Revised Draft

WORK PLAN

ENGINEERING EVALUATION/COST ANALYSIS
ARKEMA REMOVAL ACTION

PORTLAND, OREGON

APPENDIX A
SUPPLEMENTAL FIGURES

Prepared for

Legacy Site Services, LLC

468 Thomas Jones Way
Exton, PA 19341

DO NOT QUOTE OR CITE
This document is currently under review by US EPA and its federal, state, and tribal partners, and is subject to change in whole or in part.

Prepared by

integral consulting inc.

319 SW Washington Street, Suite 1150
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July 14, 2006

Appendix A – Supplemental Figures Source Reports

Anchor. 2004. Sediment stake erosion/accretion monitoring report, July 2002 – January 2004. Prepared for Lower Willamette Group, Portland, OR. Anchor Environmental, LLC, Seattle, WA.

Figure 15. Bathymetric Changes Determined from Surveys Performed in September 2002 and May 2003 – River Miles 6.5 to 8.5 Lower Willamette River

Arkema. 2006. Monthly progress report for February 2006, hexavalent chromium reduction interim remedial measure (IRM), Arkema Inc., Portland Facility. Arkema Inc., 6400 NW Front Avenue, Portland, OR.

Figure 19. Shallow Zone Hexavalent Chromium Concentration Arkema Inc., Portland, OR

Figure 20. Intermediate Zone Hexavalent Chromium Concentration Arkema Inc., Portland, OR

Figure 21. Deep Zone Hexavalent Chromium Concentration Arkema Inc., Portland, OR

Integral. 2003. Phase II stage 1 & 2 in-river groundwater and sediment investigation report. Prepared for ATOFINA Chemicals, Inc. Integral Consulting Inc., Portland, OR.

Figure 1. Stage 1 and 2 Borehole and Cross-section locations

Figure 3. Basalt Structural Contour Map

Figure 4a. Cross-section C-C′ with Chlorobenzene Concentrations in Groundwater

Figure 5a. Cross-sections D-D′ and E-E′ with Chlorobenzene Concentrations in Groundwater

Figure 6a. Cross-section K-K′ with Chlorobenzene Concentrations in Groundwater

Figure 7a. Cross-section L-L′ with Chlorobenzene Concentrations in Groundwater

Integral. 2005. Portland Harbor RI/FS round 2 groundwater pathway assessment sampling and analysis plan, appendix b: pilot study data report. Draft. IC05-0013B. Prepared for the Lower Willamette Group, Portland, OR. Integral Consulting Inc., Mercer Island, WA.

Figure 2-4. Pilot Study Trident Temperature and Sediment Type Results Arkema Acid Plant

Figure 2-6. Pilot Study Trident Temperature and Sediment Type Results Arkema Chlorate Plant

Figure 2-11. UltraSeep System Results

Integral. 2006. Portland Harbor RI/FS Round 2 groundwater pathway assessment sampling and analysis plan attachment 2: field sampling plan transition zone water sampling addendum 1. Draft. IC05-0022. Prepared for the Lower Willamette Group, Portland, OR. Integral Consulting Inc., Mercer Island, WA.

Figure 5-5. Arkema Trident Conductivity Mapping Results

Figure5-7a. Arkema Seepage Meter Data – Locations 1, 2, 3, and 4

Figure 5-7b. Arkema Seepage Meter Data – Locations 5, 6, 7, and 8

Figure 5-7c. Arkema Seepage Meter Data – Locations 9, 10, and 11

Integral. 2006. Stormwater interim remedial measures work plan – final. Prepared for Legacy Site Services LLC, 486 Thomas Jones Way, Exton, PA. Integral Consulting Inc. 12303 Airport Way, Suite 370, Broomfield, CO.

Figure 1. Outfall and Catch Basin Sampling Locations

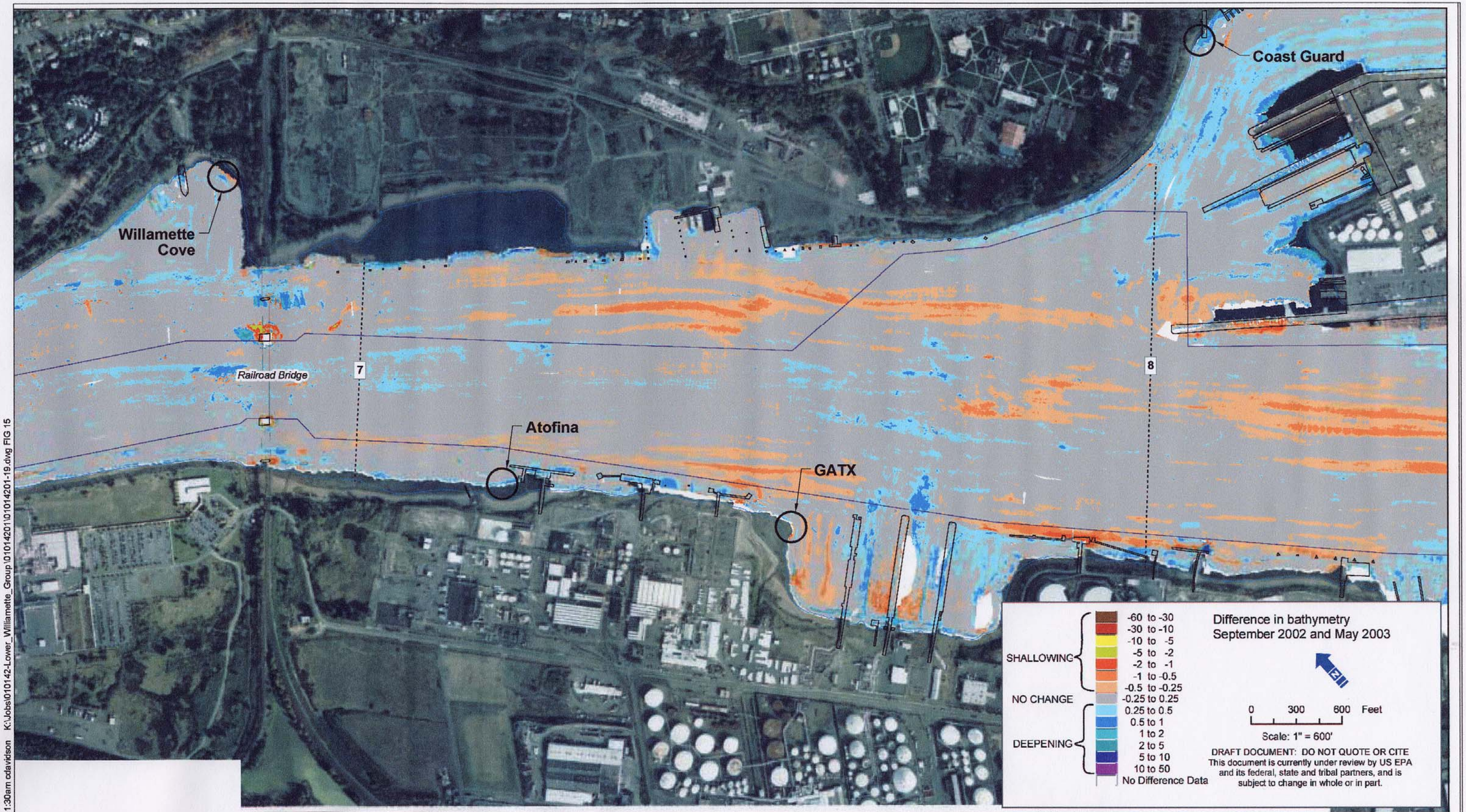
Integral and DEA. 2004. Lower Willamette River winter 2004 multibeam bathymetric survey report. Prepared for Lower Willamette Group, Portland, OR. Integral Consulting Inc, Mercer Island, WA and David Evans and Associates Inc., Portland, OR.

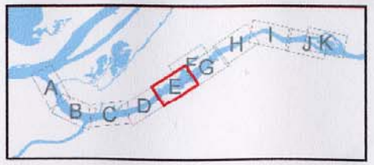
Figure 3e. Multibeam Bathymetric Survey Differences – Winter 2002 to Winter 2004 Lower Willamette River

Figure 4e. Multibeam Bathymetric Survey Differences – Spring 2003 to Winter 2004 Lower Willamette River

Gresh, Robert. 2004. Personal Communication (letter to Tom Roick, Oregon Department of Environmental Quality, Portland, OR, dated August 16, 2004, regarding the Outfall 22B camera survey results and field sampling plan, RP – Portland Site. Prepared for Starlink Logistics, Inc., Morrisville, North Carolina) AMEC Earth and Environmental, Portland, OR.

Figure 1. Outfall 22B Storm Sewer Camera Survey, Groundwater Elevations, and Proposed Water Sampling Locations





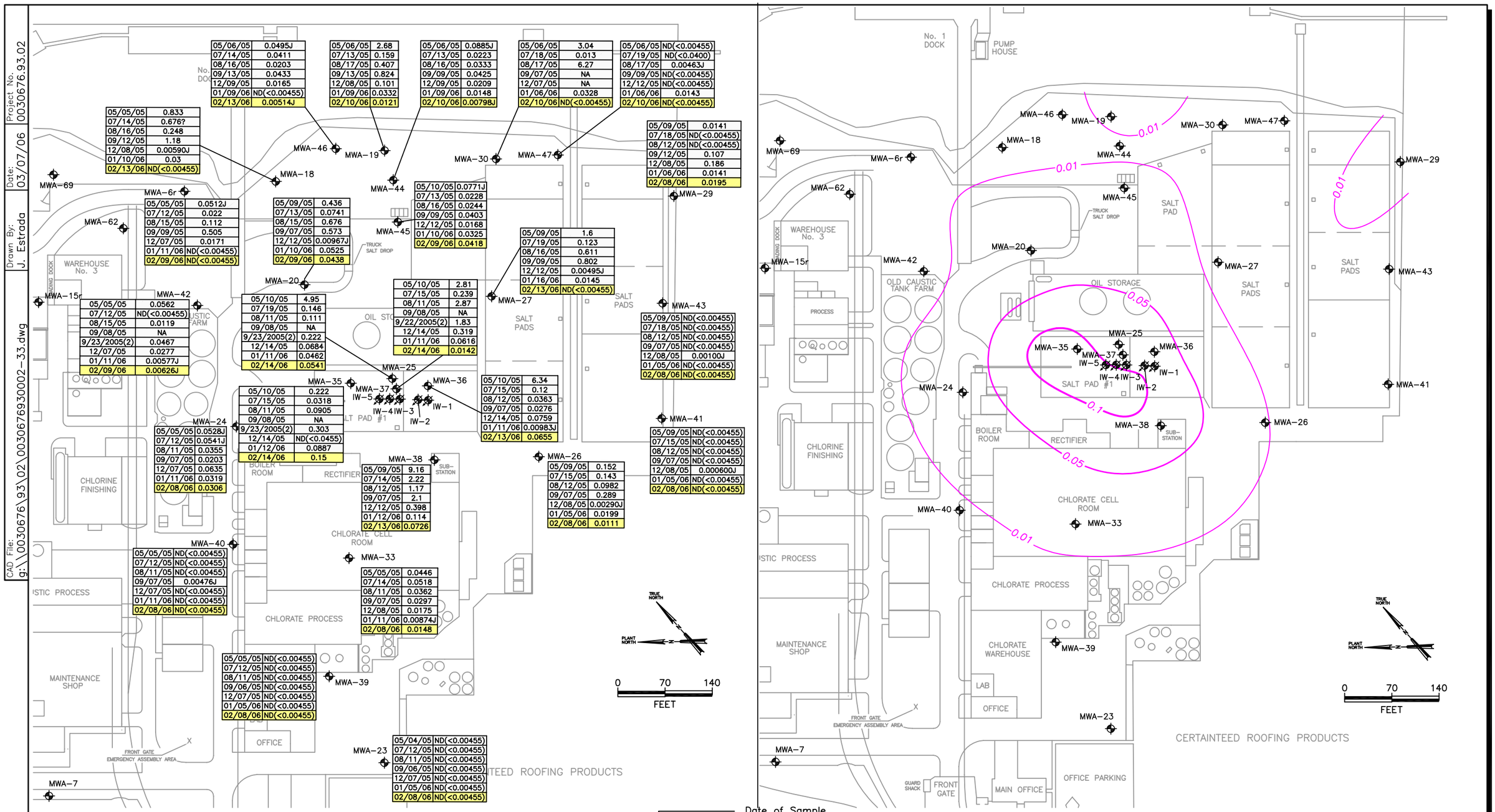
LEGEND:
- Dock & structures 2001
- River miles
- Navigation Channel
- 2001 River Edge
- Bridges

See Figure 14 for Feature Sources and Notes.

ANCHOR ENVIRONMENTAL, L.L.C.

Figure 15
Bathymetric Changes Determined from Surveys Performed in September 2002 and May 2003 - River Miles 6.5 to 8.5
Lower Willamette River

Mar 05, 2004 11:30am cdavidson K:\Jobs\010142-Lower_Willamette_Group\01014201\01014201-19.dwg FIG 15



Date	Concentration
05/05/05	0.0495J
07/14/05	0.0411
08/16/05	0.0203
09/13/05	0.0433
12/09/05	0.0165
01/09/06	ND(<0.00455)
02/13/06	0.00514J

Date	Concentration
05/06/05	2.68
07/13/05	0.159
08/17/05	0.407
09/13/05	0.824
12/08/05	0.101
01/09/06	0.0332
02/10/06	0.0121

Date	Concentration
05/06/05	0.0885J
07/13/05	0.0223
08/16/05	0.0333
09/09/05	0.0425
12/09/05	0.0209
01/09/06	0.0148
02/10/06	0.00798J

Date	Concentration
05/06/05	3.04
07/18/05	0.013
08/17/05	6.27
09/07/05	NA
12/07/05	NA
01/06/06	0.0328
02/10/06	ND(<0.00455)

Date	Concentration
05/06/05	ND(<0.00455)
07/19/05	ND(<0.0400)
08/17/05	0.00463J
09/09/05	ND(<0.00455)
12/12/05	ND(<0.00455)
01/06/06	0.0143
02/10/06	ND(<0.00455)

Date	Concentration
05/05/05	0.833
07/14/05	0.676?
08/16/05	0.248
09/12/05	1.18
12/08/05	0.00590J
01/10/06	0.03
02/13/06	ND(<0.00455)

Date	Concentration
05/09/05	0.0141
07/18/05	ND(<0.00455)
08/12/05	ND(<0.00455)
09/12/05	0.107
12/08/05	0.186
01/06/06	0.0141
02/08/06	0.0195

Date	Concentration
05/05/05	0.0512J
07/12/05	0.022
08/15/05	0.112
09/09/05	0.505
12/07/05	0.0171
01/11/06	ND(<0.00455)
02/09/06	ND(<0.00455)

Date	Concentration
05/09/05	0.436
07/13/05	0.0741
08/15/05	0.676
09/07/05	0.573
12/12/05	0.00967J
01/10/06	0.0525
02/09/06	0.0438

Date	Concentration
05/10/05	0.0771J
07/13/05	0.0228
08/16/05	0.0244
09/09/05	0.0403
12/12/05	0.0168
01/10/06	0.0325
02/09/06	0.0418

Date	Concentration
05/09/05	1.6
07/19/05	0.123
08/16/05	0.611
09/09/05	0.802
12/12/05	0.00495J
01/16/06	0.0145
02/13/06	ND(<0.00455)

Date	Concentration
05/05/05	0.0562
07/12/05	ND(<0.00455)
08/15/05	0.0119
09/08/05	NA
9/23/2005(2)	0.0467
12/07/05	0.0277
01/11/06	0.00577J
02/09/06	0.00626J

Date	Concentration
05/10/05	4.95
07/19/05	0.146
08/11/05	0.111
09/08/05	NA
9/23/2005(2)	0.222
12/14/05	0.0684
01/11/06	0.0462
02/14/06	0.0541

Date	Concentration
05/10/05	2.81
07/15/05	0.239
08/11/05	2.87
09/08/05	NA
9/22/2005(2)	1.83
12/14/05	0.319
01/11/06	0.0616
02/14/06	0.0142

Date	Concentration
05/09/05	ND(<0.00455)
07/18/05	ND(<0.00455)
08/12/05	ND(<0.00455)
09/07/05	ND(<0.00455)
12/08/05	0.00100J
01/05/06	ND(<0.00455)
02/08/06	ND(<0.00455)

Date	Concentration
05/10/05	6.34
07/15/05	0.12
08/12/05	0.0363
09/07/05	0.0276
12/14/05	0.0759
01/11/06	0.00983J
02/13/06	0.0655

Date	Concentration
05/10/05	0.222
07/15/05	0.0318
08/11/05	0.0905
09/08/05	NA
9/23/2005(2)	0.303
12/14/05	ND(<0.0455)
01/12/06	0.0887
02/14/06	0.15

Date	Concentration
05/05/05	0.0528J
07/12/05	0.0541J
08/11/05	0.0355
09/07/05	0.0203
12/07/05	0.0635
01/11/06	0.0319
02/08/06	0.0306

Date	Concentration
05/09/05	ND(<0.00455)
07/15/05	ND(<0.00455)
08/12/05	ND(<0.00455)
09/07/05	ND(<0.00455)
12/08/05	0.000600J
01/05/06	ND(<0.00455)
02/08/06	ND(<0.00455)

Date	Concentration
05/09/05	9.16
07/14/05	2.22
08/12/05	1.17
09/07/05	2.1
12/12/05	0.398
01/12/06	0.114
02/13/06	0.0726

Date	Concentration
05/09/05	0.152
07/15/05	0.143
08/12/05	0.0982
09/07/05	0.289
12/08/05	0.00290J
01/05/06	0.0199
02/08/06	0.0111

Date	Concentration
05/05/05	ND(<0.00455)
07/12/05	ND(<0.00455)
08/11/05	ND(<0.00455)
09/07/05	0.00476J
12/07/05	ND(<0.00455)
01/11/06	ND(<0.00455)
02/08/06	ND(<0.00455)

Date	Concentration
05/05/05	0.0446
07/14/05	0.0518
08/11/05	0.0362
09/07/05	0.0297
12/08/05	0.0175
01/11/06	0.00874J
02/08/06	0.0148

Date	Concentration
05/05/05	ND(<0.00455)
07/12/05	ND(<0.00455)
08/11/05	ND(<0.00455)
09/06/05	ND(<0.00455)
12/07/05	ND(<0.00455)
01/05/06	ND(<0.00455)
02/08/06	ND(<0.00455)

Date	Concentration
05/04/05	ND(<0.00455)
07/12/05	ND(<0.00455)
08/11/05	ND(<0.00455)
09/06/05	ND(<0.00455)
12/07/05	ND(<0.00455)
01/05/06	ND(<0.00455)
02/08/06	ND(<0.00455)

LEGEND

Monitoring Well, Shallow Zone

Injection Well, Shallow Zone

0.1 Hexavalent Chromium Concentration Contour (mg/L); Shallow Zone February 2006)

Notes:
Most buildings and structures noted on this diagram have been demolished and/or removed.
Highlighted data used to create concentration contour.

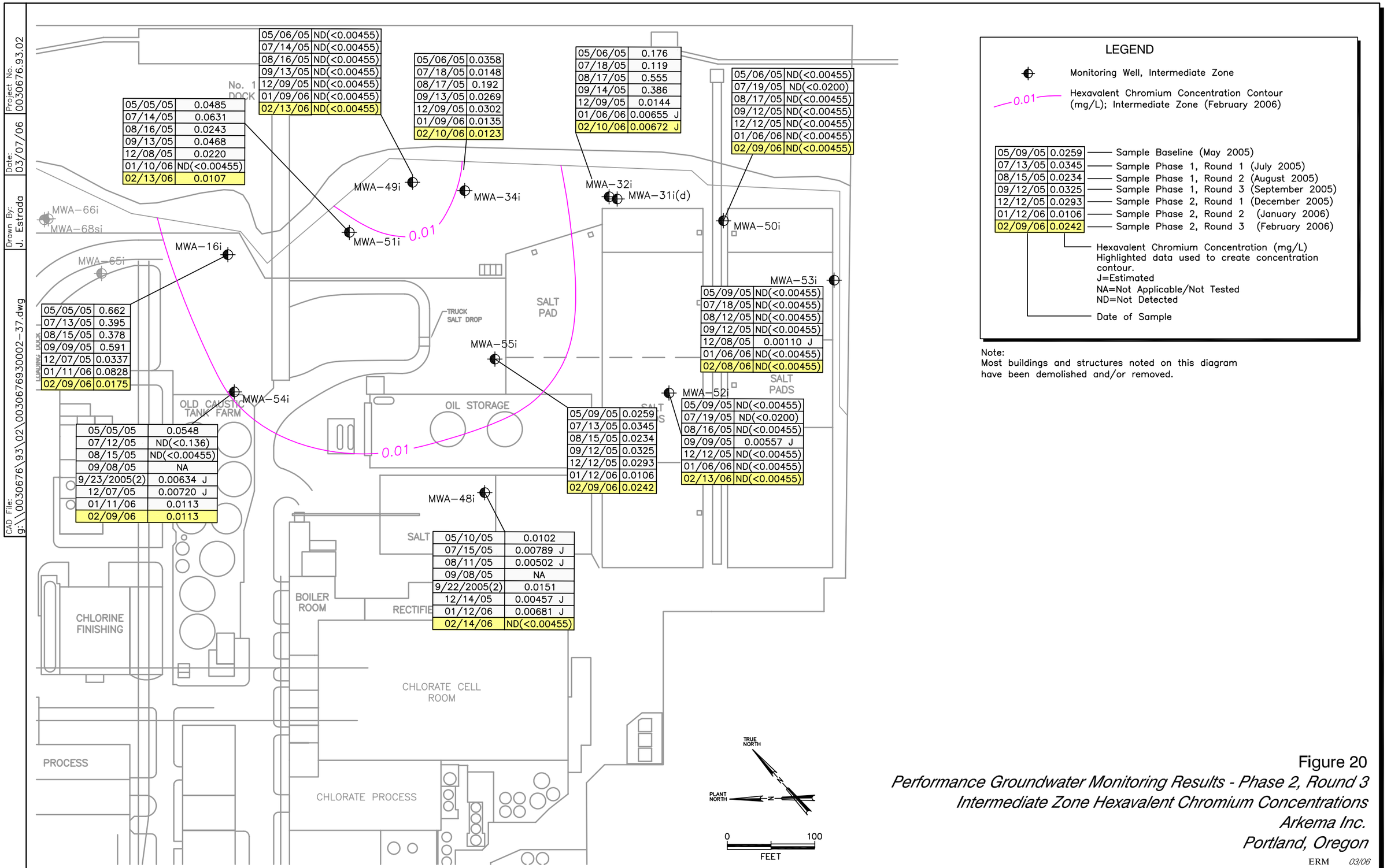
Date of Sample
Hexavalent Chromium Concentration (mg/L)

Date	Concentration	
05/10/05	0.0771J	–Baseline Monitoring (May 2005)
07/13/05	0.0228	–Round 1 Performance Monitoring (July 2005)
08/16/05	0.0244	–Round 2 Performance Monitoring (August 2005)
09/09/05	0.0403	–Round 3 Performance Monitoring (September 2005)
12/12/05	0.0168	–Phase 2, Round 1 Performance Monitoring (December 2005)
01/10/06	0.0325	–Phase 2, Round 2 Performance Monitoring (January 2006)
02/09/06	0.0418	–Phase 2, Round 3 Performance Monitoring (February 2006)

Figure 19

Performance Groundwater Monitoring Results-Phase 2, Round 3
Shallow Zone Hexavalent Chromium Concentration
Arkema Inc.
Portland, Oregon

ERM 03/06



05/05/05	0.0485
07/14/05	0.0631
08/16/05	0.0243
09/13/05	0.0468
12/08/05	0.0220
01/10/06	ND(<0.00455)
02/13/06	0.0107

05/06/05	ND(<0.00455)
07/14/05	ND(<0.00455)
08/16/05	ND(<0.00455)
09/13/05	ND(<0.00455)
12/09/05	ND(<0.00455)
01/09/06	ND(<0.00455)
02/13/06	ND(<0.00455)

05/06/05	0.0358
07/18/05	0.0148
08/17/05	0.192
09/13/05	0.0269
12/09/05	0.0302
01/09/06	0.0135
02/10/06	0.0123

05/06/05	0.176
07/18/05	0.119
08/17/05	0.555
09/14/05	0.386
12/09/05	0.0144
01/06/06	0.00655 J
02/10/06	0.00672 J

05/06/05	ND(<0.00455)
07/19/05	ND(<0.0200)
08/17/05	ND(<0.00455)
09/12/05	ND(<0.00455)
12/12/05	ND(<0.00455)
01/06/06	ND(<0.00455)
02/09/06	ND(<0.00455)

05/05/05	0.662
07/13/05	0.395
08/15/05	0.378
09/09/05	0.591
12/07/05	0.0337
01/11/06	0.0828
02/09/06	0.0175

05/09/05	ND(<0.00455)
07/18/05	ND(<0.00455)
08/12/05	ND(<0.00455)
09/12/05	ND(<0.00455)
12/08/05	0.00110 J
01/06/06	ND(<0.00455)
02/08/06	ND(<0.00455)

05/05/05	0.0548
07/12/05	ND(<0.136)
08/15/05	ND(<0.00455)
09/08/05	NA
9/23/2005(2)	0.00634 J
12/07/05	0.00720 J
01/11/06	0.0113
02/09/06	0.0113

05/09/05	0.0259
07/13/05	0.0345
08/15/05	0.0234
09/12/05	0.0325
12/12/05	0.0293
01/12/06	0.0106
02/09/06	0.0242

05/09/05	ND(<0.00455)
07/19/05	ND(<0.0200)
08/16/05	ND(<0.00455)
09/09/05	0.00557 J
12/12/05	ND(<0.00455)
01/06/06	ND(<0.00455)
02/13/06	ND(<0.00455)

05/10/05	0.0102
07/15/05	0.00789 J
08/11/05	0.00502 J
09/08/05	NA
9/22/2005(2)	0.0151
12/14/05	0.00457 J
01/12/06	0.00681 J
02/14/06	ND(<0.00455)

LEGEND

Monitoring Well, Intermediate Zone

0.01 — Hexavalent Chromium Concentration Contour (mg/L); Intermediate Zone (February 2006)

05/09/05	0.0259	Sample Baseline (May 2005)
07/13/05	0.0345	Sample Phase 1, Round 1 (July 2005)
08/15/05	0.0234	Sample Phase 1, Round 2 (August 2005)
09/12/05	0.0325	Sample Phase 1, Round 3 (September 2005)
12/12/05	0.0293	Sample Phase 2, Round 1 (December 2005)
01/12/06	0.0106	Sample Phase 2, Round 2 (January 2006)
02/09/06	0.0242	Sample Phase 2, Round 3 (February 2006)

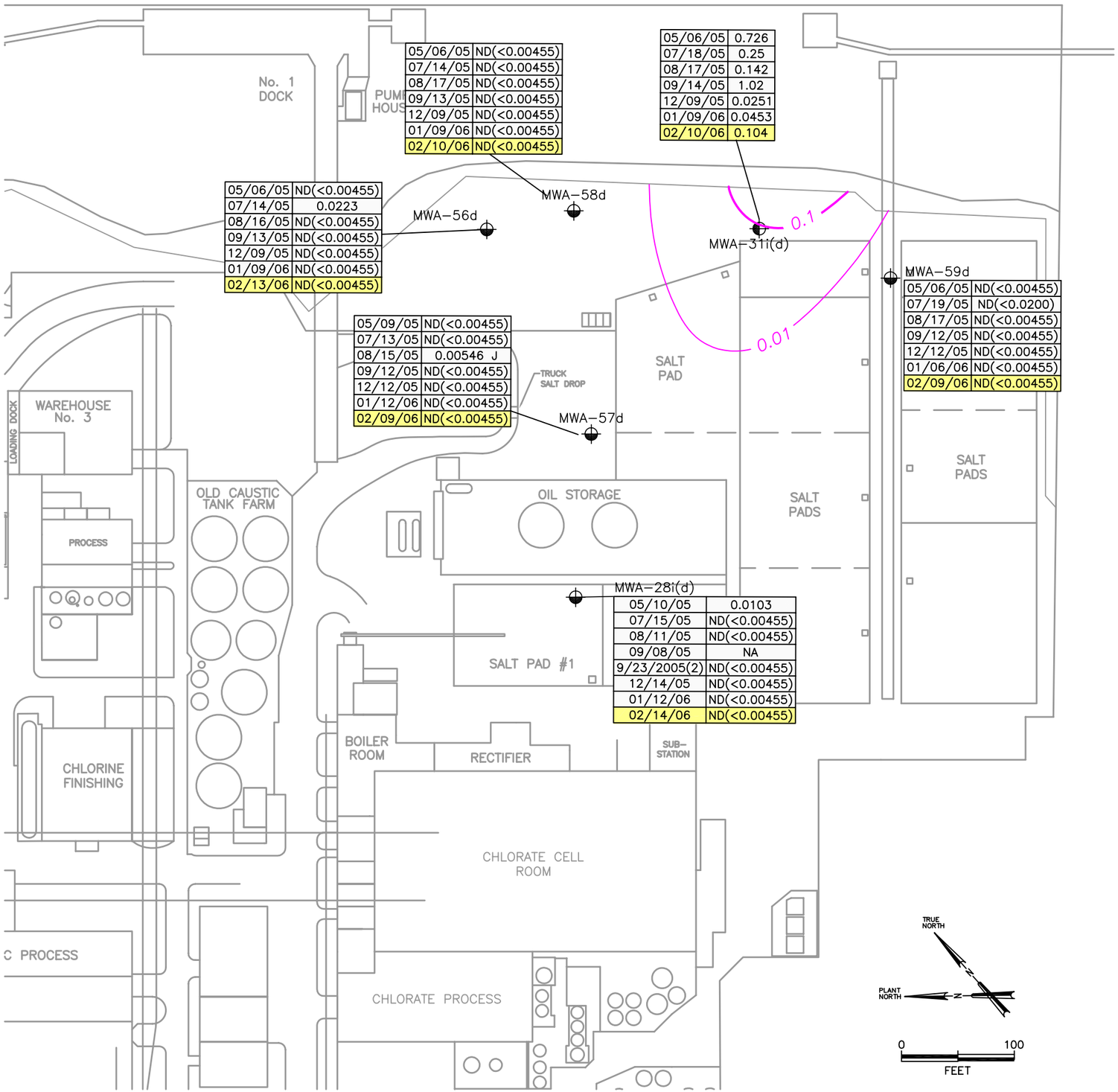
Hexavalent Chromium Concentration (mg/L)
Highlighted data used to create concentration contour.
J=Estimated
NA=Not Applicable/Not Tested
ND=Not Detected

Date of Sample

Note:
Most buildings and structures noted on this diagram have been demolished and/or removed.

Figure 20
Performance Groundwater Monitoring Results - Phase 2, Round 3
Intermediate Zone Hexavalent Chromium Concentrations
Arkema Inc.
Portland, Oregon

ERM 03/06



05/06/05	ND(<0.00455)
07/14/05	ND(<0.00455)
08/17/05	ND(<0.00455)
09/13/05	ND(<0.00455)
12/09/05	ND(<0.00455)
01/09/06	ND(<0.00455)
02/10/06	ND(<0.00455)

05/06/05	0.726
07/18/05	0.25
08/17/05	0.142
09/14/05	1.02
12/09/05	0.0251
01/09/06	0.0453
02/10/06	0.104

05/06/05	ND(<0.00455)
07/14/05	0.0223
08/16/05	ND(<0.00455)
09/13/05	ND(<0.00455)
12/09/05	ND(<0.00455)
01/09/06	ND(<0.00455)
02/13/06	ND(<0.00455)

05/09/05	ND(<0.00455)
07/13/05	ND(<0.00455)
08/15/05	0.00546 J
09/12/05	ND(<0.00455)
12/12/05	ND(<0.00455)
01/12/06	ND(<0.00455)
02/09/06	ND(<0.00455)

05/06/05	ND(<0.00455)
07/19/05	ND(<0.0200)
08/17/05	ND(<0.00455)
09/12/05	ND(<0.00455)
12/12/05	ND(<0.00455)
01/06/06	ND(<0.00455)
02/09/06	ND(<0.00455)

05/10/05	0.0103
07/15/05	ND(<0.00455)
08/11/05	ND(<0.00455)
09/08/05	NA
9/23/2005(2)	ND(<0.00455)
12/14/05	ND(<0.00455)
01/12/06	ND(<0.00455)
02/14/06	ND(<0.00455)

LEGEND

Monitoring Well, Deep Zone

0.01 — Hexavalent Chromium Concentration Contour (mg/L); Deep Zone (February 2006)

05/06/05	0.726	Sample Baseline (May 2005)
07/18/05	0.25	Sample Phase 1, Round 1 (July 2005)
08/17/05	0.142	Sample Phase 1, Round 2 (August 2005)
09/14/05	1.02	Sample Phase 1, Round 3 (September 2005)
12/09/05	0.0251	Sample Phase 2, Round 1 (December 2005)
01/09/06	0.0453	Sample Phase 2, Round 2 (January 2006)
02/10/06	0.104	Sample Phase 2, Round 2 (February 2006)

Hexavalent Chromium Concentration (mg/L)
Highlighted data used to create concentration contour.
J=Estimated
NA=Not Applicable/Not Tested
ND=Not Detected

Date of Sample

Note:
Most buildings and structures noted on this diagram have been demolished and/or removed.

Figure 21
Performance Groundwater Monitoring Results-Phase 2, Round 3
Deep Zone Hexavalent Chromium Concentrations
Arkema Inc.
Portland, Oregon

ERM 03/06

Project No. 0030676.93.02
Date: 03/07/06
Drawn By: J. Estrada
CAD File: g:\0030676\93\02\0030676930002-38.dwg

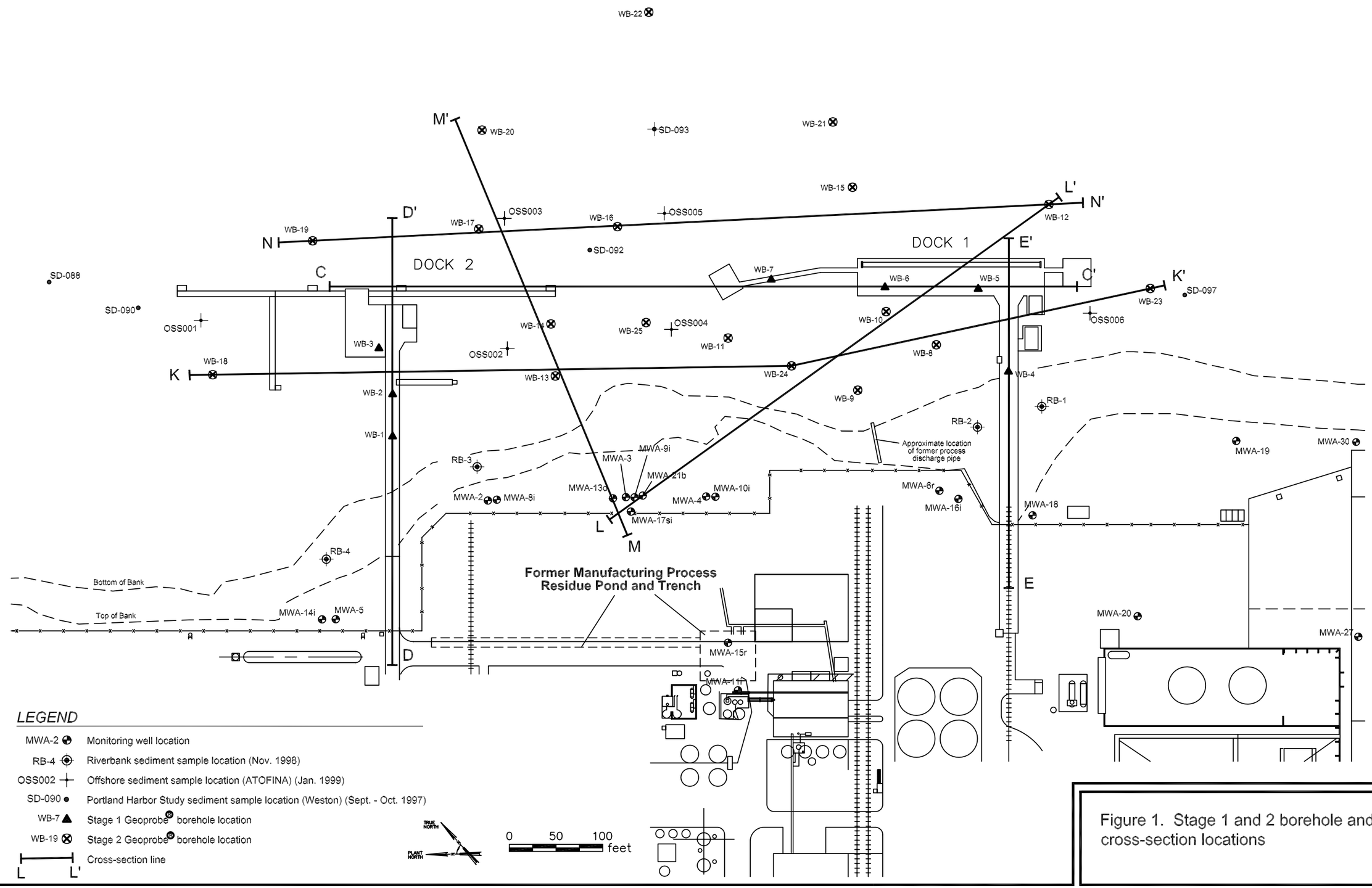


Figure 1. Stage 1 and 2 borehole and cross-section locations

8601192.001.0634/S1 2 BHXSXN.dwg 12/05/03 OR

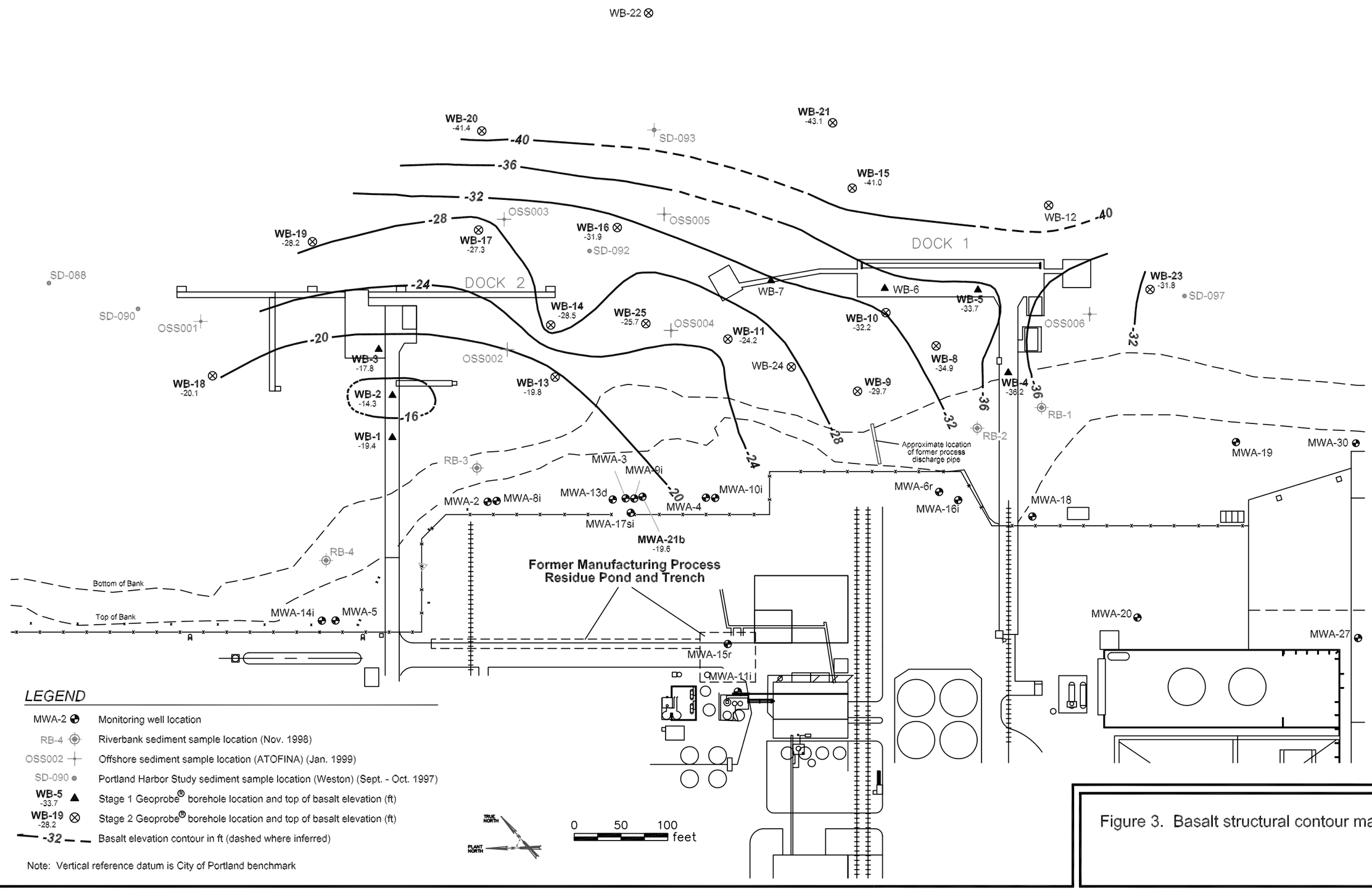
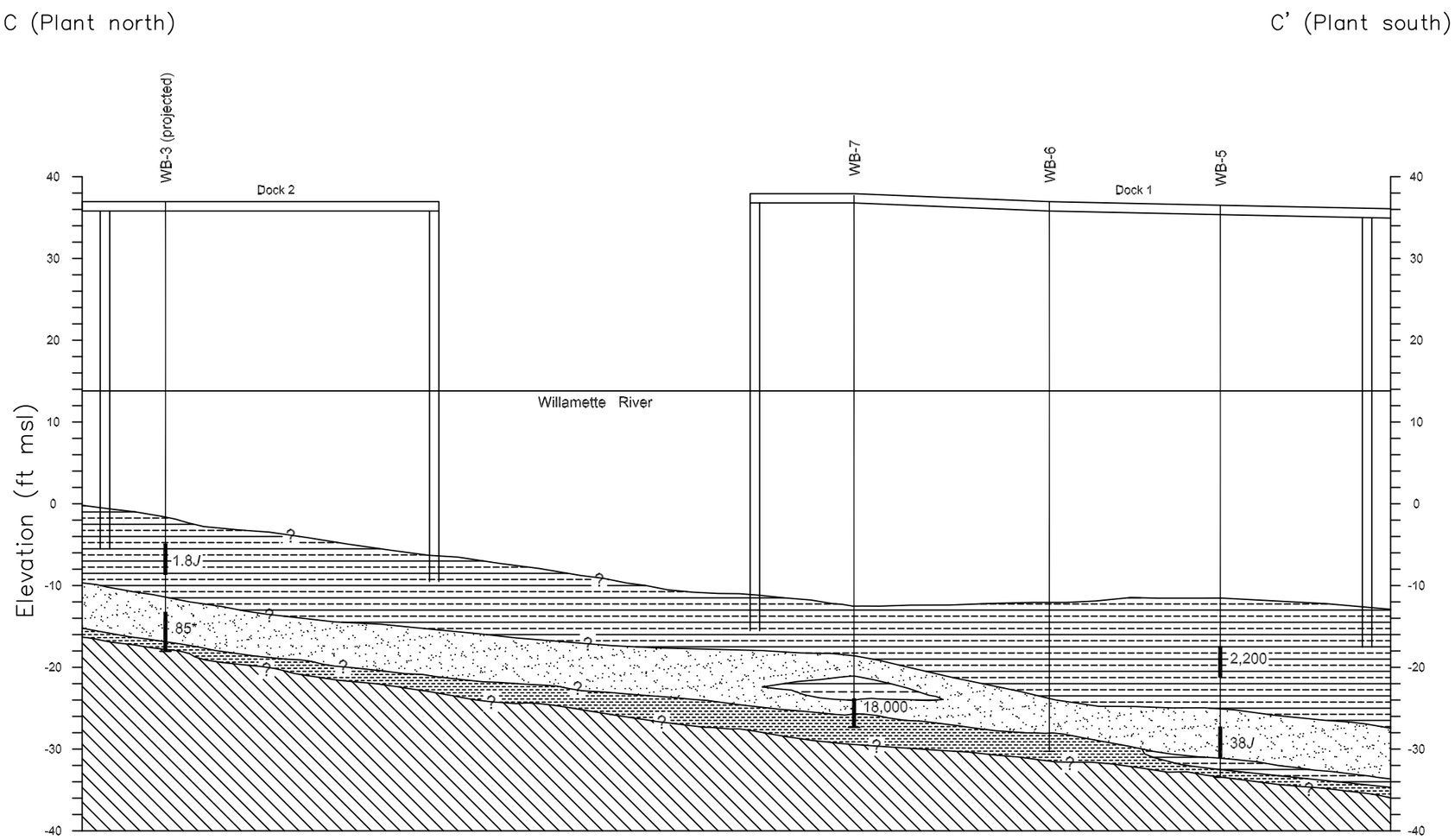


Figure 3. Basalt structural contour map

8601192.001.0634/BASALT.dwg 12/08/03 OR



LEGEND

- Sand with varying amounts of silt
- Silt with varying amounts of fine sand
- Silt with some clay and fine sand
- Basalt
- WB-3 — Geoprobe® boring number
- Boring with grab groundwater sample interval
- Inferred soil or geologic contact (queried where uncertain)
- *J* - Estimated
- * - Average of sample and sample duplicate

0 80 feet

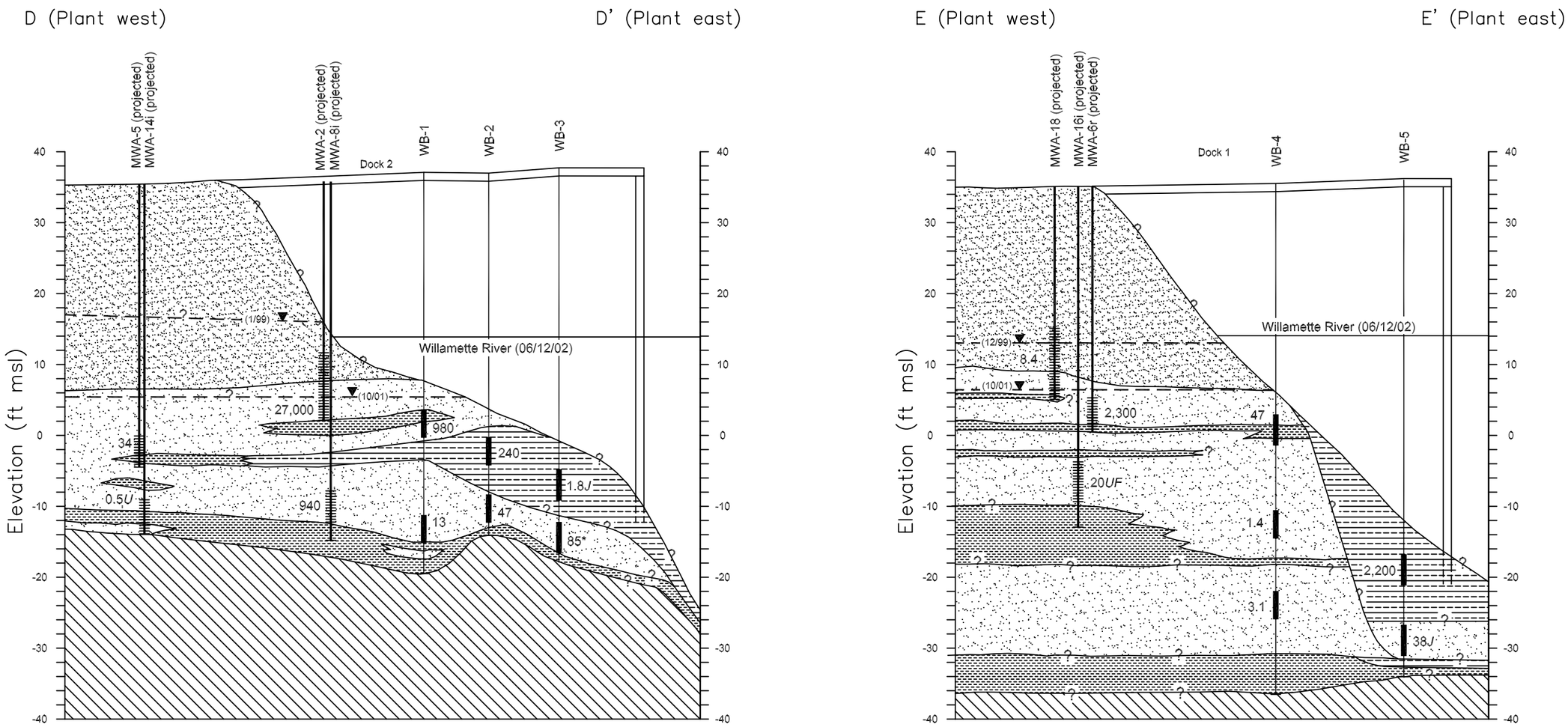
Note: Vertical scale exaggerated 5x

Note: All concentrations are in micrograms per liter (μg/L).
Chlorobenzene concentrations are from grab groundwater samples collected in June 2002.

Exponent

Figure 4a. Cross-section C-C' with chlorobenzene concentrations in groundwater

8601192.001.0634\C-C' Chlor.dwg 11/18/03 OR



LEGEND

- Fill with debris
- Sand with varying amounts of silt
- Silt with varying amounts of fine sand
- Silt with some clay and fine sand
- Basalt

WB-3 — Geoprobe® boring number
MWA-1 — Well number
Cased interval
Screen interval

Shallow zone groundwater surface (approximate)
Inferred soil or geologic contact (queried where uncertain)
Boring with grab groundwater sample interval

F - Field quality control sample (blanks or reference materials) criteria not met
J - Estimated
U - Undetected at detection limit shown
* - Average of sample and sample duplicate

0 80 feet

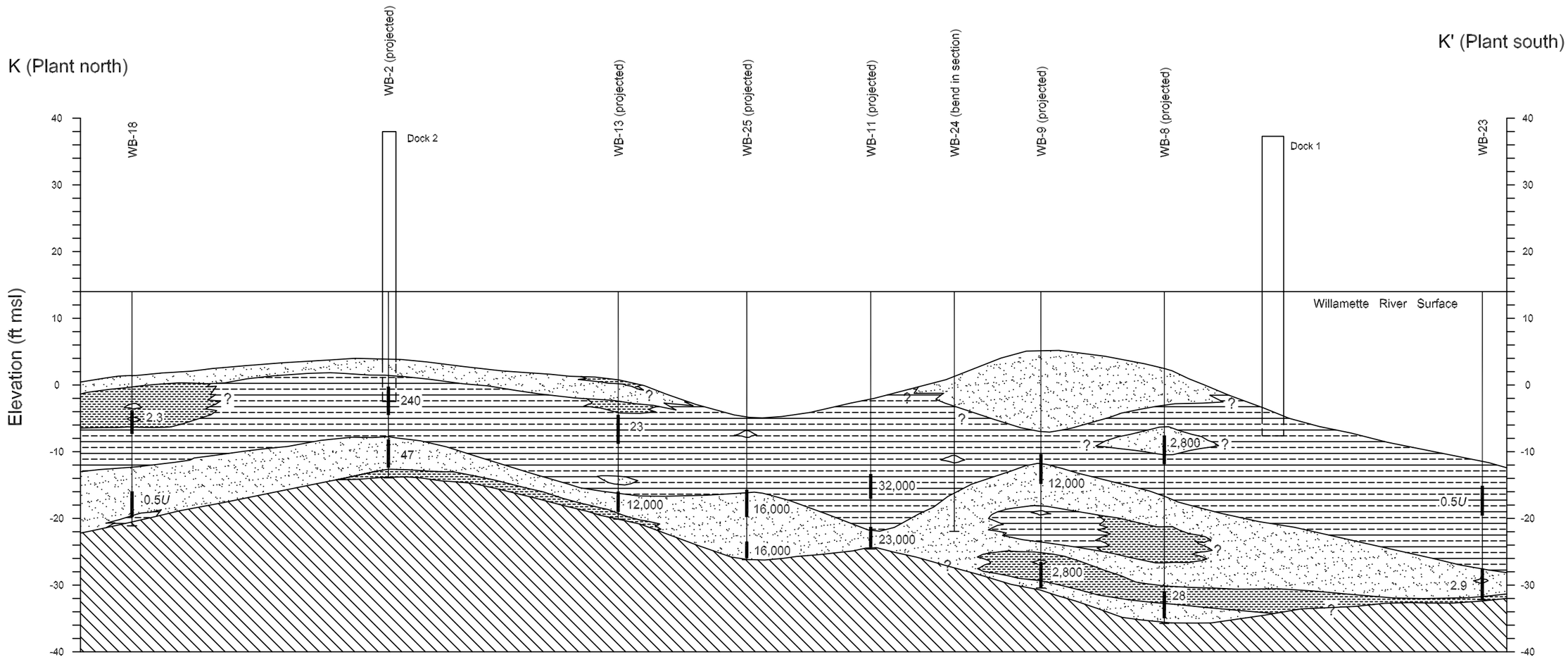
Note: Vertical scale exaggerated 5x

Note: All concentrations are in micrograms per liter (µg/L).
Chlorobenzene concentration data in monitoring wells are from April 2002; Geoprobe® boring data are from June 2002.

Exponent

Figure 5a. Cross-sections D-D' and E-E' with chlorobenzene concentrations in groundwater

8601192.001.0634\DD/EE.dwg 12/05/03 OR



LEGEND

- Sand with varying amounts of silt
- Silt with varying amounts of fine sand
- Silt with some clay and fine sand
- Basalt

WB-3 — Geoprobe® boring number

Boring with grab groundwater sample interval

Inferred soil or geologic contact (queried where uncertain)

* Average of sample and sample duplicate
J Estimated
U Undetected at detection limit shown

0 80 feet

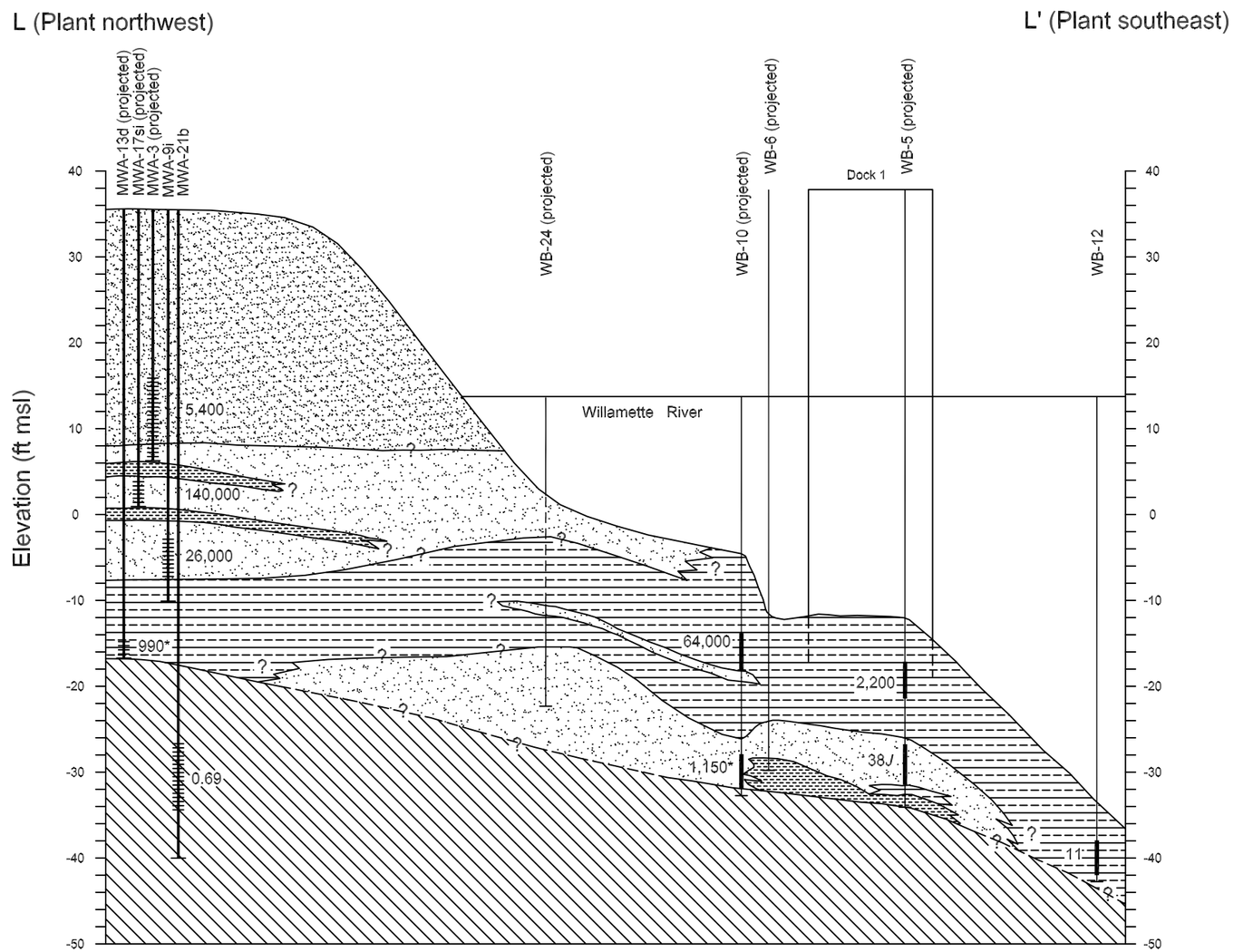
Note: Vertical scale exaggerated 5x

Notes: Stratigraphy in portions of WB-8, WB-9 and WB-25 consists of interlayered silts and sands. Contacts on cross-section are interpretive.
All concentrations are in micrograms per liter (μg/L). Chlorobenzene concentrations are from grab groundwater samples collected in June 2002 and February-March 2003.

Exponent

Figure 6a. Cross-section K-K' with chlorobenzene concentrations in groundwater

8601192.001.0634\K-K' CHLOR.dwg 12/05/03 OR



LEGEND

- Fill with debris
- Sand with varying amounts of silt
- Silt with varying amounts of fine sand
- Silt with some clay and fine sand
- Basalt

WB-24 — Geoprobe® boring number

Boring with grab groundwater sample interval

MWA-21b — Well number

Cased interval

Screen interval

Inferred soil or geologic contact (queried where uncertain)

* Average of sample and sample duplicate

J Estimated

0 80 feet

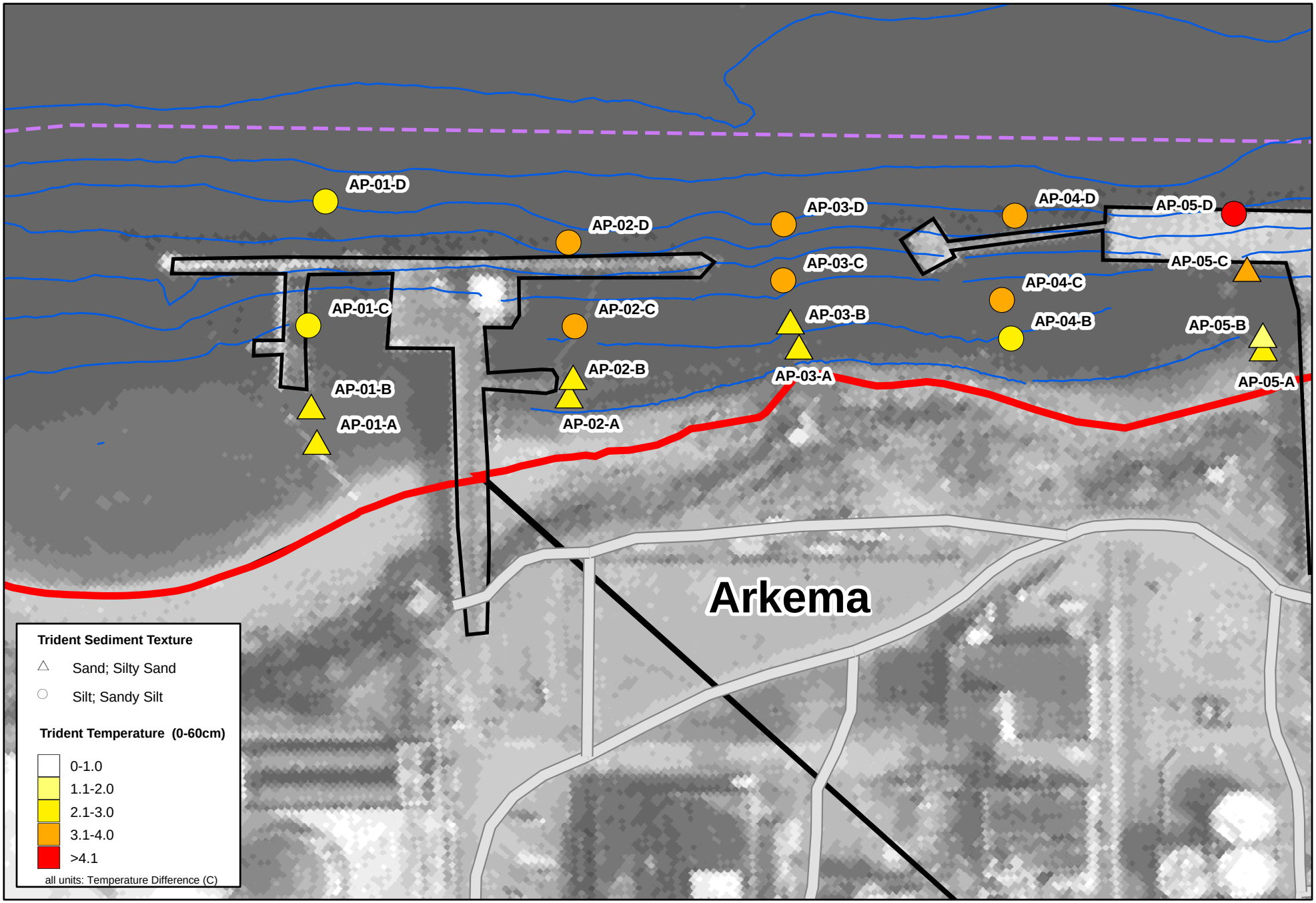
Note: Vertical scale exaggerated 5x

Notes: All concentrations are in micrograms per liter (μg/L). Chlorobenzene concentrations are from grab groundwater samples collected in June 2002 and February-March 2003. Chlorobenzene concentrations in monitoring wells are from April 2002.

Exponent

Figure 7a. Cross-section L-L' with chlorobenzene concentrations in groundwater

8601192.001.0634\L-L' CHLOR.dwg 12/05/03 OR



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0 25 50 100 Feet

N

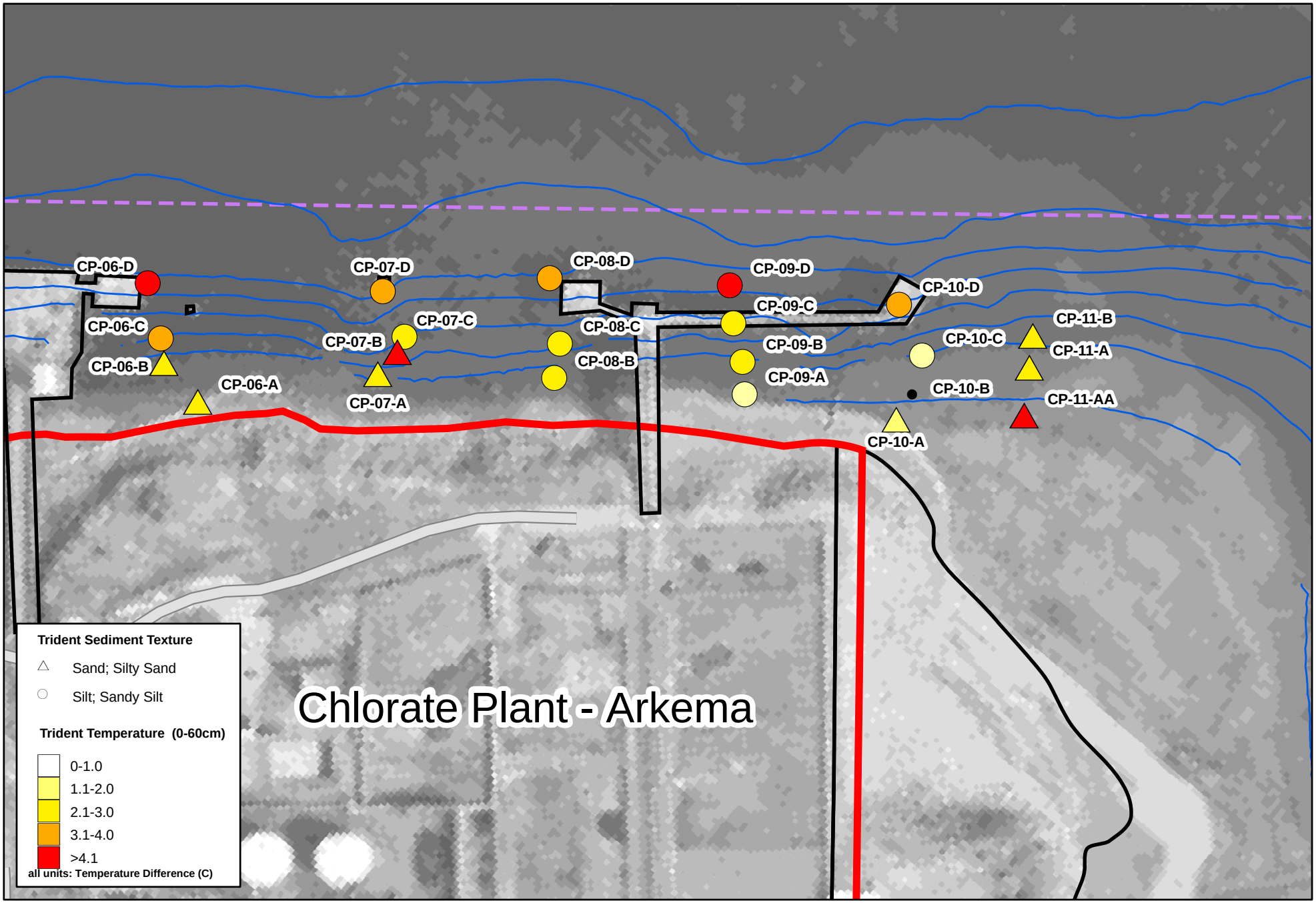
LEGEND

2003 Bathymetric 5 Ft. Contours (NAVD 88)

Site Property Boundary

FEATURE SOURCES:
Aerial Photo: Spencer B. Cross, October 2001.
Base Map features from Portland Metro's RLIS.
Channel and River Miles: Developed from US Army Corps of Engineers information.
Docks & In-water Structures: created by heads-up digitizing from the October 2001 0.33 ft. resolution color orthophotos.
Map Document: (C:\GIS\Projects\Portland_Harbor\LWG-Map-Projects\Groundwater_Workplan\arco_Trident_sedtype.mxd)
Plot Date: 04/12/2005

Figure 2-4
Portland Harbor RI/FS
Pilot Study Trident Tempurature and Sediment Type Results
Arkema Acid Plant



integral consulting inc

0 25 50 100 Feet

N

LWG Lower Willamette Group

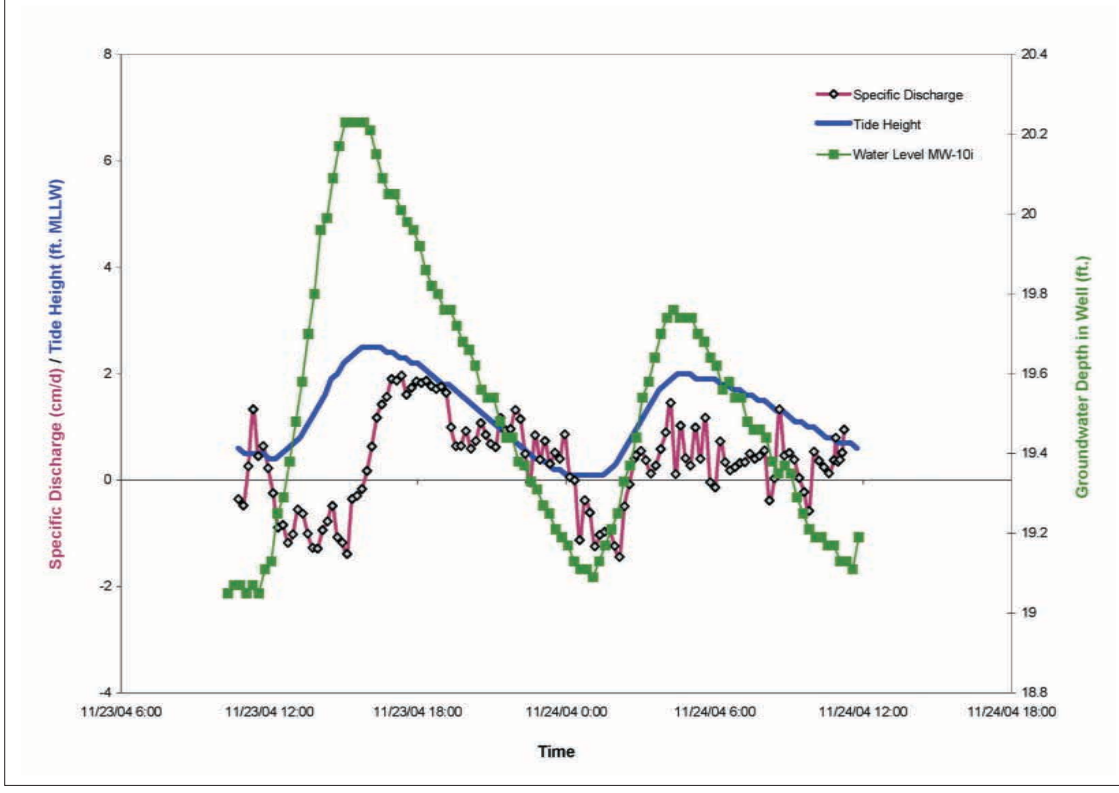
LEGEND

2003 Bathymetric 5 Ft. Contours (NAVD 88)

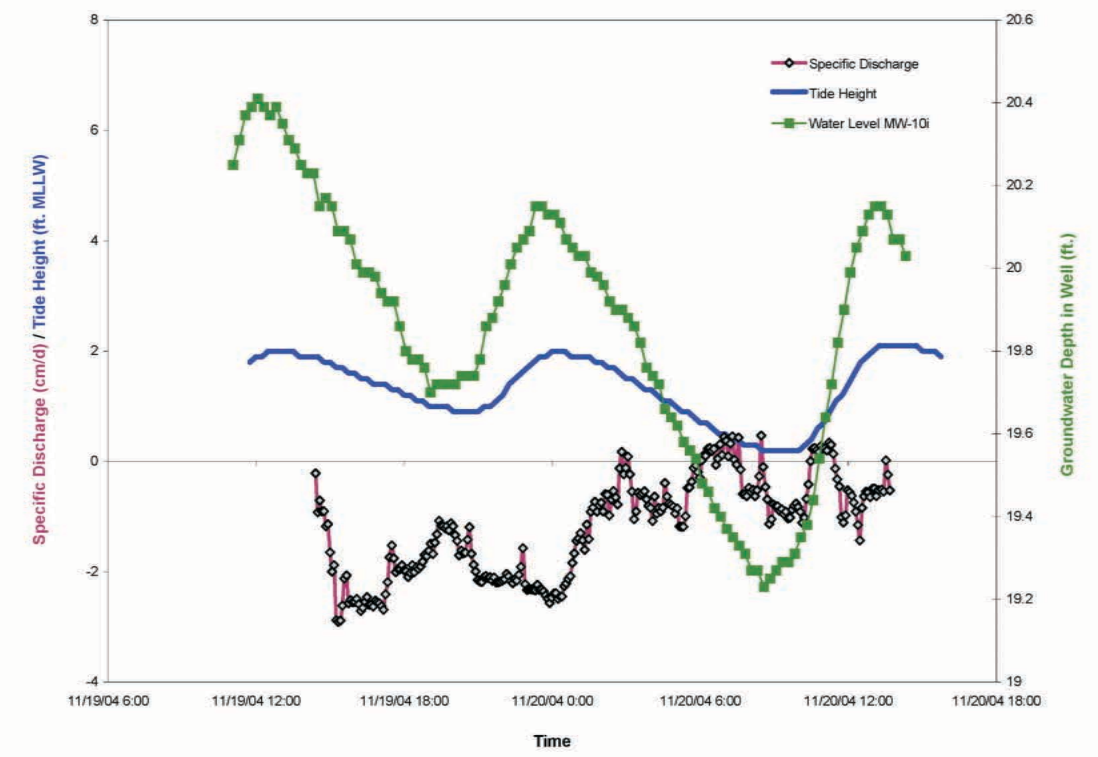
Site Property Boundary

FEATURE SOURCES:
Aerial Photo: Spencer B. Cross, October 2001.
Base Map features from Portland Metro's RLIS.
Channel and River Miles: Developed from US Army Corps of Engineers information.
Docks & In-water Structures: created by heads-up digitizing from the October 2001 0.33 ft. resolution color orthophotos.
Map Document: (C:\GIS\Projects\Portland_Harbor\LWG-Map-Projects\Groundwater_Workplan\arco_Trident_sedtype.mxd)
Plot Date: 04/12/2005

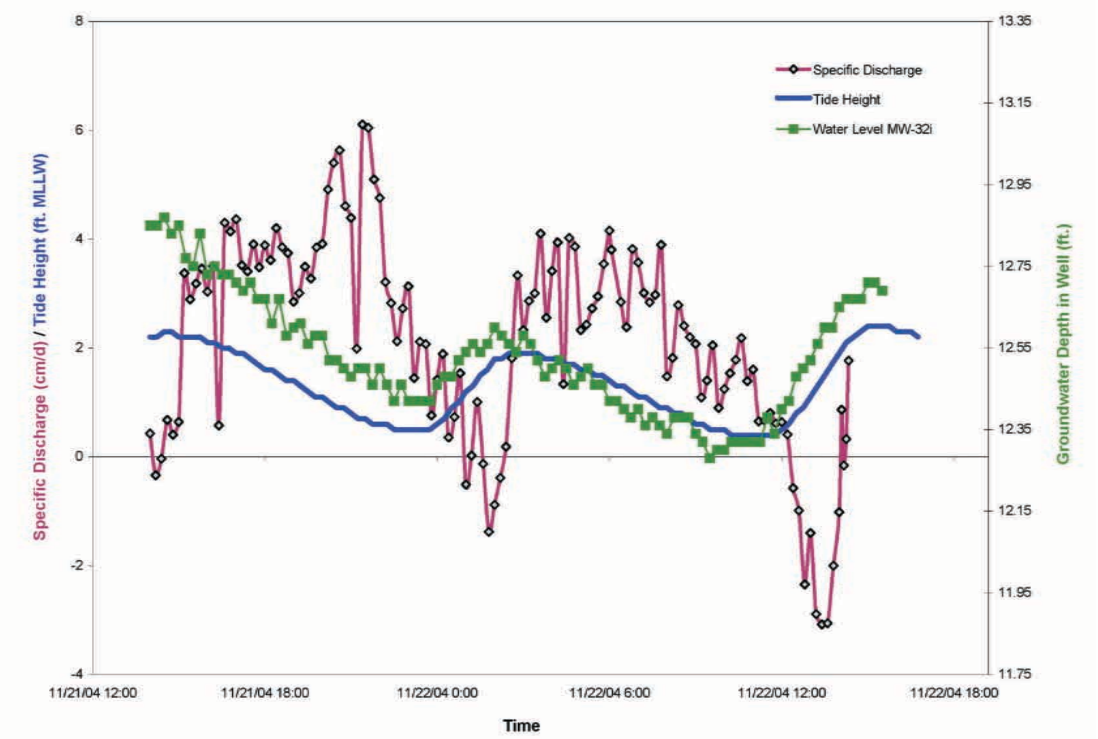
Figure 2-6
Portland Harbor RI/FS
Pilot Study Trident Temperature and Sediment Type Results
Arkema Chlorate Plant



a. AP04B UltraSeep Results



b. AP04D UltraSeep Results

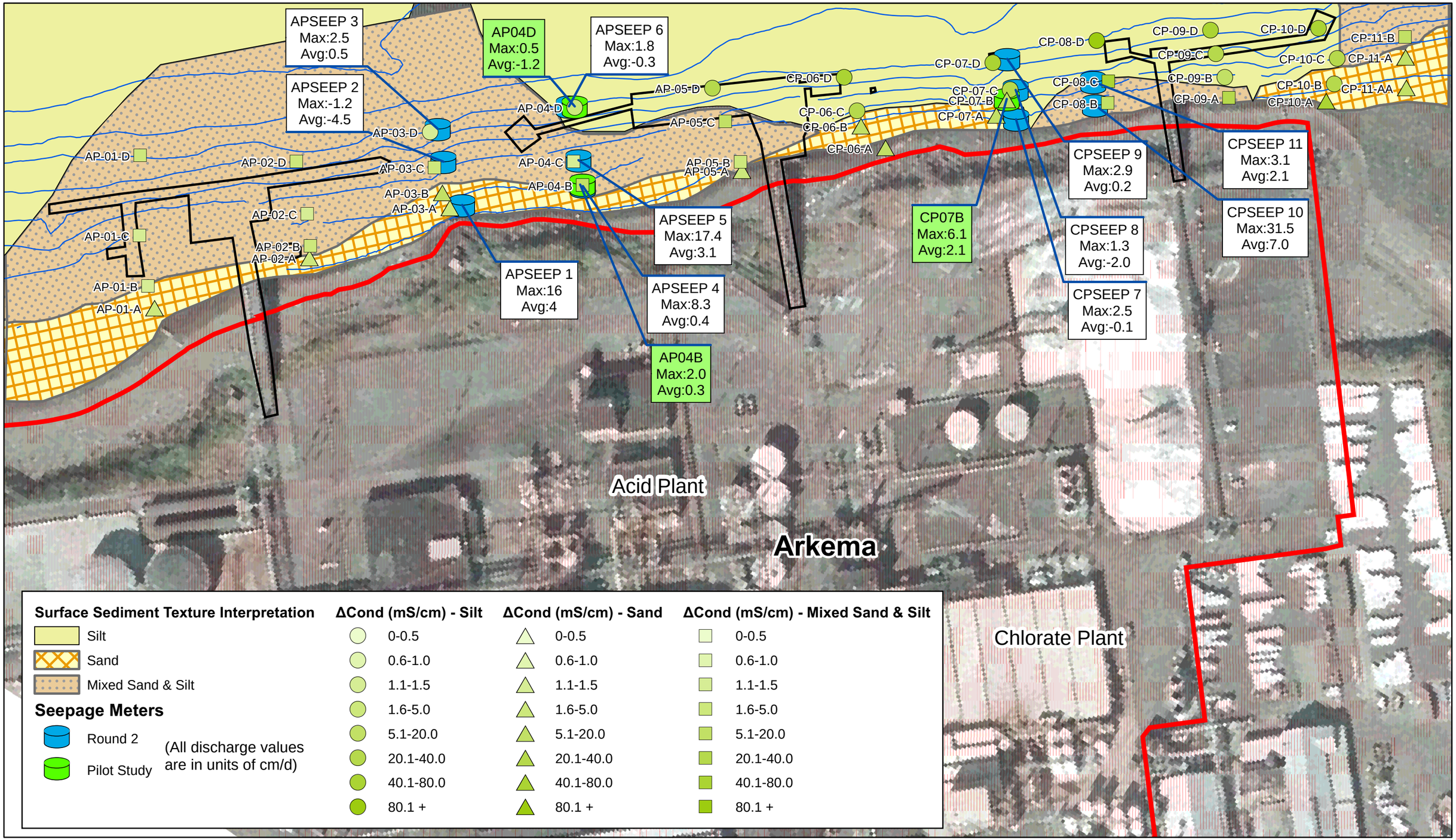


c. CP07B UltraSeep Results

integral consulting inc.

LWG Lower Willamette Group

Figure 2-11
Portland Harbor RI/FS
UltraSeep System Results



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N

0 50 100 200 Feet

LEGEND

2003 Bathymetric 5 Ft. Contours (NAVD 88)

Site Property Boundary

FEATURE SOURCES:
Aerial Photo: Spencer B. Cross, October 2001.
Base Map features from Portland Metro's RLIS.
Channel and River Miles: Developed from US Army Corps of Engineers information.
Docks & In-water Structures: created by heads-up digitizing from the October 2001 0.33 ft. resolution color orthophotos.

Map Document: (O:\Projects\Portland_Harbor\LWG-Map-Projects\Groundwater_Workplan\arkema_trident_actuals_20050822.mxd)
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Figure 5-5
Portland Harbor RI/FS
Round 2 Groundwater Pathway Assessment SAP
Attachment 2 Transition Zone Water FSP Addendum 1
Arkema Trident Conductivity Mapping Results

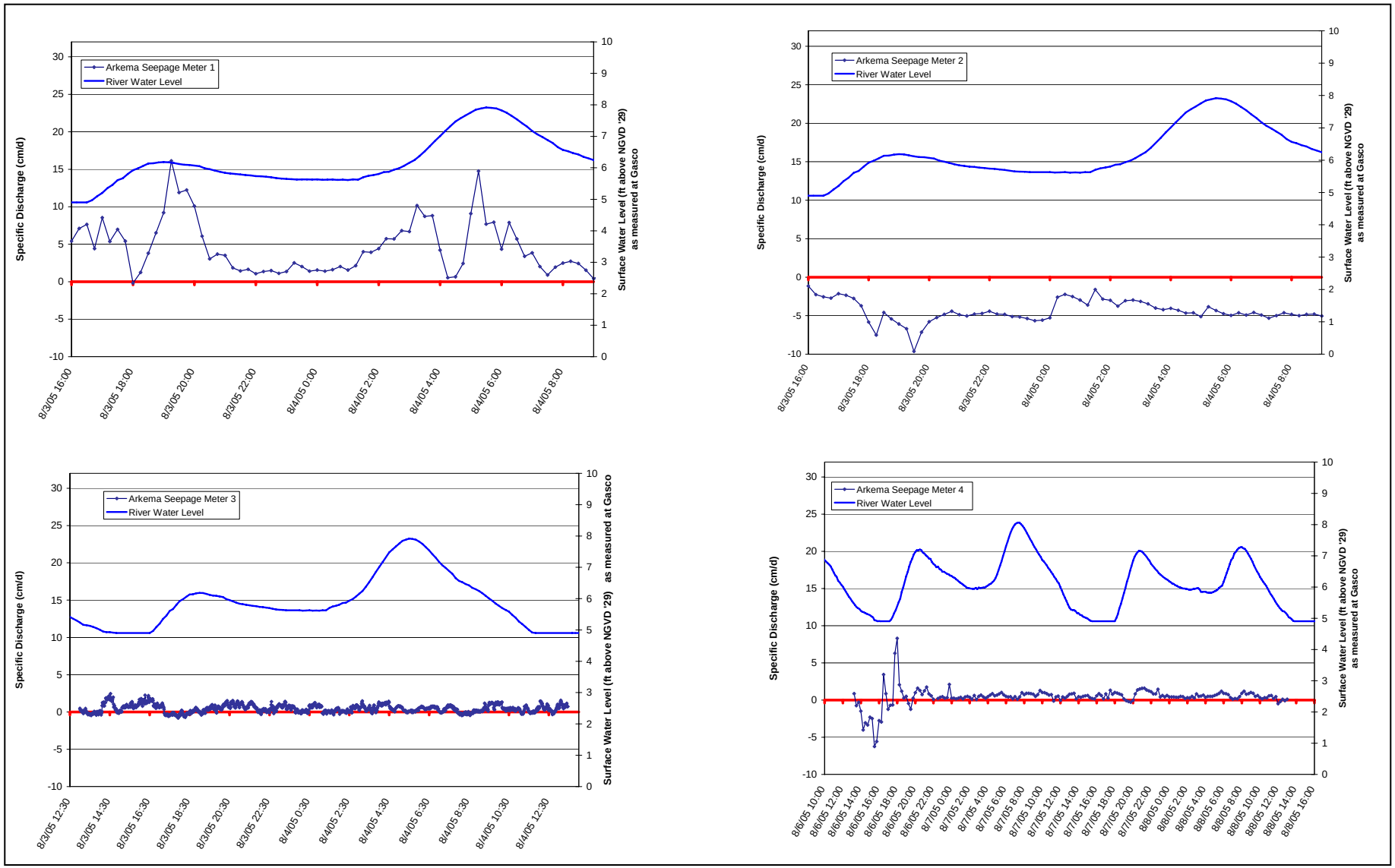


Figure 5-7a
Portland Harbor RI/FS
Round 2 Groundwater Pathway Assessment SAP
Attachment 2 Transition Zone Water FSP Addendum 1
Arkema Seepage Meter Data – Locations 1,2,3 and 4

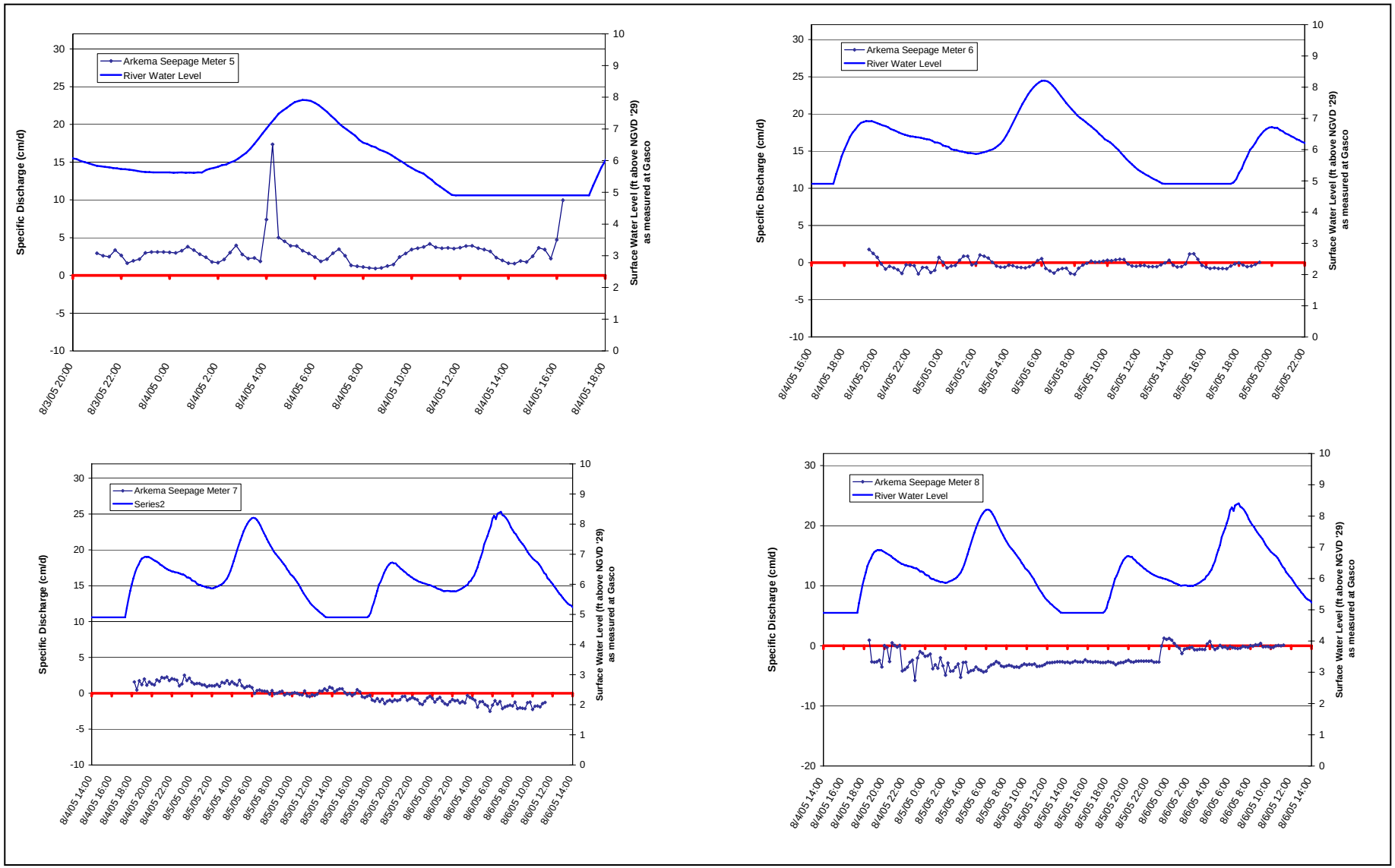
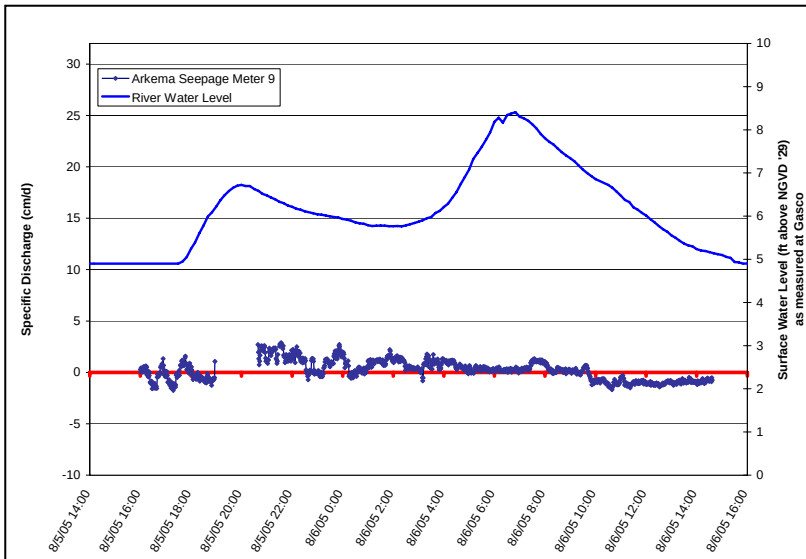
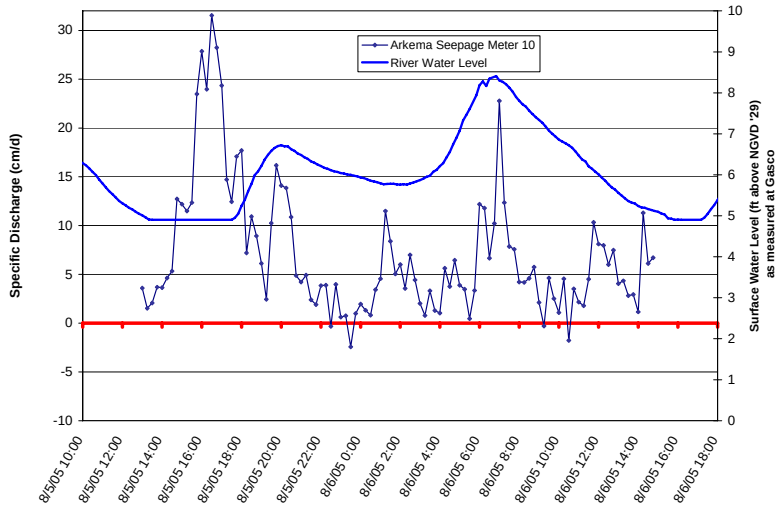


Figure 5-7b
Portland Harbor RI/FS
Round 2 Groundwater Pathway Assessment SAP
Attachment 2 Transition Zone Water FSP Addendum 1
Arkema Seepage Meter Data – Locations 5,6,7 and 8





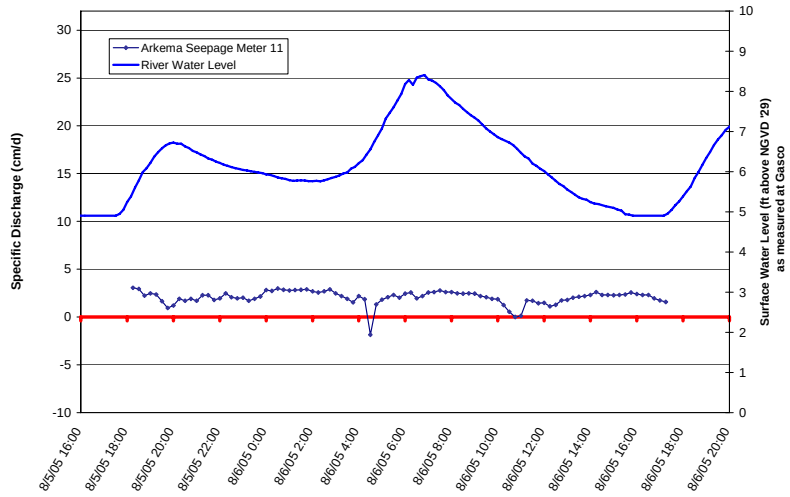
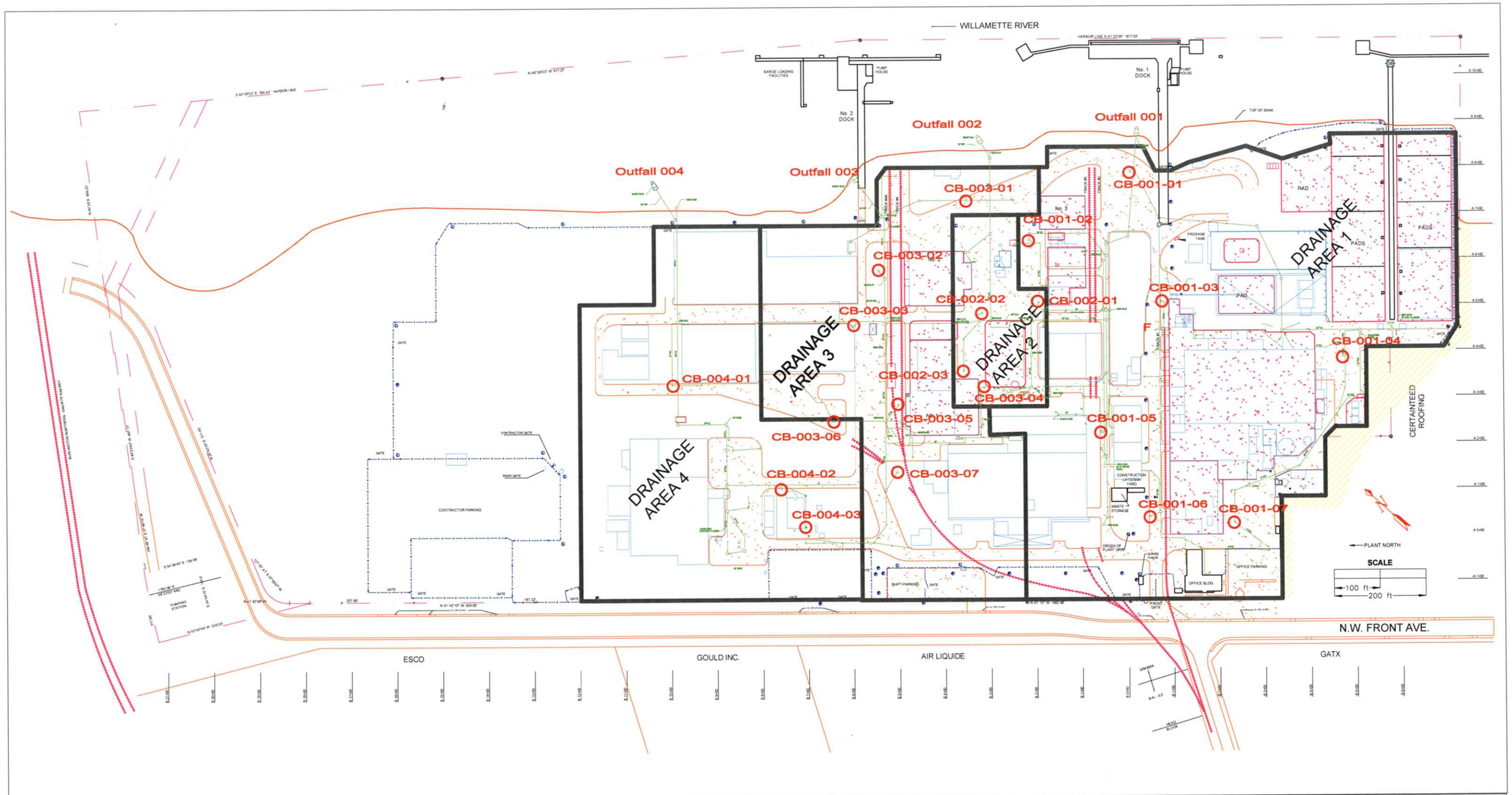


Figure 5-7c
Portland Harbor RI/FS
Round 2 Groundwater Pathway Assessment SAP
Attachment 2 Transition Zone Water FSP Addendum 1
Arkema Seepage Meter Data – Locations 9,10 and 11



NOTES

○ = Proposed Sample Points
CB-XXX-XX = Catch Basin Filter Sock Sample,
XXX = Outfall location of Catch Basin
XX = Sample Number
Outfall XXX = Outfall Water Sample,
XXX = Outfall designation

STORMWATER LEGEND

- DRAINAGE AREA (approx)
- Indust Sewer, Drain, Manhole
- Former Buildings, Tank Farms

LEGEND

- LEGAL BOUNDARY, EASEMENT
- FOUNDATIONS, ASPHALT PADS, IMPERVOUS
- STREETS, PARKING AREAS, IMPERVIOUS
- RAILROAD
- FENCE
- (L) (P) LIGHT POLE, POWER POLE

ARKEMA

Arkema Inc, 6400 NW Front Ave, Portland, OR 97210

Figure 1. Outfall and Catch Basin Sampling Locations

DRAWN BY: **JMB** DATE: **05/31/05** SCALE: **1" = 100'**
DWG No. **P - 003 - 00052** REV. **4** APPROVED _____

Map Document: (C:\GIS\Projects\Portland_Harbor\LWG-Map-Projects\DE-Bathy\Template_a-k_11x17.mxd)
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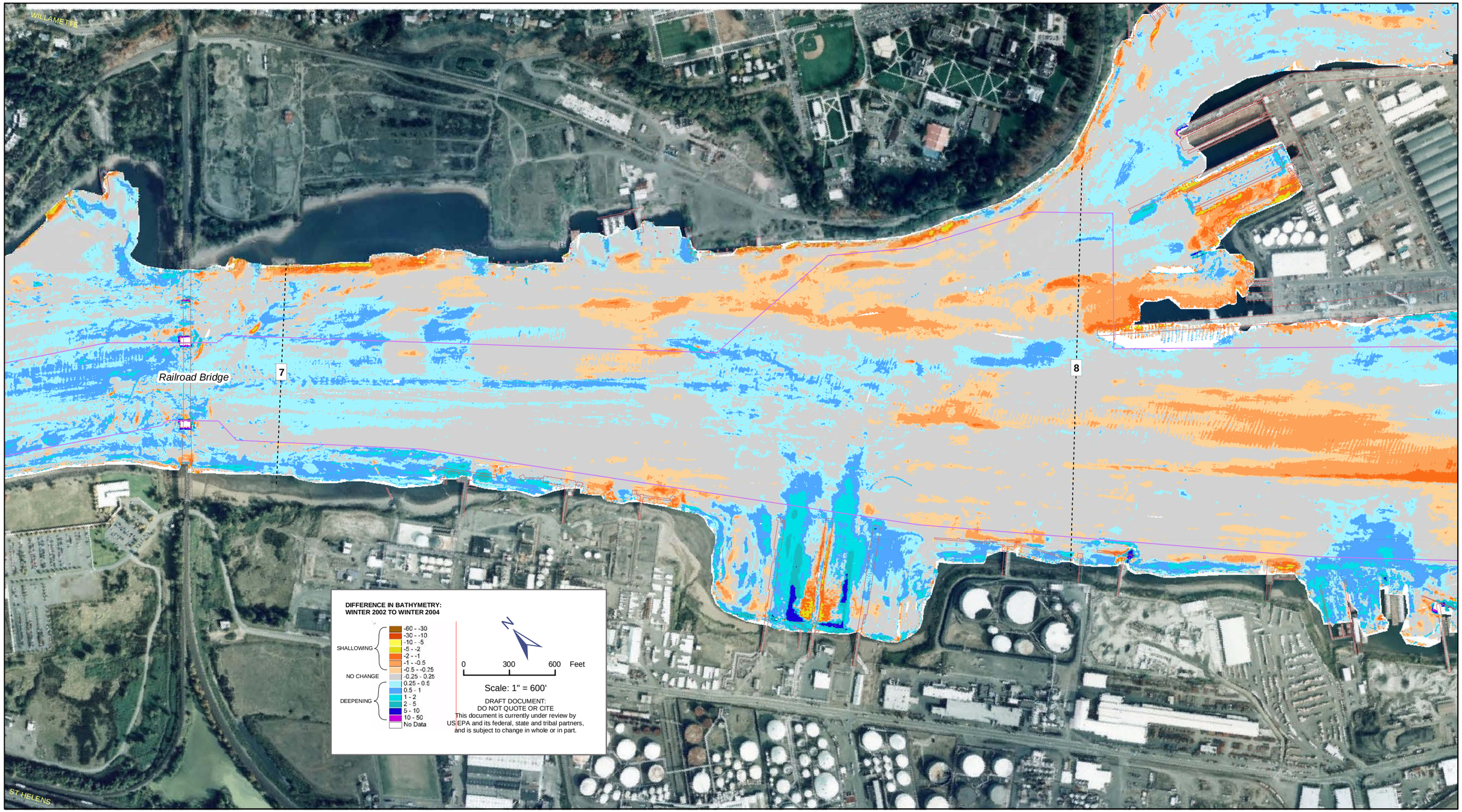

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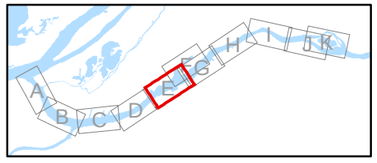
LWG
LOWER WILLAMETTE GROUP



LEGEND:

- Dock & structures 2001
- River miles
- Navigation Channel
- Bridges

FEATURE SOURCES:
Transportation, Water, Property,Zoning or Boundaries: Metro RLIS .
Channel: Developed from US Army Corps of Engineers information.
Bathymetric Survey Data: David Evans and Associates Inc.
Aerial Image: Spencer B. Gross, October 2001.

Plot date: August 6, 2004

NOTES:
*Horizontal Datum: North American Datum of 1983 – 91 adj. (NAD83/91),
State Plane Coordinate System (SPCS), Oregon North Zone, International Feet.
Vertical Datum: North American Vertical Datum of 1988 (NAVD88).
Bathymetry was exported from Caris into 3-foot ESRI grids for calculation
in ArcView 3.3. The values of the grid nodes for the March 2004 survey
were subtracted from the grid node values for the previous surveys to produce
the difference grids.

Figure 3e. Multibeam Bathymetric Survey
Differences - Winter 2002 to Winter 2004
Lower Willamette River

Map Document: (C:\GIS\Projects\Portland_Harbor\LWG-Map-Projects\DE-Bathy\Template_a-k_11x17.mxd)
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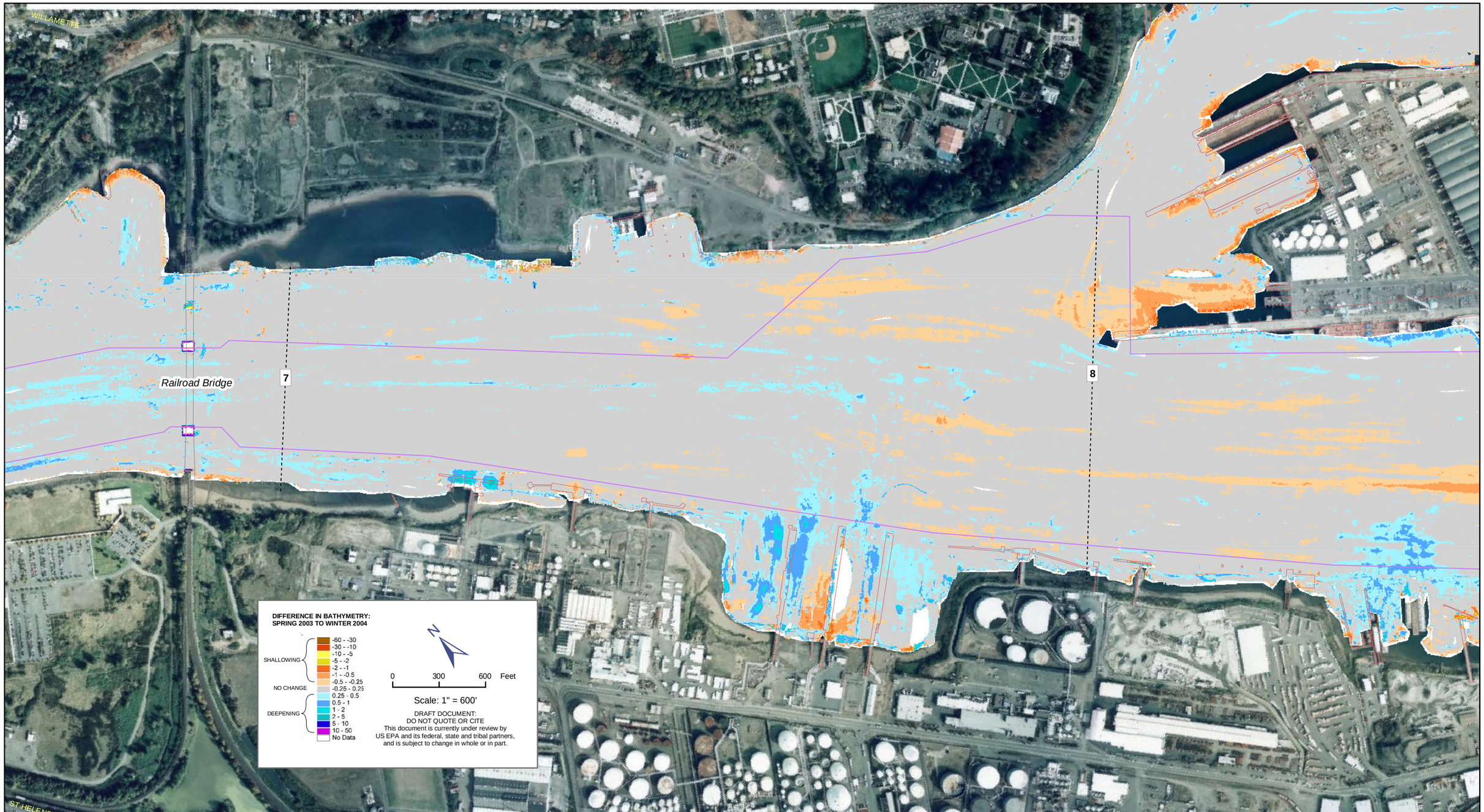
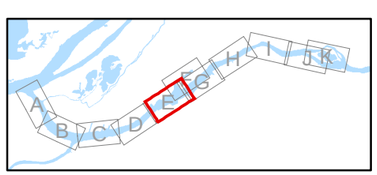


integral consulting inc

LWG
LOWER WILLAMETTE GROUP



LEGEND:

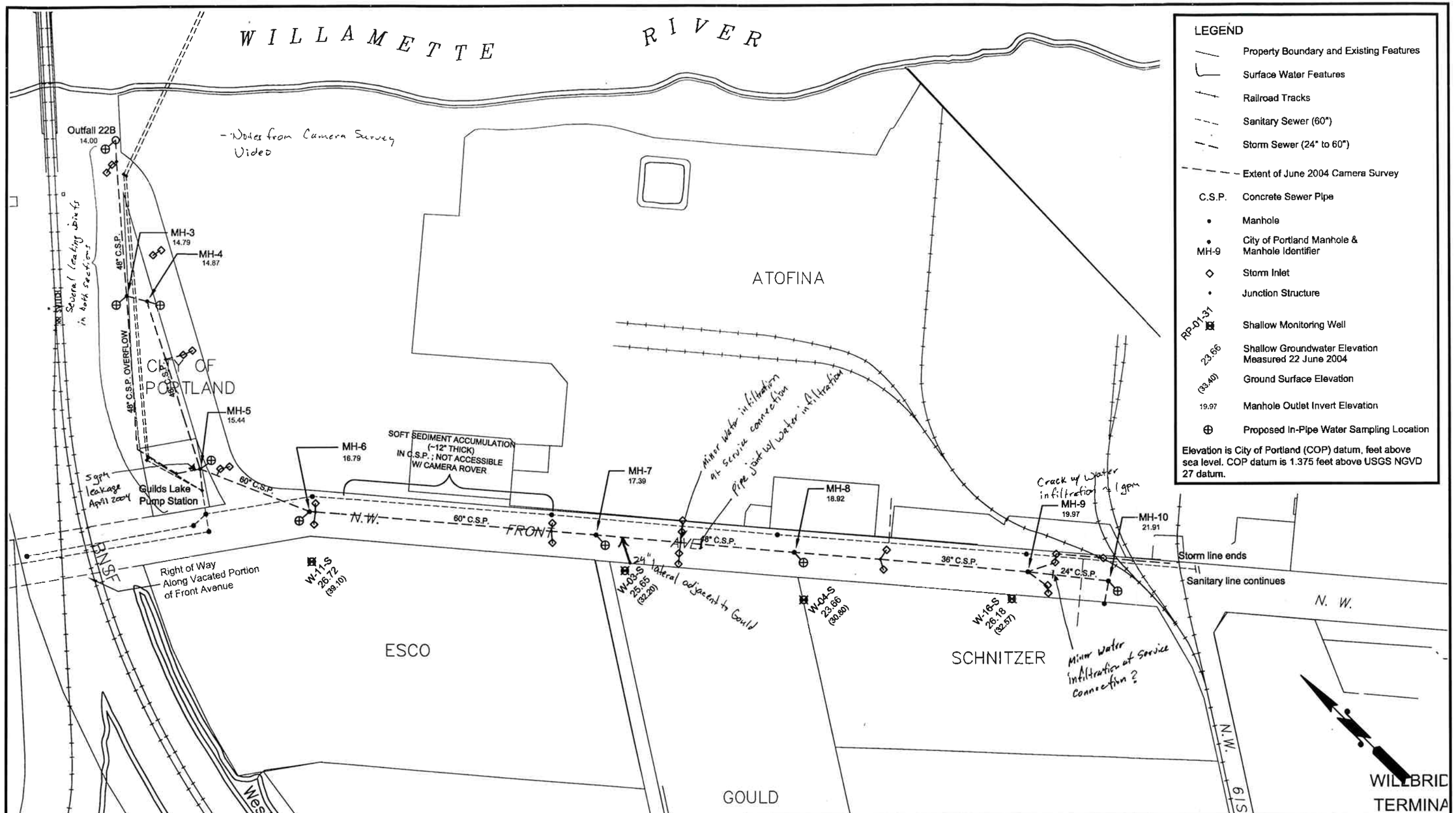
- Dock & structures 2001
- River miles
- Navigation Channel
- Bridges

FEATURE SOURCES:
Transportation, Water, Property,Zoning or Boundaries: Metro RLIS .
Channel: Developed from US Army Corps of Engineers information.
Bathymetric Survey Data: David Evans and Associates Inc.
Aerial Image: Spencer B. Gross, October 2001.

Plot date: August 6, 2004

NOTES:
*Horizontal Datum: North American Datum of 1983 – 91 adj. (NAD83/91),
State Plane Coordinate System (SPCS), Oregon North Zone, International Feet.
Vertical Datum: North American Vertical Datum of 1988 (NAVD88).
Bathymetry was exported from Caris into 3-foot ESRI grids for calculation
in ArcView 3.3. The values of the grid nodes for the March 2004 survey
were subtracted from the grid node values for the previous surveys to produce
the difference grids.

Figure 4e. Multibeam Bathymetric Survey Differences - Spring 2003 to Winter 2004
Lower Willamette River



LEGEND

- Property Boundary and Existing Features
- Surface Water Features
- Railroad Tracks
- Sanitary Sewer (60")
- Storm Sewer (24" to 60")
- Extent of June 2004 Camera Survey
- C.S.P. — Concrete Sewer Pipe
- Manhole
- MH-9 — City of Portland Manhole & Manhole Identifier
- Storm Inlet
- Junction Structure
- RP-01-31 — Shallow Monitoring Well
- 23.66 — Shallow Groundwater Elevation Measured 22 June 2004
- (33.40) — Ground Surface Elevation
- 19.97 — Manhole Outlet Invert Elevation
- Proposed In-Pipe Water Sampling Location

Elevation is City of Portland (COP) datum, feet above sea level. COP datum is 1.375 feet above USGS NGVD 27 datum.

Sewer information and location from www.portlandmaps.com, August 2003.

0 200 400
SCALE IN FEET

amec
7376 SW Durham Road
Portland, OR, U.S.A. 97224-7307

W.O.	0-61M-10703-0 T-66
DESIGN	SB
DRAWN	DD
DATE	JULY 2004
SCALE	1"=200'

FIGURE 1
OUTFALL 22B STORM SEWER CAMERA SURVEY, GROUNDWATER ELEVATIONS, AND PROPOSED WATER SAMPLING LOCATIONS
RP - PORTLAND SITE

AMEC DRAWING NO. K:\ 10000 \ 10700 \ 10703 \ Task 68 Outfall 22B IRAM \ DWG \ 0704 GW ELEV. dwg