24	0.24	0.24	**0.0419**	8.9[l]	0.204	0.24	**0.0419**	Smith et al.(1996)
Benzo(a)anthracene	0.261	0.261	0.261	**0.0317**	8.9[l]	0.108	0.261	**0.0317**	Smith et al.(1996)
Benzo(a)pyrene	0.43	0.43	0.43	**0.0319**	8.9[l]	0.150	0.430	**0.0319**	Smith et al.(1996)
Benzo(b)fluoranthene	NA	NA	NA	NA	8.9[l]	10.4	**1.800**	**1.8**	NJDEP (2009)
Benzo[e]pyrene	NA	NA	NA	NA	NA	NA	NA	**-**	
Benzo(g,h,i)perylene	NA	**0.17**[h]	NA	NA	8.9[l]	**0.170**	NA	**0.17**	NJDEP (1998); NJDEP (2009)
Benzo(k)fluoranthene	NA	**0.24**[h]	NA	NA	8.9[l]	**0.240**	NA	**0.24**	NJDEP (1998); NJDEP (2009)
Chrysene	0.384	0.384	0.384	**0.0571**	8.9[l]	0.166	0.384	**0.0571**	Smith et al.(1996)
Dibenzo(a,h)anthracene	0.063	0.063	0.063	**0.00622**[k]	8.9[l]	0.033	0.063	**0.00622**	CCME (2002)
Dibenzothiophene	NA	NA	NA	NA	NA	NA	NA	**-**	
Fluoranthene	0.60	0.60	0.60	**0.111**	8.9[l]	0.423	0.600	**0.111**	Smith et al.(1996)
Indeno(1,2,3-cd)pyrene	NA	**0.20**[h]	NA	NA	8.9[l]	**0.200**	NA	**0.20**	NJDEP (1998); NJDEP (2009)
Perylene	NA	NA	NA	NA	NA	NA	NA	**-**	
Pyrene	0.665	0.665	0.665	**0.053**	8.9[l]	0.195	0.665	**0.053**	Smith et al.(1996)
Pesticides									
2,4'-DDD	**0.0020**	NA	NA	0.00354	NA	NA	NA	**0.0020**	NOAA (2008)
2,4'-DDE	0.0022	NA	NA	**0.00142**	NA	NA	NA	**0.00142**	Smith et al.(1996)
2,4'-DDT	**0.001**	0.0080[h]	NA	NA	NA	NA	NA	**0.001**	NOAA (2008)
4,4'-DDD	0.0020	0.0080[h]	**0.001**[i]	0.00354	NA	0.00488	0.002	**0.001**	NYDEC (1999)
4,4'-DDE	0.0022	0.0022	0.0022	**0.00142**	NA	0.00316	0.0022	**0.00142**	Smith et al.(1996)
4,4'-DDT	**0.001**	0.0080[h]	**0.001**[i]	NA	NA	0.00416	**0.001**	**0.001**	NOAA (2008); NYDEC (1999); NJDEP (1999)
Sum DDD	NA	NA	NA	NA	**5.7**	NA	NA	**5.7**	Heath et al. (1969)
Sum DDE	NA	NA	NA	NA	**2.0**	NA	NA	**2.0**	Mendenhall et al. (1983)
Sum DDT	NA	NA	NA	NA	**0.95**	NA	NA	**0.95**	Stickel and Rhodes (1970)
Total DDTs	NA	NA	NA	NA	**5.7**	**0.007**	0.0016	**0.007**	NJDEP (1999)

Analyte	Ecological Sediment Thresholds (mg/kg dw)							Lowest Ecological Sediment DQL (mg/kg dw)[f]	Lowest Ecological Sediment DQL Source
	Benthic Invertebrate Thresholds				Back-Calculated NOAEL Shorebird Threshold[e]	NJDEP (1999) Screening Criteria			
	NOAA ER-L (2008)[a]	NJDEP (1998)[b]	NYSDEC (1999)[c]	Freshwater TELs[d]		Fresh-water	Marine		
Aldrin	NA	**0.002**[h]	0.0077[l]	NA	0.25	**0.002**	NA	**0.002**	NJDEP (1998); NJDEP (1999)
alpha-Hexachlorocyclohexane	NA	0.006[h]	NA	**0.00094**[q]	51	0.006	NA	**0.00094**	Smith et al.(1996)
alpha-Chlordane	NA	0.007[h,p]	**0.00002**[i,p]	0.00450[r]	19	NA	NA	**0.00002**	NYDEC (1999)
beta-Hexachlorocyclohexane	NA	0.005[h]	NA	**0.00094**[q]	51	0.005	NA	**0.00094**	Smith et al.(1996)
delta-Hexachlorocyclohexane	NA	0.003[h]	NA	**0.00094**[q]	51	0.003	NA	**0.00094**	Smith et al.(1996)
Dieldrin	**0.00002**	0.002[h]	0.090[i]	0.00285	2.1	0.0019	NA	**0.00002**	NOAA (2008)
Endosulfan I	NA	NA	NA	NA	**318**	NA	NA	**318**	Abiola (1992)
Endosufan II	NA	NA	NA	NA	**318**	NA	NA	**318**	Abiola (1992)
Endosulfan sulfate	NA	NA	NA	NA	**318**	0.0346	NA	**318**	Abiola (1992)
Endrin	NA	0.003[h,s]	0.0073[i,s]	0.00267	0.38	**0.00222**	NA	**0.00222**	NJDEP (1999)
Endrin aldehyde	NA	0.003[s]	0.0073[i,s]	**0.00267**[t]	0.38	0.480	NA	**0.00267**	Smith et al.(1996)
Endrin ketone	NA	0.003[s]	0.0073[i,s]	**0.00267**[t]	0.38	NA	NA	**0.00267**	Smith et al.(1996)
gamma-BHC (Lindane)	NA	0.003[h]	NA	**0.00094**	51	0.003	NA	**0.00094**	Smith et al.(1996)
gamma-Chlordane	NA	0.007[h,p]	**0.00002**[i,p]	0.00450[r]	19	NA	NA	**0.00002**	NYDEC (1999)
Heptachlor	NA	0.005[u]	0.0009[i,v]	0.00060[u]	3.2	0.0006	**0.0003**	**0.0003**	NJDEP (1999)
Heptachlor epoxide	NA	0.005[h]	0.0009[i]	**0.00060**	3.2	0.00247	NA	**0.0006**	Smith et al.(1996)
Methoxychlor	NA	NA	**0.006**[i]	NA	1,099	0.0136	NA	**0.006**	NYDEC (1999)
Total Chlordane	0.0005[p]	0.007[h,p]	**0.00002**[i]	0.0045	19	0.00324	NA	**0.00002**	NYDEC (1999)
cis-Nonachlor	NA	NA	NA	NA	**19**	NA	NA	**19**	Ludke (1976)
trans-Nonachlor	NA	NA	NA	NA	**19**	NA	NA	**19**	Ludke (1976)
Oxychlordane	NA	NA	NA	NA	**19**	NA	NA	**19**	Ludke (1976)
Butyltins									
Dibutyl tin	NA	NA	NA	NA	44[w]	NA	NA	**44**	Schlatterer et al. (1993)
Monobuyltin	NA	NA	NA	NA	44[w]	NA	NA	**44**	Schlatterer et al. (1993)
Tetrabutyl tin	NA	NA	NA	NA	44[w]	NA	NA	**44**	Schlatterer et al. (1993)

Analyte	Ecological Sediment Thresholds (mg/kg dw)							Lowest Ecological Sediment DQL (mg/kg dw)[f]	Lowest Ecological Sediment DQL Source
	Benthic Invertebrate Thresholds				Back-Calculated NOAEL Shorebird Threshold[e]	NJDEP (1999) Screening Criteria			
	NOAA ER-L (2008)[a]	NJDEP (1998)[b]	NYSDEC (1999)[c]	Freshwater TELs[d]		Fresh-water	Marine		
Tributyl tin	NA	NA	NA	NA	**44**	NA	NA	**44**	Schlatterer et al. (1993)
Nutrients									
Ammonia as N	NA	NA	NA	NA	NA	NA	NA	-	
Chlorophyll a	NA	NA	NA	NA	NA	NA	NA	-	
Nitrogen (total Kjeldahl)	NA	NA	NA	NA	NA	NA	NA	-	
Phosphate	NA	NA	NA	NA	NA	NA	NA	-	
Total orthophosphate	NA	NA	NA	NA	NA	NA	NA	-	
Herbicides									
2,4-D	NA	NA	NA	NA	NA	NA	NA	-	
2,4-DB	NA	NA	NA	NA	NA	NA	NA	-	
2,4,5-T	NA	NA	NA	NA	NA	NA	NA	**12.3**[x]	USEPA Region 3 Benchmark[x]
2,4,5-TP (Silvex)	NA	NA	NA	NA	NA	NA	NA	**0.675**[x]	USEPA Region 3 Benchmark[x]

[a] ERL = effects range-low from Long et al. (1995), except where noted.

[b] Thresholds based on NJDEP guidance for sediment quality evaluations, November 1998; references Long et al. (1995) when available. Other sources include Persaud (1993) and MacDonald et al (1992).

[c] Thresholds based on NYSDEC, 1999; reference Long et al. (1995) when available. Other sources include Long and Morgan (1990), Persaud (1993), or DoW (1991).

[d] Source: Smith et al. 1996, except where noted.

[e] Shorebird DQLs derived by back-calculating sediment thresholds from literature based dietary NOAEL TRVs using shorebird exposure parameters (i.e., body weight and sediment ingestion rate) Sandpiper was selected as an appropriate ecological receptor for developing sediment thresholds, because of its high incidental ingestion of sediments. NOAEL TRVs derived from toxicity studies were expressed as daily dietary doses normalized for body weight. To convert these NOAEL TRVs to a concentration in ingested sediment, the following equation was used:

C_{Sed} = (Dose x BW)/DSC

where: C_{Sed} = concentration in sediment (mg/kg dw)
Dose = NOAEL TRV (mg/kg BW/day)
BW = body weight (kg)
DSC = daily sediment consumption rate (kg dw/day).

[f] Selected Ecological DQL based on the lower of the benthic invertebrate, shorebird threshold, or NJDEP screening criteria. Ecological DQLs are analytical goals listed solely for the purpose of evaluating laboratory analytical methods and achievable laboratory limits; these are not project-specific screening levels

or PRGs and are not approved by the USEPA as the appropriate risk assessment criteria for this project. These values will be developed in subsequent phases of the project.

[g] Source: Long and Morgan (1991).

[h] Source: Persaud et al. (1993).

[i] Benthic aquatic life chronic toxicity criteria for saltwater used and converted to parts per million assuming 1% organic carbon.

[j] New Jersey volatile organic sediment screening guidelines derived from MacDonald et al. (1992).

[k] Based on NYSDEC (1994) as cited in CCME (2002).

[l] Shorebird DQLs for individual PAHs were based on benzo(a)pyrene.

[m] Wildlife bioaccumulation criteria were used and are expressed in terms of organic carbon and converted to ppm.

[n] Shorebird DQLs for individual dioxins, furans, and dioxin-like congeners calculated by dividing the 2,3,7,8-TCDD TRV by the respective bird TEF (Van den berg et al. 1998)

[o] DQL based on apparent effects threshold, which is based on *Neanthes* toxicity test (NOAA 2008).

[p] The DQL for this analyte was based on chlordane.

[q] The DQL for this analyte was based on lindane.

[r] The DQL for this analyte was based on total chlordane.

[s] The DQL for this analyte was based on total endrin (sum of endrin ketone and endrin aldehyde).

[t] The DQL for this analyte was based on endrin.

[u] The DQL for this analyte was based on heptachlor epoxide.

[v] The DQL for this analyte was based on total heptachlor (sum of heptachlor and heptachlor epoxide).

[w] The DQL for this analyte was based on tributyltin.

[x] Sediment thresholds not available from any of the listed thresholds. Ecological DQLs based on Region 3 freshwater sediment screening benchmarks: http://www.epa.gov/reg3hwmd/risk/eco/btag/sbv/fwsed/screenbench.htm.

AWQC – ambient water quality criteria
CAS – chemical abstracts service
COPC – compound of potential concern
COPEC – compound of potential ecological concern
DQL – data quality level
dw – dry weight
MCL – maximum contaminant level
NA – not available/applicable
NJDEP – New Jersey Department of Environmental Protection
NYSDEC – New York State Department of Environmental Conservation
NOAEL – no observed adverse effect level
PAH – polycyclic aromatic hydrocarbon
PCB – polychlorinated biphenyl
PCDD – polychlorinated dibenzo-*p*-dioxin
PCDF – polychlorinated dibenzofuran
TEF – toxic equivalency factor
TPH – total petroleum hydrocarbons
TRV – toxicity reference value
SVOC – semivolatile organic compound
USEPA – US Environmental Protection Agency
VOC – volatile organic compound

Bold identifies the lowest ecological threshold that was selected as the DQL.

Table 3. Human Health Thresholds Used to Derive Human Health Sediment DQLs

Analyte	Human Health Sediment Threshold (mg/kg dw)		Lowest Human Health Sediment Threshold (mg/kg dw)[c]
	USEPA RSL[a]	NJDEP SRS[b]	
Metals			
Aluminum	**7.70E+03**	7.80E+04	**7,700**
Antimony	**3.10E+00**	3.10E+01	**3.1**
Arsenic (total)	**3.90E-01**[d]	1.90E+01[e]	**0.39**
Barium	**1.50E+03**	1.60E+04	**1,500**
Beryllium	**1.60E+01**	**1.60E+01**	**16**
Cadmium	**7.00E+00**	7.80E+01	**7.0**
Calcium	NA[f]	NA[f]	-
Chromium (total)	**2.80E+02**	NA	**280**
Cobalt	**2.30E+00**	1.60E+03	**2.3**
Copper	**3.10E+02**	3.10E+03	**310**
Cyanide	**1.60E+02**	1.60E+03	**160**
Iron	**5.50E+03**	NA	**5,500**
Lead	**4.00E+01**	4.00E+02	**40**
Magnesium	NA[f]	NA[f]	-
Manganese	NA	**1.10E+04**	**11,000**
Mercury	**4.30E-01**	2.30E+01	**0.43**
Methyl mercury	**7.80E-01**	NA	**0.78**
Nickel	**1.50E+02**	1.60E+03	**150**
Potassium	NA[f]	NA[f]	-
Selenium	**3.90E+01**	3.90E+02	**39**
Silver	**3.90E+01**	3.90E+02	**39**
Sodium	NA[f]	NA[f]	-
Thallium	**5.10E-01**	5.00E+00	**0.51**
Titanium	**1.00E+05**[g]	NA	**100,000**
Vanadium	**5.50E+01**	7.80E+01	**55**
Zinc	**2.30E+03**	2.30E+04	**2,300**
VOCs			
1,1,1-Trichloroethane	6.80E+02[h]	**2.90E+02**	**290**
1,1,2,2-Tetrachloroethane	**5.90E-01**	1.00E+00	**0.59**
1,2,2-Trichloro-1,1,2-trifluoroethane	**9.40E+02**[h]	NA	**940**
1,1,2-Trichloroethane	**1.10E+00**	2.00E+00	**1.1**
1,1-Dichloroethane	**3.40E+00**	8.00E+00	**3.4**
1,1-Dichloroethene	2.50E+01	**1.10E+01**	**11**
1,2,3-Trichlorobenzene	**8.70E+00**[i]	7.30E+01[i]	**8.7**
1,2,4-Trichlorobenzene	**8.70E+00**	7.30E+01	**8.7**
1,2-Dibromo-3-chloropropane	**5.60E-03**	8.00E-02	**0.0056**
1,2-Dibromoethane	3.40E-02	**8.00E-03**	**0.0080**

Analyte	Human Health Sediment Threshold (mg/kg dw)		Lowest Human Health Sediment Threshold (mg/kg dw)[c]
	USEPA RSL[a]	NJDEP SRS[b]	
1,2-Dichlorobenzene	**2.00E+02**	5.30E+03	**200**
1,2-Dichloroethane	**4.50E-01**	9.00E-01	**0.45**
1,2-Dichloropropane	**9.30E-01**	2.00E+00	**0.93**
1,3-Dichlorobenzene	**2.00E+02**[j]	5.30E+03	**200**
1,4-Dichlorobenzene	**2.60E+00**	5.00E+00	**2.6**
1,4-Dioxane	**4.40E+01**	NA	**44**
2-Butanone	**2.80E+03**	3.10E+03	**2,800**
2-Hexanone	NA	NA	**-**
4-Methyl-2-pentanone	**5.30E+02**	NA	**530**
Acetone	**6.10E+03**	7.00E+04	**6,100**
Benzene	**1.10E+00**	2.00E+00	**1.1**
Bromochloromethane	**2.80E-01**[k]	1.00E+00[k]	**0.28**
Bromodichloromethane	**2.80E-01**	1.00E+00	**0.28**
Bromoform	**6.10E+01**	8.10E+01	**61**
Bromomethane	**7.90E-01**	2.50E+01	**0.79**
Carbon disulfide	**6.70E+01**	7.80E+03	**67**
Carbon tetrachloride	**2.50E-01**	6.00E-01	**0.25**
Chlorobenzene	**3.10E+01**	5.10E+02	**31**
Chloroethane	1.50E+03	**2.20E+02**	**220**
Chloroform	**3.00E-01**	6.00E-01	**0.30**
Chloromethane	1.20E+01	**4.00E+00**	**4.0**
cis-1,2-Dichloroethene	**7.80E+01**	2.30E+02	**78**
cis-1,3-Dichloropropene	**1.70E+00**[l]	2.00E+00	**1.7**
Cyclohexane	**1.20E+02**[h]	NA	**120**
Dibromochloromethane	**7.00E-01**	3.00E+00	**0.70**
Dichorodifluoromethane	**1.90E+01**	4.90E+02	**19**
Ethylbenzene	**5.70E+00**	7.80E+03	**5.7**
Isopropylbenzene	**2.20E+02**	NA	**220**
m, p-Xylene	**6.00E+01**[m]	1.20E+04[m]	**60**
Methyl acetate	**7.80E+03**	7.80E+04	**7,800**
Methyl tert-butyl ether	**3.90E+01**	1.10E+02	**39**
Methylcyclohexane	NA	NA	**-**
Methylene chloride	**1.10E+01**	3.40E+01	**11**
o-Xylene	**3.00E+02**[h]	1.20E+04[m]	**300**
Styrene	6.50E+02	**9.00E+01**	**90**
Tetrachloroethene	**5.70E-01**	2.00E+00	**0.57**
Toluene	**5.00E+02**	6.30E+03	**500**
Trans-1,2-Dichloroethene	**1.10E+01**	2.30E+02	**11**
Trans-1,3-Dichloropropene	**1.70E+00**[l]	2.00E+00	**1.7**
Trichloroethene	**2.80E+00**	7.00E+00	**2.8**
Trichlorofluoromethane	**8.00E+01**	2.30E+04	**80**

Analyte	Human Health Sediment Threshold (mg/kg dw)		Lowest Human Health Sediment Threshold (mg/kg dw)[c]
	USEPA RSL[a]	NJDEP SRS[b]	
Vinyl Chloride	**6.00E-02**	7.00E-01	**0.060**
SVOCs			
1,1'-Biphenyl	**2.62E+02**[h]	3.10E+03	**262**
1,2,4,5-Tetrachlorobenzene	**1.80E+00**	NA	**1.8**
2,2'-Oxybis (1-chloropropane)	**3.50E+00**	NA	**3.5**
2,3,4,6-Tetrachlorophenol	**1.80E+02**	NA	**180**
2,4,5-Trichlorophenol	**6.10E+02**	6.10E+03	**610**
2,4,6-Trichlorophenol	4.40E+01	**1.90E+01**	**19**
2,4-Dichlorophenol	**1.80E+01**	1.80E+02	**18**
2,4-Dimethylphenol	**1.20E+02**	1.20E+03	**120**
2,4-Dinitrophenol	**1.20E+01**	1.20E+02	**12**
2,4-Dinitrotoluene	1.60E+00	**7.00E-01**	**0.70**
2,6-Dinitrotoluene	6.10E+00	**7.00E-01**	**0.70**
2-Chloronaphthalene	**6.30E+02**	NA	**630**
2-Chlorophenol	**3.90E+01**	3.10E+02	**39**
2-Methylnaphthalene	**3.10E+01**	2.30E+02	**31**
2-Methylphenol	**3.10E+02**	**3.10E+02**	**310**
2-Nitroaniline	**1.80E+01**	3.90E+01	**18**
2-Nitrophenol	**1.80E+03**[n]	1.80E+04[n]	**1,800**
3,3',-Dichlorobenzidine	1.10E+00	**1.00E+00**	**1.0**
3-Nitroaniline	**1.80E+01**[o]	3.90E+01[o]	**18**
4,6-Dinitro-2-methylphenol	**6.10E-01**	6.00E+00	**0.61**
4-Bromophenyl phenylether	NA	NA	**-**
4-Chloro-3-methylphenol	NA	NA	**-**
4-Chloroaniline	**2.40E+00**	NA	**2.4**
4-Chlorophenyl phenylether	NA	NA	**-**
4-Methylphenol	**3.10E+01**	**3.10E+01**	**31**
4-Nitroaniline	**2.40E+01**	3.90E+01[o]	**24**
4-Nitrophenol	**1.80E+03**[n]	1.80E+04[n]	**1,800**
Acenaphthene	**3.40E+02**	3.40E+03	**340**
Acenaphthylene	**3.40E+02**[p]	3.40E+03[p]	**340**
Acetophenone	7.80E+02	**2.00E+00**	**2.0**
Anthracene	**1.70E+03**	1.70E+04	**1,700**
Atrazine	**2.10E+00**	2.10E+02	**2.1**
Benzaldehyde	**7.80E+02**	6.10E+03	**780**
Benzo(a)anthracene	**1.50E-01**	6.00E-01	**0.15**
Benzo(a)pyrene	**1.50E-02**	2.00E-01	**0.015**
Benzo(b)fluoranthene	**1.50E-01**	6.00E-01	**0.15**
Benzo(g,h,i)perylene	**1.70E+02**[q]	3.80E+05	**170**
Benzo(k)fluoranthene	**1.50E+00**	6.00E+00	**1.5**
bis-(2-Chloroethoxy) methane	**1.80E+01**	NA	**18**

Analyte	Human Health Sediment Threshold (mg/kg dw)		Lowest Human Health Sediment Threshold (mg/kg dw)[c]
	USEPA RSL[a]	NJDEP SRS[b]	
bis-(2-Chloroethyl)ether	**1.90E-01**	4.00E-01	**0.19**
bis(2-Ethylhexyl) phthalate	**3.50E+01**	**3.50E+01**	**35**
Butylbenzylphthalate	**2.60E+02**	1.20E+03	**260**
Caprolactam	**3.10E+03**	3.10E+04	**3,100**
Carbazole	NA	**2.40E+01**	**24**
Chrysene	**1.50E+01**	6.20E+01	**15**
Dibenzo(a,h)anthracene	**1.50E-02**	2.00E-01	**0.015**
Dibenzofuran	NA	NA	**-**
Diethylphthalate	**4.90E+03**	4.90E+04	**4,900**
Dimethylphthalate	NA	NA	**-**
Di-n-butylphthalate	**6.10E+02**	6.10E+03	**610**
Di-n-octylphthalate	NA	**2.40E+03**	**2,400**
Fluoranthene	**2.30E+02**	2.30E+03	**230**
Fluorene	**2.30E+02**	2.30E+03	**230**
Hexachlorobenzene	**3.00E-01**	**3.00E-01**	**0.30**
Hexachlorobutadiene	6.20E+00	**6.00E+00**[r]	**6.0**
Hexachloroethane	**3.50E+01**	**3.50E+01**	**35**
Hexchlorocyclopentadiene	**3.70E+01**	4.50E+01	**37**
Indeno(1,2,3-cd)pyrene	**1.50E-01**	6.00E-01	**0.15**
Isophorone	**5.10E+02**	**5.10E+02**	**510**
Naphthalene	**3.90E+00**	6.00E+00	**3.9**
Nitrobenzene	**4.40E+00**	3.10E+01	**4.4**
N-Nitrosodi-n-propylamine	**6.90E-02**	2.00E-01	**0.069**
N-Nitrosodiphenylamine	**9.90E+01**	**9.90E+01**	**99**
Pentachlorophenol	**3.00E+00**	**3.00E+00**	**3.0**
Phenanthrene	**1.70E+03**[s]	1.70E+04[s]	**1,700**
Phenol	**1.80E+03**	1.80E+04	**1,800**
Pyrene	**1.70E+02**	1.70E+03	**170**
PCB Aroclors			
Aroclor 1016	3.90E-01	**2.00E-01**[t]	**0.20**
Aroclor 1221	**1.70E-01**	2.00E-01[t]	**0.17**
Aroclor 1232	**1.70E-01**	2.00E-01[t]	**0.17**
Aroclor 1242	2.20E-01	**2.00E-01**[t]	**0.20**
Aroclor 1248	2.20E-01	**2.00E-01**[t]	**0.20**
Aroclor 1254	2.20E-01	**2.00E-01**[t]	**0.20**
Aroclor 1260	2.20E-01	**2.00E-01**[t]	**0.20**
PCB Congeners[u]			
PCB 77	**3.40E-02**	2.00E-01[t]	**0.034**
PCB 81	**3.40E-02**	2.00E-01[t]	**0.034**
PCB 105	**3.40E-02**	2.00E-01[t]	**0.034**
PCB 114	**6.80E-04**	2.00E-01[t]	**0.00068**

Analyte	Human Health Sediment Threshold (mg/kg dw)		Lowest Human Health Sediment Threshold (mg/kg dw)[c]
	USEPA RSL[a]	NJDEP SRS[b]	
PCB 118	**3.40E-02**	2.00E-01[t]	**0.034**
PCB 123	**3.40E-02**	2.00E-01[t]	**0.034**
PCB 126	**3.40E-05**	2.00E-01[t]	**0.000034**
PCB 156	**6.80E-04**	2.00E-01[t]	**0.00068**
PCB 157	**6.80E-04**	2.00E-01[t]	**0.00068**
PCB 167	**3.40E-02**	2.00E-01[t]	**0.034**
PCB 169	**3.40E-02**	2.00E-01[t]	**0.034**
PCB 189	**3.40E-02**	2.00E-01[t]	**0.034**
Dioxins/Furans			
1,2,3,4,6,7,8-HpCDD	**4.50E-04**[v]	NA	**0.00045**
1,2,3,4,6,7,8-HpCDF	**4.50E-04**[v]	NA	**0.00045**
1,2,3,4,7,8-HxCDD	**4.50E-05**[w]	NA	**0.000045**
1,2,3,4,7,8-HxCDF	**4.50E-05**[w]	NA	**0.000045**
1,2,3,4,7,8,9-HpCDF	**4.50E-04**[v]	NA	**0.00045**
1,2,3,6,7,8-HxCDD	**4.50E-05**[w]	NA	**0.000045**
1,2,3,6,7,8-HxCDF	**4.50E-05**[w]	NA	**0.000045**
1,2,3,7,8,9-HxCDD	**4.50E-05**[w]	NA	**0.000045**
1,2,3,7,8,9-HxCDF	**4.50E-05**[w]	NA	**0.000045**
1,2,3,7,8-PeCDD	**4.50E-06**[x]	NA	**0.0000045**
1,2,3,7,8-PeCDF	**1.50E-04**[y]	NA	**0.00015**
2,3,4,6,7,8-HxCDF	**4.50E-05**[w]	NA	**0.000045**
2,3,4,7,8-PeCDF	**1.50E-05**[z]	NA	**0.000015**
2,3,7,8-TCDD	**4.50E-06**	NA	**0.0000045**
2,3,7,8-TCDF	**4.50E-05**[w]	NA	**0.000045**
OCDD	**1.50E-02**[aa]	NA	**0.015**
OCDF	**1.50E-02**[aa]	NA	**0.015**
Pesticides			
2,4'-DDD	**2.00E+00**[bb]	3.00E+00[cc]	**2.0**
2,4'-DDE	**1.40E+00**[dd]	2.00E+00[dd]	**1.4**
2,4'-DDT	**1.70E+00**[ee]	2.00E+00[ff]	**1.7**
4,4'-DDD	**2.00E+00**[bb]	3.00E+00	**2.0**
4,4'-DDE	**1.40E+00**[dd]	2.00E+00	**1.4**
4,4'-DDT	**1.70E+00**[ee]	2.00E+00	**1.7**
Aldrin	**2.90E-02**	4.00E-02	**0.029**
alpha-BHC	**7.70E-02**	1.00E-01	**0.077**
beta-BHC	**2.70E-01**	4.00E-01	**0.27**
cis-Chlordane	1.60E+00[gg]	**2.00E-01**[gg]	**0.20**
cis-Nonachlor	1.60E+00[gg]	**2.00E-01**[gg]	**0.20**
delta-BHC	**7.70E-02**[hh]	1.00E-01[hh]	**0.077**
Dieldrin	**3.00E-02**	4.00E-02	**0.030**
Endosulfan I	**3.70E+01**[ii]	4.70E+02	**37**

Analyte	Human Health Sediment Threshold (mg/kg dw)		Lowest Human Health Sediment Threshold (mg/kg dw)[c]
	USEPA RSL[a]	NJDEP SRS[b]	
Endosufan II	**3.70E+01**[ii]	4.70E+02	**37**
Endosulfan sulfate	**3.70E+01**[ii]	4.70E+02	**37**
Endrin	**1.80E+00**	2.30E+01	**1.8**
Endrin aldehyde	**1.80E+00**[jj]	2.30E+01[jj]	**1.8**
Endrin ketone	**1.80E+00**[jj]	2.30E+01[jj]	**1.8**
gamma-BHC (Lindane)	5.20E-01	**4.00E-01**	**0.40**
Hexachlorobenzene	3.00E-01	**3.00E-01**	**0.30**
Heptachlor	1.10E-01	**1.00E-01**	**0.10**
Heptachlor epoxide	**5.30E-02**	7.00E-02	**0.053**
Methoxychlor	**3.10E+01**	3.90E+02	**31**
Oxychlordane	1.60E+00[gg]	**2.00E-01**[gg]	**0.20**
trans-Chlordane	1.60E+00[gg]	**2.00E-01**[gg]	**0.20**
trans-Nonachlor	1.60E+00[gg]	**2.00E-01**[gg]	**0.20**
PAHs			
1-Methylnaphthalene	**2.20E+01**	2.30E+02[kk]	**22**
1-Methylphenanthrene	**1.70E+03**[s]	1.70E+04[s]	**1,700**
2,3,5-Trimethylnaphthalene	**3.90E+00**[ll]	6.00E+00[ll]	**3.9**
2,6-Dimethylnaphthalene	**3.90E+00**[ll]	6.00E+00[ll]	**3.9**
2-Methylnaphthalene	**3.10E+01**	2.30E+02	**31**
Acenaphthene	**3.40E+02**	3.40E+03	**340**
Acenaphthylene	**3.40E+02**[p]	3.40E+03[p]	**340**
Anthracene	**1.70E+03**	1.70E+04	**1,700**
Fluorene	**2.30E+02**	2.30E+03	**230**
Naphthalene	**3.90E+00**	6.00E+00	**3.9**
Phenanthrene	**1.70E+03**[s]	1.70E+04[s]	**1,700**
Benzo[a]anthracene	**1.50E-01**	6.00E-01	**0.15**
Benzo[a]pyrene	**1.50E-02**	2.00E-01	**0.015**
Benzo[b]fluoranthene	**1.50E-01**	6.00E-01	**0.15**
Benzo[e]pyrene	**1.70E+02**[q]	1.70E+03[q]	**170**
Benzo[g,h,i]perylene	**1.70E+02**[q]	3.80E+05	**170**
Benzo[k]fluoranthene	**1.50E+00**	6.00E+00	**1.5**
Chrysene	**1.50E+01**	6.20E+01	**15**
Dibenzo[a,h]anthracene	**1.50E-02**	2.00E-01	**0.015**
Dibenzothiophene	NA	NA	**-**
Fluoranthene	**2.30E+02**	2.30E+03	**230**
Indeno[1,2,3-c,d]pyrene	**1.50E-01**	6.00E-01	**0.15**
Perylene	**1.70E+02**[q]	1.70E+03[q]	**170**
Pyrene	**1.70E+02**	1.70E+03	**170**
Butyltins			
Dibutyl tin	**1.80E+00**[mm]	NA	**1.8**
Monobutyltin	**1.80E+00**[mm]	NA	**1.8**

Analyte	Human Health Sediment Threshold (mg/kg dw)		Lowest Human Health Sediment Threshold (mg/kg dw)[c]
	USEPA RSL[a]	NJDEP SRS[b]	
Tetrabutyltin	**1.80E+00**[mm]	NA	**1.8**
Tributyltin	**1.80E+00**	NA	**1.8**
Herbicides			
2,4-D	**6.90E+01**	NA	**69**
2,4-DB	**4.90E+01**	NA	**49**
2,4,5-T	**6.10E+01**	NA	**61**
2,4,5-TP (Silvex)	**4.90E+01**	NA	**49**

[a] USEPA RSLs for residential soil (April 2009). RSLs for carcinogenic compounds are based on a target risk level of 1E-06; RSLs for non-carcinogenic compounds have been divided by a factor of 10 to adjust for a hazard index of 0.1 to account for potential additive effects.
[b] NJDEP SRS for residential soil (June 2008). SRS for carcinogenic compounds are based on a target risk level of 1E-06; SRSs for non-carcinogenic compounds are based on a hazard index of 1.
[c] DQLs are analytical goals listed solely for the purpose of evaluating laboratory analytical methods and achievable laboratory limits; these are not project-specific screening levels or PRGs and are not approved by the USEPA as the appropriate risk assessment criteria for this project. These values will be developed in subsequent phases of the project.
[d] The DQL for this analyte was based on inorganic arsenic.
[e] DQL based on natural background.
[f] Essential nutrient.
[g] DQL for titanium from USEPA Region 9 preliminary remediation goal table (USEPA 2004).
[h] The RSL is greater than the saturation limit; therefore, the saturation limit was used.
[i] The DQL for this analyte was based on 1,2,4-trichlorobenzene.
[j] The DQL for this analyte was based on 1,2-dichlorobenzene.
[k] The DQL for this analyte was based on bromodichloromethane.
[l] The DQL for this analyte was based on 1,3-dichloropropene.
[m] The DQL for this analyte was based on mixed xylenes.
[n] The DQL for this analyte was based on phenol.
[o] The DQL for this analyte was based on 2-nitroaniline.
[p] The DQL for this analyte was based on acenaphthene.
[q] The DQL for this analyte was based on pyrene.
[r] The DQL for this analyte was based on hexachloro-1,3-butadiene.
[s] The DQL for this analyte was based on anthracene.
[t] DQL based on value for PCBs.
[u] DQLs for individual PCB congeners based on the DQL for PCBs (high risk). For dioxin-like PCB congeners, DQLs are based on the lower of the DQL for PCBs (high risk) and the individual PCB congener DQL.
[v] DQL based on 2,3,7,8-TCDD DQL divided by a TEF of 0.01 (Van den Berg et al. 2006).
[w] DQL based on 2,3,7,8-TCDD DQL divided by a TEF of 0.1 (Van den Berg et al. 2006).
[x] DQL based on 2,3,7,8-TCDD DQL divided by a TEF of 1 (Van den Berg et al. 2006).
[y] DQL based on 2,3,7,8-TCDD DQL divided by a TEF of 0.03 (Van den Berg et al. 2006).
[Z] DQL based on 2,3,7,8-TCDD DQL divided by a TEF of 0.3 (Van den Berg et al. 2006).
[aa] DQL based on 2,3,7,8-TCDD DQL divided by a TEF of 0.0003 (Van den Berg et al. 2006).
[bb] The DQL for this analyte was based on DDD.
[cc] The DQL for this analyte was based on 4,4-DDD.
[dd] The DQL for this analyte was based on 4,4'-DDE.
[ee] The DQL for this analyte was based on DDT.
[ff] The DQL for this analyte was based on 4,4-DDT.
[gg] The DQL for this analyte was based on chlordane.
[hh] The DQL for this analyte was based on alpha-BHC.
[ii] The DQL for this analyte was based on endosulfan.
[jj] The DQL for this analyte was based on endrin.
[kk] The DQL for this analyte was based on 2-methylnaphthalene.
[ll] The DQL for this analyte was based on naphthalene.
[mm] The DQL for this analyte was based on tributyltin compounds.

BHC – hexachlorocyclohexane
CAS – Chemical Abstract Service
DDD – dichlorodiphenyldichloroethane
DDE – dichlorodiphenyldichloroethylene
DDT – dichlorodiphenyltrichloroethane
DQL – data quality level
NA – not available
NJDEP – New Jersey Department of Environmental Protection
PAH – polycyclic aromatic hydrocarbon
PCB – polychlorinated biphenyl
PRG – preliminary remediation goal
RSL – regional screening level
SRS – soil remediation standards
SVOC – semivolatile organic compound
TCDD – tetrachlorodibenzo-*p*-dioxin
TEF – toxic equivalency factor
USEPA – US Environmental Protection Agency
VOC – volatile organic compound

Bold identifies the lowest human health threshold that was selected as the DQL.

Table 4. Selected Sediment DQLs

Analyte	Lowest Ecological Threshold (mg/kg dw)[a]	Lowest Human Health Threshold (mg/kg dw)[b]	Selected DQL (mg/kg dw)
Metals			
Aluminum	18,000	**7,700**	**7,700**
Antimony	**2.0**	3.1	**2.0**
Arsenic	5.9	**0.39**	**0.39**
Barium	6,614	**1,500**	**1,500**
Beryllium	NA	**16**	**16**
Cadmium	**0.60**	7.0	**0.60**
Calcium	NA	NA	**-**
Chromium	**26**	280	**26**
Chromium VI	NA	NA	**-**
Cobalt	10	**2.3**	**2.3**
Copper	**16**	310	**16**
Cyanide	**0.0001**	160	**0.0001**
Iron	20,000	**5,500**	**5,500**
Lead	**31**	40	**31**
Magnesium	NA	NA	**-**
Manganese	**260**	11,000	**260**
Mercury	**0.15**	0.43	**0.15**
Methylmercury	**0.15**	0.78	**0.15**
Nickel	**16**	150	**16**
Potassium	NA	NA	**-**
Selenium	**1.0**	39	**1.0**
Silver	**0.5**	39	**0.5**
Sodium	NA	NA	**-**
Thallium	15.2	**0.51**	**0.51**
Titanium	NA	**100,000**	**100,000**
Vanadium	**38.1**	55	**38.1**
Zinc	**120**	2,300	**120**
VOCs			
1,1,1-Trichloroethane	**0.213**	290	**0.213**
1,1,2,2-Tetrachloroethane	0.850	**0.59**	**0.59**
1,2,2-Trichloro-1,1,2-trifluoroethane	NA	**940**	**940**
1,1,2-Trichloroethane	**0.518**	1.1	**0.518**
1,1-Dichloroethane	NA	**3.4**	**3.4**
1,1-Dichloroethene	**0.0194**	11	**0.0194**
1,2,3-Trichlorobenzene	NA	**8.7**	**8.7**
1,2,4-Trichlorobenzene	**0.0048**	8.7	**0.0048**
1,2-Dibromo-3-chloropropane	NA	**0.0056**	**0.0056**
1,2-Dibromoethane	NA	**0.0080**	**0.0080**
1,2-Dichlorobenzene	**0.013**	200	**0.013**
1,2-Dichloroethane	**0.260**	0.45	**0.260**
1,2-Dichloropropane	**0.333**	0.93	**0.333**

Analyte	Lowest Ecological Threshold (mg/kg dw)[a]	Lowest Human Health Threshold (mg/kg dw)[b]	Selected DQL (mg/kg dw)
1,3-Dichlorobenzene	**0.12**	200	**0.12**
1,4-Dichlorobenzene	**0.110**	2.6	**0.110**
1,4-Dioxane	NA	**44**	**44**
2-Butanone	NA	**2,800**	**2,800**
2-Hexanone	NA	NA	**-**
4-Methyl-2-pentanone	NA	**530**	**530**
Acetone	7,050	**6,100**	**6,100**
Benzene	**0.142**	1.1	**0.142**
Bromochloromethane	NA	**0.28**	**0.28**
Bromodichloromethane	NA	**0.28**	**0.28**
Bromoform	**0.492**	61	**0.492**
Bromomethane	**0.00137**	0.79	**0.00137**
Carbon disulfide	NA	**67**	**67**
Carbon tetrachloride	1.450	**0.25**	**0.25**
Chlorobenzene	**0.035**	31	**0.035**
Chloroethane	NA	**220**	**220**
Chloroform	**0.121**	0.30	**0.121**
Chloromethane	NA	**4.0**	**4.0**
cis-1,2-Dichloroethene	NA	**78**	**78**
cis-1,3-Dichloropropene	NA	**1.7**	**1.7**
Cyclohexane	NA	**120**	**120**
Dibromochloromethane	NA	**0.70**	**0.70**
Dichorodifluoromethane	NA	**19**	**19**
Ethylbenzene	**0.064**	5.7	**0.064**
Isopropylbenzene	NA	**220**	**220**
m, p-Xylene	**0.12**	60	**0.12**
Methyl acetate	NA	**7,800**	**7,800**
Methyl tert-butyl ether	NA	**39**	**39**
Methylcyclohexane	NA	NA	**-**
Methylene chloride	**0.159**	11	**0.159**
o-Xylene	**0.12**	300	**0.12**
Styrene	**0.254**	90	**0.254**
Tetrachloroethene	**0.45**	0.57	**0.45**
Toluene	**0.45**	500	**0.45**
Trans-1,2-Dichloroethene	**0.654**	11	**0.654**
Trans-1,3-Dichloropropene	NA	**1.7**	**1.7**
Trichloroethene	**0.122**	2.8	**0.122**
Trichlorofluoromethane	NA	**80**	**80**
Vinyl chloride	0.202	**0.060**	**0.060**
SVOCs			
1-Methylnaphthalene	NA	NA	**-**
1-Methyl-phenanthrene	NA	NA	**-**
1,1'-Biphenyl	NA	**262**	**262**
1,2,4,5-Tetrachlorobenzene	**1.252**	1.8	**1.252**

Analyte	Lowest Ecological Threshold (mg/kg dw)[a]	Lowest Human Health Threshold (mg/kg dw)[b]	Selected DQL (mg/kg dw)
2,2'-Oxybis (1-chloropropane)	NA	**3.5**	**3.5**
2,3,4,6-Tetrachlorophenol	NA	**180**	**180**
2,3,5-Trimethylnaphthalene	NA	NA	**-**
2,4,5-Trichlorophenol	**0.003**	610	**0.003**
2,4,6-Trichlorophenol	**0.006**	19	**0.006**
2,4-Dichlorophenol	**0.005**	18	**0.005**
2,4-Dimethylphenol	**0.304**	120	**0.304**
2,4-Dinitrophenol	**0.00621**	12	**0.00621**
2,4-Dinitrotoluene	**0.0144**	0.70	**0.0144**
2,6-Dinitrotoluene	NA	**0.70**	**0.70**
2-Chloronaphthalene	**0.417**	630	**0.417**
2-Chlorophenol	**0.008**	39	**0.008**
2,6-Dimethylnaphthalene	NA	NA	**-**
2-Methylnaphthalene	**0.0202**	31	**0.0202**
2-Methylphenol	NA	**310**	**310**
2-Nitroaniline	NA	**18**	**18**
2-Nitrophenol	NA	**1,800**	**1,800**
3,3',-Dichlorobenzidine	**0.127**	1.0	**0.127**
3-Nitroaniline	NA	**18**	**18**
4,6-Dinitro-2-methylphenol	NA	**0.61**	**0.61**
4-Bromophenyl phenylether	NA	NA	**-**
4-Chloro-3-methylphenol	NA	NA	**-**
4-Chloroaniline	NA	**2.4**	**2.4**
4-Chlorophenyl phenylether	NA	NA	**-**
4-Methylphenol	NA	**31**	**31**
4-Nitroaniline	NA	**24**	**24**
4-Nitrophenol	**0.0133**	1,800	**0.0133**
Acenaphthene	**0.00671**	340	**0.00671**
Acenaphthylene	**0.00587**	340	**0.00587**
Acetophenone	NA	**2.0**	**2.0**
Anthracene	**0.0469**	1,700	**0.0469**
Atrazine	NA	**2.1**	**2.1**
Benzaldehyde	NA	**780**	**780**
Benzo(a)anthracene	**0.0317**	0.15	**0.0317**
Benzo(a)pyrene	0.0319	**0.015**	**0.015**
Benzo(b)fluoranthene	1.8	**0.15**	**0.15**
Benzo(e)pyrene	NA	NA	**-**
Benzo(g,h,i)perylene	**0.17**	170	**0.17**
Benzo(k)fluoranthene	**0.24**	1.5	**0.24**
bis(2-Chloroethoxy) methane	NA	**18**	**18**
bis(2-Chloroethyl)ether	3.520	**0.19**	**0.19**
bis(2-Ethylhexyl) phthalate	**0.182**	35	**0.182**
Butylbenzylphthalate	**0.063**	260	**0.063**
Caprolactam	NA	**3,100**	**3,100**

Analyte	Lowest Ecological Threshold (mg/kg dw)[a]	Lowest Human Health Threshold (mg/kg dw)[b]	Selected DQL (mg/kg dw)
Carbazole	NA	**24**	**24**
Chrysene	**0.0571**	15	**0.0571**
Dibenzo(a,h)anthracene	**0.00622**	0.015	**0.00622**
Dibenzofuran	NA	NA	**-**
Dibenzothiophene	NA	NA	**-**
Diethylphthalate	**0.006**	4,900	**0.006**
Dimethylphthalate	**46**	NA	**46**
Di-n-butylphthalate	**0.058**	610	**0.058**
Di-n-octylphthalate	**46**	2,400	**46**
Fluoranthene	**0.111**	230	**0.111**
Fluorene	**0.019**	230	**0.019**
Hexachlorobenzene	**0.002**	0.30	**0.002**
Hexachlorobutadiene	**0.0013**	6.0	**0.0013**
Hexachloroethane	**0.073**	35	**0.073**
Hexchlorocyclopentadiene	**0.007**	37	**0.007**
Indeno(1,2,3-cd)pyrene	0.20	**0.15**	**0.15**
Isophorone	**0.432**	510	**0.432**
Naphthalene	**0.0346**	3.9	**0.0346**
Nitrobenzene	**0.145**	4.4	**0.145**
N-Nitrosodi-n-propylamine	NA	**0.069**	**0.069**
N-Nitrosodiphenylamine	NA	**99**	**99**
Pentachlorophenol	**0.017**	3.0	**0.017**
Phenanthrene	**0.0419**	1,700	**0.0419**
Phenol	**0.0491**	1,800	**0.0491**
Pyrene	**0.053**	170	**0.053**
Perylene	NA	NA	**-**
Petroleum hydrocarbons (extractable)	NA	NA	**-**
Petroleum hydrocarbons (purgeable)	NA	NA	**-**
TPH	NA	NA	**-**
TPH - DRO	NA	NA	**-**
PCBs			
Aroclor 1016	**0.0227**	0.20	**0.0227**
Aroclor 1221	**0.0227**	0.17	**0.0227**
Aroclor 1232	**0.0227**	0.17	**0.0227**
Aroclor 1242	**0.0227**	0.20	**0.0227**
Aroclor 1248	**0.0227**	0.20	**0.0227**
Aroclor 1254	**0.0227**	0.20	**0.0227**
Aroclor 1260	**0.0227**	0.20	**0.0227**
Total PCBs	**0.0227**	0.17	**0.0227**
PCB 77	**0.0089**	0.034	**0.0089**
PCB 81	**0.0044**	0.034	**0.0044**
PCB 105	4.4	**0.034**	**0.0227**[c]
PCB 114	4.4	**0.00068**	**0.00068**
PCB 118	44.5	**0.034**	**0.0227**[c]

Analyte	Lowest Ecological Threshold (mg/kg dw)[a]	Lowest Human Health Threshold (mg/kg dw)[b]	Selected DQL (mg/kg dw)
PCB 123	44.5	**0.034**	**0.0227**[c]
PCB 126	0.0044	**0.000034**	**0.000034**
PCB 156	4.4	**0.00068**	**0.00068**
PCB 157	4.4	**0.00068**	**0.00068**
PCB 167	44.5	**0.034**	**0.0227**[c]
PCB 169	0.44	**0.034**	**0.0227**[c]
PCB 189	44.5	**0.034**	**0.0227**[c]
PCDDs/PCDFs			
2,3,7,8-Tetrachlorodibenzo-*p*-dioxin	**0.00000012**	0.0000045	**0.00000012**
1,2,3,7,8-Pentachlorodibenzo-*p*-dioxin	0.00044	**0.0000045**	**0.0000045**
1,2,3,4,7,8-Hexachlorodibenzo-*p*-dioxin	0.0089	**0.000045**	**0.000045**
1,2,3,6,7,8-Hexachlorodibenzo-*p*-dioxin	0.044	**0.000045**	**0.000045**
1,2,3,7,8,9-Hexachlorodibenzo-*p*-dioxin	0.0044	**0.000045**	**0.000045**
1,2,3,4,6,7,8-Heptachlorodibenzo-*p*-dioxin	0.44	**0.00045**	**0.00045**
Octachlorodibenzo-*p*-dioxin	4.4	**0.015**	**0.015**
2,3,7,8-Tetrachlorodibenzofuran	0.00044	**0.000045**	**0.000045**
1,2,3,7,8-Pentachlorodibenzofuran	0.0044	**0.00015**	**0.00015**
2,3,4,7,8-Pentachlorodibenzofuran	0.00044	**0.000015**	**0.000015**
1,2,3,4,7,8-Hexachlorodibenzofuran	0.0044	**0.000045**	**0.000045**
1,2,3,6,7,8-Hexachlorodibenzofuran	0.0044	**0.000045**	**0.000045**
1,2,3,7,8,9-Hexachlorodibenzofuran	0.0044	**0.000045**	**0.000045**
2,3,4,6,7,8-Hexachlorodibenzofuran	0.0044	**0.000045**	**0.000045**
1,2,3,4,6,7,8-Heptachlorodibenzofuran	0.044	**0.00045**	**0.00045**
1,2,3,4,7,8,9-Heptachlorodibenzofuran	0.044	**0.00045**	**0.00045**
Octachlorodibenzofuran	4.4	**0.015**	**0.015**
PAHs			
1-Methylnaphthalene	NA	**22**	**22**
1-Methylphenanthrene	NA	**1,700**	**1,700**
2,3,5-Trimethylnaphthalene	NA	**3.9**	**3.9**
2,6-Dimethylnaphthalene	NA	**3.9**	**3.9**
2-Methylnaphthalene	**0.0202**	31	**0.0202**
Acenaphthene	**0.00671**	340	**0.00671**
Acenaphthylene	**0.00587**	340	**0.00587**
Anthracene	**0.0469**	1,700	**0.0469**
Fluorene	**0.019**	230	**0.019**
Naphthalene	**0.0346**	3.9	**0.0346**
Phenanthrene	**0.0419**	1,700	**0.0419**
Benzo(a)anthracene	**0.0317**	0.15	**0.0317**
Benzo(a)pyrene	0.0319	**0.015**	**0.015**
Benzo(b)fluoranthene	1.8	**0.15**	**0.15**
Benzo[e]pyrene	NA	**170**	**170**
Benzo(g,h,i)perylene	**0.17**	170	**0.17**
Benzo(k)fluoranthene	**0.24**	1.5	**0.24**
Chrysene	**0.0571**	15	**0.0571**

Analyte	Lowest Ecological Threshold (mg/kg dw)[a]	Lowest Human Health Threshold (mg/kg dw)[b]	Selected DQL (mg/kg dw)
Dibenzo(a,h)anthracene	**0.00622**	0.015	**0.00622**
Dibenzothiophene	NA	NA	-
Fluoranthene	**0.111**	230	**0.111**
Indeno(1,2,3-cd)pyrene	0.20	**0.15**	**0.15**
Perylene	NA	**170**	**170**
Pyrene	**0.053**	170	**0.053**
Pesticides			
2,4'-DDD	**0.0020**	2.0	**0.0020**
2,4'-DDE	**0.00142**	1.4	**0.00142**
2,4'-DDT	**0.001**	1.7	**0.001**
4,4'-DDD	**0.001**	2.0	**0.001**
4,4'-DDE	**0.00142**	1.4	**0.00142**
4,4'-DDT	**0.001**	1.7	**0.001**
Sum DDD	**5.7**	NA	**5.7**
Sum DDE	**2.0**	NA	**2.0**
Sum DDT	**0.95**	NA	**0.95**
Total DDTs	**0.007**	NA	**0.007**
Aldrin	**0.002**	0.029	**0.002**
alpha-Hexachlorocyclohexane	**0.00094**	0.077	**0.00094**
alpha-Chlordane	**0.00002**	0.20	**0.00002**
beta-Hexachlorocyclohexane	**0.00094**	0.27	**0.00094**
delta-Hexachlorocyclohexane	**0.00094**	0.077	**0.00094**
Dieldrin	**0.00002**	0.030	**0.00002**
Endosulfan I	318	**37**	**37**
Endosufan II	318	**37**	**37**
Endosulfan sulfate	318	**37**	**37**
Endrin	**0.00222**	1.8	**0.00222**
Endrin aldehyde	**0.00267**	1.8	**0.00267**
Endrin ketone	**0.00267**	1.8	**0.00267**
gamma-BHC (Lindane)	**0.00094**	0.40	**0.00094**
gamma-Chlordane	**0.00002**	0.20	**0.00002**
Heptachlor	**0.0003**	0.10	**0.0003**
Heptachlor epoxide	**0.0006**	0.053	**0.0006**
Methoxychlor	**0.006**	31	**0.006**
Total Chlordane	**0.00002**	0.20	**0.00002**
cis-Nonachlor	19	**0.20**	**0.20**
trans-Nonachlor	19	**0.20**	**0.20**
Oxychlordane	19	**0.20**	**0.20**
Hexachlorobenzene	**0.002**	0.30	**0.002**
Butyltins			
Dibutyl tin	44	**1.8**	**1.8**
Monobuyltin	44	**1.8**	**1.8**
Tetrabutyl tin	44	**1.8**	**1.8**
Tributyl tin	44	**1.8**	**1.8**

Analyte	Lowest Ecological Threshold (mg/kg dw)[a]	Lowest Human Health Threshold (mg/kg dw)[b]	Selected DQL (mg/kg dw)
Nutrients			
Ammonia as N	NA	NA	-
Chlorophyll a	NA	NA	-
Nitrogen (total Kjeldahl)	NA	NA	-
Phosphate	NA	NA	-
Total Orthophosphate	NA	NA	-
Herbicides			
2,4-D	NA	**69**	**69**
2,4-DB	NA	**49**	**49**
2,4,5-T	**12.3**	61	**12.3**
2,4,5-TP (Silvex)	**0.675**	49	**0.675**

[a] Lowest ecological sediment threshold based on Table 2.

[b] Lowest human health sediment threshold based on Table 3.

[c] DQL for PCB congener based on the DQL for total PCBs because the total PCB DQL is lower of the individual PCB congener DQL.

dw – dry weight
NA – not available/applicable
PAH – polycyclic aromatic hydrocarbon
PCB – polychlorinated biphenyl
TPH – total petroleum hydrocarbons
TRV – toxicity reference value
SVOC – semi-volatile organic compound
VOC – volatile organic compound

Bold identifies the lower of the ecological and human health threshold that was selected as the DQL.

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Attachment L: Health and Safety Plan

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LOWER PASSAIC RIVER RESTORATION PROJECT

QUALITY ASSURANCE PROJECT PLAN
SURFACE SEDIMENT CHEMICAL ANALYSES AND TOXICITY AND BIOACCUMULATION TESTING: ATTACHMENT L – HEALTH AND SAFETY PLAN

FINAL

October 8, 2009
Revision Number: 0

Prepared by: Wind Ward environmental LLC

200 West Mercer Street, Suite 401 ♦ Seattle, Washington ♦ 98119

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Health and Safety Plan for Surface Sediment Chemical Analyses and Toxicity and Bioaccumulation Testing of the LPRSA

By their signature, the undersigned certify that this health and safety plan is approved and that it will be used to govern health and safety aspects of fieldwork described in the quality assurance project plan to which it is attached.

Name Project Manager	Date
Name Corporate Health and Safety Manager	Date
Name Field Coordinator/Health and Safety Officer	Date

1 Introduction

This site-specific health and safety plan (HSP) describes safe working practices for conducting field activities at potentially hazardous sites and for handling potentially hazardous materials/waste products. This HSP covers elements as specified in 29 CFR 1910§120 and certain sections of 29 CFR§1926. The procedures and guidelines contained herein are based on generally recognized health and safety practices. Any changes or revisions to this plan will be made by a written amendment that will become a permanent part of this plan. The goal of the HSP is to establish procedures for safe working practices for all field personnel and visitors.

This HSP is specific to field activities of the sediment collection for chemical analysis and toxicity and bioaccumulation testing, which will be conducted to support the remedial investigation/feasibility study (RI/FS) of the Lower Passaic River Restoration Project (LPRRP). This HSP has been developed on behalf of the Lower Passaic River Study Area (LPRSA) Cooperating Parties Group (CPG). It includes relevant elements from the HSP Core Document developed by Malcolm Pirnie Inc. (Malcolm Pirnie 2005). The HSP Core Document describes the general health and safety issues related to field activities for the RI/FS.

This HSP addresses all activities associated with the collection and handling of sediment from the LPRSA for the preparation of chemical analyses and toxicity and bioaccumulation testing. During site work, this HSP will be implemented by the field coordinator (FC), who is also the designated site health and safety officer (HSO), in cooperation with the Windward corporate health and safety manager (HSM) and the Windward project manager (PM).

All personnel involved in fieldwork on this project, including Windward, AECOM, and de maximis, inc. (dmi), employees and any contractor employees, are required to comply with this HSP. The contents of this HSP reflect the anticipated types of activities to be performed, knowledge of the physical characteristics of the site, and consideration of preliminary chemical data from previous investigations at the site. The HSP may be revised based on new information and/or changed conditions during site activities. Revisions will be documented in the project records. Each employee must sign the Field Team Health and Safety Plan Review Form (Appendix A) affirming that they have read and understood the details of the HSP.

2 Site Description and Project Scope

2.1 SITE DESCRIPTION

The sampling area is in the LPRSA (see Figure 2 in the quality assurance project plan [QAPP]). The CPG field facility and dock is located on the east bank of the Lower Passaic River (LPR) at approximately River Mile (RM) 13.3. The address and phone number of the field facility are:

Kellways Industrial Park
1 Madison Street, East Rutherford, NJ 07073
Phone: (973) 773-0200

The QAPP to which this HSP is attached summarizes the site and provides complete details of the sampling program. Additional details about the site are provided in Section 2 of the HSP Core Document (Malcolm Pirnie 2005). The following section summarizes the types of work that will be performed during field activities.

2.2 SCOPE OF WORK

Specific tasks to be performed are as follows:

- Collection of surface sediments from a boat (subtidal or intertidal) or on foot (intertidal) for chemistry analyses and toxicity and bioaccumulation testing
- Sample handling, processing, and shipping from the field facility

One sampling event is specified for this QAPP and scheduled to occur in autumn 2009. Additional details on the sampling design and sampling methods are provided in QAPP Worksheet Nos. 10, 11, 14, and 17.

3 Health and Safety Personnel

Key health and safety personnel and their responsibilities are described below. These individuals are responsible for the implementation of this HSP and will be responsible for informing all individuals assigned to work on the site, or visit the site, of the contents of this plan and ensuring that each person signs the Health and Safety Plan Review Form. By signing the Health and Safety Plan Review Form, individuals recognize the site health and safety hazards, known or suspected, and will adhere to the protocols required to minimize exposure to such hazards.

Project Manager: The PM has overall responsibility for the successful outcome of the project. The PM will ensure that adequate resources and budget are provided for the

health and safety staff to carry out their responsibilities during fieldwork. The PM, in consultation with the HSM, makes final decisions concerning the implementation of the HSP.

Field Coordinator/Health and Safety Officer: The FC and HSO will be the same person and will direct field sampling activities, coordinate the technical components of the field program with health and safety components, and ensure that work is performed according to the QAPP.

The FC/HSO will implement this HSP at the work location and will be responsible for all health and safety activities and the delegation of duties to a health and safety technician in the field and in the field facility, as appropriate. The FC/HSO also has stop-work authority, to be used if there is an imminent safety hazard or potentially dangerous situation. The FC/HSO or his designee will be present during sampling and operations.

Corporate Health and Safety Manager: The HSM has overall responsibility for preparation, approval, and revisions of this HSP. The HSM will not necessarily be present during fieldwork but will be readily available, if required, for consultation regarding health and safety issues during fieldwork.

Field Crew: All field crew members must be familiar with and comply with the information in this HSP. They also have the responsibility to report any potentially unsafe or hazardous conditions to the FC/HSO immediately.

Boat Captain: All boat captains assigned to the project will be responsible for managing all on-water operations associated with the field work described in the QAPP and will have completed the Boating Safely course offered by the United States Coast Guard (USCG) Auxiliary. These responsibilities include:

- Serving as primary point of contact for coordinating marine operations
- Monitoring local boat traffic during on-water operations
- Broadcasting a security call prior to the start of each day's on-water activity and at regular intervals during the day to alert boat traffic of on-going marine sampling activities
- Verifying that the vessels are properly licensed and registered and that the vessels are properly sized and equipped for existing river conditions
- Conducting a mandatory all-hands safety briefing prior to the start of on-water activities and conducting a supplemental briefing for all visitors and/or personnel coming aboard after the initial briefing

- Conducting daily safety briefings to remind staff of on-water hazards and review any suggestions for improving vessel safety
- Performing a thorough inspection of the boat and deck
- Postponing or suspending on-water operations due to weather conditions
- Coordinating any emergency response efforts

4 Hazard Evaluation and Control Measures

This section covers potential physical, chemical, and biological hazards that may be associated with the proposed project activities and presents control measures for addressing these hazards. Confined-space entry will not be necessary for this project. Therefore, hazards associated with this activity are not discussed in this HSP.

4.1 PHYSICAL HAZARDS

For this project, it is anticipated that physical hazards will present a greater risk of injury than chemical hazards. Physical hazards are identified and discussed below.

4.1.1 Slips, trips, and falls

As with all field work, caution should be exercised to prevent slips on slick surfaces. In particular, sampling from a boat or other floating platform requires careful attention to minimize the risk of falling down or falling overboard. The same care should be used in rainy conditions or on the shoreline where slick rocks are found. Slips can be minimized by wearing boots with good tread, made of material that does not become overly slippery when wet.

Trips are always a hazard on the uneven deck of a boat, in a cluttered work area, or in the intertidal zone where uneven substrate is common. Personnel will keep work areas as free as possible from items that interfere with walking.

Falls may be avoided by working as far from exposed edges as possible, by erecting railings, and by using fall protection when working on elevated platforms. For this project, no work that would present a fall hazard is anticipated.

4.1.2 Sampling equipment deployment

A sediment grab sampler will be used to collect surface sediment samples for the chemical analyses and toxicity and bioaccumulation testing (see QAPP Worksheet No. 17 for additional details). The sampler will be deployed from the stern of the boat by a winch. Care will be taken to ensure that the sampler is safely guided from the stern

over the railing and into the water. Before sampling activities begin, there will be a training session for all field personnel for the equipment that will be onboard the sampling vessel.

At some locations in the intertidal, sampling will be conducted by hand using stainless steel spoons, as described in the QAPP.

4.1.3 Working on or near water

Some of the sampling activities will be conducted from a boat and are thereby subject to the "Working on or Near Water" regulations (29 CFR§1926.106). As with any work from a floating platform, there is a chance of falling overboard. USCG Type II or III personal flotation devices (PFDs) will be worn while working on the boat. A Type IV PFD (ring-type) with 90 ft of line, an air horn, and flares will also be available on all boats.

4.1.4 Manual lifting

Equipment and sample containers/coolers must be lifted and carried. Back strain can result if lifting is done improperly. During any manual handling tasks, personnel should lift with the load supported by their legs and not their backs. For heavy loads, an adequate number of people will be used, or if possible, a mechanical lifting/handling device will be used.

4.1.5 Hypothermia or frostbite

Because this field effort is scheduled for autumn, cold temperatures potentially associated with hypothermia or frostbite are not anticipated; however, if the sampling schedule is delayed or extended into late autumn-early winter, such temperatures may be experienced. Cold temperatures at or below freezing or due to wind chill can lead to cold stress-related problems, including frostbite or hypothermia. Frostbite occurs in several degrees, ranging from frost nip (whitening of the skin) to deep frostbite (tissues become solid resulting in serious injury). Hypothermia is a systemic response caused by exposure to freezing temperatures and can be fatal. The five stages of hypothermia include: shivering; apathy or sleepiness; unconsciousness and slow pulse and respiratory rate; freezing of extremities; and death.

All personnel will wear protective clothing, such as protective gloves or mittens or a USCG-approved survival suit, appropriate for the weather conditions and physical activity. A person exhibiting any of the signs of cold stress should be removed from the work area to a warm area. Immediate steps that can be taken to reduce the symptoms of frostbite and/or hypothermia include minimizing contact with cold metal surfaces and bare skin, limiting sitting or standing still for long periods,

rehydration with warm fluids, and the removal of outer layers of clothing to permit sweat evaporation during rest periods in a warm environment.

4.1.6 Heat stress

Heat stress could be an issue during the fall sampling event. Heat-related problems include heat rash, heat cramps, heat exhaustion, and heat stroke if the person does not ingest enough fluids. Heat rash can occur when sweat is not allowed to evaporate, leaving the skin wet most of the time and making it subject to irritation. Heat cramps are painful spasms of the muscles from excessive salt loss associated with sweating. Excessive sweating can also lead to heat exhaustion, resulting in moist, clammy skin. Physical signs and symptoms of heat exhaustion include headache, nausea, vertigo, weakness, thirst, and giddiness. Heat exhaustion may progress to heat stroke if a worker is unable to cool and re-hydrate their body. The primary signs and symptoms of heat stroke are confusion, irrational behavior, loss of consciousness, convulsions, a lack of sweating, hot dry skin, and an abnormally high body temperature. Workers should be aware of the key differences between the signs and symptoms of heat stroke and those of heat exhaustion, such as the lack of sweating, the color of the skin (red), and the rise in body temperature. Heat stroke is a medical emergency that requires immediate medical attention.

A person exhibiting any of the signs of heat stress should be removed from the work area to a shaded area. Immediate steps that can be taken to reduce the symptoms include use of a fan or soaking with water to increase cooling and promote evaporation, rehydration with electrolyte replacement fluids, and the removal of outer layers of clothing.

4.1.7 Inclement weather

In general, field team members will be equipped for the normal range of weather conditions. The FC/HSO will be aware of current weather conditions and of the potential for those conditions to pose a hazard to the field crew. Some conditions that might force work stoppage are thunderstorms, high winds, or high waves resulting from winds.

During the expected sampling period, severe thunderstorms may pose a hazard to site personnel. The project team will be issued a battery-operated National Oceanic and Atmospheric Administration (NOAA) weather radio equipped with an alarm that will automatically broadcast any pertinent information from NOAA's National Weather Service. The most pertinent information would be whether severe thunderstorm watches or warnings have been issued for the work area by the National Weather Service. A severe thunderstorm watch indicates that a severe thunderstorm is possible.

A severe thunderstorm warning, in contrast, indicates that a severe thunderstorm has actually been spotted or is strongly indicated on radar and it is time to seek safe shelter immediately.

If a severe thunderstorm watch is issued, field team members must remain alert for approaching storms and review the procedures for seeking refuge in the event that a warning is issued. If a severe thunderstorm warning is issued and thunder is heard, field team members will take the following measures:

- Cease all work, and contact shore support teams to coordinate a meeting at the nearest pre-defined access point on the river, then immediately seek shelter in a vehicle or back at the CPG field facility.
- Do not take shelter in small sheds, under isolated trees, or in convertible automobiles.
- If in a car, keep the windows up.

In the event that no shelter is available, field team members should find a low spot away from trees, fences and poles, and squat low to the ground on the balls of their feet and place their hands on their knees with their heads positioned between them.

Field team members should not return to work until 30 minutes after thunder was last heard.

4.1.8 Vessel traffic

Because of the high volumes of vessel and barge traffic in some areas of the LPRSA (i.e., specifically the lower 8 miles), precautions and safe boating practices will be implemented to ensure that field boats do not interrupt vessel traffic. As practical, field boats will stay out of the navigation channel. When samples are collected near cable crossing points in the LPRSA, clearance will be requested from the USCG prior to sampling.

In addition, when multiple boats are working to collect samples or transfer equipment, supplies and/or field personnel, the boat operators will clearly communicate their position to each other to avoid any potential interference or collision. All boats will work a safe distance from one another and approach any dock one at a time.

4.1.9 Sharp objects

Sampling operations might result in exposure of field personnel to sharp objects on top of or buried within the sediment. If encountered, field personnel should not touch these objects. Also, field personnel should not dig in the sediment by hand.

4.1.10 Feral animals

Some field activities may take place on land, and field personnel may come into contact with a feral animal (i.e., dog or cat). If encountered, field personnel should not approach or touch the feral animal because it may have contracted a disease from another wild animal. Also, if field personnel encounter a pack of feral dogs, they should avoid eye contact, watch them cautiously while walking slowly to a safe area and give the dogs a wide berth. In the event that a field team member is scratched or bitten by a feral animal, that person will receive the appropriate medical care.

4.1.11 Pinch point

Pinch points can occur anywhere a part of the body can get caught between two objects. This is a concern while field personnel are operating the grab sampler and boat winch. Proper equipment and safety training will be provided to each individual who will be working with the sampling equipment. Field personnel will keep clothing and body extremities well clear of pinch points while the machine is operating and clear of moving parts at all times. Guards are provided with the equipment for safety reasons (where practical without compromising equipment performance). The pinch point and moving part areas include the mouth of the grab sampler, the loading winch, cable, and carriage.

4.1.12 Poisonous plants

Persons working on the site should be aware of the possible presence of poisonous plants. Poison ivy is a climbing plant with leaves that consist of three glossy, greenish leaflets. Poison ivy has conspicuous red foliage in the fall. Small yellowish-white flowers appear in May through July at the lower leaf axils of the plant. White berries appear from August through November. Poison ivy is typically found east of the Rockies. Poison oak is similar to poison ivy but its leaves are oak-like in form. Poison oak occurs mainly in the south and southwest. Poison sumac typically occurs as a small tree or shrub and may be 6 to 20 ft in height. The bark is smooth, dark, and speckled with darker spots. Poison sumac is typically found in swampy areas and east of the Mississippi. The leaves have 7 to 13 smooth-edged leaflets, and drooping clusters of ivory-white berries appear in August and last through spring.

The leaves, roots, stems, and fruit of these poisonous plants contain urushiol. Contact with the irritating oil causes an intensely itching skin rash and characteristic blister-like lesions. The oil can be transmitted on soot particles when burned and may be carried on the fur of animals, equipment, and apparel.

Proper identification of these plants is the key to preventing contact and subsequent dermatitis. Wear long sleeves and pants when working in wooded areas. In areas of

known infestation, wear Tyvek® coveralls and gloves. Oils are easily transferred from one surface to another. If you come in contact with these poisonous plants, wash all exposed areas immediately with cool water to remove the oils. Some commercial products such as Tecnu's Poison Oak-n-Ivy Cleanser claim to further help with the removal of oils.

4.1.13 Insects

Persons working on the site should be aware of the possible presence of poisonous and disease-bearing insects such as ticks, mosquitoes, wasps, and bees.

4.1.13.1 Ticks

Ticks are bloodsuckers and attach themselves to warm-blooded vertebrates to feed. Deer ticks are associated with the transmission the bacteria that causes Lyme disease. Female deer ticks are about one-quarter inch in length and are black and brick red in color. Males are smaller and all black. If a tick is not removed, or if the tick is allowed to remain for days feeding on human blood, a condition known as tick paralysis can develop. This is the result of a neurotoxin, which the tick apparently injects while engorging. This neurotoxin acts upon the spinal cord, causing a lack of coordination, weakness, and paralysis.

The early stages of Lyme disease, which can develop within a week to a few weeks of the tick bite, are usually marked by one or more of these signs and symptoms:

- Tiredness
- Chills and fever
- Headache
- Muscle and/or joint pain
- Swollen lymph glands
- Characteristic skin rash (i.e., bulls-eye rash)

Rocky Mountain spotted fever is spread by the American dog tick, the lone-star tick, and the wood tick, all of which live in wooded areas and tall, grassy fields. The disease is most common in the spring and summer when these ticks are active, but it can occur anytime during the year when the weather is warm. Rocky Mountain spotted fever is found throughout the United States, except in Maine, Alaska, and Hawaii. Despite the name, few cases are reported from the Rocky Mountain region. Most cases occur in the southeastern United States.

Initial signs and symptoms of Rocky Mountain spotted fever include the sudden onset of a fever, headache, and muscle pain, followed by the development of a rash. Initial symptoms may include fever, nausea, vomiting, severe headache, muscle pain, and lack of appetite. The rash first appears 2 to 5 days after the onset of fever though is often not present or may be very subtle. Most often, it begins as small, flat, pink, non-itchy spots on the wrists, forearms, and ankles. These spots turn pale when pressure is applied and eventually become raised on the skin. Later signs and symptoms include rash, abdominal pain, joint pain, and/or diarrhea.

The characteristic red, spotted rash of Rocky Mountain spotted fever is usually not seen until the sixth day or later after the onset of symptoms, and this type of rash occurs in only 35% to 60% of patients with Rocky Mountain spotted fever. The rash involves the palms or soles in as many as 50% to 80% of patients; however, this distribution may not occur until later in the course of the disease.

Tick season lasts from April through October; peak season is May through July. Risk can be reduced with the following precautions:

- During outside activities, wear long sleeves and long pants tucked into socks. Wear a hat and tie hair back.
- Use insecticides to repel or kill ticks. Repellents containing the compound DEET can be used on exposed skin except for the face, but they do not kill ticks and are not 100% effective in discouraging ticks from biting. Products containing permethrin kill ticks, but they cannot be used on the skin – only on clothing. When using any of these chemicals, follow label directions carefully.
- After outdoor activities, perform a tick check. Check body areas where ticks are commonly found: behind the knees, between the fingers and toes, under the arms, in and behind the ears, and on the neck, hairline, and top of the head. Check places where clothing presses on the skin.
- Remove attached ticks promptly. Removing a tick before it has been attached for more than 24 hours greatly reduces the risk of infection. Use tweezers, grab as closely to the skin as possible and extract. Do not try to remove ticks by squeezing them, coating them with petroleum jelly, or burning them with a match.
- Report any of the above symptoms and all tick bites to the FC or HSO for evaluation.

4.1.13.2 Mosquitoes

West Nile encephalitis is an infection of the brain caused by the West Nile virus, which is transmitted by infected mosquitoes. Following transmission from an infected mosquito, West Nile virus multiplies in an individual's blood system and crosses the blood-brain barrier to reach the brain. The virus interferes with normal central nervous system functioning and causes inflammation of the brain tissue. However, most infections are mild; symptoms include fever, headache, and body aches. More severe infections may be marked by headache, high fever, neck stiffness, stupor, disorientation, coma, tremors, convulsions, muscle weakness, paralysis and, rarely, death. Persons over the age of 50 have the highest risk of severe disease.

Prevention centers on public health action to control mosquitoes and on individual action to avoid mosquito bites. To avoid being bitten by the mosquitoes that cause the disease, use the following control measures:

- If possible, stay inside between dusk and dark. This is when mosquitoes are most active.
- When outside between dusk and dark, wear long pants and long-sleeved shirts.
- Spray exposed skin with an insect repellent, preferably one that contains DEET.

4.1.13.3 Wasps and bees

Wasps (hornets and yellow jackets) and bees (honeybees and bumblebees) are common insects that may pose a potential hazard to the field team if work is performed during spring, summer, or fall. Bees normally build their nests in the soil. However, they use other natural holes such as abandoned rodent nests or tree hollows. Wasps make a football-shaped, paper-like nest either below or above the ground. Yellow jackets tend to build their nests in the ground, but hornets tend to build their nests in trees and shrubbery. Bees are generally more mild-mannered than wasps and are less likely to sting. Bees can only sting once; wasps sting multiple times because their stinger is barbless. Wasps sting when they feel threatened. By remaining calm and not annoying wasps by swatting, you lessen the chance of being stung.

Wasps and bees inject a venomous fluid under the skin when they sting. The venom causes a painful swelling that may last for several days. If the stinger is still present, carefully remove it with tweezers. Some people may develop an allergic reaction (i.e., anaphylactic shock) to a wasp or bee sting. If such a reaction develops, seek medical attention at once. In addition, if an individual knows that she/he will have an allergic reaction to wasp and bee stings, they are encouraged to consult their doctor prior to working in the area that may pose such a risk and carry the proper medication.

4.2 CHEMICAL HAZARDS

Chemical hazards include those occurring in the natural environment of the site (i.e., sediments and surface water) and those that are used in sample preservation and decontamination.

4.2.1 Exposure routes

Potential routes of chemical exposure include inhalation, dermal contact, and ingestion. Exposure will be minimized by using safe work practices and by wearing the appropriate personal protective equipment (PPE). Further discussion of PPE requirements is presented in Section 7.

Inhalation — Inhalation of chemical vapors from sediment samples is possible. Exposure to chemicals via this route will be controlled through the use of appropriate PPE, as dictated by the air monitoring procedures described in Section 8.1. In addition, engineering controls associated with sediment processing in the field facility are expected to minimize exposure to chemicals from inhalation.

Dermal exposure — Dermal exposure to hazardous substances associated with sediments, surface water, or equipment decontamination will be controlled by the use of PPE and by adherence to detailed sampling and decontamination procedures.

Ingestion — Incidental ingestion of sediment or surface water is not considered a major route of exposure for this project. Accidental ingestion of surface water is possible. However, careful handling of equipment and containers onboard the boat should prevent the occurrence of water splashing or spilling during sample collection and handling activities.

4.2.2 Chemical hazards occurring in natural environment

Previous investigations have shown that some chemicals are present at higher-than-background concentrations in the sampling area. For the purpose of discussing potential exposure to chemicals in sediments, the chemical contaminants of concern are metals, dioxins, pesticides, polycyclic aromatic hydrocarbons (PAHs), and polychlorinated biphenyls (PCBs), and volatile organic compounds (VOCs). Each of these chemical groups is associated with significant adverse health effects. Additional details on the chemical hazards associated with these chemicals are provided in Section 4.2 of the HSP Core Document (Malcolm Pirnie 2005).

The site contaminants of concern are predominantly non-volatile in nature so exposure to the vapors of these compounds is not likely to occur. Similarly, the potential for exposure to dust containing the chemical contaminants of concern during

sample collection and sample processing will also be minimal because the sampling equipment is not likely to come into contact with soils that could generate dust.

To avoid direct dermal contact with contaminated media, PPE, as described in Section 7, will be required when collecting samples. Exposure to chemical contaminants of concern may occur via ingestion (i.e., hand-to-mouth transfer). The decontamination procedures described in Section 9 address personal hygiene issues that will limit the potential for chemical contaminant ingestion.

4.2.3 Chemical hazards used in sample preservation and decontamination

Chemicals that may be used in the field for sample preservation or decontamination include:

- Formalin
- Nitric acid
- Hexane
- Acetone
- Methanol

The specific uses of these chemicals are described in QAPP Attachments E and I. Field personnel will safely handle these chemicals according to the QAPP and will wear appropriate PPE. A ventilation hood will be used in the field facility to minimize exposure to solvent vapors.

Material safety data sheets (MSDS) will be available for each of the chemicals listed above that is used in the field or the field facility. These MSDS will be maintained in a binder located in the field office, as well as on the boat. In addition, all containers of hazardous materials must be clearly labeled, ideally using the original manufacturer's label. Such a label will also need to be applied to any transfer bottles that are used.

4.3 BIOLOGICAL HAZARDS

Microbiological hazards, in the form of bacteria, protozoans, and viruses, might be encountered from contact with raw sewage or through cuts or wounds.

4.3.1 Raw sewage

Raw sewage may be discharged into the study area through combined sewer outfalls. The most common pathogenic organisms found in raw sewage include bacteria, viruses, and parasitic protozoa.

Ingestion of and direct contact with contaminated water are the primary methods of disease transmission in humans. Infection generally results from bacterial penetration of the skin in scratched or abraded areas. Bacterial infection cause varying degrees of gastrointestinal disease and may be accompanied by fever, headache, and chills. Waterborne microbes can also cause eye and ear infections, as well as more serious diseases such as hepatitis A, jaundice, and gastrointestinal discomfort.

4.3.2 Tetanus

Tetanus is a bacterial disease that may be contracted through a cut or wound that becomes contaminated with tetanus bacteria. Tetanus bacteria may cause a fatal disease characterized by respiratory paralysis and tonic spasms and rigidity of the voluntary muscles, especially those of the neck and lower jaw (lockjaw). Common first signs of tetanus are a headache and muscular stiffness in the jaw followed by stiffness of the neck, difficulty in swallowing, rigidity of abdominal muscles, spasms, sweating and fever. Symptoms usually begin 8 days after the infection, but may range in onset from 3 days to 3 weeks.

4.3.3 Needles and syringes

Some riverbank areas may be littered with needles or syringes that have been used for medical and/or illicit drug use. To avoid contact with needles that could possibly be infected with the HIV or other viruses, field team members will not work in areas where drug paraphernalia and/or hypodermic needles are present.

4.3.4 Infection control

The following control measures will be implemented to minimize exposure to biological hazards:

- Field team members with skin lesions or abraded skin areas that are particularly susceptible to infection will be assigned to tasks that do not pose a potential exposure to bacterial hazards.
- Gloves of sufficient length to prevent contact with water and safety glasses will be worn when collecting or processing samples.
- Field team members will wash their faces and hands and any other part of their body that may have contacted contaminated water as soon as possible. Alcohol-based hand sanitizer or Wash ‘n Dri towelettes will be available on each boat.
- All field team members will receive hepatitis A and tetanus booster vaccines if their existing vaccines are out of date.

5 Work Zones and Shipboard Access Control

During sampling and sample handling activities, work zones will be established to identify where sample collection and processing are actively occurring. The intent of the zone is to limit the migration of sample material out of the zone and to restrict access to active work areas by defining work zone boundaries.

5.1 WORK ZONE

The work zone will encompass the area where sample collection and handling activities are performed. Work zones will be identified for each sampling gear type. The FC/HSO will delineate the work zone as a particular area on-board the collection vessels or on the beach. Only persons with appropriate training, PPE, and authorization from the FC/HSO will be allowed to enter the work zone while work is in progress.

5.2 DECONTAMINATION STATION

A decontamination station will be set up, and personnel will clean soiled boots or PPE prior to leaving the work zone. The station will have the buckets, brushes, soapy water, rinse water, or wipes necessary to clean boots, PPE, or other equipment leaving the work zones. Plastic bags will be provided for expendable and disposable materials. If the location does not allow the establishment of a decontamination station, the FC/HSO will provide alternatives to prevent the spread of contamination.

Decontamination of the boat will also be completed at the end of each work day. Cockpit and crew areas will be rinsed down with water to minimize the accumulation of sediment.

5.3 ACCESS CONTROL

Security and control of access to the boat will be the responsibility of the FC/HSO and boat captain. Boat access will be granted only to necessary project personnel and authorized visitors. Any security or access control problems will be reported to the client or appropriate authorities.

6 Safe Work Practices

Following common sense rules will minimize the risk of exposure or accidents at a work site. These general safety rules will be followed on site:

- Do not climb over or under obstacles of questionable stability.

- Do not eat, drink, smoke, or perform other hand-to-mouth transfers in the work zone.
- Work only in well-lighted spaces.
- Never enter a confined space without the proper training, permits, and equipment.
- Make eye contact with equipment operators when moving within the range of their equipment.
- Be aware of the movements of shipboard equipment when not in the operator's range of vision.
- Get immediate first aid for all cuts, scratches, abrasions, or other minor injuries.
- Use the established sampling and decontamination procedures.
- Always use the buddy system.
- Be alert to your own and other workers' physical condition.
- Report all accidents, no matter how minor, to the FC/HSO.
- Do not do anything dangerous or unwise even if ordered by a supervisor.

7 Personal Protective Equipment and Safety Equipment

This section discusses: 1) the appropriate type of PPE, as determined by the specific field activity, 2) respiratory protection, and 3) safety equipment in the field facility and on the sampling boat.

7.1 PPE

Appropriate PPE will be worn as protection against potential hazards, as summarized in Table 1. Prior to donning PPE, the field crew will inspect their PPE for any defects that might render the equipment ineffective.

Table 1. PPE by field activity

PPE Item	Sediment Sampling	Transport of Sediment to Field Facility	Sample Processing and Preparation	Decontamination Activities	IDW Management
Hard hat	√				
Hip waders	when wading in river				
Steel-toed boots	√	√	√	√	√

PPE ITEM	SEDIMENT SAMPLING	TRANSPORT OF SEDIMENT TO FIELD FACILITY	SAMPLE PROCESSING AND PREPARATION	DECONTAMINATION ACTIVITIES	IDW MANAGEMENT
Safety glasses	√	√	√	√	√
Face shield				√	√
Type III PFD	√	while on the boat			
Inner PVC gloves/outer nitrile gloves	√	√	√	√	√
Kevlar® gloves					√
Tyvek® coveralls	√	√	√	√	√

IDW – investigation-derived waste
PFD – personal flotation device
PPE – personal protection equipment
PVC – polyvinyl chloride

Fieldwork will be conducted in Level D or modified Level D PPE. Situations warranting PPE beyond modified Level D are associated with possible use of respiratory protection, as discussed in Section 7.2.

New personnel or visitors will be informed of PPE requirements during their initial site briefing (see Section 3).

7.2 RESPIRATORY PROTECTION

Although the sediment samples will be collected from a boat or on foot from intertidal zones, the majority of the sample handling and processing will be conducted in the field facility. The field facility contains a tented enclosure equipped with exhaust fans that vent to outside of the facility. These engineering controls are likely to minimize the release of chemical vapors into the breathing space of personnel working in the field facility. However, as a precautionary measure, respiratory protection equivalent to Level C (e.g., half-mask air-purifying respirators equipped with cartridges that provide protection from organic vapors and mercury) will be made available to site personnel working in the field facility. Because all the field sampling will be conducted in the open air, additional respiratory protection is not expected to be necessary because ventilation provided by the ambient air should adequately dissipate any vapors from the collected sediment.

As discussed in Section 8.1, air monitoring will be conducted for total VOCs, benzene, mercury, and hydrogen sulfide to verify that the engineering controls discussed above are performing adequately. Table 2 indicates when Level C respiratory protection would be necessary based on the results of air monitoring. Two action limits are

specified, corresponding to: 1) donning of Level C respiratory protection, and 2) cessation of work until the PM and HSM are consulted.

Table 2. Air monitoring action limits and respiratory protection requirements

CHEMICAL	ACTION LIMIT	RESPONSE
Total VOCs	≥ 5 ppm (sustained for 15 minutes)	Take benzene measurement.
	≥ 10 and < 100 ppm (sustained for 15 minutes)	Don Level C respiratory protection.
	≥ 100 ppm	Cease work until PM and HSM are consulted.
Benzene	≥ 1 and < 100 ppm (instantaneous)	Don Level C respiratory protection.
	≥ 100 ppm (instantaneous)	Cease work until PM and HSM are consulted.
Mercury	≥ 0.1 and < 2 mg/m^3 (instantaneous)	Don Level C respiratory protection.
	≥ 2 mg/m^3 (instantaneous)	Cease work until PM and HSM are consulted.
Hydrogen sulfide	10 ppm (sustained for 10 minutes)	Cease work until PM and HSM have been consulted.

HSM – health and safety manager
PM – project manager
ppm – parts per million
VOCs – volatile organic compounds

Site personnel who may wear respirators will have successfully passed a qualitative fit test within the past year for a respirator of the same brand, model, and size of the one they would wear for this field program. Site visitors will not be permitted to enter work areas within the field facility unless they can demonstrate they can meet the fit test requirements listed above.

7.3 SAFETY EQUIPMENT

In addition to PPE that will be worn by field personnel, basic emergency and first aid equipment will also be provided. Equipment for the field team will include:

- A copy of this HSP
- First aid kit adequate for the number of personnel
- Emergency eyewash
- ABC-class fire extinguisher
- Flares (sampling boats only)

The FC/HSO will ensure that the safety equipment is available on the sampling boats and in the field facility. Equipment will be checked daily to ensure its readiness for use.

8 Monitoring Procedures for Site Activities

A monitoring program that addresses the potential site hazards will be maintained. Two types of monitoring will be conducted. Air monitoring will be conducted in the field facility to aid in the determination of appropriate processing protocols and PPE (Section 8.1). The second type of monitoring will consist of all workers monitoring themselves and their co-workers for signs that might indicate physical stress or illness (Section 8.2). For this project, dust and noise monitoring will not be necessary. The sampled media will be wet and will not pose a dust hazard, and none of the equipment emits high-amplitude (>85 dBA) sound.

8.1 AIR MONITORING

The processing of the sediment samples will occur in a tented enclosure within the field facility that is provided with exhaust ventilation to minimize the release of potentially harmful vapors. As a precautionary measure, air monitoring will be performed in the general vicinity of the breathing space for the site workers in the enclosed processing area. Total VOCs, benzene, mercury, and hydrogen sulfide will be measured to verify that the venting in the tent is sufficient to control vapors.

Air monitoring devices for the chemicals described below will be operated continuously within the sediment processing facility, except for benzene, which will only be monitored as needed, as described in Section 8.1.2. Each air monitoring device (except for the Draeger tubes used to monitor benzene) will be set to alarm at the action limits specified below and in Table 2.

8.1.1 Total VOCs

Total VOCs will be measured with a RAE Systems MiniRAE 2000, equipped with an 11.7-eV lamp. The MiniRAE is a photoionization detector (PID) designed to detect a broad array of organic vapors. If the lower action limit of 5 ppm is sustained for 15 minutes or more within the tented processing area, a reading for benzene will be collected (see Section 8.1.2). If benzene is present at less than its lower action limit (1 ppm), then the medium action limit of 10 ppm (sustained for 15 minutes or more) for total VOCs will dictate whether site workers will don Level C respiratory protection. When the processing of the sample that triggered the requirement for a benzene measurement is completed, the lower action limit of 5 ppm will once again apply.

If total VOC concentrations are greater than 100 ppm, all processing work for the specific sediment sample being processed will cease, and the PM and HSM will be contacted for further instructions.

8.1.2 Benzene

If total VOCs in the tented processing enclosure exceed 5 ppm, as measured by the PID (see Section 8.1.1), then benzene will be analyzed using a Draeger tube.[1] Benzene will be measured because it is one of the most toxic VOCs that could be present in the sediment samples, and the VOC measurement obtained from the PID is not specific to a single chemical. If benzene is not detected above 1 ppm (the National Institute of Occupational Safety and Health [NIOSH] short-term exposure limit [STEL]), no action is necessary specifically related to benzene. Although the STEL is based on a 15-minute average, the Draeger tube measures instantaneous concentrations. As a health protective measure, the instantaneous concentrations will be treated as 15-minute averages for the purpose of making a comparison to the action limit.

If benzene is detected at a concentration of 1 ppm or greater, but less than 100 ppm (20% of the immediately dangerous to life and health [IDLH] threshold), within the processing area, Level C respiratory protection will be donned within the processing area. When the processing of the sample that triggered the requirement to measure benzene is completed, benzene will no longer be monitored unless the lower action limit for VOCs of 5 ppm is triggered again.

If benzene concentrations are greater than 100 ppm, all processing work for the specific sediment sample being processed will cease, and the PM and HSM will be contacted for further instructions.

8.1.3 Mercury

A Jerome® mercury vapor analyzer[2] will be used to screen the air in the tented processing area. If the lower action limit of 0.1 mg/m^3 (the NIOSH ceiling limit), as measured instantaneously, is exceeded, and the concentration is below 2 mg/m^3 (20% of the NIOSH IDLH limit), site workers will don Level C respiratory protection until that sediment sample is processed, at which time sediment processing may resume without additional respiratory protection (assuming no other relevant action limits have been exceeded).

If mercury concentrations are greater than 2 mg/m^3 in the processing area, all processing work for the specific sediment sample being processed will cease, and the PM and HSM will be contacted for further instructions.

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[1] The specific Draeger tube model is benzene 0.5/c (item number 8101841) and has a measuring range of 0.5 to 10 ppm. A Draeger bellows pump will be used to collect the reading.

[2] Jerome J405, or equivalent, manufactured by Arizona Instruments.

8.1.4 Hydrogen sulfide

A hydrogen sulfide meter[3] will be used to screen for the presence of hydrogen sulfide in the tented processing area. If the action limit of 10 ppm (the NIOSH ceiling limit) is sustained for 10 minutes in the processing area, all processing work for the specific sediment sample being processed will cease, and the PM and HSM will be contacted for further instructions.

8.1.5 Calibration and record keeping

All air monitoring equipment will be calibrated in accordance with the manufacturer's specifications. Calibration details will be noted in the field log book, as will any occurrences of action limit exceedances.

8.2 PERSONNEL MONITORING

All personnel will be instructed to look for and inform each other of any deleterious changes in their physical or mental condition during the performance of all field activities. Examples of such changes are as follows:

- Headaches
- Dizziness
- Nausea
- Symptoms of heat stress
- Blurred vision
- Cramps
- Irritation of eyes, skin, or respiratory system
- Changes in complexion or skin color
- Changes in apparent motor coordination
- Increased frequency of minor mistakes
- Excessive salivation or changes in papillary response
- Changes in speech ability or speech pattern
- Shivering
- Blue lips or fingernails

[3] A T40 Rattler, or equivalent, manufactured by Industrial Scientific, will be used to monitor hydrogen sulfide.

If any of these conditions develop, work will be halted immediately, and the affected person(s) evaluated. If further assistance is needed, personnel at the local hospital will be notified, and an ambulance will be summoned if the condition is thought to be serious. If the condition is the direct result of sample collection or handling activities, procedures will be modified to address the problem.

9 Decontamination

Decontamination is necessary to prevent the migration of contaminants from the work zone(s) into the surrounding environment and to minimize the risk of exposure of personnel to contaminated materials that might adhere to PPE. The following sections discuss personnel and equipment decontamination. The following supplies will be available to perform decontamination activities:

- Wash buckets
- Rinse buckets
- Long-handled scrub brushes
- Clean water sprayers
- Paper towels
- Plastic garbage bags
- Alconox® or similar decontamination solution

9.1 MINIMIZATION OF CONTAMINATION

The first step in addressing contamination is to prevent or minimize exposure to existing contaminated materials and the spread of those materials. During field activities, the FC/HSO will enforce the following measures:

Personnel:

- Do not walk through areas of obvious or known contamination.
- Do not handle, touch, or smell contaminated materials directly.
- Make sure PPE has no cuts or tears prior to use. If it tears while working, stop and replace PPE.
- Fasten all closures on outer clothing, covering with tape if necessary.
- Protect and cover any skin injuries.
- Stay upwind of airborne dusts and vapors.

- Do not eat, drink, chew tobacco, or smoke in the work zones.

Sampling equipment and boat:

- Place clean equipment on a plastic sheet or aluminum foil to avoid direct contact with contaminated media.
- Keep contaminated equipment and tools separate from clean equipment and tools.
- Clean boots before entering the boat.

9.2 PERSONNEL DECONTAMINATION

The FC/HSO will ensure that all site personnel are familiar with personnel decontamination procedures. Personnel will perform the following decontamination procedures, as appropriate, before eating lunch, taking a break, or leaving the work location:

1. If outer suit is heavily soiled, rinse it off.
2. Wash and rinse outer gloves and boots with water.
3. Remove outer gloves; inspect and discard if damaged.
4. Wash hands if taking a break.
5. Don necessary PPE before returning to work.

Dispose of soiled, expendable PPE before leaving for the day.

9.3 SAMPLING EQUIPMENT DECONTAMINATION

Sampling equipment will be decontaminated as described in QAPP Attachment E: SOP—Procedure to Decontaminate Biological Sampling Equipment. In summary, to minimize sample contamination, the following practices will be followed:

- Ice chests will be scrubbed with Alconox® detergent and rinsed with deionized water prior to any sampling activities.
- Samples will be placed in resealable, waterproof containers and wet ice will be double bagged in plastic bags to avoid contamination from melting ice.
- Sampling equipment will be free from contaminants such as oils, grease, and fuels.
- All utensils or equipment used directly in handling sediment will be scrubbed with Alconox® detergent and rinsed with deionized water and/or appropriate

solvents (e.g., 10% nitric acid, acetone, methanol and hexane), and stored in aluminum foil until use.

10 Disposal of Contaminated Materials

Contaminated materials that may be generated during field activities include PPE and excess sample material. These contaminated materials will be disposed of as an integral part of the project.

10.1 Personal Protective Equipment

Gross surface contamination will be removed from PPE, including PFDs. All disposable sampling materials and PPE, such as disposable coveralls, gloves, and paper towels used in sample processing, will be placed in heavyweight garbage bags. Filled garbage bags will be placed in a normal refuse container for disposal as solid waste.

Respirators, if worn, will be cleaned after each use with respirator wipe pads and stored in plastic bags after cleaning.

10.2 Excess Sample Materials And Other Waste

During the sediment collection activities, sediment exposed to the water column can be washed off the grab sampler and hosed off the deck of the boat into the river. At each sampling location, excess or unwanted sediment collected in the sampler will be held in dedicated containers on the boat. The excess sediment will be combined with the other excess sediment in 55-gallon drums located at the field facility. Other wastes generated during the investigation may include detergent wash water or decontamination solvents; these will be collected on the boat or at the CPG field facility and stored in dedicated waste solvent 55-gallon drums at the field facility. Disposable PPE will also be collected in dedicated waste containers.

11 Training Requirements

Individuals performing work at locations where potentially hazardous materials and conditions may be encountered must meet specific training requirements. It is not anticipated that hazardous concentrations of contaminants will be encountered in sampled material, so training will consist of site-specific instruction for all personnel and the oversight of inexperienced personnel by an experienced person for one working day. The following sections describe the training requirements for this fieldwork.

11.1 PROJECT-SPECIFIC TRAINING

In addition to HAZWOPER training, field personnel will undergo training specifically for this project. All personnel and visitors must read this HSP and be familiar with its contents before beginning work or providing oversight. They must acknowledge reading the HSP by signing the Field Team Health and Safety Plan Review form (Appendix A). The form will be kept in the project files.

The boat captain and FC/HSO will also be required to have a USCG Auxiliary Boating Safely certification. The boat captain or a designee will provide project-specific training prior to the first day of fieldwork and whenever new workers arrive. Field personnel will not be allowed to begin work until project-specific training is completed and documented by the FC/HSO. Training will address the HSP and all health and safety issues and procedures pertinent to field operations. Training will include, but not be limited to, the following topics:

- Activities with the potential for chemical exposure
- Activities that pose physical hazards and actions to control the hazard
- Ship access control and procedures
- Use and limitations of PPE
- Decontamination procedures
- Emergency procedures
- Use and hazards of sampling equipment
- Location of emergency equipment on the vessel
- Vessel safety practices
- Vessel evacuation and emergency procedures

11.2 DAILY SAFETY BRIEFINGS

The FC/HSO or a designee and the boat captain will present safety briefings before the start of each day's activities. These safety briefings will outline the activities expected for the day, update work practices and hazards, address any specific concerns associated with the work location, and review emergency procedures and routes. The FC/HSO or designee will document safety briefings in the logbook.

11.3 FIRST AID AND CPR

At least one member of the field team must have first-aid and cardiopulmonary resuscitation (CPR) training. Documentation of which individuals possess first-aid and CPR training will be kept in the project health and safety files.

12 Medical Surveillance

A medical surveillance program conforming to the provisions of 29 CFR 1910§120(f) is not necessary for field team members because they do not meet any of the following four criteria outlined in the regulations for implementation of a medical surveillance program:

- Employees who are or may be exposed to hazardous substances or health hazards at or above permissible exposure levels for 30 days or more per year (1910.120(f)(2)(I)
- Employees who must wear a respirator for 30 days or more per year (1910.120(f)(2)(ii))
- Employees who are injured or become ill as a result of possible over-exposures involving hazardous substances or health hazards from an emergency response or hazardous waste operation (1910.120(f)(2)(iii))
- Employees who are members of HAZMAT teams (1910.120(f)(2)(iv))

As described in Section 8, employees will monitor themselves and each other for any deleterious changes in their physical or mental condition during the performance of all field activities.

13 Reporting and Record Keeping

Each member of the field crew will sign the Field Team Health and Safety Plan Review form (see Appendix A). If necessary, accident/incident report forms and Occupational Safety and Health Administration (OSHA) Form 200s will be completed by the FC/HSO.

The FC/HSO or a designee will maintain records on the health- and safety-related details of the project in electronic field logbook entries (see QAPP Attachment H: SOP—Documenting Field Activities). At a minimum, each day's entries must include the following information:

- Project name or location

- Names of all personnel onboard
- Weather conditions
- Type of fieldwork being performed

The person maintaining the entries will initial and date the bottom of each completed page. Each day's entries will begin on the first blank page after the previous workday's entries.

14 Emergency Response Plan

As a result of the hazards onboard and the conditions under which operations will be conducted, the potential exists for an emergency situation to occur. Emergencies may include personal injury, exposure to hazardous substances, fire, explosion, or release of toxic or non-toxic substances (spills). OSHA regulations require that an emergency response plan be available for use onboard to guide actions in emergency situations.

Onshore organizations will be relied upon to provide response in emergency situations. The local fire department and ambulance service can provide timely response. Field personnel will be responsible for identifying an emergency situation, providing first aid if applicable, notifying the appropriate personnel or agency, and evacuating any hazardous area. Shipboard personnel will attempt to control only very minor hazards that could present an emergency situation, such as a small fire, and will otherwise rely on outside emergency response resources.

The following sections identify the onboard individual(s) who should be notified in case of emergency, provide a list of emergency telephone numbers, offer guidance for particular types of emergencies, and provide directions and a map for getting from any sampling location to a hospital.

14.1 PRE-EMERGENCY PREPARATION

Before the start of field activities, the FC/HSO will ensure that preparation has been made in anticipation of emergencies. Preparatory actions include the following:

- Meeting with the FC/HSO and equipment handlers concerning the emergency procedures in the event that a person is injured
- A training session given by the FC/HSO informing all field personnel of emergency procedures, locations of emergency equipment and their use, and proper evacuation procedures

- A training session given by senior staff operating field equipment to apprise field personnel of operating procedures and specific risks associated with that equipment
- Ensuring that field personnel are aware of the existence of the emergency response plan in the HSP and ensuring that a copy of the HSP accompanies the field team

14.2 PROJECT EMERGENCY COORDINATOR

The FC/HSO will serve as the project emergency coordinator in the event of an emergency. He/she will designate his replacement for times when he/she is not on board or is not serving as the project emergency coordinator. The designation will be noted in the logbook. The project emergency coordinator will be notified immediately when an emergency is recognized. The project emergency coordinator will be responsible for evaluating the emergency situation, notifying the appropriate emergency response units, coordinating access with those units, and directing interim actions onboard before the arrival of emergency response units. The project emergency coordinator will notify the HSM and the Windward PM as soon as possible after initiating an emergency response action. The Windward PM will have responsibility for notifying the client.

14.3 EMERGENCY RESPONSE CONTACTS

All onboard personnel must know whom to notify in the event of an emergency situation, even though the FC/HSO has primary responsibility for notification. Table 3 lists the names and phone numbers for emergency response services and individuals. A copy of this HSP will be made available for every vehicle designated for field use or emergency transport and on each sampling boat.

Table 3. Emergency response contacts

CONTACT	TELEPHONE NUMBER
Emergency Numbers:	
Ambulance	911
Police	911
Fire	911
St. Michael's Medical Center (Newark, NJ)	(973) 268-8000
St. Mary's Hospital (Passaic, NJ)	(973) 365-4489
Emergency Responders:	

CONTACT	TELEPHONE NUMBER
US Coast Guard Emergency General information – Sector New York Command Center	 (718) 354-4119 (718) 354-4353/4193 VHF Channel 16
National Response Center	(800) 424-8802
US Environmental Protection Agency	(800) 424-8802
New Jersey Department of Environmental Protection – Bureau of Emergency Response (24-hour emergency line)	(877) 927-6337
Emergency Contacts:	
Windward Project Manager	
Lisa Saban	(206) 577-1288
Windward Corporate Health and Safety Manager	
Tad Deshler	(206) 577-1285
Field Coordinator/Field Health and Safety Officer	
Thai Do/Angelita Rodriquez	Site cellular telephone: To be determined at start of each sampling event
CPG Field Facility	(973) 773-0200

14.4 RECOGNITION OF EMERGENCY SITUATIONS

Emergency situations will generally be recognizable through observation. An injury or illness will be considered an emergency if it requires treatment by a medical professional and cannot be treated with simple first-aid techniques.

14.5 DECONTAMINATION

In the case of evacuation, decontamination procedures will be performed only if doing so does not further jeopardize the welfare of site workers. If an injured individual is also heavily contaminated and must be transported by emergency vehicle, the emergency response team will be told of the type of contamination. To the extent possible, contaminated PPE will be removed but only if doing so does not exacerbate the injury. Plastic sheeting will be used to reduce the potential for spreading contamination to the inside of the emergency vehicle.

14.6 FIRE

Field personnel will attempt to control only small fires, should they occur. If an explosion appears likely, personnel will follow evacuation procedures specified during the training session. If a fire cannot be controlled with the on-board fire extinguisher that is part of the required safety equipment, personnel will either

withdraw from the vicinity of the fire or evacuate the boat as specified in the training session.

14.7 PERSONAL INJURY

In the event of serious personal injury, including unconsciousness, possibility of broken bones, severe bleeding or blood loss, burns, shock, or trauma, the first responder will immediately do the following:

- Administer first aid, if qualified.
- If not qualified, seek out an individual who is qualified to administer first aid, if time and conditions permit.
- Notify the project emergency coordinator of the incident, the name of the injured individual(s), the location, and the nature of the injury.

The project emergency coordinator will immediately do the following:

- Notify the boat captain and the appropriate emergency response organization.
- Assist the injured individual(s).
- Follow the emergency procedures for retrieving or disposing of equipment reviewed in the training session and leave the site en route to the predetermined land-based emergency pickup.
- Designate someone to accompany the injured individual to the hospital.
- If a life-threatening emergency occurs (i.e., injury where death is imminent without immediate treatment), the FC/HSO or boat captain will call 911 and arrange to meet the emergency personnel at the nearest accessible dock. Otherwise, for emergency injuries that are not life-threatening (e.g., broken bones, minor lacerations), the project emergency coordinator will follow the procedures outlined above and proceed to the CPG field facility or to an alternative location if that would be more expedient.
- Notify the HSM and the PM.

If the project emergency coordinator determines that emergency response is not necessary, he/she may direct someone to decontaminate and transport the individual by vehicle to the nearest hospital. Directions showing the route to the hospital are in Section 14.11.

If a worker leaves the boat to seek medical attention, another worker should accompany that individual to the hospital. When in doubt about the severity of an

injury or exposure, personnel should always seek medical attention as a conservative approach and notify the project emergency coordinator.

The project emergency coordinator will have responsibility for completing all accident/incident field reports, OSHA Form 200s, and other required follow-up forms.

14.8 OVERT PERSONAL EXPOSURE OR INJURY

If an overt exposure to toxic materials occurs, the first responder to the victim will initiate actions to address the situation. The following actions should be taken, depending on the type of exposure.

14.8.1 Skin contact

- Wash/rinse the affected area thoroughly with copious amounts of soap and water.
- If eye contact has occurred, eyes should be rinsed for at least 15 minutes using the eyewash that is part of the emergency equipment onboard.
- After initial response actions have been taken, seek appropriate medical attention.

14.8.2 Inhalation

- Move victim to fresh air.
- Seek appropriate medical attention.

14.8.3 Ingestion

- Seek appropriate medical attention.

14.8.4 Puncture wound or laceration

- Seek appropriate medical attention.

14.9 SPILLS AND SPILL CONTAINMENT

No bulk chemicals or other materials subject to spillage are expected to be used during this project. Accordingly, no spill containment procedure is required for this project.

14.10 BOATING HAZARDS

Emergency responses to boating hazards are described in Table 4.

Table 4. Potential boat emergency hazards and responses

POTENTIAL EMERGENCY HAZARD	RESPONSE
Fire or explosion	If manageable, attempt to put out a small fire with a fire extinguisher. Otherwise, call the US Coast Guard or 911 and evacuate the area (by life raft, rescue boat, or swimming) and meet at a designated area. The FC will take roll call to make sure everyone evacuated safely. Emergency meeting places will be determined in the field during the daily safety briefings.
Medical emergency/ personal injury	At least one person with current first aid/CPR training will be on board the vessel at all times. This person will attempt to assess the nature and critical path of the injury, call 911 immediately, and apply CPR if necessary. Stop work and wait for medical personnel to arrive. Fill out a site accident report.
Person overboard	Immediately throw the person in the water a life ring (Type III PFD). Have one person keep an eye on the person and shout the distance (boat lengths) and direction (o'clock) of the person from the vessel. Stop work and use the vessel to retrieve the person in the water.
Sinking vessel	Call the US Coast Guard immediately. If possible, wait for a rescue boat to arrive to evacuate vessel personnel. Stay with the boat until rescue arrives, if possible. See the fire/explosion section for emergency evacuation procedures. The FC will take a roll call to make sure everyone is present.
Hydraulic oil spill or leak	If the leak/spill is small, immediately apply absorbent pads to control the leak and continue work. If the leak/spill is uncontainable, stop work, call 911 immediately, and wait for assistance. The vessel operator will call the USCG for spill control, assess the personal safety hazard associated with the leak/spill and begin evacuation procedures if necessary.
Lack of visibility	If navigation visibility or personal safety is compromised because of smoke, fog, or other unanticipated hazards, stop work immediately. The vessel operator and FC will assess the hazard and, if necessary, send out periodic horn blasts to mark the vessel location and to warn other vessels potentially in the area, move to a secure location (i.e., berth), and wait for the visibility to clear.
Loss of power	Stop work and call the US Coast Guard for assistance. Vessel personnel should watch for potential collision hazards and notify vessel operator if hazards exist. Secure vessel to a berth, dock, or mooring as soon as possible.
Collision	Stop work and call the US Coast Guard for assistance. The FC and vessel operator will assess damage and potential hazards. If necessary, the vessel will be evacuated and secured until repairs can be made.

14.11 EMERGENCY ROUTE TO THE HOSPITAL

The names, addresses, and telephone numbers of the hospitals that will be used to provide medical care are as follows:

St. Michael's Medical Center
268 Dr. Martin Luther King Jr. Blvd., Newark, NJ
Phone: (973) 268-8000

or:

St. Mary's Hospital

350 Boulevard, Passaic, NJ
Phone: (973) 365-4489

The hospital will be selected by the project emergency coordinator (i.e., the FC) based on proximity to the emergency scene. If the emergency occurs on the boat, the vessel will be docked at the closest available launch or dock.

Directions from the vicinity of the LPRSA to St. Michael's Medical Center (Figure 1) are as follows:

- From McCarter Highway, turn left on Chestnut St.
- Turn right on Broad St.
- Turn left on Central Ave.
- The visitors' parking lot is located on Central Ave., between University Ave. and Dr. Martin Luther King, Jr., Blvd.

Figure 1. Route to St. Michael's Medical Center

Directions from the CPG field facility to St. Mary's Hospital (Figure 2) are as follows:

- Head northeast on Madison St. toward Plosia Pl.
- Turn left at Carlton Ave.
- Continue straight onto Paterson Ave.
- Turn left at Main Ave.
- Take a slight right at River Rd./River Dr., continue to follow River Dr.
- Turn left at Prospect St.
- Turn left at Pennington Ave.
- Turn right at Paulison Ave.
- Turn left at Broadway
- Turn right at Boulevard St.
- Hospital will be on the right.

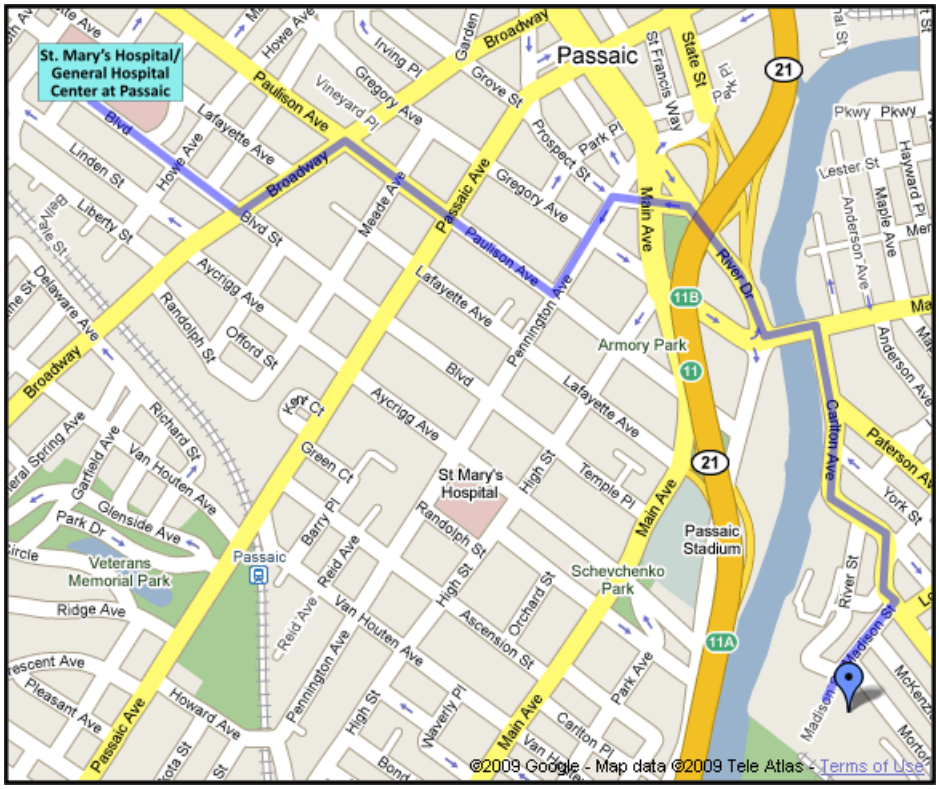

Figure 2. Route to St. Mary's Hospital from the CPG field facility

Directions to St. Mary's Hospital from the north (e.g., Dundee Dam) are as follows (Figure 3):

- Head southwest on Clifton Ave. toward Schoonmaker Pl.
- Turn left at Paulison Ave.
- Turn right at Oak St.
- Turn left at Boulevard St.
- Hospital will be on the left.

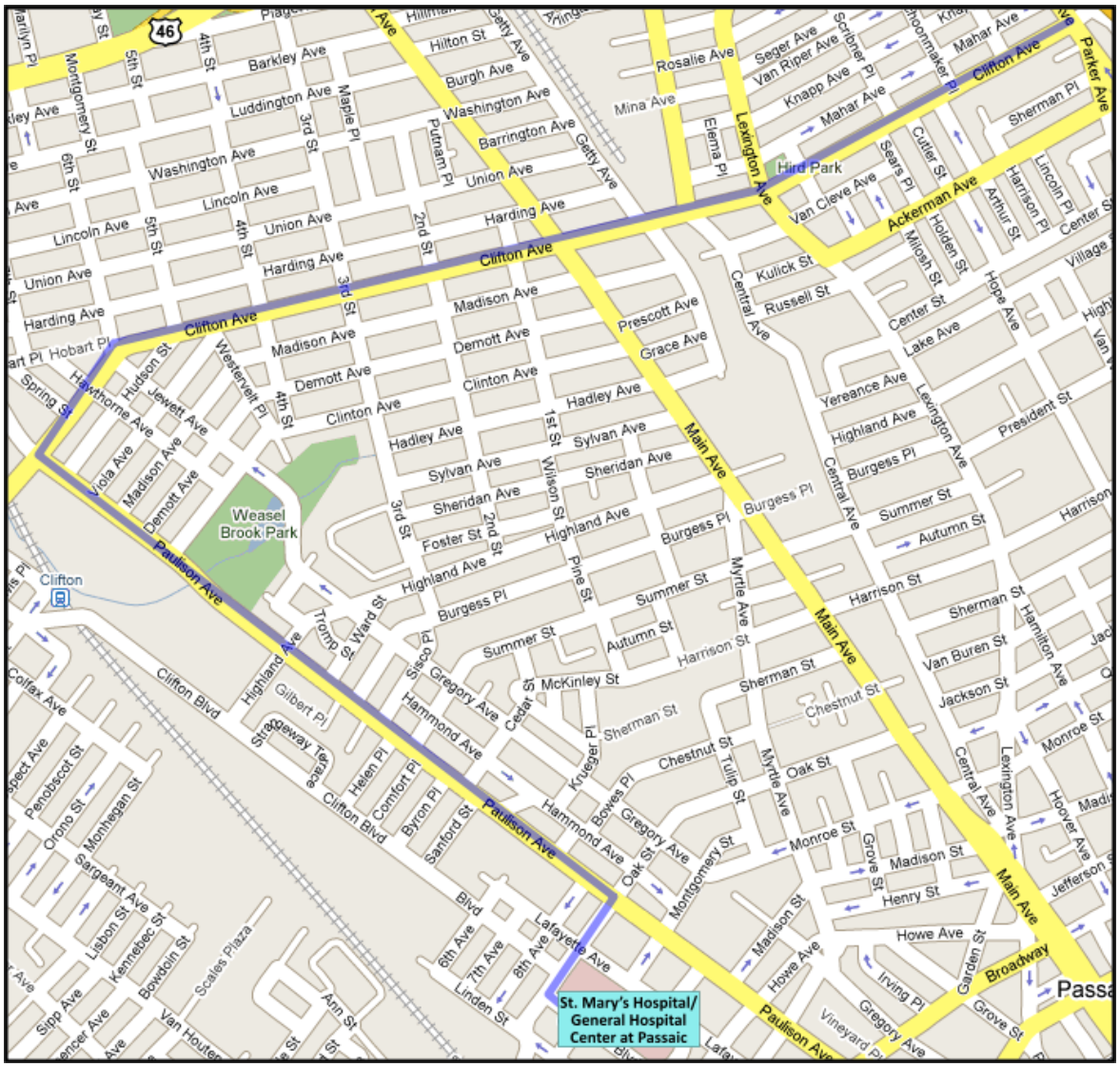

Figure 3. Route to St. Mary's Hospital from the north

Directions to St. Mary's Hospital from the south (e.g., Nutley, Belleville, or River Bank Park in Lyndhurst) (Figure 4) are as follows:

- If located on the east side of the river (e.g., River Bank Park in Lyndhurst), head north on Riverside Ave.
- Turn left on Kingsland Ave.
- Turn right to merge onto NJ-21 N.
- Continue (or from points on west bank of river, head) north on NJ-21 N.
- Take Exit 11A to merge onto River Rd./River Dr. toward Passaic.
- Turn left at Paulison Ave.
- Turn left at Broadway.
- Turn right at Boulevard St.
- Hospital will be on the right.

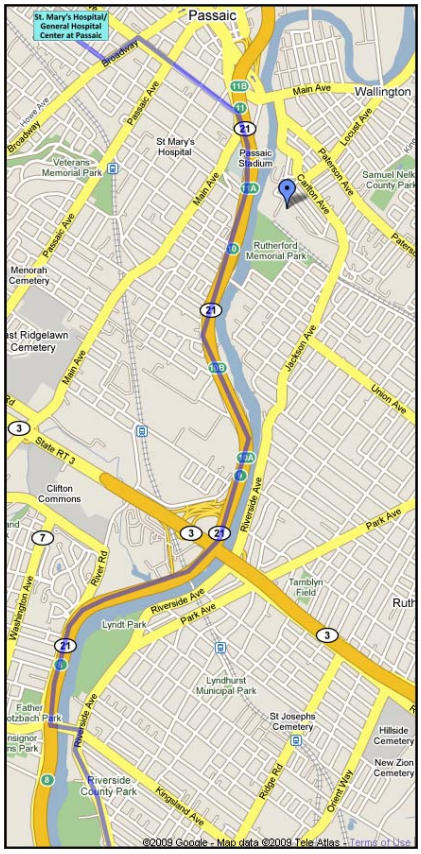

Figure 4. Route to St. Mary's Hospital from the south

15 References

Malcolm Pirnie. 2005. Lower Passaic River Restoration Project. Health and safety plan - core document and hydrodynamic studies. Final. Prepared for US Environmental Protection Agency and US Army Corps of Engineers. Malcolm Pirnie, Inc., White Plains, NY.

Appendix A. Field Team Health and Safety Plan Review

I have read a copy of the health and safety plan, which covers field activities that will be conducted to investigate potentially contaminated areas in the LPRSA. I understand the health and safety requirements of the project, which are detailed in this health and safety plan.

Signature	Date
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Attachment M: Laboratory SOPs

Title, Revision Date, and/or Number	Reference No.
SOP No. OP-003, Tissue Preparation and Homogenization, Revision 0.0, 4/25/02	M1
SOP No. AP-CM-7, High Resolution Mass Spectrometry, Method 1668A for Solid/Air/Aqueous/Tissue Matrices, Revision 7, 2/14/05	M2
SOP No. AP-CM-5, Polychlorinated dibenzo dioxin/furans, USEPA Methods 8290, 1613, 23, 0023A, & TO-9A, Revision 12-5, 1/7/09	M3
SOP No. BRL-00423, PAH Compounds by HRGC HRMS in Food Products, Sediment and Water 4/13/09 Technical Summary in reference to SOP Version 4, 7/15/09	M4
SOP No. BRL-00003, Cleanup of Sample Extract Using Gel Permeation Chromatography, 4/13/09 Technical Summary in reference to SOP GPC Cleanup, Version 1, 7/17/06	M5
SOP No. BRL-00010, Extraction Organochlorine Pesticides from Liquids and Solids, 4/13/09 Technical Summary in reference to SOP Version 1, 7/17/06	M6
SOP No. BRL-00415, OC Pesticides by HRMS, 4/13/09 Technical Summary in reference to SOP Version 3, 7/15/09	M7
SOP No. MET-3050, Standard Operating Procedure for Metals Digestion, Revision 10, 7/12/07.	M8
SOP No. MET-TDIG, Standard Operating Procedure for Sample Preparation of Biological Tissue for Metals Analysis by GFAA, ICP-OES, and ICP-MS, Revision 1, 2/27/2002	M9
SOP No. MET-6020, Standard Operating Procedure for Determination of Metals and Trace Elements by Inductively Coupled Plasma-Mass Spectrometry (ICP-MS); EPA Method 6020, Revision 12, 9/26/2008	M10
SOP No. MET-ICP, Standard Operating Procedure for Determination of Metals and Trace Elements by Inductively Coupled Plasma Atomic Emission Spectrometry (ICP), Revision 20, 9/26/2008	M11
SOP No. MET-7742, Standard Operating Procedure for Selenium by Borohydride Reduction Atomic Absorption, Revision 2, 1/6/2006	M12
SOP No. GEN-AVS, Sulfides, Acid Volatile, Rev. 5, 1/26/2005	M13
SOP No. BR-0002, BRL Procedure for EPA Method 1631, Appendix: Total Mercury in Tissue, Sludge, Sediment, and Soil by Acid Digestion and BrCl Oxidation by Cold Vapor Atomic Fluorescence Spectrophotometry (CVAFS), Revision 010a, 9/08/08	M14
SOP No. BR-0006, BRL Procedure for EPA Method 1631, Revision E: Mercury in Water by Oxidation, Purge and Trap, and Cold Vapor Atomic Fluorescence Spectrometry, Revision 004a, 9/08/08	M15

Title, Revision Date, and/or Number	Reference No.
SOP No. BR-0011, Determination of Methyl Mercury by Aqueous Phase Ethylation, Trap Pre-Collection, Isothermal GC Separation, and CVAFS Detection: BRL Procedure for EPA Method 1630 (Waters) and EPA Method 1630, Modified (Solids), Revision 012a, 9/5/08	M16
SOP No. OP-016, Microscale Solvent Extraction (MSE), Revision 2, 2/12/08	M17
SOP No. OP-006, Gel Permeation Chromatography Method 3640A, Revision 1.0, 2/11/08	M18
SOP No. OP-014, Silica Gel Cleanup Procedure (Automated and Manual), Revision 1.1, 5/2/08	M19
SOP No. O-006, Method 8270, Semivolatile Organic Compounds by GC/MS, Revision 5, 3/6/09	M20
SOP No. SOC-OSWT, Extraction of Organotins in Sediment, Water, and Tissue Matrices, Revision 5, 1/20/06	M21
SOP No. SOC-BUTYL, Butyltins, Revision 8, 7/31/07	M22
SOP No. SOC-LIPID, Percent Lipids in Tissue, Revision 1, 4/30/07	M23
SOP No. W-001, Percent Solids Determination, Revision 3, 5/4/07	M24
SOP No. W-028, Total Organic Carbon in Soil, Sediment and Water, Revision 2.0, 1/22/03	M25
SOP No. W-029, Particle Size Analysis of Soils – With / Without Hydrometer and Liquid Limit, Plastic Limit, and Plasticity Index, Revision 0.0, 7/17/06	M26
SOP No. GEN-350.1, Ammonia by Flow Injection Analysis, Revision 7, 5/1/07	M27
SOP No. GEN-9013, Cyanide Extraction of Solids and Oils, Revision 0, 7/8/98	M28
SOP No. GEN-335, Total Cyanides and Cyanides Amenable to Chlorination, Revision 12, 4/12/07	M29
SOP No. GEN-TKN, Nitrogen, Total and Soluble Kjeldahl, Revision 9, 1/7/08	M30
SOP No. GEN-365.3, Phosphorus Determination Using Colorimetric Procedure, Revision 10, 8/28/08 (includes sample preparation)	M31
SOP No. GEN-9030M, Total Sulfides by Methylene Blue Determination, Revision 8, 1/5/06 (includes sample preparation)	M32
SOP No. 04-20 Quantification of Semivolatile Petroleum Products in Water, Soil, Sediment and Sludge, Revision 1, 3/12/09 (NJDEP OQA-QAM-025-02/08 Rev.7)	M33
SOP No. 04-13, TPH-Gasoline Range Organics, Revision 3, 7/4/07	M34
SOP No. O-012, Determination of Polychlorinated Biphenyls (PCBs) as Aroclors or Congeners By Gas Chromatography/Electron Capture Detection (GC-ECD), Revision 2.0, 2/11/08	M35
SOP No. QA-1407. Acute Toxicity of Sediments To Midge Larvae, *Chironomus dilutus,* Revision 12, 01/09	M36

Title, Revision Date, and/or Number	Reference No.
SOP No. QA-1467. Assessment Toxicity (28-Day) of Sediments To The Amphipod, *Hyalella azteca* based on Survival and Growth – Project-Specific Document, Revision 0, 08/09 (Draft document – final to be provided as an addendum to the Benthic QAPP)	M37
SOP No. QA-1426. Acute Toxicity of Sediments to the Marine Amphipod, *Ampelisca abdita.* Revision 8, 4/09	M38
SOP No. QA-1435. Marine Sediment Bioaccumulation Evaluation with the Polychaete, *Nereis virens,* Revision 8, 1/09	M39
SOP No. QA-1445. Assessment of Bioaccumulative Potential of Sediments to the Freshwater Oligochaete, *Lumbriculus variegatus*. Revision No. 4, 4/09	M40
SOP No. QA-1373 Pore Water Salinity Adjustment from EnviroSystem. Revision 0, 4/09	M41
EcoAnalysts' Macroinvertebrate Laboratory QA Plan	M42
SOP No. O-008. Analysis of Parent and Alkylated Polynuclear Aromatic Hydrocarbons, Selected Heterocyclic Compounds, Steranes, Triterpanes, and Triaromatic Steroids by GC/MS – SIM, Revision 4, 10/08/08	M43
SOP No. O-004. Volatile Organic Compounds by Gas Chromotography/Mass Spectrometry, Revision 6.2, 6/27/08	M44
SOP No. 04-16. Chlorinated Herbicides by GC Using Methylation Derivatization, Revision 4.0, 7/2/09	M45
SOP OP-009. Alumina Column Cleanup of Organic Extracts, Revision 1.0 4/17/08	M46
SOP No. OP-003, Total Petroleum and Saturated Hydrocarbons by Gas Chromatography/Flame Ionization Detector, Revision 4.0, 10/28/08	M47
SOP No OP-013. Shaker Table Extraction, Revision 2.0, 10/22/08	M48
SOP No G-003, Balance Calibration and Maintenance, Revision 2.0, 1/31/08	M49

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Attachment N: SOP—Measuring Interstitial Salinity Using a Refractometer

I. Purpose

The purpose of this procedure is to provide guidelines for measuring interstitial salinity using a refractometer.

II. Definition

Refractometers are instruments used to measure the concentration of dissolved substances in liquid, such as the salt content in seawater, by applying the principle of light refraction. Light refraction is the "bending" effect that liquid has on light passing through it. As the concentration of dissolved substances increases, the "bending" effect also increases. Refractometers measure the amount of dissolved substances in liquids by measuring the refracted angle of light as it passes through the sample. A salinity refractometer contains carefully aligned prisms and mirrors and is calibrated to measure the salt content.

III. Equipment and Supplies

The Vee Gee® Refractometer, Model STX-3, is a hand-held salinity refractometer with a built-in automatic temperature compensation system (Vee Gee 2007). The refractometer automatically compensates for ambient temperature changes between 10 and 30 °C.

IV. Procedure

A. Calibration

1. Calibration of the refractometer must take place in a controlled environment of 20 °C (68 °F) using distilled water of the same temperature. It is recommended that the refractometer and the distilled water be allowed to reach temperature equilibrium with the controlled environment before calibration takes place.
2. Open the daylight plate. Make sure that the refractometer is held horizontally or the sample will run off. Use distilled water to rinse the cover and prism three times (to remove all salt crystals); wipe clean.
3. Drop one or two drops of distilled water on the prism. Close the daylight plate and press it lightly so the water spreads across the entire surface of the prism without any air bubbles or dry spots. Allow the sample to remain on the prism for about 30 seconds.
4. Point the refractometer towards the light source and look through the eyepiece; a circular field with graduations down the center should be seen. The upper portion should be blue and with a white lower portion. If the field is not in focus, gently turn the eyepiece either clockwise or counterclockwise until the graduations are clearly distinguishable.
5. When the refractometer scale is viewed through the eyepiece, the upper field of the view will appear blue, and the lower field will appear white. Confirm that the boundary line crosses the scale at "0."
6. If the boundary line falls above or below zero, gently loosen the set screw on the calibration ring with the supplied screwdriver. While looking through the eyepiece, gently turn the calibration ring clockwise or counterclockwise until

the boundary line is at zero. Once this is achieved, gently tighten the set screw with the screwdriver. Note: Do not over-tighten. If the set screw is over-tightened, the boundary line may shift slightly.

7. When calibration is completed, gently wipe the prism using tissue paper.

B. Sample Measurement

1. Place 1 to 2 drops of the sample on the main prism using a pipette. Make sure that the refractometer is held horizontally or the sample will run off. Close the daylight plate making sure the sample spreads across the entire plate without any air bubbles or dry spots. Allow the sample to remain for 30 seconds before taking the reading. Point the refractometer in the direction of the light source and look through the eyepiece; a circular field with graduations down the center should be visible. The upper portion should be blue, and the lower portion should be white. If the field is not in focus, gently turn the eyepiece either clockwise or counterclockwise until the graduations are clearly distinguishable. Be careful not to overturn the focusing mechanism.
2. The refractometer has two scales, a refractive index scale, which typically ranges from 1 to 1.07, and a salinity scale, which ranges from 0 to 100 parts per thousand (ppt or 0/00). Record the salinity in parts per thousand (ppt or 0/00) as indicated by the boundary between blue and white portions of the field in the refractometer. Repeat with a second observer if desired.
3. When each measurement is complete, the sample must be cleaned from the prism using distilled water and tissue paper.
4. If the same pipette is used to read salinity for different samples, the pipette must be rinsed with the new sample three times to remove the previous sample.

C. Precautions

1. Do not drop or handle roughly. It is very important that the refractometer not be dropped or jolted, which will cause misalignment.
2. Do not hold the refractometer under the faucet or splash with water, and do not immerse the refractometer in water.
3. Do not apply rough or abrasive materials to the prism.
4. If the surface of the prism becomes coated with an oily solution, it will repel test samples and affect the readings. If this occurs, the prism must be cleaned with a weakened detergent or similar solvent.

V. Quality Control

To ensure accuracy, the refractometer should be calibrated at least once a month.

VI. Reference

Vee Gee. 2007. Operation manual, Model STX-3 refractometer. Vee Gee Scientific, Inc., Kirkland, WA.

Attachment O: Benthic Sampling Flow Charts

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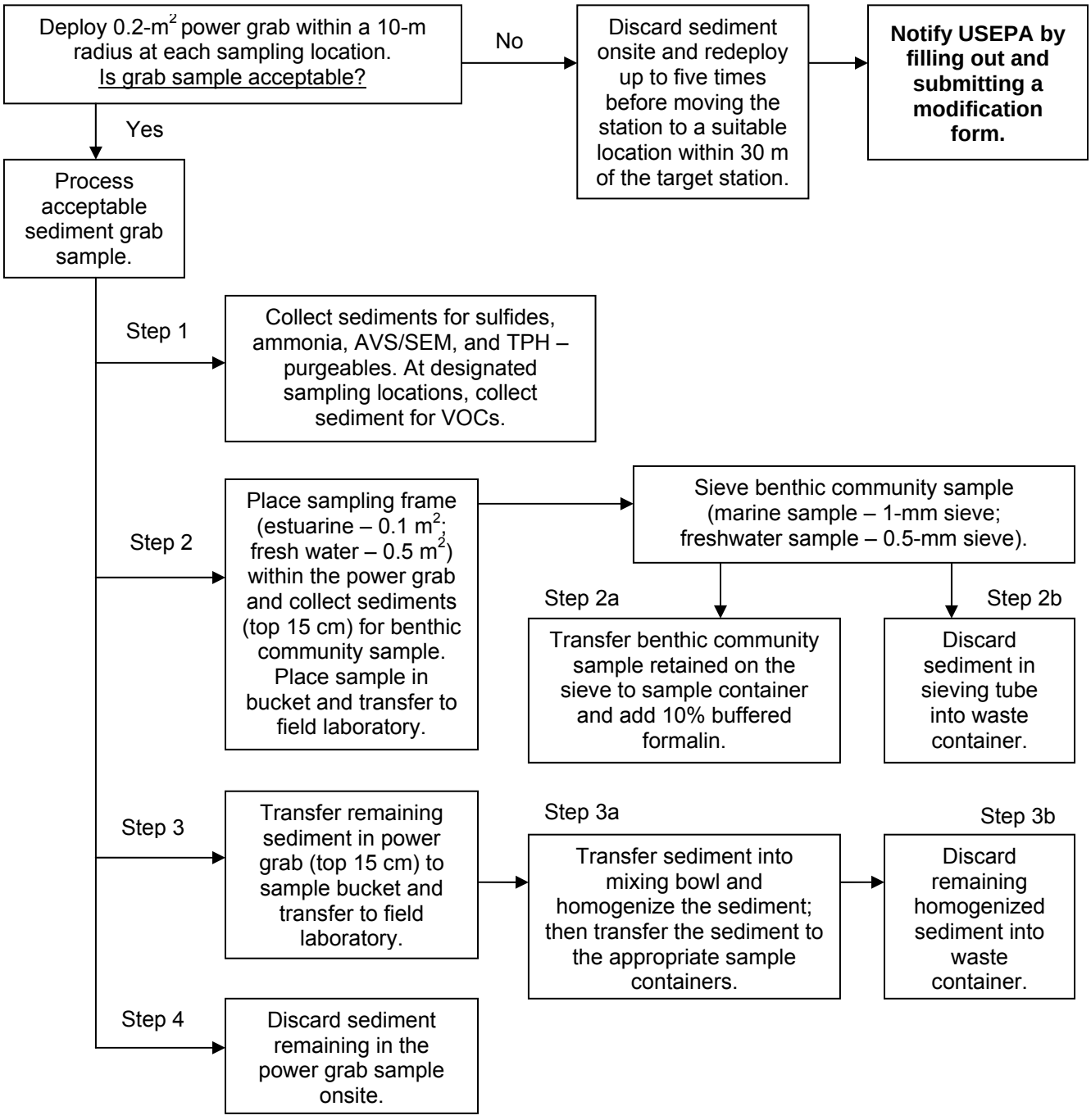
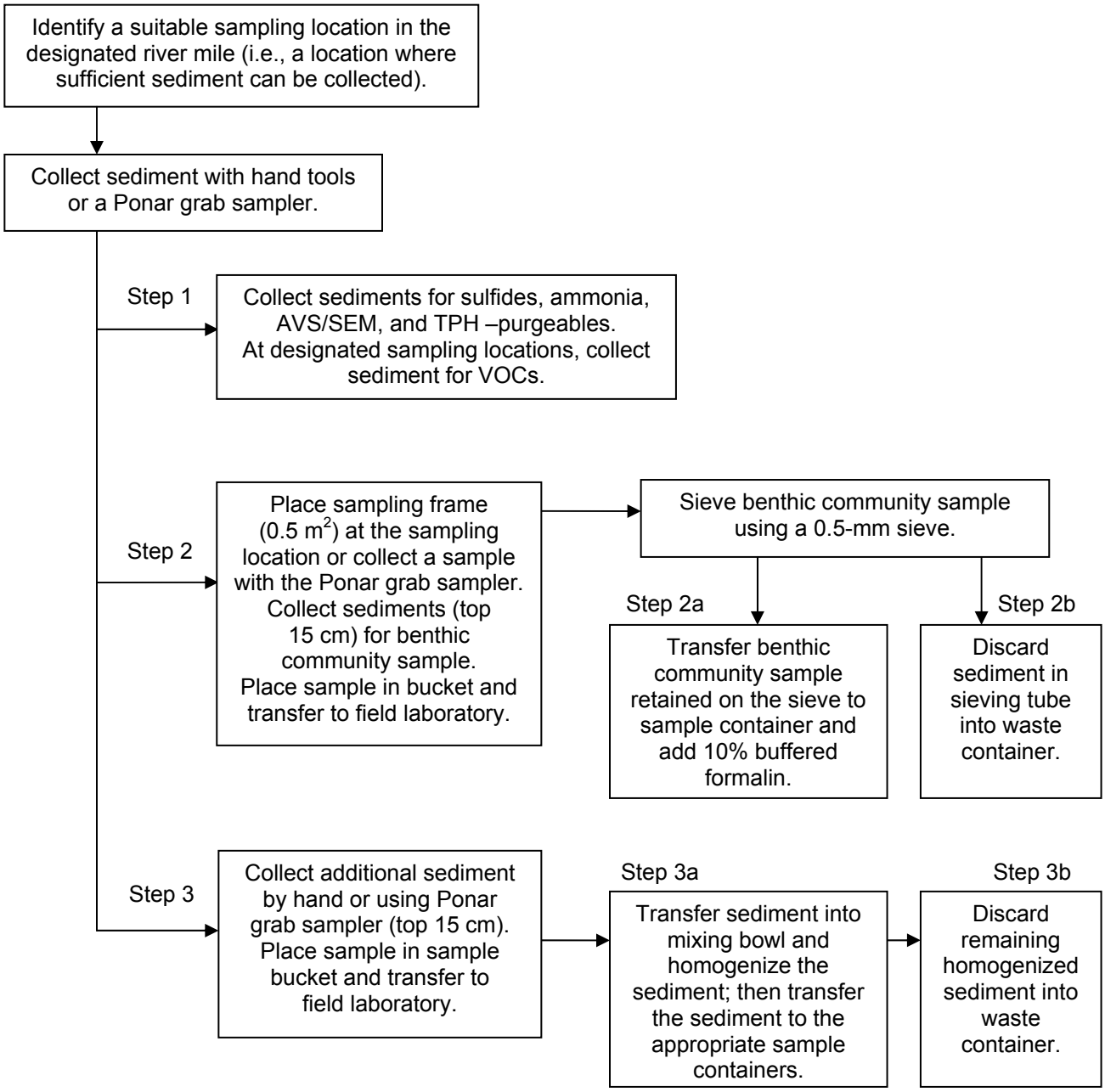
Field Sampling Flow Chart – Power Grab Sediment Sampling



Notes:
Flow chart presents the process for the collection of sediment (for chemistry, bioassay, and benthic community) at 97 SQT sampling locations between RM 0 and RM 16, including the 20 locations where sediment will also be collected for bioaccumulation testing. Step 2 is repeated at least four times to collect the four replicate community samples. For chemistry, bioassay, and bioaccumulation samples, additional grab samples will be processed until sufficient sediment is collected (at the SQT sampling locations, .8 L [2 gallons] are needed for bioassay, and 5.7 L [1.5 gallons] are needed for chemistry; at the bioaccumulation stations, 64.3 L [17 gallons] are needed for the freshwater bioaccumulation test, and 30 L [8 gallons] are needed for the marine bioaccumulation test, based on 115 g of tissue per station). For these grab samples, Steps 1 and 3 will be performed.
For the collection of sediment (for chemistry only) at up to 14 human health sampling locations, Step 2 is omitted, and grabs will be processed until sufficient sediment is collected (5.7 L [1.5 gallons] for chemistry).

Field Sampling Flow Chart – Hand or Ponar Sediment Sampling



Notes:
Flow chart presents the process for the collection of sediment (for chemistry, bioassay, and benthic community) at five SQT sampling locations above RM 16. Step 2 is repeated at least four times to collect the four replicate community samples. For chemistry and bioassay, additional grab samples will be processed until sufficient sediment is collected (3.8 L [1 gallon] are needed for bioassay, and 5.7 L [1.5 gallons] are needed for chemistry). For these grab samples, Steps 1 and 3 will be performed.

Attachment P: SOP—Measuring Water Quality Parameters Using a Handheld Multi-Probe Meter

IV. Purpose

The purpose of this procedure is to provide guidelines for measuring water quality parameters (i.e., temperature, dissolved oxygen [DO], salinity, conductivity, and pH) using a handheld multi-probe meter. These water quality measurements will be taken at all sediment sampling locations.

V. Definition

Water quality parameters are important for characterizing sampling conditions during environmental investigations. For example, parameters such as temperature, DO, salinity, conductivity, and pH can influence the bioavailability of contaminants to organisms, as well as which biological communities are present. Handheld monitoring devices can be used in the field to take *in situ* measurements of water quality parameters.

VI. Equipment and Supplies

The required equipment is a YSI 556 (multi-probe system [MPS]) or equivalent handheld model that measures temperature, DO, salinity, conductivity, pH, and oxidization-reduction potential (ORP) (YSI Environmental 2009). The YSI 556 probe module contains sensors enclosed in a heavy-duty probe sensor guard with attached sinking weight. The YSI 556 is available with 4-, 10-, and 20-m cable lengths.

VII. Procedure

A. Calibration

All of the sensors, except temperature, require periodic calibration to ensure high performance. The transport/calibration cup that comes with the probe module serves as a calibration chamber for all calibrations and minimizes the volume of calibration reagents required. Alternatively, laboratory glassware may be used to perform calibrations. The key to successful calibration is to ensure that the sensors are completely submersed when calibration values are entered. Recommended volumes should be used when performing calibrations. It is further recommended that a bucket with ambient-temperature water be used to rinse the probe module between calibration solutions.

The following are recommended prior to calibration:

- Ensure that port plugs are installed in all ports where sensors are not installed. It is extremely important that these electrical connectors be kept dry.
- Loosen the seal to allow pressure equilibration before calibration. The DO calibration is a water-saturated air calibration.
- Ensure that an o-ring is installed in the o-ring groove of the transport/calibration cup bottom cap and that the bottom cap is securely tightened. Do not over-tighten inasmuch as this could cause damage to the threaded portions.
- Remove the probe sensor guard, if it is installed.

- Remove the o-ring from the probe module, if installed, and inspect the o-ring for obvious defects and, if necessary, replace it with the supplied spare o-ring.
- When using the transport/calibration cup for dissolved oxygen % saturation calibration, ensure that the vessel is vented to the atmosphere by loosening the bottom cap or cup assembly and that approximately 1/8 inch of water is present in the cup.

Some calibrations can be accomplished with the probe module upright or upside down. A separate clamp and stand, such as a ring stand, is required to support the probe module in the inverted position. The approximate volumes of the reagents are specified below for both the upright and upside-down orientations.

Table 1. Calibration Volumes

Sensor to be Calibrated	Volume of Reagent by Orientation	
	Upright	Upside Down
Conductivity	55 mL	55 mL
pH/ORP	30 mL	60 mL

Source: YSI Environmental (2009)
ORP – oxidation-reduction potential

Calibration will be performed for conductivity/salinity, DO, and pH. The YSI 556 is also equipped to measure oxidization-reduction potential (ORP); however, this water parameter is not needed for this sampling effort and thus no calibration or recording of ORP will be performed.

B. Conductivity and Salinity Calibration

To calibrate conductivity and salinity:

1. Turn on the meter and select “calibrate” from the main menu. Select “conductivity” from the calibrate screen. Select “specific conductance” from the conductivity calibration screen. Note that by calibrating specific conductance, conductivity and salinity will automatically be updated.
2. Place the correct amount of conductivity calibration reagent (see Table 1) into a clean, dry, and pre-rinsed transport/calibration cup. For maximum accuracy, the conductivity calibration reagent should be within the same conductivity range as the samples that will be measured. For fresh water, use a 1-mS/cm conductivity standard. For brackish water, use a 10-mS/cm conductivity standard. For seawater, use a 50-mS/cm conductivity standard.

   WARNING: Calibration reagents may be hazardous to your health.
3. Before proceeding, ensure that the sensor is as dry as possible. Ideally, rinse the conductivity sensor with a small amount of the

calibration reagent that can be discarded. Be careful to avoid the cross-contamination of calibration reagents. Make certain that there are no salt deposits around the oxygen and pH/ORP sensors, particularly if low-conductivity calibration reagents are being employed.

4. Carefully immerse the sensor end of the probe module into the calibration reagent.
5. Gently rotate and/or move the probe module up and down to remove any bubbles from the conductivity cell. The sensor must be completely immersed past its vent hole. Using the recommended volumes from Table 1, ensure that the vent hole is covered.
6. Screw the transport/calibration cup on the threaded end of the probe module and securely tighten. Do not overtighten inasmuch as this could cause damage to the threaded portions.
7. Use the keypad to enter the calibration value of the calibration reagent being used. Be sure to enter the value in mS/cm at 25°C.
8. Press “Enter.” The conductivity calibration screen will be displayed. Allow at least 1 minute for temperature equilibration before proceeding. The current values of all enabled sensors will appear on the screen and will change with time as they stabilize.
9. Observe the reading under specific conductance. When the reading shows no significant change for approximately 30 seconds, press “Enter.” The screen will indicate that the calibration has been accepted and display a prompt to press Enter again to continue.
10. Press “Enter.” This will bring up the conductivity calibrate selection screen. Press “Escape” to return to the calibration menu.
11. Rinse the probe module and sensors in tap or purified water and dry.

C. Dissolved Oxygen Calibration

To calibrate dissolved oxygen:

1 Turn on the meter and select “calibrate” from the main menu. Select “dissolved oxygen” from the calibrate screen. Select “DO %” from the DO calibration screen. Note that calibrating any one DO option (% or mg/L) automatically calibrates the other.

2. Place approximately 3 mm (1/8 inch) of water in the bottom of the transport/calibration cup.
3. Place the probe module into the transport/calibration cup, making sure that the DO and temperature sensors are not immersed in the water.
4. Engage only one or two threads of the transport/calibration cup to ensure that the DO sensor is vented to the atmosphere.
5. Use the keypad to enter the current local barometric pressure. If the unit has the optional barometer, no entry is required. Barometer readings that appear in meteorological reports are generally corrected to sea level and must be uncorrected before use (refer to the YSI operations manual for additional information, as necessary).

6. Press “Enter.” The DO% saturation calibration screen will be displayed. Allow approximately 10 minutes for the air in the transport/calibration cup to become water saturated and for the temperature to equilibrate before proceeding. The current values of all enabled sensors will appear on the screen and will change with time as they stabilize.
7. Observe the reading under DO %. When the reading shows no significant change for approximately 30 seconds, press “Enter.” The screen will indicate that the calibration has been accepted and display a prompt to press Enter again to continue.
8. Press “Enter.” This will bring up the DO calibration screen. Press “Escape” to return to the calibrate menu.
9. Rinse the probe module and sensors in tap or purified water and dry.

D. pH Calibration

To calibrate pH:

1. Turn on the meter and select “Calibrate” from the main menu. Select “pH” from the calibrate screen. The following options will be available:
    - **1-point:** Select the 1-point option only if adjusting a previous calibration. If a 2-point or 3-point calibration has been performed previously, the calibration can be adjusted by carrying out a 1-point calibration. The procedure for this calibration is the same as for a 2-point calibration, but the software will display a prompt to select only one pH buffer.
    - **2-point:** Select the 2-point option to calibrate the pH sensor for two calibration reagents. Use this option if the media being monitored is known to be either basic or acidic. For example, if the pH of a pond is known to vary between 5.5 and 7, a 2-point calibration with pH 7 and pH 4 buffers is sufficient. A 3-point calibration with an additional pH 10 buffer will not increase the accuracy of this measurement because the pH is not within this higher range.
    - **3-point:** Select the 3-point option to calibrate the pH sensor using three calibration reagents. In this procedure, the pH sensor is calibrated with a pH 7 buffer and two additional buffers. The 3-point calibration method ensures maximum accuracy when the pH of the media to be monitored cannot be anticipated. The procedure for this calibration is the same as for a 2-point calibration, but the software will display a prompt to select a third pH buffer.
2. The 2-point option is recommended. Select the 2-point option.
3. Place the correct amount (see Table 1) of pH calibration reagent into a clean, dry, and pre-rinsed transport/calibration cup. For maximum accuracy, the selected pH buffers should be within the same pH range as that of the water being sampled.

WARNING: Calibration reagents may be hazardous to your health.

4. Before proceeding, ensure that the sensor is as dry as possible. Ideally, rinse the pH sensor with a small amount of calibration agent that can be discarded. Be certain that you avoid the cross-contamination of buffers with other solutions.
5. Carefully immerse the sensor end of the probe module into the solution.
6. Gently rotate and/or move the probe module up and down to remove any bubbles from the pH sensor. The sensor must be completely immersed. Using the recommended volumes from Table 1, ensure that the sensor is covered.
7. Screw the transport/calibration cup on the threaded end of the probe module and securely tighten. Do not overtighten inasmuch as this could cause damage to the threaded portions.
8. Use the keypad to enter the calibration value of the buffer being used at the current temperature. pH vs. temperature values are printed on the labels of all YSI pH buffers.
9. Press “Enter.” The pH calibration screen will be displayed. Allow at least 1 minute for temperature equilibration before proceeding. The current values of all enabled sensors will appear on the screen and will change with time as they stabilize.
10. Observe the reading under pH. When the reading shows no significant change for approximately 30 seconds, press “Enter.” The screen will indicate that the calibration has been accepted and display a prompt to press Enter again to continue.
11. Press “Enter.” This will bring up the specified pH calibration screen.
12. Rinse the probe module, transport/calibration cup, and sensors in tap or purified water and dry.
13. Repeat Steps 3 through 10 above using a second pH buffer.
14. Press “Enter.” This will bring up the pH calibration screen. Press “Escape” to return to the calibrate menu.
15. Rinse the probe module and sensors in tap or purified water and dry.

E. Sample Measurement

Procedures for sample measurement are as follows:

5. Turn on the meter. Make sure that the probe sensor guard is installed.
6. Lower the probe module at the sampling location using a lead-line based on the known depth of the sampling location. The probe should be located approximately 1 to 3 ft from bottom depth where sediment sample will be collected.
7. Rapidly move the probe module through the sample to provide fresh reagent to the DO sensor.
8. Watch the readings on the display until they are stable.

9. Record the probe readings for temperature, DO, salinity, conductivity, and pH.

F. Precautions

5. Exercise caution when using calibration reagents. Reagents that are used to calibrate this instrument may be hazardous to your health.
6. Wear gloves when using calibration reagents.
7. Avoid inhalation, skin contact, eye contact, and ingestion of calibration reagents.
8. Do not attempt to disassemble or tamper with any electrical component or batteries within the rechargeable battery pack. Never dispose of the battery pack in fire.
9. Do not charge the battery pack outside the 0 to 40°C temperature range.
10. Do not use or store the battery at high temperature, such as in strong direct sunlight, in cars during hot weather, or directly in front of heaters.
11. Do not expose the battery pack to water or allow the terminals to become damp.
12. Avoid striking or dropping the battery pack. If the pack appears to have sustained damage or malfunctions after an impact or drop, do not attempt to repair the unit. Instead, contact YSI Customer Service. Refer to the YSI operations manual for additional customer service information.
13. If the battery pack is removed from the YSI 556 MPS, do not store it in pockets or packaging where metallic objects such as keys can short between the positive and negative terminals.

VIII. Quality Control

All of the sensors, except temperature, require periodic calibration to ensure high performance. To ensure accuracy, the YSI 556 should be calibrated at the beginning of every day.

IX. Reference

YSI Environmental. 2009. YSI 556 Multi-Probe System Operations Manual. https://www.ysi.com/DocumentServer/DocumentServer?docID=WQS_556_MANUAL. Accessed September 14, 2009.

Attachment Q: Certified Reference Materials

Analytical Group	Matrix	Certified Reference Material	Manufacturer
PAH, organochlorine pesticides, PCB congeners, and PCDDs/PCDFs	sediment	NIST-1944	NIST
PAH and organochlorine pesticides	tissue	NIST-1974b	NIST
PCB congeners and PCDDs/PCDFs	tissue	CARP-2	NRC
Total mercury	sediment	MESS-3	NRC
Methylmercury	sediment	CC-580	IRMM
Total mercury, methylmercury	tissue	DORM-3	NRC
SVOC	sediment	NIST-1944	NIST
Lipids	tissue	NIST-1946	NIST
Metals	sediment	ERA D045540	ERA
Metals	tissue	DORM-3, TORT-2	NRC

ERA – Environmental Research Associates
IRMM – Institute for Reference Materials and Measurements
NIST – National Institute of Standards and Technology
NRC – National Regional Council of Canada
PAH – polycyclic aromatic hydrocarbon
PCB – polychlorinated biphenyl
PCDD – polychlorinated dibenzo-*p*-dioxin
PCDF – polychlorinated dibenzofuran
SVOC – semivolatile organic compound

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Oversize Figures