Prepared by:
Dredged Material Management Office
Seattle District, U.S. Army Corps of Engineers

MEMORANDUM FOR RECORD **March 10, 2020**

SUBJECT: DETERMINATION REGARDING THE SUITABILITY OF PROPOSED DREDGED MATERIAL FROM AND RE-RANKING OF THE KEYSTONE FEDERAL NAVIGATION CHANNEL EVALUATED UNDER SECTION 404 OF THE CLEAN WATER ACT FOR UNCONFINED OPEN-WATER DISPOSAL OR BENEFICIAL USE.

1. **Introduction**. This memorandum reflects the consensus determination of the Dredged Material Management Program (DMMP) agencies (U.S. Army Corps of Engineers, Washington State Department of Ecology [Ecology], Washington State Department of Natural Resources, and the Environmental Protection Agency) regarding the suitability of up to 72,000 cubic yards (CY) of proposed dredged material from the Keystone federal navigation project for open-water disposal or placement and compliance of the sediment surface to be exposed by this dredging with the State of Washington's antidegradation standard. This memorandum further documents the re-ranking of the Keystone project based on historical sampling data.

2. **Background.** The Keystone Harbor Navigation Project ("Keystone") is a federally maintained navigation channel and boat basin located on the west side of Whidbey Island in Island County, Washington (Figure 1). Keystone Harbor provides a harbor of refuge, a public boat launch ramp, and a terminal for the Washington State ferry run between Port Townsend and Whidbey Island.

   The project has an authorized depth of -25 feet (ft) Mean Lower Low Water (MLLW). Although the authorized channel area (blue outline) is larger than the yellow boundary, USACE historically only dredges the area defined by the yellow rectangle (Figure 2). Construction of the basin, entrance channel, and adjacent rock jetty interrupted the natural eastward transport of beach material. Consequently, shoaling of the entrance channel requires routine maintenance dredging to ensure safe navigation. The project was previously dredged in 1987, 1993, 1999, 2005, and 2011, and the material was placed on the beach to the east. In the most recent dredging event (2011), a total of 34,920 CY of material was dredged from the project and beneficially used for beach nourishment.

   A bathymetric survey of the waterway was conducted by USACE in July 2019 and showed infill above the authorized depth. USACE contracted with NewFields Government Services (NGS) to characterize the navigation channel to the authorized depth (-25 ft MLLW) plus two feet of overdepth plus two feet of advance maintenance dredging for area represented by the yellow outline in Figure 2.

   This memorandum documents the evaluation of the shoaled sediment for open-water disposal and the new surface to be exposed by dredging for compliance with the State of Washington's anti-degradation standard.

3. **Project Summary**. Table 1 provides project summary and tracking information.

Table 1. Project Summary

Former Project ranking	Low
Authorized depth	-25 ft MLLW
Proposed dredging depth	-29 ft MLWW (includes 2 ft overdepth + 2 ft advance maintenance)
Calculated volume to -29 ft MLLW	58,935 CY
Characterized dredging volume	72,000 CY
1st draft SAP received	October 14, 2019
Comments provided on 1st draft SAP	October 18, 2019
Final SAP received	October 24, 2019
SAP approved	October 24, 2019
Sampling dates	November 13, 2019
Draft Sediment Characterization Report (SCR) received	February 21, 2020
DMMP comments provided on draft SCR	
Final SCR received	
DMMO tracking number	KEYST-1-A-F-410
EIM Study ID	KEYST19
New Project Rank	Very Low
New Recency Determination (very low rank = 10 years)	November 2029

4. **Project Ranking and Sampling Requirements**. Keystone was ranked "low" by the DMMP agencies for concern for potential contamination for the 2011 Suitability Determination (DMMP, 2011). For the purposes of this sediment characterization, the project rank remained unchanged.

For a low-ranked project, the requirements for the number of field samples and dredged material management units (DMMUs) are as follows (DMMP, 2018):

- Maximum volume of sediment represented by each field sample = 8,000 cubic yards
- Maximum volume of sediment represented by each DMMU in homogeneous sediment = 60,000 cubic yards

Since the material is primarily expected to be infill from natural erosion that has accumulated since the last maintenance dredge event, the material is assumed to be well-mixed, homogenous sediment. No subsurface DMMUs were required.

The estimated volume for the project area bounded by the yellow outline (included side-slopes) was 58,935 CY. To ensure sufficient sampling frequency to cover additional infill that will accumulate after characterization and before dredging, two DMMUs were allocated to characterize this material.

Within each DMMU, five grab sample locations were targeted.

5. **Sampling and Analysis**. Sediment grabs were collected November 13, 2019. Grab samples were collected via Van Veen and Young grab samplers from aboard the R/V George Davidson, owned and operated by Ecology. A total of ten sediment surface grab locations were targeted inside two DMMUs. Due to difficulty encountered collecting viable samples from the rocky sloping bottom, the DMMP was consulted during field sampling and actual sampling locations differed slightly from the target locations. One target location (D01-2) was removed altogether due to sampling difficulties. Figure 2 shows the proposed and actual coring locations and Table 2 lists the location coordinates.

   Given the maximal volume allowed per DMMU and the maximum volume allowed per field sample, the total characterized volume for the two DMMUs tested is 72,000 cy.

   All samples were submitted to Analytical Resources, Inc. of Tukwila, WA, for analysis.

6. **Analytical Results**. The conventional and chemistry results for the two DMMU composites are presented alongside the DMMP and SMS marine guidelines in Table 3. Stage 2B data validation was conducted by Herrera Environmental Consultants, Inc. Only minor issues were documented and all data were considered usable, as qualified, by the data validator.

   Grain Size and Sediment Conventionals. All samples were analyzed for the conventional sediment parameters of total organic carbon (TOC), total solids, total volatile solids, ammonia, sulfides, and grain size. TOC was low, and grain size analysis showed that the material was primarily composed of sand and gravel.

   Standard DMMP Chemicals of Concern. No analytical results (detects and non-detects) exceeded the DMMP Screening Level (SL) or Bioaccumulation Trigger (BT) for the DMMP chemicals of concern (COCs).

   Standard SMS Chemicals of Concern. No analytical results (detects and non-detects) exceeded the dry-weight Sediment Quality Standards (SQS) equivalents for all SMS COCs.

   Dioxins/furans. Dioxin/furan analysis was not required. Dioxins/furans were previously measured during the 2011 full characterization, and all results were less than 1 pptr TEQs.

   TBT. Tributyltin (TBT) analyses were not required for this project based on previous non-detect results from the 2011 characterization and given the source of the dredged material (natural bluff erosion).

7. **Biological Testing**. Biological testing was not required; concentrations of all detected and non-detected chemicals of concerns were below DMMP screening levels.

8. **Sediment Exposed by Dredging**. 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). Concentrations of all DMMP chemicals of concern were below the DMMP SLs; therefore, this project is in compliance with the State of Washington anti-degradation standard.

9. **Debris Management**. The DMMP agencies implemented a debris screening requirement following the 2015 SMARM in order to prevent the disposal of solid waste and large debris at open-water disposal sites in Puget Sound (DMMP, 2015).

   Geographically, the dredging area is in a highly dynamic littoral drift current/tidal area and the accumulated material is composed of sand and gravel eroding from bluffs to the west of the navigation channel. The navigation channel has no significant development beyond the active ferry terminal, and the primary source of sediment is from longshore drift. The project area is used primarily for the state ferry terminal, and the entrance channel has been previously dredged twice to maintain navigational access. No debris was encountered during sediment sampling in November 2019. Based on the above information, the DMMP agencies concur that the project dredge area is of low concern for debris and a debris screening grid is not required for this proposed dredging project. However, if any large debris is encountered, it must be segregated and disposed of in an upland landfill or other appropriate use. At no time may any debris greater than one foot in any dimension be disposed at an open-water disposal site.

10. **Re-ranking**. The DMMP guidelines allow down-ranking of a project after two testing cycles, based on the results from those testing events and the use of best professional judgment (DMMP, 2018). The definitions of the various ranks must be considered:

    - High = many known chemical sources, high concentration of COCs and/or significant acute toxicity
    - Moderate = chemical and biological data are not available or are incomplete, and some sources of chemicals of concern exist nearby
    - Low-moderate = available data indicate a low rank, but there are insufficient data to confirm the ranking
    - Low = few or no sources of COCs, data are available to verify low chemical concentrations.
    - Very Low = sufficiently removed from potential sources of sediment; bioaccumulative compounds are not likely present at levels of concern based on review of historical data and comparison to DMMP bioaccumulation triggers. Site is subject to strong current and/or tidal energy and contains coarse-grained sediment with at least 80 percent sand retained in a No. 230 sieve and total organic carbon (TOC) content of less than 0.5 percent.

    For the purposes of the November 2019 characterization, Keystone Harbor was ranked low by the DMMP agencies. However, with the conclusion of the November 2019 sampling event summarized in this document, the waterway has undergone two consecutive cycles of sampling and testing as summarized below:

    - 1991. No CoCs were detected or not detected above the 1989 PSDDA screening levels.
    - 2011. No CoCs (including dioxin/furans and TBT) were detected or not detected above the DMMP screening levels available at the time. Grain size analysis indicated that the material was predominantly sand and gravel.
    - 2019. No CoCs were detected or not detected above DMMP screening levels in the waterway. Grain size was again found to be predominantly sand and gravel.

Based on the above information, the DMMP agencies **have determined that a re-ranking of the Entrance Channel area of the Keystone Harbor Navigation Project from low to very low** is supported by the available data.

Future sampling at the very low rank shall be performed by grab sampling and must characterize initially for TOC and grain size. If the material meets DMMP exclusionary criteria based on grain size (>80% sand and gravel) and TOC (<0.5% TOC), no further testing will be required. If the material does **not** meet DMMP exclusionary criteria, archived sample material must be analyzed for the standard list of DMMP conventional and chemistry COCs for marine sediments.

The new ranking for the Keystone project is based on information available at this time. Any significant future changes in condition, such as spills or new contaminant sources, may prompt the DMMP agencies to perform a re-evaluation of project rank.

11. Suitability and Antidegradation Determination. This memorandum documents the evaluation of the suitability of sediment proposed for dredging from the Keystone Harbor federal navigation project for open-water disposal at a DMMP open-water disposal site. Comparison of sediment analytical results to Washington State SQS also indicates this material is suitable for open-water placement or beneficial use. The data gathered were deemed sufficient and acceptable for regulatory decision-making under the DMMP program.

In summary, based on the results of the previously described testing, the DMMP agencies have concluded that **up to 72,000 CY of characterized material per dredging event from the Keystone Harbor federal navigation project is suitable** for open-water disposal and the material has been found suitable for open-water placement (e.g. beneficial use such as beach nourishment).

The actual volume proposed for dredging in each individual dredging event will be 50,000 CY or less based on other factors such as environmental coordination and contract limitations. Any significant future changes in condition, such as spills or new contaminant sources, may prompt the DMMP agencies to require a re-evaluation of the material proposed for dredging.

Furthermore, the DMMP agencies have determined that the sediment to be exposed by dredging **meets the state antidegradation standard.**

A decision regarding the suitability of the material for beneficial use or upland disposal at any location other than a permitted landfill must be approved by the entity receiving the material. Additional coordination with local resource agencies may be required.

This suitability determination does ***not*** constitute final agency approval of the 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.

12. References.

NewFields Government Services (NGS), 2019. Sampling and Analysis Plan, Keystone Harbor Navigation Project, Dredged Material Characterization, Island County, Washington. Prepared for USACE Seattle District by NGS, October 23, 2019.

NGS, 2020. Data Report, Keystone Harbor Navigation Project, Dredged Material Characterization, Island County, Washington. Prepared for USACE Seattle District by NGS, March 2020.

DMMP, 1998. Determination on the Suitability of Maintenance Material Dredged from the Lake Crockett Navigation Project (Keystone Ferry Terminal), Whidbey Island, WA. (CENWS-OD-TS-NS-24, Dated 19 June 1998) for Disposal along an Adjacent Shoreline as a Beneficial Use Beach Renourishment. Prepared by the Seattle District Dredged Material Management Office for the Dredged Material Management Program, August 7, 1998.

DMMP, 2005. Determination on the Suitability of Maintenance Material Dredged from the Lake Crockett Navigation Project (Keystone Ferry Terminal), Whidbey Island, WA. (CENWS-OD-TS-NS-24) for Disposal along an Adjacent Shoreline as a Beneficial Use Beach Renourishment. Prepared by the Seattle District Dredged Material Management Office for the Dredged Material Management Program, May 11, 2005.

DMMP, 2011. Determination Regarding the Suitability of Proposed Dredged Material from Keystone Harbor Navigation Project (CENWS-OD-TS-NS-24) Whidbey Island, Washington, for Unconfined Disposal at a DMMP Disposal Site or Beneficial Re-Use. Prepared by the Seattle District Dredged Material Management Office for the Dredged Material Management Program, July 28, 2011.

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, 2018. *Dredged Material Evaluation and Disposal Procedures (User Manual)*. Prepared by the Seattle District Dredged Material Management Office for the Dredged Material Management Program, December 2018.

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

Ecology, 2019. *Sediment Cleanup User's Manual (SCUM).* Publication No. 12-09-057. Toxics Cleanup Program, Washington State Department of Ecology, December 2019.

PSDDA, 1991. Determination on the Suitability of Dredged Material Tested under PSDDA Criteria for the Keystone Harbor Channel Deepening Project to be Disposed of at the Port Townsend PSDDA Open-Water Disposal Site. Prepared by the Seattle District Dredged Material Management Office for the PSDDA agencies, April 4, 1991.

13. <u>Agency Signatures</u>.

signed copy on file in DMMO - Seattle District office

Concur:

_____ _____
Date Heather Whitney Fourie – Seattle District Corps of Engineers, Seattle District

_____ _____
Date Erika Hoffman - Environmental Protection Agency Region 10

_____ _____
Date Laura Inouye, Ph.D. - Washington Department of Ecology

_____ _____
Date Shannon Soto - Washington Department of Natural Resources

Copies furnished:
DMMP signatories
John Hicks, USACE Navigation Section Chief
Chemine Jackels, USACE Environmental
Justine Barton, EPA

Table 2. Sampling locations, DMMU Compositing, Water Depths, and Mudline Elevations.

DMMU	Location Name	Date	State Plane WA-N, NAD83		Latitude (°N) NAD83	Longitude (°W) NAD 83	Water Depth (ft.)	Recorded Tidal Height (ft. MLLW)	Calculated Mudline Elevation (ft. MLLW)
			Northing	Easting					
KH19-D01-C	D01-1	11/13/2019	427302.5	1191573.4	48.156723	−122.672451	−36.4	7.4	29
	D01-2[a]	-	-	-	-	-	-	-	-
	D01-3	11/13/2019	427423.5	1191648	48.157059	−122.672157	−26.9	6.2	20.7
	D01-4	11/13/2019	427512.7	1191627.7	48.157302	−122.672249	−33.6	5.2	28.4
	D01-5	11/13/2019	427625.7	1191603.2	48.15761	−122.672360	−36.3	6.1	30.2
KH19-D02-C	D02-1	11/13/2019	427669.7	1191636.6	48.157733	−122.672228	−35.0	8.2	26.8
	D02-2	11/13/2019	427989.5	1191519.7	48.158602	−122.672738	−28.3	7.8	20.6
	D02-3	11/13/2019	427947.8	1191625.9	48.158495	−122.672299	−33.3	7.8	25.6
	D02-4	11/13/2019	428127	1191623.3	48.158986	−122.672327	−23.5	7.8	15.8
	D02-5	11/13/2019	428143.7	1191473.4	48.159022	−122.672943	−19.8	7.1	12.7

a. Not sampled, please refer to section 2.4.

Source: Table 2-1 of the Keystone Harbor Data Report (NGS, 2020)

Table 3. Analytical Results

Parameter	Sediment		DMMP			SMS SQS (d.w.)[a]		KH19-D01			KH19-D02		
	MDL	RL	SL	BT	ML	SCO	CSL	Results	LQ	VQ	Results	LQ	VQ
Conventionals													
Total Solids (%)	---	0.1	---	---	---	---	---	83.84			79.46		
Total Volatile Solids (%)	---	0.1	---	---	---	---	---	0.96			0.85		
Total Organic Carbon (%)	0.02	0.05	---	---	---	---	---	0.13			0.12		
Total Sulfides (mg/kg)	0.06	0.1	---	---	---			1.79			144		
Ammonia (mg/kg)	0.04	0.5	---	---	---			4.62			1.77		
Grain Size: Gravel (%)	---	0.1	---	---	---	---		38.8			8.7		
Grain Size: Sand (%)	---	0.1	---	---	---	---		60			87.7		
Grain Size: Silt (%)	---	0.1	---	---	---	---		1.5			3.9		
Grain Size: Clay (%)	---	0.1	---	---	---	---		0.3			0.3		
Grain Size: Fines (%)	---	0.1	---	---	---	---		1.8			4.2		
Metals (mg/kg)													
Arsenic	2	4	57	507.1	700	57	93	1.68			3.08		
Cadmium	0.09	0.2	5.1	---	14	5.1	6.7	0.08	J		0.09	J	
Chromium	0.3	0.8	260	---	---	260	270	16			22.7		
Copper	0.4	0.8	390	---	1,300	390	390	10.5			7.67		
Lead	0.7	2	450	975	1,200	450	530	1.32			4.61		
Mercury	0.002	0.02	0.41	1.5	2.3	0.41	0.59	0.0678			0.0846		
Selenium	0.03	1	---	3	---	---	---	0.72			0.68		
Silver	0.3	0.8	6.1	---	8.4	6.1	6.1	0.04	J	J	0.04	J	
Zinc	0.2	1	410	---	3,800	410	960	20.5			20.3		
Organics (µg/kg)													
Low Molecular Polycyclic Aromatic Hydrocarbons (LPAH)													
Naphthalene	2.9	10	2,100	---	2,400	2,100	2,100	19.7	U		6.8	J	
Acenaphthylene	2.6	10	560	---	1,300	1,300	1,300	19.7	U		19.8	U	
Acenaphthene	3.2	10	500	---	2,000	500	500	19.7	U		19.8	U	
Fluorene	3.3	10	540	---	3,600	540	540	19.7	U		6.4	J	
Phenanthrene	3.6	10	1,500	---	21,000	1,500	1,500	5.4	J		21.2		
Anthracene	3.2	10	960	---	13,000	960	960	5.9	J		15.6	J	
2-Methylnaphthalene	2.8	10	670	---	1,900	670	670	19.7	U		19.8	U	
Total LPAH	---	---	5,200	---	29,000	5,200	5,200	11.3	J		50		
High Molecular Polycyclic Aromatic Hydrocarbons (HPAH)													
Fluoranthene	3.7	10	1,700	4,600	30,000	1,700	2,500	14	J		69.1		
Pyrene	3.7	10	2,600	11,980	16,000	2,600	3,300	9.8	J		60.5		
Benzo(a)anthracene	3.6	10	1,300	---	5,100	1,300	1,600	19.7	U		44.6		
Chrysene	4.1	10	1,400	---	21,000	1,400	2,800	5.4	J		159		
Benzofluoranthenes	---	10	3,200	---	9,900	3,200	3,600	39.5	U		53.1		
Benzo(a)pyrene	3.6	10	1,600	---	3,600	1,600	1,600	19.7	U		19.9		
Indeno(1,2,3-c,d)pyrene	3.2	10	600	---	4,400	600	690	19.7	U		9.1	J	
Dibenzo(a,h)anthracene	3	10	230	---	1,900	230	230	19.7	U		19.8	U	
Benzo(g,h,i)perylene	3.7	10	670	---	3,200	670	720	19.7	U		8.1	J	
Total HPAH	---	---	12,000	---	69,000	12,000	17,000	29.2	J		423.4		
Chlorinated Hydrocarbons													
1,4-Dichlorobenzene	2.5	10	110	---	120	110	110	19.7	U		19.8	U	
1,2-Dichlorobenzene	2.4	10	35	---	110	35	50	19.7	U		19.8	U	
1,2,4-Trichlorobenzene	2.6	10	31	---	64	31	51	19.7	U		19.8	U	
Hexachlorobenzene	3.3	10	22	168	230	22	70	19.7	U		19.8	U	
1,3-Dichlorobenzene	nm	nm	---	---	---	170	---	---			---		
Phthalates													
Dimethyl phthalate	4	10	71	---	1,400	71	160	19.7	U		19.8	U	
Diethyl phthalate	3.7	10	200	---	1,200	200	1,200	19.7	U		19.8	U	
Di-n-butyl phthalate	4.8	20	1,400	---	5,100	1,400	5,100	11.2	J		14.4	J	
Butyl benzyl phthalate	3.7	10	63	---	970	63	900	19.7	U		19.8	U	
Bis(2-ethylhexyl)phthalate	8.9	100	1,300	---	8,300	1,300	3,100	49.3	U		49.6	U	
Di-n-octyl phthalate	3.2	10	6,200	---	6,200	6,200	6,200	19.7	U		19.8	U	
Phenols													
Phenol	3.1	30	420	---	1,200	420	1,200	10.5	J		10.6	J	
2 Methylphenol	4.1	10	63	---	77	63	63	19.7	U		19.8	U	
4 Methylphenol	4.5	10	670	---	3,600	670	670	19.7	U		19.8	U	
2,4-Dimethylphenol	6.3	50	29	---	210	29	29	19.7	U		19.8	U	
Pentachlorophenol	5.3	100	400	504	690	360	690	98.7	U		99.2	U	
Miscellaneous Extractables													
Benzyl alcohol	4.9	20	57	---	870	57	73	19.7	U		19.8	U	
Benzoic acid	96	400	650	---	760	650	650	197	U		198	U	
Dibenzofuran	3.4	10	540	---	1,700	540	540	19.7	U		5.8	J	
Hexachlorobutadiene	3	10	11	---	270	11	120	8.3	J		5	U	
N-Nitrosodiphenylamine	20	50	28	---	130	28	40	19.7	U		19.8	U	
Pesticides													
4,4'-DDD	1	5	16	---	---	16[b]	---	1	U		1	U	
4,4'-DDE	1.6	5	9	---	---	9[b]	---	1	U		1	U	
4,4'-DDT	0.85	5	12	---	---	6[b]	---	1	U		1	U	
Total 4,4'-DDx	---	5	---	50	69	---	---	1	U		1	U	
Aldrin	0.34	5	9.5	---	---	---	---	0.5	U		0.5	U	
Total Chlordane	---	5	2.8	37	---	---	---	0.5	U		0.5	U	
Dieldrin	0.48	5	1.9	---	1,700	---	---	1	U		1	U	
Heptachlor	0.83	5	1.5	---	270	---	---	0.5	U		0.5	U	
PCB Aroclors													
PCB-Aroclor 1016	---	---	---	---	---	---	---	4	U		4	U	
PCB-Aroclor 1221	---	---	---	---	---	---	---	4	U		4	U	
PCB-Aroclor 1232	---	---	---	---	---	---	---	4	U		4	U	
PCB-Aroclor 1242	---	---	---	---	---	---	---	4	U		4	U	
PCB-Aroclor 1248	---	---	---	---	---	---	---	4	U		4	U	
PCB-Aroclor 1254	---	---	---	---	---	---	---	4	U		4	U	

Table 3. Analytical Results

Parameter	Sediment		DMMP			SMS SQS (d.w.)[a]		KH19-D01			KH19-D02		
	MDL	RL	SL	BT	ML	SCO	CSL	Results	LQ	VQ	Results	LQ	VQ
PCB-Aroclor 1260	---	---	---	---	---	---	---	4	U		4	U	
PCB-Aroclor 1262	---	---	---	---	---	---	---	4	U		4	U	
PCB-Aroclor 1268	---	---	---	---	---	---	---	4	U		4	U	
Total PCBs	2.1	10	130	38*	3,100	130	1,000	4	U		4	U	
Other non-DMMP COCs													
Tetrachloroethene	nm	nm	---	---	---	57	---	---			---		
Ethylbenzene	nm	nm	---	---	---	10	---	---			---		
Total xylenes	nm	nm	---	---	---	40	---	---			---		

Notes: Non-detect results reported at the method detection limit.

a: Dry weight equivalents are provided for all SMS chemicals because organic carbon normalization was not indicated due to TOC < 0.5% (Ecology, 2019)

b: total of 2,4- and 4,4-DDx

d.w.: dry weight

LQ: laboratory qualifier VQ: validation qualifier SL: screening level ML: maximum level BT: bioaccumulation trigger

U: the analyte was not detected

J: the result is estimated

UJ: the analyte was not detected above the reported sample quantitation limit, and the reported quantitation limit is approximate

nm: not measured

Fines: sum of silt and clay fractions

LPAH: sum of detected values of naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, and anthracene

HPAH: sum of detected values of fluoranthene, pyrene, benzo(a)anthracene, chrysene, benzofluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, dibenzo(a,h)anthracene, and benzo(ghi)perylene

Total PCBs: sum of detected PCB Aroclors

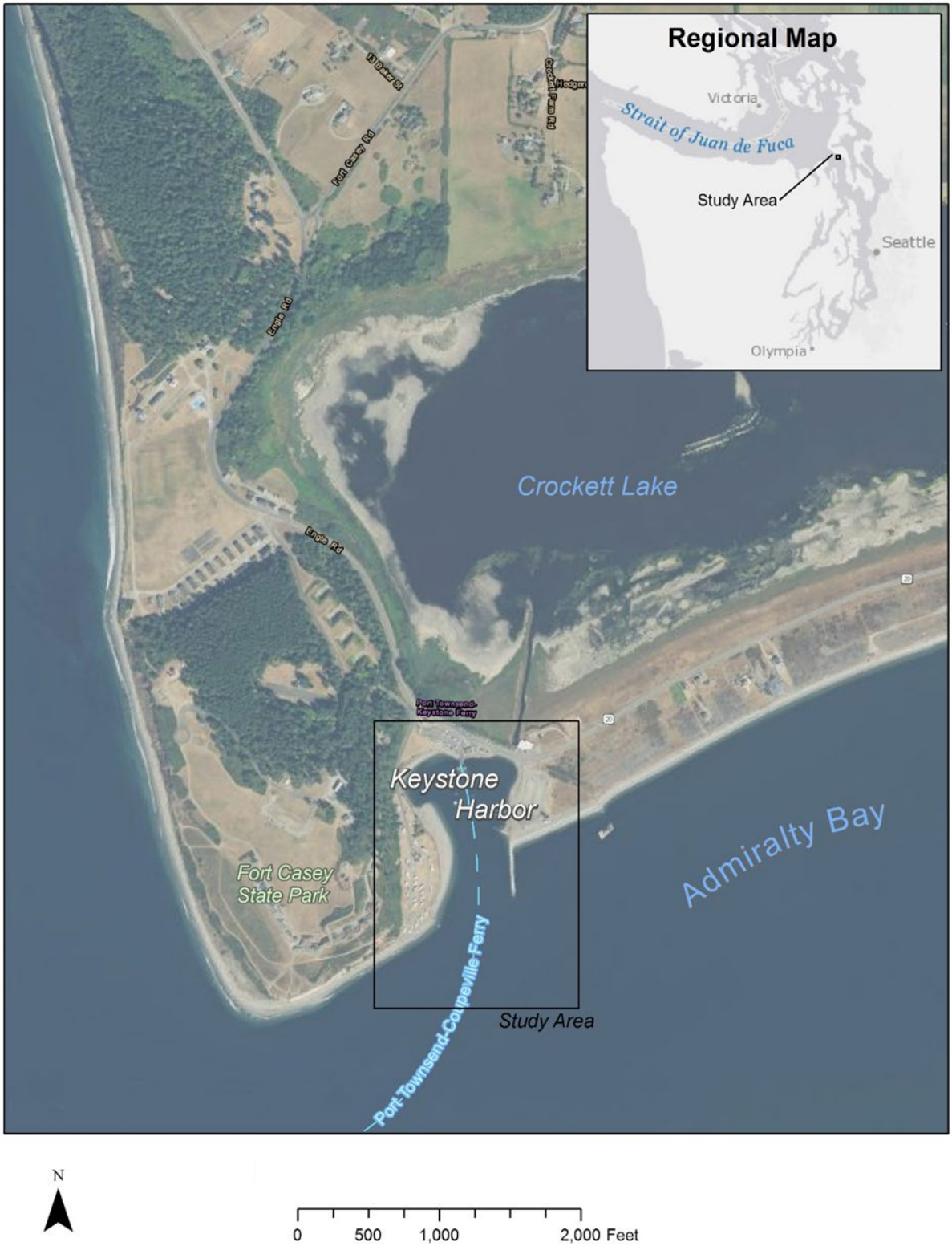
Total 4,4'-DDx: sum of detected 4,4'-DDE, 4,4'-DDD, and 4,4'-DDT

Total Chlordane: sum of detected gamma-chlordane, cis-chlordane, cis-nonachlor, trans-nonachlor, and oxychlordane

* This BT value is normalized to total organic carbon, and is expressed in mg/kg organic carbon (mg/kg OC).

Source: Table 3-1 of the Keystone Harbor Data Report (NGS, 2020)

Figure 1. Project Location Map



Source: Figure 1-1 of Keystone Harbor Data Report (NGS, 2020)

Figure 2. Proposed and Actual Grab Sampling Locations

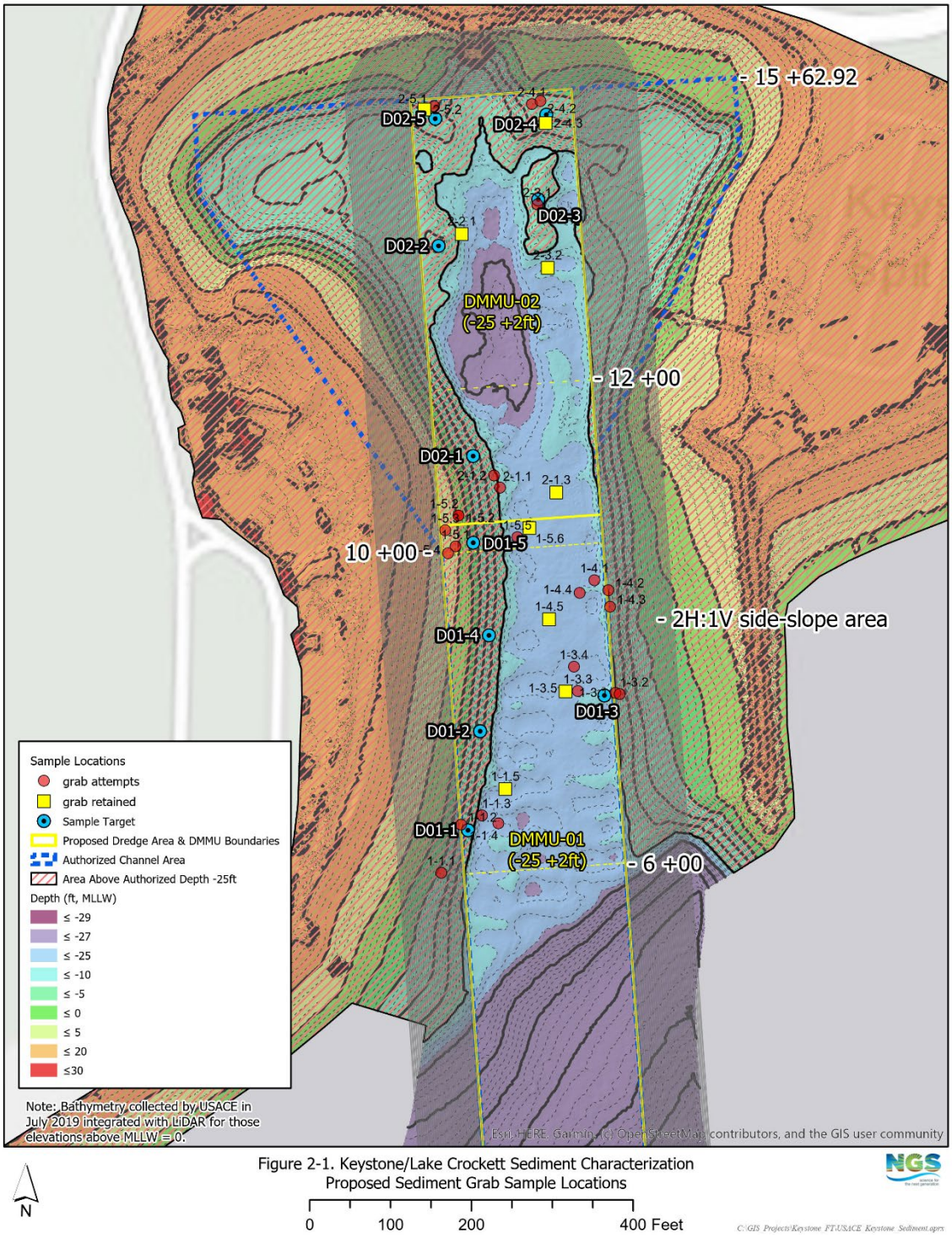


Figure 2-1. Keystone/Lake Crockett Sediment Characterization
Proposed Sediment Grab Sample Locations

N

0 100 200 400 Feet

C:\GIS_Projects\Keystone_FT\USACE_Keystone_Sediment.aprx

Source: Figure 2-1 of Keystone Harbor Data Report (NGS, 2020)