NEW ENGLAND

REGIONAL IMPLEMENTATION MANUAL

Framework for the Evaluation of Dredged Material Proposed for Disposal in New England Waters

APPENDICES

Prepared by:

U.S. EPA
Region 1

US Army Corps of Engineers.

U.S. ARMY CORPS OF ENGINEERS, NEW ENGLAND DISTRICT

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List of Appendices

Appendix A - Dredged Material Evaluation Sampling and Analysis (SAP) Request Checklist

Dredged Material Evaluation
Sampling and Analysis Plan (SAP) Request Checklist

General site description (location, type of site, zoning):
Types of work performed on site:
Proposed dredge footprint area (sq ft):
Proposed dredge volume (cy) (should include side slopes and if more than one dredge area, include volumes for each dredge area):
Proposed overdepth volume (cy):
Proposed dredge depth (ft MLLW):
Proposed overdepth (ft):
Maintenance, Improvement, or both? (If both, include volumes/areas for maintenance vs improvement dredging)
Proposed dredge method (hydraulic or mechanical):
Proposed disposal site:
Proposed timeframe for dredging to occur:
History of hazardous waste generation:

Spill history since last dredging or previous 5 years if not dredged recently (cite sources and attach if lengthy):
Remediation history (cite sources):
List of previous dredging including year dredged, volume dredged, and where material was placed:

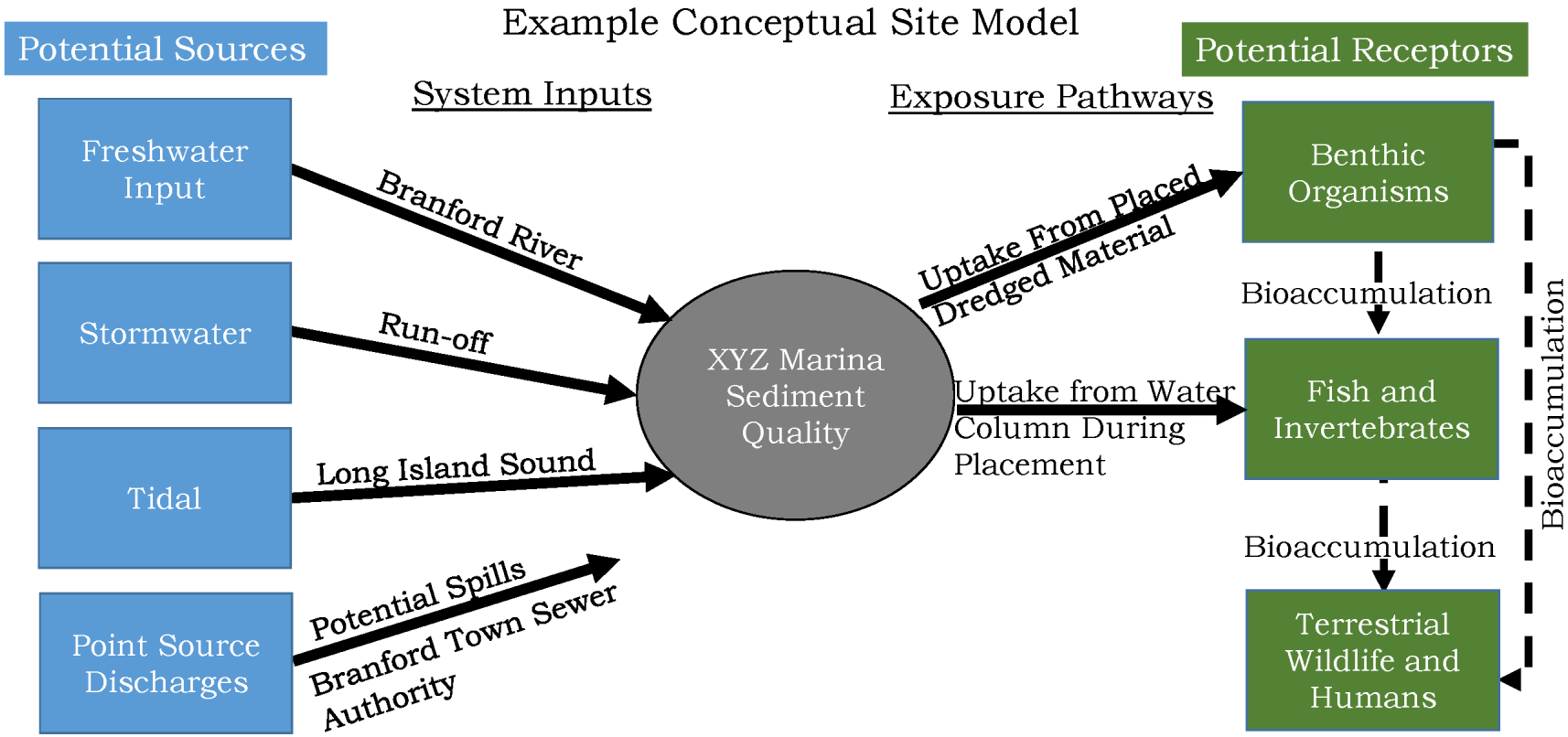
Attach the following:

- If data exists, most recent grain size, chemistry, and biological data (crosstab excel tables preferred)
- PDF overview figure showing project site in relation to the surrounding harbor/waterway
- PDF dredge plan including the proposed dredge footprint, channel boundaries, existing site bathymetry (relative to mean lower low water), property boundaries, site structures (e.g. fuel dock, travel lift), relevant shoreline features, and any outfalls or underwater utilities
- PDF locations of previously collected samples (if applicable)

Provide geospatial data for:

- Project Dredge Boundary – polygon labeled in attributes as “Proposed Dredged Boundary” with fields for dredge depth and overdepth included
- Side Slopes – polyline labeled in attributes as “side slope” with field for degree of slope included
- Outfalls, catch basins, storm drains – points labeled in attributes accordingly
- Underwater utilities, cables, sewage pipelines – polygon or polylines labeled in attributes accordingly
- Fuel dock – polygon or polyline labeled in attributes as “fuel dock”
- Travel lift – polygon or polyline labeled in attributes as “travel lift”
- Docks, floating docks, piers – polygon or polylines labeled in attributes accordingly
- Bathymetry – submitted as xyz data, CAD or GIS shapefiles as polyline contour lines with elevations labeled in attributes

Appendix B - Example Conceptual Site Model and Risk Ranking Table


Example Conceptual Site Model
Potential Sources
System Inputs
Exposure Pathways
Potential Receptors
Freshwater Input
Stormwater
Tidal
Point Source Discharges
Branford River
Run-off
Long Island Sound
Potential Spills
Branford Town Sewer Authority
XYZ Marina Sediment Quality
Uptake From Placed Dredged Material
Uptake from Water Column During Placement
Benthic Organisms
Bioaccumulation
Fish and Invertebrates
Bioaccumulation
Terrestrial Wildlife and Humans
Bioaccumulation

Project Risk Ranking Table

Rank	Guidelines
Low	Few or no sources of contamination. Data available to verify no significant potential for adverse biological effects.
Low-Moderate	Few or no sources of contamination but existing data is insufficient to confirm ranking.
Moderate	Contamination sources exist within the vicinity of the project with the potential to produce chemical concentrations that may cause adverse biological effects.
High	Known sources of contamination within the project area and project area or project(s) in the vicinity were previously unsuitable for unconfined open water placement.

Appendix C - Additional Contaminants of Concern and Reporting Limits

Parameter	Units	Analytical Method	Sediment Reporting Limit (dry wt)	Tissue Reporting Limit (wet wt)
Miscellaneous				
Cyanide	mg/kg	9010C, 9012B	2	1
AVS/SEM	umol/g	EPA-821-R-91-100	0.7	-
Organotins	ug/kg	Organotins/GCMS, Rice et al., 1987	10	10
Metals				
Antimony	mg/kg	EPA 6010D, 6020B	2.5	2.5
Beryllium	mg/kg	EPA 6010D, 6020B	2.5	2.5
Selenium	mg/kg	EPA 6010D, 6020B	1	1
Silver	mg/kg	EPA 6010D, 6020B	0.2	0.2
Thallium	mg/kg	EPA 6010D, 6020B	0.2	0.2
Aromatic Hydrocarbons and PAHs				
Biphenyl	ug/kg	8270E	10	20
Benzo(e)pyrene	ug/kg	8270E	10	20
2-6-Dimethylnaphthalene	ug/kg	8270E	10	20
1-methylphenanthrene	ug/kg	8270E	10	20
1-Methylnaphthalene	ug/kg	8270E	10	20
2-Methylnaphthalene	ug/kg	8270E	10	20
Perylene	ug/kg	8270E	10	20
Phthalates				
Dimethyl phthalate	ug/kg	8270E	50	100
Diethyl phthalate	ug/kg	8270E	50	100
Di-n-butyl phthalate	ug/kg	8270E	50	100
Butyl benzyl phthalate	ug/kg	8270E	50	100
Bis(2-ethylhexyl) phthalate	ug/kg	8270E	50	100
Dioctyl phthalate	ug/kg	8270E	50	100
Dioxins and Furans				
2,3,7,8-TCDD	pg/g	8290A, 1613B	1	0.5
1,2,3,7,8-PeCDD	pg/g	8290A, 1613B	5	0.5
1,2,3,4,7,8-HxCDD	pg/g	8290A, 1613B	5	5
1,2,3,6,7,8-HxCCD	pg/g	8290A, 1613B	5	5
1,2,3,7,8,9-HxCDD	pg/g	8290A, 1613B	5	5
1,2,3,4,6,7,8-HpCDD	pg/g	8290A, 1613B	5	5
OCDD	pg/g	8290A, 1613B	10	10
2,3,7,8-TCDF	pg/g	8290A, 1613B	1	0.5
1,2,3,7,8-PeCDF	pg/g	8290A, 1613B	5	0.5
2,3,4,7,8-PeCDF	pg/g	8290A, 1613B	5	5
1,2,3,4,7,8-HxCDF	pg/g	8290A, 1613B	5	5
1,2,3,6,7,8-HxCDF	pg/g	8290A, 1613B	5	5
2,3,4,6,7,8-HxCDF	pg/g	8290A, 1613B	5	5
1,2,3,7,8,9-HxCDF	pg/g	8290A, 1613B	5	5
1,2,3,4,6,7,8-HpCDF	pg/g	8290A, 1613B	5	5
1,2,3,4,7,8,9-HpCDF	pg/g	8290A, 1613B	5	5
OCDF	pg/g	8290A, 1613B	10	10
PCBs				
PCB-49	ug/kg	8082A, 8270E	1	0.5
PCB-77	ug/kg	8082A, 8270E	1	0.5
PCB-81	ug/kg	8082A, 8270E	1	0.5
PCB-87	ug/kg	8082A, 8270E	1	0.5
PCB-105	ug/kg	8082A, 8270E	1	0.5
PCB-114	ug/kg	8082A, 8270E	1	0.5
PCB-118	ug/kg	8082A, 8270E	1	0.5
PCB-123	ug/kg	8082A, 8270E	1	0.5
PCB-126	ug/kg	8082A, 8270E	1	0.5
PCB-156	ug/kg	8082A, 8270E	1	0.5
PCB-157	ug/kg	8082A, 8270E	1	0.5
PCB-167	ug/kg	8082A, 8270E	1	0.5
PCB-169	ug/kg	8082A, 8270E	1	0.5
PCB-183	ug/kg	8082A, 8270E	1	0.5
PCB-184	ug/kg	8082A, 8270E	1	0.5
PCB-189	ug/kg	8082A, 8270E	1	0.5
Volatile Organic Compounds (VOCs)	**ug/kg**	**8260D**	**project dependent**	**-**

Additional Physical Analytes

Parameter	Units	Analytical Method
Physical Analyses		
Grain Size (Hydrometer)	%	ASTM D7928
Specific Gravity	NA	ASTM D854
Bulk Density	pcf	ASTM D7263
Atterberg Limits	%	ASTM D4318
Ignitibility (Flashpoint)	pass/fail	EPA 1030
Corrosivity (pH)	pH units	EPA 9040B
Paint Filter Test	pass/fail	EPA 9095B

Appendix D - Data Validation

Sediment Chemistry Data Submittal Checklist

When submitting sediment chemistry data for evaluation (i.e. suitability determination or for a biological testing compositing plan), please include all items listed below.

- ☐ Core logs including:
  - ☐ Date and time
  - ☐ Longitude/latitude in NAD 83 decimal degrees to 6 decimal places
  - ☐ GPS accuracy
  - ☐ Measured water depth and tidal correction
  - ☐ Core penetration and recovery
  - ☐ Chemistry/grain size sample intervals
  - ☐ Sediment descriptions with intervals with 0 at the top of core/sediment water interface
  - ☐ Photos with 0 on stadia rod at sediment water interface
- ☐ Field Data Review Worksheet (Sediment Chemistry)
- ☐ Lab Report with QC data and Chemistry Data Validation Worksheets (RIM Appendix E)
- ☐ EDD, including field table, in the format specified on the NAE website: (http://www.nae.usace.army.mil/Missions/Disposal-Area- Monitoring-System DAMOS/Electronic-Data-Deliverables.aspx.)
- ☐ OPTIONAL: Data validation report and EDD with all data validation qualifiers applied (if the applicant chooses to perform the data validation by utilizing a professional data validation firm or competent individual with relevant data validation experience)

Biological Testing Data Submittal Checklist

When submitting biological assays, elutriate, and tissue chemistry data for a suitability determination please include all items listed below.

- ☐ Sampling logs including:
  - ☐ Date and time
  - ☐ Longitude/latitude in NAD 83 decimal degrees to 6 decimal places
  - ☐ GPS accuracy
  - ☐ Measured water depth and tidal correction
  - ☐ Core penetration and recovery
  - ☐ Number of cores collected at each station
  - ☐ Sediment descriptions
  - ☐ NOTE: If any cores were significantly different from phase 1 sampling a representative core should be photographed and described and provided in sampling log
- ☐ Field Data Review Worksheet (Elutriate/Biological Testing)
- ☐ Biological testing laboratory report for all assays conducted (whole sediment toxicity, water column toxicity, bioaccumulation) with the Biological Testing Data Review Worksheet filled out (RIM Appendix E)
  - ☐ Please note for bioaccumulation assays the applicant must submit the results of the statistical analysis comparing the site tissue chemistry results to reference tissue chemistry, either as part of the bioaccumulation laboratory report or under separate cover
- ☐ Elutriate and tissue chemistry laboratory report with QC data and Chemistry Data Validation Worksheets (RIM Appendix E)
- ☐ For elutriate data: EDD, including field table, in the format specified on the NAE website: (http://www.nae.usace.army.mil/Missions/Disposal-Area- Monitoring-System DAMOS/Electronic-Data-Deliverables.aspx.)
- ☐ Bioaccumulation EDD in the format specified on the NAE website: (http://www.nae.usace.army.mil/Missions/Disposal-Area- Monitoring-System DAMOS/Electronic-Data-Deliverables.aspx.)
- ☐ OPTIONAL for elutriate chemistry only: data validation report and EDD with all data validation qualifiers applied (if the applicant chooses to perform the data validation by utilizing a professional data validation firm or competent individual with relevant data validation experience)

Field Data Review Worksheet (Sediment Chemistry)

Project Name and File Number:

City and State:

Date:

Field Data: The field sampling data table provided in the EDD must be filled out (http://www.nae.usace.army.mil/Missions/Disposal-Area- Monitoring-System DAMOS/Electronic-Data-Deliverables.aspx.)

Completeness Criteria	Y/N + Any Comments (for Applicant)	Review Comments (for DMMT)
Do core logs include date, time, latitude, longitude, GPS accuracy, measured water depth, tidal correction, core penetration and recovery, sample depth intervals, and photos?		
Were sample coordinates within 10 ft of proposed coordinates?		
Are core recoveries within 75% of target penetrations or best core kept after 6 attempts if poor recoveries?		
Based on corrected MLLW elevations, do actual core lengths include full dredge plus overdepth?		
Was the sampling equipment appropriate for the project sediments?		
Were cores collected using inert materials?		
Was subsampling necessary and then completed based on sediment layering or other characteristics?		

Chemistry (Sediment/Elutriate/Tissue) Data Validation Worksheet

Project Name and File Number:

City and State:

Date:

Chemistry Data

Completeness Check	Y/N + Any Comments (for Lab/Applicant)	Data Validation Review Action/Comments (for Data Validator)
Title sheet identifying laboratory name, location, contact information		
Authorization statement and dated signature		
Analytical case narrative (i.e., data quality report)		
Sample identification table		
Method summary		
Sample results including date and time of analysis, (metric units, dry weight basis for sediment)		
QC results and acceptance criteria		
Signed Chain of Custody (COC) forms		
All non-detects met RIM reporting limits (RLs)		

PAHs (or pentachlorophenol for elutriates) Method:

Quality Control (QC) Element	Acceptance Criteria*	Criteria Met? (Y/N) List Any Results Outside Criteria (for Lab/Applicant)	Data Validation Review Action/Comments (for Data Validator)
Sample Holding Time	*Aqueous:* ≤ 7 days (for extraction) and ≤ 40 days (for analysis) <6°C *Non-Aqueous:* ≤ 14 days (for extraction) and ≤ 40 days (for analysis) <6°C or frozen		
Standard Reference Materials	Within the limits provided by vendor (Provide vendor limits in laboratory report)		
Method Blank	No target analytes > MDL		
Equipment Blank (if applicable)	No target analytes > MDL		
Field Duplicates (if applicable)	*Aqueous:* RPD<30% if sample or dup result <5xRL, then absolute value of the difference <2xRL *Non-aqueous:* RPD <50% if sample or dup result <5xRL, then absolute value of the difference <4xRL		
LCS/LCSD	%Recovery 30-120 *Aqueous:* RPD 30% *Non-aqueous*: RPD <50%		
MS/MSD	% Recovery Limits: 30-120% RPD <50%		
Analytical Replicates	*Aqueous:* RPD<30% if sample or dup result <5xRL, then absolute value of the difference <2xRL *Non-aqueous:* RPD <50% if sample or dup result <5xRL, then absolute value of the difference <4xRL		
Surrogate Recoveries	% Recovery Limits: 30 - 150%		

* The Quality Control Acceptance Criteria are general guidelines. If alternate criteria are used, they must be documented in this table.

Pesticides Method:

Quality Control (QC) Element	Acceptance Criteria*	Criteria Met? (Y/N) List Any Results Outside Criteria (for Lab/Applicant)	Data Validation Review Action/Comments (for Data Validator)
Sample Holding Time	*Aqueous:* ≤ 7 days (for extraction) and ≤ 40 days (for analysis) <6°C *Non-Aqueous:* ≤ 14 days (for extraction) and ≤ 40 days (for analysis) <6°C or frozen		
Standard Reference Materials	Within the limits provided by vendor (Provide vendor limits in laboratory report)		
Method Blank	No target analytes > MDL		
Equipment Blank (if applicable)	No target analytes > MDL		
Field Duplicates	*Aqueous:* RPD<30% if sample or dup result <5xRL, then absolute value of the difference <2xRL *Non-aqueous:* RPD <50% if sample or dup result <5xRL, then absolute value of the difference <4xRL		
LCS/LCSD	%Recovery 30-120 *Aqueous:* RPD 30% *Non-aqueous*: RPD <50%		
MS/MSD	% Recovery Limits: 30-120% RPD <50%		
Analytical Replicates	*Aqueous:* RPD<30% if sample or dup result <5xRL, then absolute value of the difference <2xRL *Non-aqueous:* RPD <50% if sample or dup result <5xRL, then absolute value of the difference <4xRL		
Surrogate Recoveries	% Recovery Limits: 30 - 150%		

* The Quality Control Acceptance Criteria are general guidelines. If alternate criteria are used, they must be documented in this table.

PCBs Method:

Quality Control (QC) Element	Acceptance Criteria*	Criteria Met? (Y/N) List Any Results Outside Criteria (for Lab/Applicant)	Data Validation Review Action/Comments (for Data Validator)
Sample Holding Time	Aqueous and Non-Aqueous: ≤ 1 year (for extraction) and ≤ 40 days (for analysis) <6°C or frozen (solids)		
Standard Reference Materials	Within the limits provided by vendor (Provide vendor limits in laboratory report)		
Method Blank	No target analytes > MDL		
Equipment Blank (if applicable)	No target analytes > MDL		
Field Duplicates (If applicable)	*Aqueous:* RPD<30% if sample or dup result <5xRL, then absolute value of the difference <2xRL *Non-aqueous:* RPD <50% if sample or dup result <5xRL, then absolute value of the difference <4xRL		
LCS/LCSD	%Recovery 50-150 *Aqueous:* RPD 30% *Non-aqueous*: RPD <50%		
MS/MSD	% Recovery Limits: 50-150% RPD <50%		
Analytical Replicates	*Aqueous:* RPD<30% if sample or dup result <5xRL, then absolute value of the difference <2xRL *Non-aqueous:* RPD <50 if sample or dup result <5xRL, then absolute value of the difference <4xRL		
Surrogate Recoveries	% Recovery Limits: 30 - 150%		

* The Quality Control Acceptance Criteria are general guidelines. If alternate criteria are used, they must be documented in this table.

Metals Method:

Quality Control (QC) Element	Acceptance Criteria*	Criteria Met? (Y/N) List Any Results Outside Criteria (for Lab/Applicant)	Data Validation Review Action/Comments (for Data Validator)
Sample Holding Time and preservation	Metals- *Aqueous*: < 180 days and received with pH<2; <6°C *Non-aqueous*: <180 days, <6°C or frozen Mercury- *Aqueous*: < 28 days and received with pH<2; <6°C *Non-aqueous*: <28 days <6°C or frozen		
Standard Reference Materials	Within the limits provided by vendor (Provide vendor limits in laboratory report)		
Method Blank	No target analytes > MDL		
Equipment Blank (if applicable)	No target analytes > MDL		
Field Duplicates (if applicable)	*Aqueous:* RPD<30% if sample or dup result <5xRL, then absolute value of the difference <2XRL *Non-aqueous:* RPD <50 if sample or dup result <5xRL, then absolute value of the difference <4xRL		
LCS/LCSD	%Recovery 70-130 *Aqueous:* RPD <20% *Non-aqueous*: RPD <35%		
MS/MSD	% Recovery Limits: 75-125% *Aqueous:* RPD <20% *Non-aqueous*: RPD <35% Was a post-digestion spike done? If so, what was the % recovery?		
Analytical Replicates	*Aqueous:* RPD<20% if sample or dup result <5xRL, then absolute value of the difference <RL *Non-aqueous:* RPD <35% if sample or dup result <5xRL, then absolute value of the difference <2xRL		

* The Quality Control Acceptance Criteria are general guidelines. If alternate criteria are used, they must be documented in this table.

Total Organic Carbon (TOC) and Grain Size Method:

Quality Control (QC) Element	Acceptance Criteria*	Criteria Met? (Y/N) List Any Results Outside Criteria (for Lab/Applicant)	Data Validation Review Action/Comments (for Data Validator)
Grain Size: Analytical Replicates	RPD < 50%		
Total Organic Carbon: Standard Reference Materials	Within the limits provided by vendor (provide vendor limits in laboratory report)		
Total Organic Carbon: Analytical Replicates	RPD <50%		

* The Quality Control Acceptance Criteria are general guidelines. If alternate criteria are used, they must be documented in this table.

Qualifiers:

- U - The analyte was analyzed for but was not detected above the reported sample quantitation limit.
- J - The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
- N - The analysis indicates the presence of an analyte for which there is presumptive evidence to make a "tentative identification".
- JN - The analysis indicates the presence of an analyte that has been "tentatively identified" and the associated numerical value represents its approximate concentration.
- UJ - The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
- R - The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

To calculate RPD:

$$RPD = \frac{|S-D|}{(S+D)/2} \times 100$$

where S = sample result (original/parent) and D = duplicate result

Field Data Review Worksheet (Elutriate/Biological Testing Data)

Project Name and File Number:

City and State:

Date:

Field Data: The field sampling data table provided in the EDD must be filled out (http://www.nae.usace.army.mil/Missions/Disposal-Area- Monitoring-System DAMOS/Electronic-Data-Deliverables.aspx.)

Completeness Criteria	Y/N + Any Comments (for Applicant)	Review Comments (for DMMT)
Does sample log include date, time, latitude, longitude, GPS accuracy, measured water depth, tidal correction, core penetration and recovery, number of cores collected at each station, and sediment descriptions?		
Were sample coordinates within 10 ft of proposed coordinates?		
Are core recoveries within 75% of target penetrations or best core kept after 6 attempts if poor recoveries?		
Based on corrected MLLW elevations, do actual core lengths include full dredge plus overdepth?		
Was the sampling equipment appropriate for the project sediments?		
Were cores collected using inert materials?		
Were the samples composted correctly based on the compositing plan provided by DMMT?		

Biological Testing Data Review Worksheet

Project Name and File Number:

City and State:

Date:

1. 10-day Whole Sediment Acute Toxicity Test:

Quality Control (QC) Element	Acceptance Criteria	Criteria Met? (Y/N) List Any Results Outside Criteria (for Lab/Applicant)	Data Review Comments (for DMMT)
Test condition requirements for each species: temperature, salinity, pH, D.O., test species age etc.	Test conditions within the requirements specified for each species (see RIM Appendix G)		
Ammonia Mitigation	Provide ammonia concentrations; was an ammonia mitigated assay conducted?		
Control mortality	Below 10% mean of replicates See section 5.5.1 in the RIM		

2. Water Column Toxicity Test:

Quality Control (QC) Element	Acceptance Criteria	Criteria Met? (Y/N) List Any Results Outside Criteria (for Lab/Applicant)	Data Review Comments (for DMMT)
Test condition requirements for each species: temperature, salinity, pH, D.O., test species age etc.	Test conditions within the requirements specified for each species (see RIM Appendix G)		
Ammonia Mitigation	Provide ammonia concentrations; was an ammonia mitigated assay conducted?		
Control mortality Control abnormality	Below 10% mean of replicates ≤30% for oyster and mussel larvae ≤40% for clam larvae ≤30% for sea urchin larvae See section 5.5.2 in the RIM		

3. Bioaccumulation Test:

Quality Control (QC) Element	Acceptance Criteria	Criteria Met? (Y/N) List Any Results Outside Criteria (for Lab/Applicant)	Data Review Comments (for DMMT)
Test condition requirements for each species: temperature, salinity, pH, D.O., test species age etc.	Test conditions within the requirements specified for each species (see RIM Appendix G)		
Was there sufficient tissue to conduct required chemical analyses?	If no, provide explanation		
Were any analytes found to have higher concentrations in the pre-test tissue than in the site tissue samples?	If yes, provide summary of analytes where this occurred		

Validation Reference Information: Adapted from National Functional Guidelines for Inorganic Superfund Methods Data Review, 2020 and Region 1 EPA New England Environmental Data Review Supplement, 2018

Metals, method 6010B, 6020 or similar

1. Sample Holding Times

Criteria	Action	
	Detected Results	**Non-detect Results**
Aqueous/Water samples received with pH > 2 and pH not adjusted	J	R
Metals: Aqueous/Water samples > 180 days	J	R
Metals: Soil/Sediment samples > 180 days	J	R
Mercury: Aqueous/Water samples > 28 days	J	R
Mercury: Soil/Sediment samples > 28 days	J	R

Blanks

- Use each Preparation/Method in the analytical batch

Blank Type	Blank Result	Sample Result	Action for Samples
Preparation/Method Blank	> RL	≥ IDL/MDL but ≤ RL	Qualify as non-detect (U) at the reported concentration
		>RL but < Blank Result	Qualify results as unusable (R)
		> Blank Result but < 10x Blank Result	Qualify results as estimated (J)
		≥ 10x Blank Result	No action is taken based on professional judgment
	≥ IDL/MDL but ≤ RL	Non-detect	No action is taken based on professional judgment
		≥ IDL/MDL but ≤ RL	Qualify as non-detect (U) at the reported concentration
		> RL	Use professional judgment (see below [1])

Equipment Blank (EB)	>RL and >PB	>RL but <EB	Qualify results as unusable (R)
		>EB but <10x EB	Qualify results as estimated (J)
		≥ IDL/MDL but ≤ RL	Qualify as non-detect (U) at the reported concentration
		≥ 10x EB	No action is taken based on professional judgment

[1] Establish an action level (AL) at 5x the blank contamination. If sample result is <AL, qualify the reported result with a "U".

2. LCS/LCSD

Criteria	Action	
	Detected Compounds	**Non-detected Compounds**
RPD > 35%	J	UJ
%R> 150	R	No qualification
%R > 130	J+	No qualification
40% ≤%R < 69	J-	UJ
%R < 40%	J-	R

%R = % recovery
RPD = relative percent difference
Apply actions to all samples in associated batch.

3. MS/MSD

RPD < 20% for aqueous, RPD < 35% for soil samples, if sample and duplicate results ≥ 5x the RL else qualify J/UJ

For RPD > 120%, reject data

Apply action to all samples in associated batch.

If the sample result (SR) > 4x the spike concentration (S), no action is taken. Otherwise, for metals:

Criteria	Action	
	Detected Compounds	**Non-detect**
Matrix Spike %R < 30% Post-digestion spike %R < 75%	J-	R
Matrix Spike %R < 30% Post-digestion spike %R ≥ 75%	J	UJ
Matrix Spike %R 30-74% Post-digestion spike %R < 75%	J-	UJ
Matrix Spike %R 30-74% Post-digestion spike %R ≥ 75%	J	UJ
Matrix Spike %R > 125% Post-digestion spike %R > 125%	J+	No qualification
Matrix Spike %R > 125% Post-digestion spike %R ≤ 125%	J	No qualification
Matrix Spike %R < 30% No post-digestion spike performed	J-	R
Matrix Spike %R 30-74% No post-digestion spike performed	J-	UJ
Matrix Spike %R 75-125% No post-digestion spike is required	No qualification	No qualification
Matrix Spike %R > 125% No post-digestion spike performed	J+	No qualification

For mercury:

Criteria	Action	
	Detected Compounds	**Non-detect**
Matrix Spike %R < 30%	J-	R
Matrix Spike %R 30-74%	J-	UJ
Matrix Spike %R > 125%	J+	No qualification

%R = % recovery

4. Analytical Replicates

Criteria	Action	
	Detect	Non-detect
Duplicate analysis not performed at the specified frequency	J	UJ
Both original sample and duplicate sample results are ≥ 5x RL and RPD> 20 aqueous RPD >35% soils	J	UJ
RPD >100%	Use professional judgment	Use professional judgment
Original sample or duplicate sample <5x RL (including non-detects) and absolute difference between sample and duplicate >RL (aqueous) and >2X RL (non-aqueous)	J	UJ
Original sample or duplicate sample <5x RL (including non-detects) and absolute difference between sample and duplicate <RL (aqueous) and <2X RL (non-aqueous)	No qualification	No qualification

Apply actions to all samples in preparation batch.

5. Field Duplicates

Criteria	RPD	Action	
		Detected	Non-detect
Sample and duplicate are nondetect results	Not calculable (NC)	No qualification	No qualification
Sample and duplicate results ≥5x RL	>30 (aqueous) >50 (solids)	J	Not Applicable
Sample and duplicate results <5x RL	Absolute difference > 2X RL (aqueous) Absolute difference > 4XRL (non-aqueous)	J	UJ

Apply actions to the affected analyte in all samples of the same matrix prepared and analyzed by the same method.

7. SRM

Criteria	Action	
	Detect	Non-Detect
SRM %R <10%	J-	R
SRM sample results below lower range limits and greater than 10%	J-	UJ
SRM sample results within limits provided by the vendor	No qualification	No qualification
SRM sample results above upper range limit	J+	No qualification

Apply actions to all samples in the preparation batch.

Validation Reference Information: National Functional Guidelines for Organic Superfund Methods Data Review, 2020 and Region 1 EPA New England Environmental Data Review Supplement, 2018

PAHs, method 8270E (GC/MS) or similar:

1. Sample Holding Times

Extraction from sampling (Days)		Analysis from Extraction (Days)	Action	
Water	**Soil/Sediment**		**Detected Results**	**Non-detect Results**
1-7	1-14	1-40	No qualification	No qualification
8-14	15-28	41-80	J	UJ
≥ 15	≥ 29	≥ 81	J	R

2. Method Blank or Equipment Blank

Blank result	Sample result	Action for samples
Detects	Not detected	No qualification
≤ RL	< RL	Report sample result with UJ
	≥ RL	No qualification
>RL	< RL	Report sample result with UJ
	≥ RL and < blank concentration	Report the sample result with a U
	≥ RL and blank concentration	No qualification
TIC detected	Detects	If the result is ≤ blank result, report the sample result U. If the result is > blank result, no qualification is required
Gross Contamination	Detects	Qualify results as unusable (R)

RL = reporting limit
MDL = method detection limit

3. MS/MSD

Criteria	Action	
	Detected	**Non-detected Compounds**
%R> 120	J	No qualification
10% ≤ %R < 30	J	UJ
%R <10%	J	R*
%RPD > 50	J	No qualification
Note: Actions are applied to the native unspiked sample only *When the native sample concentration is >4X the concentration of the spike added no action taken		

%R = % recovery
RPD = relative percent difference
Apply actions only to sample that was used for the MSD/MSD

4. LCS/LCSD

Criteria	Action	
	Detect	**Non-Detect**
LCS not performed at specified frequency or concentration	Use professional judgement	Use professional judgement
%R < 10	J-	R
10%<%R<30	J-	UJ
30 < %R <120	No qualification	No qualification
%R > 120	J+	No qualification
RPD>50%	J	No qualification

%R = % recovery
RPD = relative percent difference
Apply actions to all samples in the associated batch.

5. Analytical Replicates/Field Duplicates

Criteria	RPD	Action	
		Detected	**Non-detect**
Sample and duplicate are non-detect	Not calculable (NC)	No qualification	No qualification
Sample and duplicate results ≥5x RL	>30 (aqueous) >50 (solids)	J	Not Applicable
One or both sample and duplicate results <5x RL	Absolute difference > 2X RL (aqueous) Absolute difference > 4XRL (non-aqueous)	J	UJ

Apply actions to the affected analyte in all samples of the same matrix prepared and analyzed by the same method.

6. Surrogate Recoveries

Notes:

Base/Neutral Surrogates	Acid Surrogates
NBZ = Nitrobenzene-d5	PHL = Phenol-d5
FBP = 2-Fluorobiphenyl	2FP = 2-Fluorophenol
TPH = Terphenyl-d14	TBP = 2,4,6-Tribromophenol

- Actions are only taken when one surrogate %R is <10% or when 2 or more surrogates in one fraction are outside 30-150% limits.
- Actions apply to only the compounds in the affected fraction. i.e. if 2 acid surrogate %Rs are below 30% (the lower limit), then all acid compounds will be qualified as indicated in the table.

Criteria	Action	
	Detected Results	**Non-detect Results**
%R> 150	J	No qualification
10% ≤ %R < 30	J	UJ
%R <10% (sample dilution is not a factor)	J	R
%R <10% (sample dilution is a factor)[1]	No qualification	No qualification

[1] If there is no surrogate information due to dilution then estimate (J/UJ) all results. However, in cases where there is surrogate information from multiple runs then base the surrogate actions on the least diluted run.

%R = % recovery

7. SRM

Criteria	Action	
	Detect	**Non-Detect**
SRM %R <10%	J-	R
SRM sample results below lower range limits and greater than 10%	J-	UJ
SRM sample results within limits provided by the vendor	No qualification	No qualification
SRM sample results above upper range limit	J+	No qualification

Apply actions to all samples in the preparation batch.

Validation Reference Information: National Functional Guidelines for Organic Superfund Methods Data Review, 2020 and Region 1 EPA New England Environmental Data Review Supplement, 2018

PCBs, method 8082A or similar

1. Sample Holding Times

Extraction from sampling (Days)		Analysis from Extraction (Days)	Action	
Water	**Soil/Sediment**		**Detected Results**	**Non-detect Results**
365	365	1-40	No qualification	No qualification
≥365	≥365	41-80	J	UJ
≥365	≥365	≥ 81	J	R

2. Method Blank or Equipment Blank

Blank result	Sample result	Action for samples
Detects	Not detected	No qualification
≤ RL	< RL	Report sample result with a UJ
	≥ RL	No qualification
>RL	< RL	Report sample result with a UJ
	≥ RL and < blank concentration	Report the sample result with a U
	≥ RL and blank concentration	No qualification
TIC detected	Detects	If the result is ≤ blank result, report the sample result U. If the result is > blank result, no qualification is required
Gross Contamination	Detects	Qualify results as unusable (R)

RL = reporting limit
MDL = method detection limit

3.LCS/LCSD

Criteria	Action	
	Detected Compounds	**Non-detect Compounds**
%R > 150, RPD > 50%	J+	No qualification
10% ≤%R < 50%	J-	UJ
50 < %R <150	No qualification	No qualification
%R < 10%	J-	R
RPD>50%	J	No qualification

%R = % recovery
RPD = relative percent difference
Apply actions to all samples in the associated batch.

4. MS/MSD

Criteria	Action	
	Detected	**Non-detect Compounds**
%R> 150	J	No qualification
20% ≤ %R < 50%	J	UJ
%R <20%	J	R*
%RPD > 50	J	No qualification
Note: Actions are applied to the native unspiked sample only *When the native sample concentration is >4X the concentration of the spike added (based on Region I criteria), evaluate the MS, MSD, and native sample with regards to %RSD rather than %R		

%R = % recovery
RPD = relative percent difference

5. Analytical Replicates/Field Duplicates

Criteria	RPD	Action	
		Detected	**Non-detect**
Sample and duplicate are nondetect results	Not calculable (NC)	No qualification	No qualification
Sample and duplicate results ≥5x RL	>30 (aqueous) >50 (solids)	J	Not Applicable
Sample and duplicate results <5x RL	Absolute difference > 2X RL (aqueous) Absolute difference > 4XRL (non-aqueous)	J	UJ

Apply actions to the affected analyte in all samples of the same matric prepared and analyzed by the same method.

6. Surrogate Recoveries

Criteria	Action	
	Detected Results	**Non-detect Results**
%R> 150	J	No qualification
10% ≤ %R < 30	J	UJ
%R <10% (sample dilution is not a factor)	J	R
%R <10% (sample dilution is a factor)[1]	No qualification	No qualification
[1] If there is no surrogate information due to dilution then estimate (J/UJ) all results. However, in cases where there is surrogate information from multiple runs then base the surrogate actions on the least diluted run.		

%R = % recovery

7. SRM

Criteria	Action	
	Detect	**Non-Detect**
SRM %R <10%	J-	R
SRM sample results below lower range limits and greater than 10%	J-	UJ
SRM sample results within limits provided by the vendor	No qualification	No qualification
SRM sample results above upper range limit	J+	No qualification

Apply actions to all samples in the preparation batch.

Validation Reference Information: National Functional Guidelines for Organic Superfund Methods Data Review, 2020 and Region 1 EPA New England Environmental Data Review Supplement, 2018

Pesticides, method SW846 8081B or similar:

1. Sample Holding Times

Extraction from sampling (Days)		Analysis from Extraction (Days)	Action	
Water	**Soil/Sediment**		**Detected Results**	**Non-detect Results**
1-7	1-14	1-40	No qualification	No qualification
8-14	15-28	41-80	J	UJ
≥ 15	≥ 29	≥ 81	J	R

2. Method Blank or Equipment Blank

Blank result	Sample result	Action for samples
Detects	Not detected	No qualification
≤ RL	< RL	Report sample result with a UJ
	≥ RL	No qualification
>RL	< RL	Report sample result with a UJ
	≥ RL and < blank concentration	Report the sample result with a U
	≥ RL and blank concentration	No qualification
TIC detected	Detects	If the result is ≤ blank result, report the sample result U. If the result is > blank result, no qualification is required
Gross Contamination	Detects	Qualify results as unusable (R)

RL = reporting limit
MDL = method detection limit

3. LCS/LCSD

Criteria	Action	
	Detect	**Non-Detect**
LCS not performed at specified frequency or concentration	Use professional judgement	Use professional judgement
%R < 10	J-	R
10%<%R<30	J-	UJ
30 < %R <120	No qualification	No qualification
%R > 120	J+	No qualification
RPD>50%	J	No qualification

%R = % recovery
RPD = relative percent difference
Apply actions to all samples in the associated batch.

4. MS/MSD

Criteria	Action	
	Detected	**Nondetected Compounds**
%R> 120	J	No qualification
20% ≤ %R < 30%	J	UJ
%R <20%	J	R*
%RPD > 50	J	No qualification
Note: Actions are applied to the native unspiked sample only *When the native sample concentration is >4X the concentration of the spike added (based on Region I criteria), evaluate the MS, MSD, and native sample with regards to %RSD rather than %R		

%R = % recovery
RPD = relative percent difference

5. Analytical Replicates/Field Duplicates

Criteria	RPD	Action	
		Detected	Non-detect
Sample and duplicate are non-detect results	Not calculable (NC)	No qualification	No qualification
Sample and duplicate results ≥5x RL	>30 (aqueous) >50 (solids)	J	Not Applicable
One or both sample and duplicate results <5x RL	Absolute difference > 2X RL (aqueous) Absolute difference > 4XRL (non-aqueous)	J	UJ

Apply actions to the affected analyte in all samples of the same matric prepared and analyzed by the same method.

6. Surrogate Recoveries

Criteria	Action	
	Detected Results	Non-detect Results
%R> 150	J+	No qualification
10% ≤ %R < 30	J-	UJ
%R <10% (sample dilution is not a factor)	J-	R
%R <10% (sample dilution is a factor)[1]	No qualification	No qualification

[1] If there is no surrogate information due to dilution then estimate (J/UJ) all results. However, in cases where there is surrogate information from multiple runs then base the surrogate actions on the least diluted run.

%R = % recovery

* Use professional judgment in qualifying data, as surrogate recovery problems may not directly apply to target analytes.

7. SRM

Criteria	Action	
	Detect	Non-Detect
SRM %R <10%	J-	R
SRM sample results below lower range limits and greater than 10%	J-	UJ
SRM sample results within limits provided by the vendor	No qualification	No qualification
SRM sample results above upper range limit	J+	No qualification

Apply actions to all samples in the preparation batch.

Appendix E - Species Specific Test Conditions

SUMMARY OF TEST CONDITIONS AND TEST ACCEPTABILITY CRITERIA FOR MYSID SHRIMP, *Americamysis bahia*, ACUTE TOXICITY WATER COLUMN TESTS

1. Test type:	Static Non-Renewal
2. Test duration:	96 h
3. Temperature:	20±1°C: or 25±1°C C (recommended) Test temperatures must not deviate (i.e., maximum minus minimum temperature) by more than 3°C during the test
4. Salinity:	20-30 %0 ±10%
5. Light quality:	Ambient laboratory illumination
6. Light intensity:	10-20 uE/m^2/s (50-100 ft-c) (
7. Photoperiod:	16 h light / 8 h darkness
8. Test chamber size:	250 ml (recommended minimum)
9. Test solution volume:	200 ml (recommended minimum)
10. Renewal of test solutions:	None
11. Age of test organisms:	1 - 5 days; less than or equal to 24 h range in age
12. No. organisms per test chamber:	10
13. No. replicate chambers per concentration:	4 minimum
14. Feeding regime:	*Artemia* naupli*i* are made available while holding prior to the test; feed 0.2 ml of concentrated suspension of *Artemia* nauplii ≤24 h old, daily (approximately 100 A. nauplii per mysid)
15. Test chamber cleaning:	None
16. Test solution aeration:	If needed to maintain DO> 40% (< 100 bubbles/min.)
17. Dilution water:	Natural seawater, deionized water mixed with hypersaline brine or artificial sea salts (HW MARINEMIX®, modified GP2, or equivalent) prepared with MILLI-Q® or equivalent deionized water
18. Test concentrations:	Three concentrations for site sediment and control water
19. Dilution series: elutriate	100%, 50%, 10% of the dredged material

20.	Endpoint:	Survival
21.	Sampling and sample holding requirements:	<8 wk (sediment); elutriates are to be used within 24h of preparation
22.	Sample volume required:	1 L per site
23.	Test acceptability criterion:	≥ 90% survival in controls

Reference:

USEPA. 2002. Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms, Fifth Edition. U.S. Environmental Protection Agency, Office of Water, Washington, DC. EPA 821-R-02-012, October 2002.

SUMMARY OF TEST CONDITIONS AND TEST ACCEPTABILITY CRITERIA FOR SHEEPSHEAD MINNOW, *Cyprinodon variegatus*, INLAND SILVERSIDE, *Menidia beryllina*, ATLANTIC SILVERSIDE, *M. menidia*, ACUTE TOXICITY WATER COLUMN TESTS

1. Test type:	Static Non-Renewal
2. Test duration:	96 h
3. Temperature: 4.	20±1°C: or 25±1°C C (recommended) Test temperatures must not deviate (i.e., maximum minus minimum temperature) by more than 3°C during the test (required)
5. Salinity: 6.	Sheepshead minnow: 5-30 %0 ± 10% Silversides: 5-32 %0 ± 10%
7. Light quality:	Ambient laboratory illumination
8. Light intensity:	10-20 uE/m^2/s (50-100 ft-c)
9. Photoperiod:	16 h light / 8 h darkness
10. Test chamber size:	250 ml minimum
11. Test solution volume:	200 ml minimum
12. Renewal of test solutions:	None
13. Age of test organisms:	Sheepshead minnow: 1-14 days; 24-h range in age Silversides:9-14 days; 24-h range in age
14. No. organisms per test chamber:	10 minimum
15. No. replicate chambers per concentration:	4 minimum
16. Feeding regime:	*Artemia* nauplii are made available while holding prior to the test; add 0.2 mL *Artemia* nauplii concentrate at 48 h
17. Test chamber cleaning:	None
18. Test solution aeration:	If needed to maintain DO> 40% (< 100 bubbles/min.)
19. Dilution water:	Natural seawater, deionized water mixed with hypersaline brine or artificial sea salts (HW MARINEMIX®, modified GP2, or equivalent) prepared with MILLI-Q® or equivalent deionized water
20. Test concentrations:	Three concentrations for site sediment and control water
21. Dilution series:	100%, 50%, 10% of the dredged material elutriate

22.	Endpoint:	Survival
23.	Sampling and sample holding requirements:	<8 wk (sediment); elutriates are to be used within 24h of preparation
24.	Sample volume required:	1 L sediment per sample station/4 L site water for creation of 100% elutriate
25.	Test acceptability criterion:	≥ 90% survival in controls

Reference:

USEPA. 2002. Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms, Fifth Edition. U.S. Environmental Protection Agency, Office of Water, Washington, DC. EPA 821-R-02-012, October 2002.

SUMMARY OF TEST CONDITIONS AND TEST ACCEPTABILITY CRITERIA FOR OYSTER, *Crassostrea virginica*, AND MUSSEL, *Mytilus edulis*, ACUTE TOXICITY WATER COLUMN TESTS

1. Test type:	Static Non-Renewal
2. Test duration:	48 h
3. Temperature:	25±1°C for *Crassostrea virginica* 15-18°C for *Mytilus edulis*
4. Salinity:	18-34 ± 1%
5. Light quality:	Ambient laboratory illumination
6. Light intensity:	10-20 uE/m^2/s (50-100 ft-c)
7. Photoperiod:	16 h light / 8 h darkness
8. Test chamber size:	1 L
9. Test solution volume:	500 ml minimum
10. Renewal of test solutions:	None
11. Age of test organisms:	Larvae less than 4 h old
12. Concentration of organism per test chamber:	15-30 embryos / ml
13. No. replicate chambers per concentration:	5 minimum, plus 1 for water quality measurements
14. Feeding regime:	None
15. Test chamber cleaning:	None
16. Test solution aeration:	None
17. Dilution water:	Natural seawater, deionized water mixed with hypersaline brine or artificial sea salts (HW MARINEMIX®, modified GP2, or equivalent) prepared with MILLI-Q® or equivalent deionized water
18. Test concentrations:	Three concentrations for site sediment and control water
19. Dilution series:	100%, 50%, 10%, 1% of the dredged material elutriate
20. Endpoint:	Survival; Shell development to hinged, D-shaped prodissoconch I larva
21. Sampling and sample holding requirements:	<8 wk (sediment); elutriates are to be used within 24h of preparation
22. Sample volume required:	1 L sediment per sample station/4 L site water

	for creation of 100% elutriate
23. Test acceptability criterion:	Seawater controls must produce at least 70 % (oysters) or 90 % (mussels) normally developed prodissoconch I larvae

Reference:

American Society for Testing and Materials (ASTM). 2021. E724-21, Standard Guide for Conducting Static Acute Toxicity Tests Starting with Embryos of Four Species of Saltwater Bivalve Molluscs. Published March 2021.

SUMMARY OF TEST CONDITIONS AND TEST ACCEPTABILITY CRITERIA FOR SEA URCHINS, *Strongylocentrotus* sp. (*Arbacia punctulata*), ACUTE TOXICITY WATER COLUMN TESTS

1. Test type:	Static Non-Renewal
2. Test duration:	48 h
3. Temperature:	20 ± 1 ºC
4. Salinity:	30-32 ‰
5. Light quality:	Ambient laboratory illumination
6. Light intensity:	10-20 uE/m^2/s (50-100 ft-c)
7. Photoperiod:	Not essential, 16 h light / 8 h darkness
8. Test chamber size:	1 L
9. Test solution volume:	900 ml minimum
10. Renewal of test solutions:	None
11. Age of test organisms:	≤ 4 h old embryos
12. Concentration of organism per test chamber:	15-30 embryo/ml recommended, up to 50 embryos/ml is acceptable
13. No. replicate chambers per concentration:	5 minimum, plus 1 extra for water quality measurements
14. Feeding regime:	None
15. Test chamber cleaning:	None
16. Test solution aeration:	None
17. Dilution water:	Natural seawater, deionized water mixed with hypersaline brine or artificial sea salts (HW MARINEMIX®, modified GP2, or equivalent) prepared with MILLI-Q® or equivalent deionized water
18. Test concentrations:	Three concentrations for site sediment and control water
19. Dilution series:	100%, 50%, 10% of the dredged material elutriate
20. Endpoint:	Survival, Embryo Development
21. Sampling and sample holding requirements:	<8 wk (sediment); elutriates are to be used within 24h of preparation
22. Sample volume required:	1 L per site

23. Test acceptability criterion:	Seawater controls must produce at least 70% normal pluteus larvae

Reference:

USEPA. 1990. Conducting the Sea Urchin Larval Development Test. ERL-Narragansett Standard Operating Procedure 1.03.007.

ASTM. 2021. Standard Guide for Conducting Static Acute Toxicity Tests with Echinoid Embryos. ASTM. E 1563-21a. Published January 2022.

SUMMARY OF TEST CONDITIONS AND TEST ACCEPTABILITY CRITERIA FOR THE AMPHIPOD, *Ampelisca abdita*, ACUTE TOXICITY SEDIMENT TESTS

1. Test type:	Static Non-Renewal*
2. Test duration:	10 day
3. Temperature:	20 ± 1°C
4. Salinity:	28 ±1‰
5. Light quality:	Ambient laboratory illumination
6. Light intensity:	10-20 uE/m^2/s (50-100 ft-c)
7. Photoperiod:	Continuous Light
8. Test chamber size:	1 L
9. Test solution volume:	Vol. to 950 ml
10. Sediment depth:	2 cm minimum
11. Renewal of test solutions:	None*
12. Age of test organisms:	Immature amphipods, 3 mm to 5 mm
13. No. organisms per test chamber:	20
14. No. replicate chambers per sediment:	4, minimum
15. Feeding regime:	None
16. Test chamber cleaning:	None
17. Test solution aeration:	Water should be aerated overnight before start of test, and throughout the test; aeration at rate that maintains >90 % saturation of DO concentration.
18. Dilution water:	Natural seawater, deionized water mixed with hypersaline brine or artificial sea salts (HW MARINEMIX®, modified GP2, or equivalent) prepared with MILLI-Q® or equivalent deionized water
19. Test concentrations:	Site sediment, reference sediment and a control sediment
20. Dilution series:	N/A
21. Endpoint:	Survival
22. Sampling and sample holding requirements:	<2 wk (recommended) Sediment toxicity tests should be started within 2 wk of sampling, but not later than 8 wk

	after sampling.
23. Sample volume required:	2 L
24. Test acceptability criterion:	≥ 90% survival in controls

Reference:

ASTM. 2023. Standard Test Method for Measuring the Toxicity of Sediment-Associated Contaminants with Estuarine and Marine Invertebrates. E 1367-03 (Reapproved 2023). Published March 2023.

SUMMARY OF TEST CONDITIONS AND TEST ACCEPTABILITY CRITERIA FOR THE AMPHIPOD, *Leptocheirus plumulosus*, ACUTE TOXICITY SEDIMENT TESTS

1. Test type:	Static Non-Renewal*
2. Test duration:	10 days
3. Temperature:	25°C
4. Salinity:	20‰
5. Light quality:	Ambient laboratory illumination
6. Light intensity:	10-20 uE/m^2/s (50-100 ft-c)
7. Photoperiod:	Continuous light
8. Test chamber size:	1 L
9. Test solution volume:	Vol. to 950 ml
10. Sediment depth:	2 cm minimum
11. Renewal of test solutions:	None
12. Age of test organisms:	Immature only, 2 mm to 4 mm
13. No. organisms per test chamber:	20
14. No. replicate chambers per sediment:	4, minimum
15. Feeding regime:	None
16. Test chamber cleaning:	None
17. Test solution aeration:	Water should be aerated overnight before start of test, and throughout the test; aeration at rate that maintains >90 % saturation of DO concentration.
18. Dilution water:	Natural seawater, deionized water mixed with hypersaline brine or artificial sea salts (HW MARINEMIX®, modified GP2, or equivalent) prepared with MILLI-Q® or equivalent deionized water
19. Test concentrations:	N/A
20. Dilution series:	N/A
21. Endpoint:	Survival, reburial optional
22. Sampling and sample holding requirements:	<2 wk (recommended) Sediment toxicity tests should be started within 2 wk of sampling, but not later than 8 wk after sampling.

23. Sample volume required: 2 L

24. Test acceptability criterion: ≥ 90% survival in controls

Reference:

ASTM. 2023. Standard Test Method for Measuring the Toxicity of Sediment-Associated Contaminants with Estuarine and Marine Invertebrates. E 1367-03 (Reapproved 2023). Published March 2023.

SUMMARY OF TEST CONDITIONS AND TEST ACCEPTABILITY CRITERIA FOR THE AMPHIPOD, *Eohaustorius estuarius*, ACUTE TOXICITY SEDIMENT TESTS

1. Test type:	Static Non-Renewal*
2. Test duration:	10 days
3. Temperature:	15°C
4. Salinity:	20‰
5. Light quality:	Ambient Laboratory
6. Light intensity:	10-20 uE/m^2/s (50-100 ft-c)
7. Photoperiod:	Continuous Light
8. Test chamber size:	1 L
9. Test solution volume:	Vol. to 950 ml
10. Sediment depth:	2 cm minimum
11. Renewal of test solutions:	None
12. Age of test organisms:	3-5 mm, mixed sexes
13. No. organisms per test chamber:	20
14. No. replicate chambers per sediment:	4, minimum
15. Feeding regime:	None
16. Test chamber cleaning:	None
17. Test solution aeration:	Water should be aerated overnight before start of test, and throughout the test; aeration at rate that maintains >90 % saturation of DO concentration.
18. Dilution water:	Natural seawater, deionized water mixed with hypersaline brine or artificial sea salts (HW MARINEMIX®, modified GP2, or equivalent) prepared with MILLI-Q® or equivalent deionized water
19. Test concentrations:	Site sediment, a reference sediment, and a control sediment
20. Dilution series:	N/A
21. Endpoint:	Survival, reburial optional
22. Sampling and sample holding requirements:	<2 wk (recommended) Sediment toxicity tests should be started within 2 wk of sampling, but not later than 8 wk

	after sampling.
23. Sample volume required:	2 L
24. Test acceptability criterion:	≥ 90% survival in controls

Reference:

ASTM. 2023. Standard Test Method for Measuring the Toxicity of Sediment-Associated Contaminants with Estuarine and Marine Invertebrates. E 1367-03 (Reapproved 2023). Published March 2023.

SUMMARY OF TEST CONDITIONS AND TEST ACCEPTABILITY CRITERIA FOR MYSID SHRIMP, *Americamysis bahia*, ACUTE TOXICITY SEDIMENT TESTS

1. Test type:	Static Non-Renewal*
2. Test duration:	10 days
3. Temperature:	20±1°C or 25±1°C
4. Salinity:	25 to 30 ‰ ± 10 ‰
5. Light quality:	Ambient laboratory illumination
6. Light intensity:	10-20 uE/m^2/s (50-100 ft-c)
7. Photoperiod:	16 h light / 8 h darkness
8. Test chamber size:	1 L
9. Test solution volume:	Vol. to 950 ml
10. Sediment depth:	2 cm minimum
11. Renewal of test solutions:	None*
12. Age of test organisms:	1-5 days; 24 h range in age
13. No. organisms per test chamber:	10 minimum
14. No. replicate chambers per concentration :	5 minimum
15. No. organisms per concentration:	50 minimum
16. Feeding regime:	*Artemia* nauplii are made available while holding prior to the test; feed 0.2 ml of concentrated suspension of *Artemia* nauplii ≤24 h old, daily (approximately 100 A. nauplii per mysid)
17. Test chamber cleaning:	None
18. Test solution aeration:	If needed to maintain DO > 40%saturation
19. Dilution water:	Natural seawater, deionized water mixed with hypersaline brine or artificial sea salts (HW MARINEMIX®, modified GP2, or equivalent) prepared with MILLI-Q® or equivalent deionized water
20. Test concentrations:	Site sediment, a reference sediment, and a control sediment
21. Dilution series:	N/A
22. Endpoint:	Survival

25.	Sampling and sample holding requirements:	<2 wk (recommended) Sediment toxicity tests should be started within 2 wk of sampling, but not later than 8 wk after sampling.
23.	Sample volume required:	2 L
24.	Test acceptability criterion:	≥ 90% survival in controls

Reference:

USEPA. 2002. Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms, Fifth Edition. U.S. Environmental Protection Agency, Office of Water, Washington, DC. EPA 821-R-02-012, October 2002.

SUMMARY OF TEST CONDITIONS AND TEST ACCEPTABILITY CRITERIA FOR THE POLYCHAETE, *Alitta virens*, SEDIMENT BIOACCUMULATION TESTS

1. Test type:	Flow through or Static Renewal
2. Test duration:	28 days
3. Temperature:	10 – 20 ±1 °C
4. Salinity:	30‰, range 25-35‰ ±10
5. Light quality:	Ambient laboratory illumination
6. Light intensity:	10-20 uE/m^2/s (50-100 ft-c)
7. Photoperiod:	16 h light / 8 h darkness, 14 h light / 10 h darkness, 12 h light / 12 h darkness
8. Test chamber size:	20-40 L
9. Test solution volume:	250-300 g wet wt sediment per g tissue
10. Sediment depth:	5 cm minimum
11. Renewal of test solutions:	Flow-through = 5-10 vol/d; Static Renewal = 3x/week
12. Age of test organisms:	adult (3 – 15 g)
13. No. organisms per test chamber:	depends on chamber size, i.e. One per 1 L beaker, 20 per 20 gallon aquarium
14. No. replicate chambers per sediment:	5 minimum
15. Feeding regime:	None
16. Test chamber cleaning:	As needed
17. Test solution aeration:	Moderate, as needed
18. Dilution water:	Natural seawater, deionized water mixed with hypersaline brine or artificial sea salts (HW MARINEMIX®, modified GP2, or equivalent) prepared with MILLI-Q® or equivalent deionized water
19. Test concentrations:	Site sediment, a reference sediment, and a control sediment
20. Dilution series:	N/A
21. Endpoint:	Survival, Bioaccumulation
22. Sampling and sample holding requirements:	<8 wk
23. Sample volume required:	20 – 40 L of site, reference site, and control

	sediment, depending on chamber size
24. Test acceptability criterion:	Adequate mass of organisms at test completion for detection of target analyte(s), ≥90% survival in control

Reference:

ASTM. 2021. Standard Guide for Conducting Sediment Toxicity Tests with Polychaetous Annelids. E 1611-21 Published January 2022.

ASTM. 2019. Standard Guide for Determination of the Bioaccumulation of Sediment-Associated Contaminants by Benthic Invertebrates. E 1688-19. Published April 2020.

Lee II, H., B. Boese, J. Pelletier, M. Winsor, D. Specht and R. Randall. 1989. Guidance Manual: Bedded Sediment Bioaccumulation Tests. EPA/600/x-89/302. U.S. Environmental Protection Agency. 232 pp.

SUMMARY OF TEST CONDITIONS AND TEST ACCEPTABILITY CRITERIA FOR THE MACOMA CLAM, *Macoma nasuta*, SEDIMENT BIOACCUMULATION TESTS

1. Test type:	Flow through or Static Renewal
2. Test duration:	28 d
3. Temperature:	12 – 16 °C
4. Salinity:	30‰ ,range: 25-35 + 10%
5. Light quality:	Ambient Laboratory
6. Light intensity:	10-20 uE/m^2/s (50-100 ft-c)
7. Photoperiod:	12 h light / 12 h darkness, 16 h light / 8 h darkness
8. Test chamber size:	10 – 30 L
9. Test solution volume:	250-300 g wet wt sediment per g tissue (without shell)
10. Sediment depth:	5 cm minimum
11. Renewal of test solutions:	Flow-through = 5-10 vol/d; Static Renewal = 3x/week
12. Age of test organisms:	2 – 4 year, 28-45 mm shell length
13. No. organisms per test chamber:	depends on chamber size, i.e. One per 1 L beaker, 20 per 20 gallon aquarium
14. No. replicate chambers per sediment:	5 minimum
15. Feeding regime:	None
16. Test chamber cleaning:	As needed
17. Test solution aeration:	Moderate, as needed
18. Dilution water:	Natural seawater, deionized water mixed with hypersaline brine or artificial sea salts (HW MARINEMIX®, modified GP2, or equivalent) prepared with MILLI-Q® or equivalent deionized water
19. Test concentrations:	Site sediment, a reference sediment, and a control sediment
20. Dilution series:	N/A
21. Endpoint:	Survival, Bioaccumulation
22. Sampling and sample holding requirements:	<8 wk

23. Sample volume required:	8 Lminimum
24. Test acceptability criterion:	Adequate mass of organisms at test completion for detection of target analyte(s), ≥90% survival in control

Reference:

ASTM. 2019. Standard Guide for Determination of the Bioaccumulation of Sediment-Associated Contaminants by Benthic Invertebrates. E 1688-19. Published April 2020

Lee II, H., B. Boese, J. Pelletier, M. Winsor, D. Specht and R. Randall. 1989. Guidance Manual: Bedded Sediment Bioaccumulation Tests. EPA/600/x-89/302. U.S. Environmental Protection Agency. 232 pp.

Ferraro, S., H. Lee II, R. Ozretich, and D. Specht. 1990. Predicting bioaccumulation potential: A test of a fugacity-based model. Arch. Environ. Contamin. Toxicol. 19:386-394.

Appendix F - Pore Water Collection Procedure for Ammonia Measurement

Set up of surrogate (or “dummy”) containers

Pore water ammonia measurements should be made in surrogate chambers (i.e., chambers with no animals added) for each homogenized sediment treatment level (control, reference, dredged material site). Total and un-ionized ammonia levels must be monitored in the pore water on days 1, 3 (or 5) and 10 during the test. Therefore, three additional containers (one for each monitoring day) should be maintained for each sediment treatment (control, reference, dredged material site).

Collection of Pore water:

Interstitial pore water should be extracted by centrifuge using the methods described in Burgess et al. (1993) or in Ferretti et al. (2000). Here, up to 200 ml of sediment (typically 100 ml is sufficient) is placed in a 250 ml teflon centrifuge tube and centrifuged at 4°C for 60 minutes at 4,000 rpm (2520 G) or 30 minutes at 8,000 rpm. In general, about 20 ml of interstitial water would be needed to measure ammonia with an ion-selective electrode. Ferretti (personal communication) observed that 100 ml of sediment is usually sufficient to capture 25 to 50 ml of pore water. Alternatively, interstitial pore water may be collected using peepers (see Section 6.2.1 of EPA 2001d).

Analysis of Ammonia:

Total and un-ionized ammonia must be analyzed on the sediment interstitial water using the ionselective electrode method (Merks, 1975) following the manufacturer's instructions or the colorimetric method as described in Bower and Holm-Hansen (1980). Acceptable detection limits are 0.1 mg/L. Un-ionized ammonia can be calculated using the dissociation model of Whitfield (1972) as programmed by Hampson (1977).

References

Bower, C.E. and T. Holm-Hansen. 1980. A Salicylate-hypochlorite Method for Determining Ammonia in Seawater. Can. J. Aquat. Sci. 37: 794-798.

Burgess, R.M., K.A. Schweitzer, R.A. McKinney, and D.K. Phelps.1993. Contaminated Marine sediments: Water column and Interstitial Toxic Effects. Environmental Toxicology and Chemistry12: 127-138.

Ferretti, J.A., D.F. Calesso, and T.R. Hermon. 2000. Evaluation of methods to remove ammonia interference in marine sediment toxicity tests. Environmental Toxicology and Chemistry19(8): 1935-1941.

Hampson, B.L. 1977. The Analysis of Ammonia in Polluted Sea Water. Water Research 11: 305-308.

Merks, A.G.A. 1975. Determination of Ammonia in Sea Water with an Ion-Selective Electrode. Netherlands J. Sea Res. 9: 371-375.