Prepared by:
Dredged Material Management Office
Seattle District, US Army Corps of Engineers

Memorandum for Record **April 15, 2024**

Subject: Suitability Determination Memorandum and Antidegradation Assessment for Blair Waterway, Pierce County Terminal in Tacoma, Washington (NWS-2022-0681).

Introduction

This suitability determination memorandum (SDM) and antidegradation assessment documents the consensus regarding the suitability of the proposed dredged material for unconfined aquatic disposal and compliance of the post-dredge leave surface as determined by the Dredged Material Management Program (DMMP) agencies (U.S. Army Corps of Engineers (USACE), Washington Departments of Ecology and Natural Resources, and the U.S. Environmental Protection Agency (EPA)).

Project Description

In October 2020, the Port of Tacoma (Port) conducted a Dredged Material Management Program (DMMP) chemistry-only characterization of sediment mounds created by propeller-wash in the berthing area of Washington United Terminal (WUT), Husky Terminal (Husky), and Pierce County Terminal (PCT), Port of Tacoma, WA (NewFields and Leon Environmental, 2021). The mounds posed a navigation hazard to Port operations, requiring terminal operators to "light-load" vessels. The 2020 DMMP characterization determined that the proposed dredged material from WUT and Husky terminals was suitable for open-water disposal (DMMP, 2021a). However, the dioxin/furan (D/F) concentrations measured in the proposed dredged material at PCT triggered supplemental bioaccumulation testing to determine whether the material would be suitable for open-water disposal. Because bioaccumulation testing would have delayed the more urgently required dredging at WUT and Husky, the Port removed dredging of PCT from the 2020 maintenance action.

In the summer of 2022, the Port conducted DMMP bioaccumulation testing and chemical analysis at PCT to assess whether the proposed dredged material was suitable for open-water disposal at the Commencement Bay DMMP site. Bioaccumulation testing was conducted due to D/F concentrations that exceeded the bioaccumulation trigger (BT) for DMMUs PCT-1 and PCT-2 during the 2020 DMMP characterization. In addition, the test sediment from DMMU PCT-2 was re-analyzed for total chlordane using a high-resolution method (EPA method 1699) to ensure reporting limits were below the SL. All other DMMP chemical parameters were undetected or measured at concentrations below corresponding SLs during the 2020 DMMP characterization.

The berthing depth for PCT is −51 feet MLLW. The sediment characterization depth was the berthing depth including an additional 1 foot of allowable overdepth to −52 feet MLLW. After the 2020 characterization the Port requested an additional 1 ft of overdepth to -53 feet MLLW. The DMMP requested that the characterization depth remain consistent with the 2020 study to avoid any dilution with deeper native material. Characterization of the Z-sample composites covered the additional 1 foot of overdepth that may be needed by the Port due to dredging constraints, as well as compliance with the antidegradation standards for the "leave" surface (DMMP, 2022).

Project Summary

Waterbody	Blair Waterway in Tacoma Harbor
Water classification	Marine

Project rank	Moderate
Total proposed dredging volume (cy)	27,462
Authorized dredging depth	-51 ft MLLW
Max. proposed dredging depth (includes 2 feet overdepth)	-53 ft MLLW
Proposed disposal location(s)	Non-dispersive open-water disposal
Dredged Material Management Units (DMMUs): No. of stations	2 DMMUs from 6 stations
Z-samples	2 composites (same stations as DMMUs)
DMMO tracking number	POTBW1AF456
EIM Study ID	POTBW24
USACE Regulatory Reference Number	NWS-2020-1017-WRD
Sampling and Analysis Plan (SAP) Approval Date	June 17, 2022 (NewFields and Leon Env., 2022)
Sampling Date(s)	June 21-24, 2022
Sediment Characterization Report Approval Date	April 10, 2024 (NewFields and Leon Env., 2024)
Testing Parameters	Total chlordane and dioxins/furans (D/F)
Biological Testing	Bioaccumulation study for D/F
Suitability Outcome	All material found suitable for non-dispersive in-water disposal
Recency Expiration Date M=5 years	June 2027
Antidegradation Assessment	In compliance

Sampling and Analysis Description

Sediment sampling activities were conducted in the PCT berthing areas from June 21 through 24, 2022 using Gravity Environmental's research vessel *Ingalls*, a 36-foot aluminum landing craft. The mudline elevation at each sampling location was determined using a lead line. Real-time tidal corrections were applied using water level measurements from the National Oceanic and Atmospheric Administration (NOAA) Tacoma, WA, tide station (Station ID: 9446484). Samples were transported to a shore-side location for processing.

To obtain similar D/F concentrations, core sampling locations were the same as targeted during the 2020 Blair Waterway maintenance dredging project, except for Station P3. Based on the review of the bathymetry collected by Seattle District in October 2021, the mound near P3 had shifted 25 meters to the northeast. Figure 1 shows the sample locations and Table 1 provides the sample collection details.

A reference sediment was collected from Carr Inlet by EcoAnalysts on June 30, 2022, using a stainless steel 0.6-m^2 Ponar grab sampler. The latitude and longitude of the reference sample in NAD83 datum are 47.33240 and 122.67673, respectively.

Bioaccumulation testing was conducted by EcoAnalysts using the adult bivalve (*Macoma nasuta*) and adult polychaete (*Alitta virens*) exposed in separate exposure tanks for a 45-day period. Five replicates for each species were generated for each DMMU and Z-layer composite, as well as three pre-test replicates for each species.

Sediment and tissue D/F testing and conventionals were conducted by Analytical Resources, Inc. High resolution total chlordane sediment testing was conducted by Vista Analytical.

Data Validation

NewFields conducted an EPA Stage 2B review and validation of all sediment and tissue chemistry data. The validation process resulted in some additional J and UJ qualified data (estimated values) and U qualified data (estimated maximum possible concentrations [EMPCs] and analytes associated with method blank detections) beyond those assigned by the lab, based on specified protocol or technical advisory. Due to elevated estimated detection limits (EDLs) in the initial tissue analyses, maintenance was performed on the laboratory instrument and samples were re-analyzed, yielding lower EDLs. The reanalyzed data were used, and the original results were qualified as "Do Not Report" to provide just one reportable result per sample parameter. Completeness was 100%; all reported data are usable as qualified.

Analytical Testing Results

Total Chlordane and Conventionals. Table 2 provides the sediment chemistry data. Sample PCT-2-C, which was 2.98 ug/kg U in the 2020 analysis was 0.26 ug/kg using the high-resolution method, which is below the 2.8 DMMP screening level.

Samples were predominately sand (52%-70%) with varying fines (28%-46%). TOC ranged from 0.34% – 0.63%.

Dioxins/furans. The DMMU and Z-sample composite sediment chemistry results were comparable to the 2020 characterization (DMMP, 2021a) and ranged from 8.9 to 17.5 ng/kg-TEQ. *Macoma nasuta* and *Alitta virens* tissue chemistry results for D/Fs are provided in Table 3 and 4, respectively. All results were below 1 ng/kg-TEQ.

Bioaccumulation Evaluation

The Port used a weight-of-evidence approach, outlined in the DMMP User Manual (DMMP 2021b), to evaluate the bioaccumulation study tissue data. The factors included:

- Statistical comparison to reference.
- The magnitude of the bioaccumulation from PCT sediments compared to reference sediments.
- Evaluation of PCT tissue concentrations relative to Practical Quantitation Limits (PQLs).
- Evaluation of the impact of non-detects on PCT tissue total TEQ values.
- Comparison of PCT tissue total TEQ values to those of comparable species found in the vicinity of the Commencement Bay DMMP disposal site.

Statistical Comparisons to Reference

The mean D/F total TEQs in tissues exposed to each DMMU and Z-layer composite (Table 5) were compared with the mean D/F total TEQs in tissues exposed to the Carr Inlet reference using a one-sided t-test and an alpha level of 0.1. The t-tests were conducted using BioStat (USACE 2007) and evaluated the null hypothesis that mean tissue D/F total TEQ for the test sediment was less than or equal to the mean tissue D/F total TEQ for the reference.

A Bonferroni correction for the t-test was then applied using R Studio 4.3.1 to confirm statistical significance. A Bonferroni correction adjusts the probability value (p-value) for a statistical test to reduce the instance of a false positive (type I error) and prevent data from incorrectly appearing to be statistically significant. A significance level of 0.1 was used for the Bonferroni's correction and one-tailed was specified for the t-test.

The results of the t-tests with Bonferroni's p-value adjustments are summarized in Table 6. The tissue concentrations for *A. virens* for sample PCT-1-C were not statistically different from the Carr Inlet reference for both ND=1/2*EDL and ND=0*EDL. The tissue concentrations for *A. virens* for sample PCT-2-C were not statistically different from the Carr Inlet reference for ND=1/2*EDL.

With the exception of tissue concentrations for *A. virens* for PCT-1-C for ND=1/2*EDL and ND=0*EDL and *A. virens* for PCT-2-C for ND=1/2*EDL, the remaining *A. virens* and all *M. nasuta* tissue concentrations associated with the DMMUs and Z-layer composites were significantly greater than the Carr Inlet reference for both ND=1/2*EDL and ND=0*EDL (Table 6). Because statistically significant differences between test tissues and reference were observed, several additional factors were considered to determine whether PCT dredged material is suitable for open-water disposal.

Magnitude of Bioaccumulation Compared to Reference

The statistical comparison presented identified significant differences between PCT and reference sediment bioaccumulation, but not the magnitude of these differences. Therefore, relative percent differences (RPDs) were calculated for the mean D/F TEQ tissue values (ND=1/2*EDL) for the DMMUs and Z-layer composites and compared to the mean D/F TEQ tissue values for Carr Inlet. The RPDs for the *A. virens* samples ranged from 22.9% for PCT-1-C to 56.4% for PCT-2-Z relative to the Carr Inlet reference. The RPDs were greater for the *M. nasuta* samples due to the relatively low mean TEQ for the Carr Inlet tissues. The RPDs for the *M. nasuta* samples ranged from 82.7% for PCT-2-C to 120.4% for PCT-2-Z relative to the Carr Inlet reference. Expressed differently, the mean *A. virens* TEQ for each DMMU and Z-layer composite was between 1.26 and 1.79 times greater than the mean *A. virens* TEQ exposed to the Carr Inlet reference material. The mean TEQ among *M. nasuta* samples ranged between 2.41 and 4.02 times greater than the Carr Inlet reference material.

Evaluation of Tissue Concentrations Relative to PQLs

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 reported above the PQL can be considered with a high degree of confidence, while concentrations below the PQL are typically considered estimated values. Therefore, PQLs are an important consideration for evaluating data when concentrations are low. The PQL for each D/F congener for this project was defined as the lowest method calibration standard used by ARI to calibrate its instruments.

The significance of laboratory-reported estimated D/F congener concentrations can be evaluated by comparing TEQs measured in tissue to the sum TEF-weighted PQLs. The sum of TEF-weighted PQLs for this project was 1.58 ng/kg ww TEQ. The tissue PQL for dioxins/furans as a sum of TEQ is defined by Ecology as 1 ng/kg ww TEQ (Ecology 2021). For both *M. nasuta* and *A. virens*, the mean total TEQ as well as the total TEQs for the five replicates analyzed for each sample were less than both the project-specific and Ecology PQLs (Figures 2 and 3).

Influence of Non-Detects on the Total TEQ

The DMMU and Z-layer exceedances of BT and SL criteria are driven predominantly by the summation of non-detected D/F congeners. On average 36% to 49% of the congeners were not detected for both the *M. nasuta* and *A. virens* tissues.

The influence of the non-detected D/F congener results on the TEQs were evaluated based on their TEF-weighted concentrations. The contribution of the TEF-weighted non-detected congener concentrations

to the D/F total TEQs (ND=1/2*EDL) for each sample is shown in Figures 4 and 5. Non-detected congeners contributed 20.8% to 39.1% of the total TEQ for *M. nasuta* when ND=1/2*EDL. On average, non-detected congeners contributed 30% of the total TEQ calculated for the *M. nasuta* tissues. For *A. virens*, non-detected congeners contributed approximately 14.4% to 34.7% of the total TEQ when ND=1/2*EDL. On average, non-detected congeners contributed 25% of the total TEQ calculated for the *A. virens* tissues.

For this project, all EMPCs were qualified as non-detects. Congeners reported and validated as EMPCs contributed between 17.4% and 26.1% of the total TEQ for *M. nasuta* and between 18.2% and 21.5% of the total TEQ for *A. virens* (when calculated as half of the reported concentration). The contribution of the TEF-weighted EMPC concentrations to the D/F total TEQs (ND=1/2*EDL) for each sample is also shown in Figures 4 and 5.

Tissue Concentrations of Comparable Species in Commencement Bay

Comparing PCT tissue total TEQ values to those measured in comparable species at the Commencement Bay DMMP disposal site provides additional evidence to evaluate the potential for PCT material to cause unacceptable adverse ecological impacts at the site. In 2007, the DMMP conducted a special D/F study at the unconfined open water dredged material disposal sites in Puget Sound (SAIC 2008). Organisms were collected in the vicinity of the DMMP sites and analyzed for D/F congeners. At the Commencement Bay DMMP site, three genera of polychaetes (*Glyceridae*, *Maldanidae*, and *Travisia*) and one genera of bivalve (*Compsomyax*) were collected from six offsite stations in the vicinity of the disposal site boundary (perimeter and transect stations).

Figures 6 and 7 present comparisons of the PCT D/F tissue total TEQs (ND=1/2*EDL) to tissue total TEQs from species found in the vicinity of the Commencement Bay disposal site. Comparison of the *M. nasuta* bioaccumulation results to the *Compsomyax* tissue in Commencement Bay is not considered to be appropriate due to the different feeding strategies of these two species of clams. The *Compsomyax* clam has a relatively short siphon and is typically a filter feeder that lives exclusively in the subtidal (Lauzier 1997), compared to the *Macoma* clam which has adapted to a broad range of depths and substrate types and is primarily a deposit feeder (Hylleberg and Gallucci 1975). Therefore, comparison of the *M. nasuta* bioaccumulation results to the Commencement Bay polychaete species was deemed a more appropriate comparison.

Observed D/F TEQ values in PCT test organisms are generally comparable to that observed in polychaete tissues collected from the vicinity of the Commencement Bay DMMP disposal site.

DMMP Determinations

Suitability Determination

The bioaccumulation testing data can be summarized as follows. Dredged material samples from the PCT resulted in tissue concentrations that were statistically greater than reference, however the accumulated concentrations were very low. Statistical comparisons were driven by the low measured variance among reference replicates, resulting in even small differences between test and reference being statistically significant. In addition to bioaccumulated concentrations being very low, the calculated TEQs were driven to a large extent by non-detects and EMPCs. All detected concentrations were below the Ecology tissue PQL. Lastly, the test results were within the range of tissue

concentrations found in the vicinity of the Commencement Bay disposal site (perimeter and transect stations) during testing in 2007.

The DMMP dioxin guidelines allow for case-by-case determinations to be made based on consideration of the individual aspects of a dredging project. After careful evaluation, the DMMP agencies find that the weight of evidence supports a determination that placement of the PCT material at the Commencement Bay site will not result in adverse effects. Therefore, the DMMP agencies concluded that all 27,462 cubic yards proposed for dredging from PCT are suitable for open-water disposal at the Commencement Bay non-dispersive site.

Antidegradation Determination

The sediment to be exposed by dredging must either meet the State of Washington Sediment Management Standards (SMS) or the State's Antidegradation Standard (Ecology, 2013) as outlined by DMMP guidance (DMMP, 2008). Z-layer samples were included in the bioaccumulation testing and evaluation presented in this memo. The pre-dredge and post-dredge tissue concentrations were similar to each other and all below the Ecology tissue PQL of 1 ng/kg ww TEQ (Ecology 2021), thus considered compliant with the State of Washington Antidegradation Standard.

Dredge Sequencing

Because higher D/F concentrations were measured in DMMU PCT-2 sediments, dredging shall be sequenced so this DMMU is dredged and disposed first.

Debris Management

The DMMP agencies implemented a debris management requirement following the 2015 SMARM to prevent the disposal of debris (natural or anthropogenic) greater than 12 inches in any dimension at open-water disposal sites in Puget Sound. Debris screens shall be used for this project unless it can be demonstrated that debris is unlikely to be present or that the debris is large woody debris that can be easily observed and removed by other means during dredging. Debris screen usage, or detailed justification for not using one, must be included in the dredging quality assurance plan.

Notes and Clarifications

The decisions documented in this memorandum do **not** constitute final agency approval of the project. During the public comment period that follows a public notice, resource agencies will provide input on the overall project. A final decision will be made after full consideration of agency input, and after an alternatives analysis is done under section 404(b)(1) of the Clean Water Act.

A pre-dredge meeting with DNR, Ecology and the Corps of Engineers is required at least 7 days prior to dredging. A dredging quality control plan must be developed and submitted to the USACE Seattle District's Regulatory Branch and Ecology. Refer to the USACE permit and Ecology 401 certification for project-specific submittal requirements and timelines.

Projects proposing to use one of the DMMP open-water disposal sites must submit their application for a Site Use Authorization (SUA) to the Washington State Department of Natural Resources (DNR) at least 4 weeks prior to dredging. Applications submitted less than 4 weeks prior to dredging may be subject to delays.

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USACE. 2007. Bioassay Statistics Software (BioStat) 2.0. David Fox, David Gustafson, and Travis Shaw. U.S. Army Corps of Engineers, Seattle District. Updated August 3, 2007.

Agency Signatures

The signed copy is on file in the Dredged Material Management Office, Seattle District U.S. Army Corps of Engineers

_____	_____
Date	Joy Dunay – U.S. Army Corps of Engineers, Seattle District
_____	_____
Date	Whitney Conard, PhD. – U.S. Environmental Protection Agency, Region 10
_____	_____
Date	Laura Inouye, PhD. – Washington State Department of Ecology
_____	_____
Date	Shannon Soto – Washington State Department of Natural Resources

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Peter Leon, Leon Environmental, LLC
DMMO File

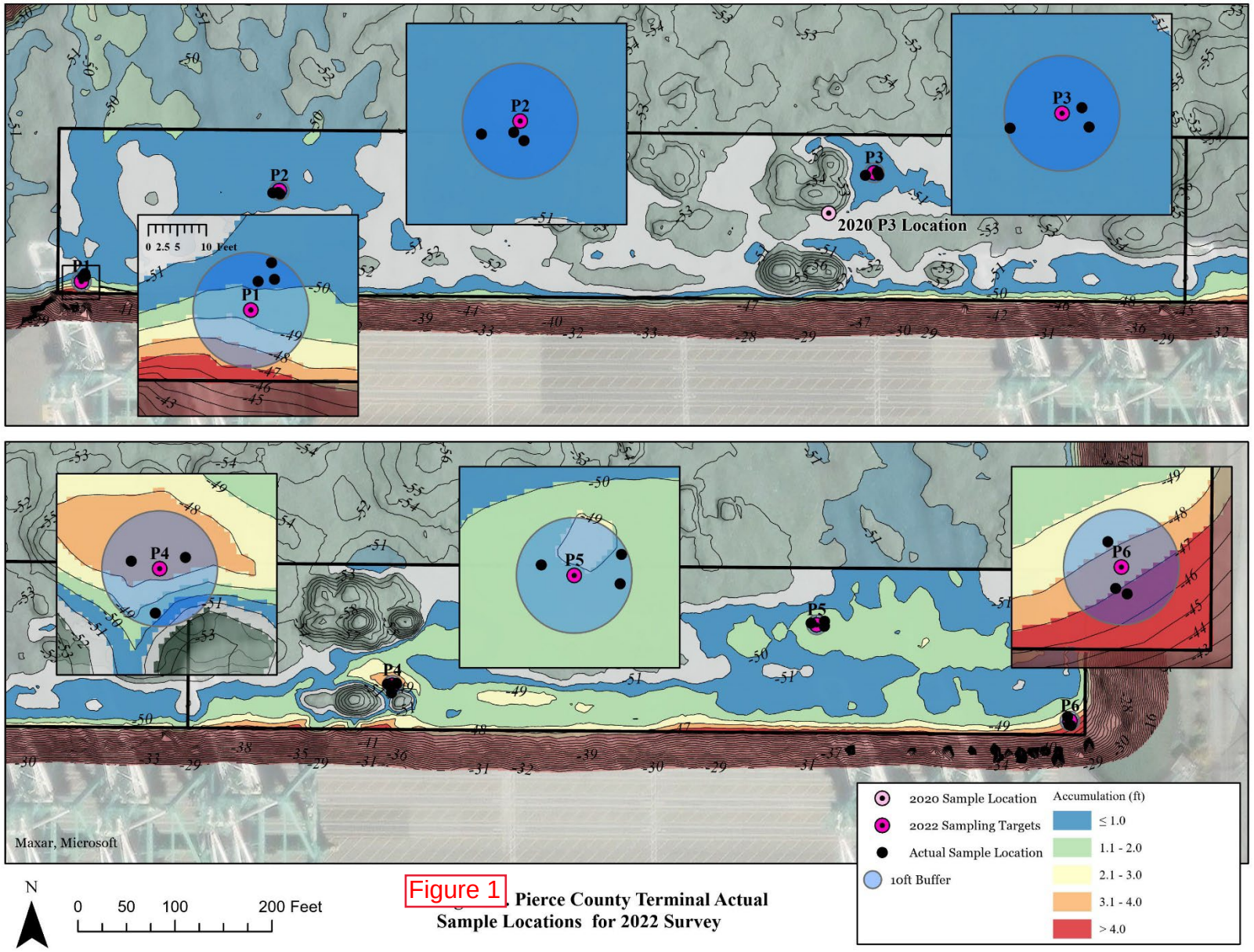
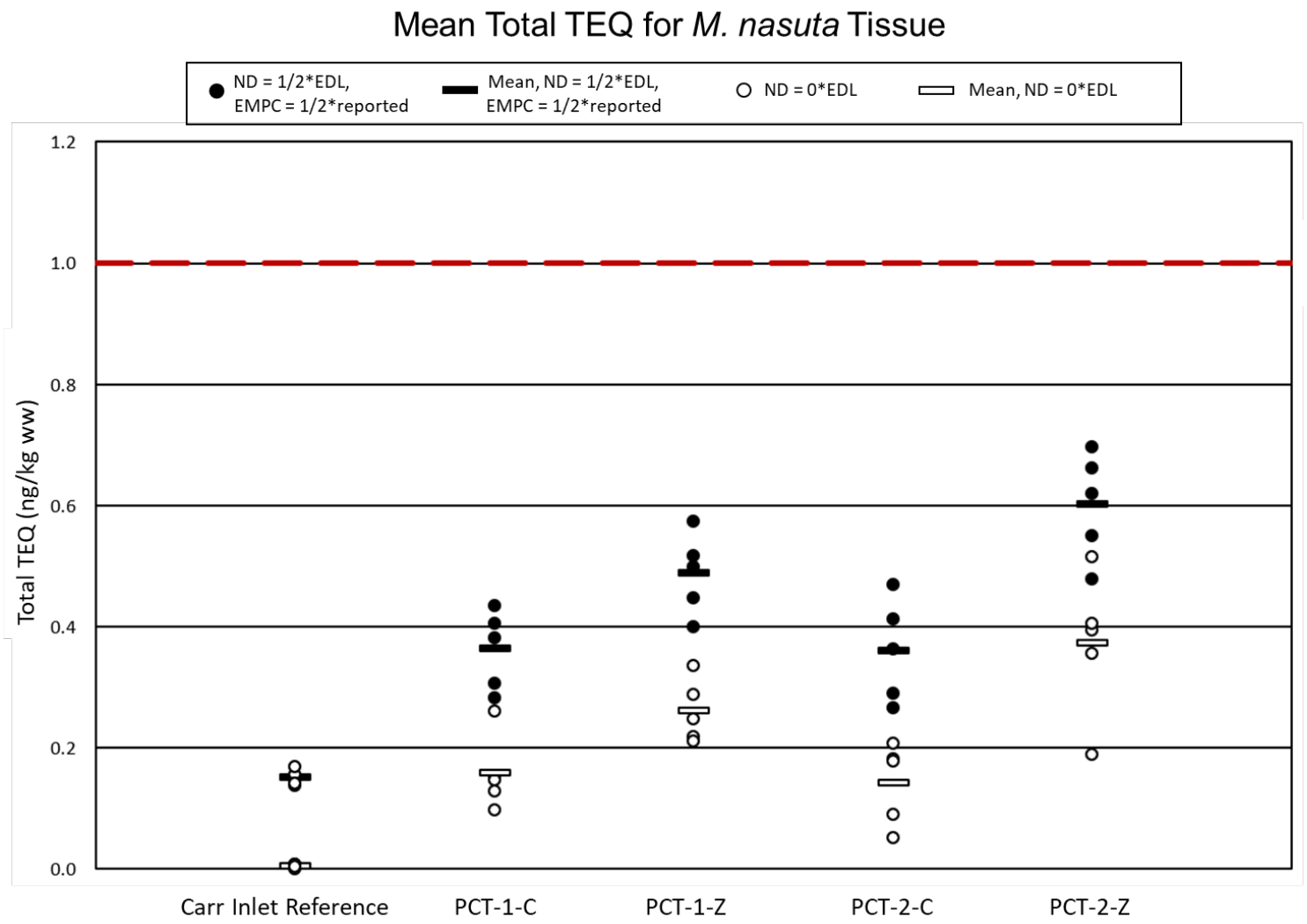
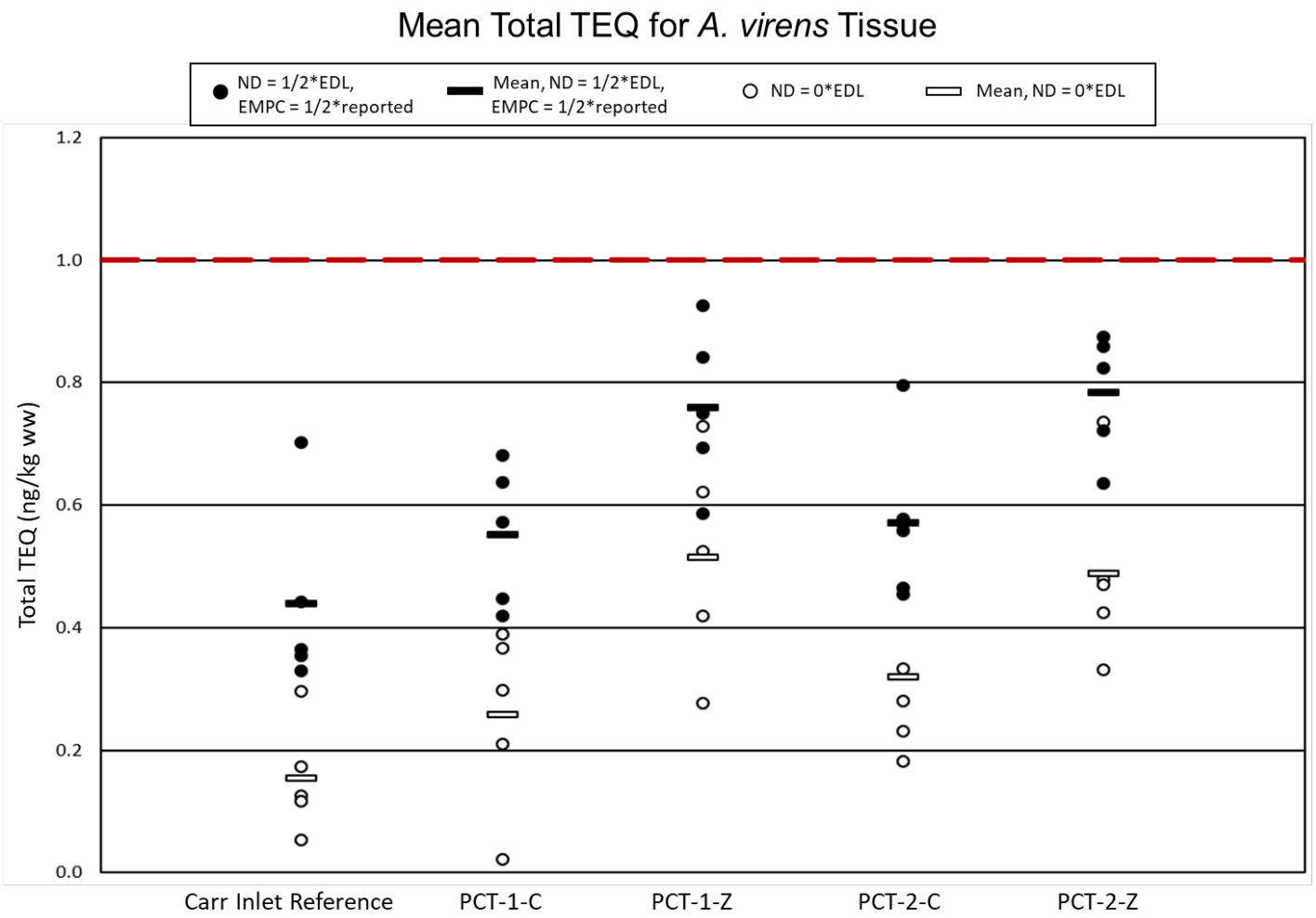


Figure 1. Pierce County Terminal Actual Sample Locations for 2022 Survey



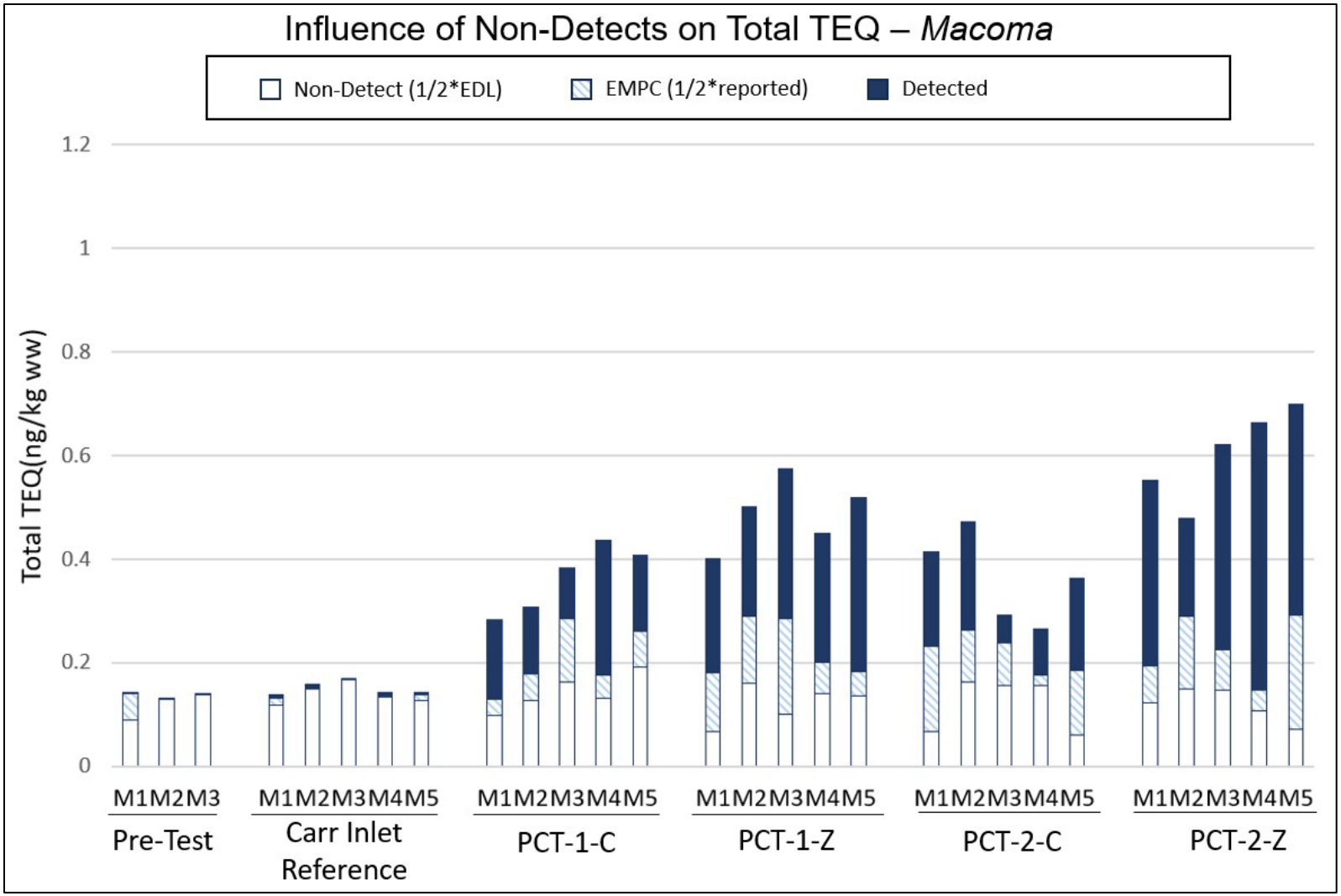
Notes:
EDL = estimated detection limit
PQL = practical quantitation limit
EMPC = estimated maximum possible concentration
TEQ = toxic equivalent
ND = not detected

Figure 2. **Mean Total TEQ for *M. nasuta* Tissue Samples**



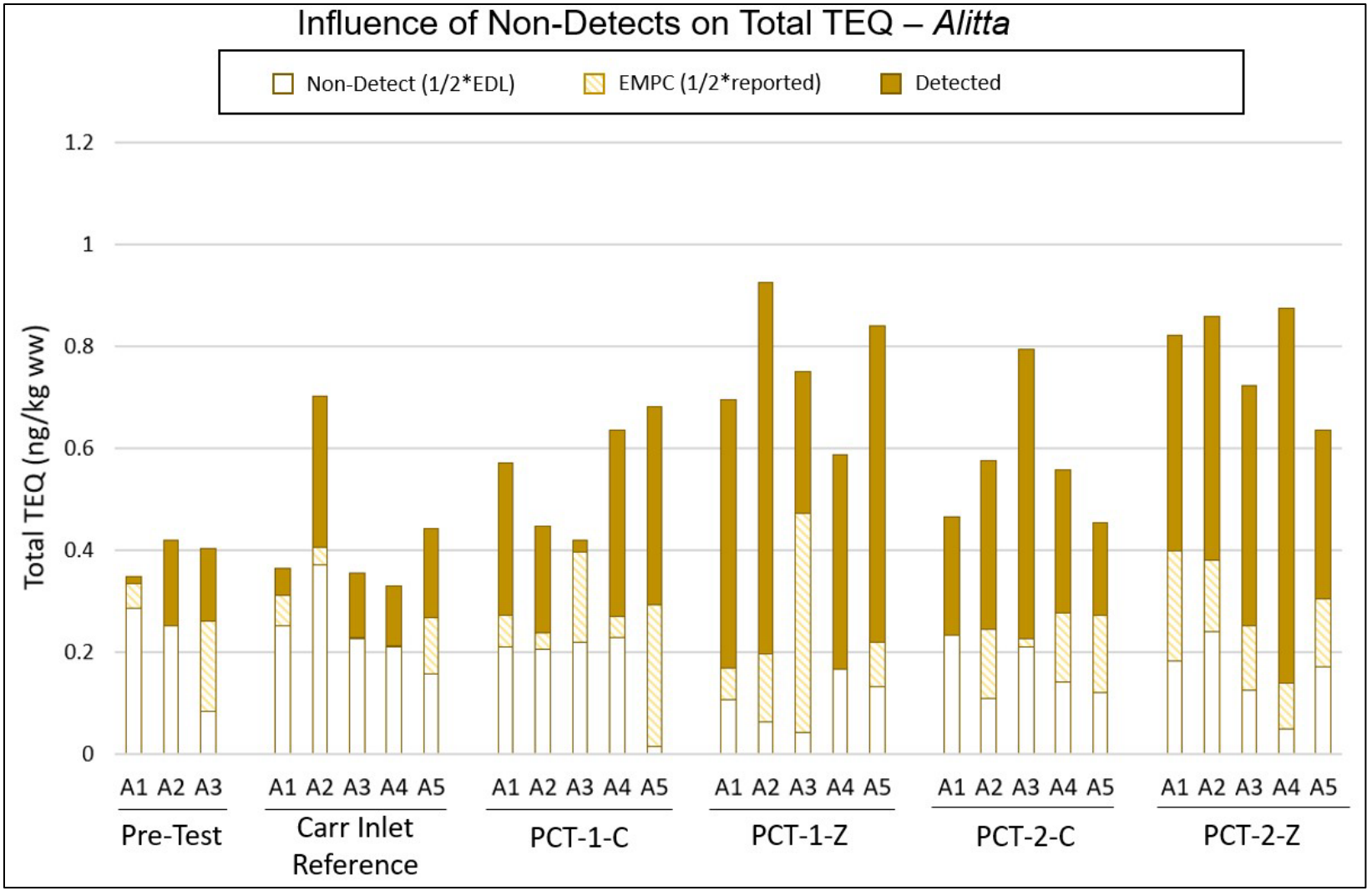
Notes:
EDL = estimated detection limit
PQL = practical quantitation limit
EMPC = estimated maximum possible concentration
TEQ = toxic equivalent
ND = not detected

Figure 3 **Mean Total TEQ for *A. virens* Tissue Samples**



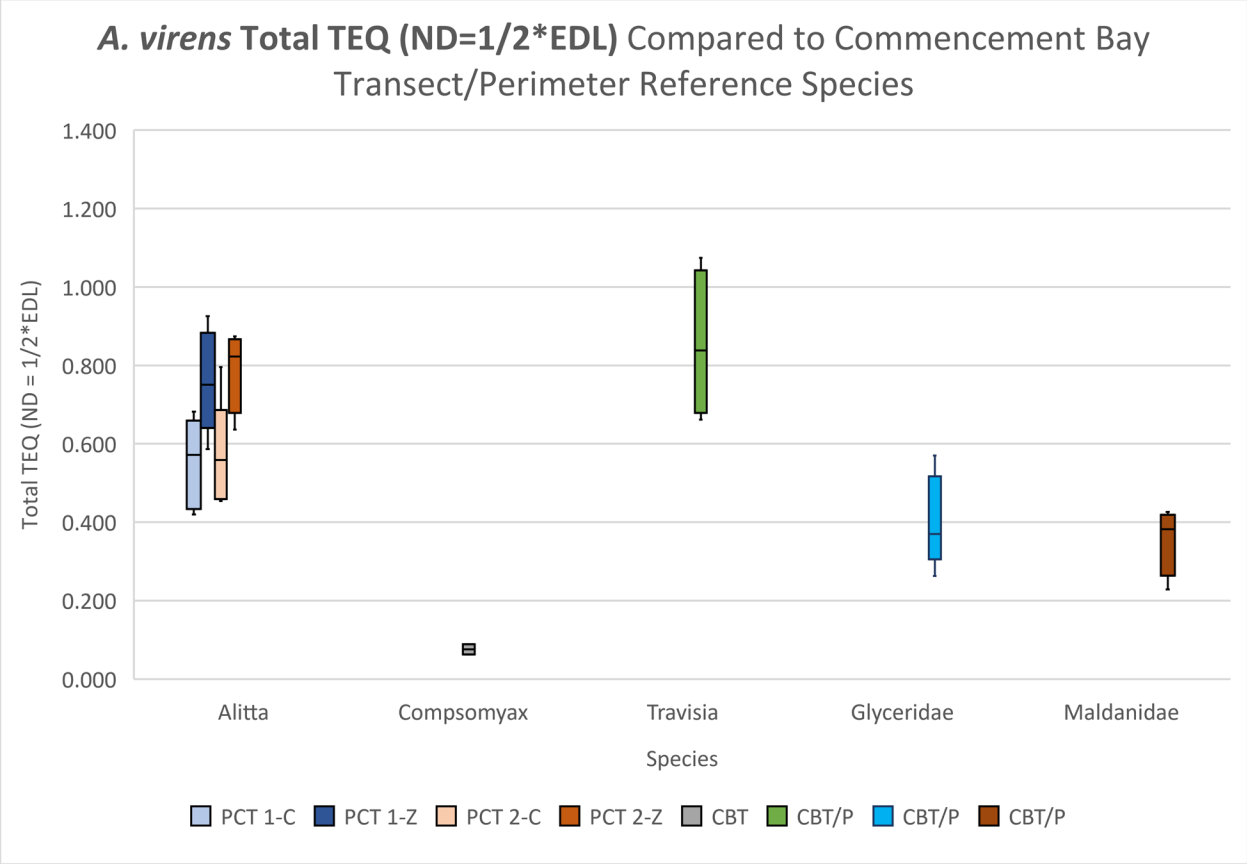
Notes:
EDL = estimated detection limit
EMPC = estimated maximum possible concentration
TEQ = toxic equivalent

Figure 4 **Influence of Non-Detects on Total TEQ for *M. nasuta***



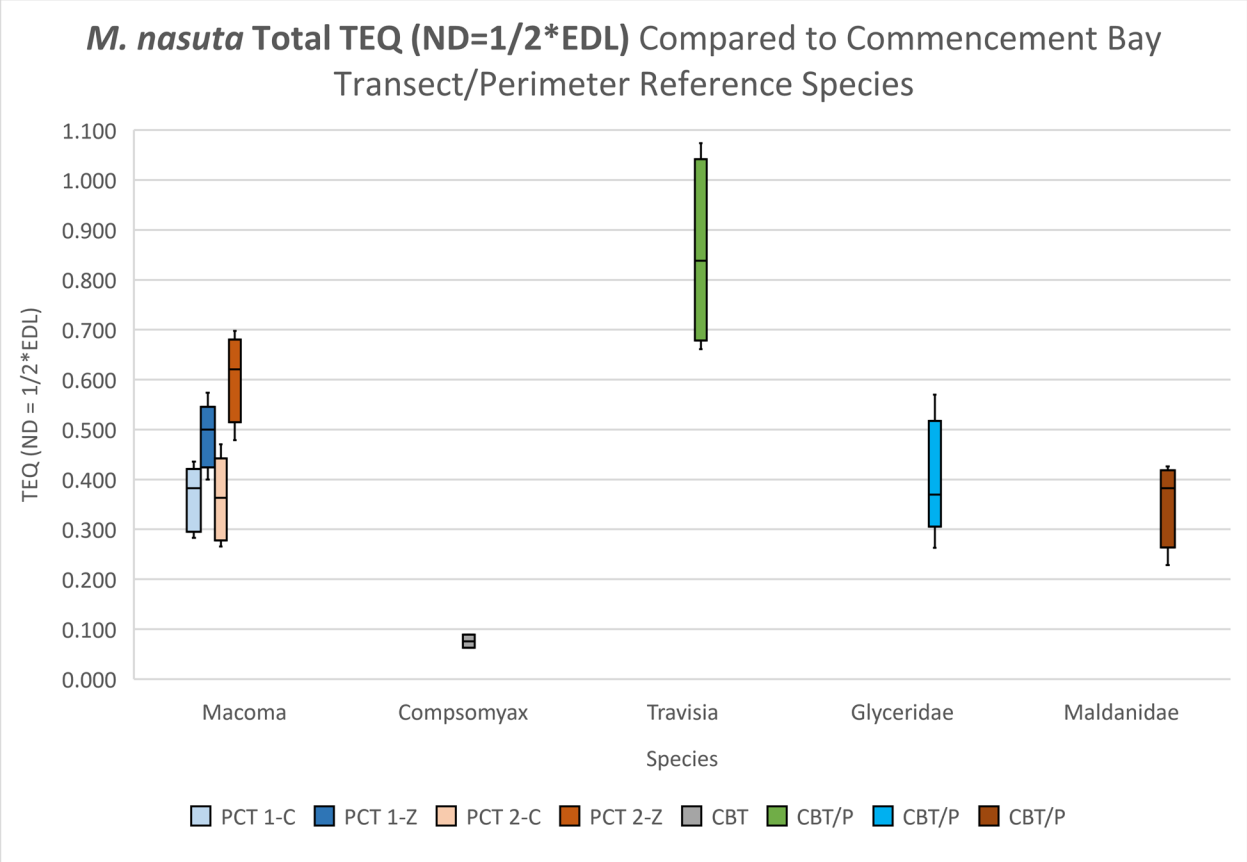
Notes:
EDL = estimated detection limit
EMPC = estimated maximum possible concentration
TEQ = toxic equivalent

Figure 5 **Influence of Non-Detects on Total TEQ for *A. virens***



Notes:
EDL = estimated detection limit ND = not detected TEQ = toxic equivalent

Figure 6 ***A. virens*** **Dioxin/Furan Total TEQ (ND=1/2*EDL) Compared to Commencement Bay DMMP Site Tissues**



Notes:
EDL = estimated detection limit ND = not detected TEQ = toxic equivalent

Figure 7 ***M. nasuta*** **Dioxin/Furan Total TEQ (ND=1/2*EDL) Compared to Commencement Bay DMMP Site Tissues**

Table 1 **DMMUs, Sample Locations, Actual Sampling Coordinates, Mudline, and Sample Elevations**

Surface DMMU	Estimated Volume (cy)	Z-Layer Composite	Sample Location	Core Replicate Processed	Date (mm/dd/yyyy)	Time (hh:mm)	State Plane WA-S, NAD83 (ft)		Latitude (N) NAD83	Longitude (W) NAD83	Core Penetration (ft.)	Core Recovery (ft.)	Recovery (percent)	Measured Water Depth (ft.)	Tidal Height (ft.)	Mudline (ft. MLLW)	Surface DMMU (ft. MLLW)		Z-sample (ft. MLLW)		Z2-sample (ft. MLLW)	
							Northing	Easting									Top	Bottom	Top	Bottom	Top	Bottom
PCT-1-C	15,969	PCT-1-Z	P1	D	6/21/2022	13:45	1173077.41	706092.76	47.25425125	122.38205669	5.5	6.2	113	-56.8	+6.5	-50.3	-50.3	-52.0	-52.0	-54.0	-54.0	-56.2
				G	6/21/2022	15:37	1173074.97	706089.62	47.25424249	122.38206621	5.5	6.8	124	-54.2	+3.9	-50.3	-50.3	-52.0	-52.0	-54.0	-54.0	-56.4
				H	6/23/2022	8:10	1173077.81	706089.87	47.25424336	122.38205480	5.7	5.6	98	-51.5	+1.3	-49.8	-49.8	-52.0	-52.0	-54.0	-54.0	-55.4
			P2	C	6/22/2022	11:07	1173281.28	706167.74	47.25447008	122.38124319	6.0	4.5	75	-56.5	+6.5	-50.0	-50.0	-52.0	-52.0	-54.0		
				D	6/22/2022	11:40	1173273.96	706169.14	47.25447344	122.38127278	6.0	4.7	78	-57.4	+7.1	-50.3	-50.3	-52.0	-52.0	-54.0	-54.0	-54.5
				G	6/22/2022	13:17	1173279.57	706169.25	47.25447411	122.38125022	5.0	4.0	80	-58.3	+8.0	-50.3	-50.3	-52.0	-52.0	-54.0	-54.0	-54.3
			P3	D	6/24/2022	10:30	1173898.82	706165.16	47.25450336	122.37875694	5.0	4.0	80	-51.9	+1.2	-50.7	-50.7	-52.0	-52.0	-54.0	-54.0	-54.7
				E	6/24/2022	10:50	1173885.15	706165.46	47.25450331	122.37881197	5.0	4.6	92	-52.3	+1.4	-50.8	-50.8	-52.0	-52.0	-54.0	-54.0	-55.1
				F	6/24/2022	11:00	1173897.69	706168.56	47.25451261	122.37876181	5.0	5.0	100	-52.7	+2.0	-50.7	-50.7	-52.0	-52.0	-54.0	-54.0	-55.4
PCT-2-C	11,384	PCT-2-Z	P4	A	6/23/2022	09:10	1174417.04	706060.76	47.25425106	122.37666072	8.0	6.0	75	-49.0	+1.6	-47.4	-47.4	-52.0	-52.0	-53.4		
				B	6/23/2022	09:40	1174426.44	706061.06	47.25425247	122.37662294	8.0	7.9	98	-49.4	+2.1	-47.3	-47.3	-52.0	-52.0	-54.0	-54.0	-54.7
				E	6/23/2022	10:54	1174420.89	706051.62	47.25422625	122.37664436	6.0	5.3	88	-55.6	+5.6	-50.0	-50.0	-52.0	-52.0	-54.0	-54.0	-54.8
			P5	A	6/23/2022	14:00	1174855.77	706108.06	47.25440928	122.37489911	6.0	5.6	93	-57.9	+8.4	-49.5	-49.5	-52.0	-52.0	-54.0	-54.0	-54.8
				B	6/23/2022	14:30	1174869.69	706109.39	47.25441383	122.37484319	6.0	7.0	117	-58.0	+8.7	-49.3	-49.3	-52.0	-52.0	-54.0	-54.0	-56.0
				C	6/23/2022	14:55	1174869.28	706104.32	47.25439992	122.37484433	6.0	5.0	83	-58.0	+8.7	-49.3	-49.3	-52.0	-52.0	-54.0		
			P6	A	6/23/2022	15:35	1175119.64	705993.06	47.25411128	122.37382583	9.0	9.5	106	-55.2	+8.6	-46.6	-46.6	-52.0	-52.0	-54.0	-54.0	-56.0
				B	6/23/2022	15:55	1175117.68	705994.07	47.25411392	122.37383383	9.0	9.0	100	-55.1	+8.9	-46.7	-46.7	-52.0	-52.0	-54.0	-54.0	-55.4
				D	6/24/2022	09:35	1175116.62	706002.19	47.25413611	122.37383886	9.0	8.3	92	-48.3	+0.2	-48.1	-48.1	-52.0	-52.0	-54.0	-54.0	-56.0

Notes:
Z-layer composites were comprised of the Z-samples collected for each of the DMMUs. For example, PCT-1-Z is the Z-layer composite sample comprised of Z-samples collected from the cores collected at P1, P2, and P3.
Z2 sample archives not available for collection in cores P2 Rep C, P4 Rep A, and P5 Rep C
NAD83 = North American Datum of 1983

Table 2 **PCT DMMU, Z-Layer Composite, and Carr Inlet Sediment Chemistry Results**

Compound	Units	DMMP SL	DMMP BT	DMMP ML	BW22-PCT-1-C	VQ	BW22-PCT-1-Z	VQ	BW22-PCT-2-C	VQ	BW22-PCT-2-Z	VQ	BW22-CAR-C	VQ
Conventionals														
Total Solids	%	-	-	-	67.02		75.08		68.1		71.17		70.86	
Total Solids, Sulfide	%	-	-	-	68.24		73.23		67.56		71.11		71.92	
Total Volatile Solids	%	-	-	-	2.75		1.84		3.1		2.34		1.47	
Total Organic Carbon	% dry	-	-	-	0.5		0.34		0.63		0.53		0.28	
Total Sulfides	mg/kg dry	-	-	-	527	J	501		1300		964		130	J
Ammonia	mg/kg dry	-	-	-	13.7		13.1		22.1		28.2		8.73	
Total Gravel	%	-	-	-	1.30		2.20		5.10		1.80		0.2	
Total Sand	%	-	-	-	55.10		69.50		60.80		52.30		75.2	
Total Silt	%	-	-	-	32.90		22.90		28.50		39.20		17.3	
Total Clay	%	-	-	-	10.80		5.40		5.70		6.80		7.2	
Total Fines (Silt + Clay)	%	-	-	-	43.70		28.30		34.20		46.00		24.50	
Pesticides														
Total Chlordane	µg/kg	2.8	37	-	-		-		0.26	J	-		-	
Dioxin/Furan Congeners														
2,3,7,8-TCDD	ng/kg dw	-	-	-	0.241	U	0.243	U	0.205	U	0.234	U	0.207	U
1,2,3,7,8-PeCDD	ng/kg dw	-	-	-	1.12		1.08		0.934	UJ	0.965	J	0.32	U
1,2,3,4,7,8-HxCDD	ng/kg dw	-	-	-	0.386	U	1.44		1.64		0.954	J	0.339	U
1,2,3,6,7,8-HxCDD	ng/kg dw	-	-	-	4.89		6.11		6.97		5.53		0.32	U
1,2,3,7,8,9-HxCDD	ng/kg dw	-	-	-	2.65		2.82		3.31		0.45	U	0.355	U
1,2,3,4,6,7,8-HpCDD	ng/kg dw	-	-	-	125		113		126		81.6		5.16	
OCDD	ng/kg dw	-	-	-	1200		1050		1120		667		37.5	
2,3,7,8-TCDF	ng/kg dw	-	-	-	5.76	J	5.18		8.3		15.6		0.209	U
1,2,3,7,8-PeCDF	ng/kg dw	-	-	-	10.3	J	12		20.7		29.9		0.258	U
2,3,4,7,8-PeCDF	ng/kg dw	-	-	-	3.78		4.42		7.59		10.6		0.243	U
1,2,3,4,7,8-HxCDF	ng/kg dw	-	-	-	19.4	J	17.7		31		56.2		0.25	U
1,2,3,6,7,8-HxCDF	ng/kg dw	-	-	-	5.2	J	4.9		8.94		17.3		0.243	U
1,2,3,7,8,9-HxCDF	ng/kg dw	-	-	-	2.62		3.08		4.74		7.7		0.344	U
2,3,4,6,7,8-HxCDF	ng/kg dw	-	-	-	2.12		2.29		3.91		4.97		0.249	U
1,2,3,4,6,7,8-HpCDF	ng/kg dw	-	-	-	23.7		21.4		33.5		35.2		1.23	U
1,2,3,4,7,8,9-HpCDF	ng/kg dw	-	-	-	4.45		3.3		5.67		9.86		0.336	U
OCDF	ng/kg dw	-	-	-	67.6		48		81.9		67.4		1.9	UJ

Table 2

Compound	Units	DMMP SL	DMMP BT	DMMP ML	BW22-PCT-1-C	VQ	BW22-PCT-1-Z	VQ	BW22-PCT-2-C	VQ	BW22-PCT-2-Z	VQ	BW22-CAR-C	VQ
Total TEQ (ND = 0*EDL)	ng/kg dw	4	10	-	**8.74**		**8.82**		**12.73**		**17.35**		**0.063**	
Total TEQ (ND = 1/2*EDL)	ng/kg dw	4	10	-	**8.88**		**8.95**		**12.83**		**17.49**		**0.490**	
Total TCDF	ng/kg dw	-	-	-	11.5		12.1		22.7		37.9		0.999	U
Total TCDD	ng/kg dw	-	-	-	1.4		0.147	U	1.13		1.61		0.999	U
Total PeCDF	ng/kg dw	-	-	-	33.6		32		58.1		59.9		0.408	J
Total PeCDD	ng/kg dw	-	-	-	2.38		2.11		1.92		2.54		0.999	U
Total HxCDF	ng/kg dw	-	-	-	60.9		57		90.6		123		0.342	J
Total HxCDD	ng/kg dw	-	-	-	40.7		47		46.5		31.5		1.09	
Total HpCDF	ng/kg dw	-	-	-	78.6		61.8		93.2		84.1		1.75	
Total HpCDD	ng/kg dw	-	-	-	304		272		264		190		11.9	

Exceeds SL	Exceeds BT	Exceeds ML

Validation Qualifiers (VQ):

J	The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample
U	The analyte was analyzed for but was not detected above the reported sample quantitation limit.
UJ	The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

Table 3 **PCT Bioaccumulation Testing – *M. nasuta* Tissue Chemistry Results**

M. nasuta Tissue Sample	Total Solids (%)	Lipids (%)	Dioxin/Furan Total TEQ (ND = 0*EDL) ng/kg ww	Dioxin/Furan Total TEQ (ND = ½*EDL) ng/kg ww
PreTest-M1	15.02	0.61	0.000	0.139
PreTest-M2	15.66	0.76	0.000	0.130
PreTest-M3	19.36	0.72	0.000	0.139
BW22-PCT-1-C-M1	15.72	0.53	0.153	0.283
BW22-PCT-1-C-M2	15.34	0.67	0.129	0.307
BW22-PCT-1-C-M3	16.17	0.65	0.098	0.382
BW22-PCT-1-C-M4	15.96	0.65	0.261	0.436
BW22-PCT-1-C-M5	17.33	0.65	0.147	0.406
BW22-PCT-1-Z-M1	14.80	0.54	0.219	0.399
BW22-PCT-1-Z-M2	13.81	0.61	0.211	0.500
BW22-PCT-1-Z-M3	14.74	0.54	0.289	0.574
BW22-PCT-1-Z-M4	14.55	0.61	0.249	0.449
BW22-PCT-1-Z-M5	14.75	0.70	0.335	0.517
BW22-PCT-2-C-M1	14.71	0.52	0.183	0.413
BW22-PCT-2-C-M2	14.42	0.55	0.209	0.471
BW22-PCT-2-C-M3	14.20	0.51	0.052	0.291
BW22-PCT-2-C-M4	16.41	0.63	0.091	0.266
BW22-PCT-2-C-M5	14.70	0.62	0.179	0.363
BW22-PCT-2-Z-M1	14.85	0.69	0.357	0.550
BW22-PCT-2-Z-M2	14.06	0.62	0.190	0.479
BW22-PCT-2-Z-M3	15.20	0.58	0.395	0.620
BW22-PCT-2-Z-M4	14.20	0.68	0.515	0.663
BW22-PCT-2-Z-M5	15.37	0.61	0.406	0.698
BW22-CAR-M1	15.24	0.52	0.006	0.138
BW22-CAR-M2	14.53	0.57	0.009	0.157
BW22-CAR-M3	16.28	0.63	0.000	0.169
BW22-CAR-M4	16.01	0.69	0.007	0.142
BW22-CAR-M5	15.78	0.66	0.005	0.142

Table 4. PCT Bioaccumulation Testing – *A. virens* Tissue Chemistry Results

A. virens Tissue Sample	Total Solids (%)	Lipids (%)	Dioxin/Furan Total TEQ (ND = 0*EDL) ng/kg ww	Dioxin/Furan Total TEQ (ND = ½*EDL) ng/kg ww
PreTest-A1	13.38	0.88	0.016	0.349
PreTest-A2	12.87	0.92	0.169	0.420
PreTest-A3	12.61	0.78	0.141	0.403
BW22-PCT-1-C-A1	12.65	1.20	0.299	0.572
BW22-PCT-1-C-A2	11.99	0.91	0.209	0.448
BW22-PCT-1-C-A3	12.34	0.82	0.022	0.420
BW22-PCT-1-C-A4	12.59	0.81	0.366	0.637
BW22-PCT-1-C-A5	12.18	0.72	0.389	0.682
BW22-PCT-1-Z-A1	12.16	1.10	0.526	0.694
BW22-PCT-1-Z-A2	13.02	1.40	0.728	0.925
BW22-PCT-1-Z-A3	12.68	1.20	0.277	0.751
BW22-PCT-1-Z-A4	11.79	0.90	0.420	0.587
BW22-PCT-1-Z-A5	11.96	0.82	0.621	0.840
BW22-PCT-2-C-A1	12.32	0.81	0.231	0.465
BW22-PCT-2-C-A2	11.96	0.66	0.333	0.577
BW22-PCT-2-C-A3	12.99	1.20	0.568	0.795
BW22-PCT-2-C-A4	12.83	0.80	0.281	0.558
BW22-PCT-2-C-A5	11.43	1.00	0.183	0.454
BW22-PCT-2-Z-A1	11.68	0.80	0.425	0.823
BW22-PCT-2-Z-A2	12.97	0.77	0.480	0.859
BW22-PCT-2-Z-A3	11.90	0.94	0.469	0.722
BW22-PCT-2-Z-A4	12.74	1.00	0.735	0.874
BW22-PCT-2-Z-A5	12.48	0.86	0.331	0.636
BW22-CAR-A1	13.30	1.10	0.053	0.365
BW22-CAR-A2	12.79	1.70	0.297	0.701
BW22-CAR-A3	12.38	0.92	0.125	0.354
BW22-CAR-A4	12.35	0.70	0.118	0.329
BW22-CAR-A5	12.60	0.83	0.174	0.443

Table 5. Mean Dioxin/Furan TEQ Values in Tissues

Sample	Mean Dioxin/Furan TEQ ng/kg ww (ND=1/2*EDL)			
	M. nasuta		*A. virens*	
	Mean	Standard Deviation	Mean	Standard Deviation
Carr Inlet	0.150	0.013	0.438	0.153
PCT-1-C	0.363	0.065	0.552	0.115
PCT-1-Z	0.488	0.067	0.759	0.131
PCT-2-C	0.361	0.085	0.570	0.137
PCT-2-Z	0.602	0.088	0.783	0.101
Sample	**Mean Dioxin/Furan TEQ ng/kg ww (ND=0*EDL)**			
	M. nasuta		*A. virens*	
	Mean	Standard Deviation	Mean	Standard Deviation
Carr Inlet	0.005	0.003	0.153	0.091
PCT-1-C	0.158	0.062	0.257	0.149
PCT-1-Z	0.261	0.052	0.514	0.175
PCT-2-C	0.143	0.067	0.319	0.150
PCT-2-Z	0.373	0.118	0.488	0.150

Table 6 Results of the T-Tests and Bonferroni Tests Comparing Mean Dioxin/Furan TEQs in Organisms Exposed to PCT Sediments with Organisms Exposed to the Carr Inlet Reference

Organism	Dioxin/Furan TEQ	P Value (one-sided)			
		PCT-1-C	PCT-1-Z	PCT-2-C	PCT-2-Z
M. nasuta	ND=1/2*EDL	0.0007	0.0001	0.0023	0.0001
	ND=0*EDL	0.0026	0.0002	0.0051	0.0011
A. virens	ND=1/2*EDL	0.1126	0.0037	0.0954	0.0015
	ND=0*EDL	0.1098	0.0017	0.0339	0.0014
Organism	**Dioxin/Furan TEQ**	**Bonferroni-Adjusted P Value (one-sided)**			
		PCT-1-C	PCT-1-Z	PCT-2-C	PCT-2-Z
M. nasuta	ND=1/2*EDL	0.0120	0.0019	0.0374	0.0022
	ND=0*EDL	0.0411	0.0030	0.0818	0.0177
A. virens	ND=1/2*EDL	1	0.0585	1	0.0241
	ND=0*EDL	1	0.0277	0.5416	0.0220

Notes:
P values < 0.10 indicate a value significantly greater than the Carr Inlet reference.
ND = not detected
EDL = estimated detection limit
TEQ = toxic equivalent