LABORATORY DATA CONSULTANTS, INC.
2701 Loker Ave. West, Suite 220, Carlsbad, CA 92010 Bus: 760-827-1100 Fax: 760-827-1099

Windward Environmental, LLC
200 West Mercer Street, Suite 401
Seattle, WA 98119
ATTN: Amara Vandervort
amarav@windwardenv.com

December 7, 2020

SUBJECT: Duwamish AOC4, Data Validation

Dear Ms. Vandervort,

Enclosed are the final validation reports for the fractions listed below. This SDG was received on November 23, 2020. Attachment 1 is a summary of the samples that were reviewed for each analysis.

LDC Project #49779:

SDG #	**Fraction**
20K0074	Polychlorinated Biphenyls, Wet Chemistry

The data validation was performed under Stage 2B guidelines. The analyses were validated using the following documents, as applicable to each method:

- Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation; May 2020
- USEPA National Functional Guidelines for Organic Superfund Methods Data Review; January 2017
- USEPA National Functional Guidelines for Inorganic Superfund Methods Data Review; January 2017
- EPA SW 846, Third Edition, Test Methods for Evaluating Solid Waste, update 1, July 1992; update IIA, August 1993; update II, September 1994; update IIB, January 1995; update III, December 1996; update IIIA, April 1998; IIIB, November 2004; update IV, February 2007; update V, July 2014

Please feel free to contact us if you have any questions.

Sincerely,

Pei Geng

Pei Geng
pgeng@lab-data.com
Project Manager/Senior Chemist

554 pages-ADV

Attachment 1

Stage 2B/4 (client Select) EDD

LDC #49779 (Windward Environmental, LLC - Seattle WA / Duwamish AOC4)

LDC	SDG#	DATE REC'D	(3) DATE DUE	PCBs (8082A)		TOC (9060A)		Total Solids (2540G)																											
Matrix:	Water/Sediment			W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S
A	20K0074	11/23/20	12/16/20	0	13	0	13	0	13																										
Total	J/PG			0	13	0	13	0	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	39

Shaded cells indicate Stage 4 validation (all other cells are Stage 2B validation). These sample counts do not include MS/MSD, and DUPs

L:\Windward\Duwamish\49779ST.wpd

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: December 7, 2020

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20K0074

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS103	20K0074-01	Sediment	06/30/20
LDW20-SS104	20K0074-02	Sediment	06/30/20
LDW20-SS111	20K0074-03	Sediment	06/30/20
LDW20-SS114	20K0074-04	Sediment	06/30/20
LDW20-SS115	20K0074-05	Sediment	06/30/20
LDW20-SS118	20K0074-06	Sediment	06/30/20
LDW20-SS119	20K0074-07	Sediment	06/30/20
LDW20-SS120	20K0074-08	Sediment	06/30/20
LDW20-SC134	20K0074-09	Sediment	06/24/20
LDW20-SS145	20K0074-10	Sediment	06/30/20
LDW20-IT147	20K0074-11	Sediment	06/25/20
LDW20-SC153A	20K0074-12	Sediment	06/26/20
LDW20-SC207A	20K0074-13	Sediment	06/23/20
LDW20-SS103MS	20K0074-01MS	Sediment	06/30/20
LDW20-SS103MSD	20K0074-01MSD	Sediment	06/30/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Organic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Polychlorinated Biphenyls (PCBs) by Environmental Protection Agency (EPA) SW 846 Method 8082A

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all compounds.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for all compounds.

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

VII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

VIII. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits with the following exceptions:

SRM ID	Column	Compound	%R (Limits)	Associated Samples	Flag	A or P
Blk0288-SRM1	1C	Aroclor-1260	197 (38-167)	All samples in SDG 20K0074	J (all detects)	A
Blk0288-SRM1	2C	Aroclor-1260	218 (38-167)	All samples in SDG 20K0074	J (all detects)	A

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Compound Quantitation

Raw data were not reviewed for Stage 2B validation.

XI. Target Compound Identification

Raw data were not reviewed for Stage 2B validation.

XII. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to SRM %R, data were qualified as estimated in thirteen samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable.

Duwamish AOC4
Polychlorinated Biphenyls - Data Qualification Summary - SDG 20K0074

Sample	Compound	Flag	A or P	Reason
LDW20-SS103 LDW20-SS104 LDW20-SS111 LDW20-SS114 LDW20-SS115 LDW20-SS118 LDW20-SS119 LDW20-SS120 LDW20-SC134 LDW20-SS145 LDW20-IT147 LDW20-SC153A LDW20-SC207A	Aroclor-1260	J (all detects)	A	Standard reference materials (%R)

Duwamish AOC4
Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 20K0074

No Sample Data Qualified in this SDG

Duwamish AOC4
Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 20K0074

No Sample Data Qualified in this SDG

LDC #: 49779A3b

SDG #: 20K0074

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 12/2/20

Page: 1 of 1

Reviewer: F

2nd Reviewer:

METHOD: GC Polychlorinated Biphenyls (EPA SW846 Method 8082A)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	
II.	Initial calibration/ICV	A, A	RSD ≤ 20%. RRF ≥ 20%
III.	Continuing calibration	A	CCV ≤ 50%
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Surrogate spikes	A	
VII.	Matrix spike/Matrix spike duplicates	A	
VIII.	Laboratory control samples 1 SRM	A/SW	LCS
IX.	Field duplicates	N	
X.	Compound quantitation/RL/LOQ/LODs	N	
XI.	Target compound identification	N	
XII.	Overall assessment of data	A	

Note:
A = Acceptable
N = Not provided/applicable
SW = See worksheet
ND = No compounds detected
R = Rinsate
FB = Field blank
D = Duplicate
TB = Trip blank
EB = Equipment blank
SB=Source blank
OTHER:

	Client ID	Lab ID	Matrix	Date
1	LDW20-SS103	20K0074-01	Sediment	06/30/20
2	LDW20-SS104	20K0074-02	Sediment	06/30/20
3	LDW20-SS111	20K0074-03	Sediment	06/30/20
4	LDW20-SS114	20K0074-04	Sediment	06/30/20
5	LDW20-SS115	20K0074-05	Sediment	06/30/20
6	LDW20-SS118	20K0074-06	Sediment	06/30/20
7	LDW20-SS119	20K0074-07	Sediment	06/30/20
8	LDW20-SS120	20K0074-08	Sediment	06/30/20
9	LDW20-SC134	20K0074-09	Sediment	06/24/20
10	LDW20-SS145	20K0074-10	Sediment	06/30/20
11	LDW20-IT147	20K0074-11	Sediment	06/25/20
12	LDW20-SC153A	20K0074-12	Sediment	06/26/20
13	LDW20-SC207A	20K0074-13	Sediment	06/23/20
14	LDW20-SS103MS	20K0074-01MS	Sediment	06/30/20
15	LDW20-SS103MSD	20K0074-01MSD	Sediment	06/30/20
16				
17	BK0288			

LDC #: 49779A-2b

VALIDATION FINDINGS WORKSHEET
Laboratory Control Samples (LCS)

Page: 1 of 1
Reviewer: 9

METHOD: ✓ **GC** __ **HPLC**

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Were a laboratory control samples (LCS) and laboratory control sample duplicate (LCSD) analyzed for each matrix in this SDG?

Y N N/A Were the LCS percent recoveries (%R) and relative percent differences (RPD) within the QC limits?

Level IV/D Only

Y N N/A Was an LCS analyzed every 20 samples for each matrix or whenever a sample extraction was performed?

#	LCS/LCSD ID	Compound	LCS %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
	BIK0288-SRM1	Aroclor 1260 (PC)	197 (38-167)	( )	( )	All (dets)	dets/A
		↓	218 (↓)	( )	( )		↓
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
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Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Duwamish AOC4

LDC Report Date: December 7, 2020

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): 20K0074

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LDW20-SS103	20K0074-01	Sediment	06/30/20
LDW20-SS104	20K0074-02	Sediment	06/30/20
LDW20-SS111	20K0074-03	Sediment	06/30/20
LDW20-SS114	20K0074-04	Sediment	06/30/20
LDW20-SS115	20K0074-05	Sediment	06/30/20
LDW20-SS118	20K0074-06	Sediment	06/30/20
LDW20-SS119	20K0074-07	Sediment	06/30/20
LDW20-SS120	20K0074-08	Sediment	06/30/20
LDW20-SC134	20K0074-09	Sediment	06/24/20
LDW20-SS145	20K0074-10	Sediment	06/30/20
LDW20-IT147	20K0074-11	Sediment	06/25/20
LDW20-SC153A	20K0074-12	Sediment	06/26/20
LDW20-SC207A	20K0074-13	Sediment	06/23/20
LDW20-SS103MS	20K0074-01MS	Sediment	06/30/20
LDW20-SS103DUP1	20K0074-01DUP1	Sediment	06/30/20
LDW20-SS103DUP2	20K0074-01DUP2	Sediment	06/30/20

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Lower Duwamish Waterway Quality Assurance Project Plan for Remedial Design of Upper Reach: Pre-Design Investigation (May 2020) and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following methods:

Total Organic Carbon by Environmental Protection Agency (EPA) SW 846 Method 9060A
Total Solids by Standard Method 2540G

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Initial Calibration

All criteria for the initial calibration of each method were met.

III. Continuing Calibration

Continuing calibration frequency and analysis criteria were met for each method when applicable.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the methods. No contaminants were found in the laboratory blanks with the following exceptions:

Blank ID	Analyte	Maximum Concentration	Associated Samples
ICB/CCB	Total organic carbon	0.02%	All samples in SDG 20K0074

Data qualification by the laboratory blanks was based on the maximum contaminant concentration in the laboratory blanks in the analysis of each analyte. The sample concentrations were either not detected or were significantly greater than the concentrations found in the associated laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits.

VII. Duplicate Sample Analysis

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits.

VIII. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) were analyzed as required by the methods. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the methods. The results were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

XI. Overall Assessment of Data

The analysis was conducted within all specifications of the methods. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable.

Duwamish AOC4
Wet Chemistry - Data Qualification Summary - SDG 20K0074

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 20K0074

No Sample Data Qualified in this SDG

Duwamish AOC4
Wet Chemistry - Field Blank Data Qualification Summary - SDG 20K0074

No Sample Data Qualified in this SDG

LDC #: 49779A6

SDG #: 20K0074

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 12-2-20

Page: 1 of 1

Reviewer: [illegible]

2nd Reviewer:

METHOD: (Analyte) TOC (EPA SW846 9060A), Total Solids (SM 2540G)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A/A	Frozen
II	Initial calibration	A	
III.	Calibration verification	A	
IV	Laboratory Blanks	SW	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	A	
VII.	Duplicate sample analysis	A	
VIII.	Laboratory control samples	A/A	LCS, SRM
IX.	Field duplicates	N	
X.	Sample result verification	N	
XI	Overall assessment of data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

	Client ID	Lab ID	Matrix	Date
1	LDW20-SS103	20K0074-01	Sediment	06/30/20
2	LDW20-SS104	20K0074-02	Sediment	06/30/20
3	LDW20-SS111	20K0074-03	Sediment	06/30/20
4	LDW20-SS114	20K0074-04	Sediment	06/30/20
5	LDW20-SS115	20K0074-05	Sediment	06/30/20
6	LDW20-SS118	20K0074-06	Sediment	06/30/20
7	LDW20-SS119	20K0074-07	Sediment	06/30/20
8	LDW20-SS120	20K0074-08	Sediment	06/30/20
9	LDW20-SC134	20K0074-09	Sediment	06/24/20
10	LDW20-SS145	20K0074-10	Sediment	06/30/20
11	LDW20-IT147	20K0074-11	Sediment	06/25/20
12	LDW20-SC153A	20K0074-12	Sediment	06/26/20
13	LDW20-SC207A	20K0074-13	Sediment	06/23/20
14	LDW20-SS103MS	20K0074-01MS	Sediment	06/30/20
15	LDW20-SS103DUP1	20K0074-01DUP 1	Sediment	06/30/20
16	↓ Dup2	↓ 2		
17				

Sample Specific Element Reference

Reviewer:CR

All elements are applicable to each sample as noted below.

Sample ID	Target Analyte List
1 to 13	Total solids, TOC
QC:	
14	TOC
15	TOC, TS
16	TS

VALIDATION FINDINGS WORKSHEET

Laboratory Blank Contamination (PB/ICB/CCB)

Reviewer:CR

METHOD: Inorganics

Soil preparation factor applied (if applicable):

Sample Concentration, unless otherwise noted: % Associated Samples: All

				Sample Identification								
Analyte	**PB (%)**	**Maximum ICB/CCB (%)**	**Action Level**	No qual								
TOC		0.02	0.02									

Comments: The listed analyte concentrtaion is the highest ICB or CCB detected in the analysis. The action level, when applicable, is establisec