Memorandum for Record **July 14, 2025**

Subject: Suitability Determination Memorandum and Antidegradation Assessment for the City of Oak Harbor, Oak Harbor Marina, Whidbey Island (NWS-2025-375).

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

The City of Oak Harbor owns and operates the Oak Harbor Marina (Figure 1), which was constructed in 1974 and expanded with a floating breakwater in 1988. The marina accommodates up to 420 boats with a mix of permanent slips, guest moorage, side-tie docks, and 96 dry-storage sheds. The facility includes a fuel dock with pump out services, electrical hookups, and a boat launch. The City plans to dredge sections of the marina to restore navigable depths that have been compromised by sediment accumulation. Prior characterizations occurred in 1997 and 2007 and the areas evaluated were determined to be suitable for disposal.

Project Summary

Waterbody	Northern Puget Sound
Water classification	Marine
Project rank	Moderate
Total proposed dredging volume (cy)	180,760 cy
Target proposed dredging depth	Three target depths: -9, -12, and -14 ft MLLW
Max. proposed dredging depth (includes 1 feet overdepth)	-10, -13, and -15 ft MLLW
Proposed disposal location(s)	Non-dispersive open-water disposal
Dredged Material Management Units (DMMUs)	11 DMMUs
EIM Study ID	OAKHM25
USACE Regulatory Reference Number	NWS-2025-375
Sampling and Analysis Plan (SAP) Approval Date	August 16, 2024 (Moffat & Nichol, 2024)
Sampling Date(s)	August 19 - 22, 2024
Sediment Characterization Report Approval Date	July 9, 2025 (Moffat & Nichol, 2025)
Testing Parameters	DMMP Marine COCs plus dioxins/furans
Suitability Outcome	DMMUs 1-7 and 10-11 suitable DMMU 8 and 9 suitable only with VWA for dioxins.
Recency Expiration Date: Moderate=5 years	August 2029
Antidegradation Assessment	In compliance

Sampling and Analysis Description

Sediment sampling activities were conducted in the project areas from August 19 – 22, 2024, using Gravity Marine Services' vessel and vibracore equipment. Figures 2 and 3 show the sediment sampling locations and Table 1 lists the sampling station details, including adjusted mudline elevations for each station. Four of the 33 coring stations were relocated greater than 10 ft from the targeted locations. These adjustments were coordinated and approved by the DMMP at the time of core collection.

Material representative of the dredge prism was collected and composited according to the sampling and analysis plan to create nine surface (DMMU 1 – 9) and two subsurface (DMMU 10 – 11) DMMUs.

Initially the two nearshore DMMUs (DMMU 8 and 9) were analyzed for dioxins/furans (D/F). Due to D/F concentration in these two DMMUs above the disposal site management objective of 4 pptr TEQ, additional DMMU composites were analyzed for D/F. Two Z-layer composite samples were also created and analyzed due to dioxin/furan (D/F) concentrations in the overlying DMMU composites.

Samples were transported to a shore-side location for initial processing. Sediment samples were submitted to Analytical Resources, LLC in Tukwila, WA for analysis. Additional D/F analyses were conducted by Bureau Veritas, Mississauga, Canada.

Data Validation

A data quality assurance/quality control review comparable to an EPA Stage 2b data validation was performed by Moffatt & Nichol. Only minor issues were documented. No analytical results were rejected, and all data were considered usable, as qualified, by the data validator.

Analytical Testing Results

Tables 2, 3, and 4 summarize the analytical results for the samples alongside the DMMP marine guidelines (DMMP, 2021). All chemical concentrations were below Screening Levels except for D/F discussed below.

Dioxins/furans. All D/F results discussed herein are reported as toxicity equivalence (TEQ) calculations utilizing non-detected values at ½ the estimated detection limit. Initial analyses were conducted on the nearshore surface DMMUs 8 and 9 and resulted in elevated levels of D/F above the site management objective of 4 pptr TEQ. This data included a high incidence of non-detects and EMPCs in addition to the lab indicating there were quality control issues with their instrument during this time period. This prompted an investigation into the quality of derived values that resulted in samples being reanalyzed at a different laboratory. The supplemental data was of a higher quality, but the resultant TEQ values were similar to the initial run (Table 3) and still exceeding the site management objective. In order to evaluate the extent of D/F across the entire site and at depth, DMMU composites were created and subsequently analyzed. These included four DMMU composites: Composite 1 (DMMU1, 2, 3,4), Composite 2 (DMMU 5,6,7), Composite 3 (DMMU 10, 11), and Composite 4 (DMMU 8Z, 9Z). The table below summarizes the results of the D/F analyses conducted on the Oak Harbor Marina samples.

Dioxins/Furans TEQ Summary

Analytical Sample	Sample Components	Marina Area	Sample Strata	D/F TEQ pptr	
				ARL	BV
DMMU 8	DMMU 8	Nearshore/Inner Harbor	Surface	6.06	5.63
DMMU 9	DMMU 9	Nearshore/Inner Harbor	Surface	5.29	7.33
Comp 1	DMMU 1, 2, 3, 4	Outer Harbor	Surface	1.79	NA
Comp 2	DMMU 5, 6, 7	Middle Harbor	Surface	5.32	NA
Comp 3	DMMU 10, 11	Outer and Middle Harbor	Subsurface	0.97	NA
Comp 4	DMMU 8Z, 9Z	Nearshore/Inner Harbor	Z-layer/Leave Surface	1.66	NA

ARL = Analytical Resources, LLC.

BV = Bureau Veritas

NA = Not analyzed

Exceeds 4 pptr TEQ

Volume-weighted averaging (VWA) for D/F exceedances is allowed for DMMUs with dioxin concentrations between 4 and 10 pptr TEQ, if the final VWA concentration is less than 4 pptr TEQ. If the full volume of dredge material from the Oak Harbor Marina was disposed in same dredging and disposal window, the VWA would be 3.07 pptr TEQ. The applicant has indicated that complete dredging may not be able to be accomplished in single dredge season due to financial and logistical limitations. In order to comply with the VWA approach with partial dredging events, two scenarios have been presented and are summarized in Tables 5 and 6 and in both cases the VWA D/F concentration would be less than the site management objective of 4 pptr TEQ.

Butyltins. Butyltins (mono, di, tri, and tetra-) analysis was not required by the DMMP for this project based on site history.

Biological Testing

Biological Testing was not required based on the results of the analytical screening.

DMMP Determinations

Suitability Determination

Chemical concentrations from the Oak Harbor Marina composite samples were below the DMMP marine SLs and BTs, except for dioxins/furans. The D/F volume-weighted average concentration meets the non-dispersive disposal site guidance (less than 4 ng/kg TEQ) under the proposed disposal scenarios summarized in Table 5 and 6. The DMMP agencies have concluded that the characterized material is suitable for open-water disposal at a non-dispersive disposal site, under the proposed disposal scenarios. The DMMP must be contacted prior to dredging if alternative volume-weighted average approaches are considered and will include the issuing of an SDM addendum.

Any dredging must meet the following requirements:

- The volume-weighted average dioxin concentration for dredged material taken to the Port Gardner site must be at or below 4 ng/kg TEQ.
- Where possible, dredged material taken to the disposal site must be sequenced, with material with the highest dioxin concentrations disposed first and dredged material with the lowest dioxin concentrations last.

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). With the exception discussed below, concentrations of DMMP chemicals of concern were below the DMMP screening levels and there is no reason to believe that a new exposed surface would be contaminated relative to the overlying materials.

Because DMMUs 8 and 9 had D/F concentrations above 4.0 ng/kg TEQ, Z-layer interval archives from these DMMUs were composited into a single sample (Comp 4) and analyzed for D/Fs. The result (1.66 ng/kg TEQ) was less than the overlying intervals and below the DMMP guideline of 4 ng/kg TEQ. The surface DMMU composite representing the middle reach of the marina (Comp 2) had a D/F of 5.32 ng/kg TEQ, also above the site management objective; however, the area included a subsurface layer that was found to have a D/F of 0.97 ng/kg TEQ. Based on this information, the exposed leave surface after dredging to the target depths would be considered compliant with the State of Washington Antidegradation Standard.

Suitability for Beneficial Use

The DMMP agencies do not determine the suitability of material for beneficial use projects. It is up to the project proponents, the site receiving the material, and other interested stakeholders including applicable resource agencies and Tribes to determine the physical and chemical suitability of dredged materials for a beneficial use site.

Aquatic Invasive Species (AIS)

Per RCW 77.135.020, the Washington Department of Fish and Wildlife (WDFW) is the lead agency for managing invasive species statewide. The DMMP defers to WDFW's expertise for decisions regarding AIS management and transport.

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 an alternative debris management plan, 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.

References

Moffatt & Nichol, 2025. City of Oak Harbor. Marina Recency Sediment Characterization. Final Sediment Characterization Report. July 2025. Produced for the City of Oak Harbor. Prepared by Moffatt & Nichol.

Moffatt & Nichol, 2024. Sampling and Analysis Plan. City of Oak Harbor Marina. Draft. August 2024. Produced for the City of Oak Harbor. Prepared by Moffatt & Nichol.

DMMP, 2008. *Quality of Post-Dredge Sediment Surfaces (Updated).* A Clarification Paper Prepared by David Fox (USACE), Erika Hoffman (EPA) and Tom Gries (Ecology) for the Dredged Material Management Program, June 2008.

DMMP, 2021b. *Dredged Material Evaluation and Disposal Procedures (User Manual)*. Dredged Material Management Program, updated July 2021.

Ecology. 2021. Sediment Cleanup User's Manual (SCUM): Guidance for Implementing the Cleanup Provisions of the Sediment Management Standards, Chapter 173-204-WAC. December 2021.

Ecology, 2013. *Sediment Management Standards – Chapter 173-204 WAC*. Washington State Department of Ecology, February 2013.

Agency Signatures

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

_____	_____
Date	Brian Hester – 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

Copies Furnished:
DMMP agencies
Jaime Liljegren, Regulatory Project Manager
Allison Kinney, Moffatt & Nichol
DMMO File

Figure 1.

DRAWING INDEX

1. VICINITY MAP
2. PROPOSED DREDGING
3. SURFACE SAMPLE PLAN
4. SUBSURFACE SAMPLE PLAN

VICINTY MAP

N 0 20,000 40,000

Scale: 1" = 40,000'

USACE REFERENCE #: TBD

APPLICATION BY: CITY OF OAK HARBOR

GENERAL LOCATION: OAK HARBOR

DATUM: 0.0' = FT MLLW

OAK HARBOR MARINA SEDIMENT CHARACTERIZATION REPORT

VICINITY MAP

PROPOSED: MAINTENANCE DREDGING

IN: OAK HARBOR

AT: OAK HARBOR MARINA

COUNTY: ISLAND COUNTY STATE: WASHINGTON

SHEET 1 OF 4 DATE: 10-02-2024

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Figure 2.

USACE REFERENCE #: TBD

APPLICATION BY: CITY OF OAK HARBOR

GENERAL LOCATION: OAK HARBOR

DATUM: 0.0' = FT MLLW

OAK HARBOR MARINA SEDIMENT CHARACTERIZATION REPORT

SURFACE CORE LOCATIONS

PROPOSED: MAINTENANCE DREDGING

IN: OAK HARBOR

AT: OAK HARBOR MARINA

COUNTY: ISLAND COUNTY STATE: WASHINGTON

SHEET 3 OF 4 DATE: 10-02-2024

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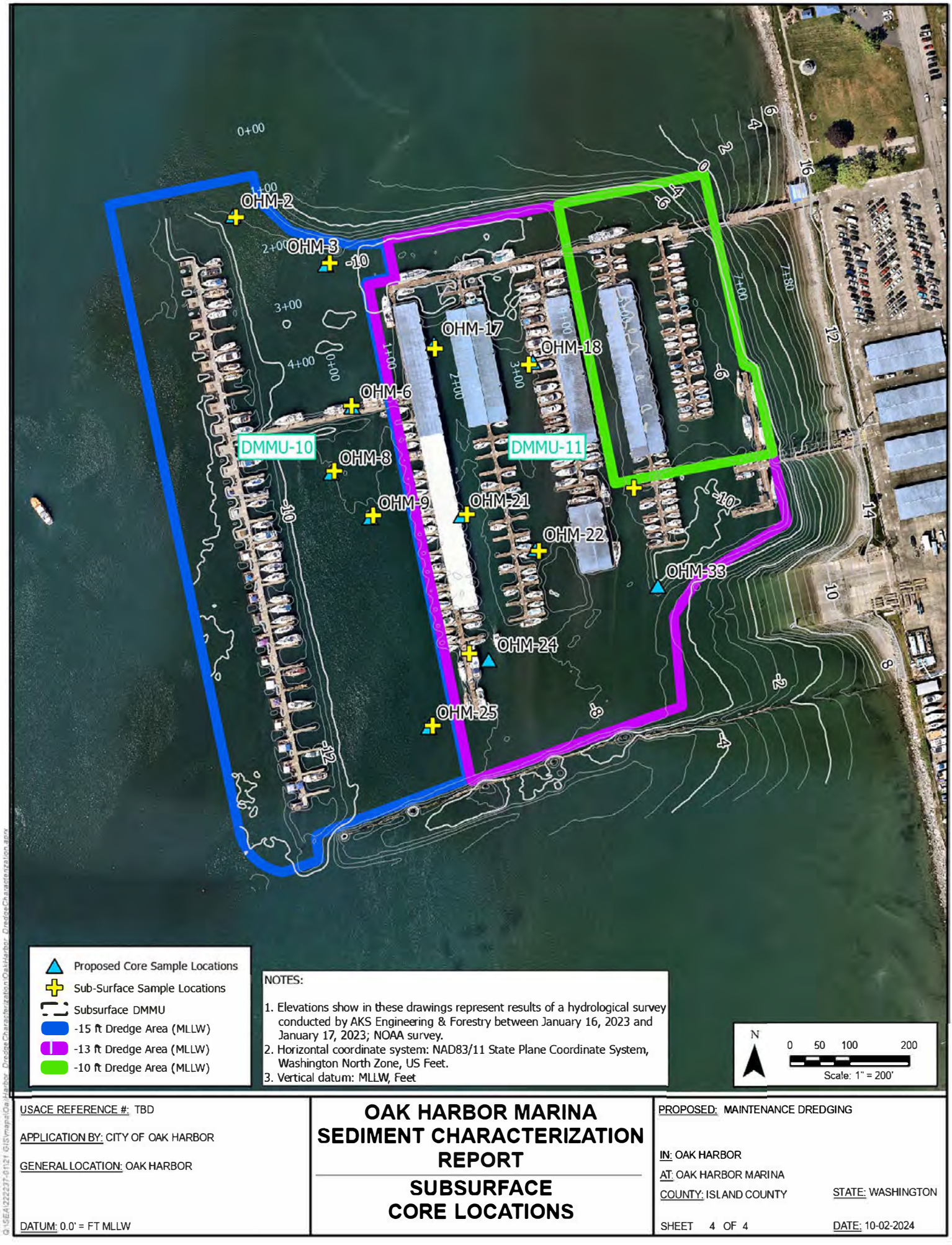
Figure 3.



USACE REFERENCE #: TBD

APPLICATION BY: CITY OF OAK HARBOR

GENERAL LOCATION: OAK HARBOR

DATUM: 0.0' = FT MLLW

OAK HARBOR MARINA SEDIMENT CHARACTERIZATION REPORT

SUBSURFACE CORE LOCATIONS

PROPOSED: MAINTENANCE DREDGING

IN: OAK HARBOR

AT: OAK HARBOR MARINA

COUNTY: ISLAND COUNTY STATE: WASHINGTON

SHEET 4 OF 4 DATE: 10-02-2024

TABLE 1. SUMMARY OF SAMPLE COORDINATES, ADJUSTED MUDLINE ELEVATIONS AND COMPOSITING SCHEME

CITY OF OAK HARBOR MARINA

DREDGED MATERIAL SEDIMENT CHARACTERIZATION REPORT

OAK HARBOR, WASHINGTON

DMMU ID (dredge volume and design dredge elevation[1])	Sample ID	Northing[2]	Easting[2]	Date Sampled	Water Depth (feet)	Adjusted Mudline Elevation (ft MLLW)[3]	Core Percent Recovery	Core Section Length (feet)	Core Bottom Elevation (ft. MLLW)	Z-layer Elevation (ft. MLLW)
Surface DMMUs										
DMMU-1 (16,449 CY: surface to -4 ft)	OHM-1	48.28639988	-122.63702903	8/19/2024	9	-9	100%	4	-13	--
	OHM-2	48.28669516	-122.63647233		6.7	-8.9	--	4	--	--
	OHM-3	48.28649376	-122.63582153		8.7	-9.7	--	4	--	--
	OHM-4	48.2862598	-122.63635894		8	-10	100%	4	-14	--
DMMU-2 (16,473 CY; surface to -4 ft)	OHM-5	48.2859352	-122.63622925	8/20/2024	11.9	-10.3	100%	4	-14.3	--
	OHM-6	48.28584499	-122.6356398		12.9	-8.8	--	4	--	--
	OHM-7	48.28562861	-122.63670806		10.2	-9.7	100%	4	-13.7	--
	OHM-8	48.28554368	-122.63576202		16.9	-9.6	--	4	--	--
DMMU-3 (16,435 CY; surface to -4 ft)	OHM-9	48.285333959	-122.63547831		7.8	-9.3	--	4	--	--
	OHM-10	48.28506951	-122.63580408		8.6	-7.5	100%	4	-11.5	--
	OHM-11	48.28492611	-122.63656264		11.1	-9.87	93%	4	-16.5	-15 to -16.5[4]
	OHM-12	48.28477533	-122.63551718		8.9	-9.4	82%	4	-13.4	--
DMMU-4 (12,450 CY; surface to -4 ft)	OHM-13	48.28440421	-122.63639181	8/19/2024	18.8	-10.7	89%	4	-16.3	-15 to -16.3[4]
	OHM-14	48.2838075	-122.63593161		22.5	-12.1	--	2.9	--	--
	OHM-15	48.283115	-122.63562		21.4	-10.2	100%	4	-17	-15 to -17[4]
DMMU-5 (16,431 CY; surface to -4 ft)	OHM-16	48.28657763	-122.63472219	8/22/2024	11.9	-10.2	--	2.8	-13	--
	OHM-17	48.171562	-122.280999		12.8	-8.1	--	4	--	--
	OHM-18	48.28605812	-122.6344386		13.6	-8	--	4	--	--
	OHM-19	48.2857449	-122.63490203		12.4	-8.5	100%	4	-12.5	--
DMMU-6 (16,196 CY; surface to -4 ft)	OHM-20	48.28558988	-122.634371284	8/21/2024	10.2	-8	100%	4	-12	--
	OHM-21	48.28535426	-122.63483947		9.5	-8.1	--	4	--	--
	OHM-22	48.28520392	-122.63432146		8	-7.6	--	4	--	--
	OHM-23	48.28520392	-122.63432146		8.1	-8.3	100%	4	-12.3	--
DMMU-7 (15,926 CY; surface to -4 ft)	OHM-24	48.2847268	-122.63479437		15.4	-7.3	--	4	--	--
	OHM-25	48.2843801	-122.63504715		16	-9.7	--	4	--	--
	OHM-26	48.28445082	-122.6309222		15.4	-8.6	100%	4	-12.6	--
	OHM-27	48.2846827	-122.63351843		17.2	-7.6	100%	4	-11.6	--
DMMU-8/DMMU-8Z (16,447 CY; -10 ft)	OHM-28	48.28678781	-122.63338759	8/22/2024	7.2	-4.8	94%	4	-8.8	--
	OHM-29	48.2865411	-122.6336911		8.2	-7.3	100%	2.7	-12	-10 to -12
	OHM-30	48.28591625	-122.63382918		7.2	-6.9	100%	3.1	-12	-10 to -12
	OHM-31	48.28583794	-122.63307241		8	-7.5	100%	2.5	-10	--
DMMU-9/DMMU-9Z (7,125 CY; -13 ft)	OHM-32	48.28532519	-122.6331085	8/23/2024	12.5	-10.2	98%	2.8	-15	-13 to -15
	OHM-33	48.28549659	-122.63368859		13.8	-6.5	87%	4	-10.5	-13 to -14
Subsurface DMMUs										
DMMU-10 (24,000 CY; -14 ft and -15 ft)	OHM-2	48.28669516	-122.63647233	8/19/2024	--	--	85%	2.1	-15.8	-15 to -15.8
	OHM-3	48.28649376	-122.63582153		--	--	100%	1.3	-17	-15 to -17
	OHM-6	48.28584499	-122.6356398	8/20/2024	--	--	91%	2.2	-16.3	-15 to -16.3
	OHM-8	48.28554368	-122.63576202		--	--	100%	1.4	-17	-15 to -17
	OHM-9	48.285333959	-122.63547831		--	--	94%	1.7	-15	-15 to -16.5
	OHM-25	48.2843801	-122.63504715	8/21/2024	--	--	100%	1.3	-17	-15 to -17
DMMU-11 (22,827 CY; -13 ft)	OHM-17	48.171562	-122.280999	8/22/2024	--	--	100%	0.9	-15	-13 to -15
	OHM-18	48.28605812	-122.6344386		--	--	100%	1	-15	-13 to -15
	OHM-21	48.28535426	-122.63483947	8/21/2024	--	--	100%	0.9	-15	-13 to -15
	OHM-22	48.28520392	-122.63432146		--	--	100%	1.4	-15	-13 to -15
	OHM-24	48.2847268	-122.63479437		--	--	100%	1.7	-15	-13 to -15
	OHM-33	48.28549659	-122.63368859	8/23/2024	--	--	87%	2.5	-14	--[5]

Notes:

[1]These are maximum design dredge depths. The design dredge depths may include up to a -1 or -2 overdredge (OD) allowance (e.g. -11 ft + 2 ft OD MLLW or -9 ft + 1 ft OD MLLW) depending on available funding.

[2] Northing and easting are based on the North American Datum of 1983 (NAD83) State Plane Coordinate System, Washington South

[3] Adjusted mudline elevation = water depth + tidal stage; Calculated at the time of sampling using the National Oceanic and Atmosphere Association (NOAA) Tides and Currents chart for Crescent Bay, Washington – (Station ID: 9443826).

[4] This core was advanced into the subsurface DMMU-10 Z-layer to obtain additional Z-layer samples at the request of the DMMO.

[5] The OHM-33 Z-layer subunit sample was composited as part of sample DMMU-9Z.

TABLE 2. SUMMARY OF GRAIN SIZE DATA

CITY OF OAK HARBOR MARINA

DREDGED MATERIAL SEDIMENT CHARACTERIZATION REPORT

OAK HARBOR, WASHINGTON

Sample ID	DMMU-1	DMMU-2	DMMU-3	DMMU-4	DMMU-5	DMMU-6	DMMU-7	DMMU-8	DMMU-8Z	DMMU-9	DMMU-9Z	DMMU-10	DMMU-11
Gravel	6.5%	2.9%	2.1%	0.6%	1.56%	0.9%	7.7%	0.5%	0.5%	8.6%	7.2%	6.6%	5.8%
Sand	14%	10.8%	7.2%	11%	9.3%	10.2%	14.4%	4.9%	8.1%	8.6%	53.7%	18.3%	25.5%
Silt	5%	63.1%	60.2%	66.3%	58%	69.8%	49.4%	67.2%	68.4%	57%	23.5%	57.2%	54.9%
Clay	26%	23.9%	30.4%	22.8%	30%	19.3%	28.4%	27.4%	23.2%	25.8%	15.5%	16.7%	13.8%

Table 3. SUMMARY OF CHEMICAL DATA COMPARED TO DMMP GUIDELINES[1]

CITY OF OAK HARBOR MARINA

DREDGED MATERIAL SEDIMENT CHARACTERIZATION REPORT

OAK HARBOR, WASHINGTON

Sample ID	DMMU-1	DMMU-2	DMMU-3	DMMU-4	DMMU-5	DMMU-6	DMMU-7	DMMU-8	DMMU-8Z	DMMU-9	DMMU-9Z	DMMU-10	DMMU-11	DMMP Marine Guidelines		
Sample date	8/19/24	8/20/24	8/20/24	8/19/24	8/22/24	8/21/24	8/21/24	8/23/24	8/23/24	8/22/24	8/22/24	8/21/24	8/23/24	SL	BT	ML
CONVENTIONALS																
Ammonia as N (mg/kg dry weight)	**56.6**	**51.6**	**47.9**	**64.9**	**82.3**	**67**	**47.3**	**187**	**108**	**153**	**52.5**	**43.1**	**50.4**	--	--	--
Sulfide (mg/kg dry weight)	**323**	**253**	**192**	**274**	**675**	**409**	**373**	**826**	**298**	**513**	**136**	**15**	**142**	--	--	--
Total Organic Carbon (%)	**0.96**	**1.10**	**1.01**	**1.00**	**1.37**	**1.17**	**0.99**	**1.98**	**1.21**	**1.73**	**0.49**	**0.61**	**0.74**	--	--	--
Total Volatile Solids (%)	**4.41**	**4.92**	**4.83**	**4.68**	**4.84**	**4.87**	**4.32**	**7.69**	**4.38**	**6.14**	**2.49**	**2.90**	**3.04**	--	--	--
CHEMICAL																
METALS (mg/kg dry weight)																
Antimony	0.34 U	0.36 U	0.36 U	0.40 U	0.38 U	0.38 U	0.37 U	0.48 U	0.38 U	0.44 U	0.29 U	0.29 U	0.32 U	150	---	200
Arsenic	**5.37**	**6.55**	**7.59**	**6.93**	**6.12**	**6.37**	**6.63**	**6.23**	**7.15**	**5.86**	**4.76**	**4.98**	**5.47**	57	507.1	700
Cadmium	**0.56**	**0.53**	**0.58**	**0.63**	**0.68**	**0.68**	**0.66**	**0.86**	**0.63**	**0.78**	**0.32**	**0.41**	**0.420**	5.1	---	14
Chromium	**40.8**	**42.5**	**45.7**	**49.1**	**45.2**	**46.9**	**47.5**	**49.6**	**48.7**	**47.3**	**26.4**	**36.9**	**38.1**	260	---	---
Copper	**32.8**	**38.6**	**139**	**38.6**	**42.5**	**41.9**	**41.7**	**51.6**	**40.8**	**45.7**	**22.3**	**25.4**	**26.6**	390	---	1,300
Lead	**6.11**	**8.71**	**14.9**	**7.9**	**9.87**	**36.5**	**9.80**	**10.8**	**12.6**	**10.3**	**4.36**	**4.37**	**6.68**	450	975	1,200
Mercury	**0.0559**	**0.174**	**0.106**	**0.08**	**0.119**	**0.110**	**0.111**	**0.0924**	**0.114**	**0.10**	**0.0498**	**0.0839**	**0.0708**	0.41	1.5	2.3
Selenium	**0.81 J**	**1.08**	**1.00**	**1.08**	**0.92 J**	**1.18**	**1.12**	**0.24 J**	**0.27 J**	**1.14**	**0.70 J**	**0.82**	**0.990**	---	3	---
Silver	**0.16 J**	**0.23 J**	**0.24 J**	**0.18 J**	**0.23 J**	**0.22 J**	**0.22 J**	**0.24 J**	**0.27 J**	**0.22 J**	**0.10 J**	**0.12 J**	**0.15 J**	6.1	---	8.4
Zinc	**60.7**	**72.5**	**72.7**	**72.2**	**77.9**	**76.1**	**75.6**	**91.9**	**76.8**	**87.3**	**42.9**	**49.8**	**53.1**	410	---	3,800
PAHs (µg/kg dry weight)																
Naphthalene	29.3 U	**16.5 J**	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	19.9 U	20.0 U	19.9 U	2,100	---	2,400
Acenaphthylene	29.3 U	19.9 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	19.9 U	20.0 U	19.9 U	560	---	1,300
Acenaphthene	29.3 U	19.9 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	19.9 U	20.0 U	19.9 U	500	---	2,000
Fluorene	29.3 U	19.9 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	19.9 U	20.0 U	19.9 U	540	---	3,600
Phenanthrene	29.3 U	12.7 U	20.0 U	20.0 U	**11.2 J**	**18.5 J**	**17.8 J**	**20.9**	**15.9 J**	**18.7 J**	19.9 U	20.0 U	**10.2 J**	1,500	---	21,000
Anthracene	29.3 U	19.9 U	20.0 U	20.0 U	20.0 U	**17.4 J**	**11.7 J**	**15.4 J**	**11.5 J**	**14.6 J**	19.9 U	20.0 U	**11.3 J**	960	---	13,000
2-Methylnaphthalene	29.3 U	19.9 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	19.9 U	20.0 U	19.9 U	670	---	1,900
Total LPAH	29.3 U	**16.5 J**	20.0 U	20.0 U	**11.2 J**	**35.9 J**	**29.5 J**	**36.3**	**27.4 J**	**33.3 J**	19.9 U	20.0 U	**21.5 J**	5,200	---	29,000
Fluoranthene	**34.7**	**37.2**	**29.0**	**16.6 J**	**45.3**	**51.5**	**50.7**	**109**	**47**	**178**	**19.6 J**	**13.0 J**	**1,040**	1,700	4,600	30,000
Pyrene	**63.6**	**76.4**	**41.4**	**22.7**	**92.9**	**216**	**153**	**140**	**153**	**200**	**28.8**	**21.6**	**909**	2,600	11,980	16,000
Benzo(a)anthracene	**17.4 J**	**17.2 J**	**14.0 J**	20.0 U	**25.8**	**60.3**	**30.1**	**42.5**	**27.6**	**39.4**	**11.9 J**	20.0 U	**232**	1,300	---	5,100
Chrysene	**30**	**25.6**	**18.8 J**	20.0 U	**95.7**	**107**	**45.1**	**84.8**	**50.8**	**72.2**	**22**	20.0 U	**324**	1,400	---	21,000
Benzofluoranthenes (b, j ,k)	**56.6 J**	**64.2**	**38.9 J**	39.9 U	**193**	**296**	**96.0**	**137**	**116**	**128**	**37 J**	40.0 U	**704**	3,200	---	9,900
Benzo(a)pyrene	**17.8 J**	**21.5**	**15.1 J**	20.0 U	**44.7**	**81.1**	**30.1**	**37.7**	**31.7**	**33.7**	**10.1 J**	20.0 U	**133**	1,600	---	3,600
Indeno(1,2,3-c,d)pyrene	29.3 U	19.9 U	20.0 U	20.0 U	**25.3**	**41.1**	20.0 U	**21.5**	20.0 U	20.0 U	19.9 U	20.0 U	**57.3**	600	---	4,400
Dibenz(a,h)anthracene	**3.7 J**	**4.0 J**	**3.1 J**	5.0 U	**9.3**	**17.6**	**5.8**	**7.4**	**6.4**	**6.7**	5.0 U	5.0 U	**21.9 J**	230	---	1,900
Benzo(g,h,i)perylene	29.3 U	19.9 U	20.0 U	20.0 U	**26.0**	**44.3**	20.0 U	**25.8**	**21.1**	**24**	19.9 U	20.0 U	**54 J**	670	---	3,200
Total HPAH	**224**	**246**	**160**	**39.3**	**558**	**915**	**411**	**606**	**454**	**682**	**129**	**34.6**	**3,475**	12,000	---	69,000
CHLORINATED HYDROCARBONS (µg/kg dry weight)																
1,4-Dichlorobenzene	7.3 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	110	---	120
1,2-Dichlorobenzene	7.3 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	35	---	110
1,2,4-Trichlorobenzene	7.3 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	31	---	64
Hexachlorobenzene (HCB)	7.3 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	22	168	230
PHTHALATES (µg/kg dry weight)																
Dimethyl phthalate	7.3 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	**2.5 J**	5.0 U	20.0 U	5.0 U	5.0 U	5.0 U	71	---	1,400
Diethyl phthalate	**15.1 J**	**21.9 J**	**10.3 J**	**11.6 J**	**18.2 J**	**21.2 J**	**99.7 J**	**25.3 J**	**28.1 J**	49.9 U	49.8 U	**14.1 J**	**17.8 J**	200	---	1,200
Di-n-butyl phthalate	29.3 U	19.9 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	5.0 U	5.0 U	19.9 U	1,400	---	5,100
Butyl benzyl phthalate	**8.3**	5.0 U	5.0 U	5.0 U	**3.2 J**	5.0 U	**3.4 J**	**6.5**	**4.8 J**	**4.7 J**	19.9 U	20.0 U	5.0 U	63	---	970
Bis(2-ethylhexyl) phthalate	73.3 U	49.9 U	50.0 U	49.9 U	**42.8 J**	50.0 U	**59.9 J**	**47.7 J**	**40.9 J**	49.9 U	49.8 U	50.0 U	49.8 U	1,300	---	8,300
Di-n-octyl phthalate	29.3 U	19.9 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	19.9 U	20.0 U	19.9 U	6,200	---	6,200
PHENOLS (µg/kg dry weight)																
Phenol	**27.3**	**7.5**	**11.3 J**	**9.3**	**19.3**	**6.5**	**8.1**	**14.4**	**48.8**	**12.2**	**6.4**	**13.1**	**26.2**	420	---	1,200
2-Methylphenol	**15.6**	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	63	---	77
4-Methylphenol	29.3 U	**11.5**	**19.8**	**9.3**	**18.9**	**12.7**	**11.9**	**35.6**	**15.7**	**43.8**	**4.1 J**	**7.2**	**6.0**	670	---	3,600
2,4-Dimethylphenol	28.9 U	19.9 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	19.9 U	20.0 U	19.9 U	29	---	210
Pentachlorophenol	29.3 U	19.9 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	19.9 U	20.0 U	19.9 U	400	504	690
MISCELLANEOUS EXTRACTABLES (µg/kg dry weight)																
Benzyl alcohol	29.3 U	19.9 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	19.9 U	20.0 U	19.9 U	57	---	870
Benzoic acid	**77 J**	99.7 U	100 U	99.8 U	99.9 U	100 U	99.8 U	100.0 U	100.0 U	99.8 U	99.6 U	100 U	99.7 U	650	---	760
Dibenzofuran	29.3 U	19.9 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	20.0 U	19.9 U	20.0 U	19.9 U	540	---	1,700
Hexachlorobutadiene	7.3 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	11	---	270
N-Nitrosodiphenylamine	7.3 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	28	---	130
PESTICIDES & PCBs (µg/kg dry weight)																
4,4'-DDD	1.83 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	**0.61 J**	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 UJ	16	---	---
4,4'-DDE	1.83 U	1.00 U	**0.55 J**	1.00 U	**0.52 J**	1.00 U	**0.54 J**	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 UJ	9	---	---
4,4'-DDT	1.83 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	**1.27**	1.00 U	**1.09**	1.00 U	1.00 U	1.00 UJ	12	---	---
sum of 4,4'-DDD, 4,4'-DDE and 4,4'-DDT	1.83 U	1.00 U	**0.55 J**	1.00 U	**0.52 J**	1.00 U	1.15 J	**1.27**	1.00 U	**1.09**	1.00 U	1.00 U	1.00 UJ	---	50	69
Aldrin	0.92 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 UJ	9.5	---	---
Total Chlordane	--	--	--	--	--	--	--	--	--	**0.6**	--	--	--	2.8	37	---
cis-chlordane	0.92 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 UJ	---	---	---
trans-chlordane	0.92 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	**0.6**	0.50 U	0.50 U	0.50 UJ	---	---	---
cis-nonachlor	1.83 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 UJ	---	---	---
trans-nonachlor	1.83 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 UJ	---	---	---
oxychlordane	1.83 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 UJ	---	---	---
Dieldrin	1.83 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 UJ	1.9	---	1,700
Heptachlor	0.92 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 UJ	1.5	---	270
Total PCBs Aroclors (Sum of: 1016, 1221, 1242, 1248, 1254, 1260, 1268)	7.3 U	4.0 U	4.0 U	4.0 U	**9.3**	**11.1 J**	**7.7**	4.0 U	**14.9 J**	4.0 U	4.0 U	4.0 U	4.0 U	130	--	3,100
Total PCBs (mg/kg OC)	--	--	--	--	0.7	0.6	0.8	--	1.2	--	--	--	--	--	38[2]	---
PETROLEUM HYDROCARBONS (mg/kg dry weight)																
TPH - Diesel	**17**	**15.4**	**12.8**	**14.4**	**20.2**	**22.4**	**17.8**	**36.6**	**21.6**	**31.3**	7.18 U	9.88 U	**10.8**	--	--	---
TPH - Residual	**71.1**	**55**	**48.5**	**34.1**	**75.1**	**78**	**65.2**	**142**	**78.6**	**110**	**26.8**	**23.2**	**43.5**	--	--	---

Notes:

[1] DMMP = Dredged Material Management Program (July 2021)

[2] This value is normalized to total organic carbon, and is expressed in mg/kg organic carbon.

Total LPAH = The sum of acenaphthylene, acenaphthene, anthracene, fluorene, naphthalene and phenanthrene.

Total HPAH = The sum of benzo(a)anthracene, benzo(a)pyrene, total benzofluoranthenes, benzo(g,h,i)perylene, chrysene, dibenzo(a,h)anthracene, fluoranthene, indeno(1,2,3,-c,d)pyrene and pyrene.

Total benzofluoranthenes = the sum of the "b," "j" and "k" isomers. The "j" isomer co-elutes with the "k" isomer, thus the concentration of the "j" isomer is included in the "k" isomer concentration.

SL = Screening Level

LPAH = low molecular weight polynuclear aromatic hydrocarbon compounds

HPAH = high molecular weight polynuclear aromatic hydrocarbon compounds

TOC = Total organic carbon

ng/kg = nanograms per kilogram or parts per trillion dry weight

µg/kg = micrograms per kilogram

mg/kg OC = milligrams per kilogram organic carbon

--- = not established or not analyzed

J = The analyte was positively identified; the associated value is the approximate concentration of the analyte in the sample.

U = The analyte was analyzed for, but was not detected above the level of the adjusted detection limit or quantitation limit, as appropriate.

UJ = The analyte was analyzed for, but was not detected at or above the associated value (reporting limit), which is considered approximate due to deficiencies in one or more quality control criteria.

TABLE 4. SUMMARY OF DIOXINS/FURANS DATA COMPARED TO DMMP GUIDELINES[1]

CITY OF OAK HARBOR MARINA

DREDGED MATERIAL SEDIMENT CHARACTERIZATION REPORT

OAK HARBOR, WASHINGTON

Sample ID	DMMUs-1,2,3,4	DMMUs-5,6,7	DMMU-8[1]	DMMU-8 re-analysis[2]	DMMU-8Z, 9Z	DMMU-9[1]	DMMU-9 re-analysis[2]	DMMUs - 10,11	DMMP Marine Guidelines		
Lab Sample Composite	Comp-1	Comp-2	n/a		Comp-4	n/a		Comp-3	SL	BT	ML
Sample Date	8/19/24	8/21/24	8/24/24		8/22/24	8/23/24		8/21/24			
DIOXINS/FURANS (ng/kg dry weight)											
2,3,7,8-TCDF (TEF = 0.1)	**0.907**	**1.47**	**1.57 EMPC**	**0.880**	**0.503**	**2.11 EMPC**	**0.947**	**0.399**	---	---	---
1,2,3,7,8-PeCDF (TEF = 0.03)	**0.309**	**0.795**	0.967 U	**0.510**	**0.317 EMPC**	0.983 U	**0.774**	0.164 U	---	---	---
2,3,4,7,8-PeCDF (TEF = 0.3)	0.575 U	**0.831**	1.07 U	**0.577**	**0.3**	1.00 U	**0.989**	**0.297**	---	---	---
1,2,3,7,8-PeCDD (TEF = 1.0)	**0.419**	**0.9**	1.12 U	**1.05**	**0.369 EMPC**	**1.33 EMPC**	**1.14**	0.280 U	---	---	---
1,2,3,4,7,8-HxCDF (TEF = 0.1)	**0.725**	**1.90**	**1.32**	**1.38**	**0.488**	**1.19**	**1.60**	**0.471**	---	---	---
1,2,3,6,7,8-HxCDF (TEF = 0.1)	**0.512**	**0.998**	0.987 U	**0.923**	**0.148 EMPC**	**0.647 EMPC, J**	**0.947**	**0.323**	---	---	---
2,3,4,6,7,8-HxCDF (TEF = 0.1)	**0.463**	**1.06**	1.03 U	**0.790**	**0.285**	0.768 U	**1.10**	**0.267**	---	---	---
1,2,3,7,8,9-HxCDF (TEF = 0.1)	0.124 U	**0.178**	1.56 U	0.136 U	0.123 U	1.03 U	0.279 U	0.121 U	---	---	---
1,2,3,4,7,8-HxCDD (TEF = 0.1)	**0.462**	**1.5**	1.63 U	**1.62**	**0.576**	1.43 U	**1.73**	**0.3**	---	---	---
1,2,3,6,7,8-HxCDD (TEF = 0.1)	**1.69**	**6.12**	**8.93**	**6.69**	**1.99**	**6.92 EMPC**	**10.3**	**0.92**	---	---	---
1,2,3,7,8,9-HxCDD (TEF = 0.1)	**1.37**	**4.0**	**4.65 EMPC**	**4.61**	**1.65**	**4.53 EMPC**	**5.38**	**0.643**	---	---	---
1,2,3,4,6,7,8-HpCDF (TEF = 0.01)	**6.33**	**15.4**	**16.3**	**16.0**	**4.8**	**16.5**	**19.6**	**2.53**	---	---	---
1,2,3,4,7,8,9-HpCDF (TEF = 0.01)	**0.427**	**0.901**	1.91 U	**0.898**	**0.284**	2.18 U	**0.881**	**0.172**	---	---	---
1,2,3,4,6,7,8-HpCDD (TEF = 0.01)	**41.6**	**171.0**	**262**	**196**	**54.9**	**239**	**259**	**23.1**	---	---	---
OCDF (TEF = 0.0003)	**20.8**	**43.3**	**33.1**	**39.7**	**12.7**	**33.1**	**34.1**	**7.13**	---	---	---
OCDD (TEF = 0.0003)	**344.0**	**1350.0**	**2,150**	**1,600**	**437**	**2,100**	**2,180**	**184.0**	---	---	---
2,3,7,8-TCDD (TEF = 1.0)	0.119 U	**0.18**	0.564 U	0.146 U	0.135 U	0.541 U	**0.194**	0.150 U	---	---	---
Total TEQ of dioxins/furans[3]	**1.79**	**5.32**	**6.06**	**5.63**	**1.66**	**5.29**	**7.33**	**0.966**	---	4 or 10[4]	---

Notes:

[1] Analyzed by ARI Laboratory in Tukwila, Washington

[2] Analyzed by Bureau Veritas in Mississauga, Ontario

[3] The laboratory results for dioxins and furans are listed in the the main body of the table. The total TEQ is calculated using the applicable TEFs as noted in the table and 1/2 the EDL/EMPC value.

[4] For non-dispersive sites - DMMUs with dioxin concentrations below 10 parts per trillion TEQ will be allowed for disposal as long as the volume-weighted average concentration of dioxins in material from the entire dredging project does not exceed the Disposal Site Management Objective of 4 parts per trillion TEQ. Where possible, disposal of DMMUs is sequenced such that those with higher dioxin concentrations are disposed before those with lower concentrations.

Screening Level (SL) = the chemical concentration at or below which there is no reason to believe that dredged material disposal would result in unacceptable adverse effects to benthic species.

Bioaccumulation trigger (BT) = guideline value to determine when bioaccumulation testing is required

Maximum level (ML) = the highest Apparent Effects Threshold a chemical concentration at which all biological indicators with AETs show significant effects.

TEF = toxicity equivalency factor

TEQ = toxicity equivalency quotiient

ng/kg = nanograms per kilogram or parts per trillion dry weight

--- = not established or not analyzed

J = The analyte was positively identified; the associated value is the approximate concentration of the analyte in the sample.

U = The analyte was analyzed for, but was not detected above the level of the adjusted detection limit or quantitation limit, as appropriate.

EMPC = estimated maximum possible conentration qualifier for high resolution capillary gas chromatography mass spectrometry dioxin

TABLE 5. DIOXIN/FURAN TEQ VOLUME WEIGHTED AVERAGE - FULL DREDGE PRISM
CITY OF OAK HARBOR MARINA
DREDGED MATERIAL SEDIMENT CHARACTERIZATION REPORT
OAK HARBOR, WASHINGTON

Composite Sample ID	Associated DMMUs	DMMU Volume	Composite Volume	TEQ	TEQ*Vol
COMP-1	1	16,449	61,807	1.79	110,634.53
	2	16,473			
	3	16,435			
	4	12,450			
COMP-2	5	16,431	48,553	5.32	258,301.96
	6	16,196			
	7	15,926			
DMMU-8	8	16,447	16,447	5.85	96,214.95
DMMU-9	9	7,125	7,125	6.31	44,958.75
COMP-4	10	24,000	46,827	0.966	45,234.88
	11	22,827			
				Σ TEQ*Vol=	555,345.07
				Volume Weighted Average =	**3.07**

Notes:

(Σ (Concentration * Volume)) / Σ Volume

TEQ values for for DMMU-8 and DMMU-9 include the average of TEQ concentrations results from the multiple rounds of analysis.

Total Dredge Volume 180,760 CY

TABLE 6. DIOXIN/FURAN TEQ VOLUME WEIGHTED AVERAGE - INITIAL DREDGE EVENT
CITY OF OAK HARBOR MARINA
DREDGED MATERIAL SEDIMENT CHARACTERIZATION REPORT
OAK HARBOR, WASHINGTON

Composite Sample ID	Associated DMMUs	DMMU Volume	Composite Volume	TEQ	TEQ*Vol
COMP-1	1	4,144	18,916	1.79	33,859.26
	2	6,654			
	3	4,357			
	4	3,760			
COMP-2	5	16,157	43,559	5.32	231,735.21
	6	16,196			
	7	11,206			
DMMU-8	8	10,643	10,643	5.85	62,260.61
DMMU-9	9	6,280	6,280	6.31	39,625.92
COMP-4	10	2,377	16,650	0.966	16,083.46
	11	14,273			
				Σ TEQ*Vol=	383,564.46
				Volume Weighted Average =	**3.99**

Notes:

(Σ (Concentration * Volume)) / Σ Volume

TEQ values for for DMMU-8 and DMMU-9 include the average of TEQ concentrations results from the multiple rounds of analysis.

Total Year-1 Dredge Volume 96,047 CY