2020 PILOT STUDY: DMMP MONITORING OF THE PORT GARDNER NON-DISPERSIVE UNCONFINED OPEN-WATER DREDGED MATERIAL DISPOSAL SITE

DATA REPORT
FINAL

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LIST OF ACRONYMS AND ABBREVIATIONS

ARI	Analytical Resources, Inc.
aRPD	apparent redox potential discontinuity
BCOC	bioaccumulative chemical of concern
BT	bioaccumulation trigger
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	chemical of concern
CSAP	Conceptual Sampling and Analysis Plan
CSL	cleanup screening level
DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenyldichloroethylene
DDT	dichlorodiphenyltrichloroethane
DGPS	differential Global Positioning System
DMMP	Dredged Material Management Program
DNR	Washington State Department of Natural Resources
DU	decision unit
Ecology	Washington Department of Ecology
EIM	Environmental Information Management
FDA	Food and Drug Administration
HPAH	high molecular weight polycyclic aromatic hydrocarbon
LOC	level of chlorination
LOD	level of detection
LPAH	low molecular weight polycyclic aromatic hydrocarbon
MBD	may be determined on a project-specific basis
MDL	method detection limit
ML	maximum level
MLLW	mean lower low water
MRL	method reporting limit
NA	not applicable
NAD83	North American Datum 1983
OC	organic carbon
PAH	polycyclic aromatic hydrocarbon
PBDE	polybrominated diphenyl ether
PCB	polychlorinated biphenyl
PED	polyethylene device
PQL	practical quantification limit
PRC	performance reference compounds
PSEP	Puget Sound Estuary Program
PS-SRM	Puget Sound Sediment Reference Material

QC	quality control
RL	reporting limit
RRQRR	reverse randomized quadrant-recursive raster
R/V	research vessel
SAP	Sampling and Analysis Plan
SAIC	Science Applications International Corporation
SDG	sample delivery group
SL	screening level
SMS	Sediment Management Standards
SPME	Solid-phase microextraction
SPI	sediment profile imaging
SQS	Sediment Quality Standards
SVOC	semi-volatile organic compound
TBT	tributyltin ion
TEF	toxicity equivalent factor
TEQ	toxic equivalency
TOC	total organic carbon
TTL	target tissue level
TVS	total volatile solids
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
ww	wet weight

Revisions to the July 12, 2021 Foreword **March 29, 2022**

The following minor revisions were made to the 2020 Port Gardner Pilot Study Data Report Foreword:

1. Tables 1 and 2 were further revised during development of the 2022 SMARM Monitoring Framework Revisions Issue Paper to simplify the framework and avoid redundancies and unlikely hypothetical scenarios. There were no changes to the "Questions", "Goals", or monitoring methods.
2. Table 3 had the wrong benthic CSL for hexachlorobenzene.
3. Table 5 was updated to reflect the correction in Table 3. Additionally, the On-site sediment composite chemical concentrations were added.
4. In Table 7, the SCUM Appendix K reference was corrected to SCUM Table 9-5. Risk-based tissue concentrations were updated accordingly. Additionally, the DMMP User Manual Table 10-6 TTLs for fluoranthene and pentachlorophenol were added, a clarification was made to the selenium SEF Table 8-5 value, and the fluoranthene SEF Table 8-6 value was updated.
5. Tables 8, 9, and 10 were updated to reflect corrections in Table 7.

None of the changes made to the foreword tables impact the overall conclusions of the data evaluation.

July 12, 2021 (Revised on March 29, 2022)

Foreword to the 2020 Port Gardner Non-Dispersive Unconfined Open-Water Dredged Material Disposal Site Pilot Study Data Report

The results of the 2020 Port Gardner non-dispersive disposal site monitoring event are documented in the enclosed *2020 Port Gardner Non-Dispersive Unconfined Open-Water Dredged Material Disposal Site Pilot Study Data Report* (Data Report). The monitoring data for this site were evaluated using the draft revised monitoring framework (Table 2 in the Data Report) described in the March 2020 Conceptual Sampling and Analysis Plan (CSAP; DMMP, 2020). This CSAP framework reflected the DMMP's approach at that time. The agencies recognized that the outcome and lessons learned from the pilot would likely inform additional revisions to the monitoring framework.

As anticipated, the monitoring evaluation framework has since undergone several revisions and is now simplified into a series of questions and goals that differentiate routine monitoring from additional monitoring required if a goal is not met.

This foreword by the DMMP agencies presents an additional evaluation of the Port Gardner pilot study results using the most up-to-date monitoring framework and a more detailed evaluation of sediment and tissue cleanup compliance.

The key differences between the evaluation in the Data Report and this evaluation are:

1. Sediment Profile Imaging (SPI) is explicitly used to make a qualitative assessment of on-site conditions when assessing Question 2 (Table 1).
2. Sediment composites (Disposal Site and Environs Decision Units (DUs)) and individual on-site sediment grab samples are compared to the WA State's Cleanup Screening Level (CSL).
3. Disposal Site DU-exposed tissues are compared to compliance-based Target tissue levels (TTLs)[1] that include the following refined and/or expanded definitions for the TTL and the Practical Quantitation Limit (PQL):
    a. TTLs were selected in a manner similar to the sediment CSLs (highest of risk-based concentration, regional background, or PQL) to develop "compliance TTLs".
    b. A broader review of risk levels resulted in a larger list of TTLs for comparison.
    c. Promulgated PQLs from the Sediment Cleanup User's Manual (Ecology, 2019) were used instead of laboratory specific PQLs.

The overall conclusions for the Data Report and the additional evaluation remain the same: sediment and tissue concentrations indicate that deposited dredged material does not cause unacceptable adverse impacts to biological conditions on-site.

SPI On-Site Qualitative Evaluation

Physical monitoring has always been a component of the disposal site monitoring program. SPI data are collected both on-site and off-site. The images can be used to understand typical site conditions over time. Recently deposited dredged material will cover any newly formed biological structures; however,

[1] The SMS doesn't have a framework for tissue CSL, but rather uses it for compliance.

regeneration of new structures should appear over time until the next dredged material disposal restarts the process. The CSAP framework did not clearly specify that the SPI qualitative analysis of on-site conditions would be used to support Hypothesis B; however, the SPI data results show the presence of infauna and biological structures in recent dredged material which supports the goal of no long-term adverse impacts from recently deposited material (Question 2). The revised framework now explicitly includes this component (Table 1; Question 2; Goal B).

Sediment CSL Evaluation

Comparison of sediment chemistry to the CSL is not currently included in the revised framework; however, the DMMP agencies opted to perform this additional evaluation for the on-site individual samples and Disposal Site DU composite as another check to ensure that the disposal sites are not becoming cleanup sites.

The SMS sediment framework sets the sediment CSL as the highest of risk, regional background, or PQL. For this evaluation, risk values included benthic SMS CSL and DMMP SLs where there are no SMS values (e.g., selenium and TBT, called "Eco risk" in Table 3). Sediment values associated with human and wildlife risk from sediments were not used for this evaluation, as they are highly site-specific and require back-calculations from risk-based TTLs. Although regional background has been established for some compounds at Port Gardner, it is not available for all compounds, and in some cases, natural background is slightly higher. Therefore, background was based on the highest of established regional and natural backgrounds. Where regional background is not available, the highest of natural background or mean Environs data were used (Table 4). PQLs established by Ecology and published in SCUM Table 11-1 (Ecology, 2019) were used. Table 5 shows values for risk, background, PQL, and the selected value for CSL. All on-site data (5 individually analyzed samples, plus the on-site composite) passed sediment CSLs (see Data Report Table 7 for all sediment results).

Tissue Compliance Evaluation

For the TTL comparison, the DMMP evaluation used a framework similar to the sediment CSL selection, which uses the highest value of risk-based concentration, regional background, or PQL (Table 6). Multiple sources were incorporated into the risk value selection and the lowest value for each compound was selected as the risk-based concentration (Table 7). The sources used included:

- Risk-based DMMP TTLs (DMMP, 2018 [Table 10-6])
- Sediment Evaluation Framework (SEF) TTLs for protection of aquatic life (species sensitivity distribution- based values only) (RSET, 2018 [Table 8-5])
- SEF TTLs for protection of deep-water populations (RSET, 2018 [Table 8-6])
- Human health values from SCUM (Suquamish exposure parameters, 10^{-5} risk) (Ecology, 2019 [Appendix K]).

Ecology has no established tissue background values (regional or natural), so the mean Environs bioaccumulation results were used to represent background [2]. Tissue PQLs established by Ecology and published in SCUM Table 11-1 (Ecology, 2019) were used, if available. Table 8 shows the information used to select the compliance TTL for *Macoma* based on the highest of risk, background, and PQL. The

[2] Background would be an upper tolerance limit (UTL), not a mean value, but bioaccumulation testing did not produce sufficient sample numbers (n=5, need n=10) to establish an upper percentile.

same information (except for mean Environs bioaccumulation results) and process was used to determine the TTL for *Alitta*.

When comparing to the results of bioaccumulation testing using *Macoma*, all on-site tissue data values were at or below the selected TTL, with one exception (Table 9). Arsenic in on-site tissues was higher than the arsenic TTL (based on the mean Environs bioaccumulation results), but the difference was not statistically different. For *Alitta*, all on-site tissue values were at or below the selected TTL (Table 10) except for carcinogenic PAHs (cPAHs) which had an elevated non-detect reporting limit.

cPAHs were evaluated in bioaccumulation test tissues for the pilot study but will not be included in future monitoring because there is no completed exposure pathway for cPAHs in disposal site sediments to humans (DMMP, 2021).

Issues identified during this evaluation include the need to review laboratory PQLs for compounds that had PQLs above the selected TTL in tissue without Ecology-established PQLs (i.e., DDX compounds, pentachlorophenol), and consideration/selection of a more appropriate statistical metric when using the Environs tissue data. This evaluation used the mean as a surrogate for the 90/90 UTL, that would normally be used to establish background.

Lastly, detected CoC concentrations in unexposed (pre-test) tissues were, in some cases, similar to those in post-test tissues from both the Disposal Site DU and Environs DU. While this finding did not impact this evaluation, it emphasizes the importance of gathering pre-test tissue concentrations during future bioaccumulation testing.

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Table 10: TTL Compliance Evaluation (*Alitta*)

References

DMMP, 2020. Conceptual sampling and analysis plan for non-dispersive dredged material disposal sites in Puget Sound. Final. February 20, 2020. Prepared by the Dredged Material Management Program.

Ecology, 2019. Sediment Cleanup User's Manual (SCUM), Guidance for Implementing the Cleanup Provisions of the Sediment Management Standards, Chapter 173-204 WAC, Washington State Department of Ecology, Second Revision December 2019.

DMMP, 2018. *Dredged Material Evaluation and Disposal Procedures (User Manual)*. Dredged Material Management Program, updated December 2018.

DMMP, 2021. PAH Guidelines: Considerations for Dredged Material Testing and Disposal Site Monitoring in Puget Sound, DMMP Clarification Paper prepared by Inouye and Hoffman. April 2021.

Northwest Regional Sediment Evaluation Team (RSET), 2018. Sediment Evaluation Framework for the Pacific Northwest. Prepared by the RSET agencies. May 2018.

Table 1: Routine Monitoring and Testing				
Question	**Goal**	**Metric**	**Method**	**Goal Achievement Guideline[3]**
1. Does the deposited dredged material stay on site?	**A.** Dredged material stays within site boundaries	SPI/PV quantitative assessment	Conduct SPI/PV survey of site and surrounding area	< 10 cm at or beyond site boundary OR < 3 cm at or beyond site perimeter
2. Does deposited dredged material cause unacceptable[1,2] adverse impacts to biological conditions on site?	**B.** No long-term adverse effects to on-site benthic biological resources and habitat as defined by SCII	SPI/PV qualitative assessment	Review SPI/PV parameters including successional stage, apparent redox potential discontinuity, and others	Benthic community shows expected levels of recovery based on historical data
		Sediment chemistry	Collect 5 individual 0-10 cm samples from stratified random grid within the Disposal Site DU; analyze for benthic DMMP COC list	All COCs ≤ DMMP SL
		Sediment bioassays (Tiered)	Run on all samples with any COC > SL	No bioassay toxicity test exhibits a 1-hit (major) response or two 2-hit (minor) responses
	C. No long-term adverse bioaccumulative risk to on-site resources as defined by SCII and SMS	Tier 1 analysis	Review existing on-site bioaccumulation data, project data and other relevant data[4]	Sufficient evidence of no bioaccumulative risk > SCII and SMS
		Laboratory bioaccumulation tests (Tiered)	• Composite 20 subsamples from stratified random grid within the Disposal Site DU into a single sample; analyze for sediment chemistry and bioaccumulation • Composite 20 subsamples from random grid within the Environs DU into a single sample; analyze for sediment chemistry and bioaccumulation • Analyze sediment and tissue for relevant DMMP List 1 BCOCs	1. SCII: Sediment BCOCs ≤ DMMP BT; Tissue BCOCs ≤ DMMP TTLs 2. SMS: BCOCs from Disposal Site DU-exposed tissues are ≤ the highest of: • Risk-based values (including relevant TTLs) • Background including Environs DU tissue data • PQLs if available
3. Does use of the disposal site cause unacceptable[1,2] adverse impacts to biological conditions off site?	**D.** No significant decrease in off-site biological conditions due to use of site, either from - indirect effects (no off-site disposal), or - direct effects (off-site disposal)	Indirect impacts: SPI/PV qualitative assessment	Review SPI/PV parameters including successional stage, apparent redox potential discontinuity, and others	Nearby off-site benthic community shows expected levels of habitat quality
		Direct impacts (Tiered) 1. Sediment chemistry/bioassays 2. Laboratory bioaccumulation tests	If Goal A not achieved: 1. Run chemistry analyses and tiered bioassays on individual grab sample(s) collected from any off-site DM 2. Include off-site DM grab sample(s) in Disposal Site DU composite for BCOC sediment analysis and bioaccumulation testing	1. All sediment COCs and bioassay responses ≤ SMS SCO 2. All BCOCs from Disposal Site DU-exposed tissues are ≤ the highest of: • Risk-based values (including relevant TTLs) • Natural background[5] • PQLs if available

Table 2: Follow-up Actions and Management Options

Question	Issue Found	Evaluations Needed	Potential Evaluation Actions	Management Options
1. Does the deposited dredged material stay on site?	**A.** DM found ≥10 cm at or beyond site boundary or ≥3 cm at or beyond site perimeter	• Verify extent: - Where did off-site material end up? • Consider cause(s): - Disposal operations? - Currents, tides, or other localized phenomena? • Confirm no off-site adverse impacts (Question 3)	• Floating stations added to SPI/PV study to determine extent of off-site DM • Chemistry (DMMP COC list) and tiered bioassay analysis of individual grab sample(s) collected from off-site DM • Off-site DM grab sample(s) included in Disposal Site DU composite for BCOC sediment analysis and bioaccumulation testing • Collect additional sample(s) in off-site DM • Use sediment from natural background[5] DU for laboratory bioaccumulation tests and tissue comparisons	**Prevention of off-site DM:** Prevent future occurrences using disposal management tools, e.g.: • Disposal target modification • Timing modifications (e.g. tidal stages) • Vessel approach/direction modification **Prevention of adverse biological effects:** Prevent future occurrences by modifying project evaluation guidelines, e.g.: • Additions/modifications to COC list • Adjust SLs/BTs • Special studies **Mitigation/Remediation** Mitigate/remediate unacceptable adverse effects on site or off site, e.g.: • Cover with suitable material • Monitor for natural recovery • In-situ remediation • Temporary site closure
2. Does deposited dredged material cause unacceptable[1,2] adverse impacts to biological conditions on site?	**B.** Disposal site sample(s) exceed SL and fail bioassays, thus indicating potential adverse effects on benthic biological resources as defined by SCII	• Verify extent: - Single sample, or more? - Benthic and/or bioaccumulation failure? • Consider cause(s): - Evidence of recent DM? - Potential sources? - Regional conditions? • Verify impact (per SMS and relevant Site Conditions) • Determine severity of adverse effect	• Case by case: additional data collection or analyses may be needed	
	C. BCOCs in Disposal Site DU sediments or tissues exceed SCII or SMS			
3. Does use of the disposal site cause unacceptable[1,2] adverse impacts to biological conditions off site?	**D.** Significant decrease in off-site biological conditions due to use of site, either from - indirect effects (no off-site disposal), or - direct effects (off-site disposal)			

Notes

[1] per Washington State Sediment Management Standards (SMS)

[2] per Site Condition II, based on the Clean Water Act, 404(b)1

[3] If goal not fully achieved, go to Follow-up Actions and Management Options (Part 2)

[4] At least one round of laboratory bioaccumulation tests will be conducted at each disposal site before Tier 1 analyses will be considered sufficient for evaluating on-site bioaccumulation risk

[5] In some instances, the Environs will be used as natural background.

Acronyms

BCOC	Bioaccumulative Chemical of Concern
BT	Bioaccumulation Trigger
COC	Chemical of Concern
CSL	Cleanup Screening Level (per SMS)
DM	Dredged Material
DU	Decision Unit
EIS	Environmental Impact Statement
PQL	Practical Quantitation Limit
SCII	Site Condition II (per CWA)
SCO	Sediment Cleanup Objective (per SMS)
SL	Screening Level
SMS	Sediment Management Standards
SPI/PV	Sediment Profile Imaging and Plan View
TTL	Target Tissue Level

Table 3. Sediment CSL Risk (lowest of)	Risk INPUT		
BCoC	Benthic CSL	Eco risk	Human risk
Arsenic	93	--	No established SLs for protection of human health
Lead	390	--	
Mercury	0.59	--	
Selenium	--	3	
Tributyltin	--	73	
Fluoranthene	2500	--	
Pyrene	3300	--	
Chlordane	--	--	
Total DDT	--	--	
Hexachlorobenzene	70	--	
Pentachlorophenol	690	--	
Total PCBs (ug/kg)	1000	--	
Dioxins/Furans (pptr TEQ)	--	--	
PCB-TEQ	--	--	
cPAH (ppb BaP TEQ)	--	--	

Table 4. Sediment CSL Background (highest of)	BACKGROUND INPUT		
BCoC	Natural	PG Regional	Environs
Arsenic	11	12	8
Lead	21	--	12.7
Mercury	0.2	0.14	0.092
Selenium	--	--	1.37
Tributyltin	--	--	0.55
Fluoranthene	--	--	22.4
Pyrene	--	--	22.9
Chlordane	--	--	1U
Total DDT	--	--	1U
Hexachlorobenzene	--	--	19.9U
Pentachlorophenol	--	--	99.3U
Total PCBs (ug/kg)	3.5 ppb	--	5.1
Dioxins/Furans (pptr TEQ)	4	4	2.9
PCB-TEQ	0.2 pptr	0.38	0.12
cPAH (ppb BaP TEQ)	21	56	18

Table 5. Sediment CSL Selection	(Highest of)			Sample
BCoC	Risk INPUT	Sediment PQL	Background	On site*
Arsenic	93	0.3	12	9
Lead	390	0.1	21	11.7
Mercury	0.59	0.02	0.2	0.103
Selenium	3	--	1.37	1.37
Tributyltin	73	--	0.55	1.36
Fluoranthene	2500	--	22.4	37.7
Pyrene	3300	--	22.9	45.8
Chlordane	--	--	1U	0.5U
Total DDT	--	--	1U	1U
Hexachlorobenzene	70	--	19.9U	19.9U
Pentachlorophenol	690	--	99.3U	99.4U
Total PCBs (ug/kg)	1000	--	5.1	5.3
Dioxins/Furans (pptr TEQ)	--	5	4	2.9
PCB-TEQ	--	0.7	0.38	0.09
cPAH (ppb BaP TEQ)	--	9	56	27
*Only On site sample is shown. All 5 benthic grab samples are also below CSL. See data report tables for complete sample results.				

Table 6: Target Tissue Levels

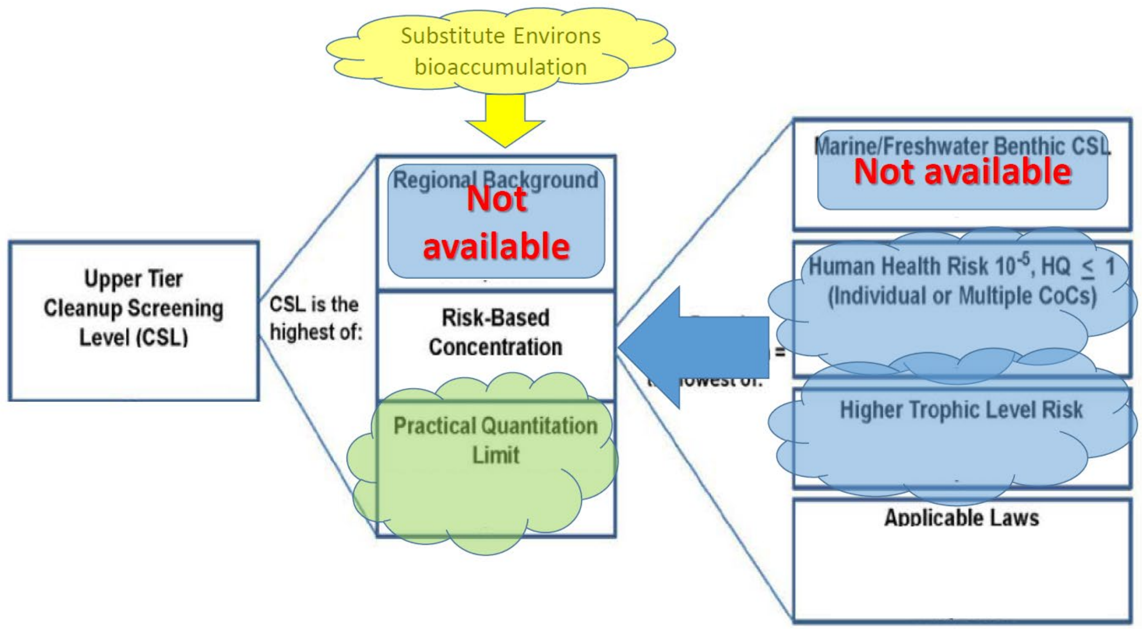

Table 7. TTL Risk input (lowest of)	RISK-BASED TARGET TISSUE LEVELS (TTLs)			
	DMMP TTL	SEF	SEF	SCUM
BCoC	Table 10-6	Table 8-5[1]	Table 8-6[2]	Table 9-5
Arsenic (mg/kg)	10.1	--	53	0.0001
Lead (mg/kg)	--		39	
Mercury (mg/kg)	1	0.11	0.12	0.015
Selenium (mg/kg)	--	7.9/1.6[3]	6.9	--
Tributyltin (ug/kg)	600	190	42000	46
Fluoranthene (ug/kg)	8400000	--	36000	--
Pyrene (ug/kg)	--	--	36000	--
Chlordane (ug/kg)	300	--	5100	
Total DDT (ug/kg)	5000	90	50	0.45
Hexachlorobenzene (ug/kg)	180000	--	--	--
Pentachlorophenol (ug/kg)	900000	1	160000	--
Total PCBs (ug/kg)	750	--	180	--
Dioxins/Furans (TEQ) (ng/kg)	--	--	26	0.0012
PCB-TEQ (ng/kg)	--	--	26	0.0012
cPAH (BaP TEQ) (ug/kg)	--	--	--	0.059

Notes:

[1]Species Sensitivity Distribution (SSD) values were used when available

[2]Population-level protection values used when available

[3]7.9 ppm is a dry wt value. Assuming 20% solids = 1.6 ppm wet

Table 8. *Macoma* TTL Selection (highest of)	TISSUE: MACOMA				
	RISK INPUT		PQL INPUT	BACKGROUND INPUT	
BCoC	risk TTL	source	Tissue PQL	Natural/Regional	Environs:Macoma
Arsenic (mg/kg)	0.0001	SCUM	0.5	No ECY tissue background values NOTE: if developed would be upper UTL on upper percentile	3.8
Lead (mg/kg)	39	SEF 8-6	0.08		0.19
Mercury (mg/kg)	0.015	SCUM	0.01		0.01
Selenium (mg/kg)	1.6	SEF 8-5	--		0.28
Tributyltin (ug/kg)	46	SCUM	--		3.9 U
Fluoranthene (ug/kg)	36000	SEF 8-6	--		8.1
Pyrene (ug/kg)	36000	SEF 8-6	--		8.8
Chlordane (ug/kg)	300	DMMP 10-6	--		1 U
Total DDT (ug/kg)	0.45	SCUM	--		1U
Hexachlorobenzene (ug/kg)	180000	DMMP 10-6	--		20U
Pentachlorophenol (ug/kg)	1	SEF 8-5	--		100U
Total PCBs (ug/kg)	180	SEF 8-6	--		2.9
Dioxins/Furans (TEQ) (ng/kg)	0.0012	SCUM	1		0.11
PCB-TEQ (ng/kg)	0.0012	SCUM	1		0.12
cPAH (BaP TEQ) (ug/kg)	0.059	SCUM	10		8

Table 9. TTL Compliance Evaluation (*Macoma)*		
BCoC	Selected TTL	Onsite Macoma
Arsenic (mg/kg)	3.8	**4.1***
Lead (mg/kg)	39	0.20
Mercury (mg/kg)	0.015	0.01
Selenium (mg/kg)	1.6	0.28
Tributyltin (ug/kg)	46	3.9 U
Fluoranthene (ug/kg)	36000	7.62
Pyrene (ug/kg)	36000	10.24
Chlordane (ug/kg)	300	1 U
Total DDT (ug/kg)	1U	1U
Hexachlorobenzene (ug/kg)	1800000	20U
Pentachlorophenol (ug/kg)	100U	100U
Total PCBs (ug/kg)	180	4.4
Dioxins/Furans (TEQ) (ng/kg)	1	0.12
PCB-TEQ (ng/kg)	1	0.16
cPAH (BaP TEQ) (ug/kg)	10	8

*not statisticallly different

Table 10. TTL Compliance Evaluation (*Alitta)*		
BCoC	Selected TTL	Onsite Alitta
Arsenic (mg/kg)	2.2	2.2
Lead (mg/kg)	39	0.07
Mercury (mg/kg)	0.11	0.03
Selenium (mg/kg)	1.6	0.24
Tributyltin (ug/kg)	46	3.9 U
Fluoranthene (ug/kg)	36000	20U
Pyrene (ug/kg)	36000	20U
Chlordane (ug/kg)	300	1 U
Total DDT (ug/kg)	1U	1U
Hexachlorobenzene (ug/kg)	1800000	20U
Pentachlorophenol (ug/kg)	100U	100U
Total PCBs (ug/kg)	180	11.1
Dioxins/Furans (TEQ) (ng/kg)	1	0.32
PCB-TEQ (ng/kg)	1	0.28
cPAH (BaP TEQ) (ug/kg)	10	**40U***

*cPAHs are not on the BCOC list; no exposure pathway to humans

1.0 INTRODUCTION

The Dredged Material Management Program (DMMP) is comprised of four federal and state agencies that cooperatively manage dredged material testing and disposal in Washington State: the U.S. Army Corps of Engineers (USACE), U.S. Environmental Protection Agency (USEPA), Washington Department of Ecology (Ecology), and Washington Department of Natural Resources (DNR). The DMMP manages eight open-water dredged material disposal sites in Puget Sound, including five non-dispersive and three dispersive sites. Over the last few years, the DMMP has conducted a series of public meetings and workshops to explore revising the monitoring program for non-dispersive dredged material disposal sites. The proposed revisions to the monitoring framework will:

- Incorporate lessons learned and information gained over 30 years of monitoring of the disposal sites,
- Update the monitoring program based on new technologies and approaches, and
- Comply with federal and state regulations, particularly the 2013 update of Part V of the Washington State Sediment Management Standards (SMS).

The DMMP prepared a Conceptual Sampling and Analysis Plan for Non-Dispersive Dredged Material Disposal Sites in Puget Sound (CSAP) that describes the proposed revisions for verifying predictions at DMMP sites following dredged material disposal (DMMP 2020). Bioaccumulation monitoring at the dredged material disposal sites was a focus of the revisions incorporated into the CSAP.

This report presents the results of the 2020 pilot monitoring study conducted at the Port Gardner non-dispersive dredged material disposal site in Everett, Washington, which incorporated the updated monitoring elements and revised framework of the CSAP. Monitoring was conducted at Port Gardner because the 500,000 cubic yard (cy) monitoring trigger was reached (Table 1).

Sediment sampling and analysis procedures for the pilot monitoring study followed the Sampling and Analysis Plan, 2020 Pilot Study, DMMP Monitoring of the Port Gardner Non-Dispersive Unconfined Open-Water Dredged Material Disposal Site (Appendix A; NewFields 2020). As a special study to the pilot study, solid-phase microextraction (SPME) passive samplers were also utilized during the laboratory testing for bioaccumulation. The DNR, in coordination with the DMMP agencies, conducted the chemical and biological monitoring through a contract with NewFields, Edmonds, WA. The USACE is the lead agency for physical monitoring at DMMP sites and conducted the sediment profile imaging (SPI) and plan view survey under a separate contract with Integral and EcoAnalysts, Inc. (Integral & EcoAnalysts 2020).

An overview of the revised questions and hypotheses for the DMMP monitoring framework is presented in Section 2.0. A review of the overall sampling design incorporated in the Port Gardner pilot monitoring study is provided in Section 3.0 and a summary of sample collection activities and any modifications to the sampling plan are presented in Section 4.0. Section 5.0 presents the results of the SPI and plan view survey conducted by the USACE, the sediment chemistry analysis, and the bioaccumulation testing. The results for SPME passive samplers utilized during the laboratory testing for bioaccumulation are presented in Appendix B. A summary of the Port Gardner monitoring results within the context of the revised monitoring framework is presented in Section 6.0, and recommendations for additional/future refinements to the program are provided in Section 7.0. References are listed in Section 8.0.

2.0 DRAFT REVISED MONITORING FRAMEWORK

The draft revised questions and hypotheses of the DMMP monitoring framework are presented in Table 2[1]. The reader is referred to the CSAP (DMMP 2020), which provides the background for incorporating the revisions to the monitoring framework, the basis for the sampling design, and the sampling and analysis requirements. An overview of the questions and hypotheses for the monitoring framework is provided below.

2.1 Onsite Questions and Hypotheses

Question 1. *Does the deposited dredged material stay onsite?*
Hypothesis A. *Dredged material remains within the disposal site boundary.*

Hypothesis A is rejected if dredged material accumulation ≥3 cm is observed at or beyond the perimeter line OR if dredged material accumulation ≥10 cm is observed at or beyond the disposal site boundary. This hypothesis was previously addressed solely by determining whether there was more than 3 cm of dredged material beyond the "perimeter line," which is located one-eighth of a nautical mile beyond the disposal site boundary. However, the current approach has been updated to add a determination that is consistent with the 10-cm depth of the SMS biologically active zone for marine environments. The presence of dredged material is monitored using SPI.

Question 2. *Is benthic toxicity onsite consistent with DMMP Site Condition II?*
Hypothesis B. *Sediment toxicity onsite does not exceed Site Condition II benthic interpretive guidelines due to dredged material disposal.*

This question is addressed by collecting 5 discrete samples from a stratified random sampling grid within the Disposal Site decision unit (DU)[2]. Sediment chemistry is analyzed and compared to DMMP screening level (SL) interpretive guidelines. If DMMP SL chemistry guidelines are exceeded, bioassay tests are conducted and interpreted according to the DMMP one-hit and two-hit rules (DMMP 2018). The Site Condition II is more protective than the SMS cleanup screening level (CSL) and represents the goal for onsite conditions. This evaluation ensures that the CSL is also met.

Question 3. *Is bioaccumulation onsite consistent with Site Condition II and compliant with SMS CSL?*
Hypothesis C. *Bioaccumulation onsite does not exceed SMS CSL bioaccumulation interpretive criteria due to dredged material disposal.*

This question is addressed by collecting 20 subsamples from a stratified random sampling grid within the Disposal Site DU and compositing them for sediment chemistry analysis and bioaccumulation testing. In

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[1]This data report addresses the questions and hypotheses as defined in the February 2020 CSAP. As the monitoring framework has evolved since that time, the Foreword provides an additional data evaluation based on the most up-to-date version of the framework .

[2] Decision units (DUs) include an onsite Disposal Site DU, an offsite Environs DU, and if needed, a Carr Inlet DU to represent natural background. The approach for developing station sampling grids within the DUs is described in Section 3.2.

addition, 20 subsamples are collected from the Environs DU and composited for sediment chemistry analysis and bioaccumulation testing.

Site Condition II is not well defined with respect to bioaccumulation and for now is evaluated using SMS CSL criteria. Tissue chemistry from the Disposal Site DU sample is compared to the highest of the Environs DU tissue data, risk-based values such as target tissue levels (TTLs), and practical quantitation limits[3] (PQLs). See additional evaluation of this analysis in the Foreword.

2.2 Offsite Question and Hypotheses

Question 4. *Are unacceptable adverse effects due to dredged material disposal occurring to biological resources offsite?*
Hypothesis D. *There is no significant decrease in benthic habitat quality offsite due to dredged material disposal.*

SPI and plan view images are collected both onsite and offsite to evaluate Hypothesis D. Quantitative and qualitative information from the images are interpreted and reported to evaluate this hypothesis. The key chemical and biological parameters determined from SPI images to assess benthic habitat quality include the apparent redox potential discontinuity (aRPD), infaunal successional stage, presence of methane gas or reduced sediment, and presence and characteristics of biological structures.

Hypothesis E. *Sediment toxicity in offsite dredged material does not exceed the SMS sediment quality standards (SQS) due to dredged material disposal.*
Hypothesis F. *Bioaccumulation from offsite dredged material does not exceed the SMS SQS due to dredged material disposal.*

If ≥10 cm of dredged material at any single location is **not** present at or beyond the disposal site boundary, Hypotheses E and F are considered met. However, if ≥10 cm of dredged material is observed at or beyond the disposal site boundary, the Disposal Site DU is expanded to incorporate the offsite area with ≥10 cm of dredged material. At least one of the 5 discrete samples described for Question 2 is placed in an offsite area with ≥10 cm of dredged material to evaluate Hypothesis E. To evaluate Hypothesis F, 20 subsamples are also collected from a natural background/reference area (e.g. Carr Inlet) and composited for sediment chemistry analysis and bioaccumulation testing.

For benthic toxicity assessment, sediment chemistry results from one or more discrete samples collected in offsite areas of the expanded Disposal Site DU are compared to the SMS SQS criteria. If SQS chemical criteria are exceeded, bioassay tests are conducted on these samples and interpreted according to the biological SQS criteria. For compliance purposes, the results of this comparison are applicable only to the dredged material outside the disposal site boundary. The DMMP applies best professional judgment to interpret the results and may carry out further sampling of offsite areas if the SQS is exceeded.

For bioaccumulation assessment, sediment and tissue chemistry within the expanded Disposal Site DU are compared to the highest of natural background, risk-based values such as TTLs, and PQLs. For

[3] The PQL is the lowest concentration of an analyte that can be reliably measured within specified limits of precision and accuracy under routine laboratory operating conditions. Concentrations above the PQL can be measured with a high degree of confidence, while concentrations below the PQL are typically considered estimates.

compliance purposes, the results of this comparison are applicable only to the dredged material outside the disposal site boundary, although subsamples for the composite will be collected from both onsite and offsite locations. The DMMP applies best professional judgment to interpret the results in the context of regional information if the SQS is exceeded.

3.0 PORT GARDNER SAMPLING DESIGN

3.1 Physical Monitoring

A SPI and plan view survey of the Port Gardner disposal site was conducted separately from chemical and biological monitoring under the direction of the USACE. The survey provided the locations and depths of recent dredged material accumulations and verified whether the dredged material had remained onsite or extended beyond the disposal site perimeter (Appendix C, Integral & EcoAnalysts 2020). Contours of 3 cm and 10 cm for recent dredged material accumulation were determined. This information was used to inform the sediment sampling design for chemical and biological monitoring at the Port Gardner disposal site in accordance with the CSAP (DMMP 2020). The sampling report for the Port Gardner SPI and plan view survey is provided in Appendix C.

3.2 Chemical and Biological Monitoring

3.2.1 Sediment Sampling Design

The sediment sampling design for the Port Gardner pilot monitoring study was based on the development of a sampling station grid within each decision unit (DU) (DMMP 2020). DUs included an onsite Disposal Site DU, an offsite Environs DU, and if needed, a Carr Inlet DU to represent natural background.

The boundary of the Port Gardner Disposal Site DU is the same as the boundary of the disposal site (Figure 1). The boundary of the Environs DU was determined based on bathymetry and grain size at the site prior to disposal of dredged material and site-specific physical constraints in Port Gardner as follows:

- The outer boundary of the Environs DU to the west and south was established at 15 meters (50 feet) deeper than the deepest point of the original disposal site boundary (432 ft + 50 ft).
- The outer boundary of the Environs DU to the east and north was established at 15 meters (50 feet) shallower than the shallowest point of the original disposal site boundary (402 ft – 50 ft).
- Areas with less than 50 percent fines were removed, because of potential influence of the Snohomish River delta, Hat Island, and other sources of sand that are not representative of the sediment present at the deep-water disposal sites.
- The inner boundary of the Environs DU corresponded to a 46-meter (150-foot) buffer[4] around the measured cumulative footprint of trace dredged material to avoid potential dredged material influence on sampling stations within the Environs DU.

The station sampling grid for the Disposal Site DU does not require sample independence and utilized a grid spacing of 125 meters (Figure 2). The station sampling grid for the Environs DU was designed to allow for sample independence and utilized a grid spacing of 500 meters (Figure 3). The Port Gardner Disposal Site sampling stations were identified with "PGD" followed by a unique number. Similarly, the Environs sampling stations were identified with a "PGE" followed by a unique number.

[4] In a water depth of 420 feet (average water depth of the disposal site), a 20-degree Van Veen sediment sampler wire angle would result in a radius of 150 feet off the vertical line to the mudline. The 150-foot buffer minimizes the potential influence of dredged material on the Environs DU.

The Port Gardner SPI and plan view survey conducted June 20 through 22, 2020, determined that recently deposited dredged material observed at the Port Gardner disposal site remained within the site boundary (i.e., dredged material accumulation beyond the site boundary did not equal or exceed either 3 cm or 10 cm at any location – Figures 4 and 5) (Integral & EcoAnalysts 2020). The evaluation of results for Hypothesis A is presented in Section 5.1. Therefore, the boundary of the Disposal Site DU remained the same as the boundary of the Port Gardner disposal site. Sampling of a Carr Inlet DU for natural background conditions was not needed to address Hypothesis F (i.e. natural background was not needed for comparison of sediment and tissue chemistry to an expanded Disposal Site DU).

3.2.2 Sampling Station Selection

Stations determined for sediment sampling in the Disposal Site and Environs DUs (20 each) were randomly selected from the station grids using the ArcGIS Geostatistical Analyst tool "Create Spatially Balanced Points" to select spatially balanced sampling locations. This software is based on the algorithm proposed by Theobald et al. (2007) and methodology developed by Stevens and Olsen (2004). Briefly, the method is based on the following:

- The Reverse Randomized Quadrant-Recursive Raster (RRQRR) algorithm is used to map 2D space into a 1D space in which successive samples constitute a spatially balanced sampling design.
- Unequal inclusion probabilities are used to handle variations in sampling intensity. Inclusion probabilities are relative values (between 0 and 1, inclusive), which specify the probability that a location (raster cell) will be selected relative to other locations.

The randomly selected sediment sampling locations in the Disposal Site and Environs DUs are displayed in Figures 4 and 5. Recently deposited dredged material observed at the Port Gardner disposal site through physical monitoring remained within the site boundary. Therefore, the Disposal Site DU did not require expansion to incorporate an offsite area. Five sampling stations were randomly selected from the existing grid of 20 Disposal Site DU sampling stations for benthic toxicity testing (PGD-16, PGD-32, PGD-38, PGD-66, PGD-84) (see Figure 5).

Sediments were collected from each station following procedures and methods described in Section 4.0.

4.0 METHODS

This section provides a summary of the data collection, sampling, and analysis methods for the 2020 pilot monitoring study of the Port Gardner DMMP disposal site. All sediment sampling activities for chemical and biological monitoring were conducted from July 13 through 15, 2020, aboard the research vessel (R/V) *Kittiwake* owned and operated by the University of Washington Friday Harbor Labs. The detailed sampling and analysis methods are provided in the Sampling and Analysis Plan (SAP) (Appendix A). Deviation encountered during the sediment sampling and analysis program or plan modifications are described in Section 4.7.

Physical monitoring (SPI survey) of the Port Gardner site was conducted by the USACE June 20 through 23, 2020 (Integral & EcoAnalysts 2020). The survey methods are discussed in the SPI survey report, which is included as Appendix C.

4.1 Navigation and Positioning

A differential Global Positioning System (DGPS) was used for positioning and navigation during the 2020 sediment sampling program. The DGPS used U.S. Coast Guard differential beacons, which provided an accuracy of ±2 meters. All samples were collected within 15 meters (50 feet) of the target locations, except for PGD-47 where coarse-grained sediments were present at the target location and an undisturbed grab sample could not be collected. In coordination with the DMMP representative, a sample was successfully collected 30 meters east of the original target location for PGD-47. The geographic coordinates for the collected sediment grab samples are provided in Table 3.

4.2 Sediment Sample Collection

Sediment grab samples were collected using a 0.2-m^2 stainless steel double Van Veen grab sampler. Sediment sample handling, subsampling, judgment of sample acceptability, gear and utensil decontamination, compositing, storage, and chain-of-custody procedures followed the SAP (Appendix A). Sample descriptions for each grab sample are summarized in Section 5.2 and detailed in the Sample Log (Appendix D). Selected photos of field activities are also provided in Appendix D.

4.2.1 Sampling for Benthic Toxicity Testing

Sediment samples for benthic toxicity analysis were collected from five locations within the Disposal Site DU. Each sample was a composite of equal volumes of sediment collected from three individual grab sampler deployments at each location. Sediment was collected from the top 10 cm of each grab. Once sediment from all three grabs was collected, the sediment was mixed until homogeneous in color and texture and placed into appropriate pre-cleaned containers provided by the analytical laboratories. All sample containers were stored in coolers at 4±2 degrees Celsius (ºC) in darkness until delivery to the analytical laboratories (Analytical Resources, Inc. [ARI], Tukwila, WA; SGS-Axys, Sidney, B.C., Canada) except where noted in Section 4.7.

Sediment for potential DMMP bioassay testing was placed in a labeled polyethylene bag and sealed with no headspace with a zip tie and sample tag. The bioassay samples were archived at the bioaccumulation testing laboratory (EcoAnalysts, Port Gamble, WA) at 4±2 °C, pending receipt of chemistry results under the tiered testing approach. A summary of benthic toxicity sediment samples and required analyses is provided in Table 4.

4.2.2 Sampling for Bioaccumulation

Sample collection and compositing for bioaccumulation testing of the Disposal Site DU and Environs DU followed an incremental approach in which an equal volume of sediment (5 liters) was collected from each of the 20 subsample locations within a DU and then combined into one composite sample for that DU. This method of compositing was used so that each point sample was equally represented within the DU composite and provided a concentration that represented the mean of the area sampled. The sediment sample collection resulted in a composite sample volume of approximately 100 liters, which exceeded the minimum sediment volume (73 liters) needed for bioaccumulation and chemical analyses.

Samples were collected by taking a single grab sample at each station for bioaccumulation testing composites. Sediment from the top 10 cm of each grab was collected in a two-gallon bucket lined with a labeled polyethylene bag. A line was marked on the bucket to indicate a fill volume of 5 liters. Only those sediments not in direct contact with the sampler walls were collected. Once the necessary volume of sediment was collected, the labeled polyethylene bag was sealed with no headspace with a zip tie and sample tag. Each subsample was stored in a cooler on ice until transport to the bioaccumulation testing laboratory for composite preparation.

Sample compositing was conducted at the bioaccumulation testing laboratory, rather than on the sampling vessel, due to the large volumes of sediment required for each DU composite sample. Two cement mixers coated with a fish-safe epoxy were used for compositing each sample (see Appendix D). The following steps were followed:

- The sediment from each sample bag for a composite sample was opened, homogenized, and half of the sediment volume was placed in each cement mixer.
- Once all the samples for the composite was added, the sediment was turned in the cement mixers for a minimum of 15 minutes until the sediment was fully homogenized to a consistent color and texture. The sediment was fined-grained with approximately 50 percent moisture and mixed easily in the cement mixers.
- Once the composite sample was homogeneous, the sediment was transferred to large polyethylene bags for storage (4±2 ºC) until the bioaccumulation testing was initiated. Each polyethylene bag was filled with approximately equal volumes of sediment from each cement mixer, composited, then sealed with no headspace with a zip tie and label.
- An aliquot sample was removed from each composite for chemistry analyses. The sediment was placed in appropriate pre-cleaned containers and stored in coolers at 4±2 ºC in darkness until delivery to the analytical laboratories. A summary of the bioaccumulation sediment samples and required analyses is included in Table 4.

4.3 Bioaccumulation Testing

Bioaccumulation testing was conducted following DMMP guidance (DMMP 2018) with modifications as described in the SAP (Appendix A). Testing was conducted using the adult bivalve (*Macoma nasuta*) and adult polychaete (*Alitta virens*) using separate exposure tanks for a 45-day period. The start of the *A. virens* bioaccumulation testing was delayed relative to the *M. nasuta* testing to allow for preparation of the SPME fibers, which were included in the *A. virens* exposure (see Sections 4.4 and 4.7).

Five replicates for each species (approximately 64 grams/species/replicate) were generated for each DU. Approximately 64 grams/species/replicate was needed for the required tissue chemical analyses. A list of tissue samples and analytical parameters is provided in Table 5.

The bioaccumulation test chambers were maintained under flow-through conditions and daily water quality measurements were taken on each chamber. The test chambers were checked daily for the presence of dead organisms. Mortality observed during the testing was less than 10% for both species and testing was completed for the full 45-day period for all samples. On the 45th day of each test, the sediment was sieved to remove the worms or clams. The surviving animals were placed in clean flow-through aquaria to purge their gut contents for 24 hours after which the tissues for each replicate (shucked clams or whole worms) were placed into certified-clean glass sample jars, frozen, and sent to ARI for compositing and tissue analysis.

At ARI, the tissues for each replicate were homogenized and subsamples were prepared for submittal to SGS-Axys for the analysis of dioxins/furans and PCB congeners. The frozen samples were sent by overnight courier to SGS-Axys. The remaining tissues were analyzed by ARI for the parameters listed in Table 5.

4.4 SPME Passive Sampler Testing and Analysis

SPME passive samplers were included for exposure during the 45-day bioaccumulation testing. The passive samplers were prepared by SGS-Axys and consisted of 5-cm long fibers protected in stainless steel mesh holders. The SPME fibers were spiked with performance reference compounds (PRC) to allow for evaluation of uptake kinetics. PRC concentrations were selected based on site concentrations for polychlorinated biphenyl (PCB) congeners and dioxins/furans measured at the Port Gardner site in 2010 (SAIC 2010).

The SPME passive samplers were placed horizontally within the sediment at a depth of 2-3 cm in the adult polychaete (*A. virens*) exposure tanks. The devices were included in three of the five replicates for both the Disposal Site and Environs DUs, resulting in a total of six project samples (triplicate results for each sampling location, Table 6). To maintain consistent physical conditions in each *A. virens* exposure tank, empty mesh holders were placed in the two exposure tanks with no SPME samplers. The SPME passive samplers included a trip/field blank and a zero blank (retained at the analytical laboratory) for a total of eight samples.

Upon retrieval, each SPME sampler was removed from the sediment, wiped with a tissue paper (damp with distilled water), wrapped in foil, and sealed in polyethylene bags. The SPME samplers were first sent to ARI in a cooler at 4±2 ºC. The samplers were then shipped priority overnight to SGS-Axys at the same time as the bioaccumulation tissue subsamples. The SPME fibers were analyzed for dioxins/furans and PCB congeners following analytical procedures described in the SAP. The analyses were run as co-extractions from a common SPME fiber.

4.5 Sediment Chemical Analytical Methods

Chemical analytical procedures used in this program followed the SAP (Appendix A) and were performed in accordance with PSEP guidelines (PSEP 1997a,b,c,d) with applicable DMMP updates (DMMP 2018). The five benthic toxicity sediment composite samples were analyzed for the DMMP conventional parameters and chemicals of concern (COCs). The Disposal Site DU and Environs DU composite samples required analysis of all List 1 bioaccumulative chemicals of concern (BCOCs), which include tributyltin, PCB congeners, polycyclic aromatic hydrocarbons (PAHs), hexachlorobenzene, pentachlorophenol, pesticides, and dioxins/furans. Analysis of polybrominated diphenyl ethers (PBDEs) was also required for the DU composite samples in response to National Marine Fisheries Service's essential fish habitat conservation recommendations for the continued use of DMMP disposal sites in Puget Sound (USACE 2016).

The laboratories performed all method-required QC procedures specified in the SAP. The Puget Sound Sediment Reference Material (PS-SRM) was analyzed with the PCBs and dioxins/furans and results are provided in Section 5.2.3.

4.6 Tissue Analyses

Tissues generated from the 45-day bioaccumulation testing included the adult bivalve (*M. nasuta*) and adult polychaete (*A. virens*). Tissue samples for each replicate were homogenized by NewFields personnel at ARI's laboratory facility following ARI's standard operating procedures. ARI analyzed the tissues for total solids, total lipid content, the majority of the DMMP List 1 BCOCs (metals, semi-volatiles, pesticides, and tributyltin), and the full list of PAHs. SGS-Axys analyzed the remaining DMMP List 1 BCOCs (dioxins/furans and PCB congeners). Analytical methods followed the SAP and were the same as those described for sediments.

4.7 SAP Deviations or Modifications

On July 20, 2020, the PGD-DU and PGE-DU sediment samples for the analysis of dioxins/furans, PCB congeners, and PBDEs were packed in a cooler on ice and shipped by FedEx priority overnight to SGS-Axys, Sidney, B.C. Due to customs delays, the samples were delivered in two days instead of overnight. SGS-Axys received the samples on the morning of July 22, 2020, and the receipt temperature was logged at 10.5 °C, which was above the compliance temperature of 4±2 ºC. The DMMP agencies were notified and approved proceeding with the analyses given the short amount of time the samples were above compliance temperature and the refractory nature of these compounds.

The start of the bioaccumulation testing using *A. virens* (September 4, 2021) versus *M. nasuta* (July 21, 2020) was delayed to allow completion of the SPME fiber preparations that were to be included with the *A. virens* testing (see Section 4.4). Both bioaccumulation tests were initiated within the 8-week holding time for the sediments. During the *A. virens* bioaccumulation testing, test chambers for sample PGD-DU were not augmented with sediment on Day 28 due to a perceived lack of sufficient material to complete all weekly additions. Sufficient sediment was subsequently located in the laboratory's cold storage, and the remaining weekly additions were performed on this sample through test completion. This deviation did not appear to affect the performance of the test.

SGS-Axys prepared the SPME passive samplers that were included with the 45-day bioaccumulation testing using *A. virens*. Due to the COVID-19 pandemic, SGS-Axys experienced a delay in obtaining the 575-micron Poly Micro SPME fibers that are normally used for sediment testing. A thinner diameter 170-micron Restek SPME fiber was evaluated as an alternative, but there were concerns with the PRC loading as the fibers tended to stick together while in the PRC solution. A supply of 575-micron Poly Micro SPME fibers was eventually located by SGS-Axys and were prepared for the Port Gardner pilot study. Due to sediment holding time constraints for the bioaccumulation testing sediments, the PRC loading for the Poly Micro SPME fibers was limited to 26 days instead of the recommended 28 days. This slightly shorter loading time did not appear to affect the performance of the SPME fibers.

For the 45-day bioaccumulation testing, three pre-test tissue replicate samples for each species (*M. nasuta* and *A. virens*) were planned for chemical analysis. However, the bioaccumulation testing laboratory could only provide enough pre-test tissues for one replicate sample for each species. The analytical laboratories were requested to conduct duplicate analysis of the pre-test tissue samples, if possible, but volume was only available for the duplicate analysis of PCB congeners and dioxins/furans. The parent sample for the *A. virens* pre-test tissue was possibily contaminated by a spiking solution for the dioxin/furan analysis. Therefore, the results of the duplicate were used in lieu of the parent sample (see Stage 4 data validation report – Appendix F).

5.0 RESULTS

This section presents a summary of results for the 2020 Port Gardner SPI and plan view survey conducted by the USACE, the results of the sediment chemistry analysis, bioaccumulation testing and tissue analyses, and SPME analysis conducted for the pilot monitoring study. A summary of the data within the context of the updated DMMP monitoring framework is provided in Section 6.0.

5.1 SPI and Plan View Imaging Survey

The purpose of the 2020 Port Gardner SPI and plan view survey was to provide physical monitoring information required by the DMMP agencies to evaluate the current conditions of the Port Gardner disposal site in accordance with the CSAP. The SPI images were the primary tool used to identify the locations and thickness of recent dredged material accumulations at the Port Gardner site to address ***Hypothesis A.*** *Dredged material remains within the disposal site boundary.* Mapped accumulations included 3 cm and 10 cm layers for determining the extent of recently disposed dredged material and whether the dredged material has remained onsite or extends beyond the disposal site boundary. In addition, the SPI and plan view imaging results were used to evaluate ***Hypothesis D[5].*** *There is no significant decrease in benthic habitat quality offsite due to dredged material disposal.*

SPI and plan view images from 50 stations were collected and analyzed as part of the 2020 monitoring effort (Figure 6). The full SPI and plan view imaging data report prepared by Integral & EcoAnalysts (2020) is provided in Appendix C and the results are summarized in the following sections.

5.1.1 Ambient Sediment Characteristics

Ambient sediments characteristics observed near the Port Gardner site in 2020 were like previous surveys (SAIC 2010) and generally consisted of fine-grained tan to gray homogenous unconsolidated silts and clays, with deep apparent redox potential discontinuity (aRPD) depths (Figure 7). The plan view images (see Appendix C) showed the presence of homogeneous surface sediments with numerous feeding voids and burrows, which suggested the presence of established, relatively undisturbed benthic communities (Integral & EcoAnalysts 2020).

5.1.2 Dredged Material Distribution

The mapped distribution of dredged material during the 2020 survey, including the dredged material thickness, is shown in Figure 8. Dredged material near the center of the site consisted of gray, fine to medium sands with scattered woody debris, pebbles, and shell particles (Figure 9). Recent dredged material was observed in the SPI images at 12 stations. Like the 2010 monitoring survey, the dredged material footprint was confined within the Port Gardner disposal site boundary. Some locations with recent dredged material showed evidence of benthic infauna (e.g., feeding tubes, burrows) (Integral & EcoAnalysts 2020). Historical dredged material[6] was observed in the SPI images at 12 stations located along the disposal site boundary line.

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[5] SPI was also added to Hypothesis B in the most recent revised framework. See Foreword.

[6] Dredged material was identified as historical when enough time has passed for a deep aRPD to be developed, feeding voids are present, and sedimentary layering due to dredged material disposal (if present) is not completely obscured through bioturbation (SAIC 2010).

5.1.3 Physical and Sedimentary Features

Information on sediment physical features from SPI images includes grain size major mode (in phi sizes), camera prism penetration depths, and bottom boundary roughness measurements.

The grain size major mode or modes determined from SPI images collected in Port Gardner are mapped in Figure 10. Several stations within the disposal zone exhibited distinct layering with silt (e.g., >4 phi) overlying coarse (1 - 0 phi), medium (2 - 1phi), fine (3 - 2 phi), or very fine (4 - 3 phi) sands. This textural heterogeneity reflected the presence of recently disposed dredged material (Figure 8). Station locations with historical dredged material generally had fine silt on top of very fine sands. Outside of the disposal zone, the sediment grain size predominantly consisted of silt and clay (>4 phi), reflecting the ambient bottom conditions in this area offshore of Port Gardner (Figures 7 and 11).

Station-averaged penetration depths of the SPI camera prism into the sediment (in centimeters) are presented in Figure 12. Penetration depths are a function of the bearing capacity and shear strength of the sediments and give an indication of the relative water content and consolidation of the sediment. Relatively low prism penetration was measured in the disposal zone (6.0 cm) at PGZ01 and PGZ06 (12.7 cm). This was due to the compact, coarse-grained dredged material underlying silt, (see images from these stations in Appendix C). Prism penetration was generally deep outside of the disposal zone, with a range of 11.1 to 20.0 cm, reflecting the less-consolidated, biogenically-reworked, fine grained ambient sediment (Integral & EcoAnalysts 2020).

Surface boundary roughness (Figure 13) was calculated as the vertical distance between the highest and lowest points of the sediment-water interface. The surface boundary roughness may be related to either physical structures (e.g., ripples, mud clasts) or biogenic features (e.g., burrow openings, fecal mounds, foraging depressions). The average boundary roughness measured per station across the site ranged from 0.53 to 5.8 cm. Most of the surface relief was identified as biogenic (97 percent of replicates) (Integral & EcoAnalysts 2020). The average boundary roughness at stations within the disposal site boundary were generally less than surrounding areas, which appears to be due to the paucity of large burrows. The higher boundary roughness values observed are typically due to large biogenic burrows, depressions, and mounds in fine-grained sediments (Integral & EcoAnalysts 2020).

5.1.4 Chemical and Biological Features

Chemical and biological parameters obtainable from SPI data provide an overall assessment of the health of the benthic habitat. The key parameters included the aRPD depth, evidence of organic loading, benthic infaunal successional stage, and biological structures. Features observed in the plan view images are also discussed below.

Apparent Redox Potential Discontinuity and Other Geochemical Features

The aRPD depth estimates the depth of oxygenation in the upper sediment column and provides an estimate of the biological mixing depth by infaunal organisms. It is a key SPI parameter for documenting changes (or gradients) that develop over time in response to benthic disturbance factors, such as sediment erosion or depositional events, demersal fish foraging, and temporal changes in environmental factors, such as water temperature and organic loading (Integral & EcoAnalysts 2020).

Mean aRPD depths at the Port Gardner site ranged from 2.4 to 6.3 cm and averaged 4.3 cm across the site (Figure 14). The mean aRPD depths from the 2010 survey ranged from 1.2 to 5.3 cm and averaged 3.2 cm across the site. Overall, near surface biogenic mixing levels across the survey area, as indicted by aRPD depths, were greater than found in the 2010 survey. This may reflect the fact that the 2010 survey was conducted in April (versus June in 2020) and closer to the cessation of dredged material disposal at the site, as well as conducted earlier in the season (biological activity may be greater in the summer than in the spring) (Integral & EcoAnalysts 2020).

There was no evidence of excess organic loading of high sediment oxygen demand in any of the SPI or plan view images. This conclusion was based on the absence of both sedimentary methane and thiophilic bacteria at all locations. Additionally, the thinnest aRPD measured across all replicates was 1.7 cm (Integral & EcoAnalysts 2020).

Successional Stage and Other Biological Features

Benthic infaunal communities generally follow a three-stage succession following a disturbance of the seafloor (Pearson and Rosenberg 1978, Rhoads and Germano 1986). Stage 1 infauna typically colonize the sediment surface soon after disturbance (e.g., following dredged material disposal). These opportunistic organisms may consist of small, tubicolous, surface-dwelling polychaetes. Stage 2 organisms are typically shallow-dwelling bivalves or tube-dwelling amphipods. Stage 2 communities are considered a transitional community before reaching Stage 3, the high-order successional stage consisting of long-lived, infaunal deposit-feeding organisms. Stage 3 invertebrates may feed at depth in a head-down orientation and create distinctive feeding voids visible in SPI images.

The highest-order benthic infaunal successional stages observed at each station in the 2020 survey are presented in Figure 15. Stage 3 or Stage 1 on 3[7] benthic communities were observed at all stations and in nearly all replicate images (Integral & EcoAnalysts 2020). All SPI images in Figures 7 and 9 were classified as Stage 1 on 3 based on the presence of subsurface feeding voids created by head down deposit-feeding polychaetes (Stage 3 organisms) and small, surface-dwelling tubiculous polychaetes evident at the sediment-water interface (Stage 1 organisms). Overall, recolonization and/or re-establishment of high-order successional infauna (i.e., larger subsurface deposit feeders, feeding voids, and relatively deep aRPDs) was widespread within the disposal zone, disposal site, and along the disposal area perimeter (Integral & EcoAnalysts 2020).

The plan view images provided evidence of epifaunal organisms at the Port Gardner site. Surface sediment and water-column dwelling fauna observed include shrimp, isopods, Dungeness crabs, and flat fish. Other evidence of the presence of both infauna and epifauna, such as tubes, tracks, and burrows, were also observed in plan view images (Integral & EcoAnalysts 2020). Figure 16 shows co-located SPI and plan view images displaying ambient, historical dredged material, and recent dredged material at Port Gardner. Figure 17 presents the distribution and count of large burrows as observed in the plan view images.

While the infaunal successional stage patterns did not indicate a difference between areas with recent dredged material and areas beyond the disposal mound footprint (see Figure 15), the burrow counts mapped in the Figure 17 pointed to a notable difference in the distribution/abundance of large burrowers (e.g., burrowing shrimp, *Molpadia* sea cucumber) on and off the disposal mound. Ten of the 12 stations located inside the 10 cm dredged material contour had four or fewer large burrows in the plan images (Figure 17). Three stations with no burrows observed were found in the disposal zone. All 26 stations sampled on or

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[7] Stage 1 can be associated with Stage 3 succession, as the opportunistic Stage 1 species are able to take advantage of available organic matter at the sediment-water interface in habitats where Stage 3 infauna are also present.

beyond the disposal site boundary have four or more large burrow opening, and 16 (50%) of those stations exhibit eight or more burrows (Integral & EcoAnalysts 2020).

5.2 Sediment Chemistry Results

This section provides a summary of the sediment chemistry results for the 2020 Port Gardner pilot monitoring study. Five sediment toxicity samples within the Disposal Site DU were analyzed for the DMMP conventionals and COCs to address ***Hypothesis B.*** *Sediment toxicity onsite does not exceed Site Condition II benthic interpretive guidelines due to dredged material disposal.* Composite sediment samples for the Disposal Site and Environs DUs were analyzed for the DMMP conventionals, COCs, List 1 BCOCs including PCB congeners, and PBDEs. The List 1 BCOC results supported the evaluation of ***Hypothesis C.*** *Bioaccumulation onsite does not exceed SMS CSL bioaccumulation interpretive criteria due to dredged material disposal*[8].

Table 7 presents the sediment chemistry results and provides a comparison to the DMMP sediment guidelines. The chemistry laboratory reports are provided in Appendix E. Independent data validation was conducted by Herrera Environmental Consultants, Inc. and EcoChem Inc., and demonstrated that the data were suitable for use (as qualified) in addressing the DMMP monitoring questions and hypotheses. Validation included U.S. EPA Stage 2B data validation for all DMMP chemical data, and Stage 4 validation of the dioxins/furans and PCB congener data (Appendix F). Environmental Information Management (EIM) electronic data files of the validated data are provided as Appendix G.

5.2.1 Sediment Toxicity Samples within the Disposal Site DU

Five sediment toxicity samples within the Disposal Site DU (PGD-16, PGD-32, PGD-38, PGD-66, PGD-84; see Figure 5) were analyzed for the DMMP conventionals and COCs. All detected and undetected COC concentrations for all samples were below DMMP SLs (Table 7). Therefore, bioassay testing was not required. A summary of the sediment chemistry results is provided below.

Conventional Parameters

Sediment conventional parameters for the five sediment toxicity samples were relatively similar but varied based on the location within the Disposal Site DU (Table 7). Samples PGD-16, PGD-38 and PGD-66 were located within the 10 cm contour of recent material within the disposal site and were coarser grained (average of 60% fines) than samples PGD-32 and PGD-84 located near the disposal site boundary (average of 72% fines). Samples PGD-16, PGD-38, and PGD-66 were also slightly higher in total organic carbon (TOC) (average of 2.3%), and total sulfides (average of 162 mg/kg) compared to the outer samples (TOC average of 1.4% and total sulfides average of 29 mg/kg). Dredged material is often characterized by higher concentrations of organic debris and total sulfides (see SPI image from onsite station GC03; Figure 16).

Metals

All DMMP metals were detected at low concentrations in the five sediment toxicity samples except for antimony, which was undetected (Table 7). All DMMP metals concentrations were below the DMMP SLs.

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[8] The CSL evaluations are included in the Foreword.

Tributyltin

Tributyltin was undetected in all five sediment toxicity samples and the reporting limits (RLs) were below the DMMP bioaccumulation trigger (BT).

DMMP Organic Compounds

Most of the low molecular weight polycyclic aromatic hydrocarbons (LPAH) and high molecular weight polycyclic aromatic hydrocarbons (HPAH) were detected at low or estimated concentrations in the five sediment toxicity samples (Table 7). The chlorinated hydrocarbons, phthalates, phenols, and miscellaneous extractables were undetected or detected at low concentrations well below the SLs. All DMMP pesticides were undetected. Total PCB Aroclors were detected at low concentrations well below the DMMP SL.

5.2.2 Composite Sediment Samples for the Disposal Site and Environs DUs

Composite sediment samples for the Disposal Site and Environs DUs (PGD-DU and PGE-DU, respectively) were analyzed for the DMMP conventionals, COCs, List 1 BCOCs including PCB congeners, and PBDEs. The DU sediment samples were analyzed in the same batch as the benthic toxicity samples. Therefore, in addition to the List 1 BCOCs, all SVOCs compounds were analyzed and reported. All COC concentrations were below DMMP SLs, and the List 1 BCOCs were below the BTs (Table 7).

Conventional Parameters

The conventional parameters measured in the DU composite sediment samples were comparable to the five onsite toxicity sediment samples and followed a similar trend. The Disposal Site DU sample (PGD-DU) was slightly more coarse-grained (67.1% fines) than the Environs DU sample (PGE-DU) (71.9% fines). PGD-DU was also higher in total sulfides (126 mg/kg) compared to PGE-DU (6.42 mg/kg).

Metals

All DMMP metals were detected at low concentrations in the DU composite sediment samples except for antimony, which was undetected (Table 7). All DMMP metals concentrations were below the DMMP SLs. Arsenic, lead, mercury, and selenium concentrations were also well below their respective DMMP BTs.

Tributyltin

Tributyltin was detected at estimated (J-qualified) concentrations in both DU composite samples, well below the DMMP BT.

DMMP Organic Compounds

Most of the LPAH and HPAH compounds were detected at low levels or undetected in the DU composite samples (Table 7). Chlorinated hydrocarbons, phthalates, phenols, and miscellaneous extractable compounds were mostly undetected or detected at low concentrations. Fluoranthene was measured at 37.7 µg/kg in sample PGD-DU and 22.4 µg/kg in sample PGE-DU, well below the DMMP BT of 4,600 µg/kg. Pyrene was measured at 45.8 µg/kg in sample PGD-DU and 21.9 µg/kg in sample PGE-DU, also well below the DMMP BT of 11,980 µg/kg. Hexachlorobenzene and pentachlorophenol were undetected, and the RLs were below the DMMP BTs.

All pesticides were undetected and the RLs for total 4,4'-DDX and total chlordane were below the DMMP BT. Total PCB Aroclors were detected and had organic carbon (OC) normalized concentrations of 0.81 mg/kg OC for PGD-DU and 0.74 mg/kg OC for PGE-DU, well below the DMMP BT of 38 mg/kg OC. The dry weight total PCB Aroclors was 12.2 µg/kg PGD-DU and 9.9 µg/kg for PGE-DU.

Dioxins/Furans

Dioxin/furan congener results for the DU composite sediment samples are reported in Table 7. The toxic equivalency (TEQs) for dioxins/furans were calculated both using zero for undetected congeners (ND = 0) as well as half of the estimated detection limit value for undetected congeners (ND=½DL) (Appendix H).

The total TEQ for sample PGD-DU was 2.81 ng/kg TEQ (ND=0) and 2.86 ng/kg TEQ (ND=½DL). The total TEQ for sample PGE-DU was 2.45 ng/kg TEQ (ND=0) and 2.88 ng/kg TEQ (ND=½DL). Both DU samples were below the DMMP disposal site management objective (DSMO) of 4 ng/kg TEQ and the DMMP BT of 10 ng/kg TEQ.

PCB Congeners

In addition to PCB Aroclors, the PCB congeners were analyzed in the DU composite sediment samples and reported in Table 7. The total PCBs (the sum of all measured PCB congener concentrations) were calculated both using zero for undetected congeners (ND=0) as well as half of the detection limit value for undetected congeners (ND=½DL) (Appendix H).

The total PCBs for sample PGD-DU was 5.27 µg/kg for both ND=0 and ND=½DL. The total PCBs for sample PGE-DU was 5.09 µg/kg (ND=0) and 5.10 µg/kg (ND=½DL). Like the PCB Aroclors, the OC-normalized concentrations of total PCBs were well below the DMMP BT of 38 mg/kg OC. The OC-normalized total PCBs for sample PGD-DU was 0.35 mg/kg OC (ND=0 and ND=½DL) and for sample PGE-DU was 0.38 mg/kg OC (ND=0 and ND=½DL).

PBDEs

The PBDE congeners were analyzed in the DU composite sediment samples per the National Marine Fisheries Service's essential fish habitat conservation recommendations. The PBDE results were similar in the DU composite sediment samples and are listed in Table 7. For the Disposal Site sample PGD-DU, 24 of the 40 individual or co-eluting pairs of PBDE congeners were detected. For the Environs sample PGE-DU, 26 of the 40 individual or co-eluting pairs of PBDE congeners were detected.

5.2.3 Puget Sound Sediment Reference Material

The PS-SRM was included in the analysis of the sediment samples. ARI analyzed the PCB Aroclors under sample delivery group (SDG) #20G0193, and SGS-Axys analyzed the dioxins/furans and PCB congeners under SDGs #DPWG73691 and #DPWG73668, respectively. The PS-SRM bottle/container numbers and analytical results are listed in Table 8. The PS-SRM analysis Form 1 from the laboratory reports and applicable data validation report sections are provided in Appendix I.

The PS-SRM guidance limits of 50%-150% were met except for the following five congeners:

- Dioxins/Furans – The recovery for 2,3,7,8-TCDF was greater than the upper control limit, and the recovery for 1,2,3,7,8,9-HxCDF was less than the lower control limit.

- PCB Congeners – The recoveries for PCB-146, PCB-159, and PCB-197/200 were less than the lower control limit.

5.3 Bioaccumulation Tissue Chemistry Results

Laboratory bioaccumulation testing was conducted on the PGD-DU and PGE-DU composite samples using the adult bivalve (*M. nasuta*) and adult polychaete (*A. virens*). Five replicate tissue samples for each species were generated for each DU. The tissue samples were analyzed for total solids, lipids, PAHs, and the List 1 BCOCs including PCB congeners. The List 1 BCOCs results were evaluated by comparison to the highest of risk-based values (DMMP TTLs), the Environs DU tissue data, and Ecology's programmatic tissue PQLs to address ***Hypothesis C.*** *Bioaccumulation onsite does not exceed SMS CSL bioaccumulation interpretive criteria due to dredged material disposal*[9].

The DMMP TTLs for chemicals of concern are listed in Table 9, the *M. nasuta* tissue chemistry results are provided in Table 10, and the *A. virens* tissue chemistry results are provided in Table 11. The bioaccumulation testing laboratory report, as well as the chemistry laboratory reports are provided in Appendix E. The data validation reports are provided in Appendix F, and the EIM electronic data files are included in Appendix G. Where needed, ProUCL was used to statistically compare the mean chemical concentrations for the five replicate tissue samples from the disposal site (PGD-DU) to the mean concentrations for the five replicate tissue samples from the environs (PGE-DU) using the one-tailed t-test (alpha level of 0.1) (Table 12). The ProUCL output files are provided in Appendix H.

5.3.1 Metals

Metals with TTLs include arsenic, mercury, and silver (Table 9). The DMMP may determine TTLs for lead and selenium on a project-specific basis (DMMP 2018).

Arsenic concentrations in the *M. nasuta* and *A. virens* tissues were below the TTL of 10.1 mg/kg ww. The pre-test *M. nasuta* tissue concentration for arsenic was 3.34 mg/kg ww, and a slight increase was measured after exposure to disposal site sediments (Figure 18). The average arsenic concentrations for *M. nasuta* tissue for PGD-DU was 4.08 mg/kg ww and for PGE-DU was 3.85 mg/kg ww. The pre-test *A. virens* tissue concentration for arsenic was 2.11 mg/kg ww, which was comparable to arsenic measured after exposure to sediments. The average arsenic concentrations for *A. virens* tissue for PGD-DU was 2.15 mg/kg ww and for PGE-DU was 2.17 mg/kg ww (Figure 18). There was no statistical difference between the disposal site (PGD-DU) and environs (PGE-DU) tissue concentrations for both *M. nasuta* and *A. virens* (Table 12).

Mercury concentrations in the *M. nasuta* and *A. virens* tissues were well below the TTL of 1.0 mg/kg ww. The pre-test *M. nasuta* tissue concentration for mercury was 0.00880 mg/kg ww, and a very slight increase was measured in *M. nasuta* tissues after exposure to disposal site sediments (Figure 19). The average mercury for *M. nasuta* tissue for PGD-DU was 0.0109 mg/kg ww and for PGE-DU was 0.00974 mg/kg ww. These concentrations were at Ecology's programmatic tissue PQL of 0.01 mg/kg ww (Ecology 2019). The difference in averages between the disposal site and environs tissues was statistically significant due to low variability (Table 12) but represented a very small difference in mercury concentration. The pre-test *A. virens* tissue concentration for mercury was 0.0252 mg/kg ww, which was comparable to mercury measured in *A. virens* tissues after exposure to disposal site sediments. The average mercury for *A. virens* tissue for

[9] The CSL evaluations are included in the Foreword.

PGD-DU was 0.0251 mg/kg ww. The average mercury for PGE-DU was slightly lower than the pre-test tissue at 0.0230 mg/kg ww (Figure 19). There was no statistical difference between the disposal site and environs tissue concentrations for *A. virens* (Table 12).

Silver concentrations in the *M. nasuta* and *A. virens* tissues were well below the TTL of 200 mg/kg ww, and below Ecology's programmatic tissue PQL of 0.06 mg/kg ww. The pre-test *M. nasuta* tissue concentration for silver was 0.0153 mg/kg ww, and a slight increase was measured in *M. nasuta* tissues after exposure to sediments (Figure 20). The average silver for *M. nasuta* tissue for PGD-DU was 0.0246 mg/kg ww and for PGE-DU was 0.0255 mg/kg ww. The pre-test *A. virens* tissue concentration for silver was 0.0137 mg/kg ww, and a very slight increase was measured after exposure to sediments (Figure 20). The average silver for *A. virens* tissue for PGD-DU was 0.0180 mg/kg ww and for PGE-DU was 0.0231 mg/kg ww. There was no statistical difference between the disposal site and environs tissue concentrations for both *M. nasuta* and *A. virens* (Table 12).

Project-specific TTLs were not established for lead and selenium tissue concentrations. Sediment concentrations for lead and selenium were low at the disposal site and environs, and below the DMMP BT guidelines (see Section 5.2.2) The increase of lead in *M. nasuta* and *A. virens* tissues followed a pattern like the other metals. The pre-test *M. nasuta* tissue concentration for lead was 0.0891 mg/kg ww, and an increase was measured after exposure to sediments. The average lead concentrations for *M. nasuta* tissue for PGD-DU was 0.200 mg/kg ww and for PGE-DU was 0.188 mg/kg ww. The pre-test *A. virens* tissue concentration for lead was 0.0674 mg/kg ww, which was similar to concentrations measured after exposure to sediments. The average lead concentrations for *A. virens* tissue for PGD-DU was 0.0726 mg/kg ww and for PGE-DU was 0.0763 mg/kg ww (Figure 21). These concentrations were very near Ecology's programmatic tissue PQL of 0.08 mg/kg ww. There was no statistical difference between the disposal site and environs tissue concentrations for both *M. nasuta* and *A. virens* (Table 12).

In contrast, the pre-test *M. nasuta* tissue concentration for selenium was 0.308 mg/kg ww, and a very slight decrease in selenium concentrations was measured following exposure to sediments. The average selenium concentrations for *M. nasuta* tissue for PGD-DU was 0.279 mg/kg ww and for PGE-DU was 0.280 mg/kg ww. The pre-test *A. virens* tissue concentration for selenium was 0.221 mg/kg ww, and a very slight increase was measured after exposure to sediments. The average selenium concentrations for *A. virens* tissue for PGD-DU was 0.244 mg/kg ww and for PGE-DU was 0.239 mg/kg ww (Figure 22). There was no statistical difference between the disposal site and environs tissue concentrations for both *M. nasuta* and *A. virens* (Table 12).

5.3.2 Tributyltin

Tributyltin has an ecological effects TTL of 0.6 mg/kg ww. Tributyltin was detected at low, estimated concentrations in the disposal site and environs sediments, but was not detected in any tissues following bioaccumulation exposure.

5.3.3 SVOCs

The *M. nasuta* and *A. virens* tissues were analyzed for all PAH compounds, hexachlorobenzene, and pentachlorophenol. Table 9 lists the DMMP TTLs for fluoranthene, hexachlorobenzene, and pentachlorophenol. The DMMP may determine a TTL for pyrene on a project-specific basis (DMMP 2018).

Hexachlorobenzene and pentachlorophenol were undetected in both sediments and tissues. All PAH compounds were undetected in the *A. virens* tissues for both the disposal site and environs (see Table 11). All PAH compounds were also undetected in the *M. nasuta* tissues except for fluoranthene, pyrene, benzo(a)pyrene, and chrysene. The concentrations for these PAHs were estimated (J-qualified) and below the laboratory-specific PQLs. Fluoranthene was measured at estimated concentrations in four of five tissue replicates at PGD-DU (average of 7.0±0.25 µg/kg ww; n=4), and one tissue replicate at PGE-DU (0.3 µg/kg ww) (Table 10). These concentrations were far below the TTL of 8,400 mg/kg ww. A project specific TTL was not established for pyrene. Sediment concentrations for pyrene were low at the disposal site and environs, and well below the DMMP BT guidelines (see Section 5.2.2). Pyrene was measured at estimated concentrations in four of five tissue replicates at PGD-DU (average of 10.3±1.1 µg/kg ww; n=4). Benzo(a)pyrene was measured at a low estimated concentration in one replicate at PGE-DU (1.4 µg/kg ww), and chrysene was also measured at a very low estimated concentration in one replicate at PGD-DU (0.9 µg/kg ww).

5.3.4 Pesticides

Pesticides with TTLs include total chlordane and total DDT (Table 9). Total chlordane and total DDT were undetected in the disposal site and environs sediments. Both pesticides were also undetected in the *M. nasuta* and *A. virens* tissues following bioaccumulation exposure.

5.3.5 PCBs

The *M. nasuta* and *A. virens* tissues were analyzed for PCB congeners and total PCBs were calculated using half of the detection limit for non-detects (ND=½DL) (see Tables 10 and 11). The DMMP human health TTL for total PCBs is 0.75 mg/kg ww (750 µg/kg ww).

Total PCB concentrations in the *M. nasuta* and *A. virens* tissues were well below the TTL of 750 µg/kg ww. Two pre-test *M. nasuta* tissue samples were analyzed and the average concentration for total PCBs was 0.261 µg/kg ww (ND=½DL). An increase in total PCBs was measured after exposure to on-site and environs sediments (Figure 23). The *M. nasuta* tissue average total PCBs for PGD-DU was 4.45 µg/kg ww (ND=½DL) and for PGE-DU was lower at 2.93 µg/kg ww (ND=½DL). The difference in averages between the disposal site and environs tissues was statistically significant (Table 12) but represented a relatively small increase (1.5 µg/kg) in total PCBs.

A. virens tissues started with a higher body burden of total PCBs prior to bioaccumulation testing relative to *M. nasuta*. Two pre-test *A. virens* tissue samples were analyzed and the average concentration for total PCBs was 9.00 µg/kg ww (ND=½DL). An increase in total PCBs was measured in the *A. virens* tissues after exposure to both on-site and environs sediments (Figure 23). The *A. virens* tissue average total PCBs for PGD-DU was 11.1 µg/kg ww (ND=½DL) and for PGE-DU was lower at 9.29 µg/kg ww (ND=½DL). The difference in averages between the disposal site and environs tissues was statistically significant (Table 12) but represented a relatively small increase (1.7 µg/kg) in total PCBs.

5.3.6 Dioxins/Furans

The *M. nasuta* and *A. virens* tissues were analyzed for dioxins/furans and the total TEQs were calculated using half of the detection limit for non-detects (ND=½DL) (see Tables 10 and 11).

Two pre-test *M. nasuta* tissue samples were analyzed and the average dioxin/furan TEQ was 0.0946 ng/kg ww TEQ (ND=½DL). Following bioaccumulation testing, the *M. nasuta* tissue average dioxin/furan TEQ for PGD-DU was 0.124 ng/kg ww TEQ (ND=½DL) and for PGE-DU was lower at 0.112 ng/kg ww TEQ (ND=½DL) (Figure 24). The difference in dioxin/furan TEQ averages between the disposal site and environs tissues was statistically significant for ND=½DL (Table 12). Again, the difference represented a relatively small increase of 0.012 ng/kg ww TEQ (ND=½DL).

One pre-test *A. virens* tissue sample was analyzed and the dioxin/furan TEQ was 0.364 ng/kg ww TEQ (ND=½DL), which was a higher body burden of dioxin/furans compared to *M. nasuta*. However, following bioaccumulation testing, the *A.virens* tissue average dioxin/furan TEQ for PGD-DU (0.319 ng/kg ww TEQ; ND=½DL) and for PGE-DU (0.306 ng/kg ww TEQ; ND=½DL) were both lower than the pre-test average (Figure 24). The slight difference in dioxin/furan TEQ averages between the disposal site and environs tissues was not statistically significant for ND=½DL (Table 12). The concentrations for both *M. nasuta* and *A. virens* tissues were below Ecology's programmatic tissue PQL of 1.0 ng/kg ww TEQ and below laboratory specific PQLs (Table 13).

For context, Figure 24 also includes tissue dioxin/furan concentrations for the polychaetes *Nephtys* and *Travisia* tissues that were collected at the Port Gardner site in 2006 (SAIC 2008). The average *M. nasuta* concentrations at the disposal site (0.124 ng/kg ww TEQ; ND=½DL) and environs (0.112 ng/kg ww TEQ; ND=½DL) were comparable to the 2006 *Nephtys* average concentration (0.129 ng/kg ww TEQ; ND=½DL). The average *A. virens* concentrations at the disposal site (0.319 ng/kg ww TEQ; ND=½DL) and environs (0.306 ng/kg ww TEQ; ND=½DL) were higher than the 2006 *Nephtys* average concentration (0.129 ng/kg ww TEQ; ND=½DL), but lower than the 2006 *Travisia* average concentration (0.418 ng/kg ww TEQ; ND=½DL).

6.0 SUMMARY OF RESULTS[10]

This section summarizes the results of the 2020 pilot monitoring study conducted at the Port Gardner site following the updated DMMP interpretive guidelines described in Section 2.0. The findings are organized according to the questions and hypotheses of the DMMP updated monitoring framework.

6.1 Question 1: Does the Dredged Material Stay Onsite?

6.1.1 SPI Physical Monitoring

Hypothesis A: Dredged material remains within the disposal site boundary.

The 2020 SPI survey at Port Gardner did not identify the presence of dredged material beyond the site boundary that exceeded 10 cm, nor identified the presence of dredged material beyond the disposal site perimeter that exceeded the 3 cm (Integral & EcoAnalysts 2020). ***Hypothesis A is accepted.***

6.2 Question 2: Is Benthic Toxicity Onsite Consistent with Site Condition II?

6.2.1 Onsite Sediment Chemistry

Hypothesis B: Sediment toxicity onsite does not exceed the DMMP Site Condition II benthic interpretive guidelines due to dredged material disposal.

Composite surface sediment samples (0-10 cm) were collected from five onsite locations randomly selected from a stratified random grid within the Disposal Site DU. The samples were analyzed for the DMMP conventionals and benthic COCs. The onsite chemistry results for all locations did not exceed the DMMP SL values. Therefore, tiered bioassay testing was not required. ***Hypothesis B is accepted.***

6.3 Question 3: Is Bioaccumulation Onsite Consistent with Site Condition II and Compliant with the SMS CSL?

6.3.1 Bioaccumulation Testing

Hypothesis C: Bioaccumulation onsite does not exceed the SMS CSL due to dredged material disposal.

Laboratory bioaccumulation testing using *M. nasuta* and *A. virens* was conducted on composite sediment samples collected for the Disposal Site DU and the Environs DU. The concentrations of List 1 BCOCs measured in sediments were below the DMMP BTs. Bioaccumulation testing using *M. nasuta* and *A. virens* confirmed that uptake of the BCOCs from exposure to disposal site sediments was low. Measured tissue concentrations were below the human health TTLs. Statistically significant differences in tissue concentrations between the environs and disposal site DUs were observed for mercury and total PCBs in *M. nasuta* and *A. virens*, and dioxin/furan TEQ (ND=½DL) for *M. nasuta*. However, the differences in tissue

[10] See the Foreword for the updated data evaluation and conclusions. Consistent with the conclusions in this section, all goals were met.

concentrations were relatively small and did not suggest ecological concern. In the case of dioxins/furans, the concentrations were below Ecology's programmatic tissue PQL of 1.0 ng/kg ww TEQ.

All PAH compounds were undetected in the tissues except for fluoranthene, pyrene, and chrysene in some *M. nasuta* tissue replicates at the disposal site (PGD-DU), and benzo(a)pyrene in one *M. nasuta* tissue replicate at the environs (PGE-DU). All detected concentrations were estimated and below the PQLs. Fluoranthene was well below the human health TTL. Therefore, ***Hypothesis C is accepted.***

6.4 Question 4: Are Unacceptable Adverse Effects Due to Dredged Material Disposal Occurring to Biological Resources Offsite?

6.4.1 SPI and Plan View Data Analysis

Hypothesis D: There is no significant decrease in benthic habitat quality offsite due to dredged material disposal.

The 2020 Port Gardner SPI and plan view imaging found no evidence of a decrease in benthic habitat quality in offsite areas due to dredged material disposal. Ambient sediment characteristics observed in 2020 were like those from previous monitoring surveys, with evidence of well-established benthic communities in both the SPI and plan view images. Biogenic mixing levels across the site (e.g., based on the aRPD depths) were also greater than those measured in the 2010 survey, although this observation could have been a seasonal effect or related to the amount of time that had elapsed since the last disposal event at the site (Integral & EcoAnalysts 2020). ***Hypothesis D is accepted***.

Under the revised DMMP monitoring framework, Hypotheses E and F do not require evaluation with the acceptance of Hypothesis A (see Table 2).

7.0 OBSERVATIONS AND RECOMMENDATIONS

The following observations and recommendations are offered following the completion of the 2020 Port Gardner pilot monitoring study under the revised DMMP monitoring framework:

- The overall sampling and testing approach in Port Gardner was effective in confirming that recent dredged material has remained within the disposal site boundary, sediment toxicity and bioaccumulation impacts onsite are consistent with Site Condition II, and benthic habitat quality in offsite areas has not been affected.
- The sediment sampling using a 0.2 m^2 stainless van Veen grab was an efficient approach for collecting the sediment volumes required for bioaccumulation testing. Two cement drum mixers coated with a fish-safe epoxy coating were needed for sediment compositing due to the sediment volume (100 liters) collected for each composite sample. A cross-compositing approach between the two cement mixers was used successfully as described in Section 4.2.2. Future monitoring at Port Gardner may not require the same volume of sediment for bioaccumulation testing if the tissue analyte list is refined based on these results. However, it is recommended that sediment compositing for the bioaccumulation sediment samples continue to be done at a controlled setting onshore such as the bioaccumulation laboratory.
- There is value in measuring pre-test tissue concentrations. For the bioaccumulation testing program, it is recommended that pre-test tissues be prepared and analyzed in triplicate to allow for a more robust assessment of body burdens in the test organisms prior to bioaccumulation testing. The requested pre-test tissue volumes should be confirmed with the bioaccumulation laboratory prior to the start of testing.
- The *A. virens* worms used for the bioaccumulation testing had a higher-than-expected pre-test body burden of PCBs and dioxins/furans. An alternate supplier or further evaluation of PCB and dioxin/furan body burdens may be beneficial prior to future exposure studies using *A. virens*.
- The relationship between PCB uptake in SPME fibers and *M. nasuta* tissue could be modelled to predict tissue uptake. However, the use of SPME as a proxy for the uptake of dioxins/furans was limited, likely due to the relatively low concentrations of dioxins/furans at the Port Gardner site. The pre-test body burden of PCBs in the *A. virens* tissues likely affected the ability to determine a relationship with the uptake of PCBs in the SPME fibers. Additional testing with SPME fibers at a different disposal site may be helpful for building the relationship between dioxins/furans and PCB data in SPME and tissues and evaluating the utility of SPME as a proxy for bioaccumulation at the DMMP disposal sites.
- Acquisition of the appropriate SPME fiber material required more time than anticipated. If future SPME testing is planned, orders for SPME should be done as soon as possible prior to bioaccumulation testing to allow time for acquisition and the full 28 days for PRC loading.
- The use of an alternative material to SPME such as polyethylene devices (PEDs) should be investigated and considered. PED sampler devices are low-density polyethylene sheets that are cut to size based on project needs. The sampler surface area can be much larger than SPME, which would significantly improve the analytical detection limits. This would be of value given the relatively low concentrations of dioxins/furans and PCBs that may be evaluated at the disposal sites.

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FIGURES

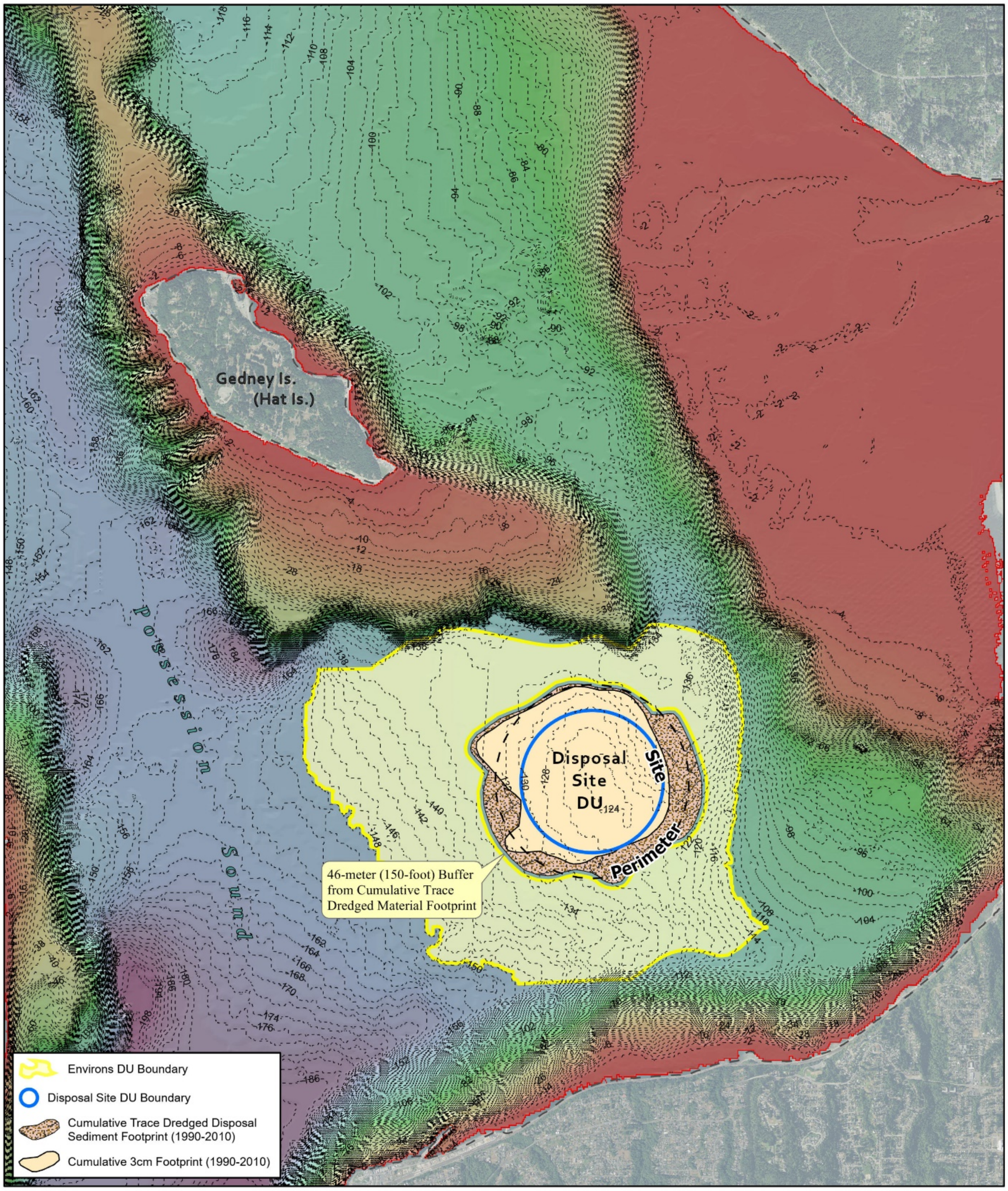

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Figure 1. Port Gardner Disposal Site DU and Environs DU Boundaries

State Plane WA North,
Lambert Conformal Conic Projection
NAD 83 Datum
Units: Meters
6/15/2020

0 500 1,000 2,000 Meters

NewFields

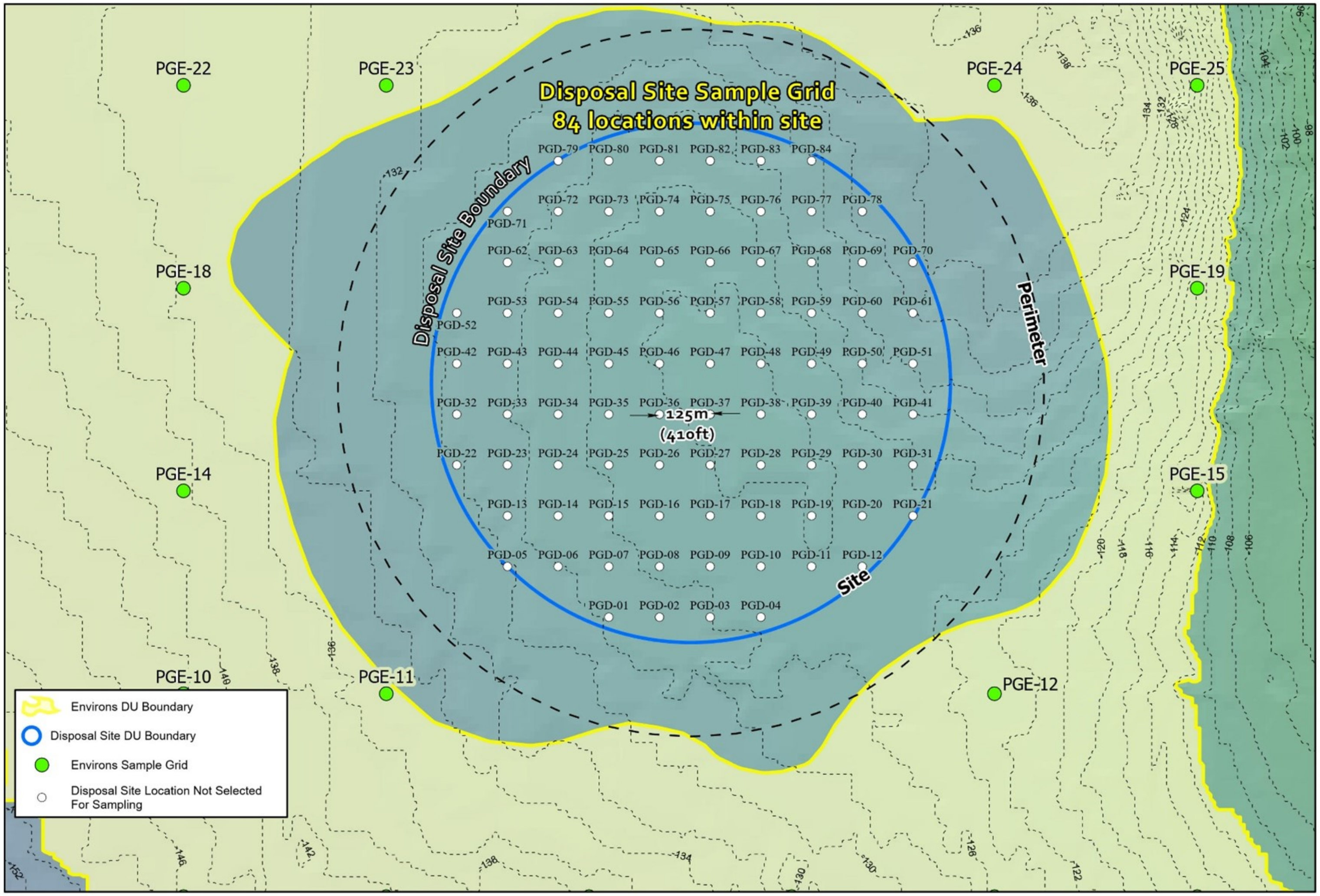

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Figure 2. Port Gardner Disposal Site DU and Sample Grid

0 250 500 1,000 Meters

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Lambert Conformal Conic Projection
NAD 83 Datum
Units: Meters
7/2/2020

NewFields

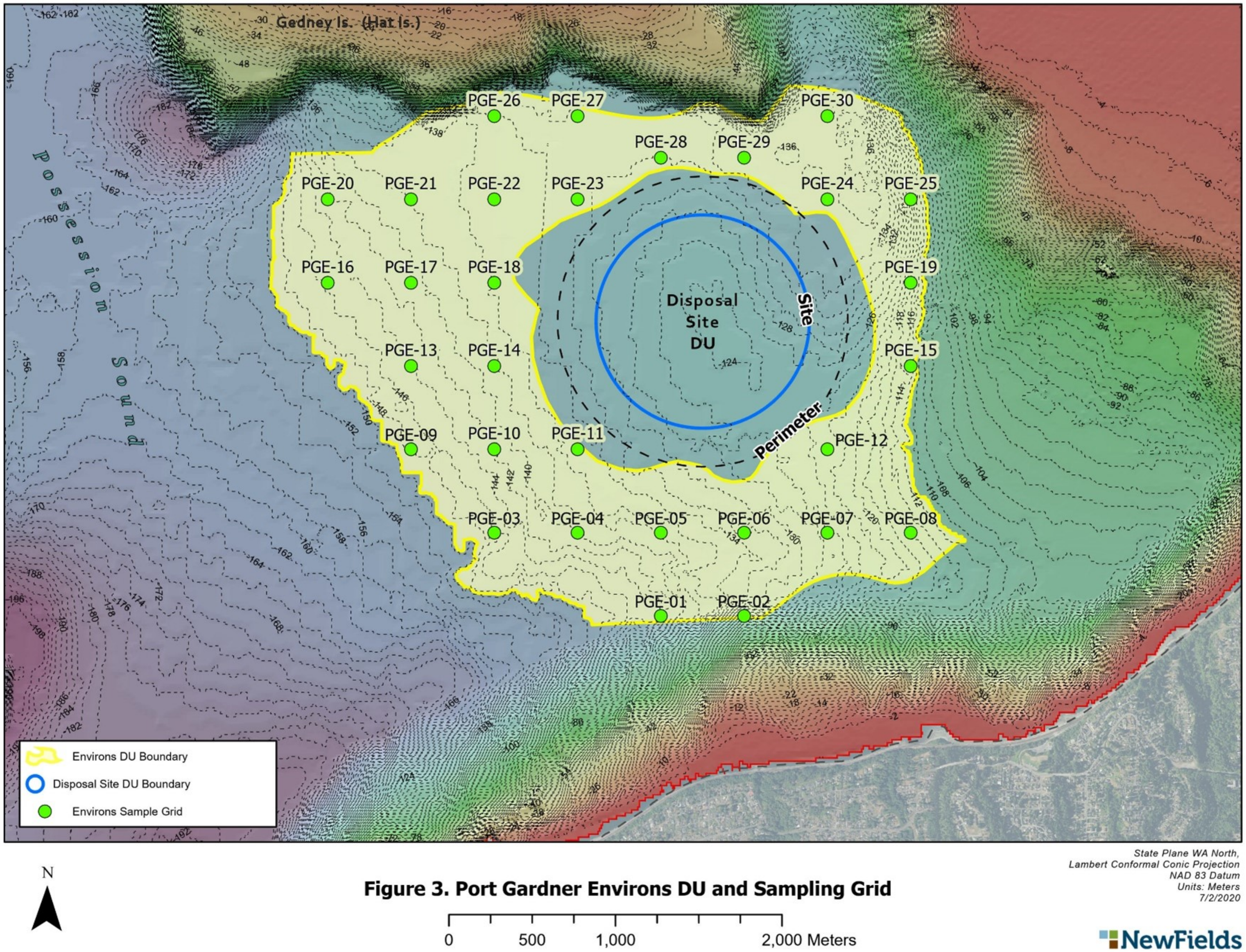
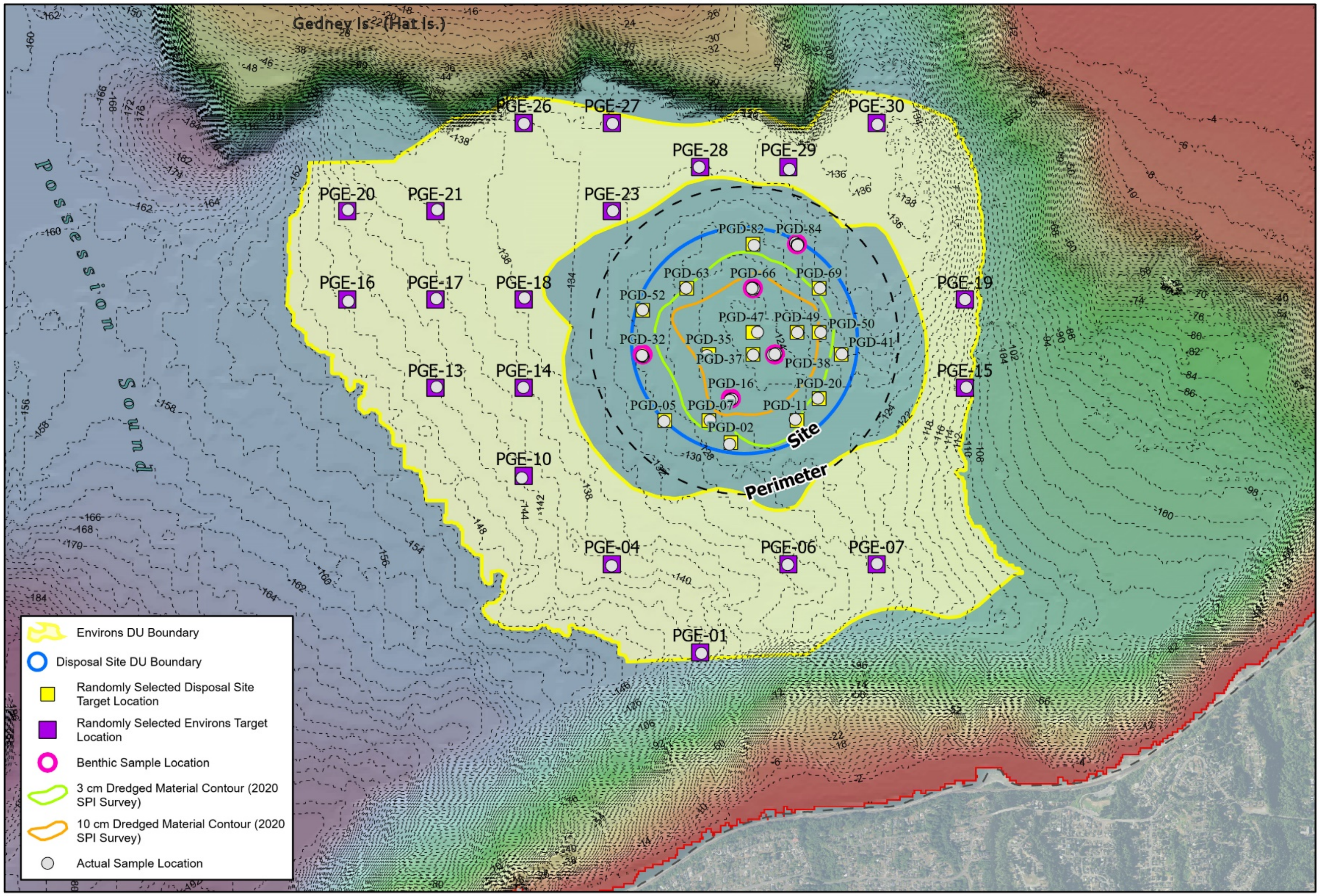


Figure 3. Port Gardner Environs DU and Sampling Grid



State Plane WA North,
Lambert Conformal Conic Projection
NAD 83 Datum
Units: Meters
3/12/2021

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Figure 4. Actual Sampling Locations at the Port Gardner Disposal Site and Environs DUs

0 500 1,000 2,000 Meters

NewFields

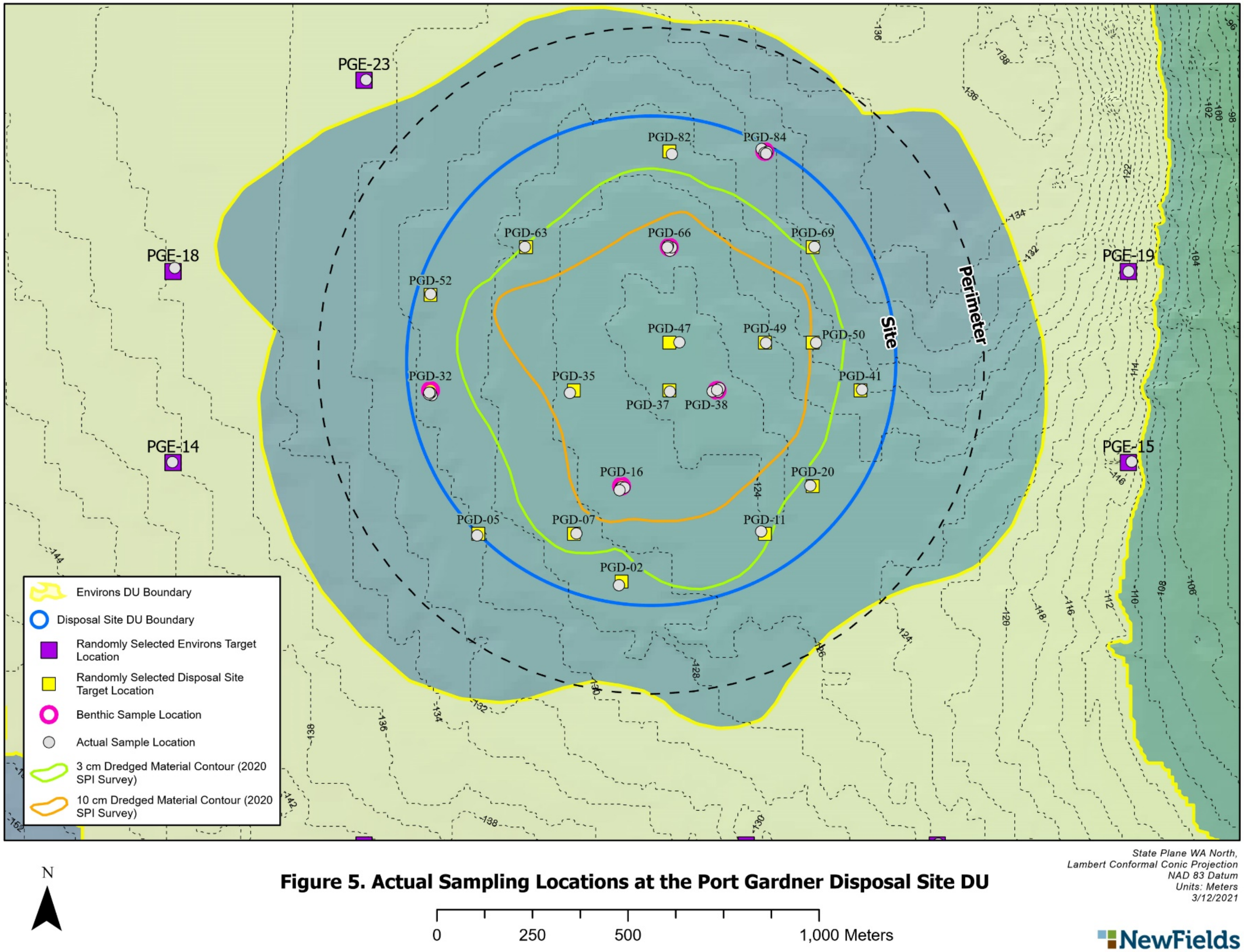


Figure 5. Actual Sampling Locations at the Port Gardner Disposal Site DU

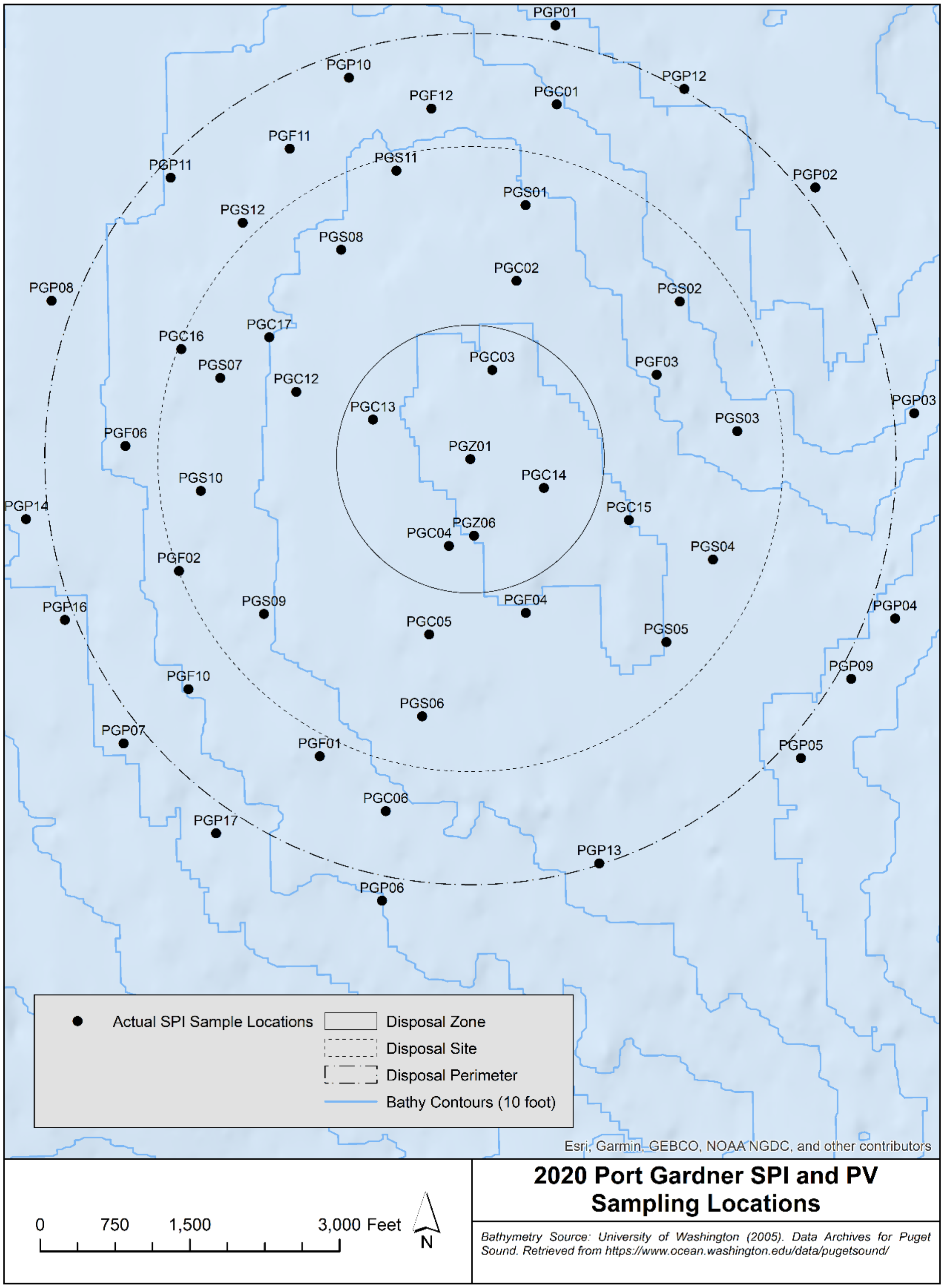
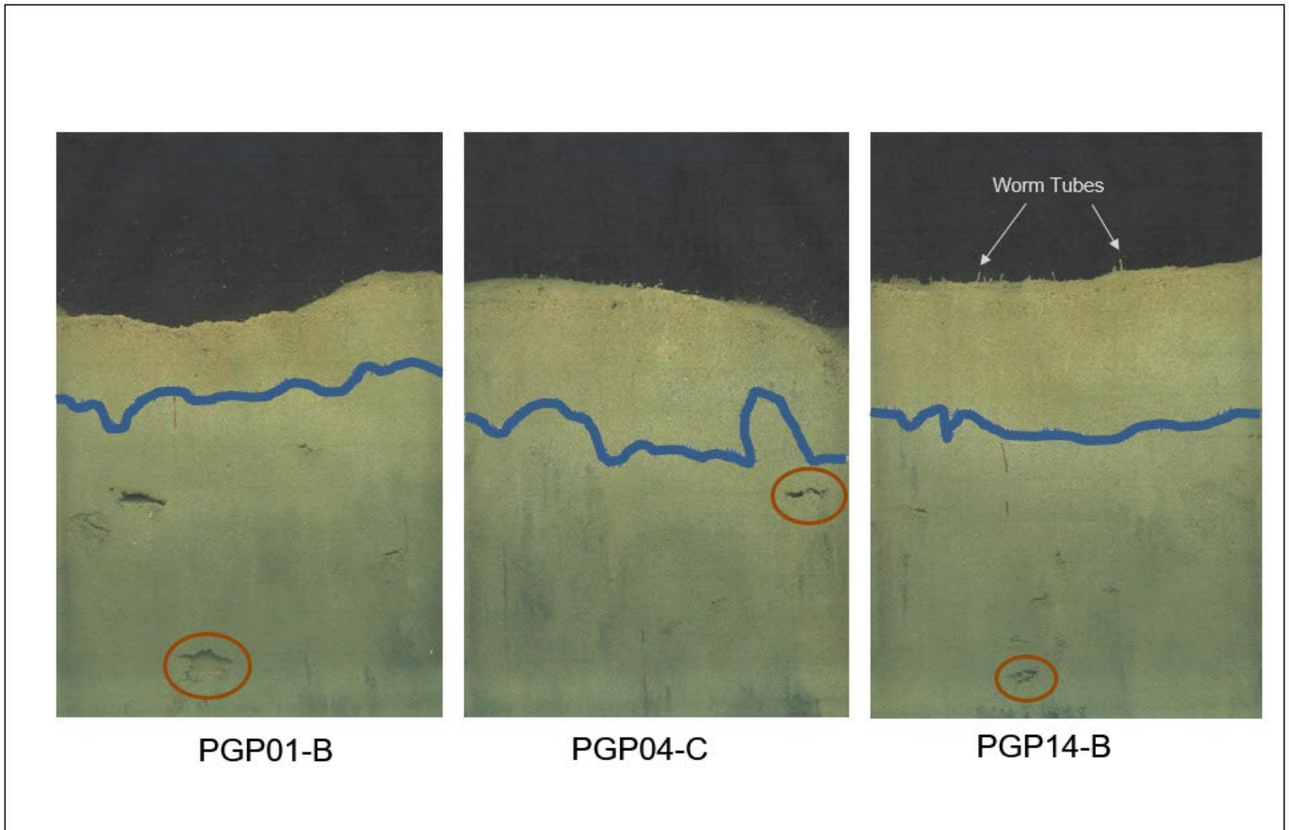


Figure 6. Port Gardner 2020 SPI and Plan View Sampling Locations (Integral & EcoAnalysts 2020)



Shown: Three SPI images from the disposal perimeter that illustrate the fine-grained ambient conditions with deep aRPD depths (shown as blue lines) and well established benthic infaunal communities. All images are Stage 1 on 3 successional stages based on the presence of feeding voids at depth (examples circled in orange) and surface worm tubes. Image width is 14.6 cm.

Figure 7. Port Gardner 2020 Ambient Sediment SPI Images (Integral & EcoAnalysts 2020)

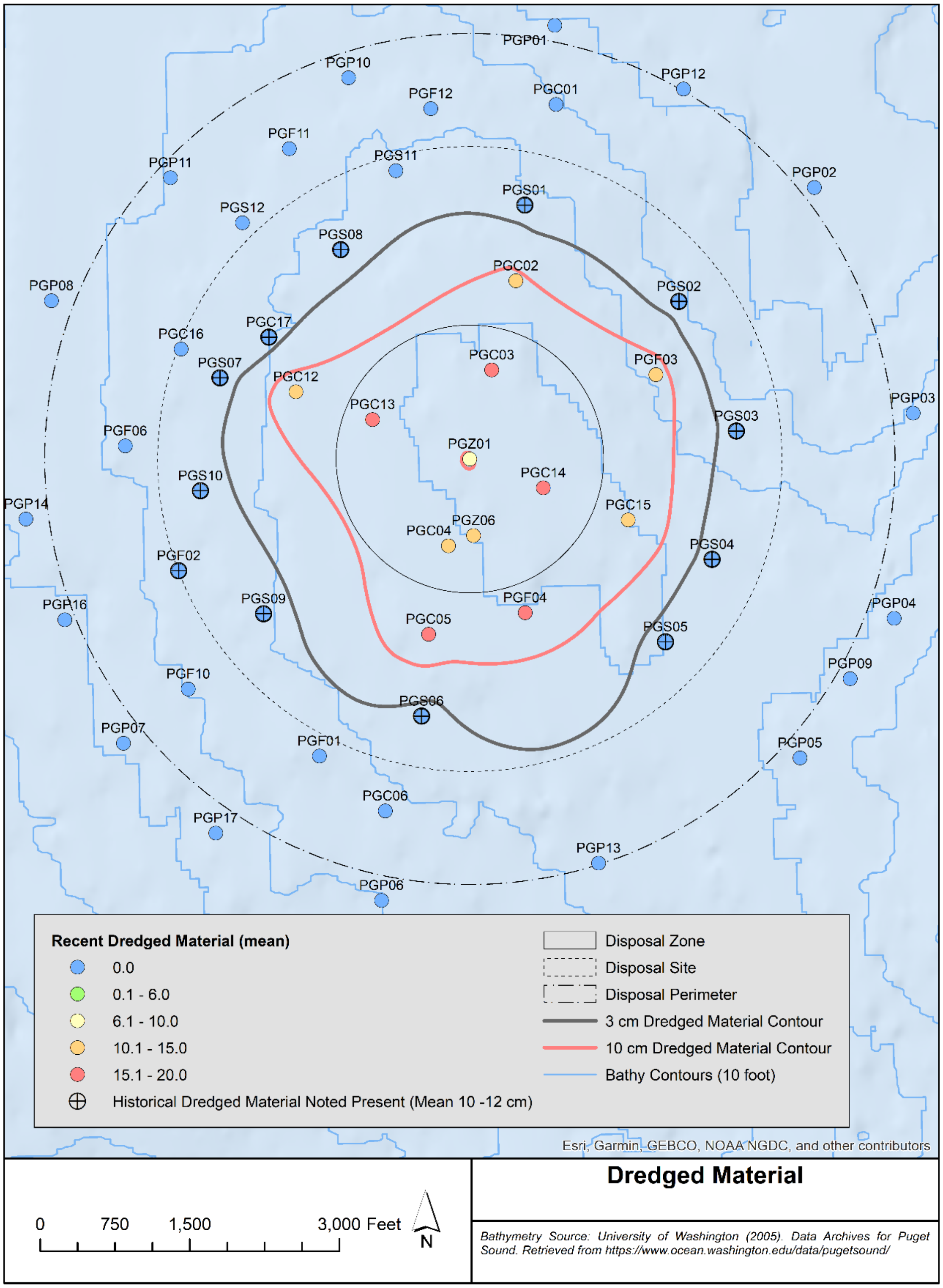
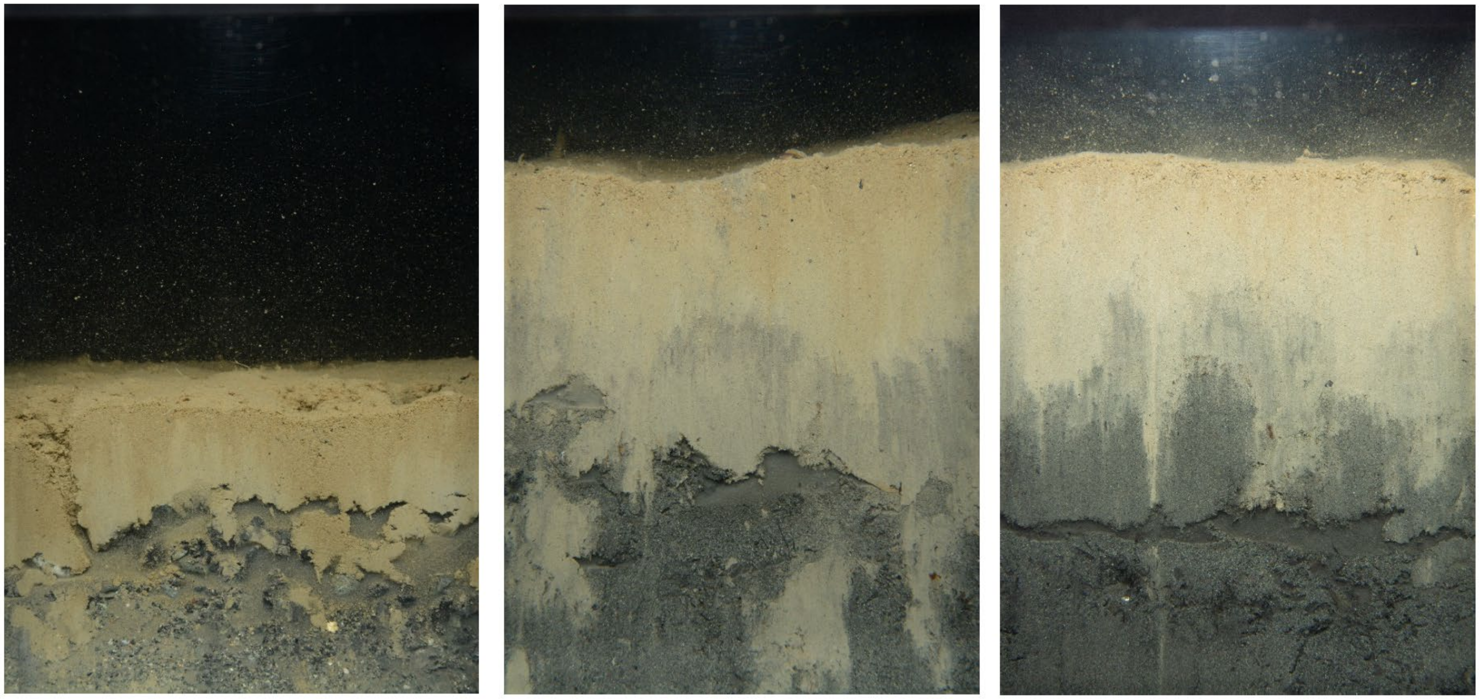


Figure 8. Port Gardner 2020 Dredged Material Distribution (Integral & EcoAnalysts 2020)



PGZ01-A PGC13-B PGF04-C

Shown: Three SPI images from within the disposal zone show recent dredged material deposits consisting of silt clay on top of dark grayish coarse to medium sands. Image width is 14.6 cm.

Figure 9. Port Gardner 2020 Recent Dredged Material Image (Integral & EcoAnalysts 2020)

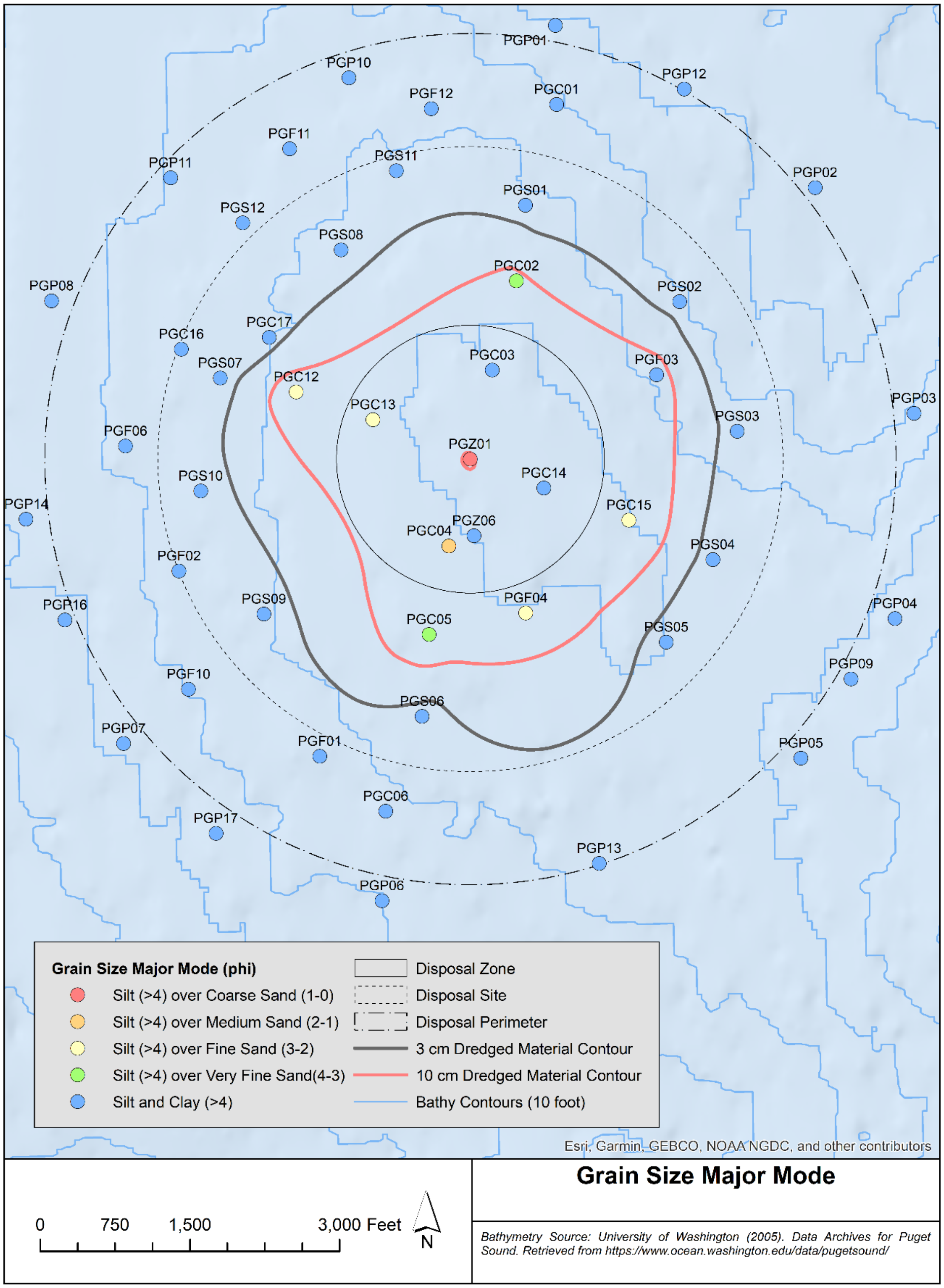
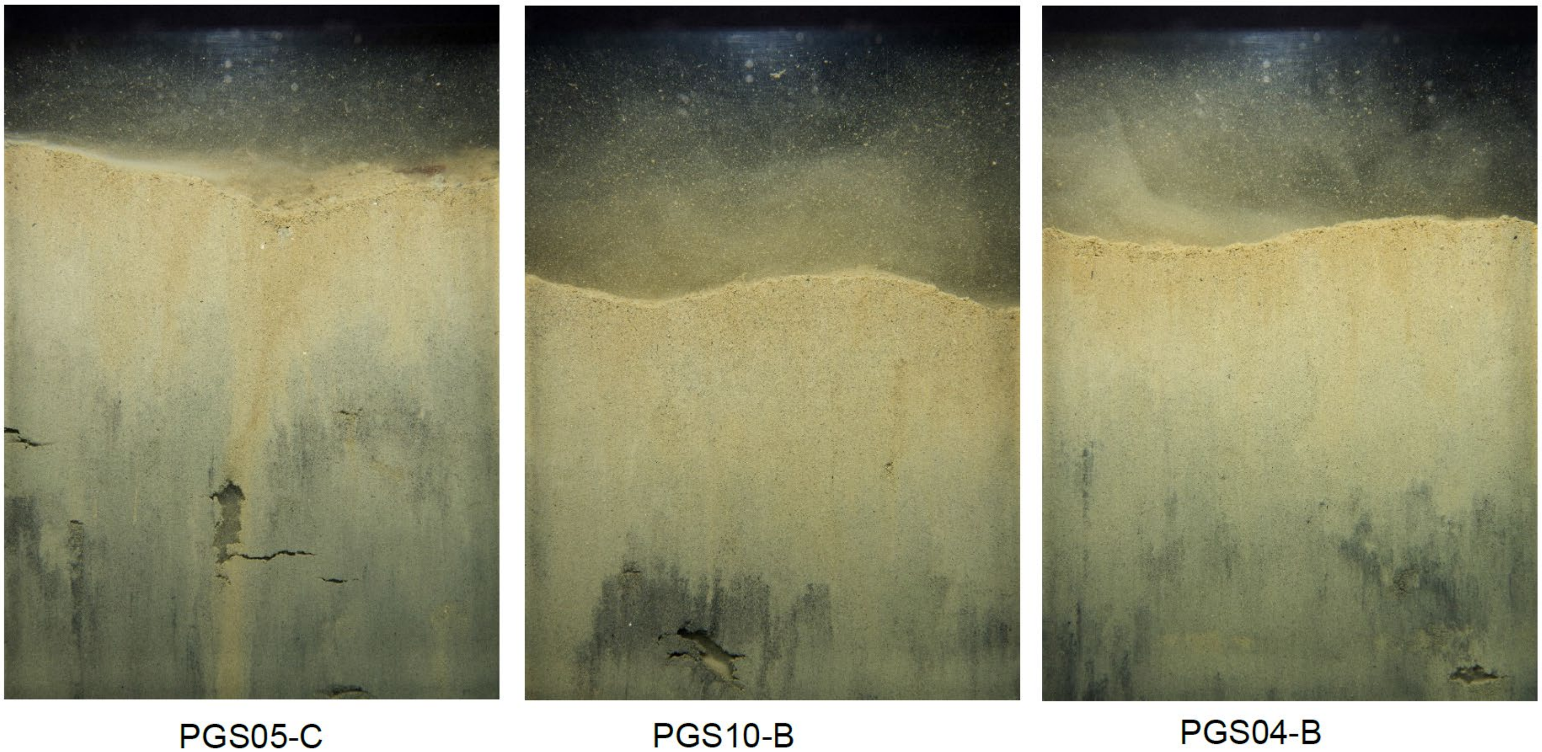


Figure 10. Port Gardner 2020 Grain Size Major Mode (Integral & EcoAnalysts 2020)



integral consulting inc.

Shown: Three SPI images from within the disposal site show historical dredged material deposits consisting of silt clay on top of dark grayish fine to very fine sands. Image width is 14.6 cm.

Figure 11. Port Gardner 2020 Historical Dredged Material Images (Integral & EcoAnalysts 2020)

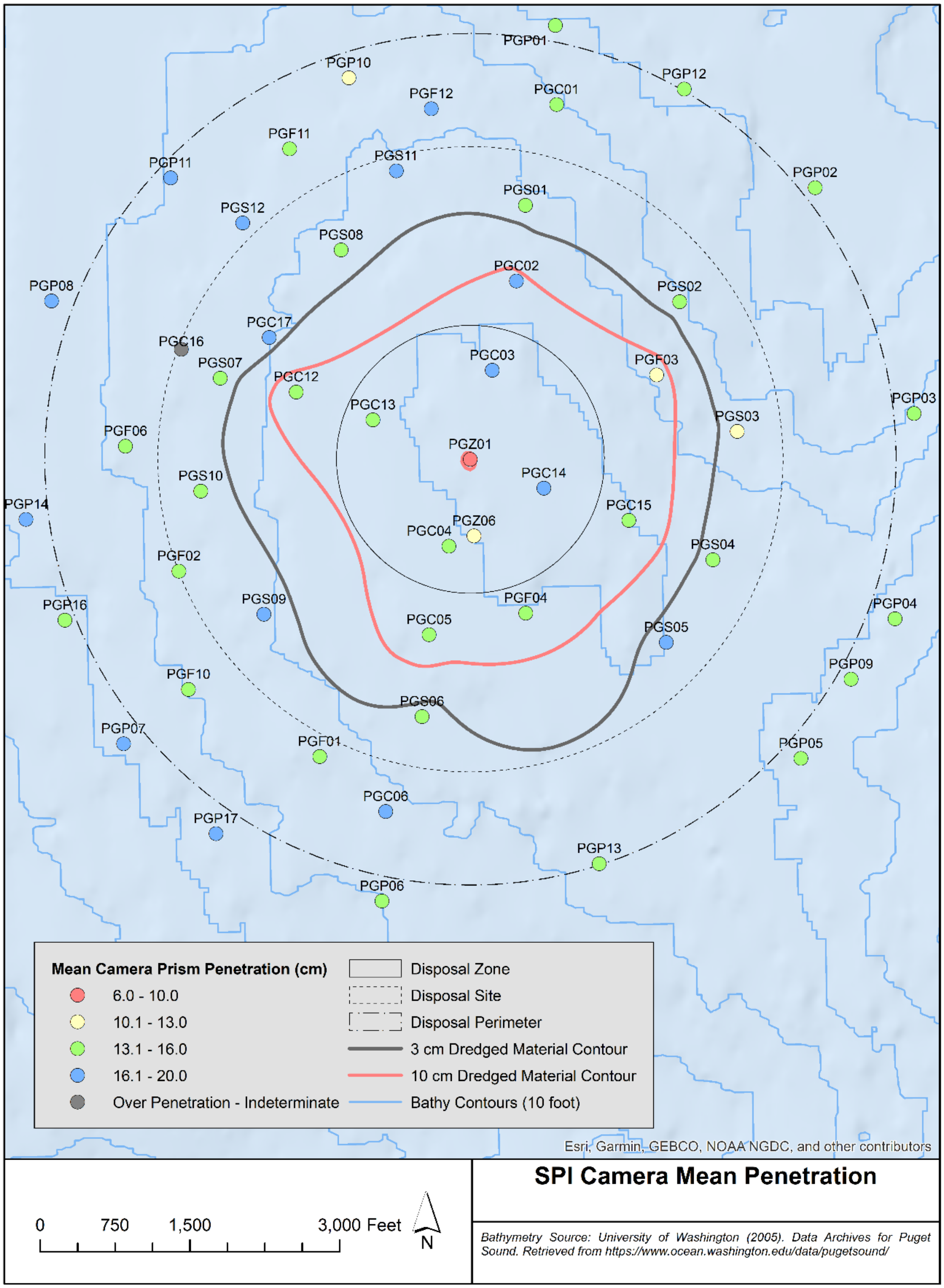


Figure 12. Port Gardner 2020 SPI Camera Mean Penetration (Integral & EcoAnalysts)

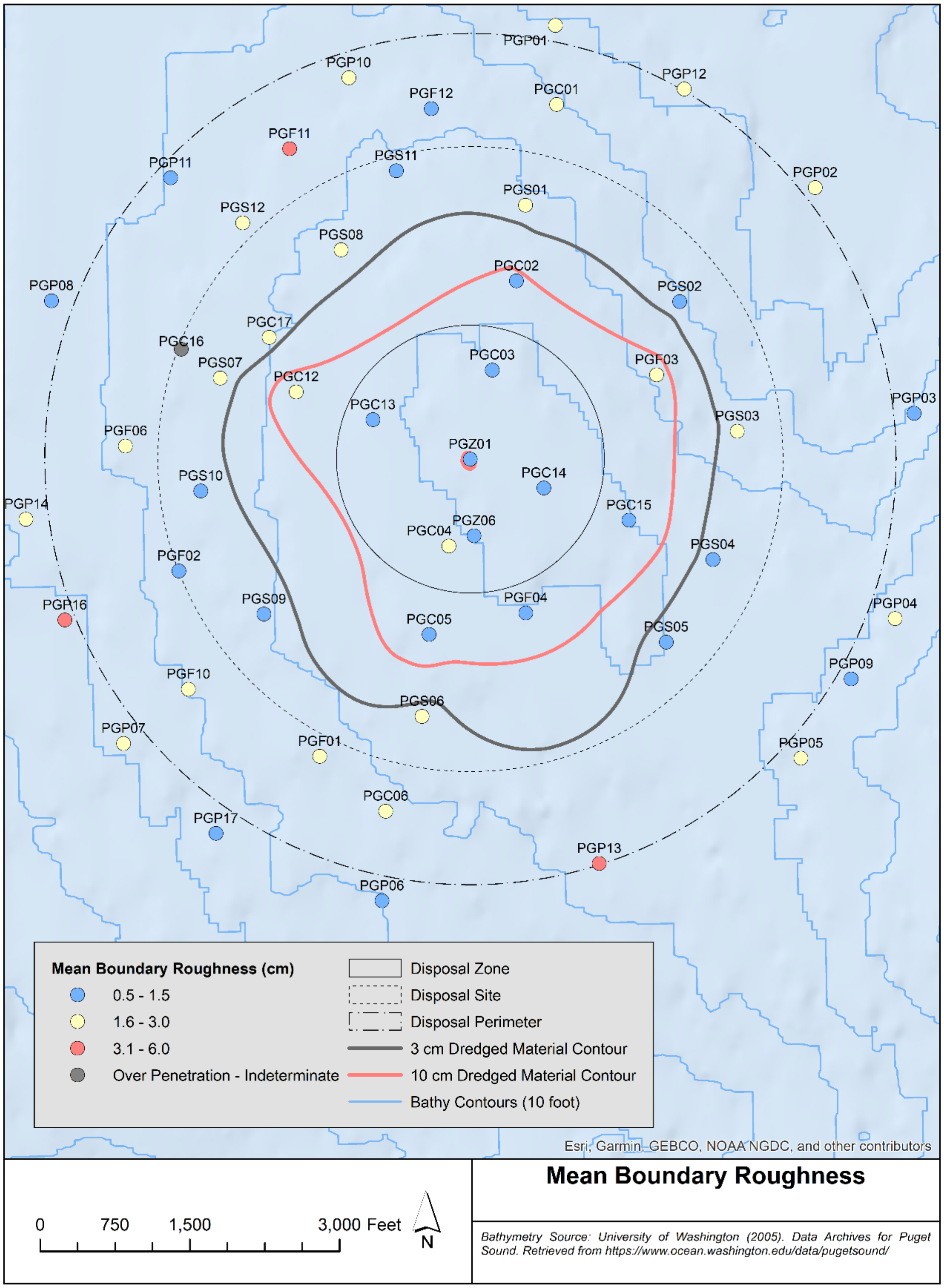


Figure 13. Port Gardner 2020 Mean Surface Boundary Roughness (Integral & EcoAnalysts 2020)

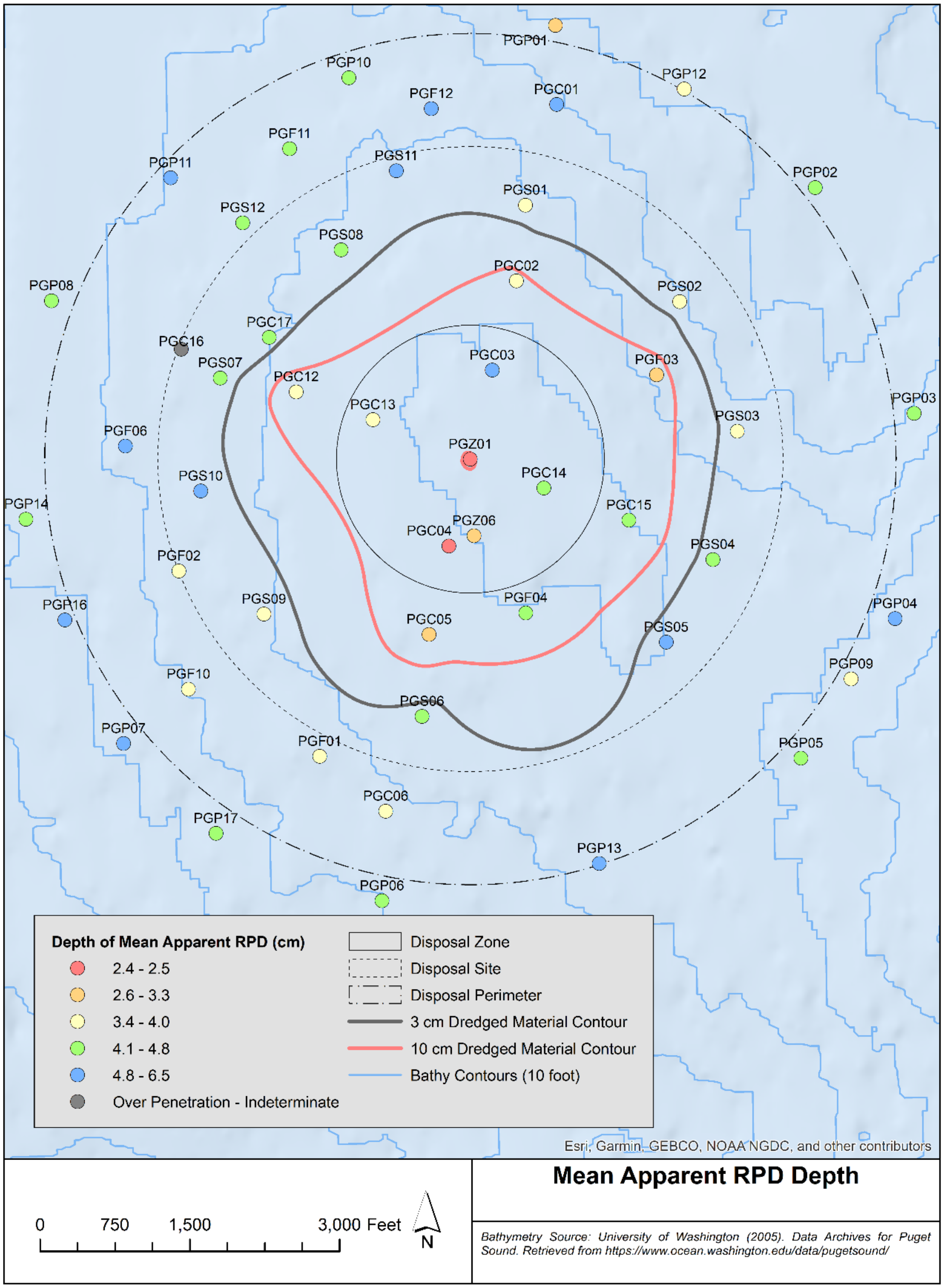


Figure 14. Port Gardner 2020 Mean aRPD Depth (Integral & EcoAnalysts 2020)

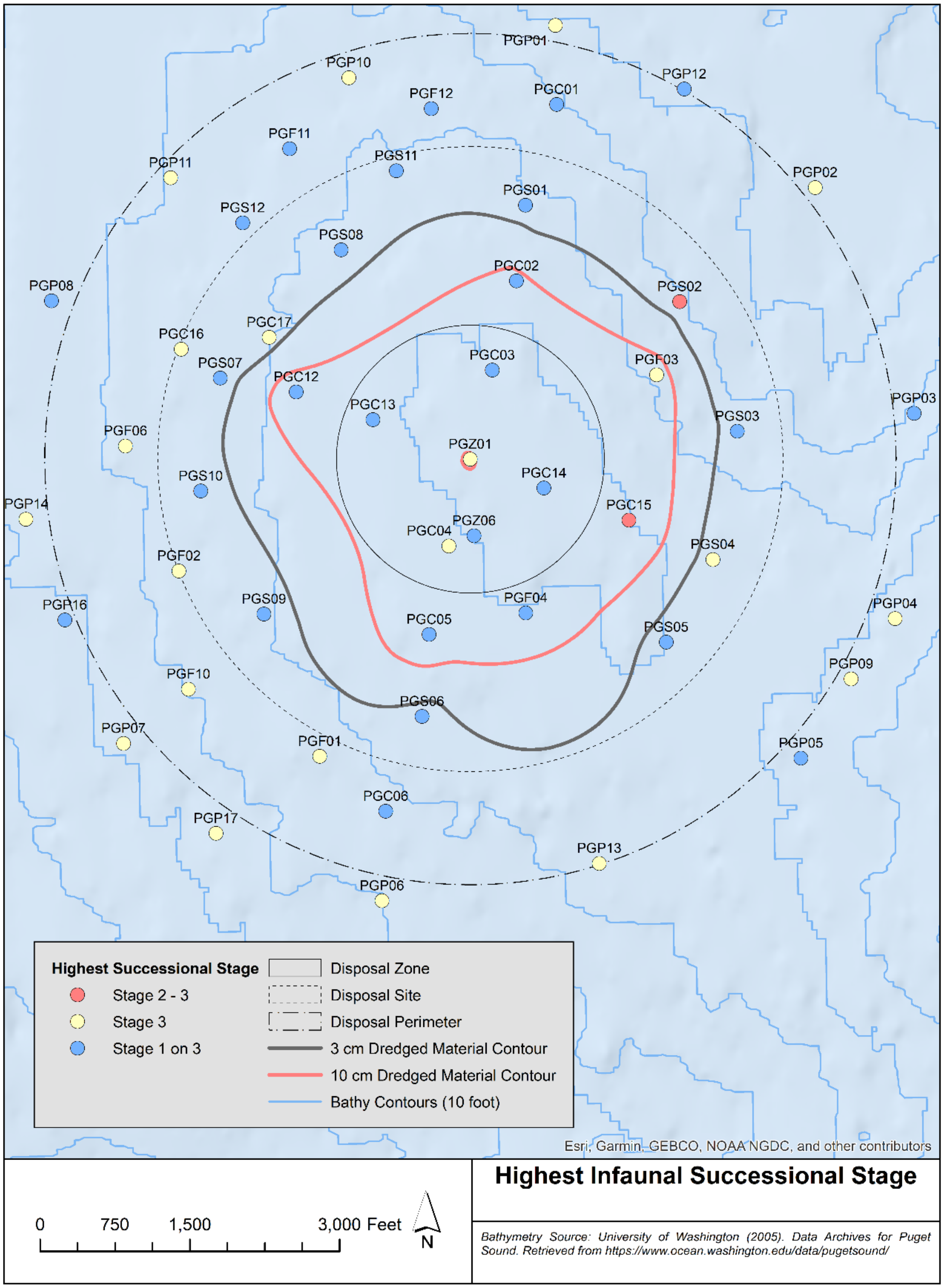
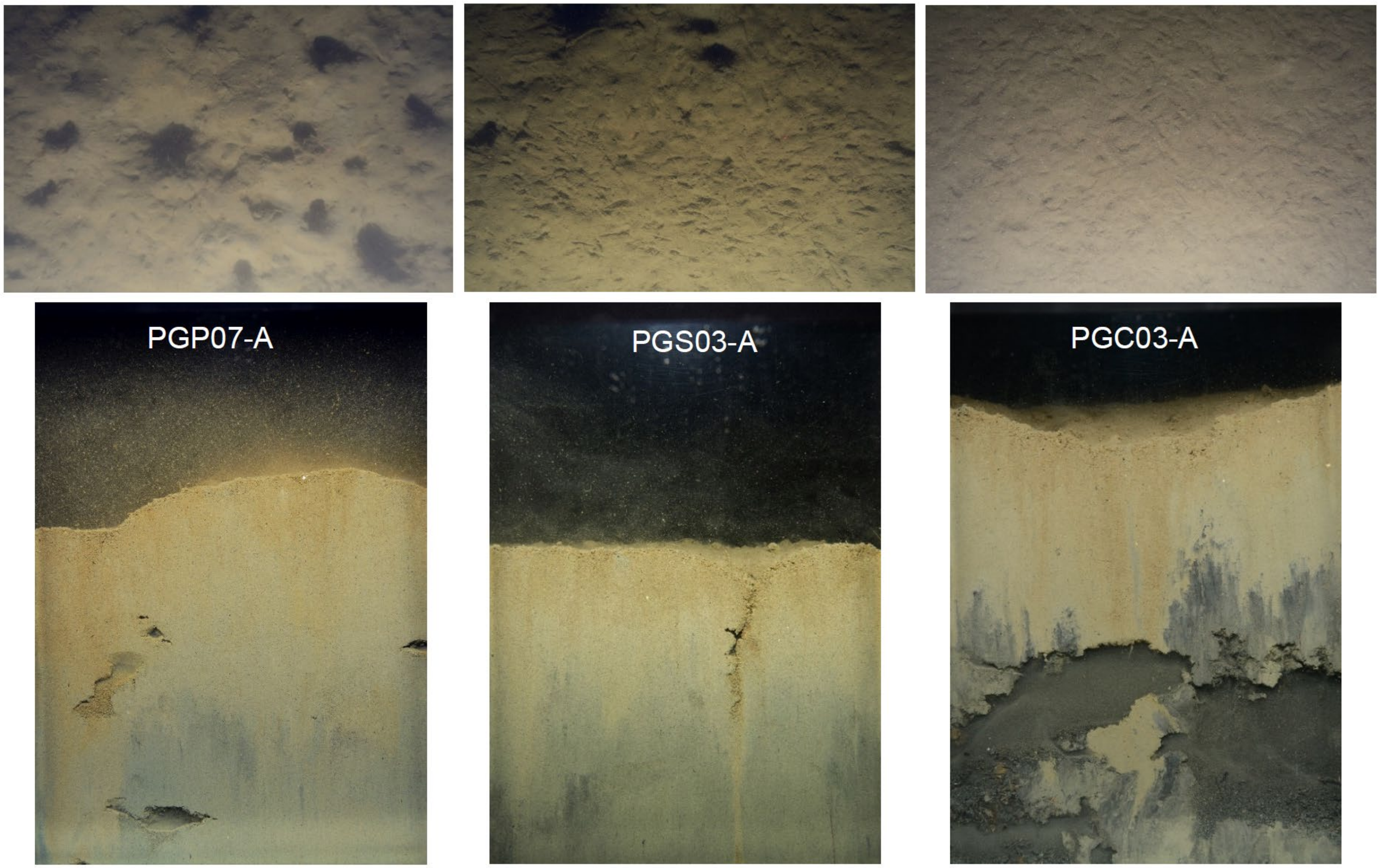


Figure 15. Port Gardner 2020 Highest Infaunal Successional Stage (Integral & EcoAnalysts 2020)



Shown: **PGP07-A**: Ambient conditions. SPI: deep aRPD, feeding voids and burrow. PV: extensive burrow field. **PGS03-A**: Historic dredge material at depth. SPI: evidence of head down deposit organism burrows. PV: fewer large diameter burrows. **PGC03-A**: Recent dredge material below fine silt. PV: no large burrows and relatively homogenous surface relief. Scale: width of SPI images = 14.4 cm; width of PV PGP07-A = 77 cm, PGS03-A = 76 cm, PGC03-A = 79 cm.

Figure 16. Co-located SPI and Plan View Images Across the Port Gardner Disposal Site (2020) (Integral & EcoAnalysts 2020)

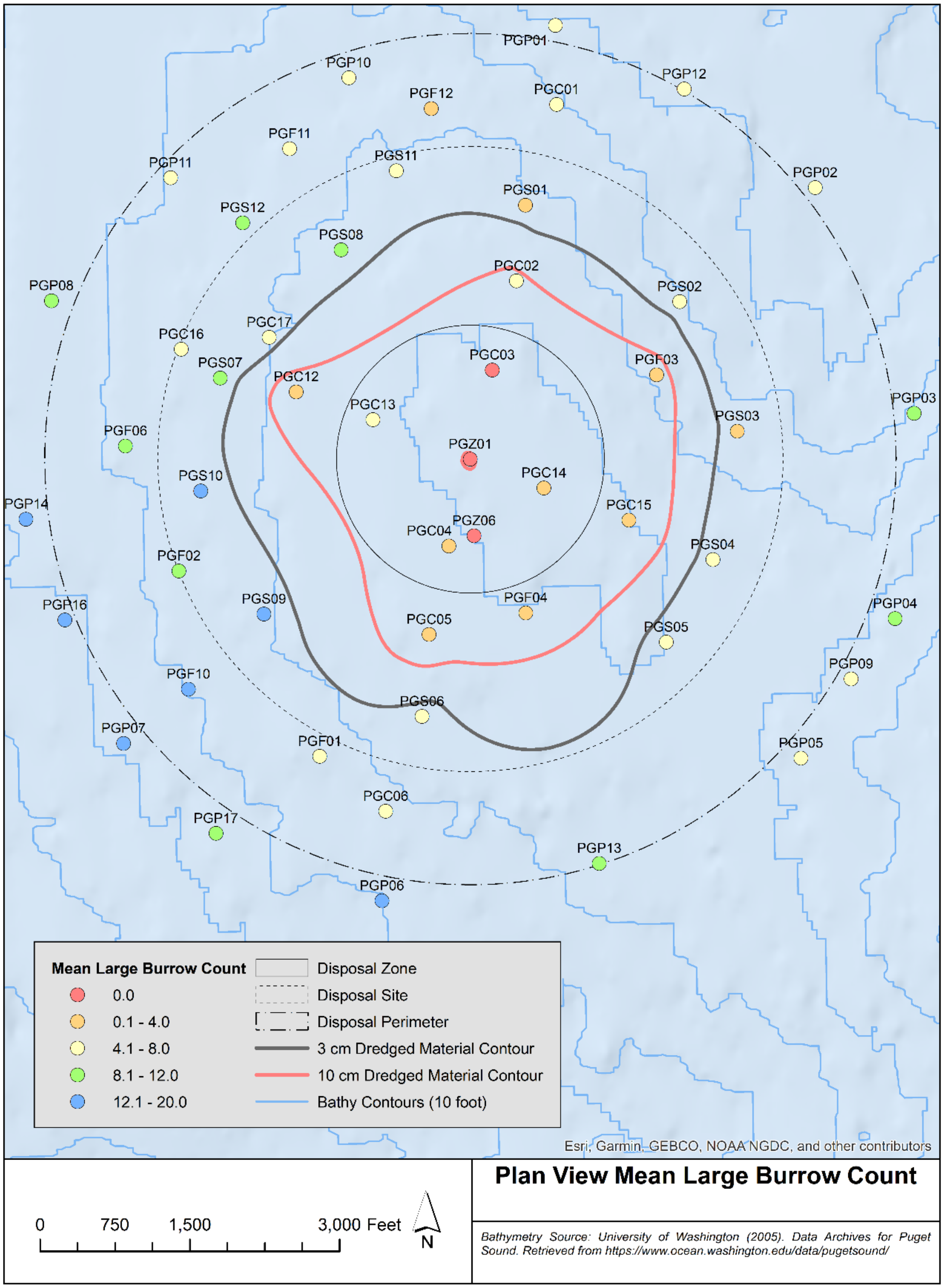


Figure 17. Port Gardner 2020 Plan View Mean Large Burrow Count (Integral & EcoAnalysts 2020)

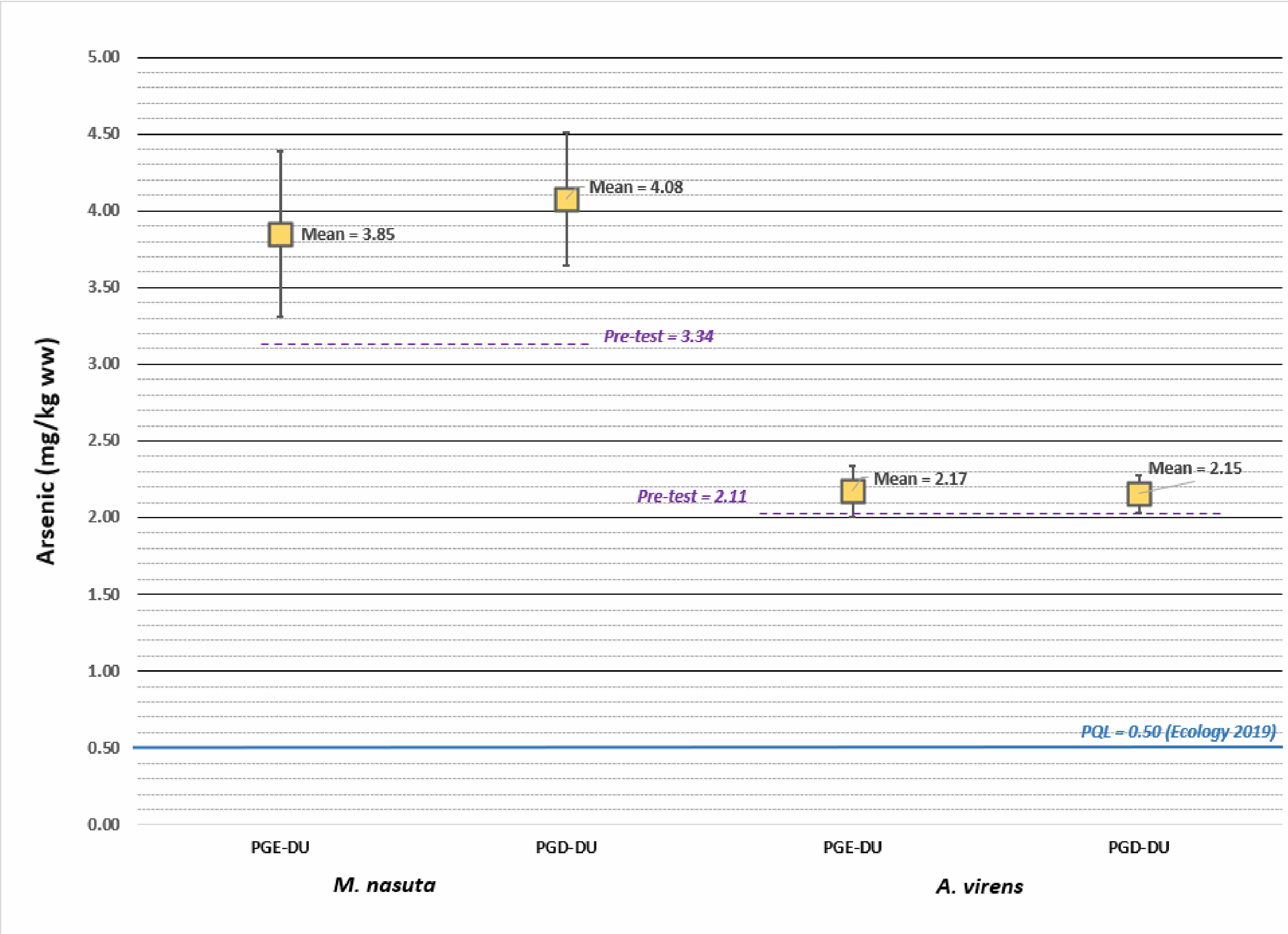


Figure 18. Arsenic Concentrations (Mean and Standard Deviation) in *A. virens* and *M. nasuta* Tissues

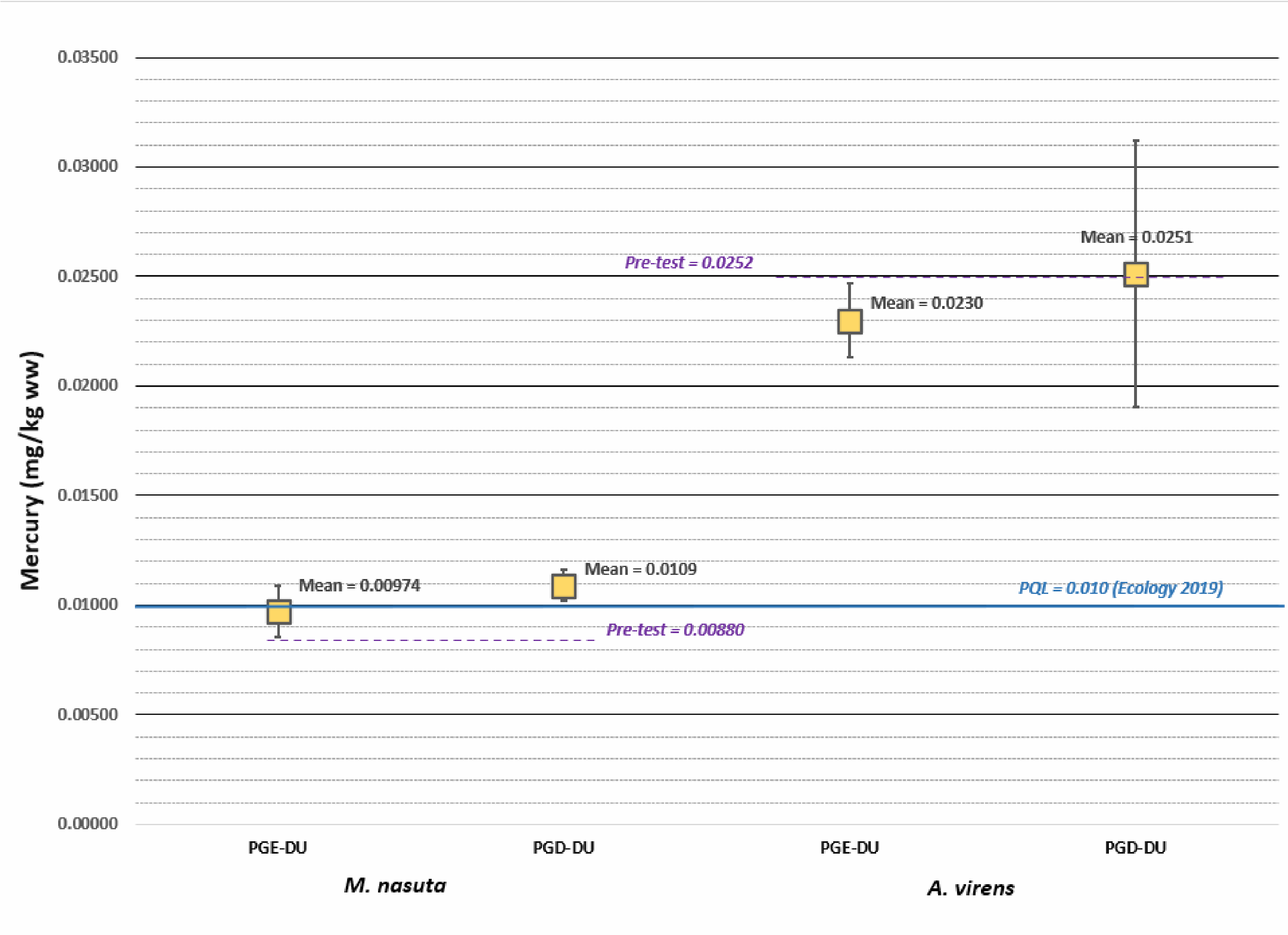


Figure 19. Mercury Concentrations (Mean and Standard Deviation) in *A. virens* and *M. nasuta* Tissues

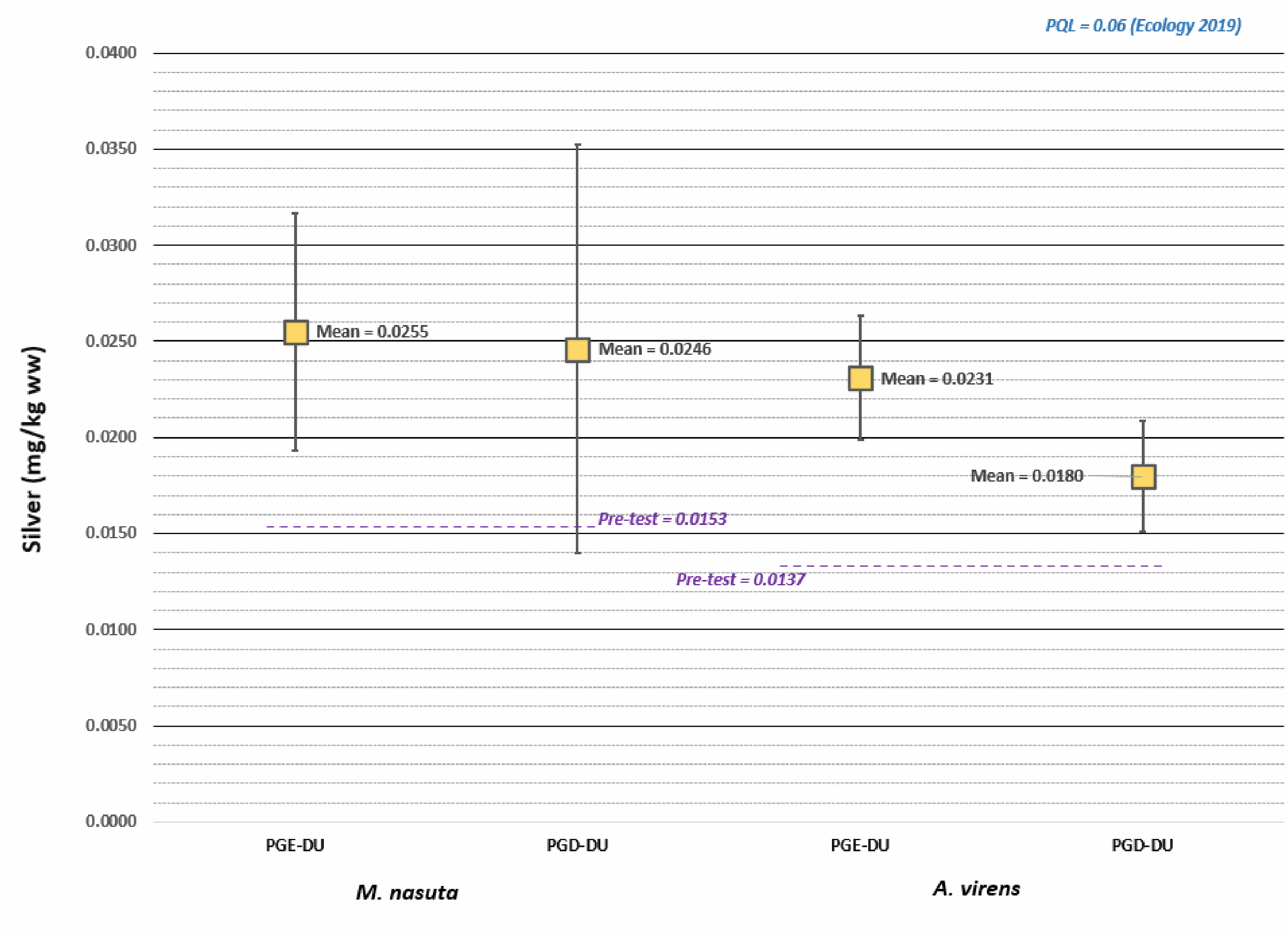


Figure 20. Silver Concentrations (Mean and Standard Deviation) in *A. virens* and *M. nasuta* Tissues

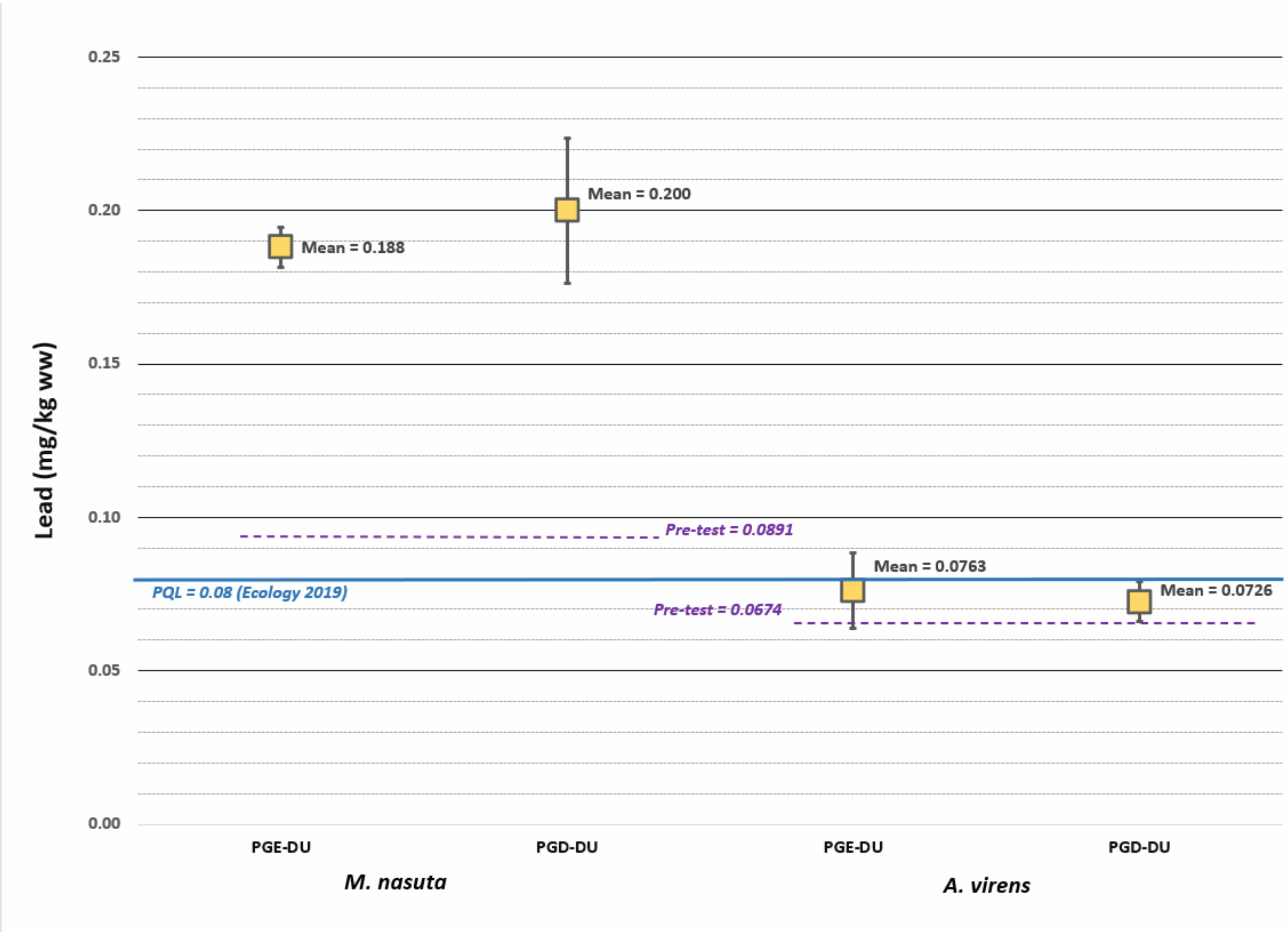


Figure 21. Lead Concentrations (Mean and Standard Deviation) in *A. virens* and *M. nasuta* Tissues

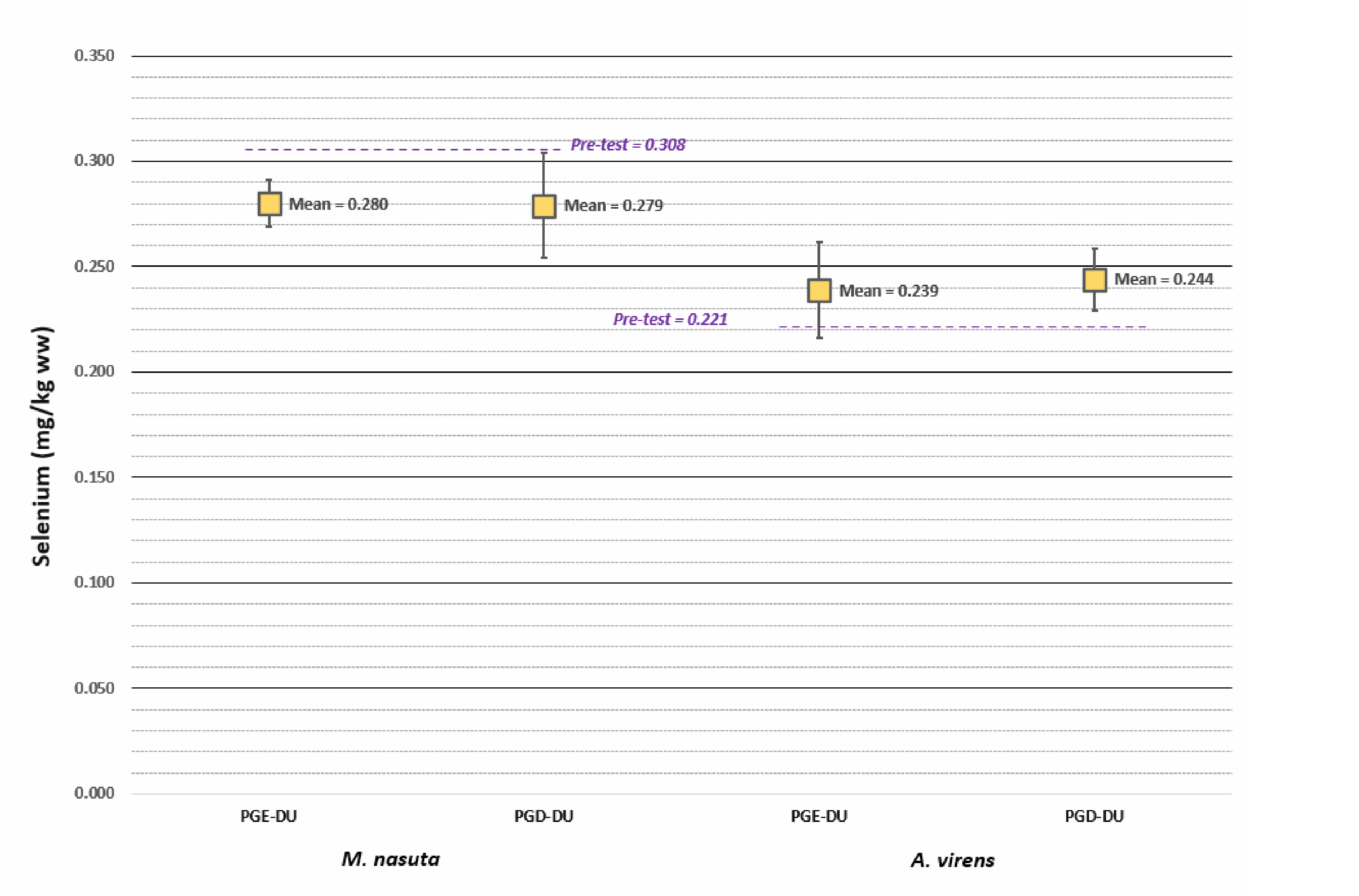


Figure 22. Selenium Concentrations (Mean and Standard Deviation) in *A. virens* and *M. nasuta* Tissues

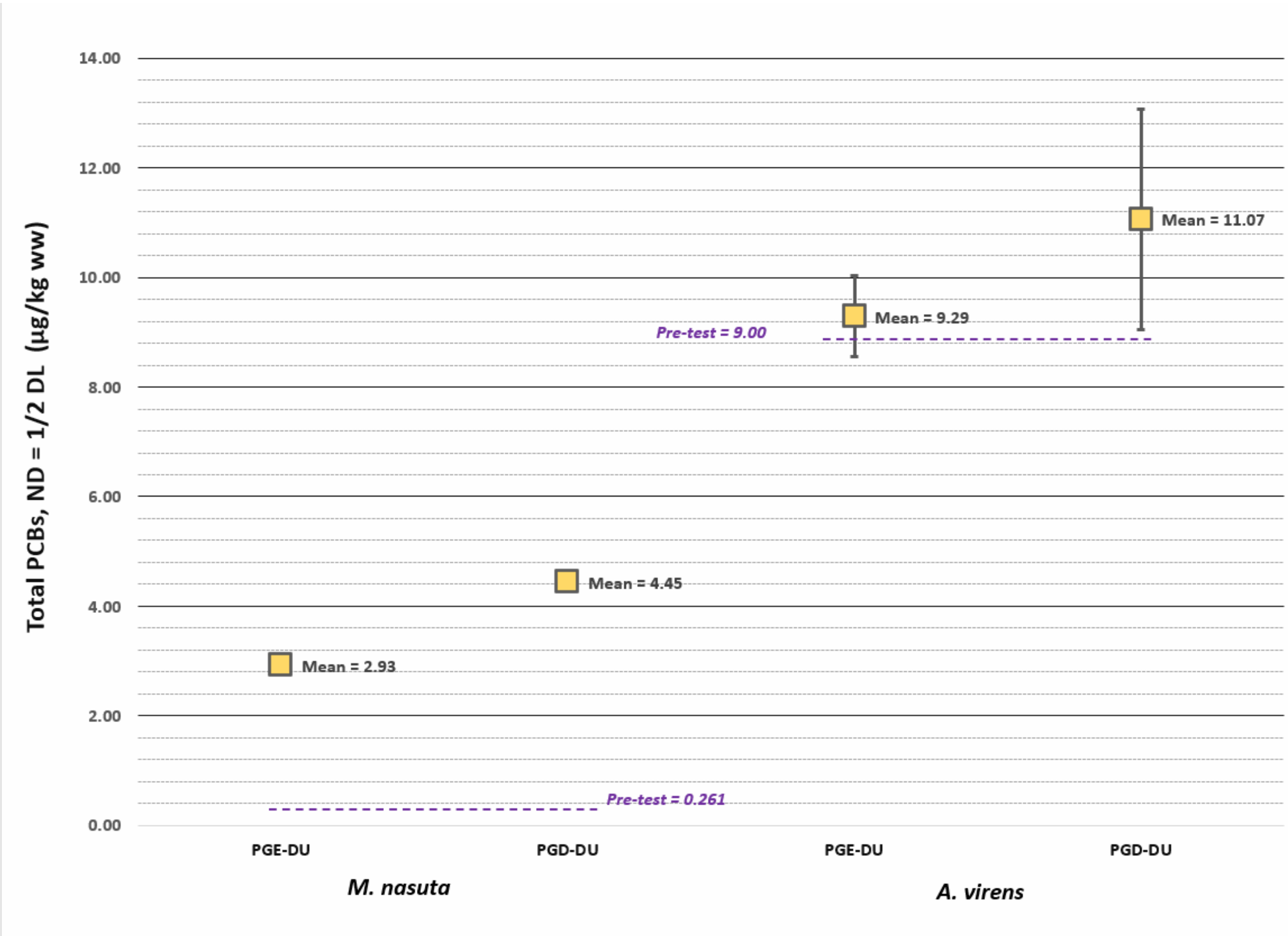


Figure 23. Total PCB Concentrations (ND=½DL) (Mean and Standard Deviation) in *A. virens* and *M. nasuta* Tissues

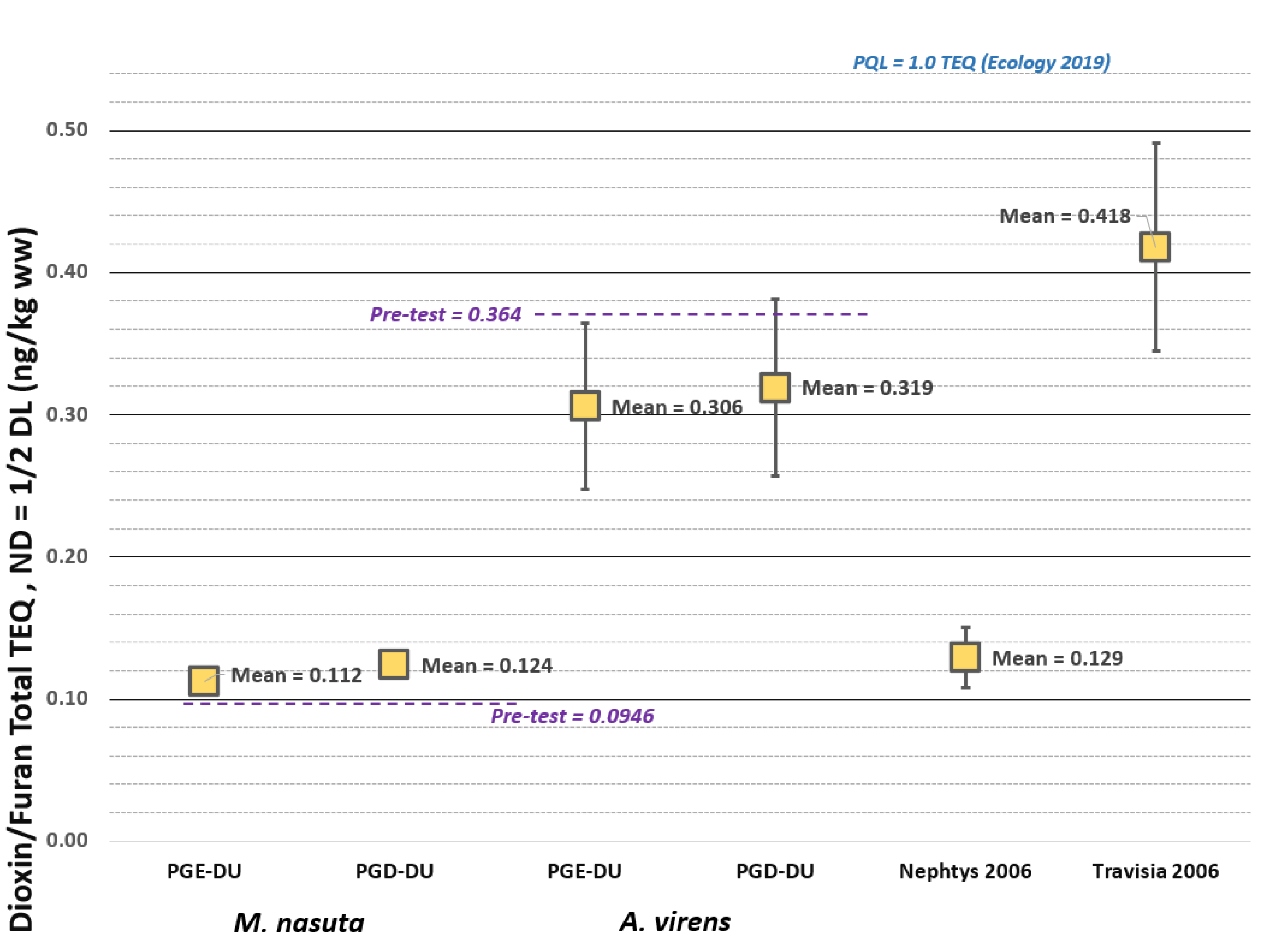


Figure 24. Dioxin/Furan TEQs (ND=½DL) (Mean and Standard Deviation) in *A. virens*, *M. nasuta*, *Nephtys*, and *Travisia* Tissues

TABLES

Table 1. Dredged Material Disposal Volumes at Port Gardner since 2010

Dredge Year	Volume (cy)	Projects
2011	44,196	City of Oak Harbor Marina
2012	34,143	Port of Everett – Pacific Terminal, Everett Marina
2013	104,199	Port of Everett / USACE Snohomish
2014	0	None
2015	11,480	Port of Kingston Marina
2016	128,094	USACE Snohomish, U.S. Navy – NAS Whidbey Island Fuel Pier, Mukilteo Ferry Dock
2017	12,623	Port of Everett – Mill A
2018	0	None
2019	201,602	USACE Snohomish, Port of Everett Marina
2020	25,570	USACE Squalicum, Port of Everett Marina
Total	**561,907**	

cy cubic yards

Table 2. DMMP Updated Monitoring Framework (February 20, 2020)

	Question	Hypothesis	Monitored Variable	Interpretive Guideline	Verification/Management
Onsite	**1. Does the deposited dredged material stay onsite?**	**A.** Dredged material **remains within the disposal site boundary.**	**SPI Data Analysis** • Depth and extent of deposited dredged material • Onsite and offsite	**Dredged Material Thickness** ➢ *If there is ≥3 cm thickness of recent dredged material at or beyond the perimeter OR ≥10 cm at or beyond the disposal site boundary, then **Hypothesis A** is rejected.*	Assess area and volume of offsite dredged material to determine significance. If significant: • Further evaluate offsite material (go to Q4). • Consider changes to disposal management practices.
Onsite	**2. Is benthic toxicity onsite consistent with Site Condition II?**	**B. Sediment toxicity** onsite does not exceed the DMMP Site Condition II benthic interpretive guidelines due to dredged material disposal.	**Sediment Chemistry** • 5 individual samples from stratified random grid within the Disposal Site DU • 0–10 cm samples analyzed for full DMMP COC list **Sediment Bioassays** • Run on all samples with any COC > SL	**Compare Data to DMMP Guidelines** ➢ *If all sediment COCs ≤ SL, then **Hypothesis A** is accepted.* ➢ *If bioassay toxicity tests exhibit a 1-hit response or two 2-hit responses, then **Hypothesis B** is rejected.*	• Compare onsite chemistry and toxicity with project evaluation data from dredged material disposed since last monitoring event. • Compare to CSL bioassay criteria to evaluate the status of the disposal site with respect to cleanup standards. • Consider changes to dredged material evaluation guidelines.
Onsite	**3a. Is bioaccumulation onsite consistent with Site Condition II?[1]** **3b. Is bioaccumulation onsite compliant with SMS CSL?**	**C. Bioaccumulation** onsite does not exceed the SMS CSL due to dredged material disposal.	**Laboratory Bioaccumulation Tests** • 20 subsamples from a stratified random grid within the Disposal Site DU are composited into a single sample analyzed for sediment chemistry and bioaccumulation testing • 20 subsamples from the Environs DU are composited into a single sample and analyzed for sediment chemistry and bioaccumulation testing • Analyze for all DMMP List 1 BCOCs	**Compare Disposal Site DU tissue data to the highest of:** • Risk-based values (including relevant TTLs) • Environs DU tissue data • PQLs if available ➢ *If BCOCs in Disposal Site DU tissues are significantly higher than the highest of the above, **Hypothesis C** is rejected.*	• Compare onsite chemistry with project evaluation data from dredged material disposed since last monitoring event. • Consider changes to dredged material evaluation guidelines
Offsite	**4. Are unacceptable adverse effects due to dredged material disposal occurring to biological resources offsite?** • Focuses on chemical/biological impacts due to detection of significant amounts of dredged material beyond the disposal site boundary. • If **Hypothesis A** is rejected, **Hypotheses E–F** will be evaluated based on best professional judgement (e.g., extent of ≥10 cm of dredged material offsite, physical characteristics, significant reduction in benthic habitat quality)	**D.** There is no significant decrease in **benthic habitat quality** offsite due to dredged material disposal.	**SPI Data Analysis** Successional stage/apparent redox potential discontinuity and other SPI parameters	**Evaluate Offsite SPI Data** ➢ *Narrative interpretation of qualitative and quantitative variables from SPI and plan view images.*	• Evaluate data (e.g., regional datasets) to determine whether impacts are due to dredged material, not ambient/regional conditions existing in the disposal site vicinity.
Offsite		**E. Sediment toxicity** in offsite dredged material does not exceed the SMS Sediment Quality Standards (SQS) due to dredged material disposal.	**Sediment Chemistry** • Individual grab samples from offsite stations with ≥10 cm of DM • Analyze for full DMMP COC list **Sediment Bioassays** • Run on all discrete offsite samples with any COC > SQS	**Compare Data to SMS SQS Criteria** ➢ *If all sediment COCs ≤ SQS, then **Hypothesis E** is accepted.* ➢ *If bioassay toxicity tests exceed SQS biological criteria, **Hypothesis E** is rejected for the offsite dredged material.*	• Evaluate Environs DU tissue data from Q3 to determine whether impacts are due to dredged material, not ambient/regional conditions existing in the disposal site vicinity. • Develop protocols to prevent significant offsite movement of dredged material. • Special studies on why offsite movement occurred and how to prevent in the future.
Offsite		**F. Bioaccumulation** from offsite dredged material does not exceed the SMS SQS due to dredged material disposal.	**Laboratory Bioaccumulation Tests** • Disposal Site DU expanded to include offsite areas with ≥10 cm of dredged material • 20 subsamples from a stratified random grid within expanded Disposal Site DU are composited into a single sample and analyzed for sediment chemistry and bioaccumulation testing • 20 subsamples from the Carr Inlet Reference area are composited into a single sample and analyzed for sediment chemistry and bioaccumulation testing • Analyze for all DMMP List 1 BCOCs	**Compare tissue data from the expanded Disposal Site DU to the highest of:** • Natural background (Carr Inlet reference sample) • Risk-based values (including relevant TTLs) • PQLs if available ➢ *If BCOCs in expanded Disposal Site DU tissues are significantly higher than the highest guideline, **Hypothesis F** is rejected for the offsite dredged material.*	

Dark shading = Tier 1 (always conducted); Light shading = Tier 2 (conducted if indicated by Tier 1 results)

[1] Because Site Condition II is not well-defined for evaluating bioaccumulation, SMS criteria will be used in the interim.

Table 3. Geographic Coordinates for Sediment Grab Samples Collected in Port Gardner

Station ID	Date	Local Time	Sample Rep	Target Coordinates (NAD83) Latitude N	Target Coordinates (NAD83) Longitude W	Actual Coordinates (NAD83) Latitude N	Actual Coordinates (NAD83) Longitude W	Distance to Target (m)	Water Depth (m)	Tide (m)	Depth MLLW (m)
Bioaccumulation Grab Samples											
PGD-02	7/14/2020	1113	1	47° 58.54028	-122° 16.79346	47° 58.5351	-122° 16.7989	10.8	-133	1.72	-131
PGD-05	7/14/2020	1137	1	47° 58.60388	-122° 17.09664	47° 58.6016	-122° 17.0990	5.6	-137	1.86	-135
PGD-07	7/14/2020	1203	1	47° 58.60646	-122° 16.89576	47° 58.6070	-122° 16.8904	7	-133	1.99	-131
PGD-11	7/14/2020	1331	1	47° 58.61150	-122° 16.49400	47° 58.6148	-122° 16.5020	11.7	-132	2.26	-130
PGD-16	7/14/2020	1354	1	47° 58.67516	-122° 16.79724	47° 58.6729	-122° 16.7992	4.7	-132	2.28	-130
PGD-20	7/14/2020	1513	1	47° 58.68020	-122° 16.39542	47° 58.6808	-122° 16.4005	6.9	-132	2.25	-130
PGD-32	7/14/2020	1536	1	47° 58.80494	-122° 17.20278	47° 58.7982	-122° 17.1999	12.7	-139	2.22	-137
PGD-35	7/14/2020	1656	1	47° 58.80878	-122° 16.90146	47° 58.8051	-122° 16.9096	11.6	-131	2.04	-129
PGD-37	7/15/2020	845	1	47° 58.81130	-122° 16.70052	47° 58.8096	-122° 16.6995	3.4	-126	0.43	-126
PGD-38	7/15/2020	906	1	47° 58.81256	-122° 16.60008	47° 58.8109	-122° 16.5982	4.5	-127	0.5	-127
PGD-41	7/15/2020	1052	1	47° 58.81634	-122° 16.29876	47° 58.8174	-122° 16.2956	5	-133	1.18	-132
PGD-47	7/15/2020	1219	1	47° 58.87874	-122° 16.70244	47° 58.8795	-122° 16.6814	4.4	-126	1.83	-124
PGD-49	7/15/2020	1324	1	47° 58.88126	-122° 16.50156	47° 58.8809	-122° 16.4993	3.4	-127	2.23	-125
PGD-50	7/15/2020	1344	1	47° 58.88252	-122° 16.40106	47° 58.8825	-122° 16.3939	8.9	-136	2.32	-134
PGD-52	7/15/2020	1408	1	47° 58.93982	-122° 17.20662	47° 58.9410	-122° 17.2066	2.2	-137	2.41	-135
PGD-63	7/15/2020	1427	1	47° 59.00984	-122° 17.00760	47° 58.0101	-122° 17.0101	2.7	-134	2.46	-132
PGD-66	7/15/2020	1444	1	47° 59.01362	-122° 16.70622	47° 59.0085	-122° 16.7050	9.3	-133	2.51	-130
PGD-69	7/15/2020	1555	1	47° 59.01746	-122° 16.40484	47° 59.0179	-122° 16.4012	4.8	-140	2.55	-137
PGD-82	7/15/2020	1608	1	47° 59.14850	-122° 16.71000	47° 59.1448	-122° 16.7046	8.7	-141	2.55	-138
PGD-84	7/15/2020	1624	1	47° 59.15108	-122° 16.50906	47° 59.1544	-122° 16.5161	10.6	-138	2.53	-135
PGE-01	7/13/2020	1012	1	47° 57.89702	-122° 16.91520	47° 57.8945	-122° 16.9096	8.2	-150	1.76	-148
PGE-04	7/13/2020	1048	1	47° 58.16174	-122° 17.32446	47° 58.1572	-122° 17.3256	9	-145	1.91	-143
PGE-06	7/13/2020	1114	1	47° 58.17188	-122° 16.52106	47° 58.1707	-122° 16.5240	1.3	-138	2.01	-136
PGE-07	7/13/2020	1136	1	47° 58.17692	-122° 16.11930	47° 58.1788	-122° 16.1172	4.5	-134	2.07	-132

Station ID	Date	Local Time	Sample Rep	Target Coordinates (NAD83) Latitude N	Target Coordinates (NAD83) Longitude W	Actual Coordinates (NAD83) Latitude N	Actual Coordinates (NAD83) Longitude W	Distance to Target (m)	Water Depth (m)	Tide (m)	Depth MLLW (m)
PGE-10	7/13/2020	1207	1	47° 58.42640	-122° 17.73384	47° 58.4200	-122° 17.7421	14.5	-148	2.12	-146
PGE-13	7/13/2020	1304	1	47° 58.69100	-122° 18.14328	47° 58.6932	-122° 18.1378	7.5	-153	2.12	-151
PGE-14	7/13/2020	1323	1	47° 58.69616	-122° 17.74146	47° 58.6967	-122° 17.7428	2.0	-148	2.09	-146
PGE-15	7/13/2020	1537	1	47° 58.72148	-122° 15.73248	47° 58.7228	-122° 15.7257	8.6	-119	1.74	-117
PGE-16	7/13/2020	1619	1	47° 58.95566	-122° 18.55278	47° 58.9502	-122° 18.5475	12.8	-153	1.61	-151
PGE-17	7/13/2020	1639	1	47° 58.96082	-122° 18.15096	47° 58.9634	-122° 18.1470	6.2	-151	1.57	-149
PGE-18	7/13/2020	1702	1	47° 58.96592	-122° 17.74914	47° 58.9710	-122° 17.7455	10.4	-144	1.54	-142
PGE-19	7/14/2020	1045	1	47° 58.99130	-122° 15.73998	47° 58.9913	-122° 15.7395	0.9	-125	1.55	-123
PGE-20	7/14/2020	910	1	47° 59.22542	-122° 18.56046	47° 59.2292	-122° 18.5572	8.5	-151	0.96	-150
PGE-21	7/14/2020	934	1	47° 59.23058	-122° 18.15858	47° 59.2348	-122° 18.1506	12.6	-145	1.09	-144
PGE-23	7/14/2020	955	1	47° 59.24084	-122° 17.35488	47° 59.2416	-122° 17.3506	5.6	-138	1.22	-137
PGE-26	7/13/2020	1347	1	47° 59.50550	-122° 17.76438	47° 59.5035	-122° 17.7628	5	-141	2.05	-139
PGE-27	7/13/2020	1419	1	47° 59.51060	-122° 17.36250	47° 59.5087	-122° 17.3594	6.3	-139	1.98	-137
PGE-28	7/13/2020	1443	1	47° 59.38082	-122° 16.95684	47° 59.3805	-122° 16.9614	5.6	-137	1.91	-135
PGE-29	7/13/2020	1506	1	47° 59.38586	-122° 16.55496	47° 59.3785	-122° 16.5503	15	-142	1.84	-140
PGE-30	7/14/2020	1018	1	47° 59.52584	-122° 16.15680	47° 59.5208	-122° 16.1528	10.9	-143	1.36	-142
Benthic Toxicity Grab Samples											
PGD-16	7/14/2020	1414	1	47° 58.67516	-122° 16.79724	47° 58.6737	-122° 16.1970	3	-131	2.29	-129
PGD-16	7/14/2020	1427	2	47° 58.67516	-122° 16.79724	47° 58.6730	-122° 16.7913	7.2	-132	2.29	-130
PGD-16	7/14/2020	1442	3	47° 58.67516	-122° 16.79724	47° 58.6693	-122° 16.8014	11.9	-132	2.28	-130
PGD-32	7/14/2020	1552	1	47° 58.80494	-122° 17.20278	47° 58.8015	-122° 17.2026	6.4	-138	2.19	-136
PGD-32	7/14/2020	1611	2	47° 58.80494	-122° 17.20278	47° 58.7995	-122° 17.2060	10.6	-138	2.15	-136
PGD-32	7/14/2020	1627	3	47° 58.80494	-122° 17.20278	47° 58.8017	-122° 17.2052	6.5	-138	2.11	-136
PGD-38	7/15/2020	939	1	47° 58.81256	-122° 16.60008	47° 58.8155	-122° 16.5953	7.1	-127	0.65	-126
PGD-38	7/15/2020	1008	2	47° 58.81256	-122° 16.60008	47° 58.8111	-122° 16.6097	12	-127	0.82	-126
PGD-38	7/15/2020	1024	3	47° 58.81256	-122° 16.60008	47° 58.8131	-122° 16.6004	0.4	-127	0.94	-126

Station ID	Date	Local Time	Sample Rep	Target Coordinates (NAD83) Latitude N	Target Coordinates (NAD83) Longitude W	Actual Coordinates (NAD83) Latitude N	Actual Coordinates (NAD83) Longitude W	Distance to Target (m)	Water Depth (m)	Tide (m)	Depth MLLW (m)
PGD-66	7/15/2020	1500	1	47° 59.01362	-122° 16.70622	47° 59.0132	-122° 16.7017	5.3	-133	2.52	-130
PGD-66	7/15/2020	1514	2	47° 59.01362	-122° 16.70622	47° 59.0151	-122° 16.7092	5.0	-131	2.54	-128
PGD-66	7/15/2020	1529	3	47° 59.01362	-122° 16.70622	47° 59.0133	-122° 16.7102	5.3	-131	2.55	-128
PGD-84	7/15/2020	1640	1	47° 59.15108	-122° 16.50906	47° 59.1504	-122° 16.5045	5.7	-138	2.51	-135
PGD-84	7/15/2020	1653	2	47° 59.15108	-122° 16.50906	47° 59.1489	-122° 16.5097	3.9	-138	2.49	-136
PGD-84	7/15/2020	1707	3	47° 59.15108	-122° 16.50906	47° 59.1479	-122° 16.5064	5.8	-138	2.46	-136

Notes:
Latitude and longitude in degrees and decimal minutes
MLLW mean lower low water
NAD83 North American Datum 1983

Table 4. 2020 Port Gardner Sediment Samples and Analyses

Sample ID	Sediment Depth Interval	Conventionals	Metals	TBT (bulk)	SVOCs/PAHs/ Pesticides	PCB Aroclors	PCB Congeners	Dioxin/Furan Congeners	PBDEs	Bioaccumulation	Bioassays
Laboratory		**ARI**	**ARI**	**ARI**	**ARI**	**ARI**	**SGS-Axys**	**SGS-Axys**	**SGS-Axys**	**EcoAnalysts**	**EcoAnalysts**
PGD-DU	0–10 cm	✓	✓	✓	✓	✓	✓	✓	✓	✓	
PGE-DU	0–10 cm	✓	✓	✓	✓	✓	✓	✓	✓	✓	
PGD-16	0–10 cm	✓	✓		✓	✓					(A)
PGD-32	0–10 cm	✓	✓		✓	✓					(A)
PGD-38	0–10 cm	✓	✓		✓	✓					(A)
PGD-66	0–10 cm	✓	✓		✓	✓					(A)
PGD-84	0–10 cm	✓	✓		✓	✓					(A)
PS-SRM						✓	✓	✓			

(A) archived
✓ analyzed
PBDE polybrominated diethyl ether
PCB polychlorinated biphenyl
PS-SRM Puget Sound Sediment Reference Material
SVOC semivolatile organic compound
TBT tributyltin ion
Note: The DU composite samples required analysis of the List 1 BCOC compounds. However, the samples were analyzed in the same batch as the benthic toxicity samples and were analyzed for the full DMMP COC list for metals, SVOCs, and pesticides.

Table 5. 2020 Port Gardner Bioaccumulation Tissue Samples and Analyses

Sample ID	Organism	Total Solids	Lipids	Metals[1]	TBT (bulk)	SVOCs[2]	Pesticides[3]	PCB Congeners	Dioxins/ Furans
Laboratory		**ARI**	**ARI**	**ARI**	**ARI**	**ARI**	**ARI**	**SGS-Axys**	**SGS-Axys**
Macoma Pre-Test	*M. nasuta*	✓	✓	✓	✓	✓	✓	✓	✓
(Dupl) Macoma Pre-Test[4]	*M. nasuta*							✓	✓
PGD-DU Rep 1	*M. nasuta*	✓	✓	✓	✓	✓	✓	✓	✓
PGD-DU Rep 2	*M. nasuta*	✓	✓	✓	✓	✓	✓	✓	✓
PGD-DU Rep 3	*M. nasuta*	✓	✓	✓	✓	✓	✓	✓	✓
PGD-DU Rep 4	*M. nasuta*	✓	✓	✓	✓	✓	✓	✓	✓
PGD-DU Rep 5	*M. nasuta*	✓	✓	✓	✓	✓	✓	✓	✓
PGE-DU Rep 1	*M. nasuta*	✓	✓	✓	✓	✓	✓	✓	✓
PGE-DU Rep 2	*M. nasuta*	✓	✓	✓	✓	✓	✓	✓	✓
PGE-DU Rep 3	*M. nasuta*	✓	✓	✓	✓	✓	✓	✓	✓
PGE-DU Rep 4	*M. nasuta*	✓	✓	✓	✓	✓	✓	✓	✓
PGE-DU Rep 5	*M. nasuta*	✓	✓	✓	✓	✓	✓	✓	✓
N.v.Pretest Rep 1[5]	*A. virens*	✓	✓	✓	✓	✓	✓	✓	
(Dupl) N.v.Pretest Rep 1[6]	*A. virens*							✓	✓
A.v.PGD-DU Rep 1	*A. virens*	✓	✓	✓	✓	✓	✓	✓	✓
A.v.PGD-DU Rep 2	*A. virens*	✓	✓	✓	✓	✓	✓	✓	✓
A.v.PGD-DU Rep 3	*A. virens*	✓	✓	✓	✓	✓	✓	✓	✓
A.v.PGD-DU Rep 4	*A. virens*	✓	✓	✓	✓	✓	✓	✓	✓
A.v.PGD-DU Rep 5	*A. virens*	✓	✓	✓	✓	✓	✓	✓	✓
A.v.PGE-DU Rep 1	*A. virens*	✓	✓	✓	✓	✓	✓	✓	✓
A.v.PGE-DU Rep 2	*A. virens*	✓	✓	✓	✓	✓	✓	✓	✓
A.v.PGE-DU Rep 3	*A. virens*	✓	✓	✓	✓	✓	✓	✓	✓
A.v.PGE-DU Rep 4	*A. virens*	✓	✓	✓	✓	✓	✓	✓	✓
A.v.PGE-DU Rep 5	*A. virens*	✓	✓	✓	✓	✓	✓	✓	✓

1. Metals include arsenic, lead, mercury, and selenium
2. Hexachlorobenzene, pentachlorophenol, and full list of PAHs
3. Dichlorodiphenyltrichloroethanes (DDTs) and chlordanes
4. Tissue volume for the (Dupl) Macoma Pre-Test sample was only available to run PCB congeners and dioxins/furans
5. Dioxin/furan results for N.v.Prestest Rep 1 were rejected due to possible contamination by a spiking solution (see Stage 4 data validation report in Appendix F)
6. Tissue volume for the (Dupl) N.v.Pretest Rep 1 sample was only available to run PCB congeners and dioxins/furans

TBT tributyltin

Table 6. 2020 Port Gardner SPME Fiber Samples and Analyses

Sample ID	PCB Congeners	Dioxins/ Furans
Laboratory	**SGS-Axys**	**SGS-Axys**
PGD-DU Rep 1	✓	✓
PGD-DU Rep 2	✓	✓
PGD-DU Rep 3	✓	✓
PGE-DU Rep 1	✓	✓
PGE-DU Rep 2	✓	✓
PGE-DU Rep 5	✓	✓
Day Zero Sample	✓	✓
Trip Blank	✓	✓

Table 7. 2020 Port Gardner Sediment Chemistry Results

Compound	Units Dry Weight	DMMP SL	DMMP BT	DMMP ML	PGD-16 Results	PGD-16 Q	PGD-32 Results	PGD-32 Q	PGD-38 Results	PGD-38 Q	PGD-66 Results	PGD-66 Q	PGD-84 Results	PGD-84 Q	PGD-DU Results	PGD-DU Q	PGE-DU Results	PGE-DU Q
Conventionals																		
Total Solids	%	---	---	---	45.99		48.08		53		52.46		45.17		49.87		41.57	
Total Volatile Solids	%	---	---	---	6.56		5.7		6.42		6.64		6.31		6.09		7.21	
Total Organic Carbon	%	---	---	---	2.13		1.37		2.05		2.58		1.52		1.5		1.34	
Total Sulfides	mg/kg	---	---	---	115		25.6		188		183		33.3		126		6.42	
Ammonia	mg/kg	---	---	---	7.08		2.98		5.76		3.7		5.69		5.86		6.09	
Gravel	%	---	---	---	0.4		0.1		2.5		0.8		0.1		0.9		0.2	
Sand	%	---	---	---	30.8		32.2		38.7		45.5		20.2		32.2		28	
Silt	%	---	---	---	46.8		46.5		40.6		37.1		50.2		45.5		42.2	
Clay	%	---	---	---	21.9		21.3		18.3		16.5		29.5		21.8		29.6	
Fines (Silt + Clay)	%	---	---	---	68.8		67.7		58.9		53.6		79.7		67.1		71.9	
Metals and Metalloid																		
Antimony	mg/kg	150	---	200	0.41	UJ	0.42	U	0.37	U	0.37	U	0.44	U	0.39	U	0.46	U
Arsenic	mg/kg	57	507.1	700	9.75		8.64		8.71		8.11		8.28		9.03		8.19	
Cadmium	mg/kg	5.1	---	14	0.27		0.21		0.35		0.27		0.2	J	0.26		0.17	J
Chromium	mg/kg	260	---	---	43		42.1		39.5		37.8		42.8		42.2		41.9	
Copper	mg/kg	390	---	1,300	43.1		41.9		69.5		37.6		40.5		43		34.3	
Lead	mg/kg	450	975	1,200	11.2		10.8		9.86		8.39		11.6		11.7		12.7	
Mercury	mg/kg	0.41	1.5	2.3	0.0946		0.0812		0.129		0.071		0.0983		0.103		0.092	
Selenium	mg/kg	---	3	---	1.3		1	J	1.91		1.11		1.24		1.37		1.37	
Silver	mg/kg	6.1	---	8.4	0.19	J	0.19	J	0.24	J	0.14	J	0.21	J	0.17	J	0.19	J
Zinc	mg/kg	410	---	3,800	75.8		72.1		69		66.6		73.3		74.6		72.2	
Butyltins																		
Bulk tributyltin	ug/kg	---	73	---	NA		NA		NA		NA		NA		1.36	J	0.552	J
Organics																		
PAHs																		
Naphthalene	ug/kg	2,100	---	2,400	26.3		16.7	J	181		41.4		22.8		18	J	12.1	J
Acenaphthylene	ug/kg	560	---	1,300	7.6	J	6.3	J	12.8	J	7.3	J	5.3	J	5.7	J	19.9	U
Acenaphthene	ug/kg	500	---	2,000	7.2	J	19.9	U	26.8		16.8	J	5.6	J	19.9	U	19.9	U
Fluorene	ug/kg	540	---	3,600	9.9	J	6.5	J	35.2		21.7		6.9	J	10.9	J	19.9	U

Compound	Units Dry Weight	DMMP SL	DMMP BT	DMMP ML	PGD-16 Results	Q	PGD-32 Results	Q	PGD-38 Results	Q	PGD-66 Results	Q	PGD-84 Results	Q	PGD-DU Results	Q	PGE-DU Results	Q
Phenanthrene	ug/kg	1,500	---	21,000	43.5		24.1		94		51.7		24.9		33.1		14.9	J
Anthracene	ug/kg	960	---	13,000	24.7		8.6	J	31.2		53.9		7	J	13.8	J	19.9	U
2-Methylnaphthalene	ug/kg	670	---	1,900	10.9	J	7	J	72.3		15.9	J	11.1	J	7.3	J	8.5	J
Total LPAH	ug/kg	5,200	---	29,000	130.1		69.2		453.3		208.7		83.6		88.8		35.5	
Fluoranthene	ug/kg	1,700	4,600	30,000	131		39.6		476		112		30.9		37.7		22.4	
Pyrene	ug/kg	2,600	11,980	16,000	122		40		401		110		32.9		45.8		21.9	
Benzo(a)anthracene	ug/kg	1,300	---	5,100	57.2		18.9	J	104		33		14.3	J	16.4	J	9	J
Chrysene	ug/kg	1,400	---	21,000	107		34.1		222		63.6		20.2		27.6		13.5	J
Benzofluoranthenes	ug/kg	3,200	---	9,900	85.8		38.9	J	218		69.4		27.1	J	36.5	J	21	J
Benzo(a)pyrene	ug/kg	1,600	---	3,600	34.9		18.9	J	65.7		31.8		11.9	J	17.4	J	11.9	J
Indeno(1,2,3-c,d)pyrene	ug/kg	600	---	4,400	19.8		13.4	J	41.1		18.3	J	10.1	J	11.9	J	8.2	J
Dibenzo(a,h)anthracene	ug/kg	230	---	1,900	9.3	J	19.9	U	14.5	J	7	J	20	U	19.9	U	19.9	U
Benzo(g,h,i)perylene	ug/kg	670	---	3,200	19.7	U	15.3	J	41		18.8	J	12.1	J	11.5	J	19.9	U
Total HPAH	ug/kg	12,000	---	69,000	567		219.1		1583.3		463.9		159.5		204.8		107.9	
Chlorinated Hydrocarbons																		
1,4-Dichlorobenzene	ug/kg	110	---	120	19.7	U	19.9	U	7.5	J	19.6	U	20	U	19.9	U	19.9	U
1,2-Dichlorobenzene	ug/kg	35	---	110	19.7	U	19.9	U	19.9	U	19.6	U	20	U	19.9	U	19.9	U
1,2,4-Trichlorobenzene	ug/kg	31	---	64	19.7	U	19.9	U	19.9	U	19.6	U	20	U	19.9	U	19.9	U
Hexachlorobenzene	ug/kg	22	168	230	19.7	U	19.9	U	19.9	U	19.6	U	20	U	19.9	U	19.9	U
Phthalates																		
Dimethyl phthalate	ug/kg	71	---	1,400	19.7	U	19.9	U	19.9	U	19.6	U	20	U	19.9	U	19.9	U
Diethyl phthalate	ug/kg	200	---	1,200	19.7	U	19.9	U	19.9	U	19.6	U	20	U	19.9	U	19.9	U
Di-n-butyl phthalate	ug/kg	1,400	---	5,100	19.7	U	19.9	U	19.9	U	19.6	U	20	U	19.9	U	19.9	U
Butyl benzyl phthalate	ug/kg	63	---	970	19.7	U	19.9	U	19.9	U	19.6	U	20	U	19.9	U	19.9	U
Bis(2-ethylhexyl)phthalate	ug/kg	1,300	---	8,300	49.4	U	49.7	U	49.7	U	49.1	U	50	U	37	J	49.7	U
Di-n-octyl phthalate	ug/kg	6,200	---	6,200	19.7	U	19.9	U	19.9	U	19.6	U	20	U	19.9	U	19.9	U
Phenols																		
Phenol	ug/kg	420	---	1,200	21		13.9	J	20		12.6	J	71.1		26.5		16.5	J
2-Methylphenol	ug/kg	63	---	77	19.7	U	19.9	U	19.9	U	19.6	U	20	U	19.9	U	19.9	U
4-Methylphenol	ug/kg	670	---	3,600	35.6		19.1	J	41.6		54.9		19.8	J	22		19.9	U
2,4-Dimethylphenol	ug/kg	29	---	210	3	J	2.9	J	2.5	J	19.6	U	20	U	19.9	U	19.9	U
Pentachlorophenol	ug/kg	400	504	690	98.7	U	99.3	U	99.5	U	98.1	U	100	U	99.4	U	99.3	U

Compound	Units Dry Weight	DMMP SL	DMMP BT	DMMP ML	PGD-16 Results	Q	PGD-32 Results	Q	PGD-38 Results	Q	PGD-66 Results	Q	PGD-84 Results	Q	PGD-DU Results	Q	PGE-DU Results	Q
Miscellaneous Extractables																		
Benzyl alcohol	ug/kg	57	---	870	19.7	U	19.9	U	19.3	J	25		20	U	19.9	U	19.9	U
Benzoic acid	ug/kg	650	---	760	93.5	J	72.8	J	66.1	J	74.7	J	200	U	199	U	199	U
Dibenzofuran	ug/kg	540	---	1,700	7.9	J	4.9	J	52		17.1	J	5.8	J	6.4	J	19.9	U
Hexachlorobutadiene	ug/kg	11	---	270	4.9	U	5	U	5	U	4.9	U	5	U	5	U	5	U
N-Nitrosodiphenylamine	ug/kg	28	---	130	19.7	U	19.9	U	19.9	U	19.6	U	20	U	19.9	U	10.3	J
Pesticides and PCBs																		
4,4'-DDD	ug/kg	16	---	---	1	U	1	U	0.99	U	1	U	1	U	1	U	1	U
4,4'-DDE	ug/kg	9	---	---	1	U	1	U	0.99	U	1	U	1	U	1	U	1	U
4,4'-DDT	ug/kg	12	---	---	1	U	1	U	0.99	U	1	U	1	U	1	U	1	U
Total 4,4'-DDX	ug/kg	---	50	69	1	U	1	U	0.99	U	1	U	1	U	1	U	1	U
Aldrin	ug/kg	9.5	---	---	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
Total Chlordane	ug/kg	2.8	37	---	1	U	1	U	0.99	U	1	U	1	U	0.5	U	1	U
Dieldrin	ug/kg	1.9	---	1,700	1	U	1	U	0.99	U	1	U	1	U	1	U	1	U
Heptachlor	ug/kg	1.5	---	270	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
Total PCBs	ug/kg	130	38*	3,100	14.5		10.4		17.1		12.2		10.4		12.2		9.9	
Dioxins/Furans																		
2,3,7,8-TCDD	ng/kg	---	---	---	NA		NA		NA		NA		NA		0.20	J	0.392	J
1,2,3,7,8-PeCDD	ng/kg	---	---	---	NA		NA		NA		NA		NA		0.612	J	0.847	U
1,2,3,4,7,8-HxCDD	ng/kg	---	---	---	NA		NA		NA		NA		NA		0.994	U	0.888	J
1,2,3,6,7,8-HxCDD	ng/kg	---	---	---	NA		NA		NA		NA		NA		3.30		3.21	
1,2,3,7,8,9-HxCDD	ng/kg	---	---	---	NA		NA		NA		NA		NA		2.97		3.43	
1,2,3,4,6,7,8-HpCDD	ng/kg	---	---	---	NA		NA		NA		NA		NA		65		47.8	
OCDD	ng/kg	---	---	---	NA		NA		NA		NA		NA		484		336	
2,3,7,8-TCDF	ng/kg	---	---	---	NA		NA		NA		NA		NA		1.4		1.91	
1,2,3,7,8-PeCDF	ng/kg	---	---	---	NA		NA		NA		NA		NA		0.367	J	0.488	J
2,3,4,7,8-PeCDF	ng/kg	---	---	---	NA		NA		NA		NA		NA		0.462	J	0.722	J
1,2,3,4,7,8-HxCDF	ng/kg	---	---	---	NA		NA		NA		NA		NA		0.732	J	0.946	J
1,2,3,6,7,8-HxCDF	ng/kg	---	---	---	NA		NA		NA		NA		NA		0.499	J	0.542	J
1,2,3,7,8,9-HxCDF	ng/kg	---	---	---	NA		NA		NA		NA		NA		0.083	J	0.134	U
2,3,4,6,7,8-HxCDF	ng/kg	---	---	---	NA		NA		NA		NA		NA		0.452	J	0.595	J

Compound	Units Dry Weight	DMMP SL	DMMP BT	DMMP ML	PGD-16 Results	Q	PGD-32 Results	Q	PGD-38 Results	Q	PGD-66 Results	Q	PGD-84 Results	Q	PGD-DU Results	Q	PGE-DU Results	Q
1,2,3,4,6,7,8-HpCDF	ng/kg	---	---	---	NA		NA		NA		NA		NA		9.82		8.87	
1,2,3,4,7,8,9-HpCDF	ng/kg	---	---	---	NA		NA		NA		NA		NA		0.602	J	0.545	J
OCDF	ng/kg	---	---	---	NA		NA		NA		NA		NA		22.5		16.2	
TEQ (0 DL)	ng/kg	4	10	---	NA		NA		NA		NA		NA		2.81		2.45	
TEQ (1/2 DL)	ng/kg	4	10	---	NA		NA		NA		NA		NA		2.86		2.88	
TOTAL TETRA-DIOXINS	ng/kg				NA		NA		NA		NA		NA		11.4		13.4	
TOTAL PENTA-DIOXINS	ng/kg				NA		NA		NA		NA		NA		9.07		12.7	
TOTAL HEXA-DIOXINS	ng/kg				NA		NA		NA		NA		NA		33.8		39	
TOTAL HEPTA-DIOXINS	ng/kg				NA		NA		NA		NA		NA		170		121	
TOTAL TETRA-FURANS	ng/kg				NA		NA		NA		NA		NA		13.1		20.5	
TOTAL PENTA-FURANS	ng/kg				NA		NA		NA		NA		NA		7.89		10.8	
TOTAL HEXA-FURANS	ng/kg				NA		NA		NA		NA		NA		15.4		15.1	
TOTAL HEPTA-FURANS	ng/kg				NA		NA		NA		NA		NA		28		23.4	
PBDEs																		
BR2-DPE-7	ng/kg	---	---	---	NA		NA		NA		NA		NA		8.43		6.22	
BR2-DPE-8/11	ng/kg	---	---	---	NA		NA		NA		NA		NA		9.16		11.2	
BR2-DPE-10	ng/kg	---	---	---	NA		NA		NA		NA		NA		0.165	J	0.106	U
BR2-DPE-12/13	ng/kg	---	---	---	NA		NA		NA		NA		NA		1.2	J	1.31	J
BR2-DPE-15	ng/kg	---	---	---	NA		NA		NA		NA		NA		3.56	J	5.12	
BR3-DPE-17/25	ng/kg	---	---	---	NA		NA		NA		NA		NA		33.7		39	
BR3-DPE-28/33	ng/kg	---	---	---	NA		NA		NA		NA		NA		7.33		11.9	
BR3-DPE-30	ng/kg	---	---	---	NA		NA		NA		NA		NA		0.168	U	0.242	U
BR3-DPE-32	ng/kg	---	---	---	NA		NA		NA		NA		NA		0.454	U	0.41	J
BR3-DPE-35	ng/kg	---	---	---	NA		NA		NA		NA		NA		0.121	U	0.176	U
BR3-DPE-37	ng/kg	---	---	---	NA		NA		NA		NA		NA		0.436	J	0.653	J
BR4-DPE-47	ng/kg	---	---	---	NA		NA		NA		NA		NA		82.6		99.3	
BR4-DPE-49	ng/kg	---	---	---	NA		NA		NA		NA		NA		37.3		42.5	
BR4-DPE-51	ng/kg	---	---	---	NA		NA		NA		NA		NA		5.25		6.84	
BR4-DPE-66	ng/kg	---	---	---	NA		NA		NA		NA		NA		3.65	J	3.88	J
BR4-DPE-71	ng/kg	---	---	---	NA		NA		NA		NA		NA		1.33	J	1.72	J
BR4-DPE-75	ng/kg	---	---	---	NA		NA		NA		NA		NA		0.187	U	0.121	U
BR4-DPE-77	ng/kg	---	---	---	NA		NA		NA		NA		NA		0.095	U	0.096	U

	Units		DMMP		PGD-16		PGD-32		PGD-38		PGD-66		PGD-84		PGD-DU		PGE-DU	
Compound	Dry Weight	SL	BT	ML	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q
BR4-DPE-79	ng/kg	---	---	---	NA		NA		NA		NA		NA		0.165	U	0.363	U
BR5-DPE-85	ng/kg	---	---	---	NA		NA		NA		NA		NA		2.36	J	1.8	J
BR5-DPE-99	ng/kg	---	---	---	NA		NA		NA		NA		NA		52.9		60.8	
BR5-DPE-100	ng/kg	---	---	---	NA		NA		NA		NA		NA		18.1		21.2	
BR5-DPE-105	ng/kg	---	---	---	NA		NA		NA		NA		NA		0.31	U	0.364	U
BR5-DPE-116	ng/kg	---	---	---	NA		NA		NA		NA		NA		0.363	U	0.426	U
BR5-DPE-119/120	ng/kg	---	---	---	NA		NA		NA		NA		NA		0.445	U	0.55	U
BR5-DPE-126	ng/kg	---	---	---	NA		NA		NA		NA		NA		0.102	U	0.225	U
BR6-DPE-128	ng/kg	---	---	---	NA		NA		NA		NA		NA		1.01	U	2.28	U
BR6-DPE-138/166	ng/kg	---	---	---	NA		NA		NA		NA		NA		1.58	J	1.47	J
BR6-DPE-140	ng/kg	---	---	---	NA		NA		NA		NA		NA		0.649	J	0.88	J
BR6-DPE-153	ng/kg	---	---	---	NA		NA		NA		NA		NA		6.65		7.9	
BR6-DPE-154	ng/kg	---	---	---	NA		NA		NA		NA		NA		7.53		9.37	
BR6-DPE-155	ng/kg	---	---	---	NA		NA		NA		NA		NA		1.24	J	2.27	J
BR7-DPE-181	ng/kg	---	---	---	NA		NA		NA		NA		NA		0.176	U	0.174	U
BR7-DPE-183	ng/kg	---	---	---	NA		NA		NA		NA		NA		2.28	U	2.73	J
BR7-DPE-190	ng/kg	---	---	---	NA		NA		NA		NA		NA		0.386	U	0.535	U
BR8-DPE-203	ng/kg	---	---	---	NA		NA		NA		NA		NA		5.73	U	7.21	U
BR9-DPE-206	ng/kg	---	---	---	NA		NA		NA		NA		NA		35.4		56.8	
BR9-DPE-207	ng/kg	---	---	---	NA		NA		NA		NA		NA		50		99.6	
BR9-DPE-208	ng/kg	---	---	---	NA		NA		NA		NA		NA		16.6	U	58.9	
BR10-DPE-209	ng/kg	---	---	---	NA		NA		NA		NA		NA		1060		1130	
PCB Congeners																		
PCB-001	ng/kg	---	---	---	NA		NA		NA		NA		NA		8.51		11.7	
PCB-002	ng/kg	---	---	---	NA		NA		NA		NA		NA		2.61	J	3.78	
PCB-003	ng/kg	---	---	---	NA		NA		NA		NA		NA		6.11		5.94	
PCB-004	ng/kg	---	---	---	NA		NA		NA		NA		NA		11.8		16.5	
PCB-005	ng/kg	---	---	---	NA		NA		NA		NA		NA		0.669	J	0.443	J
PCB-006	ng/kg	---	---	---	NA		NA		NA		NA		NA		9.02		6.43	
PCB-007	ng/kg	---	---	---	NA		NA		NA		NA		NA		2.22	J	3.08	
PCB-008	ng/kg	---	---	---	NA		NA		NA		NA		NA		40.2		46.9	
PCB-009	ng/kg	---	---	---	NA		NA		NA		NA		NA		1.86	J	1.43	J

Compound	Units Dry Weight	DMMP			PGD-16		PGD-32		PGD-38		PGD-66		PGD-84		PGD-DU		PGE-DU	
		SL	BT	ML	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q
PCB-010	ng/kg	---	---	---	NA		NA		NA		NA		NA		0.537	J	0.762	J
PCB-011	ng/kg	---	---	---	NA		NA		NA		NA		NA		14.7		20.8	
PCB-012/013	ng/kg	---	---	---	NA		NA		NA		NA		NA		4.17	J	4.31	J
PCB-014	ng/kg	---	---	---	NA		NA		NA		NA		NA		0.204	J	0.3	J
PCB-015	ng/kg	---	---	---	NA		NA		NA		NA		NA		25.3		34.9	
PCB-016	ng/kg	---	---	---	NA		NA		NA		NA		NA		16.9		10.9	
PCB-017	ng/kg	---	---	---	NA		NA		NA		NA		NA		25.5		20.1	
PCB-018/030	ng/kg	---	---	---	NA		NA		NA		NA		NA		43		25.2	
PCB-019	ng/kg	---	---	---	NA		NA		NA		NA		NA		4.94		4.6	
PCB-020/028	ng/kg	---	---	---	NA		NA		NA		NA		NA		117		103	
PCB-021/033	ng/kg	---	---	---	NA		NA		NA		NA		NA		43.1		27.7	
PCB-022	ng/kg	---	---	---	NA		NA		NA		NA		NA		31.4		21	
PCB-023	ng/kg	---	---	---	NA		NA		NA		NA		NA		0.116	U	0.0872	U
PCB-024	ng/kg	---	---	---	NA		NA		NA		NA		NA		0.484	U	0.305	U
PCB-025	ng/kg	---	---	---	NA		NA		NA		NA		NA		10.9		6.51	
PCB-026/029	ng/kg	---	---	---	NA		NA		NA		NA		NA		22.8		11.3	
PCB-027	ng/kg	---	---	---	NA		NA		NA		NA		NA		4.42		3.45	
PCB-031	ng/kg	---	---	---	NA		NA		NA		NA		NA		82.6		57	
PCB-032	ng/kg	---	---	---	NA		NA		NA		NA		NA		18.2		22.4	
PCB-034	ng/kg	---	---	---	NA		NA		NA		NA		NA		0.841	J	0.456	J
PCB-035	ng/kg	---	---	---	NA		NA		NA		NA		NA		2.38	J	2.93	
PCB-036	ng/kg	---	---	---	NA		NA		NA		NA		NA		0.115	U	0.0866	U
PCB-037	ng/kg	---	---	---	NA		NA		NA		NA		NA		36.1		40.7	
PCB-038	ng/kg	---	---	---	NA		NA		NA		NA		NA		0.114	U	0.0855	U
PCB-039	ng/kg	---	---	---	NA		NA		NA		NA		NA		1.02	J	0.763	J
PCB-040/041/071	ng/kg	---	---	---	NA		NA		NA		NA		NA		58.1		49.4	
PCB-042	ng/kg	---	---	---	NA		NA		NA		NA		NA		33.2		26.1	
PCB-043	ng/kg	---	---	---	NA		NA		NA		NA		NA		4.26		2.83	J
PCB-044/047/065	ng/kg	---	---	---	NA		NA		NA		NA		NA		133		107	
PCB-045/051	ng/kg	---	---	---	NA		NA		NA		NA		NA		16.9		13.8	
PCB-046	ng/kg	---	---	---	NA		NA		NA		NA		NA		5.58		3.84	
PCB-048	ng/kg	---	---	---	NA		NA		NA		NA		NA		20		14.8	

Compound	Units Dry Weight	DMMP SL	DMMP BT	DMMP ML	PGD-16 Results	PGD-16 Q	PGD-32 Results	PGD-32 Q	PGD-38 Results	PGD-38 Q	PGD-66 Results	PGD-66 Q	PGD-84 Results	PGD-84 Q	PGD-DU Results	PGD-DU Q	PGE-DU Results	PGE-DU Q
PCB-049/069	ng/kg	---	---	---	NA		NA		NA		NA		NA		103		70.7	
PCB-050/053	ng/kg	---	---	---	NA		NA		NA		NA		NA		14.1		10.4	
PCB-052	ng/kg	---	---	---	NA		NA		NA		NA		NA		154		99.5	
PCB-054	ng/kg	---	---	---	NA		NA		NA		NA		NA		0.418	U	0.332	J
PCB-055	ng/kg	---	---	---	NA		NA		NA		NA		NA		2.02	J	2.06	J
PCB-056	ng/kg	---	---	---	NA		NA		NA		NA		NA		57.5		50.4	
PCB-057	ng/kg	---	---	---	NA		NA		NA		NA		NA		0.516	J	0.387	J
PCB-058	ng/kg	---	---	---	NA		NA		NA		NA		NA		0.785	J	0.56	J
PCB-059/062/075	ng/kg	---	---	---	NA		NA		NA		NA		NA		12.4		8.96	
PCB-060	ng/kg	---	---	---	NA		NA		NA		NA		NA		24.6		27.9	
PCB-061/070/074/076	ng/kg	---	---	---	NA		NA		NA		NA		NA		233		194	
PCB-063	ng/kg	---	---	---	NA		NA		NA		NA		NA		5.47		4.8	
PCB-064	ng/kg	---	---	---	NA		NA		NA		NA		NA		47.8		37.2	
PCB-066	ng/kg	---	---	---	NA		NA		NA		NA		NA		142		124	
PCB-067	ng/kg	---	---	---	NA		NA		NA		NA		NA		4.02		3.72	
PCB-068	ng/kg	---	---	---	NA		NA		NA		NA		NA		2.51	J	1.95	J
PCB-072	ng/kg	---	---	---	NA		NA		NA		NA		NA		3.22		1.86	J
PCB-073	ng/kg	---	---	---	NA		NA		NA		NA		NA		0.0474	U	0.0482	U
PCB-077	ng/kg	---	---	---	NA		NA		NA		NA		NA		16.6		19.5	
PCB-078	ng/kg	---	---	---	NA		NA		NA		NA		NA		0.176	U	0.213	U
PCB-079	ng/kg	---	---	---	NA		NA		NA		NA		NA		2.84	J	2.83	J
PCB-080	ng/kg	---	---	---	NA		NA		NA		NA		NA		0.152	U	0.185	U
PCB-081	ng/kg	---	---	---	NA		NA		NA		NA		NA		0.612	J	0.69	J
PCB-082	ng/kg	---	---	---	NA		NA		NA		NA		NA		23.7		25.7	
PCB-083/099	ng/kg	---	---	---	NA		NA		NA		NA		NA		167		152	
PCB-084	ng/kg	---	---	---	NA		NA		NA		NA		NA		51.2		39.7	
PCB-085/116/117	ng/kg	---	---	---	NA		NA		NA		NA		NA		40.4		42	
PCB-086/087/097/109/119/125	ng/kg	---	---	---	NA		NA		NA		NA		NA		142		135	
PCB-088/091	ng/kg	---	---	---	NA		NA		NA		NA		NA		33.3		26.8	
PCB-089	ng/kg	---	---	---	NA		NA		NA		NA		NA		2.52	J	2.56	J
PCB-090/101/113	ng/kg	---	---	---	NA		NA		NA		NA		NA		235		207	

Compound	Units Dry Weight	DMMP SL	DMMP BT	DMMP ML	PGD-16 Results	Q	PGD-32 Results	Q	PGD-38 Results	Q	PGD-66 Results	Q	PGD-84 Results	Q	PGD-DU Results	Q	PGE-DU Results	Q
PCB-092	ng/kg	---	---	---	NA		NA		NA		NA		NA		45.6		37.1	
PCB-093/095/098/100/102	ng/kg	---	---	---	NA		NA		NA		NA		NA		164		133	
PCB-094	ng/kg	---	---	---	NA		NA		NA		NA		NA		1.14	J	0.917	J
PCB-096	ng/kg	---	---	---	NA		NA		NA		NA		NA		1.27	J	0.98	J
PCB-103	ng/kg	---	---	---	NA		NA		NA		NA		NA		4.04		3.05	
PCB-104	ng/kg	---	---	---	NA		NA		NA		NA		NA		0.088	U	0.123	U
PCB-105	ng/kg	---	---	---	NA		NA		NA		NA		NA		82.7		105	
PCB-106	ng/kg	---	---	---	NA		NA		NA		NA		NA		0.348	U	0.554	U
PCB-107	ng/kg	---	---	---	NA		NA		NA		NA		NA		19.3		19.1	
PCB-108/124	ng/kg	---	---	---	NA		NA		NA		NA		NA		6.49		7.16	
PCB-110/115	ng/kg	---	---	---	NA		NA		NA		NA		NA		264		240	
PCB-111	ng/kg	---	---	---	NA		NA		NA		NA		NA		0.441	U	0.41	U
PCB-112	ng/kg	---	---	---	NA		NA		NA		NA		NA		0.0938	U	0.169	U
PCB-114	ng/kg	---	---	---	NA		NA		NA		NA		NA		4.44		4.21	
PCB-118	ng/kg	---	---	---	NA		NA		NA		NA		NA		248		258	
PCB-120	ng/kg	---	---	---	NA		NA		NA		NA		NA		2.19	J	1.61	J
PCB-121	ng/kg	---	---	---	NA		NA		NA		NA		NA		0.102	J	0.177	U
PCB-122	ng/kg	---	---	---	NA		NA		NA		NA		NA		2.45	J	2.35	J
PCB-123	ng/kg	---	---	---	NA		NA		NA		NA		NA		3.89		4.35	
PCB-126	ng/kg	---	---	---	NA		NA		NA		NA		NA		0.719	J	0.933	J
PCB-127	ng/kg	---	---	---	NA		NA		NA		NA		NA		0.398	U	0.633	U
PCB-128/166	ng/kg	---	---	---	NA		NA		NA		NA		NA		42.8		53.9	
PCB-129/138/160/163	ng/kg	---	---	---	NA		NA		NA		NA		NA		284		339	
PCB-130	ng/kg	---	---	---	NA		NA		NA		NA		NA		18.5		21.9	
PCB-131	ng/kg	---	---	---	NA		NA		NA		NA		NA		2.6	J	2.8	J
PCB-132	ng/kg	---	---	---	NA		NA		NA		NA		NA		89.6		91.4	
PCB-133	ng/kg	---	---	---	NA		NA		NA		NA		NA		5.75		5.36	
PCB-134/143	ng/kg	---	---	---	NA		NA		NA		NA		NA		13.6		13.3	
PCB-135/151/154	ng/kg	---	---	---	NA		NA		NA		NA		NA		90.2		91.4	
PCB-136	ng/kg	---	---	---	NA		NA		NA		NA		NA		28.8		26.7	
PCB-137	ng/kg	---	---	---	NA		NA		NA		NA		NA		9.06		10.1	
PCB-139/140	ng/kg	---	---	---	NA		NA		NA		NA		NA		5.56		5.37	

Compound	Units Dry Weight	DMMP SL	DMMP BT	DMMP ML	PGD-16 Results	Q	PGD-32 Results	Q	PGD-38 Results	Q	PGD-66 Results	Q	PGD-84 Results	Q	PGD-DU Results	Q	PGE-DU Results	Q
PCB-141	ng/kg	---	---	---	NA		NA		NA		NA		NA		31.6		29.1	
PCB-142	ng/kg	---	---	---	NA		NA		NA		NA		NA		0.261	U	0.718	U
PCB-144	ng/kg	---	---	---	NA		NA		NA		NA		NA		9.8		10.5	
PCB-145	ng/kg	---	---	---	NA		NA		NA		NA		NA		0.149	U	0.12	U
PCB-146	ng/kg	---	---	---	NA		NA		NA		NA		NA		31.7		49.4	
PCB-147/149	ng/kg	---	---	---	NA		NA		NA		NA		NA		211		220	
PCB-148	ng/kg	---	---	---	NA		NA		NA		NA		NA		1.3	J	1.14	J
PCB-150	ng/kg	---	---	---	NA		NA		NA		NA		NA		0.98	U	0.971	J
PCB-152	ng/kg	---	---	---	NA		NA		NA		NA		NA		0.193	J	0.188	U
PCB-153/168	ng/kg	---	---	---	NA		NA		NA		NA		NA		271		306	
PCB-155	ng/kg	---	---	---	NA		NA		NA		NA		NA		0.116	U	0.107	J
PCB-156/157	ng/kg	---	---	---	NA		NA		NA		NA		NA		30.4		36.5	
PCB-158	ng/kg	---	---	---	NA		NA		NA		NA		NA		23.4		25.8	
PCB-159	ng/kg	---	---	---	NA		NA		NA		NA		NA		3.19	J	3.16	J
PCB-161	ng/kg	---	---	---	NA		NA		NA		NA		NA		0.188	U	0.515	U
PCB-162	ng/kg	---	---	---	NA		NA		NA		NA		NA		0.827	J	1.13	J
PCB-164	ng/kg	---	---	---	NA		NA		NA		NA		NA		18.2		18.4	
PCB-165	ng/kg	---	---	---	NA		NA		NA		NA		NA		0.327	J	0.595	U
PCB-167	ng/kg	---	---	---	NA		NA		NA		NA		NA		11.2		13.5	
PCB-169	ng/kg	---	---	---	NA		NA		NA		NA		NA		0.395	U	0.647	U
PCB-170	ng/kg	---	---	---	NA		NA		NA		NA		NA		53.2		56.1	
PCB-171/173	ng/kg	---	---	---	NA		NA		NA		NA		NA		19.8		22.5	
PCB-172	ng/kg	---	---	---	NA		NA		NA		NA		NA		10.4		10.1	
PCB-174	ng/kg	---	---	---	NA		NA		NA		NA		NA		60.5		61	
PCB-175	ng/kg	---	---	---	NA		NA		NA		NA		NA		3.21		3.68	
PCB-176	ng/kg	---	---	---	NA		NA		NA		NA		NA		8.89		9.34	
PCB-177	ng/kg	---	---	---	NA		NA		NA		NA		NA		43.4		51.6	
PCB-178	ng/kg	---	---	---	NA		NA		NA		NA		NA		18		21.2	
PCB-179	ng/kg	---	---	---	NA		NA		NA		NA		NA		30.4		33.8	
PCB-180/193	ng/kg	---	---	---	NA		NA		NA		NA		NA		139		130	
PCB-181	ng/kg	---	---	---	NA		NA		NA		NA		NA		0.667	J	0.688	J
PCB-182	ng/kg	---	---	---	NA		NA		NA		NA		NA		0.836	J	0.669	U

Compound	Units Dry Weight	DMMP SL	DMMP BT	DMMP ML	PGD-16 Results	Q	PGD-32 Results	Q	PGD-38 Results	Q	PGD-66 Results	Q	PGD-84 Results	Q	PGD-DU Results	Q	PGE-DU Results	Q
PCB-183/185	ng/kg	---	---	---	NA		NA		NA		NA		NA		47.7		51.5	
PCB-184	ng/kg	---	---	---	NA		NA		NA		NA		NA		0.255	J	0.24	U
PCB-186	ng/kg	---	---	---	NA		NA		NA		NA		NA		0.0567	U	0.114	U
PCB-187	ng/kg	---	---	---	NA		NA		NA		NA		NA		103		123	
PCB-188	ng/kg	---	---	---	NA		NA		NA		NA		NA		0.434	J	0.553	J
PCB-189	ng/kg	---	---	---	NA		NA		NA		NA		NA		2.41	J	2.81	J
PCB-190	ng/kg	---	---	---	NA		NA		NA		NA		NA		10.9		12.1	
PCB-191	ng/kg	---	---	---	NA		NA		NA		NA		NA		2.52	J	2.54	J
PCB-192	ng/kg	---	---	---	NA		NA		NA		NA		NA		0.0621	U	0.125	U
PCB-194	ng/kg	---	---	---	NA		NA		NA		NA		NA		31.3		31.2	
PCB-195	ng/kg	---	---	---	NA		NA		NA		NA		NA		12.5		13.2	
PCB-196	ng/kg	---	---	---	NA		NA		NA		NA		NA		19.2		21.2	
PCB-197/200	ng/kg	---	---	---	NA		NA		NA		NA		NA		3.19		6.13	J
PCB-198/199	ng/kg	---	---	---	NA		NA		NA		NA		NA		50.9		59.9	
PCB-201	ng/kg	---	---	---	NA		NA		NA		NA		NA		6.32		7.1	
PCB-202	ng/kg	---	---	---	NA		NA		NA		NA		NA		12		14.7	
PCB-203	ng/kg	---	---	---	NA		NA		NA		NA		NA		27.4		29.5	
PCB-204	ng/kg	---	---	---	NA		NA		NA		NA		NA		0.0474	U	0.054	U
PCB-205	ng/kg	---	---	---	NA		NA		NA		NA		NA		1.8	J	2.11	J
PCB-206	ng/kg	---	---	---	NA		NA		NA		NA		NA		30.1		34.9	
PCB-207	ng/kg	---	---	---	NA		NA		NA		NA		NA		3.6		4.76	
PCB-208	ng/kg	---	---	---	NA		NA		NA		NA		NA		10.4		13.3	
PCB-209	ng/kg	---	---	---	NA		NA		NA		NA		NA		35.6		42.8	
Total PCBs (ND=0)	ug/kg	130	38*	3,100											5.27		5.09	
Total PCBs (ND=1/2)	ug/kg	130	38*	3,100											5.27		5.10	

Exceeds SL	Exceeds BT	Exceeds ML

* this value is normalized to total organic carbon, and is expressed in mg/kg carbon
BT bioaccumulation trigger
ML Maximum level
NA: not analyzed

SL	screening level
Q:	final validation qualifier
Qualifiers	
J:	concentration less than limit of quantification
U:	this analyte is not detected above the reporting limit (RL) or if noted, not detected above the limit of detection (LOD).
UJ:	identified a compound that was not detected

Table 8. Puget Sound Sediment Reference Material Results

Analyte	TRUE (ng/kg wet)	FOUND (ng/kg wet)	MDL	MRL	Q	PS-SRM % REC.	QC LIMITS % REC.
Dioxins/Furans **(PSRM0126) (SGS-Axys SDG: DPWG73691)**							
2,3,7,8-TCDD	1.05	0.855	0.0447	0.715		81	50 - 150
1,2,3,7,8-PeCDD	1.08	0.921	0.0447	2.23	J	85	50 - 150
1,2,3,4,7,8-HxCDD	1.59	1.44	0.0447	2.23	J	91	50 - 150
1,2,3,6,7,8-HxCDD	3.88	3.80	0.0447	2.23		98	50 - 150
1,2,3,7,8,9-HxCDD	3.04	3.64	0.0447	2.23		120	50 - 150
1,2,3,4,6,7,8-HpCDD	90.6	112	0.0653	2.23		124	50 - 150
OCDD	811	894	0.0447	4.47		110	50 - 150
2,3,7,8-TCDF	1.11	1.71	0.0447	0.447		154 *	50 - 150
1,2,3,7,8-PeCDF	1.23	0.959	0.0447	2.23	J	78	50 - 150
2,3,4,7,8-PeCDF	1.07	0.682	0.0447	2.23	J	64	50 - 150
1,2,3,4,7,8-HxCDF	3.02	2.76	0.0447	2.23		91	50 - 150
1,2,3,6,7,8-HxCDF	1.09	0.924	0.0447	2.23	J	85	50 - 150
1,2,3,7,8,9-HxCDF	0.511	0.143	0.0447	2.23	J	28 *	50 - 150
2,3,4,6,7,8-HxCDF	1.83	1.28	0.0447	2.23	J	70	50 - 150
1,2,3,4,6,7,8-HpCDF	18.7	21.1	0.0447	2.23		113	50 - 150
1,2,3,4,7,8,9-HpCDF	1.63	1.56	0.0447	2.23	J	96	50 - 150
OCDF	58.4	53.9	0.0447	4.47		92	50 - 150
Total PCB Congeners **(PSRM0126) (SGS-Axys SDG: DPWG73668)**							
PCB-001	23	22.4	0.0446	4.91		97	50 - 150
PCB-002		4.86	0.0446	2.68			50 - 150
PCB-003	25	16.6	0.0446	2.68		66	50 - 150
PCB-004	114	114	0.162	2.68		100	50 - 150
PCB-005		4.33	0.0929	2.68			50 - 150
PCB-006	169	142	0.0841	2.68		84	50 - 150
PCB-007	17	14	0.0862	2.68		82	50 - 150
PCB-008	366	303	0.0784	4.73		83	50 - 150
PCB-009	20	15.4	0.0844	2.68		77	50 - 150
PCB-010		3.74	0.0881	2.68			50 - 150
PCB-011	74	60.1	0.0916	9.01		81	50 - 150
PCB-012/013	70	56.3	0.0919	9.46		80	50 - 150
PCB-014		0.24	0.0876	2.68	J		50 - 150
PCB-015	308	302	0.103	3.39		98	50 - 150
PCB-016	212	222	0.0446	2.68		105	50 - 150
PCB-017	363	310	0.0446	2.68		85	50 - 150
PCB-018/030	615	571	0.0446	6.42		93	50 - 150
PCB-019	68	70.4	0.0446	2.68		104	50 - 150
PCB-020/028	1436	1140	0.0834	3.93		79	50 - 150
PCB-021/033	545	457	0.0819	2.68		84	50 - 150
PCB-022	385	345	0.0922	2.68		90	50 - 150
PCB-023		0.809	0.0863	2.68	J		50 - 150
PCB-024		5.38	0.0446	2.68			50 - 150
PCB-025	245	207	0.0737	2.68		84	50 - 150

Analyte	TRUE (ng/kg wet)	FOUND (ng/kg wet)	MDL	MRL	Q	PS-SRM % REC.	QC LIMITS % REC.
PCB-026/029	506	423	0.0852	2.68		84	50 - 150
PCB-027	81	74.2	0.0446	2.68		92	50 - 150
PCB-031	1132	958	0.0811	3.03		85	50 - 150
PCB-032	237	178	0.0816	2.68		75	50 - 150
PCB-034		7.65	0.0862	2.68			50 - 150
PCB-035	26	21.1	0.0913	2.68		81	50 - 150
PCB-036		0.0839	0.0839	2.68	U		50 - 150
PCB-037	355	365	0.106	2.68		103	50 - 150
PCB-038		2.33	0.0851	2.68	U		50 - 150
PCB-039		10.8	0.0834	2.68			50 - 150
PCB-040/041/071	717	688	0.0446	2.68		96	50 - 150
PCB-042	413	359	0.0446	2.68		87	50 - 150
PCB-043		44.1	0.0446	2.68			50 - 150
PCB-044/047/065	2026	1710	0.0446	3.48		84	50 - 150
PCB-045/051	224	205	0.0446	2.68		92	50 - 150
PCB-046	75	64.7	0.0446	2.68		86	50 - 150
PCB-048	246	221	0.0446	2.68		90	50 - 150
PCB-049/069	1550	1330	0.0446	2.94		86	50 - 150
PCB-050/053	242	223	0.0446	2.68		92	50 - 150
PCB-052	3743	3070	0.0446	3.39		82	50 - 150
PCB-054		3.79	0.0446	2.68			50 - 150
PCB-055		20.8	0.703	2.68			50 - 150
PCB-056	651	559	0.692	2.68		86	50 - 150
PCB-057		10.8	0.638	2.68			50 - 150
PCB-058		5.18	0.673	2.68			50 - 150
PCB-059/062/075	142	124	0.0446	2.68		87	50 - 150
PCB-060	253	236	0.692	2.68		93	50 - 150
PCB-061/070/074/076	3251	2620	0.662	4.37		81	50 - 150
PCB-063	59	49.2	0.649	2.68		83	50 - 150
PCB-064	659	581	0.0446	2.68		88	50 - 150
PCB-066	1654	1360	0.648	3.12		82	50 - 150
PCB-067	56	45.8	0.567	2.68		82	50 - 150
PCB-068	22	18.7	0.625	2.68		85	50 - 150
PCB-072	37	31.6	0.63	2.68		85	50 - 150
PCB-073		0.0446	0.0446	2.68	U		50 - 150
PCB-077	135	128	0.852	2.68		95	50 - 150
PCB-078		0.712	0.712	2.68	U		50 - 150
PCB-079		42.9	0.592	2.68			50 - 150
PCB-080		0.622	0.622	2.68	U		50 - 150
PCB-081		5.65	0.849	2.68	U		50 - 150
PCB-082	486	423	0.99	2.68		87	50 - 150
PCB-083/099	2548	2310	0.876	2.68		91	50 - 150
PCB-084	1327	1150	0.997	2.68		87	50 - 150
PCB-085/116/117	737	645	0.74	2.68		88	50 - 150
PCB-086/087/097/109/119/125			0.765	2.68		86	50 - 150

Analyte	TRUE (ng/kg wet)	FOUND (ng/kg wet)	MDL	MRL	Q	PS-SRM % REC.	QC LIMITS % REC.
PCB-088/091	674	614	0.893	2.68		91	50 - 150
PCB-089		35.8	0.925	2.68			50 - 150
PCB-090/101/113	6957	5890	0.761	3.66		85	50 - 150
PCB-092	1180	1000	0.87	2.68		85	50 - 150
PCB-093/095/098/100/102	5608	4960	0.85	3.93		88	50 - 150
PCB-094	20	17.6	0.944	2.68		88	50 - 150
PCB-096	29	23.2	0.0446	2.68		80	50 - 150
PCB-103	57	50.4	0.764	2.68		88	50 - 150
PCB-104		0.624	0.0446	2.68	J		50 - 150
PCB-105		1280	3.32	2.68			50 - 150
PCB-106		2.72	2.72	2.68	U		50 - 150
PCB-107	249	261	2.88	2.68		105	50 - 150
PCB-108/124		151	3.18	2.68			50 - 150
PCB-110/115	6488	5350	0.667	3.75		82	50 - 150
PCB-111		2.65	0.71	2.68	J		50 - 150
PCB-112		0.608	0.608	2.68	U		50 - 150
PCB-114	68	70	3.21	2.68		103	50 - 150
PCB-118	4021	3780	3.18	2.68		94	50 - 150
PCB-120	19	18.3	0.667	2.68		96	50 - 150
PCB-121		0.697	0.655	2.68	U		50 - 150
PCB-122	44	41.3	3.05	2.68		94	50 - 150
PCB-123	54	61.3	3.43	2.68		114	50 - 150
PCB-126		16.4	3.5	2.68	U		50 - 150
PCB-127		9.05	2.96	2.68			50 - 150
PCB-128/166	1354	1120	6.48	2.68		83	50 - 150
PCB-129/138/160/163	14189	11600	6.41	4.82		82	50 - 150
PCB-130	591	497	7.86	2.68		84	50 - 150
PCB-131	116	94.3	7.71	2.68		81	50 - 150
PCB-132	4569	3780	7.83	2.68		83	50 - 150
PCB-133	179	147	7.16	2.68		82	50 - 150
PCB-134/143	657	564	7.89	2.68		86	50 - 150
PCB-135/151/154	6326	4920	0.0446	2.68		78	50 - 150
PCB-136	2141	1620	0.0446	2.68		76	50 - 150
PCB-137	223	180	7.48	2.68		81	50 - 150
PCB-139/140	115	100	7.31	2.68		87	50 - 150
PCB-141	3657	2820	6.54	2.68		77	50 - 150
PCB-142		7.82	7.82	2.68	U		50 - 150
PCB-144	862	732	0.0446	2.68		85	50 - 150
PCB-145		1.4	0.0446	2.68	J		50 - 150
PCB-146	2029	938	6.36	2.68		46 *	50 - 150
PCB-147/149	14314	11100	6.99	2.68		78	50 - 150
PCB-148		10.8	0.0446	2.68			50 - 150
PCB-150		11.2	0.0446	2.68			50 - 150
PCB-152		3.57	0.0446	2.68			50 - 150
PCB-153/168	13913	11400	5.66	4.46		82	50 - 150

Analyte	TRUE (ng/kg wet)	FOUND (ng/kg wet)	MDL	MRL	Q	PS-SRM % REC.	QC LIMITS % REC.
PCB-155		0.547	0.0446	2.68	J		50 - 150
PCB-156/157	891	892	7.35	2.68		100	50 - 150
PCB-158	1257	1010	4.89	2.68		80	50 - 150
PCB-159	239	5.53	5.53	2.68	U	2 *	50 - 150
PCB-161		5.24	5.24	2.68	U		50 - 150
PCB-162		15	5.64	2.68			50 - 150
PCB-164	1068	878	5.36	2.68		82	50 - 150
PCB-165		5.9	5.9	2.68	U		50 - 150
PCB-167	367	375	5.84	2.68		102	50 - 150
PCB-169		23.1	23.1	2.68	U		50 - 150
PCB-170	5251	5180	0.241	2.68		99	50 - 150
PCB-171/173	1794	1560	0.203	2.68		87	50 - 150
PCB-172	903	387	0.225	2.68	U	43	50 - 150
PCB-174	6604	5410	0.184	2.68		82	50 - 150
PCB-175	249	216	0.182	2.68		87	50 - 150
PCB-176	806	671	0.137	2.68		83	50 - 150
PCB-177	3630	3170	0.201	2.68		87	50 - 150
PCB-178	1237	1040	0.184	2.68		84	50 - 150
PCB-179	2719	2240	0.133	2.68		82	50 - 150
PCB-180/193	12396	14100	0.223	4.55		114	50 - 150
PCB-181		18	0.194	2.68			50 - 150
PCB-182		12.7	0.185	2.68			50 - 150
PCB-183/185	4184	4040	0.192	2.68		97	50 - 150
PCB-184		0.136	0.136	2.68	U		50 - 150
PCB-186		0.145	0.145	2.68	U		50 - 150
PCB-187	7316	5290	0.178	2.68		72	50 - 150
PCB-188		3.55	0.152	2.68			50 - 150
PCB-189	185	182	1.05	2.68		98	50 - 150
PCB-190	1077	1130	0.176	2.68		105	50 - 150
PCB-191	217	214	0.166	2.68		99	50 - 150
PCB-192		0.189	0.189	2.68	U		50 - 150
PCB-194	2624	3020	0.961	2.68		115	50 - 150
PCB-195	1169	1190	0.921	2.68		102	50 - 150
PCB-196	1579	1220	0.0446	2.68		77	50 - 150
PCB-197/200	496	169	0.0446	2.68	J	34 *	50 - 150
PCB-198/199	3260	2660	0.0446	2.68		82	50 - 150
PCB-201	373	307	0.0446	2.68		82	50 - 150
PCB-202	487	504	0.0446	2.68		103	50 - 150
PCB-203	1829	1610	0.0446	2.68		88	50 - 150
PCB-204		0.169	0.0446	2.68	U		50 - 150
PCB-205	143	141	0.819	2.68		99	50 - 150
PCB-206	575	610	0.196	2.68		106	50 - 150
PCB-207	91	78	0.122	2.68		86	50 - 150
PCB-208	124	135	0.128	2.68		109	50 - 150
PCB-209	97	136	0.0568	2.68		140	50 - 150

Analyte	TRUE (ng/kg wet)	FOUND (ng/kg wet)	MDL	MRL	Q	PS-SRM % REC.	QC LIMITS % REC.
PCB Aroclor **(Bottle #PSRM0127) (ARI SDG: 20G0193)**							
Aroclor 1260 (µg/kg wet)	108	133	2.9	20.0		123	38 - 167
Aroclor 1260 [2C] (µg/kg wet)	108	117	2.9	20.0		108	38 - 167

* Value outside of QC limits

MDL method detection limit

MRL method reporting limit

PS-SRM Puget Sound Sediment Reference Material

QC quality control

Lab Qualifiers (Q):

J The result is an estimated value below the reporting limit

U This analyte is not detected above the reporting limit (RL) or if noted, not detected above the limit of detection (LOD).

Table 9. Target Tissue Levels for Chemicals of Concern (DMMP 2018)

Analyte	TTL (mg/kg ww) For Protection of Human Health	TTL (mg/kg ww) For Protection of Ecological Effects	Source	Reference
Arsenic	10.1	---	Human Health	EPTA 1988
Lead	MBD	MBD	---	---
Mercury	1.0 *	MBD	FDA Action Level (fish, shellfish, crustaceans)	FDA 2000
Silver	200	---	Human Health	EPTA 1988
Selenium	MBD	MBD	---	---
Tributyltin	---	0.6 [1]	Benthic Eco-Risk at Harbor Island/Elliott Bay	EPA 1999
Fluoranthene	8400	MBD	Human Health	EPTA 1988
Pyrene	MBD	MBD	---	---
Hexachlorobenzene	180	---	Human Health	EPTA 1988
Pentachlorophenol	900	MBD	Human Health	EPTA 1988
Chlordane [2]	0.3 *	---	FDA Action Level (fish)	FDA 2000
Total DDT [3]	5.0 *	---	FDA Action Level (fish)	FDA 2000
Total PCBs	0.75 [4]	---	Human Health Risk at Elliott Bay	DMMP 1999
Dioxins/Furans	---	---	---	---

FDA Food and Drug Administration
TTL Target tissue level
MBD May be determined on a project-specific basis
ww Wet weight

* FDA Action Level

[1] The target tissue level for TBT was derived from a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) risk assessment and is based on site-specific considerations of ecological risk for benthos found in the Harbor Island/Elliott Bay area, but the DMMP concluded it is appropriate for use at other DMMP disposal sites.

[2] Total chlordane includes the chlordane isomers and metabolites cis-chlordane, trans-chlordane, cis-nonachlor, trans-nonachlor, and oxychlordane.

[3] Total DDT is determined by summing the p,p'- isomers of DDT and its metabolites dichlorodiphenyldichloroethane (DDD) and dichlorodiphenyldichloroethylene (DDE).

[4] The target tissue level for PCBs is based on site-specific considerations of subsistence human exposure in Elliott Bay and may not be appropriate for all disposal sites.

Table 10. *M. nasuta* Tissue Chemistry Results

Compound	Units Wet Weight	Macoma Pre-Test		(Dupl) Macoma Pre-Test		PGD-DU Rep 1		PGD-DU Rep 2		PGD-DU Rep 3		PGD-DU Rep 4		PGD-DU Rep 5		PGE-DU Rep 1		PGE-DU Rep 2		PGE-DU Rep 3		PGE-DU Rep 4		PGE-DU Rep 5	
		Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q
Conventionals																									
Total Solids	%	17.32				17.53		17.85		17.47		17.39		17.77		16.54		18.26		18.18		17.59		17.62	
Lipids	%	0.71				0.64		0.63		0.7		0.62		0.64		0.98		0.73		0.76		0.65		0.73	
Metals and Metalloid																									
Arsenic	mg/kg	3.34				3.68		3.78		4.14		4.78		4.01		3.73		3.18		4.68		3.75		3.9	
Lead	mg/kg	0.0891				0.19		0.164		0.22		0.204		0.221		0.192		0.19		0.188		0.177		0.194	
Mercury	mg/kg	0.00880	J			0.0114	J	0.0113	J	0.0114	J	0.0105	J	0.00984	J	0.00998	J	0.00986	J	0.0106	J	0.0105	J	0.00775	J
Silver	mg/kg	0.0153	J			0.0218		0.0201		0.0434		0.0201		0.0177	J	0.0180	J	0.0281		0.0297		0.0199		0.0318	
Selenium	mg/kg	0.308				0.26		0.257		0.319		0.278		0.282		0.288		0.267		0.293		0.271		0.281	
Butyltins																									
Tributyltin	ug/kg	3.84	UJ			3.84	UJ	3.83	UJ	3.84	U	3.82	U	3.86	U	3.86	UJ	3.86	UJ	3.86	U	3.86	U	3.86	U
Organics																									
PAHs																									
Naphthalene	ug/kg	20	U			20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U
Acenaphthylene	ug/kg	20	U			20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U
Acenaphthene	ug/kg	20	U			20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U
Fluorene	ug/kg	20	U			20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U
Phenanthrene	ug/kg	20	U			20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U
Anthracene	ug/kg	20	U			20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U
2-Methylnaphthalene	ug/kg	20	U			20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U
Total LPAH	ug/kg	20	U			20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U
Fluoranthene	ug/kg	20	U			20	U	7.1	J	6.7	J	7.3	J	7.0	J	20	U	20	U	20	U	0.3	J	20	U
Pyrene	ug/kg	20	U			20	U	10.1	J	8.9	J	10.6	J	11.6	J	20	U	20	U	20	U	3.9	J	20	U
Benzo(a)anthracene	ug/kg	20	U			20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	1.4	J	20	U
Chrysene	ug/kg	20	U			20	U	20	U	0.7	J	20	U	0.9	J	20	U	20	U	20	U	20	U	20	U
Benzofluoranthenes	ug/kg	40	U			40	U	40	U	40	U	40	U	40	U	40	U	40	U	40	U	40	U	40	U
Benzo(a)pyrene	ug/kg	20	U			20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U
Indeno(1,2,3-c,d)pyrene	ug/kg	20	U			20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U
Dibenzo(a,h)anthracene	ug/kg	20	U			20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U
Benzo(g,h,i)perylene	ug/kg	20	U			20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U
Total HPAH	ug/kg	20	U			40	U	17.2	U	16.3	J	17.9	J	19.5	J	40	U	40	U	40	U	5.6	J	40	U
Chlorinated Hydrocarbons																									
Hexachlorobenzene	ug/kg	20	U			20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U
Phenols																									
Pentachlorophenol	ug/kg	100	UJ			100	UJ	100	UJ	100	UJ	100	UJ	100	UJ	100	UJ	100	UJ	100	UJ	100	UJ	100	UJ
Pesticides																									
4,4'-DDD	ug/kg	1	U			1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
4,4'-DDE	ug/kg	1	U			1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
4,4'-DDT	ug/kg	1	U			1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U

Compound	Units Wet Weight	Macoma Pre-Test Results	Q	(Dupl) Macoma Pre-Test Results	Q	PGD-DU Rep 1 Results	Q	PGD-DU Rep 2 Results	Q	PGD-DU Rep 3 Results	Q	PGD-DU Rep 4 Results	Q	PGD-DU Rep 5 Results	Q	PGE-DU Rep 1 Results	Q	PGE-DU Rep 2 Results	Q	PGE-DU Rep 3 Results	Q	PGE-DU Rep 4 Results	Q	PGE-DU Rep 5 Results	Q
Total 4,4'-DDX	ug/kg	1	U			1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Total Chlordane	ug/kg	1	U			1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Dioxins/Furans																									
2,3,7,8-TCDD	ng/kg	0.0499	U	0.0564	U	0.0488	U	0.0496	U	0.049	U	0.0495	U	0.0496	U	0.0487	U	0.0493	U	0.0498	U	0.0495	U	0.05	U
1,2,3,7,8-PECDD	ng/kg	0.0499	U	0.0564	U	0.053	U	0.0496	U	0.051	U	0.052	U	0.0496	U	0.0487	U	0.0493	U	0.0498	U	0.0495	U	0.05	U
1,2,3,4,7,8-HXCDD	ng/kg	0.0499	U	0.0564	U	0.053	U	0.0496	U	0.049	U	0.05	J	0.056	J	0.0487	U	0.0493	U	0.0498	U	0.0623	U	0.05	U
1,2,3,6,7,8-HXCDD	ng/kg	0.0499	U	0.073	J	0.168	J	0.153	U	0.167	U	0.16	U	0.176	J	0.106	J	0.145	U	0.114	J	0.141	J	0.123	U
1,2,3,7,8,9-HXCDD	ng/kg	0.064	U	0.0564	U	0.126	U	0.089	U	0.136	J	0.147	U	0.117	J	0.097	J	0.108	J	0.097	U	0.099	J	0.098	U
1,2,3,4,6,7,8-HPCDD	ng/kg	0.556	J	0.501	J	1.7		1.48		1.46		1.54		1.18		0.86	J	0.966	J	0.838	J	0.939	J	0.884	J
OCDD	ng/kg	3.06		2.92		10.4		8.89		9.51		10.5		6.92		5.52		5.41		5.39		6.48		5.34	
2,3,7,8-TCDF	ng/kg	0.0499	U	0.0564	U	0.137	J	0.107	J	0.122	J	0.121	J	0.125	U	0.116	J	0.118	J	0.137	U	0.122	J	0.105	J
1,2,3,7,8-PECDF	ng/kg	0.0499	U	0.063	J	0.0488	U	0.0496	U	0.049	U	0.0495	U	0.0496	U	0.0487	U	0.0493	U	0.0498	U	0.0495	U	0.05	U
2,3,4,7,8-PECDF	ng/kg	0.0499	U	0.0564	U	0.0488	U	0.0496	U	0.052	U	0.0495	U	0.0496	U	0.0487	U	0.0493	U	0.0498	U	0.0495	U	0.05	U
1,2,3,4,7,8-HXCDF	ng/kg	0.0499	U	0.0564	U	0.0488	U	0.0496	U	0.049	U	0.05	U	0.0496	U	0.0487	U	0.0493	U	0.0498	U	0.0495	U	0.05	U
1,2,3,6,7,8-HXCDF	ng/kg	0.0499	U	0.0564	U	0.0488	U	0.0496	U	0.049	U	0.0495	U	0.0496	U	0.0487	U	0.0493	U	0.0498	U	0.0495	U	0.05	U
1,2,3,7,8,9-HXCDF	ng/kg	0.068	U	0.084	U	0.074	U	0.0496	U	0.088	U	0.088	U	0.07	U	0.065	U	0.059	U	0.059	U	0.065	U	0.05	U
2,3,4,6,7,8-HXCDF	ng/kg	0.0499	U	0.0564	U	0.0488	U	0.0496	U	0.049	U	0.0495	U	0.0496	U	0.0487	U	0.0493	U	0.0498	U	0.0495	U	0.05	U
1,2,3,4,6,7,8-HPCDF	ng/kg	0.09	J	0.097	U	0.306	U	0.296	J	0.323	U	0.371	U	0.283	U	0.207	J	0.288	J	0.19	J	0.263	J	0.172	U
1,2,3,4,7,8,9-HPCDF	ng/kg	0.0499	U	0.0564	U	0.0488	U	0.0496	U	0.054	U	0.0495	U	0.0496	U	0.0487	U	0.0493	U	0.0498	U	0.0495	U	0.05	U
OCDF	ng/kg	0.15	J	0.159	J	0.566	J	0.468	J	0.484	J	0.683	J	0.384	J	0.321	J	0.401	J	0.33	U	0.408	J	0.297	J
Total TEQ (ND = 0)	ng/kg	0.0074		0.0151		0.0508		0.0313		0.0434		0.0359		0.0489		0.0443		0.0369		0.0233		0.0503		0.0210	
Total TEQ (ND = 1/2 DL)	ng/kg	0.0874		0.1019		0.1315		0.1138		0.1264		0.1241		0.1255		0.1143		0.1146		0.1062		0.1220		0.1039	
TOTAL TETRA-DIOXINS	ng/kg	0.0499	U	0.0564	U	0.064		0.356		0.483		0.454		0.342		0.175		0.19		0.274		0.148		0.078	
TOTAL PENTA-DIOXINS	ng/kg	0.0499	U	0.0564	U	0.12		0.117		0.049	U	0.0495	U	0.0496	U	0.197		0.0493	U	0.116		0.0495	U	0.156	
TOTAL HEXA-DIOXINS	ng/kg	0.203		0.191		0.889		0.835		1.07		0.868		0.992		0.467		0.788		0.763		1.01		0.496	
TOTAL HEPTA-DIOXINS	ng/kg	1.22		1.16		4.4		3.81		3.99		4.21		3.12		2.15		2.42		2.08		2.36		2.35	
TOTAL TETRA-FURANS	ng/kg	0.0499	U	0.0564	U	0.385		0.249		0.69		0.536		0.281		0.312		0.496		0.381		0.1		0.294	
TOTAL PENTA-FURANS	ng/kg	0.051	U	0.063		0.244	U	0.188	U	0.291		0.141	U	0.124	U	0.188	U	0.0493	U	0.178	U	0.296		0.05	U
TOTAL HEXA-FURANS	ng/kg	0.052	U	0.0564	U	0.204	U	0.399	U	0.418	U	0.205	U	0.51	U	0.15	U	0.059	U	0.0498	U	0.281	U	0.371	U
TOTAL HEPTA-FURANS	ng/kg	0.226	U	0.13		0.496		0.296	U	0.448		0.594		0.0496		0.207	U	0.709		0.463		0.567		0.313	U
PCB Congeners																									
PCB-001	ng/kg	0.613	U	0.417	U	1.05	U	0.973	U	0.865	U	1.06	U	0.916	U	0.691	U	0.816	U	0.761	U	0.764	U	0.803	U
PCB-002	ng/kg	0.613	U	0.471	U	0.541	U	0.538	U	0.44	U	0.502	U	0.521	U	0.422	U	0.55	U	0.438	U	0.381	U	0.434	U
PCB-003	ng/kg	0.902	U	0.907	U	1.31	U	1.07	U	0.919	U	0.885	U	1.21	U	0.949	U	0.862	U	0.757	U	0.834	U	0.841	U
PCB-004	ng/kg	0.892	U	0.668	U	3.01		2.76	J	2.75	J	3.09		2.73	J	2.18	J	2.27	J	1.99	J	2.39	J	2.08	J
PCB-005	ng/kg	0.502	U	0.394	U	0.384	U	0.235	U	0.247	U	0.26	U	0.357	U	0.293	U	0.338	U	0.244	U	0.243	U	0.265	U
PCB-006	ng/kg	0.453	U	0.356	U	2.08	J	2.43	J	1.85	J	2	J	2.13	J	0.905	J	0.703	J	0.712	J	0.649	J	0.701	J
PCB-007	ng/kg	0.466	U	0.366	U	1.05	J	0.781	J	0.657	J	0.857	J	0.872	J	0.773	J	0.845	J	0.721	J	0.836	J	0.624	J
PCB-008	ng/kg	1.43	U	1.52	U	7.16		6.81		6.08		7.19		7.1		6.07		4.34		4.48		4.51		4.57	
PCB-009	ng/kg	0.445	U	0.349	U	0.341	U	0.249	J	0.286	J	0.358	J	0.327	U	0.268	U	0.31	U	0.223	U	0.222	U	0.243	U

Compound	Units Wet Weight	Macoma Pre-Test Results	Q	(Dupl) Macoma Pre-Test Results	Q	PGD-DU Rep 1 Results	Q	PGD-DU Rep 2 Results	Q	PGD-DU Rep 3 Results	Q	PGD-DU Rep 4 Results	Q	PGD-DU Rep 5 Results	Q	PGE-DU Rep 1 Results	Q	PGE-DU Rep 2 Results	Q	PGE-DU Rep 3 Results	Q	PGE-DU Rep 4 Results	Q	PGE-DU Rep 5 Results	Q
PCB-010	ng/kg	0.455	U	0.358	U	0.349	U	0.223	J	0.228	U	0.24	U	0.33	U	0.271	U	0.313	U	0.225	U	0.224	U	0.246	U
PCB-011	ng/kg	10.9		10.9		19.3		21.3		17.7		20.8		23.8		21.3		20.8		19.9		22.2		20.7	
PCB-012/013	ng/kg	0.525	J	0.416	J	0.86	J	1.17	J	0.961	J	0.818	J	1.11	J	0.735	J	0.545	J	0.973	J	0.622	J	0.759	J
PCB-014	ng/kg	0.47	U	0.369	U	0.36	U	0.224	U	0.236	U	0.248	U	0.341	U	0.28	U	0.323	U	0.233	U	0.232	U	0.253	U
PCB-015	ng/kg	0.991	J	0.914	J	2.39	J	2.52	J	2.36	J	2.26	J	2.22	J	1.39	J	1.38	J	1.68	J	1.55	J	1.63	J
PCB-016	ng/kg	0.626	U	0.694	J	7.18		6.18		6		5.97		6.34		3.11		2.13	J	2.03	J	2.19	J	1.87	J
PCB-017	ng/kg	1.15	J	1.08	J	17.5		16.2		16.2		16.8		16.6		9.31		6.69		7.05		7.53		7.38	
PCB-018/030	ng/kg	1.61	U	1.51	U	14.9		9.06		11.6		11		12.7		5.27		2.94	J	3.44		3.77		3.53	
PCB-019	ng/kg	0.302	U	0.376	J	2.58	J	2.61	J	2.64	J	2.87	J	2.79	J	1.29	J	1.26	J	1.13	J	1.47	J	1.47	J
PCB-020/028	ng/kg	7.47		7.75		45.7		46.6		45.4		44.9		46.2		25.4		21.6		19.6		20.3		20.2	
PCB-021/033	ng/kg	1.99	U	1.89	U	18		18.3		17.5		17.1		18		8.35		6.35		6.56		6.19		6.46	
PCB-022	ng/kg	1.36	U	1.35	U	10.9		11.6		11		10.9		11.2		4.85		3.78		3.64		3.83		3.69	
PCB-023	ng/kg	0.0829	U	0.0719	U	0.234	U	0.0731	U	0.0746	U	0.211	U	0.149	U	0.097	U	0.162	U	0.131	U	0.0747	U	0.15	U
PCB-024	ng/kg	0.0499	U	0.064	U	0.182	J	0.228	J	0.129	U	0.219	J	0.105	J	0.09	J	0.099	U	0.087	U	0.0495	U	0.084	U
PCB-025	ng/kg	0.308	J	0.33	J	6.36		8.78		7.44		7.31		7.81		1.92	J	2.06	J	1.6	J	1.66	J	1.55	J
PCB-026/029	ng/kg	0.68	J	0.544	U	12.4		13.2		11.6		11.6		12.3		2.62	J	2.92	J	1.96	J	2.11	J	2	J
PCB-027	ng/kg	0.17	J	0.315	J	3.27		2.93	J	2.71	J	2.95	J	2.74	J	1.32	J	0.98	J	1.27	J	1.1	J	0.976	J
PCB-031	ng/kg	4.02		3.92		30.8		32.8		30.8		30.9		30.7		12.9		11.2		9.87		10.3		9.98	
PCB-032	ng/kg	1.52	J	1.42	J	15.8		14.8		14.7		14.8		15		13.8		9.58		10.5		10.2		10.2	
PCB-034	ng/kg	0.0818	U	0.071	U	0.512	J	0.608	J	0.525	J	0.522	J	0.616	J	0.247	J	0.223	J	0.209	J	0.16	J	0.216	J
PCB-035	ng/kg	0.263	J	0.208	J	0.529	J	0.76	J	0.526	J	0.653	J	0.429	J	0.456	J	0.564	J	0.343	J	0.351	J	0.461	J
PCB-036	ng/kg	0.359	J	0.298	J	0.229	U	0.278	J	0.265	J	0.277	J	0.356	J	0.289	J	0.225	J	0.268	J	0.273	J	0.191	J
PCB-037	ng/kg	0.98	U	0.884	U	3.51		3.74		3.69		3.32		3.43		2.36	J	2.14	J	2.09	J	2.13	J	2.08	J
PCB-038	ng/kg	0.0797	U	0.0692	U	0.225	U	0.227	J	0.211	J	0.202	U	0.143	U	0.094	J	0.155	U	0.126	U	0.072	J	0.144	U
PCB-039	ng/kg	0.092	J	0.081	J	0.94	J	0.965	J	0.942	J	0.833	J	0.91	J	0.39	J	0.416	J	0.283	J	0.358	J	0.368	J
PCB-040/041/071	ng/kg	3.47		3.48		55.5		53.3		55.5		51.9		54.7		27.3		27.1		26.2		26.6		25.6	
PCB-042	ng/kg	1.46	J	1.41	J	33		32.9		34.6		31.7		34.4		14.1		14		13.9		13.8		13.2	
PCB-043	ng/kg	0.23	J	0.217	J	4.16		3.61		4.35		3.83		4.12		1.52	J	1.39	J	1.63	J	1.51	J	1.53	J
PCB-044/047/065	ng/kg	6.37	U	7.32	U	76.8		72.7		77.8		72.8		77.3		34		34.8		35.5		33.2		35.4	
PCB-045/051	ng/kg	1.05	J	1.26	J	16		14.9		16.1		15.5		16.1		9.46		8.01		8.69		9.17		8.66	
PCB-046	ng/kg	0.232	J	0.211	J	4.1		3.26		4.13		3.57		4.36		1.94	J	1.59	J	1.59	J	2.02	J	1.36	J
PCB-048	ng/kg	0.995	J	0.951	J	20.7		20.3		22.7		20.2		21.9		8.95		8.19		8.57		8.64		7.82	
PCB-049/069	ng/kg	4.45		4.09		104		109		109		103		109		39		40		36.2		36.7		37.3	
PCB-050/053	ng/kg	0.562	J	0.685	J	12.7		12.6		14.3		14.1		15		7.44		6.54		7.43		7.43		6.36	
PCB-052	ng/kg	8.21		8.22		138		126		138		131		142		51.1		51.5		45.8		47.2		48.5	
PCB-054	ng/kg	0.155	J	0.0836	U	0.486	J	0.493	J	0.508	J	0.486	J	0.446	J	0.247	J	0.302	J	0.358	J	0.366	J	0.301	J
PCB-055	ng/kg	0.217	J	0.218	U	3.17		3.31		3.11		3.38		2.62	J	1.71	J	1.6	J	1.39	J	1.83	J	1.83	J
PCB-056	ng/kg	2.06	J	1.88	J	31.5		32.4		31.6		29.3		31.6		12		13		11.5		11.3		11.3	
PCB-057	ng/kg	0.18	U	0.201	U	0.599	J	0.673	J	0.987	J	0.77	J	0.411	U	0.282	U	0.321	J	0.319	J	0.331	J	0.284	U
PCB-058	ng/kg	0.192	U	0.215	U	1.25	J	1.25	J	1.09	J	0.949	J	0.818	J	0.334	J	0.434	J	0.32	J	0.317	J	0.327	J

Compound	Units Wet Weight	Macoma Pre-Test Results	Q	(Dupl) Macoma Pre-Test Results	Q	PGD-DU Rep 1 Results	Q	PGD-DU Rep 2 Results	Q	PGD-DU Rep 3 Results	Q	PGD-DU Rep 4 Results	Q	PGD-DU Rep 5 Results	Q	PGE-DU Rep 1 Results	Q	PGE-DU Rep 2 Results	Q	PGE-DU Rep 3 Results	Q	PGE-DU Rep 4 Results	Q	PGE-DU Rep 5 Results	Q
PCB-059/062/075	ng/kg	0.783	J	1.12	J	12.5		12.2		11.7		11.9		13		4.8		4.76		4.5		4.44		4.77	
PCB-060	ng/kg	2.1	J	2.14	J	11.6		12.2		11.8		11.3		12.3		7.4		8.38		7.24		7.18		7.38	
PCB-061/070/074/076	ng/kg	11.9		11.3		142		147		143		136		144		53.9		61.6		51.3		51.8		50.4	
PCB-063	ng/kg	0.354	J	0.409	J	4.57		4.69		4.52		4.33		4.58		1.79	J	1.92	J	1.69	J	1.81	J	1.79	J
PCB-064	ng/kg	2.79	J	3	J	48.1		48.1		49		45.3		49.4		19.5		20.7		18.9		18.5		18.2	
PCB-066	ng/kg	5.09		5.05		75.8		79.7		78.5		73.7		78.3		27		29.7		26.4		26.1		26	
PCB-067	ng/kg	0.202	J	0.249	J	2.73	J	2.91	J	3.08		3.06		3.18		1.25	J	1.55	J	1.24	J	1.17	J	1.14	J
PCB-068	ng/kg	0.211	U	0.248	U	2.7	J	2.72	J	2.46	J	2.48	J	2.72	J	0.978	U	0.936	U	0.967	U	0.987	U	1.09	U
PCB-072	ng/kg	0.183	J	0.194	U	4.14		4.33		4.24		4.01		4.21		1.25	J	1.38	J	1.31	J	1.22	J	1.14	J
PCB-073	ng/kg	0.102	J	0.133	J	1.96	J	1.87	J	2.04	J	2.04	J	2.14	J	0.887	J	0.9	J	1.06	J	0.922	J	0.953	J
PCB-077	ng/kg	0.756	J	0.672	J	3.09		3.11		2.81	J	3.01		2.79	J	1.84	J	2.12	J	1.82	J	1.89	J	1.58	J
PCB-078	ng/kg	0.197	U	0.22	U	0.364	U	0.355	U	0.748	U	0.415	U	0.465	U	0.318	U	0.298	U	0.35	U	0.234	U	0.321	U
PCB-079	ng/kg	0.219	J	0.177	U	4.2		4.51		4.07		3.72		4.09		2.46	J	2.33	J	2.27	J	2.14	J	1.79	J
PCB-080	ng/kg	0.173	U	0.192	U	0.319	U	0.302	U	0.637	U	0.353	U	0.395	U	0.271	U	0.254	U	0.298	U	0.199	U	0.273	U
PCB-081	ng/kg	0.22	U	0.249	U	0.626	U	0.62	U	0.837	U	0.461	U	0.517	U	0.335	U	0.305	U	0.386	U	0.256	U	0.349	U
PCB-082	ng/kg	1.06	J	0.902	J	23.2		23.5		22.4		21.3		21.2		14.6		16.2		15.2		14.6		13.4	
PCB-083/099	ng/kg	13.3		11.7		232		224		224		206		219		130		136		124		125		120	
PCB-084	ng/kg	1.58	J	1.25	J	46.7		42.3		44.7		39.2		42.2		21.9		24		20.9		24.7		19.5	
PCB-085/116/117	ng/kg	3.14		2.89	J	45.3		43.4		44.7		40.5		43.3		28.9		31.1		29.2		28.2		27.2	
PCB-086/087/097/109/119/125	ng/kg	7.38		6.48		145		143		138		128		136		78		85.4		74.7		76.5		73.3	
PCB-088/091	ng/kg	1.56	J	1.41	J	49.9		46.4		47		43		45.9		26.2		27.9		25.7		26.5		24.9	
PCB-089	ng/kg	0.0717	U	0.136	U	2.86	J	3.16		2.87	J	2.62	J	3.36		2.46	J	2.54	J	2.35	J	2.52	J	2.41	J
PCB-090/101/113	ng/kg	13.5		12.8		261		262		247		235		246		140		156		136		136		132	
PCB-092	ng/kg	2.97	J	2.43	J	54		50.8		51.7		47.8		50.8		28.5		30.1		28		27.8		26	
PCB-093/095/098/100/102	ng/kg	6.59		5.97		158		154		152		142		151		81.9		90.4		81.9		83		83	
PCB-094	ng/kg	0.107	J	0.0953	U	1.78	J	1.41	J	1.61	J	1.52	J	1.63	J	0.917	J	1.1	J	1.2	J	1.1	J	0.878	J
PCB-096	ng/kg	0.0499	U	0.0702	U	1.43	J	1.53	J	1.73	J	1.42	J	1.45	J	0.935	J	0.81	J	1	J	0.967	J	0.859	J
PCB-103	ng/kg	0.198	U	0.145	J	7.33		7.3		7.08		6.31		6.84		4.18		4.42		4.37		4.25		4.36	
PCB-104	ng/kg	0.0499	U	0.069	J	0.089	J	0.158	U	0.111	J	0.0711	U	0.084	J	0.103	J	0.116	J	0.195	J	0.15	J	0.107	J
PCB-105	ng/kg	5.09		4.53		57.4		59.1		56.7		52.9		53.1		37.4		38.7		34.9		34.8		33.3	
PCB-106	ng/kg	0.12	U	0.173	U	0.703	U	0.67	U	0.867	U	0.677	U	0.776	U	0.428	U	0.538	U	0.375	U	0.585	U	0.569	U
PCB-107	ng/kg	1.41	J	1.38	J	17.3		16.6		15.6		13.8		15.4		9.03		9.5		8.38		8.34		8.18	
PCB-108/124	ng/kg	0.414	J	0.455	J	5.24		5.18		4.72		4.64		4.82		3.32		3.77		3.38		3.08		2.64	J
PCB-110/115	ng/kg	13.4		11.1		282		276		266		248		257		148		160		142		140		131	
PCB-111	ng/kg	0.057	J	0.072	J	0.326	J	0.304	J	0.417	J	0.191	U	0.312	J	0.186	J	0.219	U	0.161	U	0.151	J	0.214	J
PCB-112	ng/kg	0.051	U	0.0661	U	0.256	U	0.131	U	0.252	U	0.178	U	0.161	U	0.114	U	0.134	U	0.15	U	0.0684	U	0.154	U
PCB-114	ng/kg	0.266	J	0.25	J	3.24		3.88		3.15		3.43		3.13		1.87	J	1.98	J	1.92	J	1.91	J	1.39	J
PCB-118	ng/kg	13		11.8		193		199		195		178		182		101		109		94.2		98		92.8	
PCB-120	ng/kg	0.162	U	0.122	J	2.42	J	2.34	J	2.13	J	2.08	J	2.21	J	1.14	J	1.26	J	1.12	J	1.01	J	1.17	J
PCB-121	ng/kg	0.0516	U	0.0668	U	0.262	J	0.286	J	0.27	U	0.268	J	0.176	J	0.123	U	0.172	J	0.242	J	0.209	J	0.165	U

Compound	Units Wet Weight	Macoma Pre-Test Results	Q	(Dupl) Macoma Pre-Test Results	Q	PGD-DU Rep 1 Results	Q	PGD-DU Rep 2 Results	Q	PGD-DU Rep 3 Results	Q	PGD-DU Rep 4 Results	Q	PGD-DU Rep 5 Results	Q	PGE-DU Rep 1 Results	Q	PGE-DU Rep 2 Results	Q	PGE-DU Rep 3 Results	Q	PGE-DU Rep 4 Results	Q	PGE-DU Rep 5 Results	Q
PCB-122	ng/kg	0.182	J	0.205	J	2.24	J	2.87	J	2.64	J	2.63	J	1.98	J	1.63	J	1.66	J	1.52	J	1.56	J	1.14	J
PCB-123	ng/kg	0.267	J	0.205	U	4.79	U	3.42	U	3.33	U	3.52	U	2.24	U	2.13	U	2.33	U	2.32	U	2.52	U	2.01	U
PCB-126	ng/kg	0.171	U	0.282	U	1.05	U	1.06	U	1.42	U	1.15	U	1.35	U	0.718	U	0.878	U	0.643	U	1.01	U	0.99	U
PCB-127	ng/kg	0.12	U	0.174	U	0.706	U	0.766	U	0.991	U	0.774	U	0.888	U	0.489	U	0.615	U	0.428	U	0.669	U	0.651	U
PCB-128/166	ng/kg	2.34	J	1.85	J	42.2		44.7		40.9		40.8		37.6		43.3		38.6		32		32.1		32.1	J
PCB-129/138/160/163	ng/kg	18.1		14.8		313		314		293		283		278		253		271		236		241		258	
PCB-130	ng/kg	1.15	J	1.24	J	16.7		16.5		16.9		15.8		15.1		14.4		15.5		13.5		13.4		12.8	
PCB-131	ng/kg	0.172	U	0.159	U	3.03		2.46	J	2.61	J	2.18	J	2.19	J	2.04	J	2.13	J	1.98	J	1.91	J	1.89	J
PCB-132	ng/kg	3.47		2.72	J	109		101		99.3		94.3		96		76.4		83.5		76.2		75.3		71	
PCB-133	ng/kg	0.484	J	0.365	J	5.83		5.79		6.14		5.28		5.24		3.82		4.68		4.31		4.24		4.27	
PCB-134/143	ng/kg	0.484	J	0.387	J	12.8		11.5		12.6		11.9		11.2		9.04		10.5		10.6		9.33		8.78	
PCB-135/151/154	ng/kg	4.39		3.83		109		103		99.5		98.2		102		83.1		93.2		88		88.2		80.5	
PCB-136	ng/kg	1.12	J	0.935	J	32.2		29.7		30.8		28.8		28.8		22.1		24.6		24.1		25.1		21.4	
PCB-137	ng/kg	0.514	J	0.283	J	7.96		8.69		7.14		7.47		7.21		4.08		5.64		5.08		4.04		3.98	
PCB-139/140	ng/kg	0.205	J	0.211	J	7.61		6.91		7.27		6.83		6.77		5.63		5.64		5.48		5.58		5.25	
PCB-141	ng/kg	1.4	J	1.17	J	31.4		30.2		27.7		31.1		30.4		18.2		19.1		17.1		17.5		16.7	
PCB-142	ng/kg	0.166	U	0.153	U	1.09	U	1.5	U	1.05	U	0.799	U	1.55	U	0.651	U	1.22	U	0.842	U	0.799	U	1.04	U
PCB-144	ng/kg	0.476	J	0.449	J	11.5		10.6		10.2		10.2		10		8.88		9.62		8.47		8.92		8.55	
PCB-145	ng/kg	0.0562	U	0.0648	U	0.14	J	0.206	J	0.134	J	0.0709	U	0.152	J	0.114	J	0.121	J	0.116	U	0.0661	U	0.113	J
PCB-146	ng/kg	3.15		2.61	J	49.8		58.5		57.8		54.8		55.3		44		48.2		45.4		47.4		43.6	
PCB-147/149	ng/kg	11.7		9.73		286		261		258		248		250		211		228		212		209		197	
PCB-148	ng/kg	0.074	J	0.082	U	1.94	J	1.61	J	1.66	J	1.74	J	2.04	J	1.14	J	1.25	J	1.46	J	1.2	J	1.28	J
PCB-150	ng/kg	0.0539	U	0.0622	U	1.53	J	1.26	J	1.54	J	1.19	J	1.43	J	1.38	J	1.2	J	1.11	J	1.22	J	1.24	J
PCB-152	ng/kg	0.0515	U	0.0594	U	0.347	J	0.218	J	0.27	J	0.241	J	0.266	J	0.197	J	0.267	J	0.167	J	0.282	J	0.202	J
PCB-153/168	ng/kg	21.4		18		300		307		295		285		293		256		281		254		258		238	
PCB-155	ng/kg	0.0499	U	0.0564	U	0.182	J	0.288	J	0.155	J	0.175	J	0.205	J	0.236	J	0.283	J	0.207	J	0.278	J	0.187	J
PCB-156/157	ng/kg	1	J	1.03	J	20.8		23.1		21.6		21.1		19.7		15.2		16		13.5		14.3		13.4	
PCB-158	ng/kg	0.989	J	0.845	J	23		22.8		21.7		22		21.6		17.2		18.4		17.3		17		16.1	
PCB-159	ng/kg	0.109	U	0.101	U	0.712	U	2.4	J	2.33	J	2.32	J	2.31	J	2.16	J	2.62	J	1.79	J	2.1	J	1.78	J
PCB-161	ng/kg	0.107	U	0.0989	U	0.7	U	0.965	U	0.677	U	0.513	U	0.993	U	0.418	U	0.781	U	0.541	U	0.513	U	0.666	U
PCB-162	ng/kg	0.113	U	0.104	U	0.811	J	1.06	U	0.741	U	0.562	U	1.09	U	0.458	U	0.856	U	0.593	U	0.725	J	0.73	U
PCB-164	ng/kg	0.566	J	0.453	U	15.2		14.7		15.3		14.7		14.1		11.2		12		11.1		11.5		10.8	
PCB-165	ng/kg	0.128	U	0.118	U	0.837	U	1.14	U	0.8	U	0.607	U	1.17	U	0.542	J	0.923	U	0.64	U	0.607	U	0.788	U
PCB-167	ng/kg	0.536	J	0.43	J	7.14		7.89		7.11		6.82		6.76		6.27		6.57		5.92		6.12		5.69	
PCB-169	ng/kg	0.147	U	0.148	U	0.965	U	1.54	U	1.1	U	0.867	U	1.69	U	0.691	U	1.25	U	0.918	U	0.829	U	1.09	U
PCB-170	ng/kg	1.51	J	1.24	U	35.3		44.6		34.8		32.7		31		30.5		34.1		27.6		28.3		29	
PCB-171/173	ng/kg	0.604	J	0.327	J	16.7		19.6		17.6		15.7		16.9		17.8		21		18.4		17.6		17.1	
PCB-172	ng/kg	0.452	J	0.341	J	5.9		7.79		6.07		5.66		6.04		5.45		6.11		5.34		5.21		5.37	
PCB-174	ng/kg	1.56	J	1.32	J	42.9		46.3		42.9		39.5		40.8		38		46.5		38.2		37.2		35.7	
PCB-175	ng/kg	0.152	J	0.117	J	2.35	J	2.85	J	2.2	J	2.13	J	2.1	J	2.25	J	2.75	J	2.47	J	2.68	J	2.28	J

Compound	Units Wet Weight	Macoma Pre-Test Results	Q	(Dupl) Macoma Pre-Test Results	Q	PGD-DU Rep 1 Results	Q	PGD-DU Rep 2 Results	Q	PGD-DU Rep 3 Results	Q	PGD-DU Rep 4 Results	Q	PGD-DU Rep 5 Results	Q	PGE-DU Rep 1 Results	Q	PGE-DU Rep 2 Results	Q	PGE-DU Rep 3 Results	Q	PGE-DU Rep 4 Results	Q	PGE-DU Rep 5 Results	Q
PCB-176	ng/kg	0.257	J	0.273	J	7.95		8.41		7.64		7.57		8.46		7.66		8.9		7.88		7.76		7.54	
PCB-177	ng/kg	1.86	J	1.11	U	38.6		40		36.7		33.8		36.3		40		43.8		43.9		36.2		38.3	
PCB-178	ng/kg	0.97	J	0.926	J	13.8		14.9		13.6		13.2		15.3		15.3		16.9		16		15.2		15.6	
PCB-179	ng/kg	0.915	J	0.768	J	24.7		25.4		23.5		22.3		24.6		25.1		28.4		26.2		25.4		24.7	
PCB-180/193	ng/kg	3.74		3.16	J	75.9		104		79		74		76.6		62.4		70.7		60.6		59		63	
PCB-181	ng/kg	0.074	U	0.0798	U	0.398	J	0.543	U	0.546	J	0.594	J	0.746	J	0.449	J	0.527	J	0.224	J	0.34	J	0.418	J
PCB-182	ng/kg	0.091	J	0.074	U	1.16	J	1.04	J	1.18	J	0.883	J	1.24	J	0.748	J	1.24	J	0.906	J	0.889	J	1.23	J
PCB-183/185	ng/kg	2	J	1.51	J	37.4		41.9		38.2		34.5		38.5		37		41.5		37.7		37.7		36.3	
PCB-184	ng/kg	0.0551	U	0.0595	U	0.221	J	0.22	J	0.234	J	0.267	J	0.191	J	0.311	J	0.176	J	0.214	J	0.142	J	0.155	J
PCB-186	ng/kg	0.0598	U	0.0645	U	0.0739	U	0.0574	U	0.0613	U	0.0642	U	0.0593	U	0.0648	U	0.11	U	0.0841	U	0.078	U	0.107	U
PCB-187	ng/kg	6.13		4.88		89.9		102		92.9		87.7		97.6		100		115		98.7		98.2		102	J
PCB-188	ng/kg	0.126	J	0.057	U	0.32	J	0.497	J	0.535	J	0.444	J	0.414	J	0.252	J	0.707	J	0.541	J	0.636	J	0.493	J
PCB-189	ng/kg	0.145	J	0.112	U	1.39	J	2.1	J	1.23	J	1.31	J	1.35	J	1.12	J	1.37	J	1.16	U	1.13	J	0.96	J
PCB-190	ng/kg	0.391	J	0.265	J	7.58		9.87		7.78		6.85		6.96		6.9		7.54		6.13		5.83		5.88	
PCB-191	ng/kg	0.0559	U	0.0603	U	1.35	J	1.66	J	1.49	J	1.36	J	1.26	J	1.22	J	1.52	J	1.13	J	1.19	J	1.59	J
PCB-192	ng/kg	0.0609	U	0.0657	U	0.0752	U	0.0661	U	0.0706	U	0.074	U	0.0683	U	0.0746	U	0.126	U	0.0969	U	0.064	U	0.123	U
PCB-194	ng/kg	0.738	J	0.588	J	11.1		22.2		11.8		11.5		11.6		10.4		13.2		9.74		9.69		10.2	
PCB-195	ng/kg	0.299	J	0.219	J	6.77		11.8		6.99		6.79		6.41		7.86		8.69		7.09		7.03		7.2	
PCB-196	ng/kg	0.52	J	0.473	J	8.28		15.3		9.28		8.72		8.73		9.43		11.1		9.19		8.63		9.06	
PCB-197/200	ng/kg	0.173	J	0.164	U	3.66		6.01		3.87		4.21		3.75		4.26		4.72		4.36		4.04		4.23	
PCB-198/199	ng/kg	1.91	J	1.57	J	26.5		34.5		27.2		25		27.1		29.7		34		28.2		29.5		30.1	
PCB-201	ng/kg	0.254	J	0.286	U	4.14		5.37		4.51		4.46	U	4.32		4.94	U	5.66		4.8		4.76		4.21	
PCB-202	ng/kg	0.598	J	0.598	J	6.69		9.24		8.1		7.93		7.3		9.69		10.6		9.21		9.49		9.27	
PCB-203	ng/kg	0.708	J	0.59	J	13		19.7		14		12.7		13.1		14		16.7		13.1		13.4		14	
PCB-204	ng/kg	0.0499	U	0.0564	U	0.0488	U	0.0496	U	0.051	U	0.075	U	0.0658	U	0.0487	U	0.0599	U	0.093	J	0.0634	U	0.0699	U
PCB-205	ng/kg	0.088	J	0.0689	U	0.692	J	1.27	J	0.805	J	0.761	J	0.843	J	0.768	J	1.03	J	0.729	J	0.922	J	0.841	J
PCB-206	ng/kg	0.95	J	0.927	J	10.8		14.6		12.3		11		11		13.6		16		12.6		12.1		13.2	
PCB-207	ng/kg	0.185	J	0.151	U	1.54	J	2.04	J	1.69	J	1.65	J	1.42	J	1.9	J	2.07	J	1.95	J	2.04	J	1.88	J
PCB-208	ng/kg	0.561	J	0.452	J	4.69		5.44		4.96		4.81		4.91		5.74		6.76		5.94		5.91		6.03	
PCB-209	ng/kg	1.33	J	0.997	J	9.83		10.4		10.3		9.37		9.95		12.5		14.9		11.8		12.4		13.1	
Total PCBs (ND=0)	ng/kg	264.056		232.33		4554.916		4623.534		4439.215		4202.905		4366.32		2943.71		3175.98		2849.51		2860.948		2783.61	
Total PCBS (ND=1/2)	ng/kg	276.30625		246.59		4564.085		4632.292		4447.736		4212.65		4375.41		2952.11		3183.86		2856.66		2867.234		2791.08	

Q: final validation qualifier

Qualifiers

J: concentration less than limit of quantification

U: this analyte is not detected above the reporting limit (RL) or if noted, not detected above the limit of detection (LOD)

UJ: identified a compound that was not detected

Table 11. *A. virens* Tissue Chemistry Results

Compound	Units Wet Weight	N.v.Pretest Rep 1		(Dupl) N.v.Pretest Rep 1		A.v.PGD-DU Rep 1		A.v.PGD-DU Rep 2		A.v.PGD-DU Rep 3		A.v.PGD-DU Rep 4		A.v.PGD-DU Rep 5		A.v.PGE-DU Rep 1		A.v.PGE-DU Rep 2		A.v.PGE-DU Rep 3		A.v.PGE-DU Rep 4		A.v.PGE-DU Rep 5	
		Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q
Conventionals																									
Total Solids	%	15.04				14.73		14.76		16.11		13.46		14.56		15.76		14.68		15.01		15.16		15.29	
Lipids	%	1				1.3		0.99		1		0.96		1.1		1.1		0.91		1		1.1		1.2	
Metals and Metalloid																									
Arsenic	mg/kg	2.11				2.21		2.1		2.3		2.18		1.98		2.02		2.15		2.01		2.4		2.28	
Lead	mg/kg	0.0674				0.0683		0.0709		0.084		0.0717		0.068		0.0697		0.0788		0.0631		0.074		0.0958	
Mercury	mg/kg	0.0252	J			0.0188	J	0.0352	J	0.0233	J	0.025	J	0.0234	J	0.022	J	0.0257	J	0.0224	J	0.0215	J	0.0235	J
Silver	mg/kg	0.0137	J			0.0209		0.0162	J	0.0200		0.0190	J	0.0139	J	0.0223		0.0223		0.0189	J	0.0246		0.0276	
Selenium	mg/kg	0.221				0.264		0.229		0.255		0.235		0.237		0.212		0.257		0.219		0.261		0.248	
Butyltins																									
Tributyltin	ug/kg	3.86	U			3.86	U	3.86	U	3.86	U	3.86	U	3.86	U	3.86	U	3.86	U	3.86	U	3.86	U	3.86	U
Organics																									
PAHs																									
Naphthalene	ug/kg	20	U			20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U
Acenaphthylene	ug/kg	20	U			20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U
Acenaphthene	ug/kg	20	U			20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U
Fluorene	ug/kg	20	U			20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U
Phenanthrene	ug/kg	20	U			20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U
Anthracene	ug/kg	20	U			20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U
2-Methylnaphthalene	ug/kg	20	U			20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U
Total LPAH	ug/kg	20	U			20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U
Fluoranthene	ug/kg	20	U			20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U
Pyrene	ug/kg	20	U			20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U
Benzo(a)anthracene	ug/kg	20	U			20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U
Chrysene	ug/kg	20	U			20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U
Benzofluoranthenes	ug/kg	40	U			40	U	40	U	40	U	40	U	40	U	40	U	40	U	40	U	40	U	40	U
Benzo(a)pyrene	ug/kg	20	U			20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U
Indeno(1,2,3-c,d)pyrene	ug/kg	20	U			20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U
Dibenzo(a,h)anthracene	ug/kg	20	U			20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U
Benzo(g,h,i)perylene	ug/kg	20	U			20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U
Total HPAH	ug/kg	40	U			40	U	40	U	40	U	40	U	40	U	40	U	40	U	40	U	40	U	40	U
Chlorinated Hydrocarbons																									
Hexachlorobenzene	ug/kg	20	U			20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U
Phenols																									
Pentachlorophenol	ug/kg	14	J			100	U	100	U	100	U	100	U	100	U	100	U	100	U	100	U	100	U	100	U
Pesticides																									
4,4'-DDD	ug/kg	1	U			1	U	1	U	1	U	1	U	1	U	5	U	1	U	1	U	1	U	1	U
4,4'-DDE	ug/kg	1	U			1	U	1	U	1	U	1	U	1	U	5	U	1	U	1	U	1	U	1	U
4,4'-DDT	ug/kg	1	U			1	U	1	U	1	U	1	U	1	U	5	U	1	U	1	U	1	U	1	U

Compound	Units Wet Weight	N.v.Pretest Rep 1		(Dupl) N.v.Pretest Rep 1		A.v.PGD-DU Rep 1		A.v.PGD-DU Rep 2		A.v.PGD-DU Rep 3		A.v.PGD-DU Rep 4		A.v.PGD-DU Rep 5		A.v.PGE-DU Rep 1		A.v.PGE-DU Rep 2		A.v.PGE-DU Rep 3		A.v.PGE-DU Rep 4		A.v.PGE-DU Rep 5	
		Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q
Total 4,4'-DDX	ug/kg	1	U			1	U	1	U	1	U	1	U	1	U	5	U	1	U	1	U	1	U	1	U
Total Chlordane	ug/kg	1	U			1	U	1	U	1	U	1	U	1	U	5	U	1	U	1	U	1	U	1	U
Dioxins/Furans																											
2,3,7,8-TCDD	ng/kg			0.096	U	0.083	U	0.097	U	0.0499	U	0.078	U	0.079	U	0.064	J	0.066	U	0.07	J	0.076	J	0.074	J
1,2,3,7,8-PECDD	ng/kg			0.183	U	0.121	J	0.134	J	0.077	J	0.125	J	0.108	J	0.08	U	0.093	J	0.09	J	0.106	J	0.096	J
1,2,3,4,7,8-HXCDD	ng/kg			0.116	U	0.054	U	0.057	U	0.0499	U	0.062	U	0.049	U	0.049	U	0.05	U	0.05	U	0.0499	U	0.0499	U
1,2,3,6,7,8-HXCDD	ng/kg			0.236	J	0.182	U	0.201	J	0.122	J	0.157	J	0.165	J	0.116	J	0.126	J	0.128	J	0.163	J	0.145	U
1,2,3,7,8,9-HXCDD	ng/kg			0.173	J	0.079	U	0.085	J	0.064	J	0.095	J	0.081	J	0.062	U	0.066	U	0.074	U	0.075	U	0.065	J
1,2,3,4,6,7,8-HPCDD	ng/kg			1.63		0.984	J	1.07		0.8	J	0.938	J	0.998		0.657	J	0.789	J	0.769	J	0.866	J	0.769	J
OCDD	ng/kg			9.35		4		4.13		3.73		4.27		4.11		2.78		3.18		2.81		3.17		2.7	
2,3,7,8-TCDF	ng/kg			0.746		1.07		0.923		0.535		0.745		0.755		0.667		0.658		0.792		0.784		0.958	
1,2,3,7,8-PECDF	ng/kg			0.154	U	0.161	U	0.122	U	0.074	U	0.116	U	0.114	U	0.101	U	0.102	U	0.113	U	0.098	U	0.156	U
2,3,4,7,8-PECDF	ng/kg			0.19	U	0.217	U	0.162	J	0.099	U	0.16	U	0.155	J	0.126	U	0.137	J	0.144	U	0.161	J	0.205	J
1,2,3,4,7,8-HXCDF	ng/kg			0.145	J	0.061	U	0.055	U	0.0499	U	0.061	U	0.05	J	0.049	U	0.05	U	0.05	U	0.052	J	0.056	U
1,2,3,6,7,8-HXCDF	ng/kg			0.112	J	0.0497	U	0.053	U	0.0499	U	0.0499	U	0.051	J	0.049	U	0.05	U	0.05	U	0.0499	U	0.0499	U
1,2,3,7,8,9-HXCDF	ng/kg			0.106	J	0.056	U	0.054	J	0.051	J	0.053	J	0.06	J	0.049	U	0.064	U	0.05	U	0.062	J	0.051	U
2,3,4,6,7,8-HXCDF	ng/kg			0.095	J	0.052	U	0.0497	U	0.0499	U	0.0499	U	0.049	U	0.049	U	0.05	U	0.05	U	0.0499	U	0.0499	U
1,2,3,4,6,7,8-HPCDF	ng/kg			0.659	J	0.333	U	0.267	U	0.199	J	0.277	J	0.287	J	0.218	J	0.244	U	0.236	J	0.265	U	0.238	U
1,2,3,4,7,8,9-HPCDF	ng/kg			0.08	U	0.0497	U	0.0497	U	0.0499	U	0.0499	U	0.049	U	0.049	U	0.05	U	0.05	U	0.0499	U	0.0499	U
OCDF	ng/kg			0.697	J	0.247	J	0.211	J	0.202	J	0.301	J	0.231	J	0.162	J	0.215	J	0.186	J	0.165	J	0.173	J
Total TEQ (ND = 0)	ng/kg			0.1872		0.2391		0.3209		0.1654		0.2435		0.2849		0.1519		0.2214		0.2629		0.3461		0.3424	
Total TEQ (ND = 1/2 DL)	ng/kg			0.3637		0.3442		0.3836		0.2165		0.3197		0.3312		0.2279		0.2739		0.3027		0.3603		0.3662	
TOTAL TETRA-DIOXINS	ng/kg			0.232		0.173		0.283		0.096		0.197		0.07		0.064		0.118		0.208		0.076		0.074	
TOTAL PENTA-DIOXINS	ng/kg			0.282		0.294		0.134		0.077		0.206		0.177		0.049	U	0.093		0.09		0.228		0.243	
TOTAL HEXA-DIOXINS	ng/kg			1.38		0.591		0.911		0.619		0.828		0.831		0.349		0.126		0.358		0.69		0.602	
TOTAL HEPTA-DIOXINS	ng/kg			3.48		2.12		2.21		1.88		2.12		2.18		1.42		1.64		1.67		1.76		1.67	
TOTAL TETRA-FURANS	ng/kg			1.88		1.5		1.47		1.02		1.26		0.875		0.9		1.35		1.79		1.81		2.48	
TOTAL PENTA-FURANS	ng/kg			0.154		0.572		1.52		0.695		0.489		0.809		0.668		1.04		1.1		0.688		1.85	
TOTAL HEXA-FURANS	ng/kg			1.37		0.385		0.267		0.123		0.293		0.576		0.298		0.365		0.394		0.462		0.384	
TOTAL HEPTA-FURANS	ng/kg			1.05		0.188		0.111		0.32		0.277		0.287		0.313		0.05	U	0.354		0.0499	U	0.093	
PCB Congeners																											
PCB-001	ng/kg	0.431	J	0.667	J	0.399	U	0.437	J	0.448	J	0.413	J	0.449	J	0.412	U	0.429	J	0.419	J	0.541	U	0.47	U
PCB-002	ng/kg	0.277	U	0.353	U	0.222	U	0.221	U	0.215	U	0.218	U	0.199	U	0.269	U	0.215	U	0.213	U	0.235	U	0.228	U
PCB-003	ng/kg	1.24	U	2.6	U	0.579	U	0.499	U	0.646	U	0.561	U	0.448	U	0.752	U	0.633	U	0.631	U	0.655	U	0.559	U
PCB-004	ng/kg	1.12	J	1.13	U	1.34	J	1.79	J	1.16	J	1.4	J	1.49	J	1.24	J	1.35	J	1.37	J	1.41	J	1.73	J
PCB-005	ng/kg	0.283	U	0.419	U	0.317	U	0.361	U	0.313	U	0.332	U	0.287	U	0.232	U	0.247	U	0.25	U	0.265	U	0.166	U
PCB-006	ng/kg	0.243	U	0.36	U	0.272	U	0.311	U	0.269	U	0.286	U	0.255	U	0.197	U	0.209	U	0.213	U	0.225	U	0.153	J
PCB-007	ng/kg	0.249	U	0.369	U	0.279	U	0.318	U	0.275	U	0.293	U	0.249	U	0.201	U	0.214	U	0.217	U	0.23	U	0.143	U
PCB-008	ng/kg	0.528	J	0.61	U	0.521	U	0.573	J	0.529	J	0.605	J	0.555	J	0.508	U	0.531	U	0.516	J	0.496	U	0.538	U
PCB-009	ng/kg	0.249	U	0.369	U	0.279	U	0.318	U	0.275	U	0.293	U	0.254	U	0.205	U	0.218	U	0.222	U	0.235	U	0.146	U

Compound	Units Wet Weight	N.v.Pretest Rep 1		(Dupl) N.v.Pretest Rep 1		A.v.PGD-DU Rep 1		A.v.PGD-DU Rep 2		A.v.PGD-DU Rep 3		A.v.PGD-DU Rep 4		A.v.PGD-DU Rep 5		A.v.PGE-DU Rep 1		A.v.PGE-DU Rep 2		A.v.PGE-DU Rep 3		A.v.PGE-DU Rep 4		A.v.PGE-DU Rep 5	
		Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q
PCB-010	ng/kg	0.252	U	0.373	U	0.282	U	0.322	U	0.279	U	0.296	U	0.256	U	0.206	U	0.22	U	0.223	U	0.237	U	0.148	U
PCB-011	ng/kg	44.6		44.3		16		15.8		14.3		15.1		17.9		9.16		10.8		15.4		18.1		17.3	
PCB-012/013	ng/kg	0.298	U	0.442	U	0.334	U	0.381	U	0.33	U	0.351	U	0.299	U	0.241	U	0.257	U	0.261	U	0.276	U	0.172	U
PCB-014	ng/kg	0.259	U	0.383	U	0.29	U	0.331	U	0.286	U	0.304	U	0.262	U	0.211	U	0.225	U	0.228	U	0.242	U	0.151	U
PCB-015	ng/kg	3.63	U	3.67	U	2.73	J	2.53	U	1.75	J	2	J	2.32	J	1.6	J	1.37	U	1.83	J	2.26	U	2.38	J
PCB-016	ng/kg	0.153	U	0.144	U	0.148	U	0.174	U	0.229	J	0.218	U	0.364	U	0.212	U	0.34	J	0.255	U	0.183	U	0.255	U
PCB-017	ng/kg	0.395	U	0.389	U	0.459	U	0.713	U	0.422	U	0.482	U	0.718	U	0.352	U	0.631	U	0.426	U	0.482	U	0.463	U
PCB-018/030	ng/kg	15.4		14.3		16.6		17.5		12.2		15.8		14.5		4.86		6.32		8.09		6.57		6.09	
PCB-019	ng/kg	1.56	U	1.4	J	3.17		3.63		2.49	J	2.97	J	3.4		1.72	U	1.76	J	2.29	U	2.06	J	2.19	J
PCB-020/028	ng/kg	35.2		34.7		34.5		29.3		21.5		26.5		33.8		9.46		11.8		17.8		15		12.6	
PCB-021/033	ng/kg	1.35	U	1.35	U	0.0783	U	0.969	U	0.818	U	0.782	U	0.155	U	0.708	U	0.747	U	0.689	U	0.847	U	0.676	U
PCB-022	ng/kg	5.14		5.23		4.37		3.83		2.7	J	3.85		4		1.23	J	1.19	J	1.84	J	1.61	J	1.49	J
PCB-023	ng/kg	0.113	U	0.0831	U	0.0846	U	0.145	U	0.119	U	0.176	U	0.172	U	0.0693	U	0.0726	U	0.138	U	0.0791	U	0.0945	U
PCB-024	ng/kg	0.089	U	0.095	U	0.0976	U	0.106	J	0.1	J	0.092	J	0.109	J	0.0873	U	0.0729	U	0.076	U	0.0851	U	0.0594	U
PCB-025	ng/kg	1.62	J	1.54	J	2.13	J	2.57	J	1.58	J	1.97	J	1.84	J	0.769	J	0.876	J	0.927	J	0.948	J	0.826	J
PCB-026/029	ng/kg	2.33	J	2.27	J	2.03	J	1.74	J	2.5	J	2.74	J	2.67	J	0.315	J	0.517	J	0.577	U	0.58	J	0.455	J
PCB-027	ng/kg	0.789	J	0.735	J	1.41	J	1.61	J	0.922	J	1.26	J	1.25	J	0.475	U	0.47	U	0.714	J	0.426	J	0.71	J
PCB-031	ng/kg	4.47		4.32	B	8.44		2.63	J	7.29		3.35		12.3		1.25	U	1.31	U	1.4	U	1.54	U	1.47	U
PCB-032	ng/kg	2.5	J	2.31	J	2.59	J	2.62	J	1.39	J	2.23	J	2.13	J	1.52	J	1.58	J	2.06	J	1.55	J	2.2	J
PCB-034	ng/kg	0.125	J	0.168	U	0.16	U	0.148	U	0.122	U	0.181	U	0.172	U	0.0696	U	0.073	U	0.139	U	0.0795	U	0.095	U
PCB-035	ng/kg	0.558	U	0.567	J	0.169	U	0.192	J	0.134	U	0.181	U	0.171	U	0.0692	U	0.136	U	0.138	U	0.239	U	0.201	U
PCB-036	ng/kg	1.85	J	2.11	J	0.884	U	0.133	U	0.109	U	0.162	U	0.595	J	0.267	U	0.385	J	0.322	J	0.969	J	2.62	J
PCB-037	ng/kg	9.73		9.54		10.2		9.1		5.04		6.78		7.18		3.94		4.33		5.83		5.22		4.97	
PCB-038	ng/kg	0.111	U	0.104	J	0.178	J	0.219	U	0.117	U	0.173	U	0.168	U	0.0677	U	0.0709	U	0.135	U	0.089	U	0.0923	U
PCB-039	ng/kg	0.344	U	0.462	U	0.319	U	0.366	J	0.116	U	0.172	U	0.185	U	0.0663	U	0.111	U	0.132	U	0.117	U	0.159	J
PCB-040/041/071	ng/kg	3.25		3.13	J	3.89		3.03		1.76	U	2.78	U	2.82	J	1.61	U	2.05	J	2.25	J	1.46	J	2.46	J
PCB-042	ng/kg	6.33		6.3		6.89		7.71		3.51		6.44		5.43		2.19	J	2.22	J	3.69		2.55	J	2.91	J
PCB-043	ng/kg	4.14		4.6		3.96		3.44	U	0.16	U	2.42	J	2.26	U	0.154	U	0.124	U	2.05	U	0.145	U	1.31	U
PCB-044/047/065	ng/kg	60		58.3		73.6		78.5		56.7		67.2		66.7		34.4		38.7		46.2		43.8		39.3	
PCB-045/051	ng/kg	7.01		6.13		7.57		9.07		4.54		7.94		6.69		3.13		4.2		5.22		3.79		4.54	
PCB-046	ng/kg	0.439	U	0.415	J	0.752	J	0.927	J	0.383	J	0.692	J	0.576	J	0.255	J	0.241	U	0.407	J	0.272	U	0.415	U
PCB-048	ng/kg	4.17		4.51	U	3.07	U	2.65	J	1.47	U	2.5	J	2.23	J	0.982	U	1.47	J	1.62	J	1	U	1.67	U
PCB-049/069	ng/kg	39.4		37.7		60.3		50.1		39		49.2		53.1		16.6		18.3		25.9		22.8		19.4	
PCB-050/053	ng/kg	20.8		18.5		27.5		35.5		21.1		25.4		23.3		14.9		19		19.6		16.9		18.3	
PCB-052	ng/kg	134		128		192		220		127		153		153		96.2		87.1		105		95.8		87	
PCB-054	ng/kg	0.116	U	0.128	U	0.292	U	0.346	U	0.283	U	0.315	U	0.323	U	0.304	U	0.261	U	0.233	U	0.241	U	0.258	U
PCB-055	ng/kg	0.809	U	0.962	U	0.772	U	0.962	U	0.829	U	0.509	U	0.653	U	0.382	U	0.427	U	0.594	U	0.662	U	0.45	U
PCB-056	ng/kg	23.6		23.8		20.1		24.6		6.75	U	14.8		9.65		5.81		5.89		10.3		7.36		6.98	
PCB-057	ng/kg	0.696	U	0.828	U	0.664	U	0.828	U	0.714	U	0.438	U	0.566	U	0.332	U	0.371	U	0.515	U	0.574	U	0.39	U
PCB-058	ng/kg	0.736	J	0.843	U	0.677	U	1.15	J	0.727	U	0.447	U	0.598	U	0.35	U	0.391	U	0.544	U	0.606	U	0.412	U

Compound	Units Wet Weight	N.v.Pretest Rep 1		(Dupl) N.v.Pretest Rep 1		A.v.PGD-DU Rep 1		A.v.PGD-DU Rep 2		A.v.PGD-DU Rep 3		A.v.PGD-DU Rep 4		A.v.PGD-DU Rep 5		A.v.PGE-DU Rep 1		A.v.PGE-DU Rep 2		A.v.PGE-DU Rep 3		A.v.PGE-DU Rep 4		A.v.PGE-DU Rep 5	
		Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q	Results	Q
PCB-059/062/075	ng/kg	9.72		9.3		12.8		16.3		9.28		10.7		10.3		5.91		6.11		7.31		6.65		6.13	
PCB-060	ng/kg	29.5		29.2		38.2		38.5		18.1		23.6		21.1		13.4		17.4		20.1		20.8		14.4	
PCB-061/070/074/076	ng/kg	51.3		52.6		80.8		30.1		65.7		41.2		94.7		12		14.3		16.2		15		11	
PCB-063	ng/kg	11.1		11.3		15.7		17.7		10.1		11.6		10.5		7.74		9.35		9.72		10.4		9.56	
PCB-064	ng/kg	33.5		32.9		45.7		47.1		25.6		32.4		33		17.8		16.7		23.3		19.9		16.9	
PCB-066	ng/kg	76.2		73.5		109		69		58.7		65.7		92.9		23.6		29.6		39		37.1		26.2	
PCB-067	ng/kg	2.28	J	2.25	J	2.15	J	2.28	J	1.21	J	1.91	J	1.08	U	0.599	J	0.669	U	1.13	J	1.02	J	0.949	J
PCB-068	ng/kg	3.07	U	2.66	U	4.68		4.91		3.5		4.12		3.14		2.88	J	2.88	J	3	J	2.76	J	3.72	U
PCB-072	ng/kg	2.75	U	2.56	J	3.5		2.48	J	2.39	J	2.58	J	2.44	J	0.953	J	1.29	J	1.01	J	1.1	U	1.06	J
PCB-073	ng/kg	0.1	U	0.106	U	0.0941	U	0.103	U	0.0947	U	0.0973	U	0.0786	U	0.101	U	0.0813	U	0.0746	U	0.0949	U	0.0787	U
PCB-077	ng/kg	12.6		12.5		18.9		15.2		8.48		11.3		10.6		8.43		9.08		9.69		10.3		10.4	
PCB-078	ng/kg	0.724	U	0.86	U	0.69	U	0.861	U	0.742	U	0.456	U	0.626	U	0.367	U	0.41	U	0.569	U	0.635	U	0.431	U
PCB-079	ng/kg	3.08	U	3.16	U	3.77		3.95		1.05	U	2.75	J	0.929	U	1.61	J	1.59	U	1.01	U	1.23	U	1.58	J
PCB-080	ng/kg	0.694	U	0.824	U	0.662	U	0.825	U	0.711	U	0.437	U	0.557	U	0.326	U	0.365	U	0.506	U	0.564	U	0.384	U
PCB-081	ng/kg	0.911	U	0.979	U	0.811	U	1.08	U	0.862	U	0.6	U	0.752	U	0.557	U	0.711	U	0.69	U	0.806	U	0.832	U
PCB-082	ng/kg	1.83	U	1.32	U	0.536	U	0.515	U	0.365	U	0.595	U	0.21	U	0.365	U	1.54	U	0.48	U	0.415	U	0.397	U
PCB-083/099	ng/kg	224		230		328		296		217		266		260		173		177		221		208		206	
PCB-084	ng/kg	34.5		32.6		47.2		63.9		33.2		37.3		34.6		31.7		31.3		30.6		28.3		29.9	
PCB-085/116/117	ng/kg	63		61.1		83.9		93.4		58.5		69.1		62.1		45.8		55.4		61.4		61.4		56.2	
PCB-086/087/097/109/119/125	ng/kg	65.6		65.2		75.4		80		47.7		61.5		59.9		32.4		37.8		44.4		41.9		35.9	
PCB-088/091	ng/kg	39.3		38.3		51.6		62		36.2		44.4		37.7		30.1		34.8		35.5		33.6		32.9	
PCB-089	ng/kg	0.287	U	0.49	U	0.538	U	0.517	U	0.366	U	0.597	U	0.206	U	0.357	U	0.405	U	0.47	U	0.406	U	0.389	U
PCB-090/101/113	ng/kg	287		286		428		393		277		333		305		228		222		263		262		246	
PCB-092	ng/kg	43.6		43.3		57.4		58.8		36.8		41.6		37.1		28.3		27.8		32.8		32.2		29.9	
PCB-093/095/098/100/102	ng/kg	225		218		302		353		222		255		232		181		211		211		200		198	
PCB-094	ng/kg	2.83	J	2.6	J	3.77		4.65		2.84	J	3.05		2.75	J	2.47	J	2.93	J	3.03		2.51	J	2.82	J
PCB-096	ng/kg	0.874	J	0.78	J	1.09	U	1.41	J	0.672	J	1.03	J	1.03	J	0.556	U	0.781	U	0.892	J	0.63	J	0.765	J
PCB-103	ng/kg	6.64		6.4		9.9		10.5		7.8		9.37		8.7		7		6.96		8.62		7.33		8.76	
PCB-104	ng/kg	0.106	U	0.108	U	0.101	U	0.103	U	0.0852	U	0.0995	U	0.113	U	0.0788	U	0.101	J	0.0785	U	0.0983	U	0.111	U
PCB-105	ng/kg	161		162		225		223		140		157		153		118		151		148		162		149	
PCB-106	ng/kg	0.701	U	0.605	U	0.87	U	0.711	U	0.267	U	0.525	U	0.319	U	0.502	U	0.44	U	0.77	U	0.563	U	0.784	U
PCB-107	ng/kg	30.8		32.8		43.9		39.6		29		32.9		34.8		23.8		26.3		28.6		31.9		31.2	
PCB-108/124	ng/kg	2.54	U	2.13	J	2.53	U	1.95	J	1.11	J	2.11	U	2.44	J	1.13	U	1.15	J	1.72	J	1.25	U	1.3	U
PCB-110/115	ng/kg	143		147		181		243		111		128		115		113		93.1		109		97.6		103	
PCB-111	ng/kg	1.75	J	1.57	U	2.19	J	2.51	J	1.9	J	1.82	J	1.94	J	1.48	J	1.88	J	1.73	U	1.74	J	1.99	U
PCB-112	ng/kg	0.184	U	0.314	U	0.345	U	0.331	U	0.235	U	0.382	U	0.13	U	0.225	U	0.255	U	0.296	U	0.256	U	0.245	U
PCB-114	ng/kg	6.98		9.05		12		13.3		8.67		7.91		9.08		6.29	U	7.2		7.95		8.42		8.3	
PCB-118	ng/kg	224		222		338		220		202		232		277		119		139		174		156		142	
PCB-120	ng/kg	7.31		7.48		9.78		9.8		7.39		8.2		8.13		6.51		7.68		7.84		8.2		8.41	
PCB-121	ng/kg	0.329	J	0.348	U	0.509	U	0.386	U	0.297	J	0.424	U	0.5	U	0.387	J	0.36	J	0.442	J	0.332	U	0.47	U

Compound	Units Wet Weight	N.v.Pretest Rep 1 Results	Q	(Dupl) N.v.Pretest Rep 1 Results	Q	A.v.PGD-DU Rep 1 Results	Q	A.v.PGD-DU Rep 2 Results	Q	A.v.PGD-DU Rep 3 Results	Q	A.v.PGD-DU Rep 4 Results	Q	A.v.PGD-DU Rep 5 Results	Q	A.v.PGE-DU Rep 1 Results	Q	A.v.PGE-DU Rep 2 Results	Q	A.v.PGE-DU Rep 3 Results	Q	A.v.PGE-DU Rep 4 Results	Q	A.v.PGE-DU Rep 5 Results	Q
PCB-122	ng/kg	0.823	U	0.71	U	1.02	U	0.835	U	0.314	U	0.616	U	0.408	U	0.642	U	0.563	U	0.985	U	0.72	U	1	U
PCB-123	ng/kg	8.77	U	6.57	U	10.9	U	12.1	U	7.82	U	8.56	U	9.22	U	7.22	U	7.54	U	8.32	U	8.24	U	7.82	U
PCB-126	ng/kg	1.29	U	1.01	U	2.48	U	2.06	U	1.38	U	1.51	U	1.22	U	1.13	U	1.51	U	1.39	U	2.03	U	1.73	U
PCB-127	ng/kg	0.796	U	0.687	U	0.988	U	0.807	U	0.304	U	1.49	J	0.39	U	1.17	U	1.56	J	1.41	U	1.71	U	1.59	J
PCB-128/166	ng/kg	96.7		97.1		135		188		98.1		140		109		91.9		110		107		119		113	
PCB-129/138/160/163	ng/kg	918		932		1330		1480		1000		1100		1030		878		1000		1030		1100		1070	
PCB-130	ng/kg	45.3		43.8		61.5		68.2		44.4		50.4		47.1		41		42.1		46.3		45.6		48.9	
PCB-131	ng/kg	1.87	J	4.74	U	3.73	U	4.06	U	3.46	U	3.6	U	2.12	U	3.46	U	3.61	U	3.57	U	3.23	U	2.27	U
PCB-132	ng/kg	48.9		48.5		58.1		82.5		34.6		38.3		36.8		38.2		45.1		40.7		36.9		42.8	
PCB-133	ng/kg	24.6		24.2		33.9		37.4		26.4		30.1		28		25.2		28.6		28.3		29.4		31.3	
PCB-134/143	ng/kg	17	U	16.3		18	U	27.4		12.2		14.9		12	U	12.8		13.4		3.58	U	3.25	U	14.9	
PCB-135/151/154	ng/kg	176		176		217		288		152		176		155		150		170		163		156		174	
PCB-136	ng/kg	55.6		53.8		69.2		90.8		50.6		59.5		51.6		46.1		57.5		54.4		52.5		53.3	
PCB-137	ng/kg	27.2		23.7		37.4		42.1		28.1		28.8		28		22.3		32		27.2		33.4		28.2	
PCB-139/140	ng/kg	8.34		7.35		9.93		11.3	U	7.24		8.63		7.88		6.05	U	7.79		7.37		8.02		7.74	
PCB-141	ng/kg	25.2		24.7		26.2		37.3		15.6		20.3		1.98	U	3.23	U	15.9		19.6	U	20	U	16.1	
PCB-142	ng/kg	1.73	U	4.87	U	3.83	U	4.17	U	3.56	U	3.7	U	2.14	U	3.49	U	3.64	U	3.6	U	3.26	U	2.29	U
PCB-144	ng/kg	21.2		21.5		30.6		33.3		21.7		24.8		23		17.9		21		20.9		21.6		22.3	
PCB-145	ng/kg	0.246	U	0.145	U	0.18	U	0.126	U	0.119	U	0.218	U	0.105	U	0.111	U	0.209	U	0.101	U	0.114	U	0.177	U
PCB-146	ng/kg	255		250		353		398		273		308		271		238		276		275		288		303	
PCB-147/149	ng/kg	539		544		702		897		540		607		538		476		591		514		549		581	
PCB-148	ng/kg	3.4		3.62		5.17		5.39		4.06		4.5		4.5		4.41		4.2		4.7		4.9	U	5.45	
PCB-150	ng/kg	1.88	J	1.8	J	2.33	J	2.86	J	1.47	U	2.12	J	1.87	J	1.4	J	1.93	U	2.01	J	1.93	J	2.02	U
PCB-152	ng/kg	0.453	U	0.45	U	0.611	U	0.811	J	0.381	J	0.556	J	0.458	J	0.356	U	0.413	J	0.492	U	0.352	J	0.443	J
PCB-153/168	ng/kg	1330		1360		1820		2110		1460		1590		1530		1310		1580		1520		1650		1630	
PCB-155	ng/kg	0.782	U	0.695	J	1.09	J	1.23	J	0.88	U	0.964	U	0.963	J	0.776	J	0.872	J	0.922	J	0.952	J	1.16	J
PCB-156/157	ng/kg	76.8		74.4		108		118		76.9		84.5		82		66.3		87.2		80.6		92.8		86.9	
PCB-158	ng/kg	58.9		58.5		84.9		95.8		64.1		70.2		66.4		55.4		65.1		65.8		70.7		68.1	
PCB-159	ng/kg	1.58	J	3.46	U	2.73	U	2.97	U	2.53	U	2.63	U	1.62	U	2.63	U	2.75	U	2.72	U	2.46	U	1.73	U
PCB-161	ng/kg	1.12	U	3.14	U	2.48	U	2.7	U	2.3	U	2.39	U	1.49	U	2.43	U	2.54	U	2.51	U	2.27	U	1.59	U
PCB-162	ng/kg	3.24	J	3.5	U	16.7	U	5.29	U	2.66	J	3.5	U	3.06		3.73		2.82	U	2.79	U	3.32	U	1.77	U
PCB-164	ng/kg	5.93		5.64	U	6.75		9.98		2.99	U	3.72		3.45	U	3.06		6.12		3.75		2.73	U	4.51	
PCB-165	ng/kg	2.17	U	3.77	U	2.97	U	3.24	U	2.76	U	2.87	U	2.36	J	2.79	U	2.91	U	2.88	U	2.61	U	2.9	J
PCB-167	ng/kg	35.6		33.6		50.2		56.2		36.6		41.1		39.1		33.5		41.9		39.9		43.6		45.1	
PCB-169	ng/kg	1.59	U	4.51	U	3.36	U	3.88	U	3.31	U	3.48	U	2.19	U	3.76	U	3.83	U	3.77	U	3.38	U	2.25	U
PCB-170	ng/kg	199		201		279		349		216		238		216		186		230		222		257		239	
PCB-171/173	ng/kg	62.9		63.3		93.5		112		69.4		77		72		67.7		71.6		74.3		85.3		80.8	
PCB-172	ng/kg	37.4		36.3		50.7		68.1		37.4		41.6		39.7		35.9		41		40.2		48.2		42.3	
PCB-174	ng/kg	21.9		22.8		28.2		44.7		10.9		15.1		14.2		13.2		21.7		16.6		17.5		18.2	
PCB-175	ng/kg	12.6		12.3		17.9		21.4		13.2		14.7		14.5		13.9		14.4		15.2		17.4		17.3	

Compound	Units Wet Weight	N.v.Pretest Rep 1 Results	Q	(Dupl) N.v.Pretest Rep 1 Results	Q	A.v.PGD-DU Rep 1 Results	Q	A.v.PGD-DU Rep 2 Results	Q	A.v.PGD-DU Rep 3 Results	Q	A.v.PGD-DU Rep 4 Results	Q	A.v.PGD-DU Rep 5 Results	Q	A.v.PGE-DU Rep 1 Results	Q	A.v.PGE-DU Rep 2 Results	Q	A.v.PGE-DU Rep 3 Results	Q	A.v.PGE-DU Rep 4 Results	Q	A.v.PGE-DU Rep 5 Results	Q
PCB-176	ng/kg	22.6		22		30		40.8		20.2		23.7		20.7		21.2		24.1		22.6		25.1		24.6	
PCB-177	ng/kg	126		124		171		214		122		135		135		142		133		134		154		148	
PCB-178	ng/kg	64.3		65.4		93.7		108		65.9		78.8		74.5		71.7		76.8		78.1		90.3		87.6	
PCB-179	ng/kg	43.4		43		53.4		77.1		33.1		38.5		35.5		38.4		43.8		41.7		42.7		45.3	
PCB-180/193	ng/kg	595		605		845		1100		655		700		684		555		692		683		781		706	
PCB-181	ng/kg	1.73	J	1.89	J	2.73	J	2.72	J	1.93	J	2.07	U	1.92	U	1.69	J	2.09	J	2.05	U	2.31	U	2	J
PCB-182	ng/kg	0.177	U	0.142	U	0.168	U	0.169	U	0.176	U	0.163	U	0.181	U	0.161	U	0.146	U	0.169	U	0.173	U	0.128	U
PCB-183/185	ng/kg	206		203		294		360		223		242		234		223		254		246		284		270	
PCB-184	ng/kg	1.23	J	1.1	J	1.95	J	1.66	J	1.24	U	1.35	J	1.31	J	1.33	J	1.38	J	1.45	J	1.44	J	1.63	J
PCB-186	ng/kg	0.152	U	0.122	U	0.144	U	0.144	U	0.15	U	0.14	U	0.154	U	0.137	U	0.124	U	0.143	U	0.147	U	0.108	U
PCB-187	ng/kg	487		478		720		824		532		597		576		532		600		611		675		672	
PCB-188	ng/kg	2.6	J	2.87	J	4.09		3.98		2.92	J	3.5		3.43		3.34		3.49		3.78		4.07		4.07	
PCB-189	ng/kg	9.33		9.17		13.2		16.4		10.1		11.2		10.9		9.23		10.6		10.7		12		11.2	
PCB-190	ng/kg	49.1		49.9		67.2		82.8		51.5		55.4		54.4		43.5		56.7		54.2		62.7		54.6	
PCB-191	ng/kg	10.2		10.3		14.8		18.2		11.6		12.4		11.9		10.7		12.2		11.7		14.4		13	
PCB-192	ng/kg	0.165	U	0.133	U	0.157	U	0.157	U	0.164	U	0.152	U	0.179	U	0.159	U	0.144	U	0.166	U	0.234	U	0.126	U
PCB-194	ng/kg	98		89.5		132		161		99.8		115		99.5		87.5		99.4		102		119		114	
PCB-195	ng/kg	51.4		52.5		70.6		83.4		56.1		62.6		59.4		50.8		64.8		62.6		69.4		68.6	
PCB-196	ng/kg	69		70.1		97.8		112		74.4		84.1		89.1		79.3		93.6		93.7		100		108	
PCB-197/200	ng/kg	14.6		14		19.4		22.9		13.8		15.6		15.5		15.3		17.8		18.2		19		19.9	
PCB-198/199	ng/kg	118		121		164		193		115		143		142		135		154		154		166		174	
PCB-201	ng/kg	22.4		22.1		31.1		34.5		21.5		26.8		26.1		24.6		26.9		29.3		31.4		33.1	
PCB-202	ng/kg	32.6		32.6		45.2		47.1		31		40.4		36.5		35.4		38.3		41.4		44.8		49.1	
PCB-203	ng/kg	125		125		167		189		130		144		145		130		161		156		165		169	
PCB-204	ng/kg	0.493	J	0.443	J	0.442	U	0.575	J	0.397	J	0.482	U	0.491	U	0.423	U	0.464	J	0.559	J	0.502	U	0.498	U
PCB-205	ng/kg	8.95		8.46		12.4		14.1		9.6		11		10.3		9.2		10.4		10.1		11.9		11.2	
PCB-206	ng/kg	181		182		227		220		194		222		207		214		214		224		234		245	
PCB-207	ng/kg	27.8		28.1		33.7		34.2		28.7		32.3		32.3		31.5		33.7		33.9		35.3		36.9	
PCB-208	ng/kg	67.4		65.6		83.6		85.9		60.8		79.4		72.5		71.1		78.4		79.1		82.5		87.4	
PCB-209	ng/kg	207		209		232		242		198		229		215		211		233		223		234		243	
Total PCBs (ND=0)	ng/kg	8959.16		8971.12		12274.93		13899.18		9030.39		10209.06		9755.27		8024.91		9274.46		9323.80		9900.73		9773.49	
Total PCBS (ND=1/2)	ng/kg	8993.13		9010.11		12320.59		13935.73		9059.01		10235.72		9783.15		8056.50		9300.14		9363.65		9944.97		9797.33	

Q: final validation qualifier

Qualifiers

J: concentration less than limit of quantification

U: this analyte is not detected above the reporting limit (RL) or if noted, not detected above the limit of detection (LOD).

Table 12. Summary of Two Sample t-Tests (alpha = 0.1) Comparing Mean Tissue Concentrations Between the Disposal Site (PGD-DU) and Environs (PGE-DU) using ProUCL

	M. Nasuta				*A. virens*			
Parameter	**Variance**	**DF**	**t-Test Value**	**P-Value**	**Variance**	**DF**	**t-Test Value**	**P-Value**
Arsenic	Equal	8	0.744	0.239	Equal	8	-0.194	0.575
Lead	Unequal	4.6	1.052	0.172	Equal	8	-0.591	0.715
Mercury	Equal	8	1.905	0.047	Unequal	4.6	0.752	0.244
Silver	Equal	8	-0.161	0.562	Equal	8	-2.657	0.986
Selenium	Equal	8	-0.066	0.525	Equal	8	0.382	0.356
Dioxin/Furan TEQ (ND=0)	Equal	8	1.005	0.172	Equal	8	-0.314	0.619
Dioxin/Furan TEQ (ND=½DL)	Equal	8	2.77	0.012	Equal	8	0.335	0.373
Total PCBs (ND=0)	Equal	8	15.086	0.000	Unequal	5.1	1.856	0.061
Total PCBs (ND=½DL)	Equal	8	15.101	0.000	Unequal	5.1	1.851	0.061

DF – degrees of freedom
Equal Variance – Student t-Test (pooled)
Unequal Variance – Welch-Satterthwaite t-Test
(shaded) Tissue concentration at PGD-DU significantly greater than PGE-DU

Table 13. Dioxin/Furan Congener-Specific PQLs (SGS-Axys)

Dioxins/Furans	Units	PQL
2,3,7,8-TCDD	ng/kg	0.2
1,2,3,7,8-PECDD	ng/kg	1
1,2,3,4,7,8-HXCDD	ng/kg	1
1,2,3,6,7,8-HXCDD	ng/kg	1
1,2,3,7,8,9-HXCDD	ng/kg	1
1,2,3,4,6,7,8-HPCDD	ng/kg	1
OCDD	ng/kg	2
2,3,7,8-TCDF	ng/kg	0.2
1,2,3,7,8-PECDF	ng/kg	1
2,3,4,7,8-PECDF	ng/kg	1
1,2,3,4,7,8-HXCDF	ng/kg	1
1,2,3,6,7,8-HXCDF	ng/kg	1
1,2,3,7,8,9-HXCDF	ng/kg	1
2,3,4,6,7,8-HXCDF	ng/kg	1
1,2,3,4,6,7,8-HPCDF	ng/kg	1
1,2,3,4,7,8,9-HPCDF	ng/kg	1
OCDF	ng/kg	2

Note:

The PQL for each dioxin congener was established as the lowest method calibration level (LMCL) standard (High Sensitivity CS-0.2) used by SGS-Axys to calibrate its instruments.

Appendices not posted are available upon request from the DMMO

APPENDIX A

Sampling and Analysis Plan

(Electronic Copy Only)

APPENDIX B

SPME Special Study Results

(Electronic Copy Only)

APPENDIX C

SPI and Plan View Report

(Electronic Copy Only)

APPENDIX D

Field Forms and Photos

(Electronic Copy Only)

APPENDIX E

Laboratory Data Reports

(Electronic Copy Only)

APPENDIX F

Data Validation Reports

(Electronic Copy Only)

APPENDIX G

EIM Data Files

(Electronic Copy Only)

APPENDIX H

Calculations for Dioxin/Furan TEQs, PCB Congener Totals, and ProUCL t-Tests

(Electronic Copy Only)

APPENDIX I

Puget Sound Sediment Reference Material Submittal

(Electronic Copy Only)