

MEMORANDUM FOR RECORD

SUBJECT: DETERMINATION ON THE SUITABILITY OF PROPOSED DREDGED MATERIAL TESTED FOR THE CRESCENT BAR RECREATIONAL IMPROVEMENT PROJECT (NWS-2010-1292) EVALUATED UNDER SECTION 404 OF THE CLEAN WATER ACT FOR EITHER IN-WATER OR UPLAND BENEFICIAL USE SITES.

1. The following summary reflects the consensus suitability determination of the Agencies that comprise the regional Dredged Material Management Program (DMMP) for the State of Washington on testing conducted for the Crescent Bar Recreational Improvement Project. This project is located on the east shoreline of the Columbia River at the approximate location of River Mile 440 (Vicinity Map: **Figure 1**). The project area encompasses the marina and boat ramp at 8894 Crescent Bar Road NW in Crescent Bar, Washington (**Figure 2**). The purpose of this characterization effort is to evaluate the sediment quality within the proposed dredging footprint within the project estimated at **57,800 cy** (previously 49,750 cy) for potential in-water beneficial reuse, or upland beneficial reuse and/or disposal.
2. **Table 1** documents the regulatory tracking information and dates for the DMMP testing.

Table 1. Regulatory Tracking Information and Dates

Initial SAP Addendum submittal date:	September 1, 2010
SAP approval date:	October 4, 2010
Sampling date(s):	February 8-10, 2011 March 11, 2011 (reference sample collection, Quilomene Bay)
Characterization Report submittal:	May 27, 2011
Volume Tested (# DMMUs), Sampling Method:	14,358 cy (revised: 40,500 cy); (3 DMMU); Untested volume: 35,392 cy (revised: 17,300 cy)(subsurface native gravel /cobble); Total volume: 49,750 cy (revised volume: 57,800 cy) Sonic Corer (9 core stations)
DAIS Tracking Number:	CBRIP-1-B-F-307
Recency Determination Date: Moderate to Low-Moderate = 5-7 years	February 2016-2018 (Moderate to Low-Moderate)

Project Area Development and Dredging History

3. Prior to 1963 the project area was upland used for agricultural (orchards) and rural residential purposes and several structures and orchards were present in the project area. In 1963, the area was razed and the channel was excavated forming Crescent Bar Island. The marina and navigation channel were excavated from the upland area prior to the water level being raised as

¹ This errata adjusts the volumes for each of the 3 DMMUs in Tables 1, 2 and 7 and paragraphs 1 and 17 based on design revisions.

part of the Wanapum Dam reservoir filling. Prior to excavation and raising of the water level, the upland area appears to have extended approximately 1,300 feet west of the existing shoreline. Based on the current elevations, approximately 20 to 25 feet of material was removed to create the marina and navigation channel to the Columbia River.

4. Chemicals including DDT, malathion and lead arsenate pesticides were identified to have been used on the orchards that formerly occupied the upland area or were adjacent to the upland area (GeoEngineers, 2009).
5. A ferry and associated dock structure were located near the southwest corner of the existing recreation vehicle RV campground prior to 1975. The current boat ramp, marina moorage, parking area and campground appear to have been constructed between 1975 and 1987 based on historical information (GeoEngineers, 2009).
6. The project area is located on the east shoreline of the present-day Columbia River. The entire project area (i.e., in-water dredge area as well as adjacent uplands) is mapped as gravel outbursts flood deposits (Shuster et al., 1997). Gravel outburst flood deposits are fluvial gravel deposits that are the result of repeated outburst floods of glacial Lake Missoula, and consist of sand to boulder-sized sediments present in various bedding forms. In the in-water portion of the project area, a thin layer of recently accumulated river-derived sediments overlay portions of the gravel outburst flood deposits.

Sampling and Characterization Background:

7. The SAP addendum was submitted on September 1, 2010, and approved by the DMMP agencies on October 4, 2010 (See **Table 1**). **Table 2** summarizes the characterization approach. The project has three proposed dredging subareas, and they are the swimming area ranked **low-moderate**, navigation channel ranked **low-moderate**, and marina and boat launch area ranked **moderate** for DMMP characterization purposes.
8. The stratigraphy within the in-water portion of the project area were observed during completion of eight borings completed in February 2010, which document surficial sediments consisting of finer grained sands and silts overlying a native gravel/cobble layer. Based on these observations sampling design pre-approved by the DMMP agencies consisted of collecting surficial sediments from the sand-silt layer for subsequent compositing within each of the nine sampling locations for compositing into 3 DMMUs as depicted in **Tables 2 and 3** and **Figure 3** with the sonic corer. Sampling depths were achieved with the sonic corer through the dredging prism at each location extending two feet into the Z-layer at each of the nine core locations.
9. **Figure 1** depicts the site vicinity and **Figure 2** depict the locations for the 3 sampling locations and nine stations occupied for the 2011 characterization effort within each of the 3 DMMUs. DMMU-1 within the Swimming area consisted of composited from 2 stations/samples collected with a Sonic corer; whereas DMMU-2 within the navigation channel consisted of compositing 4 station/samples; and DMMU-3 within the marina/boat launch area consisted of compositing 3 station/samples. Sampling with the sonic corer at all nine locations occurred between February 8-10, 2011 (see **Table 2, Table 3**). A reference sample was collected on March 11, 2011 in Quilomene Bay, located approximately 7.25 miles south of the Crescent Bar Recreational Improvement Project area (**Figure 3**).

10. The Data Characterization Report was submitted to the DMMP agencies for review on May 27, 2011. The DMMP agencies concluded, after reviewing the data validation report, that the data was acceptable for decision-making using best professional judgment.

Table 2. Characterization Approach for Crescent Bar Recreation Project

Area	DMMU*	Dredged Material Ranking	Estimated Volume of Dredge Material (revised volume), cy	Number of DMMU subsamples	Volume of Dredged Material represented by each tested DMMU, cy
Swimming Area	C1	Low-Moderate	6,500 (12,000)	2	3,250
Navigation Channel	C2	Low-Moderate	31,000 (31,600)	4	7,025
Marina & Boat Launch Area	C3	Moderate	12,250 (14,200)	3	4,083
Totals:	3 DMMUs		49,750 (57,800)	9	14,358

*DMMU = Dredged Material Management Unit

Table 3. Actual Sediment Sampling Locations (Crescent Bar Recreation Area)

DMMU ID	Core sample ID	Latitude*	Longitude*	Core Target Depth (ft bgs)	Dredge Prism Depth (ft bgs)	Z-Layer Depth Interval (feet bgs)
C1	1-1	47.21531	-119.33512	7	0 to 5	5 to 7
	1-2	47.21459	-119.99826	11	0 to 9	9 to 11
C2	2-1	47.214601	-119.998242	8	0 to 6	6 to 8
	2-2	47.214694	-119.997466	9	0 to 7	7 to 9
	2-3	47.214864	-119.996085	9	0 to 7	7 to 9
	2-4	47.214943	-119.995246	6	0 to 4	4 to 6
C3	3-1	47.215268	-119.99386	5.5	0 to 3.5	3.5 to 5.5
	3-2	47.21473	-119.99227	5.5	0 to 3.5	3.5 to 5.5
	3-3	47.214728	-119.992284	4.5	0 to 2.5	2.5 to 4.5

*NAD83 Coordinates; bgs = below ground surface

Chemical Testing Results:

11. The chemical testing results summary for the Crescent Bar project compared to DMMP freshwater and marine carbon-normalized guidelines is provided in **Table 4**. It demonstrates that for chemicals of concern no detected chemicals exceeded DMMP freshwater, or dry-weight marine guidelines, or bioaccumulation triggers, except Cadmium SL2 exceedances in DMMU-C2 (including duplicate sample) and DMMU-C3, and SL1 Zinc exceedances for DMMU-C2 (including duplicate sample) and DMMU-C3. Moreover, evaluation of these data relative to SMS guidelines, indicate that there were no detected Sediment Quality Standard (SQS) exceedances except as noted above for DMMU-C2 and DMMU-C3.
12. There were undetected carbon-normalized chemicals exceeding marine SL2 and SL2 guidelines, within DMMU-C1 (1,2,4-Trichlorobenzene, Hexachlorobenzene, and Butylbenzylphalate). Additionally, there were SL1 undetected exceedances of 1,2,4-Trichlorobenzene in DMMU-2 and DMMU-C3 (**Table 4**). All these chemicals were below the dry weight SL1 guidelines. Additionally for the carbon-normalized undetected exceedances in DMMU-C1, the TOC is below 0.5 % and was quantitated at 0.18%. The general convention when TOC is less than 0.5% is to utilize dry weight guidelines, as normalizing with low TOC may lead to false positive exceedances of guidelines. Based on DMMP review, the carbon-normalized SL1/SL2 exceedances within all three DMMUs were evaluated by DMMP as not being a concern using BPJ.

Table 4. Crescent Bar DMMP Characterization Summary

CHEMICAL NAME	Units	Sediment Quality Guidelines						Sample ID:	DMMU-1			DMMU-2			DMMU-2 (duplicate)			DMMU-3			DMMU-3 (duplicate)					
		Interim Freshwater						DMMU ID:	C1			C2			C3			C3								
		Marine Guidelines				(mg/kg-oc-normalized)			Depth (ft BGS)	0-11 ft			0-9 ft			0-5.5 ft			0-5.5 ft							
		Guidelines (dry wgt)		SL1 (dw)		SL2 (dw)		SL1 (oc)		SL2 (oc)	DMMP	mg/kg-dry wgt	mg/kg-OC	VQ	mg/kg-dry wgt	mg/kg-OC	VQ	mg/kg-dry wgt	mg/kg-OC	VQ	mg/kg-dry wgt	mg/kg-OC	VQ	mg/kg-dry wgt	mg/kg-OC	VQ
		SL1	SL2	SL1 (dw)	SL2 (dw)	SL1 (oc)	SL2 (oc)	BT (dry wgt)	DMMP	SMS		DMMP	SMS		DMMP	SMS		DMMP	SMS		DMMP	SMS				
Antimony		--	--	150	150							6.0		u	8.0		u	8.0		u	8.0		u	NA		
Arsenic	mg/kg	20	51.0	57	93			507.1				6.0		u	8.0			8.0			8.0		u	NA		
Cadmium	mg/kg	1.1	1.5	5.1	6.7			11.3				0.2		u	2.9			3.1			1.6		u	NA		
Chromium	mg/kg	95	100	260	270			267				14.2			25.9			26.8			16.0			NA		
Copper	mg/kg	80	830	390	390			1027				7.1			23.7			24.7			17.6			NA		
Lead	mg/kg	340	430	450	530			975				6.0			28.0			29.0			15.0			NA		
Mercury	mg/kg	0.28	0.75	0.0	0.59			1.5				0.03		u	0.06			0.060			0.03			NA		
Nickel	mg/kg	60	70	--	--			370				11.0			26.0			27.0			15.0			NA		
Selenium	mg/kg	--	--					3				0.60		u	0.8		u	0.8		u	0.7		u	NA		
Silver	mg/kg	2.0	2.5	6.1	6			6.1				0.4		u	0.5		u	0.5		u	0.5		u	NA		
Zinc	mg/kg	130	400	410	960			2783				40.0			266.0			278.0			164.0			NA		
ORGANIC CHEMICALS																										
Total LPAH	ug/kg	6,600	9,200	5,200	5,200	370	780					20.0	11.1	u	20.0	2.08	u	11.0	1.13	j	20.0	1.8	u	NA		
Naphthalene	ug/kg	500	1,300	2,100	2,100	99	170					20.0	11.1	u	20.0	2.08	u	20.0	2.06	u	20.0	1.8	u	NA		
Acenaphthylene	ug/kg	470	640	560	1,300	66	66					20.0	11.1	u	20.0	2.08	u	20.0	2.06	u	20.0	1.8	u	NA		
Acenaphthene	ug/kg	1,100	1,300	500	500	16	57					20.0	11.1	u	20.0	2.08	u	20.0	2.06	u	20.0	1.8	u	NA		
Fluorene	ug/kg	1,000	3,000	540	540	23	79					20.0	11.1	u	20.0	2.08	u	20.0	2.06	u	20.0	1.8	u	NA		
Phenanthrene	ug/kg	6,100	7,600	1,500	1,500	100	480					20.0	11.1	u	20.0	2.08	u	11.0	1.13	j	20.0	1.8	u	NA		
Anthracene	ug/kg	1,200	1,600	960	960.0	220	1200					20.0	11.1	u	20.0	2.08	u	20.0	2.06	u	20.0	1.8	u	NA		
2-Methylnaphthalene	ug/kg	470	560	670	670	38	64					20.0	11.1	u	20.0	2.08	u	20.0	2.06	u	20.0	1.8	u	NA		
Total HPAH	ug/kg	31,000	55,000	12,000	17,000	960	5300					20.0	11.1	u	58.0	6.04	j	65.0	6.70	j	20.0	1.8	u	NA		
Fluoranthene	ug/kg	11,000	15,000	1,700	2,500.0	160	1200	4600				20.0	11.1	u	14.0	1.46	j	16.0	1.65	j	20.0	1.8	u	NA		
Pyrene	ug/kg	8,800	16,000	2,600	3,300	1000	1400	11980				20.0	11.1	u	11.0	1.15	j	13.0	1.34	j	20.0	1.8	u	NA		
Benzo(a)anthracene	ug/kg	4,300	5,800	1,300	1,600	110	270					20.0	11.1	u	20.0	2.08	u	20.0	2.06	u	20.0	1.8	u	NA		
Chrysene	ug/kg	5,900	6,400	1,400	2,800	110	460					20.0	11.1	u	16.0	1.67	j	17.0	1.75	j	20.0	1.8	u	NA		
Total Benzo(b+k)fluoranthenes	ug/kg	600	4,000	3,200	3,600	230	450					20.0	11.1	u	17.0	1.77	j	19.0	1.96	j	20.0	1.8	u	NA		
Benzo(a)pyrene	ug/kg	3,300	4,800	1,600	1,600	99	210					20.0	11.1	u	20.0	2.08	u	20.0	2.06	u	20.0	1.8	u	NA		
Indeno(1,2,3-cd)pyrene	ug/kg	4,100	5,300	600	690	34	88					20.0	11.1	u	20.0	2.08	u	20.0	2.06	u	20.0	1.8	u	NA		
Dibenzo(a,h)anthracene	ug/kg	800	840	230	230	12	33					20.0	11.1	u	20.0	2.08	u	20.0	2.06	u	20.0	1.8	u	NA		
Benzo(g,h,i)perylene	ug/kg	4,000	5,200	670	720	31	78					20.0	11.1	u	20.0	2.08	u	20.0	2.06	u	20.0	1.8	u	NA		
1,3-Dichlorobenzene	ug/kg	--	--									0.9		u	1.2			NA			1.4		u	1.4		u
1,4-Dichlorobenzene	ug/kg	--	--	110	110.0	3.1	9					0.9	0.5	u	1.2	0.13	u	NA			1.4	0.1	u	1.4	0.13	u
1,2-Dichlorobenzene	ug/kg	--	--	35	50	2.3	2.3					0.9	0.5	u	1.2	0.13	u	NA			1.4	0.1	u	1.4	0.13	u
1,2,4-Trichlorobenzene	ug/kg	--	--	31	51	0.81	1.8					4.4	2.4	u	6.2	0.65	u	NA			7.2	0.7	u	7.2	0.67	u
Hexachlorobenzene (HCB)	ug/kg	--	--	22	70.0	0.38	2.3	168				0.97	0.5	u	0.98	0.10	u	NA			0.97	0.1	u	NA		
Dimethylphthalate	ug/kg	46	440	71	160	53	53					20.0	11.1	u	20.0	11.11	u	20.0	2.06	u	20.0	1.8	u	NA		
Diethylphthalate	ug/kg	--	--	200	200	61	110					20.0	11.1	u	20.0	2.08	u	20.0	2.06	u	20.0	1.8	u	NA		
Di-n-butylphthalate	ug/kg	--	--	1,400	1,400	220	1700					20.0	11.1	u	20.0	2.08	u	20.0	2.06	u	20.0	1.8	u	NA		
Butylbenzylphthalate	ug/kg	260	370	63	900	4.9	64					20.0	11.1	u	20.0	2.08	u	20.0	2.06	u	20.0	1.8	u	NA		
Bis(2-ethylhexyl)phthalate	ug/kg	220	320	1,300	1,900	47	78					20.0	11.1	u	10.0	1.04	j	20.0	2.06	u	13.0	1.2	j	NA		
Di-n-octylphthalate	ug/kg	26	45	6,200	6,200	58	4500					20.0	11.1	u	20.0	2.08	u	20.0	2.06	u	20.0	1.8	u	NA		
Phenol	ug/kg	--	--	420	1,200							20.0		u	20.0		u	20.0		u	20.0		u	NA		
2-Methylphenol	ug/kg	--	--	63	63							20.0		u	20.0		u	20.0		u	20.0		u	NA		
4-Methylphenol	ug/kg	--	--	670	670							20.0		u	20.0		u	20.0		u	20.0		u	NA		
2,4-Dimethylphenol	ug/kg	--	--	29	29							20.0		u	20.0		u	20.0		u	20.0		u	NA		
Pentachlorophenol	ug/kg	--	--	400	690							98.0		u	99.0		u	100.0		u	98.0		u	NA		
Benzyl alcohol	ug/kg	--	--	57	73							49.0		uj	20.0		j	22.0		j	49.0		uj	NA		
Benzoic acid	ug/kg	--	--	650	650							200.0		u	82.0		j	100.0		j	41.0		j	NA		
Dibenzofuran	ug/kg	400	440	540	540	15	58					20.0	11.1	u	20.0	2.08	u	20.0	2.06	u	20.0	1.8	u	NA		
Hexachloroethane	ug/kg	--	--	--	--	--	--					20.0		u	20.0		u	20.0		u	20.0		u	NA		
Hexachlorobutadiene	ug/kg	--	--	11	120	3.9	6.2					0.97	0.5	u	0.98	0.10	u	0.98	0.10	u	0.97	0.1	u	NA		
N-Nitrosodiphenylamine	ug/kg	--	--	28	40	11	11					20.0	11.1	u	20.0	2.08	u	20.0	2.06	u	20.0	1.8	u	NA		
Trichloroethene (DMMP*)	ug/kg	--	--	160	1,600							0.9		u	1.2		u	1.4		u	1.4		u	NA		
Tetrachloroethene (DMMP*)	ug/kg	--	--	57	210							0.9		u	1.2		u	1.4		u	1.4		u	NA		
Ethylbenzene (DMMP*)	ug/kg	--	--	10	50							0.9		u	1.2		u	1.4		u	1.4		u	NA		
Total Xylene (DMMP*)	ug/kg	--	--	40	160							0.9		u	1.2		u	1.4		u	1.4		u	NA		
Total DDT (sum of 4,4'-DDD, 4,4'-DDE and 4,4'-DDT)	ug/kg	--	--	--	--			50				1.9		u	11.1			12.4			8.8		j	NA		
p,p'-DDD	ug/kg	--	--	16	28							1.9		u	3.2			3.4			1.8		j	NA		
p,p'-DDE	ug/kg	--	--	9	9.3							1.9		u	7.9			9.0			7.0			NA		
p,p'-DDT	ug/kg	--	--	12	34							1.9		u	2.0		u	2.0		u	1.9		u	NA		
Aldrin	ug/kg	--	--	9.5	9.5							0.97		u	0.98		u	0.98		u	0.97		u	NA		
Chlordane	ug/kg	--	--	2.8	4.5			37				1.9		u	2.0		u	2.0		u	1.9		u	NA		
Dieldrin	ug/kg	--	--	1.9	3.5							1.9		u	2.0		u	2.0		u	1.9		u	NA		
Heptachlor	ug/kg	--	--	1.5	2.0							0.97		u	0.98		u	0.98		u	0.97		u	NA		
Alpha-BHC	ug/kg	--	--	--	--																					
Gamma-BHC (Lindane)	ug/kg	--	--	--	--							0.97		u	0.98		u	0.98		u	0.97		u	NA		
Total PCBs	ug/kg	60	120	130	1,000	12	65	38 (oc)																		

Table 4. Crescent Bar DMMP Characterization Summary

		Sediment Quality Guidelines				Sample ID: DMMU ID:	DMMU-1			DMMU-2			DMMU-2 (duplicate)			DMMU-3			DMMU-3 (duplicate)		
							C1			C2						C3			C3		
Total Organic Carbon	%						0.18			0.96			0.97			1.1			NA		
Total Ammonia	%						18.60			21.5			15.2			24.6			NA		
Total Sulfides	mg/kg						120		u	308			NA			944			NA		
Gravel	mg/kg						0.73			5.8			0.9			14.4					
Sand	%						94.7			50.4			52.0			61.3					
Silt	%																				
Clay	%																				
Fines (percent silt + clay)	%						4.6			44.6			47.1			24.3					
Freshwater Bioassays																					
<i>Hyalella azteca</i> (10-day survival)																					
<i>Chironomus tentans</i> (10-day survival/growth)																					
Bioassay Determination: (P/F)	%						NA			NA						PASS					
BTs exceeded:							No			No						No					
Bioaccumulation conducted:							No			No						No					
Bioaccumulation Determination: (P/F)																					
ML Rule exceeded:							No			No						No					
PSDDA Determination:							PASS			PASS (native)						PASS					
DMMU surficial tested volume	cy						3,250			7,025						4,083					
DMMU untested subsurface native volume:	cy						3,250			23,975						8,167					
DMMU total volume:	cy						6,500			31,000						12,250					
Rank (Low = L, Moderate = M, Low-Moderate =LM, High = H)							LM			LM						M					
Mean Core sampling depth (ft)	ft						9.0			8.0						5.2					
Maximum sampling depth (mudline) (with Z-sample)	ft						11.0			9.0						5.5					
DMMU ID:							DMMU-C1			DMMU-C2			DMMU-C2 (duplicate)			DMMU-C3			DMMU-C3 (duplicate)		

* Volatile Organic Compounds: No Feshwater/Marine SL1/SL2 guidelines; DMMP SL/MLs used to evaluate these data

BGS = Below Ground Surface

P = Pass (BPJ: Suitable for Beneficial Use)

SL1 or SQS = Guideline exceedance (undetected organic chemicals)

SL2 = Guideline exceedance (undetected organic chemicals)

VQ = Validation Qualifier

UCOWD = Unconfined open-water disposal

NA = Not applicable

U = undetected at the reporting limit

13. The applicant elected for DMMU-C2 with the elevated Cadmium, which were above MTCA Method A soil criteria for unrestricted land use (2 mg/kg-dry weight) and Zinc concentrations, to dredge and remove the surface fine-grained material separately from the underlying gravel and dispose of the surface material at an acceptable upland facility and reuse the underlying gravel material.
14. Due to the Cadmium SL2 exceedance and the Zinc SL1 exceedance in DMMU-C3, this DMMU was subjected to freshwater toxicity testing as described in paragraph 16.

Freshwater Bioassay Evaluation:

15. An archived sample of DMMU-C3 material was subjected to toxicity testing with *Chironomus dilutus* 10-day survival and growth bioassay (USEPA 2000 and ASTM 2000), and the *Hyalella azteca* 10-day survival bioassay (USEPA 2000 and ASTM 2000). Reference samples were collected from the Quilomene Wildlife Refuge Area located approximately 7.25 miles south of Crescent Bar project area, which is located on the east bank of the Columbia River as shown in **Figure 3**. The reference sample was selected using modified wet sieving protocol to match the grain size characteristics in DMMU-C3. Test chambers were aerated one day prior to test initiation after allowing sediments to settle in testing chambers. All tests met positive and negative control criteria, and bioassay test acceptability and test interpretation guidelines are summarized in **Table 5**. Tests were initiated on March 18, 2011 within the 8-week holding time requirement. The reference sediment met RSET acceptability criteria summarized in **Table 5** for both test species. The results of the testing are summarized in **Table 6**, and demonstrate that test sample DMMU-C3 exhibited a no-hit response relative to the RSET 1 test interpretation guidelines for **survival** and **Growth** for the *Chironomus dilutus* test. The testing results for the *Hyalla azteca* 10-day survival test demonstrated a no-hit response, with no significant difference in mortality expressed between test sediment and reference/control sediment.

Table 5. Freshwater Bioassay Quality Control/Assurance and Test Interpretation Guidelines.

Test Type	<i>Chironomus dilutus</i>	<i>Hyalella azteca</i>
Endpoint	Survival and Growth	Survival
Source	RSET 2009	RSET 2009
Test Interpretation Guidelines	<p>1-Hit Failure: mortality > reference mortality +25% and/or biomass <60% of reference biomass & significant difference</p> <p>2-Hit Failure: mortality > reference mortality + 15% &/or biomass <75% of reference biomass & significant difference</p>	<p>1-Hit failure: mortality > reference mortality + 25% & significant difference</p> <p>2-Hit failure: mortality > reference mortality + 10% & significant difference</p>
Reference criteria	≤35% mortality and ≥80% of final control growth	≤25% mortality
Control criteria	<p>Negative Control: ≤32% mortality & growth ≥0.48 mg/ind. Ash-free dry weight</p> <p>Positive Control: LC₅₀ within 2 standard deviations of historical mean</p>	<p>Negative Control: <20% mortality</p> <p>Positive Control: LC₅₀ within 2 standard deviations of historical mean</p>

Legend: LC₅₀ = Lethal Concentration for 50% of test organism

Table 6. Toxicity Testing Summary

Sample	<i>Chironomus dilutus</i>		<i>Hyalella aztecus</i>
	Percent Mortality (%)	Growth per Org. (mg) (Mean)	Percent Mortality (%)
Control	5 (Acceptable)	1.242 (Acceptable)	20 (Acceptable)
Reference (QWR*)	2.5 (Acceptable)	1.375 (Acceptable)	10 (Acceptable)
DMMU-C3	1.2 (No-Hit)**	1.528 (No-Hit)**	11.2 (No-Hit)**
Positive Control (LC50)	494.5 µg/L (Cu) Acceptable range: 0-1862 µg/L (Cu)		581.3 µg/L (Cu) Acceptable range: 0 – 678.0 µg/L (Cu)

*QWR = Quilamene Wildlife Refuge

**All treatments not statistically significant compared to reference sediment

16. The results for the three DMMUs are summarized in **Table 7**, and indicate that **36,600 cy** (previously 42,725 cy) of material is suitable for either upland or in-water beneficial use alternatives, and the surficial (1-4 ft) of fine-grained material within DMMU-C2, representing approximately **21,200 cy** (previously 7,025 cy) is not suitable for either upland or inwater beneficial reuse, and will be disposed of at an Ecology approved upland disposal site.

Table 7. Testing Summary for Crescent Bar Recreation Improvement Project*.

DMMU	Volume, cy (Revised Volume), cy	Upland/Inwater Beneficial Use	Reason for Determination
C1 (surface)	3,250 (9,000)	Suitable	Testing of Surficial layer
(subsurface)	3,250 (3,000)	Suitable	Untested native layer
Subtotal:	6,500 (12,000)		
C2 (surface: 1-4 ft)	7,025 (21,200)	Unsuitable	Cd above MTCA Method A unrestricted land use criteria
(subsurface)	23,975 (10,400)	Suitable	Untested native layer
Subtotal:	30,000 (31,600)		
C3 (surface)	4,083 (10,300)	Suitable	Testing (Chem +/-Bioassays)
(subsurface)	8,167 (3,900)	Suitable	Untested native layer
Subtotal:	12,250 (14,200)		
Totals:	7,025 cy (21,200) 42,725 cy (36,600)	Unsuitable Suitable	

- Revised errata volumes in parenthesis

Suitability Determination:

17. In summary, the results of these analyses indicate that **21,200** (previously 7,025) cy of surface material from DMMU-C2 is **unsuitable** for upland or in-water beneficial reuse, and will be disposed at an appropriate Ecology approved upland disposal site. The remainder of the material consisting of **36,600** (previously 42,725) cy of either surface material (DMMU-C1 and C3) or subsurface material underlying all three DMMUs is suitable for appropriate upland and/or in-water beneficial reuse alternatives.

18. This memorandum documents the suitability of material proposed for dredging from the Crescent Bar Recreational Improvement Area , Crescent Bar, Washington, for disposal at either an appropriate in-water or upland beneficial reuse disposal site. However, this suitability determination does not constitute final agency approval of the project. A dredging plan for this project must be completed as part of the final project approval process. 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.
-

References

GeoEngineers, 2009. Crescent Bar Phase 1 ESA

Schuster, J.E. Gulick, C.W.; Reidel, S.P.; Fecht, K.R., & Zurenko, S. (1997). Geologic Map of Washington – Southeast Quadrant. Washington State Department of Natural Resources. Geologic Map GM-45

SUBJECT: DETERMINATION ON THE SUITABILITY OF PROPOSED DREDGED MATERIAL TESTED FOR THE CRESCENT BAR RECREATIONAL IMPROVEMENT PROJECT (NWS-2010-1292) EVALUATED UNDER SECTION 404 OF THE CLEAN WATER ACT FOR EITHER IN-WATER OR UPLAND BENEFICIAL USE SITES.

Signed SDM on File in DMMO Project File

Concur:

Date David Kendall, Ph.D., Seattle District Corps of Engineers

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

Date Justine Barton, Environmental Protection Agency, Region 10

Date Celia Barton., Washington Department of Natural Resources

Copies Furnished:

- Tim Erkel, Regulatory Project Manager
- Laura Inouye, Ph.D., Ecology
- Justine Barton, EPA
- Celia Barton, DNR
- DMMO File

SUBJECT: DETERMINATION ON THE SUITABILITY OF PROPOSED DREDGED MATERIAL TESTED FOR THE CRESCENT BAR RECREATIONAL IMPROVEMENT PROJECT (NWS-2010-1292) EVALUATED UNDER SECTION 404 OF THE CLEAN WATER ACT FOR EITHER IN-WATER OR UPLAND BENEFICIAL USE SITES.

Concur:

7/12/2012
Date

David R. Kendall
David Kendall, Ph.D., Seattle District Corps of Engineers

07/12/2012
Date

Laura Inouye
Laura Inouye, Ph.D., Washington Department of Ecology

7/12/2012
Date

Justine S. Barton
Justine Barton, Environmental Protection Agency, Region 10

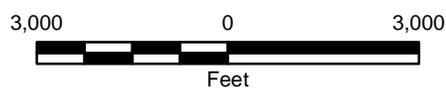
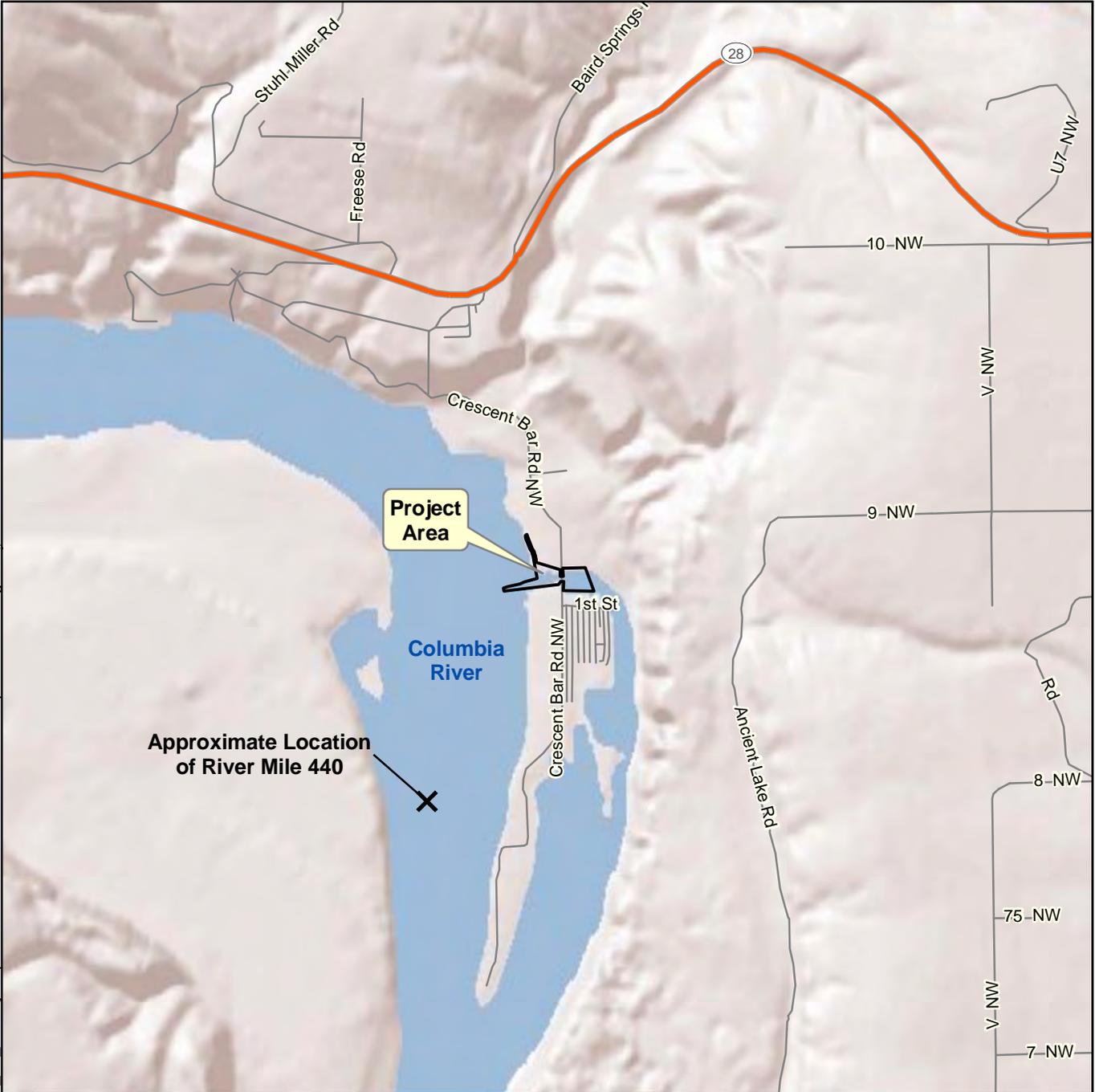
7/12/12
Date

Celia Barton
Celia Barton., Washington Department of Natural Resources

Copies Furnished:

Tim Erkel, Regulatory Project Manager
Laura Inouye, Ph.D., Ecology
Justine Barton, EPA
Celia Barton, DNR
DMMO File

Office: TAC Path: P:\2\164024\00\GIS\2\16402400T200_F1_VicinityMap.mxd Map Revised: August 5, 2010 TSD:KKS:TCK:CRC:KKS



Notes:
 1. The locations of all features shown are approximate.
 2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
 3. It is unlawful to copy or reproduce all or any part thereof, whether for personal use or resale, without permission.

Data Sources: ESRI Data & Maps, Street Maps 2005.
 Transverse Mercator, Zone 10 N North, North American Datum 1983
 North arrow oriented to grid north

Vicinity Map	
Crescent Bar Recreational Improvements Project Crescent Bar, Washington	
	Figure 1

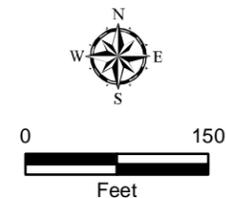


- Notes:
1. The locations of all features and sampling locations shown are approximate.
 2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
 3. It is unlawful to copy or reproduce all or any part thereof, whether for personal use or resale, without permission.

Data Sources: 2006 Aerial photograph from ESRI.

Washington State Plane South, North American Datum 1983
North arrow oriented to grid north

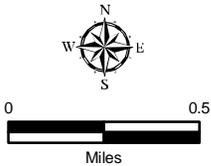
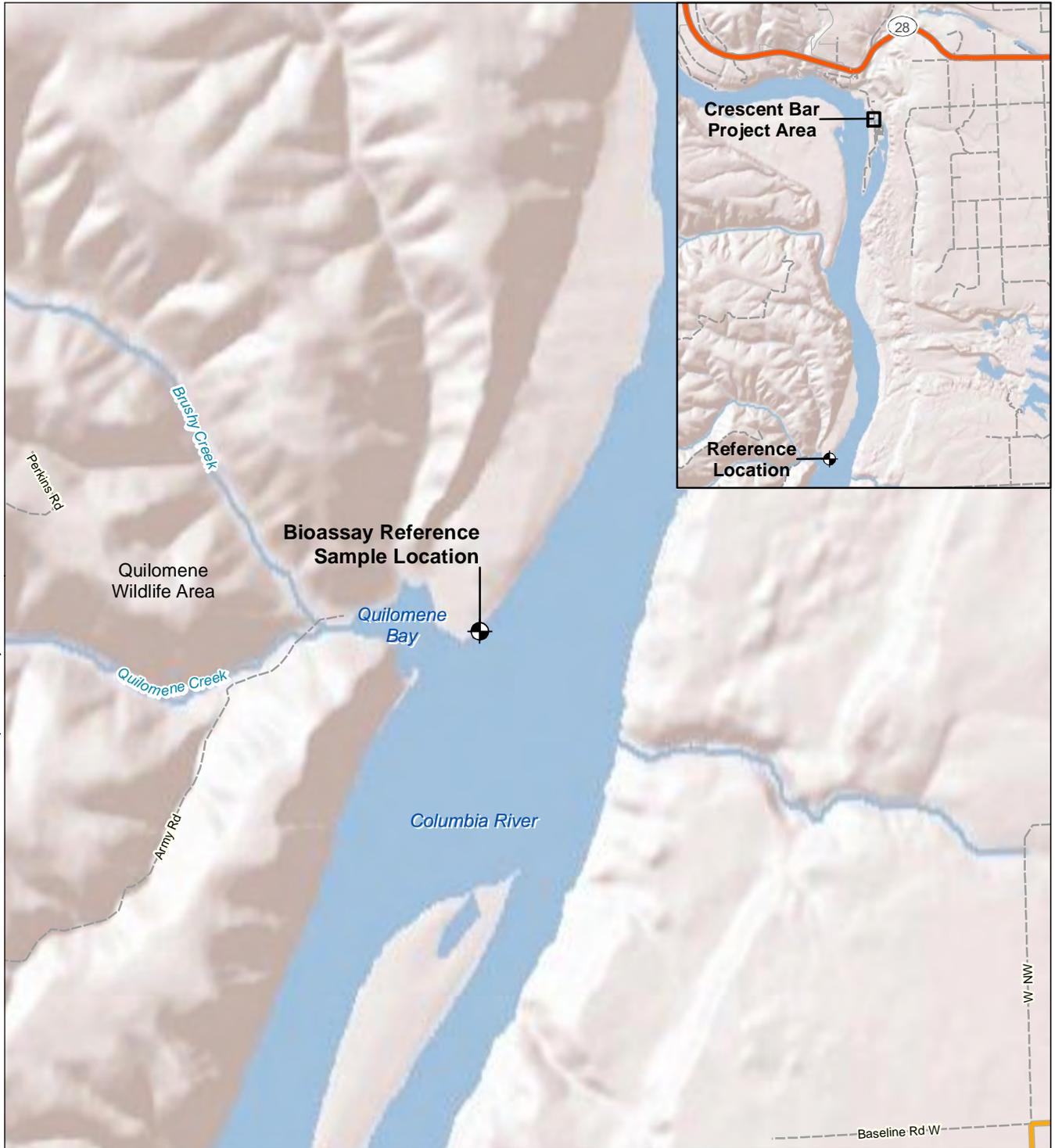
- Actual Sampling Location
 - Planned Sampling Location
- Dredge Material Management Units**
- DMMU 1
 - DMMU 2
 - DMMU 3
 - Contours (1-foot interval)



Dredge Material Management Units (DMMUs) and Sampling Locations	
Crescent Bar Recreational Improvements Project Crescent Bar, Washington	
	Figure 2

Map Revised: May 6, 2011 AMM

Path: P:\2\2164024\GIS\216402400_T500_Fig3.mxd
Office: TAC



Reference: NAD 1983 UTM Zone 10N
 Data Source: ESRI Shaded Relief, 2009, ESRI Street Map

Notes:
 1. The locations of all features shown are approximate.
 2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Bioassay Reference Sample Location

Crescent Bar Recreational Improvements Project
 Crescent Bar, Washington



Figure 3