Appendix E Adjacent Property Analytical Information

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Table E-1. 1985 S Nevada St storm drain sediment solid sample results

Chemical (mg/kg)	Measured Concentration	SQS	CSL
Cadmium	12.3	5.1	6.7
Chromium	1,790E	260	270
Lead	1,330	450	530
Zinc	654E	410	960

Source: Ecology (2004)
CSL – cleanup screening level
E – estimated value
mg/kg – milligram per kilogram
SQS – sediment quality standard

Table E-2. Summary of PAH compounds in S Oregon St soil samples

PAH Compound[a]	Unit	Carc/ Non Carc	Sample Identifications										
			B06-1-1	B06-2-5	B06-2-7.5	B06-3-2.5	B06-3-5	B06-3-7.5	B06-4-1	B06-4-10	B06-4-12.5	B06-5-2.5	B06-5-5
1-Methylnaphthalene	mg/kg	nc	0.0075 U	0.0088 U	24	4.2	0.0087	0.0083 U	0.019	0.0081 U	0.0072 U	0.092	0.0077 U
2-Methylnaphthalene	mg/kg	nc	0.0075 U	0.0088 U	35	4.8	0.010	0.0083 U	0.026	0.0081 U	0.0072 U	0.13	0.0077 U
Acenaphthene	mg/kg	nc	0.021	0.0088 U	39	0.15	0.0098	0.0083 U	0.0075	0.0081 U	0.0072 U	0.015	0.0077 U
Acenaphthylene	mg/kg	nc	0.0075 U	0.0088 U	0.93	0.045	0.0081 U	0.0083 U	0.017	0.0081 U	0.0072 U	0.0092	0.12
Anthracene	mg/kg	nc	0.031	0.0088 U	60	0.022	0.022	0.019	0.015	0.0081 U	0.0072 U	0.014	0.052
Benzo(g,h,i)perylene	mg/kg	nc	0.062	0.024	51	0.057	0.089	0.13	0.046	0.0081 U	0.0072 U	0.086	0.24
Fluoranthene	mg/kg	nc	0.16	0.049	210	0.12	0.14	0.25	0.11	0.0081 U	0.0072 U	0.13	0.22
Fluorene	mg/kg	nc	0.015	0.0088 U	40	0.17	0.0090	0.0083 U	0.0092	0.0081 U	0.0072 U	0.013	0.011
Naphthalene [b]	mg/kg	nc	0.0075 U	0.0088 U	72	0.97	0.012	0.012	0.027	0.0081 U	0.0072 U	0.025	0.0077 U
Phenanthrene	mg/kg	nc	0.11	0.027	260	0.22	0.11	0.045	0.086	0.0081 U	0.0072 U	0.31	0.038
Pyrene	mg/kg	nc	0.16	0.058	220	0.12	0.17	0.40	0.16	0.0083	0.0087	0.17	0.32
Benzo(a)anthracene	mg/kg	c	0.080	0.023	80	0.064	0.077	0.23	0.068	0.0081 U	0.0072 U	0.086	0.32
Benzo(a)pyrene	mg/kg	c	0.089	0.030	83	0.066	0.12	0.29	0.053	0.0081 U	0.0072 U	0.075 U	0.39
Benzo(b)fluoranthene	mg/kg	c	0.11	0.035	80	0.090	0.12	0.25	0.077	0.0081 U	0.0072 U	0.13	0.46
Benzo(k)fluoranthene	mg/kg	c	0.039	0.012	25	0.019	0.042	0.081	0.023	0.0081 U	0.0072 U	0.075 U	0.15
Chrysene	mg/kg	c	0.13	0.038	110	0.20	0.13	0.31	0.14	0.0081 U	0.0072 U	0.40	0.51
Dibenz(a,h)anthracene	mg/kg	c	0.023	0.0088 U	12	0.023	0.024	0.039	0.017	0.0081 U	0.0072 U	0.075 U	0.089
Indeno(1,2,3-c,d)pyrene	mg/kg	c	0.059	0.019	43	0.039	0.076	0.11	0.035	0.0081 U	0.0072 U	0.075 U	0.22
Toxicity Equivalency Evaluation													
Benzo(a)anthracene	TEF	0.1	0.008	0.002	8	0.006	0.008	0.02	0.007	0	0	0.009	0.03
Benzo(a)pyrene	TEF	1	0.089	0.030	83	0.066	0.12	0.29	0.053	0	0	0	0.39
Benzo(b)fluoranthene	TEF	0.1	0.01	0.004	8	0.009	0.01	0.03	0.008	0	0	0.01	0.05
Benzo(k)fluoranthene	TEF	0.1	0.004	0.001	2.5	0.002	0.004	0.008	0.002	0	0	0	0.02

PAH Compound[a]	Unit	Carc/ Non Carc	Sample Identifications										
			B06-1-1	B06-2-5	B06-2-7.5	B06-3-2.5	B06-3-5	B06-3-7.5	B06-4-1	B06-4-10	B06-4-12.5	B06-5-2.5	B06-5-5
Chrysene	TEF	0.01	0.001	0.000	1.1	0.002	0.001	0.003	0.001	0	0	0.004	0.01
Dibenz(a,h)anthracene	TEF	0.4	0.009	0	4.8	0.009	0.010	0.016	0.007	0	0	0	0.036
Indeno(1,2,3-c,d)pyrene	TEF	0.1	0.006	0.002	4.3	0.004	0.008	0.01	0.004	0	0	0	0.02
SUM			0.13	0.039	111.7	0.10	0.16	0.38	0.08	0	0	0.03	0.55
MTCA Method A Soil (Industrial)			2	2	2	2	2	2	2	2	2	2	2

Source: (Pacific Groundwater Group 2007)

[a] Analytical method: EPA 8270C/SIM

[b] Naphthalenes cleanup levels for MTCA Method A Soil (Unrestricted) and (Industrial) are 5 mg/kg

Green highlight – sum of toxic equivalents exceeds MTCA Method A Soil (Industrial)

U – parameter not detected; # – laboratory practical quantitation limit

C – carcinogen

EPA – US Environmental Protection Agency

mg/kg – milligram per kilogram

MTCA – Model Toxics Control Act

NC – non-carcinogen

PAH – Polycyclic Aromatic Hydrocarbon

ppm – parts per million

SIM – Simultaneous Ion Monitoring

TEF – toxic equivalency factor

Table E-3. Summary of PCBs Results in S Oregon St soil samples

Sample Location	Sample (mg/kg)	Aroclor 1016	Aroclor 1221	Aroclor 1232	Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260	Aroclor 1262	Aroclor 1268	Total PCBs
B06-1	B06-1-1	0.056 U	0.056 U	0.056 U	0.056 U	0.056 U	0.28	0.20	0.056 U	0.056 U	0.48
	B06-1-5	0.061 U	0.061 U	0.061 U	0.061 U	0.061 U	0.061 U	0.061 U	0.061 U	0.061 U	ND
	B06-1-12.5	0.060 U	0.060 U	0.060 U	0.060 U	0.060 U	0.060 U	0.060 U	0.060 U	0.060 U	ND
	B06-1-20	0.068 U	0.068 U	0.068 U	0.068 U	0.068 U	0.068 U	0.068 U	0.068 U	0.068 U	ND
B06-2	B06-2-5	0.066 U	0.066 U	0.066 U	0.12	0.066 U	0.37	0.30	0.066 U	0.066 U	0.79
	B06-2-7.5	0.057 U	0.057 U	0.057 U	0.057 U	0.057 U	0.057 U	0.057 U	0.057 U	0.057 U	ND
	B06-2-10	0.058 U	0.058 U	0.058 U	0.058 U	0.058 U	0.058 U	0.058 U	0.058 U	0.058 U	ND
	B06-2-12.5	0.060 U	0.060 U	0.060 U	0.060 U	0.060 U	0.060 U	0.060 U	0.060 U	0.060 U	ND
B06-3	B06-3-1	0.057 U	0.057 U	0.057 U	0.057 U	0.057 U	0.28	0.13	0.057 U	0.057 U	0.41
	B06-3-2.5	0.054 U	0.054 U	0.054 U	0.054 U	0.054 U	0.054 U	0.054 U	0.054 U	0.054 U	ND
	B06-3-5	0.061 U	0.061 U	0.061 U	0.061 U	0.061 U	0.061 U	0.061 U	0.061 U	0.061 U	ND
	B06-3-7.5	0.063 U	0.063 U	0.063 U	0.063 U	0.063 U	0.063 U	0.063 U	0.063 U	0.063 U	ND
B06-4	BO6-4-1	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	ND
	B06-4-2.5	0.054 U	0.054 U	0.054 U	0.054 U	0.054 U	0.26	0.054 U	0.054 U	0.054 U	0.26
	B06-4-10	0.061 U	0.061 U	0.061 U	0.061 U	0.061 U	0.061 U	0.061 U	0.061 U	0.061 U	ND
	B06-4-12.5	0.054 U	0.054 U	0.054 U	0.054 U	0.054 U	0.075	0.054 U	0.054 U	0.054 U	0.075
B06-5	B06-5-1	0.057 U	0.057 U	0.057 U	0.20	0.057 U	0.74	0.31	0.057 U	0.057 U	1.25
	B06-5-2	0.056 U	0.056 U	0.056 U	0.056 U	0.056 U	0.056 U	0.50	0.056 U	0.056 U	0.50
	B06-5-5	0.057 U	0.057 U	0.057 U	0.057 U	0.057 U	0.057 U	0.057 U	0.057 U	0.057 U	ND
	B06-5-15	0.061 U	0.061 U	0.061 U	0.061 U	0.061 U	0.061 U	0.061 U	0.061 U	0.061 U	ND
MTCA Method A Soil (Industrial)											10

Source: (Pacific Groundwater Group 2007)

Green highlight – sum of PCBs exceeds MTCA Method A Soil (Industrial)

Analytical method: EPA 8082

EPA – US Environmental Protection Agency

mg/kg – milligram per kilogram

MTCA – Model Toxics Control Act

ND – non detect

PAH – polycyclic aromatic hydrocarbon

PQL – practical quantitation limit

TEF – toxic equivalency factor

U – parameter not detected; laboratory practical quantitation limit

Table E-4. Summary of petroleum hydrocarbon compounds in S Oregon St soil samples

Sample Location	Sample Identification (mg/kg)	NWTPH-Gx/BTEX						NWTPH-Dx	
		Benzene	Toluene	Ethyl Benzene	m,p-Xylene	o-Xylene	TPH-Gas	Diesel Range	Lube Oil
B06-1	B06-1-1	0.020 U	0.044 U	0.044 U	0.044 U	0.044 U	4.4 U	28 U	760
	B06-1-5	—	—	—	—	—	—	150 U	4900
	B06-1-12.5	—	—	—	—	—	—	30 U	170
	B06-1-20	—	—	—	—	—	—	34 U	100
B06-2	B06-2-5	0.020 U	0.063 U	0.063 U	0.063 U	0.063 U	6.3 U	62	580
	B06-2-7.5	0.020 U	0.055 U	0.055 U	0.055 U	0.055 U	5.5 U	310	580
	B06-2-10	0.020 U	0.044 U	0.044 U	0.044 U	0.044 U	4.4 U	29 U	100
	B06-2-12.5	—	—	—	—	—	—	30 U	60 U
B06-3	B06-3-1	0.020 U	0.048 U	0.048 U	0.048 U	0.048 U	4.8 U	28 U	170
	BO6-3-2.5	0.020 U	0.045 U	0.045 U	0.045 U	0.045 U	4.5 U	4500	5400
	B06-3-5	0.020 U	0.054 U	0.054 U	0.054 U	0.054 U	5.4 U	31 U	160
	B06-3-7.5	0.020 U	0.047 U	0.047 U	0.047 U	0.047 U	4.7 U	31 U	90
B06-4	B06-4-1	0.020 U	0.050 U	0.050 U	0.050 U	0.050 U	5.0 U	28 U	190
	B06-4-2.5	0.020 U	0.099 U	0.099 U	0.099 U	0.099 U	9.9 U	27 U	95
	B06-4-10	0.020 U	0.053 U	0.053 U	0.053 U	0.053 U	5.3 U	170	630
	B06-4-12.5	0.020 U	0.042 U	0.042 U	0.042 U	0.042 U	4.2 U	27 U	100
B06-5	B06-5-1	0.020 U	0.050 U	0.050 U	0.050 U	0.050 U	5.0 U	200	610
	B06-5-2.5	0.020 U	0.049 U	0.049 U	0.049 U	0.049 U	4.9 U	28 U	500
	B06-5-5	0.020 U	0.044 U	0.044 U	0.044 U	0.044 U	4.4 U	29 U	87
	B06-5-15	0.020 U	0.053 U	0.053 U	0.053 U	0.053 U	5.3 U	31 U	61 U
MTCA Method A Soil (Industrial)		0.03	7	6	9	9	100	2000	2000

Source: (Pacific Groundwater Group 2007)
Green highlight – sum of PCBs exceeds MTCA Method A Soil (Industrial)
U – parameter not detected; # – laboratory practical quantitation limit
mg/kg – milligram per kilogram
MTCA – Model Toxics Control Act
NWTPH-Dx – Northwest total petroleum hydrocarbons - diesel extractable
NWTPH-Gx – Northwest total petroleum hydrocarbons - gasoline extractable
TPH – total petroleum hydrocarbons

Table E-5. Summary of metals in S Oregon St soil samples

Sample Location	Sample Identification	Arsenic (mg/kg)	Cadmium (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Nickel (mg/kg)	Zinc (mg/kg)
B06-1	B06-1-1	11 U	0.63	27	24	13	49
	B06-1-5	12 U	0.61 U	52	91	18	65
	B06-1-12.5	12 U	0.60 U	13	6.0 U	8.6	24
	B06-1-20	14 U	0.68 U	23	6.8 U	9.0	29
B06-2	B06-2-5	13 U	0.66 U	19	6.6 U	4.4	20
	B06-2-7.5	11 U	1.5	100	160	26	180
	B06-2-10	12 U	0.58 U	22	13	10	30
	B06-2-12.5	12 U	0.60 U	15	8.4	15	38
B06-3	B06-3-1	11 U	1.9	25	25	11	120
	B06-3-2.5	11 U	0.54 U	28	5.9	17	36
	B06-3-5	12 U	1.4	110	180	29	310
	B06-3-7.5	13 U	0.95	16	10	9.2	30
B06-4	B06-4-1	11 U	0.82	64	46	33	2800
	B06-4-2.5	11 U	0.54 U	35	33	11	60
	B06-4-10	12 U	0.61 U	21	6.1 U	13	68
	B06-4-12.5	11 U	0.54 U	12	5.4 U	7.5	26
B06-5	B06-5-1	11 U	0.90	40	36	12	74
	B06-5-2.5	11 U	0.56 U	36	33	30	110
	B06-5-5	11 U	0.57 U	26	34	11	35
	B06-5-15	12 U	0.61 U	10	6.1 U	9.1	19
MTCA Method A Soil (Industrial)		20	2		1000		

Source: (Pacific Groundwater Group 2007)
Green highlight – concentration exceeds MTCA Method A Soil (Industrial)
mg/kg – milligram per kilogram
MTCA – Model Toxics Control Act
U – parameter not detected; # – laboratory practical quantitation limit

Table E-6. Summary of PAH compounds in Oregon Street intertidal sediment samples

PAH Compound	PAH Concentrations - Dry Weight (mg/kg)					PAH Concentrations – TOC-Normalized (mg/kg-OC)					SQS
	IT-1-6	IT-2-6	IT-2-16	IT-3-6	IT-3-12	IT-1-6	IT-2-6	IT-2-16	IT-3-6	IT-3-12	
1-Methylnaphthalene	0.0083 U	0.0063 U	0.081	0.0087 U	0.0088 U	—	—	3	—	—	
2-Methylnaphthalene	0.0083 U	0.0063 U	0.13	0.0087 U	0.0088 U	—	—	5	—	—	38
Acenaphthene	0.0083 U	0.0063 U	0.046	0.0087 U	0.0088 U	—	—	2	—	—	16
Acenaphthylene	0.0083 U	0.0063 U	0.0078 U	0.0087 U	0.0088 U	—	—	—	—	—	66
Anthracene	0.0083 U	0.0063 U	0.0078 U	0.0098	0.023	—	—	—	0	1	220
Benzo(g,h,i)perylene	0.019	0.0063 U	0.0078 U	0.042	0.081	2	—	—	2	3	31
Fluoranthene	0.020	0.0063 U	0.0078 U	0.069	0.14	2	—	—	3	6	160
Fluorene	0.0083 U	0.0063 U	0.0098	0.0087 U	0.010	—	—	0	—	0	23
Naphthalene	0.0083 U	0.0063 U	0.22	0.0087 U	0.0088 U	—	—	9	—	—	99
Phenanthrene	0.0083 U	0.0063 U	0.0078 U	0.036	0.10	—	—	—	1	4	100
Pyrene	0.021	0.0063 U	0.0078 U	0.083	0.16	2	—	—	3	6	1000
Benzo(a)anthracene	0.014	0.0063 U	0.0078 U	0.050	0.078	1	—	—	2	3	110
Benzo(a)pyrene	0.022	0.0063 U	0.0078 U	0.051	0.095	2	—	—	2	4	99
Benzo(b)fluoranthene	0.032	0.0063 U	0.0078 U	0.068	0.11	3	—	—	3	4	230 (total)
Benzo(k)fluoranthene	0.012	0.0063 U	0.0078 U	0.023	0.041	1	—	—	1	2	
Chrysene	0.031	0.0063 U	0.0078 U	0.071	0.12	3	—	—	3	5	110
Dibenz(a,h)anthracene	0.0083 U	0.0063 U	0.0078 U	0.013	0.026	—	—	—	1	1	12
Indeno(1,2,3-c,d)pyrene	0.016	0.0063 U	0.0078 U	0.036	0.068	1	—	—	1	3	34
Estimated total organic content from PGG-5 and PGG-6 analytical results and grain size (%)[a]						1.15	0.47	2.47	2.47	2.47	

Source: (Pacific Groundwater Group 2007)

[a] Intertidal sediment samples not analyzed for TOC. Soil samples from boreholes PGG-5 (200 feet southeast of intertidal samples) and PGG-6 (500 feet southeast of intertidal samples) analyzed for TOC. Estimated TOC for IT samples from PGG-5 and PGG-6 results based on comparable soil/sediment description.

Green highlight – exceeds SQS

Analytical method: EPA 8270C/SIM

EPA – US Environmental Protection Agency

mg/kg-OC – mg/kg organic carbon (total organic carbon normalized)
mg/kg – milligram per kilogram
PAH –Polycyclic Aromatic Hydrocarbon
PGG – Pacific Groundwater Group
SIM – Simultaneous Ion Monitoring
SQS – Sediment Quality Standards (WAC 173-204-320)
TOC – total organic carbon
U – parameter not detected; # – laboratory practical quantitation limit
WAC – Washington Administrative Code
— not calculated, PAH not detected
Sample descriptions:

IT-1-6: Brown silt with roots and organic material
IT-1-12: Brown silt with organic material
IT-2-6: Wet, gray, sand and gravel
IT-2-16: Dark gray, wet, slightly sandy, organic smelling silt
IT-3-6: Brown, sandy silt with trace gravel
IT-3-12: Dark gray, moist, slightly sandy silt.

Table E-7. Summary of PCBs in S Oregon St intertidal sediment samples

CHEMICAL (mg/kg)	IT-1-6	IT-1-12	IT-2-6	IT-2-16	IT-3-6	IT-3-12
Aroclor 1016	0.063 U	0.066 U	0.052 U	0.058 U	0.065 U	0.066 U
Aroclor 1221	0.063 U	0.066 U	0.052 U	0.058 U	0.065 U	0.066 U
Aroclor 1232	0.063 U	0.066 U	0.052 U	0.058 U	0.065 U	0.066 U
Aroclor 1242	0.063 U	0.066 U	0.052 U	0.058 U	0.065 U	0.066 U
Aroclor 1248	0.063 U	0.066 U	0.052 U	0.058 U	0.065 U	0.066 U
Aroclor 1254	0.063 U	0.066 U	0.052 U	0.058 U	0.065 U	0.066 U
Aroclor 1260	0.063 U	0.066 U	0.052 U	0.058 U	0.065 U	0.066 U
Aroclor 1262	0.063 U	0.066 U	0.052 U	0.058 U	0.065 U	0.066 U
Aroclor 1268	0.063 U	0.066 U	0.052 U	0.058 U	0.065 U	0.066 U
Total PCBs	ND	ND	ND	ND	ND	ND

Source: (Pacific Groundwater Group 2007)
Analytical method: EPA 8082
EPA – US Environmental Protection Agency
mg/kg – milligram per kilogram
ND – non detect
PCB - polychlorinated biphenyl
U – parameter not detected; # – laboratory practical quantitation limit

Table E-8. Summary of petroleum hydrocarbon compounds in S Oregon St intertidal sediment samples

Sample Location	Sample (mg/kg)	NWTPH-Gx/BTEX						NWTPH-Dx	
		Benzene	Toluene	Ethyl Benzene	m,p-Xylene	o-Xylene	TPH-Gas	Diesel Range	Lube Oil
Intertidal	IT-1-6	—	—	—	—	—	—	31 U	63 U
	IT-1-12	—	—	—	—	—	—	33 U	66 U
	IT-2-6	—	—	—	—	—	—	26 U	52 U
	IT-2-16	—	—	—	—	—	—	40[a]	110
	IT-3-6	—	—	—	—	—	—	33 U	170
	IT-3-12	—	—	—	—	—	—	38	150
SQS not established under WAC 173-204 for diesel or lube oil									

Source: (Pacific Groundwater Group 2007)

[a] Identified diesel fuel #2 by lab

– parameter not analyzed

NWTPH-Dx – Northwest total petroleum hydrocarbons - diesel extractable

NWTPH-Gx – Northwest total petroleum hydrocarbons - gasoline extractable

SQS – Sediment Quality Standards (WAC 173-204-320)

TPH – total petroleum hydrocarbons

U – parameter not detected; # – laboratory practical quantitation limit

WAC – Washington Administrative Code

Table E-9. Summary of metals in S Oregon St intertidal sediment samples

Sample Location	Sample (mg/kg)	Arsenic	Cadmium	Copper	Lead	Nickel	Zinc
Intertidal	IT-1-6	13 U	0.63 U	29	53	14	48
	IT-1-12	13 U	0.66 U	13	6.6 U	4.7	12
	IT-2-6	10 U	0.52 U	120	5.2 U	22	77
	IT-2-16	12 U	0.58 U	55	100	18	95
	IT-3-6	13 U	0.65 U	84	190	22	150
	IT-3-12	13 U	0.66 U	110	330	29	180
SQS		57	5.1	390	450	na	410

Source: (Pacific Groundwater Group 2007)
na – not applicable
SQS – Sediment Quality Standards (WAC 173-204-320)
U – parameter not detected; # – laboratory practical quantitation limit
WAC – Washington Administrative Code

Table E-10. Summary of PAH compounds in S Oregon St groundwater samples

PAH Compound	Unit	Carc./non Carc.	B06-2	B06-5
1-Methylnaphthalene	µg/L	nc	0.18	0.095 U
2-Methylnaphthalene	µg/L	nc	0.27	0.095 U
Acenaphthene	µg/L	nc	0.18	0.095 U
Acenaphthylene	µg/L	nc	0.097 U	0.095 U
Anthracene	µg/L	nc	0.12	0.095 U
Benzo(g,h,i)perylene	µg/L	nc	0.095	0.018
Fluoranthene	µg/L	nc	0.37	0.095 U
Fluorene	µg/L	nc	0.12	0.095 U
Naphthalene [a]	µg/L	nc	1.1	0.095 U
Phenanthrene	µg/L	nc	0.48	0.095 U
Pyrene	µg/L	nc	0.41	0.095 U
Benzo(a)anthracene	µg/L	c	0.12	0.018
Benzo(a)pyrene	µg/L	c	0.14	0.019
Benzo(b)fluoranthene	µg/L	c	0.14	0.026
Benzo(k)fluoranthene	µg/L	c	0.048	0.0095 U
Chrysene	µg/L	c	0.17	0.023
Dibenz(a,h)anthracene	µg/L	c	0.022	0.0095 U
Indeno(1,2,3-c,d)pyrene	µg/L	c	0.076	0.013
Toxicity Equivalency Evaluation				
Benzo(a)anthracene	TEF	0.1	0.01	0.002
Benzo(a)pyrene	TEF	1	0.14	0.019
Benzo(b)fluoranthene	TEF	0.1	0.01	0.003
Benzo(k)fluoranthene	TEF	0.1	0.005	0
Chrysene	TEF	0.01	0.002	0.0002
Dibenz(a,h)anthracene	TEF	0.4	0.009	0
Indeno(1,2,3-c,d)pyrene	TEF	0.1	0.008	0.001
SUM:			0.19	0.02
MTCA Method A Groundwater			0.1	0.1

Source: (Pacific Groundwater Group 2007)
Analytical method: EPA 8270C/SIM
[a] Naphthalenes cleanup level for MTCA Method A Groundwater is 160 µg/L
Green highlight – sum of toxic equivalents exceeds MTCA Method A Groundwater
c – carcinogen
Carc. – carcinogen
EPA – US Environmental Protection Agency
µg/L – micrograms per liter
MTCA – Model Toxics Control Act
nc – non-carcinogen
PAH – Polycyclic Aromatic Hydrocarbon
TEF: toxicity equivalency factor
U – parameter not detected; # – laboratory practical quantitation limit

Table E-11. Summary of PCBs in S Oregon St groundwater samples

PCB	Units	B06-2	B06-5
Aroclor 1016	µg/L (ppb)	0.048 U	0.048 U
Aroclor 1221	µg/L (ppb)	0.048 U	0.048 U
Aroclor 1232	µg/L (ppb)	0.048 U	0.048 U
Aroclor 1242	µg/L (ppb)	0.048 U	0.048 U
Aroclor 1248	µg/L (ppb)	0.048 U	0.048 U
Aroclor 1254	µg/L (ppb)	0.053	0.070
Aroclor 1260	µg/L (ppb)	0.048 U	0.048 U
Aroclor 1262	µg/L (ppb)	0.048 U	0.048 U
Aroclor 1268	µg/L (ppb)	0.048 U	0.048 U
Total PCBs		0.053	0.070
MTCA Method A Groundwater		0.1	0.1

Source: (Pacific Groundwater Group 2007)
Analytical method: EPA 8082
µg/L – micrograms per liter
MTCA – Model Toxics Control Act
PCB – polychlorinated biphenyl
ppb – part per billion
PQL – practical quantitation limit
U – parameter not detected; # – laboratory practical quantitation limit

Table E-12. Summary of petroleum hydrocarbon compounds and metals in S Oregon St

Chemical	Unit	MTCA Method A - Groundwater	B06-2	B06-5
NWTPH-Gx/BTEX				
Benzene	µg/L	5	1.0 U	1.0 U
Toluene	µg/L	1,000	1.0 U	1.0 U
Ethyl Benzene	µg/L	700	1.0 U	1.0 U
m,p-Xylene	µg/L	1,000	1.0 U	1.0 U
o-Xylene	µg/L	1,000	1.0 U	1.0 U
TPH-Gas	µg/L	1,000	100 U	100 U
NWTPH-Dx				
Diesel Range	mg/L	0.5	0.27 U	0.26 U
Lube Oil	mg/L	0.5	1.5	0.41 U
Dissolved Metals (EPA 200.8)				
Arsenic	µg/L	5	5.7	3.0 U
Cadmium	µg/L	5	4.0 U	4.0 U
Copper	µg/L		10 U	10 U
Lead	µg/L	15	1.0 U	1.0 U
Nickel	µg/L		20 U	20 U
Zinc	µg/L		25 U	25 U

Source: (Pacific Groundwater Group 2007)
Green highlight – sum of toxic equivalents exceeds MTCA Method A Groundwater
EPA – US Environmental Protection Agency
µg/L – micrograms per liter
mg/L – milligrams per liter
MTCA – Model Toxics Control Act
NWTPH-Dx – Northwest total petroleum hydrocarbons - diesel extractable
NWTPH-Gx – Northwest total petroleum hydrocarbons - gasoline extractable
ppb – parts per billion
PQL – practical quantitation limit
TPH – total petroleum hydrocarbons
U – parameter not detected; # – laboratory practical quantitation limit

Table E-13. Summary of Duwamish/Diagonal CSO/SD source-tracing sediment data (metals and TPH)

Type	Count		Metals (mg/kg dw)					TPHs (mg/kg dw)	
			Arsenic	Copper	Lead	Mercury	Zinc	TPH - Diesel	TPH - Oil
Catch Basin	44	Mean	11	230	410	0.28	696	4160	15,200
		Range	(3 – 40)	(29.6 – 1520)	(10 – 5,830)	(0.02 – 2.05)	(54.9 – 3,940)	(0 – 46,000)	(0 – 250,000)
Right-of-way Catch Basin	36	Mean	7.4	115	161	0.15	349	1120	4,150
		Range	(2.5 – 30)	(38.4 – 751)	(19 – 1,370)	(0.02 – 1.17)	(84.7 – 966)	(130 – 6,400)	(480 – 14,000)
In-line sediment grab	33	Mean	7.3	89	254	0.26	273		1,630
		Range	(2.5 – 23)	(22.4 – 340)	(15 – 4,910)	(0.01 – 3.3)	(85 – 718)	56,300)	(0 – 13,000)
In-line sediment trap	45	Mean	7.0	138	116	0.20	508	605	2570
		Range	(3 – 25)	(6.6 – 597)	(29 – 360)	(0.025 – 2.8)	(162 – 1,930)	(0 – 1,900)	(0 – 7,500)

Source: (Schmoyer 2008)

Note: Summary statistics were calculated using one half the detection limit for non-detected values.

CSO – combined sewer overflow

dw – dry weight

mg/kg – milligrams per kilogram

SD – storm drain

TPH – total petroleum hydrocarbons

Table E-14. Summary of Duwamish/Diagonal CSO/SD source-tracing sediment data (Phthalates, PCBs, and PAHs)

Type	Count		Phthalates, PCBs and PAHs (µg/kg dw)				
			BEP	BBP	Total PCBs	HPAH	LPAH
Catch Basin	44	Mean	37,300	3,110	261	19,700	6,040
		Range	(130 – 200,000)	(19.5 – 18,000)	(8.5 – 3,200)	(95 – 256,800)	(57 – 44,965)
Right-of-way Catch Basin	36	Mean	9,570	1,720	90	5390	2,040
		Range	(740 – 48,000)	(19.5 – 37,000)	(9.5 – 670)	(461.5 – 24,290)	(155 – 13,800)
In-line sediment grab	33	Mean	1,960	156	123	3,120	766
		Range	(0 – 8,900)	(0 – 900)	(0 – 1,000)	(0 – 17,850)	(0 – 8,250)
In-line sediment trap	45	Mean	11,000	663	298	12,300	2,640
		Range	(0 – 67,000)	(0 – 3,400)	(22 – 3,250)	(0 – 127,580)	(0 – 19,750)

Source: (Schmoyer 2008)

Note: Summary statistics were calculated using one half the detection limit for non-detected values.

BEP – bis(2-ethylhexyl)phthalate

BBP – butylbenzylphthalate

CSO – combined sewer overflow

dw – dry weight

HPAA – high-molecular-weight polycyclic aromatic hydrocarbon

LPAH – low-molecular-weight polycyclic aromatic hydrocarbon

µg/L – micrograms per liter

SD – storm drain

PCB – polychlorinated biphenyl

Table E-15. Detection frequencies and concentration ranges for pollutants in Duwamish/Diagonal CSO/SD stormwater, 1995

Parameter	Detection Frequency	Concentration (µg/L)
Arsenic (total)	10/10	2 – 4
Cadmium (total)	10/10	0.4 – 1.3
Chromium (total)	10/10	2 – 22
Copper (total)	10/10	2 – 119
Lead (total)	10/10	9 – 68
Mercury (total)	1/10	0.3
Zinc (total)	10/10	50 – 225
Bis(2-ethylhexyl) phthalate	9/10	0.9 – 14.7
Butyl benzyl phthalate	5/10	0.79 – 1
Dimethyl phthalate	1/10	0.825
Di-n-butyl phthalate	1/10	9.13
Fluoranthene	1/10	0.84
PCBs	0/10	<0.26 – <0.5
Pyrene	1/10	0.998

Source: Ecology (2004)
CSO – combined sewer overflow
mg/kg – milligrams per kilogram
PCB – polychlorinated biphenyl
SD – storm drain

Table E-16. Storm drain sediment samples in Duwamish/ Diagonal CSO/SD system, 1985

Chemical	Measured Concentration		SQS	CSL
	Sample MH1	Sample MHU		
Zinc (mg/kg)	293E	419E	410	960
Organic compounds (mg/kg TOC)				
Acenaphthene	83E	63U	16	57
Fluorene	65E	54U	23	79
Phenanthrene	270E	49E	100	480
Total LPAH	574	379	370	780
Fluoranthene	230E	74E	160	1,200
Benzo(a)anthracene	210E	12E	110	270
Chrysene	240E	29E	110	460
Total benzofluoranthenes	350E	66E	230	450
Benzo(a)pyrene	140E	3.4E	99	210
Indeno(1,2,3-c,d)pyrene	170E	220U	34	88
Dibenzo(a,h)anthracene	47E	340U	12	33
Benzo(g,h,i)perylene	130E	200U	31	78
Total HPAH	1,697	1,001	960	5,300
1,2-Dichlorobenzene	39XE	270U	2.3	2.3
1,4-Dichlorobenzene	5,200XE	7,100X	3.1	9
Dimethyl phthalate	56E	40U	53	53
Dibenzofuran	45E	69E	15	58
Phenol	1,500E	75B	420	1,200
4-Methylphenol	5,900E	870E	670	670

Source: Tetra Tech as cited in Ecology (2004)
B – compound detected in method blank – possible laboratory contamination
CSO – combined sewer overflow
E – estimated value
HPAH– high-molecular-weight polycyclic aromatic hydrocarbon
LPAH – low-molecular-weight polycyclic aromatic hydrocarbon
mg/kg – milligrams per kilogram
SD – storm drain
TOC – total organic carbon
U – Compound not detected at value shown
X – Standard recovery <10 %

Table E-17. Storm drain sediments in Duwamish/Diagonal SD, 1985

Chemical	Units	Measured Concentration	SQS	CSL
Chromium	mg/kg	287E	260	270
Zinc	mg/kg	675E	410	960
Di-n-octyl phthalate	mg/kg TOC	560ZE	58	4,500
Indeno (1,2,3-c,d)pyrene	mg/kg TOC	85E	34	88

Source: Tetra Tech as cited in (Ecology 2004)
CSL – cleanup screening level
E – Estimated value
mg/kg – milligrams per kilogram
SD – storm drain
SQS – sediment quality standard
TOC – total organic carbon
Z – Concentration corrected for blank contribution. Value still exceeds detection limit.

References

Ecology. 2004. Lower Duwamish Waterway source control action plan for the Duwamish/Diagonal Way early action cleanup. No. 04-09-003. Washington Department of Ecology, Northwest Regional Office, Toxics Cleanup Program, Bellevue, WA.

Pacific Groundwater Group. 2007. Soil and groundwater data report, Oregon Street right-of-way, Port of Seattle. Pacific Groundwater Group, Seattle, WA.

Schmoyer B. 2008. Personal communication (e-mail to Jeffrey Fellows, Windward Environmental, regarding source data through December 2007, with Excel attachment: source_chemistry_thru_12-07b.xls). Seattle Public Utilities, Seattle, WA. June 3, 2008.