CENWS-ODS-DM

MEMORANDUM FOR RECORD December 1, 2017

SUBJECT: DETERMINATION REGARDING THE SUITABILITY OF PROPOSED DREDGED MATERIAL FROM THE COLUMBIA BUSINESS CENTER, VANCOUVER, WASHINGTON – EVALUATED UNDER SECTION 404 OF THE CLEAN WATER ACT – FOR UNCONFINED FLOW-LANE DISPOSAL IN THE COLUMBIA RIVER.

1. Introduction. This memorandum reflects the consensus determination of the Dredged Material Management Program (DMMP) agencies (U.S. Army Corps of Engineers, Washington Departments of Ecology and Natural Resources, and the Environmental Protection Agency) regarding the suitability of 36,688 cubic yards (cy) of dredged material from the Columbia Business Center (CBC) for flow-lane disposal in the Columbia River.

2. Background. The proposed project involves dredging at four sites including two barge slips (an East slip and West slip), a shipway ramp, and a barge/ship berth on the Columbia River (see Figure 1). These four sites serve the marine-dependent uses at the CBC. Ongoing marine-dependent commerce includes moorage, loadouts, repairs and fabrication. Maintenance dredging is necessary to maintain safe navigation access and required depths in the barge slips and barge/ship berth; to maintain required depths for safe launching and removal of barges and vessels along an existing ramp at the shipway site (Cardno, 2016). The dredged material will either be transloaded and hauled to an upland disposal site located at CBC or placed in the flow lane of the Columbia River.

   A Tier 1 evaluation was provided in the sampling and analysis plan (SAP) and included a site history and documentation of past characterization data (Cardno, 2016). There were no detected exceedances of current freshwater screening levels in sediment testing conducted in 1999 and 2008, although not all chemicals on the current list of chemicals of concern (COCs) were analyzed.

3. Project Summary. Table 1 includes project summary and tracking information.

Table 1. Project Summary

Project ranking	Low-moderate
Characterized volume, including a 25% contingency factor	Total: 36,688 cy Barge/Ship Berth: 10,875 cy West Barge Slip: 17,875 cy Shipway: 438 cy East Barge Slip: 7,500 cy
Design maintenance depth (feet) relative to the Columbia River Datum (CRD), with overdredge depth in parentheses	Barge/Ship Berth: -15 (-17) West Barge Slip: -10 (-12) Shipway: 0 to -4 (-2 to -6) East Barge Slip: -10 (-12)
Draft SAP received	October 5, 2016
Draft SAP returned for revisions	October 12, 2016
Revised SAP received	October 26, 2016

Revised SAP returned for revisions	November 4, 2016
Final SAP received	November 14, 2016
Final SAP approved	November 15, 2016
Sampling dates	November 15-16, 2016
Draft data report received	June 7, 2017
Draft report returned for revisions	June 22, 2017
Revised data report received	August 31, 2017
Revised report returned for revisions	September 12, 2017
Final report received	November 2, 2017
DMMO Tracking number	COLBC-A-385-16
EIM Study ID	COLBC16
USACE Permit Application Number	TBD
Recency Determination (low-moderate rank = 6 years)	November 2022

4. Project Ranking and Sampling Requirements. CBC is ranked "low-moderate" (Cardno, 2016). The minimum numbers of field samples and dredged material management units (DMMUs) for a low-moderate ranked project with heterogeneous sediment were calculated using the guidelines in effect at the time (DMMP, 2015):
   - Maximum volume of sediment represented by each field sample = 8,000 cubic yards
   - Maximum volume of sediment represented by each surface DMMU = 32,000 cubic yards.

   Based on these guidelines, the following numbers of field samples and DMMUs were required:

Dredging Area	Volume (cy)	field samples	DMMUs
Barge/Ship Berth	10,875	2	1
West Barge Slip	17,875	3	1
Shipway	438	1	1
East Barge Slip	7,500	1	1

5. Sampling. Sampling took place November 15-16, 2016 using a vibracore sampler. Table 2 provides the sampling data. Difficulties were encountered in all four DMMUs, as documented in Cardno (2017). Following is a brief summary of the sampling effort:

   DMMU 1 (barge/ship berth; Figure 2). Refusal occurred at Station 1A due to cobbles and gravel; a Z-sample was not recovered. The target location of Station 1B was inaccessible at the time of sampling due to the presence of a dry dock. This station was moved to a location where the mudline elevation was below the design depth.

   DMMU 2 (west barge slip; Figure 3). The target locations for Stations 2A and 2B were in shallow water, which limited the ability to drive a core of adequate length due to the height of the sampling vessel's A-frame. In addition, refusal was encountered at both stations, likely due to densely compacted sand. A third sampling station (2C) was added, in deeper water. A Z-sample was collected at this station; however the units used during sampling (U.S. survey feet) differed from the units used during the bathymetric

survey (international feet). This resulted in the "Z-sample" having been taken from the dredge prism, not the Z-layer.

DMMU 3 (shipway; Figure 4). The mudline elevation at Station 3 was a foot below the design depth. Therefore, the sample collected was from the overdepth, not the design prism. A Z-sample was successfully collected.

DMMU 4 (east barge slip; Figure 5). Multiple attempts were made at both Station 4A and 4B with refusal at similar elevations each time. Refusal was due to cobble and gravel. No Z-samples could be collected in DMMU 4.

6. Grain Size, Sediment Conventional and Chemical Analysis. Grain-size results (Table 3) show that the sediment collected for analysis was primarily sand, with the fines content ranging from 4.9% in DMMU 1 to 26.7% in DMMU 3. DMMU 4 also included a significant gravel fraction (17.5%). However, as discussed in the previous section of this memorandum, cobbles and gravel were encountered at depth in DMMUs 1 and 4. Therefore, the laboratory results do not totally reflect the sediment conditions existing at CBC.

   Sediment conventional and chemical results are shown in Table 4. The total organic carbon content was relatively low, ranging from 0.16% in DMMU 1 to 0.78% in DMMU 2. The total solids content was uniformly high, reflecting the generally coarse nature of the sediment. Sulfides concentrations were low. Ammonia was to be analyzed per the SAP, but was inadvertently not analyzed.

   COC concentrations were compared to the DMMP freshwater guidelines. There were no detected exceedances of the Screening Level 1 (SL1) values for any of the chemicals. Detection limits for non-detected COCs were all below SL1. Dioxins/furans were not required to be analyzed, due to existing data in the area showing that these chemicals were not of concern for this project.

   Based on the evaluation of the chemical data, bioassay testing was not required for the dredged material. All four DMMUs met suitability guidelines, based on chemistry alone, for flow-lane disposal in the Columbia River.

7. Biological Testing. No bioassays or bioaccumulation testing were required.

8. Suitability Determination. This memorandum documents the evaluation of the suitability of sediment proposed for dredging from the Columbia Business Center in Vancouver for flow-lane disposal. A critical assumption underlying the evaluation is that the samples collected are representative of the material that will be dredged. Given the sampling difficulties and resulting deviations from the sampling plan discussed previously, the DMMP agencies spent considerable time evaluating the representativeness of the samples, especially in DMMU 1. Following are the results of that evaluation on a DMMU-by-DMMU basis:

   DMMU 1 (barge/ship berth). Three sampling attempts were made at Station 1A, with cobbles and gravel encountered approximately four feet below mudline. The sample collected from this station was completely within the dredge prism and was described as very fine sand with a biological layer on top. The sample from Station 1B, while collected at a mudline elevation that was deeper than the proposed dredge depth, was similar to that at Station 1A, being described as very fine sand over a layer of rocks. Only the top foot of sediment from Station 1B was included in the composite, thereby avoiding the introduction of deeper native material into the composite. The similarity in the description of the substrate at Stations 1A and 1B was reflected in the grain-size results for the composite from these stations, which

was 95% sand. The evidence suggests a layer of cobble overlain by sand throughout the DMMU. The DMMP agencies considered the samples collected to be representative of the general conditions in DMMU 1.

In addition to the general representativeness of samples from Stations 1A and 1B of conditions in DMMU 1, a second issue was the location of Station 1B in relation to the dry dock. In a response to DMMP agency comments on the draft data report, Cardno indicated that the dry dock is owned by JT Marine, who leases the area around DMMU 1 from CBC. The dry dock has been in the vicinity of DMMU 1 since approximately 2007. It is used for a variety of ship repair and maintenance activities. The target location for Station 1B was inadvertently placed under the dry dock, which made it inaccessible during sampling. Instead, the sample at Station 1B was taken adjacent to the dry dock. While the sample collected from 1B was not within the initial dredge prism, the DMMP agencies considered it likely that any contaminants originating from repair and maintenance activities on the dry dock would have been found both under and adjacent to the dry dock. The collected sample was, therefore, considered representative of conditions in the vicinity of the dry dock.

In summary, the DMMP agencies consider the composite created from samples taken at Stations 1A and 1B to be representative of the dredge prism in DMMU 1 and, therefore, an acceptable basis for making a suitability determination for this DMMU.

<u>DMMU 2 (west barge slip)</u>. The samples collected and composited from the three stations in DMMU 2 were all taken from the proposed dredge prism, albeit not to its full depth. Refusal at Stations 2A and 2B, described in the report as “likely due to compacted sand”, prevented full penetration. The sediment collected from these two stations for compositing was described as fine sand. A discrepancy in the units used by the surveyor and the sampling team resulted in the core collected at Station 2C also falling short of full penetration of the dredge prism. However, the recovered core at 2C did extend nearly to the design depth. The core collected from Station 2C was described as fine sand transitioning to sandy silt. Results from the grain-size analysis of the composited sample from DMMU 2 were consistent with the field descriptions of the cores, with fine sand predominating. The fines fraction was approximately 22%. While none of the recovered core sections used in the composite extended fully to the bottom of the overdepth, the available evidence indicates that DMMU 2 is largely sand, with a relatively small fraction of silt. The DMMP agencies consider the composite created from samples at Stations 2A, 2B and 2C to be representative of the dredge prism and acceptable for decision-making.

<u>DMMU 3 (shipway)</u>. The discrepancy in units discussed previously resulted in an alteration of the boundary of required dredging in DMMU 3. As a result, both the target and actual sampling locations ended up outside the revised dredge prism. The sediment characterization report indicated that, based on the current bathymetry, it is unlikely that DMMU 3 will require dredging in the immediate future. Therefore, while the sample collected from Station 3 was outside what was called the “limits of initial dredging”, the DMMP agencies consider it representative of sediment conditions in the shipway and the type of material that may be dredged in the future.

<u>DMMU 4 (east barge slip)</u>. A total of seven attempts were made to collect sediment from Stations 4A and 4B, but refusal due to cobble and gravel was encountered in each attempt. However, the core lengths included in the composite sample extended from mudline into the overdepth and were, therefore, considered representative samples of the dredge prism.

Antidegradation evaluation. Sediment exposed by dredging must either meet the State of Washington Sediment Quality Standards (SQS) (Ecology, 2013) or the State's antidegradation standard (DMMP, 2008). Comparison of the proposed dredged material to SQS serves as a first-tier indicator for this purpose. The DMMP freshwater SL1 concentrations are equivalent to the Sediment Cleanup Objectives (SCOs) under the Sediment Management Standards (SMS). The SCOs are functionally equivalent to SQS. For this project, chemical concentrations in the dredged material were all below SCO. In addition, cobbles and gravel were encountered in deeper sediment in DMMUs 1 and 4. Hydrophobic COCs, such as PAHs, PCBs and pesticides, sorb strongly to finer-grained sediment. The absence of fine-grained sediment at depth is predictive of low concentrations of COCs. Similarly, sand was encountered at depth in DMMU 2. This type of material is also at low risk for contamination. In summary, there is no reason to believe that the sediment to be exposed by dredging is of lesser quality than the existing sediment surface. Therefore, the DMMP agencies have determined that the antidegradation standard has been met for this project.

Based on the results of the previously described testing and the evaluation of the representativeness of the samples collected for analysis, the DMMP agencies conclude that **all 36,688 cubic yards proposed for dredging are suitable** for flow-lane disposal in the Columbia River. Upland disposal would require further consultation with Ecology's Solid Waste Management office and the local health district.

A pre-dredge conference call with DNR, Ecology and the Corps of Engineers will be required. A dredging quality control plan must be developed and submitted to the Corps of Engineers Regulatory Branch Project Manager for this project at least 7 days prior to the pre-dredge conference call. This plan must include: the equipment and vessels to be used, operational controls to ensure dredging accuracy, disposal location, spill control and response measures, water quality monitoring, contingency plans in the event water quality standards are exceeded, debris management, personnel and responsibilities, dredging and disposal schedule, report submittals, agency contact information and coordination procedures. Debris is to be disposed at an upland location. The dredging and disposal quality control plan must be approved by the U.S. Army Corps of Engineers, Washington State Department of Natural Resources and the Washington State Department of Ecology prior to commencement of open-water disposal.

9. References.

Cardno, 2016. *Columbia Business Center Maintenance Dredging Sediment Sampling and Analysis Plan*. Prepared by Cardno for FC Services, LLC, November 14, 2016.

Cardno, 2017. *Columbia Business Center Maintenance Dredging Sediment Characterization Report*. Prepared by Cardno for FC Services, LLC, October 31, 2017.

DMMP, 2008a. *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, 2015. *Dredged Material Evaluation and Disposal Procedures (User Manual)*. Dredged Material Management Program, November 2015.

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

10. Agency Signatures.

Concur:

The signed copy is on file in the Dredged Material Managment Office.

_____ _____
Date David Fox, P.E. - Seattle District Corps of Engineers

_____ _____
Date Erika Hoffman - Environmental Protection Agency

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

_____ _____
Date Celia Barton - Washington Department of Natural Resources

Copies furnished:

DMMP signatories
Danette Guy, Corps Regulatory
Kim Gould, Cardno
Janet Wuestneck, FC Services, LLC

Table 2 Sampling penetration and recovery depths (Cardno, 2017)

DMMU sample	Design depth, overdredge, z-sample bottom elevation below CRD at target location	Estimated mudline elevation at target location in relation to CRD[a]	Estimated mudline elevation at actual location in relation to CRD	Measured water depth (ft)	Gauge height above CRD (ft)	Mudline elevation at actual location in relation to CRD (ft)	Penetration (ft)	Recovery (ft)	% Recovery	Penetration depth below CRD (ft)	Recovery elevation below CRD (ft)
DMMU 1A	-15, -17, -19	-7.6	-8.2	9.5	5.3	-4.2	4	3	75%	-8.2	-7.2
DMMU 1B	-15, -17, -19	-15.7	-21.8	25.6	5.3	-20.3	9.5	7.9	83%	-29.8	-28.2
DMMU 2A	-10, -12, -14	5.1	4.3	3.8	6.8	3	11.2	6	54%	-8.2	-3
DMMU 2B	-10, -12, -14	2.2	2.1	5	6.1	1.1	11	7.3	66%	-9.9	-6.2
DMMU 2C[b]	-10, -12, -14	-5.1	-5.1	10	5.8	-4.2	8	5.66	71%	-12.2	-9.86
DMMU 3	-1.2, -3.2, -5.2	-1.2	-3.3	7.9	5.7	-2.2	8	5.5	69%	-10.2	-7.7
DMMU 4A	-10, -12, -14	-8.9	-9.7	14	4.8	-9.2	3	1.7	57%	-12.2	-10.9
DMMU 4B	-10, -12, -14	-7.9	-8.2	13.8	5.8	-8	4	2.5	63%	-12	-10.5

[a] Mudline elevations differ from SAP estimates due to horizontal shift in bathymetry due to unit error (i.e, target coordinates did not change, but underlying bathymetry was realigned).

[b] Additional sample location at 2C added during field events.

Table 3 Grain size (% total weight of sample) (Cardno, 2017)

Grain Size	DMMU 1	DMMU 2	DMMU 3	DMMU 4
Gravel, Medium	1.42	0.00	0.00	8.57
Gravel, Fine	2.18	0.04	0.08	8.96
Sand, Very Coarse	7.26	0.22	0.61	14.34
Sand, Coarse	17.09	0.61	2.42	18.96
Sand, Medium	23.26	13.88	6.81	23.97
Sand, Fine	40.55	55.78	42.01	15.73
Sand, Very Fine	3.36	4.72	18.63	2.61
Silt	3.47	17.75	23.02	10.13
Clay	1.43	4.19	3.63	2.33

Table 4 DMMP sediment conventionals and chemicals of concern (Cardno, 2017)

Chemical of Concern	Fresh-water Guide-lines	DMMU 1			DMMU 2			DMMU 3			DMMU 4		
	SL1	MDL	MRL	Results	MDL	MRL	Results	MDL	MRL	Results	MDL	MRL	Results
Conventionals													
Total organic carbon (%)	---	---	0.050	**0.164**	---	0.050	**0.784**	---	0.050	**0.480**	---	0.05	**0.206**
Total solids (%)	---	---	---	**74.1**	---	---	**71.1**	---	---	**69.5**	---	---	**74.6**
Total sulfides (mg/kg)	---	0.8	2.6	**2.7**	0.8	2.7	**7.4**	2.2	7.0	**21.3**	0.8	2.6	**6.1**
Total volatile solids (%)	---	---	0.010	**1.20**	---	0.010	**2.70**	---	0.010	**2.20**	---	0.010	**1.40**
METALS (mg/kg dry weight)													
Arsenic	**14**	0.02	0.26	**1.76**	0.02	0.28	**4.04**	0.02	0.29	**2.93**	0.02	0.28	**2.24**
Cadmium	**2.1**	0.004	0.010	**0.203**	0.004	0.011	**0.661**	0.004	0.011	**0.407**	0.004	0.011	**0.198**
Chromium	**72**	0.03	0.10	**8.22**	0.03	0.11	**13.2**	0.03	0.11	**13.9**	0.03	0.11	**10.1**
Copper	**400**	0.021	0.052	**8.09**	0.022	0.056	**13.8**	0.023	0.057	**13.7**	0.023	0.057	**9.39**
Lead	**360**	0.010	0.026	**4.79**	0.011	0.028	**10.5**	0.011	0.029	**11.3**	0.011	0.028	**5.22**
Mercury	**0.66**	0.003	0.025	**0.017 J**	0.003	0.026	**0.046**	0.003	0.028	**0.057**	0.003	0.026	**0.032**
Nickel	**38**	0.02	0.10	**8.59**	0.02	0.11	**13.6**	0.02	0.11	**12.4**	0.02	0.11	**8.92**
Selenium	**11**	0.04	0.52	**0.07 J**	0.04	0.56	**0.14 J**	0.04	0.57	**0.14 J**	0.04	0.57	**0.09 J**
Silver	**0.57**	0.002	0.010	**0.022**	0.002	0.011	**0.053**	0.002	0.011	**0.044**	0.002	0.011	**0.023**
Zinc	**3,200**	0.10	0.26	**52.0**	0.11	0.28	**95.3**	0.11	0.29	**99.2**	0.11	0.28	**45.6**
ORGANOMETALLIC COMPOUNDS (bulk; µg/kg)													
Tributyltin ion	**47**	0.57	1.4	**ND**	0.60	1.4	**ND**	0.61	1.5	**2.1**	0.58	1.4	**1.0 J**
Monobutyltin ion	**540**	0.35	1.4	**ND**	0.37	1.4	**ND**	0.37	1.5	**0.65 J**	0.35	1.4	**ND**
Dibutyltin ion	**910**	0.26	1.4	**ND**	0.27	1.4	**ND**	0.27	1.5	**0.48 J**	0.26	1.4	**0.37 J**
Tetrabutyltin ion	**97**	0.58	1.4	**ND**	0.61	1.4	**ND**	0.62	1.5	**ND**	0.59	1.4	**ND**
PAHs (µg/kg dry weight)													
Naphthalene	---	2.9	6.7	**ND**	2.9	7.0	**13**	2.9	7.2	**3.0 J**	2.9	6.7	**ND**

Table 4 DMMP sediment conventionals and chemicals of concern (Cardno, 2017)

Chemical of Concern	Fresh-water Guide-lines	DMMU 1			DMMU 2			DMMU 3			DMMU 4		
	SL1	MDL	MRL	Results	MDL	MRL	Results	MDL	MRL	Results	MDL	MRL	Results
Acenaphthylene	---	2.6	6.7	**ND**	2.6	7.0	**3.2 J**	2.6	7.2	**ND**	2.6	6.7	**ND**
Acenaphthene	---	3.2	6.7	**ND**	3.2	7.0	**ND**	3.2	7.2	**ND**	3.2	6.7	**ND**
Fluorene	---	3.3	6.7	**ND**	3.3	7.0	**ND**	3.3	7.2	**ND**	3.3	6.7	**ND**
Phenanthrene	---	3.6	6.7	**ND**	3.6	7.0	**11**	3.6	7.2	**8.6**	3.6	6.7	**ND**
Anthracene	---	3.2	6.7	**ND**	3.2	7.0	**ND**	3.2	7.2	**ND**	3.2	6.7	**ND**
2-Methylnaphthalene	---	2.8	6.7	**ND**	2.8	7.0	**ND**	2.8	7.2	**ND**	2.8	6.7	**ND**
Total LPAH	---	---	---	**ND**	---	---	**27.2 J**	---	---	**11.6 J**	---	---	**ND**
Fluoranthene	---	3.7	6.7	**4.0 J**	3.7	7.0	**12**	3.7	7.2	**22**	3.7	6.7	**4.9 J**
Pyrene	---	3.7	6.7	**ND**	3.7	7.0	**7.9**	3.7	7.2	**15**	3.7	6.7	**ND**
Benz(a)anthracene	---	3.6	6.7	**ND**	3.6	7.0	**ND**	3.6	7.2	**11**	3.6	6.7	**ND**
Chrysene	---	4.1	6.7	**ND**	4.1	7.0	**4.9 J**	4.1	7.2	**15**	4.1	6.7	**ND**
Benzo(b)fluoranthene	---	3.4	6.7	**4.3 J**	3.4	7.0	**5.1 J**	3.4	7.2	**17**	3.4	6.7	**4.2 J**
Benzo(k)fluoranthene	---	4.0	6.7	**ND**	4.0	7.0	**ND**	4.0	7.2	**5.9 J**	4.0	6.7	**ND**
Benzofluoranthenes (b,j,k)	---	---	---	**4.3 J**	---	---	**5.1 J**	---	---	**22.9 J**	---	---	**4.2 J**
Benzo(a)pyrene	---	3.6	6.7	**ND**	3.6	7.0	**5.2 J**	3.6	7.2	**14**	3.6	6.7	**ND**
Indeno(1,2,3-c,d)pyrene	---	3.2	6.7	**ND**	3.2	7.0	**ND**	3.2	7.2	**12**	3.2	6.7	**ND**
Dibenz(a,h)anthracene	---	3.0	6.7	**ND**	3.0	7.0	**ND**	3.0	7.2	**ND**	3.0	6.7	**ND**
Benzo(g,h,i)perylene	---	3.7	6.7	**ND**	3.7	7.0	**4.3 J**	3.7	7.2	**13**	3.7	6.7	**ND**
Total HPAH	**---**	**---**	---	**8.3 J**	**---**	---	**39.4 J**	**---**	---	**124.9 J**	**---**	---	**9.1 J**
Total PAHs	**17,000**	**---**	---	**8.3 J**	**---**	---	**66.6 J**	**---**	---	**136.5 J**	**---**	---	**9.1 J**
CHLORINATED HYDROCARBONS (µg/kg dry weight)													
β-Hexachlorocyclohexane	**7.2**	0.18	0.68	**ND**	0.18	0.71	**0.22 JP**	0.18	0.72	**0.27 JP**	0.18	0.67	**ND**
PHTHALATES (µg/kg dry weight)													
Di-n-butyl phthalate	**380**	4.8	14	**6.4 J**	4.8	14	**7.5 J**	4.8	15	**7.3 J**	4.8	14	**5.4 J**

Total PAHs are the sum of naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, 1-methylnaphthalene, 2-methylnaphthalene, anthracene, benzofluoranthenes, fluoranthene, pyrene, benz(a)anthracene, chrysene, benzo(a)pyrene, indeno(1,2,3-c,d)pyrene, dibenz(a,h)anthracene and benzo(g,h,i)perylene.

Table 4 DMMP sediment conventionals and chemicals of concern (Cardno, 2017)

Chemical of Concern	Fresh-water Guide-lines	DMMU 1			DMMU 2			DMMU 3			DMMU 4		
	SL1	MDL	MRL	Results	MDL	MRL	Results	MDL	MRL	Results	MDL	MRL	Results
Bis(2-ethylhexyl) phthalate	**500**	8.9	67	**ND**	8.9	70	**ND**	8.9	72	**28 J**	8.9	67	**16 J**
Di-n-octyl phthalate	**39**	3.2	6.7	**ND**	3.2	7.0	**ND**	3.2	7.2	**ND**	3.2	6.7	**ND**
PHENOLS (µg/kg dry weight)													
Phenol	**120**	3.1	21	**ND**	3.1	21	**ND**	3.1	22	**ND**	3.1	20	**ND**
4-Methylphenol	**260**	4.5	6.7	**ND**	4.5	7.0	**34**	4.5	7.2	**ND**	4.5	6.7	**ND**
Pentachlorophenol	**1,200**	5.3	67	**ND**	5.3	70	**ND**	5.3	72	**ND**	5.3	67	**ND**
MISCELLANEOUS EXTRACTABLES (µg/kg dry weight)													
Benzoic acid	**2,900**	96	270	**ND**	96	280	**ND**	96	290	**ND**	96	270	**ND**
Dibenzofuran	**200**	3.4	6.7	**ND**	3.4	7.0	**ND**	3.4	7.2	**ND**	3.4	6.7	**ND**
Carbazole	**900**	3.8	6.7	**ND**	3.8	7.0	**ND**	3.8	7.2	**ND**	3.8	6.7	**ND**
PESTICIDES & PCBs (µg/kg dry weight)													
2,4'-DDD and 4.4'-DDD	**310**	0.11	0.68	**0.34 JP**	0.11	0.71	**2.14 JP**	0.11	0.72	**0.35 JP**	0.11	0.67	**0.17 JP**
2,4'-DDE and 4,4'-DDE	**21**	0.13	0.68	**ND, i**	0.11	0.71	**0.62 JP**	0.11	0.72	**0.26 J**	0.11	0.67	**ND**
2,4'-DDT and 4,4'-DDT	**100**	1.4	1.4	**ND, i**	0.27	0.71	**0.15 JP**	0.55	0.72	**ND, i**	0.50	0.67	**ND, i**
Dieldrin	**4.9**	0.083	0.68	**0.17 JP**	0.083	0.71	**ND**	0.14	0.72	**ND i**	0.083	0.67	**0.10 J**
Endrin ketone	**8.5**	0.20	0.68	**ND i**	0.076	0.71	**ND**	0.076	0.72	**ND**	0.076	0.67	**ND**
Total PCBs (Aroclors)	**110**	2.1	6.8	**15**	2.1	7.1	**6.20 J**	2.1	7.2	**5.7 J**	2.1	6.7	**5.3 J**
BULK PETROLEUM HYDROCARBONS (mg/kg)													
TPH – Diesel	**340**	1.6	34	**6.9 J**	1.6	33	**33 J**	1.7	35	**8.4 J**	1.6	32	**8.4 J**
TPH – Residual	**3,600**	3.9	140	**38 J**	3.9	140	**120 J**	4.1	140	**24 J**	3.7	130	**24 J**

MDL – method detection limit; MRL – method reporting limit; PCB – polychlorinated biphenyl; TPH – total petroleum hydrocarbon.

Total chlordane is the sum of cis-chlordane, trans-chlordane, cis-nonachlor, trans-nonachlor and oxychlordane.
Total PCBs is the sum of the following Aroclor 1016, 1221, 1232, 1242, 1248, 1254, and 1260.

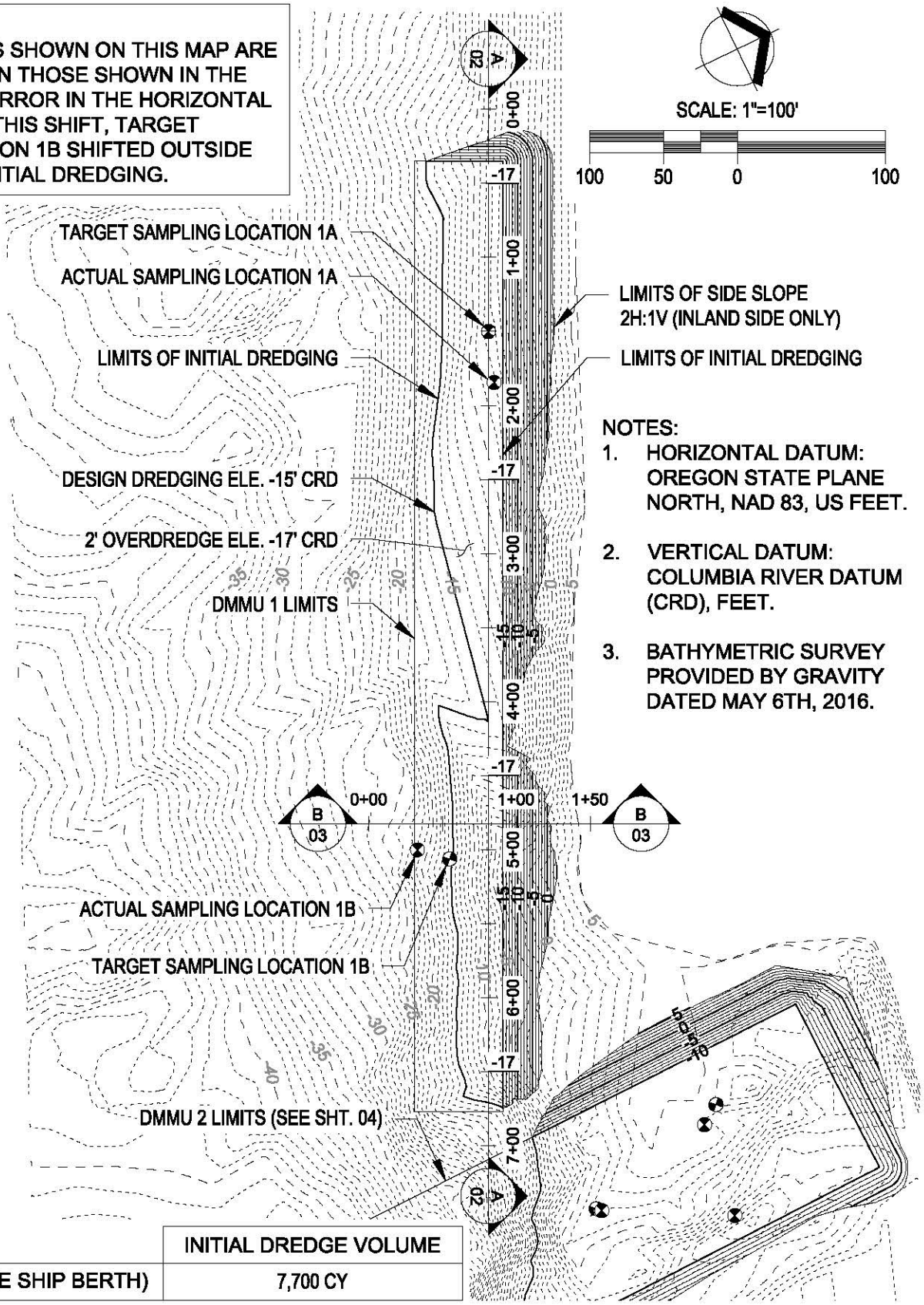
Data qualifiers:

J – Result is an estimated value.
P – The GC or HPLC confirmation criteria was exceeded. The relative percent difference is greater than 40% between the two analytical results.
i – For metals and inorganics: MRL/MDL is elevated due to a matrix interference; for organics - MRL/MDL is elevated due to a chromatographic interference.
ND – The analyte was analyzed for, but was not detected at or above the MDL.

Figure 1. Columbia Business Center Site

Figure 2

NOTE:
CONTOUR LINES SHOWN ON THIS MAP ARE DIFFERENT THAN THOSE SHOWN IN THE SAP DUE TO A ERROR IN THE HORIZONTAL UNITS. DUE TO THIS SHIFT, TARGET SAMPLE LOCATION 1B SHIFTED OUTSIDE OF LIMITS OF INITIAL DREDGING.



NOTES:

1. HORIZONTAL DATUM: OREGON STATE PLANE NORTH, NAD 83, US FEET.
2. VERTICAL DATUM: COLUMBIA RIVER DATUM (CRD), FEET.
3. BATHYMETRIC SURVEY PROVIDED BY GRAVITY DATED MAY 6TH, 2016.

	INITIAL DREDGE VOLUME
DMMU 1 (BARGE SHIP BERTH)	7,700 CY

Cardno
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DMMU 1 (Barge Ship Berth) - Plan View
CBC Dredge Project

FC Services, LLC
Vancouver, Washington

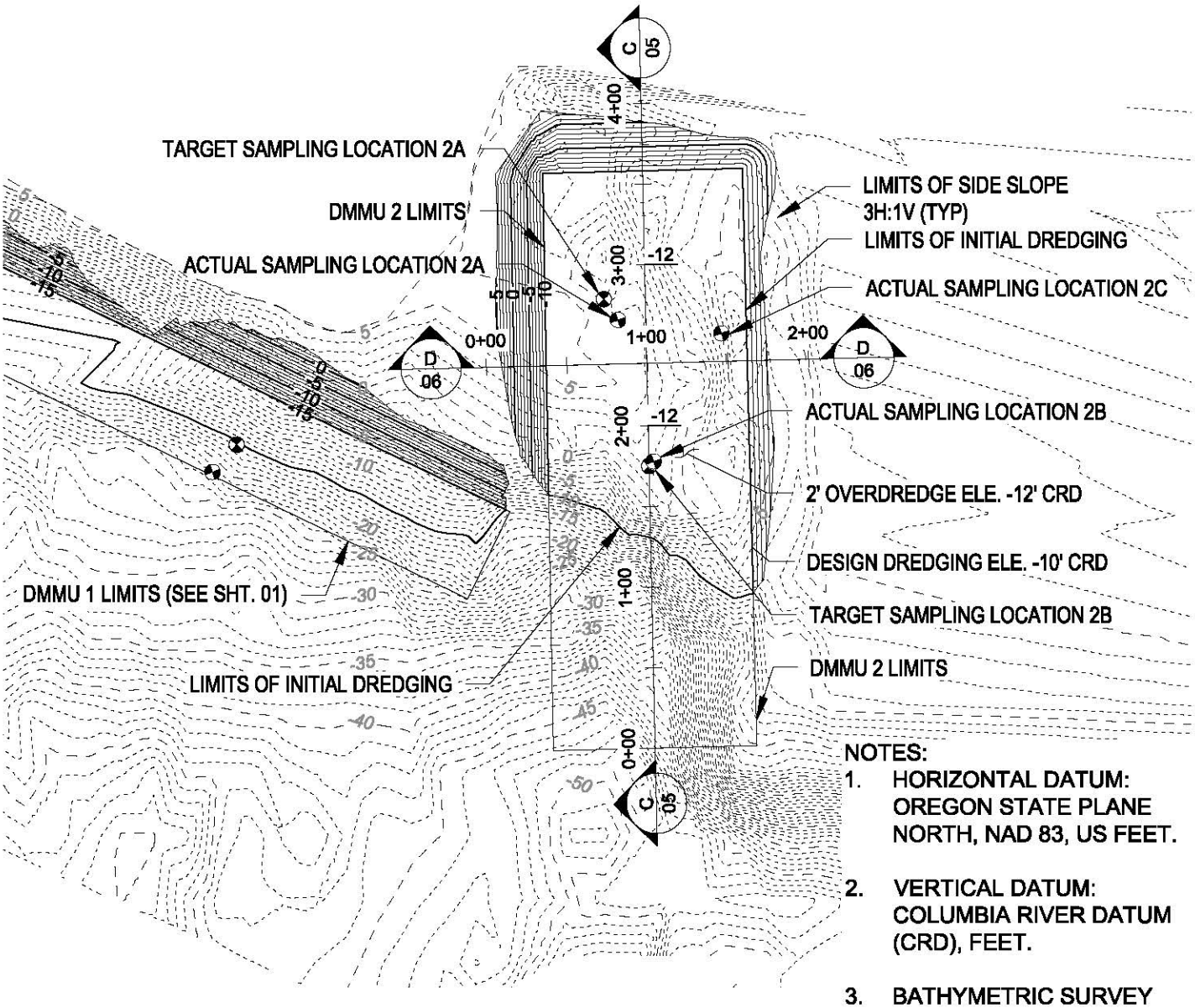
PROJECT NO.	E316200700
DATE:	10/27/2017
BY:	ND
SCALE:	1" = 100'
SHEET NO.	01

Figure 3

	INITIAL DREDGE VOLUME
DMMU 2 (WEST BARGE SLIP)	15,000 CY

SCALE: 1"=100'

100 50 0 100



NOTES:

1. HORIZONTAL DATUM: OREGON STATE PLANE NORTH, NAD 83, US FEET.
2. VERTICAL DATUM: COLUMBIA RIVER DATUM (CRD), FEET.
3. BATHYMETRIC SURVEY PROVIDED BY GRAVITY DATED MAY 6TH, 2016.

NOTE:
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DMMU 2 (West Barge Slip) - Plan View
CBC Dredge Project

FC Services, LLC
Vancouver, Washington

PROJECT NO.	E316200700
DATE:	10/27/2017
BY:	ND
SCALE:	1" = 100'
SHEET NO.	04

Figure 4

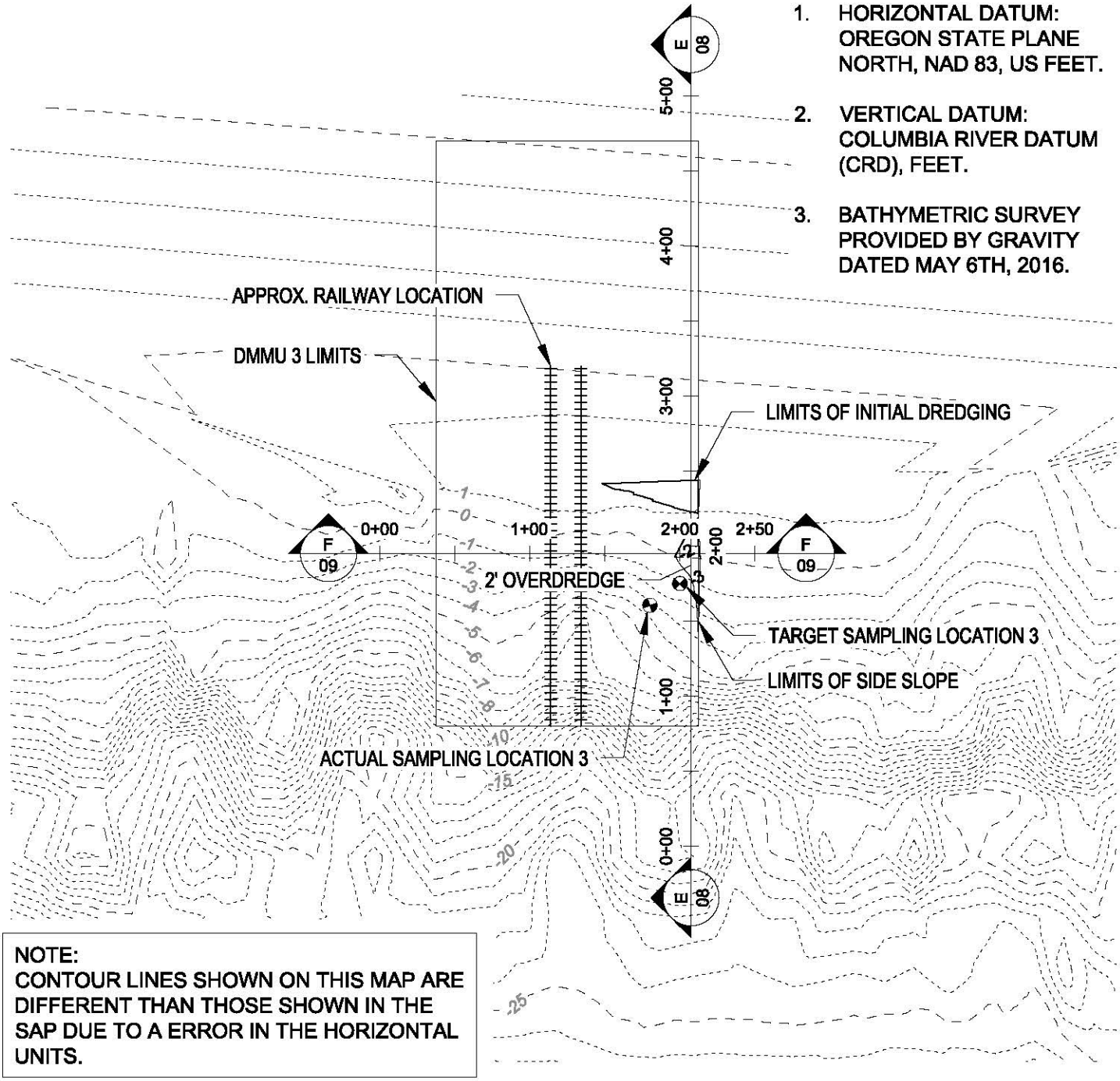
	INITIAL DREDGE VOLUME
DMMU 3 (SHIPWAY)	200 CY

SCALE: 1"=100'

100 50 0 100

NOTES:

1. HORIZONTAL DATUM: OREGON STATE PLANE NORTH, NAD 83, US FEET.
2. VERTICAL DATUM: COLUMBIA RIVER DATUM (CRD), FEET.
3. BATHYMETRIC SURVEY PROVIDED BY GRAVITY DATED MAY 6TH, 2016.



NOTE:
CONTOUR LINES SHOWN ON THIS MAP ARE DIFFERENT THAN THOSE SHOWN IN THE SAP DUE TO A ERROR IN THE HORIZONTAL UNITS.

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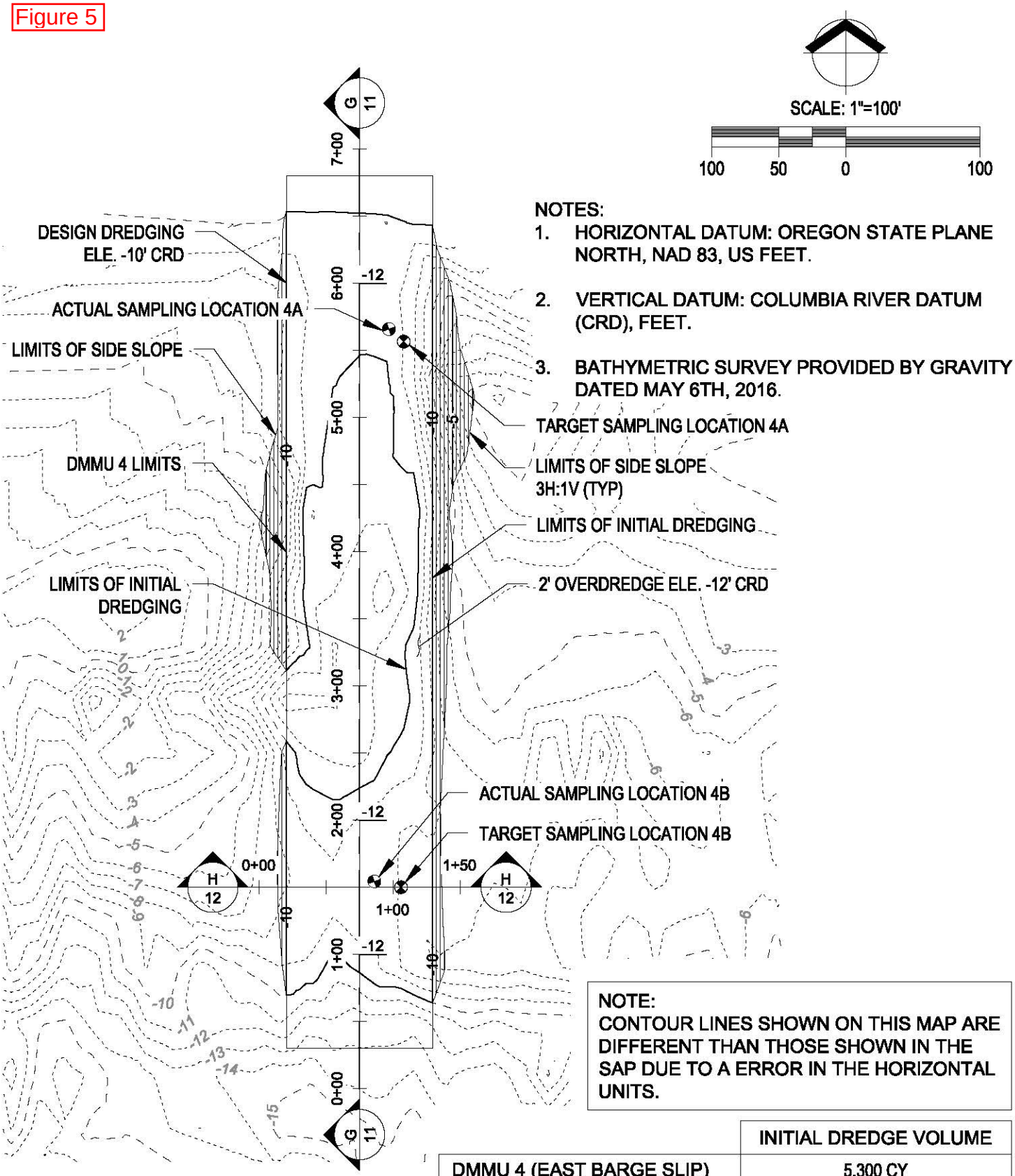
DMMU 3 (Shipway) - Plan View
CBC Dredge Project

FC Services, LLC
Vancouver, Washington

PROJECT NO.	E316200700
DATE:	10/27/2017
BY:	ND
SCALE:	1" = 100'
SHEET NO.	07

Figure 5



NOTES:

1. HORIZONTAL DATUM: OREGON STATE PLANE NORTH, NAD 83, US FEET.
2. VERTICAL DATUM: COLUMBIA RIVER DATUM (CRD), FEET.
3. BATHYMETRIC SURVEY PROVIDED BY GRAVITY DATED MAY 6TH, 2016.

NOTE:
CONTOUR LINES SHOWN ON THIS MAP ARE DIFFERENT THAN THOSE SHOWN IN THE SAP DUE TO A ERROR IN THE HORIZONTAL UNITS.

	INITIAL DREDGE VOLUME
DMMU 4 (EAST BARGE SLIP)	5,300 CY

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DMMU 4 (East Barge Slip) - Plan View
CBC Dredge Project

FC Services, LLC
Vancouver, Washington

PROJECT NO.	E316200700
DATE:	10/27/2017
BY:	ND
SCALE:	1" = 100'
SHEET NO.	10