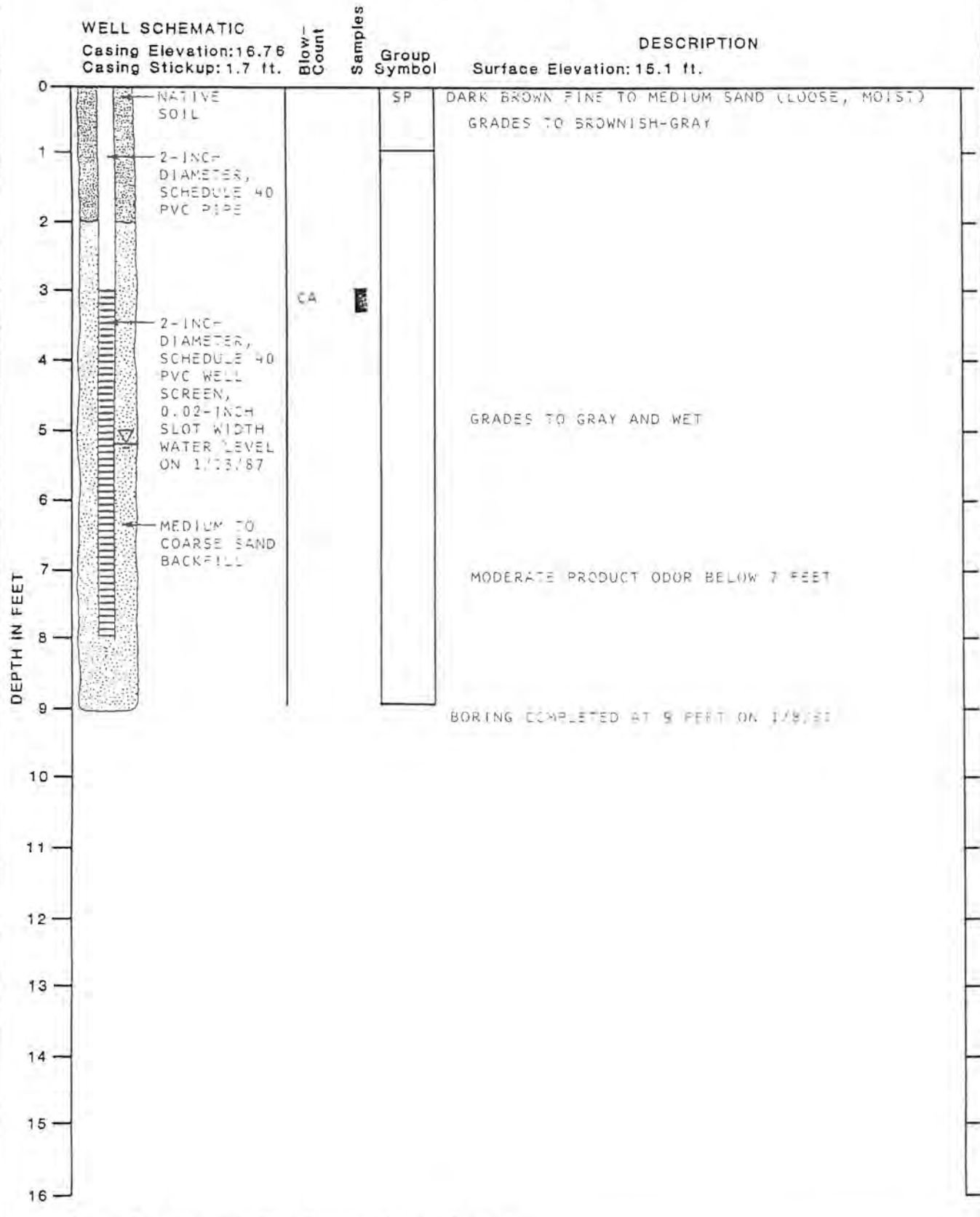
APPENDIX D
BORING LOGS COMPILATION

TABLE 1

MONITOR WELL CONSTRUCTION DETAILS

Well No.	Length of Screen (feet)	Length of Blank Pipe (feet)	Casing Stickup (feet)	Depth of Well (feet)	Comments
1	5	2.6	1.1	6.6	Installed with hand auger on 10/20/86
2	5	2.3	1.0	6.3	Installed with hand auger on 10/20/86
3	5	2.8	1.2	6.6	Installed with hand auger on 10/20/86
4	5	2.6	1.0	6.6	Installed with hand auger on 10/20/86
5	5	1.4	-0.1	6.5	Installed with hand auger on 10/20/86
6	7.5	3	2.0	8.5	Installed with backhoe on 10/30/86
7	7.5	3	2.1	8.4	Installed with backhoe on 10/31/86

MONITOR WELL NO. 8



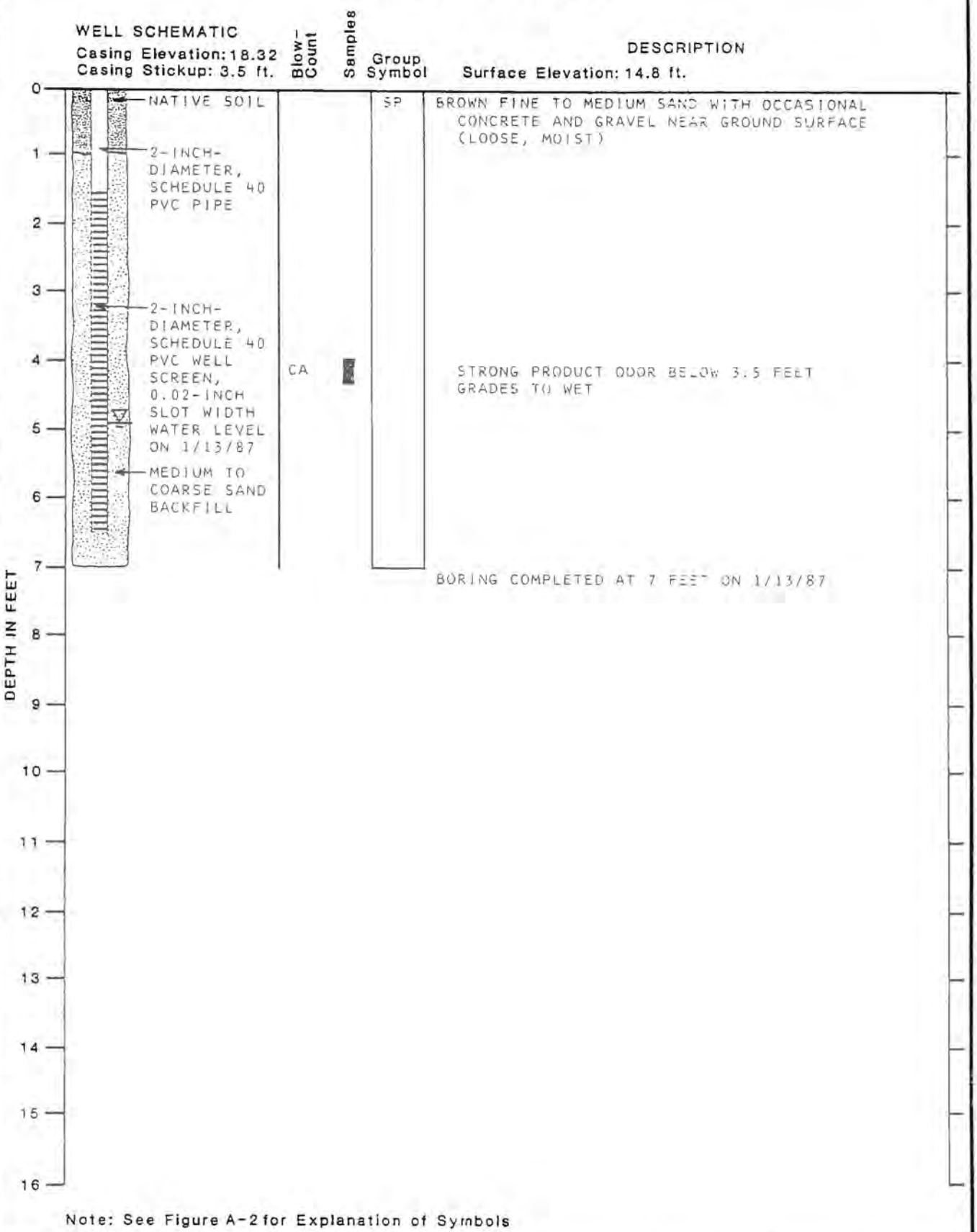
Note: See Figure A-2 for Explanation of Symbols

GeoEngineers Incorporated

LOG OF MONITOR WELL

FIGURE A-3

MONITOR WELL NO. 9



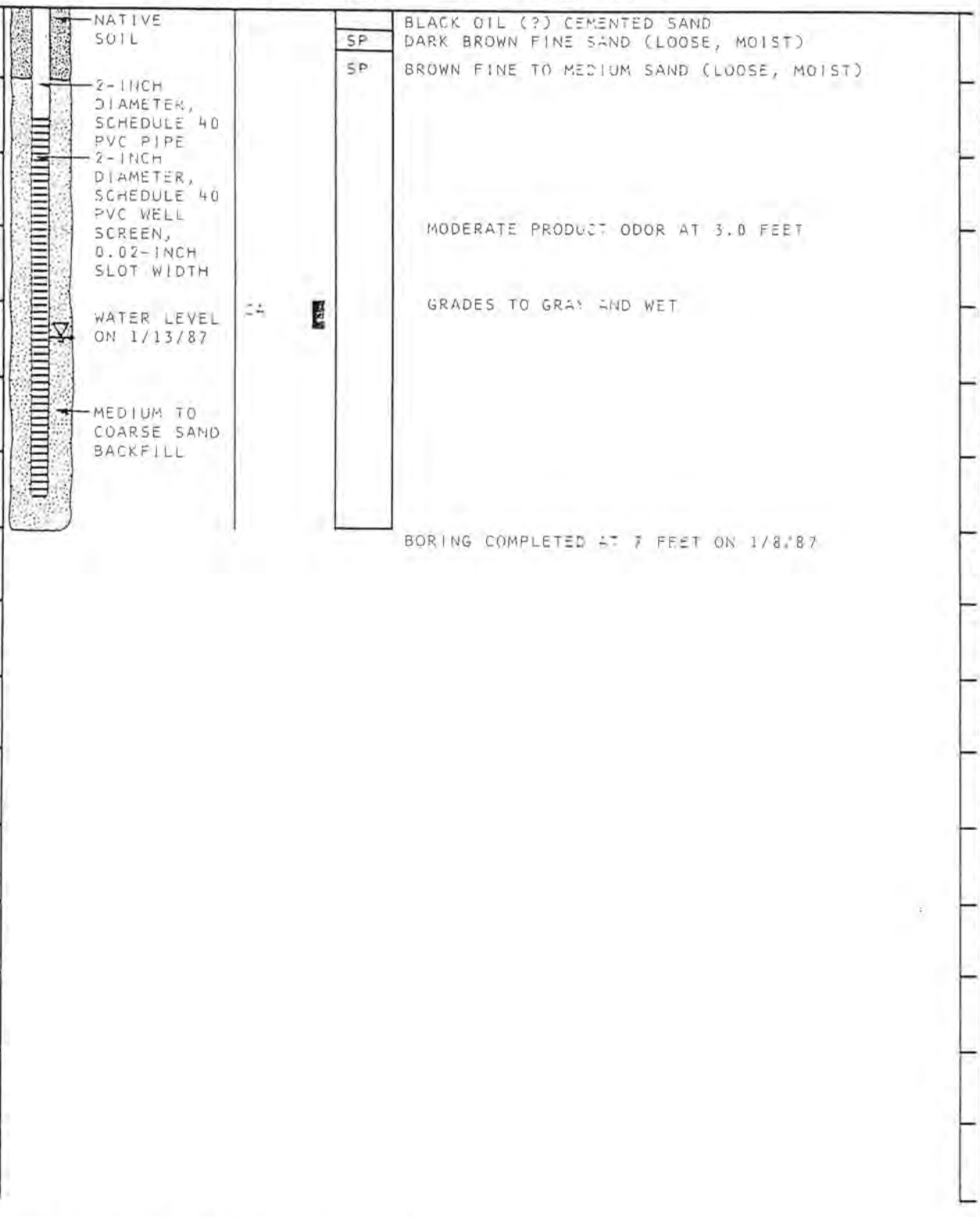
Note: See Figure A-2 for Explanation of Symbols

GeoEngineers Incorporated

LOG OF MONITOR WELL

FIGURE A-4

MONITOR WELL NO.10



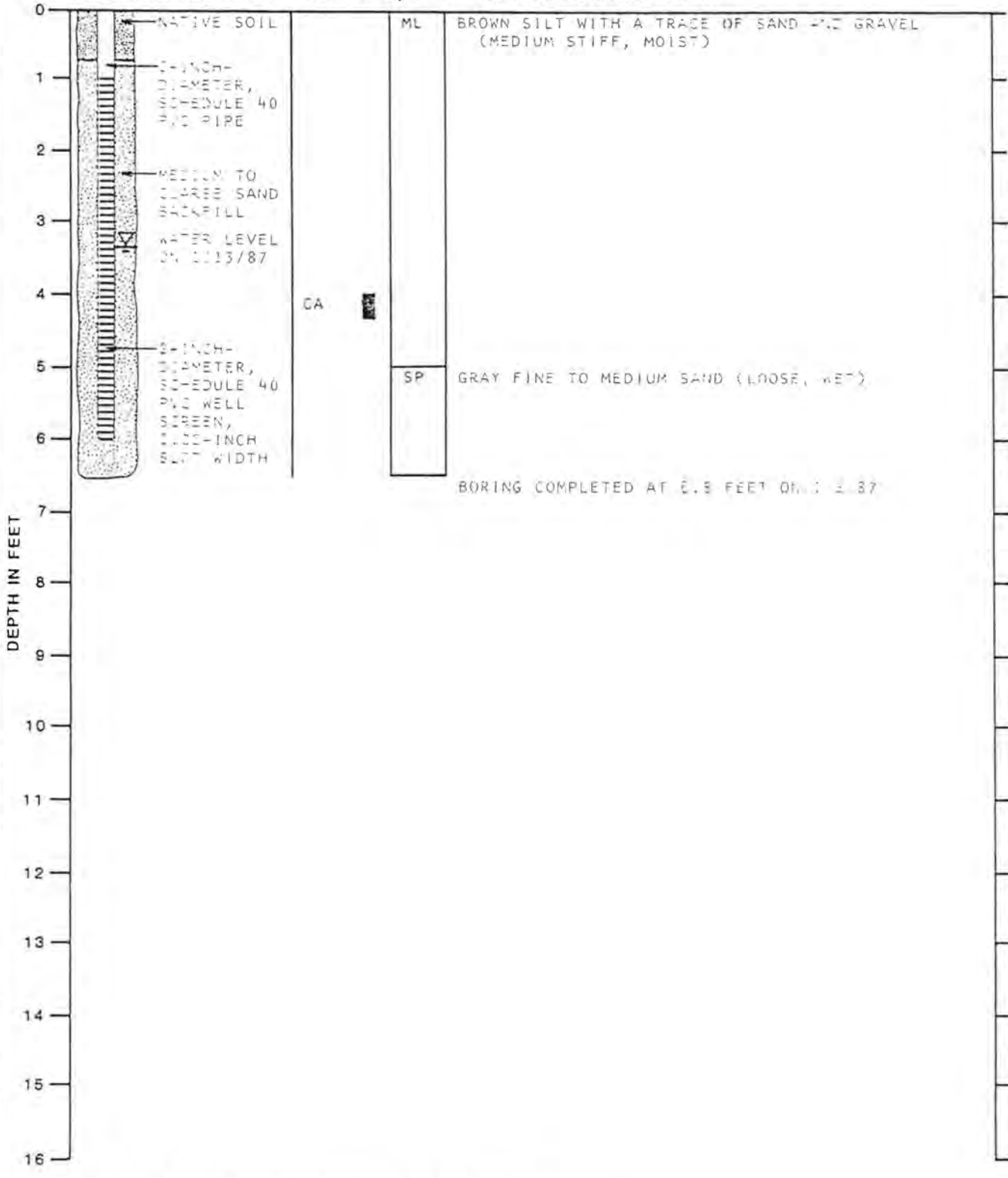
Note: See Figure A-2 for Explanation of Symbols

GeoEngineers Incorporated

LOG OF MONITOR WELL

FIGURE A-5

MONITOR WELL NO. 11



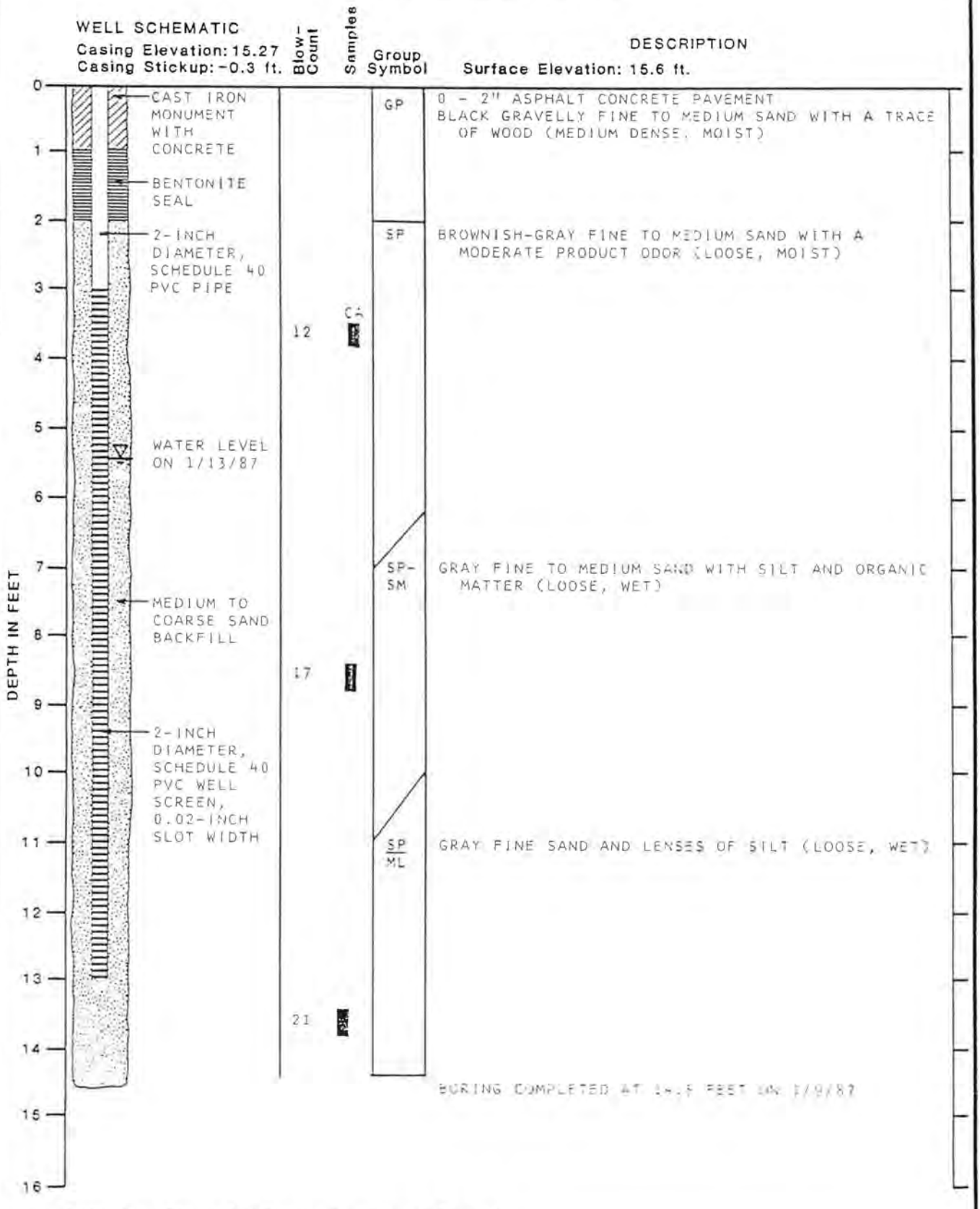
Note: See Figure A-2 for Explanation of Symbols

GeoEngineers Incorporated

LOG OF MONITOR WELL

FIGURE A-6

MONITOR WELL NO.12



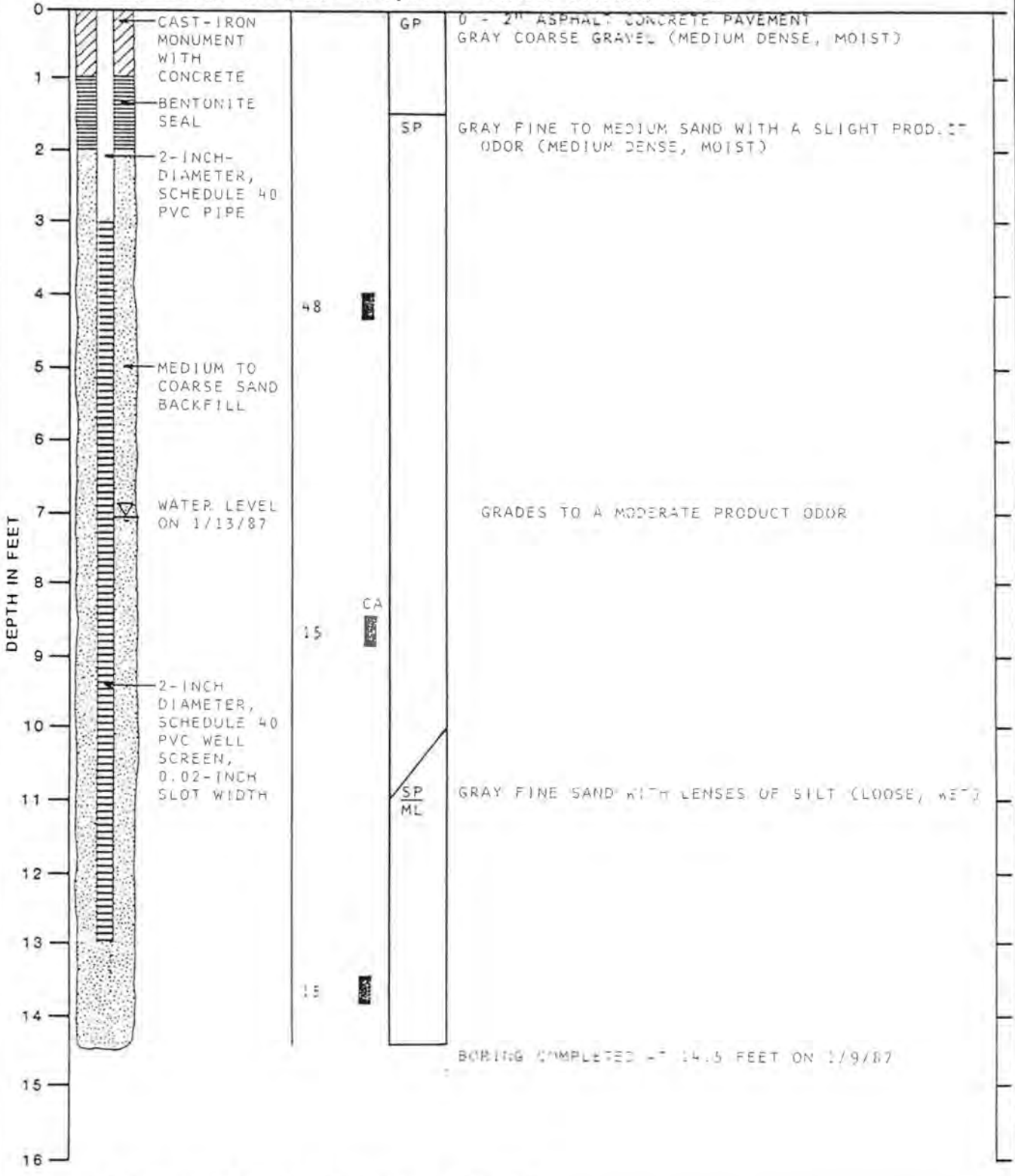
Note: See Figure A-2 for Explanation of Symbols

GeoEngineers Incorporated

LOG OF MONITOR WELL

FIGURE A-7

MONITOR WELL NO. 13



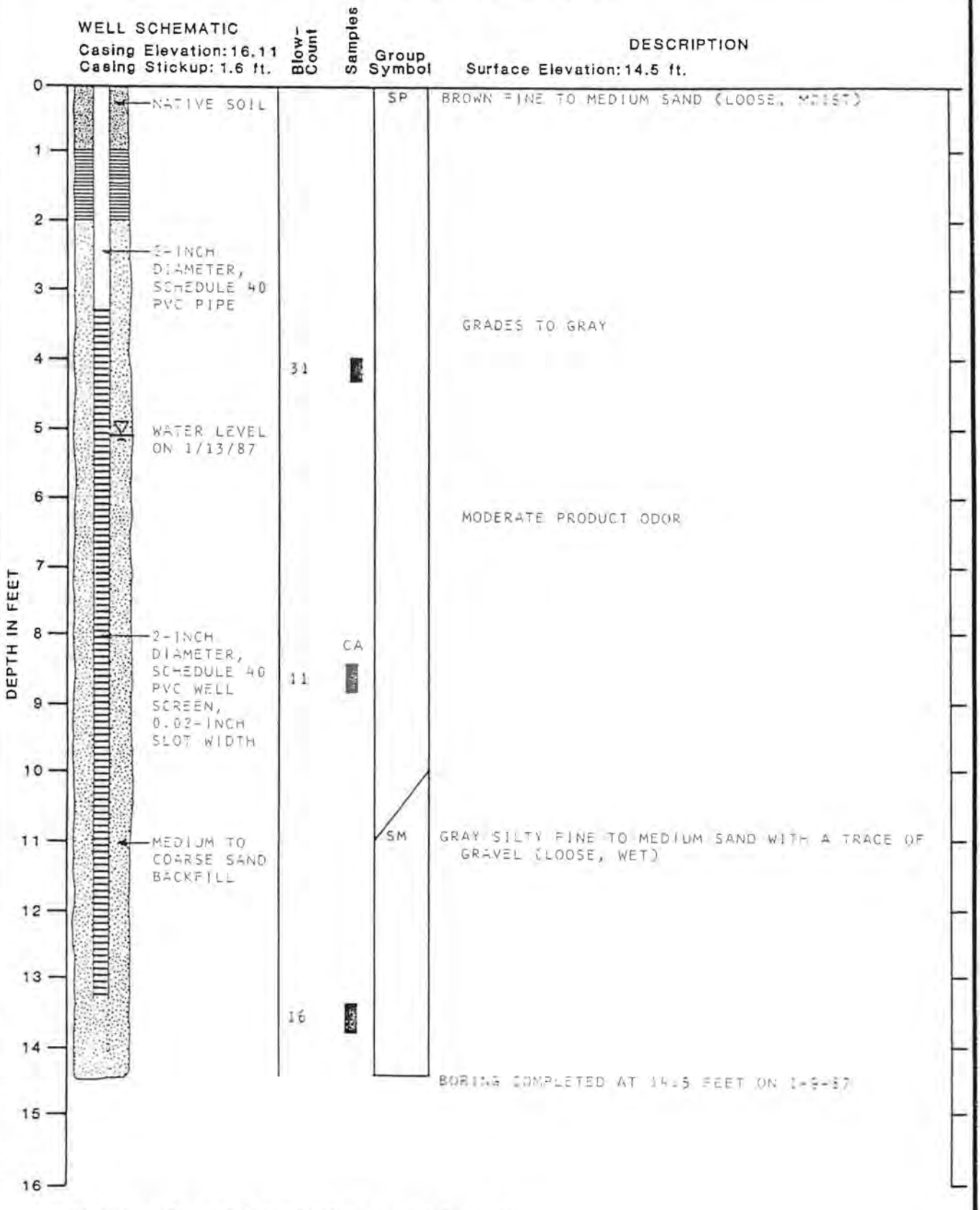
Note: See Figure A-2 for Explanation of Symbols

GeoEngineers Incorporated

LOG OF MONITOR WELL

FIGURE A-8

MONITOR WELL NO. 14



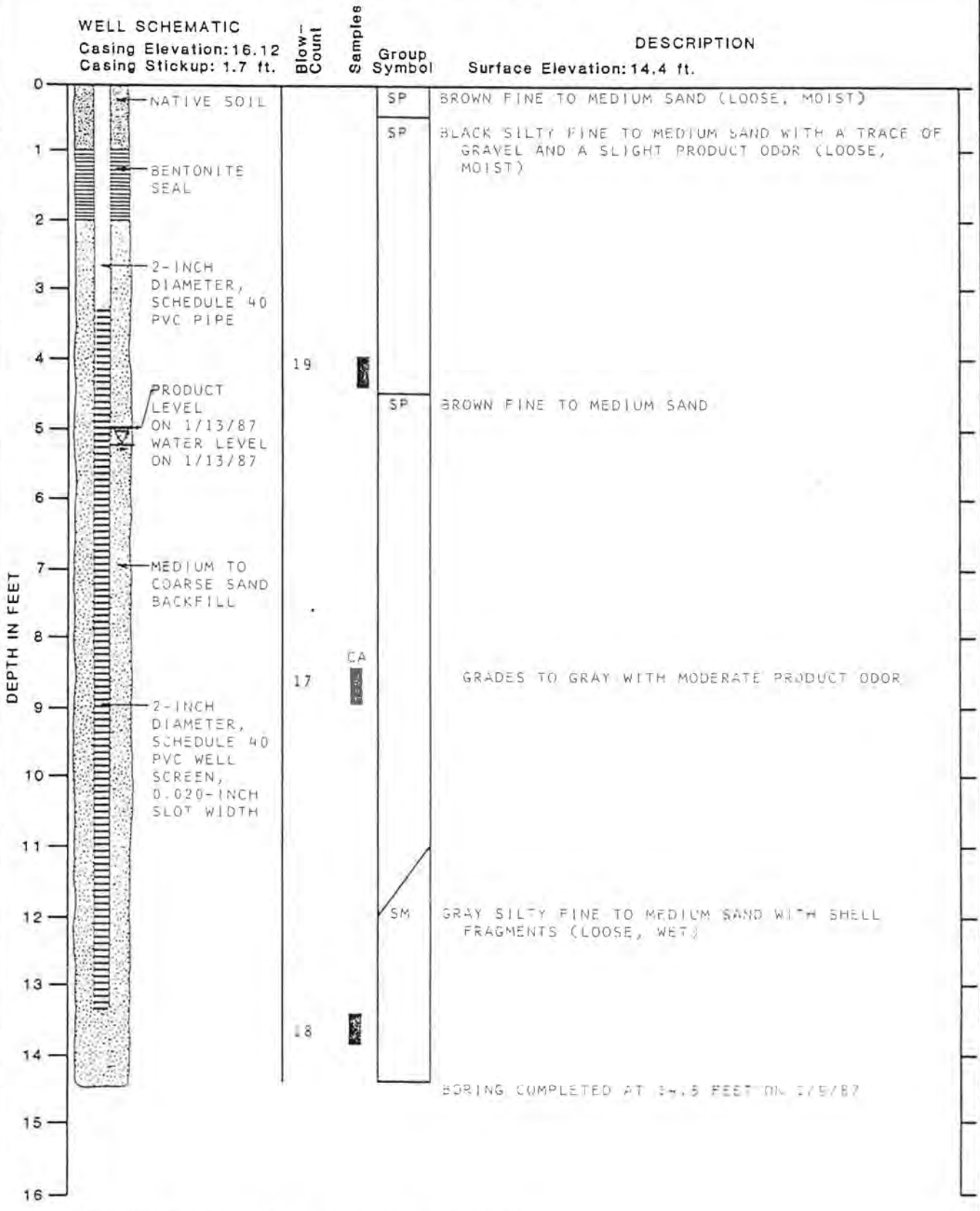
Note: See Figure A-2 for Explanation of Symbols

GeoEngineers Incorporated

LOG OF MONITOR WELL

FIGURE A-9

MONITOR WELL NO. 15



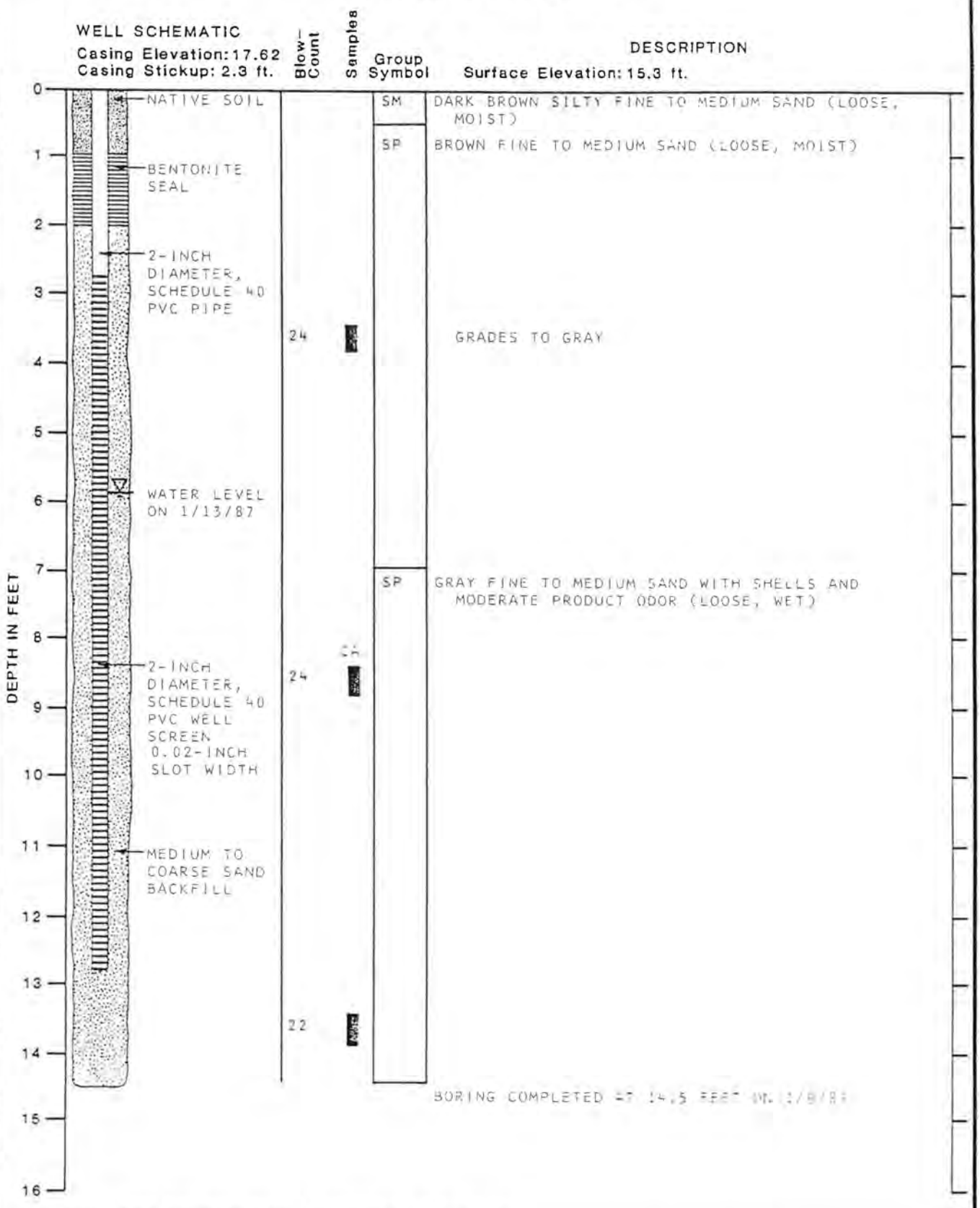
Note: See Figure A-2 for Explanation of Symbols

GeoEngineers Incorporated

LOG OF MONITOR WELL

FIGURE A-10

MONITOR WELL NO. 16



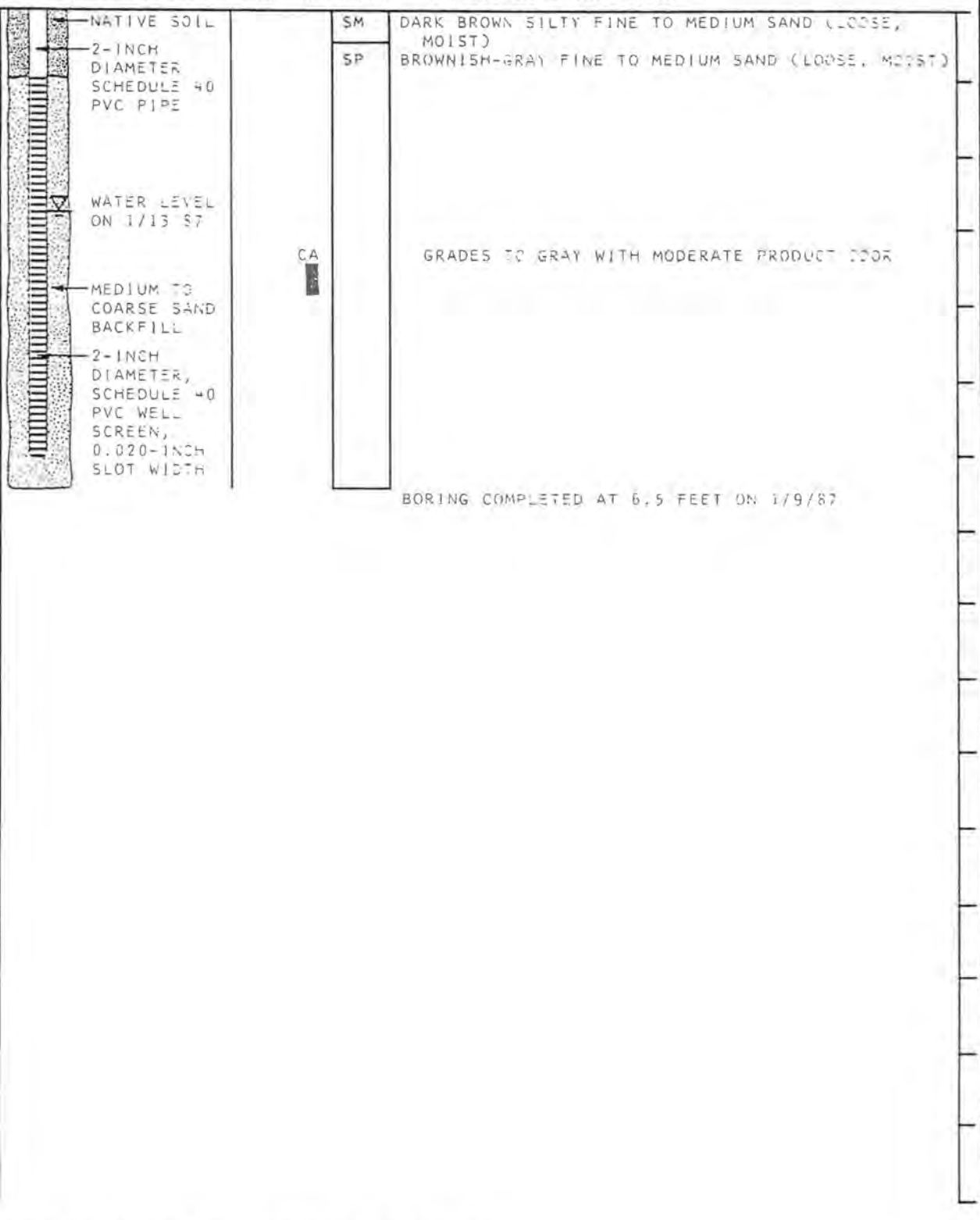
Note: See Figure A-2 for Explanation of Symbols

GeoEngineers Incorporated

LOG OF MONITOR WELL

FIGURE A-11

MONITOR WELL NO. 17



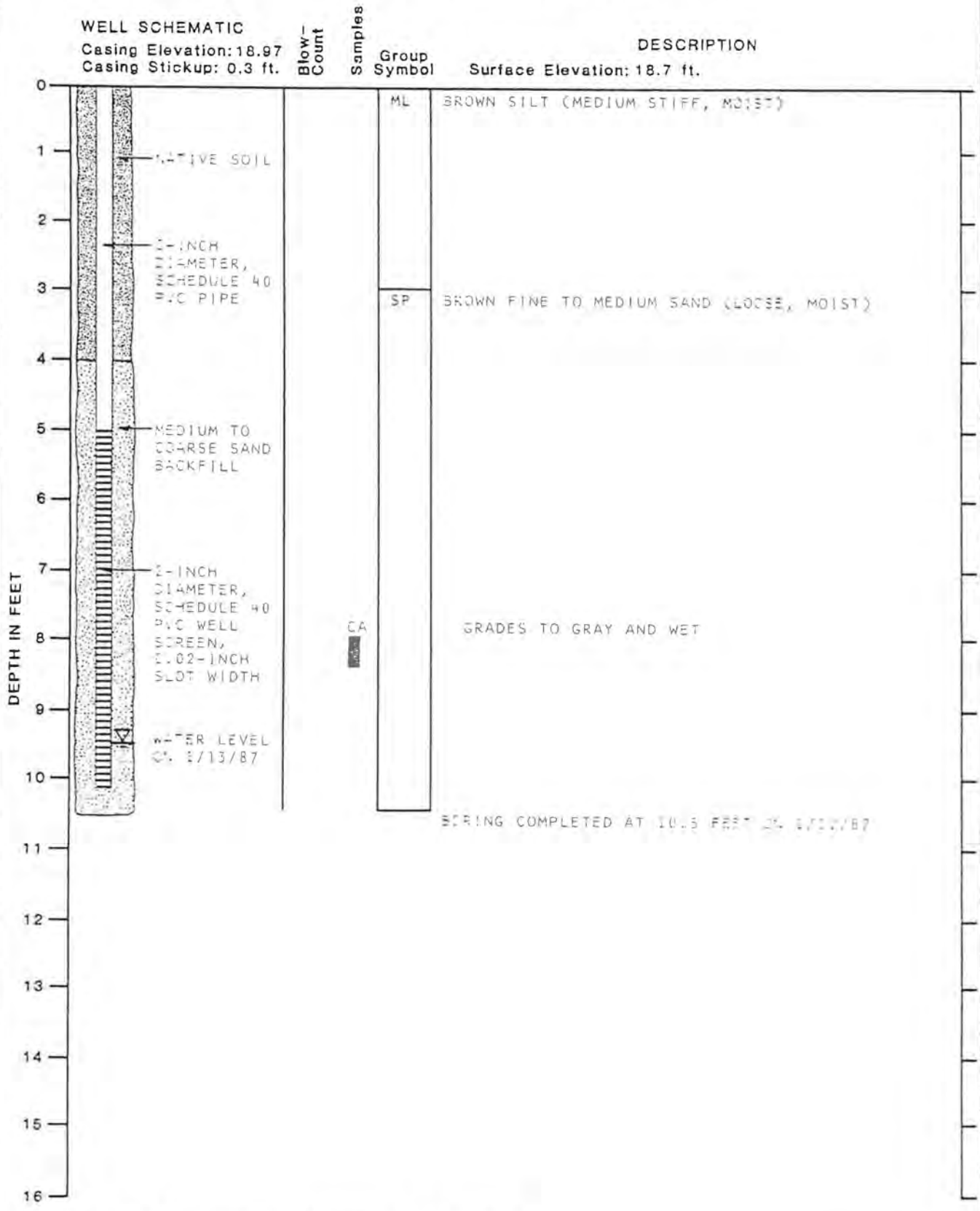
Note: See Figure A-2 for Explanation of Symbols

GeoEngineers Incorporated

LOG OF MONITOR WELL

FIGURE A-12

MONITOR WELL NO. 18



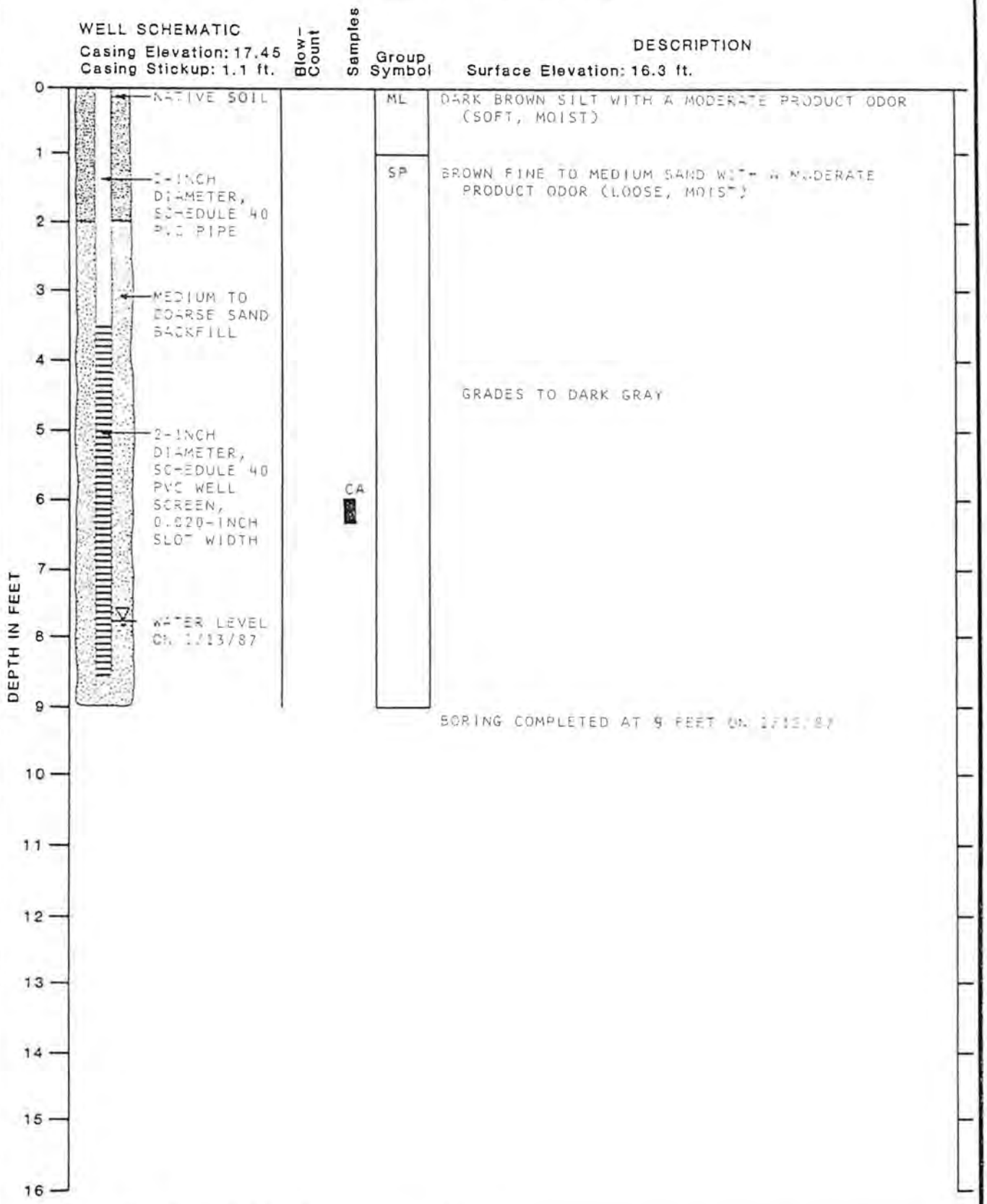
Note: See Figure A-2 for Explanation of Symbols

GeoEngineers Incorporated

LOG OF MONITOR WELL

FIGURE A-13

MONITOR WELL NO. 19



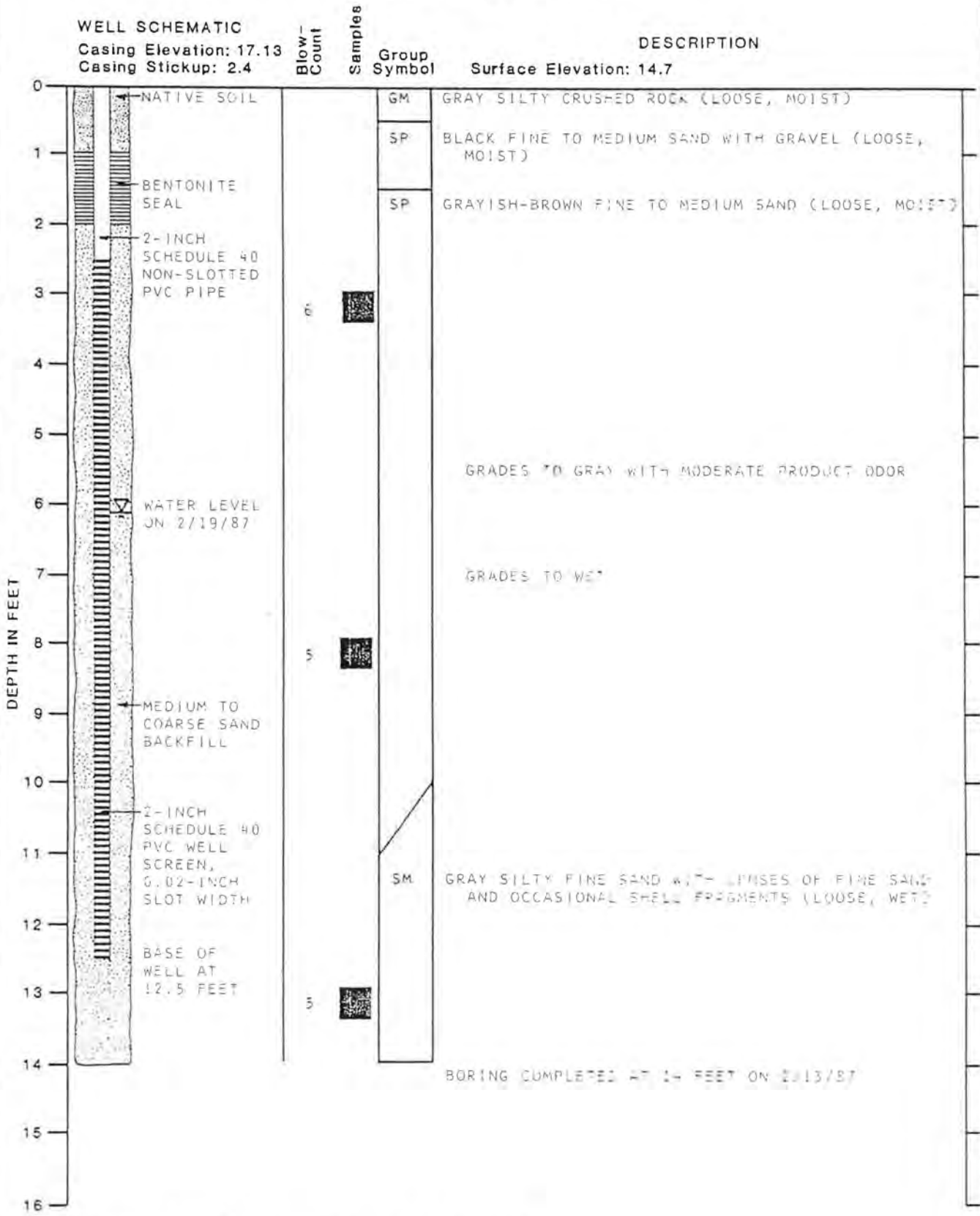
Note: See Figure A-2 for Explanation of Symbols

GeoEngineers Incorporated

LOG OF MONITOR WELL

FIGURE A-14

MONITOR WELL NO. 20



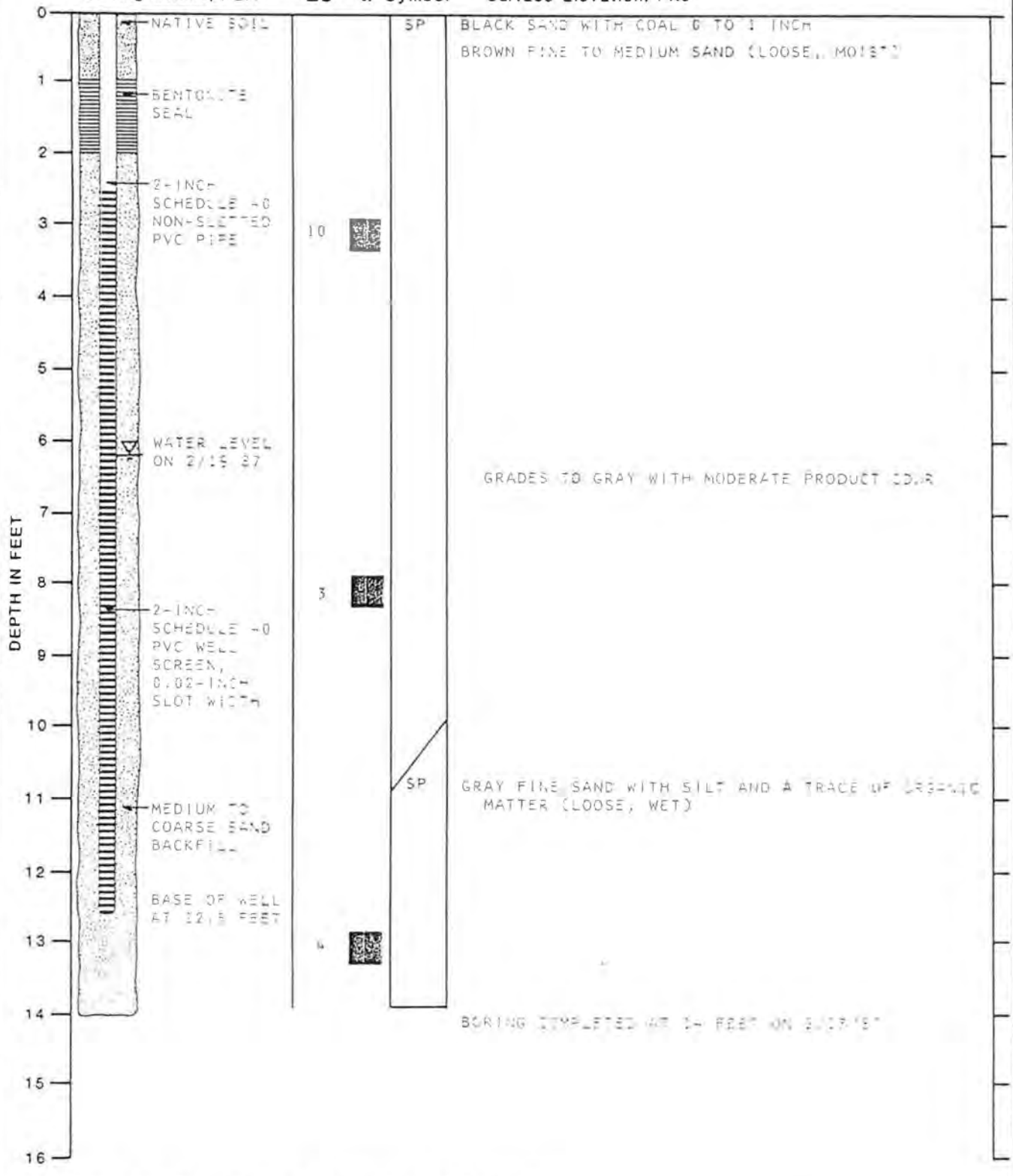
Note: See Figure A-2 for Explanation of Symbols

GeoEngineers Incorporated

LOG OF MONITOR WELL

FIGURE A-15

MONITOR WELL NO. 21



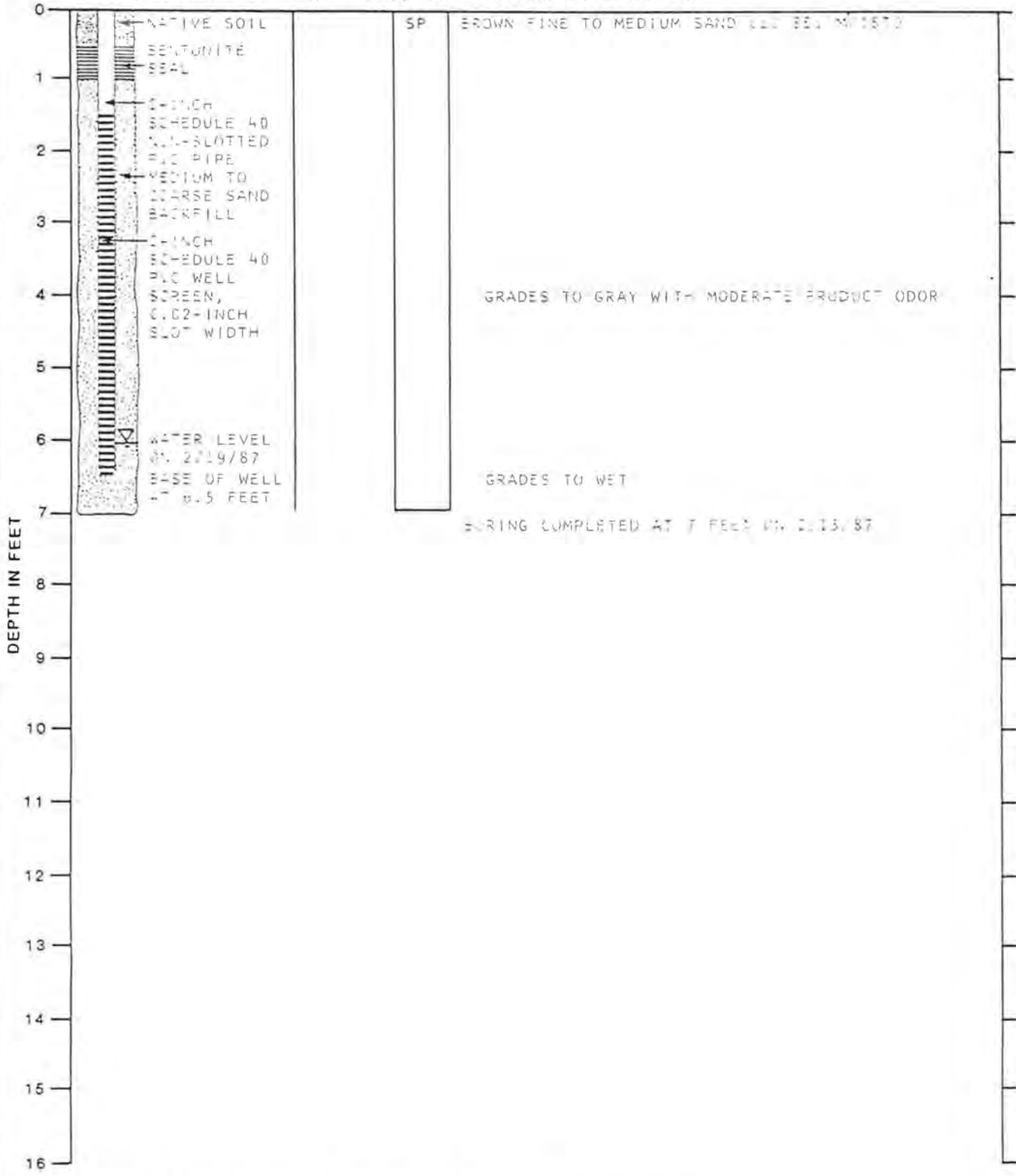
Note: See Figure A-2 for Explanation of Symbols

GeoEngineers Incorporated

LOG OF MONITOR WELL

FIGURE A-16

MONITOR WELL NO. 22



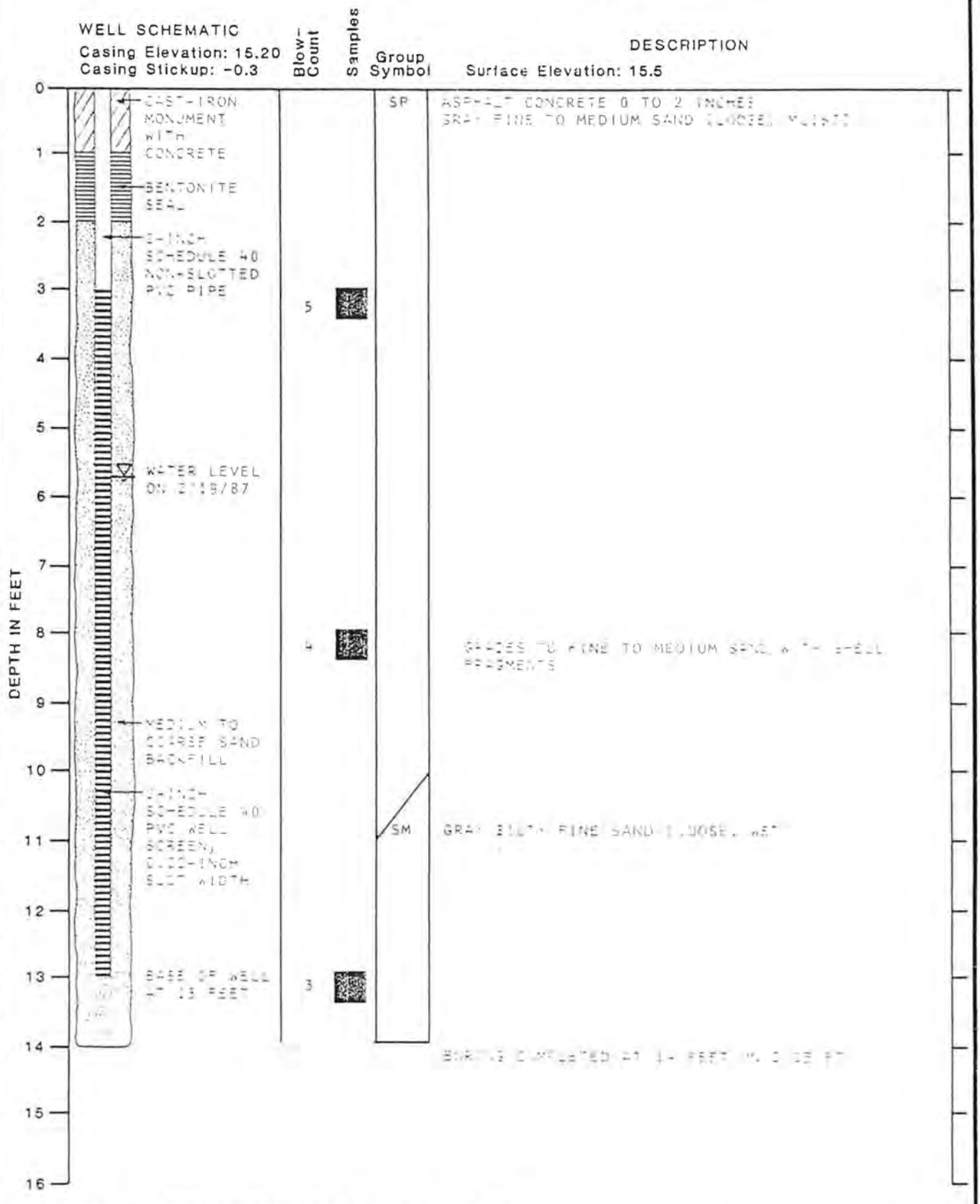
Note: See Figure A-2 for Explanation of Symbols

GeoEngineers Incorporated

LOG OF MONITOR WELL

FIGURE A-17

MONITOR WELL NO. 23



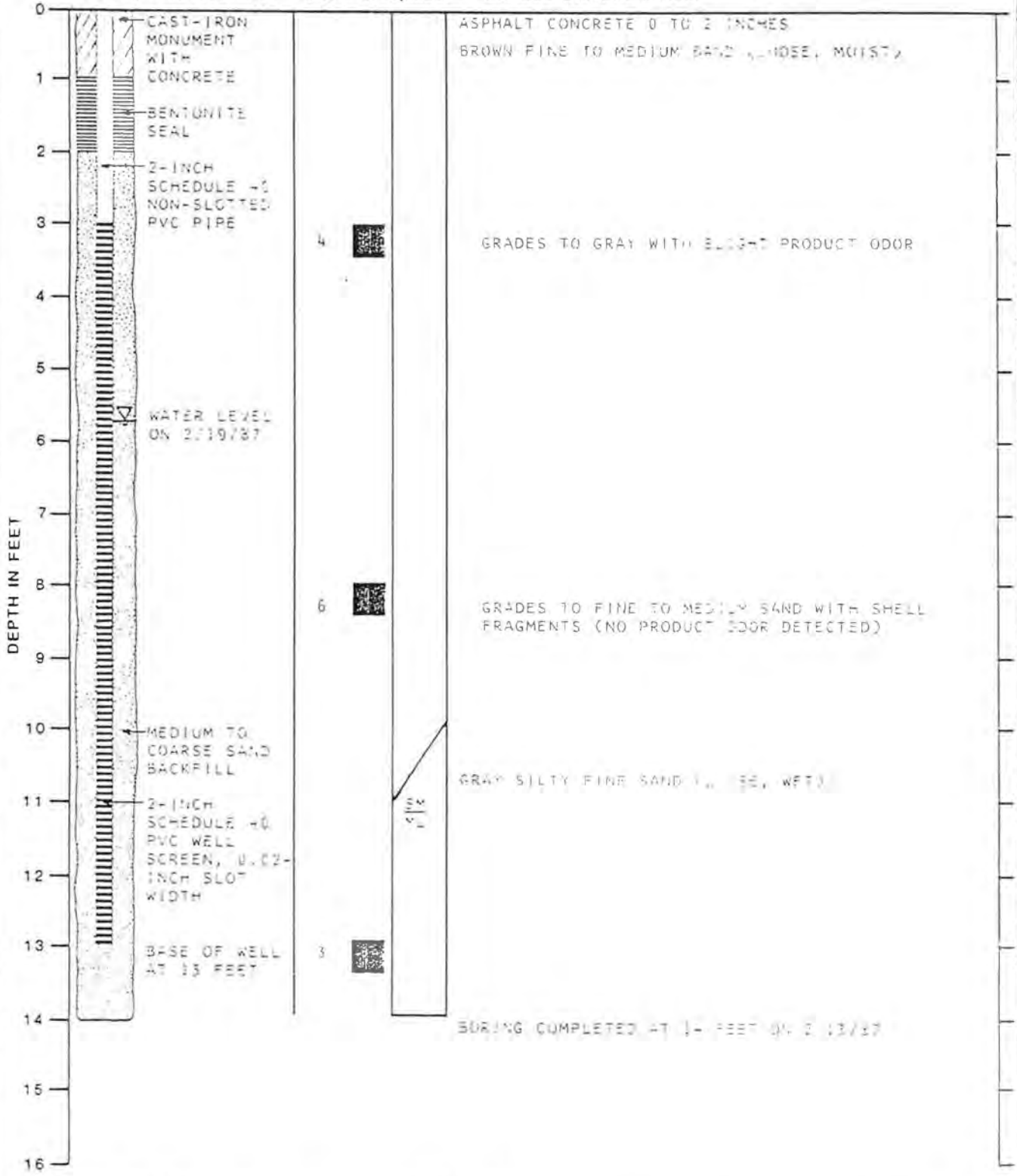
Note: See Figure A-2 for Explanation of Symbols

GeoEngineers Incorporated

LOG OF MONITOR WELL

FIGURE A-18

MONITOR WELL NO. 24



Note: See Figure A-2 for Explanation of Symbols

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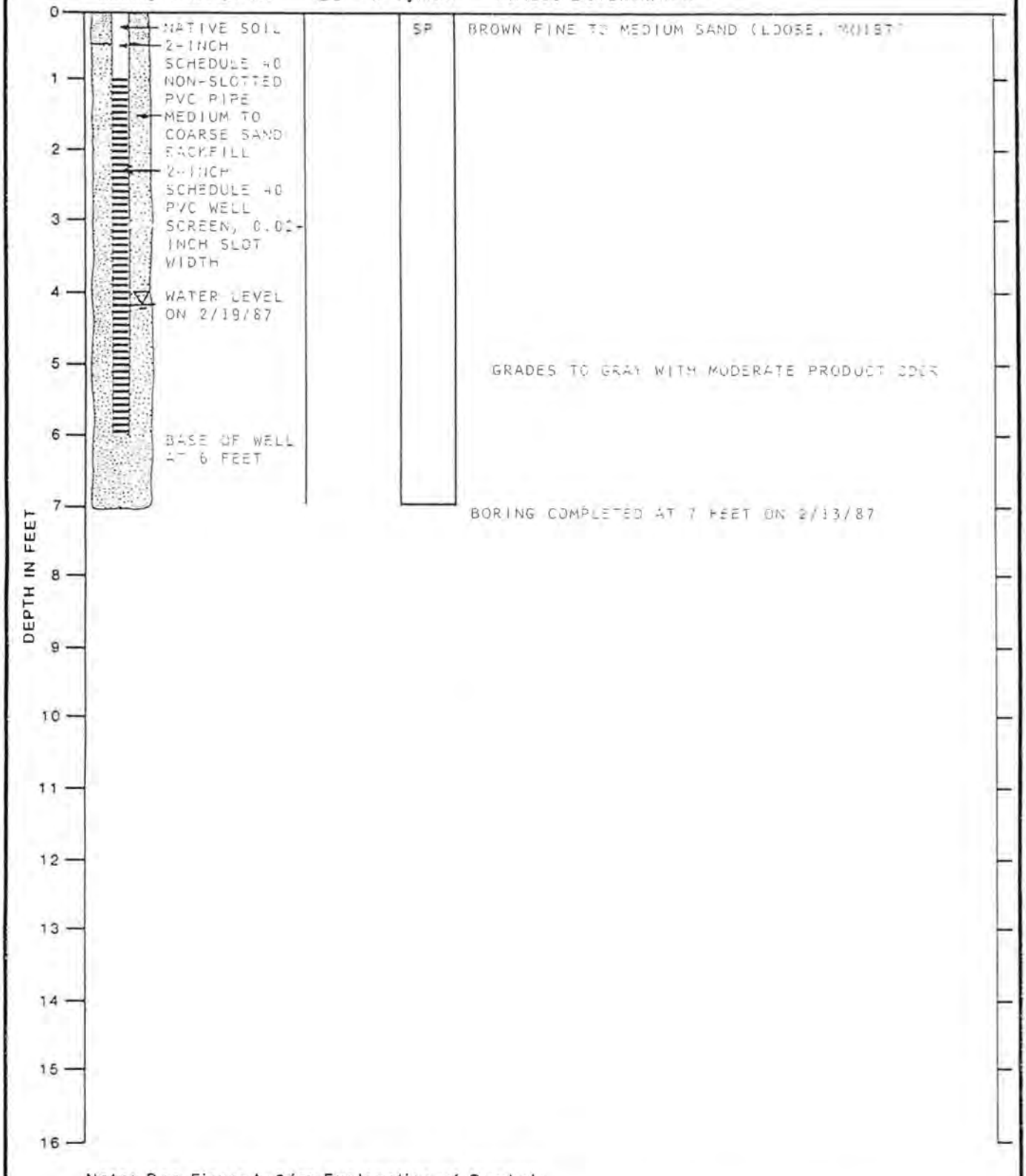
LOG OF MONITOR WELL

FIGURE A-19

MONITOR WELL NO. 25



Note: See Figure A-2 for Explanation of Symbols

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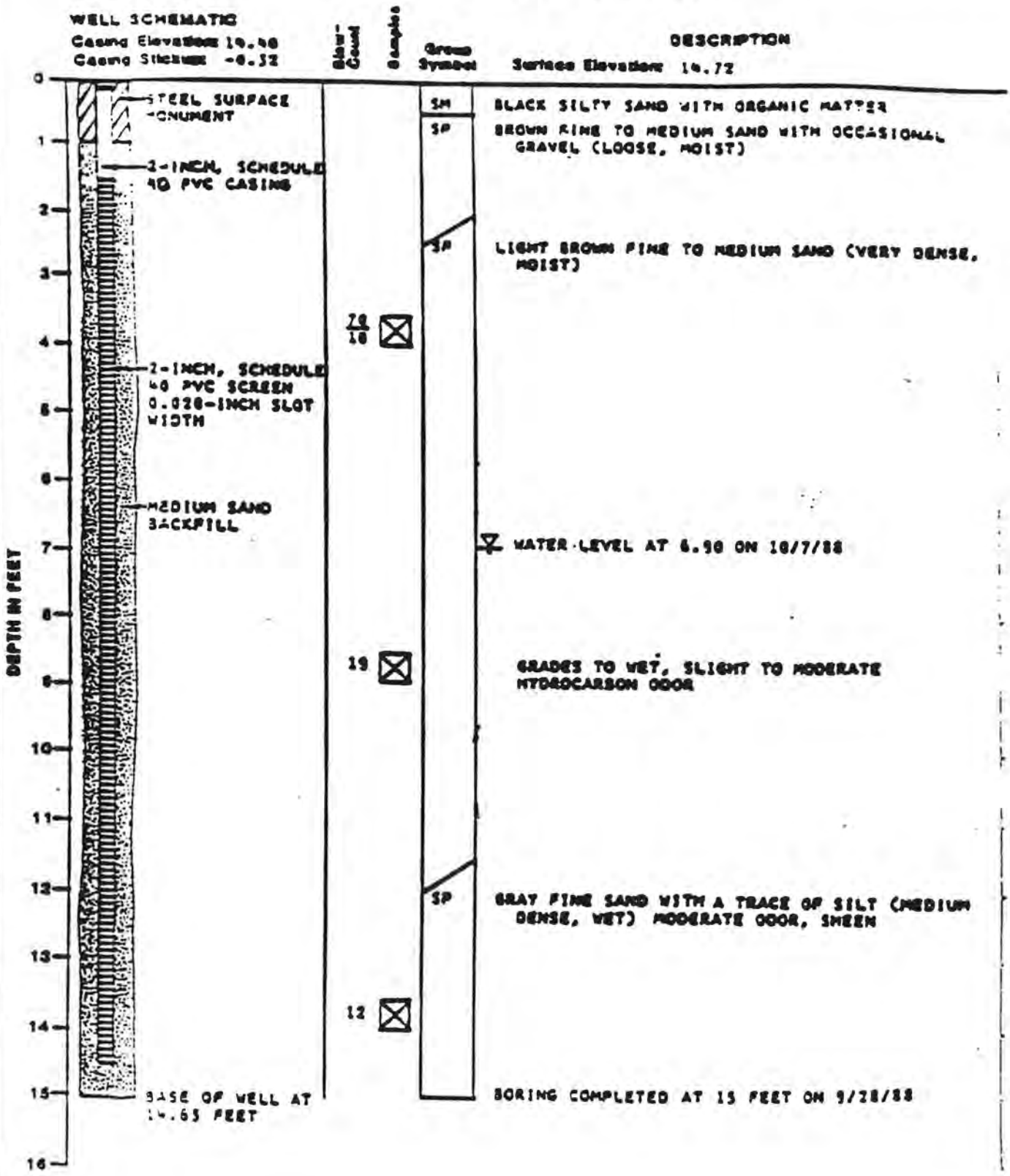
LOG OF MONITOR WELL

FIGURE A-20

MONITOR WELL NO. MW-25A

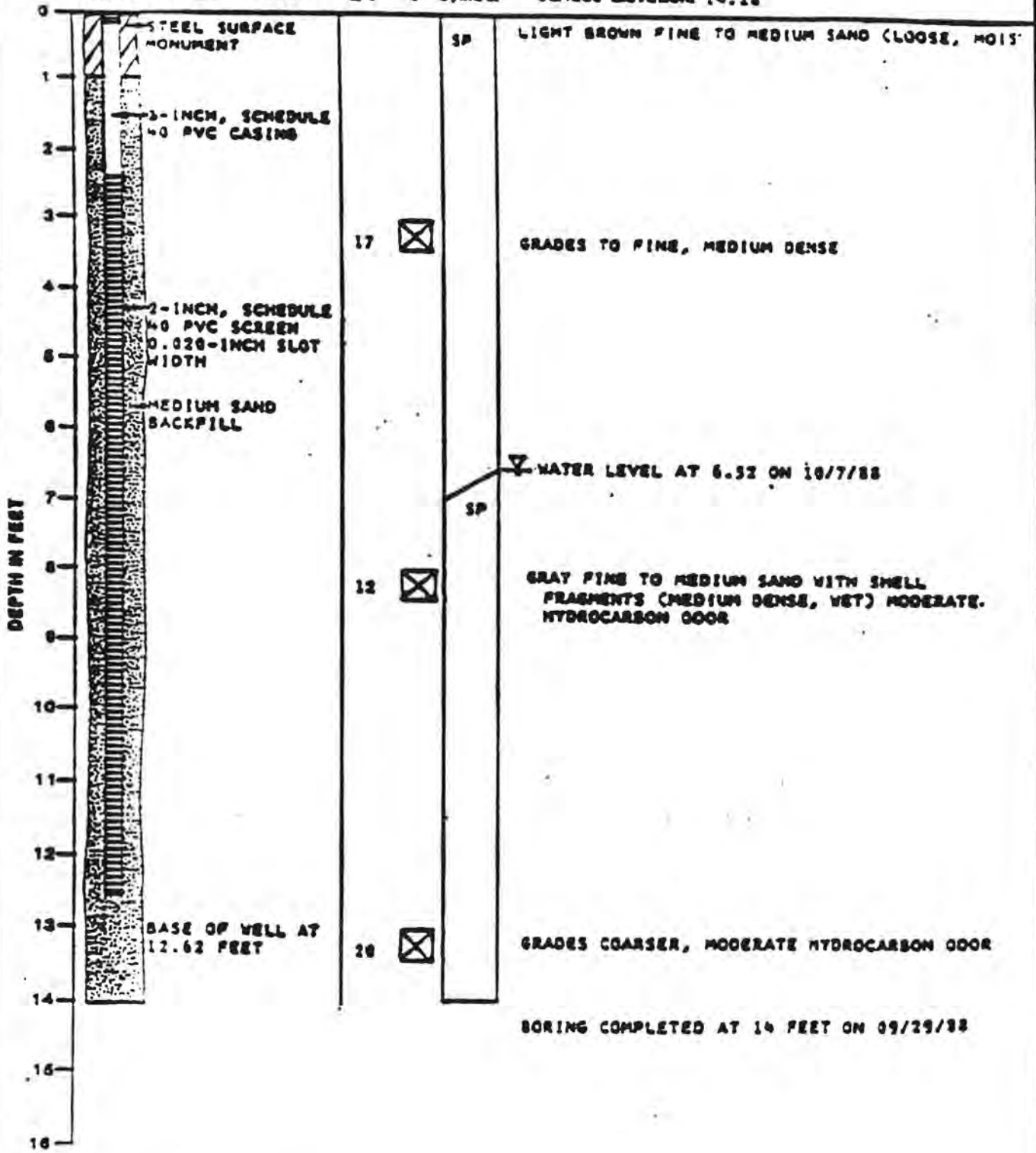


Reference: GeoEngineers 1988

LOG OF MONITOR WELL

TABLE A-20

MONITOR WELL NO. MW-26

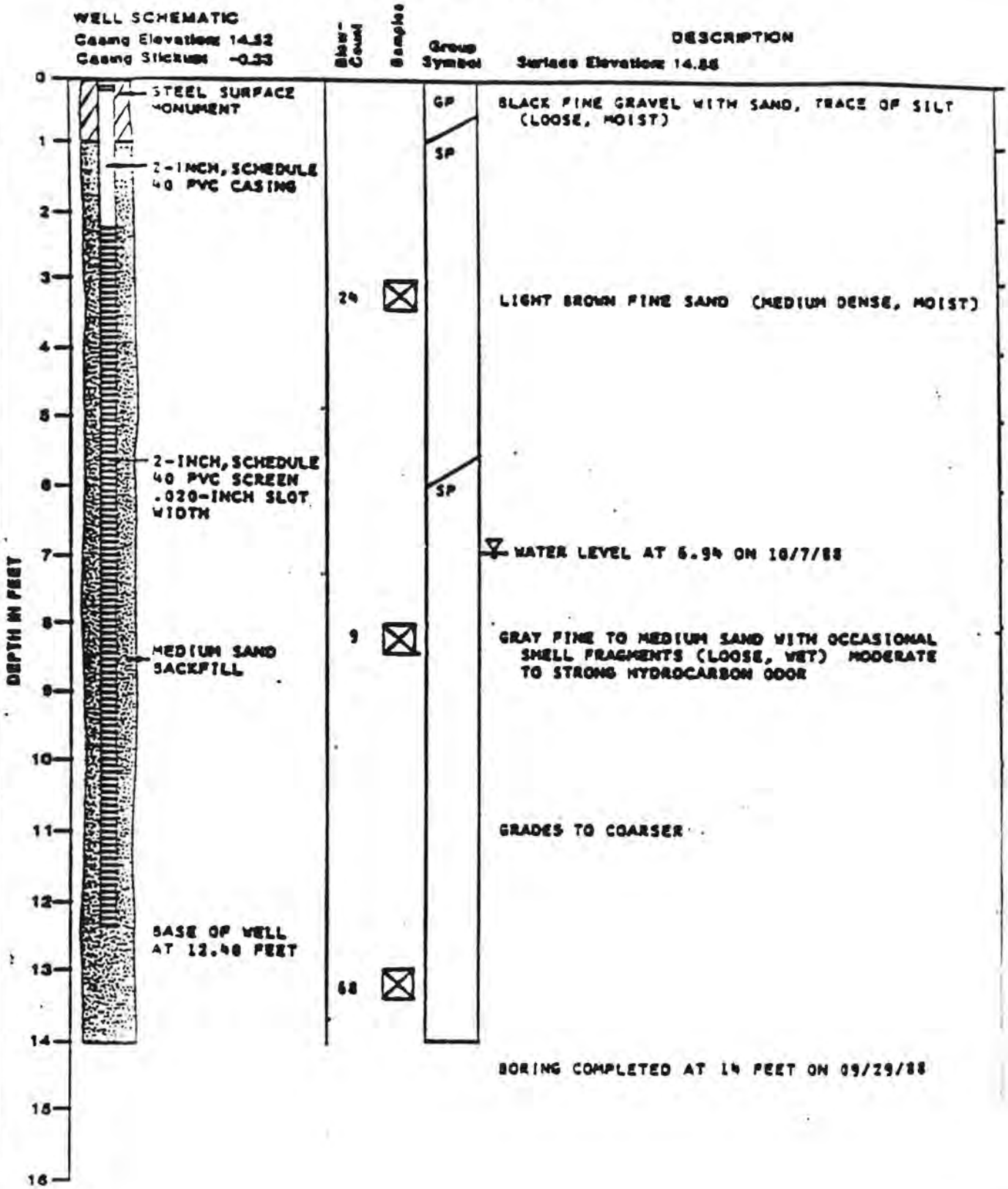


Reference: GeoEngineers 1988

LOG OF MONITOR WELL

TABLE A-21

MONITOR WELL NO. MW-27

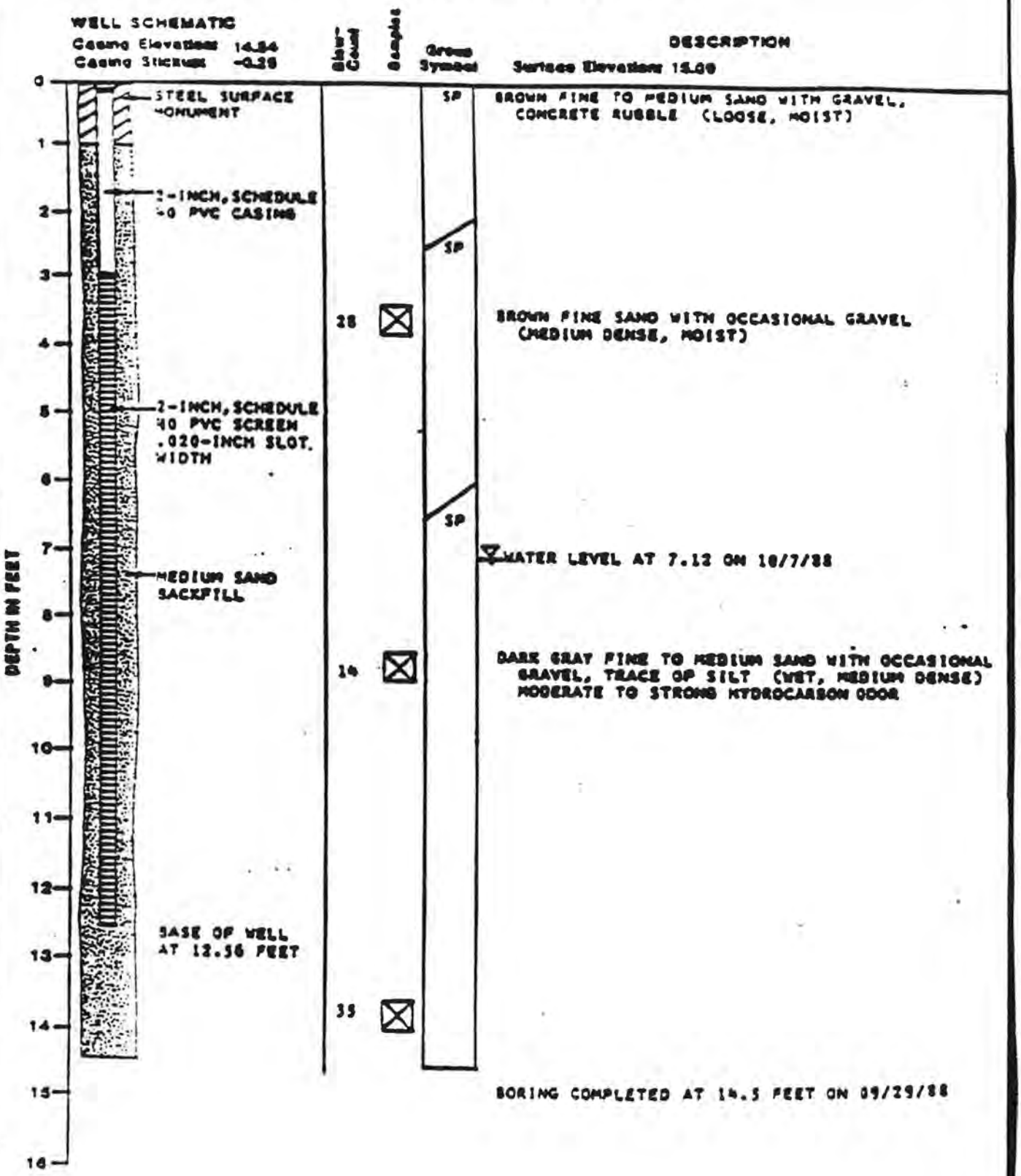


Reference: GeoEngineers 1988

LOG OF MONITOR WELL

TABLE A-22

MONITOR WELL NO. MW-28

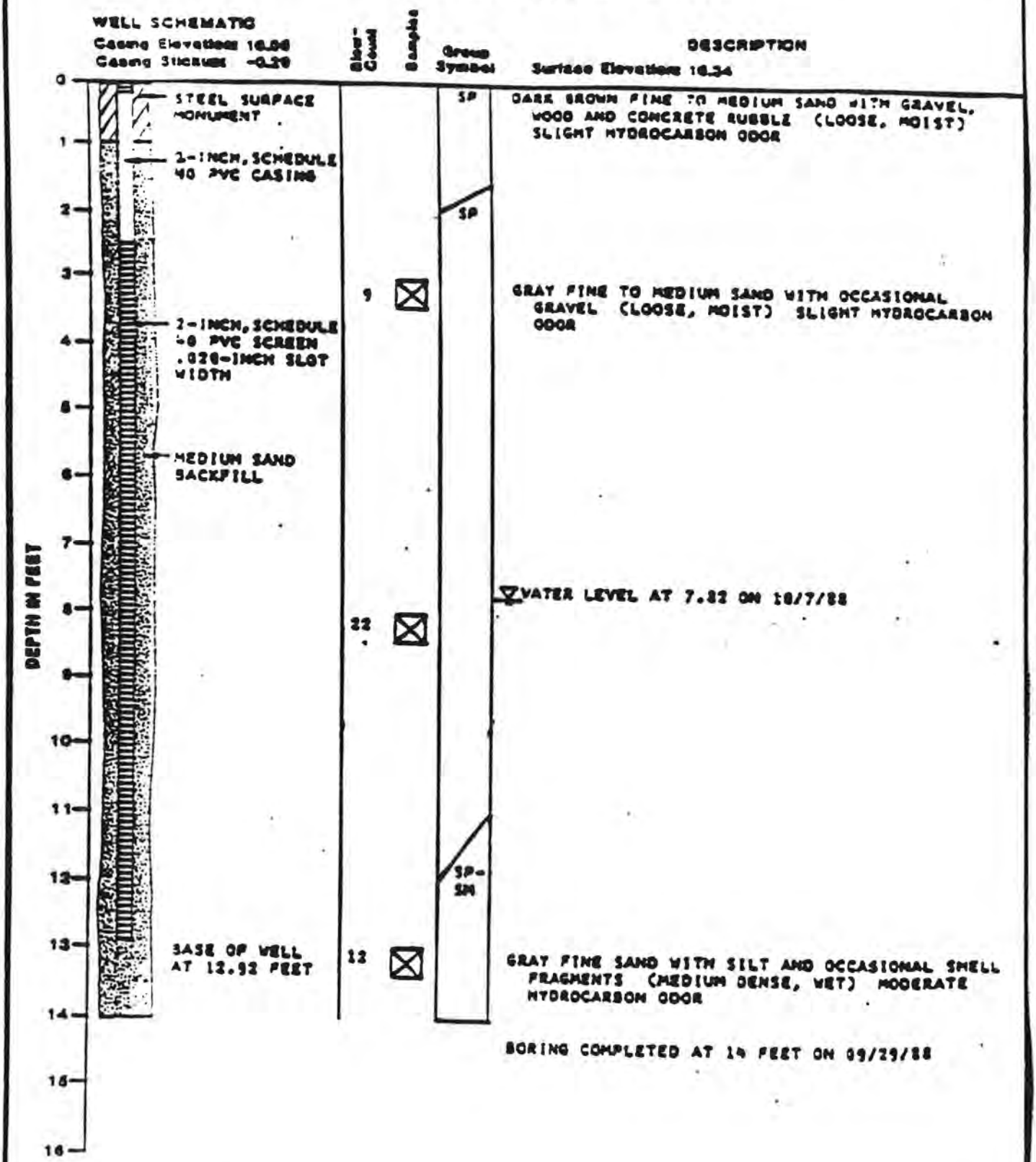


Reference: GeoEngineers 1988

LOG OF MONITOR WELL

TABLE A-23

MONITOR WELL NO. MW-29

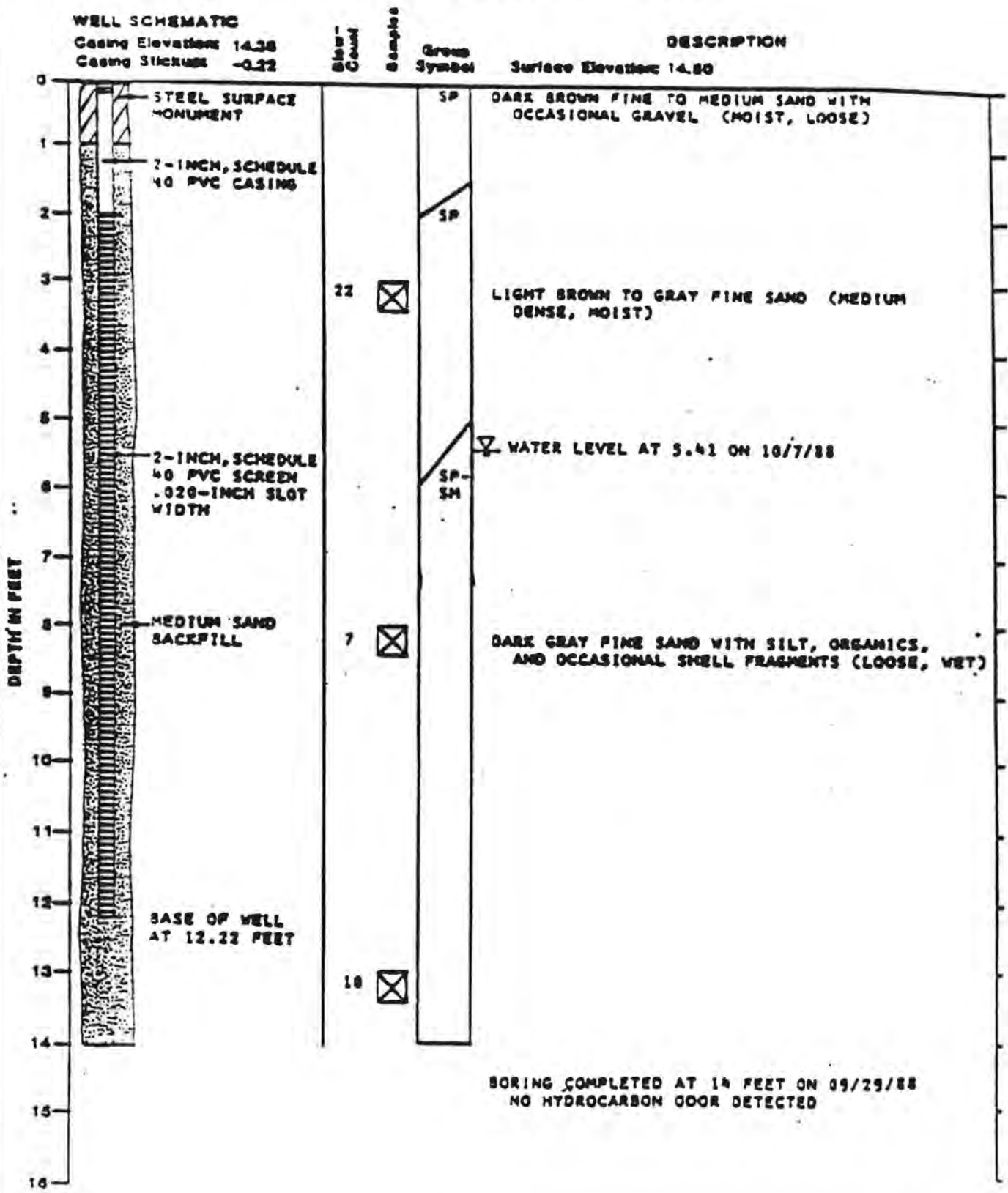


Reference: GeoEngineers 1988

LOG OF MONITOR WELL

TABLE A-24

MONITOR WELL NO. MW-30

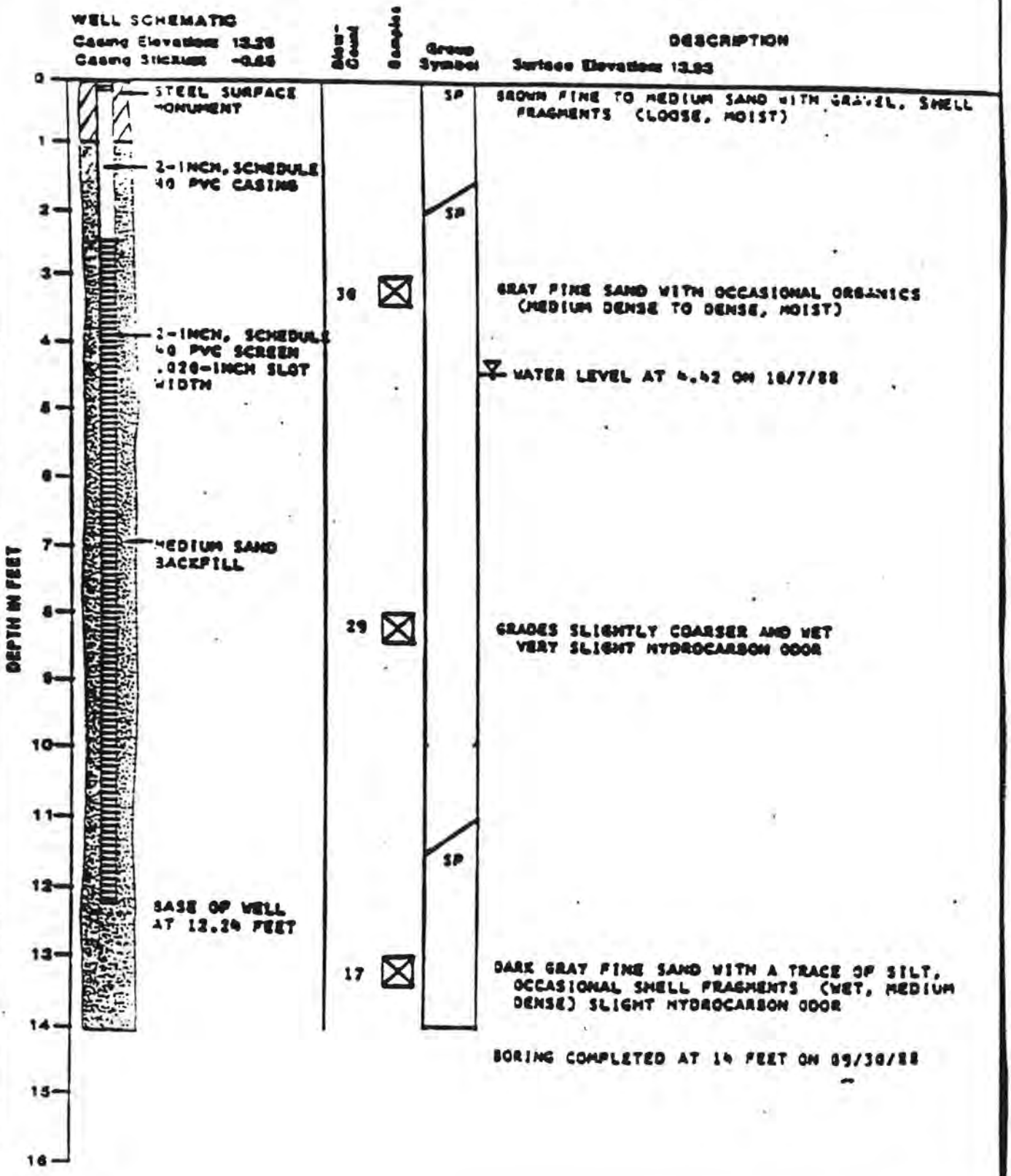


Reference: GeoEngineers 1988

LOG OF MONITOR WELL

TABLE A-25

MONITOR WELL NO. MW-31

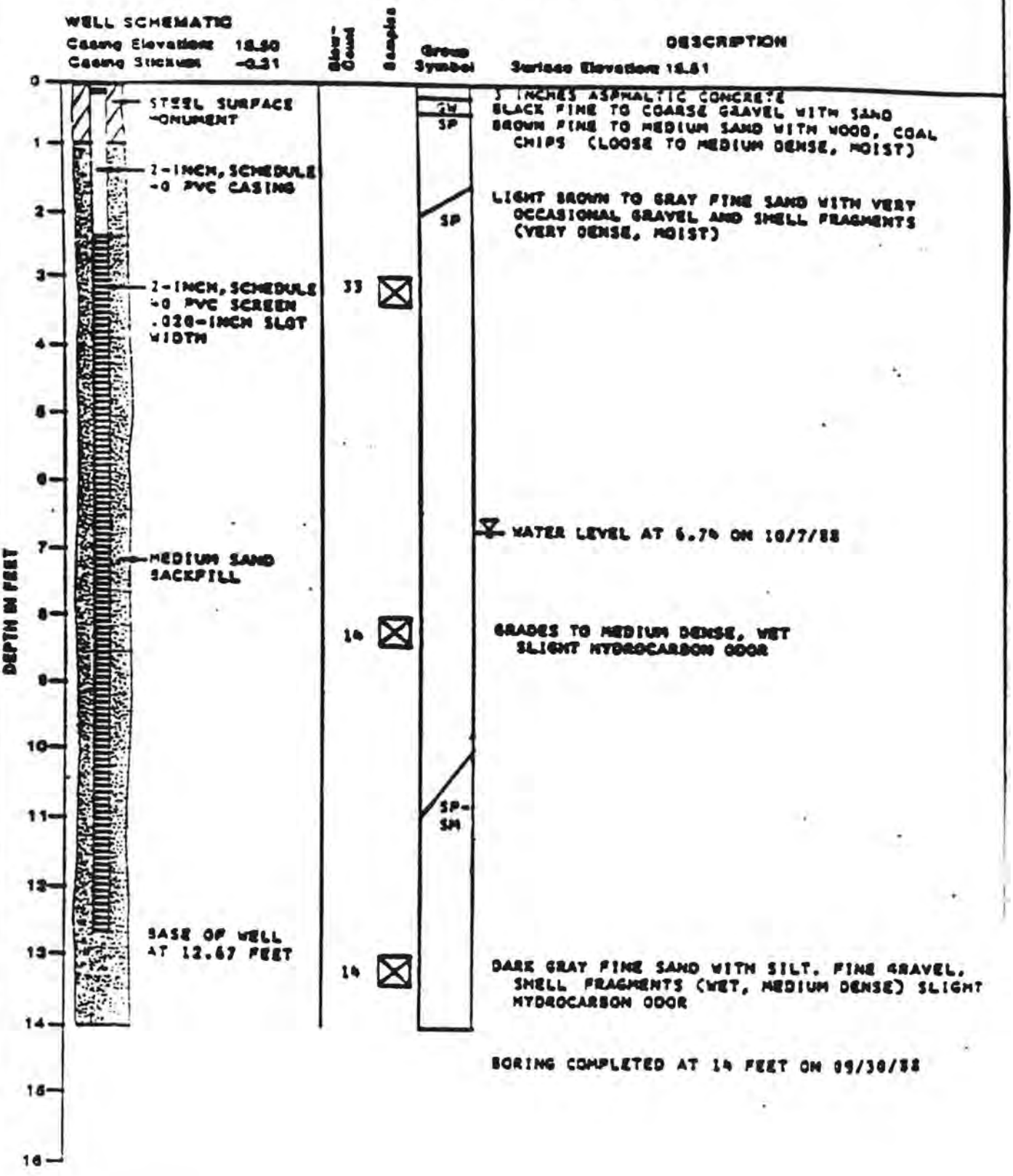


Reference: GeoEngineers 1988

LOG OF MONITOR WELL

TABLE A-26

MONITOR WELL NO. MW-32



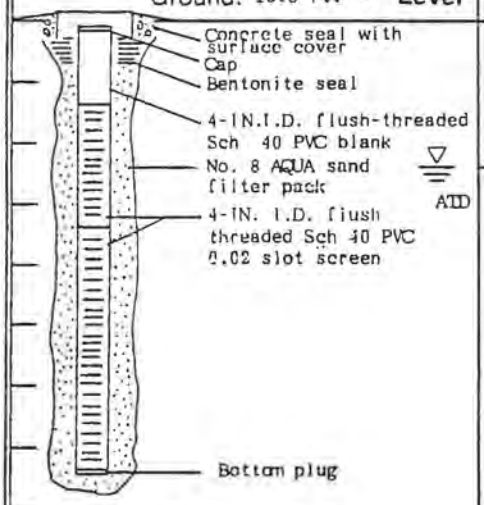
Reference: GeoEngineers 1988

LOG OF MONITOR WELL

TABLE A-27

AS-BUILT WELL CONSTRUCTION

Elevation: Casing: 15.39 ft.** Water Level
Ground: 15.8 ft. **



Hydrogeologic Unit	Blows/ft	Sample Interval	Depth in Feet	Field Analysis	Graphic Log	DESCRIPTION
	5		0	0		Loose, moist, brown to gray, fine to medium SAND with trace to some silt
	8	*	5	0		Loose, wet to saturated, gray to brown, silty fine to medium SAND with trace coarse sand and gravel
	11			0		Loose to medium dense, saturated, gray, fine to medium SAND with trace of silt layers and scattered wood and shell fragments
	9		10	0		
	2		15	0		Very loose, saturated, gray-brown, gravelly, silty fine to medium SAND with silt layers and scattered wood and shell fragments
	14	*	20	1		Medium dense, saturated, gray, silty fine to medium SAND with trace of gravel and scattered wood and shell fragments
			25			
			30			
			35			
			40			
			45			
			50			

Notes: 1) Boring terminated at 21.5 feet
2) No hydrocarbon-like sheens or odors noted on samples

* Denotes analyzed sample

** Based on survey completed for this project

ATD= Water level at time of drilling

Field Analysis: PID headspace concentrations in ppm

Date Started: 6/26/89
Date Completed: 6/26/89

Logged By: C.R. Andersen

Drilled By: Geoboring & Develop., Inc.
Drilling Method: H.S.A.

THORNE ENVIRONMENTAL

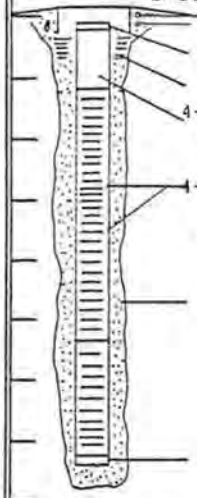
Project Number: 5E-1030-1

HYDROGEOLOGIC LOG AND AS-BUILT FOR MONITORING WELL MW -33

TABLE A-1

AS-BUILT WELL CONSTRUCTION

Elevation: Casing: 14.96 ft. ** Water
Ground: 15.5 ft. ** Level



Hydrogeologic Unit	Blows/ft	Sample Interval	Depth in Feet	Field Analysis	Graphic Log	DESCRIPTION
	22		0	0		Medium dense, moist, gray, fine to medium SAND with trace silt and scattered shell fragments
	6	*	5	0		Loose, saturated, gray, silty fine to medium SAND with silt layers and scattered wood fragments
	10			0		
	16		10	0		Loose to medium dense, saturated, gray, fine to medium SAND with trace to some silt, trace gravel, occasional silt layers, and scattered wood and shell fragments
	4		15	0		Very loose to loose, saturated, gray, gravelly, silty fine to medium SAND with scattered wood and shell fragments
	11	*	20	0		Medium dense, saturated, gray, silty fine to medium SAND with scattered wood and shell fragments
			25			NOTES: (1) Boring terminated at 21.5 feet (2) No hydrocarbon-like sheens or odors noted on samples * Denoted analyzed sample ** Based on survey completed for this project ATD= Water level at time of drilling Field Analysis: PID headspace concentrations in ppm
			30			
			35			
			40			
			45			
			50			

Date Started: 6/26/89
Date Completed: 6/26/89

Logged By: C.R. Andersen

Drilled By: Geoboring & Develop., Inc.
Drilling Method: H.S.A.

THORNE ENVIRONMENTAL

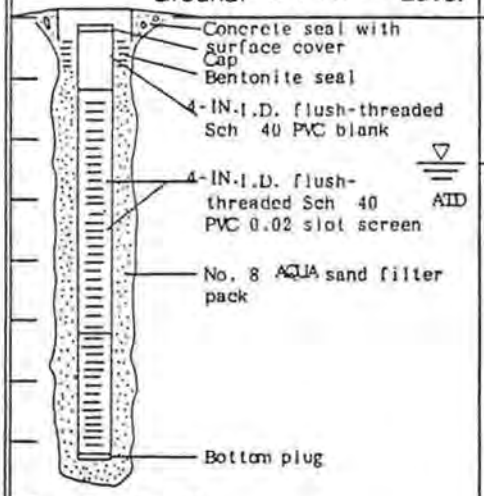
Project Number: 5E-1030-1

HYDROGEOLOGIC LOG AND AS-BUILT FOR MONITORING WELL MW - 34

TABLE A-2

AS-BUILT WELL CONSTRUCTION

Elevation: Casing: 15.15 ft. ** Water
Ground: 15.5 ft. ** Level



Hydrogeologic Unit	Blows/ft	Sample Interval	Depth in Feet	Field Analysis	Graphic Log	DESCRIPTION
	27			0		Medium dense, moist, gray-brown, fine to medium SAND with trace coarse sand, gravel and silt and scattered wood and shell fragments
	14	*	5	0		
	7	*		4		Loose to medium dense, wet to saturated, gray to brown, silty fine to medium SAND with trace coarse sand and gravel, trace silt layers and scattered wood and shell fragments
	6	*	10	44		
	10		15	42		
	15	*	20	0		Medium dense, saturated, gray, gravelly SAND with trace to some silt and scattered shell fragments
			25			NOTES: (1) Boring terminated at 21.5 feet (2) Hydrocarbon-like sheens noted on samples from about 6 to 20 feet * Denotes analyzed sample ** Based on survey completed for this project AID= Water level at time of drilling Field Analysis: PID headspace concentrations in ppm
			30			
			35			
			40			
			45			
			50			

Date Started: 6/26/89
Date Completed: 6/26/89

Logged By: C.R. Andersen

Drilled By: Geoboring & Develop., Inc.
Drilling Method: H.S.A.

THORNE ENVIRONMENTAL

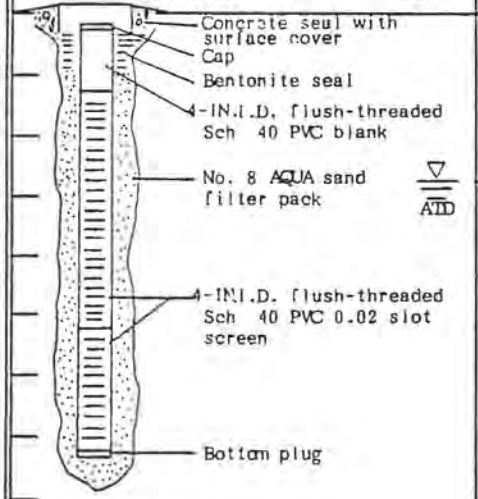
Project Number: 5E-1030-1

HYDROGEOLOGIC LOG AND AS-BUILT FOR MONITORING WELL MW - 35

TABLE A-3

AS-BUILT WELL CONSTRUCTION

Elevation: Casing: 15.49 ft. ** Water
Ground: 15.9 ft. ** Level



Hydrogeologic Unit	Blows/ft	Sample Interval	Depth in Feet	Field Analysis	Graphic Log	DESCRIPTION
	27		0	0		Loose to medium dense, moist to saturated, gray to brown, fine to medium SAND with trace coarse sand, gravel and silt, trace silt layers and scattered wood and shell fragments
	22	*	5	143		
	12	*		32		
	7		10	3		
	7		15	0		Loose, saturated, brown-gray,gravelly, silty SAND with scattered shell fragments
	11	*	20	1		Medium dense, saturated, gray, fine to medium SAND with trace coarse sand, trace silt layers and scattered shell fragments
			25			NOTES: (1) Boring terminated at 21.5 feet (2) Hydrocarbon-like sheens and odors noted on samples from about 7 to 15 feet * Denotes analyzed sample ** Based on survey completed for this project ATD= Water level at time of drilling Field Analysis: PID headspace concentrations in ppm
			30			
			35			
			40			
			45			
			50			

Date Started: 6/27/89
Date Completed: 6/27/89

Logged By: C.R. Andersen

Drilled By: Geoboring & Develop., Inc.
Drilling Method: H.S.A.

THORNE ENVIRONMENTAL

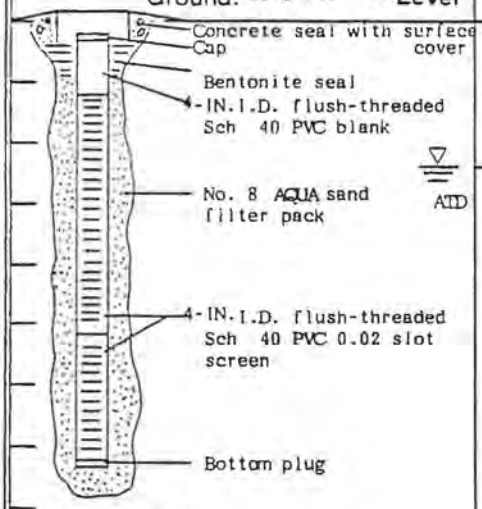
Project Number: 5E-1030-1

HYDROGEOLOGIC LOG AND AS-BUILT FOR MONITORING WELL
MW - 36

TABLE
A-4

AS-BUILT WELL CONSTRUCTION

Elevation: Casing: 15.14 ft. ** Water
Ground: 15.8 ft. ** Level



Hydrogeologic Unit	Blows/ft	Sample Interval	Depth in Feet	Field Analysis	Graphic Log	DESCRIPTION
	26			4		Medium dense, moist, gray, fine to medium SAND with trace to some silt and scattered shell fragments
	11	*	5	9		
	17	*		53		Very loose to medium dense, saturated, gray, silty fine to medium SAND with trace gravel, trace silt layers and scattered wood and shell fragments
	4		10	25		
	2		15	1		
						Very loose, saturated, gray, gravelly, silty SAND with trace silt layers and scattered wood fragments
	9	*	20	1		Loose, saturated, gray, silty, fine to medium SAND with trace silt layers
			25			
			30			
			35			
			40			
			45			
			50			

NOTES:

(1) Boring terminated at 21.5 feet
(2) Hydrocarbon-like sheens noted on samples from about 7.5 to 10 feet

* Denotes analyzed sample.
** Based on survey completed for this project

ATD=Water level at time of drilling

Field Analysis: PID headspace concentrations in ppm

Date Started: 6/27/89
Date Completed: 6/27/89

Logged By: C.R. Andersen

Drilled By: Geoboring & Develop., Inc.
Drilling Method: H.S.A.

THORNE ENVIRONMENTAL

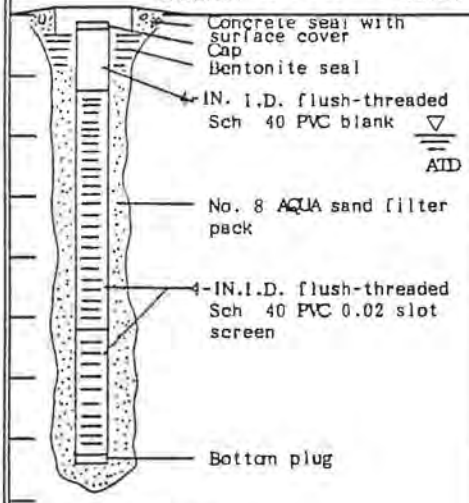
Project Number: 5E-1030-J

HYDROGEOLOGIC LOG AND AS-BUILT FOR MONITORING WELL MW-37

TABLE A-5

AS-BUILT WELL CONSTRUCTION

Elevation: Casing: 14.78 ft. ** Water
Ground: 15.0 ft. ** Level



Hydrogeologic Unit	Blows/ft	Sample Interval	Depth in Feet	Field Analysis	Graphic Log	DESCRIPTION
	28			0		Loose to medium dense, moist to saturated, gray, fine to medium SAND with trace to some silt, trace gravel, trace coarse sand and silt layers and scattered wood and shell fragments
	7	*	5	0		
	8			0		
	3		10	0		
	6	NR	15	0		Soft, saturated, brown, fine sandy SILT with scattered wood fragments
	7	*	20	2		Loose, saturated, gray, silty fine to medium SAND with trace silt layers and scattered wood and shell fragments
			25			NOTES: (1) Boring terminated at 21.5 feet (2) No hydrocarbon-like sheens or odors noted on samples NR= Sample not recovered * Denotes analyzed sample ** Based on survey completed for this project ATD= Water level at time of drilling Field Analysis: PID headspace concentrations in ppm
			30			
			35			
			40			
			45			
			50			

Date Started: 6/28/89
Date Completed: 6/28/89

Logged By: C. R. Andersen

Drilled By: Geoboring & Develop., Inc.
Drilling Method: H.S.A.

THORNE ENVIRONMENTAL

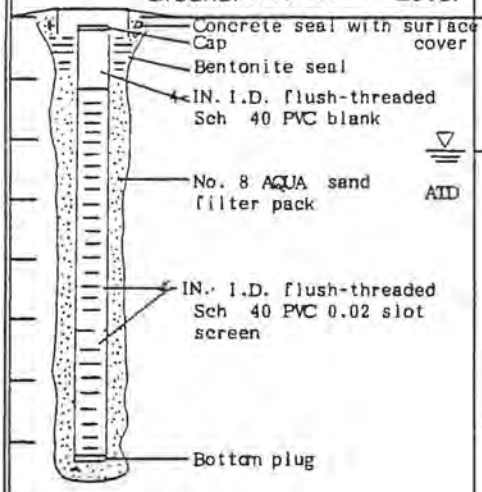
Project Number: 5E-1030-1

HYDROGEOLOGIC LOG AND AS-BUILT FOR MONITORING WELL
MW - 38

TABLE
A-6

AS-BUILT WELL CONSTRUCTION

Elevation: Casing: 15.36 ft. ** Water
Ground: 15.8 ft. ** Level



Hydrogeologic Unit	Blows/ft	Sample Interval	Depth in Feet	Field Analysis	Graphic Log	DESCRIPTION
	10		0	0		Loose to medium dense, moist, gray-brown, fine to medium SAND with trace to some silt and scattered wood and shell fragments
	6	*	5	0		Loose, saturated, gray, silty fine to medium SAND with trace silt and coarse sand layers and scattered wood and shell fragments
	8			0		Loose, saturated, gray, fine to medium SAND with trace to some silt, trace gravel, trace silt layers and scattered wood and shell fragments
	8		10	0		
	2	NR	15	0		
	8	*	20	0		Loose, saturated, gray, silty fine to medium SAND with trace coarse sand layers and scattered wood and shell fragments
			25			NOTES: (1) Boring terminated at 21.5 feet (2) No hydrocarbon-like sheens or odors noted on samples NR= Sample not recovered * Denotes analyzed sample ** Based on survey completed for this project AID= Water level at time of drilling Field Analysis: PID headspace concentrations in ppm
			30			
			35			
			40			
			45			
			50			

Date Started: 6/28/89
Date Completed: 6/28/89

Logged By: C.R. Andersen

Drilled By: Geoboring & Develop., Inc.
Drilling Method: H.S.A.

THORNE ENVIRONMENTAL

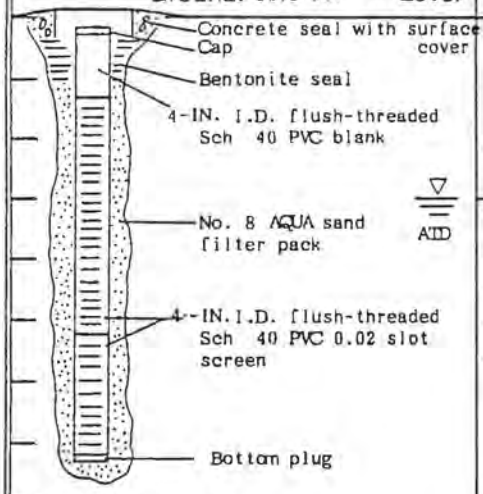
Project Number: 5E-1030-1

HYDROGEOLOGIC LOG AND AS-BUILT FOR MONITORING WELL MW - 3S

TABLE A-7

AS-BUILT WELL CONSTRUCTION

Elevation: Casing: 15.88 ft. ** Water
Ground: 16.1 ft. ** Level



Hydrogeologic Unit	Blows/ft	Sample Interval	Depth in Feet	Field Analysis	Graphic Log	DESCRIPTION
	17		0	0		Loose to medium dense, moist to saturated, gray to brown, fine to medium SAND with trace to some silt, coarse sand and gravel, trace silt layers and scattered wood and shell fragments
	17		5	0		
	10	*		24		
	13		10	2		
	6		15	0		Loose, saturated, gray, silty fine to medium SAND with scattered wood and shell fragments
						Loose, saturated, gray, gravelly, silty SAND with scattered wood and shell fragments
	11	*	20	3		Medium dense, saturated, gray, SAND with trace to some silt and gravel, trace silt layers and scattered wood and shell fragments
			25			NOTES: (1) Boring terminated at 21.5 feet (2) Hydrocarbon-like odors noted in samples from about 7.5 to 10 feet * Denotes analyzed sample ** Based on survey completed for this project ATD= Water level at time of drilling Field Analysis: PID headspace concentrations in ppm
			30			
			35			
			40			
			45			
			50			

Date Started: 6/28/89
Date Completed: 6/28/89

Logged By: C.R. Andersen

Drilled By: Geoboring & Develop., Inc.
Drilling Method: H.S.A.

THORNE ENVIRONMENTAL

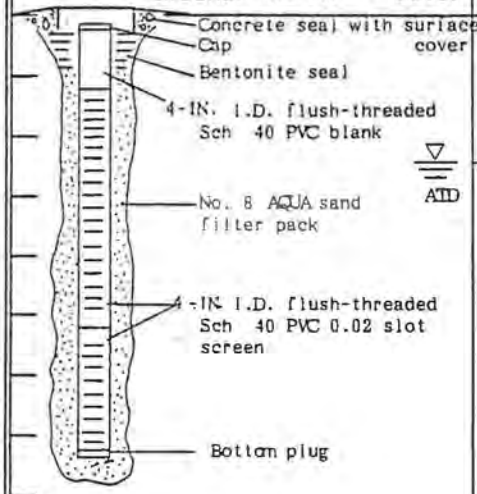
Project Number: 5E-1030-1

HYDROGEOLOGIC LOG AND AS-BUILT FOR MONITORING WELL MW - 40

TABLE A-8

AS-BUILT WELL CONSTRUCTION

Elevation: Casing: 13.90 ft. ** Water
Ground: 14.2 ft. ** Level



Hydrogeologic Unit	Blows/ft	Sample Interval	Depth In Feet	Field Analysis	Graphic Log	DESCRIPTION
	18		0	133		Loose to medium dense, moist to saturated, gray, fine to medium SAND with trace to some silt, trace coarse sand and gravel and scattered wood and shell fragments
	14	*	5	149		
	7			#		
	20		10	#		
	2		15	#		Very loose, saturated, brown, gravelly, silty SAND with scattered shell fragments
	12	*	20	#		Medium dense, saturated, gray, silty fine SAND with scattered wood and shell fragments
			25			
			30			
			35			
			40			
			45			
			50			

NOTES:

(1) Boring terminated at 21.5 feet
(2) Hydrocarbon-like sheens and odors noted on samples from about 6 to 20 feet

* Denotes analyzed sample
** Based on survey completed for this project

ATD= Water level at time of drilling

Field Analysis: PID headspace concentrations in ppm

= No concentrations obtained due to PID malfunction

Date Started: 6/28/89
Date Completed: 6/28/89

Logged By: C.R. Andersen

Drilled By: Geoboring & Develop., Inc.
Drilling Method: H.S.A.

THORNE ENVIRONMENTAL

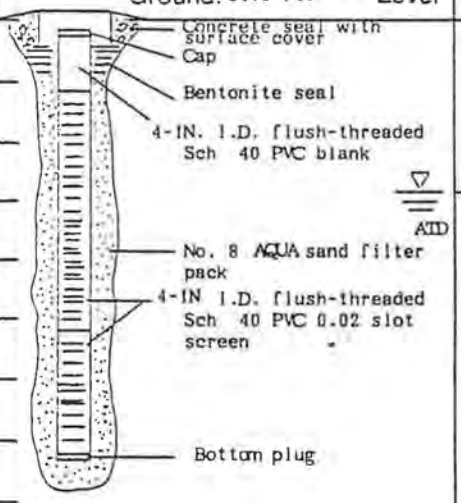
Project Number: 5E-1030-1

HYDROGEOLOGIC LOG AND AS-BUILT FOR MONITORING WELL MW -41

TABLE A-9

AS-BUILT WELL CONSTRUCTION

Elevation: Casing: 14.22 ft. ** Water
Ground: 14.6 ft. ** Level



Hydrogeologic Unit	Blows/ft	Sample Interval	Depth in Feet	Field Analysis	Graphic Log	DESCRIPTION
	14		0	#		Medium dense, moist to wet, gray-brown to black, fine to medium SAND with trace to some silt, trace coarse sand and gravel and trace silt layers
	12		5	#		
	6	*		#		Loose, saturated, gray, silty fine to medium SAND with trace silt layers and scattered shell fragments
	10		10	#		Very loose to medium dense, saturated, gray fine to medium SAND with trace to some silt, trace silt layers and scattered wood and shell fragments
	4		15	#		Very loose to loose, saturated, brown-gray, gravelly, silty SAND with scattered shells
	25	*	20	#		Medium dense, saturated, gray, silty fine SAND with scattered wood and shell fragments
			25			
			30			
			35			
			40			
			45			
			50			

NOTES;

(1) Boring terminated at 21.5 feet
(2) Hydrocarbon-like sheens and odors noted on samples from about 7 to 15 feet

* Denotes analyzed sample
** Based on survey completed for this project

ATD= Water level at time of drilling

Field Analysis: PID headspace concentrations in ppm

= No concentrations obtained due to PID malfunction

Date Started: 6/28/89
Date Completed: 6/28/89

Logged By: C.R. Andersen

Drilled By: Geoboring & Develop., Inc.
Drilling Method: H.S.A.

THORNE ENVIRONMENTAL

Project Number: 5E-1030-1

HYDROGEOLOGIC LOG AND AS-BUILT FOR MONITORING WELL MW - 42

TABLE A-10

GROUND ELEVATION / Water Level	Hydrogeologic Unit	Blows/ft	Sample Interval	Depth in Feet	Field Analysis	Graphic Log	DESCRIPTION
		25		0	0		Loose to medium dense, moist to saturated, gray to rust, fine to medium SAND with trace to some silt, trace gravel and scattered charcoal and shell fragments
▽		26		5	0		
ATD		10	*		3.4		
		8		10	4		
				15			NOTES: (1) Boring terminated at 11.5 feet and backfilled to surface with bentonite chips (2) Hydrocarbon-like sheens and odors were noted from about 6.5 to 11.5 feet * Denotes analyzed sample ATD= Water level at time of drilling Field Analysis: PID headspace concentrations in ppm
				20			
				25			
				30			
				35			
				40			
				45			
				50			

Date Started: 6/27/89
Date Completed: 6/27/89

Logged By: C.R. Andersen

Drilled By: Geoboring & Develop., Inc.
Drilling Method: H.S.A.

THORNE ENVIRONMENTAL

Project Number: 5E-1030-1

HYDROGEOLOGIC LOG FOR SOILS BORING B-1

TABLE A-11

GROUND ELEVATION	Water Level	Hydrogeologic Unit	Blows/ft	Sample Interval	Depth in Feet	Field Analysis	Graphic Log	DESCRIPTION
			7		0	0		Loose, moist, brown, gravelly fine to medium SAND with trace to some silt and scattered wood fragments
	▽ ATD		36	*	5	65		Very loose to dense, wet to saturated, brown to gray, fine to medium SAND with trace to some silt, trace gravel and scattered wood fragments
			31			130		
			4	*	10	15		
					15			NOTES: (1) Boring terminated at 11.5 feet and backfilled to surface with bentonite chips (2) Hydrocarbon-like sheens and odors noted from about 6 to 11.5 feet * Denotes analyzed sample ATD= Water level at time of drilling Field Analysis: PID headspace concentrations in ppm
					20			
					25			
					30			
					35			
					40			
					45			
					50			

Date Started: 6/27/89
Date Completed: 6/27/89

Logged By: C.R. Andersen

Drilled By: Geoboring & Develop., Inc.
Drilling Method: H.S.A.

THORNE ENVIRONMENTAL

Project Number: 5E-1030-1

HYDROGEOLOGIC LOG FOR SOILS BORING B-2

TABLE A-12

GROUND ELEVATION / Water Level	Hydrogeologic Unit	Blows/ft	Sample Interval	Depth in Feet	Field Analysis	Graphic Log	DESCRIPTION
▽ ATD		9 6 16 17	* *	5 10	0 58 25 35		Loose, moist to wet, gray to orange-brown, gravelly, silty SAND with wood fragments Medium dense, saturated, gray, gravelly SAND with trace silt and scattered roots

NOTES:

(1) Boring terminated at 11.5 feet and backfilled to surface with bentonite chips
(2) Hydrocarbon-like sheens and odors noted from about 6 to 11.5 feet

* Denotes analyzed sample

ATD= Water level at time of drilling

Field Analysis: PID headspace concentrations in ppm

Date Started: 6/27/89
Date Completed: 6/27/89

Logged By: C.R. Andersen

Drilled By: Geoboring & Develop., Inc.
Drilling Method: H.S.A.

THORNE ENVIRONMENTAL

Project Number: 5E-1030-1

HYDROGEOLOGIC LOG FOR SOILS BORING B-3

TABLE A-13

GROUND ELEVATION	Water Level	Hydrogeologic Unit	Blows/ft	Sample Interval	Depth in Feet	Field Analysis	Graphic Log	DESCRIPTION
	▽ ATD		13 2 2 7	NR *	5 10	0 -- 10 8		Very loose to medium dense, moist to saturated, brown to gray, fine to medium SAND with trace silt and gravel Loose, saturated, gray, silty fine to medium SAND with trace gravel and scattered wood and shell fragments

NOTES:

(1) Boring terminated at 11.5 feet and backfilled to surface with bentonite chips
(2) Hydrocarbon-like sheens and odors noted from about 6.5 to 11.5 feet

NR= Sample not recovered

* Denotes analyzed sample

ATD= Water level at time of drilling

Field Analysis: PID headspace concentrations in ppm

Date Started: 6/27/89
Date Completed: 6/27/89

Logged By: C.R. Andersen

Drilled By: Geoboring & Develop., Inc.
Drilling Method: H.S.A.

THORNE ENVIRONMENTAL

Project Number: 5E-1030-1

HYDROGEOLOGIC LOG FOR SOILS BORING B- 4

TABLE A-14

GROUND ELEVATION / Water Level	Hydrogeologic Unit	Blows/ft	Sample Interval	Depth in Feet	Field Analysis	Graphic Log	DESCRIPTION
		14	*	0	89		Medium dense, moist to saturated, brown to gray, fine to medium SAND with trace to some silt
▽ ATD		20	*	5	110		
		10			3		Loose to medium dense, saturated, gray, silty fine to medium SAND with trace gravel and scattered wood fragments
		15		10	48		Medium dense, gray, saturated, gravelly fine to medium SAND with trace to some silt and scattered wood fragments
				15			NOTES: (1) Boring terminated at 11.5 feet and backfilled to surface with bentonite chips (2) Hydrocarbon-like sheens and odors noted from about 6 to 11.5 feet * Denotes analyzed sample ATD= Water level at time of drilling Field Analysis: PID headspace concentrations in ppm
				20			
				25			
				30			
				35			
				40			
				45			
				50			

Date Started: 6/27/89
Date Completed: 6/27/89

Logged By: C.R. Andersen

Drilled By: Geoboring & Develop., Inc.
Drilling Method: H.S.A.

THORNE ENVIRONMENTAL

Project Number: 5E-1030-1

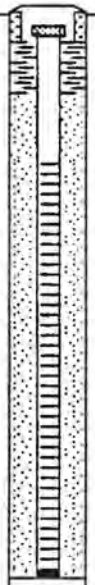
HYDROGEOLOGIC LOG FOR SOILS BORING B-5

TABLE A-15

AS-BUILT
WELL CONSTRUCTION

Casing Elevation: 14.83 **

Water Level



Concrete seal with surface cover
Bentonite seal

4-in. I.D. flush-threaded Sch. 40 PVC blank pipe

16 Colorado silica sand

4-in. I.D. flush-threaded Sch. 40 PVC 0.01-in. slot well screen
Screened Interval: 5.8 to 20.2 feet.
Bottom cap
Bottom of 8-in. diameter boring

Hydrogeologic Unit	Blows/ft	Sample Interval	Depth in feet	Field Analysis	Graphic Log	DESCRIPTION
			0			Asphalt
	9			0		Loose, slightly moist to dry, medium gray, fine to very fine, silty SAND, with some small gravel
			5			Loose, slightly moist to moist, dark gray-red-brown, very fine to fine, silty SAND, medium to poor cohesion
	11			0		Gravel in shoe, blocked
	9		10	0		Loose, very wet to saturated, dark gray, very fine, silty SAND, little gravel, poor cohesion
	5			0		Some wood
			15			
	3			1.2		Loose, saturated, dark gray, fine to medium, SAND with silt, some gravel, some wood, slight musty-sewage odor
			20			
			25			Notes: 1) Boring terminated at 20.9 feet.
						** Based on survey completed for this project.
			30			
			35			
			40			
			45			

Date Started: 11/2/89 Logged By: Tony Bahnick Drilled By: Geoboring & Develop

Date Completed: 11/2/89 ▽ = Water Level at time of drilling Drilling Method: HSA

Field Analysis: PID concentrations in ppm.

Sheet 1 of 1

THORNE ENVIRONMENTAL

Project Number: 5E-1030-2

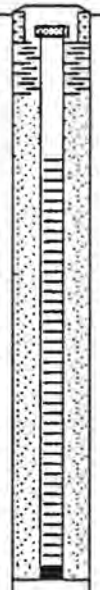
HYDROGEOLOGIC LOG AND AS-BUILT
FOR MONITORING WELL
MW-43

TABLE
A-38

AS-BUILT
WELL CONSTRUCTION

Casing Elevation: 14.42 **

Water Level



Concrete seal with surface cover
Bentonite seal

4-in. I.D. flush-threaded Sch. 40 PVC blank pipe

16 Colorado silica sand

4-in. I.D. flush-threaded Sch. 40 PVC 0.01-in. slot well screen
Screened Interval: 5.6 to 20.0 feet
Bottom cap
Bottom of 8-in. diameter boring

Hydrogeologic Unit	Blows/ft	Sample Interval	Depth in feet	Field Analysis	Graphic Log	DESCRIPTION
	10		5	0		Loose, moist, brown-gray, very fine to fine, silty SAND,
	4		10	0		Loose, moist, red-brown to medium gray, very fine to fine silty SAND Moist, dark gray, silty SAND
	6		15	0		Soft, saturated, dark gray, very fine to fine, silty SAND
	2		20	0		Soft to medium stiff, moist to wet, olive-brown to olive gray, SILT/CLAY, some fine sand, good cohesion, poor to good plasticity
			25			Notes: 1) Boring terminated at 20.7 feet. ** Based on survey completed for this project.
			30			
			35			
			40			
			45			

Date Started: 11/2/89
Logged By: Tony Bahnick
Drilled By: Geoboring & Develop

Date Completed: 11/2/89
▽ = Water Level at time of drilling
Drilling Method: HSA

Field Analysis: PID concentrations in ppm.

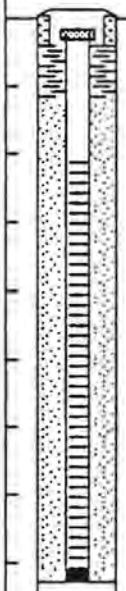
Sheet 1 of 1

THORNE ENVIRONMENTAL

Project Number: 5E-1030-2

HYDROGEOLOGIC LOG AND AS-BUILT
FOR MONITORING WELL
MW-44

TABLE
A-39



AS-BUILT
WELL CONSTRUCTION

Casing Elevation: 14.63 **

Water Level

Concrete seal with surface cover
Bentonite seal

4-in. I.D. flush-threaded Sch. 40 PVC blank pipe

16 Colorado silica sand

4-in. I.D. flush-threaded Sch. 40 PVC 0.01-in. slot well screen
Screened Interval: 5.6 to 20.0 feet
Bottom cap
Bottom of 8-in. diameter boring

Hydrogeologic Unit	Blows/ft	Sample Interval	Depth in feet	Field Analysis	Graphic Log	DESCRIPTION
			0			Loose, moist, red-brown, sandy GRAVEL with silt
	12			0		Loose, moist, dark gray, very fine to fine, silty SAND
			5			Loose, moist to wet, gray-brown, fine to medium, SAND, with silt, trace gravel, poor cohesion
	3			0		Loose, very moist to wet, dark gray, very fine to fine, silty SAND
			10			Soft to medium stiff, very moist, olive-gray to olive-brown, SILT/CLAY, some fine sand, some woody material, good cohesion, poor to good plasticity
	7			0		
			15			
	13			0		Medium to dense, saturated, dark gray, fine to medium SAND, some silt, shell fragments
			20			
			25			Notes: 1) Boring terminated at 20.7 feet.
						** Based on survey completed for the project.
			30			
			35			
			40			
			45			

Date Started: 11/2/89
Logged By: Tony Bahnick
Drilled By: Geoboring & Develop

Date Completed: 11/2/89
▽ = Water Level at time of drilling
Drilling Method: HSA

Field Analysis: PID concentrations in ppm.

Sheet 1 of 1

THORNE ENVIRONMENTAL

Project Number: 5E-1030-2

HYDROGEOLOGIC LOG AND AS-BUILT
FOR MONITORING WELL
MW-45

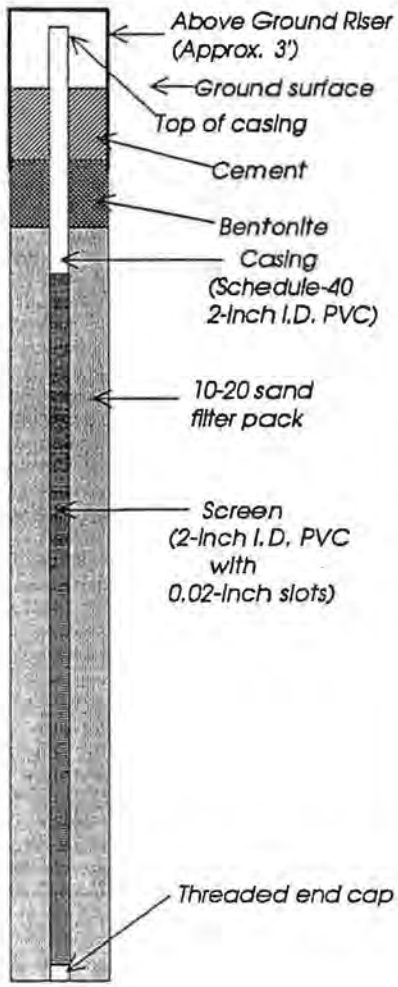
TABLE
A-40

PROJECT: *Chevron Bulk Plant* W.O. *11-10067-00* WELL NO. *MW-1A*

Elevation reference: *Unknown*
Ground surface elevation: *Unknown*
Well completed: *31 January 1995*
Casing elevation: *Unknown*

DEPTH (feet)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNTS	OVM READING	GROUND WATER	TESTING
0	*Medium dense, moist, gray, fine SAND with some gravel and some silt*		S-1	14	0		Pb PAH G/BTEX D-Ex
5	*Becomes wet with trace silt*		S-2	24	2		
	Medium dense, moist, light gray, fine to medium SAND with trace silt and trace gravel		S-3	13	1		Pb G/BTEX D-Ex
10	*Becomes loose, saturated, fine to medium SAND*		S-4	2	1	ATD	Pb G/BTEX D-Ex
	(Fill Soils) / *(Native Soils)*						
	Loose to soft, saturated, gray-brown, interbedded fine SAND with trace to some silt to fine sandy SILT with organics		S-5	2	11		
15	*Loose, saturated, gray-brown, fine SAND with shells fragments*		S-6	2	12		
20	*Grades with some organics*		S-7	2	0		Pb G/BTEX D-Ex
	Bottom of boring at 21.5 feet.						
25							
30							

AS-BUILT DESIGN



Note: Collapsed formation from 19 to 20 feet.

LEGEND

2-inch O.D. split-spoon sample

Observed groundwater level
ATD = at time of drilling

WDOE ID No. ABN-144

Pb PAH G/BTEX D-Ex TOC

Anlytical Testing
Pb - Total Lead, EPA Method 7420
PAH = Polynuclear Aromatic Hydrocarbons, EPA Method 8310
G/BTEX = WTPH-G with BTEX Distinction, by Method TPH-G/EPA 8020
D-EX = WTPH-D Extended, by Method WTPH-D Extended
TOC = Total Organic Carbon, by EPA 9060 Modified.

AGRA Earth & Environmental
11335 NE 122nd Way, Suite 100
Kirkland, Washington 98034-6918

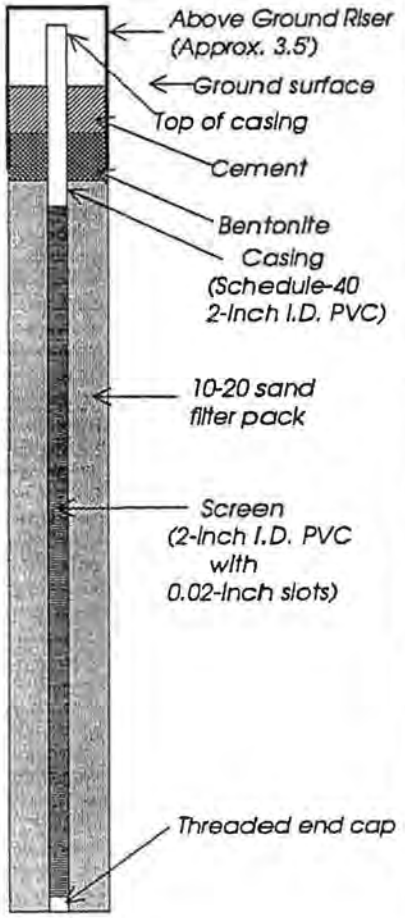
Drilling started: *31 January 1995* Drilling completed: *31 January 1995* Logged by: *SLN*

PROJECT: *Chevron Bulk Plant* W.O. *11-10067-00* WELL NO. *MW-2A*

Elevation reference: *Unknown*
Ground surface elevation: *Unknown*
Well completed: *31 January 1995*
Casing elevation: *Unknown*

DEPTH (feet)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNTS	OVM READING	GROUND WATER
0						
	Loose to medium dense, moist, dark gray, fine to medium SAND		S-1	7	20	
5	*Medium dense, wet to saturated, gray SAND (blowcounts overstated)*		S-2	39	10	ATD
	(Fill Soils) / *(Native Soils)*					
	Loose, saturated, black to gray-brown, fine to medium SAND		S-3	5	16	
10	*Becomes gray-brown with trace silt*		S-4	5	9	
	Loose, saturated, gray-brown, fine to medium SAND with shell fragments		S-5	5	3	
15						
	Becomes silty with organic-rich layers		S-6	3	1	
20	*Bottom of boring at 19 feet.*					
25						
30						

AS-BUILT DESIGN



TESTING

- Pb PAH G/BTEX D-Ex
- Pb G/BTEX D-Ex
- Pb G/BTEX D-Ex
- Pb G/BTEX D-Ex

LEGEND

2-inch O.D. split-spoon sample

ATD Observed groundwater level ATD = at time of drilling

WDOE ID No. ABN-143

Anlytical Testing

Pb - Total Lead, EPA Method 7420
PAH = Polynuclear Aromatic Hydrocarbons, EPA Method 8310
G/BTEX = WTPH-G with BTEX Distinction, by Method TPH-G/EPA 8020
D-EX = WTPH-D Extended, by Method WTPH-D Extended
TOC = Total Organic Carbon, by EPA 9060 Modified.

AGRA Earth & Environmental
11335 NE 122nd Way, Suite 100
Kirkland, Washington 98034-6918

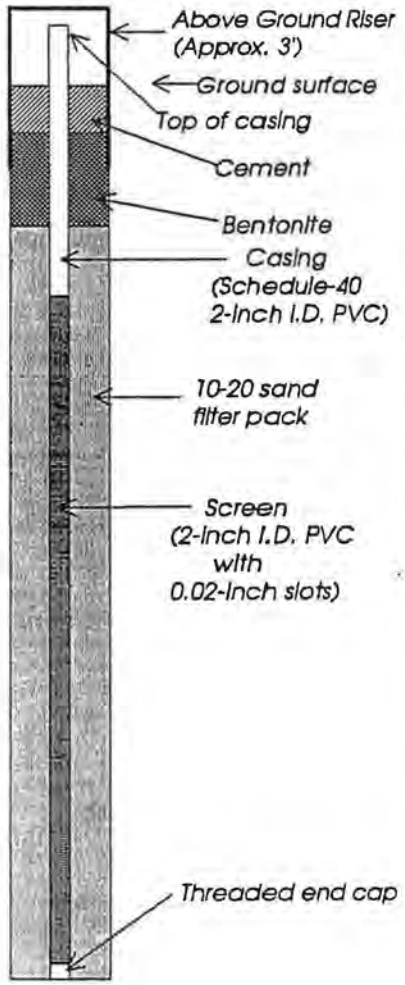
Drilling started: *31 January 1995* Drilling completed: *31 January 1995* Logged by: *SLN*

PROJECT: *Chevron Bulk Plant* W.O. *11-10067-00* WELL NO. *MW-3A*

Elevation reference: *Unknown* Well completed: *31 January 1995*
Ground surface elevation: *Unknown* Casing elevation: *Unknown*

AS-BUILT DESIGN

DEPTH (feet)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNTS	OVM READING	GROUND WATER	TESTING
0							
	Becomes gray *Loose to medium dense, moist to wet, gray, fine to medium SAND with some gravel and silt*		S-1	9	0		Pb PAH G/BTEX D-Ex
5	*Becomes brown*		S-2	19	0		D-Ex TOC
	Loose to medium dense, moist, light gray, fine to medium SAND with trace to some gravel		S-3	7	8		Pb G/BTEX D-Ex
10	*Becomes saturated*		S-4	5	7	ATD	Pb G/BTEX D-Ex
	(Fill Soils) *(Native Soils)*						
15	*Loose, saturated, gray-brown, fine SAND with some silt and shell fragments*		S-5	2	8		
20			S-6	3	0		Pb G/BTEX D-Ex
	Bottom of boring at 21.5 feet.						
25							
30							



Note: Collapsed formation from 19 to 20 feet.

LEGEND

2-inch O.D. split-spoon sample

Observed groundwater level
ATD = at time of drilling

WDOE ID No. ABN-142

Analytical Testing

Pb - Total Lead, EPA Method 7420
PAH = Polynuclear Aromatic Hydrocarbons, EPA Method 8310
G/BTEX = WTPH-G with BTEX Distinction, by Method TPH-G/EPA 8020
D-EX = WTPH-D Extended, by Method WTPH-D Extended
TOC = Total Organic Carbon, by EPA 9060 Modified.

AGRA
Earth & Environmental
11335 NE 122nd Way, Suite 100
Kirkland, Washington 98034-6918

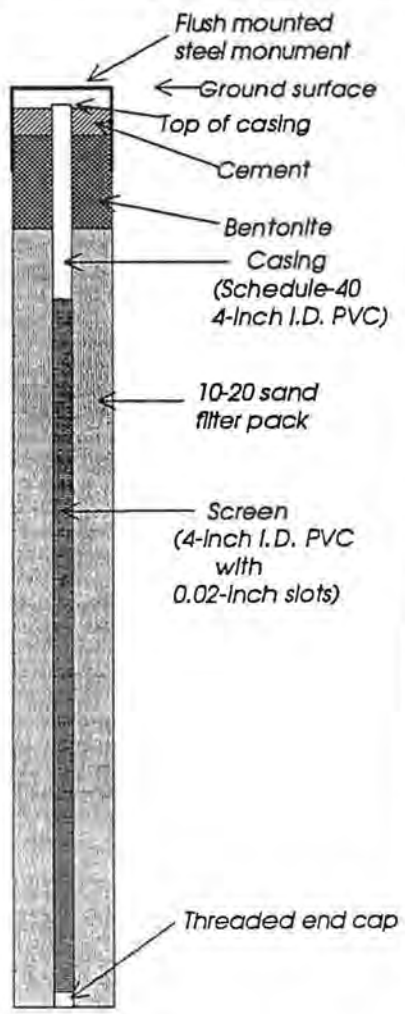
Drilling started: *31 January 1995* Drilling completed: *31 January 1995* Logged by: *SLN*

PROJECT: *Chevron Bulk Plant* W.O. *11-10067-00* WELL NO. *MW-4A*

Elevation reference: *Unknown*
Ground surface elevation: *Unknown*
Well completed: *31 January 1995*
Casing elevation: *Unknown*

AS-BUILT DESIGN

DEPTH (feet)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNTS	OVM READING	GROUND WATER	TESTING
0	*Loose to medium dense, moist, brown, gravelly, silty SAND*		S-1	16	3		Pb PAH G/BTEX D-Ex
	(Fill Soils)						
	(Native Soils)						
5	*Loose to soft, moist to wet, brown, silty SAND to sandy SILT*		S-2	3	2		Pb G/BTEX D-Ex
	Very soft, moist, gray-brown, gravelly SILT with some to trace sand		S-3	0	4		
10	*Loose to medium dense, saturated, black to gray/brown, gravelly SAND with some silt*		S-4	8	8	ATD	Pb G/BTEX D-Ex
	Wood fragments are common		S-5	12	10		
15			S-6	17	3		
20	*Loose to medium dense, saturated, gray-brown, fine to medium SAND with trace silt and gravel with wood fragments*		S-7	17	2		Pb G/BTEX D-Ex
	Bottom of boring at 21.5 feet.						
25							
30							



Note: Collapsed formation from 19.5 to 20 feet.

LEGEND

2-Inch O.D. split-spoon sample

ATD Observed groundwater level
ATD = at time of drilling

WDOE ID No. ABN-141

Analytical Testing
Pb - Total Lead, EPA Method 7420
PAH = Polynuclear Aromatic Hydrocarbons, EPA Method 8310
G/BTEX = WTPH-G with BTEX Distinction, by Method TPH-G/EPA 8020
D-EX = WTPH-D Extended, by Method WTPH-D Extended
TOC = Total Organic Carbon, by EPA 9060 Modified.

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Kirkland, Washington 98034-6918

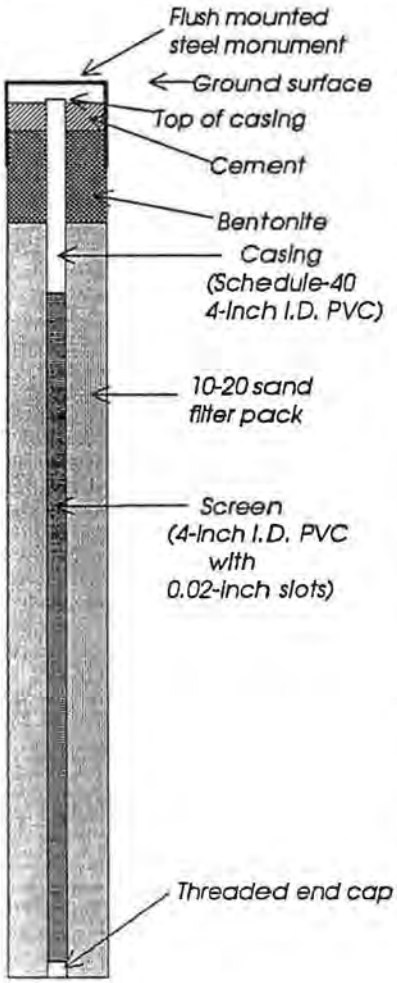
Drilling started: *31 January 1995* Drilling completed: *31 January 1995* Logged by: *SLN*

PROJECT: *Chevron Bulk Plant* W.O. *11-10067-00* WELL NO. *MW-5A*

Elevation reference: *Unknown* Well completed: *31 January 1995*
Ground surface elevation: *Unknown* Casing elevation: *Unknown*

AS-BUILT DESIGN

DEPTH (feet)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNTS	OVM READING	GROUND WATER	TESTING
0	*Loose, moist, gray, fine SAND with trace to some gravel*		S-1	3	7		Pb PAH G/BTEX D-Ex
	(Fill Soils)						
5	*(Native Soils) Loose, moist to wet, gray-brown, silty, fine SAND with shell fragments*		S-2	1	2		
	Wood fragments are common		S-3	5	6		
10	*Loose, saturated, gray-brown, fine to medium SAND with trace to some gravel*		S-4	4	4	ATD	Pb G/BTEX D-Ex
15	*Loose, saturated, gray-brown, SAND with some gravel to silty, fine SAND with shell fragments*		S-5	5	1		D-Ex TOC
20	*Loose to medium dense, saturated, gray-brown, fine to medium SAND with trace silt and wood fragments*		S-6	10	3		Pb G/BTEX D-Ex
	Bottom of boring at 21.5 feet.						
25							
30							



Note: Collapsed formation from 19 to 20 feet.

LEGEND

2-inch O.D. split-spoon sample

Observed groundwater level ATD = at time of drilling

WDOE ID No. ABN-140

Analytical Testing

Pb - Total Lead, EPA Method 7420
PAH = Polynuclear Aromatic Hydrocarbons, EPA Method 8310
G/BTEX = WTPH-G with BTEX Distinction, by Method TPH-G/EPA 8020
D-EX = WTPH-D Extended, by Method WTPH-D Extended
TOC = Total Organic Carbon, by EPA 9060 Modified.

AGRA
Earth & Environmental
11335 NE 122nd Way, Suite 100
Kirkland, Washington 98034-6918

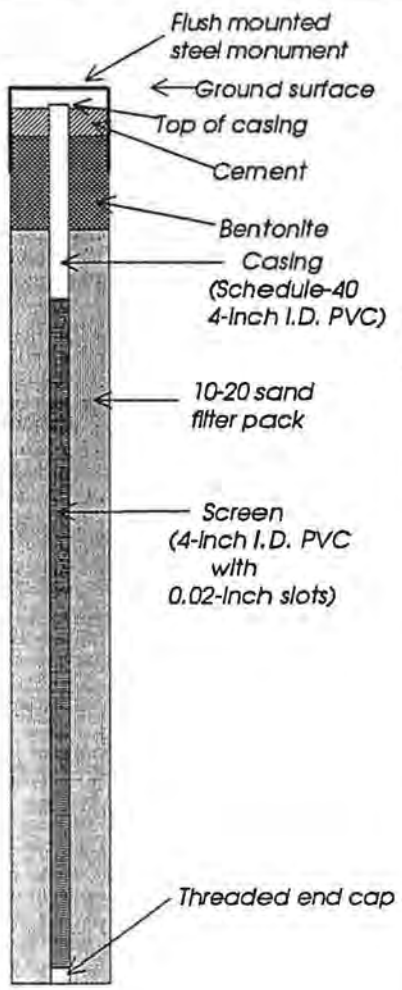
Drilling started: *31 January 1995* Drilling completed: *31 January 1995* Logged by: *SLN*

PROJECT: *Chevron Bulk Plant* W.O. *11-10067-00* WELL NO. *MW-6A*

Elevation reference: *Unknown*
Ground surface elevation: *Unknown*
Well completed: *01 February 1995*
Casing elevation: *Unknown*

AS-BUILT DESIGN

DEPTH (feet)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNTS	OVM READING	GROUND WATER	TESTING
0	*Loose, moist, gray, fine to medium SAND*		S-1	4	0		Pb PAH G/BTEX D-Ex
5	*Becomes wet*		S-2	4	0		D-Ex TOC
	Becomes black		S-3	3	30	ATD	Pb G/BTEX D-Ex
10	*Grades to trace gravel*		S-4	6	7		
15	*Becomes gray-brown*		S-5	2	4		
20	*Grades to some gravel*		S-6	6	6		Pb G/BTEX D-Ex
25	*Bottom of boring at 21.5 feet.*						
30							



Note: Collapsed formation from 19 to 20 feet.

LEGEND

2-inch O.D. split-spoon sample

Observed groundwater level
ATD = at time of drilling

WDOE ID No. ABN-139

Analytical Testing

Pb - Total Lead, EPA Method 7420
PAH = Polynuclear Aromatic Hydrocarbons, EPA Method 8310
G/BTEX = WTPH-G with BTEX Distinction, by Method TPH-G/EPA 8020
D-EX = WTPH-D Extended, by Method WTPH-D Extended
TOC = Total Organic Carbon, by EPA 9060 Modified.

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11335 NE 122nd Way, Suite 100
Kirkland, Washington 98034-6918

Drilling started: *31 January 1995* Drilling completed: *31 January 1995* Logged by: *SLN*

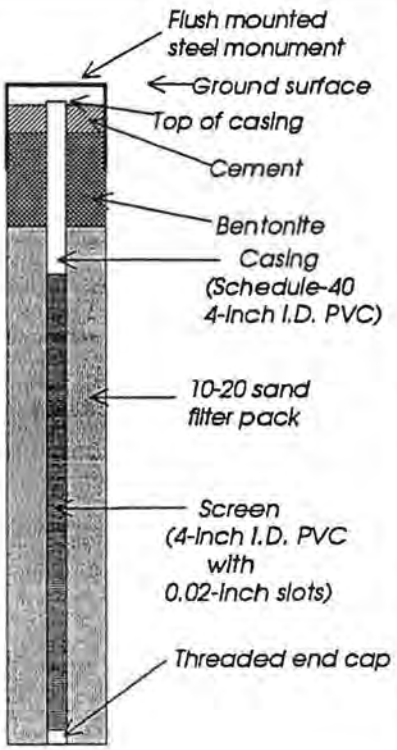
PROJECT: *Chevron Bulk Plant* W.O. *11-10067-00* WELL NO. *MW-7A*

Elevation reference: *Unknown* Well completed: *01 February 1995*
Ground surface elevation: *Unknown* Casing elevation: *Unknown*

AS-BUILT DESIGN

Page 1 of 1

DEPTH (feet)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNTS	OVM READING	GROUND WATER	TESTING
0							
5	*Loose, saturated, brown to black, fine to medium SAND*		S-1	3	16	ATD	Pb PAH G/BTEX D-Ex
10	*Becomes black with some gravel*		S-2	2	35		
15	*Becomes gray-brown, fine to medium SAND*		S-3	2	7		Pb G/BTEX D-Ex
20	*Bottom of boring at 15.5 feet.*						
25							
30							



LEGEND

2-inch O.D. split-spoon sample

ATD Observed groundwater level ATD = at time of drilling

WDOE ID No. ABN-137

Analytical Testing

Pb - Total Lead, EPA Method 7420
PAH = Polynuclear Aromatic Hydrocarbons, EPA Method 8310
G/BTEX = WTPH-G with BTEX Distinction, by Method TPH-G/EPA 8020
D-EX = WTPH-D Extended, by Method WTPH-D Extended
TOC = Total Organic Carbon, by EPA 9060 Modified.

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Kirkland, Washington 98034-6918

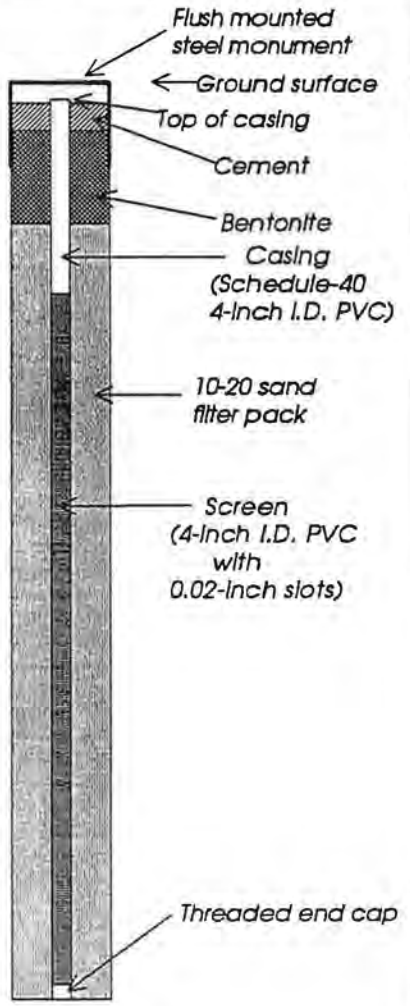
Drilling started: *01 Febuary 1995* Drilling completed: *01 Febuary 1995* Logged by: *SLN*

PROJECT: *Chevron Bulk Plant* W.O. *11-10067-00* WELL NO. *MW-8A*

Elevation reference: *Unknown*
Ground surface elevation: *Unknown*
Well completed: *01 February 1995*
Casing elevation: *Unknown*

AS-BUILT DESIGN

DEPTH (feet)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNTS	OVM READING	GROUND WATER	TESTING
0							
5	*Loose, saturated, black to dark gray, fine to medium SAND*		S-1	3	320	ATD	Pb PAH G/BTEX D-Ex
10	*Becomes gray-brown with shell fragments*		S-2	1	32		
15			S-3	1	11		
20	*Wood fragments are common*		S-4	4	60		Pb G/BTEX D-Ex
	Bottom of boring at 21.5 feet.						
25							
30							



Note: Collapsed formation from 19.5 to 20 feet.

LEGEND

2-inch O.D. split-spoon sample

Observed groundwater level
ATD = at time of drilling

WDOE ID No. ABN-138

Anlytical Testing
Pb - Total Lead, EPA Method 7420
PAH = Polynuclear Aromatic Hydrocarbons, EPA Method 8310
G/BTEX = WTPH-G with BTEX Distinction, by Method TPH-G/EPA 8020
D-EX = WTPH-D Extended, by Method WTPH-D Extended
TOC = Total Organic Carbon, by EPA 9060 Modified.

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Kirkland, Washington 98034-6918

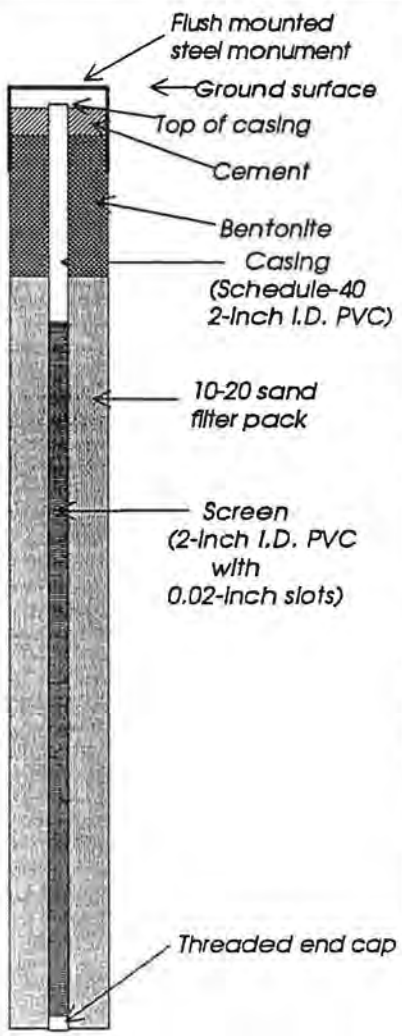
Drilling started: *01 Febuary 1995* Drilling completed: *01 Febuary 1995* Logged by: *SLN*

PROJECT: *Chevron Bulk Plant* W.O. *11-10067-00* WELL NO. *MW-9A*

Elevation reference: *Unknown* Well completed: *01 February 1995*
Ground surface elevation: *Unknown* Casing elevation: *Unknown*

AS-BUILT DESIGN

DEPTH (feet)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNTS	OVM READING	GROUND WATER	TESTING
0	*Loose, moist, tan to light gray, SAND with trace gravel*		S-1	6	8		Pb PAH G/BTEX D-Ex
5	*Becomes tan and wet*		S-2	4	2		Pb G/BTEX D-Ex
	(Fill Soils) / *(Native Soils)*					ATD	
10	*Loose, saturated, gray-brown, fine SAND with trace to some silt and shell fragments*		S-3	2	3		Pb G/BTEX D-Ex
15	*Loose, saturated, gray-brown, silty SAND with trace to some gravel and shell fragments*		S-4	2	0		D-Ex TOC
20	*Loose, saturated, gray-brown, fine to medium SAND with trace to some silt*		S-5	4	2		Pb G/BTEX D-Ex
	Bottom of boring at 21.5 feet.						
25							
30							



LEGEND

I 2-inch O.D. split-spoon sample

▼ ATD Observed groundwater level ATD = at time of drilling

WDOE ID No. ABN-136

Anlytical Testing

Pb - Total Lead, EPA Method 7420
PAH = Polynuclear Aromatic Hydrocarbons, EPA Method 8310
G/BTEX = WTPH-G with BTEX Distinction, by Method TPH-G/EPA 8020
D-EX = WTPH-D Extended, by Method WTPH-D Extended
TOC = Total Organic Carbon, by EPA 9060 Modified.

AGRA Earth & Environmental
11335 NE 122nd Way, Suite 100
Kirkland, Washington 98034-6918

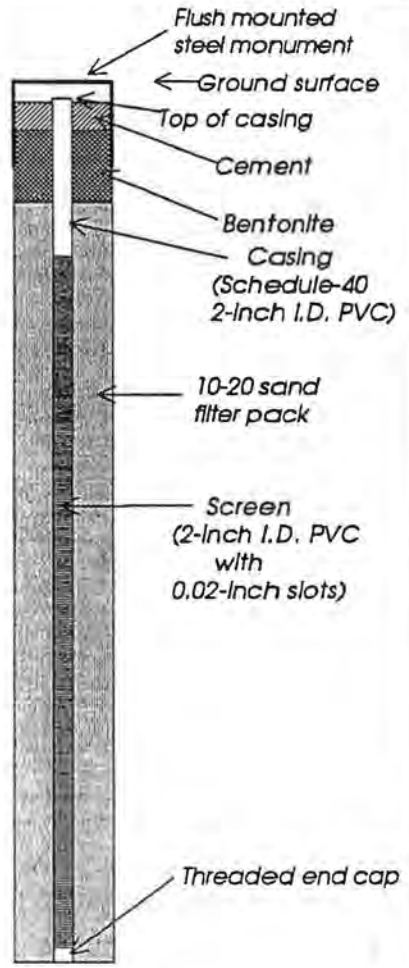
Drilling started: *01 Febuary 1995* Drilling completed: *01 Febuary 1995* Logged by: *SLN*

PROJECT: *Chevron Bulk Plant* W.O. *11-10067-00* WELL NO. *MW-10A*

Elevation reference: *Unknown*
Ground surface elevation: *Unknown*
Well completed: *01 February 1995*
Casing elevation: *Unknown*

AS-BUILT DESIGN

DEPTH (feet)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNTS	OVM READING	GROUND WATER	TESTING
0							
5	*Loose, moist to wet, tan, fine to medium SAND with trace gravel*		S-1	6	7		Pb PAH G/BTEX D-Ex
10	*(Fill Soils)* / *(Native Soils)* *Grades with trace gravel*		S-2	3	179	ATD	Pb G/BTEX D-Ex
15	*Loose, saturated, gray-brown, SAND with shell fragments*		S-3	2	16		
20			S-4	5	7		Pb G/BTEX D-Ex
25	*Bottom of boring at 21.5 feet.*						
30							



Note: Collapsed formation from 18.75 to 20 feet.

LEGEND

2-inch O.D. split-spoon sample

Observed groundwater level
ATD = at time of drilling

WDOE ID No. ABN-135

Analytical Testing
Pb - Total Lead, EPA Method 7420
PAH = Polynuclear Aromatic Hydrocarbons, EPA Method 8310
G/BTEX = WTPH-G with BTEX Distinction, by Method TPH-G/EPA 8020
D-EX = WTPH-D Extended, by Method WTPH-D Extended
TOC = Total Organic Carbon, by EPA 9060 Modified.

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Earth & Environmental
11335 NE 122nd Way, Suite 100
Kirkland, Washington 98034-6918

Drilling started: *01 Febuary 1995*
Drilling completed: *01 Febuary 1995*
Logged by: *SLN*

PROJECT: *Chevron Bulk Plant* W.O. *11-10067-00* WELL NO. *MW-11A*

Elevation reference: *Unknown*
Ground surface elevation: *Unknown*
Well completed: *01 February 1995*
Casing elevation: *Unknown*

AS-BUILT DESIGN

DEPTH (feet)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNTS	OVM READING	GROUND WATER	TESTING
0							
5	*Loose, wet to saturated, gray mottled brown, fine to medium SAND*		S-1	6	1	ATD	Pb PAH G/BTEX D-Ex
	Becomes tan and saturated						
10	*(Fill Soils)* / *(Native Soils)*		S-2	2	1		
15	*Loose, saturated, gray-brown, fine to medium SAND with shell fragments*		S-3	1	3		
	Becomes medium dense with some gravel		S-4	10	4		Pb G/BTEX D-Ex
20	*Bottom of boring at 19 feet.*						
25							
30							

AS-BUILT DESIGN:
- *Flush mounted steel monument*
- *Ground surface*
- *Top of casing*
- *Cement*
- *Bentonite*
- *Casing (Schedule-40 2-inch I.D. PVC)*
- *10-20 sand filter pack*
- *Screen (2-inch I.D. PVC with 0.02-inch slots)*
- *Threaded end cap*

LEGEND

2-inch O.D. split-spoon sample

Observed groundwater level
ATD = at time of drilling

WDOE ID No. ABN-134

Anlytical Testing
Pb - Total Lead, EPA Method 7420
PAH = Polynuclear Aromatic Hydrocarbons, EPA Method 8310
G/BTEX = WTPH-G with BTEX Distinction, by Method TPH-G/EPA 8020
D-EX = WTPH-D Extended, by Method WTPH-D Extended
TOC = Total Organic Carbon, by EPA 9060 Modified.

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Earth & Environmental
11335 NE 122nd Way, Suite 100
Kirkland, Washington 98034-6918

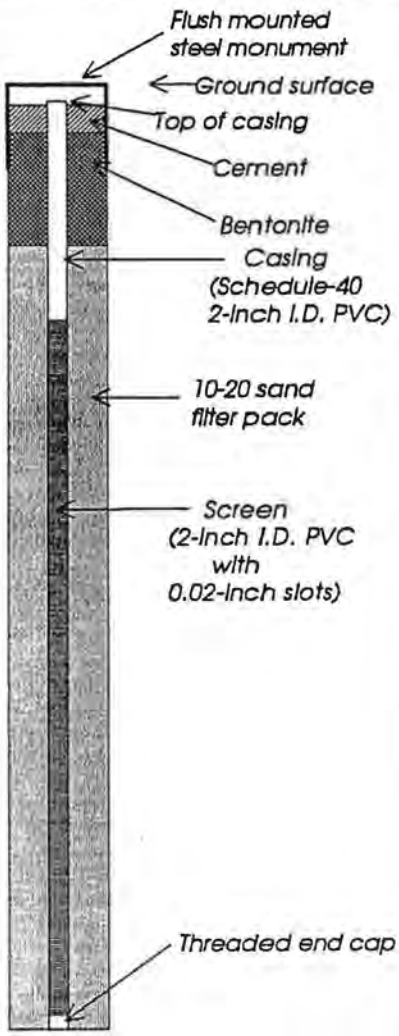
Drilling started: *01 Febuary 1995*
Drilling completed: *01 Febuary 1995*
Logged by: *SLN*

PROJECT: *Chevron Bulk Plant* W.O. *11-10067-00* WELL NO. *MW-12A*

Elevation reference: *Unknown* Well completed: *01 February 1995*
Ground surface elevation: *Unknown* Casing elevation: *Unknown*

AS-BUILT DESIGN

DEPTH (feet)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNTS	OVM READING	GROUND WATER	TESTING
0							
5	*Loose, wet, brown, gravelly SAND with some silt to gravelly, silty SAND*		S-1	6	1		Pb PAH G/BTEX D-Ex
	(Fill Soils)						
	(Native Soils)						
10	*Loose, wet to satruated, gray-brown, fine to medium SAND with shell fragments*		S-2	2	1	ATD	Pb G/BTEX D-Ex
15			S-3	1	3		
20			S-4	10	4		Pb G/BTEX D-Ex
	Bottom of boring at 21.5 feet.						
25							
30							



LEGEND

2-inch O.D. split-spoon sample

Observed groundwater level
ATD = at time of drilling

WDOE ID No. ABN-133

Analytical Testing

Pb - Total Lead, EPA Method 7420
PAH = Polynuclear Aromatic Hydrocarbons, EPA Method 8310
G/BTEX = WTPH-G with BTEX Distinction, by Method TPH-G/EPA 8020
D-EX = WTPH-D Extended, by Method WTPH-D Extended
TOC = Total Organic Carbon, by EPA 9060 Modified.

AGRA
Earth & Environmental
11335 NE 122nd Way, Suite 100
Kirkland, Washington 98034-6918

Drilling started: *01 Febuary 1995* Drilling completed: *01 Febuary 1995* Logged by: *SLN*

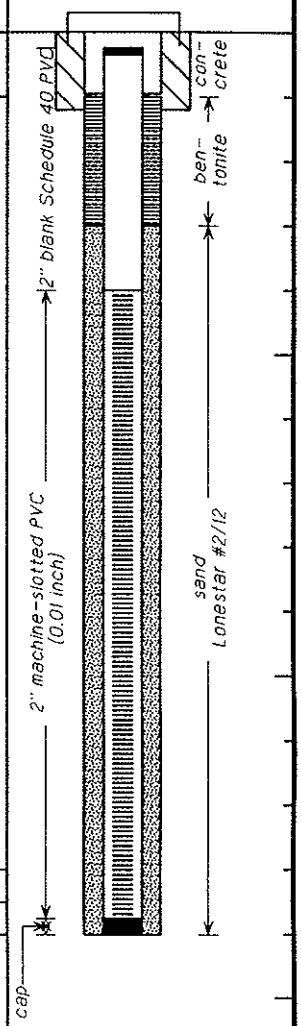
Gettler-Ryan Inc.

Log of Boring MW-50

PROJECT: *Chevron Bulk Terminal No. 100-1350*	LOCATION: *1020 C Street, Bellingham, WA*
PROJECT NO.: *346606.01*	CASING ELEVATION:
DATE STARTED: *10/21/98*	WL (ft. bgs): *10* DATE: *10/21/98* TIME: *10:53 am*
DATE FINISHED: *10/21/98*	WL (ft. bgs): DATE: TIME:
DRILLING METHOD: *8" hollow-stem auger*	TOTAL DEPTH: *14 Feet*
DRILLING COMPANY: *Cascade Drilling*	GEOLOGIST: *Steve Carter*

DEPTH feet	PID (ppm)	BLOWS/FT. *	SAMPLE NUMBER	SAMPLE INT.	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
							Pavement - asphalt over baserock.
						SP	
		40	MW-50-4				SAND (SP) - light yellowish brown (2.5Y 6/2), damp to moist, dense, 100% fine to medium sand, shell fragments.
5							Becomes moist, 85-90% fine to medium sand, 10-15% silt, trace lithic fragment at 6 feet.
		52	MW-50-7				Color change to very dark gray (2.5Y N3) at 6.5 feet, becomes 100% fine to medium sand, hydrocarbon odor.
10		21					▼ Becomes saturated at 10 feet, hydrocarbon odor.
		35				SM	SILTY SAND (SM) - very dark gray (2.5Y N3), saturated, dense, 70-80% fine sand, 20-30% silt, hydrocarbon odor.
						SP	SAND (SP) - very dark gray (2.5Y N3), saturated, dense, 100% fine to medium sand, trace coarse sand to fine gravel, hydrocarbon odor.
15							* Converted to standard penetration blows/foot.
20							

WELL DIAGRAM



JOB NUMBER: *346606.01*

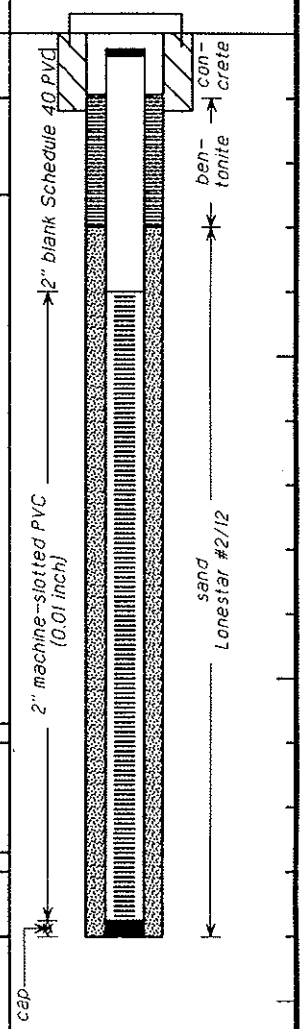
Gettler-Ryan Inc.

Log of Boring MW-51

PROJECT: *Chevron Bulk Terminal No. 100-1350*	LOCATION: *1020 C Street, Bellingham, WA*
PROJECT NO.: *346606.01*	CASING ELEVATION:
DATE STARTED: *10/21/98*	WL (ft. bgs): *10* DATE: *10/21/98* TIME: *11:39 am*
DATE FINISHED: *10/21/98*	WL (ft. bgs): DATE: TIME:
DRILLING METHOD: *8" hollow-stem auger*	TOTAL DEPTH: *14 Feet*
DRILLING COMPANY: *Cascade Drilling*	GEOLOGIST: *Steve Carter*

DEPTH feet	PID (ppm)	BLOWS/FT. *	SAMPLE NUMBER	SOIL CLASS	GEOLOGIC DESCRIPTION
					Road base.
				SM	SILTY SAND (SM) - olive brown (2.5Y 4/4), 60-70% fine sand, 30-40% silt, wood fragments, roots.
				SP	SAND (SP) - grayish brown (2.5Y 5/2) to light olive brown (2.5Y 5/4), damp to moist, dense, 100% fine to medium sand. Color change to dark gray (2.5Y N 4/) at 3.5 feet, no hydrocarbon odor.
		41	MW-51-4		
5					Color change to very dark grayish brown (2.5Y 3/2) grading downward to very dark gray (2.5Y N/3), hydrocarbon odor.
		28	MW-51-7		
10					SAND (SP) - black (2.5Y N 2/), medium dense, saturated, 100% fine to medium sand, shell fragments, hydrocarbon odor.
		20		SM	SILTY SAND (SM) - black (2.5Y N 2/), saturated, 70-80% fine sand, 20-30% silt.
				SP	SAND (SP) - black (2.5Y N 2/), medium dense, saturated, 100% fine to medium sand, shell fragments, hydrocarbon odor.
		32		SM	SILTY SAND (SM) - black (2.5Y N 2/), saturated, 70-80% fine sand, 20-30% silt.
15				SP	SAND (SP) - black (2.5Y N 2/), saturated, medium dense, 95-100% fine to medium sand, 0-5% silt, wood and shell fragments.
					* Converted to standard penetration blows/foot.
20					

WELL DIAGRAM



JOB NUMBER: *346606.01*

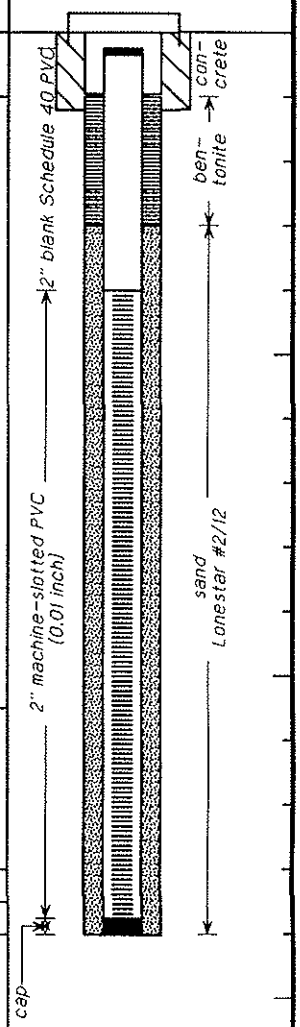
Gettler-Ryan Inc.

Log of Boring MW-52

PROJECT: *Chevron Bulk Terminal No. 100-1350*	LOCATION: *1020 C Street, Bellingham, WA*
PROJECT NO. : *346606.01*	CASING ELEVATION:
DATE STARTED: *10/21/98*	WL (ft. bgs): *6.5* DATE: *10/21/98* TIME: *1:35 pm*
DATE FINISHED: *10/21/98*	WL (ft. bgs): DATE: TIME:
DRILLING METHOD: *8" hollow-stem auger*	TOTAL DEPTH: *14 Feet*
DRILLING COMPANY: *Cascade Drilling*	GEOLOGIST: *Steve Carter*

DEPTH feet	PID (ppm)	BLOWS/FT. *	SAMPLE NUMBER	SAMPLE INT.	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
							Base rock.
						SP	SAND (SP) - light olive yellow (2.5Y 6/6), damp to moist, 100% fine to medium sand.
	0	57					Color change to very dark gray (2.5Y N 3/), becomes 85-90% fine to medium sand, 10-15% coarse sand to fine gravel, concrete fragments (from cuttings); shoe blocked by concrete.
5							
	2,300	57					Concrete in shoe 6 to 6.5 feet. Color change to black (2.5Y N2/0), hydrocarbon odor.
10							Shell fragments, hydrocarbon odor.
	314	19				SM	SILTY SAND (SM) - black (2.5Y N2/0), saturated, medium dense, 80-85% fine sand, 15-20% silt.
						SP	
							Trace fine gravel at 12.5 feet.
	649	10				SM	SILTY SAND (SM) - very dark grayish brown (2.5Y 3/2) to black (2.5Y N2/0), saturated, loose to medium dense, 60-70% fine sand, 30-40% silt.
						ML	SILT (ML) - very dark grayish brown (2.5Y 3/2), saturated, no plasticity, stiff, 90-100% silt, 0-10% fine sand, hydrocarbon odor.
15							
20							* Converted to standard penetration blows/foot.

WELL DIAGRAM



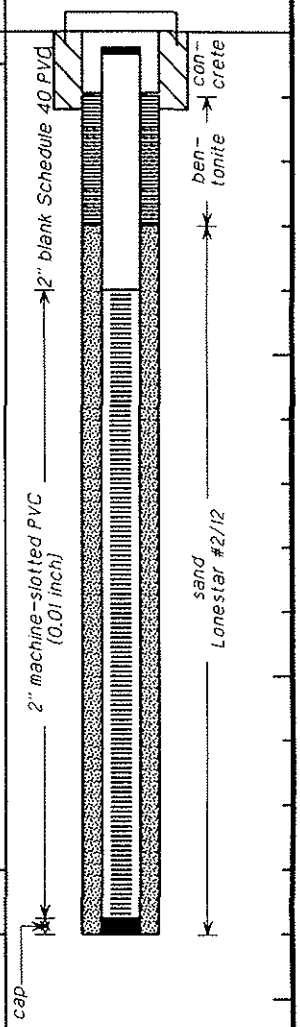
Gettler-Ryan Inc.

Log of Boring MW-53

PROJECT: *Chevron Bulk Terminal No. 100-1350*	LOCATION: *1020 C Street, Bellingham, WA*
PROJECT NO. : *346606.01*	CASING ELEVATION:
DATE STARTED: *10/21/98*	WL (ft. bgs): *6.5* DATE: *10/21/98* TIME: *2:45 pm*
DATE FINISHED: *10/21/98*	WL (ft. bgs): DATE: TIME:
DRILLING METHOD: *8" hollow-stem auger*	TOTAL DEPTH: *14 Feet*
DRILLING COMPANY: *Cascade Drilling*	GEOLOGIST: *Steve Carter*

DEPTH feet	PID (ppm)	BLOWS/FT. *	SAMPLE NUMBER	SAMPLE INT.	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
							Base rock.
						SP	
	8	62	MW-53-3.5				SAND (SP) - grayish brown (2.5Y 5/2), damp to moist, very dense, 100% fine sand.
5							
	11	35	MW-53-6.5				Color change to dark gray (2.5Y N4/0) to very dark gray (2.5Y N3/0) at 6 to 6.5 feet, becomes 100% fine to medium sand, trace fine sand; becomes saturated at 6.5 feet.
10							
	14	11					Shell fragments, loose to medium dense.
	21	11				SM	SILTY SAND (SM) - very dark gray (2.5Y N3/0), saturated, medium dense, 70-80% fine sand, 20-30% silt, wood fragments at 13.5 feet.
15							* Converted to standard penetration blows/foot.
20							

WELL DIAGRAM



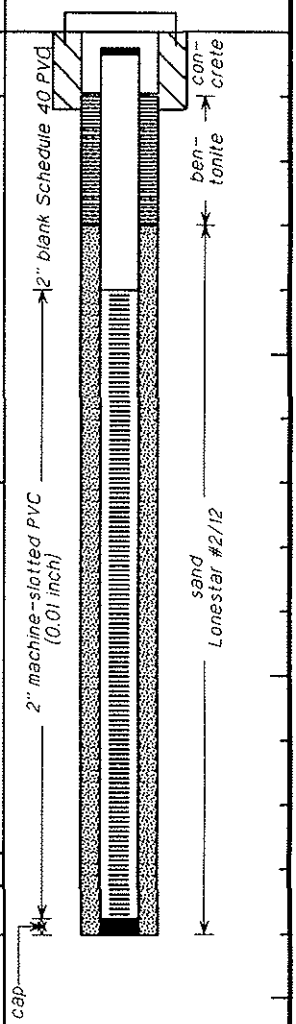
Gettler-Ryan Inc.

Log of Boring MW-54

PROJECT: *Chevron Bulk Terminal No. 100-1350*	LOCATION: *1020 C Street, Bellingham, WA*
PROJECT NO. : *346606.01*	CASING ELEVATION:
DATE STARTED: *10/21/98*	WL (ft. bgs): *9* DATE: *10/21/98* TIME: *3:40 pm*
DATE FINISHED: *10/21/98*	WL (ft. bgs): DATE: TIME:
DRILLING METHOD: *8" hollow-stem auger*	TOTAL DEPTH: *14 Feet*
DRILLING COMPANY: *Cascade Drilling*	GEOLOGIST: *Steve Carter*

DEPTH feet	PID (ppm)	BLOWS/FT. *	SAMPLE NUMBER	SAMPLE INT.	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
							Base rock.
						SP	
	7	66	MW-54-3.5				SAND (SP) - gray (5Y 5/1), damp to moist, very dense, 100% fine to medium sand, shell fragments.
5	7	33	MW-54-6				
						SM	
							SILTY SAND (SM) - dark gray (2.5Y N4/0) to very dark gray (2.5Y N3/0), saturated, medium dense, 70-80% fine sand, 20-30% silt, shell fragments, wood fragments, silt stratum 1 inch thick at 9.8 feet.
10	7	20					
						ML	SILT (ML) - very dark grayish brown (2.5Y 3/2), saturated, no plasticity, stiff, 90-95% silt, 5-10% fine sand, wood fragments.
	8	22				SM	
15							SILTY SAND (SM) - dark gray (2.5Y N4/0) to very dark gray (2.5Y N3/0), saturated, medium dense, 70-80% fine sand, 20-30% silt, shell fragments, wood fragments, stratum of sand (SP) 1 inch thick at 13.6 feet.
20							* Converted to standard penetration blows/foot.

WELL DIAGRAM



JOB NUMBER: *346606.01*

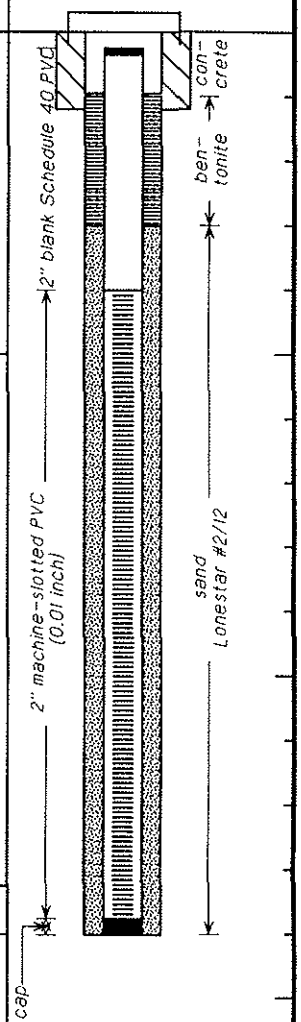
Gettler-Ryan Inc.

Log of Boring MW-55

PROJECT: *Chevron Bulk Terminal No. 100-1350*	LOCATION: *1020 C Street, Bellingham, WA*
PROJECT NO.: *346606.01*	CASING ELEVATION:
DATE STARTED: *10/22/98*	WL (ft. bgs): *3* DATE: *10/22/98* TIME: *8:05 am*
DATE FINISHED: *10/22/98*	WL (ft. bgs): DATE: TIME:
DRILLING METHOD: *8" hollow-stem auger*	TOTAL DEPTH: *14 Feet*
DRILLING COMPANY: *Cascade Drilling*	GEOLOGIST: *Steve Carter*

DEPTH feet	PID (ppm)	BLOWS/FT. *	SAMPLE NUMBER	SAMPLE INT.	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
	7	27	MW-55-3.5			ML	SANDY SILT (ML) - olive brown (2.5Y 4/4), saturated, very stiff, 70-80% silt, 20-30% fine sand, trace coarse sand to fine gravel.
5						SP	
	4	10					SAND (SP) - very dark gray (2.5Y N3/0), saturated, loose to medium dense, 100% fine to medium sand, silt layer 1 inch thick at 8.4 feet, silt layer (100%) 3 inches thick in bottom of sample (olive gray (5Y 4/2), shell fragments in sand.
10							Becomes 95-100% fine to medium sand, 0-5% silt, trace fine gravel.
	3	12				SM	SILTY SAND (SM) - dark grayish brown (2.5Y 4/2), saturated, medium dense, 70-80% fine sand, 20-30% silt, shell fragments.
15							* Converted to standard penetration blows/foot.
20							

WELL DIAGRAM



JOB NUMBER: *346606.01*

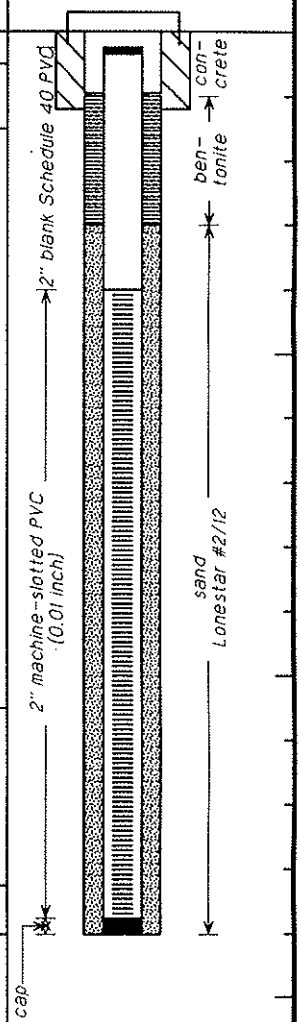
Gettler-Ryan Inc.

Log of Boring MW-56

PROJECT: *Chevron Bulk Terminal No. 100-1350*	LOCATION: *1020 C Street, Bellingham, WA*
PROJECT NO.: *346606.01*	CASING ELEVATION:
DATE STARTED: *10/22/98*	WL (ft. bgs): *5* DATE: *10/22/98* TIME: *9:25 am*
DATE FINISHED: *10/22/98*	WL (ft. bgs): DATE: TIME:
DRILLING METHOD: *8" hollow-stem auger*	TOTAL DEPTH: *14 Feet*
DRILLING COMPANY: *Cascade Drilling*	GEOLOGIST: *Steve Carter*

DEPTH feet	PID (ppm)	BLOWS/FT. *	SAMPLE NUMBER	SAMPLE INT.	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
							Base rock.
							Asphalt and base rock.
						SP	
	5	65	MW-56-4				SAND (SP) - grayish brown (2.5Y 3/2), damp to moist, dense, 100% fine sand, shell fragments.
5							Color change to black (2.5Y N2/0) at 4.5 feet, becomes 95-100% fine sand, 0-5% coarse sand to fine gravel.
	5	21	MW-56-6.5				
	9	19					SAND (SP) - black (2.5Y N2/0), saturated, medium dense, 90-95% fine to medium sand, 5-10% coarse sand to fine gravel, shell fragments.
10						SM	
	4	24				ML	SILTY SAND (SM) - dark olive gray (2.5Y 3/2), saturated, medium dense, 70-80% fine sand, 20-30% silt, shell and wood fragments.
							SILT (ML) - olive gray (5Y 4/2), saturated, very stiff, no plasticity, 100% silt.
15							* Converted to standard penetration blows/foot.
20							

WELL DIAGRAM



JOB NUMBER: *346606.01*

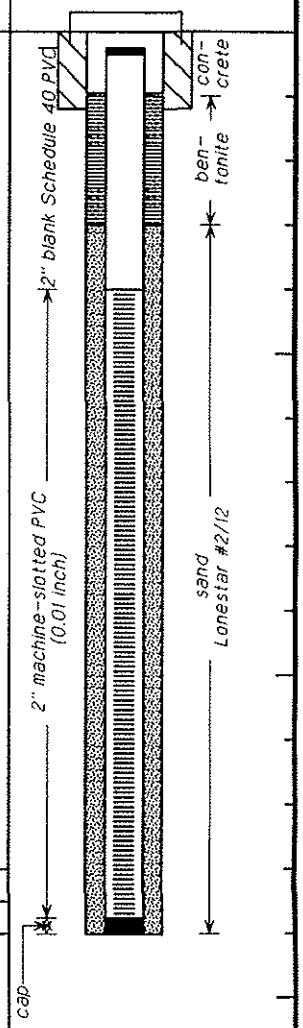
Gettler-Ryan Inc.

Log of Boring MW-57

PROJECT: *Chevron Bulk Terminal No. 100-1350*	LOCATION: *1020 C Street, Bellingham, WA*
PROJECT NO.: *346606.01*	CASING ELEVATION:
DATE STARTED: *10/22/98*	WL (ft. bgs): *5* DATE: *10/22/98* TIME: *12:39 pm*
DATE FINISHED: *10/22/98*	WL (ft. bgs): DATE: TIME:
DRILLING METHOD: *8" hollow-stem auger*	TOTAL DEPTH: *14 Feet*
DRILLING COMPANY: *Cascade Drilling*	GEOLOGIST: *Steve Carter*

DEPTH feet	PID (ppm)	BLOWS/FT. *	SAMPLE NUMBER	SAMPLE INT.	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
						SP	
	73	79	MW-57-3.5				SAND (SP) - light brownish gray (2.5Y 6/2), damp to moist, very dense, 100% fine to medium sand.
5	352	36	MW-57-5				Color change to dark yellowish brown (10YR 4/4) grading to black (2.5Y N2/0), hydrocarbon odor.
	9	22					SAND (SP) - very dark gray (2.5Y N3/0), saturated, medium dense, 95% fine to medium sand (predominantly fine), 5% coarse sand, shell and wood fragments, hyrdrocarbon odor.
10	41	20				ML	SILT (ML) - dark grayish brown (2.5Y 4/2), saturated, very stiff, no plasticity, 100% silt.
						SP SM	SAND WITH SILT (SP-SM) - black (2.5Y N2/0), saturated, medium dense, 90-95% fine sand, 5-10% silt, wood and shell fragments, hydrocarbon odor.
15							* Converted to standard penetration blows/foot.
20							

WELL DIAGRAM



JOB NUMBER: *346606.01*

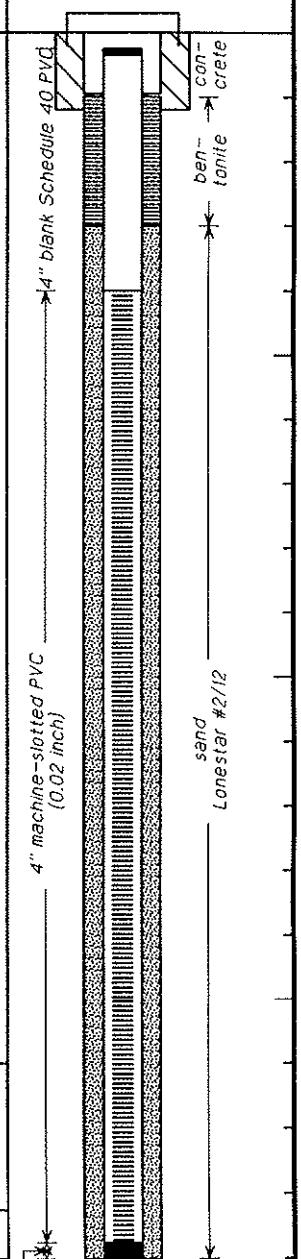
Gettler-Ryan Inc.

Log of Boring MW-58

PROJECT: *Chevron Bulk Terminal No. 100-1350*	LOCATION: *1020 C Street, Bellingham, WA*
PROJECT NO. : *346606.01*	CASING ELEVATION:
DATE STARTED: *10/22/98*	WL (ft. bgs): *6* DATE: *10/22/98* TIME: *10:55 am*
DATE FINISHED: *10/22/98*	WL (ft. bgs): DATE: TIME:
DRILLING METHOD: *8" hollow-stem auger*	TOTAL DEPTH: *19 Feet*
DRILLING COMPANY: *Cascade Drilling*	GEOLOGIST: *Steve Carter*

DEPTH feet	PID (ppm)	BLOWS/FT. *	SAMPLE NUMBER	SOIL CLASS	GEOLOGIC DESCRIPTION
				SP	
	5	58	MW-58-4		SAND (SP) - light grayish brown (2.5Y 6/2) to light yellowish brown (2.5Y 6/4), damp to moist, dense to very dense, 100% medium sand, shell fragments.
5	6	20	MW-58-6		Becomes 100% fine sand.
10	6	9			SAND (SP) - very dark gray (2.5Y N3/0) to black (2.5Y N2/0), saturated, loose, 100% fine to medium sand, fining downward, 1 inch thick silt layer at 11 feet, shell and wood fragments.
15	5	7		SW	SAND (SW) - black (2.5Y N2/0), saturated, loose, 95-100% fine to coarse sand, trace fine gravel, trace silt, shell and wood fragments.
	5	6		SM	SILTY SAND (SM) - very dark gray (2.5Y N3/0), saturated, loose, 70-80% fine sand, 20-30% silt, shell fragments, sulphur odor.
20					* Converted to standard penetration blows/foot.

WELL DIAGRAM



JOB NUMBER: *346606.01*

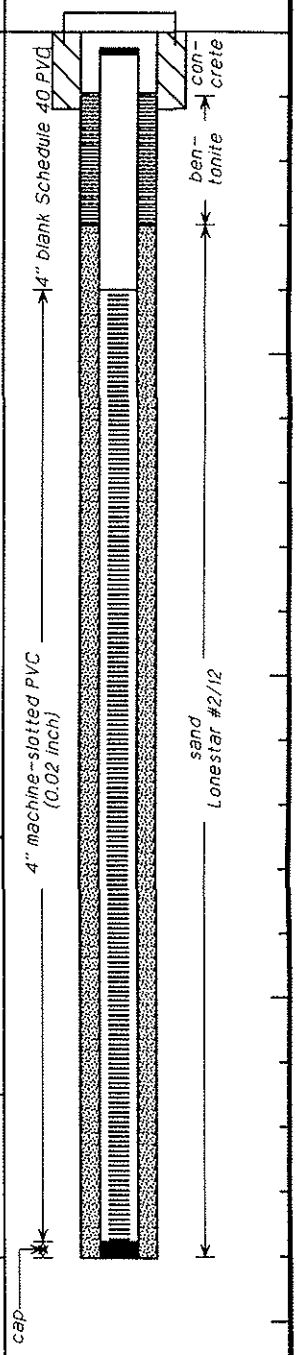
Gettler-Ryan Inc.

Log of Boring MW-59

PROJECT: *Chevron Bulk Terminal No. 100-1350*	LOCATION: *1020 C Street, Bellingham, WA*
PROJECT NO. : *346606.01*	CASING ELEVATION:
DATE STARTED: *10/22/98*	WL (ft. bgs): *6* DATE: *10/22/98* TIME: *3:02 pm*
DATE FINISHED: *10/22/98*	WL (ft. bgs): DATE: TIME:
DRILLING METHOD: *8" hollow-stem auger*	TOTAL DEPTH: *19 Feet*
DRILLING COMPANY: *Cascade Drilling*	GEOLOGIST: *Steve Carter*

DEPTH feet	PID (ppm)	BLOWS/FT. *	SAMPLE NUMBER	SAMPLE INT.	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
						SP	SAND (SP) - light brownish gray (10YR 6/2), damp to moist, dense, 100% fine to medium sand, shell fragments. Trace coarse sand at 4.5 feet. Oxidized layer 3 inches thick at 4.7 feet.
5	3	30	MW-59-4				
	3	25	MW-59-5				
	3	28	MW-59-6				
10	3	12					Color change to black (2.5Y N2/0), becomes saturated, 95-100% fine to medium sand, 0-5% coarse sand to fine gravel, shell fragments, sulphur smell, 1 inch thick silt layer at 10.9 feet.
						SM	SILTY SAND (SM) - very dark grayish brown (2.5Y 3/2), saturated, medium dense, 65-75% fine to coarse sand, 25-35% silt (increasing downward), shell and wood fragments, sulphur smell.
15	3	16					
						SP	SAND (SP) - black (2.5Y N2/0), saturated, loose, 90% fine to medium grained sand, 5% coarse sand to fine gravel, trace silt, shell and wood fragments, sulphur smell, silt layer (dark yellowish brown (10YR 3/4)) 1 inch thick at 18.5 feet.
	3	5					
20							* Converted to standard penetration blows/foot.

WELL DIAGRAM



JOB NUMBER: *346606.01*

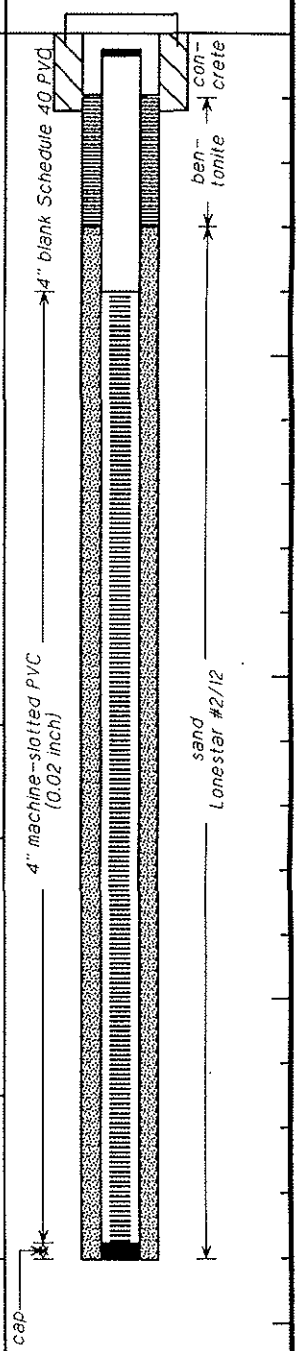
Gettler-Ryan Inc.

Log of Boring MW-60

PROJECT: *Chevron Bulk Terminal No. 100-1350*	LOCATION: *1020 C Street, Bellingham, WA*
PROJECT NO.: *346606.01*	CASING ELEVATION:
DATE STARTED: *10/23/98*	WL (ft. bgs): *7* DATE: *10/23/98* TIME: *8:19 am*
DATE FINISHED: *10/23/98*	WL (ft. bgs): DATE: TIME:
DRILLING METHOD: *8" hollow-stem auger*	TOTAL DEPTH: *19 Feet*
DRILLING COMPANY: *Cascade Drilling*	GEOLOGIST: *Steve Carter*

DEPTH feet	PID (ppm)	BLOWS/FT. *	SAMPLE NUMBER	SAMPLE INT.	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
						SM	SAND (SP) - light brownish gray (2.5Y 6/2), damp to moist, 100% fine to medium sand.
5		75					Rock in front of sampler.
	8	27	MW-60-6.5				SAND WITH SILT AND GRAVEL (SP-SM) - black (2.5Y N2/0), moist, medium dense, 50-60% fine to medium sand, 30-40% gravel, 10% silt.
10	79	12				SP	SILTY SAND (SM) - very dark grayish brown (2.5Y 3/2) to black (2.5Y N2/0), saturated, 70-80% fine to medium sand, 20-30% silt, trace coarse sand to fine gravel, shell fragments, hydrocarbon odor. 1 inch thick silt stratum at 10.8 feet.
							SAND (SP) - black (2.5Y N2/0), saturated, loose, 100% fine to medium sand, shell fragments, hydrocarbon odor.
						SM	SILTY SAND (SM) - black (2.5Y N2/0), saturated, medium dense, 70-80% fine to coarse sand, 20-30% silt, shell framents, hydrocarbon odor, product sheen.
15	13	18					
						SP	SAND (SP) - very dark gray (2.5Y N3/0), saturated, medium dense, 100% medium sand, 5-10% coarse sand to fine gravel from 18.5 to 19 feet, hydrocarbon odor, shell fragments.
	8	26					
20							* Converted to standard penetration blows/foot.

WELL DIAGRAM



JOB NUMBER: *346606.01*

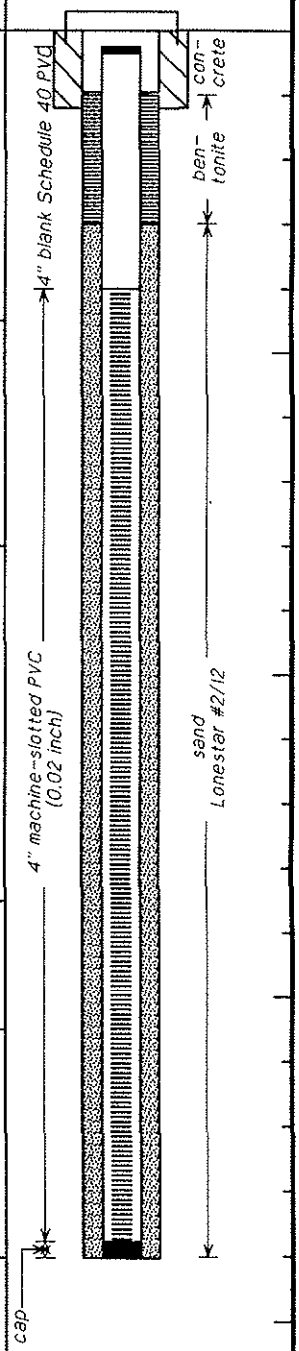
Gettler-Ryan Inc.

Log of Boring MW-61

PROJECT: *Chevron Bulk Terminal No. 100-1350*	LOCATION: *1020 C Street, Bellingham, WA*
PROJECT NO. : *346606.01*	CASING ELEVATION:
DATE STARTED: *10/23/98*	WL (ft. bgs): *7* DATE: *10/23/98* TIME: *9:51 am*
DATE FINISHED: *10/23/98*	WL (ft. bgs): DATE: TIME:
DRILLING METHOD: *8" hollow-stem auger*	TOTAL DEPTH: *19 Feet*
DRILLING COMPANY: *Cascade Drilling*	GEOLOGIST: *Steve Carter*

DEPTH feet	PID (ppm)	BLOWS/FT. *	SAMPLE NUMBER	SAMPLE INT.	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
						SW	
	8	51	MW-61-4				SAND (SW) - dark yellowish brown (10YR 4/4), damp to moist, dense, 100% fine to coarse sand, predominantly fine to medium.
5						SP	
	610	37	MW-61-7				SAND (SP) - black (2.5Y N2/0), moist, dense, 100% fine to medium sand, hydrocarbon odor. ▽
						SW	
10	45	5					SAND (SW) - black (2.5Y N2/0), saturated, loose, 100% fine to coarse sand, predominantly fine to medium, hydrocarbon odor.
						SP	
15							SAND (SP) - black (2.5Y N2/0), saturated, medium dense, 100% fine to medium sand, hydrocarbon odor and sheen.
	15	16				SM	SILTY SAND (SM) - very dark grayish brown (2.5Y 3/2), saturated, medium dense, 50-60% fine to coarse sand, 20-30% fine gravel, 10-20% silt, wood and shell fragments, hydrocarbon odor and sheen.
	6	20					Becomes 70-80% fine to medium sand, 20-25% silt, 0-5% coarse sand to fine gravel at 17.5 feet.
20							* Converted to standard penetration blows/foot.

WELL DIAGRAM



JOB NUMBER: *346606.01*

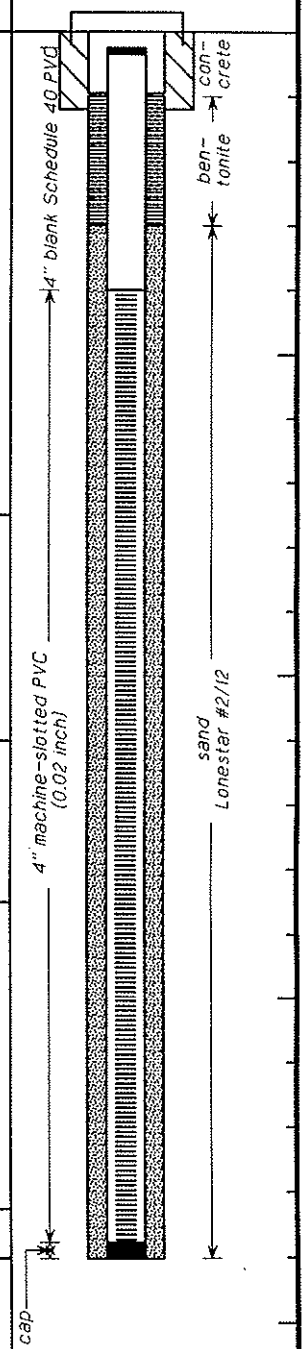
Gettler-Ryan Inc.

Log of Boring MW-62

PROJECT: *Chevron Bulk Terminal No. 100-1350*	LOCATION: *1020 C Street, Bellingham, WA*
PROJECT NO. : *346606.01*	CASING ELEVATION:
DATE STARTED: *10/23/98*	WL (ft. bgs): *7* DATE: *10/23/98* TIME: *11:42 am*
DATE FINISHED: *10/23/98*	WL (ft. bgs): DATE: TIME:
DRILLING METHOD: *8" hollow-stem auger*	TOTAL DEPTH: *19 Feet*
DRILLING COMPANY: *Cascade Drilling*	GEOLOGIST: *Steve Carter*

DEPTH feet	PID (ppm)	BLOWS/FT. *	SAMPLE NUMBER	SOIL CLASS	GEOLOGIC DESCRIPTION
5	41	88	MW-62-3.5	SP	SAND (SP) - very dark grayish brown (2.5Y 3/2), very dense, damp to moist, 90-95% fine to medium sand, 5-10% fine gravel to coarse sand, 0-5% silt.
	22	79			Silt increases to 20-30% in shoe, wood fibers.
10	679	5		SP SM	SAND WITH SILT (SP-SM) - very dark grayish brown (2.5Y 3/2), saturated, loose, 90-95% fine to medium sand, 5-10% silt, trace coarse sand, hydrocarbon odor.
				SP	SAND (SP) - black (2.5Y N2/0), saturated, loose, 95-100% fine to medium sand, 0-5% silt, shell fragments, hydrocarbon odor and sheen.
15	5	9		SM	SILTY SAND (SM) - very dark grayish brown (2.5Y 3/2), saturated, loose, 75-85% fine to coarse sand, 15-25% silt, shell fragments, hydrocarbon odor.
	5	12		SW SM	SAND (SW) - black (2.5Y N2/0), saturated, medium dense, 100% fine to coarse sand, shell fragments.
20					* Converted to standard penetration blows/foot.

WELL DIAGRAM



APPENDIX A

Test Pit and Hand-Augered Boring Logs

TEST PIT T-1

Depth Below Ground Surface (feet)	Soil Type	Comments
0 to 1.5	Light brown SAND (SM) with bricks and wood fragments (Fill)	
1.5 to 5	Light brown SAND (SP), loose, moist with some shell fragments (Fill)	
5 to 7.5	Gray SAND (SP), trace fine gravel	Hydrocarbon odor, grab sample at 7.5 feet. Organic vapor meter (OVM) reading at 6.5 feet = 127 parts per million (ppm).

Note: Bottom of hole (BOH) at 7.5 feet, water seeping into hole at 7 feet, hole discontinued due to caving.

TEST PIT T-2

Depth Below Ground Surface (feet)	Soil Type	Comments
0 to 1.5	Brown to gray GRAVEL (Fill)	Abandoned pipe at 1 foot.
1.5 to 4	Gray SAND (SP), fine- to medium-grained (Fill)	OVM ?
4 to 6.5	Dark brown SAND (SP), fine-grained	Hydrocarbon odor, hydrocarbon staining

Note: Bottom of hole at 6.5 feet due to caving.

Test Pit Logs
Excavated June 4, 1991
Chevron Bulk Terminal No. 61001350
Bellingham, Washington

TEST PIT T-3

Depth Below Ground Surface (feet)	Soil Type	Comments
0 to 1.5	Brown, sandy SILT with some gravel, roots present to 1.5 feet (Fill)	
1.5 to 3	Brown silty SAND	Timber debris.
3 to 4	Gray silty CLAY	Timber debris.
4 to 6	Gray SAND	Hydrocarbon odor; hydrocarbon staining; timber debris. OVM?
6 to 8.5	Gray silty SAND to sandy SILT	Timber debris; hydrocarbon staining/sheen; hydrogen sulfide odor; grab sample at 7.5 feet.

Note: Bottom of hole at 8.5 feet.

TEST PIT T-4

Depth Below Ground Surface (feet)	Soil Type	Comments
0 to 1.5	Tan gravelly SAND with cobbles to 6-inch diameter	
1.5 to 6	Tan SAND, grading to silty SAND with depth	OVM?
6 to 7	Dark gray silty SAND	Hydrocarbon staining/ sheen; hydrocarbon odor.

Note: Bottom of hole 7 feet due to caving.

Test Pit Logs
Excavated June 4, 1991
Chevron Bulk Terminal No. 61001350
Bellingham, Washington

TEST PIT T-5

Depth Below Ground Surface (feet)	Soil Type	Comments
0 to 1	GRAVEL (Fill)	
1 to 3.5	Light brown SAND (SP)	
3.5 to 8	Dark brown SAND (SP)	Hydrocarbon odor to full depth, OVM reading at 4 feet = 385 ppm, grab sample at 7 feet.

Note: Bottom of hole at 8 feet; test pit was dry.

TEST PIT T-6

Depth Below Ground Surface (feet)	Soil Type	Comments
0 to 7	Light brown SAND (SP)	
7 to 9	Light brown SAND (SP)	Hydrocarbon odor, grab sample at 7 feet, OVM reading at 7 feet = 206 ppm.

Note: Bottom of hole at 9 feet.

TEST PIT T-7

Depth Below Ground Surface (feet)	Soil Type	Comments
0 to 5	Light brown SAND (SP)	
5 to 7	Dark gray SAND (SP)	Hydrocarbon odor.

OVM ?

Note: Bottom of hole at 7 feet. Grab sample taken from test pit spoils; depth unknown.

Test Pit Logs
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Bellingham, Washington

TEST PIT T-8

Depth Below Ground Surface (feet)	Soil Type	Comments
0 to 5	Light brown SAND (SP)	
5 to 7	Dark gray SAND (SP)	Hydrocarbon odor.

Note: Bottom of hole at 7 feet.

TEST PIT T-9

Depth Below Ground Surface (feet)	Soil Type	Comments
0 to 1/2	GRAVEL (Fill)	
1/2 to 6	Light brown SAND (SP) with some shell fragments (Fill)	OVM reading at 4.5 feet = 135 ppm.
6 to 7	Dark gray, gravelly SAND (SP)	Hydrocarbon odor.

Note: Hole left open for approximately 4 hours, water level at 7 feet below ground surface (BGS) just prior to backfilling. Bottom of hole at 7 feet.

TEST PIT T-10

Depth Below Ground Surface (feet)	Soil Type	Comments
0 to 2	GRAVEL (Fill)	
2 to 4	Light brown, gravelly SAND (SP)	
4 to 8.5	Dark gray SAND (SP)	Hydrocarbon odor at 4.5 feet; odor increasing with depth; OVM reading at 5.5 feet = 29 ppm.

Note: Bottom of hole at 8.5 feet.

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TEST PIT T-11

Depth Below Ground Surface (feet)	Soil Type	Comments
0 to 1.5	GRAVEL (Fill)	
1.5 to 3.5	Yellow, silty, gravelly SAND (SM)	
3.5 to 8.5	Dark gray, silty SAND (SM) with old landfill materials (bottles, shoes, etc.). Becomes moist with depth	Hydrocarbon odor, sheen observed at 7.5 feet. OVM reading at 7.5 feet = 320 ppm.

Note: Bottom of hole at 8.5 feet.

TEST PIT T-12

Depth Below Ground Surface (feet)	Soil Type	Comments
0 to 2.5	GRAVEL with some wood fragments and old landfill materials (bottles)	
2.5 to 8	Light brown SAND (SP) fine- to medium-grained	OVM reading at 4.5 feet.
8 to 10	Dark gray SAND, moist	

Note: Bottom of hole at 10 feet.

TEST PIT T-13

Depth Below Ground Surface (feet)	Soil Type	Comments
0 to 2	Brown, silty SAND (SM), loose, dry, fine- to medium-grained, with cobbles at 2 feet (Fill)	
2 to 6	Gray SAND (SP), loose, moist, trace fine-grained	Hydrocarbon odor at 6 feet.

Note: Bottom of hole at 6 feet. Water seeping into hole at 6 feet bgs.

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TEST PIT T-14

Depth Below Ground Surface (feet)	Soil Type	Comments
0 to 3.5	Brown, silty SAND (SM), loose, dry, fine- to medium-grained, trace roots with cobbles at 2 to 3 feet (Fill)	OVM?
3.5 to 5.5	Dark gray SAND (SP), loose, wet to saturated, medium-grained	

Note: Bottom of hole at 5.5 feet. Water seeping into hole at 5.5 feet bgs.

TEST PIT T-15

Depth Below Ground Surface (feet)	Soil Type	Comments
0 to 1	Dark brown, silty SAND (SP), loose, moist, fine-grained, trace roots	
1 to 6	Gray SAND, loose, moist, medium-grained, orange striations; with silty interbedding at 6 feet bgs	OVM?

Note: Bottom of hole at 6 feet.

TEST PIT T-16

Depth Below Ground Surface (feet)	Soil Type	Comments
0 to 0.5	Dark brown silty SAND (SM), loose, moist, fine-grained, trace roots	
0.5 to 6	Light gray SAND, loose, moist, medium-grained, with orange striations	OVM

Note: Bottom of hole at 6 feet. Water seeping into hole at 6 feet bgs.

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TEST PIT T-17

Depth Below Ground Surface (feet)	Soil Type	Comments
0 to 1	Dark brown, silty SAND (SM), loose, dry to moist, fine-grained, trace shells	Hydrocarbon odor
1 to 6	Gray SAND (SP), loose, moist, medium-grained, with orange striations. Becomes wet at 5.5 feet bgs	

OVM ?

Note: Bottom of hole at 6 feet. Water seeping into hole at 6 feet bgs.

TEST PIT T-18

Depth Below Ground Surface (feet)	Soil Type	Comments
0 to 0.5	Brown, silty SAND (SM), loose, moist	
0.5 to 3	Gray, SAND (SP), loose, moist, medium-grained, with orange streaks	
3 to 6	Black SAND (SP), loose, moist, medium-grained, with orange streaks	Strong HC odor.

OVM ?

Note: Bottom of hole at 6 feet. Water seeping into hole at 5 feet bgs.

TEST PIT T-19

Depth Below Ground Surface (feet)	Soil Type	Comments
0 to 1	Brown, silty SAND (SM), loose, moist, fine- to medium-grained	
1 to 6	Gray-brown SAND (SP), loose, dry to moist, becoming gray and wet with depth, trace shells	Hydrocarbon odor at 4.5 feet. OVM reading at 5 feet = 1.0 ppm.

Note: Bottom of hole at 6 feet. Water seeping into hole at 5 feet bgs, sheen observed on water.

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TEST PIT T-20

Depth Below Ground Surface (feet)	Soil Type	Comments
0 to 0.25	Asphalt	
0.25 to 1.5	Brown, sandy GRAVEL (GP), loose, moist	
1.5 to 2	Black silty SAND (SM)	
2 to 6	Light gray, silty SAND (SM), loose, moist, fine-grained, trace shells becoming dark gray at 4 feet, wet	Odor of unknown source detected at 5 feet, OVM reading at 5 feet = 0 ppm.

Note: Bottom of hole at 6 feet. Water seeping into hole at 5 feet bgs.

TEST PIT T-21

Depth Below Ground Surface (feet)	Soil Type	Comments
0 to 1	Light brown, silty SAND (SM)	
1 to 5	Light brown SAND (SW) fine- to medium-grained	OVM reading at 3.5 feet = 45 ppm; grab sample at 3.5 feet.

Note: Bottom of hole at 5 feet. Vertical interface encountered 3 feet east of concrete wall. Black, glossy HC-stained material to the west, clean SAND to the east. HC appeared to be heavy-end petroleum.

TEST PIT T-22

Depth Below Ground Surface (feet)	Soil Type	Comments
0 to 3.5	Brown, silty SAND (SM), loose, dry to moist, fine-grained with trace fine to coarse gravel	Hydrocarbon odor, grab sample at 2 feet. OVM reading at 2 feet = 120 ppm.

Note: Bottom of hole at 3.5 feet. Encountered north-south trending pipes (4 each) at 3.5 feet bgs.

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TEST PIT T-23

Depth Below Ground Surface (feet)	Soil Type	Comments
0 to 4	Brown SAND (SP), loose, moist, medium-grained	OVM reading at 3 feet = 1 ppm.
4 to 6	Black SAND (SP) loose, moist, medium-grained	Hydrocarbon odor, OVM reading at 6 feet = 663 ppm.
6 to 8.5	Gray SAND (SP) loose, saturated, course-grained with trace of gravel	Hydrocarbon staining/sheen OVM reading at 8 feet = 225 ppm.

Note: Bottom of hole at 8.5 feet.

TEST PIT T-24

Depth Below Ground Surface (feet)	Soil Type	Comments
0 to 3.5	Brown SAND (SP), loose, moist, fine-grained	3 feet OVM = 352.
3.5 to 6	Dark gray SAND (SP) loose, moist, fine-grained	Hydrocarbon odor, 6 feet, OVM reading = 290 ppm.
6 to 8.5	Black SAND (SP) saturated at 8 feet	Hydrocarbon staining/sheen 8 feet, OVM reading = 465.

Note: Bottom of hole at 8.5 feet.

TEST PIT T-25

Depth Below Ground Surface (feet)	Soil Type	Comments
0 to 5	Brown SAND (SP), loose, moist, medium-grained	OVM reading at 3 feet = 0.2 ppm.
5 to 7	Gray SAND (SP)	Hydrocarbon odor, OVM reading at 6 feet = 360 ppm.
7 to 8.5	Gray SAND (SP) with shell fragments, coarse-grained, saturated	OVM reading at 8 feet = 125 ppm; hydrocarbon staining.

Note: Bottom of hole at 8.5 feet.

Test Pit Logs
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TEST PIT T-26

Depth Below Ground Surface (feet)	Soil Type	Comments
0 to 5	Brown SAND (SP), loose, moist, medium-grained	OVM reading at 3 feet = 1.3 ppm.
5 to 7	Gray SAND (SP)	Hydrocarbon odor, OVM reading at 6 feet = 81 ppm.
7 to 8.5	Gray SAND (SP) loose, saturated, coarse-grained, trace of gravel and shell debris	OVM reading at 8 feet = 38 ppm.

Note: Bottom of hole at 8.5 feet.

TEST PIT T-27

Depth Below Ground Surface (feet)	Soil Type	Comments
0 to 4.5	Brown SILTY SAND (SM), moist, dense, fine- to medium-grained	OVM reading at 3 feet = 4 ppm.
4.5 to 7.5	Gray SAND (SP) loose, moist, fine-grained, trace gravel, shell debris	OVM reading at 6 feet = 124 ppm.
7.5 to 8.5	Gray SILTY SAND (SM) medium dense, saturated fine- to medium-grained, trace of gravel and shell debris	Hydrocarbon odor, OVM reading at 8 feet = 175 ppm.

Note: Bottom of hole at 8.5 feet.

Test Pit Logs
Excavated June 4, 1991
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TEST PIT T-28

Depth Below Ground Surface (feet)	Soil Type	Comments
0 to 5	Brown SAND (SP) loose, moist, medium-grained	OVM reading at 3 feet = 4 ppm; OVM reading at 6 feet = 437 ppm.
5 to 8.5	Gray SAND (SP) loose, moist, saturated at 7.5 feet	OVM reading at 8 feet = 102 ppm; hydrocarbon odor 7.5 feet.

Note: Bottom of hole at 8.5 feet.

TEST PIT T-29

Depth Below Ground Surface (feet)	Soil Type	Comments
0 to 5	Light brown SAND (SP) loose, moist, medium-grained	OVM reading at 3 feet = 0.2 ppm; OVM reading at 6 feet = 1.8 ppm.
5 to 8.5	Gray SAND (SP) moist, saturated at 8 feet	OVM reading at 8 feet = 59 ppm; hydrocarbon odor.

Note: Bottom of hole at 8.5 feet.

TEST PIT T-30

Depth Below Ground Surface (feet)	Soil Type	Comments
0 to 4	Light brown SAND (SP), loose, moist, medium-grained	OVM reading at 3 feet = 0.2 ppm.
4 to 7	Light to dark gray SAND (SP)	Hydrocarbon odor, OVM reading at 6 feet = 428 ppm.
7 to 8.5	Dark dray SAND (SP) saturated with trace shell debris	OVM reading at 8 feet = 510 ppm.

Note: Bottom of hole at 8.5 feet.

Test Pit Logs
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TEST PIT T-31

Depth Below Ground Surface (feet)	Soil Type	Comments
0 to 5.5	Light brown SAND (SP) loose, moist, medium-grained	OVM reading at 3 feet = 0.2 ppm.
5.5 to 7	Orange brown SAND (SP) with trace of gravel	OVM reading at 6 feet = 0.2 ppm.
7 to 8.5	SAND (SP), becomes coarse-grained, saturated	OVM reading at 8 feet = 0.2 ppm.

Note: Bottom of hole at 8.5 feet.

TEST PIT T-32

Depth Below Ground Surface (feet)	Soil Type	Comments
0 to 7	Light gray SAND (SP) loose, moist, medium-grained	OVM reading at 3 feet = 0.2 ppm; OVM reading at 6 feet = 0.2 ppm.
7 to 8.5	Dark gray SAND (SP) trace shell fragments, saturated at 8 feet	OVM reading at 8 feet = 502 ppm; strong hydrocarbon odor.

Note: Bottom of hole at 8.5 feet.

TEST PIT T-33

Depth Below Ground Surface (feet)	Soil Type	Comments
Surface	Asphalt	
0.5 to 7	Gray brown SAND (SP) loose, moist, medium-grained, some gravel 0 to 4 feet	OVM reading at 3 feet = 0.2 ppm; OVM reading at 6 feet = 0.2 ppm.
7 to 8.5	Gray SAND (SP) saturated at 8 feet	OVM reading at 8 feet = 466 ppm; hydrocarbon odor.

Note: Bottom of hole at 8.5 feet.

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TEST PIT T-34

Depth Below Ground Surface (feet)	Soil Type	Comments
Surface	Asphalt	
0.5 to 7.5	Gray SAND (SP) loose, moist, medium-grained	OVM reading at 3 feet = 39 ppm; hydrocarbon odor; OVM reading at 6 feet = 547 ppm.
7.5 to 8.5	Gray SILTY SAND (SM), medium dense, saturated, fine-grained, trace coarse sand, trace of roots debris	Hydrocarbon odor, OVM reading at 8 feet = 49.

Note: Bottom of hole at 8.5 feet.

TEST PIT T-35

Depth Below Ground Surface (feet)	Soil Type	Comments
Surface	Asphalt	
0.5 to 7	Gray SAND (SP) loose, moist, medium-grained	Hydrocarbon odor; OVM reading at 3 feet = 198 ppm; OVM reading at 6 feet = 450 ppm.
7 to 8.5	Gray SILTY SAND (SM) trace shell fragments	OVM reading at 8 feet = 458 ppm.

Note: Bottom of hole at 8.5 feet.

Test Pit Logs
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TEST PIT T-36

Depth Below Ground Surface (feet)	Soil Type	Comments
Surface	Asphalt	
0.5 to 8	Dark gray SAND (SP) loose, moist, medium-grained	OVM reading at 3 feet = 169 ppm; hydrocarbon odor; OVM reading at 6 feet = 305 ppm.
8 to 8.5	Black SILTY SAND (SM) medium dense, saturated, fine-grained, trace shell debris	Hydrocarbon odor, OVM reading at 8 feet = 2 ppm.

Note: Bottom of hole at 8.5 feet.

TEST PIT T-37

Depth Below Ground Surface (feet)	Soil Type	Comments
Surface	Concrete	
0.5 to 8.5	Dark gray SAND (SP), loose, moist, becomes saturated at 8 feet, trace silt, trace shell debris at 8 feet	OVM reading at 3 feet = 614; OVM reading at 6 feet = 434 ppm; OVM reading at 8 feet = 442 ppm; strong hydrocarbon odor.

Note: Bottom of hole at 8.5 feet.

TEST PIT T-38

Depth Below Ground Surface (feet)	Soil Type	Comments
Surface	Concrete	
0.5 to 7	Gray SAND (SP) loose, moist, fine- to medium-grained	OVM reading at 3 feet = 489; hydrocarbon odor; OVM reading at 6 feet = 522 ppm.
7 to 8.5	Gray SAND (SP) with trace shell debris	OVM reading at 8 feet = 233 ppm.

Note: Bottom of hole at 8.5 feet.

Test Pit Logs
Excavated June 4, 1991
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HAND AUGER HA1

Depth Below Ground Surface (feet)	Soil Type	Comments
0 to 4	Brown SILT (ML), soft, moist, trace fine sand	OVM reading at 1.5 feet = 0.2 ppm.
4 to 10	Gray SAND (SP) loose, dry, very fine to fine-grained	OVM reading at 4 feet = 0.2 ppm.
10 to 10.5	Gray SILTY SAND (SM) loose, saturated, fine- to medium-grained	Hydrocarbon odor; OVM reading at 10 feet = 826 ppm.

Note: Bottom of hole at 10.5 feet.

HAND AUGER HA2

Depth Below Ground Surface (feet)	Soil Type	Comments
0 to 1	Brown SAND (SP), dry	OVM reading at 1.5 feet = 0.2 ppm.
1 to 4	Brown SILT (ML) soft, moist, trace, very fine sand	OVM reading at 3 feet = 0.2 ppm.
4 to 10	Light gray SAND (SP) loose, dry, very fine to medium-grained	OVM reading at 7 feet = 0.2 ppm.
10 to 10.5	Brown gray SILTY SAND (SM) loose, saturated, fine- to medium-grained	OVM reading at 10 feet = 0.2 ppm.

Note: Bottom of hole at 10.5 feet.

Test Pit Logs
Excavated June 4, 1991
Chevron Bulk Terminal No. 61001350
Bellingham, Washington

HAND AUGER HA3

Depth Below Ground Surface (feet)	Soil Type	Comments
0 to 1	Brown SAND (SP), dry	OVM reading at 1.5 feet = 0.2 ppm.
1 to 4	Brown SILT (ML) soft, moist, trace of very fine sand	OVM reading at 3 feet = 0.2 ppm.
4 to 9	Gray SAND (SP) loose, dry, very fine to fine-grained	OVM reading at 7 feet = 0.2 ppm.
9 to 10.5	Brown gray SILTY SAND (SM) loose, saturated, fine- to medium-grained, trace gravel	OVM reading at 10 feet = 0.2 ppm.

Note: Bottom of hole at 10.5 feet.

HAND AUGER HA4

Depth Below Ground Surface (feet)	Soil Type	Comments
0 to 1	Brown SAND (SP), dry, loose	
1 to 4	Brown SILT (ML) soft, moist, trace of very fine sand	OVM reading at 1.5 feet = 0.2 ppm; OVM reading at 3 feet = 0.2 ppm.
4 to 9	Light to dark gray SAND (SP), loose, dry, very fine to medium-grained	OVM reading at 7 feet = 0.2 ppm.
9 to 10.5	Dark gray SAND (SP) with trace silt, fine-grained, saturated	OVM reading at 10 feet = 0.2 ppm.

Note: Bottom of hole at 10.5 feet.

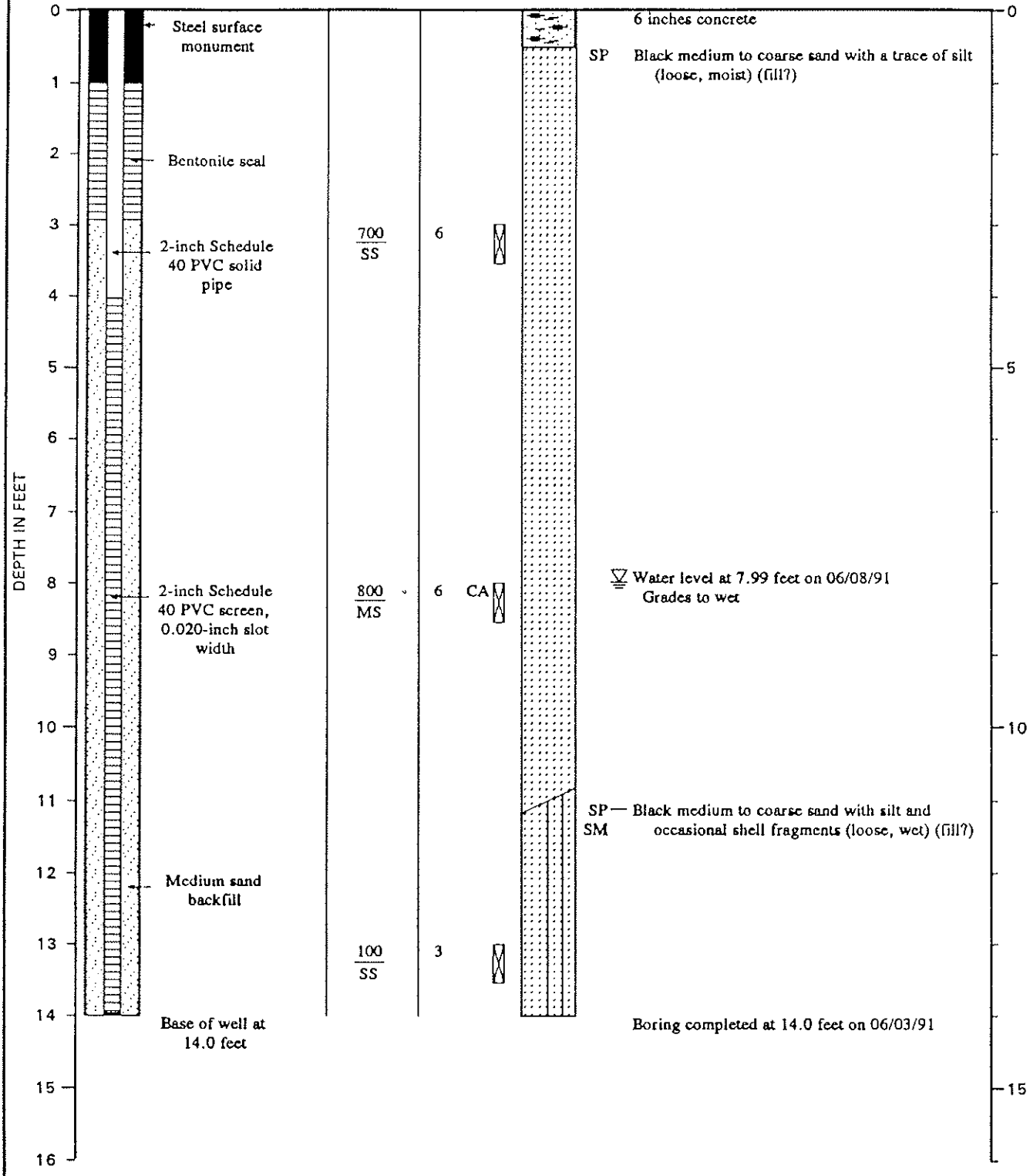
Test Pit Logs
Excavated June 4, 1991
Chevron Bulk Terminal No. 61001350
Bellingham, Washington

HAND AUGER HA5

Depth Below Ground Surface (feet)	Soil Type	Comments
0 to 1	Brown SAND (SP), dry, loose	
1 to 4	Brown SILT (ML) soft, moist, trace of very fine sand	OVM reading at 1.5 feet = 0.2 ppm; OVM reading at 3 feet = 0.2 ppm.
4 to 9.5	Light gray SAND (SP) loose, dry, very fine to fine-grained with some shell debris	OVM reading at 7 feet = 0.2 ppm.
9.5 to 10.5	Brown SILTY SAND (SM) loose, saturated, medium-grained	OVM reading at 10 feet = 0.2 ppm.

Note: Bottom of hole at 10.5 feet.

MONITOR WELL NO. MW-1



Note: See Figure A-2 for explanation of symbols

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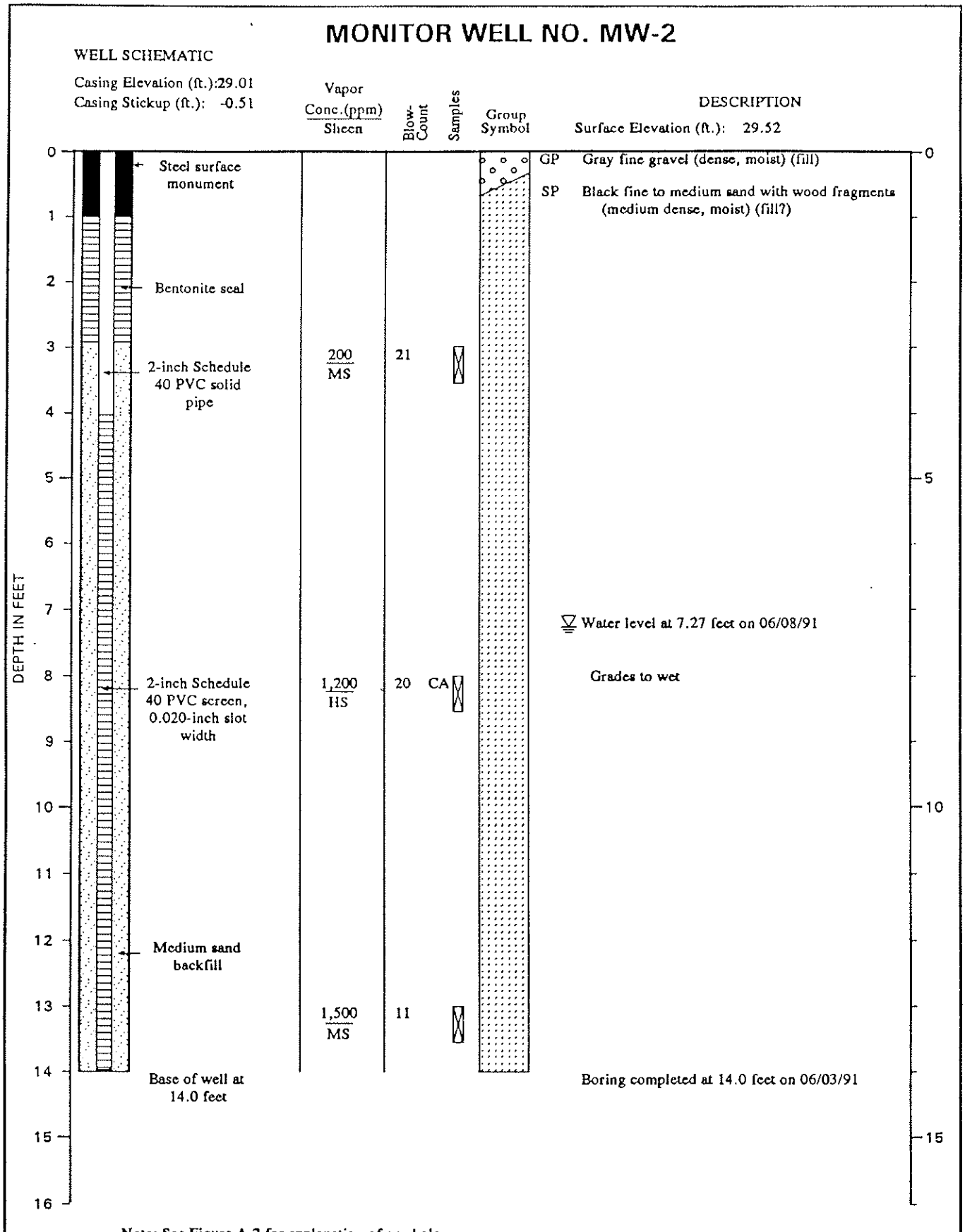
Log of Monitor Well

Figure A-3

:MDW:CMS 8/26/91

1979-002-B14

MONITOR WELL NO. MW-2



Note: See Figure A-2 for explanation of symbols

:MDW:CMS 8/26/91

1979-002-B14

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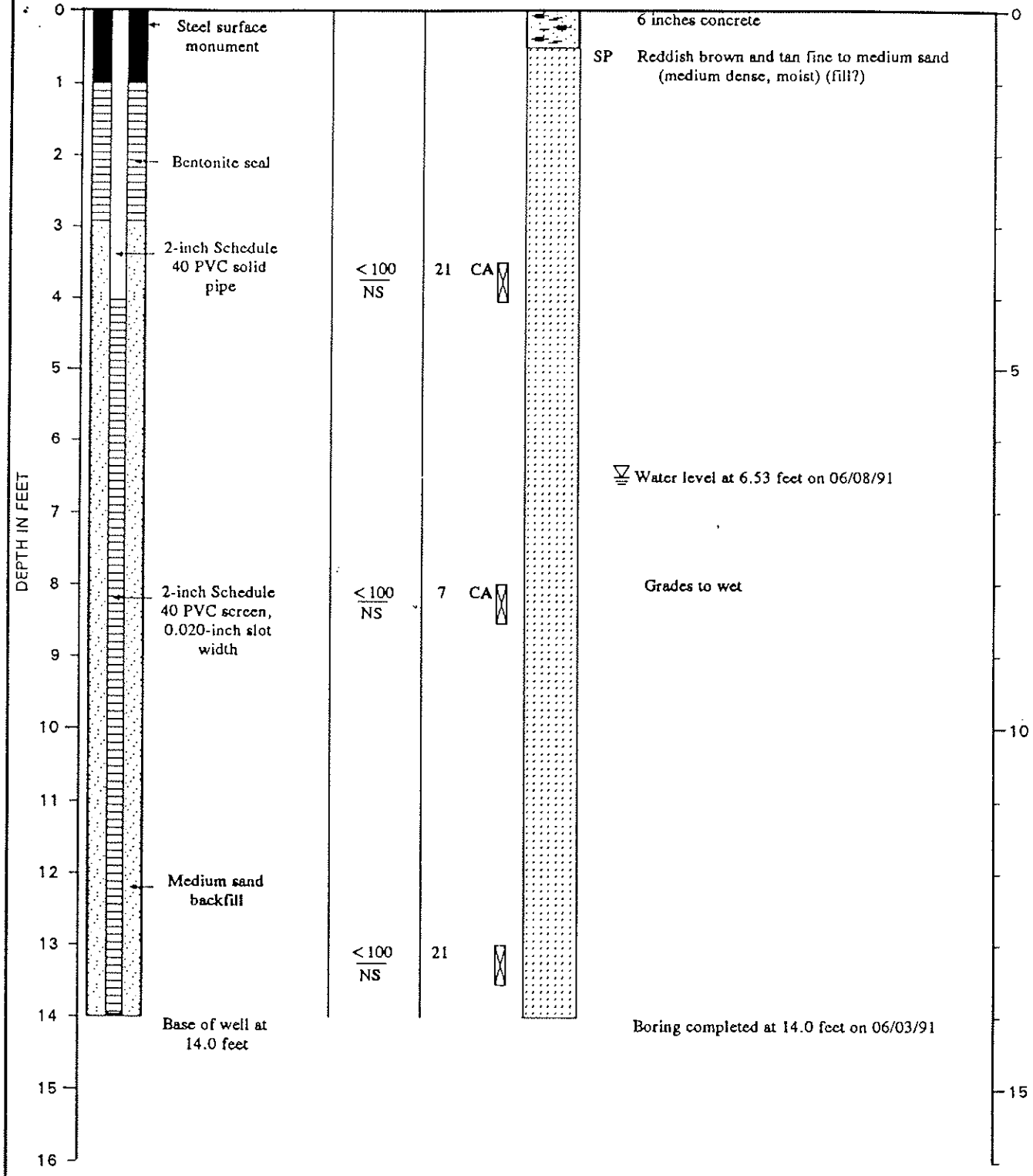
Log of Monitor Well

Figure A-4

MONITOR WELL NO. MW-3



Note: See Figure A-2 for explanation of symbols

:MDW:CMS 8/26/91

1979-002-B14

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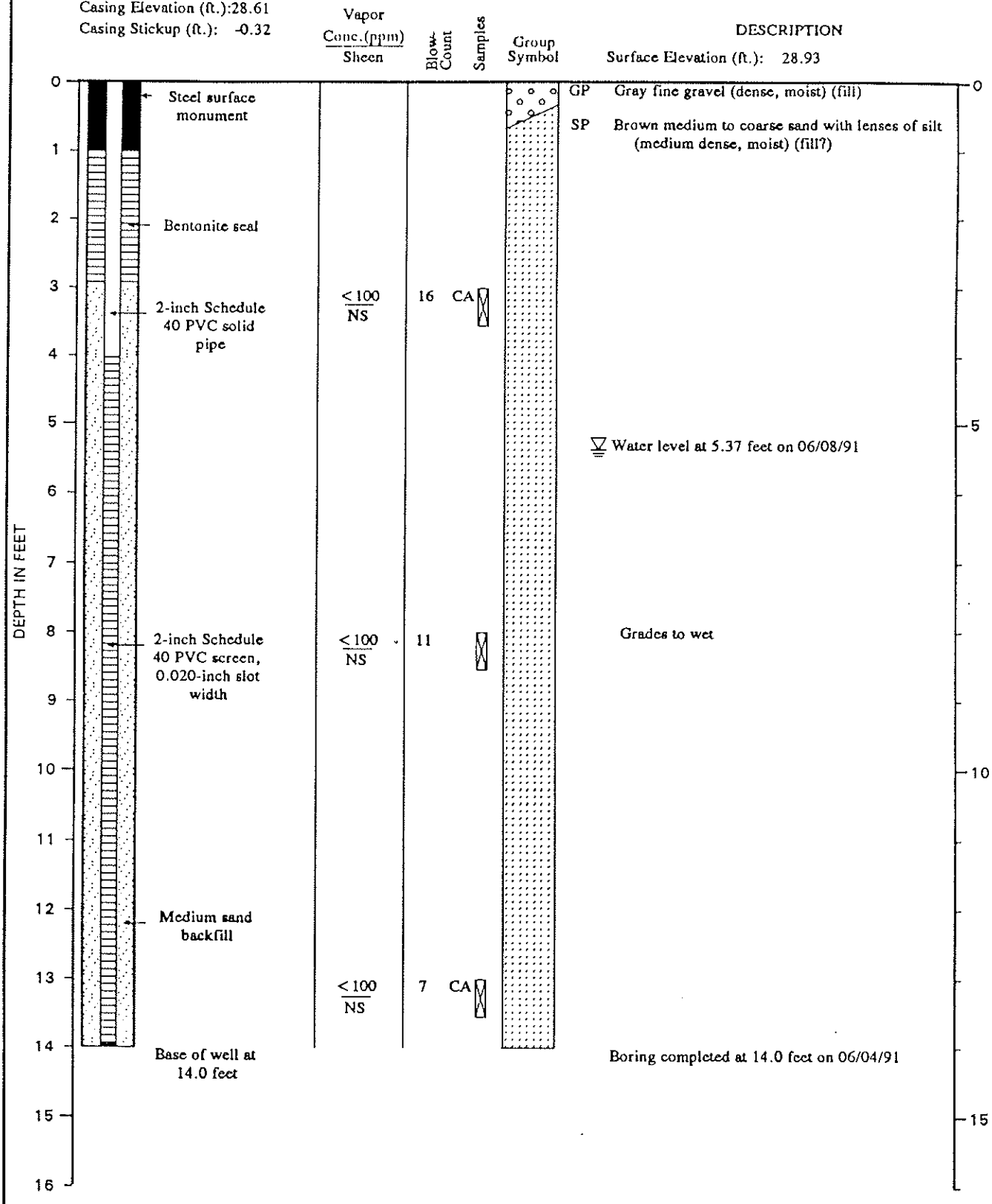
Log of Monitor Well

Figure A-5

MONITOR WELL NO. MW-4



Note: See Figure A-2 for explanation of symbols

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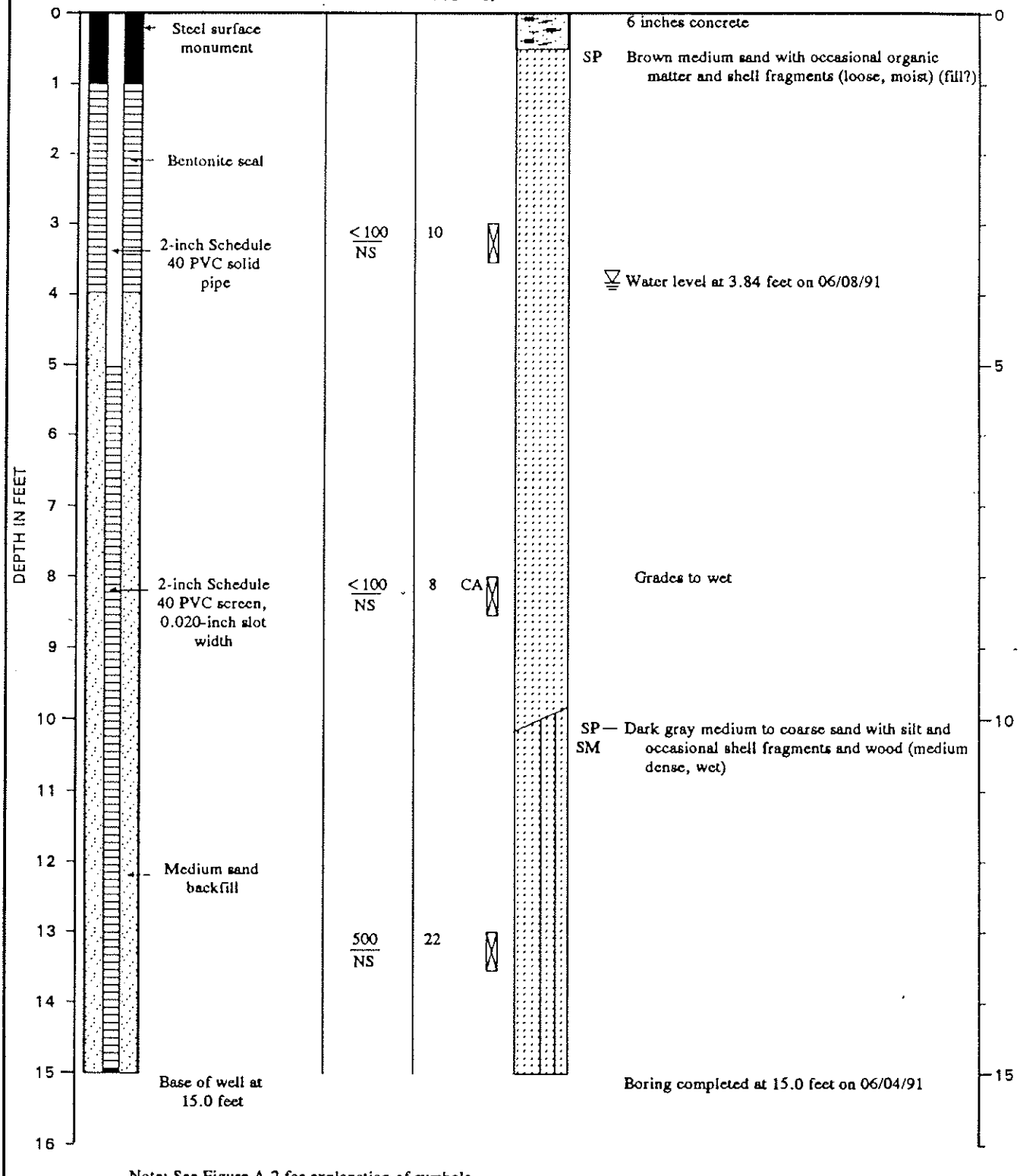
Log of Monitor Well

Figure A-6

:MDW:CMS 8/26/91

1979-002-814

MONITOR WELL NO. MW-5



Note: See Figure A-2 for explanation of symbols

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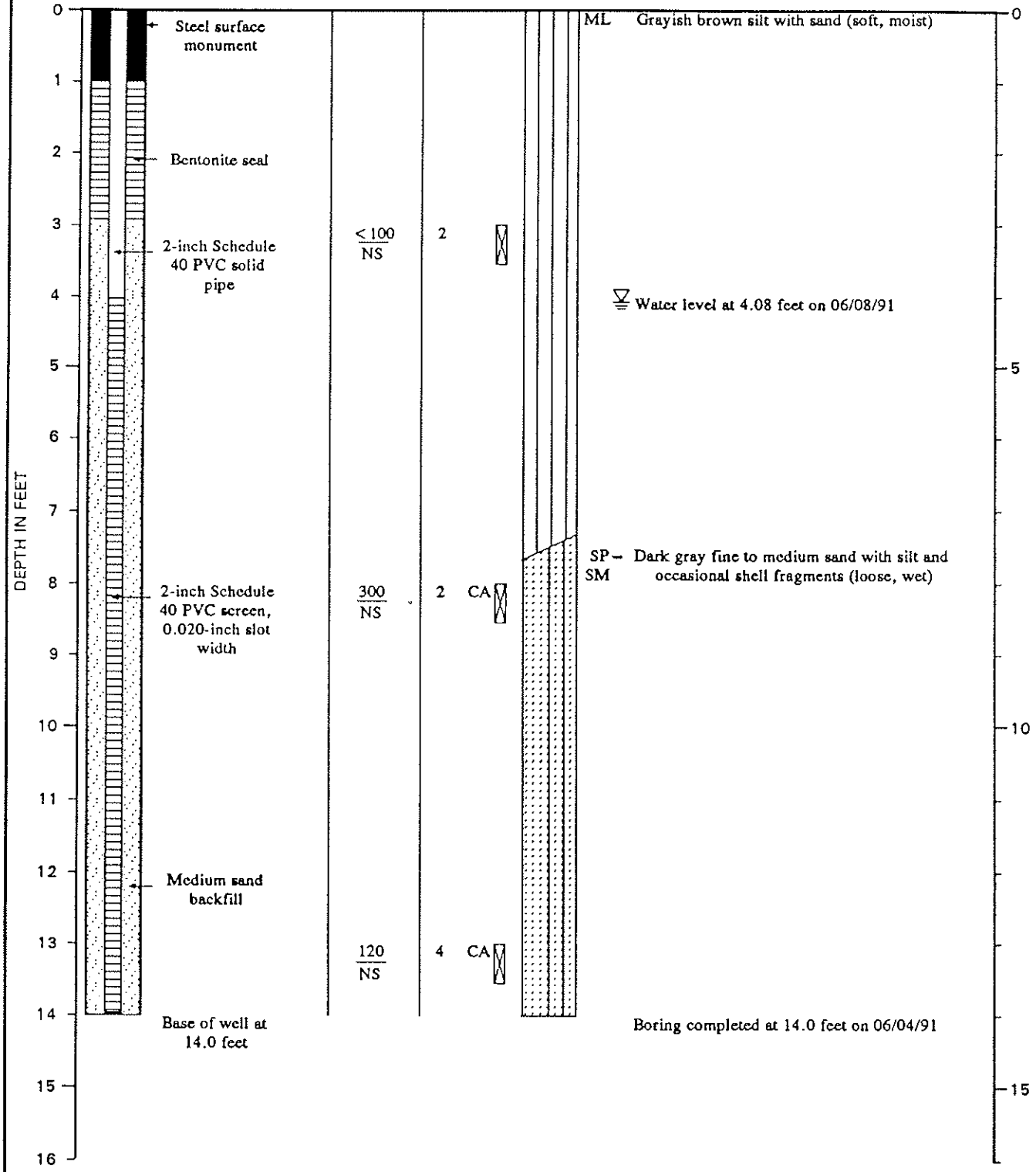
Log of Monitor Well

Figure A-7

:MDW:CMS 8/26/91

1979-002-B14

MONITOR WELL NO. MW-6



Note: See Figure A-2 for explanation of symbols

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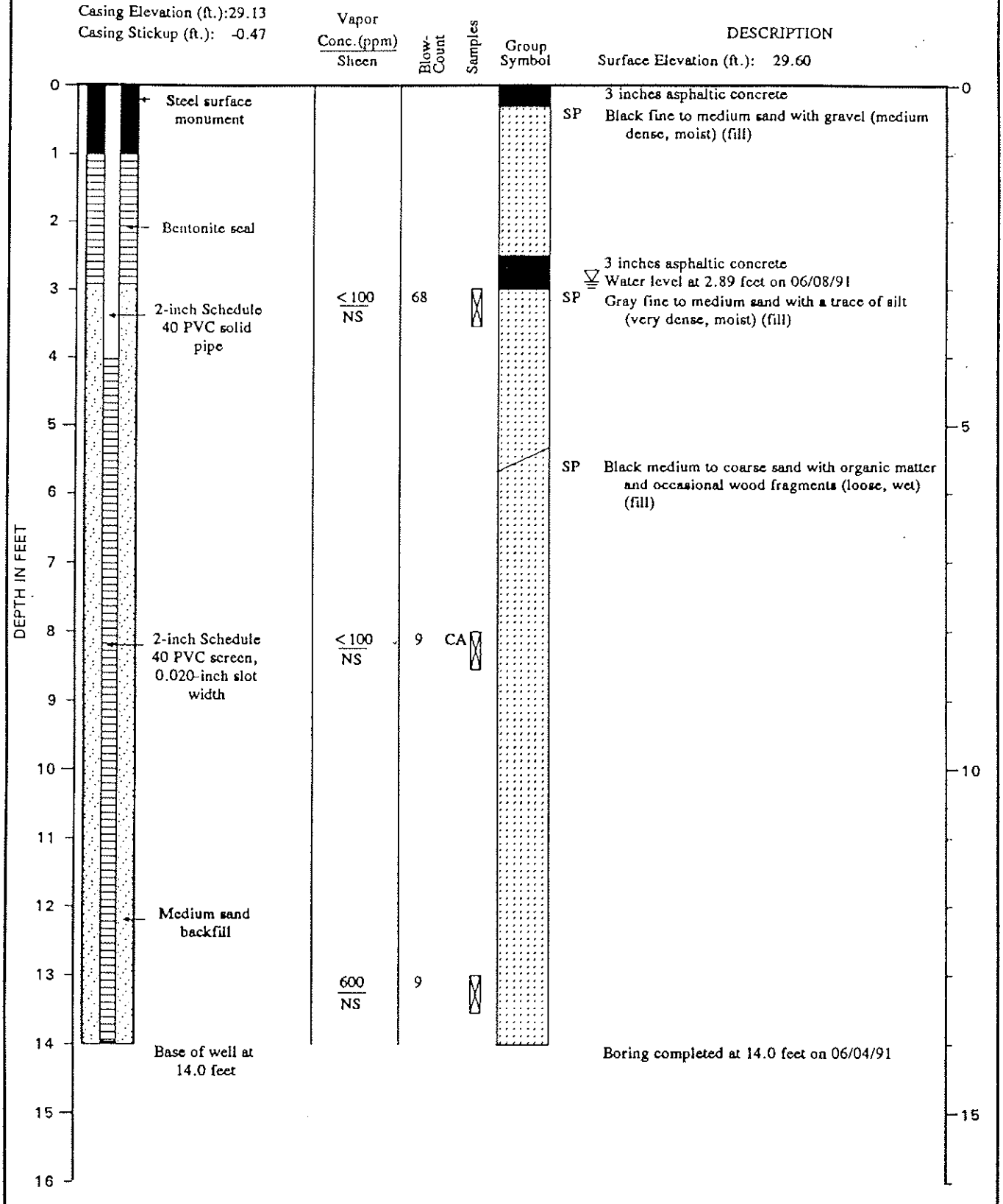
Log of Monitor Well

Figure A-8

:MDW:CMS 8/26/91

1979-002-814

MONITOR WELL NO. MW-7



Note: See Figure A-2 for explanation of symbols

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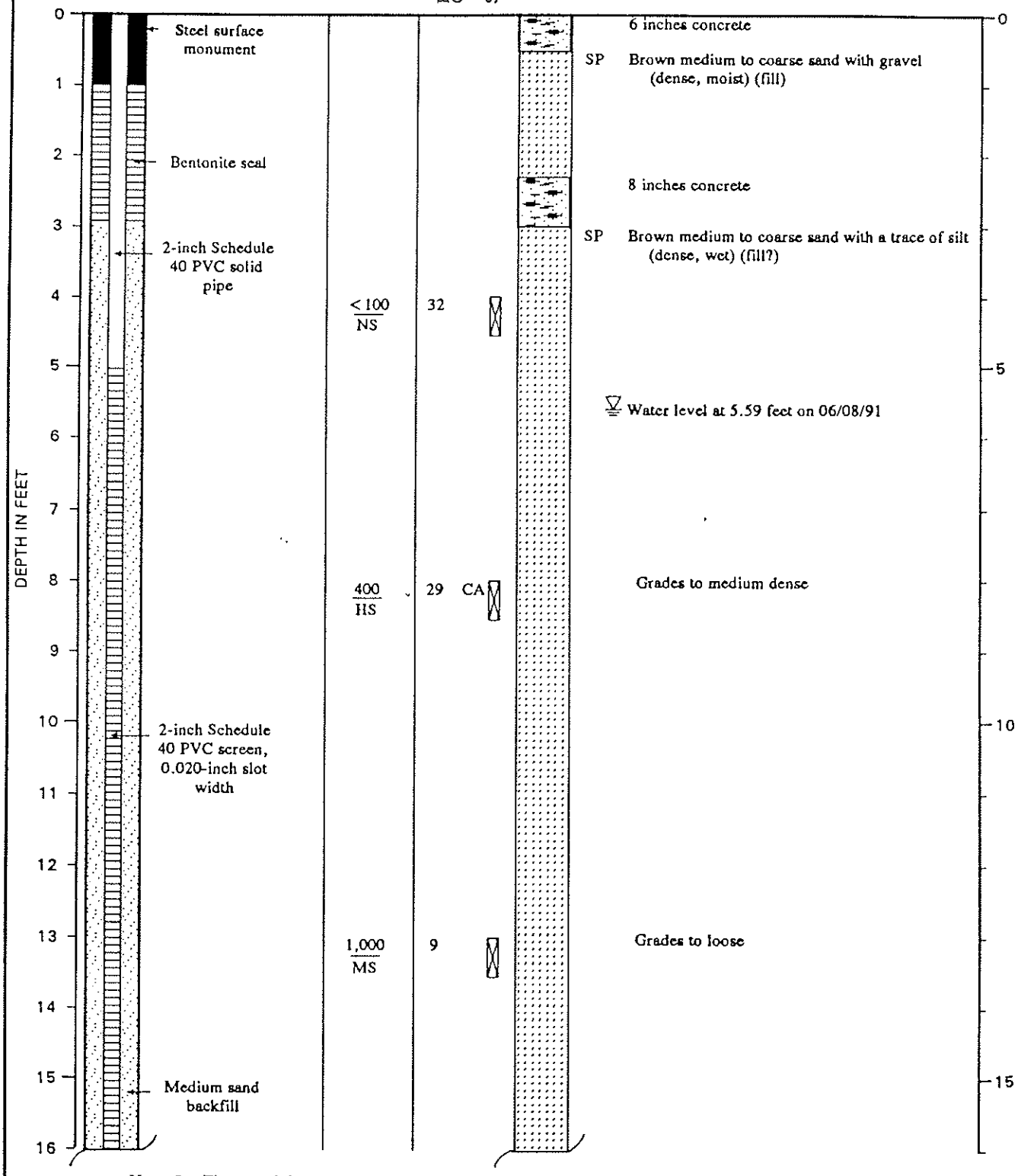
Log of Monitor Well

Figure A-9

:MDW:CMS 8/26/91

1979-002-B14

MONITOR WELL NO. MW-8



Note: See Figure A-2 for explanation of symbols

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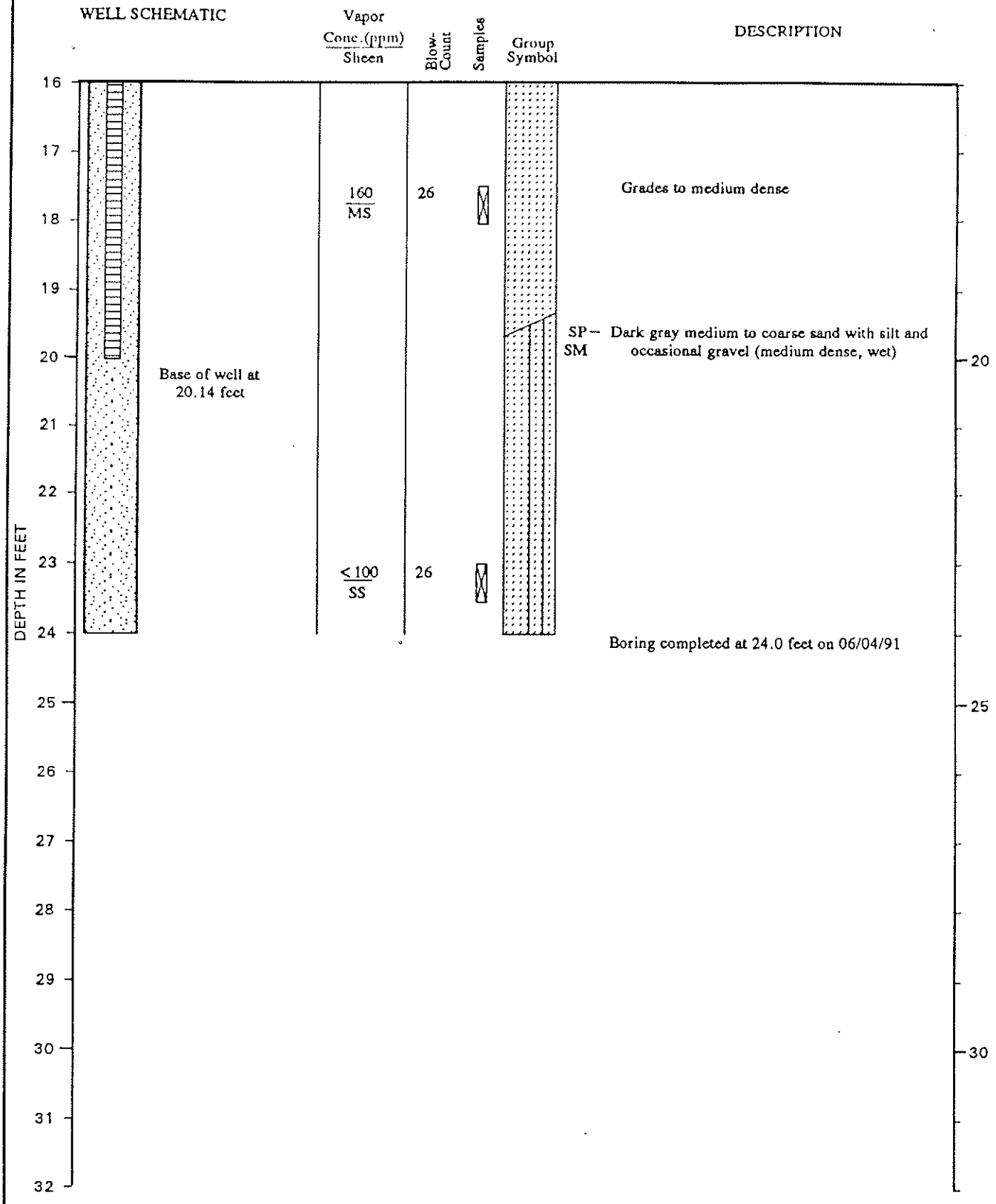
Log of Monitor Well

Figure A-10

:MDW:CMS 8/26/91

1979-002-814

MONITOR WELL NO. MW-8
(Continued)



Note: See Figure A-2 for explanation of symbols

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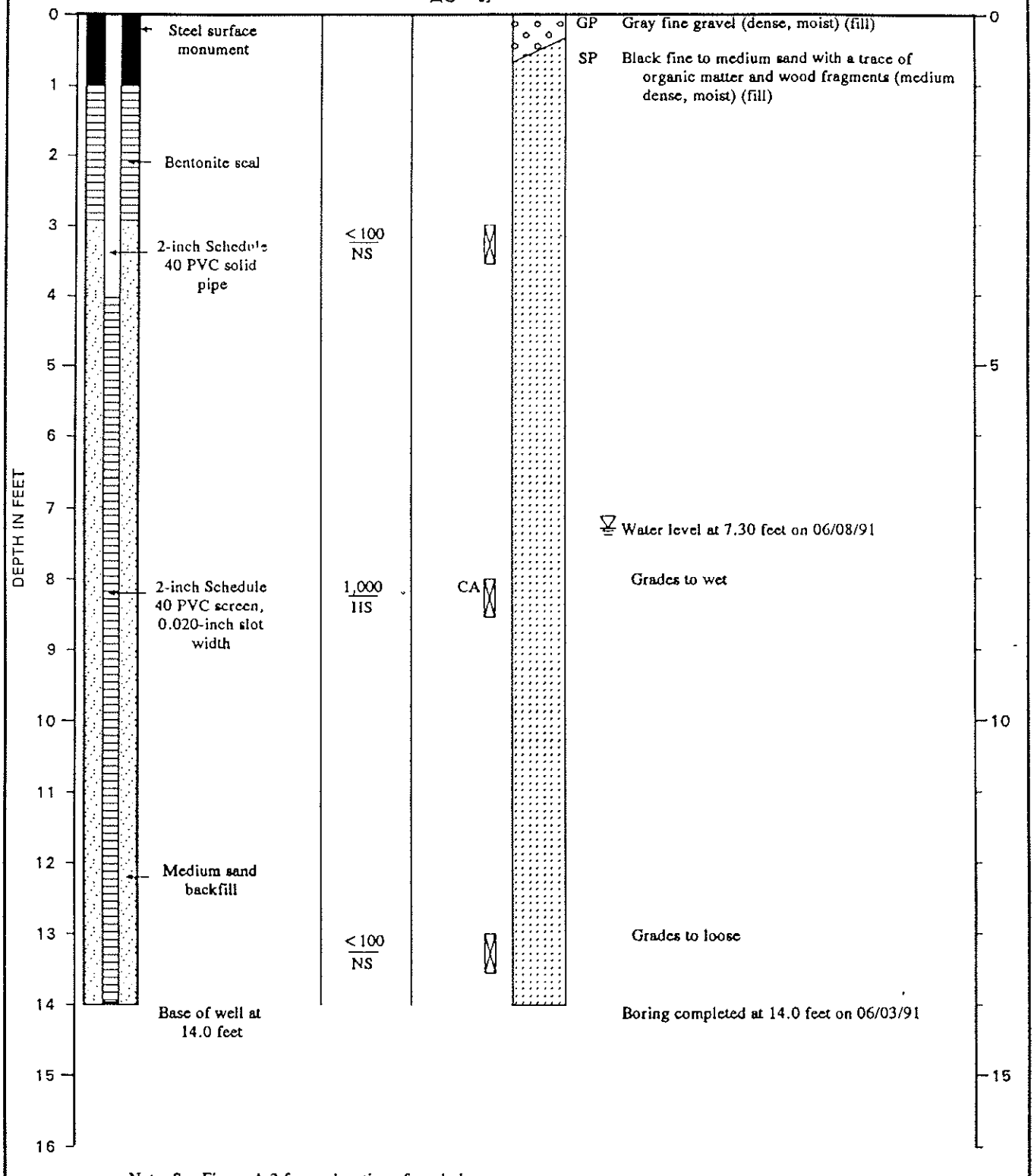
Log of Monitor Well

Figure A-10

:MDW:CMS 8/26/91

1979-002-B14

MONITOR WELL NO. MW-9



Note: See Figure A-2 for explanation of symbols

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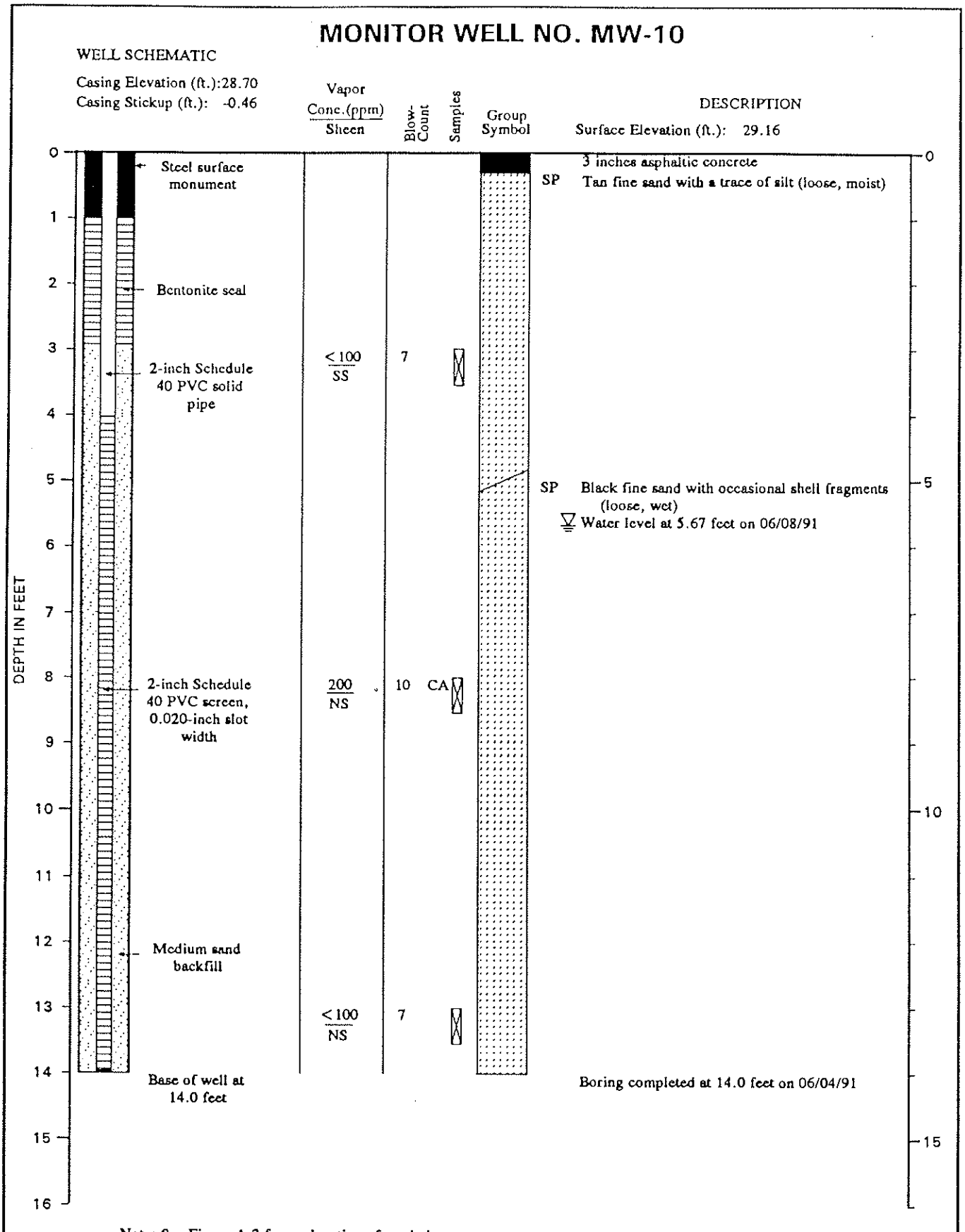
Log of Monitor Well

Figure A-11

:MOW:CMS 8/26/91

1979-002-B14

MONITOR WELL NO. MW-10



Note: See Figure A-2 for explanation of symbols

:MDW:CMS 8/26/91

1979-002-B14

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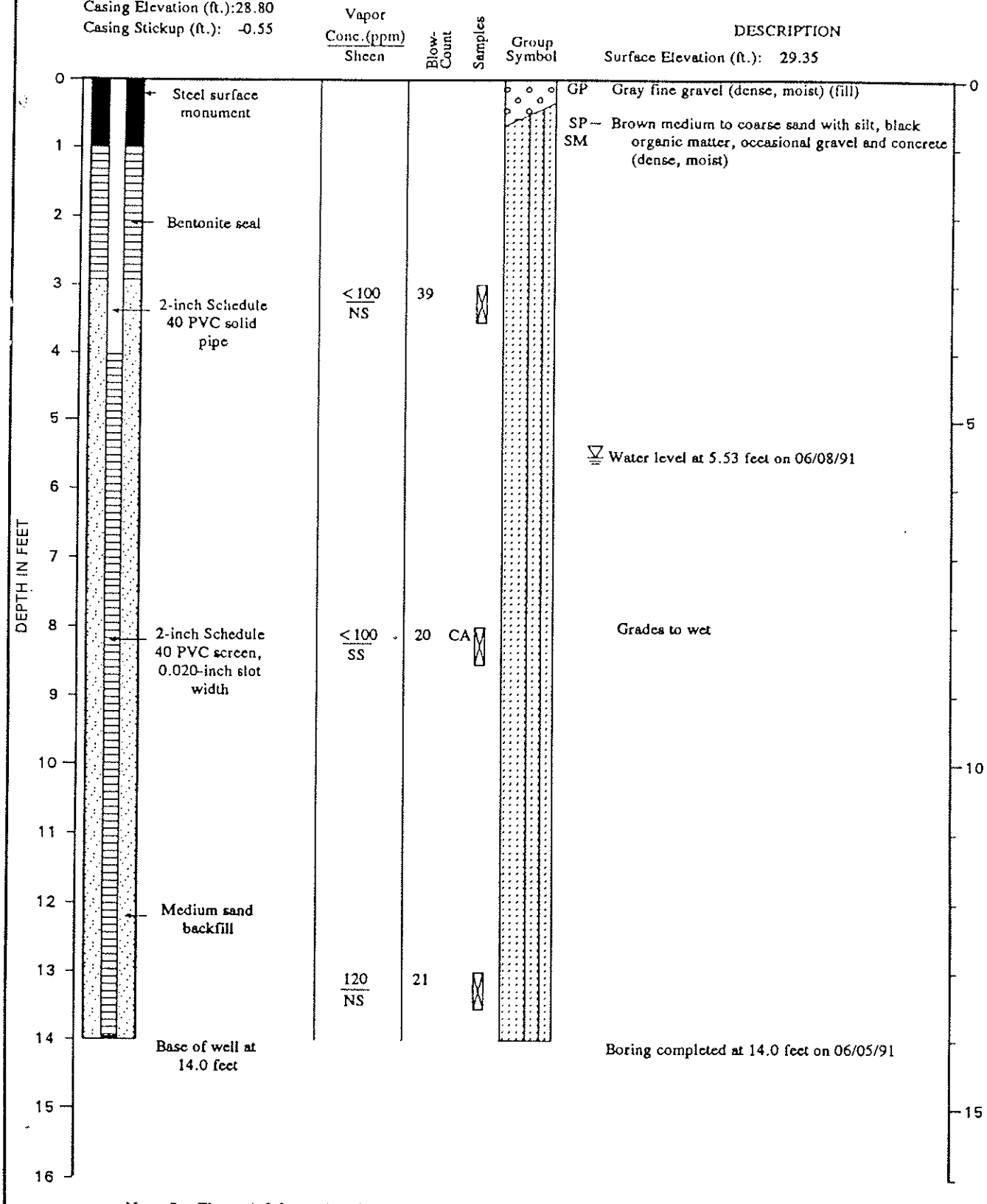
Log of Monitor Well

Figure A-12

MONITOR WELL NO. MW-11



Note: See Figure A-2 for explanation of symbols

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Log of Monitor Well

Figure A-13

:MDW:CMS 8/26/91

1979-002-B14

MONITORING WELL NO. MW-12

WELL SCHEMATIC

Casing Elevation (ft.): 27.69
Casing Stickup (ft.): -0.36

Steel surface monument
Bentonite seal
2-inch Schedule 40 PVC solid pipe
2-inch Schedule 40 PVC screen, 0.020-inch slot width
Medium sand backfill
Base of well at 13.0 feet

Vapor Conc.(ppm) / Sheen	Blow Count	Samples	Group Symbol	DESCRIPTION (Surface Elevation (ft.): 28.05)
				14 inches concrete
			SP	Gray fine to coarse sand (loose, moist) (fill)
			ML	▽ Water level at 2.39 feet on 03/28/92 Gray silt with lenses of fine to medium sand and occasional shell fragments (soft, wet) (fill)
<100 / SS	5	CA ■		
<100 / NS	2	☒		Sand content increases
	3	□		
			SP— SM	Gray fine to medium sand with silt and occasional shell fragments and wood (loose, wet) (fill)
200 / NS	8	☒		
200 / NS	2	■		
			ML	Gray silt with lenses of fine to medium sand (medium stiff, wet)
<100 / NS	7	■		
				Boring completed at 16.5 feet on 11/22/91

Note: Headspace vapors measured using a Bacharach TLV Sniffer

DEPTH IN FEET

0 5 10 15 20 25 30 35 40

Note: See Figure A-2 for explanation of symbols

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LOG OF MONITORING WELL

FIGURE A-3

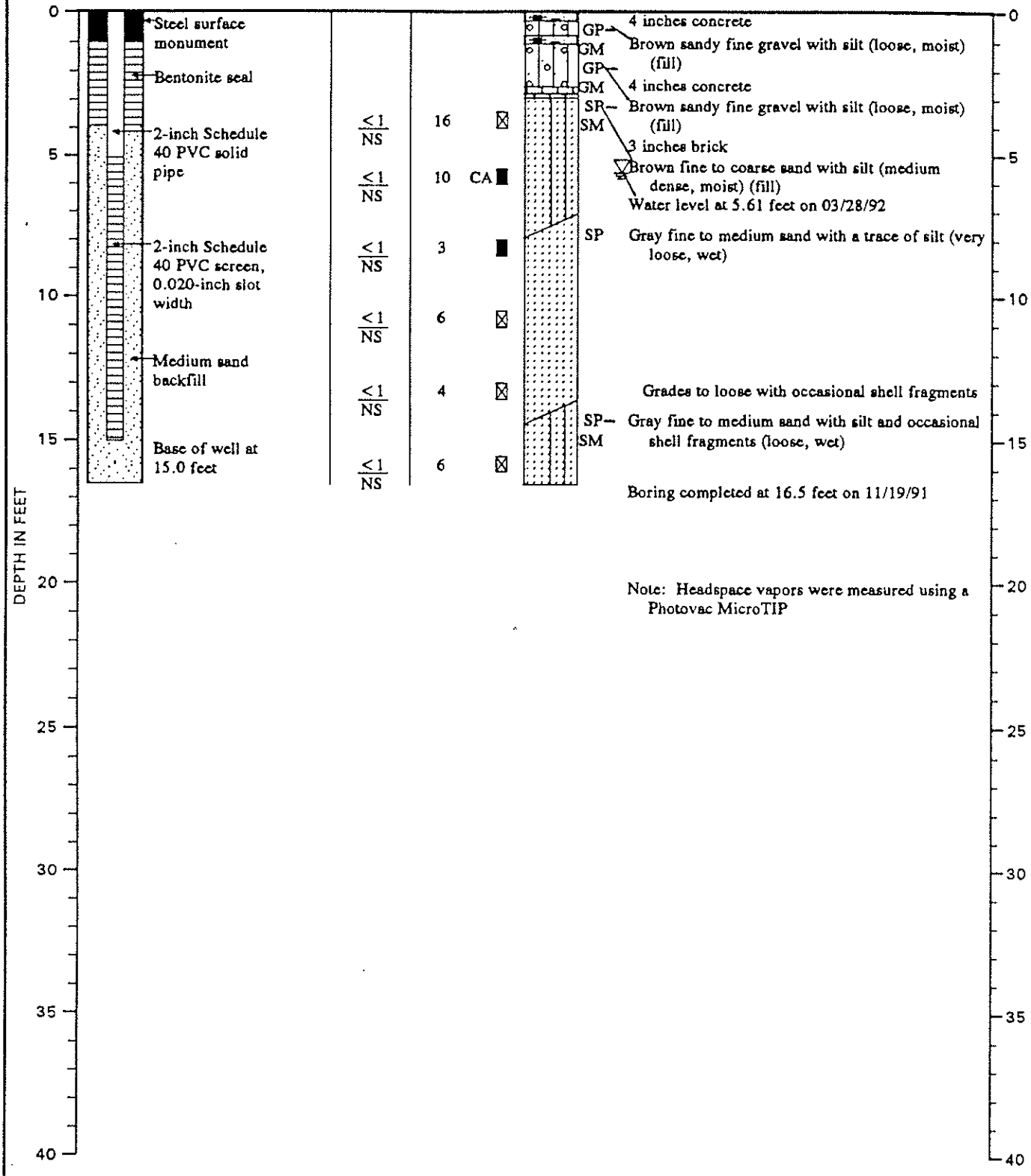
:MDW:CMS 4/2/92

1979-003-R14

MONITORING WELL NO. MW-13

WELL SCHEMATIC

Casing Elevation (ft.): 28.67
Casing Stickup (ft.): -0.26



Note: See Figure A-2 for explanation of symbols

Geo Engineers

LOG OF MONITORING WELL

FIGURE A-4

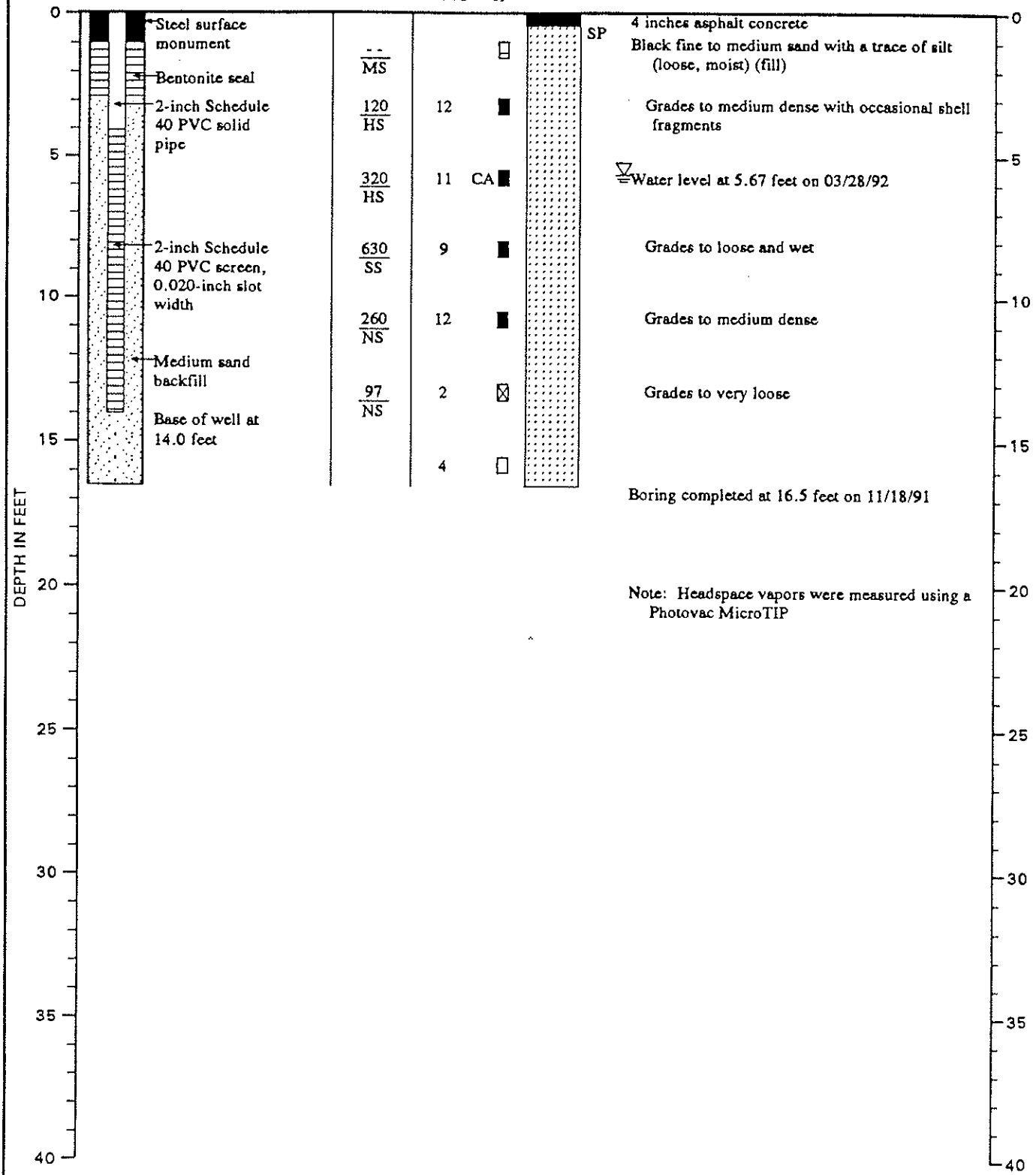
:MDW:CMS 4/2/92

979-003-R14

MONITORING WELL NO. MW-14

WELL SCHEMATIC

Casing Elevation (ft.): 28.91
Casing Stickup (ft.): -0.27



Note: See Figure A-2 for explanation of symbols

Geo Engineers

LOG OF MONITORING WELL

FIGURE A-5

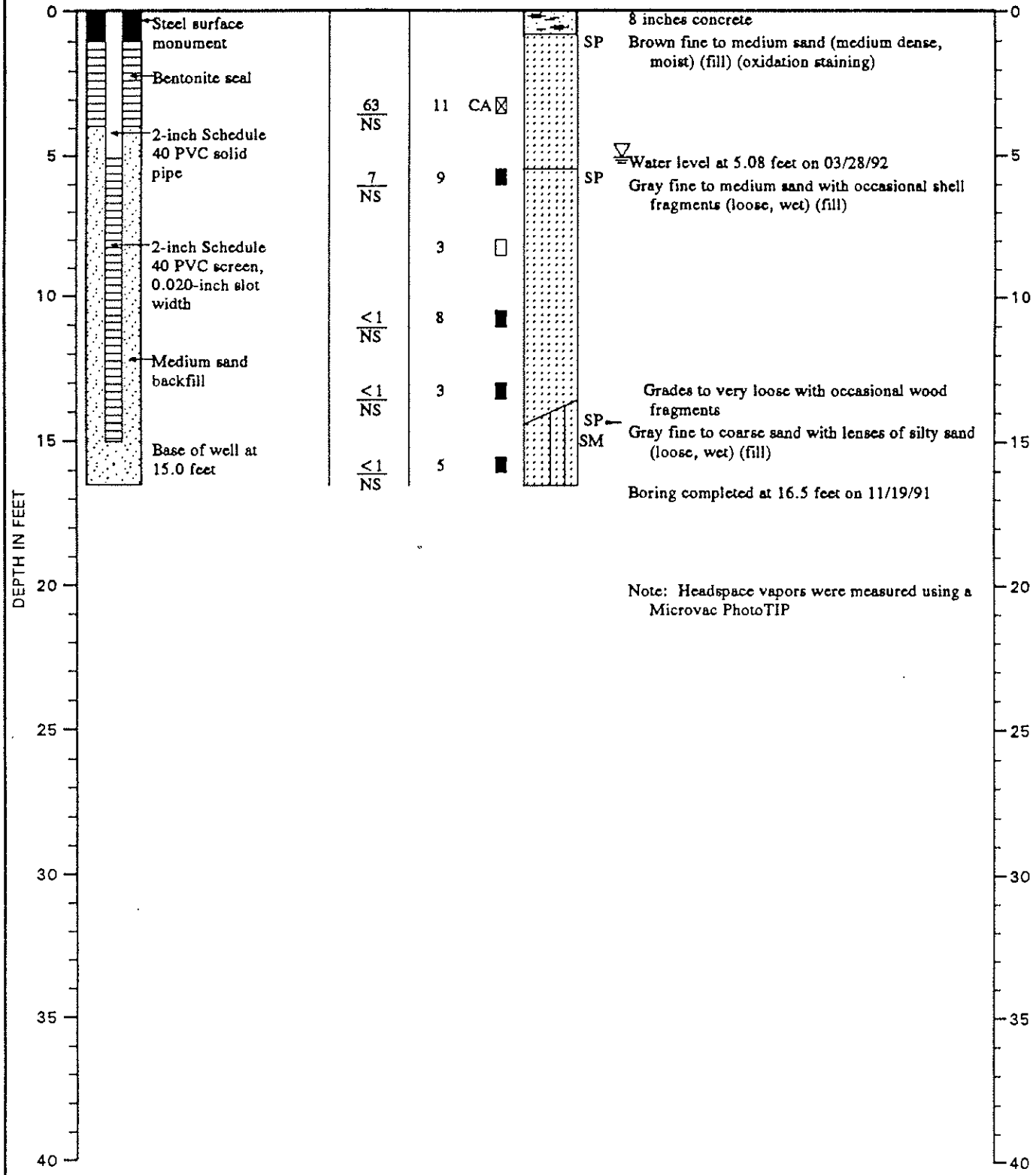
:MDW:CMS 4/2/92

1979-003-R14

MONITORING WELL NO. MW-15

WELL SCHEMATIC

Casing Elevation (ft.): 28.17
Casing Stickup (ft.): -0.22



Note: See Figure A-2 for explanation of symbols

Geo Engineers

LOG OF MONITORING WELL

FIGURE A-6

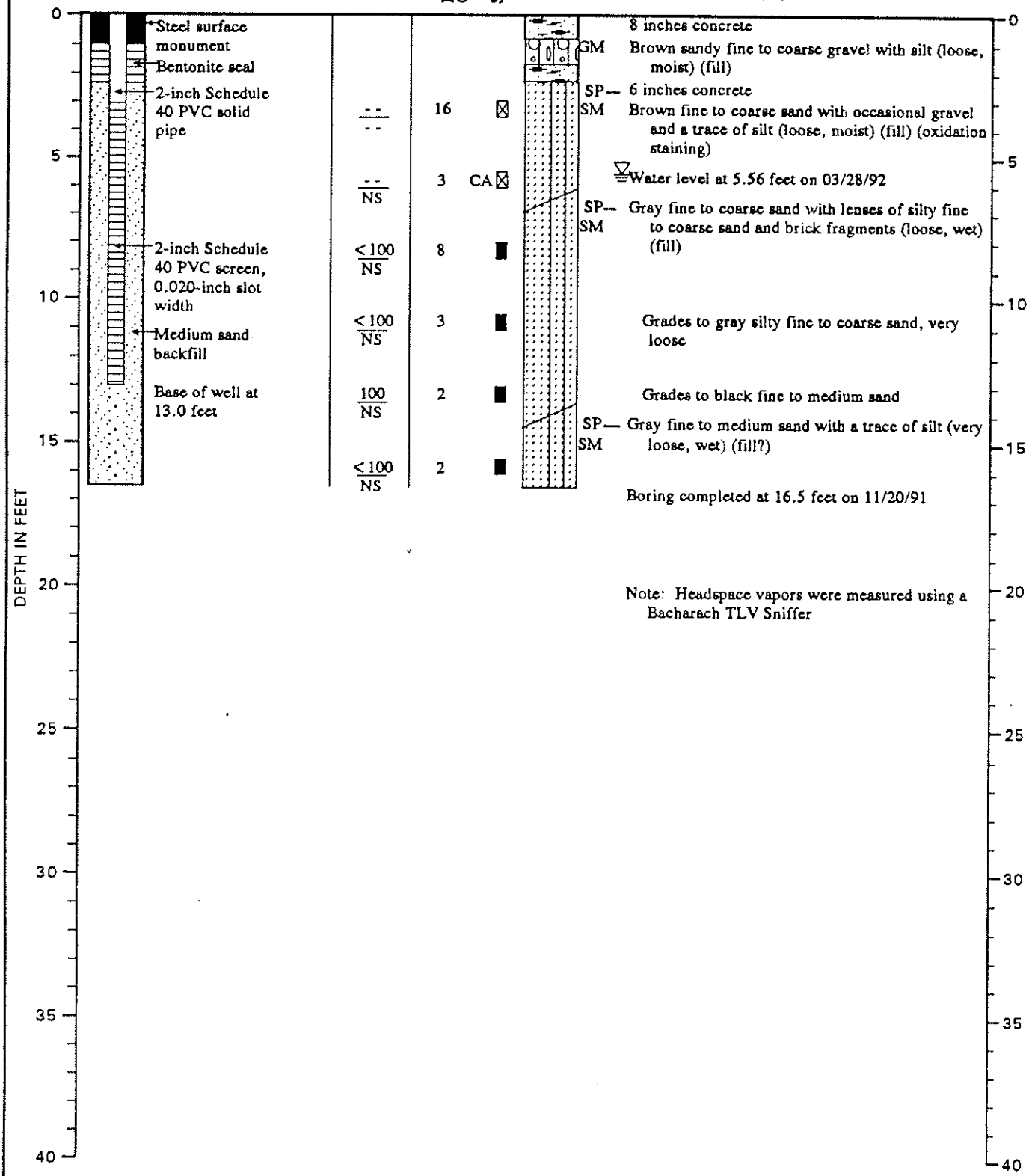
:MDW:CMS 4/2/92

1979-003-R14

MONITORING WELL NO. MW-16

WELL SCHEMATIC

Casing Elevation (ft.): 27.73
Casing Stickup (ft.): -0.38



Note: Headspace vapors were measured using a Bacharach TLV Sniffer

Note: See Figure A-2 for explanation of symbols

:MDW:CMS 4/2/92

1979-003-R14

Geo Engineers

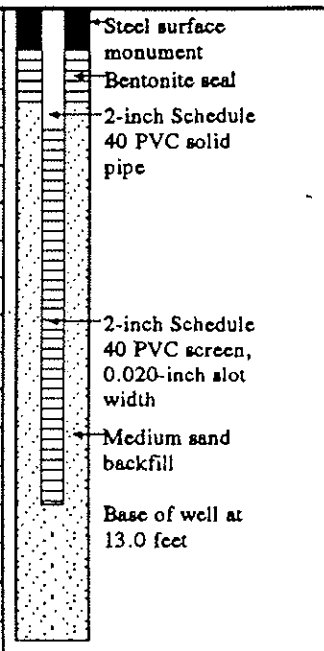
LOG OF MONITORING WELL

FIGURE A-7

MONITORING WELL NO. MW-17

WELL SCHEMATIC

Casing Elevation (ft.): 28.11
Casing Stickup (ft.): -0.26



Vapor Conc.(ppm) / Sheen	Blow Count	Samples	Group Symbol	DESCRIPTION (Surface Elevation (ft.): 28.37)	Depth (ft.)
				8 inches concrete	0
160* / SS	16	☒	SM	Black fine to medium sand with occasional shell fragments (medium dense, moist) (fill)	
				▽ Water level at 4.95 feet on 03/28/92	5
-- / HS	16	CA ☒	SP-SM	Gray fine to medium sand with silt and occasional shell fragments (loose, wet) (fill)	
-- / MS	8	☒			
800** / NS	8	☒			10
			SP-SM	Gray fine to coarse sand with a trace of silt and occasional shell fragments (very loose, wet) (fill)	
400** / NS	2	☒			
					15
100** / NS	8	■		Lenses of silty sand, grades to loose	
				Boring completed at 16.5 feet on 11/20/91	
					20
					25
					30
					35
					40

DEPTH IN FEET

Notes:

*Headspace vapors were measured using a Microvac PhotoTIP

**Headspace vapors were measured using a Bacharach TLV Sniffer

Note: See Figure A-2 for explanation of symbols

Geo Engineers

LOG OF MONITORING WELL

FIGURE A-8

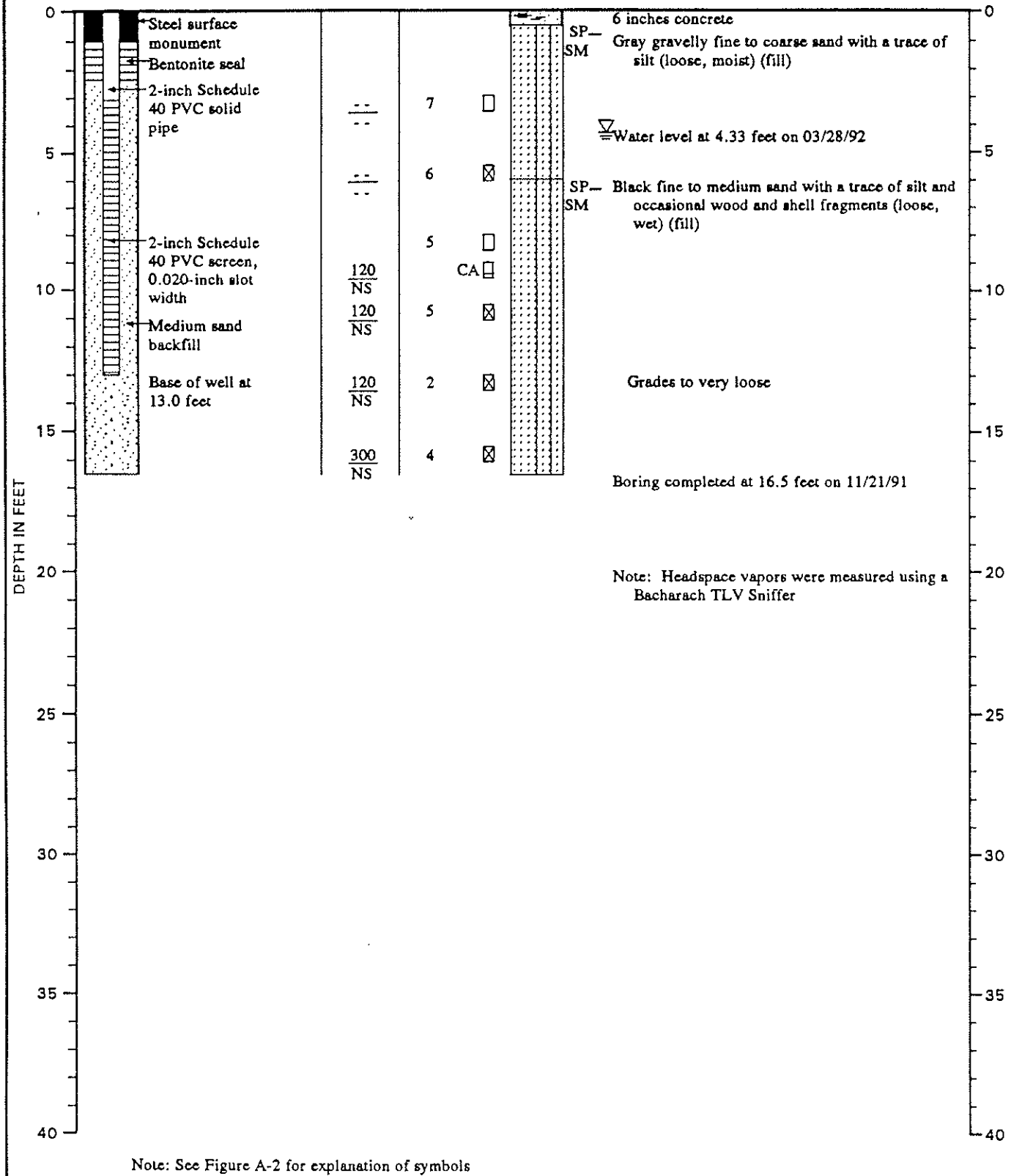
:MDW:CMS 4/2/92

1979-003-R14

MONITORING WELL NO. MW-18

WELL SCHEMATIC

Casing Elevation (ft.): 29.37
Casing Stickup (ft.): -0.28



Note: See Figure A-2 for explanation of symbols

Geo Engineers

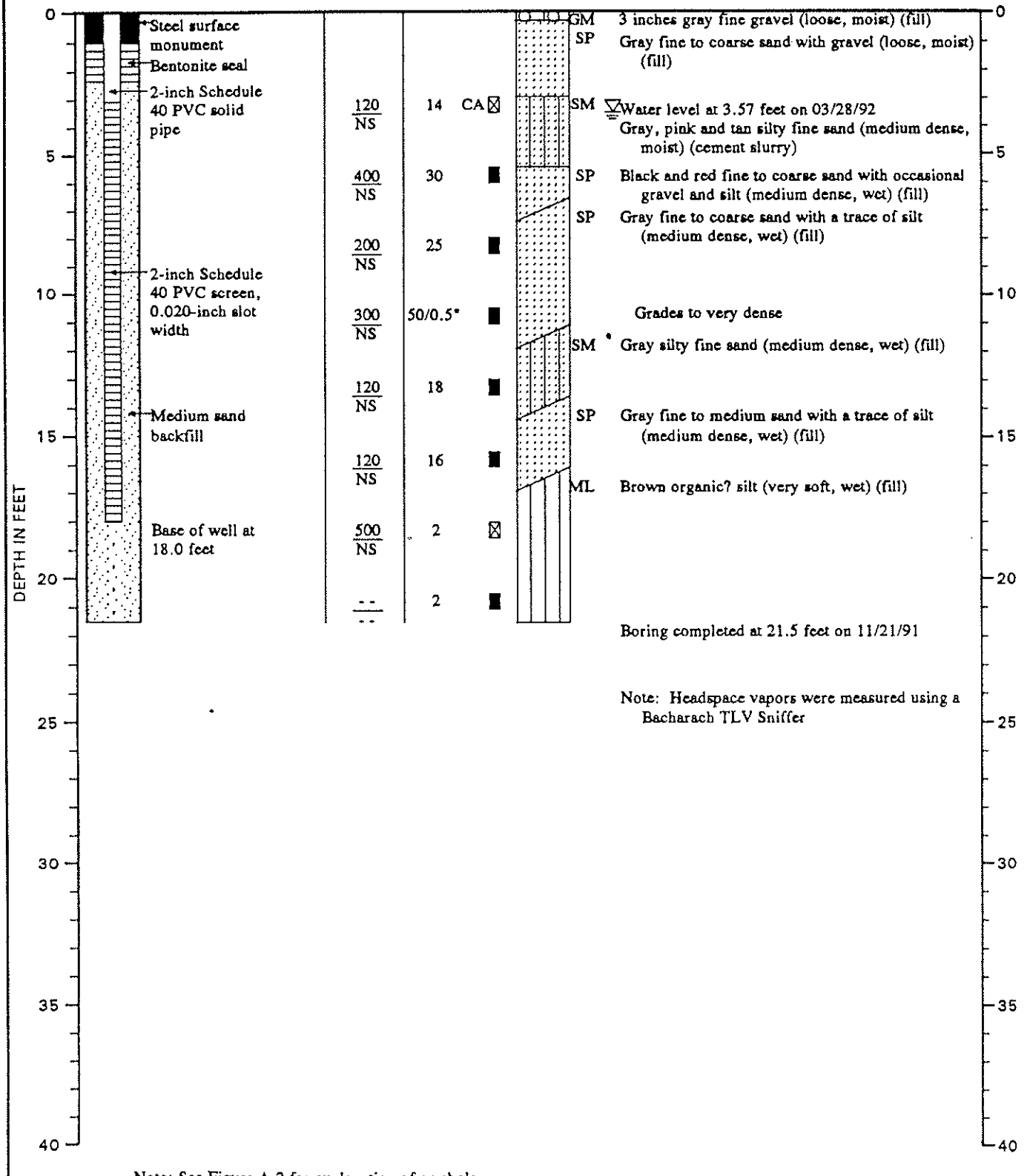
LOG OF MONITORING WELL

FIGURE A-9

:MDW:CMS 4/2/92

1979-003-R14

MONITORING WELL NO. MW-19



Note: See Figure A-2 for explanation of symbols

Geo Engineers

LOG OF MONITORING WELL

FIGURE A-10

:MDW:CMS 4/2/92

1979-003-R14

BORING B-1

Depth (ft.)	Sheen	Vapor Conc. (ppm)	Other Tests	Blow-Count	Samples	Group Symbol	DESCRIPTION (Surface Elevation (ft.): 28.1)
0						GP	6 inches concrete
						SP	6 inches gray fine to coarse gravel (fill)
							Black fine to medium sand with a trace of silt (medium dense, moist) (fill)
	MS	2,000		14	■		
5	HS	> 10,000	CA	9	⊠		Grades to loose, wet with black fragments
						SP	Gray fine to medium sand with a trace of silt (medium dense, wet) (fill)
	SS	2,000		13	⊠		
10	SS	2,000		16	■		
	NS	160		3	■		Grades to very loose with occasional wood and shell fragments
						SP–SM	Gray fine to coarse sand with silt (loose, wet) (fill)
15	NS	800		5	■		
							Boring completed at 16.5 feet on 11/22/91
							Note: Headspace vapors measured using a Bacharach TLV Sniffer
20							
25							
30							
35							
40							

DEPTH IN FEET

Note: See Figure A-2 for explanation of symbols

Geo Engineers

Log of Boring

FIGURE A-11

:MDW:CMS 4/2/92

1979-003-R14

BORING B-2

Depth (ft.)	Sheen	Vapor Conc. (ppm)	Other Tests	Blow-Count	Samples	Group Symbol	DESCRIPTION (Surface Elevation (ft.): 29.5)
0						SP	3 inches asphalt concrete
						SP	Brown fine to coarse sand with a trace of silt (fill)
	SS	< 100	CA	14	■		Gray fine to medium sand with a trace of silt (medium dense, moist) (fill)
5	NS	400	CA	11	⊠		Grades to wet with occasional shell fragments
	NS	200		12	■		
10	NS	300		8	■		Grades to loose
	NS	400		5	■		
15	NS	< 100		3	⊠		Grades to very loose
							Boring completed at 16.5 feet on 11/22/91
20							Note: Headspace vapors measured using a Bacharach TLV Sniffer
25							
30							
35							
40							

DEPTH IN FEET

Note: See Figure A-2 for explanation of symbols

Geo Engineers

Log of Boring

FIGURE A-12

:MDW:CMS 4/2/92

1979-003-R14

BORING B-3

Sheen	Vapor Conc. (ppm)	Other Tests	Blow-Count	Samples	Group Symbol	DESCRIPTION
						Surface Elevation (ft.): 30.0
					GP	3 inches gray fine gravel (loose, moist) (crushed rock fill)
					SP	Gray fine to coarse sand with a trace of silt (loose, moist) (fill)
--	--		9	⊠		
					SP— SM	Black gravelly fine to coarse sand with silt and occasional wire, plastic bags, plastic, spark plugs, shell fragments, metal fragments, string, wood, nylon bags? (loose, wet) (landfill debris)
SS	4,000	CA	5	⊠		
						Boring completed at 6.5 feet on 11/21/91

Note: Headspace vapors measured using a Bacharach TLV Sniffer

DEPTH IN FEET

0 5 10 15 20 25 30 35 40

Note: See Figure A-2 for explanation of symbols

Geo Engineers

Log of Boring

FIGURE A-13

MDW:CMS 4/2/92

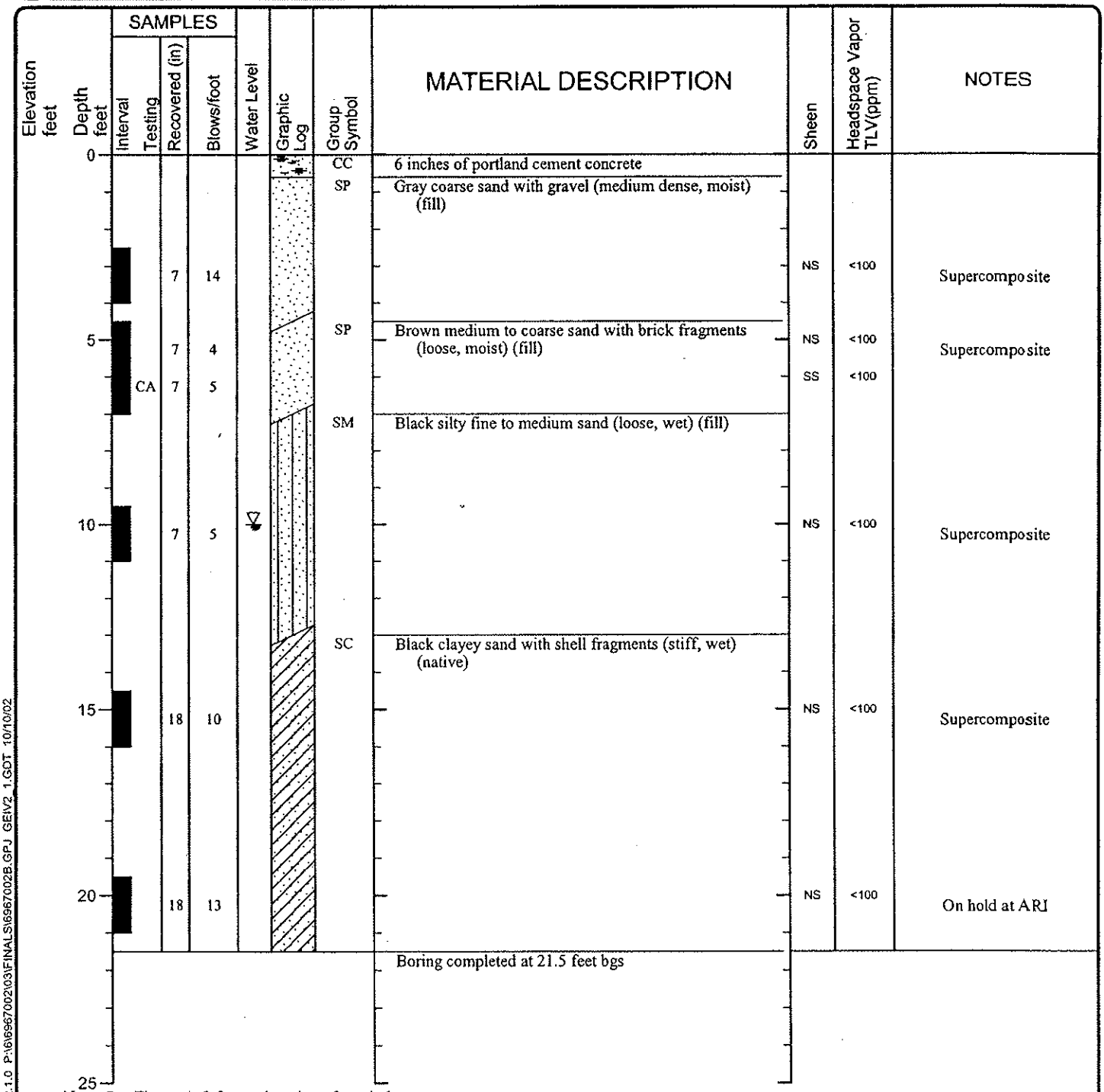
1979-003-R14

LOG OF HAND BORING

DEPTH BELOW GROUND SURFACE (INCHES)	SOIL GROUP CLASSIFICATION SYMBOL	DESCRIPTION
		HAND BORING C-1
0.0 - 5.5		Concrete
5.5 - 9.5	SP-SM	Brown fine to coarse sand with silt (loose, moist) (fill)
9.5 - 12.5		Concrete
12.5 - 15.5	SP	Dark brown fine to coarse sand with a trace of silt and occasional brick fragments (loose, moist)
		Hand boring completed at 15.5 inches on 11/22/91
		No ground water seepage observed
		Disturbed soil samples obtained at 8.0 and 15.0 inches
		HAND BORING C-2
0.0 - 3.5		Concrete
3.5 - 5.5	SP	Brown medium to coarse sand with a trace of silt (loose, moist) (crushed rock fill)
5.5 - 9.5		Concrete
9.5 - 17.0	SP	Dark brown fine to coarse sand with a trace of silt (medium dense, moist) (fill)
		Grades to light brown at 15.5 inches
		Hand boring completed at 17.0 inches on 11/22/91
		No ground water seepage observed
		Disturbed soil samples obtained at 5.0, 10.5 and 17.0 inches

THE DEPTHS ON THE HAND BORING LOGS, ALTHOUGH SHOWN TO 0.1 INCH, ARE BASED ON AN AVERAGE OF MEASUREMENTS ACROSS THE HAND BORING AND SHOULD BE CONSIDERED ACCURATE TO 0.5 INCH.

Date(s) Drilled	06/05/02	Logged By	RMB	Checked By	LJB
Drilling Contractor		Drilling Method	4.5 inch-ID HSA	Sampling Methods	Heavy-duty split-barrel sampler
Auger Data		Hammer Data	300 (lb) hammer/ 30 (in) drop	Drilling Equipment	Truck-mounted Mobile B-59
Total Depth (ft)	21.5	Surface Elevation (ft)	13 (feet MLLW)	Ground Water Level (ft. bgs)	10
Datum/ System					



Note: See Figure A-2 for explanation of symbols

LOG OF BORING CW02-1

GeoEngineers

Project: BCI Property
Project Location: Bellingham, Washington
Project Number: 6967-002-03

Figure: A-3
Sheet 1 of 1

E-6-H-00452

Date(s) Drilled	06/05/02	Logged By	RMB	Checked By	LJB
Drilling Contractor		Drilling Method	4.5 inch-ID HSA	Sampling Methods	Heavy-duty split-barrel sampler
Auger Data		Hammer Data	300 (lb) hammer/ 30 (in) drop	Drilling Equipment	Truck-mounted Mobile B-59
Total Depth (ft)	21	Surface Elevation (ft)	13 (feet MLLW)	Ground Water Level (ft. bgs)	10
Datum/ System					

Elevation feet / Depth feet	SAMPLES: Interval Testing	Recovered (in)	Blows/foot	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor TLV(ppm)	NOTES
0						CC	10 inches of portland cement concrete			
						CC	Concrete rubble with interstitial coarse sand (dense, dry) (fill)			
		7	65					SS	–	Supercomposite
5		7	8			SM	Black silty medium to coarse sand (loose, moist) (fill)			Supercomposite
	CA	7	2					MS	1,000	
10		18	5	▽		SP	Black medium sand with coal fragments (loose, wet) (fill)	SS	1,500	Supercomposite
15		18	9			SP	Black medium to coarse sand with occasional gravel (loose, wet) (native)	NS	150	Supercomposite
20		18	19			SM	Black silty sand with shell fragments (medium dense, wet)	NS	<100	On hold at ARI
25							Boring completed at 21 feet bgs			

Note: See Figure A-2 for explanation of symbols

6967-002-03 GEI ENVBORING 2.1.0 P:\6\6967002\03\FINALS\6967002B.GPJ GEIV2_1.GDT 10/10/02

LOG OF BORING CW02-2

Geo Engineers

Project: BCI Property
Project Location: Bellingham, Washington
Project Number: 6967-002-03

Figure: A-4
Sheet 1 of 1

E-6-H-00453

Date(s) Drilled	06/05/02	Logged By	RMB	Checked By	LJB
Drilling Contractor		Drilling Method	4.5 inch-ID HSA	Sampling Methods	Heavy-duty split-barrel sampler
Auger Data		Hammer Data	300 (lb) hammer/ 30 (in) drop	Drilling Equipment	Truck-mounted Mobile B-59
Total Depth (ft)	21	Surface Elevation (ft)	13 (feet MLLW)	Ground Water Level (ft. bgs)	10
Datum/ System					

Elevation feet / Depth feet	SAMPLES: Interval Testing	Recovered (in)	Blows/foot	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	Headspace Vapor TLV(ppm)	NOTES
0						CC	6.5 inches of portland cement concrete			
						CC	Concrete rubble with interstitial coarse sand and silt			
		7	5					SS	<100	Supercomposite
5		7	3			WD	No recovery because of wood in sampler			
	CA	7	21			SC	Brown clayey sand with coal fragments (very stiff, moist) (fill)	NS	<100	Supercomposite
						SP	Black sand with coal fragments (loose, wet) (fill)			
10		18	6	▽				NS	<100	Supercomposite
						SP-SM	Gray medium to coarse sand with silt (loose, wet) (native)			
15		18	8					NS	<100	Supercomposite
						SP	Gray medium sand (medium dense, wet)			
20		18	21					NS	<100	On hold at ARI
							Boring completed at 21 feet bgs			
25										

Note: See Figure A-2 for explanation of symbols

6967-002-03 GEI ENVBORING 2.1.0 P:\6\6967002\03\FINAL\S6967002B.GPJ GEIV2_1.GDT 10/10/02

LOG OF BORING CW02-3

Geo Engineers

Project: BCI Property
Project Location: Bellingham, Washington
Project Number: 6967-002-03

Figure: A-5
Sheet 1 of 1

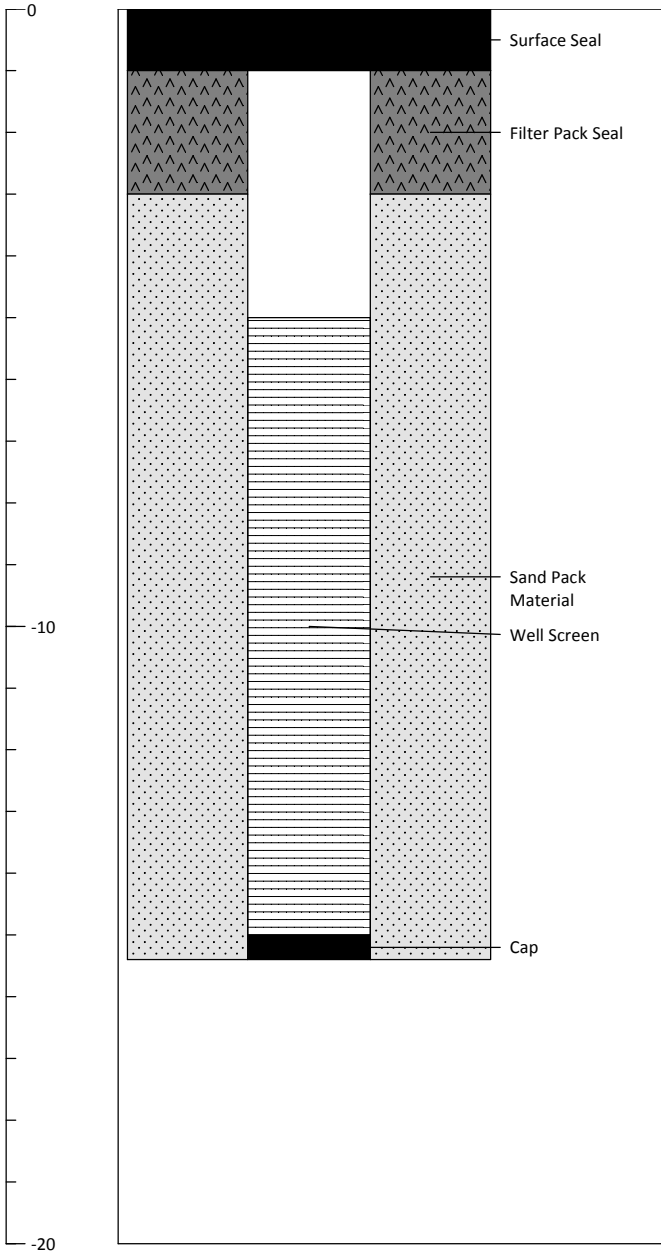
E-6-H-00454

Well Construction Details

CWF-CW-1

Project: **Central Waterfront RI/FS**	Location: **Central Waterfront, Bellingham WA**	Total Depth of Boring (ft): **15 ft bgs**
Project #: **120007-01.01**	Program: **2016 Compliance Monitoring**	Screened Interval: **5.0-15.0 ft bgs**
Client: **Port of Bellingham**	Northing/LAT: **642881.17** Easting/LONG: **1241004.44**	Well Type: **Flush Mount**
Installation Date: **7/12/2016**	Horiz. Datum: **NAD 1983 State Plane Washington North (US ft)**	Logged By: **JA**
Contractor: **Cascade Drilling, LP**	Drilling Equipment: **Hollow Stem Auger**	Drilling Method: **Hollow Stem Auger**

Feet below Ground surface	Well Construction	Notes



0.0-1.0 ft bgs: suface seal of eight-inch Morris-steel shroud flush-mount road box in concrete

0.7-5.0 ft bgs: two-inch diameter, schedule 40 PVC well casing

1.0-3.0 ft bgs: two-foot bentonite chips as filter pack seal

3.0-15.4 ft bgs: 12.4 feet 10/20 silica sand as sand pack seal

5.0-15.0 ft bgs: two-inch diameter PVC with 0.010-inch slot well screen, ten-feet long with #00 filter sand prepack

15.0-15.4 ft bgs: two-inch diameter, 0.4-inch long schedule 40 PVC flush-thread end cap

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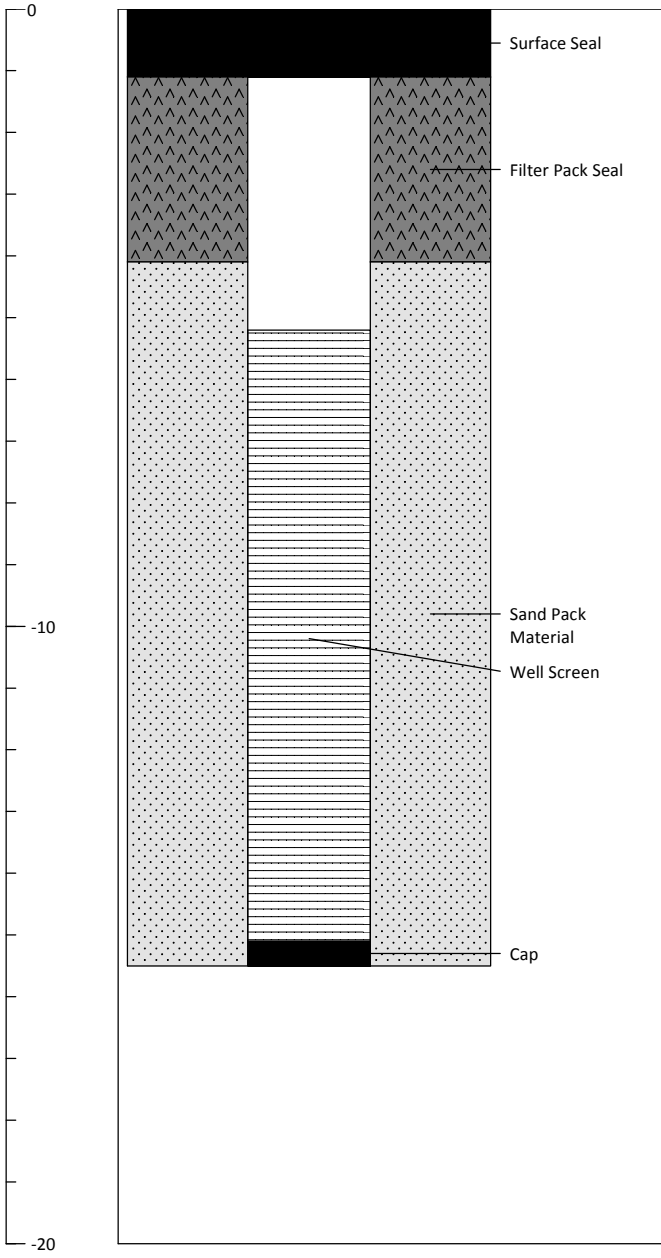
Notes: bgs = below ground surface
ft = feet

Well Construction Details

CWF-CW-2

Project: **Central Waterfront RI/FS**	Location: **Central Waterfront, Bellingham WA**	Total Depth of Boring (ft): **15.2 ft bgs**
Project #: **120007-01.01**	Program: **2016 Compliance Monitoring**	Screened Interval: **5.2-15.2 ft bgs**
Client: **Port of Bellingham**	Northing/LAT: **643335.27** Easting/LONG: **1241518.39**	Well Type: **Flush Mount**
Installation Date: **7/12/2016**	Horiz. Datum: **NAD 1983 State Plane Washington North (US ft)**	Logged By: **JA**
Contractor: **Cascade Drilling, LP**	Drilling Equipment: **Hollow Stem Auger**	Drilling Method: **Hollow Stem Auger**

Feet below Ground surface	Well Construction	Notes



0.0-1.1 ft bgs: suface seal of eight-inch Morris-steel shroud flush-mount road box in concrete

0.8-5.2 ft bgs: two-inch diameter, schedule 40 PVC well casing

1.1-4.1 ft bgs: two-foot bentonite chips as filter pack seal

4.1-15.5 ft bgs: 12.4 feet 10/20 silica sand as sand pack seal

5.2-15.2 ft bgs: two-inch diameter PVC with 0.010-inch slot well screen, ten-feet long with #00 filter sand prepack

15.1-15.5 ft bgs: two-inch diameter, 0.4-inch long schedule 40 PVC flush-thread end cap

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Notes: bgs = below ground surface
ft = feet

APPENDIX E
DATA SCREENING SUPPORTING INFORMATION

Appendix E
Figure List - Central Waterfront Data Screen

Figure No.	Figure Title
1a	Historical and RI Soil Sampling Locations - Saturated Zone
1b	Historical and RI Soil Sampling Locations - Unsaturated Zone
2	Historical and RI Groundwater Monitoring Well Locations
3a	Soil Results - Gasoline Range Hydrocarbons
3b	Groundwater Results - Gasoline Range Hydrocarbons
4a	Soil Results - Benzene
4b	Groundwater Results - Benzene
4c	Soil Results - Benzene (Non-Detect Reporting Limits Above Screening Level)
4d	Groundwater Results - Benzene (Non-Detect Reporting Limits Above Screening Level)
5a	Soil Results - Diesel Range Hydrocarbons Silica Gel Cleanup Analysis
5b	Groundwater Results - Diesel Range Hydrocarbons Silica Gel Cleanup Analysis
5c	Soil Results - Diesel Range Hydrocarbons
5d	Groundwater Results - Diesel Range Hydrocarbons
6a	Soil Results - Motor Oil Range Hydrocarbons Silica Gel Cleanup Analysis
6b	Groundwater Results - Motor Oil Range Hydrocarbons Silica Gel Cleanup Analysis
6c	Soil Results - Motor Oil Range Hydrocarbons
6d	Groundwater Results - Motor Oil Range Hydrocarbons
6e	Groundwater Results - Motor Oil Range Hydrocarbons (Non-Detect Reporting Limits Above Screening Level)
7a	Soil Results - Total cPAHs
7b	Groundwater Results - Total cPAHs
7c	Soil Results - Total cPAHs (Non-Detect Reporting Limits Above Screening Level)
7d	Groundwater Results - Total cPAHs (Non-Detect Reporting Limits Above Screening Level)
8a	Soil Results - Naphthalene
8b	Groundwater Results - Naphthalene
8c	Soil Results - Naphthalene (Non-Detect Reporting Limits Above Screening Level)
9a	Soil Results - Arsenic
9b	Groundwater Results - Arsenic
9c	Soil Results - Arsenic (Non-Detect Reporting Limits Above Screening Level)
9d	Groundwater Results - Arsenic (Non-Detect Reporting Limits Above Screening Level)
9e	Groundwater Results - Dissolved Arsenic
9f	Groundwater Results - Dissolved Arsenic (Non-Detect Reporting Limits Above Screening Level)
10a	Soil Results - Cadmium
10b	Groundwater Results - Cadmium
10c	Groundwater Results - Cadmium (Non-Detect Reporting Limits Above Screening Level)
11a	Soil Results - Chromium
11b	Groundwater Results - Chromium
11c	Groundwater Results - Dissolved Chromium
12a	Soil Results - Copper
12b	Groundwater Results - Copper
12c	Groundwater Results - Dissolved Copper
13a	Soil Results - Lead
13b	Groundwater Results - Lead
13c	Groundwater Results - Lead (Non-Detect Reporting Limits Above Screening Level)
13d	Groundwater Results - Dissolved Lead (Non-Detect Reporting Limits Above Screening Level)
14a	Soil Results - Mercury
14b	Groundwater Results - Mercury
14c	Soil Results - Mercury (Non-Detect Reporting Limits Above Screening Level)
14d	Groundwater Results - Mercury (Non-Detect Reporting Limits Above Screening Level)
14e	Groundwater Results - Dissolved Mercury (Non-Detect Reporting Limits Above Screening Level)
15a	Soil Results - Nickel
15b	Groundwater Results - Nickel
15c	Groundwater Results - Nickel (Non-Detect Reporting Limits Above Screening Level)
15d	Groundwater Results - Dissolved Nickel
15e	Groundwater Results - Dissolved Nickel (Non-Detect Reporting Limits Above Screening Level)
16a	Soil Results - Zinc
16b	Groundwater Results - Zinc
16c	Groundwater Results - Dissolved Zinc
17a	Vapor Results - Methane Gas
17b	Vapor Results - Soil Gas
18	Sediment Quality Adjacent to Central Waterfront Site

Note: The figures in Appendix E present previous "subareas" based on historical Site use and reference to historical data collection investigations. Central Waterfront CSM Subareas are shown in figures in Section 5 and 6 of the RI report.

Central Waterfront Site Boundary

Site Subareas

- Chevron Subarea
- Colony Wharf Subarea
- Olivine Upland Subarea
- Roeder Avenue Landfill Refuse Boundary

Historical Soil Sample Location

- Soil Boring
- Test Pit
- RI Soil Boring
- 2012 Soil Sample Location

Key to Previous Investigations
(B) Bellingham Marine Industries
(C) Chevron
(O) Olivine

Project North / True North

Feet
0 100 200 300 400

NOTES:
1. Saturated zone is defined as 5 or greater feet below the ground surface.
2. Aerial photo by ESRI.

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Figure 1a
Historical and RI Soil Sampling Locations – Saturated Zone
Central Waterfront RI/FS
Bellingham, WA

Central Waterfront Site Boundary

Site Subareas

- Chevron Subarea
- Colony Wharf Subarea
- Olivine Upland Subarea
- Roeder Avenue Landfill Refuse Boundary

Historical Soil Sample Location

- Soil Boring
- Test Pit
- RI Soil Boring or Surface Soil
- 2012 Soil Sample Location

Key to Previous Investigations
(B) Bellingham Marine Industries
(C) Chevron
(O) Olivine

Project North / True North

Feet
0 100 200 300 400

NOTES:
1. Unsaturated zone is defined as 0-5 feet below the ground surface.
2. Aerial photo by ESRI.

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Figure 1b
Historical and RI Soil Sampling Locations – Unsaturated Zone
Central Waterfront RI/FS
Bellingham, WA

Central Waterfront Site Boundary

Site Subareas

- Chevron Subarea
- Colony Wharf Subarea
- Olivine Upland Subarea
- Roeder Avenue Landfill Refuse Boundary

Monitoring Well Status (RI Survey)

- Well-Active
- Well-Condition Unknown, Surface Obstruction Blocks Access
- Well-Decommissioned
- Well-Missing and Likely Destroyed

Key to Previous Investigations
(B) Bellingham Marine Industries
(E) Ecology
(C) Chevron
(O) Olivine
(W) Roeder Avenue Warehouse Feasibility Analysis and Pre-Design Testing

Project North / True North

Feet
0 100 200 300 400

NOTES:
1. Aerial photo by ESRI.

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Figure 2
Historical and RI Groundwater Monitoring Well Locations
Central Waterfront RI/FS
Bellingham, WA

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Central Waterfront Site Boundary

Site Subareas

- Chevron Subarea
- Colony Wharf Subarea
- Olivine Upland Subarea
- Roeder Avenue Landfill Refuse Boundary

Gasoline Range Hydrocarbons (mg/kg)

- < 30
- 30 - 100
- 100 - 1,000
- > 1,000

Key to Previous Investigations
(B) Bellingham Marine Industries
(C) Chevron
(O) Olivine

Project North / True North

Feet
0 100 200 300 400

NOTES:
1. 30 mg/kg = MTCA Method A Unrestricted soil cleanup level (saturated, direct contact, when benzene is not present) [WAC 173-340-740].
2. For stations with multiple samples, the highest concentration is used.
3. Aerial photo by ESRI.

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ANCHOR QEA

Figure 3a
Soil Results – Gasoline Range Hydrocarbons
Central Waterfront RI/FS
Bellingham, WA

Central Waterfront Site Boundary

Site Subareas

- Chevron Subarea
- Colony Wharf Subarea
- Olivine Upland Subarea
- Roeder Avenue Landfill Refuse Boundary

Gasoline Range Hydrocarbons (µg/L)

- < 800
- 800 - 1,600
- 1,600 - 4,000
- > 4,000

- Groundwater Well Sample Location
- Porewater Sample Location
- Seep Sample Location

Key to Previous Investigations
(B) Bellingham Marine Industries
(E) Ecology
(C) Chevron
(O) Olivine
(W) Roeder Avenue Warehouse Feasibility Analysis and Pre-Design Testing

Project North / True North

Feet
0 100 200 300 400

NOTES:
1. 800 µg/L = MTCA Method A groundwater cleanup level (benzene present in groundwater) [WAC 173-340-720].
2. Results shown include the maximum concentration detected from 2002 - current.
3. Aerial photo by ESRI.

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ANCHOR QEA

Figure 3b
Groundwater Results – Gasoline Range Hydrocarbons
Central Waterfront RI/FS
Bellingham, WA

Central Waterfront Site Boundary

Site Subareas

- Chevron Subarea
- Colony Wharf Subarea
- Olivine Upland Subarea
- Roeder Avenue Landfill Refuse Boundary

Benzene (mg/kg)

- < 0.005
- 0.005 - 0.01
- 0.01 - 0.025
- > 0.025

Key to Previous Investigations
(B) Bellingham Marine Industries
(C) Chevron
(O) Olivine

Project North

True North

Feet
0 100 200 300 400

NOTES:
1. 0.005 mg/kg = MTCA Method A Unrestricted soil cleanup level (saturated, direct contact) [WAC 173-340-740].
2. For stations with multiple samples, the highest concentration is used.
3. Aerial photo by ESRI.

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Figure 4a
Soil Results – Benzene
Central Waterfront RI/FS
Bellingham, WA

Central Waterfront Site Boundary

Site Subareas

- Chevron Subarea
- Colony Wharf Subarea
- Olivine Upland Subarea
- Roeder Avenue Landfill Refuse Boundary

Benzene (µg/L)

- < 2.4
- 2.4 - 4.8
- 4.8 - 12
- > 12

- Groundwater Well Sample Location
- Porewater Sample Location
- Seep Sample Location

Key to Previous Investigations
(B) Bellingham Marine Industries
(E) Ecology
(C) Chevron
(O) Olivine
(W) Roeder Avenue Warehouse Feasibility Analysis and Pre-Design Testing

Project North / True North

Feet
0 100 200 300 400

NOTES:
1. 2.4 µg/L = MTCA Method B groundwater cleanup level (unrestricted land use, vapor intrusion) [Table B-1; Ecology, 2009].
2. Results shown include the maximum concentration detected from 2002 - current.
3. Aerial photo by ESRI.

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Figure 4b
Groundwater Results – Benzene
Central Waterfront RI/FS
Bellingham, WA

NOTES:
1. 0.005 mg/kg = MTCA Method A Unrestricted soil cleanup level (saturated, direct contact) [WAC 173-340-740].
2. Only Non-detects above 0.005 mg/kg are shown.
3. For stations with multiple samples, the highest reporting limit is shown.
4. Aerial photo by ESRI.

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Figure 4c
Soil Results – Benzene
Non-detects Above the Screening Level
Central Waterfront RI/FS
Bellingham, WA

I & J Waterway

Former ASB

Roeder Ave

MW-66(C)

MW-52(C)

MW-73(C)

Whatcom Waterway

Central Waterfront Site Boundary

Site Subareas

- Chevron Subarea
- Colony Wharf Subarea
- Olivine Upland Subarea
- Roeder Avenue Landfill Refuse Boundary

Benzene (µg/L)

- < 2.4
- 2.4 - 4.8
- 4.8 - 12
- > 12

NOTES:
1. 2.4 µg/L = MTCA Method B groundwater cleanup level (unrestricted land use, vapor intrusion) [Table B-1; Ecology, 2009].
2. Only Non-detects above 2.4 µg/L are shown.
3. Results shown include the maximum reporting limit from 2002 - current.
4. Aerial photo by ESRI.

Key to Previous Investigations
(B) Bellingham Marine Industries
(E) Ecology
(C) Chevron
(O) Olivine
(W) Roeder Avenue Warehouse Feasibility Analysis and Pre-Design Testing

Project North / True North

Feet
0 100 200 300 400

\\orcas\gis\Jobs\120007-01.01_Central_Waterfront_RIFS\Maps\Data_Screen\CWF_DataScreen_NDAboveSL_Mapbook.mxd ckiblinger 9/6/2017 4:21:47 PM

ANCHOR QEA

Figure 4d
Groundwater Results – Benzene
Non-detects Above the Screening Level
Central Waterfront RI/FS
Bellingham, WA

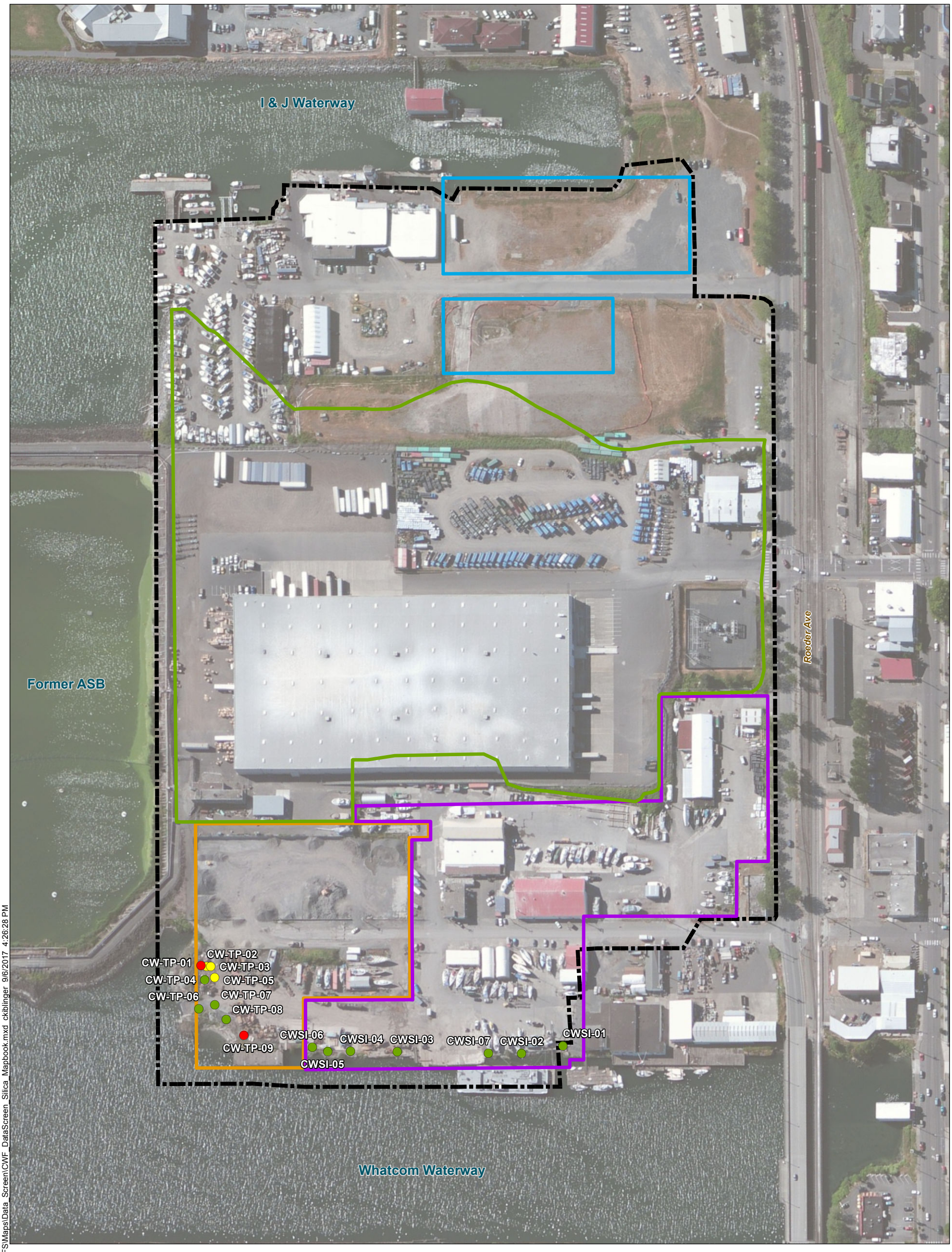

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Figure 5a
Soil Results - Diesel Range Hydrocarbons Silica Gel Cleanup Analysis
Silica Gel Cleanup Analysis
Central Waterfront RI/FS
Bellingham, WA

ANCHOR QEA

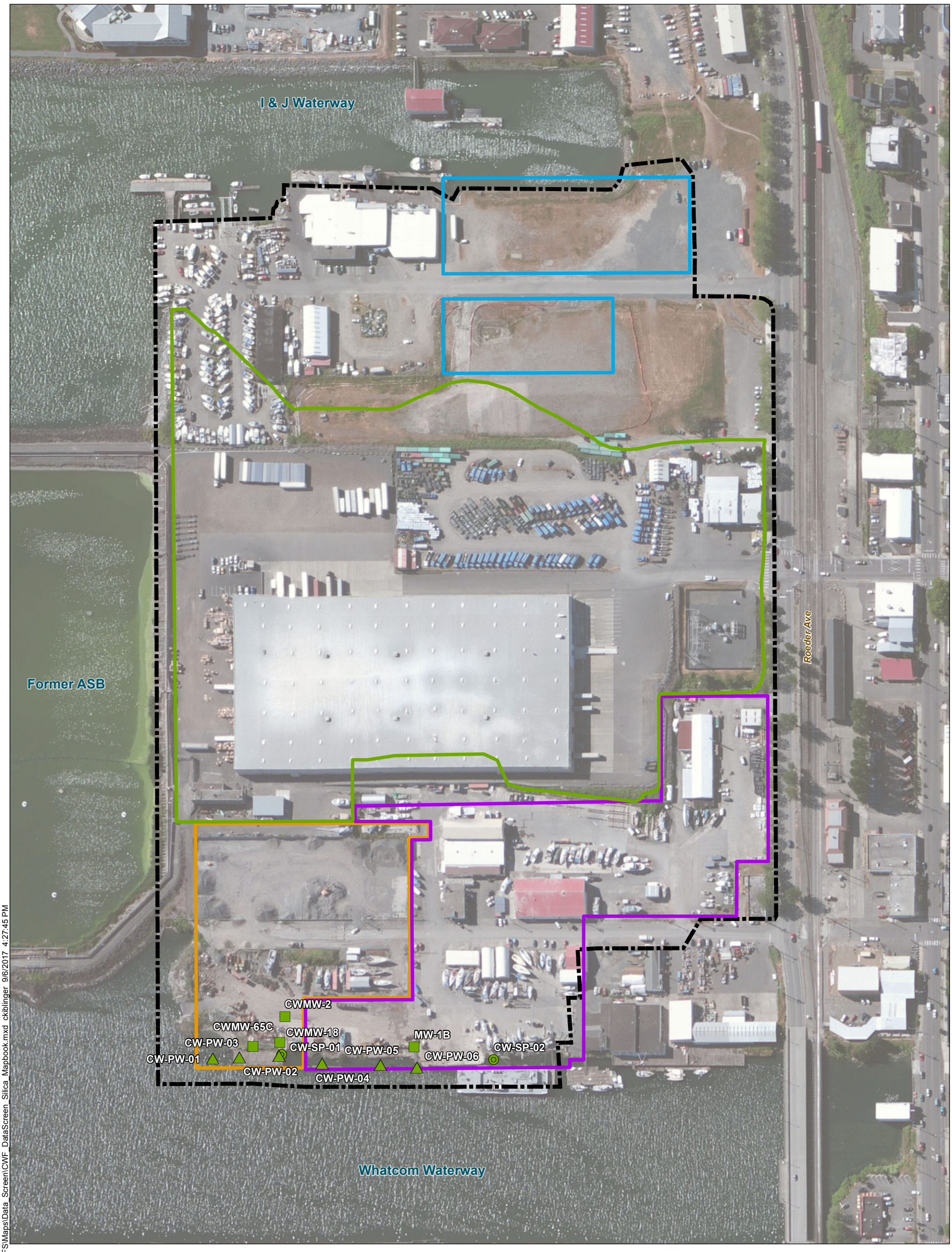

Figure 5b

Groundwater Results - Diesel Range Hydrocarbons Silica Gel Cleanup Analysis
Silica Gel Cleanup Analysis
Central Waterfront RI/FS
Bellingham, WA

ANCHOR QEA

Central Waterfront Site Boundary

Site Subareas

- Chevron Subarea
- Colony Wharf Subarea
- Olivine Upland Subarea
- Roeder Avenue Landfill Refuse Boundary

Diesel Range Hydrocarbons (mg/kg)

Without Silica Gel Cleanup

- < 2,000
- 2,000 - 4,000
- 4,000 - 10,000
- > 10,000

Key to Previous Investigations
(B) Bellingham Marine Industries
(C) Chevron
(O) Olivine

Project North / True North

Feet
0 100 200 300 400

NOTES:
1. 2,000 mg/kg = MTCA Method A Unrestricted soil cleanup level (saturated, direct contact) [WAC 173-340-740].
2. NWTPH-Dx Results without silica gel cleanup.
3. For stations with multiple samples, the highest concentration is used.
4. Aerial photo by ESRI.

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ANCHOR QEA

Figure 5c
Soil Results – Diesel Range Hydrocarbons
Central Waterfront RI/FS
Bellingham, WA

Central Waterfront Site Boundary

Site Subareas

- Chevron Subarea
- Colony Wharf Subarea
- Olivine Upland Subarea
- Roeder Avenue Landfill Refuse Boundary

Diesel Range Hydrocarbons (µg/L)

Without Silica Gel Cleanup

- < 500
- 500 - 1,000
- 1,000 - 2,500
- > 2,500

- Groundwater Well Sample Location
- Porewater Sample Location
- Seep Sample Location

Key to Previous Investigations
(B) Bellingham Marine Industries
(E) Ecology
(C) Chevron
(O) Olivine
(W) Roeder Avenue Warehouse Feasibility Analysis and Pre-Design Testing

Project North / True North

Feet
0 100 200 300 400

NOTES:
1. 500 µg/L = MTCA Method A groundwater cleanup level [WAC 173-340-720].
2. NWTPH-Dx Results without silica gel cleanup.
3. Results shown include the maximum concentration detected from 2002 - current.
4. Aerial photo by ESRI.

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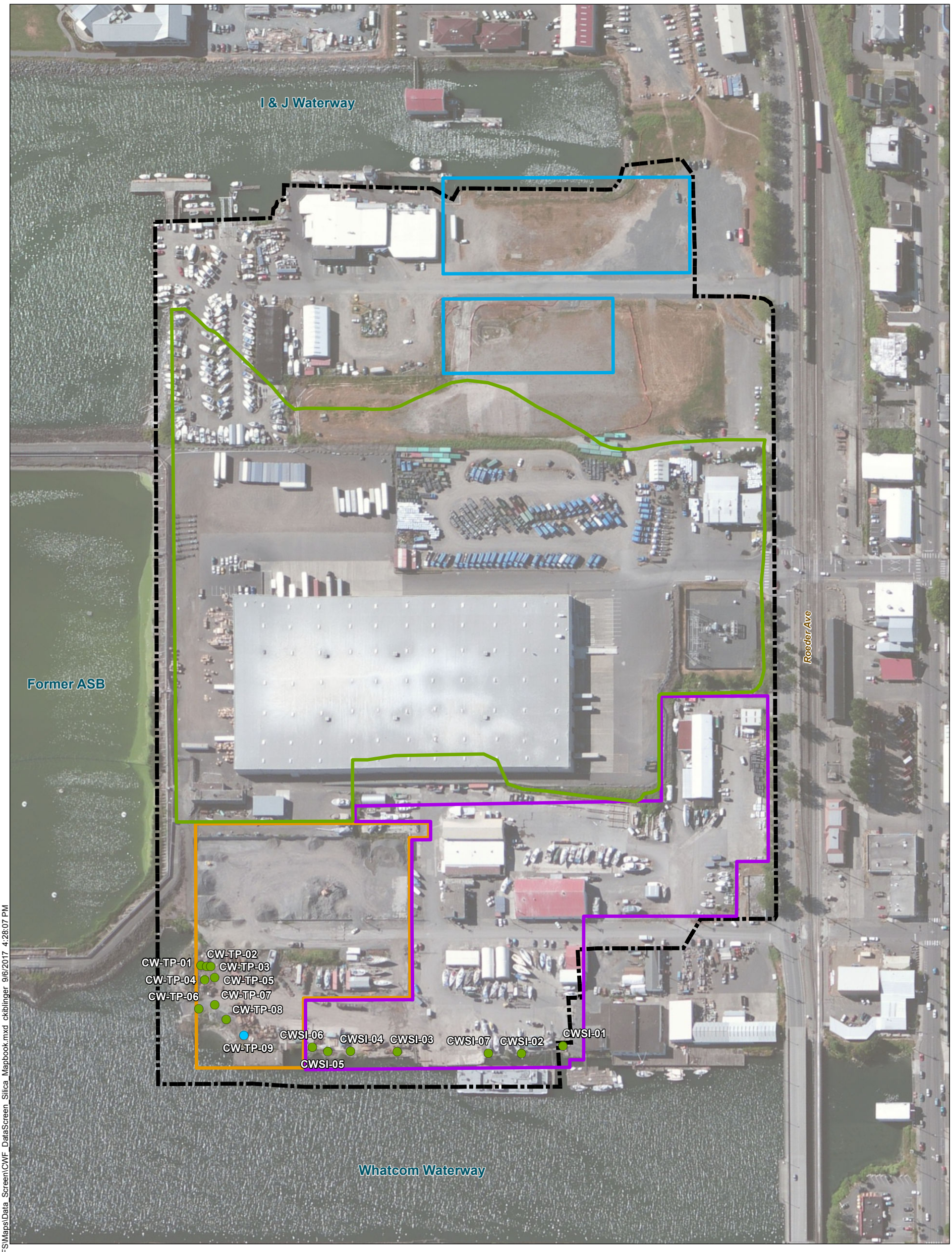
ANCHOR QEA

Figure 5d
Groundwater Results – Diesel Range Hydrocarbons
Central Waterfront RI/FS
Bellingham, WA



NOTES:
1. 2,000 mg/kg = MTCA Method A Unrestricted soil cleanup level (saturated, direct contact) [WAC 173-340-740].
2. NWTPH-Dx Results with silica gel cleanup.
3. For stations with multiple samples, the highest concentration is used.
4. Aerial photo by ESRI.

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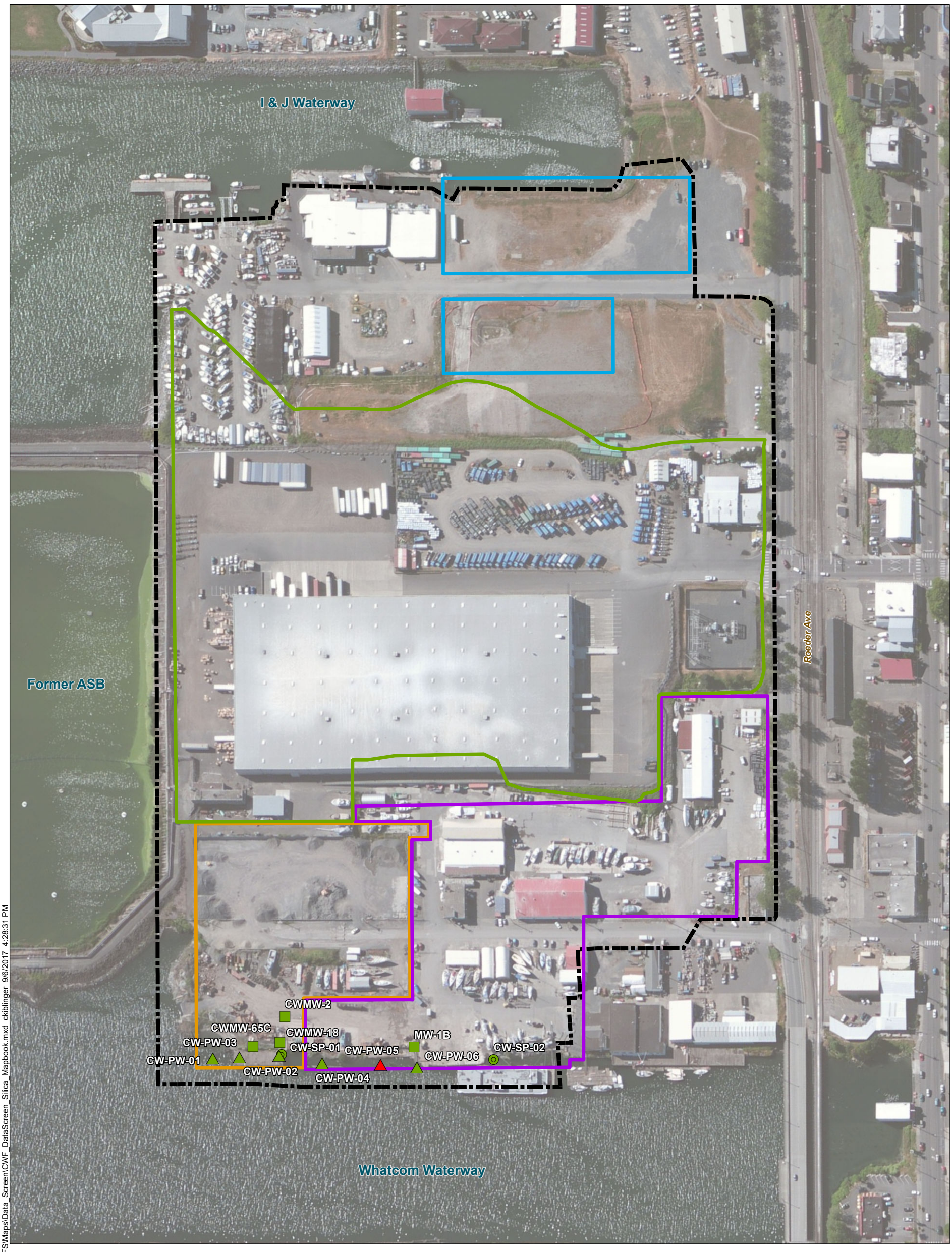
Figure 6a
Soil Results – Motor Oil Range Hydrocarbons
Silica Gel Cleanup Analysis
Central Waterfront RI/FS
Bellingham, WA

ANCHOR QEA



Central Waterfront Site Boundary

Site Subareas

- Chevron Subarea
- Colony Wharf Subarea
- Olivine Upland Subarea
- Roeder Avenue Landfill Refuse Boundary

Motor Oil Range Hydrocarbons (µg/L)

With Silica Gel Cleanup

- < 500
- 500 - 1,000
- 1,000 - 2,500
- > 2,500

- Groundwater Well Sample Location
- Porewater Sample Location
- Seep Sample Location

Key to Previous Investigations
(B) Bellingham Marine Industries
(C) Chevron

Project North / True North

Feet
0 100 200 300 400

NOTES:
1. 500 µg/L = MTCA Method A groundwater cleanup level [WAC 173-340-720].
2. NWTPH-Dx results with silica gel cleanup.
3. Results shown include the maximum concentration detected from 2002 - current.
4. Aerial photo by ESRI.

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Figure 6b
Groundwater Results – Motor Oil Range Hydrocarbons
Silica Gel Cleanup Analysis
Central Waterfront RI/FS
Bellingham, WA

ANCHOR QEA

Central Waterfront Site Boundary

Site Subareas

- Chevron Subarea
- Colony Wharf Subarea
- Olivine Upland Subarea
- Roeder Avenue Landfill Refuse Boundary

Motor Oil Range Hydrocarbons (mg/kg)

Without Silica Gel Cleanup

- < 2,000
- 2,000 - 4,000
- 4,000 - 10,000
- > 10,000

Key to Previous Investigations
(B) Bellingham Marine Industries
(C) Chevron
(O) Olivine

Project North / True North

Feet
0 100 200 300 400

NOTES:
1. 2,000 mg/kg = MTCA Method A Unrestricted soil cleanup level (saturated, direct contact) [WAC 173-340-740].
2. NWTPH-Dx Results without silica gel cleanup.
3. For stations with multiple samples, the highest concentration is used.
4. Aerial photo by ESRI.

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Figure 6c
Soil Results – Motor Oil Range Hydrocarbons
Central Waterfront RI/FS
Bellingham, WA

NOTES:
1. 500 µg/L = MTCA Method A groundwater cleanup level [WAC 173-340-720].
2. NWTPH-Dx Results without silica gel cleanup.
3. Results shown include the maximum concentration detected from 2002 - current.
4. Aerial photo by ESRI.

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Figure 6d
Groundwater Results – Motor Oil Range Hydrocarbons
Central Waterfront RI/FS
Bellingham, WA

Central Waterfront Site Boundary

Site Subareas

- Chevron Subarea
- Colony Wharf Subarea
- Olivine Upland Subarea
- Roeder Avenue Landfill Refuse Boundary

Motor Oil Range Hydrocarbons (µg/L)

Without Silica Gel Cleanup

- < 500
- 500 - 1,000
- 1,000 - 2,500
- > 2,500

Seep Sample Location

Key to Previous Investigations
(B) Bellingham Marine Industries
(E) Ecology
(C) Chevron
(O) Olivine
(W) Roeder Avenue Warehouse Feasibility Analysis and Pre-Design Testing

Project North / True North

Feet
0 100 200 300 400

NOTES:
1. 500 µg/L = MTCA Method A groundwater cleanup level [WAC 173-340-720].
2. Only Non-detects above 500 µg/L are shown.
3. NWTPH-Dx Results without silica gel cleanup.
4. Results shown include the maximum reporting limit from 2002 - current.
5. Aerial photo by ESRI.

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Figure 6e
Groundwater Results – Motor Oil Range Hydrocarbons
Non-detects Above the Screening Level
Central Waterfront RI/FS
Bellingham, WA

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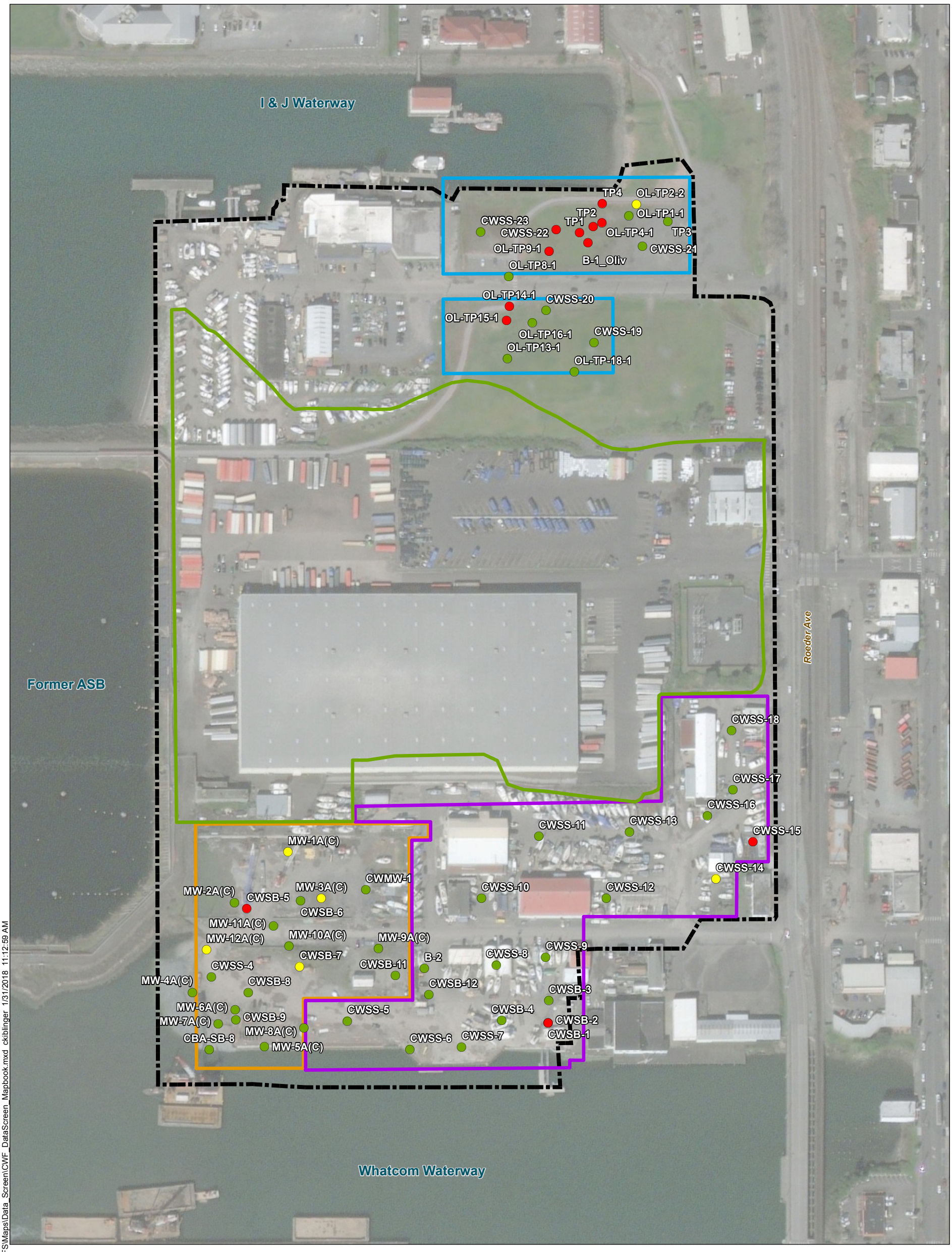

Central Waterfront Site Boundary

Site Subareas

- Chevron Subarea
- Colony Wharf Subarea
- Olivine Upland Subarea
- Roeder Avenue Landfill Refuse Boundary

Total cPAHs (TEQ) (mg/kg)

- < 0.086
- 0.086 - 0.14
- > 0.14

NOTES:
1. 0.086 mg/kg = Regional Background (Ecology, 2014)
2. 0.14 mg/kg = MTCA Method B Unrestricted soil cleanup level (saturated, direct contact) [WAC 173-340-740].
3. For stations with multiple samples, the highest concentration is used.
4. Aerial photo by ESRI.

Key to Previous Investigations
(B) Bellingham Marine Industries
(C) Chevron
(O) Olivine

Project North / True North

Feet
0 100 200 300 400

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Figure 7a
Soil Results – Total cPAHs
Central Waterfront RI/FS
Bellingham, WA

NOTES:
1. 0.02 µg/L = Applicable Practical Quantitation Level (PQL) for RI Analyses.
2. Results shown include the maximum concentration detected from 2002 - current.
3. Aerial photo by ESRI.

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Figure 7b
Groundwater Results – Total cPAHs
Central Waterfront RI/FS
Bellingham, WA

Central Waterfront Site Boundary

Site Subareas

- Chevron Subarea
- Colony Wharf Subarea
- Olivine Upland Subarea
- Roeder Avenue Landfill Refuse Boundary

Total cPAHs (TEQ) (mg/kg)

- < 0.14
- 0.14 - 0.28
- 0.28 - 0.7
- > 0.7

Key to Previous Investigations
(B) Bellingham Marine Industries
(C) Chevron
(O) Olivine

Project North / True North

Feet
0 100 200 300 400

NOTES:
1. 0.14 mg/kg = MTCA Method B Unrestricted soil cleanup level (saturated, direct contact) [WAC 173-340-740].
2. Only Non-detects above 0.14 mg/kg are shown.
3. For stations with multiple samples, the highest reporting limit is shown.
4. Aerial photo by ESRI.

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ANCHOR QEA

Figure 7c
Soil Results – Total cPAHs
Non-detects Above the Screening Level
Central Waterfront RI/FS
Bellingham, WA

NOTES:
1. 0.02 µg/L = Applicable Practical Quantitation Level (PQL) for RI Analyses.
2. Only Non-detects above 0.02 µg/L are shown.
3. Results shown include the maximum reporting limit from 2002 - current.
4. Aerial photo by ESRI.

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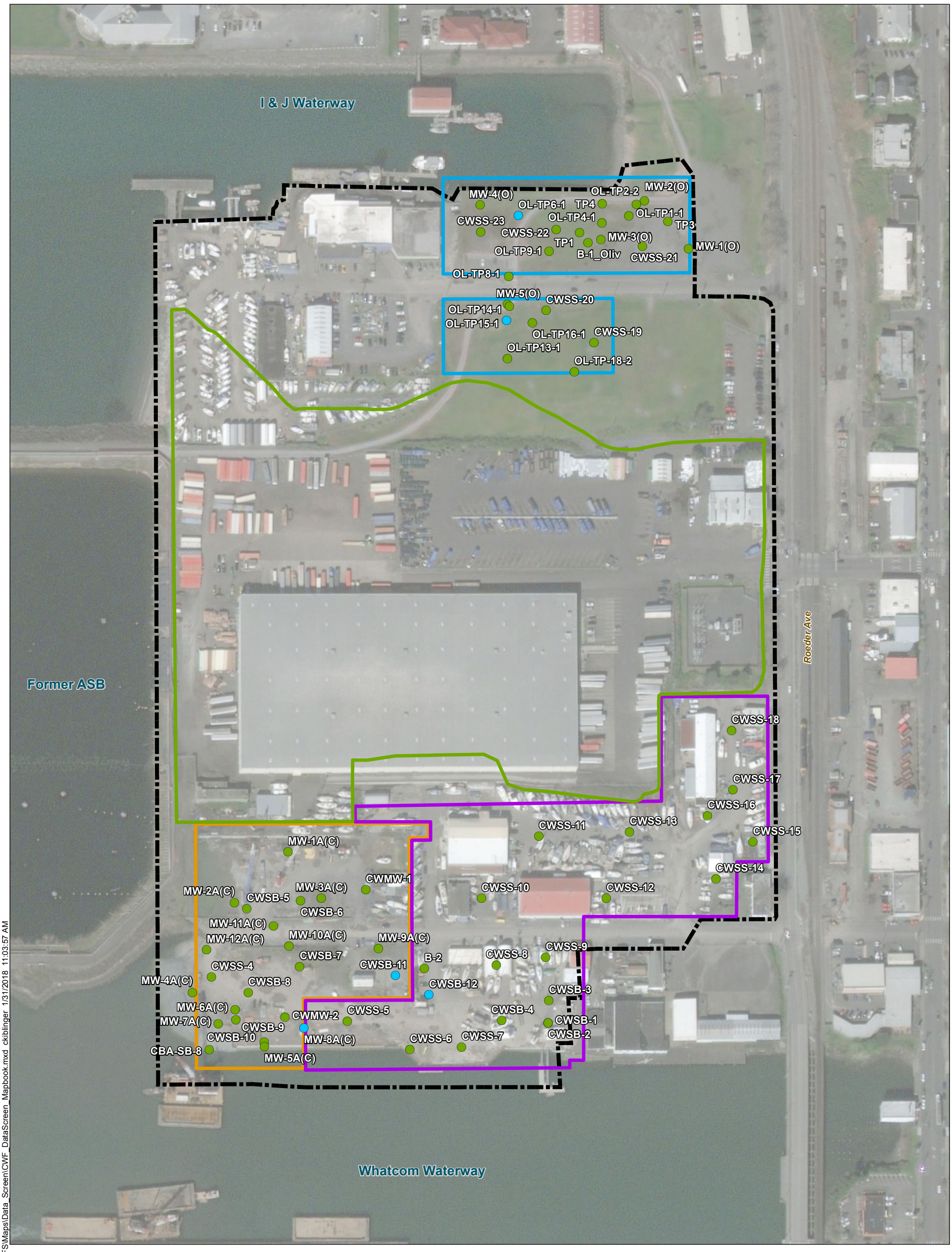
ANCHOR QEA

Figure 7d
Groundwater Results – Total cPAHs
Non-detects Above the Screening Level
Central Waterfront RI/FS
Bellingham, WA



Central Waterfront Site Boundary

Site Subareas

- Chevron Subarea
- Colony Wharf Subarea
- Olivine Upland Subarea
- Roeder Avenue Landfill Refuse Boundary

Naphthalene (mg/kg)

- < 0.8
- 0.8 - 99
- 99 - 1,600
- > 1,600

NOTES:
1. 0.8 mg/kg = MTCA Unrestricted soil cleanup level protective of leachability to groundwater [WAC 173-340-740; Equation 747-1].
2. 99 mg/kg = sediment cleanup objective (based on sediment management standards criteria).
3. 1,600 mg/kg = MTCA Method B Unrestricted soil cleanup level (saturated, direct contact) [WAC 173-340-740].
4. For stations with multiple samples, the highest concentration is used.
5. Aerial photo by ESRI.

Key to Previous Investigations
(B) Bellingham Marine Industries
(C) Chevron
(O) Olivine

Project North / True North

Feet
0 100 200 300 400

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Figure 8a
Soil Results – Naphthalene
Central Waterfront RI/FS
Bellingham, WA

Central Waterfront Site Boundary

Site Subareas

- Chevron Subarea
- Colony Wharf Subarea
- Olivine Upland Subarea
- Roeder Avenue Landfill Refuse Boundary

Naphthalene (µg/L)

- < 83
- 83 - 166
- 166 - 415
- > 415

Key to Previous Investigations
(B) Bellingham Marine Industries
(E) Ecology
(C) Chevron
(O) Olivine
(W) Roeder Avenue Warehouse Feasibility Analysis and Pre-Design Testing

Project North

True North

Feet
0 100 200 300 400

NOTES:
1. 83 µg/L = Calculated Porewater Concentration Protective of Marine Sediment [SQS; WAC 173-204-320].
2. Results shown include the maximum concentration detected from 2002 - current.
3. Aerial photo by ESRI.

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Figure 8b
Groundwater Results – Naphthalene
Central Waterfront RI/FS
Bellingham, WA

Central Waterfront Site Boundary

Site Subareas

- Chevron Subarea
- Colony Wharf Subarea
- Olivine Upland Subarea
- Roeder Avenue Landfill Refuse Boundary

Naphthalene (mg/kg)

- < 0.8
- 0.8 - 1.6
- 1.6 - 4
- > 4

Key to Previous Investigations
(B) Bellingham Marine Industries
(C) Chevron
(O) Olivine

Project North / True North

Feet
0 100 200 300 400

NOTES:
1. 0.8 mg/kg = MTCA Unrestricted soil cleanup level protective of leachability to groundwater [WAC 173-340-740; Equation 747-1].
2. Only Non-detects above 0.8 mg/kg are shown.
3. For stations with multiple samples, the highest reporting limit is shown.
4. Aerial photo by ESRI.

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ANCHOR QEA

Figure 8c
Soil Results – Naphthalene
Non-detects Above the Screening Level
Central Waterfront RI/FS
Bellingham, WA

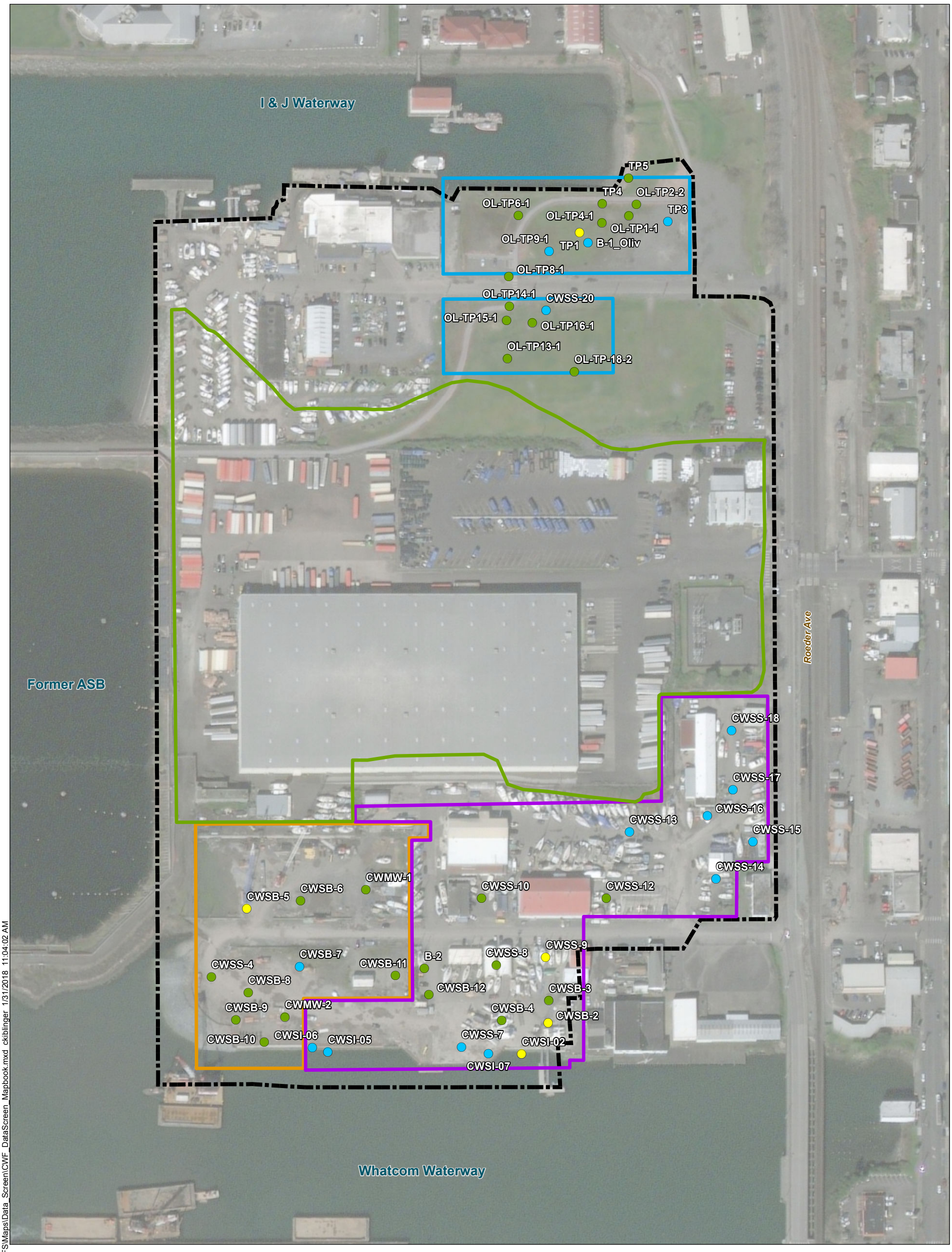

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Figure 9a
Soil Results – Arsenic
Central Waterfront RI/FS
Bellingham, WA

Central Waterfront Site Boundary

Site Subareas

- Chevron Subarea
- Colony Wharf Subarea
- Olivine Upland Subarea
- Roeder Avenue Landfill Refuse Boundary

Arsenic (µg/L)

- < 5
- 5 - 10
- 10 - 25
- > 25

Key to Previous Investigations
(B) Bellingham Marine Industries
(E) Ecology
(C) Chevron
(O) Olivine
(W) Roeder Avenue Warehouse Feasibility Analysis and Pre-Design Testing

Project North / True North

Feet
0 100 200 300 400

NOTES:
1. 5 µg/L = Background Concentration in Washington state [WAC 173-340-900 Table 720-1].
2. Results shown include the maximum concentration of the total and dissolved fractions from 2002 - current.
3. Aerial photo by ESRI.

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ANCHOR QEA

Figure 9b
Groundwater Results – Arsenic
Central Waterfront RI/FS
Bellingham, WA

Central Waterfront Site Boundary

Site Subareas

- Chevron Subarea
- Colony Wharf Subarea
- Olivine Upland Subarea
- Roeder Avenue Landfill Refuse Boundary

Arsenic (mg/kg)

- < 7
- 7 - 14
- 14 - 35
- > 35

Key to Previous Investigations
(B) Bellingham Marine Industries
(C) Chevron
(O) Olivine

Project North / True North

Feet
0 100 200 300 400

NOTES:
1. 7 mg/kg = Natural Background Concentration [Ecology, 1994].
2. Only Non-detects above 7 mg/kg are shown.
3. For stations with multiple samples, the highest reporting limit is shown.
4. Aerial photo by ESRI.

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ANCHOR QEA

Figure 9c
Soil Results – Arsenic
Non-detects Above the Screening Level
Central Waterfront RI/FS
Bellingham, WA

NOTES:
1. 5 µg/L = Background Concentration in Washington state [WAC 173-340-900 Table 720-1].
2. Only Non-detects above 5 µg/L are shown.
3. Results shown include the maximum reporting limit of the total and dissolved fractions from 2002 - current.
4. Aerial photo by ESRI.

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ANCHOR QEA

Figure 9d
Groundwater Results – Arsenic
Non-detects Above the Screening Level
Central Waterfront RI/FS
Bellingham, WA

I & J Waterway

Former ASB

MW-54(C)

Roeder Ave

Whatcom Waterway

Central Waterfront Site Boundary

Site Subareas

- Chevron Subarea
- Colony Wharf Subarea
- Olivine Upland Subarea
- Roeder Avenue Landfill Refuse Boundary

Arsenic (µg/L)

- < 5
- 5 - 10
- 10 - 25
- > 25

Key to Previous Investigations
(B) Bellingham Marine Industries
(E) Ecology
(C) Chevron
(O) Olivine (Port)
(W) Roeder Avenue Warehouse Feasibility Analysis and Pre-Design Testing

Project North

True North

Feet
0 100 200 300 400

NOTES:
1. 5 µg/L = Background Concentration in Washington state [WAC 173-340-900 Table 720-1].
2. Results shown include the maximum concentration of the total and dissolved fractions from 2002 - current.
3. Aerial photo by ESRI.

\\orcas\gis\Jobs\120007-01.01_Central_Waterfront_RIFS\Maps\Data_Screen\CWF_DataScreen_GWDissolvedMetals_Mapbook.mxd ckiblinger 9/6/2017 4:07:57 PM

ANCHOR QEA

Figure 9e
Groundwater Results – Dissolved Arsenic
Central Waterfront RI/FS
Bellingham, WA

NOTES:
1. 5 µg/L = Background Concentration in Washington state [WAC 173-340-900 Table 720-1].
2. Only Non-detects above 5 µg/L are shown.
3. Results shown include the maximum reporting limit of the total and dissolved fractions from 2002 - current.
4. Aerial photo by ESRI.

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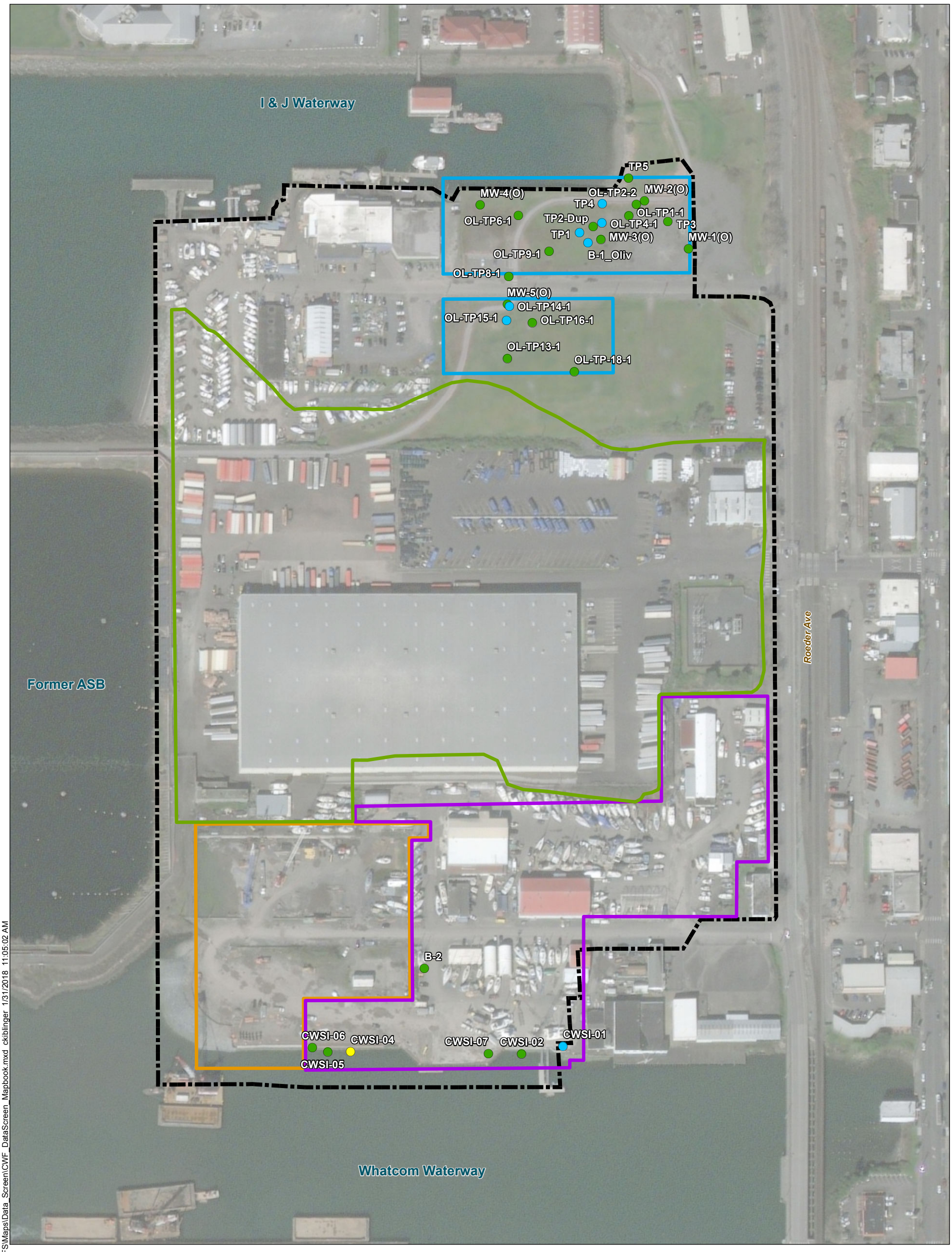
ANCHOR QEA

Figure 9f
Groundwater Results – Dissolved Arsenic
Non-detects Above the Screening Level
Central Waterfront RI/FS
Bellingham, WA



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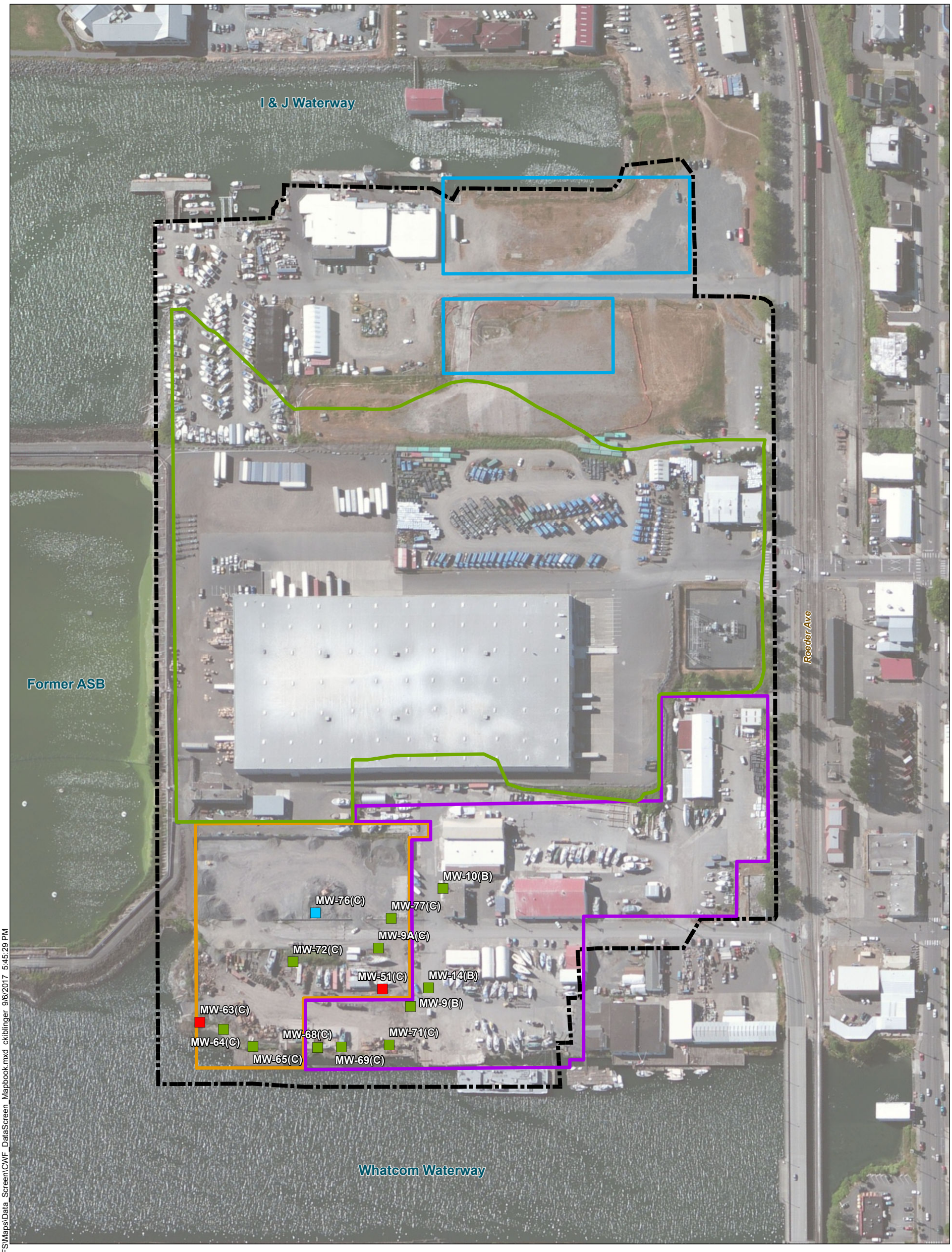
ANCHOR QEA

Figure 10a
Soil Results – Cadmium
Central Waterfront RI/FS
Bellingham, WA



NOTES:
1. 8.8 µg/L = Surface Water ARAR - Aquatic Life - Marine - Clean Water Act §304.
2. Results shown include the maximum concentration of the total and dissolved fractions from 2002 - current.
3. Aerial photo by ESRI.

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ANCHOR QEA

Figure 10b
Groundwater Results – Cadmium
Central Waterfront RI/FS
Bellingham, WA

Central Waterfront Site Boundary

Site Subareas

- Chevron Subarea
- Colony Wharf Subarea
- Olivine Upland Subarea
- Roeder Avenue Landfill Refuse Boundary

Cadmium (µg/L)

- < 8.8
- 8.8 - 17.6
- 17.6 - 44
- > 44

Key to Previous Investigations
(B) Bellingham Marine Industries
(E) Ecology
(C) Chevron
(O) Olivine
(W) Roeder Avenue Warehouse Feasibility Analysis and Pre-Design Testing

Project North / True North

Feet
0 100 200 300 400

NOTES:
1. 8.8 µg/L = Surface Water ARAR - Aquatic Life - Marine - Clean Water Act §304.
2. Only Non-detects above 8.8 µg/L are shown.
3. Results shown include the maximum reporting limit of the total and dissolved fractions from 2002 - current.
4. Aerial photo by ESRI.

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Figure 10c
Groundwater Results – Cadmium
Non-detects Above the Screening Level
Central Waterfront RI/FS
Bellingham, WA

ANCHOR QEA

Central Waterfront Site Boundary

Site Subareas

- Chevron Subarea
- Colony Wharf Subarea
- Olivine Upland Subarea
- Roeder Avenue Landfill Refuse Boundary

Chromium (mg/kg)

- < 260
- 260 - 520
- 520 - 1,300
- > 1,300

Key to Previous Investigations
(B) Bellingham Marine Industries
(C) Chevron
(O) Olivine

Project North / True North

Feet
0 100 200 300 400

NOTES:
1. 260 mg/kg = MTCA Unrestricted soil cleanup level protective of leachability to groundwater [WAC 173-340-740; Equation 747-1].
2. For stations with multiple samples, the highest concentration is used.
3. Aerial photo by ESRI.

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ANCHOR QEA

Figure 11a
Soil Results – Chromium
Central Waterfront RI/FS
Bellingham, WA

NOTES:
1. 260 µg/L = Calculated Porewater Concentration Protective of Marine Sediment [SQS; WAC 173-204-320].
2. Results shown include the maximum concentration of the total and dissolved fractions from 2002 - current.
3. Aerial photo by ESRI.

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ANCHOR QEA

Figure 11b
Groundwater Results – Chromium
Central Waterfront RI/FS
Bellingham, WA

NOTES:
1. 260 µg/L = Calculated Porewater Concentration Protective of Marine Sediment [SQS; WAC 173-204-320].
2. Results shown include the maximum concentration of the total and dissolved fractions from 2002 - current.
3. Aerial photo by ESRI.

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ANCHOR QEA

Figure 11c
Groundwater Results – Dissolved Chromium
Central Waterfront RI/FS
Bellingham, WA

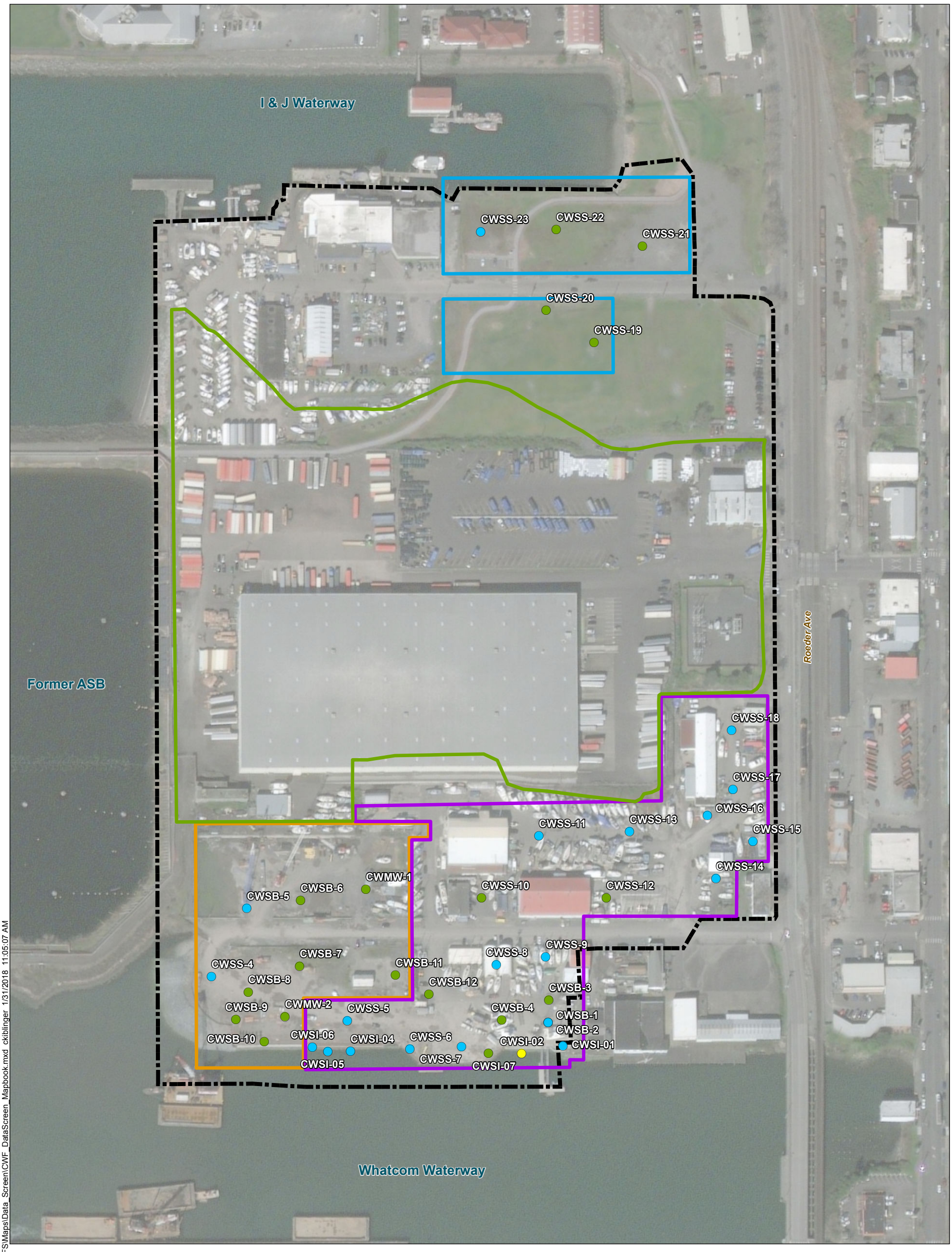

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Figure 12a
Soil Results – Copper
Central Waterfront RI/FS
Bellingham, WA

NOTES:
1. 3.1 µg/L = Surface Water ARAR (Aquatic Life, Marine) [WAC 173-201A].
2. Results shown include the maximum concentration of the total and dissolved fractions from 2002 - current.
3. Aerial photo by ESRI.

\\orcasvgis\Jobs\120007-01.01_Central_Waterfront_RIFSMaps\Data_Screen\CWF_DataScreen_Mapbook.mxd ckiblinger 9/6/2017 5:45:33 PM

ANCHOR QEA

Figure 12b
Groundwater Results – Copper
Central Waterfront RI/FS
Bellingham, WA

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NOTES:
1. 3.1 µg/L = Surface Water ARAR (Aquatic Life, Marine) [WAC 173-201A].
2. Results shown include the maximum concentration of the total and dissolved fractions from 2002 - current.
3. Aerial photo by ESRI.

ANCHOR QEA

Figure 12c
Groundwater Results – Dissolved Copper
Central Waterfront RI/FS
Bellingham, WA

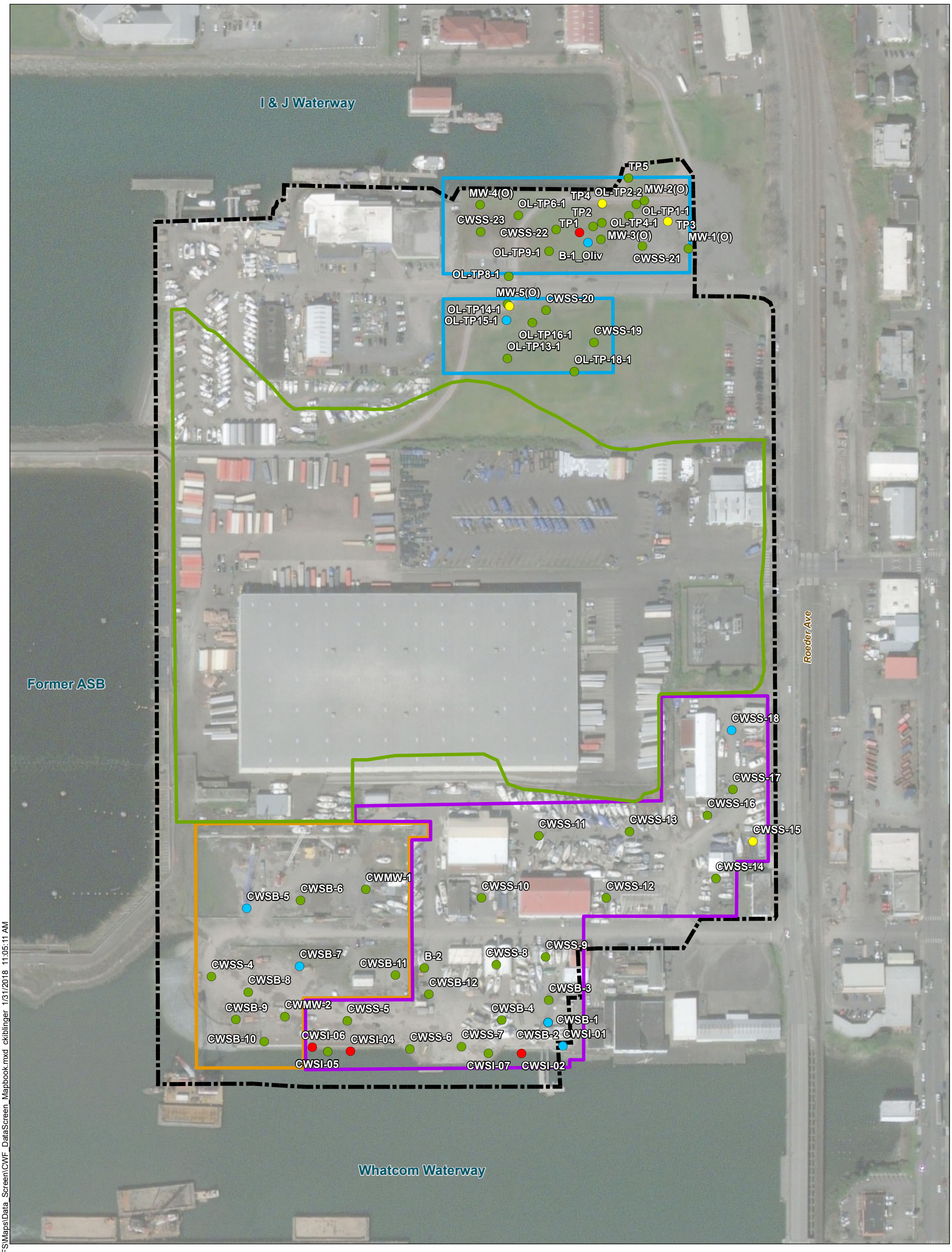

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Figure 13a
Soil Results – Lead
Central Waterfront RI/FS
Bellingham, WA

Central Waterfront Site Boundary

Site Subareas

- Chevron Subarea
- Colony Wharf Subarea
- Olivine Upland Subarea
- Roeder Avenue Landfill Refuse Boundary

Lead (µg/L)

- < 8.1
- 8.1 - 16.2
- 16.2 - 40.5
- > 40.5

Key to Previous Investigations
(B) Bellingham Marine Industries
(E) Ecology
(C) Chevron
(O) Olivine
(W) Roeder Avenue Warehouse Feasibility Analysis and Pre-Design Testing

Project North

True North

Feet
0 100 200 300 400

NOTES:
1. 8.1 µg/L = Surface Water ARAR (Aquatic Life, Marine) [WAC 173-201A].
2. Results shown include the maximum concentration of the total and dissolved fractions from 2002 - current.
3. Aerial photo by ESRI.

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ANCHOR QEA

Figure 13b
Groundwater Results – Lead
Central Waterfront RI/FS
Bellingham, WA

Central Waterfront Site Boundary

Site Subareas

- Chevron Subarea
- Colony Wharf Subarea
- Olivine Upland Subarea
- Roeder Avenue Landfill Refuse Boundary

Lead (µg/L)

- < 8.1
- 8.1 - 16.2
- 16.2 - 40.5
- > 40.5

NOTES:
1. 8.1 µg/L = Surface Water ARAR (Aquatic Life, Marine) [WAC 173-201A].
2. Only Non-detects above 8.1 µg/L are shown.
3. Results shown include the maximum reporting limit of the total and dissolved fractions from 2002 - current.
4. Aerial photo by ESRI.

Key to Previous Investigations
(B) Bellingham Marine Industries
(E) Ecology
(C) Chevron
(O) Olivine
(W) Roeder Avenue Warehouse Feasibility Analysis and Pre-Design Testing

Project North / True North

Feet
0 100 200 300 400

\\orcas\gis\Jobs\120007-01.01_Central_Waterfront_RIFS\Maps\Data_Screen\CWF_DataScreen_NDAboveSL_Mapbook.mxd ckiblinger 9/6/2017 4:22:14 PM

ANCHOR QEA

Figure 13c
Groundwater Results – Lead
Non-detects Above the Screening Level
Central Waterfront RI/FS
Bellingham, WA

NOTES:
1. 8.1 µg/L = Surface Water ARAR (Aquatic Life, Marine) [WAC 173-201A].
2. Only Non-detects above 8.1 µg/L are shown.
3. Results shown include the maximum reporting limit of the total and dissolved fractions from 2002 - current.
4. Aerial photo by ESRI.

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ANCHOR QEA

Figure 13d
Groundwater Results – Dissolved Lead
Non-detects Above the Screening Level
Central Waterfront RI/FS
Bellingham, WA

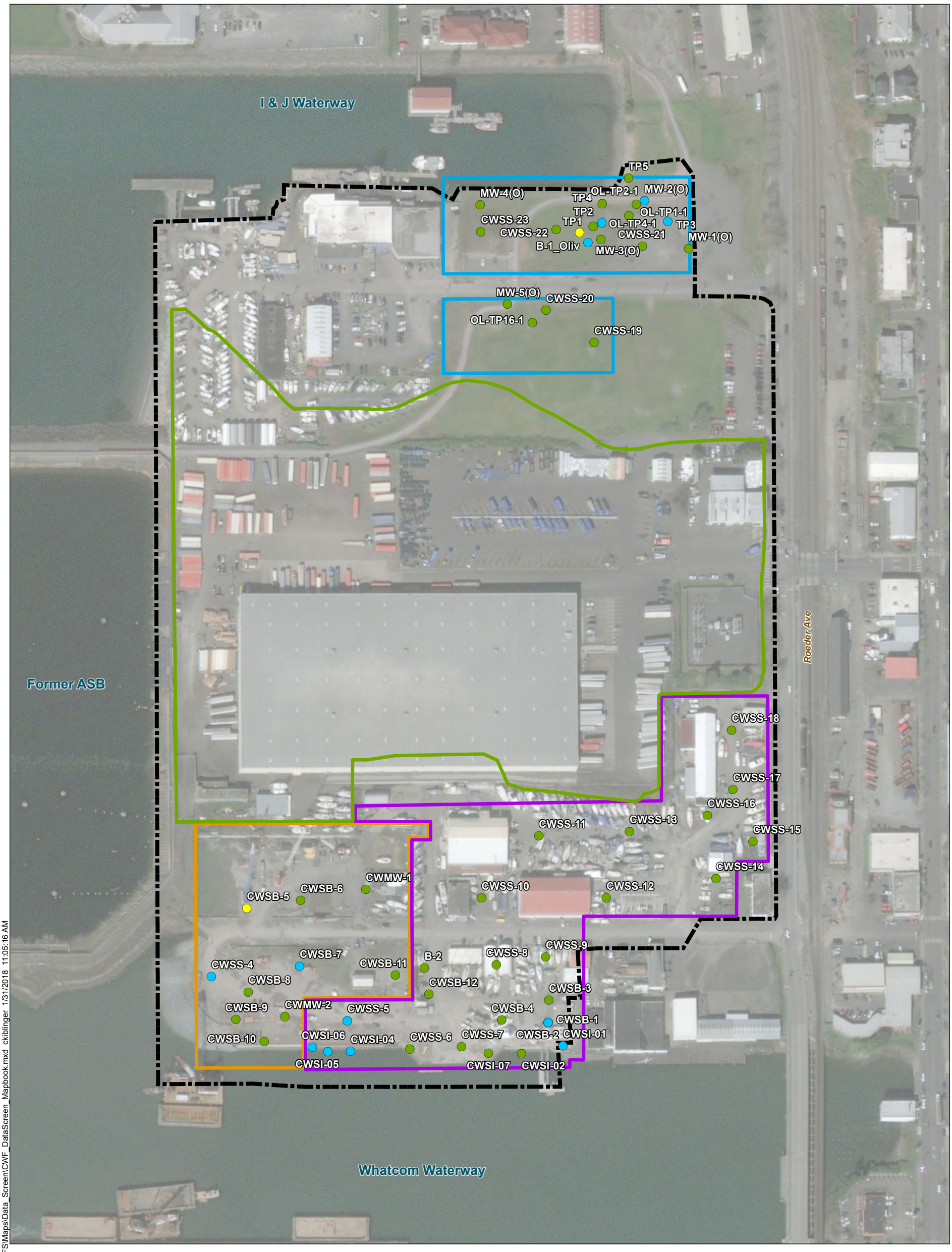

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Figure 14a
Soil Results – Mercury
Central Waterfront RI/FS
Bellingham, WA

NOTES:
1. 0.059 µg/L = Calculated Porewater Concentration Protective of Marine Sediment [SQS; WAC 173-204-320].
2. Results shown include the maximum concentration of the total and dissolved fractions from 2002 - current.
3. Aerial photo by ESRI.

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ANCHOR QEA

Figure 14b
Groundwater Results – Mercury
Central Waterfront RI/FS
Bellingham, WA

Central Waterfront Site Boundary

Site Subareas

- Chevron Subarea
- Colony Wharf Subarea
- Olivine Upland Subarea
- Roeder Avenue Landfill Refuse Boundary

Mercury (mg/kg)

- < 0.1
- 0.1 - 0.2
- 0.2 - 0.5
- > 0.5

Key to Previous Investigations
(B) Bellingham Marine Industries
(C) Chevron
(O) Olivine

Project North / True North

Feet
0 100 200 300 400

NOTES:
1. 0.1 mg/kg = MTCA Unrestricted soil cleanup level protective of leachability to groundwater [WAC 173-340-740; Equation 747-1].
2. Only Non-detects above 0.1 mg/kg are shown.
3. For stations with multiple samples, the highest reporting limit is shown.
4. Aerial photo by ESRI.

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ANCHOR QEA

Figure 14c
Soil Results – Mercury
Non-detects Above the Screening Level
Central Waterfront RI/FS
Bellingham, WA

Central Waterfront Site Boundary

Site Subareas

- Chevron Subarea
- Colony Wharf Subarea
- Olivine Upland Subarea
- Roeder Avenue Landfill Refuse Boundary

Mercury (µg/L)

- < 0.059
- 0.059 - 0.118
- 0.118 - 0.295
- > 0.295

NOTES:
1. 0.059 µg/L = Calculated Porewater Concentration Protective of Marine Sediment [SQS; WAC 173-204-320].
2. Only Non-detects above 0.059 µg/L are shown.
3. Results shown include the maximum reporting limit of the total and dissolved fractions from 2002 - current.
4. Aerial photo by ESRI.

Key to Previous Investigations
(B) Bellingham Marine Industries
(E) Ecology
(C) Chevron
(O) Olivine
(W) Roeder Avenue Warehouse Feasibility Analysis and Pre-Design Testing

Project North / True North

Feet
0 100 200 300 400

\\orcas\gis\Jobs\120007-01.01_Central_Waterfront_RIFSMaps\Data_Screen\CWF_DataScreen_NDAboveSL_Mapbook.mxd ckiblinger 9/6/2017 4:22:18 PM

ANCHOR QEA

Figure 14d
Groundwater Results – Mercury
Non-detects Above the Screening Level
Central Waterfront RI/FS
Bellingham, WA

Central Waterfront Site Boundary

Site Subareas

- Chevron Subarea
- Colony Wharf Subarea
- Olivine Upland Subarea
- Roeder Avenue Landfill Refuse Boundary

Mercury (µg/L)

- < 0.059
- 0.059 - 0.118
- 0.118 - 0.295
- > 0.295

Key to Previous Investigations
(B) Bellingham Marine Industries
(E) Ecology
(C) Chevron
(O) Olivine
(W) Roeder Avenue Warehouse Feasibility Analysis and Pre-Design Testing

Project North
True North

Feet
0 100 200 300 400

NOTES:
1. 0.059 µg/L = Calculated Porewater Concentration Protective of Marine Sediment [SQS; WAC 173-204-320].
2. Only Non-detects above 0.059 µg/L are shown.
3. Results shown include the maximum reporting limit of the total and dissolved fractions from 2002 - current.
4. Aerial photo by ESRI.

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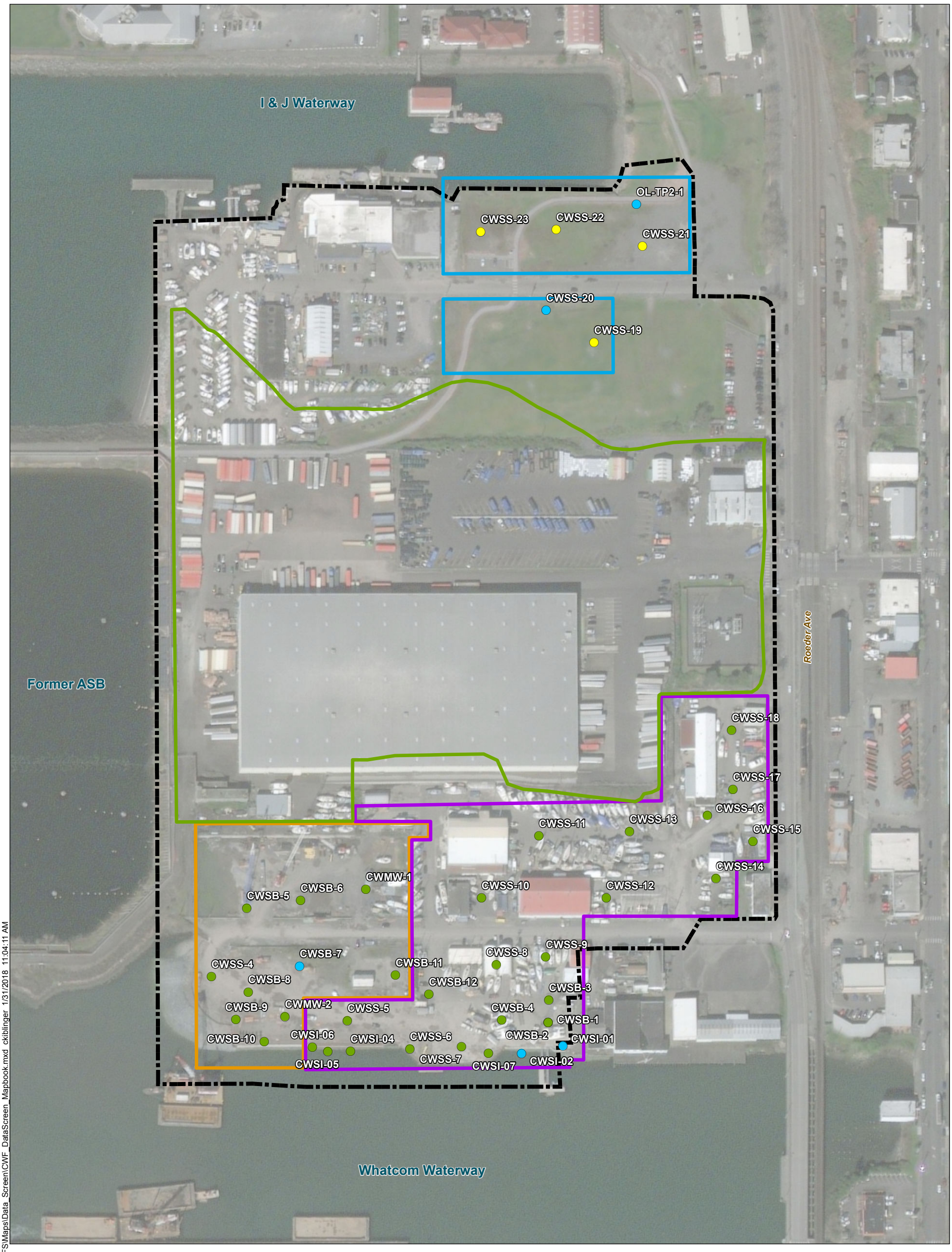
ANCHOR QEA

Figure 14e
Groundwater Results – Dissolved Mercury
Non-detects Above the Screening Level
Central Waterfront RI/FS
Bellingham, WA



Central Waterfront Site Boundary

Site Subareas

- Chevron Subarea
- Colony Wharf Subarea
- Olivine Upland Subarea
- Roeder Avenue Landfill Refuse Boundary

Nickel (mg/kg)

- < 48
- 48 - 211
- 211 - 1,600
- > 1,600

NOTES:
1. 48 mg/kg = Natural Background Concentration [Ecology, 1994].
2. 211 mg/kg = Site-specific preliminary sediment cleanup level for nickel developed for I&J Waterway.
3. 1,600 mg/kg = MTCA Method B Unrestricted soil cleanup level (saturated, direct contact) [WAC 173-340-740].
4. For stations with multiple samples, the highest concentration is used.
5. Aerial photo by ESRI.

Key to Previous Investigations
(B) Bellingham Marine Industries
(C) Chevron
(O) Olivine

Project North / True North

Feet
0 100 200 300 400

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ANCHOR QEA

Figure 15a
Soil Results – Nickel
Central Waterfront RI/FS
Bellingham, WA

NOTES:
1. 8.2 µg/L = Surface Water ARAR (Aquatic Life, Marine) [WAC 173-201A].
2. Results shown include the maximum concentration of the total and dissolved fractions from 2002 - current.
3. Aerial photo by ESRI.

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ANCHOR QEA

Figure 15b
Groundwater Results – Nickel
Central Waterfront RI/FS
Bellingham, WA

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Figure 15c
Groundwater Results – Nickel
Non-detects Above the Screening Level
Central Waterfront RI/FS
Bellingham, WA

ANCHOR QEA

Central Waterfront Site Boundary

Site Subareas

- Chevron Subarea
- Colony Wharf Subarea
- Olivine Upland Subarea
- Roeder Avenue Landfill Refuse Boundary

Nickel (µg/L)

- < 8.2
- 8.2 - 16.4
- 16.4 - 41
- > 41

Key to Previous Investigations
(B) Bellingham Marine Industries
(E) Ecology
(C) Chevron
(O) Olivine (Port)
(W) Roeder Avenue Warehouse Feasibility Analysis and Pre-Design Testing

Project North / True North

Feet
0 100 200 300 400

NOTES:
1. 8.2 µg/L = Surface Water ARAR (Aquatic Life, Marine) [WAC 173-201A].
2. Results shown include the maximum concentration of the total and dissolved fractions from 2002 - current.
3. Aerial photo by ESRI.

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ANCHOR QEA

Figure 15d
Groundwater Results – Dissolved Nickel
Central Waterfront RI/FS
Bellingham, WA

NOTES:
1. 8.2 µg/L = Surface Water ARAR (Aquatic Life, Marine) [WAC 173-201A].
2. Only Non-detects above 8.2 µg/L are shown.
3. Results shown include the maximum reporting limit of the total and dissolved fractions from 2002 - current.
4. Aerial photo by ESRI.

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ANCHOR QEA

Figure 15e
Groundwater Results – Dissolved Nickel
Non-detects Above the Screening Level
Central Waterfront RI/FS
Bellingham, WA

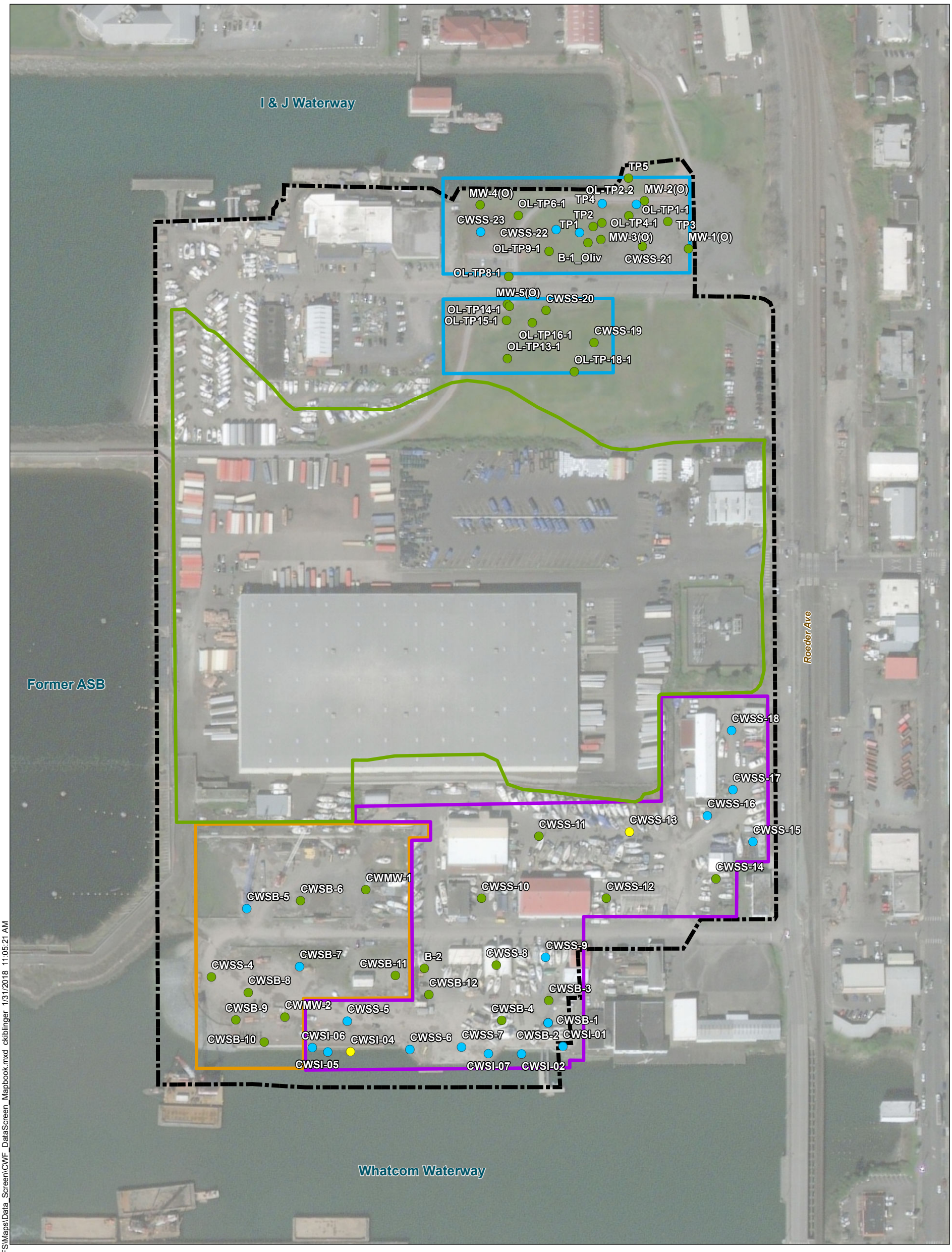

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Figure 16a
Soil Results – Zinc
Central Waterfront RI/FS
Bellingham, WA

NOTES:
1. 81 µg/L = Surface Water ARAR (Aquatic Life, Marine) [WAC 173-201A].
2. Results shown include the maximum concentration of the total and dissolved fractions from 2002 - current.
3. Aerial photo by ESRI.

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ANCHOR QEA

Figure 16b
Groundwater Results – Zinc
Central Waterfront RI/FS
Bellingham, WA

NOTES:
1. 81 µg/L = Surface Water ARAR (Aquatic Life, Marine) [WAC 173-201A].
2. Results shown include the maximum concentration of the total and dissolved fractions from 2002 - current.
3. Aerial photo by ESRI.

\\orcas\gis\Jobs\120007-01.01_Central_Waterfront_RIFSMaps\Data_Screen\CWF_DataScreen_GWDissolvedMetals_Mapbook.mxd ckiblinger 9/6/2017 4:07:53 PM

ANCHOR QEA

Figure 16c
Groundwater Results – Dissolved Zinc
Central Waterfront RI/FS
Bellingham, WA

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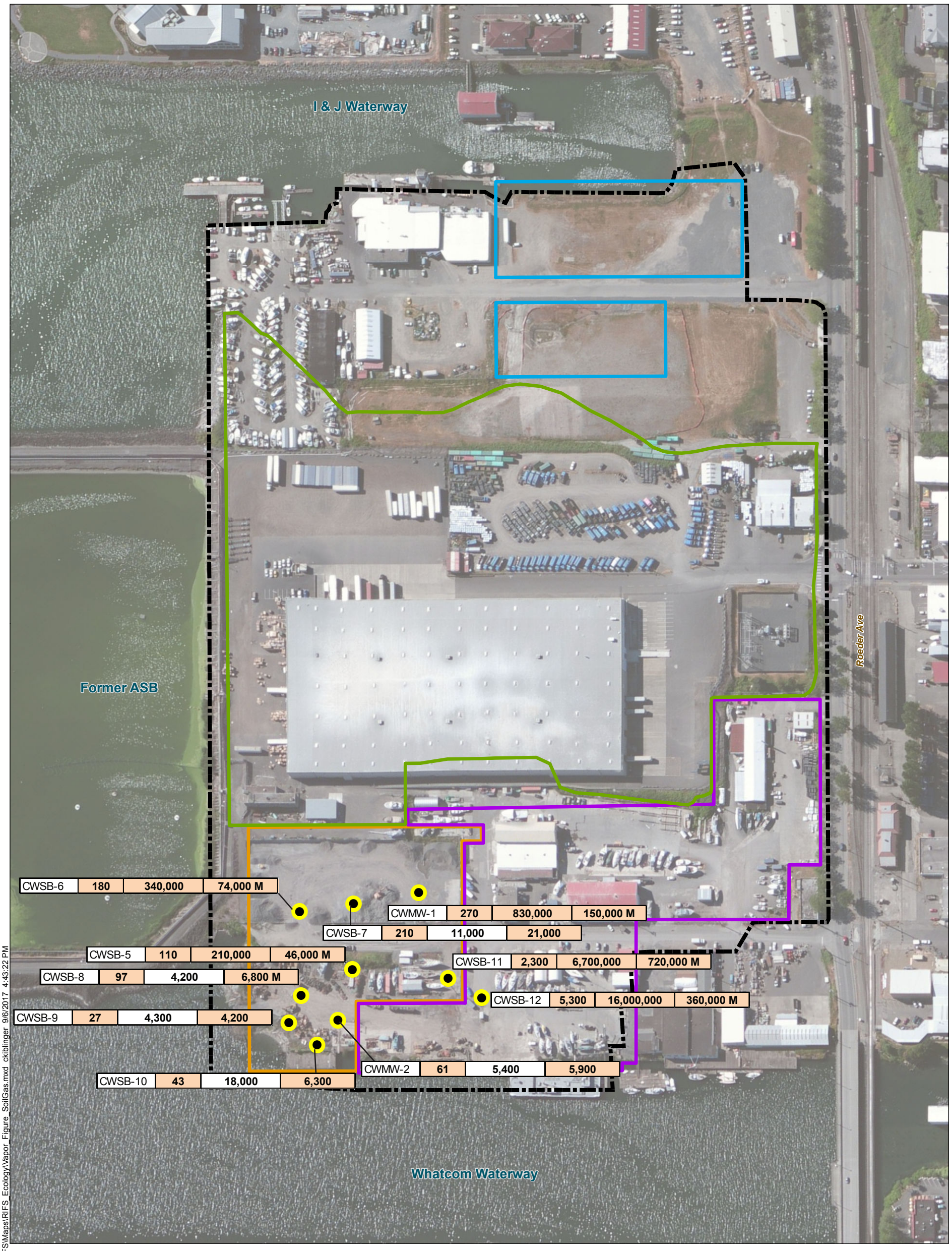
Notes (landfill gas-methane):
1. Methane concentrations were evaluated by measuring the combustible gases present in the headspace of the monitoring wells and results are reported as a percentage of the lower explosive limit (LEL).
2. Landfill gas (methane) measurements presented for monitoring well locations with measurements greater than 10% LEL.
3. Landfill gas measurements were performed as part of the 2001 Roeder Avenue Landfill RI and 2007/2008 Central Waterfront RI.

ANCHOR QEA

Figure 17a
Vapor Results - Methane Gas
Central Waterfront RI/FS
Bellingham, WA



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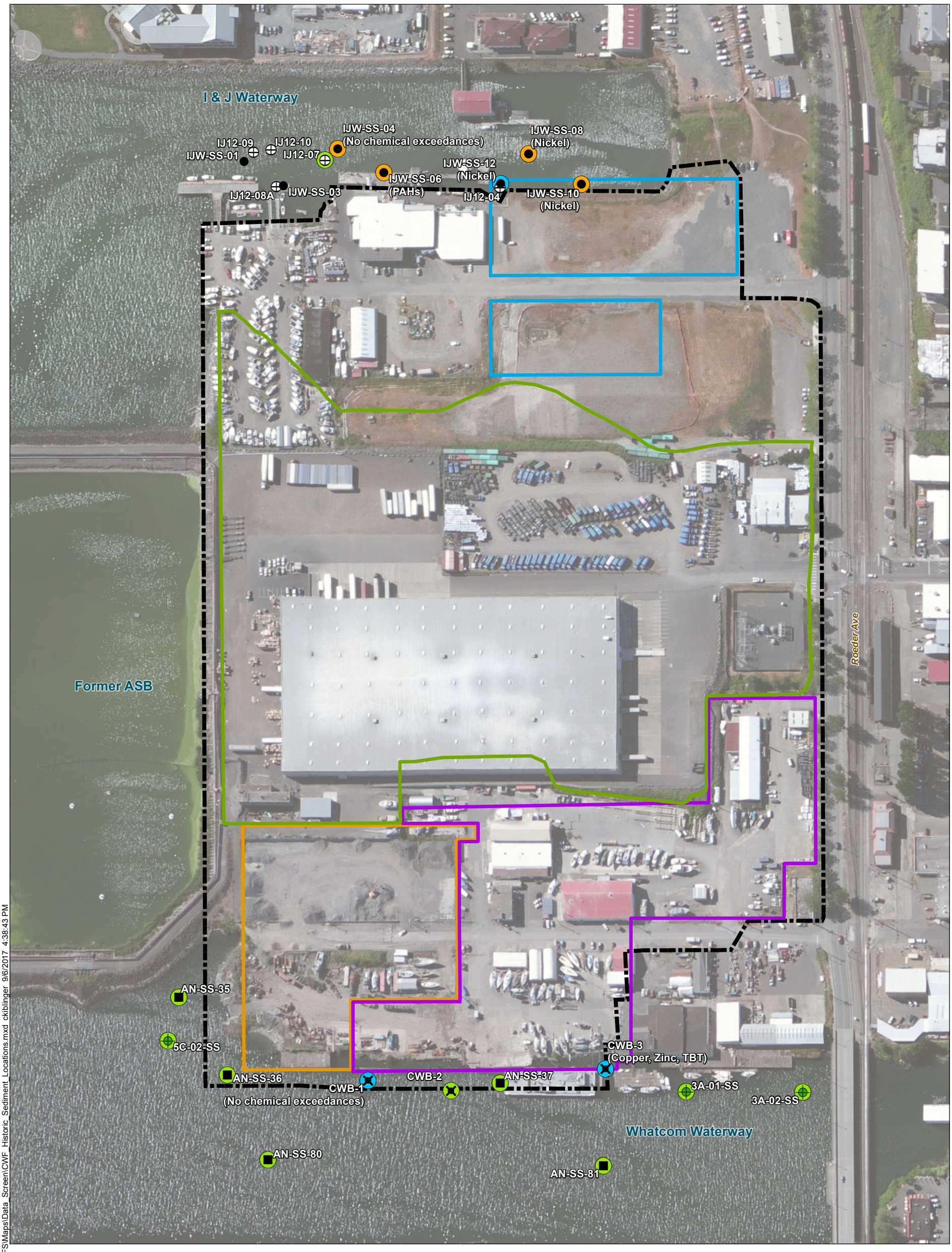
Notes (soil gas):
1. Results in ug/m^3.
2. Soil gas screening levels consistent with Ecology's draft guidance for evaluating vapor intrusion (Ecology 2009).
3. Soil gas sampling was conducted in August 2008 as part of the Central Waterfront RI. Sample intervals were all at 5-ft below ground surface.
4. M = matrix interference - result may be biased high.

ANCHOR QEA

Figure 17b
Vapor Results - Soil Gas
Central Waterfront RI/FS
Bellingham, WA



Existing Surface Sediment Sampling Station

Whatcom Waterway

- PRDI (2008)
- RI/FS (2002)
- Colony Wharf (2004)

I & J Waterway

- RI/FS (2005/2006 + 2012)
- RI/FS Addendum (2012)

Sediment Biological Criteria

- No Exceedance
- SQS Exceedance
- CSL Exceedance

- Central Waterfront Site Boundary

Site Subareas

- Chevron Subarea
- Colony Wharf Subarea
- Olivine Upland Subarea
- Roeder Avenue Landfill Refuse Boundary

NOTES:
1. Surface sediment biological and chemical exceedances are shown for the most recent sampling for both the I & J Waterway and Whatcom Waterway cleanup projects.
2. Those chemicals exceeding SMS SQS criteria are shown in parentheses. Nickel exceedances are based on the former DMMP screening level.

ANCHOR QEA

Feet
0 100 200 300 400

Project North

True North

Figure 18
Sediment Quality Adjacent to Central Waterfront Site
Central Waterfront RI/FS
Bellingham, WA

\\orcas\gis\Jobs\120007-01.01_Central_Waterfront_RIFS\Maps\Data_Screen\CWF_Historic_Sediment_Locations.mxd ckiblinger 9/6/2017 4:38:43 PM

Table 1a
Soil Summary Statistics

Analytes	No. of Detections	No. of Samples	Frequency of Detection	No. of Usable Data	Most Stringent Screening Level (MS SL)	No. of Detections > MS SL	Exceedance Frequency (Usable)	Usable Data 2x MS SL	Maximum Detected Concentration	Maximum Exceedance Factor	No. of Non-Usable Data	No. of Non-Usable Data with RL > 2x MS SL	Exceedance Frequency (w/Non-Usable)	Chemical Selected for Mapping
Total Petroleum Hydrocarbons (mg/kg)														
Gasoline range hydrocarbons	77	147	52%	147	30	42	29%	27%	16,000	533	0	0	29%	X
Diesel range hydrocarbons	125	181	69%	181	2,000	21	12%	9%	34,000	17	0	0	12%	X
Motor oil range hydrocarbons	110	161	68%	161	2,000	10	6%	2%	5,600	2.8	0	0	6%	X
Total petroleum hydrocarbons	103	105	98%	105	2,000	26	25%	23%	130,000	65	0	0	25%	
Total Petroleum Hydrocarbons - Silica Gel Treated (mg/kg)														
Diesel range hydrocarbons (silica gel treated)	10	11	91%	11	2,000	6	55%	55%	27,000	14	0	0	55%	X
Motor oil range hydrocarbons (silica gel treated)	10	11	91%	11	2,000	1	9%	0%	3,200	1.6	0	0	9%	X
Metals (mg/kg)														
Antimony	1	14	7%	14	--	0		--	5	--	--	--	--	
Arsenic	41	93	44%	71	7	23	32%	14%	33	4.7	22	8	48%	X
Barium	76	79	96%	79	16,000	0	0%	0%	545	--	0	0	0%	
Beryllium	6	14	43%	14	--	0	--	--	0.2	--	--	--	--	
Cadmium	29	44	66%	41	1.0	7	17%	7%	11.7	12	3	1	23%	X
Chromium	93	93	100%	93	260	0	0%	0%	128	--	0	0	0%	X
Chromium VI	2	64	3%	64	48	0	0%	0%	1.83	--	0	0	0%	
Copper	63	63	100%	63	36	27	43%	19%	403	11	0	0	43%	X
Lead	71	93	76%	93	81	19	20%	13%	1,260	16	0	0	20%	X
Mercury	39	93	42%	85	0.1	21	25%	7%	0.92	9.2	8	8	31%	X
Nickel	64	64	100%	64	48	9	14%	11%	1,240	26	0	0	14%	X
Selenium	11	44	25%	16	1.0	2	13%	13%	15	15	28	27	68%	
Silver	6	44	14%	6	0.02	6	100%	100%	12.4	620	38	38	100%	
Zinc	92	93	99%	93	85	29	31%	14%	5,050	59	0	0	31%	X
Polycyclic Aromatic Hydrocarbons (mg/kg)														
1-Methylnaphthalene	25	50	50%	50	35	0	0%	0%	8.9	--	0	0	0%	
2-Methylnaphthalene	25	63	40%	63	320	0	0%	0%	18	--	0	0	0%	
Acenaphthene	10	89	11%	61	0.13	5	8%	3%	1.35	10	28	14	37%	
Acenaphthylene	11	89	12%	89	--	0	--	--	0.08	--	--	--	--	
Anthracene	17	89	19%	89	1.7	0	0%	0%	0.60	--	0	0	0%	
Benzo(a)anthracene	30	89	34%	51	0.056	17	33%	23%	2.7	48	38	13	62%	
Benzo(a)pyrene	32	89	36%	75	0.14	11	15%	13%	3.5	25	14	13	28%	
Benzo(b)fluoranthene	34	88	39%	76	0.19	11	14%	15%	6.12	32	12	3	26%	
Benzo(k)fluoranthene	26	88	30%	89	0.19	0	--	2%	0.5	2.6	17	5	19%	
Total Benzofluoranthenes (lab reported total)	1	1	100%	1	--	0	--	--	0.11	--	--	--	--	
Benzo(g,h,i)perylene	24	89	27%	71	--	4	6%	--	2	--	--	--	--	
Chrysene	34	89	38%	56	0.062	19	34%	21%	3.9	63	33	14	58%	
Dibenzo(a,h)anthracene	11	89	12%	69	0.14	0	0%	0%	0.08	--	20	17	22%	
Dibenzofuran	15	50	30%	50	80	0	0%	0%	0.47	--	0	0	0%	
Fluoranthene	36	89	40%	89	1.3	3	3%	2%	5.7	4.4	0	0	3%	
Fluorene	19	89	21%	74	0.18	11	15%	4%	2.93	16	15	2	29%	
Indeno(1,2,3-c,d)pyrene	23	88	26%	86	0.55	1	1%	2%	2.3	4.2	2	0	3%	
Naphthalene	31	89	35%	87	0.8	5	6%	2%	12	15	2	0	8%	X
Phenanthrene	41	89	46%	89	--	0	--	--	5.31	--	--	--	--	
Pyrene	38	89	43%	87	8	0	0%	0%	6.8	--	2	0	2%	
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 1/2)	37	89	42%	78	0.14	16	21%	16%	4.78	34	11	10	30%	X

Table 1a
Soil Summary Statistics

Analytes	No. of Detections	No. of Samples	Frequency of Detection	No. of Usable Data	Most Stringent Screening Level (MS SL)	No. of Detections > MS SL	Exceedance Frequency (Usable)	Usable Data 2x MS SL	Maximum Detected Concentration	Maximum Exceedance Factor	No. of Non-Usable Data	No. of Non-Usable Data with RL > 2x MS SL	Exceedance Frequency (w/Non-Usable)	Chemical Selected for Mapping
Semivolatile Organics (mg/kg)														
bis(2-Ethylhexyl)phthalate	2	39	5%	37	0.86	0	0%	0%	0.29	--	2	0	5%	
Volatile Organics (mg/kg)													--	
1,2,4-Trimethylbenzene	4	28	14%	28	--	0	--	--	0.21	--	--	--	--	
1,3,5-Trimethylbenzene (Mesitylene)	2	28	7%	28	800	0	0%	0%	0.074	--	0	0	0%	
2-Butanone (MEK)	4	28	14%	28	48,000	0	0%	0%	0.0068	--	0	0	0%	
4-Isopropyltoluene (4-Cymene)	3	28	11%	28	--	0	--	--	0.35	--	--	--	--	
Acetone	15	28	54%	28	72,000	0	0%	0%	0.088	--	0	0	0%	
Benzene	15	111	14%	53	0.005	4	8%	8%	0.14	28	58	57	56%	X
Carbon disulfide	12	28	43%	28	0.26	0	0%	0%	0.063	0.2	0	0	0%	
Dichloromethane (Methylene chloride)	4	28	14%	19	0.034	4	21%	21%	0.44	13	9	9	46%	
Ethylbenzene	9	111	8%	111	3.9	2	2%	0%	4.3	1.1	0	0	2%	
Isopropylbenzene (Cumene)	7	28	25%	28	8,000	0	0%	0%	0.76	--	0	0	0%	
Methyl isobutyl ketone (4-Methyl-2-pentanone or (MIBK))	1	28	4%	28	6,400	0	0%	0%	0.0059	--	0	0	0%	
Naphthalene	7	35	20%	35	0.8	7	20%	9%	32.5	41	0	0	20%	
n-Butylbenzene	6	28	21%	28	--	0	--	--	2.3	--	--	--	--	
n-Propylbenzene	7	28	25%	28	8,000	0	0%	0%	1.8	--	0	0	0%	
sec-Butylbenzene	7	28	25%	28	--	0	--	--	2.6	--	--	--	--	
tert-Butylbenzene	2	28	7%	28	--	0	--	0%	0.34	--	--	--	--	
Toluene	18	111	16%	111	10	0	0%	0%	0.58	--	0	0	0%	
m,p-Xylene	10	54	19%	54	--	0	--	--	0.35	--	--	--	--	
o-Xylene	6	54	11%	54	0.95	0	0%	0%	0.032	--	0	0	0%	
Total Xylene (reported, not calculated)	5	57	9%	57	16,000	0	0%	0%	15	--	0	0	0%	

Notes:
1. "Usable data" includes all detected results and non-detects below the most stringent screening level.
2. Most Stringent Screening Level = Unrestricted Land Use-Saturated Soil
mg/kg = milligram per kilogram
MS SL = Most Stringent Screening Level
ND = non-detect
RL = reporting limit (from laboratory)
TEQ = toxic equivalency quotient
-- = Not Available or Not Applicable

Table 1b
Soil Summary Statistics - Non-detected Chemicals

Analytes	No. of Detections	No. of Samples	Most Stringent Screening Level (MS SL)	No. of Non-Usable Data	No. of Non-Usable Data with RL > 2x MS SL	Exceedance Frequency (RL>MS SL)
Metals (mg/kg)						
Thallium	0	14	--	--	--	
Semivolatile Organics (mg/kg)						
1,2,4-Trichlorobenzene	0	26	0.01	26	26	100%
1,2-Dichlorobenzene	0	26	0.02	26	26	100%
1,3-Dichlorobenzene	0	26	--	--	--	--
1,4-Dichlorobenzene	0	26	0.026	26	26	100%
2,2'-Oxybis (1-chloropropane)	0	26	14	0	0	0%
2,4,5-Trichlorophenol	0	26	46	0	0	0%
2,4,6-Trichlorophenol	0	26	0.01	26	26	100%
2,4-Dichlorophenol	0	26	0.11	26	26	100%
2,4-Dimethylphenol	0	26	0.38	2	0	8%
2,4-Dinitrophenol	0	26	0.40	26	5	100%
2,4-Dinitrotoluene	0	26	0.01	26	26	100%
2,6-Dinitrotoluene	0	26	80	0	0	0%
2-Chloronaphthalene	0	26	6,400	0	0	0%
2-Chlorophenol	0	26	0.12	5	4	19%
2-Methylphenol (o-Cresol)	0	26	4,000	0	0	0%
2-Nitroaniline	0	26	800	0	0	0%
2-Nitrophenol	0	26	--	--	--	--
3,3'-Dichlorobenzidine	0	26	0.1	26	26	100%
3-Nitroaniline	0	26	--	--	--	--
4-Bromophenyl-phenyl ether	0	26	--	--	--	--
4-Chloro-3-methylphenol	0	26	--	--	--	--
4-Chloroaniline	0	26	5	0	0	0%
4-Chlorophenyl phenyl ether	0	26	--	--	--	--
4-Methylphenol (p-Cresol)	0	26	400	0	0	0%
4-Nitroaniline	0	26	--	--	--	--
4-Nitrophenol	0	26	--	--	--	--
Benzoic acid	0	26	320,000	0	0	0%
Benzyl alcohol	0	26	8,000	0	0	0%
bis(2-Chloroethoxy)methane	0	26	--	--	--	--
bis(2-Chloroethyl)ether	0	26	0.01	26	26	100%
Butylbenzyl phthalate	0	26	0.038	26	6	100%
Carbazole	0	26	--	--	--	--
Diethyl phthalate	0	26	0.69	0	0	0%
Dimethyl phthalate	0	26	--	--	--	--
Di-n-butyl phthalate	0	26	1.8	0	0	0%
Dinitro-o-cresol (4,6-Dinitro-2-methylphenol)	0	26	--	--	--	--
Di-n-octyl phthalate	0	26	130	0	0	0%
Hexachlorobenzene	0	26	0.12	5	4	19%
Hexachlorobutadiene (Hexachloro-1,3-butadiene)	0	26	0.084	5	5	19%
Hexachlorocyclopentadiene	0	26	480	0	0	0%
Hexachloroethane	0	26	0.047	26	5	100%
Isophorone	0	26	0.39	2	0	8%
Nitrobenzene	0	26	0.84	0	0	0%
n-Nitrosodi-n-propylamine	0	26	0.01	26	26	100%
n-Nitrosodiphenylamine	0	26	0.039	26	12	100%
Pentachlorophenol	0	26	0.10	26	26	100%
Phenol	0	26	110	0	0	0%
Volatile Organics (mg/kg)						
1,1,1,2-Tetrachloroethane	0	28	38	0	0	0%
1,1,1-Trichloroethane	0	28	15	0	0	0%
1,1,2,2-Tetrachloroethane	0	28	0.005	13	13	46%
1,1,2-Trichloroethane	0	28	0.0069	13	13	46%
1,1,2-Trichlorotrifluoroethane	0	28	2,400,000	0	0	0%
1,1-Dichloroethane	0	28	1.6	--	--	--
1,1-Dichloroethene	0	28	0.005	13	13	46%
1,1-Dichloropropene	0	28	--	--	--	--
1,2,3-Trichlorobenzene	0	28	--	--	--	--
1,2,3-Trichloropropane	0	28	0.033	13	13	46%
1,2,4-Trichlorobenzene	0	28	0.01	13	13	46%
1,2-Dibromo-3-chloropropane	0	28	1.3	0	0	0%
1,2-Dichlorobenzene	0	28	0.02	13	13	46%
1,2-Dichloroethane	0	28	0.005	13	13	46%
1,2-Dichloroethene, cis-	0	28	0.091	0	0	0%
1,2-Dichloroethene, trans-	0	28	0.076	2	0	7%
1,2-Dichloropropane	0	28	0.0098	13	13	46%
1,3-Dichlorobenzene	0	28	--	--	--	--
1,3-Dichloropropane	0	28	--	--	--	--
1,3-Dichloropropene, cis-	0	28	--	--	--	--
1,3-Dichloropropene, trans-	0	28	--	--	--	--
1,4-Dichloro-2-butene, trans-	0	28	--	--	--	--
1,4-Dichlorobenzene	0	28	0.026	13	11	46%
2,2-Dichloropropane	0	28	--	--	--	--
2-Chloroethylvinyl ether	0	28	--	--	--	--
2-Chlorotoluene	0	28	1,600	0	0	0%
2-Hexanone (Methyl butyl ketone)	0	28	--	--	--	--
4-Chlorotoluene	0	28	--	--	--	--

Table 1b
Soil Summary Statistics - Non-detected Chemicals

Analytes	No. of Detections	No. of Samples	Most Stringent Screening Level (MS SL)	No. of Non-Usable Data	No. of Non-Usable Data with RL > 2x MS SL	Exceedance Frequency (RL>MS SL)
Acrolein	0	28	40	0	0	0%
Acrylonitrile	0	28	1.9	0	0	0%
Bromobenzene	0	28	--	--	--	--
Bromochloromethane	0	28	--	--	--	--
Bromodichloromethane	0	28	0.005	13	13	46%
Bromoform (Tribromomethane)	0	28	0.18	0	0	0%
Bromomethane (Methyl bromide)	0	28	0.005	13	13	46%
Carbon tetrachloride (Tetrachloromethane)	0	28	0.005	13	13	46%
Chlorobenzene	0	28	0.2	0	0	0%
Chloroethane	0	28	--	--	--	--
Chloroform	0	28	0.005	13	13	46%
Chloromethane	0	28	0.005	13	13	46%
Dibromochloromethane	0	28	0.005	13	13	46%
Dibromomethane	0	28	800	0	0	0%
Ethyl bromide (Bromoethane)	0	28	--	--	--	--
Ethylene dibromide (1,2-Dibromoethane)	0	28	0.02	13	13	46%
Hexachlorobutadiene (Hexachloro-1,3-butadiene)	0	28	0.084	13	13	46%
Methyl iodide (Iodomethane)	0	28	--	--	--	--
Methyl tert-butyl ether (MTBE)	0	7	--	--	--	--
Styrene	0	28	0.58	0	0	0%
Tetrachloroethene (PCE)	0	28	0.0079	13	13	46%
Trichloroethene (TCE)	0	28	0.005	13	13	46%
Trichlorofluoromethane (Fluorotrichloromethane)	0	28	24,000	0	0	0%
Vinyl acetate	0	28	2.6	0	0	0%
Vinyl chloride	0	28	0.005	13	13	46%

Notes:
1. Most Stringent Screening Level = Unrestricted Land Use-Saturated Soil
mg/kg = milligram per kilogram
MS SL = Most Stringent Screening Level
ND = non-detect
RL = reporting limit (from laboratory)
-- = Not Available or Not Applicable

Table 2a
Groundwater Summary Statistics

Analytes	No. of Detections	No. of Samples	Frequency of Detection	No. of Usable Data	Most Stringent Screening Level (MS SL)	No. of Detections > MS SL	Exceedance Frequency (Usable)	Usable Data 2x MS SL	Maximum Detected Concentration	Maximum Exceedance Factor	No. of Non-Usable Data	No. of Non-Usable Data with RL > 2x MS SL	Exceedance Frequency (w/Non-usable)	Chemical Selected for Mapping
Total Petroleum Hydrocarbons (µg/L)														
Gasoline range hydrocarbons	54	152	36%	152	800	35	23%	17%	41,000	51	0	0	23%	X
Diesel range hydrocarbons	76	153	50%	152	500	62	41%	31%	500,000	1,000	1	0	41%	X
Motor oil range hydrocarbons	52	154	34%	134	500	34	25%	16%	30,000	60.0	20	8	35%	X
Total Petroleum Hydrocarbons - Silica Gel Treated (µg/L)														
Diesel range hydrocarbons (silica gel treated)	1	4	25%	4	500	0	0%	0%	180	--	0	0	0%	X
Metals, Total (µg/L)														
Antimony	2	82	2%	82	--	0	--	--	21.5	--	--	--	--	
Arsenic	56	132	42%	63	5.0	56	89%	78%	2,460	492	69	47	95%	X
Barium	50	50	100%	50	--	0	--	--	715	--	0	0	0%	
Beryllium	15	82	18%	82	--	0	--	--	4.7	--	0	0	0%	
Cadmium	15	82	18%	50	8.8	4	8%	4%	55.9	6.4	32	0	44%	X
Chromium	104	132	79%	132	260	10	8%	4%	2,010	7.7	0	0	8%	X
Chromium VI	6	49	12%	49	50	0	0%	0%	2.7	--	0	0	0%	
Copper	77	132	58%	108	3.1	74	69%	56%	2,920	942	24	22	74%	X
Lead	57	151	38%	71	8.1	42	59%	46%	12,400	1,531	80	69	81%	X
Manganese	20	20	100%	20	100	13	65%	60%	1,910	19	0	0	65%	
Mercury	22	132	17%	22	0.059	22	100%	68%	3.4	58	110	25	100%	X
Nickel	55	129	43%	65	8.2	40	62%	43%	419	51	64	2	81%	X
Selenium	23	82	28%	82	71	0	0%	0%	69.6	--	0	0	0%	
Silver	16	82	20%	82	1,900	0	0%	0%	80.8	--	0	0	0%	
Thallium	6	82	7%	82	--	0	--	--	28.5	--	--	--	--	
Zinc	76	132	58%	132	81	31	23%	13%	11,400	141	0	0	23%	X
Metals, Dissolved (µg/L)														
Arsenic	1	17	6%	1	5.0	1.0	100%	100%	150	30	16	16	100%	
Barium	17	17	100%	17	--	0	--	--	202	--	--	--	--	
Chromium	10	17	59%	17	260	2	12%	12%	2,000	7.7	0	0	12%	
Nickel	2	17	12%	2	8.2	2	100%	100%	20	2.4	15	0	100%	
Zinc	2	17	12%	17	81	0	0%	0%	20	--	0	0	0%	
Polycyclic Aromatic Hydrocarbons (µg/L)														
1-Methylnaphthalene	14	53	26%	53	--	0	--	--	40	--	--	--	--	
2-Methylnaphthalene	7	53	13%	53	--	0	--	--	65	--	--	--	--	
Acenaphthene	56	113	50%	113	3.3	0	0%	0%	3.0	--	0	0	0%	
Acenaphthylene	21	113	19%	113	--	0	--	--	2.0	--	--	--	--	
Anthracene	39	113	35%	113	9.6	0	0%	0%	2.0	--	0	0	0%	
Benzo(a)anthracene	29	116	25%	62	0.02	21	34%	31%	2.0	100	54	54	65%	
Benzo(a)pyrene	21	116	18%	60	0.02	20	33%	28%	2.0	100	56	56	66%	
Benzo(b)fluoranthene	26	116	22%	60	0.02	23	38%	28%	2.0	100	56	56	68%	
Benzo(k)fluoranthene	22	116	19%	59	0.02	16	27%	19%	0.8	40	57	57	63%	
Benzo(g,h,i)perylene	21	113	19%	113	--	0	--	--	3.0	--	--	--	--	
Chrysene	33	116	28%	63	0.02	26	41%	33%	3.0	150	53	53	68%	
Dibenzo(a,h)anthracene	15	116	13%	59	0.02	9	15%	14%	0.5	25	57	57	57%	
Dibenzofuran	4	37	11%	53	--	0	--	--	1.0	--	--	--	--	

Table 2a
Groundwater Summary Statistics

Analytes	No. of Detections	No. of Samples	Frequency of Detection	No. of Usable Data	Most Stringent Screening Level (MS SL)	No. of Detections > MS SL	Exceedance Frequency (Usable)	Usable Data 2x MS SL	Maximum Detected Concentration	Maximum Exceedance Factor	No. of Non-Usable Data	No. of Non-Usable Data with RL > 2x MS SL	Exceedance Frequency (w/Non-usable)	Chemical Selected for Mapping
Fluoranthene	42	113	37%	113	3.3	1	1%	0%	4.0	1.2	0	0	1%	
Fluorene	48	113	42%	113	3.0	7.0	6%	4%	12	4.0	0	0	6%	
Indeno(1,2,3-c,d)pyrene	20	116	17%	60	0.02	17	28%	23%	2.0	100	56	56	63%	
Naphthalene	73	135	54%	135	83	12	9%	8%	1,900	23	0	0	9%	X
Phenanthrene	54	113	48%	113	--	0	--	--	41	--	--	--	--	
Pyrene	42	113	37%	113	15	0	0%	0%	8.0	--	0	0	0%	
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 1/2)	35	117	30%	64	0.02	24	38%	34%	2.8	138	53	53	66%	X
Semivolatile Organics (µg/L)														
1,4-Dichlorobenzene	6	16	38%	16	5.0	3.0	19%	0%	6.7	1.3	0	0	19%	
2,4-Dimethylphenol	3	16	19%	16	200	0	0%	0%	32	--	0	0	0%	
4-Methylphenol (p-Cresol)	1	16	6%	16	--	0	--	--	1.2	--	--	--	--	
bis(2-Ethylhexyl)phthalate	6	16	38%	16	1.0	5.0	31%	25%	25	25	0	0	31%	
Carbazole	2	16	13%	16	--	0	--	--	1.4	--	--	--	--	
Diethyl phthalate	1	16	6%	16	740	0	0%	0%	2.0	--	0	0	0%	
n-Nitrosodiphenylamine	1	16	6%	16	3.74	0.00	0%	0%	1.1	--	0	0	0%	
Volatile Organics (µg/L)														
1,2,4-Trimethylbenzene	5	55	9%	55	24	3	5%	0%	33	1.4	0	0	5%	
1,3,5-Trimethylbenzene (Mesitylene)	5	55	9%	55	25	0	0%	0%	19	--	0	0	0%	
1,4-Dichlorobenzene	4	28	14%	28	5.0	3.0	11%	7%	11	2.2	0	0	11%	
4-Isopropyltoluene (4-Cymene)	2	28	7%	28	--	0	--	--	1.4	--	--	--	--	
Acetone	5	28	18%	28	--	0	--	--	13	--	--	--	--	
Benzene	25	167	15%	157	2.4	21	13%	11%	970	404	10	10	19%	X
Carbon disulfide	2	28	7%	28	400	0	0%	0%	2.1	--	0	0	0%	
Chlorobenzene	3	28	11%	28	100	0	0%	0%	57	--	0	0	0%	
Ethylbenzene	38	167	23%	167	2,100	0	0%	0%	1,300	--	0	0	0%	
Isopropylbenzene (Cumene)	9	28	32%	28	720	0	0%	0%	30	--	0	0	0%	
Naphthalene	5	28	18%	28	83	1	4%	0%	130	1.6	0	0	4%	
n-Butylbenzene	5	28	18%	28	--	0	--	--	4.7	--	--	--	--	
n-Propylbenzene	8	28	29%	28	--	0	--	--	24	--	--	--	--	
sec-Butylbenzene	5	28	18%	28	--	0	--	--	8.6	--	--	--	--	
tert-Butyl alcohol (2-Methyl-2-propanol)	3	26	12%	26	--	0	--	--	130	--	--	--	--	
tert-Butylbenzene	2	28	7%	28	--	0	--	--	1.3	--	--	--	--	
Toluene	32	167	19%	167	7,300	0	0%	0%	78	--	0	0	0%	
m,p-Xylene	11	72	15%	72	--	0	--	--	140	--	--	--	--	
o-Xylene	5	72	7%	72	440	0	0%	0%	24	--	0	0	0%	
Total xylene (reported, not calculated)	24	95	25%	95	--	0	--	--	2,300	--	--	--	--	

Notes:

1. "Usable data" includes all detected results and non-detects below the most stringent screening level for groundwater results from 2002 to present.
2. Most Stringent Screening Level = Unrestricted Land Use-Groundwater

µg/L = microgram per liter
MS SL = Most Stringent Screening Level
ND = non-detect
RL = reporting limit (from laboratory)
TEQ = toxic equivalency quotient
-- = Not Available or Not Applicable

Table 2b
Groundwater Summary Statistics - Non-detected Chemicals

Analytes	No. of Detections	No. of Samples	Most Stringent Screening Level (MS SL)	No. of Non-Usable Data	No. of Non-Usable Data with RL > 2x MS SL	Exceedance Frequency (RL>MS SL)
Metals (µg/L)						
Vanadium	0	3	--	--	--	--
Metals, Dissolved (µg/L)						
Copper	0	17	3.1	0	0	0%
Lead	0	17	8.1	17	17	100%
Mercury	0	17	0.059	17	0	100%
Semivolatile Organics (µg/L)						
1,2,4-Trichlorobenzene	0	16	0.48	16	16	100%
1,2-Dichlorobenzene	0	16	6.1	0	0	0%
1,3-Dichlorobenzene	0	16	960	0	0	0%
2,2'-Oxybis (1-chloropropane)	0	16	14.3	0	0	0%
2,4,5-Trichlorophenol	0	16	3,600	0	0	0%
2,4,6-Trichlorophenol	0	16	2.4	16	16	100%
2,4-Dichlorophenol	0	16	73.3	0	0	0%
2,4-Dinitrophenol	0	16	1,400	0	0	0%
2,4-Dinitrotoluene	0	16	3.4	16	0	100%
2,6-Dinitrotoluene	0	16	--	--	--	--
2-Chloronaphthalene	0	16	390	0	0	0%
2-Chlorophenol	0	16	37.4	0	0	0%
2-Methylphenol (o-Cresol)	0	16	--	--	--	--
2-Nitroaniline	0	16	--	--	--	--
2-Nitrophenol	0	16	--	--	--	--
3,3'-Dichlorobenzidine	0	16	2.0	16	16	100%
3-Nitroaniline	0	16	--	--	--	--
4-Bromophenyl-phenyl ether	0	16	--	--	--	--
4-Chloro-3-methylphenol	0	16	--	--	--	--
4-Chloroaniline	0	16	--	--	--	--
4-Chlorophenyl phenyl ether	0	16	--	--	--	--
4-Nitroaniline	0	16	--	--	--	--
4-Nitrophenol	0	16	--	--	--	--
Benzoic acid	0	16	--	--	--	--
Benzyl alcohol	0	16	--	--	--	--
bis(2-Chloroethoxy)methane	0	16	--	--	--	--
bis(2-Chloroethyl)ether	0	16	0.53	16	0	100%
Butylbenzyl phthalate	0	16	0.35	16	16	100%
Dibenzofuran	0	16	--	--	--	--
Dimethyl phthalate	0	16	1,100,000	0	0	0%
Di-n-butyl phthalate	0	16	140	0	0	0%
Dinitro-o-cresol (4,6-Dinitro-2-methylphenol)	0	16	--	--	--	--
Di-n-octyl phthalate	0	16	0.2	16	16	100%
Hexachlorobenzene	0	16	0.2	16	16	100%
Hexachlorobutadiene (Hexachloro-1,3-butadiene)	0	16	0.2	16	16	100%
Hexachlorocyclopentadiene	0	16	1,100	0	0	0%
Hexachloroethane	0	16	3.3	0	0	0%
Isophorone	0	16	600	0	0	0%
Nitrobenzene	0	16	690	0	0	0%
n-Nitrosodi-n-propylamine	0	16	0.316	16	16	100%
Pentachlorophenol	0	16	3	16	0	100%
Phenol	0	16	216,000	0	0	0%
tert-Amyl methyl ether (TAME)	0	26	--	--	--	--
Total Petroleum Hydrocarbons - Silica Gel Treated (µg/L)						
Motor oil range hydrocarbons (silica gel treated)	0	4	500	0	0	0%
Volatile Organics (µg/L)						
1,1,1,2-Tetrachloroethane	0	28	7.4	0	0	0%
1,1,1-Trichloroethane	0	28	11,000	0	0	0%
1,1,2,2-Tetrachloroethane	0	28	4.0	0	0	0%
1,1,2-Trichloroethane	0	28	7.9	0	0	0%
1,1,2-Trichlorotrifluoroethane	0	28	1,100	0	0	0%
1,1-Dichloroethane	0	28	2,300	0	0	0%
1,1-Dichloroethene	0	28	3.2	0	0	0%
1,1-Dichloropropene	0	28	--	--	--	--
1,2,3-Trichlorobenzene	0	28	--	--	--	--
1,2,3-Trichloropropane	0	28	--	--	--	--
1,2,4-Trichlorobenzene	0	28	0.48	28	26	100%
1,2-Dibromo-3-chloropropane	0	28	--	--	--	--
1,2-Dichlorobenzene	0	28	6.1	0	0	0%
1,2-Dichloroethane	0	54	4.2	0	0	0%
1,2-Dichloroethene, cis-	0	28	160	0	0	0%
1,2-Dichloroethene, trans-	0	28	130	0	0	0%
1,2-Dichloropropane	0	28	15	0	0	0%
1,3-Dichlorobenzene	0	28	960	0	0	0%
1,3-Dichloropropane	0	28	--	--	--	--
1,3-Dichloropropene, cis-	0	28	--	--	--	--

Table 2b
Groundwater Summary Statistics - Non-detected Chemicals

Analytes	No. of Detections	No. of Samples	Most Stringent Screening Level (MS SL)	No. of Non-Usable Data	No. of Non-Usable Data with RL > 2x MS SL	Exceedance Frequency (RL>MS SL)
1,3-Dichloropropene, trans-	0	28	--	--	--	--
1,4-Dichloro-2-butene, trans-	0	28	--	--	--	--
2,2-Dichloropropane	0	28	--	--	--	--
2-Butanone (MEK)	0	28	350,000	0	0	0%
2-Chloroethylvinyl ether	0	28	--	--	--	--
2-Chlorotoluene	0	28	--	--	--	--
2-Hexanone (Methyl butyl ketone)	0	28	--	--	--	--
4-Chlorotoluene	0	28	--	--	--	--
Acrolein	0	28	20	26	26	93%
Acrylonitrile	0	28	5.0	0	0	0%
Bromobenzene	0	28	--	--	--	--
Bromochloromethane	0	28	--	--	--	--
Bromodichloromethane	0	28	0.5	26	0	93%
Bromoform (Tribromomethane)	0	28	140	0	0	0%
Bromomethane (Methyl bromide)	0	28	13	0	0	0%
Carbon tetrachloride (Tetrachloromethane)	0	28	0.5	26	0	93%
Chloroethane	0	28	12	0	0	0%
Chloroform	0	28	1.2	0	0	0%
Chloromethane	0	28	5.2	0	0	0%
Dibromochloromethane	0	28	0.5	26	0	93%
Dibromomethane	0	28	--	--	--	--
Dichloromethane (Methylene chloride)	0	28	94	0	0	0%
Diisopropylether	0	18	--	--	--	--
Ethanol	0	7	--	--	--	--
Ethyl bromide (Bromoethane)	0	28	--	--	--	--
Ethyl tert-butyl ether (ETBE)	0	26	--	--	--	--
Ethylene dibromide (1,2-Dibromoethane)	0	54	2.0	0	0	0%
Hexachlorobutadiene (Hexachloro-1,3-butadiene)	0	28	0.2	28	28	100%
Methyl iodide (Iodomethane)	0	28	--	--	--	--
Methyl isobutyl ketone (4-Methyl-2-pentanone or (MIBK))	0	28	11,000	0	0	0%
Methyl tert-butyl ether (MTBE)	0	63	--	--	--	--
Styrene	0	28	78	0	0	0%
Tetrachloroethene (PCE)	0	28	3.3	0	0	0%
Trichloroethene (TCE)	0	28	1.6	0	0	0%
Trichlorofluoromethane (Fluorotrichloromethane)	0	28	120	0	0	0%
Vinyl acetate	0	28	7,800	0	0	0%
Vinyl chloride	0	28	0.5	26	0	93%

Notes:

1. Most Stringent Screening Level = Unrestricted Land Use-Groundwater

µg/L = microgram per liter

MS SL = Most Stringent Screening Level

ND = non-detect

RL = reporting limit (from laboratory)

-- = Not Available or Not Applicable

Table 3
Porewater Summary Statistics

Analytes	No. of Detections	No. of Samples	Frequency of Detection	Most Stringent Screening Level (MS SL)	No. of Non-Usable Data	No. of Non-Usable Data with RL > 2x MS SL	Exceedance Frequency (Usable)	Maximum Detected Concentration	Maximum Exceedance Factor	Chemical Selected for Mapping
Total Petroleum Hydrocarbons (µg/L)										
Gasoline range hydrocarbons	2	7	29%	800	0	0	0%	180	--	X
Diesel range hydrocarbons	6	7	86%	500	0	0	33%	1,400	2.8	X
Motor oil range hydrocarbons	6	7	86%	500	0	0	50%	1,600	3.2	X
Total Petroleum Hydrocarbons - Silica Gel Treated (µg/L)										
Diesel range hydrocarbons (silica gel treated)	0	7	0%	500	0	0	0%	--	--	X
Motor oil range hydrocarbons (silica gel treated)	2	7	29%	500	0	0	50%	1,100	2.2	X
Volatile Organics (µg/L)										
Benzene	1	7	14%	2.4	0	0	100%	66	28	X
Ethylbenzene	1	7	14%	2,100	0	0	0%	0.32	--	--
m,p-Xylene	1	7	14%	--	--	--	--	1.50	--	--
o-Xylene	0	7	0%	440	0	0	0%	--	--	--
Toluene	3	7	43%	7,300	0	0	0%	1.90	--	--

Notes:

1. All porewater data are classified as "usable data" (includes all detected results and non-detects below the most stringent screening level).
2. Most Stringent Screening Level = Unrestricted Land Use-Groundwater

µg/L = microgram per liter

MS SL = Most Stringent Screening Level

ND = non-detect

RL = reporting limit (from laboratory)

-- = Not Available or Not Applicable

Table 4
Seep Water Summary Statistics

Analytes	No. of Detections	No. of Samples	Frequency of Detection	Most Stringent Screening Level (MS SL)	No. of Non-Usable Data	No. of Non-Usable Data with RL > 2x MS SL	Exceedance Frequency (Usable)	Maximum Detected Concentration	Maximum Exceedance Factor	Chemical Selected for Mapping
Total Petroleum Hydrocarbons (µg/L)										
Gasoline range hydrocarbons	1	2	50%	800	0	0	0%	70	0.1	X
Diesel range hydrocarbons	1	2	50%	500	0	0	100%	960	1.9	X
Motor oil range hydrocarbons	1	2	50%	500	1	0	0%	250	0.5	X
Total Petroleum Hydrocarbons - Silica Gel Treated (µg/L)										
Diesel range hydrocarbons (silica gel treated)	0	2	0%	500	0	0	0%	--	--	X
Motor oil range hydrocarbons (silica gel treated)	0	2	0%	500	0	0	0%	--	--	X
Volatile Organics (µg/L)										
Benzene	0	2	0%	2.4	0	0	0%	--	--	X
Ethylbenzene	0	2	0%	2,100	0	0	0%	--	--	--
m,p-Xylene	0	2	0%		0	0	0%	--	--	--
o-Xylene	0	2	0%	440	0	0	0%	--	--	--
Toluene	0	2	0%	7,300	0	0	0%	--	--	--

Notes:

1. All seep water data are classified as "usable data" (includes all detected results and non-detects below the most stringent screening level), except one TPH-Diesel range hydrocarbons sample.
2. Most Stringent Screening Level = Unrestricted Land Use-Groundwater

µg/L = microgram per liter
MS SL = Most Stringent Screening Level
ND = non-detect
RL = reporting limit (from laboratory)
-- = Not Available or Not Applicable

APPENDIX F
DEVELOPMENT OF SOIL TPH RESIDUAL SATURATION CONCENTRATION

This appendix documents the development of site-specific soil total petroleum hydrocarbons (TPH) residual saturation value for the Central Waterfront Site (Site). When establishing TPH soil cleanup levels, generation of mobile non-aqueous phase liquid (NAPL; i.e., residual saturation) needs to be addressed, in addition to direct contact and soil-to-groundwater pathways. Residual saturation is the concentration below which the NAPL is not mobile. The residual saturation concentration depends on characteristics of the NAPL (e.g., density and viscosity) and soil (e.g., moisture content and permeability).

A site-specific residual saturation concentration can be estimated based on empirical measurements of pore fluid saturation of NAPL following centrifuging soil samples containing NAPL. During the 2007-2008 remedial investigation, two NAPL-producing soil samples (CWSB-5-6-8 and CWSB-10-9-9.5) were centrifuged and analyzed for volume of NAPL (Table 3-6, AECOM 2009). The percent by volume of NAPL within soil pore space was 9.5% and 10.1% for each of the two samples, respectively (9.8% in average). For this analysis, NAPL volumes have been converted to concentrations using the following equation:

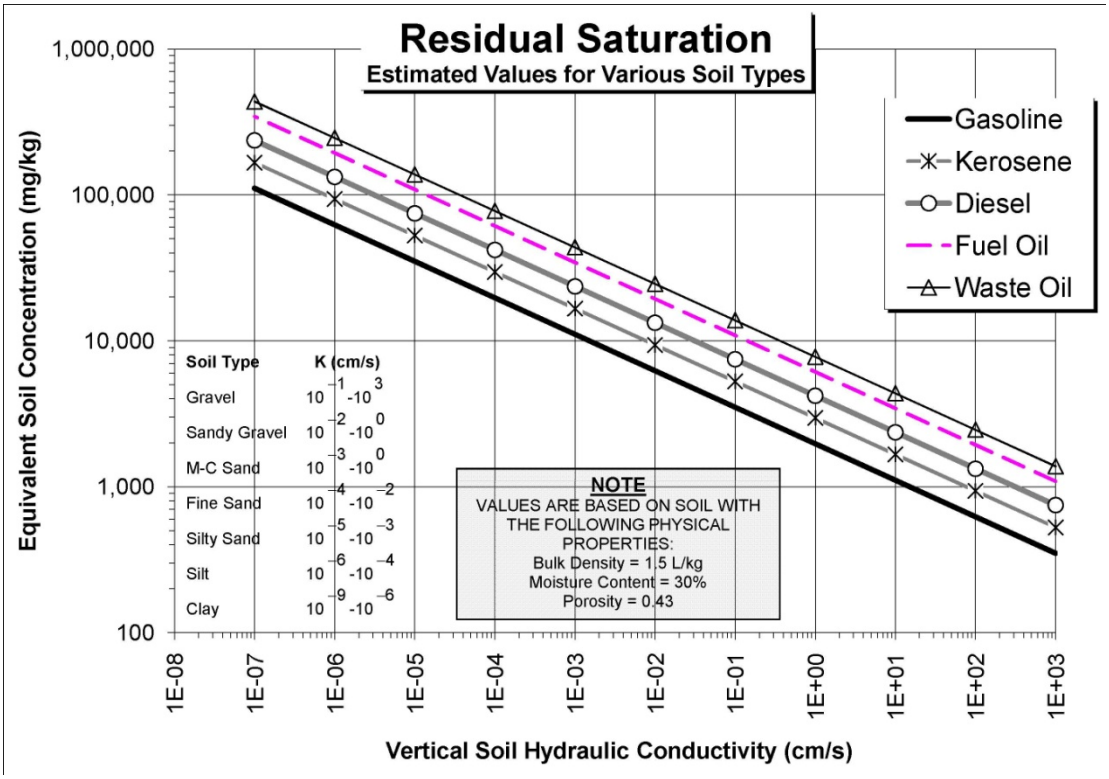
$$C_{NAPL} = \frac{M_{NAPL}}{M_{NAPL} + M_s} = \frac{V_{NAPL} \times \rho_{NAPL}}{V_{NAPL} \times \rho_{NAPL} + V_s \times \rho_s} = \frac{S_{or} \times V_b \times \rho_{NAPL}}{S_{or} \times V_b \times \rho_{NAPL} + (1 - V_b) \times \rho_s}$$

where:

C_{NAPL} = concentration of NAPL, per dry weight mass of soil
M_{NAPL} = mass of NAPL
M_s = mass of solids
ρ_{NAPL} = density of NAPL
ρ_s = density of solids
V_{NAPL} = volume of NAPL
V_s = volume of solids
S_{or} = residual NAPL pore fluid saturation after centrifuging
V_b = bulk volume (total porosity)

The calculated NAPL concentrations for samples CWSB-5-6-8 and CWSB-10-9-9.5 were 20,000 milligrams per kilogram dry weight (mg/kg dw) and 17,000 mg/kg dw, respectively, and the resulting average was 19,000 mg/kg dw using the equation above, with appropriate conversion factors and rounded to two significant digits. Table F-1 provides a detailed summary of the data input and calculation of the residual saturation value.

These site-specific calculations were compared to general estimates of residual NAPL concentrations developed from theoretical calculations and literature values. The plot below, originally generated by Ecology (Aspect Consulting 2013), provides theoretical estimates of residual saturation (as equivalent soil concentration in mg/kg) for various petroleum product types as a function of soil saturated vertical hydraulic conductivity (Kv), and using Model Toxics Control Act (MTCA) default values for soil physical properties (total porosity, moisture content, and bulk density).



In the light NAPL (LNAPL) impacted area of the Site, the groundwater table is in a silty sand lithology. Hydraulic conductivities, estimated during the Roeder Avenue Landfill RI/FS (2001) using slug test results, ranged from $2x10^{-3}$ to $2x10^{-2}$ centimeters per second (cm/s) (5 to

60 feet/day) for the Sand Unit (AECOM 2009). At these conductivities, the plot shows that the empirical calculation of residual NAPL of 19,000 mg/kg is reasonable for the diesel and gasoline mixture observed at the Site.

REFERENCES

AECOM, 2009. Remedial Investigation/Feasibility Study for the Central Waterfront Site. Bellingham, Washington. August 2009.

Aspect Consulting, 2013. Remedial Investigation for the Georgia-Pacific West Site. August 5, 2013.

TABLE

Table F-1
Calculation of Soil TPH Residual Saturation Concentration

General Equation:

Mass of Soil (M_{total}) = Mass of Water (M_w) + Mass of Solids (M_s) + Mass of NAPL (M_{NAPL}) + Mass of Air (M_a)

where Masses of Air (M_a) and Water (M_w) are negligible. Dry weight-based TPH concentrations are assumed.

Since:

Mass = density (ρ) * volume (V)

Therefore:

Mass of Soil (M_{total}), dry weight = Mass of Solids (M_s) + Mass of NAPL (M_{NAPL}) = $\rho_s * V_s + \rho_{NAPL} * V_{NAPL}$

Then:

NAPL Concentration, dry weight (C_{NAPL}) = $M_{NAPL} / (M_s + M_{NAPL}) = \rho_{NAPL} * V_{NAPL} / (\rho_s * V_s + \rho_{NAPL} * V_{NAPL})$ (NAPL fraction)

Assumed Parameters

V_{total}	1	liter = 1000 cc (unit volume)	

Measured Parameters [1]

Density of Solids (ρ_s)	=	2.69	g/cc
Density of NAPL (ρ_{NAPL})	=	0.86	g/cc
NAPL Residual Saturation, as % of V_{void} (S_{or})	=	9.8%	(post-centrifuge average measurement)
Bulk Volume (Total Porosity), as V_{void} / V_{total} (V_b)	=	37.7%	(average measurement)

Calculated Parameters

Volume of Solids (V_s)	=	62%	= 1 - Total Porosity
Volume of Solids (V_s)	=	623	gram/1000 cc of soil (units conversion to relate to 1 L of soil)
Mass of Solids (M_s)	=	1676	gram/1000 cc of soil = $\rho_s * V_s$
Volume of NAPL (V_{NAPL})	=	3.7%	= NAPL Residual Saturation * Bulk volume
Volume of NAPL (V_{NAPL})	=	37	cc/1000 cc of soil (units conversion to put in terms of 1 L of soil)
Mass of NAPL (M_{NAPL})	=	32	grams/1000 cc soil, = $\rho_{NAPL} * V_{NAPL}$
NAPL Concentration @ Residual Saturation, as %	=	1.9%	= $M_n / (M_s + M_n)$
NAPL Concentration @ Residual Saturation (C_{NAPL})	=	**19000**	**mg/kg** (expressed as parts per million, dry weight)

Note:

1. Measured parameters are based on 2007 samples CWSB-5-6-8 and CWSB-10-9-9.5, from Table 3-6 of Section 3 (Free Product Mobility: Initial and Residual Saturation) of the Central Waterfront Site RI/FS (AECOM, 2009).

APPENDIX G
DOCUMENTATION ON CLAY BERM ALONG LANDFILL/ASB INTERFACE

U. S. ARMY ENGINEER DISTRICT. SEATTLE
CORPS OF ENGINEERS
1519 ALASKAN WAY SOUTH
SEATTLE 4. WASHINGTON

ADDRESS REPLY TO
DISTRICT ENGINEER
(NOT TO INDIVIDUALS)

REFER TO NPSOP-00

29 October 1964

PUBLIC NOTICE NO. P-64-138

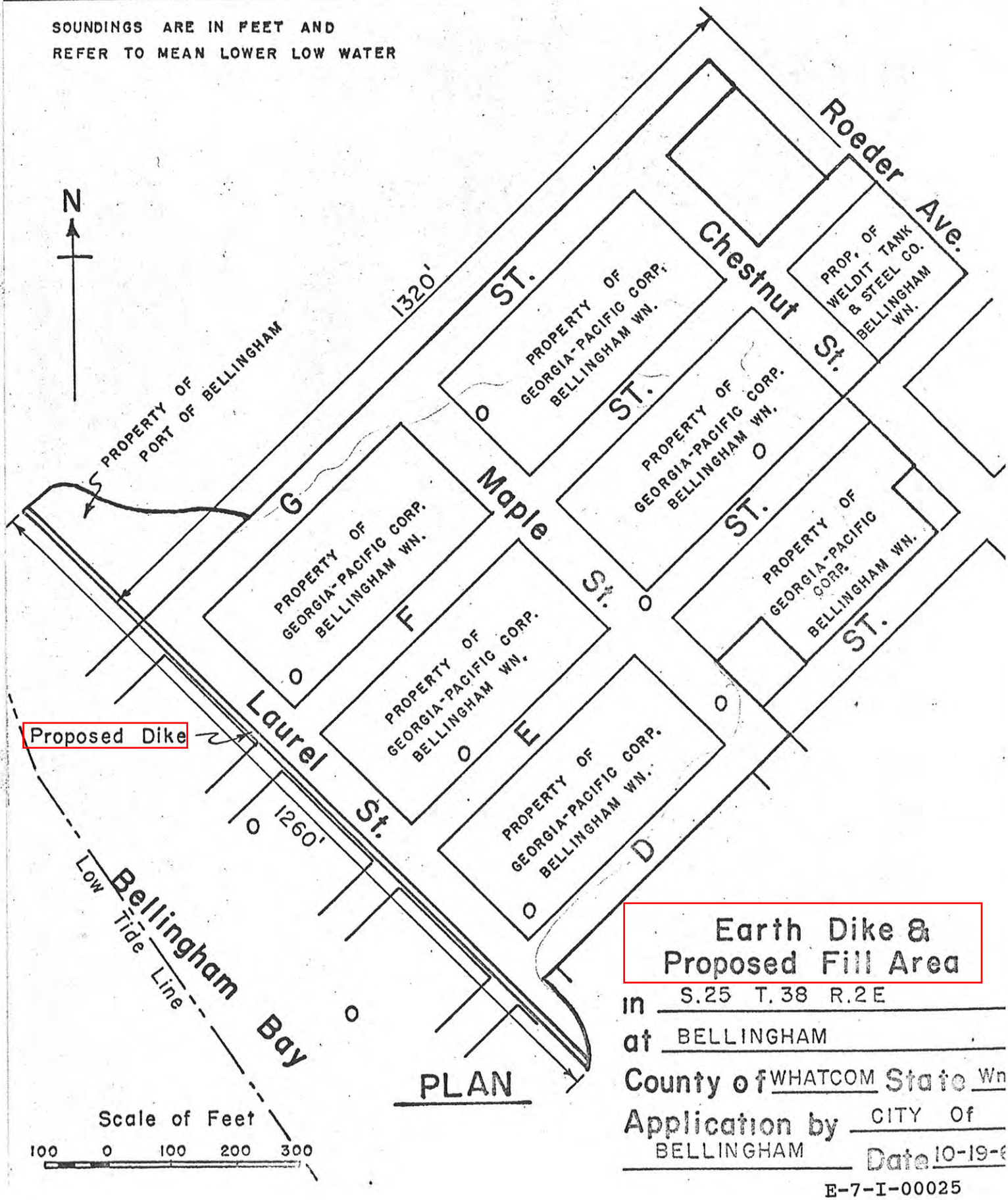
Application has been received by this office from the City of Bellingham, Engineering Department, 210 Lottie Street, Bellingham, Washington for a Department of the Army permit to construct a bulkhead and to place a sanitary fill in the waters of Bellingham Bay, at Bellingham, as shown on the inclosed prints.

Interested parties are requested to submit, in writing, any comments or objections that they may have to the proposed work. Replies to this notice should be mailed to reach this office not later than 29 November 1964 to insure consideration.

W E Spencer
FOR K. F. SMRHA
Chief, Operations Division

3 Incl
Prints (back to back)

E-7-I-00024



Earth Dike & Proposed Fill Area

in S.25 T.38 R.2E

at BELLINGHAM

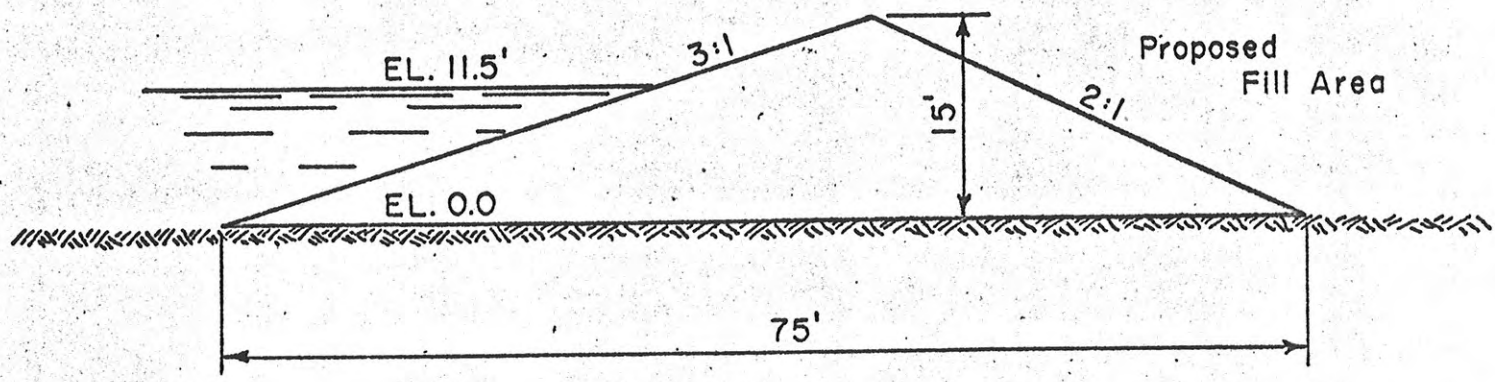
County of WHATCOM State Wn

Application by CITY Of BELLINGHAM

Date 10-19-

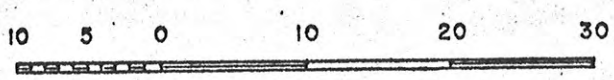
E-7-I-00025

DATUM - CORPS OF ENGINEERS
MEAN LOWER LOW WATER
TIDAL RANGE 0.0' TO 11.5'



TYPICAL SECTION

SCALE OF FEET



Proposed Earth Dike

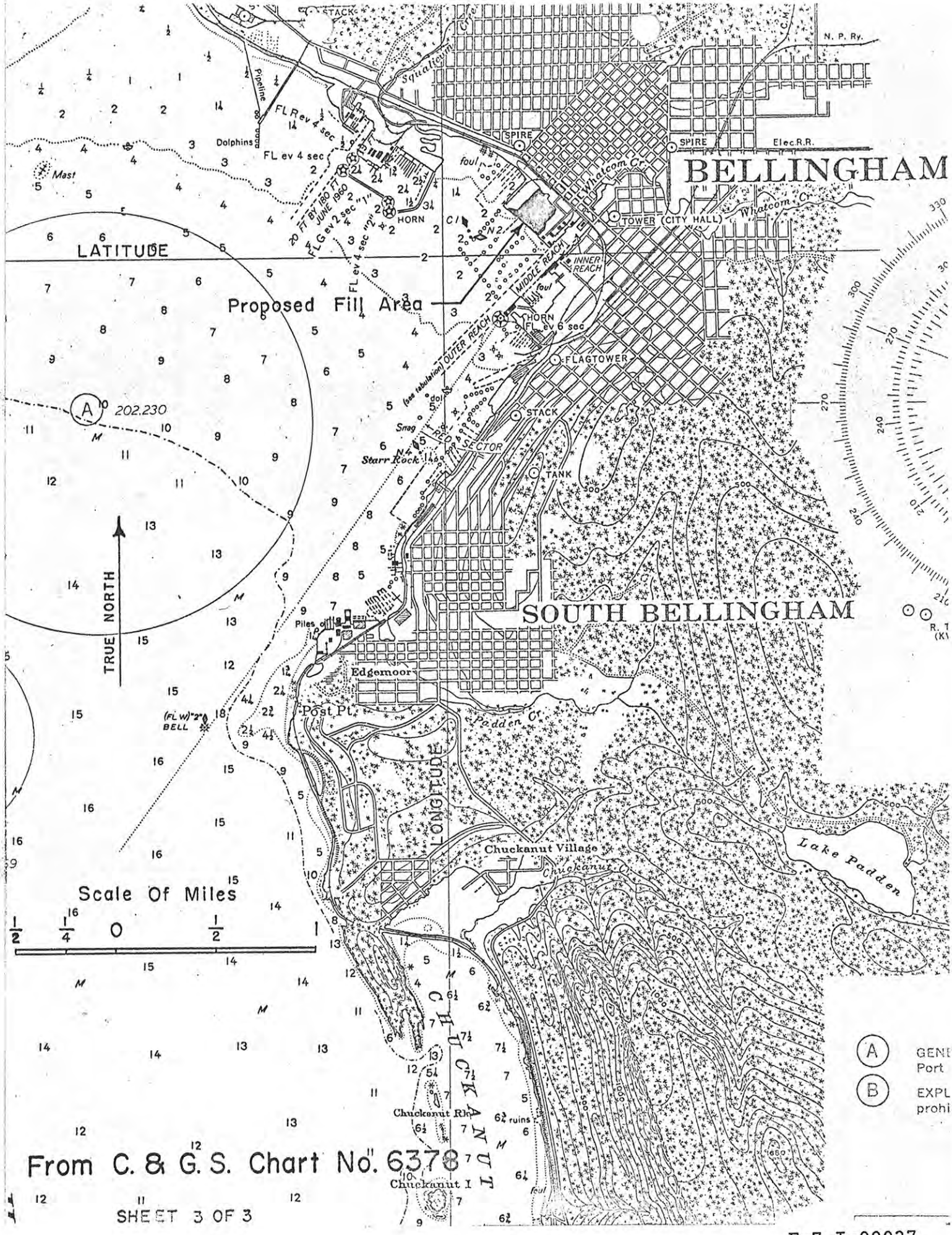
in S. 25 T. 38 R. 2 E

at BELLINGHAM

County of WHATCOM State Wn.

Application by CITY Of BELLINGHAM Date 10-19-64

E-7-I-00026


BELLINGHAM
SOUTH BELLINGHAM
Proposed Fill Area
LATITUDE
LONGITUDE
TRUE NORTH
202.230
Starr Rock
Edgemoor
Post Pt.
Padden Cr.
Lake Padden
Chuckanut Village
Chuckanut Rk
Chuckanut I
Whatcom Cr.
Squalicum Cr.
N. P. Ry.
Elec.R.R.
SPIRE
TOWER (CITY HALL)
FLAGTOWER
STACK
TANK
HORN
Mast
Dolphins
Pipeline
INNER REACH
MIDDLE REACH
OUTER REACH
Scale Of Miles
From C. & G. S. Chart No. 6378
SHEET 3 OF 3
E-7-I-00027

Mailing list attached to Public Notice No. P-64-138 - City of Bellingham - Bellingham Har

Postmaster, Bellingham, Wash. (to post)

Commandant, 13th Naval District, Sand Point Naval Air Station, Seattle, Wash. 98115
Northwest Div., Bureau of Yards & Docks, 1638 W. Lawton Way, Seattle, Wn. 98199
Commander, 13th Coast Guard District, Attn: Aids to Navigation, 618 - 2d Ave., Seattle 981
Regional Officer, Coast and Geodetic Survey, 1801 Fairview Ave. East, Seattle 98102
Public Health Service, Water Supply & Pollution Control Program, Pacific NW, Rm 570 Pittock Block, Portland, Oregon 97205
Reg. Dir., Bur of Sport Fisheries & Wildlife, PO Box 3537, Portland, Ore. 97208 (3)
Program Dir., Columbia Fisheries Program Ofc, Bur of Commercial Fisheries, PO Box 4332 Portland, Oregon 97208
Northwest Rivers and Harbors Congress, 3070 N. W. Front Avenue, Portland, Ore. 97210
Inland Empire Waterways Assn., PO Box 98, Walla Walla, Wash. 99362
S. S. SACRAMENTO, Navigation Dept., Puget Sound Naval Shipyard, Bremerton, Wn 98314

Washington State Highway Comm., Highways-Licenses Bldg., Olympia, Wash. 98502
Washington State Toll Bridge Authority, Highways-Licenses Bldg., Olympia, Wash. 98502
Washington State Dept. of Natural Resources, PO Box 110, Olympia, Wash. 98501
Washington State Pollution Control Comm., 409 Public Health Bldg., Olympia, Wn. 98501
Washington State Dept. of Fisheries, Rm 115 General Admin Bldg., Olympia, Wn. 98502
Washington State Department of Game, 600 N. Capitol Way, Olympia, Wn. 98502
Washington State Department of Conservation, 335 General Admin Bldg., Olympia, Wn. 98502
Washington State Department of Health, Department of Public Health Bldg., Olympia, Wash.

Port of Bellingham, Bellingham, Wash. PO Box 728
Whatcom County Dept. of Health, Bellingham, Wash.

Foss Launch and Tug Co., 660 West Ewing St., Seattle, Wash.
Pacific Tow Boat Co., Everett, Wash.
Pacific Tow Boat Co., Anacortes, Wash.
Bellingham Tug and Barge, Bellingham, Wash.
American Tug Boat Co., Pier 2, Everett, Wash.
Pioneer Towing Co., 5001 Ea. Marginal Way, Seattle

Bellingham Yacht Club, Bellingham, Wash.
Bellingham Boat Owners Assn., Bellingham, Wash.

Anacortes American, Box 30, Anacortes, Wash. (News item only)
KGMI Radio, Box 943, Bellingham, Wash. (News item only)
Bellingham Herald, Bellingham, Wash. -do-
Anacortes Reporter, Inc. 911 Commercial, Anacortes, Wash. (News item only)

Georgia Pacific Corp., PO Box 1236, Bellingham, Wash.
Gilbert R. Fales, 1820 16th Ave., Seattle
Bellingham Builders Supply Co., "C" & West Maple, Bellingham, Wash.
Croy Construction Co., 1107 "C" St., Bellingham, Wash.
George V. LaClair, 1400 "H" Street, Bellingham, Wash.
Standard Oil Co. of California, 1020 "C" St., Bellingham, Wash.

Natural Resources Development Assn., Box 800, Lincoln, Neb.

Information copies to:
Applicant
Chief of Engineers Attn: ENGCW-ON
US Army Engr Div., North Pacific
Exec Ofc
Smrha
Engrg Div
Technical Liaison Br

The City of Bellingham

ENGINEERING DEPARTMENT
210 Lottie Street
Bellingham, Washington

W. E. CAMERON
CITY ENGINEER

October 19, 1964

The District Engineer
U.S. Army Engineer District
1519 S. Alaskan Way
Seattle, Washington

Gentlemen:

The City of Bellingham requests permission to construct a dike on Laurel Street between "D" Street and to the northwest of "G" Street to connect to the existing bulkheads. The City plans to conduct a sanitary fill in the area between Roeder Avenue, Laurel Street, "D" Street and "G" Street. This will be done according to the rules and regulations of the Bellingham and Whatcom County Department of Public Health. This site has been approved by said Health Department.

This site is located on Bellingham Bay and is within the corporate limits of the City of Bellingham.

Very truly yours,

W. E. Cameron

W.E.CAMERON
City Engineer

WEC:1

The City of Bellingham

ENGINEERING DEPARTMENT
210 Lottie Street
Bellingham, Washington

W. E. CAMERON
CITY ENGINEER

October 23, 1964

District Engineer
Corps of Engineers
1519 Alaskan Way South
Seattle, Washington 98134

Attn: Robert R. Spearman

Refer to: NPSOP-OO

Gentlemen:

As requested in your letter of October 22, 1964, the names and mailing addresses of the adjacent property owners are listed below.

Port of Bellingham
P. O. Box 728
Bellingham, Washington

Georgia Pacific Corporation
P. O. Box 1236
Bellingham, Washington

Gilbert R. Fales
1820 16th Avenue
Seattle, Washington

Bellingham Builders Supply Co.
"C" & West Maple
Bellingham, Washington

Croy Construction Co.
1107 "C" Street
Bellingham, Washington

George V. LaClair
1400 "H" Street
Bellingham, Wash.

Standard Oil Company
of California
1020 "C" Street
Bellingham, Wash.

Very truly yours,

W. E. Cameron

W. E. CAMERON
City Engineer

WEC:cp

E-7-I-00031

4/28/65

AGREEMENT

AS TO USE OF PROPERTY

FOR SANITARY LANDFILL

THIS AGREEMENT made and entered into in duplicate this _____ day of April, 1965, by and between the CITY OF BELLINGHAM, a municipal corporation of the State of Washington of the first class, hereinafter called "First Party", and GEORGIA-PACIFIC CORPORATION, a corporation, through its Puget Sound Division, hereinafter called "Second Party",

WITNESSETH:

WHEREAS, Second Party owns certain real estate hereinafter described which First Party has inspected and believes to be suitable for use as a sanitary landfill area, and

WHEREAS, First Party is in need of a location to be used for a sanitary landfill,

NOW, THEREFORE, IT IS AGREED BETWEEN THE PARTIES, that the City of Bellingham shall use certain property on the following terms and conditions as hereinafter set forth:

1. The property owned by Second Party to be used for sanitary landfill purposes by First Party is more particularly described as follows:

All of Tideland Lots 101, 102, 122 and 131;

All of Tideland Lot 121, EXCEPT the following described tracts:

The Northwesterly 50 feet of the Southeasterly 150 feet of the Northeasterly 110 feet thereof.

AND the Northwesterly 50 feet of the Southeasterly 100 feet of the Northeasterly 110 feet thereof.

All of Tideland Lot 132, EXCEPT the following described tracts:

Commencing at the East corner of said Lot 132, thence running Northwesterly along the boundary line of said Lot and Chestnut Street in the City of Bellingham, Washington, a distance of 100 feet to a point; thence running at right angles Southwesterly on a line parallel with D Street in said City a distance of 50 feet to a point; thence at right angles Southeasterly a distance of 100 feet to the Southeasterly boundary line of said Tideland Lot; thence at right angles Northeasterly along the Southeasterly boundary line of said Tideland Lot, a distance of 50 feet to the place of beginning.

AND commencing at the Southeasterly corner of said Lot 132, being the corner of Maple and D Streets; thence Northwesterly 100 feet; thence at right angles Northeasterly, 100 feet; thence at right angles Southeasterly 100 feet, to D Street; thence Southwesterly along the line of D Street, 100 feet, to the place of beginning.

ALL in "Whatcom County Tide Land Appraisers' Map of New Whatcom Tide-Lands, State of Washington, " now a part of the consolidated City of Bellingham, Whatcom County, Washington, as per the map thereof, recorded in Book 4 of Plats, page 31, in the Auditor's office of said county and state.

Together with those portions of streets to be vacated as herein provided which will become the property of Second Party.

2. First Party will have complete supervision and responsibility for the use of this property as a sanitary landfill including the building of a dike on Laurel Street to be vacated as herein provided. First Party warrants that the operations contemplated hereunder will in all respects be in compliance with all laws, ordinances, rules, or regulations of any government agency having jurisdiction over said operations. First Party will, during the term hereof, indemnify and save harmless Second Party from any and all liability or responsibility as the result of First Party's use of said property. First Party's use shall include the operations of the contractor, the public, or any third party using said property for the disposal of waste.

3. First Party will build a dike to an elevation of approximately fifteen feet (15') above sea level according to City of Bellingham datum along Laurel Street, said dike running between "D" Street and Hilton Avenue. Second Party will reimburse First Party up to a maximum of thirty per cent (30%) of the first Thirty Thousand Dollars' ($30,000.00) cost of said dike. First Party will pay the remaining seventy per cent (70%) of the cost of the first $30,000.00 and all additional cost of said dike, if any. Prior to filling any portion of said property, including vacated streets or portions thereof belonging to Second Party, First Party shall remove all buildings or structures of any kind therefrom in preparation for said sanitary landfill.

4. As further consideration for the use of this property, the City of Bellingham will obtain the consent of other abutting property owners and will vacate streets, at no cost to Second Party or to other abutting property owners, as follows:

"D" Street from southwesterly line of Chestnut to southwesterly line of Laurel;

"E" Street from southwesterly line of Chestnut to southwesterly line of Laurel;'

"F" Street from southwesterly line of Chestnut to southwesterly line of Laurel;

"G" Street from southwesterly line of Chestnut to southwesterly line of Laurel;

Maple Street from northwesterly line of "G" Street to southeasterly line of "D" Street;

Laurel Street from northeasterly line of "G" Street to southeasterly line of "D" Street.

First Party further will fill the property of Second Party as hereinbefore described, including those portions of the vacated streets which will become the property of Second Party upon vacation, by the sanitary landfill method to a height even with the dike as constructed pursuant to this contract.

5. After commencement of operations on said property owned by Second Party, First Party will use said property exclusively for disposal of all wastes collected in the City of Bellingham until said property is filled as contemplated herein. First Party will utilize no other areas for this purpose during the term of this agreement. As soon as said landfill has been completed in accordance with the terms hereof, First Party may terminate this agreement and release the land back to Second Party, but in any event all rights to use said property for the purposes contemplated herein shall expire ten years from the commencement of operations unless said term is extended by Second Party.

6. First Party, at present, has a contract with City Sanitary Service, Bellingham, Washington, for the dumping of waste materials which will be extended to include this area, and First Party will take full responsibility for the compliance by City Sanitary Service with the provisions of this agreement as well as the performance by City Sanitary Service of the contract with First Party, a copy of which is attached hereto.

7. Irrespective of the contract with City Sanitary Service, which terminates prior to this agreement, First Party hereto will maintain the area above described and direct its use as a sanitary landfill, and at all times maintain said area in a safe and sanitary condition in all respects under rules and regulations as now are or hereafter may be promulgated or adopted by the Washington State Board of Health and in accordance with the following conditions established by the City of Bellingham and the Whatcom County Department of Public Health:

a. All garbage and refuse, including burnable refuse be disposed of by the sanitary landfill method. The term "sanitary landfill" shall mean the final deposition of garbage and refuse where each day's accumulation is formed into one or more cells on the same day that deposition occurs. A cell is formed by compacting garbage and refuse and covering the sides, top, and faces with compacted earth.

b. No burning shall be permitted on the site.

c. Blowing paper and debris shall be confined to the disposal site.

d. The fill, when finished, shall be at the level of the dike hereinbefore provided and shall have a minimum covering of earth two feet in depth.

e. There shall be no accumulation of salvage or other materials at or near the site. All such materials shall be removed from the site weekly or incorporated into the sanitary landfill.

8. Second Party shall have the right to use said property for dumping refuse resulting from its operations, including pulp screenings. Second Party shall dump its refuse and pulp screenings in trucks owned or leased by Second Party and shall limit the dumping to the times when said property is open to the public. During the term hereof, Second Party shall pay to First Party's contractor the sum of Twenty-Five Dollars ($25.00) per month as a flat rate for dumping its refuse other than pulp screenings. For all pulp screenings Second Party shall pay First Party's contractor One Dollar ($1.00) per truck load thereof. Said charges have been agreed to by said contractor and accepted by the Board of Public Works of First Party in accordance with its contract with City Sanitary Service as a reasonable charge for said use as evidenced by the signatures of First Party hereto. Said charges shall be established in future collection contracts executed by the City to be applicable to Second Party during the period of this agreement.

9. It is further agreed that the Second Party shall have the right to use portions of this fill area when the same have been filled to the level required, provided said use does not unreasonably interfere with First Party's performance of this agreement.

10. Second Party, in order to replace the log storage area lost by the proposed use of the property contemplated herein, is in the process of acquiring additional tideland properties which it does not now own within the area bounded

by "G" Street, Whatcom Creek Waterway, Laurel Street, and the Inner Harbor Line. Upon the acquisition of these properties, First Party will at the request of Second Party, vacate the streets within said area, including those streets named. In the event Second Party does not acquire all said properties, First Party will vacate those streets lying between those blocks which Second Party owns or where the owner thereof, other than Second Party, joins with Second Party and consents to the vacation of said street involved.

11. Should First Party default in the performance of any of the terms hereof, and should such default continue after thirty days' notice in writing by Second Party, then Second Party may terminate this agreement by notice in writing to that effect. Such termination shall be effective sixty days from the date of such notice at which time all rights to the use of Second Party's properties by First Party shall cease.

IN WITNESS WHEREOF, the parties hereto have executed this agreement the day and year first above written.

CITY OF BELLINGHAM

By _____
Mayor

Attest:

_____
City Comptroller

"First Party"

GEORGIA-PACIFIC CORPORATION
PUGET SOUND DIVISION

By _____
Vice President

By _____
Assistant Secretary

"Second Party"

STATE OF WASHINGTON)
: ss.
COUNTY OF WHATCOM)

On this 28 day of April, 1965, before me, the undersigned notary public, personally came JOHN E. WESTFORD and ALFRED B. LOOP, to me known to be respectively the Mayor and City Comptroller of the City of Bellingham, the municipal corporation named in the foregoing instrument, as First Party therein, and they duly acknowledged to me that they signed and sealed the said instrument as and for the free and voluntary act and deed of said municipal corporation pursuant to authority, and each on oath stated that he was authorized to execute said instrument and that the seal affixed is the official seal of said municipal corporation.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my official seal the day and year first above written.

Charles R. Olson
Notary Public in and for the State of Washington, residing at Bellingham.

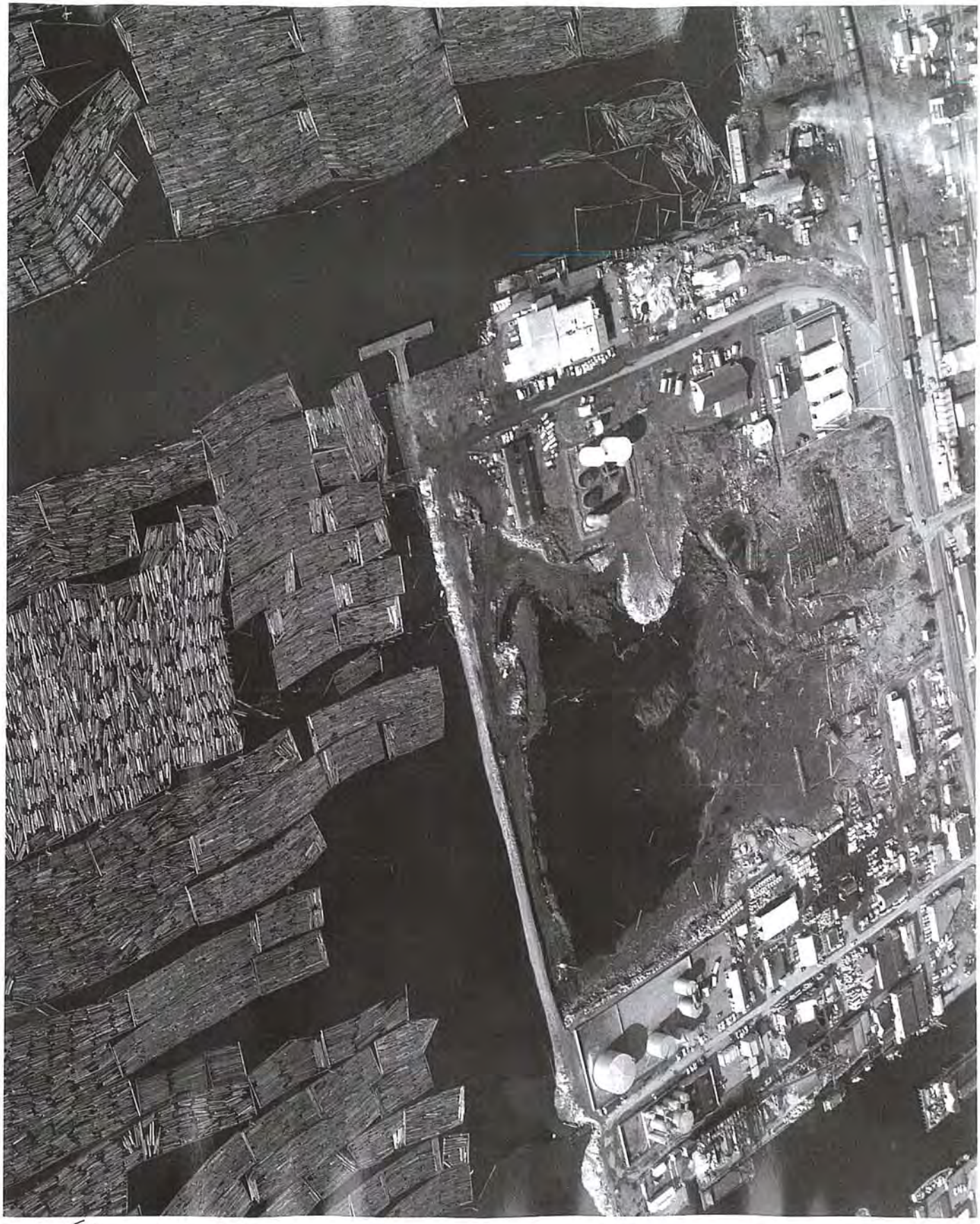
STATE OF WASHINGTON)
: ss.
COUNTY OF WHATCOM)

On this ____ day of _____, 1965, before the undersigned, a Notary Public in and for the State of Washington, duly commissioned and sworn personally appeared E. EKHOLM and J. ALLAN EVANS, to me known to be the Vice President and Assistant Secretary respectively of the Georgia-Pacific Corporation, one of the corporations that executed the foregoing instrument, and acknowledged the said instrument to be the free and voluntary act and deed of said corporation, for the uses and purposes therein mentioned, and on oath stated that they were authorized to execute the said instrument and that the seal affixed is the corporate seal of said corporation.

WITNESS my hand and official seal hereto affixed the day and year first above written.

Notary Public in and for the State of Washington, residing at Bellingham.

P-BBN0111 1963



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P-BBN0112

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P-BBN0150

APPENDIX H
GROUNDWATER QUALITY EVALUATION MEMORANDUM

ANCHOR QEA

720 Olive Way, Suite 1900
Seattle, Washington 98101
Phone 206.287.9130
Fax 206.287.9131

MEMORANDUM

To:	Brian Sato, Washington State Department of Ecology	**Date:**	February 10, 2017
From:	Halah Voges and Sylian Rodriguez, Anchor QEA, LLC	**Project:**	120007-01.01
Cc:	Brian Gouran and Ben Howard, Port of Bellingham		
Re:	Groundwater Quality Evaluation for Total Petroleum Hydrocarbons, Benzene, and Dissolved Metals in the C Street Properties Subarea, Central Waterfront Site		

Natural attenuation refers to physical, chemical, or biological processes that can lead to the reduction of mass, toxicity, mobility, volume, or concentration of contaminants in soil and/or groundwater. These processes include biodegradation, dispersion, mixing, sorption, volatilization, and chemical or biological stabilization, transformation, or destruction of contaminants of concern (COCs). Based on findings in Section 6 of the Remedial Investigation/Feasibility Study (RI/FS), monitored natural attenuation (MNA) has been retained as a viable remedial technology in the Feasibility Study (FS) at the Central Waterfront Site (Site). It is anticipated that monitoring will be required to verify the performance of natural attenuation. The information from the RI provides a baseline against which long-term monitoring data can be compared.

Additional lines of evidence are presented in this memorandum to demonstrate that natural biodegradation and/or chemical degradation is occurring and will continue to occur at reasonable rates, in support of the use of MNA at the Site and in accordance with the requirements presented in WAC 173-340-370(7)(c). Groundwater quality at the C Street Properties subarea was evaluated over time and distance, and associated trends were derived for the primary groundwater COCs for this subarea: total petroleum hydrocarbons (TPH; as gasoline [TPH-G] and diesel [TPH-Dx] fractions), benzene, and metals (in the dissolved fraction).

GROUNDWATER RESULTS AND TRENDS FOR TPH

The groundwater monitoring well network used for evaluating groundwater quality at the C Street Properties subarea is shown in Figure 1.[1] It must be noted that the network shown consists of active groundwater monitoring wells and abandoned wells that were sampled previously and provide historical groundwater quality data for temporal analysis. The network includes shallow and deep wells along the southern shoreline of this subarea—RMW-7, MW-12A(C), MW-65(C), CWMW-65(C), CWMW-2,[2] CWMW-18, MW-69(C), MW-70(C), MW-1(B), MW-3(B), MW-4(B), and MW-13(B)—which are representative of the groundwater quality that eventually discharges into Whatcom Waterway. Two shallow shoreline monitoring wells (CWF-CW-1 and CWF-CW-2) were recently installed in July 2016[3] and are also included in the groundwater monitoring well network for the C Street Properties subarea.

Figure 2a depicts TPH-G groundwater concentrations for an approximate 20-year timeframe[4] corresponding to February 1995 through July 2016. MW-1(B), MW-70(C), and CWMW-2 are the only wells that have historically exceeded the TPH-G screening level of 800 micrograms per liter (µg/L); however, TPH-G concentrations in these wells have significantly decreased in the last 12 years to be either undetected or below the screening level, with the exception of MW-1(B), which had an elevated TPH-G concentration of 1,300 µg/L during the July 2012 sampling event. Most recent groundwater results from July 2016 for CWF-CW-1 and CWF-CW-2 indicate TPH-G concentrations well below 800 µg/L (at 250 and 100 µg/L [undetected], respectively).

Groundwater quality trends for TPH-G are presented in Figure 2b for wells MW-1B, MW-70(C) and CWMW-2, indicating a decreasing trend in TPH-G concentrations. Power regression models were applied to these data sets, indicating good statistical correlation for

[1] Selected groundwater monitoring wells were used in this groundwater quality memorandum to evaluate representative groundwater temporal and spatial trends. Section 6 of the RI/FS presents the full set of groundwater data, with historical and RI results.

[2] CWMW-2 is the only deep well in this subarea, screened from approximately 30 to 40 feet below ground surface (bgs). All other wells are screened at depths shallower than 20 feet bgs.

[3] These two wells were installed at Ecology's request to inform and evaluate the performance of the containment walls in preventing the migration of contaminated Site groundwater to Whatcom Waterway surface water and sediments. They included two sampling events: July and November 2016 (Anchor QEA 2016a and 2016b). See Figure 1 for their location.

[4] Tables 6-5a and 6-5b (see Section 6 of the RI/FS) present the full set of groundwater results for TPH and other COCs for the C Street Properties subarea.

MW-1B and CWMW-2, with coefficients (R-squared value [R^2]) greater than 0.9.[5] Although the most recent TPH-G result at MW-1(B) still exceeded the screening level in 2012 (as indicated above), the trend power line (with a high R^2 of 0.98) for this well suggests the TPH-G concentration would currently be below 800 µg/L.[6]

Figure 3a shows the temporal groundwater distribution for TPH-Dx. Although all historical TPH-Dx data were used for plotting purposes, it is important to note that groundwater samples collected prior to 2012 were not analyzed using silica gel cleanup; these results include interference from unresolved complex matter, as described in the Central Waterfront RI/FS Work Plan Addendum No. 5 (Anchor QEA 2012a). Therefore, available TPH-Dx groundwater concentrations from 1995 to 2008 are assumed to be very conservative, and likely overestimated. TPH-Dx concentrations historically exceeded the screening level of 500 µg/L in wells MW-12A(C), MW-65(C), MW-1(B), MW-69(C), and MW-70(C). The most recent TPH-Dx groundwater exceedance was measured at MW-70(C) in 2008 (at 1,300 µg/L). Since then, all other remaining southern shoreline wells have historically had either non-detect TPH-Dx concentrations or concentrations detected well below the screening level, including the July 2016 TPH-Dx sampling event at CWF-CW-1 and CWF-CW-2.

Data from wells MW-1B, MW-12A(C), and MW-65(C) were used to evaluate groundwater quality trends for TPH-Dx (Figure 3b).[7] TPH-Dx concentrations were fitted to power regression models, resulting in fair statistical correlation, with coefficients ranging between 0.67 and 0.81. The lower R^2 values observed for TPH-Dx, compared to the correlations obtained for TPH-G, are likely due to the wide spread of data resulting from combining samples analyzed between 1995 and 2008 (without using silica gel cleanup) with 2012 silica gel data. However, steady declining trends in TPH-Dx concentrations are observed for the three wells, with no exceedances of the 500 µg/L TPH-Dx screening level since 2008.

[5] The R^2 obtained for the MW-70(C) data was 0.4 due to an outlying high TPH-G concentration measured in 2003 at 5,300 µg/L. However, a consistent downward trend in TPH-G concentrations is observed for this well, similar to MW-1B and CWMW-2.
[6] MW-1(B) was abandoned in conjunction with the Phase 1 Whatcom Waterway Cleanup.
[7] Groundwater results from MW-70(C) were not used in the TPH-Dx trend analysis due to the large variability of the data over time.

In addition, groundwater data were compiled with available seep and porewater data[8] for TPH-G and TPH-Dx (July 2012 and July 2016 sampling events, Anchor QEA 2012b, 2016a) to evaluate the attenuation of TPH with distance. The seep and porewater sample locations are shown in Figure 1. Groundwater-seep-porewater transects are presented in Figure 4 for the following sets of well/sample locations: 1) MW-1(B) and CW-PW-06; 2) CWMW-2, CWMW-18, CW-SP-01, and CW-PW-03; 3) CWMW-65(C) and CW-PW-02; and 4) CWF-CW-1 and CWF-PW-1. The first, second, and fourth transects indicate a decline in TPH-G concentrations with distance, from the upland (with detected results in groundwater) into the shoreline (with non-detect results in porewater). TPH-Dx for these three transects show that groundwater results are already mostly undetected and well below the screening level in the upland (and all undetected in porewater). TPH-G and TPH-Dx concentrations were non-detect along the third transect (detection limits of about 30 and 100 µg/L, respectively).

An additional line of evidence of natural attenuation for TPH in the C Street Properties subarea is the evaluation of geochemical indicators and microbial reactions involved in biological/chemical degradation of petroleum-contaminated groundwater. In accordance with the Washington State Department of Ecology's guidance (Ecology 2005), geochemical indicator data were presented in the RI/FS (Tables 6-5a and 6-5b; see Section 6 of the RI/FS) and in Attachments A through C of this appendix.[9] While oxygen, nitrates, and sulfates appear to be largely depleted, iron and manganese were predominantly present as ferrous iron and manganese oxide. These parameters indicate anaerobic conditions are established in the petroleum-impacted areas. Oxygen measurements in July 2012 in upland wells MW-1(B), CWMW-65(C), CWMW-2, and CWMW-18 ranged from 0.34 to 3.85 mg/L-O_2. During the July 2016 sampling event, oxygen measurements in upland wells CWF-CW-1 and CWF-CW-2 ranged from 0.84 to 2.21 mg/L-O_2. During the November 2016 sampling event, oxygen measurements in upland well CWF-CW-2 ranged 0.25 to 0.39 mg/L-O_2. These oxygen levels are consistent with redox potential measurements (lower than -50 mV) and indicative of a sulfate-reducing environment for petroleum hydrocarbons.

[8] Tables 6-6 and 6-7 (see Section 6 of the RI/FS) present the full set of seep and porewater results for TPH and other COCs for the C Street Properties subarea.

[9] Field sampling data sheets for selected groundwater, seep, and porewater locations, sampled during the July 2012, July 2016, and November 2016 events.

GROUNDWATER RESULTS AND TRENDS FOR BENZENE

Figure 5a depicts the benzene groundwater concentrations over time for the active shallow and deep wells along the southern shoreline of the C Street Properties subarea,[10] with data ranging from February 1995 through July 2016. Among all wells, MW-1B is the only one that has historically exceeded the most stringent benzene screening level of 2.4 µg/L.[11] Although the most recent benzene exceedance at 200 µg/L occurred during the July 2012 sampling event, benzene concentrations at MW-1B have significantly decreased in the last 11 years. All other wells have consistently shown undetected benzene results over time, including CWF-CW-1 and CWF-CW-2 (wells sampled in July 2016).

The groundwater quality trend for benzene is presented in Figure 5b for well MW-1B. Based on a power regression model with a fair statistical correlation of 0.6, a decreasing trend in benzene concentrations is observed for this well. The trend line predicts that both federal marine surface water criteria (NTR and CWA) would be met within 25 years.

In addition, groundwater-porewater transects are presented in Figure 6 using 1) the July 2012 data for MW-1B and CW-PW-06; and 2) the July 2016 data for CWF-CW-1 and CWF-PW-1. The first transect shows a decline in benzene concentrations with distance from the upland (with detected results in groundwater) into the shoreline (with non-detect results in porewater). The porewater benzene result at CW-PW-06 is also below the benzene screening level of 2.4 µg/L. Benzene concentrations observed along the second transect are well below 2.4 µg/L, at about 0.05 µg/L (in groundwater) and 0.04 µg/L (in porewater), respectively.

[10] Tables 6-5a and 6-5b (see Section 6 of the RI/FS) present the full set of groundwater results for benzene and other COCs for the C Street Properties subarea.

[11] The benzene federal marine surface water criteria (51 µg/L for the Clean Water Act [CWA] §304 and 71 µg/L for the National Toxics Rule [NTR] 40 Code of Federal Regulations 131), based on human health consumption of aquatic organisms, are also shown for comparison purposes of the benzene groundwater data, because they are more representative as a threshold of groundwater discharging into Whatcom Waterway, rather than the benzene screening level of 2.4 µg/L, which is protective of vapor intrusion.

GROUNDWATER RESULTS AND TRENDS FOR DISSOLVED METALS

The only active groundwater monitoring wells within the C Street Properties subarea with dissolved metals data[12] are RMW-7, MW-1B, CWF-CW-1, and CWF-CW-2 (Figure 1). These four wells are representative of the groundwater quality that eventually discharges into the western and southern shorelines and into Whatcom Waterway.

Figure 7 depicts the groundwater results over time for various dissolved metals, including arsenic, chromium, copper, and nickel, which are the metals with the most exceedances of screening levels. The available dissolved metal data for RMW-7 and MW-1B include two sampling events conducted in March 2008 and October 2013.[13] It is important to note that metals analyses for the 2013 groundwater samples were conducted using ICP-MS instrumentation in Universal Cell Technology (UCT) to minimize any potential salinity interference from adjacent marine water; therefore, the 2013 dissolved metal concentrations are considered more reliable. In addition, dissolved metal data were collected in July and November 2016 for RMW-7, CWF-CW-1, and CWF-CW-2 (and analyzed using ICP-MS).

Dissolved metal results at MW-1B showed no exceedances of screening levels during the 2008 and 2013 groundwater sampling events (Figure 7). While a significant decrease in dissolved arsenic and nickel concentrations was observed at MW-1B in the last 5 years (below applicable screening levels of 5 and 8.2 µg/L, respectively), dissolved copper concentrations were consistently non-detect and below the applicable screening level (3.1 µg/L). However, dissolved chromium concentrations at MW-1B increased slightly from 2008 to 2013, but still well below its screening level of 260 µg/L.

At well RMW-7, three of the four dissolved metals selected for this analysis (arsenic, chromium, and copper) showed a decline in concentrations between the three groundwater sampling events and are currently below the screening levels (Figure 7). However, dissolved

[12]Although the RI presents all groundwater results for total and dissolved metals and Figure 6-7 of the RI/FS depicts the lateral extent of metal exceedances (including the highest of total and dissolved metal concentrations from 2002 to present), the dissolved metal fractions are the most meaningful dataset for evaluating the potential for transport of metal impacts in groundwater and exposure to receptors.

[13] Table 6-5a (see Section 6 of the RI/FS) presents the full set of groundwater results for total and dissolved metals and other COCs at RMW-7 and MW-1B for the C Street Properties subarea.

nickel concentrations at this well slightly increased between 2013 and 2016 from 1.35 to 2.2 µg/L, but are still below the screening level of 8.2 µg/L.

Dissolved arsenic, chromium, and nickel results at CWF-CW-2 showed no exceedances of the screening levels during the two 2016 sampling events. Although the dissolved copper concentration was 10 µg/L in July 2016 (and exceeding the 3.1 µg/L screening level), it decreased to undetected 2 µg/L during the November 2016 sampling event.

Groundwater data at CWF-CW-1 indicated none of the four dissolved metals exceeded screening levels in July 2016.

In order to evaluate the potential for metals to migrate to the adjacent surface water and sediments in the western and southern shorelines of Whatcom Waterway, groundwater-porewater transects for dissolved metals were prepared between 1) RMW-5, RMW-7, and CWF-PW-3 (Figure 8a); 2) CWF-CW-1 and CWF-PW-1 (Figure 8b); and 3) CWF-CW-2 and CWF-PW-4 (Figure 8c). While the first two transects used data based on the July 2016 sampling event, the third transect used data from the November 2016 sampling event.

For the first transect shown in Figure 8a, RMW-5 is a well representative of the Landfill subarea (a known source of metals; well presented in Figure 1), RMW-7 is the closest well located on the western shoreline of the C Street Properties subarea, and CWF-PW-3 is a porewater sample location in the downgradient path of the other two wells. The transect shows an overall decline in dissolved metal concentrations with distance, from the source in the upland landfill, into the vicinity of the shoreline, and in porewater. The four metals have dissolved concentrations exceeding screening levels at RMW-5 (as expected, because this well is within the Landfill footprint) and well below the screening levels at RMW-7 and CWF-PW-3 (showing downgradient natural attenuation).

Figure 8b shows the second transect between CWF-CW-1 (well representative of performance of the western containment wall recently installed as part of the Phase 1 Whatcom Waterway cleanup) and CWF-PW-1 (porewater sample location on the downgradient path of CWF-CW-1). Results for dissolved arsenic, chromium, and copper both in groundwater and porewater indicate no exceedances of the screening levels in July

2016. Although an exceedance was observed for nickel at the porewater location CWF-PW-1 (10 µg/L), the upland well CWF-CW-1 showed a negligible dissolved nickel concentration (0.75 µg/L).[14] This indicates that the former Chevron Terminal area is not currently impacting groundwater and that a possible different source of nickel is contributing to the area where the porewater sample was collected. In fact, that area corresponds to the Chevron Subarea Interim Action and the Phase 1 Whatcom Waterway capping footprints (where metals may have been mobilized as part of the shoreline excavation in January 2013 and/or cap installation in the summer of 2016) and currently show up as dissolved concentrations in porewater, slightly exceeding the nickel screening level of 8.2 µg/L.

The third transect between CWF-CW-2 (well representative of performance of the eastern containment wall recently installed under the Whatcom Waterway cleanup) and CWF-PW-4 (porewater sample location on the downgradient path of CWF-CW-2) is shown in Figure 8c. The transect shows either steady or decreasing dissolved arsenic, chromium, and nickel concentrations with distance and well below the respective screening levels. Although the dissolved copper concentrations in groundwater and porewater were undetected (2 and 4 µg/L, respectively) during the November 2016 sampling event, the reporting limit for porewater exceeded the screening level of 3.1 µg/L. Because dissolved copper exceeded screening levels in July 2016 in groundwater (CWF-CW-2; 10 µg/L) and in the seep (CWF-WS-1; 4.7 µg/L; see Figure 1 for seep sample location),[15] and due to a variety of historical industrial activities (including foundry operations such as construction of marina-related equipment, boat wash, and maintenance), the former Colony Wharf area may be a source of copper releases to Whatcom Waterway surface water and sediments and, therefore, will be addressed in the FS for the C Street Properties subarea.

CONCLUSIONS

Currently, groundwater impacted with metals and petroleum hydrocarbons flows southward towards Whatcom Waterway. As the groundwater migrates, it is subject to natural attenuation processes (e.g., dilution, dispersion, sorption, and chemical or biological

[14] Table 6-5a (see Section 6 of the RI/FS) presents the full set of groundwater dissolved metals results at CWF-CW-1. The dissolved nickel concentration of the parent sample was similar to the one for the field duplicate sample at 0.28 µg/L.
[15] Table 6-5a (see Section 6 of the RI/FS) presents the full set of groundwater dissolved metals results at CWF-CW-2 and CWF-WS-1.

degradation) and in conjunction with tidal mixing, groundwater geochemistry is altered, reducing contaminant concentrations prior to discharge. Based on the available historical and current groundwater monitoring data, contaminants in groundwater in the C Street Properties subarea (such as petroleum hydrocarbons and metals) have declined in the last 10 years below applicable screening levels, prior to discharge into Whatcom Waterway, and are expected to continue to decline even further, as natural attenuation processes are active and will continue to occur.

REFERENCES

Anchor QEA, 2012a. Letter to: Brian Sato, Washington State Department of Ecology. Re: Central Waterfront Interim Action Work Plan Amendment No. 1 RI/FS Work Plan Addendum #5 (Use of Silica-Gel Cleanup for NWTPH-Dx Analysis). October 23, 2012.

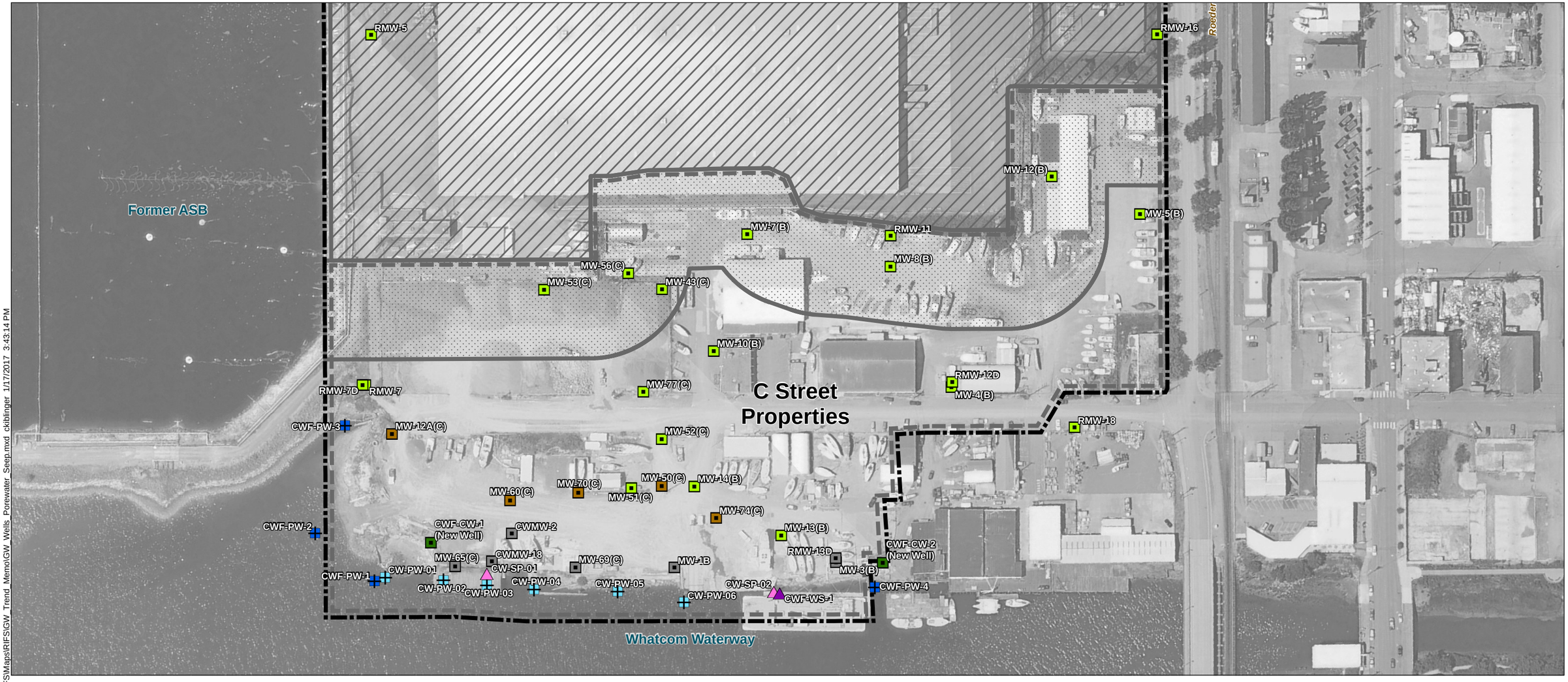
Anchor QEA, 2012b. Letter to: Lucy McInerney, Washington State Department of Ecology. Re: Central Waterfront Site – Agreed Order No. DE 3441 – RI/FS Work Plan Addendum No. 3. (Environmental Conditions along Shoreline). July 2, 2012.

Anchor QEA, 2016a. Letter to: Brian Sato, Washington State Department of Ecology. Re: Central Waterfront Site – Agreed Order No. DE 3441 – RI/FS Work Plan Addendum No. 7. (Central Waterfront Site Compliance Monitoring). July 8, 2016.

Anchor QEA, 2016b. Letter to: Brian Sato, Washington State Department of Ecology. Re: Central Waterfront Site – Agreed Order No. DE 3441 – RI/FS Work Plan Addendum No. 8. (Central Waterfront Site Compliance Monitoring). November 10, 2016.

Ecology (Washington State Department of Ecology), 2005. Guidance on Remediation of Petroleum-Contaminated Ground Water by Natural Attenuation. Toxics Cleanup Program Publication No. 05-09-091 (Version 1.0). July 2005.

FIGURES



2016 Groundwater Monitoring Well
Active Groundwater Monitoring Well
Condition Unknown/Blocked Access Monitoring Well
Decommissioned Groundwater Monitoring Well

2012 Porewater Sample Location
2016 Porewater Sample Location
2012 Seep Sample Location
2016 Seep Sample Location

Extent of Landfill Refuse
Landfill Perimeter
Subarea Boundary
Central Waterfront Site Boundary

Project North
True North

Feet
0 75 150 225 300

Note:
Aerial by U.S. Geological Survey: July 2009.

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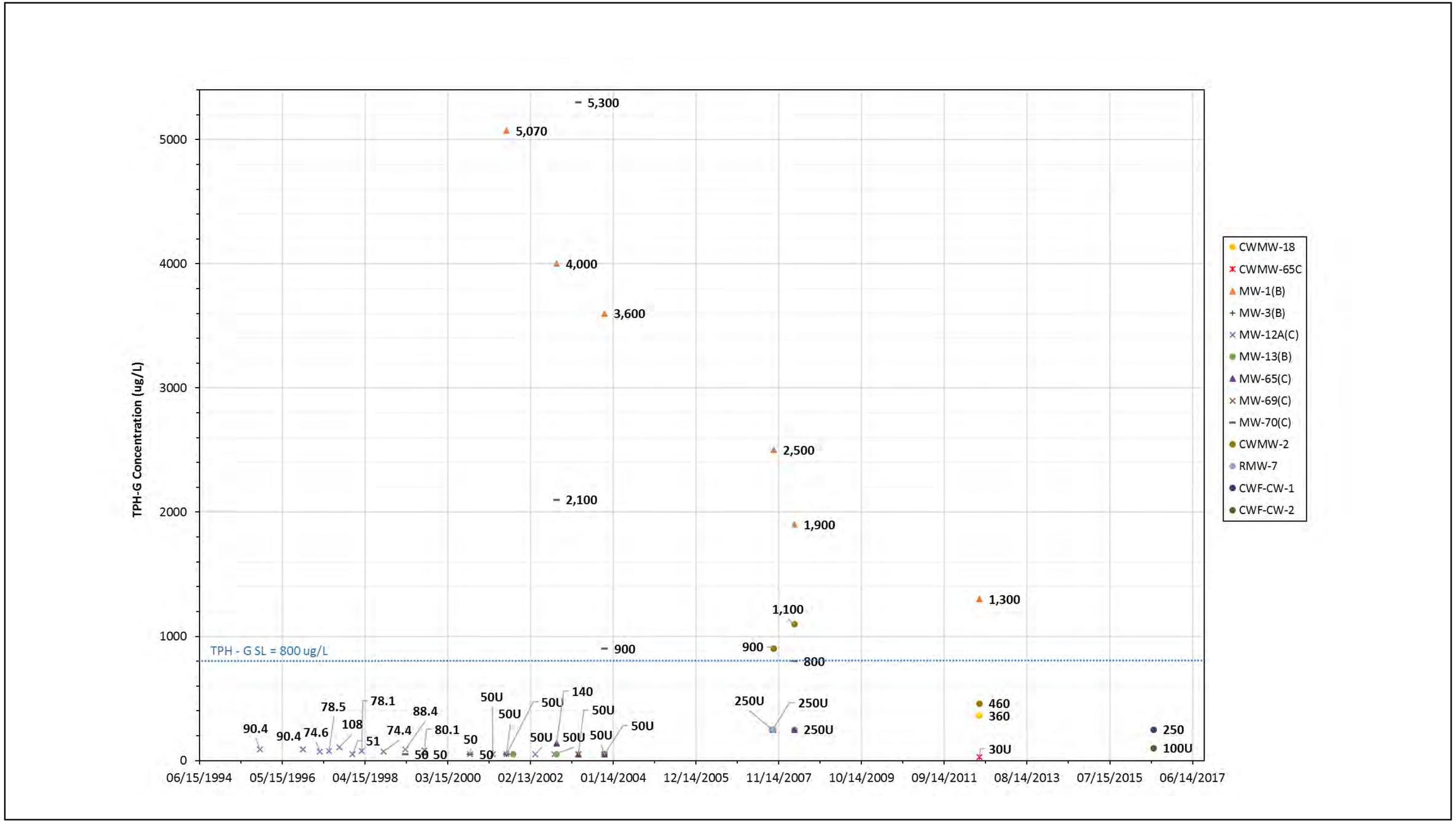
ANCHOR QEA

Figure 1
Groundwater, Porewater, and Seep Locations
Central Waterfront Site
Port of Bellingham, WA



ANCHOR QEA

Figure 2a
Groundwater Results Over Time for TPH-G in Selected Shoreline Shallow and Deep Wells
Central Waterfront Site
Port of Bellingham, WA

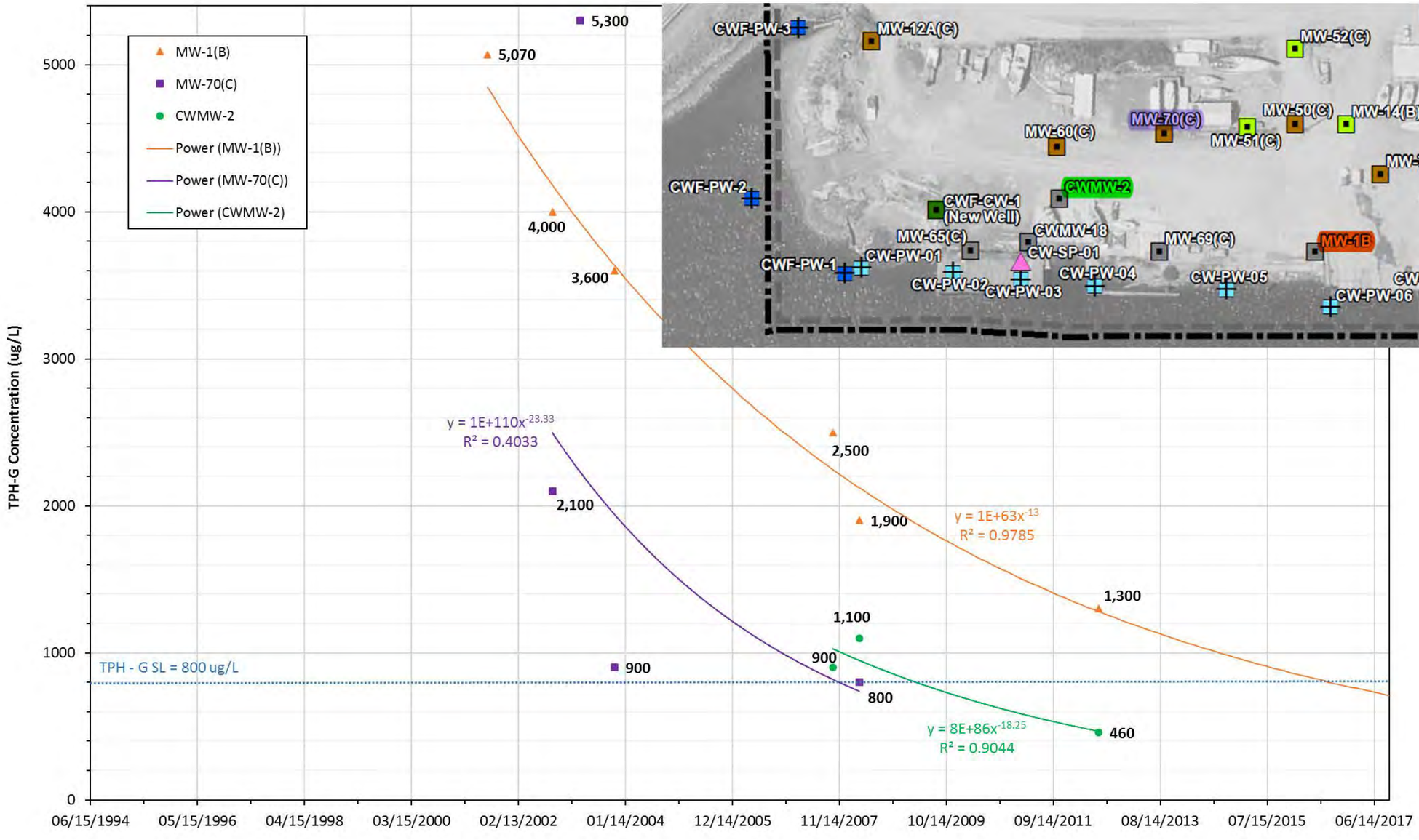
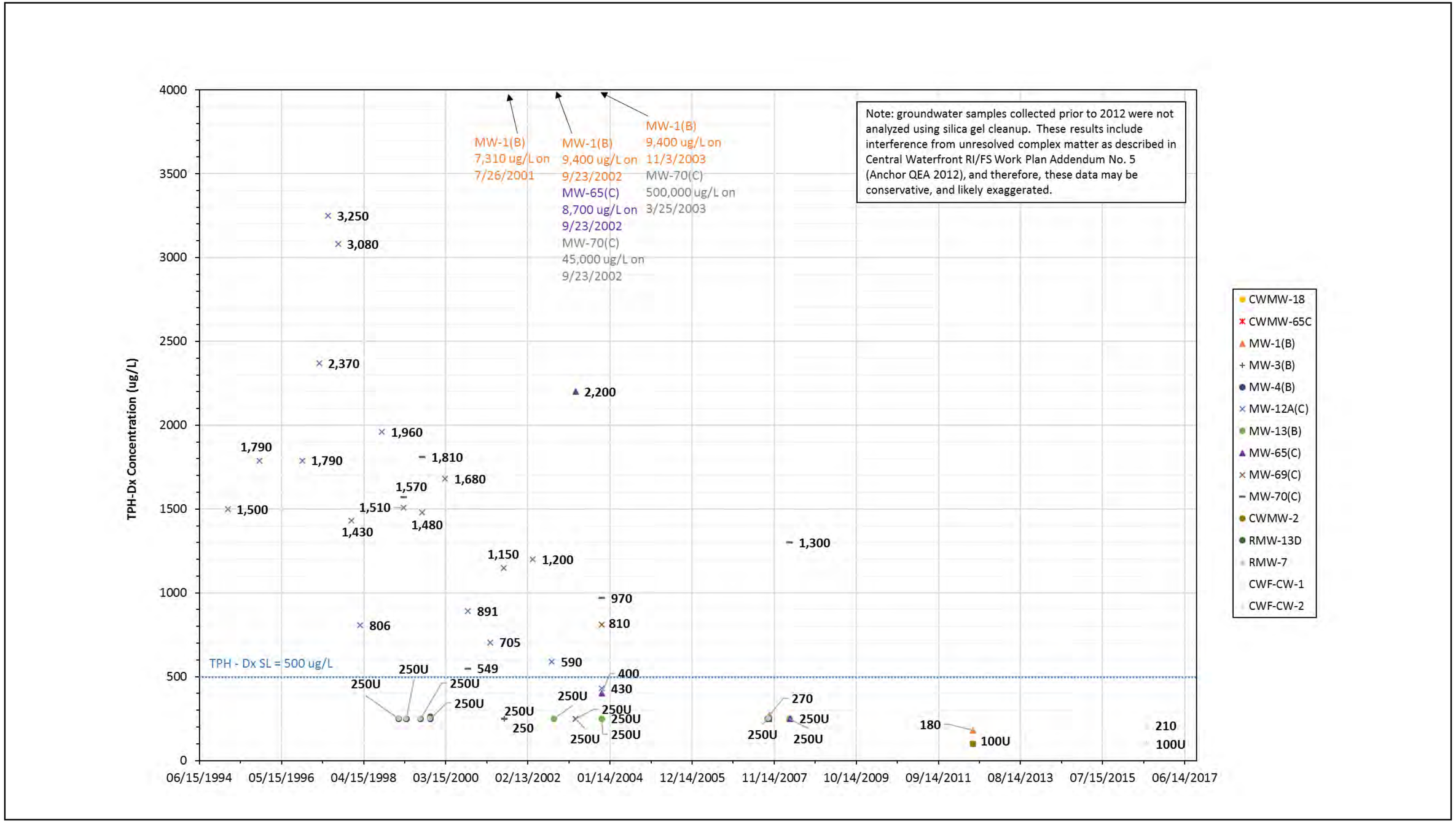


Figure 2b
Groundwater Trendlines for TPH-G at MW-1B, MW-70(C), and CWMW-2
Central Waterfront Site
Port of Bellingham, WA



ANCHOR QEA

Figure 3a
Groundwater Results Over Time for TPH-Dx in Selected Shoreline Shallow and Deep Wells
Central Waterfront Site
Port of Bellingham, WA

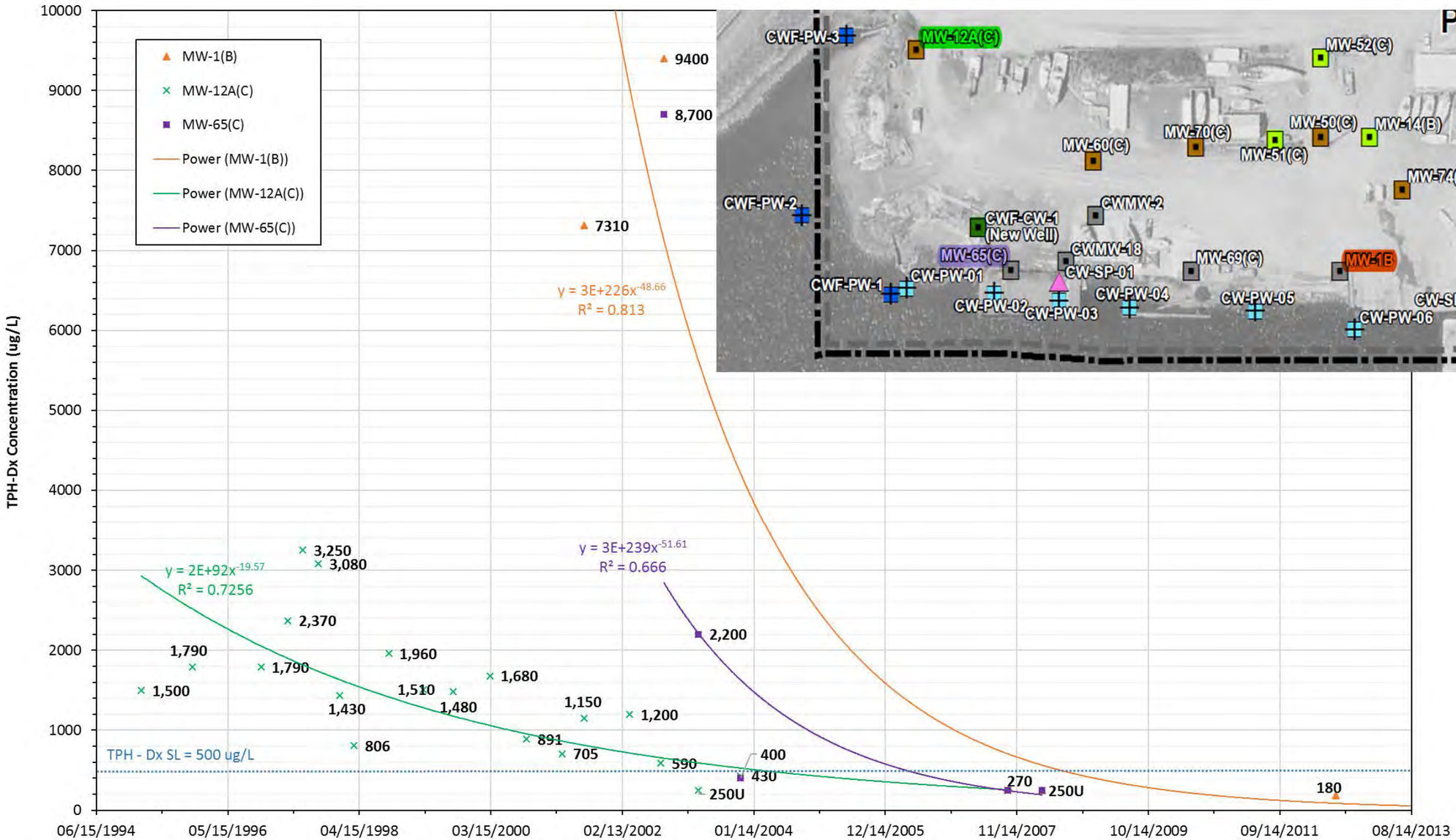


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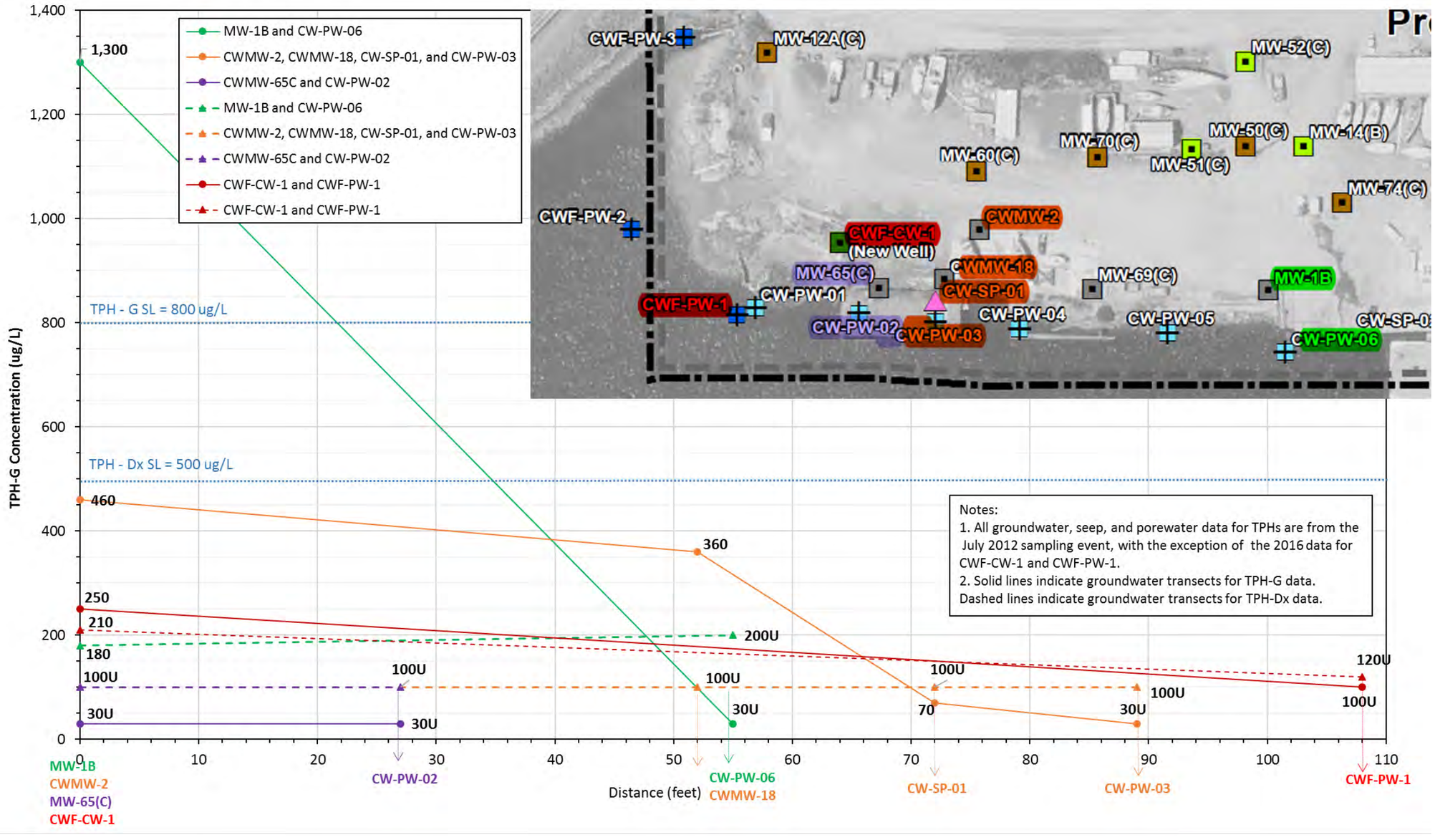
Figure 3b
Groundwater Trends for TPH-Dx at MW-1B, MW-12A(C), and MW-65(C)
Central Waterfront Site
Port of Bellingham, WA



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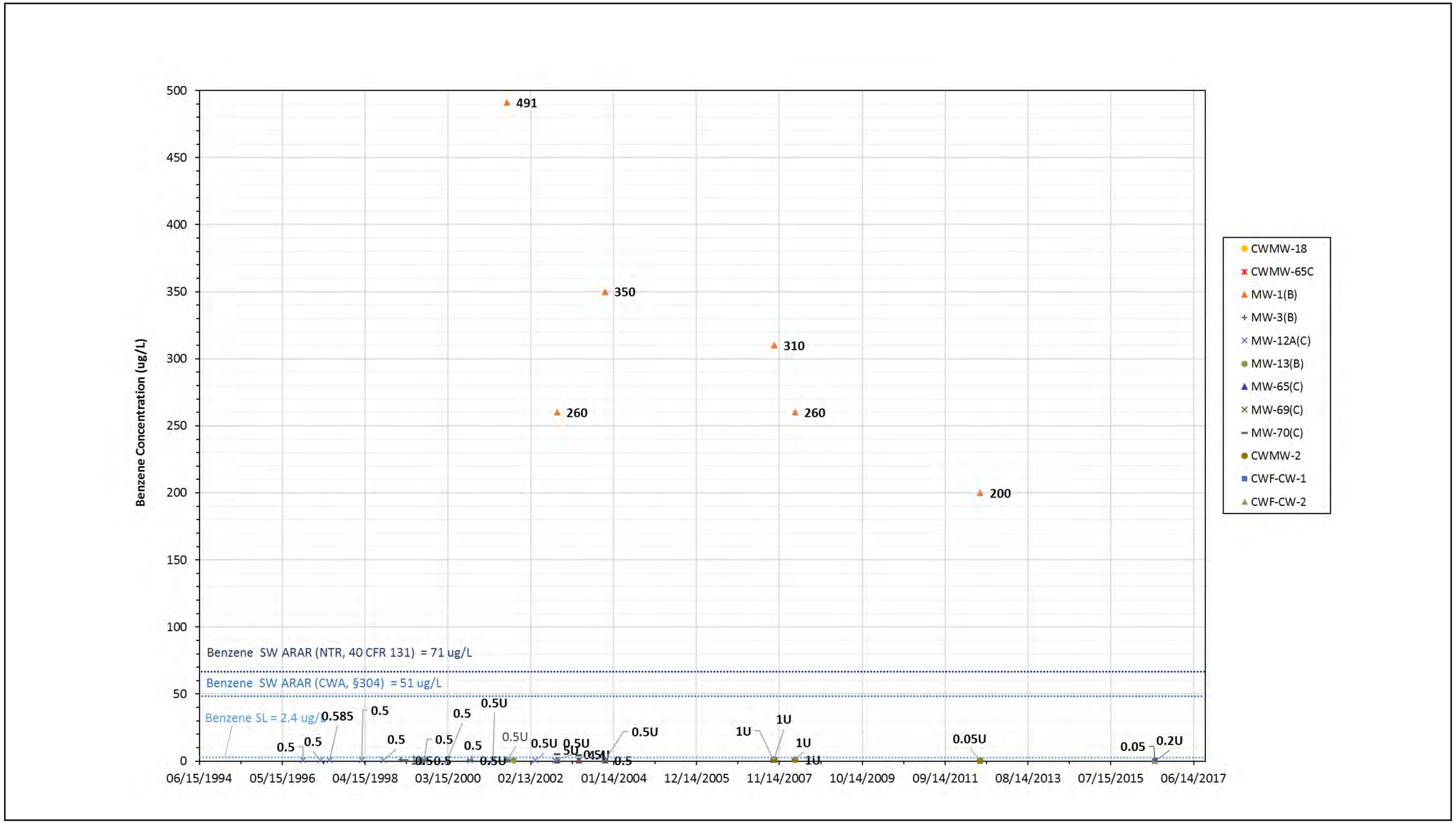
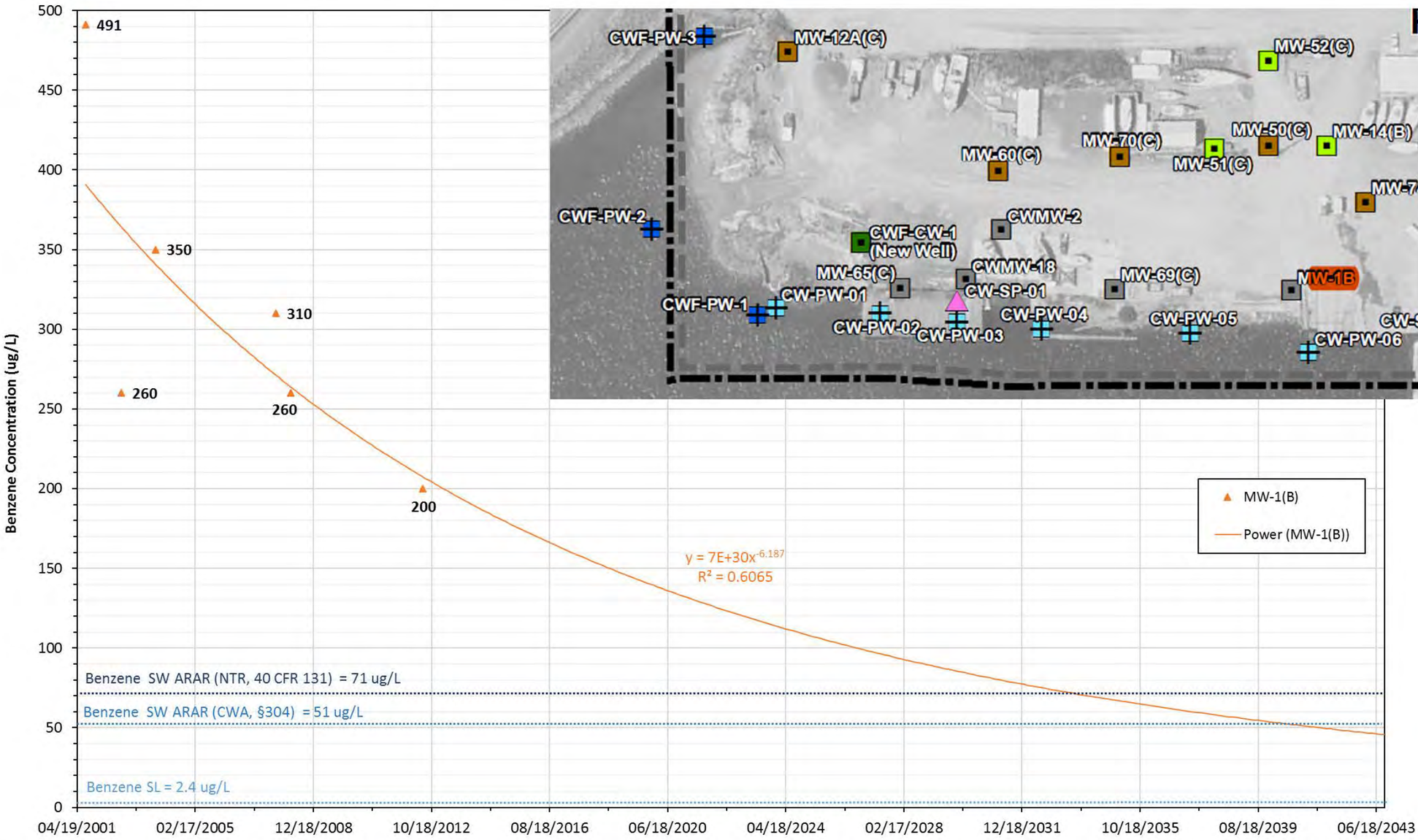
ANCHOR QEA

Figure 4
Groundwater Transects for TPH-G and TPH-Dx
Central Waterfront Site
Port of Bellingham, WA



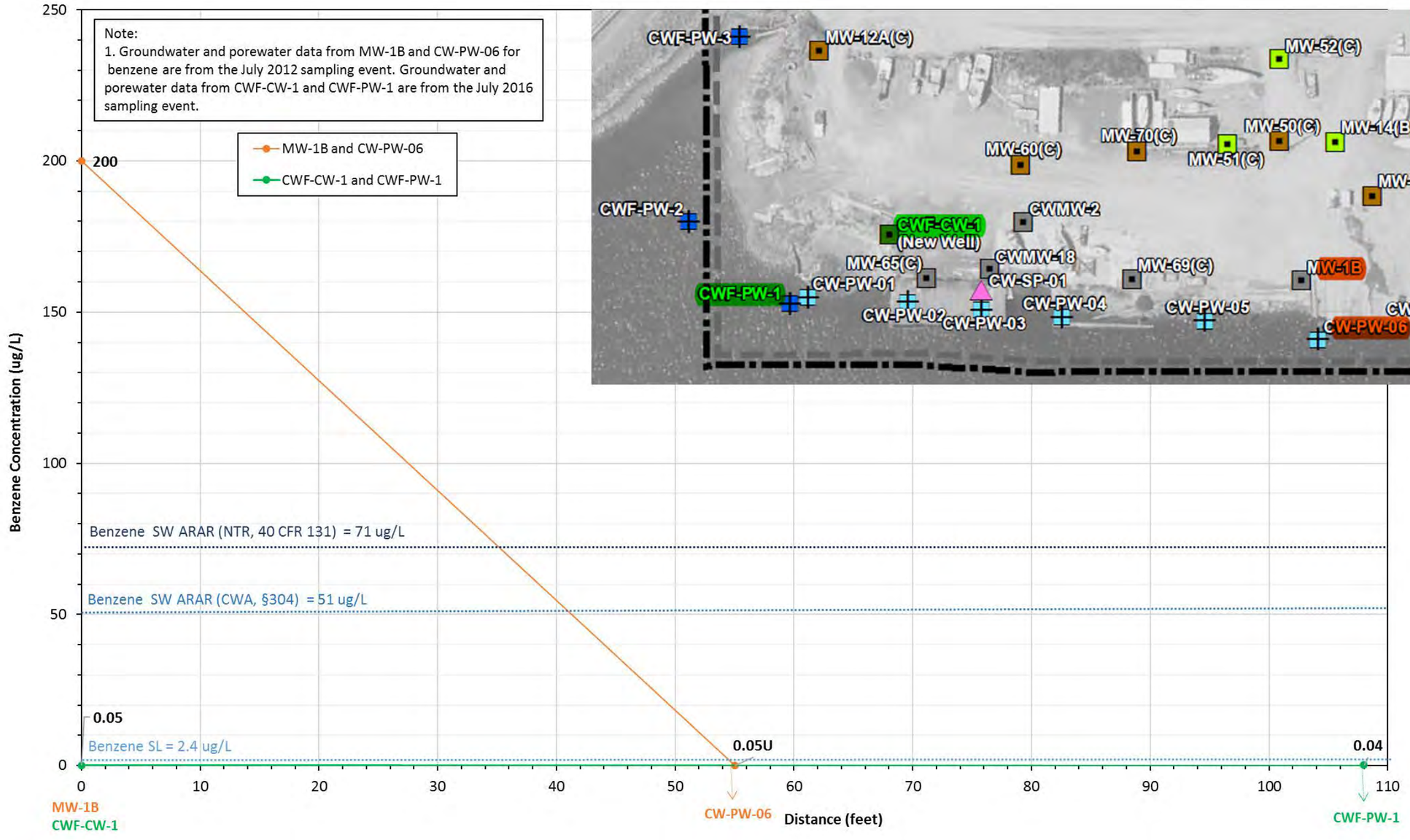
ANCHOR QEA

Figure 5a
Groundwater Results Over Time for Benzene in Selected Shoreline Shallow and Deep Wells
Central Waterfront Site
Port of Bellingham, WA



ANCHOR QEA

Figure 5b
Groundwater Trends for Benzene at MW-1B
Central Waterfront Site
Port of Bellingham, WA



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ANCHOR QEA

Figure 6
Groundwater Transect for Benzene
Central Waterfront Site
Port of Bellingham, WA

Notes:
1. Metals analyses for all groundwater samples after 2008 were conducted using ICP-MS instrumentation in Universal Cell Technology (UCT), to minimize potential salinity interference from adjacent marine water (Anchor QEA 2013).

RMW-7 - Arsenic
RMW-7 - Chromium
RMW-7 - Copper
RMW-7 - Nickel
MW(1B) - Arsenic
MW-1(B) - Chromium
MW-1(B) - Copper
MW-1(B) - Nickel
CWF-CW-1 - Arsenic
CWF-CW-1 - Chromium
CWF-CW-1 - Copper
CWF-CW-1 - Nickel
CWF-CW-2 - Arsenic
CWF-CW-2 - Chromium
CWF-CW-2 - Copper
CWF-CW-2 - Nickel

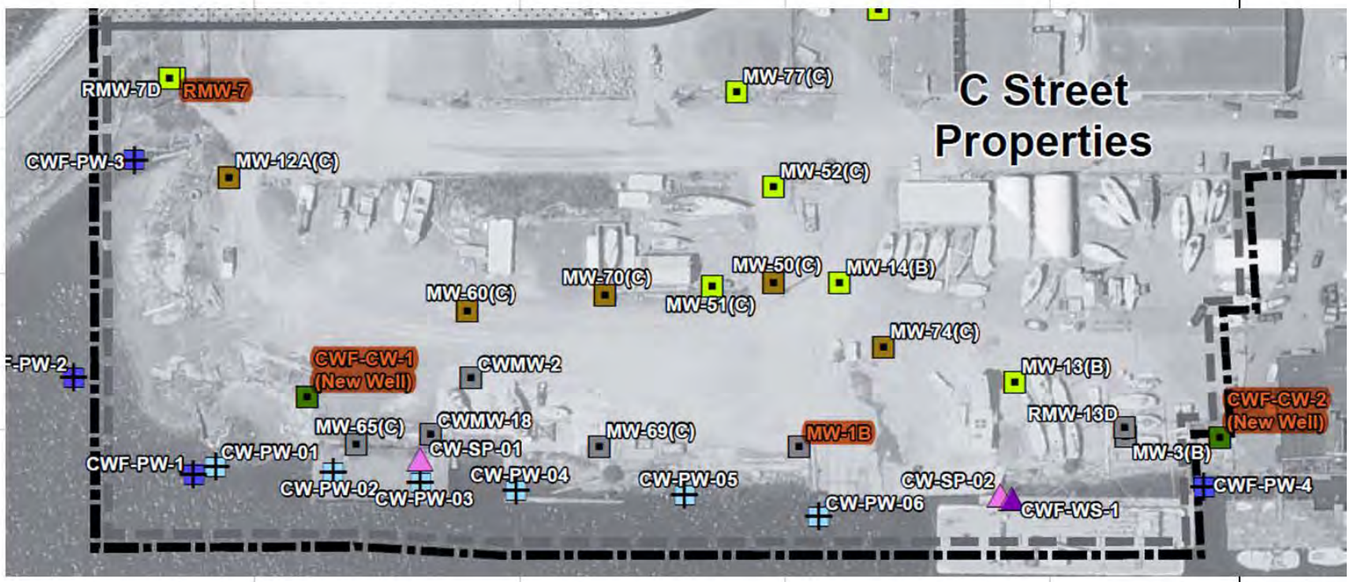
Chromium SL = 260 ug/L
Nickel SL = 8.2 ug/L
Arsenic SL = 5 ug/L
Copper SL = 3.1 ug/L

Dissolved Metal Concentration (ug/L)

70
60
50
40
30
20
10
0

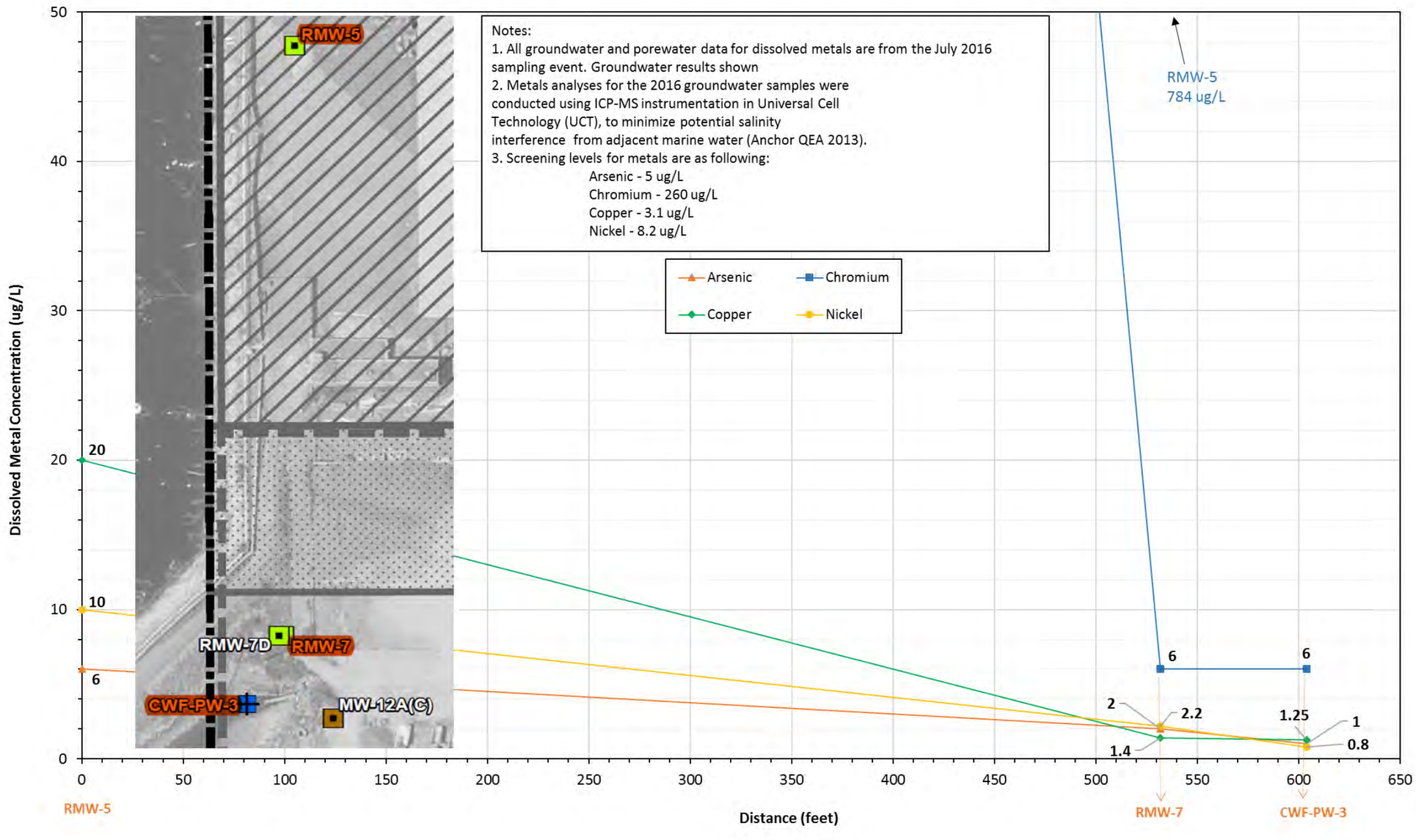
05/28/2005
04/28/2007
03/28/2009
02/26/2011
01/26/2013
12/27/2014
11/26/2016

69
50U
35
100
7
2U
8
6
4
2U
1.35
16
12.4
10
6
5
4
4.02
2
2.2
2U
0.8
1.4
1.06



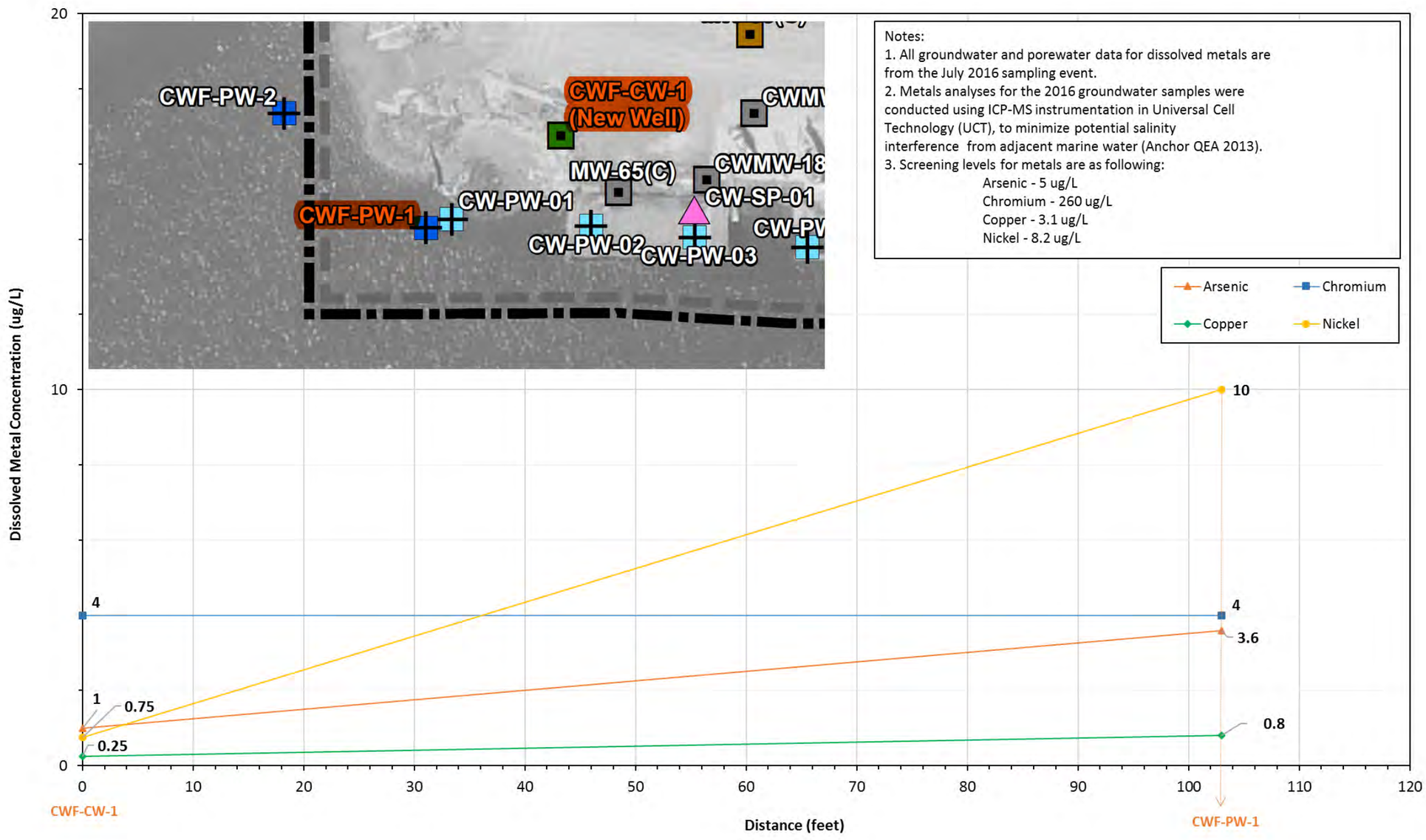
ANCHOR QEA

Figure 7
Groundwater Results Over Time for Dissolved Metals in Selected Shoreline Wells
Central Waterfront Site
Port of Bellingham, WA



ANCHOR QEA

Figure 8a
Groundwater Transects for Dissolved Metals (RMW-5, RMW-7, and CWF-PW-3)
Central Waterfront Site
Port of Bellingham, WA



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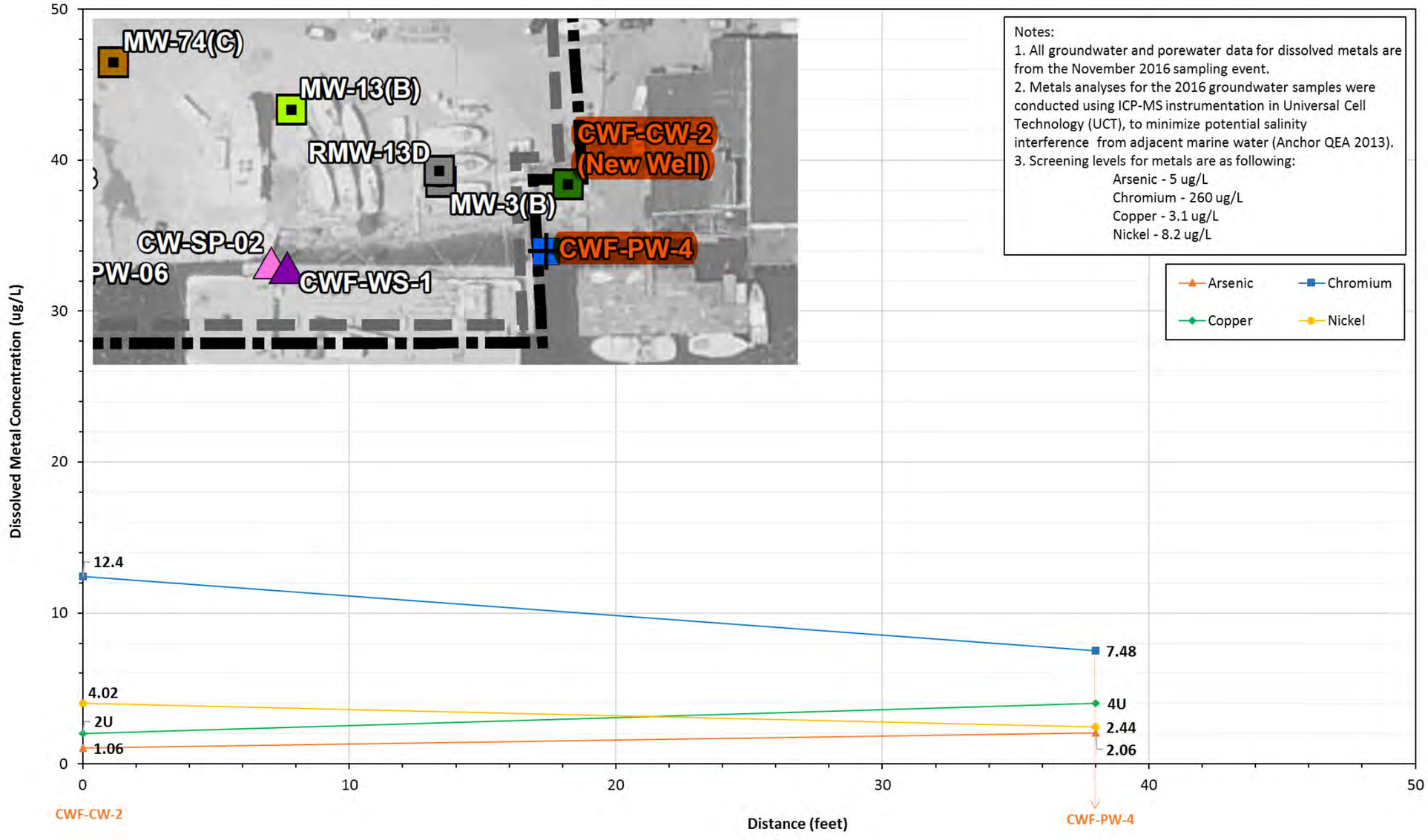
ANCHOR QEA

Figure 8b
Groundwater Transects for Dissolved Metals (CWF-CW-1 and CWF-PW-1)
Central Waterfront Site
Port of Bellingham, WA



ANCHOR QEA

Figure 8c
Groundwater Transects for Dissolved Metals (CWF-CW-2 and CWF-PW-4)
Central Waterfront Site
Port of Bellingham, WA

ATTACHMENT A
FIELD FORMS – JULY 2012

FIELD SAMPLING DATA SHEET

ANCHOR QEA

1605 Cornwall Avenue
Bellingham, WA 98225
Office: (360) 733-4311 Fax: (360) 733-4312

PROJECT NAME: Whatcom Waterway -Supplemental Shoreline Inv. **STATION ID:** CW-PW-01

SITE ADDRESS: C Street, Central Waterfront, Bellingham, WA **BLIND ID:** CW-PW-01-072412

DUP ID:

WIND FROM:	N	NE	E	SE	S	SW	W	NW	LIGHT	MEDIUM	HEAVY
WEATHER:	SUNNY		PRTLY CLDY		CLOUDY		RAIN		**TEMPERATURE:**	°F 75.	°C

[Circle appropriate units]

HYDROLOGY/LEVEL MEASUREMENTS (Nearest 0.01 ft) [Product Thickness] [Water Column] [Water Column x Gal/ft]

Date	Time	DT-Bottom	DT-Product	DT-Water	DTP-DTW	DTB-DTW		Volume (gal)
/ /	:	.	---	.	---	.	X 1	POREWATER
/ /	:	.	---	.	---	.	X 3	.

Gal/ft = (dia./2)^2 x 0.163	1" = 0.041	2" = 0.163	3" = 0.367	4" = 0.653	6" = 1.469	10" = 4.080	12" = 5.875

§ METHODS: (A) Waterra (B) Peristaltic Pump (C) Disposable Bailer (D) Grab (E)

GROUNDWATER SAMPLING DATA Sample Depth: [√ if used]

Bottle Type	Date	Time	Method §	Amount & Volume mL		Preservative [circle]	Ice	Filter	pH	√
VOA Glass	7/24/12	14:50	B	3	40 ml	HCl	YES	NO	—	X
Amber Glass	↓/	↓ :	↓	2	250, 500, 1L	(None) (HCl) (H_2SO_4)	YES	NO	—	X
	/ /	:			250, 500, 1L		YES	NO		
	/ /	:			250, 500, 1L		YES	NO		
Total Bottles (include duplicate count):				5						

Analysis Allowed per Bottle Type

BOTTLE TYPE	TYPICAL ANALYSIS ALLOWED PER BOTTLE TYPE (Circle applicable or write non-standard analysis below)
VOA - Glass	(8021) (8260B) (BTEX) (TPH-Gx)
AMBER - Glass	(PAH) (TPH-HCID) (Oil &Grease) (TPH-Dx w/Silica Gel Cleanup) (TPH-Dx w/o Silica Gel Cleanup)
WHITE - Poly	(pH) (Conductivity) (TDS) (TSS) (BOD) (Turbidity) (Alkalinity) (HCO_3/CO_3) (Cl) (SO_4) (NO_3) (NO_2) (F)
YELLOW - Poly	(COD) (TOC) (Total PO_4) (Total Keldahl Nitrogen) (NH_3) (NO_3/NO_2)

WATER QUALITY DATA Purge Start Time: 14:40

Meas.	Time	Cum. Volume	DTW(ft TOC)	pH	E Cond (µS/cm)	Temp °C	TDS (g/L)	Salinity (ppt)	DO (mg/l)	ORP (mV)	Water Quality
1	0:03	—	—	7.64	32403	16.59	21.05	20.27	1.22	-132.0	clear, colorless
2	0:06	—	—	7.63	32794	16.63	21.33	20.57	0.92	-135.1	↓ ↓
3	0:09	—	—	7.65	32431	16.57	21.09	20.33	0.77	-140.8	↓ ↓
4	:										
5	:	SEAWATER PARAMETERS ON BOTTOM									
6	:			8.14	27247	14.90	17.67	16.67	10.31	-17.2	
7	:										
8	:										
9	:										
10	:										
11	:										
12	:										
13	:										
14	:										

[gallons or liters] [Clarity, Color]

Comments: Sample Type: (Porewater) Seep Groundwater

Coordinates:

Approximate Elevation: **-5.55 ft**

SAMPLER: Matt Wilson / Julia Labodie
(PRINTED NAME)

Matt Wil
(SIGNATURE)

FIELD SAMPLING DATA SHEET

ANCHOR QEA

1605 Cornwall Avenue
Bellingham, WA 98225
Office: (360) 733-4311 Fax: (360) 733-4312

PROJECT NAME: Whatcom Waterway -Supplemental Shoreline Inv. **STATION ID:** CW-PW-02

SITE ADDRESS: C Street, Central Waterfront, Bellingham, WA **BLIND ID:** CW-PW-02-070412

DUP ID:

WIND FROM:	N	NE	E	SE	S	SW	(W)	NW	(LIGHT)	MEDIUM	HEAVY
WEATHER:	(SUNNY)	PRTLY CLDY	CLOUDY	RAIN					**TEMPERATURE:**	°F 75 .	°C

[Circle appropriate units]

HYDROLOGY/LEVEL MEASUREMENTS (Nearest 0.01 ft)

Date	Time	DT-Bottom	DT-Product	DT-Water	[Product Thickness] DTP-DTW	[Water Column] DTB-DTW	[Water Column x Gal/ft] Volume (gal)
/ /	:	.	---	.	---	.	X 1 POREWATER
/ /	:	.	---	.	---	.	X 3 .

Gal/ft = (dia./2)² x 0.163	1" = 0.041	2" = 0.163	3" = 0.367	4" = 0.653	6" = 1.469	10" = 4.080	12" = 5.875

§ METHODS: (A) Waterra (B) Peristaltic Pump (C) Disposable Bailer (D) Grab (E)

GROUNDWATER SAMPLING DATA Sample Depth:

Bottle Type	Date	Time	Method §	Amount & Volume mL	Preservative [circle]	Ice	Filter	pH	[√ if used] √
VOA Glass	7/04/12	13:00	B	3 (40 ml)	(HCl)	YES	NO	—	✓
Amber Glass	7/04/12	13:00	↓	1 (250, 500, 1L)	(None) (HCl) (H_2SO_4)	YES	NO	—	✓
	/ /	:		250, 500, 1L		YES	NO		
	/ /	:		250, 500, 1L		YES	NO		

Total Bottles (include duplicate count): 4

Analysis Allowed per Bottle Type

BOTTLE TYPE	TYPICAL ANALYSIS ALLOWED PER BOTTLE TYPE (Circle applicable or write non-standard analysis below)
VOA - Glass	(8021) (8260B) (BTEX) (TPH-Gx)
AMBER - Glass	(PAH) (TPH-HCID) (Oil &Grease) (TPH-Dx w/Silica Gel Cleanup) (TPH-Dx w/o Silica Gel Cleanup)
WHITE - Poly	(pH) (Conductivity) (TDS) (TSS) (BOD) (Turbidity) (Alkalinity) (HCO_3/CO_3) (Cl) (SO_4) (NO_3) (NO_2) (F)
YELLOW - Poly	(COD) (TOC) (Total PO_4) (Total Keldahl Nitrogen) (NH_3) (NO_3/NO_2)

WATER QUALITY DATA Purge Start Time: 13 00

Meas.	Time Min	Cum. Volume [gallons or liters]	DTW(ft TOC)	pH	E Cond (µS/cm)	Temp °C	TDS (g/L)	Salinity (ppt)	DO (mg/l)	ORP (mV)	Water Quality [Clarity, Color]
1	0 :03	~300 ml	—	7.62	29944	14.00	19.49	18.64	1.00	-149.9	sl. cloudy, l gray tint
2	0 :06	~600 ml	—	7.59	29564	14.16	19.21	18.32	0.66	-164.7	↓ ↓
3	0 :09	~900 ml	—	7.59	29007	14.17	18.84	17.93	0.61	-172.7	clear, colorless
4	:										
5	:	SEAWATER PARAMETERS at SURFACE									
6	:			8.04	4178	17.61	2.723	2.22	10.87-8.3		
7	:										
8	:										
9	:										
10	:										
11	:										
12	:										
13	:										
14	:										

Comments: Sample Type: (Porewater) Seep Groundwater

Coordinates:

Approximate Elevation: ~~-6.21 ft~~

SAMPLER: Matt Wilson / Julia Labadie
(PRINTED NAME)

(SIGNATURE)

FIELD SAMPLING DATA SHEET

ANCHOR QEA
1605 Cornwall Avenue
Bellingham, WA 98225
Office: (360) 733-4311 Fax: (360) 733-4312

PROJECT NAME: Whatcom Waterway -Supplemental Shoreline Inv. **STATION ID:** CW-PW-03

SITE ADDRESS: C Street, Central Waterfront, Bellingham, WA **BLIND ID:** CW-PW-03-070512

DUP ID: CW-PW-53-070512 (1200)

WIND FROM:	N	NE	E	SE	S	SW	W	NW	LIGHT	MEDIUM	HEAVY
WEATHER:	SUNNY		PRTLY CLDY		CLOUDY		RAIN			**TEMPERATURE:**	°F 75 . °C

[Circle appropriate units]

HYDROLOGY/LEVEL MEASUREMENTS (Nearest 0.01 ft)

Date	Time	DT-Bottom	DT-Product	DT-Water	[Product Thickness] DTP-DTW	[Water Column] DTB-DTW		[Water Column x Gal/ft] Volume (gal)
/ /	:	.	---	.	---	.	X 1	POREWATER
/ /	:	.	---	.	---	.	X 3	.

Gal/ft = (dia./2)^2 x 0.163 | 1" = 0.041 | 2" = 0.163 | 3" = 0.367 | 4" = 0.653 | 6" = 1.469 | 10" = 4.080 | 12" = 5.875

§ METHODS: (A) Waterra (B) Peristaltic Pump (C) Disposable Bailer (D) Grab (E)

GROUNDWATER SAMPLING DATA Sample Depth:

Bottle Type	Date	Time	Method §	Amount & Volume mL		Preservative [circle]	Ice	Filter	pH	[√ if used] √
VOA Glass	07/05/12	11:55	B	3	40 ml	HCl	YES	NO	—	✓
Amber Glass	07/05/12	√:	B	2	250, 500, 1L	(None) (HCl) (H_2SO_4)	YES	NO	—	✓
	/ /	:			250, 500, 1L		YES	NO		
	/ /	:			250, 500, 1L		YES	NO		

Total Bottles (include duplicate count): 5 (10)

Analysis Allowed per Bottle Type

BOTTLE TYPE	TYPICAL ANALYSIS ALLOWED PER BOTTLE TYPE (Circle applicable or write non-standard analysis below)
VOA - Glass	(8021) (8260B) (BTEX) (TPH-Gx)
AMBER - Glass	(PAH) (TPH-HCID) (Oil &Grease) (TPH-Dx w/Silica Gel Cleanup) (TPH-Dx w/o Silica Gel Cleanup)
WHITE - Poly	(pH) (Conductivity) (TDS) (TSS) (BOD) (Turbidity) (Alkalinity) (HCO_3/CO_3) (Cl) (SO_4) (NO_3) (NO_2) (F)
YELLOW - Poly	(COD) (TOC) (Total PO_4) (Total Keldahl Nitrogen) (NH_3) (NO_3/NO_2)

WATER QUALITY DATA Purge Start Time: 11 49

Meas.	Time	Cum. Volume	DTW(ft TOC)	pH	E Cond (µS/cm)	Temp °C	TDS (g/L)	Salinity (ppt)	DO (mg/l)	ORP (mV)	Water Quality
1	0:03	—	—	7.66	23398	13.72	15.10	14.08	0.92	-136.7	clear, colorless
2	0:06	—	—	7.64	22905	13.64	14.87	13.85	0.38	-166.2	↓ ✓
3	0:09	—	—	7.63	22257	13.57	14.45	13.42	0.33	-176.1	↓ ↓
4	0:12	—	—	7.63	21650	13.56	14.05	13.02	0.39	-187.7	↓ ↓
5	:										
6	:	See water parameters at surface.									
7	:			7.97	5395	16.94	3.475	2.89	10.15	17.6	
8	:										
9	:										
10	:										
11	:										
12	:										
13	:										
14	:										

[gallons or liters] [Clarity, Color]

Comments: Sample Type: (Porewater) Seep Groundwater

Coordinates:

Approximate Elevation: -8.41 ft

SAMPLER: Matt Wilson / Julia Labadie (PRINTED NAME) (SIGNATURE)

FIELD SAMPLING DATA SHEET

ANCHOR QEA

1605 Cornwall Avenue
Bellingham, WA 98225
Office: (360) 733-4311 Fax: (360) 733-4312

PROJECT NAME: Whatcom Waterway -Supplemental Shoreline Inv. **STATION ID:** CW-PW-04

SITE ADDRESS: C Street, Central Waterfront, Bellingham, WA **BLIND ID:** CW-PW-04-070512

DUP ID:

WIND FROM:	N	(NE)	E	SE	S	SW	W	NW	(LIGHT)	MEDIUM	HEAVY
WEATHER:	(SUNNY)		PRTLY CLDY		CLOUDY		RAIN			**TEMPERATURE:**	°F 75 . °C

[Circle appropriate units]

HYDROLOGY/LEVEL MEASUREMENTS (Nearest 0.01 ft)

Date	Time	DT-Bottom	DT-Product	DT-Water	[Product Thickness] DTP-DTW	[Water Column] DTB-DTW		[Water Column x Gal/ft] Volume (gal)
/ /	:	.	---	.	---	.	X 1	POREWATER
/ /	:	.	---	.	---	.	X 3	.

Gal/ft = (dia./2)² x 0.163	1" = 0.041	2" = 0.163	3" = 0.367	4" = 0.653	6" = 1.469	10" = 4.080	12" = 5.875

§ METHODS: (A) Waterra (B) Peristaltic Pump (C) Disposable Bailer (D) Grab (E)

GROUNDWATER SAMPLING DATA Sample Depth:

Bottle Type	Date	Time	Method §	Amount & Volume mL	Preservative [circle]	Ice	Filter	pH	[√ if used] √
VOA Glass	7/05/12	13:30	B	3 (40 ml)	(HCl)	(YES)	(NO)	—	√
Amber Glass	/			2 (250, 500, 1L)	(None) (HCl) (H_2SO_4)	(YES)	(NO)	—	√
	/ /	:		250, 500, 1L		YES	NO		
	/ /	:		250, 500, 1L		YES	NO		

Total Bottles (include duplicate count): 5

Analysis Allowed per Bottle Type

BOTTLE TYPE	TYPICAL ANALYSIS ALLOWED PER BOTTLE TYPE (Circle applicable or write non-standard analysis below)
VOA - Glass	(8021) (8260B) (BTEX) (TPH-Gx)
AMBER - Glass	(PAH) (TPH-HCID) (Oil &Grease) (TPH-Dx w/Silica Gel Cleanup) (TPH-Dx w/o Silica Gel Cleanup)
WHITE - Poly	(pH) (Conductivity) (TDS) (TSS) (BOD) (Turbidity) (Alkalinity) (HCO_3/CO_3) (Cl) (SO_4) (NO_3) (NO_2) (F)
YELLOW - Poly	(COD) (TOC) (Total PO_4) (Total Keldahl Nitrogen) (NH_3) (NO_3/NO_2)

WATER QUALITY DATA Purge Start Time: 13:00

Meas.	Time	Cum. Volume [gallons or liters]	DTW(ft TOC)	pH	E Cond (µS/cm)	Temp °C	TDS (g/L)	Salinity (ppt)	DO (mg/l)	ORP (mV)	Water Quality [Clarity, Color]
1	0:03	—	—	7.72	4670	23.18	3.699	3.14	—	-137.8	cloudy, dark gray
2	0:06			7.93	4039	23.30	2.918	2.67	—	-137.0	↓ ↓
3	0:09	—	—	—	—	—	—	—	—	—	—
4	0:12	—	—	8.09	6905	23.50	4.491	3.79	7.89	-148.4	sl. cloudy, brown tint
5	0:15	—	—	8.12	6953	22.71	4.579	3.82	8.12	-153.7	↓ ↓
6	0:18	(1) —	—	7.07	6150	14.25	3.970	3.34	0.41	-215.3	↓ ↓
7	0:21	800ml	—	6.99	5813	14.22	3.777	3.17	0.28	-239.8	clear, lt grey tint
8	0:24	1400ml	—	6.98	5660	14.14	3.680	3.08	0.34	-242.5	↓ ↓
9	0:27	1800ml	—	6.99	5677	14.11	3.690	3.09	0.46	-246.2	↓ ↓
10	:										
11	:	Seawater parameters in 1 foot of water on bottom									
12	:	—	—	7.56	4280	18.58	2.780	2.28	8.80	-130.7	—
13	:										
14	:										

Comments: Sample Type: (Porewater) Seep Groundwater

Coordinates:

Approximate Elevation: -7.07 ft

① Flushed screen with 150 ml of distilled water - then removed at least 10 times that volume

SAMPLER: Matt Wilson / Erica Laboudie (PRINTED NAME)

(SIGNATURE)

FIELD SAMPLING DATA SHEET

ANCHOR QEA

1605 Cornwall Avenue
Bellingham, WA 98225
Office: (360) 733-4311 Fax: (360) 733-4312

PROJECT NAME: Whatcom Waterway -Supplemental Shoreline Inv. **STATION ID:** CW-PW-05

SITE ADDRESS: C Street, Central Waterfront, Bellingham, WA **BLIND ID:** CW-PW-05-070412

DUP ID:

WIND FROM:	N	NE	E	SE	S	SW	W	NW	LIGHT	MEDIUM	HEAVY
WEATHER:	SUNNY	PRTLY CLDY	CLOUDY	RAIN					**TEMPERATURE:**	°F 70 .	°C

HYDROLOGY/LEVEL MEASUREMENTS (Nearest 0.01 ft) [Product Thickness] [Water Column] [Circle appropriate units] [Water Column x Gal/ft]

Date	Time	DT-Bottom	DT-Product	DT-Water	DTP-DTW	DTB-DTW		Volume (gal)
/ /	:	.	---	.	---	.	X 1	PORE WATER
/ /	:	.	---	.	---	.	X 3	.

Gal/ft = $(dia./2)^2 \times 0.163$ | 1" = 0.041 | 2" = 0.163 | 3" = 0.367 | 4" = 0.653 | 6" = 1.469 | 10" = 4.080 | 12" = 5.875

§ METHODS: (A) Waterra (B) Peristaltic Pump (C) Disposable Bailer (D) Grab (E)

GROUNDWATER SAMPLING DATA Sample Depth:

Bottle Type	Date	Time	Method §	Amount & Volume mL	Preservative [circle]	Ice	Filter	pH	[√ if used] √
VOA Glass	7/04/12	11:55	B	1 40 ml	HCl	YES	NO	—	✓
Amber Glass	7/04/12	↓:	↓	1 250, 500, 1L	(None) (HCl) (H_2SO_4)	YES	NO	—	✓
	/ /	:		250, 500, 1L		YES	NO		
	/ /	:		250, 500, 1L		YES	NO		
Total Bottles (include duplicate count): 2									

Analysis Allowed per Bottle Type

BOTTLE TYPE	TYPICAL ANALYSIS ALLOWED PER BOTTLE TYPE (Circle applicable or write non-standard analysis below)
VOA - Glass	(8021) (8260B) (BTEX) (TPH-Gx)
AMBER - Glass	(PAH) (TPH-HCID) (Oil &Grease) (TPH-Dx w/Silica Gel Cleanup) (TPH-Dx w/o Silica Gel Cleanup)
WHITE - Poly	(pH) (Conductivity) (TDS) (TSS) (BOD) (Turbidity) (Alkalinity) (HCO_3/CO_3) (Cl) (SO_4) (NO_3) (NO_2) (F)
YELLOW - Poly	(COD) (TOC) (Total PO_4) (Total Keldahl Nitrogen) (NH_3) (NO_3/NO_2)

WATER QUALITY DATA Purge Start Time: 10 : 14

Meas.	Time min	Cum. Volume [gallons or liters]	DTW(ft TOC)	pH	E Cond (µS/cm)	Temp °C	TDS (g/L)	Salinity (ppt)	DO (mg/l)	ORP (mV)	Water Quality [Clarity, Color]
1	0:06	100 ml	—	8.08	9544	21.88	6.209	5.37	8.83	-176.1	black, opaque
2	0:19	125 ml	—	8.33	11599	23.15	7.540	6.62	7.15	-68.9	↓ ↓
3	0:38	200 ml	—	7.63	7836	19.13	5.083	4.34	10.89	-88.1	black, opaque
4	0:44	300 ml	—	7.96	6388	19.83	4.133	3.47	7.02	-66.4	↓ ↓
5	:										clear, ~~colorless~~
6	:										slight dark
7	:										gray tint
8	:										
9	:										
10	:										
11	:										
12	:										
13	:										
14	:										

Comments: Sample Type: Porewater / Seep / Groundwater

limited volume could not get zero headspace.

Coordinates: 1241270.79 E ~~6 ft~~ 643036.53 N

Approximate Elevation: -3.92 ft

SAMPLER: Matt Wilson / Julia Labadie (PRINTED NAME) (SIGNATURE)

FIELD SAMPLING DATA SHEET

ANCHOR QEA

1605 Cornwall Avenue
Bellingham, WA 98225
Office: (360) 733-4311 Fax: (360) 733-4312

PROJECT NAME: Whatcom Waterway -Supplemental Shoreline Inv. **STATION ID:** CW-PW-06

SITE ADDRESS: C Street, Central Waterfront, Bellingham, WA **BLIND ID:** CWPW-06-070612

DUP ID:

WIND FROM:	N	NE	(E)	SE	S	SW	W	NW	(LIGHT)	MEDIUM	HEAVY
WEATHER:	(SUNNY)	PRTLY CLDY	CLOUDY	RAIN					**TEMPERATURE:**	°F 70 .	°C

[Circle appropriate units]

HYDROLOGY/LEVEL MEASUREMENTS (Nearest 0.01 ft)

Date	Time	DT-Bottom	DT-Product	DT-Water	[Product Thickness] DTP-DTW	[Water Column] DTB-DTW	[Water Column x Gal/ft] Volume (gal)
/ /	:	.	---	.	---	.	X 1 POREWATER
/ /	:	.	---	.	---	.	X 3 .

Gal/ft = (dia./2)^2 x 0.163 | 1" = 0.041 | 2" = 0.163 | 3" = 0.367 | 4" = 0.653 | 6" = 1.469 | 10" = 4.080 | 12" = 5.875

§ METHODS: (A) Waterra (B) Peristaltic Pump (C) Disposable Bailer (D) Grab (E)

GROUNDWATER SAMPLING DATA Sample Depth:

Bottle Type	Date	Time	Method §	Amount & Volume mL	Preservative [circle]	Ice	Filter	pH	[√ if used] √
VOA Glass	7/06/12	17:20	B	4 40 ml	(HCl)	(YES)	(NO)	—	✓
Amber Glass	//	:		1 250, 500, 1L	(None) (HCl) (H_2SO_4)	(YES)	(NO)	—	✓
	/ /	:		250, 500, 1L		YES	NO		
	/ /	:		250, 500, 1L		YES	NO		

Total Bottles (include duplicate count): (3)

Analysis Allowed per Bottle Type

BOTTLE TYPE	TYPICAL ANALYSIS ALLOWED PER BOTTLE TYPE (Circle applicable or write non-standard analysis below)
VOA - Glass	(8021) (8260B) (BTEX) (TPH-Gx)
AMBER - Glass	(PAH) (TPH-HCID) (Oil & Grease) (TPH-Dx w/Silica Gel Cleanup) (TPH-Dx w/o Silica Gel Cleanup)
WHITE - Poly	(pH) (Conductivity) (TDS) (TSS) (BOD) (Turbidity) (Alkalinity) (HCO_3/CO_3) (Cl) (SO_4) (NO_3) (NO_2) (F)
YELLOW - Poly	(COD) (TOC) (Total PO_4) (Total Keldahl Nitrogen) (NH_3) (NO_3/NO_2)

7/05 7/06

WATER QUALITY DATA Purge Start Time: 10:06 1701

Meas.	Time	Cum. Volume	DTW(ft TOC)	pH	E Cond (µS/cm)	Temp °C	TDS (g/L)	Salinity (ppt)	DO (mg/l)	ORP (mV)	Water Quality
7/5/12 1	:	SEAWATER PARAMETERS CW DEPTH									
2	— :	—	—	7.82	42350	12.20	27.53	27.18	7.45	71.9	—
3	0 :03	—	—	7.75	41747	13.92	27.12	27.09	6.14	10.8	slightly, lt gray/tan
4	0 :06	—	—	7.77	41389	14.36	26.90	26.55	5.91	-1.4	↓ ↓
5	0 :09	—	—	7.80	41480	14.79	26.95	26.61	6.17	-2.8	↓ ↓
6	0 :12	—	—	7.82	41485	14.81	26.99	26.66	6.36	-7.5	↓ ↓
7	0 :15	We Moved, drove screen again and restarted - did not make water									
8	(1) :	—	—	7.78	41488	13.11	26.94	26.54	7.43	may be screen clogged?	
7/6/12 9	0 :03	—	—	7.97	19735	18.69	13.02	12.03	9.15	-70.7	clear, colorless
10	0 :06	—	—	7.68	22891	20.53	14.94	13.95	9.20	-81.7	↓ ↓
11	0 :09	—	—	7.59	24603	20.93	16.07	15.09	9.05	-87.7	↓ ↓
12	0 :12	—	—	7.48	26404	21.05	17.38	16.32	8.96	-87.6	↓ ↓
13	0 :15			7.41	28743	21.14	18.75	17.87	8.95	-85.6	↓ ↓
(1) 14	~~0 :18~~	—	—	7.87	41933	12.72	27.26	26.89	7.86	18.3	—

[gallons or liters] [Clarity, Color]

Comments: Sample Type: (Porewater) Seep Groundwater

(1) Seawater parameters

Coordinates:

Approximate Elevation: **-11.16 ft**

SAMPLER: Matt Wilson / Julia Labodie

(PRINTED NAME)

(SIGNATURE)

FIELD SAMPLING DATA SHEET

ANCHOR QEA

1605 Cornwall Avenue
Bellingham, WA 98225
Office: (360) 733-4311 Fax: (360) 733-4312

PROJECT NAME: Whatcom Waterway -Supplemental Shoreline Inv. **STATION ID:** CW-SP-01

SITE ADDRESS: C Street, Central Waterfront, Bellingham, WA **BLIND ID:** CW-SP-01-070512

DUP ID:

WIND FROM:	N	NE	E	SE	S	SW	W	NW	LIGHT	MEDIUM	HEAVY
WEATHER:	SUNNY	PRTLY CLDY	CLOUDY	RAIN					TEMPERATURE:	°F 75 .	°C

[Circle appropriate units]

HYDROLOGY/LEVEL MEASUREMENTS (Nearest 0.01 ft)

Date	Time	DT-Bottom	DT-Product [Product Thickness]	DT-Water [Water Column]	DTP-DTW	DTB-DTW		Volume (gal) [Water Column x Gal/ft]
/ /	:	.	---	.	---	.	X 1	SEEP
/ /	:	.	---	.	---	.	X 3	.

Gal/ft = (dia./2)^2 x 0.163 | 1" = 0.041 | 2" = 0.163 | 3" = 0.367 | 4" = 0.653 | 6" = 1.469 | 10" = 4.080 | 12" = 5.875

§ METHODS: (A) ~~Waterra~~ (B) Peristaltic Pump (C) Disposable Bailer (D) Grab (E)

GROUNDWATER SAMPLING DATA

Bottle Type	Date	Time	Method §	Amount	Volume mL	Preservative [circle]	Ice	Filter	Sample Depth: pH	[√ if used] √
VOA Glass	7/05/12	12:10	D	3	40 ml	HCl	YES	NO	—	X
Amber Glass	7/05/12	√:	D	2	250, 500, 1L	(None) (HCl) (H_2SO_4)	YES	NO	—	X
	/ /	:			250, 500, 1L		YES	NO		
	/ /	:			250, 500, 1L		YES	NO		

Total Bottles (include duplicate count): 5

Analysis Allowed per Bottle Type

BOTTLE TYPE	TYPICAL ANALYSIS ALLOWED PER BOTTLE TYPE (Circle applicable or write non-standard analysis below)
VOA - Glass	(8021) (8260B) (BTEX) (TPH-Gx)
AMBER - Glass	(PAH) (TPH-HCID) (Oil &Grease) (TPH-Dx w/Silica Gel Cleanup) (TPH-Dx w/o Silica Gel Cleanup)
WHITE - Poly	(pH) (Conductivity) (TDS) (TSS) (BOD) (Turbidity) (Alkalinity) (HCO_3/CO_3) (Cl) (SO_4) (NO_3) (NO_2) (F)
YELLOW - Poly	(COD) (TOC) (Total PO_4) (Total Keldahl Nitrogen) (NH_3) (NO_3/NO_2)

WATER QUALITY DATA Purge Start Time: 11 : 50

Meas.	Time	Cum. Volume [gallons or liters]	DTW(ft TOC)	pH	E Cond (µS/cm)	Temp °C	TDS (g/L)	Salinity (ppt)	DO (mg/l)	ORP (mV)	Water Quality [Clarity, Color]
1	:	—	—	6.72	5321	13.08	3.459	2.89	2.65	-157.4	clear, colorless
2	:										
3	:										
4	:										
5	:										
6	:										
7	:										
8	:										
9	:										
10	:										
11	:										
12	:										
13	:										
14	:										

Comments: Sample Type: (Circle one:) Porewater Seep Groundwater

Proposed Coordinates: 1241097.82 E 642906.50

Approximate Elevation: -2.17 ft

Dug hole at base of seep waited for water to run clear and collected sample

Moderate rainbow sheen in sediment and water at ~~seep~~ location

Y on shoreline about 5 feet from seep.

SAMPLER: Matt Wilson / Julia Labadie (PRINTED NAME) (SIGNATURE)

FIELD SAMPLING DATA SHEET

ANCHOR QEA

1605 Cornwall Avenue
Bellingham, WA 98225
Office: (360) 733-4311 Fax: (360) 733-4312

PROJECT NAME: Whatcom Waterway -Supplemental Shoreline Inv. **STATION ID:** CW-SP-02

SITE ADDRESS: C Street, Central Waterfront, Bellingham, WA **BLIND ID:** CW-SP-02-070412

DUP ID:

WIND FROM:	N	NE	E	SE	S	SW	(W)	NW	(LIGHT)	MEDIUM	HEAVY
WEATHER:	(SUNNY)	PRTLY CLDY	CLOUDY	RAIN					**TEMPERATURE:**	°F 70 .	°C

[Circle appropriate units]

HYDROLOGY/LEVEL MEASUREMENTS (Nearest 0.01 ft)

Date	Time	DT-Bottom	DT-Product [Product Thickness]	DT-Water [Water Column]	DTP-DTW	DTB-DTW		Volume (gal) [Water Column x Gal/ft]
/ /	:	.	---	.	---	.	X 1	SEEP
/ /	:	.	---	.	---	.	X 3	.

Gal/ft = ~~(dia./2)^2 x 0.163~~ 1" = 0.041 2" = 0.163 3" = 0.367 4" = 0.653 6" = 1.469 10" = 4.080 12" = 5.875

§ METHODS: (A) Waterra (B) Peristaltic Pump (C) Disposable Bailer (D) Grab (E)

GROUNDWATER SAMPLING DATA Sample Depth: [√ if used]

Bottle Type	Date	Time	Method §	Amount & Volume mL		Preservative [circle]	Ice	Filter	pH	√
VOA Glass	7/04/12	09:10	D	1	40 ml	HCl	YES	NO	—	X
Amber Glass	/ /	:		1	250, 500, 1L	(None) (HCl) (H_2SO_4)	YES	NO	—	X
	/ /	:			250, 500, 1L		YES	NO		
	/ /	:			250, 500, 1L		YES	NO		
Total Bottles (include duplicate count):				2						

Analysis Allowed per Bottle Type

BOTTLE TYPE	TYPICAL ANALYSIS ALLOWED PER BOTTLE TYPE (Circle applicable or write non-standard analysis below)
VOA - Glass	(8021) (8260B) (BTEX) (TPH-Gx)
AMBER - Glass	(PAH) (TPH-HCID) (Oil &Grease) (TPH-Dx w/Silica Gel Cleanup) (TPH-Dx w/o Silica Gel Cleanup)
WHITE - Poly	(pH) (Conductivity) (TDS) (TSS) (BOD) (Turbidity) (Alkalinity) (HCO_3/CO_3) (Cl) (SO_4) (NO_3) (NO_2) (F)
YELLOW - Poly	(COD) (TOC) (Total PO_4) (Total Keldahl Nitrogen) (NH_3) (NO_3/NO_2)

WATER QUALITY DATA Purge Start Time: NA

Meas.	Time	Cum. Volume [gallons or liters]	DTW(ft TOC)	pH	E Cond (µS/cm)	Temp °C	TDS (g/L)	Salinity (ppt)	DO (mg/l)	ORP (mV)	Water Quality [Clarity, Color]
1	:										
2	:	NOT Enough volume for parameters.									
3	:										
4	:										
5	:										
6	:										
7	:										
8	:										
9	:										
10	:										
11	:										
12	:										
13	:										
14	:										

Comments: Sample Type: (Circle one:) Porewater (Seep) Groundwater Coordinates: ~~1241429.76 E~~ ~~643189.27 N~~

Approximate Elevation: ~~-2.41 ft~~

limited sample volume
Took 40 minutes to fill one 40ml VOA vial → drips collected drips out of rocks into sample containers.

SAMPLER: Matt Wilson / Julia Labadie (PRINTED NAME) Matthew Wilson (SIGNATURE)

could not get zero headspace in vial. Tried 6 times.

FIELD SAMPLING DATA SHEET

ANCHOR QEA

1605 Cornwall Avenue
Bellingham, WA 98225
Office: (360) 733-4311 Fax: (360) 733-4312

PROJECT NAME: Whatcom Waterway -Supplemental Shoreline Inv. **STATION ID:** ~~CW-MW-2~~ CW-MW-65(C)

SITE ADDRESS: C Street, Central Waterfront, Bellingham, WA **BLIND ID:** CW-MW-65C-070612 (MW-7/06/12)

DUP ID:

WIND FROM: N | NE | (E) | SE | S | SW | W | NW | (LIGHT) | MEDIUM | HEAVY

WEATHER: (SUNNY) | PRTLY CLDY | CLOUDY | RAIN **TEMPERATURE:** °F 70 . °C [Circle appropriate units]

HYDROLOGY/LEVEL MEASUREMENTS (Nearest 0.01 ft)

Date	Time	DT-Bottom	DT-Product [Product Thickness]	DT-Water [Water Column]	DTP-DTW	DTB-DTW		Volume (gal) [Water Column x Gal/ft]
7/06/12	11:29	13.98	---	5.95	---	8.03	X 1	1.40
/ /	:	.	---	.	---	.	X 3	4.20

Gal/ft = (dia./2)² x 0.163 | 1" = 0.041 | (2" = 0.163) | 3" = 0.367 | 4" = 0.653 | 6" = 1.469 | 10" = 4.080 | 12" = 5.875

§ METHODS: (A) Waterra (B) Peristaltic Pump (C) Disposable Bailer (D) Grab (E)

GROUNDWATER SAMPLING DATA Sample Depth:

Bottle Type	Date	Time	Method §	Amount & Volume mL	Preservative [circle]	Ice	Filter	pH	[√ if used] √
VOA Glass	7/06/12	12:10	B	3	40 ml HCl	YES	NO	—	√
Amber Glass	//	:	B	2	250, 500, 1L (None) (HCl) (H_2SO_4)	YES	NO	—	√
	/ /	:			250, 500, 1L	YES	NO		
	/ /	:			250, 500, 1L	YES	NO		
Total Bottles (include duplicate count):				5					

Analysis Allowed per Bottle Type

BOTTLE TYPE	TYPICAL ANALYSIS ALLOWED PER BOTTLE TYPE (Circle applicable or write non-standard analysis below)
VOA - Glass	(8021) (8260B) (BTEX) (TPH-Gx)
AMBER - Glass	(PAH) (TPH-HCID) (Oil &Grease) (TPH-Dx w/Silica Gel Cleanup) (TPH-Dx w/o Silica Gel Cleanup)
GREEN - Poly	(Total Cyanide) (Free Cyanide) (Weak and Dissociable Cyanide)
RED TOTAL - Poly	(As) (Sb) (Ba) (Be) (Ca) (Cd) (Co) (Cr) (Cu) (Fe) (Pb) (Mg) (Mn) (Ni) (Ag) (Se) (Tl) (V) (Zn) (Hg) (K) (Na)
RED DISSOLVED - Poly	(As) (Sb) (Ba) (Be) (Ca) (Cd) (Co) (Cr) (Cu) (Fe) (Pb) (Mg) (Mn) (Ni) (Ag) (Se) (Tl) (V) (Zn) (Hg) (K) (Na) (Hardness) (Silica)

WATER QUALITY DATA Purge Start Time: 11:30 Purge Type: Low Flow

Meas.	Elapsed Time min	Cum. Volume [gallons or liters]	DTW(ft TOC)	pH	E Cond (µS/cm)	Temp °C	TDS (g/L)	Salinity (ppt)	DO (mg/l)	ORP (mV)	Water Quality [Clarity, Color]
1	0:03	~~200 mL~~	6.01	6.45	3249	13.61	2.109	1.71	1.03	76.3	clear, colorless
2	0:06	0.5L	6.00	6.34	3200	13.32	2.079	1.68	0.99	64.5	clear, pale tint
3	0:09	0.9L	6.00	6.32	3173	13.74	2.058	1.66	—	53.9	↓ ↓
4	0:12	1.2L	6.13	6.32	3136	13.16	2.037	1.65	2.74	44.0	↓ ↓
5	0:15	1.7L	6.13	6.32	3103	13.07	2.017	1.63	3.85	36.5	↓ ↓
6	0:18	2.4L	6.17	6.33	3046	12.98	1.976	1.59	3.93	22.1	↓ ↓
7	0:21	2.9L	6.18	6.33	2997	12.94	1.947	1.57	1.79	10.9	↓ ↓
8	0:24	3.45L	6.19	6.34	2955	12.91	1.918	1.54	1.36	-1.1	↓ ↓
9	0:27	4.1	6.20	6.34	2908	12.90	1.893	1.53	1.35	-16.6	↓ ↓
10	0:30	4.8	6.21	6.35	2878	12.95	1.873	1.51	1.20	-28.2	clear, colorless
11	0:33	5.4	6.19	6.36	2815	13.02	1.828	1.47	0.95	-44.4	↓ ↓
12	0:36	6.0	6.17	6.37	2817	13.10	1.834	1.47	0.83	-52.8	↓ ↓
13	0:39	6.6	6.19	6.37	2835	13.18	1.842	1.47	0.96	-56.8	↓ ↓
14	:										

Comments: Sample Type: (Circle one:) Porewater Seep (Groundwater) Coordinates: Elevation:

-0.65 ft correction

SAMPLER: Matt Wilson, Julia Kabodian (PRINTED NAME) (SIGNATURE)

FIELD SAMPLING DATA SHEET

ANCHOR QEA

1605 Cornwall Avenue
Bellingham, WA 98225
Office: (360) 733-4311 Fax: (360) 733-4312

PROJECT NAME: Whatcom Waterway -Supplemental Shoreline Inv. **STATION ID:** CW-MW-18

SITE ADDRESS: C Street, Central Waterfront, Bellingham, WA **BLIND ID:** CW-MW-18-070612

DUP ID:

WIND FROM:	N	NE	(E)	SE	S	SW	W	NW	(LIGHT)	MEDIUM	HEAVY
WEATHER:	(SUNNY)	PRTLY CLDY	CLOUDY	RAIN					**TEMPERATURE:**	°F 75 .	°C

[Circle appropriate units]

HYDROLOGY/LEVEL MEASUREMENTS (Nearest 0.01 ft)

Date	Time	DT-Bottom	DT-Product	DT-Water	[Product Thickness] DTP-DTW	[Water Column] DTB-DTW		[Water Column x Gal/ft] Volume (gal)
7/06/12	12:19	15.05	---	~~5.74~~ 6.06	---	8.99	X 1	1.56
/ /	:	.	---	.	---	.	X 3	4.69

Gal/ft = (dia./2)² x 0.163 (1" = 0.041) 2" = 0.163 3" = 0.367 4" = 0.653 6" = 1.469 10" = 4.080 12" = 5.875

§ METHODS: (A) Waterra (B) Peristaltic Pump (C) Disposable Bailer (D) Grab (E)

GROUNDWATER SAMPLING DATA Sample Depth:

Bottle Type	Date	Time	Method §	Amount & Volume mL	Preservative [circle]	Ice	Filter	pH	[√ if used] √
VOA Glass	7/06/12	12:40	B	3 (40 ml)	(HCl)	YES	NO	—	✓
Amber Glass	/ /	:		2 (250, 500, 1L)	(None) (HCl) (H_2SO_4)	YES	NO	—	✓
	/ /	:		250, 500, 1L		YES	NO		
	/ /	:		250, 500, 1L		YES	NO		

Total Bottles (include duplicate count): 5

Analysis Allowed per Bottle Type

BOTTLE TYPE	TYPICAL ANALYSIS ALLOWED PER BOTTLE TYPE (Circle applicable or write non-standard analysis below)
VOA - Glass	(8021) (8260B) (BTEX) (TPH-Gx)
AMBER - Glass	(PAH) (TPH-HCID) (Oil &Grease) (TPH-Dx w/Silica Gel Cleanup) (TPH-Dx w/o Silica Gel Cleanup)
WHITE - Poly	(pH) (Conductivity) (TDS) (TSS) (BOD) (Turbidity) (Alkalinity) (HCO_3/CO_3) (Cl) (SO_4) (NO_3) (NO_2) (F)
YELLOW - Poly	(COD) (TOC) (Total PO_4) (Total Keldahl Nitrogen) (NH_3) (NO_3/NO_2)

WATER QUALITY DATA Purge Start Time: 12:20 PURGE TYPE (circle): Low Flow; 3x Purge; Well Dry

Meas.	Time elapsed min	Cum. Volume [gallons or liters]	DTW(ft TOC)	pH	E Cond (µS/cm)	Temp °C	TDS (g/L)	Salinity (ppt)	DO (mg/l)	ORP (mV)	Water Quality [Clarity, Color]
1	0:03	0.4L	6.15	6.28	1015	15.58	0.660	0.51	1.62	-144.4	clear, colorless
2	0:06	0.9L ①	6.15	6.27	1017	15.58	0.661	0.51	1.23	-158.0	↓ ↓
3	0:09	1.0L	~~6.74~~	—	—	—	—	—	—	—	↓ ↓
4	0:12	1.4L	6.18	6.29	1013	15.44	0.659	0.50	0.95	-169.2	↓ ↓
5	0:15	2.0	6.19	6.27	1017	15.48	0.661	0.51	0.58	-180.4	↓ ↓
6	0:18	2.6	6.19	6.28	1016	15.40	0.660	0.51	0.60	-185.2	↓ ↓
7	0:21	3.1	6.19	6.28	1015	15.40	0.660	0.51	0.55	-189.3	↓ ↓
8	0:24	3.65	6.19	6.28	1014	15.39	0.659	0.50	0.59	-191.6	↓ ↓
9	:										
10	:										
11	:										
12	:										
13	:										
14	:										

Comments: Sample Type: Porewater Proposed Coordinates: 1241090.12 E 642925.4 N ② water has moderate HC-like odor (petroleum-like)

-0.45' correction factor Seep Elevation: 12.75 ft

(Groundwater) ① Tubing came disconnected at P-pump.

SAMPLER: Matt Wilson / Julia Haberlie

(PRINTED NAME) (SIGNATURE)

FIELD SAMPLING DATA SHEET

ANCHOR QEA

1605 Cornwall Avenue
Bellingham, WA 98225
Office: (360) 733-4311 Fax: (360) 733-4312

PROJECT NAME: Whatcom Waterway -Supplemental Shoreline Inv. **STATION ID:** CW-MW-2

SITE ADDRESS: C Street, Central Waterfront, Bellingham, WA **BLIND ID:** CWMW-2-070612

DUP ID:

WIND FROM:	N	NE	(E)	SE	S	SW	W	NW	(LIGHT)	MEDIUM	HEAVY
WEATHER:	(SUNNY)		PRTLY CLDY		CLOUDY		RAIN		**TEMPERATURE:**	°F 75 .	°C

[Circle appropriate units]

HYDROLOGY/LEVEL MEASUREMENTS (Nearest 0.01 ft)

Date	Time	DT-Bottom	DT-Product	DT-Water	[Product Thickness] DTP-DTW	[Water Column] DTB-DTW		[Water Column x Gal/ft] Volume (gal)
7/06/12	13:00	38.26	---	6.86	---	31.40	X 1	5.46
/ /	:	.	---	.	---	.	X 3	16.39

Gal/ft = $(dia./2)^2 \times 0.163$ | 1" = 0.041 | (2" = 0.163) | 3" = 0.367 | 4" = 0.653 | 6" = 1.469 | 10" = 4.080 | 12" = 5.875

§ METHODS: (A) Waterra (B) Peristaltic Pump (C) Disposable Bailer (D) Grab (E)

GROUNDWATER SAMPLING DATA Sample Depth:

Bottle Type	Date	Time	Method §	Amount	Volume mL	Preservative [circle]	Ice	Filter	pH	[√ if used] √
VOA Glass	7/06/12	13:40	B	3	(40 ml)	(HCl)	(YES)	(NO)	—	✓
Amber Glass	//	↓	↓	2	250, (500), 1L	(None) (HCl) (H_2SO_4)	(YES)	(NO)	—	✓
	/ /	:			250, 500, 1L		YES	NO		
	/ /	:			250, 500, 1L		YES	NO		
Total Bottles (include duplicate count):				5						

Analysis Allowed per Bottle Type

BOTTLE TYPE	TYPICAL ANALYSIS ALLOWED PER BOTTLE TYPE (Circle applicable or write non-standard analysis below)
VOA - Glass	(8021) (8260B) (BTEX) (TPH-Gx)
AMBER - Glass	(PAH) (TPH-HCID) (Oil &Grease) (TPH-Dx w/Silica Gel Cleanup) (TPH-Dx w/o Silica Gel Cleanup)
WHITE - Poly	(pH) (Conductivity) (TDS) (TSS) (BOD) (Turbidity) (Alkalinity) (HCO_3/CO_3) (Cl) (SO_4) (NO_3) (NO_2) (F)
YELLOW - Poly	(COD) (TOC) (Total PO_4) (Total Keldahl Nitrogen) (NH_3) (NO_3/NO_2)

WATER QUALITY DATA Purge Start Time: 13:01 PURGE TYPE (circle): (Low Flow); 3x Purge; Well Dry

Meas.	Time	Cum. Volume [gallons or liters]	DTW(ft TOC)	pH	E Cond (µS/cm)	Temp °C	TDS (g/L)	Salinity (ppt)	DO (mg/l)	ORP (mV)	Water Quality [Clarity, Color]
1	0:03	0.4	7.55	—	—	—	—	—	—	—	—
2	0:06	0.7	7.82	7.38	2401	15.18	1.556	1.24	1.10	-216.3	sl. cloudy, dark gray ~~1 pekt~~ tint
3	0:09	1.0	8.05	—	—	—	—	—	—	—	↓ ↓
4	0:12	1.25	8.13	7.20	1716	15.84	1.114	0.87	0.53	-254.1	↓ ↓
5	0:15	1.5	8.17	7.19	1779	15.83	1.158	0.91	0.58	-265.2	↓ ↓
6	0:18	1.75	8.23	7.14	1350	15.78	0.871	0.67	0.73	-257.1	↓ ↓
7	0:21	2.0	8.27	7.14	1410	15.63	0.915	0.71	0.60	-267.6	sl. cloudy, l. gray tint
8	0:24	2.3	8.28	7.14	1465	15.61	0.953	0.74	0.48	-264.3	↓ ↓
9	0:27	2.5	8.26	7.12	1314	15.96	0.857	0.66	0.45	-266.3	↓ ↓
10	0:30	2.7	8.20	7.13	1479	16.02	0.959	0.74	0.46	-273.3	↓ ↓
11	0:33	2.95	8.25	7.14	1515	15.84	0.983	0.76	0.34	-273.0	↓ ↓
12	0:36	3.2	8.24	7.14	1499	15.94	0.975	0.76	0.38	-266.3	↓ ↓
13	:										
14	:										

Comments: Sample Type: Porewater Seep (Groundwater) Proposed Coordinates: 1241060.16 E 642671.04 N Elevation: 13.01 ft

SAMPLER: Matt Wilson / Julia Labadie (PRINTED NAME) (SIGNATURE)

FIELD SAMPLING DATA SHEET

ANCHOR QEA
1605 Cornwall Avenue
Bellingham, WA 98225
Office: (360) 733-4311 Fax: (360) 733-4312

PROJECT NAME: Whatcom Waterway -Supplemental Shoreline Inv. **STATION ID:** MW-1(B)

SITE ADDRESS: C Street, Central Waterfront, Bellingham, WA **BLIND ID:** MW-1B-070612

DUP ID:

WIND FROM:	N	NE	(E)	SE	S	SW	W	NW	LIGHT	(MEDIUM)	HEAVY
WEATHER:	(SUNNY)	PRTLY CLDY		CLOUDY		RAIN			**TEMPERATURE:**	° F	° C

HYDROLOGY/LEVEL MEASUREMENTS (Nearest 0.01 ft)

Date	Time	DT-Bottom	DT-Product	DT-Water	[Product Thickness] DTP-DTW	[Water Column] DTB-DTW		[Circle appropriate units] [Water Column x Gal/ft] Volume (gal)
7/06/12	14:05	14.32	---	7.30	---	7.07	X 1	1.14
/ /	:	.	---	.	---	.	X 3	3.43

Gal/ft = (dia./2)^2 x 0.163 | 1" = 0.041 | (2" = 0.163) | 3" = 0.367 | 4" = 0.653 | 6" = 1.469 | 10" = 4.080 | 12" = 5.875

§ METHODS: (A) Waterra (B) Peristaltic Pump (C) Disposable Bailer (D) Grab (E)

GROUNDWATER SAMPLING DATA Sample Depth: [√ if used]

Bottle Type	Date	Time	Method §	Amount & Volume mL	Preservative [circle]	Ice	Filter	pH	√
VOA Glass	7/06/12	15:00	B	3 (40 ml)	(HCl)	(YES)	(NO)	—	✓
Amber Glass	/↓	:↓	↓	2 250, 500, 1L	(None) (HCl) (H_2SO_4)	(YES)	(NO)	—	✓
	/ /	:		250, 500, 1L		YES	NO		
	/ /	:		250, 500, 1L		YES	NO		

Total Bottles (include duplicate count): 5

Analysis Allowed per Bottle Type

BOTTLE TYPE	TYPICAL ANALYSIS ALLOWED PER BOTTLE TYPE (Circle applicable or write non-standard analysis below)
VOA - Glass	(8021) (8260B) (BTEX) (TPH-Gx)
AMBER - Glass	(PAH) (TPH-HCID) (Oil &Grease) (TPH-Dx w/Silica Gel Cleanup) (TPH-Dx w/o Silica Gel Cleanup)
WHITE - Poly	(pH) (Conductivity) (TDS) (TSS) (BOD) (Turbidity) (Alkalinity) (HCO_3/CO_3) (Cl) (SO_4) (NO_3) (NO_2) (F)
YELLOW - Poly	(COD) (TOC) (Total PO_4) (Total Keldahl Nitrogen) (NH_3) (NO_3/NO_2)

WATER QUALITY DATA Purge Start Time: 14:06 PURGE TYPE (circle): (Low Flow); 3x Purge; Well Dry

Meas.	Time	Cum. Volume (Liters)	(1) DTW(ft TOC)	pH	E Cond (µS/cm)	Temp °C	TDS (g/L)	Salinity (ppt)	DO (mg/l)	ORP (mV)	Water Quality
1	0:03	0.25	7.55	7.05	6184	15.67	4.015	3.38	3.03	-294.4	clear, colorless
2	0:06	0.5	7.65	7.04	6146	15.57	3.998	3.37	1.97	-298.4	↓ ↓
3	0:09	0.8	7.74	7.03	6107	15.46	3.967	3.34	1.06	-292.4	↓ slight yellow tint
4	0:12	0.95	7.68	7.04	6122	15.65	3.980	3.35	0.83	-299.0	↓ ↓
5	0:15	1.25	7.77	7.03	6079	15.83	3.923	3.30	0.68	-302.6	↓ ↓
6	0:18	1.5	7.77	7.03	6031	15.87	3.934	3.30	0.53	-295.5	↓ ↓
7	0:21	1.75	7.82	7.03	6031	15.68	3.926	3.30	0.58	-306.8	↓ ↓
8	0:24	2.0	7.87	—	—	—	—	—	—	—	↓ ↓
9	0:27	2.4	7.98	7.04	6038	15.99	3.926	3.30	0.49	-309.2	↓ ↓
10	0:30	2.6	8.00	7.04	6035	16.23	3.926	3.30	0.46	-310.0	↓ ↓
11	0:33	2.8	8.10	7.04	6035	16.26	3.925	3.30	~~0.41~~	-296.1	↓ ↓
12	0:36	3.0	8.12	7.05	6043	16.03	3.923	3.31	0.42	-295.5	↓ ↓
13	0:39	3.25	8.14	7.04	6040	15.90	3.929	3.31	—	-295.7	↓ ↓
14	0:42	3.5	8.14	7.05	6024	16.29	3.919	3.30	0.34	-310.1	↓ ↓

[gallons or liters] [Clarity, Color]

Comments: Sample Type: Porewater (Proposed) Coordinates: 1241295.92 E 643110.95 N

-0.48 ft correction factor

Seep Elevation: 11.84 ft

(Groundwater) (1) Difficult to get an accurate DTW reading - many false readings.

0:45 3.7 8.16 7.06 6037 16.23 3.926 3.30 0.36 -298.4

SAMPLER: Matt Wilson / Julia Labalie (PRINTED NAME) (SIGNATURE)

0:48 4.0 8.15 7.06 6013 16.08 3.909 3.29 0.36 -301.3

ATTACHMENT B
FIELD FORMS – JULY 2016

FIELD SAMPLING DATA SHEET

ANCHOR QEA

1605 Cornwall Ave.
Bellingham, Washington 98225
(360) 733-4311

PROJECT NAME: Central Waterfront RI/FS **WELL ID:** CWF-CW-~~#~~BW1

SITE ADDRESS: 900 C St. Bellingham, WA **SAMPLE ID:** CWF-CW-~~#~~1-07202016

DUP ID: CWF-CW-101-07202016

WIND FROM:	N	NE	E	SE	S	(SW)	W	NW	LIGHT	(MEDIUM)	HEAVY
WEATHER:	(SUNNY)		PRTLY CLOUDY		CLOUDY		RAIN		**TEMPERATURE:**	(°F) 75.	°C

[Circle appropriate units]

HYDROLOGY/LEVEL MEASUREMENTS (Nearest 0.01 ft) [Product Thickness] [Water Column] [Water Column x Gal/ft]

Date	Time	DT-Bottom	DT-Product	DT-Water	DTP-DTW	DTB-DTW		Volume (~~gal~~) gal
7/20/16	11:30	14.62	---	5.75	---	9.07	X1	1.47
/ /	:	.	---	.	---	.	X3	4.44

Gal/ft = (dia./2)² x 0.163 | 1" = 0.041 | (2" = 0.163) | 3" = 0.367 | 4" = 0.653 | 6" = 1.469 | 10" = 4.080 | 12" = 5.875

§ METHODS: (A) Waterra (B) Peristaltic Pump (C) Disposable Bailer | Sampled via: (1) Low-flow (2) Purged 3 casing volumes (3) Purged dry, let recover, and sampled

GROUNDWATER SAMPLING DATA Sample Depth: 10 ft

Bottle Type	Date	Time	Method §	Amount	Volume mL	Preservative [circle]	Ice	Filter	pH	[√ if used] √
500mL HDPE	07/20/2016	12:47	B	2	~~1000~~ 500	HNO_3	YES	NO*		
Sm OJ HDPE	07/20/2016	12:47	B	1	BW ~~750~~ 500	none	(YES)	(NO) ~~YES~~		
500mL AG	07/20/2016	12:47	B	4	500	none	YES	NO		
40mL vial	07/20/2016	12:47	B	3	40	HCl	YES	NO		
500mL HDPE	07/20/2016	12:49	B	2	500	HNO_3	YES	NO*		
Lg OJ HDPE	07/20/2016	12:49	B	1	750	none	YES	NO		
500mL AG	07/20/2016	12:49	B	4	500	none	YES	NO		
40mL vial	07/20/2016	12:49	B	3	40	HCl	YES	NO		
	~~07/20/2016~~	~~12:49~~					YES	NO		

Total Bottles (include duplicate count): 20

Analysis Allowed per Bottle Type	BOTTLE TYPE	ANALYSIS ALLOWED PER BOTTLE TYPE (Circle applicable or write non-standard analysis below)
	500 mL HDPE	Total and Dissolved Metals: (Ag) (As) (Be) (Cd) (Cr) (Cu) (Hg) (Ni) (Pb) (Sb) (Se) (Tl) (Zn) (Ba)
	500 mL AG	(SVOCs) (PAHs) (TBT) (Pesticides) (THP-Dx)
	40 mL vial	(VOCs) (BTEX) (TPH-G)
	Lg OJ HDPE	(TDS) (TSS)
	Sm OJ HDPE	(Alkalinity) (Ammonia) (Dissolved Sulfide) (Chloride) (Nitrate) (Sulfate) (Chromium VI)
	1L AG	(PCBs) (TPH-Dx) (Dioxins/Furans)

WATER QUALITY DATA Purge Start Time: 12:23 Depth of tubing (ft btoc): 10 ft

Meas.	Time	Cum. Volume	DTW(ft bTOC)	pH	E Cond (µS/cm)	Temp °C	DO (mg/L)	ORP	Water Quality (Color, Clarity)	Turbidity
1	12:25		5.82	.		.				
2	12:30	1000mL	5.80	7.21	0.069	18.26	1.04	-268.2	trace PM, black*	6.92
3	12:33	1.6 L	5.80	6.92	~~0.069~~	17.95	1.19	-297.3	↓	3.89
4	12:36	2.2 L	5.80	6.88	0.070	17.79	1.10	-305.9	↓	3.65
5	12:39	2.8 L	5.81	6.88	0.070	17.82	0.98	-306.6	↓	4.21
6	12:42	3.4 L	5.81	6.87	0.069	18.00	0.84	-307.6	△	2.66
7	12:45	4.0 L	5.81	6.87	0.069	17.90	0.88	-308.0		2.56
8	:		.	.		.				
9	:		.	.		.				
10	:		.	.		.				
11	:		.	.		.				
12	:		.	.		.				

[gallons or liters] [Clarity, Color]

Turbidity before sample collection (NTU): **Turbidity after sample collection (NTU):**

Comments: pump @ 200 mL/min
△ = some conditioning except ~~mild~~ moderate Sulfur like odor, clear & colorless
~~slow~~ mild sulfur like odor

SAMPLER: Tyler Cohen (PRINTED NAME) (SIGNATURE)

* dissolved metals was field filtered, total metals was not

wt metals is

FIELD SAMPLING DATA SHEET

ANCHOR QEA

1605 Cornwall Ave.
Bellingham, Washington 98225
(360) 733-4311

PROJECT NAME: Central Waterfront RI/FS **WELL ID:** CW-2

SITE ADDRESS: Bellingham WA **SAMPLE ID:** CWF-CW-2-07202016

DUP ID:

WIND FROM: N | NE | E | SE | S | (SW) | W | NW | LIGHT | (MEDIUM) | HEAVY

WEATHER: (SUNNY) | PRTLY CLOUDY | CLOUDY | RAIN **TEMPERATURE:** (°F) 75. °C [Circle appropriate units]

HYDROLOGY/LEVEL MEASUREMENTS (Nearest 0.01 ft)

[Product Thickness] [Water Column] [Water Column x Gal/ft]

Date	Time	DT-Bottom	DT-Product	DT-Water	DTP-DTW	DTB-DTW		Volume (gal)
7/20/16	11:17	5.2	---	5.95	---	9.25	X 1	1.51
/ /	:	.	---	.	---	.	X 3	4.52

Gal/ft = (dia./2)² x 0.163 | 1" = 0.041 | (2" = 0.163) | 3" = 0.367 | 4" = 0.653 | 6" = 1.469 | 10" = 4.080 | 12" = 5.875

§ METHODS: (A) Waterra (B) Peristaltic Pump (C) Disposable Bailer Sampled via: (1) Low-flow (2) Purged 3 casing volumes (3) Purged dry, let recover, and sampled

GROUNDWATER SAMPLING DATA

Sample Depth: 10 ft

Bottle Type	Date	Time	Method §	Amount & Volume mL		Preservative [circle]	Ice	Filter	pH	[√ if used] √
500 mL HDPE	7/20/2016	11:58	B	2	500	HNO_3	(YES)	NO *		
Sm/Lg OJ HDPE	7/20/2016	11:58	B	1	~~250~~ 500	none	(YES)	(NO) ~~YES~~		
500 mL AG	7/20/2016	11:58	B	4	500	none	(YES)	(NO)		
40 mL vial	7/20/2016	11:58	B	3	40	HCl	(YES)	(NO)		
	/ /	:					YES	NO		
	/ /	:					YES	NO		
	/ /	:					YES	NO		
	/ /	:					YES	NO		
	/ /	:		TC			YES	NO		

Total Bottles (include duplicate count): ~~8~~ 10

* dissolved metals was field filtered
total metals was not

Analysis Allowed per Bottle Type

BOTTLE TYPE	ANALYSIS ALLOWED PER BOTTLE TYPE (Circle applicable or write non-standard analysis below)
500 mL HDPE	Total and Dissolved Metals: (Ag) (As) (Be) (Cd) (Cr) (Cu) (Hg) (Ni) (Pb) (Sb) (Se) (Tl) (Zn) (Ba)
500 mL AG	(SVOCs) (PAHs) (TBT) (Pesticides) (TPH-Dx)
40 mL vial	(VOCs) (BTEX) (TPH-G)
Lg OJ HDPE	(TDS) (TSS)
Sm OJ HDPE	(Alkalinity) (Ammonia) (Dissolved Sulfide) (Chloride) (Nitrate) (Sulfate) (Chromium VI)
1L AG	(PCBs) (TPH-Dx) (Dioxins/Furans)

0.125 SM4

WATER QUALITY DATA

Purge Start Time: 11:27 Depth of tubing (ft btoc): 10 ft

0.375

Meas.	Time	Cum. Volume	DTW(ft bTOC)	pH	E Cond (µS/cm)	Temp °C	DO (mg/L)	ORP	Water Quality (Color, Clarity)	(NTU)
1	11:28	0.28	6.05	6.43	7.43	17.11	2.21	-355.1	Yellow, Pale, clear	1.63
2	11:32	0.70	6.05	6.44	7.52	17.14	1.29	-367.6	Pale yellow, clear	1.3
3	11:35	1.075	6.07	6.55	7.692	17.23	0.97	-379.0	" , "	0.77
4	11:38	1.45	6.09	6.58	7.710	17.28	0.99	-383.5	" , "	1.10
5	11:41	1.825	6.09	6.61	7.691	17.21	1.27	-387.9	" , "	1.3
6	11:48	300 ml	6.05	6.75	7.360	18.03	6.73	-369.5	" , "	0.84
7	11:51	900 ml	6.06	6.72	7.483	17.92	6.72	-382.3	" , "	0.89
8	11:54	1.5 L	6.06	6.70	7.474	18.01	6.60	-386.9	" , "	0.64
9	11:57	2.1 L	6.07	6.71	7.456	18.04	6.52	-390.0	" , "	0.77
10	:		.	.		.				
11	:		.	.		.				
12	:		.	.		.				

11:42 STOP for DUP check 200 mL/min

[gallons or liters] [Clarity, Color]

Turbidity before sample collection (NTU): **Turbidity after sample collection (NTU):**

Comments: pump rate - 200 mL/min for sampling

SAMPLER: Bernadette Wright (PRINTED NAME) (SIGNATURE)

FIELD SAMPLING DATA SHEET

ANCHOR QEA

1605 Cornwall Ave.
Bellingham, Washington 98225
(360) 733-4311

PROJECT NAME: Central Waterfront RI/FS **WELL ID:** RMW-5 ~~07212016~~ BW

SITE ADDRESS: 900 F St Bellingham WA **SAMPLE ID:** RMW-5-07212016

DUP ID:

WIND FROM:	N	NE	E	SE	S	SW	W	NW	LIGHT	MEDIUM	HEAVY
WEATHER:	SUNNY		PRTLY CLOUDY		CLOUDY		RAIN		**TEMPERATURE:**	°F 76 .	°C

[Circle appropriate units]

HYDROLOGY/LEVEL MEASUREMENTS (Nearest 0.01 ft) [Product Thickness] [Water Column] [Water Column x Gal/ft]

Date	Time	DT-Bottom	DT-Product	DT-Water	DTP-DTW	DTB-DTW		Volume (gal)
7/21/16	12:05	18.23	---	10.54	---	7.69	X 1	1.25
/ /	:	.	---	.	---	.	X 3	3.76

Gal/ft = (dia./2)² x 0.163 | 1" = 0.041 | 2" = 0.163 | 3" = 0.367 | 4" = 0.653 | 6" = 1.469 | 10" = 4.080 | 12" = 5.875

§ METHODS: (A) Waterra (B) Peristaltic Pump (C) Disposable Bailer — Sampled via: (1) Low-flow (2) Purged 3 casing volumes (3) Purged dry, let recover, and sampled

GROUNDWATER SAMPLING DATA Sample Depth: 15ft

Bottle Type	Date	Time	Method §	Amount & Volume mL	Preservative [circle]	Ice	Filter	pH	[√ if used] √
~~Lg OJ HDPE~~ Sm	7/21/2016	13:13	B	1 BW 750 50	none	YES	NO		
~~500 mL HDPE~~	7/21/2016	13:13	B	~~1~~ 1	500 HNO_3	YES	YES		
500 mL HDPE	7/21/2016	13:13	B	1	500 HNO_3	YES	NO		
	/ /	:				YES	NO		
	/ /	:				YES	NO		
	/ /	:				YES	NO		
	/ /	:				YES	NO		
	/ /	:				YES	NO		
	/ /	:				YES	NO		

Total Bottles (include duplicate count):

Analysis Allowed per Bottle Type

BOTTLE TYPE	ANALYSIS ALLOWED PER BOTTLE TYPE (Circle applicable or write non-standard analysis below)
500 mL HDPE	Total and Dissolved Metals: ~~(Ag)~~ (As) (Be) (Cd) (Cr) (Cu) (Hg) (Ni) (Pb) ~~(Sb)~~ (Se) (Tl) (Zn) (Ba)
500 mL AG	~~(SVOCs)~~ (PAHs) ~~(TBT)~~ ~~(Pesticides)~~ ~~PH-Dx~~
40 mL vial	(VOCs) ~~(BTEX)~~ ~~(TPH-G)~~ BW
Lg OJ HDPE	(TDS) (TSS) ~~Hex Chrom~~ BW
Sm OJ HDPE	(Alkalinity) (Ammonia) (Dissolved Sulfide) (Chloride) (Nitrate) (Sulfate) ~~(Chromium VI)~~ BW Cr VI
1L AG	(PCBs) (TPH-Dx) (Dioxins/Furans)

WATER QUALITY DATA Purge Start Time: 12:17 Depth of tubing (ft btoc): 15ft

Meas.	Time	Cum. Volume	DTW(ft bTOC)	pH	E Cond (µS/cm)	Temp °C	DO (mg/L)	ORP	Water Quality (Color, Clarity)	Tube Vol.
1	12:27	2 L	10.55	6.53	0.490	18.63	8.80	-95.5	↑	10.8
2	12:30	2.6	10.55	6.48	0.463	18.65	7.71	-92.3	clear brown, TSS	14.0
3	12:33	3.2	10.55	6.46	3.576	18.61	6.92	-89.5	no odor	13.6
4	12:36	3.8	10.55	6.45	3.544	18.46	6.26	-87.6	mostly white	13.1
5	12:39	4.4	10.56	6.44	3.509	18.40	5.58	-88.3	particles	12.7
6	12:42	5.0	10.57	6.44	0.531	18.44	4.95	-89.4		13.0
7	12:45	5.6	10.57	6.43	3.502	18.35	4.47	-89.3		12.7
8	12:48	6.2	10.57	6.44	3.545	18.26	4.07	-85.4		12.5
9	12:51	6.8	10.57	6.44	3.538	18.41	3.69	-87.2		12.9
10	12:54	7.4	10.57	6.43	3.448	18.36	3.42	-85.8		11.5
11	12:57	8.0	10.57	6.43	3.456	18.28	3.09	-83.9		11.4
12	13:00	8.6	10.57	6.43	3.462	18.39	2.84	-85.4		11.8

[gallons or liters] [Clarity, Color]

Turbidity before sample collection (NTU): **Turbidity after sample collection (NTU):**

Comments: pump rate of 200 mL/minute. Soft bottom.

SAMPLER: Tyler Cohen (PRINTED NAME) Tyler Cohen (SIGNATURE)

FIELD SAMPLING DATA SHEET

ANCHOR QEA

1605 Cornwall Avenue
Bellingham, WA 98225
(360) 733-4311

PROJECT NAME: Central Waterfront RI/FS
SITE ADDRESS: 900 E Sq. Bellingham, WA 98225
PROJECT NUMBER: 120007-01.01

WELL ID: RMW-5 ~~07212016~~ BW
~~BLIND~~ ID: RMW-5-07212016
DUP ID:

WATER QUALITY DATA

Purge Start Time: 13:03 :

Method: Low Flow Peristaltic Pump

Pump/Bailer Inlet Depth:

Time	DTW (ft)	Purge ~~(gal)~~ (Cummulative Totals)	pH	E Cond (µS)	°F Temp °C (circle units)	DO (mg/L)	ORP	TDS	Salinity	Turbidity	Water Quality (Clarity, Color)
13:03	10.57	9.4	6.42	3.465	18.25	3.05	-91.3			12.0	
13:06	10.57	10.0	6.42	3.471	18.29	2.57	-87.7			11.2	
13:09	10.57	10.6	6.42	3.437	18.29	2.32	-89.0			11.6	
13:12	10.57	11.2	6.42	3.438	18.21	2.21	-89.6				

continue notes from previous page

TC

Notes:

Sampler: Tyler Cohen
(Printed Name)

Tyler Cohen
(Signature)

FIELD SAMPLING DATA SHEET

ANCHOR QEA

1605 Cornwall Ave.
Bellingham, Washington 98225
(360) 733-4311

PROJECT NAME: Central Waterfront RI/FS **WELL ID:** RMW-7
SITE ADDRESS: Bellingham, WA **SAMPLE ID:** RMW-7-072316
DUP ID: —

WIND FROM: N | NE | E | SE | (S) | SW | W | NW — LIGHT | (MEDIUM) | HEAVY
WEATHER: (SUNNY) | PRTLY CLOUDY | CLOUDY | RAIN — **TEMPERATURE:** (°F) 70 . °C [Circle appropriate units]

HYDROLOGY/LEVEL MEASUREMENTS (Nearest 0.01 ft) [Product Thickness] [Water Column] [Water Column x Gal/ft]

Date	Time	DT-Bottom	DT-Product	DT-Water	DTP-DTW	DTB-DTW		Volume (gal)
7/23/16	12:49	19.25	---	7.60	---	11.65	X 1	1.89
/ /	:	.	---	.	---	.	X 3	5.70

Gal/ft = (dia./2)² x 0.163 | 1" = 0.041 | (2" = 0.163) | 3" = 0.367 | 4" = 0.653 | 6" = 1.469 | 10" = 4.080 | 12" = 5.875

§ METHODS: (A) Waterra (B) Peristaltic Pump (C) Disposable Bailer — Sampled via: (1) Low-flow (2) Purged 3 casing volumes (3) Purged dry, let recover, and sampled

GROUNDWATER SAMPLING DATA Sample Depth: 13' [√ if used]

Bottle Type	Date	Time	Method §	Amount & Volume mL	Preservative [circle]	Ice	Filter	pH	√
HDPE	7/23/16	13:45	B	1 500mL	HNO3	YES	NO		
HDPE	/ /	13:45	↓	1 500mL	HNO3	YES	YES		
AG	↓	13:45	↓	1 500mL	—	YES	NO		
	/ /	:				YES	NO		
	/ /	:				YES	NO		
	/ /	:				YES	NO		
	/ /	:				YES	NO		
	/ /	:				YES	NO		
	/ /	:				YES	NO		

Total Bottles (include duplicate count): 3

Analysis Allowed per Bottle Type

BOTTLE TYPE	ANALYSIS ALLOWED PER BOTTLE TYPE (Circle applicable or write non-standard analysis below)
500 mL HDPE	Total and Dissolved Metals: (Ag) (As) (Be) (Cd) (Cr) (Cu) (Hg) (Ni) (Pb) (Sb) (Se) (Tl) (Zn) (Ba)
500 mL AG	(SVOCs) (PAHs) (TBT) (Pesticides) CrVI
40 mL vial	(VOCs) (BTEX) (TPH-G)
Lg OJ HDPE	(TDS) (TSS)
Sm OJ HDPE	(Alkalinity) (Ammonia) (Dissolved Sulfide) (Chloride) (Nitrate) (Sulfate) (Chromium VI)
1L AG	(PCBs) (TPH-Dx) (Dioxins/Furans)

WATER QUALITY DATA Purge Start Time: 12:56 Depth of tubing (ft btoc): 13'

Meas.	Time	Cum. Volume	DTW(ft bTOC)	pH	E Cond (µS/cm)	Temp °C	DO (mg/L)	ORP	Water Quality (Color, Clarity)	NTU FUR6
1	13:06	2L	7.8	6.82	24.19	19.7	8.79	14.5	clear, colorless	0.7
2	13:11	3L	7.2	6.83	24.24	19.6	2.42	0.8	" "	2.09
3	13:16	4L	7.82	6.87	24.09	19.54	1.94	-11.8	" "	0.75
4	13:21	5L	7.85	6.89	23.97	19.47	1.82	-21.5	" "	0.44
5	13:26	6L	7.88	6.91	23.94	19.42	1.76	-30.0	" "	0.48
6	13:31	7L	7.88	6.92	23.91	19.49	1.87	-32.1	" "	0.43
7	13:36	8L	7.88	6.93	23.85	19.50	1.76	-36.2	" "	0.53
8	13:41	9L	7.90	6.94	23.85	19.50	1.73	-36.9	" "	0.53
9	13:45	Sample	.	.		.				
10	:		.	.		.				
11	:		.	.		.				
12	:		.	.		.				

[gallons or liters] [Clarity, Color]

Turbidity before sample collection (NTU): 0.53 **Turbidity after sample collection (NTU):**

Comments: pump rate 200 mL/min

SAMPLER: Bernadette Wright (PRINTED NAME) (SIGNATURE)

ATTACHMENT C
FIELD FORMS – NOVEMBER 2016

111

200
200
200

FIELD SAMPLING DATA SHEET

ANCHOR QEA

1605 Cornwall Avenue
Bellingham, Washington 98225
Office: (360) 733-4311

PROJECT NAME: Central Waterfront RI **WELL ID:** CW-2 BW

SITE ADDRESS: Bellingham WA **SAMPLE ID:** CWF-CW-2-~~Hatch~~ 111416

Wright Work **DUP ID:**

WIND FROM:	N	NE	E	SE	S	SW	W	NW	(LIGHT)	MEDIUM	HEAVY
WEATHER:	SUNNY		PRTLY CLOUDY		(CLOUDY)		RAIN		**TEMPERATURE:**	(°F) 50 .	°C

[Circle appropriate units]

HYDROLOGY/LEVEL MEASUREMENTS (Nearest 0.01 ft)

Date	Time	DT-Bottom	DT-Product	DT-Water	DTP-DTW [Product Thickness]	DTB-DTW [Water Column]		Volume (gal) [Water Column x Gal/ft]	
11/14/16	21:55	~~6.75~~	---	6.15	---	9.2	X 1	1.5	5.7
/ /	:	15.35	---	.	---	.	X 3	4.5	17

Gal/ft = (dia./2)² x 0.163	1" = 0.041	(2" = 0.163)	3" = 0.367	4" = 0.653	6" = 1.469	10" = 4.080	12" = 5.875

§ METHODS: (A) Waterra (B) Peristaltic Pump (C) Disposable Bailer Sampled via: (1) Low-flow (2) Purged 3 casing volumes (3) Purged dry, let recover, and sampled

GROUNDWATER SAMPLING DATA Sample Depth: [√ if used]

Bottle Type	Date	Time	Method §	Amount & Volume mL		Preservative [circle]	Ice	Filter	pH	√
~~500 mL AG~~	11/14/16	22:51	B	1	500 mL	None	YES	NO		
~~40 mL vial~~	11/14/16	22:51	|	1	~~40 mL~~ |	~~HCl~~ ~~HCl~~ None	YES	~~NO~~		
	11/14/16	22:51	|	1	|	HNO_3 ~~None~~	Y	NO		
	11/14/16	22:51	|	1	|	HNO_3	Y	Y		
	/ /	:								
	/ /	:								
	Total Bottles (include duplicate count):			4						

5mO) 5mO) 500 HDPE 500 HDPE

Analysis Allowed	BOTTLE TYPE	TYPICAL ANALYSIS ALLOWED PER BOTTLE TYPE (Circle applicable or write non-standard analysis below)
	~~500 mL AG~~	~~(TPH-Dx)~~
	~~40 mL vial~~	(TPH-G) ~~(BTEX)~~
	5m BJ	Hexavalent Chromium, T&D
	500 HDPE	Metals, T&D

WATER QUALITY DATA Purge Start Time: 22:05 Depth of tubing (ft btoc): 10.5 ft

Meas.	Time	Cum. Volume	DTW(ft bTOC)	pH	SpCond	Temp °C	DO (mg/L)	ORP	Water Quality	NTU
1	~~22~~:28	3600	.	.		.	.39		cloudy, orange floc	
2	~~22~~:31	4.2	5.77	6.82	9741	14.2	~~4.05~~	-84	clear, colorless	5.21
3	22:34	4.8	5.80	6.64	9648	14.1	0.28	-92.6		1.56
4	22:37	~~5.2~~ NS	5.78	6.60	9556	14.1	0.27	-96.5		7.70
5	22:40	~~5.6~~ 5.4	5.78	6.58	9506	14.2	0.29	-99.9		9.28
6	22:43	~~5.8~~ 6.0	5.67	6.58	9509	14.2	0.28	-101.5		7.35
7	22:46	6.60 NS	5.71	6.57	9505	14.1	0.27	-102.8		7.02
8	22:49	7.20	5.71	6.56	9476	14.2	0.25	-104.1		5.37
9	:		.	.		.				
10	:		.	.		.				
11	:		.	.		.				
12	:		.	.		.				
13	:		.	.		(BW)				
14	:		.	.		.				
15	:		.	.		.				
16	:		.	.		.				
17	:		.	.		.				
18	:		.	.		.				

[gallons or liters] [Clarity, Color]

Turbidity before sample collection (NTU): 5.37 **Turbidity after sample collection (NTU):**

Comments: pumping @ 200 mL/min

SAMPLER: Bernadette Wright (PRINTED NAME) (SIGNATURE)

FIELD SAMPLING DATA SHEET

ANCHOR QEA
1605 Cornwall Avenue
Bellingham, Washington 98225
Office: (360) 733-4311

PROJECT NAME: Central Waterfront RI **WELL ID:** PW-4

SITE ADDRESS: Bellingham WA **SAMPLE ID:** CWF-PW-4-111416 @2337

Night work **DUP ID:** CWF-PW-104-111416 @2358

WIND FROM: N | NE | E | SE | S | SW | W | NW (LIGHT) MEDIUM HEAVY

WEATHER: SUNNY | PRTLY CLOUDY | (CLOUDY) | RAIN **TEMPERATURE:** (F) 51 . °C [Circle appropriate units]

HYDROLOGY/LEVEL MEASUREMENTS (Nearest 0.01 ft) [Product Thickness] [Water Column] [Water Column x Gal/ft]

Date	Time	DT-Bottom	DT-Product	DT-Water	DTP-DTW	DTB-DTW		Volume (gal)
/ /	:	.	---	.	---	.	X 1	.
/ /	:	.	--- BW	.	---	.	X 3	.

Gal/ft = (dia./2)² x 0.163 | 1" = 0.041 | 2" = 0.163 | 3" = 0.367 | 4" = 0.653 | 6" = 1.469 | 10" = 4.080 | 12" = 5.875

§ METHODS: (A) Waterra (B) Peristaltic Pump (C) Disposable Bailer Sampled via: (1) Low-flow (2) Purged 3 casing volumes (3) Purged dry, let recover, and sampled

GROUNDWATER SAMPLING DATA Sample Depth: [√ if used]

Bottle Type	Date	Time	Method §	Amount & Volume mL		Preservative [circle]	Ice	Filter	pH	√
5m OJ ~~500 mL AG~~	11/14/16	23:39	B	2	500 mL	None	(YES)	NO		
500 HDPE ~~40 mL vial~~	11/14/16	23:51		2	40 mL	HNO_3 ~~HCl~~	(YES)	NO		
500 HDPE	11/14/16	23:54	|	2		HNO_3		YES		
5m OJ	11/14/16	23:39	|	2				YES		
	/ /	:								
	/ /	:								

Total Bottles (include duplicate count): 9

Analysis Allowed	BOTTLE TYPE	TYPICAL ANALYSIS ALLOWED PER BOTTLE TYPE (Circle applicable or write non-standard analysis below)
	~~500 mL AG~~	~~(TPH-Dx)~~
	~~40 mL vial~~	~~(TPH-G) (BTEX)~~
	5m OJ	Hexavalent Chromium TDD
	500 HDPE	Metals TDD

WATER QUALITY DATA Purge Start Time: : Depth of tubing (ft btoc):

Meas.	Time	Cum. Volume	DTW(ft bTOC)	pH	SpCond	Temp °C	DO (mg/L)	ORP	Water Quality	NTU
1	23:12	0.100	.	.		.				
2	23:20	0.800	.	6.51	38392	8.8	3.3	11.8	clear	8.23
3	23:23	1.100	.	6.67	40418	8.8	3.2	-3.3		5.46
4	23:26	1.400	.	6.77	36678	8.8	3.14	-11.4		6.21
5	23:29	1.700	BW	6.76	39096	8.8	2.7	-11.0		5.32
6	23:32	2.000	.	6.79	39790	8.8	3.08	-13.6		6.09
7	23:35	2.300	.	6.80	36561	8.8	2.85	-14.6		6.39
8	23:38	2.600	.	6.78	38827	8.8	2.65	-13.7		6.86
9	:		.	.		.				3.93
10	:		.	.		.				
11	:		.	.		.				
12	:		.	.		.				
13	:		.	.		.				
14	:		.	.		.				
15	:		.	.		.				
16	:		.	.		.				
17	:		.	.		.				
18	:		.	.		.				

[gallons or liters] [Clarity, Color]

Turbidity before sample collection (NTU): 3.13 **Turbidity after sample collection (NTU):**

Comments: Pumping at 100 mL/min

SAMPLER: Bernadette Wright (PRINTED NAME) (SIGNATURE)

FIELD SAMPLING DATA SHEET

ANCHOR QEA
1605 Cornwall Avenue
Bellingham, Washington 98225
Office: (360) 733-4311

PROJECT NAME: Central Waterfront RI **WELL ID:** RMW-7

SITE ADDRESS: Bellingham WA **SAMPLE ID:** RMW7-~~1500~~ 1114/16

Night work **DUP ID:**

WIND FROM: N | NE | E | SE | S | SW | W | NW | LIGHT | MEDIUM | HEAVY

WEATHER: SUNNY | PRTLY CLOUDY | CLOUDY | RAIN **TEMPERATURE:** °F 51. °C [Circle appropriate units]

HYDROLOGY/LEVEL MEASUREMENTS (Nearest 0.01 ft) [Product Thickness] [Water Column] [Water Column x Gal/ft]

Date	Time	DT-Bottom	DT-Product	DT-Water	DTP-DTW	DTB-DTW		Volume (gal)
11/14/16	20:20	19.22	---	6~~9~~.55	---	12.67	X 1	2.07
/ /	:	.	---	.	---	.	X 3	6.20

Gal/ft = (dia./2)² x 0.163 | 1" = 0.041 | 2" = 0.163 | 3" = 0.367 | 4" = 0.653 | 6" = 1.469 | 10" = 4.080 | 12" = 5.875

§ METHODS: (A) Waterra (B) Peristaltic Pump (C) Disposable Bailer Sampled via: (1) Low-flow (2) Purged 3 casing volumes (3) Purged dry, let recover, and sampled

GROUNDWATER SAMPLING DATA Sample Depth: [√ if used]

Bottle Type	Date	Time	Method §	Amount & Volume mL	Preservative [circle]	Ice	Filter	pH	√
500 mL AG	11/14/16	21:02	B	2	500 mL	None	YES	NO	
~~40 mL vial~~	/ /	:			~~40 mL~~	HCl	YES	NO	
	/ /	:							
	/ /	:							
	/ /	:							
	/ /	:							

BW

Total Bottles (include duplicate count): 2

Analysis Allowed

BOTTLE TYPE	TYPICAL ANALYSIS ALLOWED PER BOTTLE TYPE (Circle applicable or write non-standard analysis below)
500 mL AG	~~(TPH-Dx)~~ PAHs
~~40 mL vial~~	~~(TPH-G) (BTEX)~~

WATER QUALITY DATA Purge Start Time: 9:35 Depth of tubing (ft btoc): 13 ft

Meas.	Time	Cum. Volume	DTW(ft bTOC)	pH	SpCond	Temp °C	DO (mg/L)	ORP	Water Quality	NTU
1	08:40	1 L	---	.		.				
2	20 08:43	1.6 L	~~9~~6.52	7.38	15324	13.1	5.51	~~10~~0.1		5.45
3	20 ~~0~~:46	2.2	6.59	7.10	15384	13.1	5.33	90.2	clear, colorless	5.52
4	20:49	2.8	6.55	7.00	15561	13.1	5.08	79.6		3.08
5	20:52	3.4	6.61	6.96	15645	13.1	4.94	72.7		3.22
6	20:55	4.0	6.62	6.94	15721	13.2	4.79	68.0		3.13
7	20:58	4.6	6.62	6.92	15783	13.2	4.64	64.2		2.05
8	21:01	5.2	6.62	6.92	15813	13.2	4.59	61.4		1.61
9	:		.	.		.				
10	:		.	.		.				
11	:		.	.		.				
12	:		.	.		.				
13	:		.	.		.				
14	:		.	.		.				
15	:		.	.		.				
16	:		.	.		.				
17	:		.	.		.				
18	:		.	.		.				

BW

[gallons or liters] [Clarity, Color]

Turbidity before sample collection (NTU): 1.64 **Turbidity after sample collection (NTU):** 1.93

Comments: pump rate 200 mL/m

SAMPLER: Bernadette Wright (PRINTED NAME) (SIGNATURE)

APPENDIX I
DETAILED COSTS

Table 1
Detailed Cost Estimate Summary

Item	Unit	Unit Cost	Quantities						Costs					
			A	B	C	D	E	F	A	B	C	D	E	F
Landfill Footprint and Perimeter Subarea														
Capital Costs														
Capping														
Gravel Cap	SF	$2.01	180,040	180,040	180,040	180,040	180,040		$362,567	$362,567	$362,567	$362,567	$362,567	
Under-Building Venting Systems - Existing Buildings (Footprint and Perimeter)	SF	$4.11	42,336	42,336	42,336	42,336	42,336		$173,999	$173,999	$173,999	$173,999	$173,999	
Methane Monitoring System (excluding Landfill Warehouse)	SF	$0.65	4,837	4,837	4,837	4,837	4,837		$3,144	$3,144	$3,144	$3,144	$3,144	
Permeable Reactive Barrier (PRB)														
Treatability Testing	Lump Sum	$48,840			1	1					$48,840	$48,840		
Excavation, Disposal, Reactive Material Purchase and Placement ("PRB #1" for West C Street Properties - Northern Extent, Metals Treatment)	LF	$1,420			1,118	1,118					$1,587,219	$1,587,219		
Groundwater Barrier Wall														
Barrier Wall (SCB Slurry Wall)	LF	$866					3,978						$3,446,200	
Groundwater Extraction Well Installation	Lump Sum	$536,869					1						$536,869	
Removal and Off-site Disposal														
Structures Demolition	SF	$6.28						257,618						$1,617,839
Pavement Removal	SF	$0.68						413,828						$280,483
Overburden Soil (2-ft) Removal and Stockpiling	CY	$10.00						65,851						$658,507
Soil and Waste Excavation	CY	$5.00						790,209						$3,951,045
Transport and Off-site Disposal	TON	$70.00						1,185,313						$82,971,937
Water Management	CY	$2.00						790,209						$1,580,418
Clean Soil (2-ft) Re-placement and Compaction	CY	$10.00						65,851						$658,507
Purchase, Placement, and Compaction of Clean Soil	CY	$18.00						790,209						$14,223,761
Confirmational Soil Sampling	Each	$690.00						204						$140,817
Building / PSE Substation Reconstruction	SF	$70.00						261,729						$18,321,058
Subtotal (Capital Costs)									**$539,711**	**$539,711**	**$2,175,770**	**$2,175,770**	**$4,522,780**	**$124,404,372**
Annual Costs														
Cover/Cap Inspection and Maintenance	SF	$0.21	593,868	593,868	593,868	593,868	593,868		$125,037	$125,037	$125,037	$125,037	$125,037	
Groundwater Pump Maintenance and Discharge to POTW	Lump Sum	$1,117,071					1						$1,117,071	
Subtotal (Annual Costs)									**$125,037**	**$125,037**	**$125,037**	**$125,037**	**$1,242,107**	**$0**
Other Costs														
Design and Permitting	Percentage	15%							$99,712	$99,712	$345,121	$345,121	$864,733	$18,660,656
Contingency	Percentage	30%							$199,424	$199,424	$690,242	$690,242	$1,729,466	$37,321,312
Project Management / Additional Reporting	Percentage	6%							$39,885	$39,885	$138,048	$138,048	$345,893	$7,464,262
Construction Management	Percentage	12%							$79,770	$79,770	$276,097	$276,097	$691,786	$14,928,525
Tax	Percentage	8.7%							$46,955	$46,955	$189,292	$189,292	$393,482	$10,823,180
Total for Landfill Footprint and Perimeter Subarea									**$1,130,493**	**$1,130,493**	**$3,939,606**	**$3,939,606**	**$9,790,248**	**$213,602,307**

Table 1
Detailed Cost Estimate Summary

Item	Unit	Unit Cost	Quantities						Costs					
			A	B	C	D	E	F	A	B	C	D	E	F
C Street Properties Subarea														
Capital Costs														
Capping														
Gravel Cap	SF	$2.01	155,904	147,155	147,155	147,155	147,155		$313,962	$296,343	$296,343	$296,343	$296,343	
Under-Building Venting Systems - Existing Buildings	SF	$4.11	5,350	5,350	5,350	5,350	5,350		$21,987	$21,987	$21,987	$21,987	$21,987	
Permeable Reactive Barrier (PRB)														
Treatability Testing	Lump Sum	$48,840	1	1	1	1	1		$48,840	$48,840	$48,840	$48,840	$48,840	
Excavation, Disposal, Reactive Material Purchase and Placement ("PRB #1" for West C Street Properties - Northern Extent, Metals Treatment)	LF	$1,420		251	251	251	205			$356,420	$356,420	$356,420	$291,100	
Excavation, Disposal, Reactive Material Purchase and Place ("PRB #2" for West C Street Properties - Southern Extent, Metals/Organics Treatment)	LF	$5,030		244	244	244	244			$1,227,320	$1,227,320	$1,227,320	$1,227,320	
Excavation, Disposal, Reactive Material Purchase and Place ("PRB #3" for East C Street Properties, Metals Treatment)	LF	$1,420	120	120	120	120	120		$170,400	$170,400	$170,400	$170,400	$170,400	
In-Situ Treatment (Air Sparging)														
Air Sparging System Installation	Lump Sum	$707,632				1	1					$707,632	$707,632	
Removal and Off-site Disposal														
Hotspot Removal	Lump Sum	$218,041	1	1	1	1	1	1	$218,041	$218,041	$218,041	$218,041	$218,041	$218,041
Structures Demolition	SF	$6.28						29,193						$183,330
Pavement Removal	SF	$0.68						219,571						$148,820
Soil Excavation	CY	$5.00						139,611						$698,053
Transport and Off-site Disposal	TON	$70.00						209,416						$14,659,110
Water Management	CY	$2.00						139,611						$279,221
Purchase, Placement, and Compaction of Clean Soil	CY	$18.00						139,611						$2,512,990
Confirmational Soil Sampling	Each	$1,620						102						$164,926
Building / PSE Substation Reconstruction	SF	$70.00						29,193						$2,043,492
Subtotal (Capital Costs)									**$773,230**	**$2,339,352**	**$2,339,352**	**$3,046,984**	**$2,981,664**	**$20,907,985**
Annual Costs														
Cover/Cap Inspection and Maintenance	SF	$0.21	268,718	259,969	259,969	259,969	259,969		$56,577	$54,735	$54,735	$54,735	$54,735	
Air Sparging Maintenance	Lump Sum	$96,255				1	1					$96,255	$96,255	
Subtotal (Annual Costs)									**$56,577**	**$54,735**	**$54,735**	**$150,991**	**$150,991**	**$0**
Other Costs														
Design and Permitting	Percentage	15%							$124,471	$359,113	$359,113	$479,696	$469,898	$3,136,198
Contingency	Percentage	30%							$248,942	$718,226	$718,226	$959,392	$939,796	$6,272,396
Project Management / Additional Reporting	Percentage	6%							$49,788	$143,645	$143,645	$191,878	$187,959	$1,254,479
Construction Management	Percentage	12%							$99,577	$287,290	$287,290	$383,757	$375,919	$2,508,958
Tax	Percentage	8.7%							$67,271	$203,524	$203,524	$265,088	$259,405	$1,818,995
Total for C Street Properties Subarea									**$1,419,857**	**$4,105,885**	**$4,105,885**	**$5,477,786**	**$5,365,632**	**$35,899,010**

Table 1
Detailed Cost Estimate Summary

Item	Unit	Unit Cost	Quantities						Costs					
			A	B	C	D	E	F	A	B	C	D	E	F
Hilton Avenue Properties Subarea														
Capital Costs														
Capping														
Gravel Cap	SF	$2.01	28,332	28,332	28,332	28,332	28,332		$57,056	$57,056	$57,056	$57,056	$57,056	
Removal and Off-site Disposal														
Structures Demolition	SF	$6.28						220						$1,382
Pavement Removal	SF	$0.68						5,182						$3,512
Soil Excavation	CY	$5.00						12,494						$62,471
Transport and Off-site Disposal	TON	$70.00						18,741						$1,311,885
Water Management	CY	$2.00						12,494						$24,988
Purchase, Placement, and Compaction of Clean Soil	CY	$18.00						12,494						$224,895
Confirmational Soil Sampling	Each	$690.00						8						$5,344
Reconstruct Buildings	SF	$70.00						220						$15,406
Subtotal (Capital Costs)									**$57,056**	**$57,056**	**$57,056**	**$57,056**	**$57,056**	**$1,649,882**
Annual Costs														
Cover/Cap Inspection and Maintenance	SF	$0.21	33,514	33,514	33,514	33,514	33,514		$7,056	$7,056	$7,056	$7,056	$7,056	
Subtotal (Annual Costs)									**$7,056**	**$7,056**	**$7,056**	**$7,056**	**$7,056**	**$0**
Other Costs														
Design and Permitting	Percentage	15%							$9,617	$9,617	$9,617	$9,617	$9,617	$247,482
Contingency	Percentage	30%							$19,234	$19,234	$19,234	$19,234	$19,234	$494,965
Project Management / Additional Reporting	Percentage	6%							$3,847	$3,847	$3,847	$3,847	$3,847	$98,993
Construction Management	Percentage	12%							$7,694	$7,694	$7,694	$7,694	$7,694	$197,986
Tax	Percentage	8.7%							$4,964	$4,964	$4,964	$4,964	$4,964	$143,540
Total for Hilton Avenue Properties Subarea									**$109,467**	**$109,467**	**$109,467**	**$109,467**	**$109,467**	**$2,832,848**
Site-Wide Costs														
Mobilization/ Demobilization	Lump Sum	Alternative Dependent	1	1	1	1	1	1	$200,000	$250,000	$300,000	$350,000	$400,000	$500,000
Groundwater Monitoring	Lump Sum	$684,391	1	1	1	1	1		$684,391	$684,391	$684,391	$684,391	$684,391	
Institutional Controls	Lump Sum	$19,487	1	1	1	1	1		$19,487	$19,487	$19,487	$19,487	$19,487	
Total Site-Wide Costs									**$903,878**	**$953,878**	**$1,003,878**	**$1,053,878**	**$1,103,878**	**$500,000**
Spent Costs														
Chevron Area Interim Action	Lump Sum	$314,062	1	1	1	1	1	1	$314,062	$314,062	$314,062	$314,062	$314,062	$314,062
All American Marine Building Interim Action	Lump Sum	TBD	1	1	1	1	1	1	TBD	TBD	TBD	TBD	TBD	TBD
C Street Terminal Interim Action	Lump Sum	TBD	1	1	1	1	1	1	TBD	TBD	TBD	TBD	TBD	TBD
Whatcom Waterway Cleanup	Lump Sum	$9,617,208	1	1	1	1	1	1	$9,617,208	$9,617,208	$9,617,208	$9,617,208	$9,617,208	$9,617,208
Total Spent Costs									**$9,931,270**	**$9,931,270**	**$9,931,270**	**$9,931,270**	**$9,931,270**	**$9,931,270**
Grand Total per Alternative									**$13,495,000**	**$16,231,000**	**$19,090,000**	**$20,512,000**	**$26,300,000**	**$262,765,000**

Table 2
Quantities

Remediation Areas

Location	Area
Landfill Footprint and Perimeter Remediation Area	
Existing Gravel Cover	180,040
Existing Concrete/Asphalt	413,828
Existing Buildings within Landfill Footprint [a]	257,618
Existing Buildings within Landfill Perimeter	37,499
Total Area (SF)	**888,985**

C-Street Properties Remediation Area	
Alternative A - Capping	
Existing Gravel Cover	155,904
Existing Concrete/Asphalt	112,813
Existing Buildings	5,350
Total Area - Alt. A Capping (SF)	**274,067**
Alternatives B and C - Capping	
Existing Gravel Cover	147,155
Existing Concrete/Asphalt	112,813
Existing Buildings	5,350
Total Area - Alts. B and C Capping (SF)	**265,318**
Alternatives D and E - Capping	
Existing Gravel Cover	4,488
Existing Concrete/Asphalt	101,164
Existing Buildings	4,293
Total Area - Alts. D and E Capping (SF)	**109,945**
Alternatives D and E - In Situ Treatment	
Existing Gravel Cover	142,668
Existing Concrete/Asphalt	11,649
Existing Buildings	1,057
Total Area - Alts. D and E In Situ Treatment (SF)	**155,374**
Alternative F - Removal	
Existing Gravel Cover	194,705
Existing Concrete/Asphalt	219,571
Existing Buildings	29,193
Total Area - Alt. F Removal (SF)	**443,469**

Hilton Avenue Remediation Area	
Existing Gravel Cover	28,332
Existing Concrete/Asphalt	5,182
Existing Buildings	220
Total Area (SF)	**33,734**

a. Includes area of the Landfill Warehouse building (252,781 SF).

Note:

1. Areas calculated in GIS.

Table 2
Quantities

Permeable Reactive Barrier

Location	Parameter	Unit
Landfill Footprint and Perimeter (Alt. C)		
Length	1,118	FT
West C Street Properties		
Northern Extent (Alts. B, C, and D)		
Length	251	FT
Northern Extent (Alt. E)		
Length	205	FT
Southern Extent (Alts. B, C, D, and E)		
Length	244	FT
East C Street Properties (Alt. A, B, C, D, and E)		
Length	120	FT

1. Lengths calculated in GIS.

Barrier Wall

Location	Parameter	Unit
Landfill Footprint and Perimeter		
Length	3,978	FT
Depth	30	FT
Cross-sectional Area	119,340	SF
Width	3	FT
Volume	13,260	CY
PSE Substation		
Length	870	FT
Depth	30	FT
Cross-sectional Area	26,100	SF
Width	3	FT
Volume	2,900	CY

Note:

1. Lengths calculated in GIS.

Table 2
Quantities

Excavation Volumes

Location	Parameter	Unit
Landfill Footprint and Perimeter		
Total Excavation Area	888,985	SF
Average Cleanup Overburden Depth	2	FT
Cleanup Overburden Volume	65,851	CY
Average Excavation Depth	23	FT
Over-excavation (1 ft)	32,925	CY
Total Excavation Volume	**790,209**	**CY**
C Street Properties		
Total Excavation Area	443,469	SF
Average Excavation Depth	7.5	FT
Over-excavation (1 ft)	16,425	CY
Total Excavation Volume	**139,611**	**CY**
Hilton Avenue Properties		
Total Excavation Area	33,734	SF
Average Excavation Depth	9	FT
Over-excavation (1 ft)	1,249	CY
Total Excavation Volume	**12,494**	**CY**

Note:

1. Depths based on RI cross-sections and RI data.

Piping for Groundwater Extraction/Pumping

Item	Parameter	Unit
Number of Wells (assumed)	14	-
Piping Length (measured)	7,994	LF
Additional Distance Around Obstacles (factor of 1.37)	10,920	LF
Total Piping Length (Rounded Value)	**11,000**	**LF**

Table 3
Capping Costs

Gravel Cover as Cap

Item	Unit Cost	Unit
Site preparation	$0.10	SF
Geotextile marker layer	$0.22	SF
Soil - purchase, import, place, compact fill	$18	CY
Fill thickness	1.0	FT
Soil - purchase, import, place, compact fill	$0.67	SF
Gravel - purchase, import, place, compact fill	$26	CY
Fill thickness	1.0	FT
Gravel - purchase, import, place, compact fill	$0.96	SF
Total Unit Cost per Square Foot	**$2.01**	**SF**

Cover Maintenance Unit Cost

Item	Unit Cost	Unit
Annual Inspection, Maintenance, and Repairs	$340	AC/YR
Net present value for 30 years	$9,171.38	LS
Total Unit Cost per Square Foot	**$0.21**	**SF**

Table 4
Under-Building Venting Costs

Under-Building Venting Unit Cost

Item	Unit Cost	Unit
Excavation	$0.37	SF of building
Stockpile	$0.37	SF of building
Trench Excavation	$0.65	SF of building
Gravel Fill	$0.01	SF of building
Trench Fill	$0.05	SF of building
Trench Pipe	$0.60	SF of building
Geotextile	$0.25	SF of building
Geomembrane	$1.35	SF of building
Backfill	$0.46	SF of building
Total Unit Cost per Square Foot	**$4.11**	**per SF**

Note:

1. Building LFG venting costs based on AQ conceptual design for AAM building (December 2015).

Table 5
Permeable Reactive Barrier Costs

Permeable Reactive Barrier Unit Cost

Item	Unit Cost	Unit	Usable Unit Price (2017 dollars)	Usable Unit	Assumptions
PRB Trenches					
Materials					
Bone Meal / Apatite	$0.44	LB	$816.13	CY	1600 LB/CY
Limestone	$20	TON	$32.8	CY	3000 LB/CY
GAC	$1.75	LB	$1,489	CY	756 LB/CY
Dimensions					
Widths (ft)			4	ft	
Depths (ft)			30	ft	
Excavation and Off-site Disposal					
Excavation	$3.70	CY	$4.04	CY	
Off-site Disposal in Subtitle D Landfill	$70	TON	$105	CY	1.5 TON/CY
Material Mixing and Placement	$15	CY	$16.39	CY	
Post Installation Trench Development	$11	cy	$12.02	CY	
Water/Slurry Handling and Disposal	$11	cy	$12.02	CY	
PRB #1 (West C Street Properties - Northern Extent, Metals Treatment)					
Dosage Assumptions					
Apatite/ bone meal			10%	% by mass	Basic assumptions.
Limestone			90%	% by mass	
Apatite/ bone meal			17%	% by volume	
Limestone			83%	% by volume	
Excavation, Disposal, Reactive Material Purchase, and Placement Unit Cost			**$317**	**CY**	**Cost per unit volume**
			$1,420	**LF**	**Cost per unit length**
PRB #2 (West C Street Properties - Southern Extent, Metals/Organics Treatment)					
Dosage Assumptions					
Apatite/ bone meal			10%	% by mass	Basic assumptions.
GAC			10%	% by mass	
Limestone			80%	% by mass	
Apatite/ bone meal			14%	% by volume	
GAC			29%	% by volume	
Limestone			58%	% by volume	
Excavation, Disposal, Reactive Material Purchase, and Placement Unit Cost			**$1,130**	**CY**	**Cost per unit volume**
			$5,030	**LF**	**Cost per unit length**
PRB #3 (East C Street Properties, Metals Treatment)					
Dosage Assumptions					
Apatite/ bone meal			10%	% by mass	Basic assumptions.
Limestone			90%	% by mass	
Apatite/ bone meal			17%	% by volume	
Limestone			83%	% by volume	
Excavation, Disposal, Reactive Material Purchase, and Placement Unit Cost			**$317**	**CY**	**Cost per unit volume**
			$1,420	**LF**	**Cost per unit length**

Table 5
Permeable Reactive Barrier Costs

Permeable Reactive Barrier Treatability Study Costs

Item	Labor Hours	Unit Cost	Total Labor Cost	Lab Fees	Analytical Costs
Field Sampling Preparation, Sample Collection, and Analytical (Pre-treatment)	60	$160	$9,600	$1,000	$4,500
Treatability Work Plan	16	$160	$2,560		
Sampling Support	4	$160	$640		
Round One Treatability (amendment confirmation)	36	$160	$5,760	$1,000	$3,000
Round Two Treatability (dosing and kinetics)	36	$160	$5,760	$1,000	$4,500
Leachability	16	$160	$2,560		$1,200
Reporting	12	$160	$1,920		
Alternative Reporting (Technical Memorandum)	24	$160	$3,840		
PRB Treatability Total Cost (per Groundwater Source)			**$48,840**		

Table 6
Barrier Wall Costs

Barrier Wall (Soil-Cement-Bentonite) Unit Cost

Item	Unit Cost	Unit	Quantity	Total Cost
Slurry Wall Installation	$10	SF	119,340	$1,209,411
Dispose of Excavated Trench Materials	$70	TON	19,890	$1,392,300
Imported Bentonite-amended Soil Backfill	$30	TON	13,923	$417,690
Dispose of Extra Slurry	$70	TON	5,967	$417,690
Site Restoration and Final Grading	$10,000	AC	0.4	$4,109.50
Quality Control Testing	$5,000	Lump Sum	1	$5,000
Total Barrier Wall Cost				**$3,446,200**
Total Unit Cost per Unit Length	**$866**	**LF**	**-**	

Table 7
Groundwater Extraction Well Installation Costs

Groundwater Extraction Well Installation Cost

Item	Unit	Unit Cost	Quantity	Total Cost	Notes
Well Installation	Each	$5,000	14	$70,000	Assumed same cost as GW monitoring well installation (see backup spreadsheet).
Well Decommissioning	Each	$2,500	14	$32,642	Assumed same cost as GW monitoring well decommisioning (see backup spreadsheet). Adjusted for NPV at year 10.
Piping					
4" PVC	LF	$8.8	11,000	$96,690	RS Means 2015
Pipe Fittings	LF	$8.8	11,000	$96,690	Assumed equivalent to piping costs
Trench excavation 1'-4' deep, 1/2 cy excavator	LF	$10.4	11,000	$114,620	RS Means 2015
Width	FT	3	-	-	Assumed
Asphalt	SF	$2.8	-	-	Same cost as capping (see backup spreadsheet)
	LF	$8.3	11,000	$91,227	
Pumps	Each	$2,500	14	$35,000	4" stainless multi-stage well pump
Total Groundwater Extraction Well Installation Cost				**$536,869**	**-**

Table 8
Confirmational Soil Testing Costs

Confirmational Soil Testing (Analytical Backup) Cost

Item	Unit Cost	Metals Only	Metals and Organics	Assumptions
Analytical				
Metals	$220	5	5	Priority metals
VOCs	$200		5	Includes BTEX
PAHs	$250		5	Using SIM Method
TPH-Dx	$95		5	With silica gel cleanup
TPH-G	$80		5	
TS	$20	5	5	Total solids for dry weight correction
TOC	$50	5	5	Total organic carbon
Subtotal Analytical Cost		**$1,450**	**$4,575**	**Analytical for 5 samples**
Lab Quality Analysis, Data Packaging, and Validation				
Lab QA and Data Packaging (+20%)		$290	$915	Additional 20% on analytical costs
Data Validation (+10%)		$29	$92	Additional 10% on lab QA and data packaging
Shipping to Lab (Tukwila, WA)		$300	$300	Per number of samples
Subtotal Lab QA and Data Packaging/Validation Cost		**$619**	**$1,307**	**-**
Total Analytical and Lab Costs		**$2,069**	**$5,882**	**For 5 samples**
Additional Costs				
Markup (+10%)		$207	$588	-
Multiplyer for Sampling and Management		1.5	1.25	Based on similar labor costs
Total Confirmational Soil Sampling Cost		**$3,414**	**$8,087**	**-**

Sampling and Management Per Sample Unit Cost	$341	$404	-
Cost per Sample	$683	$1,617.41	-
Cost per Sample (Rounded Value)	**$690**	**$1,620**	**-**

Notes:

1. Standard TAT (no rush).
2. Pricing for 5 or fewer samples (cost could go down if number of samples goes up).
3. Includes shipping from Bellingham, WA, to a lab (ARI) in Tukwila, WA.
4. Pricing is from ARI price sheet.
5. Includes data package (deliverable) from lab (ARI).

Table 9
Groundwater Pumping and Discharge Costs

Groundwater Pumping and Discharge Cost

Item	Unit	Quantity	Notes
Pumping rate per well	gallons/min	0.4	Assumed
Wells	-	14	Assumed
Total Flow	gallons/min	5.9	Assumed
	gallons/yr	3,103,164	
Discharge to POTW Cost	$/gallon	$0.011	Based on class 5 sewage rates per gallon from the 2016 City of Bellinghan sewage rates.
	$/yr	$35,012	
Annual Maintenance	$/yr	$6,400	Assume approximately 1 week of labor per year, assuming $160/hr.
Annual Total	**$/yr**	**$41,412**	
30-year Average Annual Discount Rate		0.899	
Total Groundwater Pumping and Discharge Cost	**$**	**$1,117,071**	**For 30 years.**

Table 10
Groundwater Monitoring and Reporting Costs

Groundwater Monitoring and Reporting Cost

Item	Unit	Unit Assumption	Quantities/Costs	Notes
Number of Groundwater Monitoring Wells (assumed)	Shallow Well	Years 1-30	14	A site-wide groundwater compliance monitoring program will be developed after the CAP is finalized. Groundwater protection, performance, and confirmational monitoring activities are anticipated for cost purposes in this FS.
	Deep Well	Years 1-30	5	
Capital Costs				
Number of New Wells (assumed)	Shallow Well	-	8	New wells installation based on current groundwater monitoring network (RI Figure 6-3).
	Deep Well	-	5	
Well Installation	$/Well	$5,000	$65,000	-
Well Decommisionning	$/Well	$2,500	$38,531	Well decommissioning assumed to occur at year 30.
Subtotal Construction Costs	**NPV $**	**-**	**$103,531**	-
Sales Tax	%	8.7%	$9,007	-
Total Construction Costs	**$**	-	**$112,538**	-
Non-Construction Costs (Labor, Analytical & Data Validation)				
Semiannual monitoring (Years 1 to 5)	$/year		$75,622	Semiannual monitoring assumed to occur from years 1 to 5.
Year 1	NPV $	-	$75,096	
Year 2	NPV $	-	$74,574	
Year 3	NPV $	-	$74,056	
Year 4	NPV $	-	$73,541	
Year 5	NPV $	-	$73,030	
Total Net Present Value (Years 1 to 5)	**NPV $**	**-**	**$370,296**	
Annual monitoring (Years 6 to 10)	$/year	-	$26,767	Annual monitoring assumed to occur from years 6 to 10.
Year 6	NPV $	-	$25,669	
Year 7	NPV $	-	$25,491	
Year 8	NPV $	-	$25,314	
Year 9	NPV $	-	$25,138	
Year 10	NPV $	-	$24,963	
Total Net Present Value (Years 6 to 10)	**NPV $**	**-**	**$126,575**	
Annual monitoring (Years 15, 20, 25 and 30)	$/year	-	$21,914	Annual monitoring assumed to occur during years 15 to 30.
Year 15	NPV $	-	$19,737	
Year 20	NPV $	-	$19,061	
Year 25	NPV $	-	$18,407	
Year 30	NPV $	-	$17,776	
Total Net Present Value (Years 15, 20, 25, and 30)	**NPV $**	**-**	**$74,982**	
Total Groundwater Monitoring Costs			**$684,391**	**For years 1 to 30.**

Note:
1. Costs are presented on a net present value basis (assuming a 0.7% discount rate) as 2017 dollars.

Table 10
Groundwater Monitoring and Reporting Costs

Groundwater Monitoring and Reporting Periodic Cost Detail

Item	Unit	Unit Assumption	Quantities/Costs			Notes
			Years 1 to 5	Years 6 to 10	Years 15, 20, 25, and 30	
			Semiannual Monitoring	Annual Monitoring	Annual Monitoring	
Assumed No. of Monitoring Wells	Shallow Well	Years 1-30	14	8	5	A site-wide ground water compliance monitoring program will be developed after the CAP is finalized. Ground water protection, performance, and confirmational monitoring activities are anticipated for cost purposes in this FS.
	Deep Well	Years 1-30	5	5	3	
Sampling Frequency	events/year	-	2	1	1	
Annual Labor Costs						
Preparation Time	hr/event	7	14	7	7	Preparation time includes field notebook, labels, reservations, bottle order, etc. Assumed 2 persons needed per event.
Sample Collection Time	hr/event/well	0.75	28.5	9.75	6	
Equipment Load/Unload & Calibration Time	hr/event	4	8	4	4	
Truck Rental/Return	hr/event	1	2	1	1	
Total Labor Time	**hr**	-	**52.5**	**21.8**	**18**	
Field Staff Billing Rate	$/hr	$160	$16,800	$6,960	$5,760	
Total Field Work Costs	**$**	-	**$16,800**	**$6,960**	**$5,760**	
Data management, reporting, and production	$/hr	$115	$23,000	$9,200	$9,200	Assumed a total of 200 hrs (years 1-5) and 80 hrs (years 6-30).
Total Labor Costs (Field work, Data Management & Reporting)	**$**	-	**$39,800**	**$16,160**	**$14,960**	-
Annual Analytical Costs						
BTEX, low level (Method EPA-8021-M)	$/sample	$75	$2,250	$675	$450	Analytical costs based on current rates from ARI. One duplicate per chemical per event assumed in the total number of samples. Monitoring natural attenuation (MNA) parameters include nitrate/nitrite, ammonia, sulfate, iron, manganese, chemical oxygen demand, total dissolved solids, total alkalinity/bicarbonate, chloride, and total organic carbon.
PAHs, low level (Method EPA-8270D modified)	$/sample	$240	$7,200	$2,160	$1,440	
Gasoline Range Hydrocarbons (NWTPH-Gx, Method 8021)	$/sample	$75	$2,250	$675	$450	
Diesel/Oil Range Hydrocarbons with Silica Gel Cleanup (Ac/Si NWTPH-Dx, Method Ac/Si-AK 102/103)	$/sample	$90	$2,700	$810	$540	
Metals, low level (Method 200.7/6010C)	$/sample	$270	$8,100	$2,430	$1,620	
Metals - salinity prep	$/sample	$50	$1,400	$400	$250	
MNA Parameters (various methods)	$/sample	$300	$8,400	$2,400	$1,500	
Total Analytical Costs	**$**	-	**$32,300**	**$9,550**	**$6,250**	
Annual Data Validation Costs						
BTEX	$/sample	$18	$540	$162	$108	Includes validation data costs for the specified analytes only.
PAHs	$/sample	$18	$540	$162	$108	
Gasoline Range Hydrocarbons	$/sample	$6	$180	$54	$36	
Diesel/Oil Range Hydrocarbons	$/sample	$6	$180	$54	$36	
Metals	$/sample	$18	$540	$162	$108	
MNA Parameters (various methods)	$/sample	$20	$600	$180	$120	
Level 4 (+10%)	$	10%	$258	$77	$52	
Qualifier (+15%)	$	15%	$426	$128	$85	
QC (+10%)	$	10%	$258	$77	$52	
Total Data Validation Costs	**$**	-	**$3,522**	**$1,057**	**$704**	
Total Groundwater Monitoring Costs Per Year			**$75,622**	**$26,767**	**$21,914**	-

Table 11
Air Sparging Treatment Costs

Air Sparging Treatment Cost

Item	Unit	Unit Assumption	Quantities/Costs	Notes
Construction Costs				
Pilot Scale Testing	Lump Sum	$50,000	$50,000	-
Assumed No. of Air Sparging Wells	Well	-	75	Air sparging wells based on layout.
Well Installation Cost	$/Well	$5,000	$375,000	-
Piping	Lump Sum	$27,450	$27,450	Assumed PVC piping, labor, and installation.
Air Injection Blower	Each	$4,500	$27,000	Assumed 6 blowers needed, for estimated flow rate of 5 scfm and pressure of 7.3 psig.
Manifold	Lump Sum	$10,000	$10,000	-
Utility Hookup	Lump Sum	$20,000	$20,000	-
Well Decommisionning	$/Well	$2,500	$174,866	Well decommissioning assumed to occur at year 10.
System Decommisionning	NPV $	$25,000	$23,316	System decommissioning assumed to occur at year 10.
Total Construction Costs ($)			**$707,632**	
Non-Construction Costs				
Maintenance and Power Consumption	$/year	-	$10,000	
Year 1	NPV $	-	$9,930	
Year 2	NPV $	-	$9,861	
Year 3	NPV $	-	$9,793	
Year 4	NPV $	-	$9,725	
Year 5	NPV $	-	$9,657	
Year 6	NPV $	-	$9,590	
Year 7	NPV $	-	$9,523	
Year 8	NPV $	-	$9,457	
Year 9	NPV $	-	$9,391	
Year 10	NPV $	-	$9,326	
Total Net Present Value (Years 1 to 10)	**NPV $**	**-**	**$96,255**	
Total Non-Construction Costs ($)			**$96,255**	-

Table 12
Institutional Controls Costs

Institutional Controls Costs

Item	Unit	Unit Cost	Quantity	Total Cost	Notes
Environmental covenant	Lump Sum	$6,000	1	$6,000	
	$/yr	$500	30	$13,487	Adjusted for NPV
Total Institutional Controls Costs				**$19,487**	-

Table 13
Methane Monitoring Cost

Methane Monitoring Cost

Item	Quantity	Unit Cost	Total Cost
Sensors	10	$1,000	$10,000
Controller	1	$4,500	$4,500
Data logger	1	$3,000	$3,000
Wireless Transmitters/Receivers	10	$500	$5,000
Design/Installation	1	$10,000	$10,000
Total Methane Monitoring Cost			**$32,500**
Total Methane Monitoring Cost per Unit Area ($/SF)			**$0.65**

Note:

1. LFG monitoring costs based on California Department of Resource Recovery and Recycling presentation (March 2015).

Table 14
Hotspot Removal Cost

Hotspot Removal Cost

Item	Quantity	Unit Cost	Unit Cost	Total Cost
Mobilization/Demobilization	1	LS	$40,000	$40,000
Temporary Erosion, Sedimentation, and Stormwater Control	1	LS	$20,000	$20,000
Soil Excavation	1000	CY	$5	$5,000
Transport and Off-site Disposal	1500	TON	$70	$105,000
Water Management	1	LS	$20,000	$20,000
Purchase, Placement, and Compaction of Clean Soil	1000	CY	$18	$18,000
Confirmational Soil Sampling	6	Each	$1,620	$10,041
Total Hotspot Removal Cost				**$218,041**

Table 15
Net Present Value Factor Calculation

Discount rate **0.7%** **Based on the November 2016 OMB Circular A-94, 30-year real discount rate.**

Year		Present Value Factor
Year 1	1	0.993
Year 2	2	0.986
Year 3	3	0.979
Year 4	4	0.972
Year 5	5	0.966
Year 6	6	0.959
Year 7	7	0.952
Year 8	8	0.946
Year 9	9	0.939
Year 10	10	0.933
Year 11	11	0.926
Year 12	12	0.920
Year 13	13	0.913
Year 14	14	0.907
Year 15	15	0.901
Year 16	16	0.894
Year 17	17	0.888
Year 18	18	0.882
Year 19	19	0.876
Year 20	20	0.870
Year 21	21	0.864
Year 22	22	0.858
Year 23	23	0.852
Year 24	24	0.846
Year 25	25	0.840
Year 26	26	0.834
Year 27	27	0.828
Year 28	28	0.823
Year 29	29	0.817
Year 30	30	0.811
30-year Average Net Present Value for Annual Costs		**0.899**

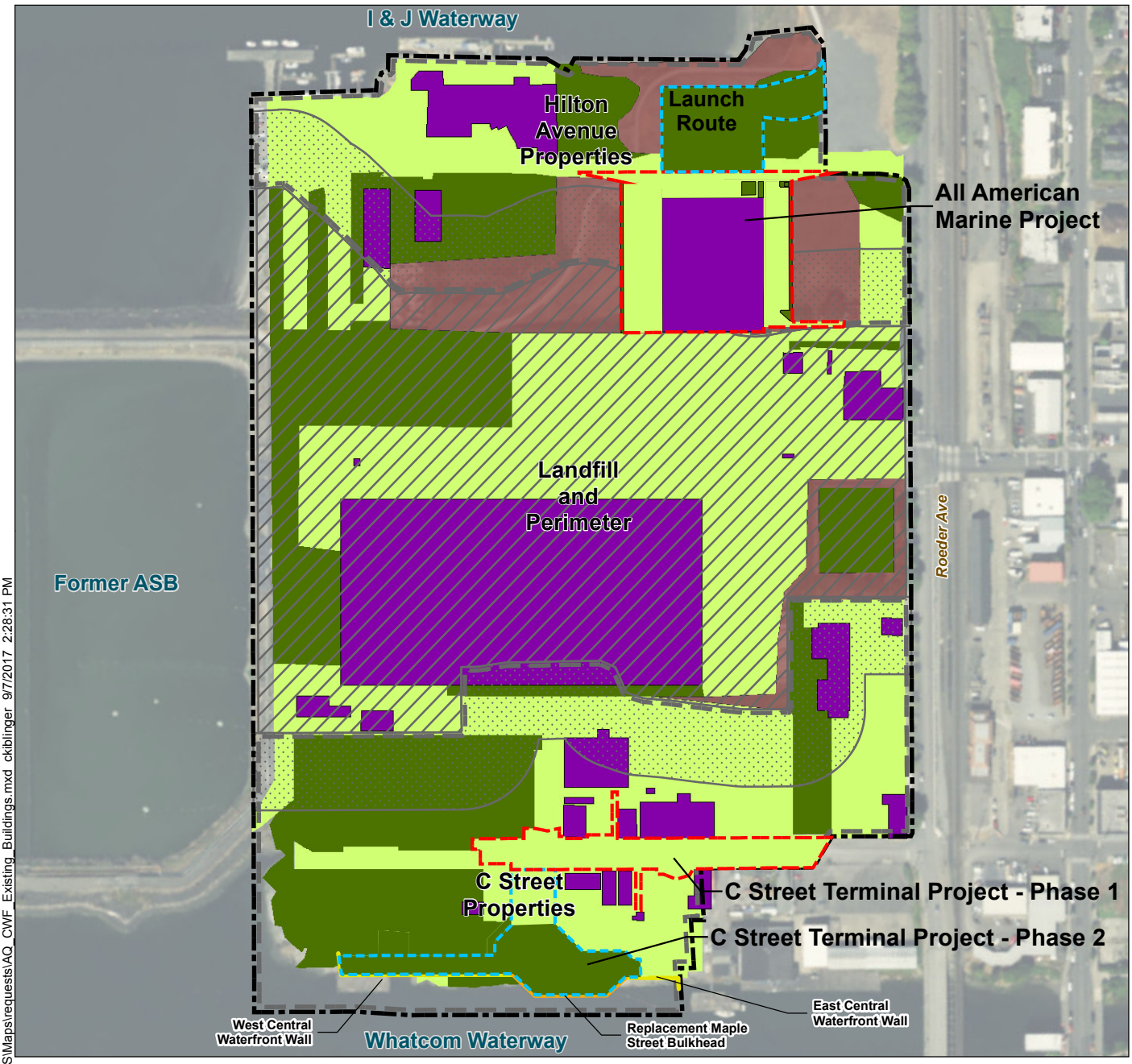
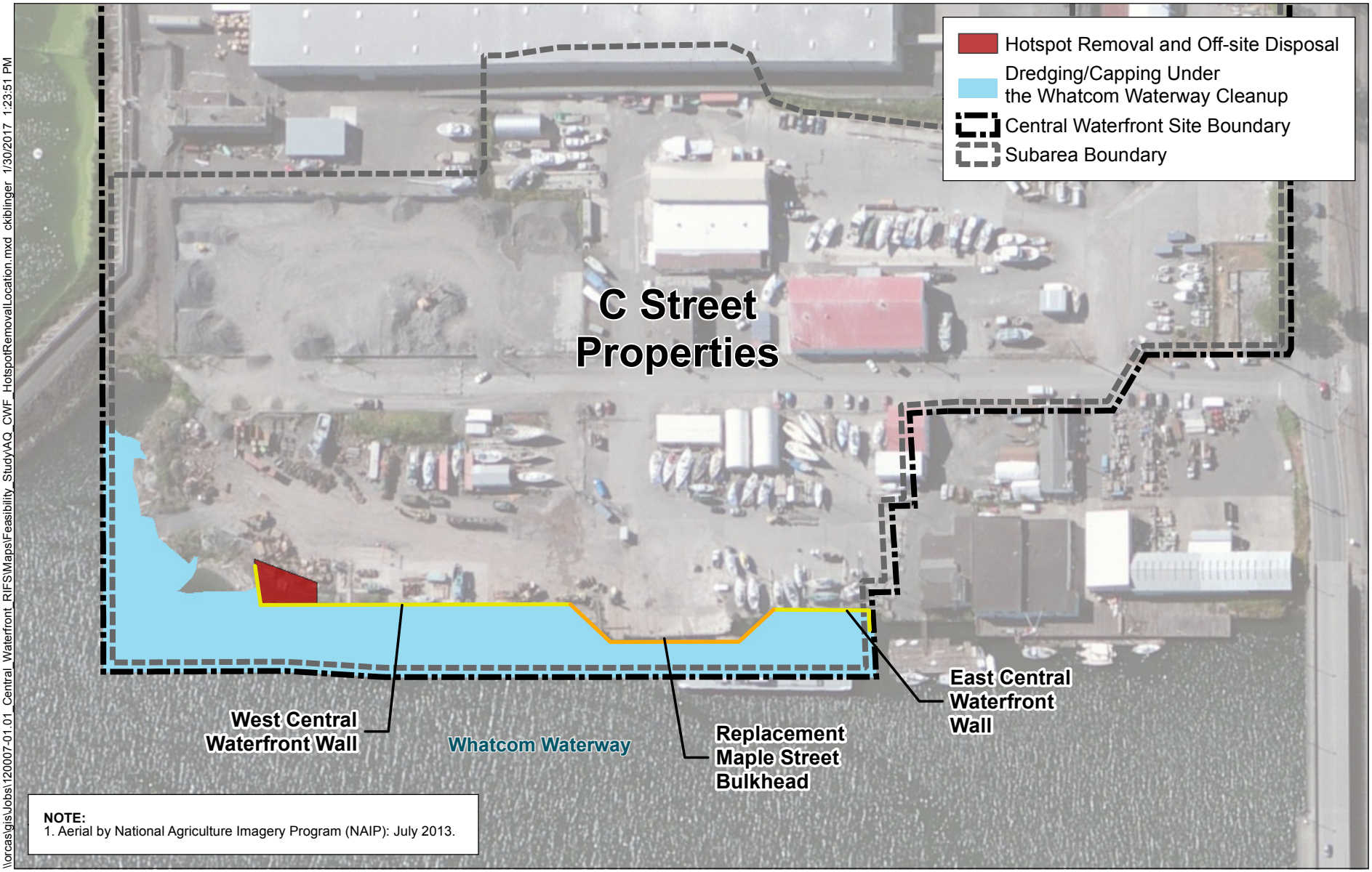


Figure 1
Existing Surface Coverage
Central Waterfront Site
Port of Bellingham, WA



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ANCHOR QEA

Feet
0 75 150

Project North

True North

Figure 2
Hotspot Removal Location
Central Waterfront Site
Port of Bellingham, WA