CHEMICAL PROCESSORS

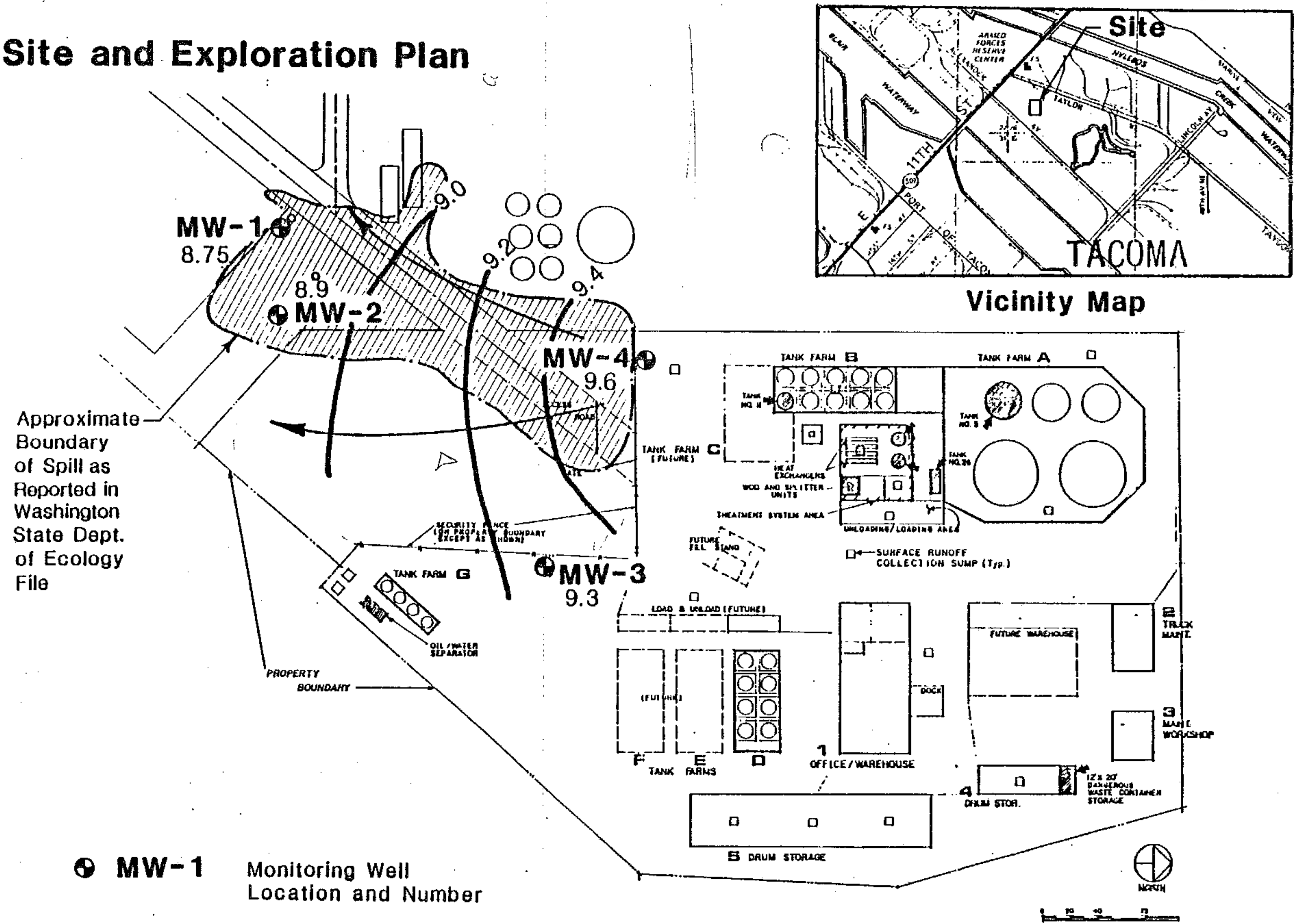
WELL MONITORING

ANALYSIS OF WATER

MW-1

SAMPLE NO.								
DATE	2/20/86							
TIME COLLECTED								
LOCATION								
SAMPLING METHOD RESULTS								
OIL & GREASE (mg/l)								
pH	8.1							
TOTAL ORGANIC CARBON (mg/l)								
HYDROCARBONS (mg/l)								
METHYLENE CHLORIDE								
1,1,1-TRICHLOROETHYLELNE								
TETRACHLOROETHYLENE								
ACETONE								
METHYL ETHYL KETONE								
METHYL ISOBUTYL KETONE								
XYLENE								
TOLUENE								
METHANOL								
ETHANOL								
ISOPROPANOL								
SPECIFIC CONDUCTANCE								
LEAD (mg/l)	L/0.01							
CHROMIUM (mg/l)	L/ 0.005							
ZINC (mg/l)	0.016							
ARSENIC (mg/l)								
CADIUM	L/ 0.002							
HEXAVALENT CHROMIUM	L/ 0.005							
NITRATE as N	26.							
OTHER								

Site and Exploration Plan

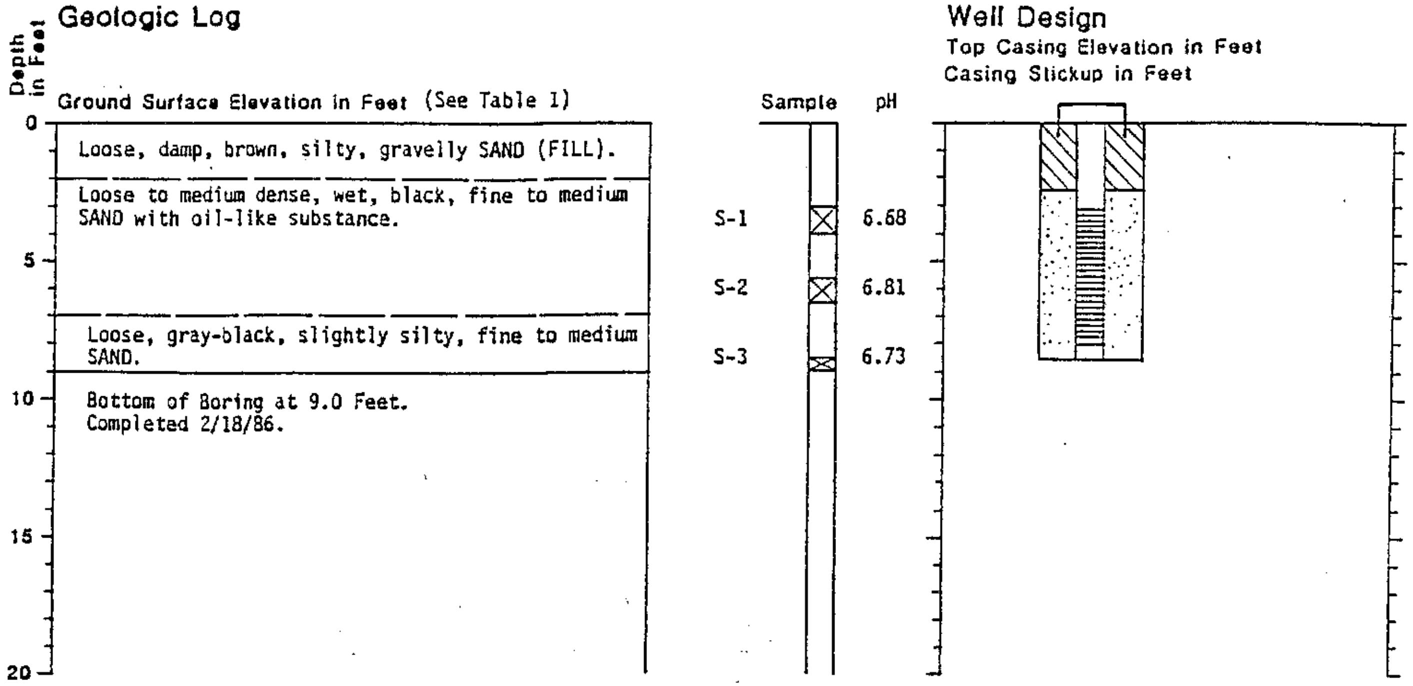


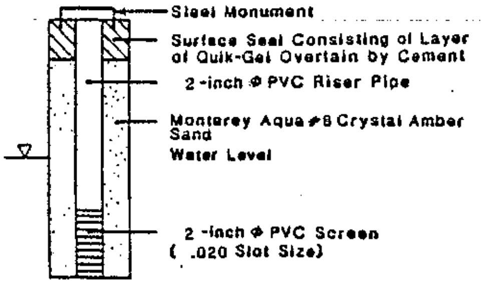
Vicinity Map

● MW-1	Monitoring Well Location and Number
9.3	Water Level Spot Elevation in Feet Measured 2/20/86
▬	Contour in Feet of Equal Water Level Elevation
←	Groundwater Flow Direction

J-1615-03 March 1986
HART-CROWSER & associates inc.
Figure 1

Boring Log and Construction Data for Well MW-1





☒	2-inch O.D. Split Spoon Sample
*	No Sample Recovery
N	Standard Penetration Resistance, Blows per foot
GS	Grain Size Analysis
K	Permeability Test
pH	Test for pH of Soil Slurry Consisting of 50% Soil and 50% Distilled Water

NOTES:

1. Soil descriptions are interpretive and actual changes may be gradual.
2. Water Level is for date indicated and may vary with time of year. ATD:At Time of Drilling

J-1615-03 March 1986

HART-CROWSER & associates, inc.

Figure 2

Table 1 Water Level and Field Water Quality Data

WELL NUMBER	MEASURING POINT		WATER LEVEL - 2/20/86				pH ④	ELECTRICAL CONDUCTIVITY IN μ MHOS/CM ⑤
			10:30-11:30 AM ②		6:10-6:35 PM ③			
	LOCATION	ELEVATION IN FEET ①	DEPTH IN FEET	ELEVATION IN FEET	DEPTH IN FEET	ELEVATION IN FEET		
MW-1	Top 6-inch Monument	10.0	1.25	8.75	1.2	8.8	6.25	625
MW-2	Top 2-inch PVC	10.0	1.1	8.9	-	-	6.45	600
	Top 6-inch Monument	10.3	-	-	1.35	8.95		
MW-3	Top 6-inch Monument	12.55	3.25	9.3	3.3	9.25	6.2	650
MW-4	Top 6-inch Monument	12.3	2.7	9.6	2.85	9.45	7.0	1450

① Elevations measured relative to an assumed elevation of 10.0 feet at top of 6-inch monument in MW-1.

② Measurement taken prior to well development and sampling

③ Measurement taken following well development and sampling

④ pH measured in field using SSE 209B pH meter

⑤ Electrical Conductivity measured in field using YSI Model 33 S-C-T meter

Laucks
Testing Laboratories, Inc.
940 South Harney St. Seattle, Washington 98108 (206)767-5060

Chemistry, Microbiology and Technical Services

Certificate

CLIENT Hart Crowser & Associates
1910 Fairview Ave. East
Seattle, WA 98102-3699
ATTN: Lori Herman

LABORATORY NO. 95346

DATE March 6, 1986

REPORT ON WATER

SAMPLE IDENTIFICATION Submitted 2/21/86 and identified as shown below:

TESTS PERFORMED AND RESULTS:

1) MW-2 LJH 2/19/86* 1:26 pm KMR
2) MW-1 LJH 2/20/86 KMR
3) MW-3 LJH 2/19/86* 12:45 pm KMR
4) MW-4 LJH 2/20/86 4:40 pm KMR
5) MW-5 LJH 2/20/86 5:00 pm KMR

	1	2	3	4	5
pH, glass electrode @ 25°C	8.1	6.8	6.9	7.3	3.4
		parts per million (mg/L)			
Hexavalent Chromium	L/0.005	L/0.005	L/0.005	L/0.005	L/0.005
Cadmium	L/0.002	L/0.002	L/0.002	L/0.002	L/0.002
Zinc	0.016	0.071	0.019	0.24	0.034
Lead	L/0.01	0.02	0.01	0.02	L/0.01
Chromium	L/0.005	L/0.005	L/0.005	L/0.005	L/0.005
Nitrate as N	26.	0.10	0.29	L/0.05	L/0.05

Key

L/ = less than

* Water samples were obtained on 2/20/86 in all wells.
LJH

Respectfully submitted,

Laucks Testing Laboratories, Inc.

J. M. Owens

J. M. Owens

JMO:veg

Figure A-1

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PAGE NO. 2

Hart Crowser

LABORATORY NO. 95346

APPENDIX

Matrix Spike/Matrix Spike Duplicate Report

Inorganics/Metals Analyses

Sample	Analyte	Spike Added	Sample Result	MS Result	% Rec	MSD Result	% Rec	RPD
		mg/L				mg/L		
2	Nitrate	0.1	0.10	0.20	100.	0.19	90.	10.
1	Cadmium	0.050	L/0.002	0.048	96.	0.048	96.	0.
1	Chromium	0.050	L/0.005	0.044	88.	0.045	90.	-2.
1	Lead	0.10	L/0.01	0.10	100.	0.09	95.	5.
1	Zinc	0.05	0.016	0.058	84.	0.060	88.	-5.

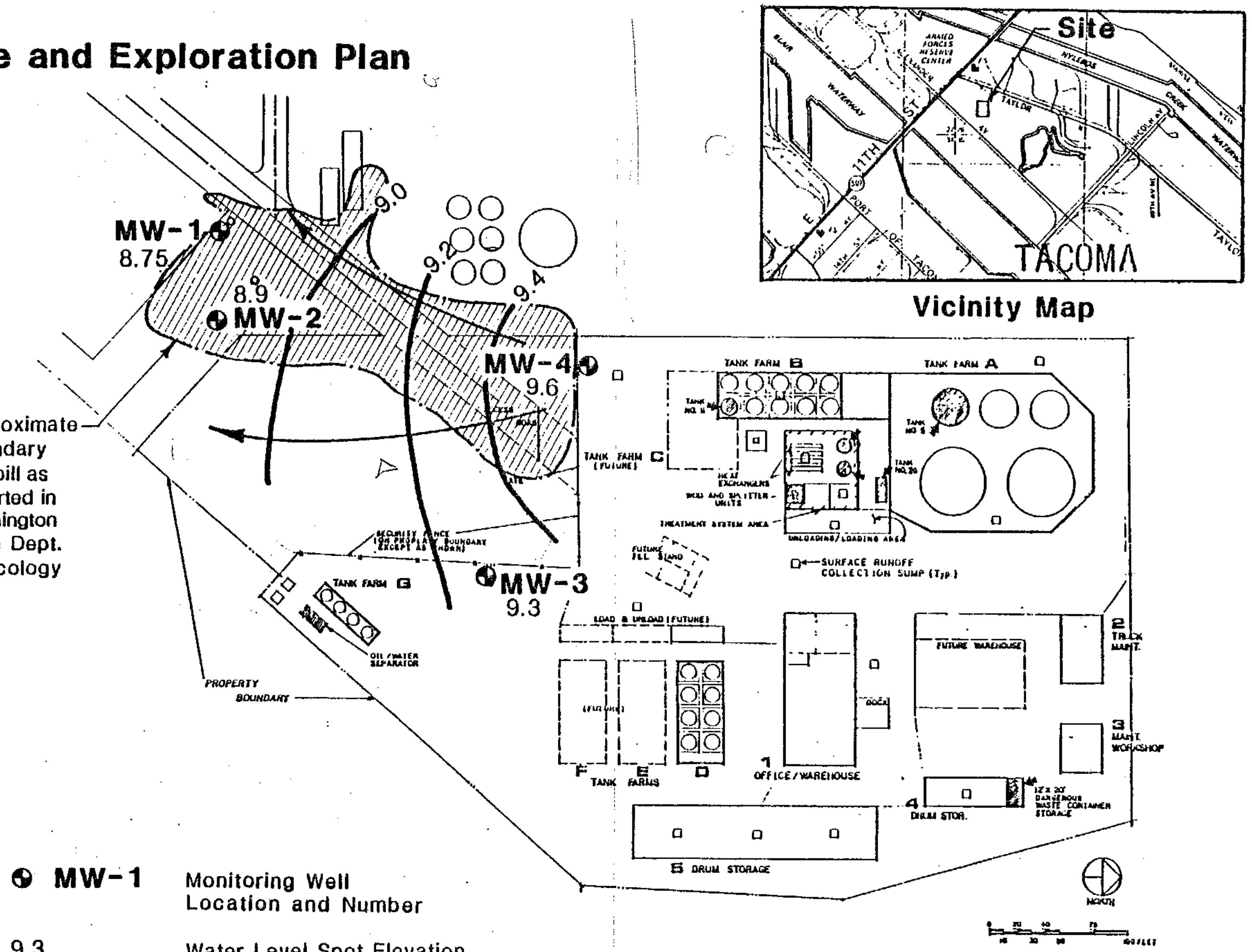
Figure A-2

ANALYSIS OF WATER

MW-2

SAMPLE NO.								
ATE	2/20/86							
TIME COLLECTED	1:26pm							
LOCATION								
SAMPLING METHOD RESULTS								
OIL & GREASE (mg/l)								
pH	6.8							
TOTAL ORGANIC CARBON (mg/l)								
HYDROCARBONS (mg/l)								
METHYLENE CHLORIDE								
1,1,1-TRICHLOROETHYLELNE								
TETRACHLOROETHYLENE								
ACETONE								
METHYL ETHYL KETONE								
METHYL ISOBUTYL KETONE								
XYLENE								
TOLUENE								
METHANOL								
ETHANOL								
ISOPROPANOL								
SPECIFIC CONDUCTANCE								
LEAD (mg/l)	0.02							
CHROMIUM (mg/l)	L/ 0.005							
ZINC (mg/l)	0.071							
ARSENIC (mg/l)								
CADIUM	L/ 0.002							
EXAVALENT CHROMIUM	L/ 0.005							
NITRATE as N	0.10							
OTHER								

Site and Exploration Plan



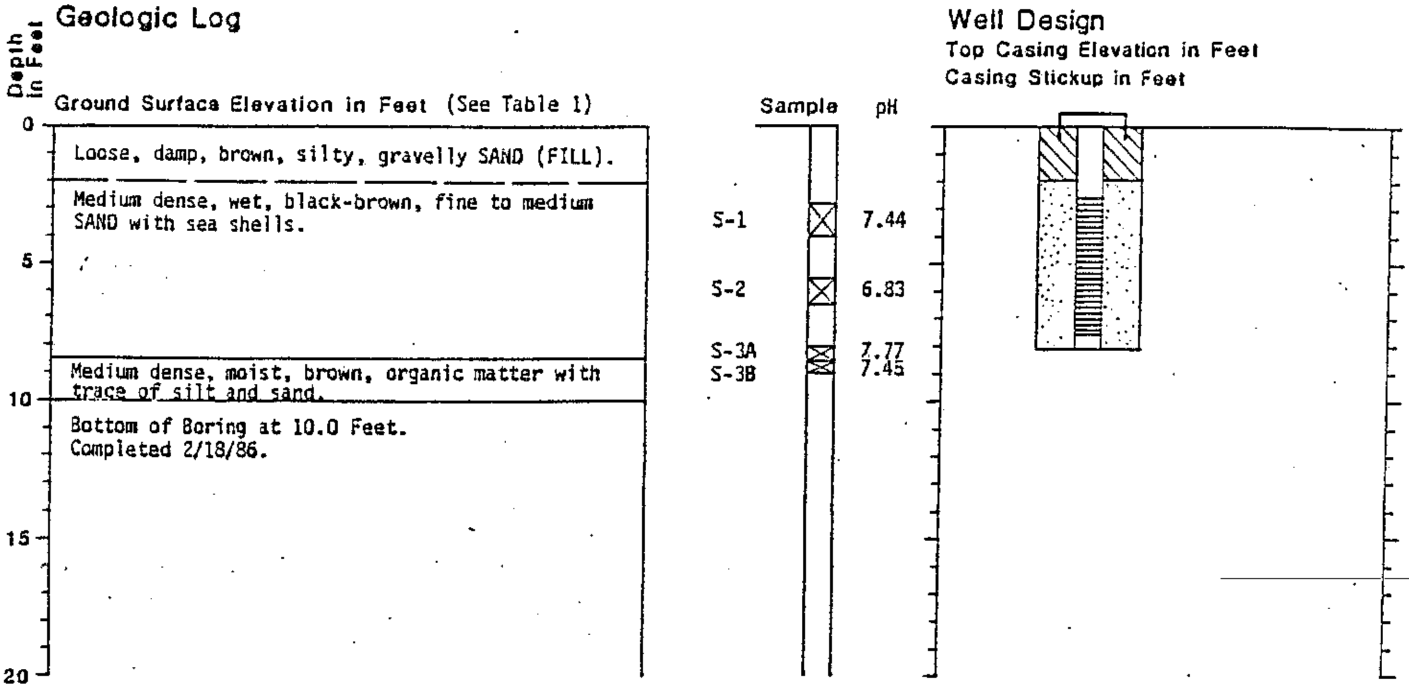
Vicinity Map

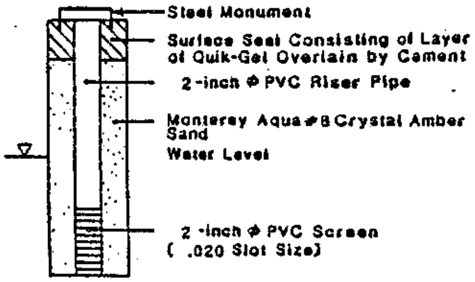
DENOTES AREAS OF DANGEROUS WASTE STORAGE OR TREATMENT

● MW-1	Monitoring Well Location and Number
9.3	Water Level Spot Elevation in Feet Measured 2/20/86
▬	Contour in Feet of Equal Water Level Elevation
←	Groundwater Flow Direction

J-1615-03 March 1986
HART-CROWSER & associates inc.
Figure 1

Boring Log and Construction Data for Well MW-2





☒	2-inch O.D. Split Spoon Sample
*	No Sample Recovery
N	Standard Penetration Resistance, Blows per foot
GS	Grain Size Analysis
K	Permeability Test
pH	Test for pH of Soil Slurry Consisting of 50% Soil and 50% Distilled Water

NOTES:

1. Soil descriptions are interpretive and actual changes may be gradual.
2. Water Level is for date indicated and may vary with time of year. ATD:At Time of Drilling

J-1615-03 March 1986

HART-CROWSER & associates, inc.

Figure 2

Table 1 Water Level and Field Water Quality Data

WELL NUMBER	MEASURING POINT		WATER LEVEL - 2/20/86				pH ④	ELECTRICAL CONDUCTIVITY IN μ MHOS/CM ⑤
			10:30-11:30 AM ②		6:10-6:35 PM ③			
	LOCATION	ELEVATION IN FEET ①	DEPTH IN FEET	ELEVATION IN FEET	DEPTH IN FEET	ELEVATION IN FEET		
MW-1	Top 6-inch Monument	10.0	1.25	8.75	1.2	8.8	6.25	625
MW-2	Top 2-inch PVC	10.0	1.1	8.9	-	-	6.45	600
	Top 6-inch Monument	10.3	-	-	1.35	8.95		
MW-3	Top 6-inch Monument	12.55	3.25	9.3	3.3	9.25	6.2	650
MW-4	Top 6-inch Monument	12.3	2.7	9.6	2.85	9.45	7.0	1450

① Elevations measured relative to an assumed elevation of 10.0 feet at top of 6-inch monument in MW-1.

② Measurement taken prior to well development and sampling

③ Measurement taken following well development and sampling

④ pH measured in field using SSE 209B pH meter

⑤ Electrical Conductivity measured in field using YSI Model 33 S-C-T meter

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Chemistry, Microbiology and Technical Services

Certificate

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LABORATORY NO. 95346

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2) MW-1 LJH 2/20/86 KMR
3) MW-3 LJH 2/19/86* 12:45 pm KMR
4) MW-4 LJH 2/20/86 4:40 pm KMR
5) MW-5 LJH 2/20/86 5:00 pm KMR

	1	2	3	4	5
pH, glass electrode @ 25°C	8.1	6.8	6.9	7.3	3.4
	parts per million (mg/L)				
Hexavalent Chromium	L/0.005	L/0.005	L/0.005	L/0.005	L/0.005
Cadmium	L/0.002	L/0.002	L/0.002	L/0.002	L/0.002
Zinc	0.016	0.071	0.019	0.24	0.034
Lead	L/0.01	0.02	0.01	0.02	L/0.01
Chromium	L/0.005	L/0.005	L/0.005	L/0.005	L/0.005
Nitrate as N	26.	0.10	0.29	L/0.05	L/0.05

Key

L/ = less than

* Water samples were obtained on 2/20/86 in all wells.

LJH

Respectfully submitted,

Laucks Testing Laboratories, Inc.

J. M. Owens

J. M. Owens

JMO:veg

Figure A-1

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PAGE NO. 2

LABORATORY NO. 95346

Hart Crowser

APPENDIX

Matrix Spike/Matrix Spike Duplicate Report

Inorganics/Metals Analyses

Sample	Analyte	Spike Added	Sample Result	MS Result	% Rec	MSD Result	% Rec	RPD
		mg/L				mg/L		
2	Nitrate	0.1	0.10	0.20	100.	0.19	90.	10.
1	Cadmium	0.050	L/0.002	0.048	96.	0.048	96.	0.
1	Chromium	0.050	L/0.005	0.044	88.	0.045	90.	-2.
1	Lead	0.10	L/0.01	0.10	100.	0.09	95.	5.
1	Zinc	0.05	0.016	0.058	84.	0.060	88.	-5.

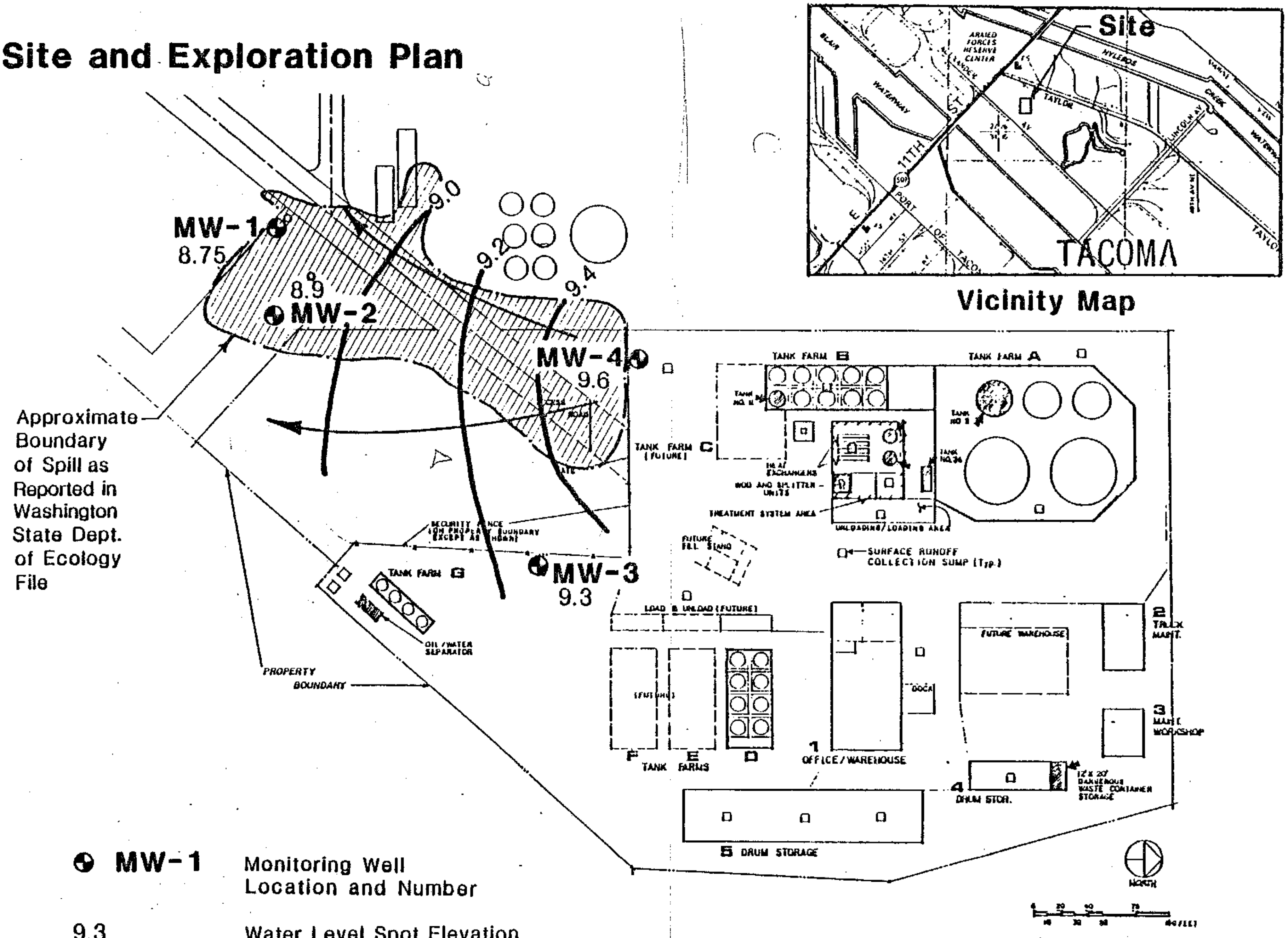
Figure A-2

ANALYSIS OF WATER

MW-3

SAMPLE NO.								
ATE	2/20/86							
TIME COLLECTED	12:45pm							
LOCATION								
SAMPLING METHOD RESULTS								
OIL & GREASE (mg/l)								
pH	6.9							
TOTAL ORGANIC CARBON (mg/l)								
HYDROCARBONS (mg/l)								
METHYLENE CHLORIDE								
1,1,1-TRICHLOROETHYLELNE								
TETRACHLOROETHYLENE								
ACETONE								
METHYL ETHYL KETONE								
METHYL ISOBUTYL KETONE								
XYLENE								
TOLUENE								
METHANOL								
ETHANOL								
ISOPROPANOL								
SPECIFIC CONDUCTANCE								
LEAD (mg/l)	0.01							
CHROMIUM (mg/l)	L/ 0.005							
ZINC (mg/l)	0.019							
ARSENIC (mg/l)								
CADIUM	L/ 0.002							
HEXAVALENT CHROMIUM	L/ 0.005							
NITRATE as N	0.29							
OTHER								

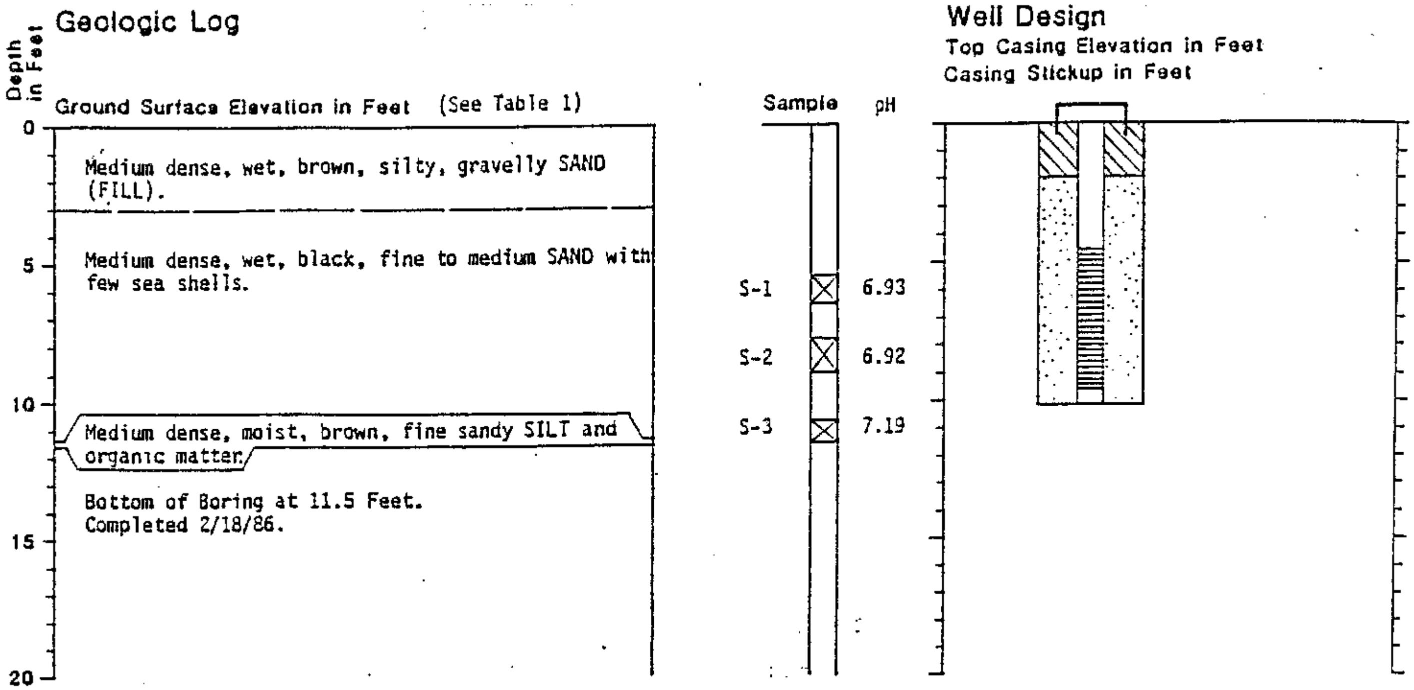
Site and Exploration Plan

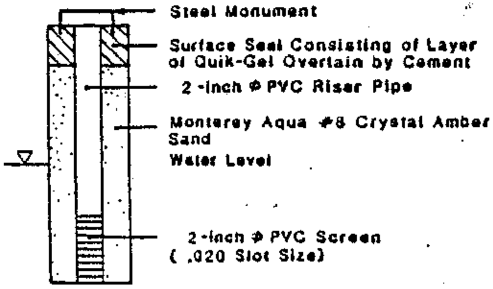


◒ MW-1	Monitoring Well Location and Number
9.3	Water Level Spot Elevation in Feet Measured 2/20/86
▬	Contour in Feet of Equal Water Level Elevation
←	Groundwater Flow Direction

J-1615-03 March 1986
HART-CROWSER & associates inc.
Figure 1

Boring Log and Construction Data for Well MW-3





☒	2-inch O.D. Split Spoon Sample
*	No Sample Recovery
N	Standard Penetration Resistance, Blows per foot
GS	Grain Size Analysis
K	Permeability Test
pH	Test for pH of Soil Slurry Consisting of 50% Soil and 50% Distilled Water

NOTES:

1. Soil descriptions are interpretive and actual changes may be gradual.
2. Water Level is for date indicated and may vary with time of year. ATD:At Time of Drilling

J-1615-03 March 1986

HART-CROWSER & associates, inc.

Figure 3

Table 1 Water Level and Field Water Quality Data

WELL NUMBER	MEASURING POINT		WATER LEVEL - 2/20/86				pH ④	ELECTRICAL CONDUCTIVITY IN μ MHOS/CM ⑤
			10:30-11:30 AM ②		6:10-6:35 PM ③			
	LOCATION	ELEVATION IN FEET ①	DEPTH IN FEET	ELEVATION IN FEET	DEPTH IN FEET	ELEVATION IN FEET		
MW-1	Top 6-inch Monument	10.0	1.25	8.75	1.2	8.8	6.25	625
MW-2	Top 2-inch PVC	10.0	1.1	8.9	-	-	6.45	600
	Top 6-inch Monument	10.3	-	-	1.35	8.95		
MW-3	Top 6-inch Monument	12.55	3.25	9.3	3.3	9.25	6.2	650
MW-4	Top 6-inch Monument	12.3	2.7	9.6	2.85	9.45	7.0	1450

① Elevations measured relative to an assumed elevation of 10.0 feet at top of 6-inch monument in MW-1.

② Measurement taken prior to well development and sampling

③ Measurement taken following well development and sampling

④ pH measured in field using SSE 209B pH meter

⑤ Electrical Conductivity measured in field using YSI Model 33 S-C-T meter

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Testing Laboratories, Inc.
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Chemistry, Microbiology and Technical Services

Certificate

CLIENT Hart Crowser & Associates
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Seattle, WA 98102-3699
ATTN: Lori Herman

LABORATORY NO. 95346

DATE March 6, 1986

REPORT ON WATER

SAMPLE IDENTIFICATION Submitted 2/21/86 and identified as shown below:

TESTS PERFORMED AND RESULTS:

1) MW-2 LJH 2/19/86* 1:26 pm KMR
2) MW-1 LJH 2/20/86 KMR
3) MW-3 LJH 2/19/86* 12:45 pm KMR
4) MW-4 LJH 2/20/86 4:40 pm KMR
5) MW-5 LJH 2/20/86 5:00 pm KMR

	1	2	3	4	5
pH, glass electrode @ 25°C	8.1	6.8	6.9	7.3	3.4
	parts per million (mg/L)				
Hexavalent Chromium	L/0.005	L/0.005	L/0.005	L/0.005	L/0.005
Cadmium	L/0.002	L/0.002	L/0.002	L/0.002	L/0.002
Zinc	0.016	0.071	0.019	0.24	0.034
Lead	L/0.01	0.02	0.01	0.02	L/0.01
Chromium	L/0.005	L/0.005	L/0.005	L/0.005	L/0.005
Nitrate as N	26.	0.10	0.29	L/0.05	L/0.05

Key

L/ = less than

* Water samples were obtained on 2/20/86 in all wells.
LJH

Respectfully submitted,

Laucks Testing Laboratories, Inc.

J. M. Owens

J. M. Owens

JMO:veg

Figure A-1

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Chemistry, Microbiology, and Technical Services

Certificate

PAGE NO. 2

Hart Crowser

LABORATORY NO. 95346

APPENDIX

Matrix Spike/Matrix Spike Duplicate Report

Inorganics/Metals Analyses

Sample	Analyte	Spike Added	Sample Result	MS Result	% Rec	MSD Result	% Rec	RPD
		mg/L				mg/L		
2	Nitrate	0.1	0.10	0.20	100.	0.19	90.	10.
1	Cadmium	0.050	L/0.002	0.048	96.	0.048	96.	0.
1	Chromium	0.050	L/0.005	0.044	88.	0.045	90.	-2.
1	Lead	0.10	L/0.01	0.10	100.	0.09	95.	5.
1	Zinc	0.05	0.016	0.058	84.	0.060	88.	-5.

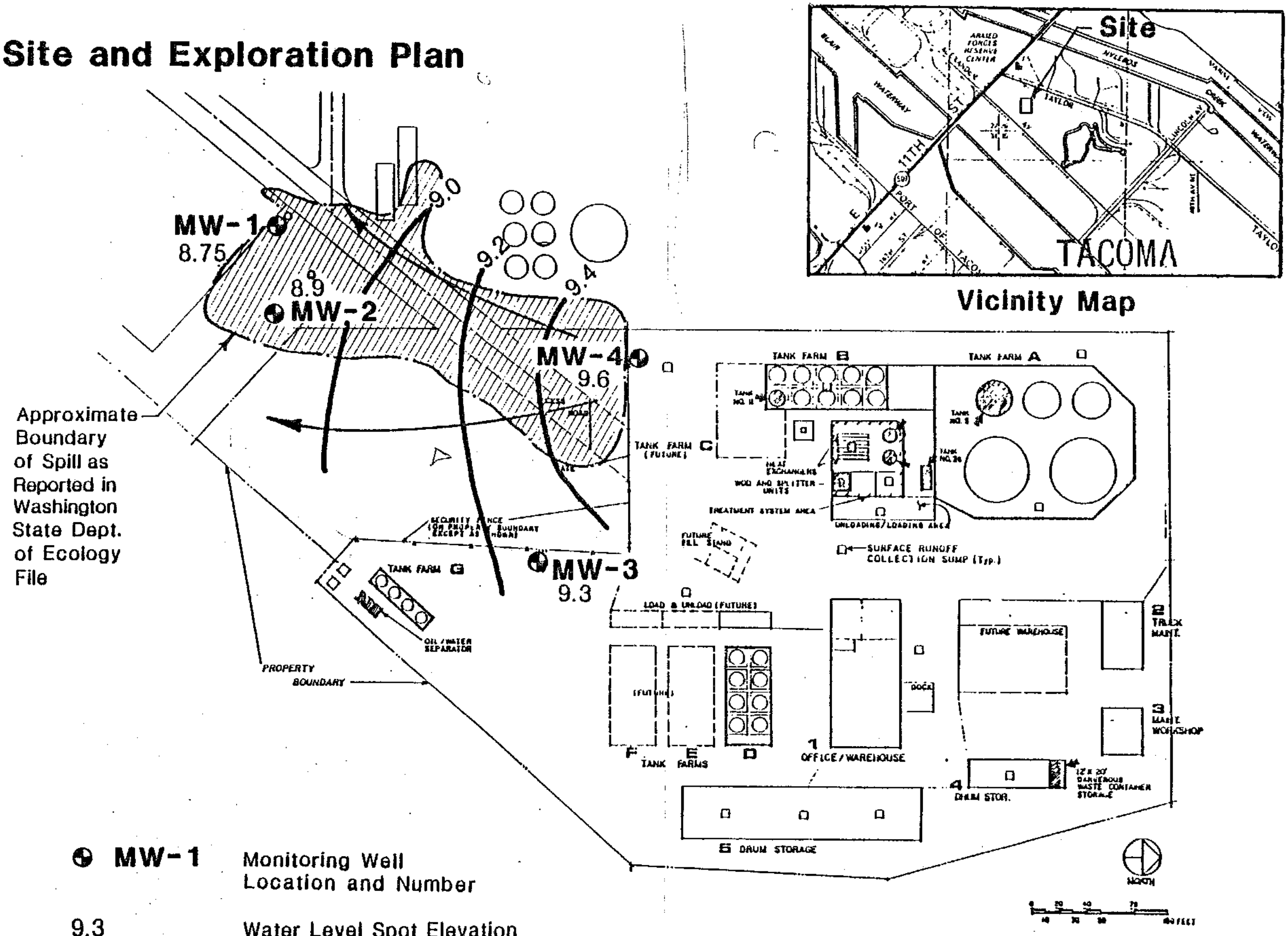
Figure A-2

ANALYSIS OF WATER

MW-4

SAMPLE NO.								
ATE	2/20/86							
TIME COLLECTED	4:40pm							
LOCATION								
SAMPLING METHOD RESULTS								
OIL & GREASE (mg/l)								
pH	7.3							
TOTAL ORGANIC CARBON (mg/l)								
HYDROCARBONS (mg/l)								
METHYLENE CHLORIDE								
1,1,1-TRICHLOROETHYLELNE								
TETRACHLOROETHYLENE								
ACETONE								
METHYL ETHYL KETONE								
METHYL ISOBUTYL KETONE								
XYLENE								
TOLUENE								
METHANOL								
ETHANOL								
ISOPROPANOL								
SPECIFIC CONDUCTANCE								
LEAD (mg/l)	0.02							
CHROMIUM (mg/l)	< 0.005							
ZINC (mg/l)	0.24							
ARSENIC (mg/l)								
CADIUM	< 0.002							
EXAVALENT CHROMIUM	< 0.005							
NITRATE as N	< 0.05							
OTHER								

Site and Exploration Plan



Vicinity Map

● MW-1 Monitoring Well Location and Number

9.3 Water Level Spot Elevation in Feet Measured 2/20/86

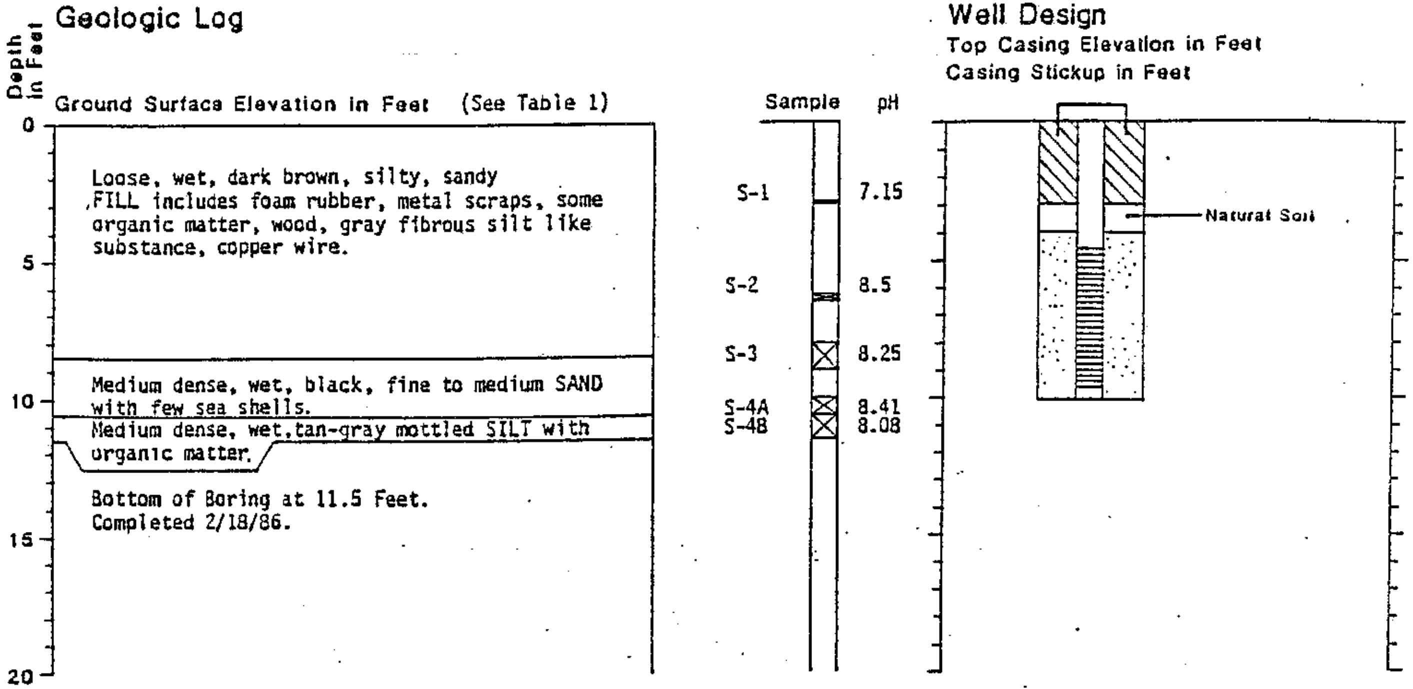
━━ Contour in Feet of Equal Water Level Elevation

← Groundwater Flow Direction

▨ DENOTES AREAS OF DANGEROUS WASTE STORAGE OR TREATMENT

J-1615-03 March 1986
HART-CROWSER & associates inc.
Figure 1

Boring Log and Construction Data for Well MW-4

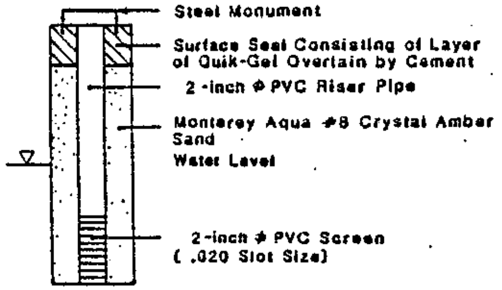


Loose, wet, dark brown, silty, sandy FILL includes foam rubber, metal scraps, some organic matter, wood, gray fibrous silt like substance, copper wire.

Medium dense, wet, black, fine to medium SAND with few sea shells.

Medium dense, wet, tan-gray mottled SILT with organic matter.

Bottom of Boring at 11.5 Feet.
Completed 2/18/86.



☒	2-inch O.D. Split Spoon Sample
*	No Sample Recovery
N	Standard Penetration Resistance, Blows per foot
GS	Grain Size Analysis
K	Permeability Test
pH	Test for pH of Soil Slurry Consisting of 50% Soil and 50% Distilled Water

NOTES:

1. Soil descriptions are interpretive and actual changes may be gradual.
2. Water Level is for date indicated and may vary with time of year. ATD:At Time of Drilling

J-1615-03 March 1986
HART-CROWSER & associates, inc.
Figure 3

Table 1 Water Level and Field Water Quality Data

WELL NUMBER	MEASURING POINT		WATER LEVEL - 2/20/86				pH ④	ELECTRICAL CONDUCTIVITY IN μ MHOS/CM ⑤
			10:30-11:30 AM ②		6:10-6:35 PM ③			
	LOCATION	ELEVATION IN FEET ①	DEPTH IN FEET	ELEVATION IN FEET	DEPTH IN FEET	ELEVATION IN FEET		
MW-1	Top 6-inch Monument	10.0	1.25	8.75	1.2	8.8	6.25	625
MW-2	Top 2-inch PVC	10.0	1.1	8.9	-	-	6.45	600
	Top 6-inch Monument	10.3	-	-	1.35	8.95		
MW-3	Top 6-inch Monument	12.55	3.25	9.3	3.3	9.25	6.2	650
MW-4	Top 6-inch Monument	12.3	2.7	9.6	2.85	9.45	7.0	1450

① Elevations measured relative to an assumed elevation of 10.0 feet at top of 6-inch monument in MW-1.

② Measurement taken prior to well development and sampling

③ Measurement taken following well development and sampling

④ pH measured in field using SSE 209B pH meter

⑤ Electrical Conductivity measured in field using YSI Model 33 S-C-T meter

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TESTS PERFORMED AND RESULTS:

1) MW-2 LJH 2/19/86* 1:26 pm KMR
2) MW-1 LJH 2/20/86 KMR
3) MW-3 LJH 2/19/86* 12:45 pm KMR
4) MW-4 LJH 2/20/86 4:40 pm KMR
5) MW-5 LJH 2/20/86 5:00 pm KMR

	1	2	3	4	5
pH, glass electrode @ 25°C	8.1	6.8	6.9	7.3	3.4
	parts per million (mg/L)				
Hexavalent Chromium	L/0.005	L/0.005	L/0.005	L/0.005	L/0.005
Cadmium	L/0.002	L/0.002	L/0.002	L/0.002	L/0.002
Zinc	0.016	0.071	0.019	0.24	0.034
Lead	L/0.01	0.02	0.01	0.02	L/0.01
Chromium	L/0.005	L/0.005	L/0.005	L/0.005	L/0.005
Nitrate as N	26.	0.10	0.29	L/0.05	L/0.05

<u>Key</u>

L/ = less than

* Water samples were obtained on 2/20/86 in all wells.

LJH

Respectfully submitted,

Laucks Testing Laboratories, Inc.

J.M. Owens

J. M. Owens

JMO:veg

Figure A-1

Laucks
Testing Laboratories, Inc.
940 South Harney St., Seattle, Washington 98108 (206)767-5060
Chemistry, Microbiology, and Technical Services

Certificate

PAGE NO. 2

Hart Crowser

LABORATORY NO. 95346

APPENDIX

Matrix Spike/Matrix Spike Duplicate Report

Inorganics/Metals Analyses

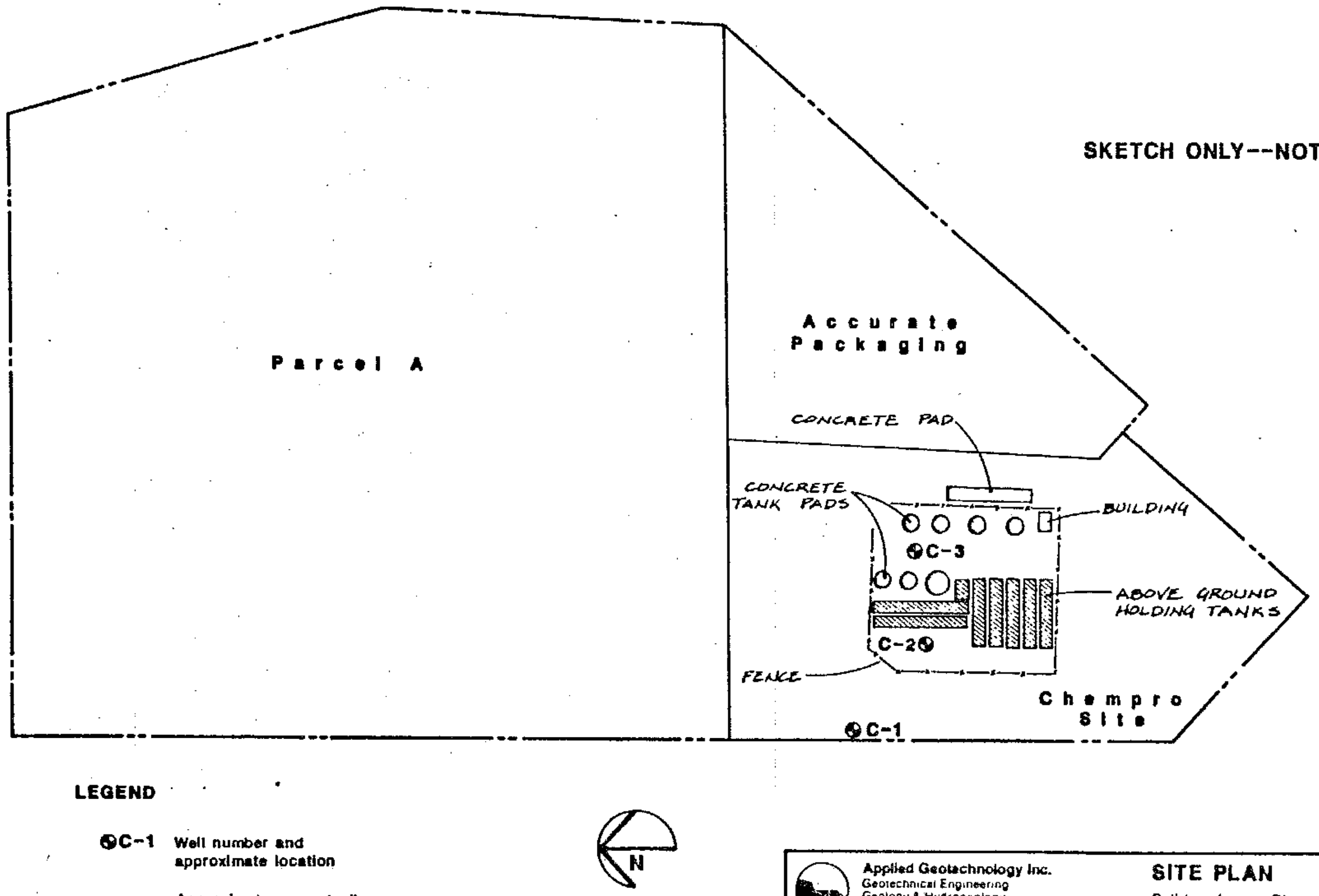
Sample	Analyte	Spike Added	Sample Result	MS Result	% Rec	MSD Result	% Rec	RPD
		mg/L	mg/L	mg/L		mg/L		
2	Nitrate	0.1	0.10	0.20	100.	0.19	90.	10.
1	Cadmium	0.050	L/0.002	0.048	96.	0.048	96.	0.
1	Chromium	0.050	L/0.005	0.044	88.	0.045	90.	-2.
1	Lead	0.10	L/0.01	0.10	100.	0.09	95.	5.
1	Zinc	0.05	0.016	0.058	84.	0.060	88.	-5.

Figure A-2

ANALYSIS OF WATER

C-1

SAMPLE NO.								
DATE								
TIME COLLECTED								
LOCATION								
SAMPLING METHOD RESULTS								
OIL & GREASE (mg/l)								
pH								
TOTAL ORGANIC CARBON (mg/l)								
HYDROCARBONS (mg/l)								
METHYLENE CHLORIDE								
1,1,1-TRICHLOROETHYLELNE								
TETRACHLOROETHYLENE								
ACETONE								
METHYL ETHYL KETONE								
METHYL ISOBUTYL KETONE								
XYLENE								
TOLUENE								
METHANOL								
ETHANOL								
ISOPROPANOL								
SPECIFIC CONDUCTANCE								
LEAD (mg/l)								
CHROMIUM (mg/l)								
ZINC (mg/l)								
ARSENIC (mg/l)								
CADIUM								
HEXAVALENT CHROMIUM								
NITRATE as N								
OTHER								



LEGEND

⊕C-1 Well number and approximate location

-·—— Approximate property lines

Reference: Undated, untitled site utility plan provided by Solidus, Inc.

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SITE PLAN

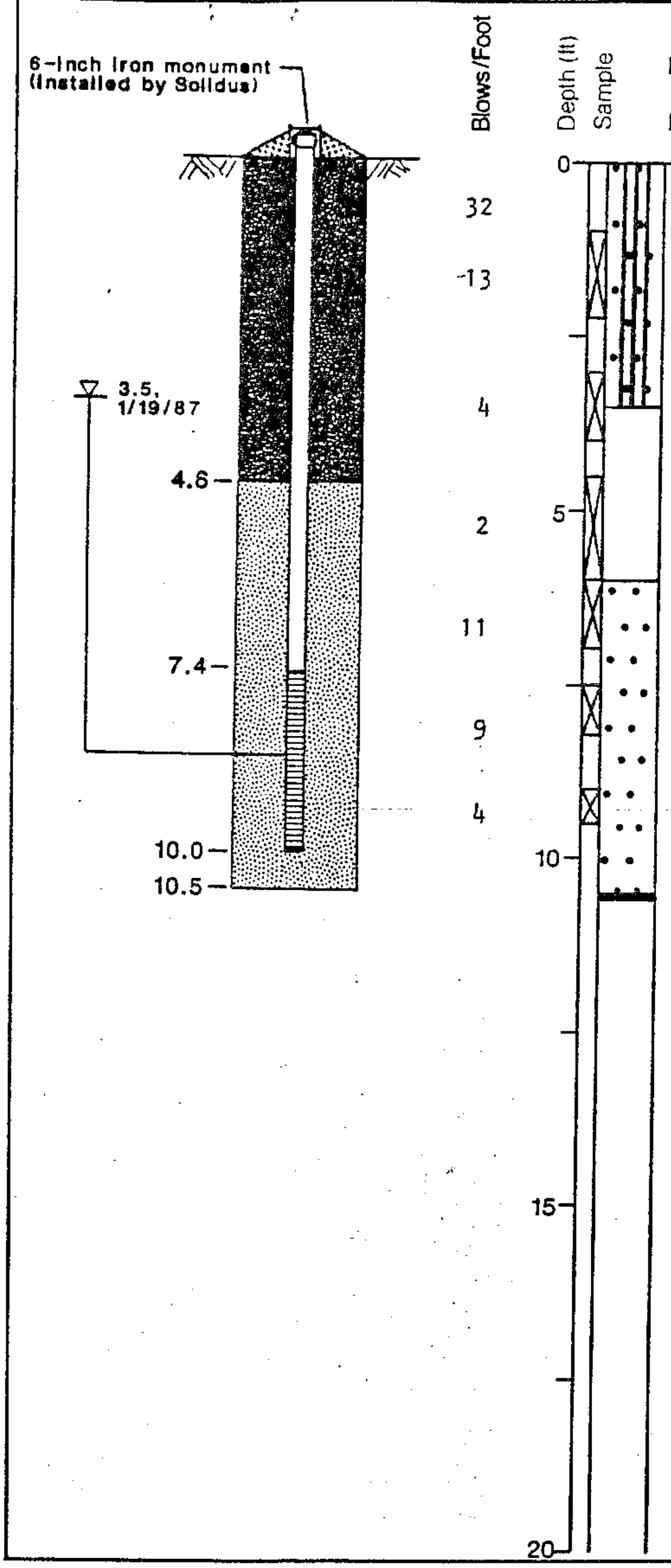
Solidus, Inc. – Chempro Site
Tacoma, Washington

FIGURE
2

JOB NUMBER	DRAWN	APPROVED	DATE	REVISED	DATE
15,181.001	NB	VL	1/26/87		

Equipment Mobile B61

Elevation Not Measured Date 1/9/87



BROWN SILTY SAND (SM) medium dense, moist to wet; with some gravel (Fill)

Note groundwater at 3 feet

Note wood chips and slight petroleum odor

GRAY SILTY CLAY-LIKE SLUDGE very soft, saturated: with paper-like fibers. Note solvent odor (gypsum residue?)

BLACK SAND (SP) loose, saturated: with occasional shell fragments. Note oily sheen and petroleum odor to bottom of boring (Hydraulic Fill)

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LOG AND INSTALLATION - WELL C-1

Solidus, Inc. - Chempro Site
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PLATE
3

JOB NUMBER	DRAWN	APPROVED	DATE	REVISED	DATE
15,181.001	NB	VK	1/26/87		

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS					TYPICAL NAMES
COARSE GRAINED SOILS MORE THAN HALF IS LARGER THAN NO. 200 SIEVE	**GRAVELS** MORE THAN HALF COARSE FRACTION IS LARGER THAN NO. 4 SIEVE SIZE	CLEAN GRAVELS WITH LITTLE OR NO FINES	**GW**	⁙	WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES
			GP	⁙	POORLY GRADED GRAVELS GRAVEL-SAND MIXTURES
		GRAVELS WITH OVER 12% FINES	**GM**	⁞	SILTY GRAVELS, POORLY GRADED GRAVEL-SAND - SILT MIXTURES
			GC	▨	CLAYEY GRAVELS, POORLY GRADED GRAVEL-SAND - CLAY MIXTURES
	SANDS MORE THAN HALF COARSE FRACTION IS LARGER THAN NO. 4 SIEVE SIZE	CLEAN SANDS WITH LITTLE OR NO FINES	**SW**	∴	WELL GRADED SANDS, GRAVELLY SANDS
			SP	∴	POORLY GRADED SANDS, GRAVELLY SANDS
		SANDS WITH OVER 12% FINES	**SM**	⁞	SILTY SANDS, POORLY GRADED SAND - SILT MIXTURES
			SC	▨	CLAYEY SANDS, POORLY GRADED SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN HALF IS SMALLER THAN NO. 200 SIEVE	**SILTS AND CLAYS** LIQUID LIMIT LESS THAN 50		**ML**	‖	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS, OR CLAYEY SILTS WITH SLIGHT PLASTICITY
			CL	▨	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
			OL	┆	ORGANIC CLAYS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50		**MH**	‖	INORGANIC SILTS, MICACEOUS OR DIATOMACIOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS
			CH	▨	INORGANIC CLAYS OF HIGH PLASTICITY FAT CLAYS
			OH	▨	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
			Pt	≈	PEAT AND OTHER HIGHLY ORGANIC SOILS

LEGEND

SAMPLE
■ "Undisturbed"
☒ Bulk
☐ Not Recovered

GRAPHIC LOG
── Well Defined Change
╱ Gradational Change
- - - Obscure Change
━━ End of Exploration

BLOWS/FOOT
Hammer is 140 pounds with 30 inch drop, unless otherwise noted
S - SPT Sampler (2.0 Inch O.D.)
T - Thin Wall Sampler (2.8 Inch Sample)
H - Split Barrel Sampler (2.4 Inch Sample)

MOISTURE DESCRIPTION

Dry	- Considerably less than optimum for compaction
Moist	- Near optimum moisture content
Wet	- Over optimum moisture content
Saturated	- Below water table, in capillary zone, or in perched groundwater

LABORATORY TESTS

Consol	- Consolidation
LL	- Liquid Limit
PL	- Plastic Limit
Gs	- Specific Gravity
SA	- Size Analysis
Tx	- Triaxial Shear
DS	- Direct Shear
VS	- Vane Shear
Comp	- Compaction

UU - Unconsolidated • Undrained
CU - Consolidated • Undrained
CD - Consolidated • Drained

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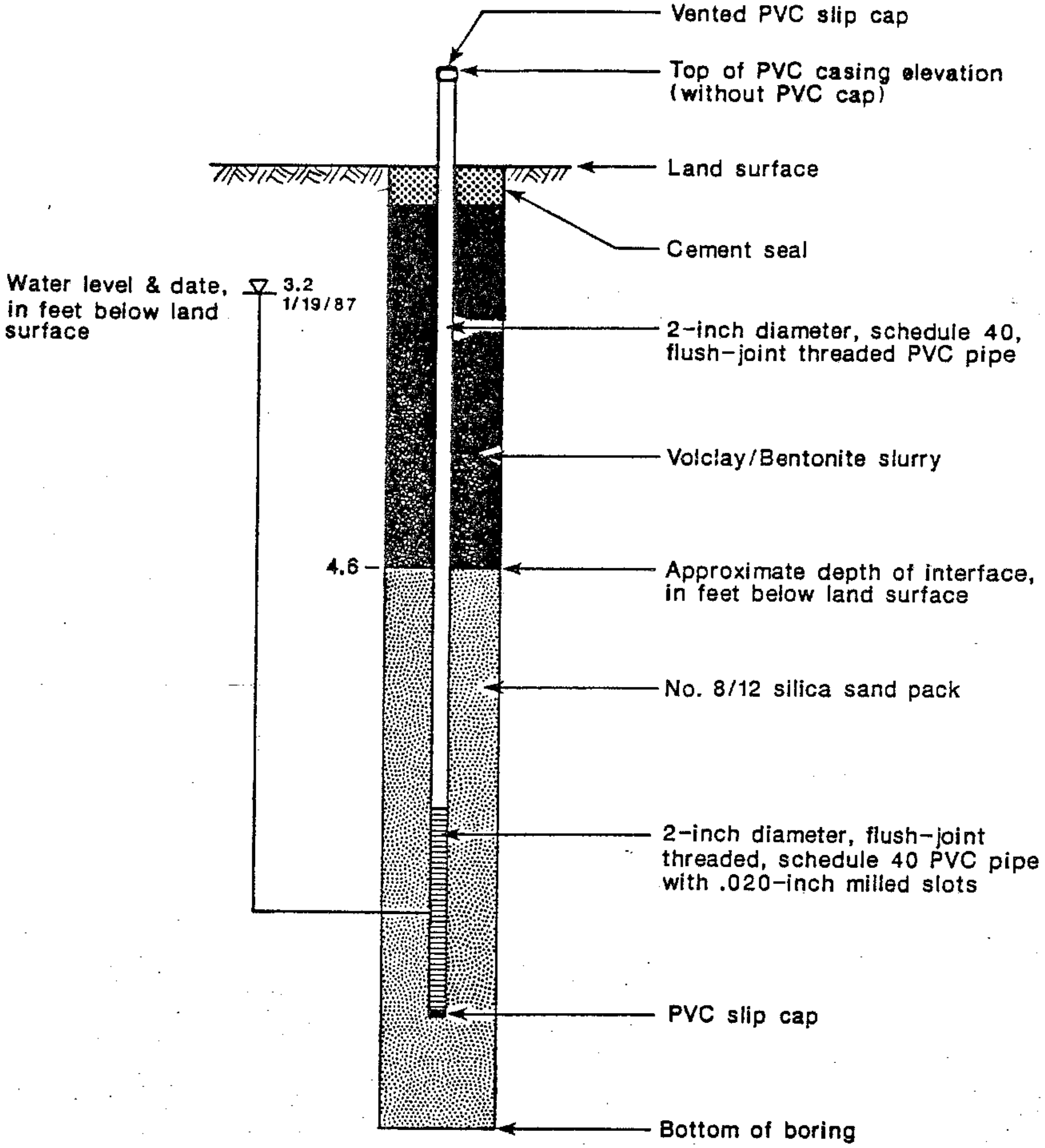
SOIL CLASSIFICATION/LEGEND

Solidus, Inc. – Chempro Site
Tacoma, Washington

PLATE
1

JOB NUMBER	DRAWN	APPROVED	DATE	REVISED	DATE
15,181.001	NB		1/26/87		



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WELL INSTALLATION LEGEND

Solidus, Inc. - Chempro Site
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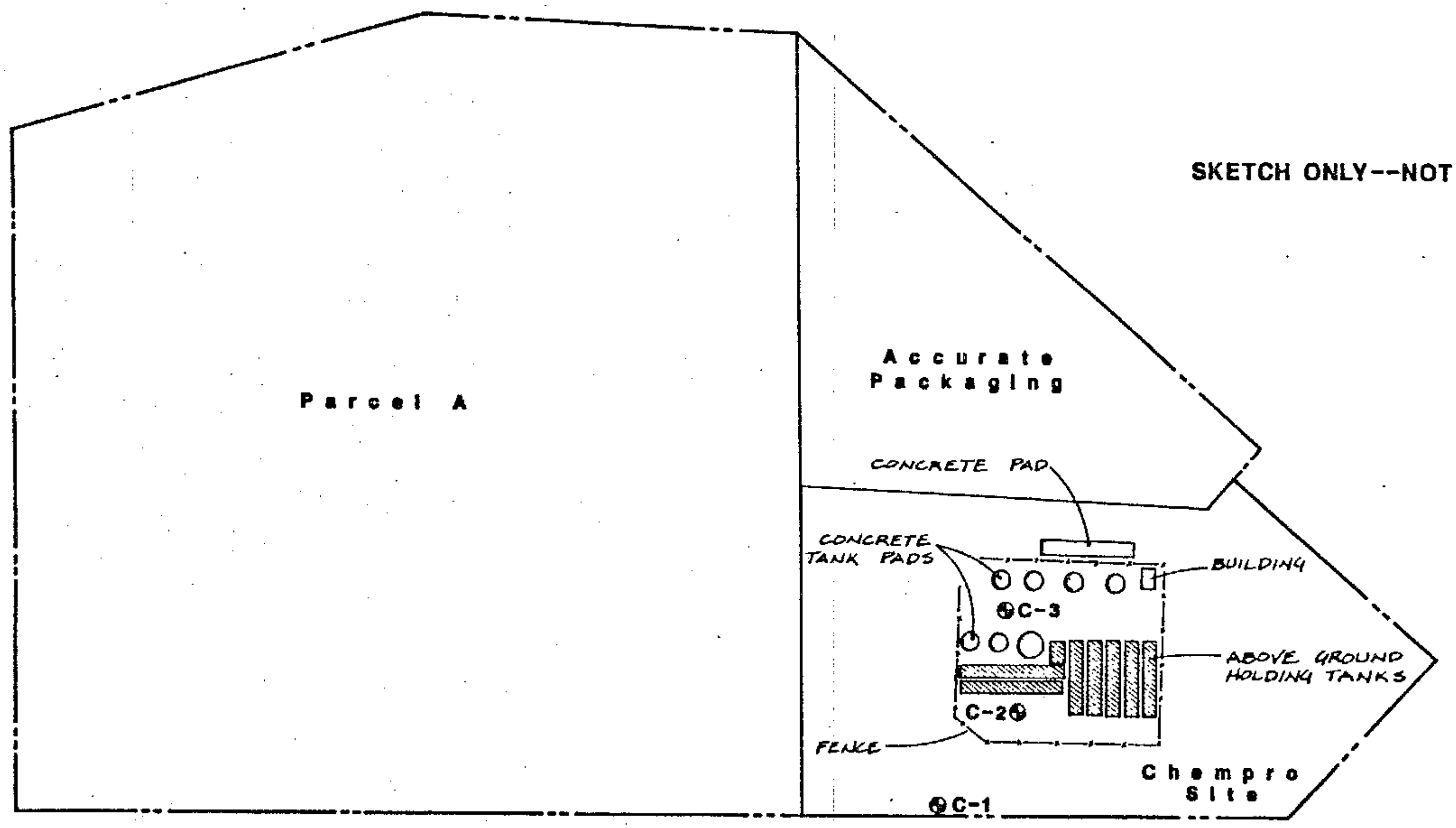
PLATE
2

JOB NUMBER	DRAWN	APPROVED	DATE	REVISED	DATE
15,181.001	NB		1/26/87		

ANALYSIS OF WATER

SAMPLE NO.								
DATE								
TIME COLLECTED								
LOCATION								
SAMPLING METHOD RESULTS								
OIL & GREASE (mg/l)								
pH								
TOTAL ORGANIC CARBON (mg/l)								
HYDROCARBONS (mg/l)								
METHYLENE CHLORIDE								
1,1,1-TRICHLOROETHYLELNE								
TETRACHLOROETHYLENE								
ACETONE								
METHYL ETHYL KETONE								
METHYL ISOBUTYL KETONE								
XYLENE								
TOLUENE								
METHANOL								
ETHANOL								
ISOPROPANOL								
SPECIFIC CONDUCTANCE								
LEAD (mg/l)								
CHROMIUM (mg/l)								
ZINC (mg/l)								
ARSENIC (mg/l)								
CADIUM								
HEXAVALENT CHROMIUM								
NITRATE as N								
OTHER								

SKETCH ONLY--NOT TO SCALE



LEGEND

⊕C-1 Well number and approximate location

-·-·— Approximate property lines

Reference: Undated, untitled site utility plan provided by Solidus, Inc.

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SITE PLAN

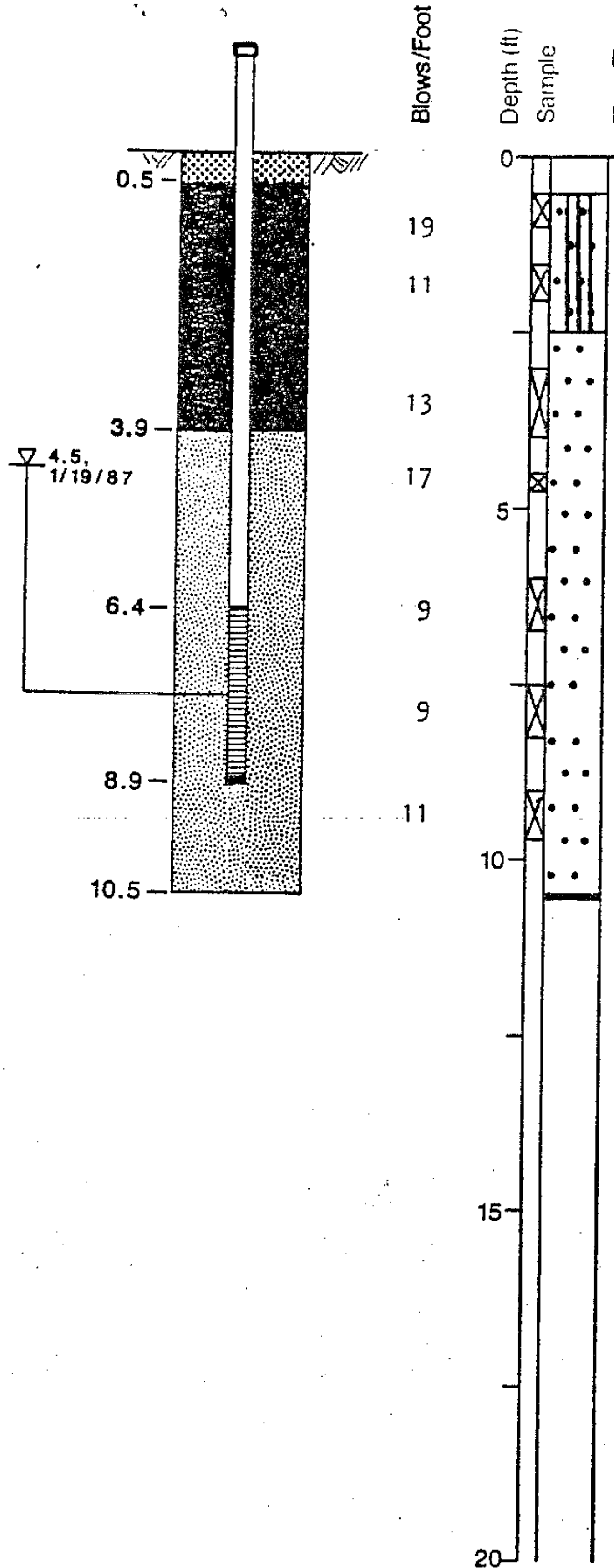
Solidus, Inc. - Chempro Site
Tacoma, Washington

FIGURE
2

JOB NUMBER	DRAWN	APPROVED	DATE	REVISED	DATE
15,181.001	NB	WL	1/26/87		

Equipment Mobile B61

Elevation Not Measured Date 1/9/87



Concrete

BROWN SILTY SAND (SM) loose, wet: with some gravel (Fill)

Note groundwater at 2.5 feet

BLACK SAND (SP) loose, wet: with occasional shells, slight petroleum odor (Hydraulic Fill)

Oil sheen and petroleum odor to bottom of boring

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LOG AND INSTALLATION - WELL C-2

Solidus, Inc. - Chempro Site
Tacoma, Washington

PLATE 4

JOB NUMBER	DRAWN	APPROVED	DATE	REVISED	DATE
15,181.001	NB		1/26/87		

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS					TYPICAL NAMES
COARSE GRAINED SOILS MORE THAN HALF IS LARGER THAN NO. 200 SIEVE	**GRAVELS** MORE THAN HALF COARSE FRACTION IS LARGER THAN NO. 4 SIEVE SIZE	CLEAN GRAVELS WITH LITTLE OR NO FINES	**GW**		WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES
			GP		POORLY GRADED GRAVELS GRAVEL-SAND MIXTURES
		GRAVELS WITH OVER 12% FINES	**GM**		SILTY GRAVELS, POORLY GRADED GRAVEL-SAND - SILT MIXTURES
			GC		CLAYEY GRAVELS, POORLY GRADED GRAVEL-SAND - CLAY MIXTURES
	SANDS MORE THAN HALF COARSE FRACTION IS LARGER THAN NO. 4 SIEVE SIZE	CLEAN SANDS WITH LITTLE OR NO FINES	**SW**		WELL GRADED SANDS, GRAVELLY SANDS
			SP		POORLY GRADED SANDS, GRAVELLY SANDS
		SANDS WITH OVER 12% FINES	**SM**		SILTY SANDS, POORLY GRADED SAND - SILT MIXTURES
			SC		CLAYEY SANDS, POORLY GRADED SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN HALF IS SMALLER THAN NO. 200 SIEVE	**SILTS AND CLAYS** LIQUID LIMIT LESS THAN 50		**ML**		INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS, OR CLAYEY SILTS WITH SLIGHT PLASTICITY
			CL		INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
			OL		ORGANIC CLAYS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50		**MH**		INORGANIC SILTS, MICACEOUS OR DIATOMACIOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS
			CH		INORGANIC CLAYS OF HIGH PLASTICITY FAT CLAYS
			OH		ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
			Pt		PEAT AND OTHER HIGHLY ORGANIC SOILS

LEGEND

SAMPLE	
■	"Undisturbed"
☒	Bulk
☐	Not Recovered

GRAPHIC LOG	
—	Well Defined Change
／	Gradational Change
- - -	Obscure Change
━	End of Exploration

BLOWS/FOOT

Hammer is 140 pounds with 30 inch drop, unless otherwise noted

S - SPT Sampler (2.0 Inch O.D.)

T - Thin Wall Sampler (2.8 Inch Sample)

H - Split Barrel Sampler (2.4 Inch Sample)

MOISTURE DESCRIPTION

Dry	- Considerably less than optimum for compaction
Moist	- Near optimum moisture content
Wet	- Over optimum moisture content
Saturated	- Below water table, in capillary zone, or in perched groundwater

LABORATORY TESTS

Consol	- Consolidation
LL	- Liquid Limit
PL	- Plastic Limit
Gs	- Specific Gravity
SA	- Size Analysis
Tx	- Triaxial Shear
DS	- Direct Shear
VS	- Vane Shear
Comp	- Compaction

UU - Unconsolidated • Undrained

CU - Consolidated • Undrained

CD - Consolidated • Drained

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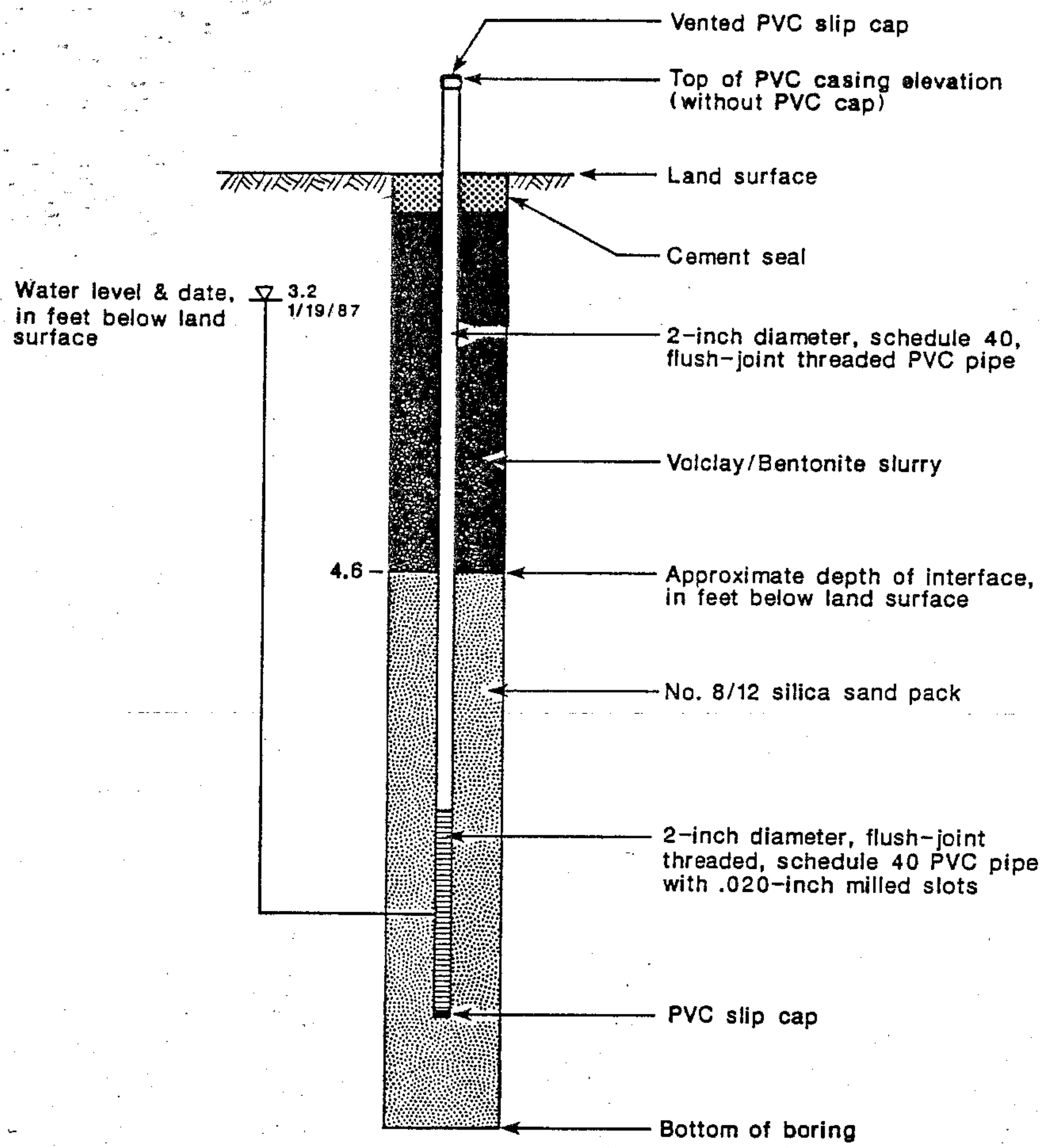
SOIL CLASSIFICATION/LEGEND

Solidus, Inc. – Chempro Site
Tacoma, Washington

PLATE
1

JOB NUMBER	DRAWN	APPROVED	DATE	REVISED	DATE
15,181.001	NB	VPL	1/26/87		



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WELL INSTALLATION LEGEND

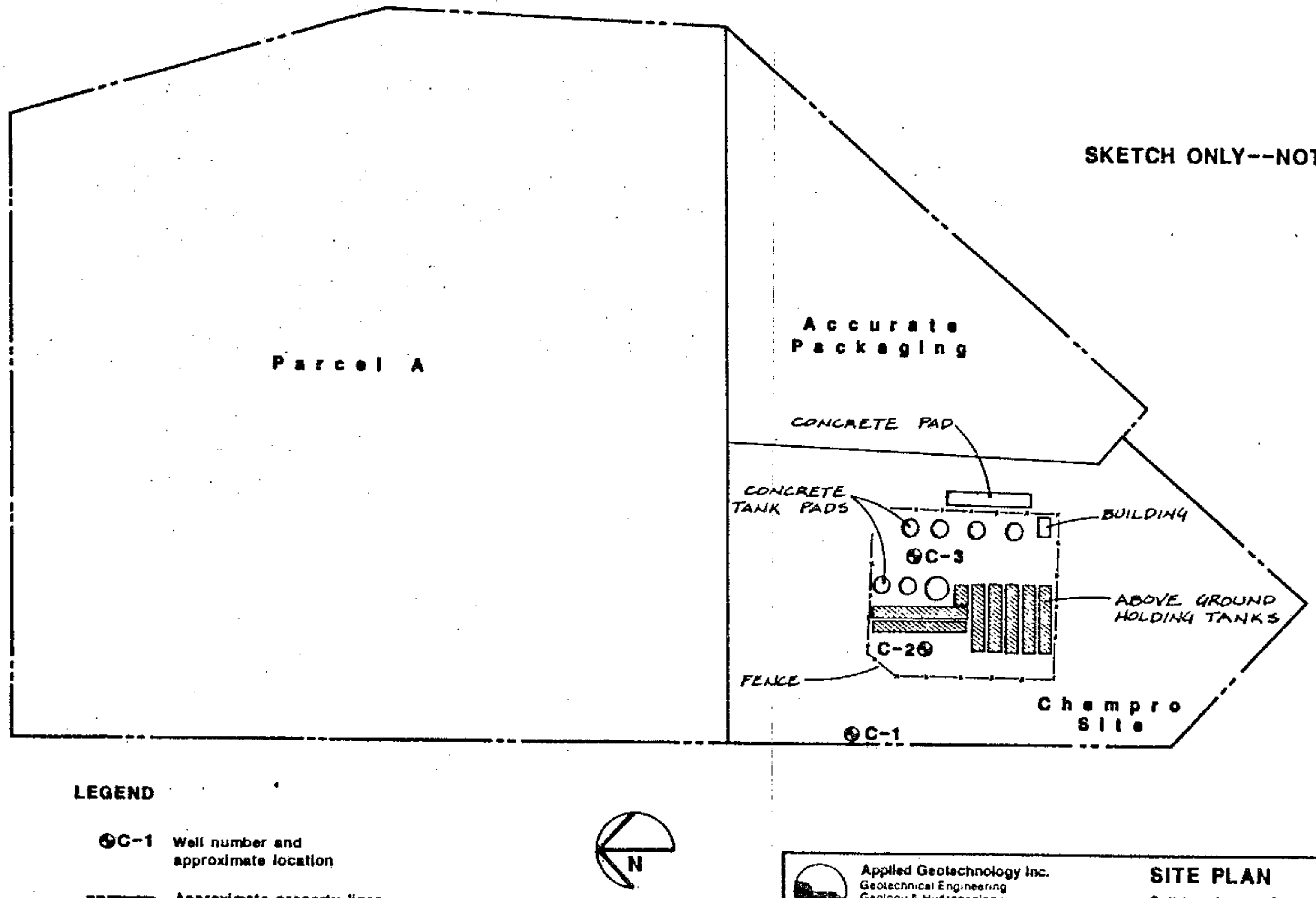
Solidus, Inc. – Chempro Site
Tacoma, Washington

PLATE
2

JOB NUMBER	DRAWN	APPROVED	DATE	REVISED	DATE
15,181.001	NB	WL	1/26/87		

ANALYSIS OF WATER

SAMPLE NO.								
ATE								
TIME COLLECTED								
LOCATION								
SAMPLING METHOD RESULTS								
OIL & GREASE (mg/l)								
pH								
TOTAL ORGANIC CARBON (mg/l)								
HYDROCARBONS (mg/l)								
METHYLENE CHLORIDE								
1,1,1-TRICHLOROETHYLELNE								
TETRACHLOROETHYLENE								
ACETONE								
METHYL ETHYL KETONE								
METHYL ISOBUTYL KETONE								
XYLENE								
TOLUENE								
METHANOL								
ETHANOL								
ISOPROPANOL								
SPECIFIC CONDUCTANCE								
LEAD (mg/l)								
CHROMIUM (mg/l)								
ZINC (mg/l)								
ARSENIC (mg/l)								
CADIUM								
HEXAVALENT CHROMIUM								
NITRATE as N								
OTHER								



LEGEND

⊕C-1 Well number and approximate location

- - - ——— Approximate property lines

Reference: Undated, untitled site utility plan provided by Solidus, Inc.

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SITE PLAN

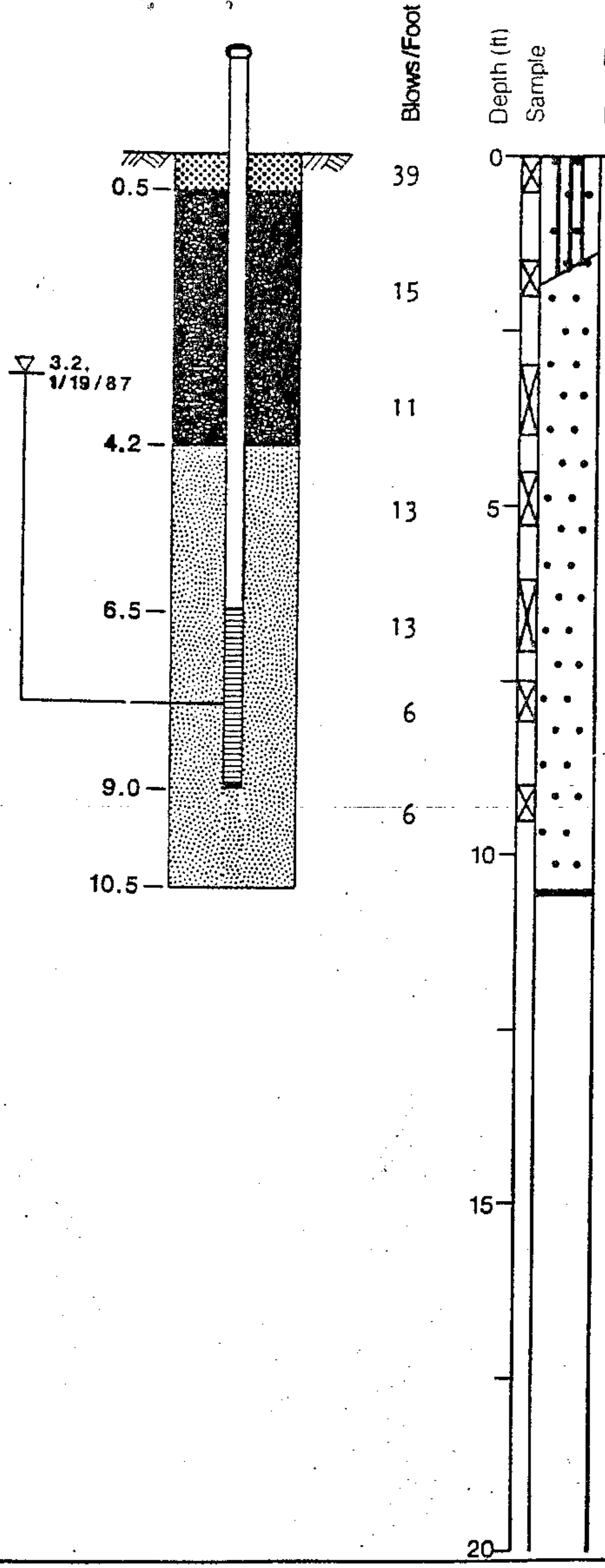
Solidus, Inc. - Chempro Site
Tacoma, Washington

FIGURE **2**

JOB NUMBER	DRAWN	APPROVED	DATE	REVISED	DATE
15,181.001	NB		1/26/87		

Equipment Mobile B61

Elevation Not Measured Date 1/9/87



BLACK SILTY SAND (SM) medium dense, moist; with petroleum odor and oily sheen

BLACK SAND (SP) loose, moist; with petroleum odor and oily sheen (Hydraulic Fill)

Note groundwater at 3 feet

Oil sheen and petroleum odor to bottom of boring

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LOG AND INSTALLATION - WELL C-3

Solidus, Inc. - Chempro Site
Tacoma, Washington

PLATE
5

JOB NUMBER	DRAWN	APPROVED	DATE	REVISED	DATE
15,181,001	NB	VPL	1/26/87		

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS					TYPICAL NAMES
COARSE GRAINED SOILS MORE THAN HALF IS LARGER THAN NO. 200 SIEVE	**GRAVELS** MORE THAN HALF COARSE FRACTION IS LARGER THAN NO. 4 SIEVE SIZE	CLEAN GRAVELS WITH LITTLE OR NO FINES	**GW**	⁘	WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES
			GP	⁘	POORLY GRADED GRAVELS GRAVEL-SAND MIXTURES
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			SP	⁘	POORLY GRADED SANDS, GRAVELLY SANDS
		SANDS WITH OVER 12% FINES	**SM**	⋮	SILTY SANDS, POORLY GRADED SAND - SILT MIXTURES
			SC	▨	CLAYEY SANDS, POORLY GRADED SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN HALF IS SMALLER THAN NO. 200 SIEVE	**SILTS AND CLAYS** LIQUID LIMIT LESS THAN 50		**ML**	▥	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS, OR CLAYEY SILTS WITH SLIGHT PLASTICITY
			CL	▨	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
			OL	▥	ORGANIC CLAYS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50		**MH**	▥	INORGANIC SILTS, MICACEOUS OR DIATOMACIOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS
			CH	▨	INORGANIC CLAYS OF HIGH PLASTICITY FAT CLAYS
			OH	▨	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
			Pt	≈	PEAT AND OTHER HIGHLY ORGANIC SOILS

LEGEND

SAMPLE

- ■ "Undisturbed"
- ☒ Bulk
- ☐ Not Recovered

GRAPHIC LOG

—	Well Defined Change
⁄	Gradational Change
- - -	Obscure Change
▬	End of Exploration

BLOWS/FOOT

Hammer is 140 pounds with 30 inch drop, unless otherwise noted

S - SPT Sampler (2.0 Inch O.D.)
T - Thin Wall Sampler (2.8 Inch Sample)
H - Split Barrel Sampler (2.4 Inch Sample)

MOISTURE DESCRIPTION

Dry	- Considerably less than optimum for compaction
Moist	- Near optimum moisture content
Wet	- Over optimum moisture content
Saturated	- Below water table, in capillary zone, or in perched groundwater

LABORATORY TESTS

Consol	- Consolidation
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UU - Unconsolidated • Undrained
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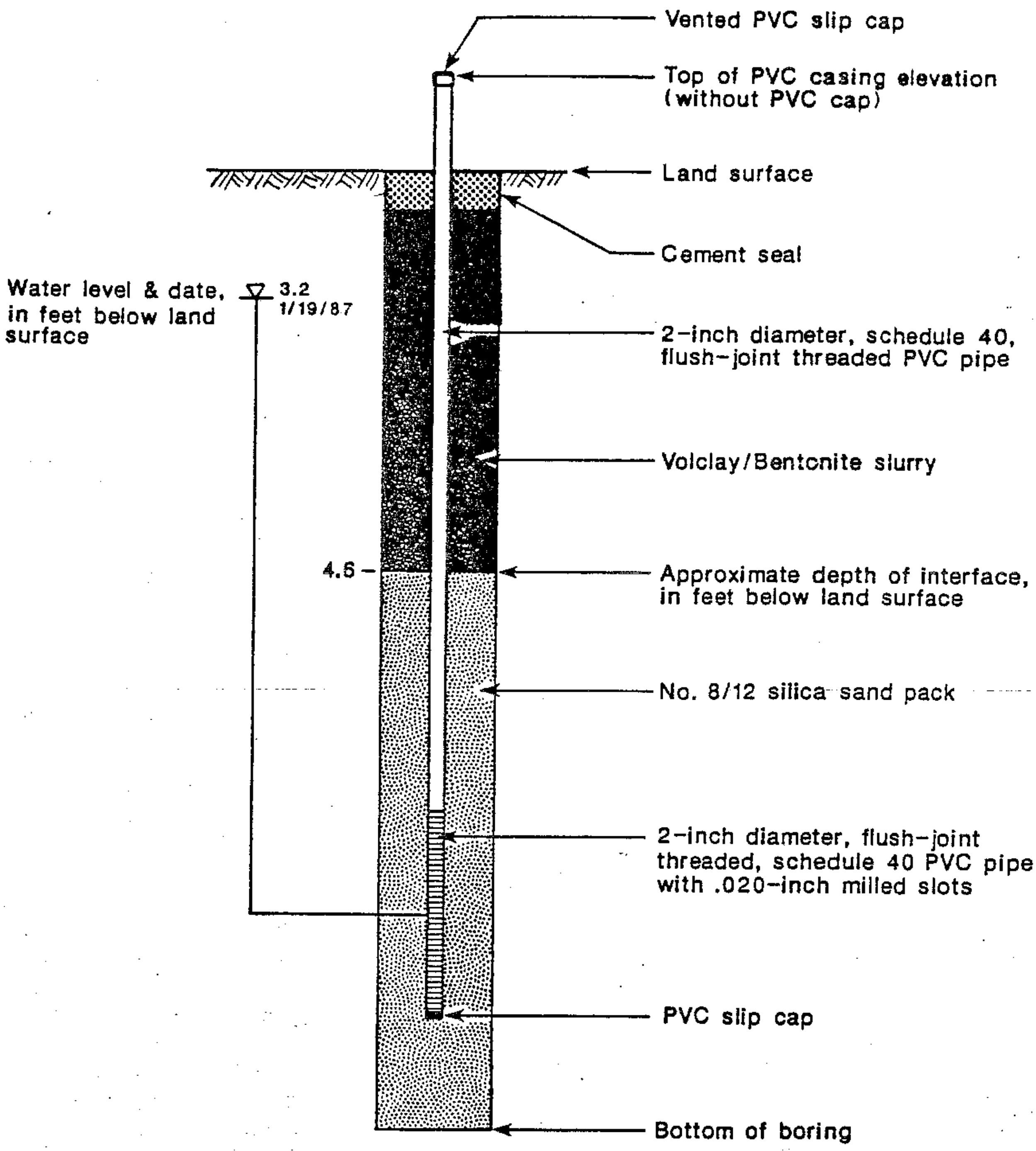
SOIL CLASSIFICATION/LEGEND

Solidus, Inc. - Chempro Site
Tacoma, Washington

PLATE
1

JOB NUMBER	DRAWN	APPROVED	DATE	REVISED	DATE
15,181.001	NB		1/26/87		



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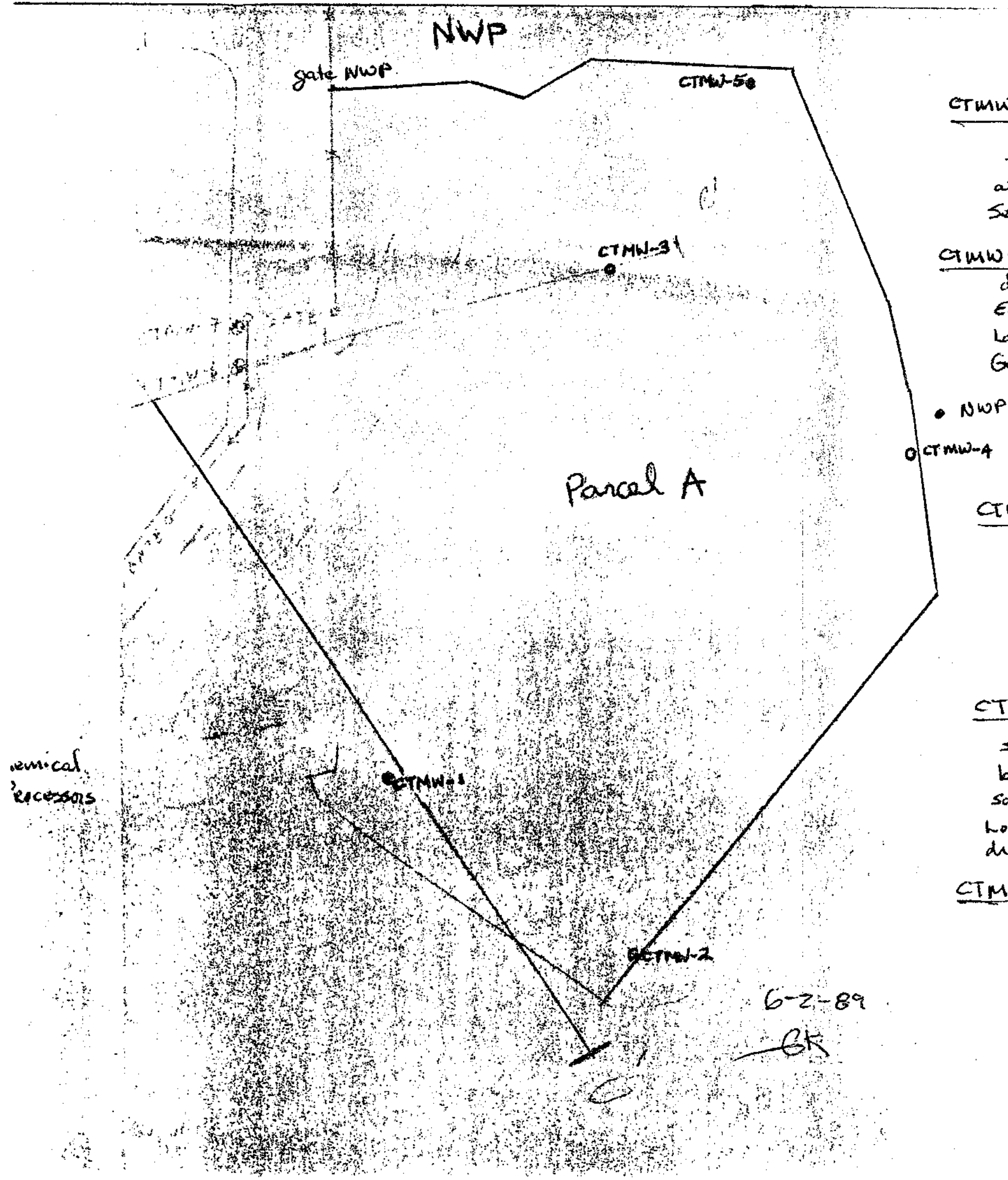
WELL INSTALLATION LEGEND

Solidus, Inc. - Chempro Site
Tacoma, Washington

PLATE
2

JOB NUMBER	DRAWN	APPROVED	DATE	REVISED	DATE
15,181.001	NB		1/26/87		



6-2-89
GK

CTMW-1 – top layer has quite a bit black solid. Stayed suspended long time – gradually settled. Lower level (siphoned at two depths) had less suspended solid. Settled to clear water.

CTMW-2 – siphoned top layer. Photographed doing so by ~~Sue~~ Anne Udaloy of Sweet-Edwards / EMCON Inc. Told her to stop. Later after she left, evacuated 5 gallons. Got about (1) qt black oil. Water well recharg: nicely.

CTMW-3 – sampled quickly. Fairly good. Slightly cloudy, yellowish. Noticed siphon tube oily. Tested top layer of H_2O. No oil. Inside well above water line looked oily. Tubing must have touched this.

CTMW-4 – quite a bit of black suspended solid. Less than CTMW-1 but enough to prevent getting clean sample. Spent time getting good sample. Looked fairly good (through tubing as drawing it up)

CTMW-5 – yellowish, cloudy. Easy sample. No oil, no suspended solid.

Sweet-Edwards/EMCON, Inc.
Geology, Ground Water, Waste Management & Engineering

ANNE UDALOY
Staff Geologist

18912 N. Creek Parkway, Suite 210 • Bothell, WA 98011

GROUNDWATER SAMPLING
AND ANALYSIS (S&A) PLAN

for

LILYBLAD PETROLEUM, INC.
TACOMA, WASHINGTON

March 1988

Prepared by

ROY F. WESTON, INC.
9618 Roosevelt Way, NE
Seattle, Washington
98115

Received
3.30.88

TABLE OF CONTENTS

SECTION 1

INTRODUCTION

The following presents the Lilyblad Petroleum, Inc. Groundwater Sampling and Analysis (S&A) Plan. The plan includes procedures and guidelines for sampling the four on-site wells and one off-site well at the Lilyblad facility. Sampling procedures are provided for the following four categories:

- o Sample collection
- o Handling Procedures
- o Chain-of-Custody Program
- o Field quality assurance/quality control program

A summary of sampling procedures for quick reference is outlined below. Detailed procedures and guidelines for the four categories are presented in the following sections.

1.1 SAMPLE COLLECTION AND HANDLING PROCEDURES

- o Static Water Level Elevation - The depth to standing water and total depth of the well should be taken in order to calculate the volume of water in the well, to enable groundwater flow directions to be calculated and to provide an integrity check of the well. Measurements should be collected from a standard surveyed reference point and should be made to the nearest tenth of a foot. A variety of manufacturers produce quality well measurement instruments.

- o Immiscible layers - If an immiscible layer is suspected the layer should be measured by procedures detailed in Section 2.2 and removed prior to well evacuation.

- o Well Evacuation - A minimum of three well volumes should be removed prior to sampling. Well volumes may be conveniently calculated by use of the following table:

Nominal Well Diameter (in inches)	Approximate Gallons Per Foot
2	0.164
3	0.367
4	0.653
6	1.468
8	2.610
10	4.078
12	5.872

Chemical stabilization parameters (conductivity and pH) should be measured during evacuation. Low-yield wells (wells incapable of yielding three case volumes) should be evacuated to dryness and sampled following sufficient recovery. Sample collection should not begin until either the appropriate volumes of water has been purged/evacuated or the well has been evacuated to dryness and allowed to recover <u>and</u> the pH and conductivity measurements have stabilized.

- o Sample Collection - Samples should be collected using dedicated gas-operated flurocarbon resin (teflon) bladder pumps or teflon/stainless steel bailers with dedicated ropes. Sampling should be conducted starting at the least contaminated well (usually upgradient) and proceeding to more contaminated wells.

- o Decontamination Procedures - Sample equipment should be dedicated to an individual well or decontaminated between wells following procedures in Section 2.6.

1.2 SAMPLE HANDLING PROCEDURES

- o Sample Containers - Sample containers should be selected based on the specific parameters to be analyzed and the detection limits required. Table 3-1 presents the type of container recommended for each specific parameter. Containers should be thoroughly cleaned based on the analyte of interest.

- o Sample Preservation - Samples should be preserved based on the specific parameters to be analyzed. Table 3-1 presents the type of preservative recommended for each specific parameter. In addition samples should be refrigerated (4° Celsius) and protected from light following collection. Samples should be analyzed in accordance with holding time specified in Table 3-1. Other general sampling procedures include:

  - Samples requiring organic analysis should not be filtered

  - Samples should not be transferred from one container to another

  - No headspace should exist in containers that are to be analyzed for volatile organics

1.3 CHAIN-OF-CUSTODY PROGRAM

- o A program should be initiated that includes the following methodology for documenting the possession and handling of individual samples
  - Sample labels should be affixed to each container identifying the sample and analysis
  - Sample seals should be affixed to shipping containers or individual bottles to insure that samples are not disturbed during transportation
  - A field Logbook should be used for documenting all activity conducted during the sampling program
  - A chain-of-custody form that includes the requested sample analysis should accompany every shipping container and document every sample

1.4 FIELD QA/QC PROGRAM

- o The following field samples should be prepared and analyzed during all sampling programs:
  - Trip blank containing Type II reagent grade water
  - Equipment blank containing Type II reagent grade water that has been passed through the sampling device
  - Duplicate samples should be collected at one per day or ten percent of the total number of samples collected per day.

SECTION 2

SAMPLE COLLECTION

2.1 MEASUREMENT OF STATIC WATER LEVEL ELEVATION

Static water elevations should be measured in each well prior to each sampling event. Collection of water elevation on a continuing basis is important to determine if horizontal and vertical flow gradients have changed since initial site characterization. A change in hydrologic conditions may necessitate a modification of the design of the groundwater monitoring system.

Field measurements should include depth to standing water and total depth of the well to the bottom of the intake screen structure. This information is required to calculate the volume of stagnant water in the well and provide a check on the integrity of the well (e.g., identify siltation problems). The measurements should be taken to 0.01 foot. Each well should have a permanent, easily identified reference point from which its water level measurement is taken. The references points should be established in relation to an established National Geodetic Vertical Datum (NGVD). The device used to detect the water level surface must be sufficiently sensitive so that a measurement to ±0.01 foot can be obtained reliably. A steel tape will usually suffice; however, it is recommended that an electronic device be used to measure depth to the surface of the groundwater or light phase immiscibles.

2.2 DETECTION OF IMMISCIBLE LAYERS

The following procedures which should be incorporated for detecting the presence of light (floaters) and/or dense (sinkers) phase immiscible organic layers. These procedures should be undertaken if immiscible organic layers are suspected, before the well is evacuated for conventional sampling:

1. Remove the locking and protective caps.

2. Sample the air in the well head for organic vapors using either a photonization analyzer or an organic vapor analyzer, and record measurements in a field log book.

3. Determine the static liquid level using a manometer and record the depth.

4. Lower an interface probe into the well to determine the existence of any immiscible layer(s), light and/or dense.

The air above the well head should be monitored in order to determine the potential for fire, explosion, and/or toxic effects on workers. This test also serves as a first indication of the presence of light phase immiscible organics. A manometer or acoustical sounder (for very shallow wells) will provide an accurate reading of the depth to the surface of the liquid in the well, but neither are capable of differentiating between the potentiometric surface and the surface of an immiscible layer. Nonetheless, it is very useful to determine that surface depth first to guide the lowering of the interface probe. The interface probe serves two related purposes. First, as it is lowered into the well, the probe registers when it is exposed to an organic liquid and thus identifies the presence of immiscible layers. Careful recording of the depths of the air/floater and floater/water interfaces establishes a measurement of the thickness of the light phase immiscible layer, the probe indicates the depth to the water level. The presence of floaters precludes the exclusive use of sounders to make a determination of static water level. Dense phase immiscible layers are detected by lowering the device to the bottom of the well where, again, the interface probe registers the presence/absence of organic liquids.

The immiscible phase must be collected prior to any purging activities. If the thickness of this phase is 2 feet or greater, a bottom valve bailer is the equipment of choice.

When the thickness of the floating layer is less than 2 feet, but the depth to the surface of the floating layer is less than 25 feet, a peristaltic pump can be used to "vacuum" a sample.

When the thickness of the floating layer is less than 2 feet and the depth to the surface of the floating layer is beyond the effective "reach" of a peristaltic pump (greater than 25 feet), a bailer must be modified to allow filling only from the top.

The best method for collecting dense phase immiscibles is to use a double check valve bailer. The key to sample collection is controlled, slow lowering (and raising) of the bailer to the bottom of the well. The dense phase must be collected prior to any purging activities.

2.3 WELL EVACUATION

The water standing in a well prior to sampling may not be representative of in-situ groundwater quality. Therefore, the standing standing water in the well and filter pack should be removed so that formation water can replace the stagnant water. Water should be drawn down from above the screen in the uppermost part of the water column in high yield formations to ensure that fresh water from the formation will move upward in the screen. Water should be removed from the bottom of the screened interval in low-yield formations.

The procedure used for well evacuation depends on the hydraulic yield characteristics of the well. When evacuating low-yield wells (wells that are incapable of yielding three casing volumes), the owner/operator should evacuate wells to dryness once. As soon as the well recovers sufficiently, the first sample should be tested for pH, temperature, and specific conductance. The well should be retested for pH, temperature, and specific conductance during evacuation and after sampling as a measure of purging efficiency and as a check on the stability of the water samples over time. Whenever full recovery to static level exceeds two hours, the sample should be extracted as soon as sufficient volume is available for a sample for each parameter. A well should not be pumped to dryness if the recharge rate causes the formation water to vigorously cascade down the sides of the screen which could cause an accelerated loss of volatiles. For higher yielding wells, the three casing volumes should be evacuated prior to sampling.

In order to minimize the introduction of contamination into the well, positive-gas displacement, fluorocarbon resin bladder pumps are recommended for purging wells. Fluorocarbon resin or stainless steel bailers are also recommended purging equipment. Where these devices cannot be used, peristaltic pumps, gas-lift pumps, centrifugal pumps, and venturi pumps may be used. Some of these pumps cause volatilization and produce high pressure differentials, which result in variability in the analysis of pH, specific conductance, metals, and volatile organic samples. They are, however, acceptable for purging the wells if sufficient time is allowed to let the water stabilize prior to sampling.

When purging equipment must be reused for subsequent wells, it should be decontaminated, following the same procedures required for the sampling equipment.

2.4 COLLECTION

To ensure the groundwater sample is representative of the formation, it is important to minimize physically altering or chemically contaminating the sample during the withdrawal process.

When collecting samples where volatile constituents or gases are of interest, using a positive gas displacement bladder pump, pumping rates should not exceed 100 milliliters/ minute. Higher rates can increase the loss of volatile constituents and can cause fluctuation in pH and pH-sensitive analytes. Once the portions of the sample reserved for the analysis of volatile components have been collected, higher pumping rates may be used particularly if a large sample volume must be collected. The sampling flow rate should not exceed the flow rate used while purging.

Samples should be collected and containerized in the order of the parameter volatilization sensitivity. A preferred collection order for some common groundwater parameters follows:

- Volatile organics (VOA)
- Purgeable organic carbon (POC)
- Purgeable organic halogens (POX)
- Total organic halogens (TOX)
- Total organic carbon (TOC)
- Extractable organics
- Total metals
- Dissolved metals
- Phenols
- Cyanide
- Sulfate and chloride
- Turbidity
- Nitrate and ammonia
- Radionuclides

Temperature, pH, and specific conductance measurements should be made in the field before and after sample collection as a check on the stability of the water sampled over time.

Sampling equipment and procedures that minimize agitation and reduce/eliminate contact with the atmosphere during sample transfer must be used. Sampling equipment should be constructed of inert materials. When used properly, the following are acceptable sampling devices for all parameters:

- Gas-operated, fluorocarbon resin or stainless steel squeeze pump (also referred to as a bladder pump with adjustable flow control);
- Bailer (fluorocarbon resin or stainless steel), provided it is equipped with double check valves and bottom emptying device;
- Syringe bailer (stainless steel or fluorocarbon resin); and
- Single check valve fluorocarbon resin or stainless steel bailer.

Sampling equipment should be constructed of inert material. Several criteria should be incorporated in the field to ensure proper sample collection.

- Sampling should first be conducted at background wells and then proceeding to downgrading wells.
- Positive gas displacement bladder pumps should be operated in a continuous manner so that they do not produce pulsating samples that are aerated in the return tube or upon discharge.
- Check valves should be designed and inspected to assure that fouling problems do not reduce delivery capabilities or result in aeration of the sample.
- Sampling equipment (e.g., especially bailers) should never be dropped into the well, because this will cause degassing of the water upon impact.
- The contents should be transferred to a sample container in a way that will minimize agitation and aeration.
- Clean sampling equipment should not be placed directly on the ground or other contaminated surfaces prior to insertion into the well.

2.5 IN-SITU OR FIELD ANALYSES

Several constituents of the parameters being evaluated are physically or chemically unstable and must be tested either in the borehole using a probe (in-situ) or immediately after collection using a field test kit. Examples of unstable elements or properties include pH, redox potential, chlorine, dissolved oxygen, and temperature. Although specific conductivity (analogus to electrical resistance of a substance) is relatively stable, it is recommended that this characteristic be determined in the field. Most conductivity instruments require temperature compensation; therefore, the temperature of the samples should be measured at the time conductivity is determined. Conductivity and pH should be monitored during well evacuation to ensure chemical stabilization of the water has occurred prior to sampling.

Calibration of any in-situ monitoring equipment or field-test probes and kits should be completed at the beginning of each use, according to the manufacturers' specifications and consistent with Test Methods for Evaluating Solid Waste - Physical/Chemical Methods (SW-846), 2nd Edition, 1982.

2.6 SAMPLING EQUIPMENT DECONTAMINATION PROCEDURES

When dedicated equipment is not used for sampling (or well evacuation), disassembly and cleaning of equipment must be complete before each use. If the constituents of interest are inorganic, the equipment should be cleaned with a nonphosphate detergent/soap mixture. The first rinse should be a dilute (0.1 N) hydrochloric acid or nitric acid, followed by a rinse of tap water and finally Type II reagent grade water. Dilute hydrochloric acid is generally preferred to nitric acid when cleaning stainless steel because nitric acid may oxidize the stainless steel.

When organics are the constituents of concern, the equipment should be washed with a nonphosphate detergent and rinsed with tap water, distilled water, acetone, and pesticide-quality hexane, in that order. The sampling equipment should be thoroughly dried before use to ensure that the residual cleaning agents (e.g., HCl) are not carried over to the sample.

SECTION 3

SAMPLE HANDLING PROCEDURES

3.1 SAMPLE CONTAINERS

Samples should be transferred in the field from the sampling equipment directly into the container that has been specifically prepared for that analysis or set of compatible parameters. It is not an acceptable practice for samples to be composited in a common container in the field and then split in the laboratory, or poured first into a wide mouth container and then transferred into smaller containers. Test methods for evaluating solid waste-Physical/Chemical Methods (SW-846) specify that sample containers should be used for each constituent or common set of parameters.

When metals are the analytes of interest, fluorocarbon resin or polyethylene containers with polypropylene caps should be used. When organics are the analytes of interest, glass bottles with fluorocarbon resin-lined caps should be used. Table 2-1 presents specific parameters and recommended types of sample containers.

Containers should be cleaned based on the analyte of interest. When samples are to be analyzed for metals, the sample containers as well as the laboratory glassware should be thoroughly washed with nonphosphate detergent and tap water, and rinsed with (1.1) nitric acid, tap water, (1.1) hydrochloric acid, tap water, and finally Type II water, in that order.

Similarly, an EPA-approved procedure is available for cleaning containers used to store samples for organics analysis. The sampling container should be emptied of any residual materials, followed by a washing with a nonphosphate detergent in hot water. It should then be rinsed with tap water, distilled water, acetone, and finally with pesticide-quality hexane. Dirty or contaminated glassware does not form a very thin sheet of water on its surface and may require treatment with chromic acid and/or baking in a muffle furnace at 400 degrees centigrade for 15 to 30 minutes to ensure that the glass is clean. Chromic acid may be useful to remove organic deposits from glassware; however, the analyst should be cautioned that the glassware must be thoroughly rinsed with water to remove the last traces of chromium. The use of chromic acid can cause a contamination problem and must be avoided if chromium is an analyte of interest.

Glassware should be sealed and stored in a clean environment immediately after drying or cooling to prevent any accumulation of dust or other contaminants. It should be stored, capped with aluminum foil and inverted.

3.1.1 Sample Preservation

Many of the chemical constituents and physiochemical parameters that are to be measured or evaluated in groundwater monitoring programs are not chemically stable, and therefore sample preservation is required.

(SW-846) includes a discussion by analyte of the appropriate sample preservation procedures.

Preservation methods are generally limited to pH, control, chemical addition, refrigeration, and protection from light. Specific preservation methods presented in SW-846 should be used for the constituent in the sample. A summary list of appropriate sample container types and sample preservation measures is presented in Table 3-1.

3.1.2 Special Handling Considerations

Samples requiring analysis for organics should not be filtered. Samples should not be transferred from one container to another, because losses of organic material onto the walls of the container or aeration may occur. Total organic halogens (TOX) and total organic carbon (TOC) samples should be handled and analyzed as materials containing volatile organics. No headspace should exist in the sample containers to minimize the possibility of volatilization of organics.

Metallic ions that migrate through the unsaturated (vadose) and saturated zones and arrive at a groundwater monitoring well may be present in the well. Particles (e.g., silt, clay), which may be present in the well even after well evacuation procedures, may absorb or absorb various ionic species to effectively lower the dissolved metal content in the well water. Groundwater samples on which metals analysis will be conducted should be split into two portions. One portion should be filtered through a 0.45-micron membrane filter, transferred to a bottle, preserved with nitric acid to a pH less than 2 (Table 4-1), and analyzed for dissolved metals. The remaining portion should be transferred to a bottle, preserved with nitric acid, and analyzed for total metals. Any difference in concentration between the total and dissolved fractions may be attributed to the original metallic ion content of the particles and any portion of ions to the particles.

3.2 CHAIN-OF-CUSTODY PROGRAM

An adequate chain-of-custody program will allow for the tracing of possession and handling of individual samples from the time of field collection through laboratory analysis. A chain-of-custody program should include:

- Sample labels, which prevent misidentification of samples;
- Sample seals to preserve the integrity of the sample from the time it is collected until it is opened in the laboratory;
- Field logbook to record information about each sample collection during the groundwater monitoring program;
- Chain-of-custody record to establish the documentation program;
- Sample analysis request sheets, which serve as official communication to the laboratory of the particular analysis(es) required for each sample and provide further evidence that the chain of custody is complete. This sheet may be incorporated onto the chain-of-custody form.

3.2.1 Sample Labels

To prevent misidentification of samples, affix legible labels to each sample container. An indelible ink pen should be used when completing sample labels. The labels should be sufficiently durable to remain legible even when wet and should contain the following types of information:

- Sample identification number
- Name of collector
- Date and time of collection
- Place and collection
- Parameter(s) requested (if space permits)
- Internal temperature of shipping container at time sample was placed
- Internal temperature of shipping container upon opening at laboratory

3.2.2 Sample Seal

In cases where samples may leave the sampler's immediate control, such as shipment to a laboratory by a common carrier (e.g., air freight), a seal should be provided on the shipping container or individual sample bottles to ensure that the samples have not been disturbed during transportation.

3.2.3 Field Logbook

The individual designated to perform groundwater monitoring operations should keep an up-to-date field logbook that documents the following:

- Identification of well
- Well depth
- Static water level depth and measurement technique
- Presence of immiscible layers and detection method
- Well yield - high or low
- Purge volume and pumping rate
- Time well purged
- Collection method for immiscible layers and sample identification numbers
- Preservative(s) used
- Parameters requested for analysis
- Field analysis data and method(s)
- Sample distribution and transporter
- Field observations on sampling event
- Name of collector
- Climatic conditions including air temperature
- Internal temperature of field and shipping (refrigerated) containers

3.2.4 Chain-of-Custody Record

To establish the documentation necessary to trace sample possession from time of collection, a chain-of-custody record should be filled out and should accompany every sample. The record should contain the following types of information:

- Sample number
- Signature of collector
- Date and time of collection
- Sample type (e.g., ground water, immiscible layer)
- Identification of well
- Number of containers
- Parameters requested for analysis

- Signature of person(s) involved in the chain of possession
- Inclusive dates of possession
- Internal temperature of shipping (refrigerated) container (chest) when samples were sealed into the shipping container
- Internal temperatures of shipping (refrigerated) container upon opening in the laboratory

3.2.5 Sample Analysis Request Sheet

This document should accompany the sample(s) on delivery to the laboratory and clearly identify which sample containers have been designated (e.g., use of preservatives) for each requested parameter. This document is commonly incorporated into the chain-of-custody form. The record should include the following types of information:

- Name of person receiving the sample
- Laboratory sample number (if different from field number)
- Date of sample receipt
- Analyses to be performed
- Internal temperature of shipping (refrigerated) container upon opening in the laboratory

3.3 FIELD QA/QC PROGRAM

During each sampling episode two types of QC blanks should be collected and analyzed to ensure the reliability and validity of the field and laboratory data. The two types of QC blanks are: trip blanks and equipment blanks. A trip blank should be subjected to the same analysis as the groundwater. Any contaminants found in the trip blanks could be attributed to (1) interaction between the sample and the container, (2) contaminated rinse water, or (3) a handling procedure that alters the sample analysis results. The following field blanks should be prepared and analyzed for all of the required monitoring parameters:

Trip Blank - Fill one of each type of sample bottle with Type II reagent grade water, transport to the site, handle like a sample, and return to the laboratory for analysis. One trip blank per sampling sent is recommended.

Equipment Blank - To ensure the nondedicated sampling device has been effectively cleaned (in the laboratory or field), fill the device with Type II reagent grade water through the device, transfer to sample bottle(s),and return to the laboratory for analysis. A minimum of one equipment blank for each day that groundwater monitoring wells are sampled is recommended.

Duplicate Sample(s).A duplicate set of samples should be collected one per day or 10 percent of the total number of samples collected whichever is greater. If both solid and liquid samples are taken, a set of duplicate samples should be taken from each media. If at all possible, duplicate samples should be taken at sampling points where contamination is expected such as downgradient wells. These samples should be labeled so as to be indistinguishable from the initial samples and submitted to the laboratory as blind duplicates.

The results of the analysis of the blanks should not be used to correct the groundwater data. If contaminants are found in the blanks, the source of the contamination should be identified and corrective action, including resampling, should be initiated.

TABLE 3 - 1

EPA Required Containers, Preservation Techniques, and Holding Times

Measurement Table/Parameter		Container[1]	Preservative [2,3]	Maximum Holding Time[4]
1A	**Bacterial Tests**			
1-4.	Coliform, fecal and total	P,G	Cool, 4°C 0.008% $Na_2S_2O_3$ [5]	6 hours
5.	Fecal streptococci	P,G	Cool, 4°C 0.008% $Na_2S_2O_2$ [5]	6 hours
1B	**Inorganic Tests**			
1.	Acidity	P,G	Cool, 4°C	14 days
2.	Alkalinity	P,G	Cool, 4°C	14 days
4.	Ammonia	P,G	Cool, 4°C H_2SO_4 to pH< 2	28 days
9.	Biochemical oxygen demand	P,G	Cool, 4°C	48 hours
10.	Biochemical oxygen demand, carbonaceous	P,G	Cool, 4°C	48 hours
12.	Bromide	P,G	None required	28 days
15.	Chemical oxygen demand	P,G	Cool, 4°C H_2SO_4 to pH< 2	28 days

EPA Required Containers, Preservation Techniques, and Holding Times

Measurement Table/Parameter	Container[1]	Preservative[2,3]	Maximum Holding Time[4]
<u>IB</u> (Con't) <u>Inorganic Tests</u>			
16. Chloride	P,G,	None required	28 days
17. Chlorine, total residual	P,G,	None required*	Analyze immediately
21. Color	P,G	Cool, 4°C	48 hours
23-24. Cyanide, total and amenable to chlorination	P,G	Cool, 4°C NaOH to pH > 12 0.6g ascorbic acid[5]	14 days[6]
25. Fluoride	P	None required	28 days
27. Hardness	P,G	HNO_3 to pH <2	6 months
28. Hydrogen ion (pH)	P,G	None required	Analyze immediately
31,43. Kjeldahl and organic Nitrogen	P,G	Cool, 4°C H_2SO_4 to pH< 2	28 days
<u>Metals</u>[7]			
18. Chromium VI	P,G	Cool, 4°C	24 hours
35. Mercury	P,G	HNO_3 to pH <2	28 days

EPA Required Containers, Preservation Techniques, and Holding Times

Measurement Table/Parameter			Container[1]	Preservative[2,3]	Maximum Holding Time[4]
1B (Con't)	3, 5-8, 11, 13, 14, 19, 20, 22, 26 29, 30, 32-34, 36, 37, 45, 47, 51, 52, 58, 59, 60, 62, 63, 70-72, 74, 75.	Metals, except above	P,G	HNO_3 to pH <2	6 Months
	38.	Nitrate	P,G	Cool, 4°C	48 hours
	39.	Nitrate-nitrite	P,G	Cool, 4°C H_2SO_4 to pH <2	28 days
	40.	Nitrite	P,G	Cool, 4°C	48 hours
	41.	Oil and grease	G	Cool, 4°C H_2SO_4 to pH <2	28 days
	42.	Organic carbon	P,G	Cool, 4°C HCl or H_2SO_4 to pH< 2	28 days
	44.	Orthophosphate	P,G	Filter immediately Cool, 4°C	48 hours

EPA Required Containers, Preservation Techniques, and Holding Times

Measurement Table/Parameter			Container[1]	Preservative[2,3]	Maximum Holding Time[4]
<u>IB</u>					
(Con't)	46.	Oxygen, Dissolved Probe	G bottle and top	None required	Analyze immediately
		Winkler	G bottle and top	Fix on site and store in dark	8 hours
	48.	Phenols	G only	Cool, 4°C H_2SO_4 to pH <2	28 days
	49.	Phosphorus (elemental)	G	Cool, 4°C	48 hours
	50.	Phosphorus, total	P,G	Cool, 4°C H_2SO_4 to pH <2	28 days
	53.	Residue, total	P,G	Cool, 4°C	7 days
	54.	Residue, Filterable	P,G	Cool, 4°C	7 days
	55.	Residue, Non-filterable (TSS)	P,G	Cool, 4°C	7 days
	56.	Residue, settleable	P,G	Cool, 4°C	48 hours
	57.	Residue, volatile	P,G	Cool, 4°C	7 days

EPA Required Containers, Preservation Techniques, and Holding Times

Measurement Table/Parameter			Container[1]	Preservative[2,3]	Maximum Holding Time[4]
<u>1B</u> (Con't)	61.	Silica	P	Cool, 4°C	28 days
	64.	Specific conductance	P,G	Cool, 4°C	28 days
	65.	Sulfate	P,G	Cool, 4°C	28 days
	66.	Sulfide	P,G	Cool, 4°C, add zinc acetate plus sodium hydroxide to pH > 9	7 days
	67.	Sulfite	P,G	None required	Analyze immediately
	68.	Surfactants	P,G	Cool, 4°C	48 hours
	69.	Temperature	P,G	None required	Analyze immediately
	73.	Turbidity	P,G	Cool, 4°C	48 hours

EPA Required Containers, Preservation Techniques, and Holding Times

Measurement Table/Parameter		Container[1]	Preservative[2,3]	Maximum Holding Time[4]
1C	Organic Tests[8]			
13, 19, 20, 21, 23, 25, 26, 27, 28, 29, 35, 36, 37, 38, 40, 41, 42, 43, 44, 46, 47, 48, 57, 67, 88, 89, 92, 93, 94, 95, 97.	Purgeable halocarbons	G, Teflon-lined septum	Cool, 4°C 0.008% $Na_2S_2O_3$ [5]	14 days
6, 50, 90	Purgeable aromatics	G, Teflon-lined septum	Cool, 4°C 0.008% $Na_2S_2O_3$ [5] HCl to pH< 2[9]	14 days
3, 4.	Acrolein and acrylonitrile	G, Teflon-lined septum	Cool, 4°C 0.008% $Na_2S_2O_3$ [5] Adjust pH to 4-5[10]	14 days
24, 31, 45, 50, 54, 68, 71, 72, 83, 85, 96.	Phenols[11]	G, Teflon-lined cap	Cool, 4°C 0.008% $Na_2S_2O_3$ [5]	7 days until extraction, 40 days after extraction

EPA Required Containers, Preservation Techniques, and Holding Times

Measurement Table/Parameter			Container[1]	Preservative[2,3]	Maximum Holding Time[4]
IC (Con't)	7, 39.	Benzidines[11]	G, Teflon-lined cap	Cool, 4°C 0.008% $Na_2S_2O_3$[5] pH 2-7[12]	7 days until extraction[11]
	14, 18, 49, 51, 52, 53.	Phthalate esters[11]	G, Teflon-lined cap	Cool, 4°C	7 days until extraction; 40 days after ex.
	73, 74, 75	Nitrosamines[11,14]	G, Teflon-lined cap	Cool, 4°C store in dark 0.008% $Na_2S_2O_3$[5]	7 days " " " " " " " "
	76, 77, 78, 79, 80, 81, 82	PCBs[11]	G, Teflon-lined cap	Cool 4°C	7 Days " " " " " " " "
	55, 56, 66, 70	Nitroaromatics and Isophorone[11]	G, Teflon-lined cap	Cool, 4°C	7 days " " " " " " " "
	1, 2, 5, 8, 9, 10, 11, 12, 33, 34, 59, 60, 65, 69, 84, 86	Polynuclear aromatic hydrocarbons[11]	G, Teflon-lined cap	Cool, 4°C 0.008% $Na_2S_2O_3$[5] store in dark	7 days " " " " " " " "
	15, 16, 17, 22, 32	Haloethers[11]	G, Teflon-lined cap	Cool, 4°C 0.008% $Na_2S_2O_3$[5]	7 Days " " " " " " " "

EPA Required Containers, Preservation Techniques, and Holding Times

Measurement Table/Parameter		Container[1]	Preservative[2,3]	Maximum Holding Time[4]
IC (Con't)				
38, 36, 37, 38, 61, 62, 63, 64 91	Chlorinated hydrocarbons[11]	G, Teflon-cap	Cool, 4°C	7 days until extraction, 40 days after extraction
87	TCDD[11]	G, Teflon-cap	Cool, 4°C 0.008% $Na_2S_2O_3$[3]	7 days " " " " " " " "
ID	Pesticides Tests			
1-70.	Pesticides[11]	G, Teflon-lined cap	Cool, 4°C pH 5-9[15]	7 days " " " " " " " "
IE	Radiological Tests			
1-5.	Alpha, beta and radium	P,G	HNO_3 to pH < 2	6 months

Notes

1. Polyethylene (P) or Glass (G).
2. Sample preservation should be performed immediately upon sample collection. For composite samples each aliquot should be preserved at the time of collection. When use of an automated sampler makes it impossible to preserve each aliquot, then samples may be preserved by maintaining at 4°C until compositing and sample splitting is completed.
3. When any sample is to be shipped by common carrier or sent through the United States Mails, it must comply with the Department of Transportation Hazardous Materials Regulations (49 CFR Part 172). The person Offering such material for transportation is responsible for ensuring such compliance. For the preservation requirements of TableF-I, the Office of Hazardous Materials, Materials Transportation Bureau, Department of Transportation has determined that the Hazardous Materials Regulations do not apply to the following materials: Hydrochloric acid (HCL) in water solutions at concentrations of 0.04% by weight or less (pH about 1.96 or greater); Nitric acid (HNO_3) in water solutions at concentrations of 0.15% by weight or less (pH about 1.62 or greater); Sulfuric acid (H_2SO_4) in water solutions at concentrations of 0.35% by weight or less (pH about 1.15 or greater); and Sodium hydroxide (NaOH) in weight or less (pH about 12.30 or less).

4. Samples should be analyzed as soon as possible after collection. The times listed are the maximum times that samples may be held before analysis and still considered valid. Samples may be held for longer periods only if the permittee, or monitoring laboratory, has data on file to show that the specific types of samples under study are stable for the longer time, and has received a variance from the Regional Administrator. Some samples may not be stable for the maximum time period given in the table. A permittee, or monitoring laboratory, is obligated to hold the sample for a shorter time if knowledge exists to show this is necessary to maintain sample stability. See § 136.3(e) for details.

5. Should only be used in the presence of residual chlorine.

6. Maximum holding time is 24 hours when sulfide is present. Optionally, all samples may be tested with lead acetate paper before the pH adjus in order to determine if sulfide is present. If sulfide is present, it can be removed by the addition of cadmium nitrate powder until a negati spot test is obtained. The sample is filtered and then NaOH is added to pH 12.

7. Samples should be filtered immediately on-site before adding preservative for dissolved metals.

8. Guidance applies to samples to be analyzed by GC, LC, or GC/MS for specific compounds.

9. Sample receiving no pH adjustment must be analyzed within seven days of sampling.

10. The pH adjustment is not required if acrolein will not be measured. Samples for acrolein receiving no pH adjustment must be analyzed within 3 days of sampling.

11. When the extractable analytes of concern fall within a single chemical category, the specified preservative and maximum holding times should be observed for optimum safeguard of sample integrity. When the analytes of concern fall within two or more chemical categories, the sample may be preserved by cooling to 4°C, reducing residual chlorine with 0.008% sodium thiosulfate, storing in the dark, and adjusting the pH to 6-9; samples preserved in this manner may be held for seven days before extraction and for forty days after extraction.

Exceptions to this optional preservation and holding time procedure are noted in footnote 6 (re the requirement for thiosulfate reduction of residual chlorine), and footnotes 13, 14 (re the analysis of benzidine).

12. If 1,2-diphenylhydrazine is likely to be present, adjust the pH of the sample to 4.0 ± 0.2 to prevent rearrangement to benzidine.

13. Extracts may be stored up to 7 days before analysis if storage is conducted under an inert (oxidant-free) atmosphere.

14. For the analysis of diphenylnitrosamine, add 0.008% $Na_2S_2O_3$ and adjust pH to 7-10 with NaOH within 24 hours of sampling.

15. The pH adjustment may be performed upon receipt at the laboratory and may be omitted if the samples are extracted within 72 hours of collection. For the analysis of aldrin, add 0.008% $Na_2S_2O_3$.