CITY OF HOUSTON

PUBLIC WORKS AND ENGINEERING
PLANNING & DEVELOPMENT DIVISION

Application for Approval of Municipal Setting Designation

APPLICANT INFORMATION

Applicant's Name: GUIC Industries, Inc.

☐Individual ☒Private Entity ☐Public Entity ☐Non-Profit Entity ☐Other _____

Address: 2801 Post Oak Blvd Suite 400 Houston, TX 77056
(Street) (City) (State) (Zip)

Phone No.: 713-627-2039 Fax No.: _____

Email: tkeng@tanglewoodproperty.com

Contact Information

Name of Contact: Tai-Li Keng

Title: Vice President

Address: 2801 Post Oak Blvd Suite 400 Houston, TX 77056
(Street) (City) (State) (Zip)

Phone No.: 713-627-2039 Fax No.: _____

Email: tkeng@tanglewoodproperty.com

SITE INFORMATION

Site HCAD No(s): 0431490000061

Site Name: GUIC Industries, Inc

Site Size: 18.29-acres

Site Address: 17011 Old Beaumont Highway Houston TX
(Street) (City) (State) (Zip)
(List all owners – additional sheet is attached, if needed)

Owner: GUIC Industries, Inc

Owner Address: 2801 Post Oak Blvd Suite 400 Houston, TX 77056
(Street) (City) (State) (Zip)

Name of Contact: Tai-Li Keng

Title: Vice President

Organization: GUIC Industries, Inc.

Phone No.: 713-627-2039 Fax No.: _____

Email: tkeng@tanglewoodproperty.com

Additional Owner List

(Cont'd from pg. 2)

Owner: UTLX Manufacturing LLC

Owner Address: 16923 Old Beaumont Hwy 90 Houston TX 77049

(Street) (City) (State) (Zip)

Name of Contact: Kim Rowlan

Title: Manager, Human Resources & Environmental

Organization: UTLX

Phone No.: 281-847-8212 Fax No.: 281-456-0519

Email: rowlan@ultx.com

Owner: _____

Owner Address: _____

(Street) (City) (State) (Zip)

Name of Contact: _____

Title: _____

Organization: _____

Phone No.: _____ Fax No.: _____

Email: _____

Owner: _____

Owner Address: _____

(Street) (City) (State) (Zip)

Name of Contact: _____

Title: _____

Organization: _____

Phone No.: _____ Fax No.: _____

Email: _____

Owner: _____

Owner Address: _____

(Street) (City) (State) (Zip)

Name of Contact: _____

Title: _____

Organization: _____

Phone No.: _____ Fax No.: _____

Email: _____

Appendix B

A description of the current use, and, to the extent known, the anticipated use(s), of the designated property and properties within 500 feet of the boundary of the designated property.

The Gulf United Investments Corporation (GUIC Industries) property, formerly Westlake Industries, has historically been used as a railcar maintenance and repair facility (Westlake Metal Fabrication Corp). Since the property was developed in the 1950s, industries occupying the site have been involved in the construction, cleaning, maintenance, and repair of railroad rolling stock. The initial operator is identified on County records as Richmond Tank Car Company. Operations were subsequently acquired and operated as Gulf Railcar, Inc., and then as Westlake Metal Fabrication Corp. In 2005, Westlake Industries was sold and operated as GUIC Industries. Railcar manufacturing operations were discontinued in 1990. In 2005, the majority of the facility (264 acres) was sold to Union Tank Car which continues to perform railcar maintenance activities on the site. A 15.28-acre parcel was retained by GUIC Industries during the divestiture due to environmental considerations. This portion of the property has largely been decommissioned and idle since the 2005 divestiture.

The immediate area surrounding the subject facility is primarily industrial with some small commercial enterprises, as well as major industrial tenants. Old Beaumont Highway (Hwy 90) and the Union Pacific Railroad form the southern boundary of the subject property. These adjacent Rights of Way extend approximately 200 feet south from the GUIC Industries property boundary. Along the south side of Hwy 90 are the Sheldon Early Children's Academy and a small grocery store. Southeast of the property (south of Hwy 90) is Federal Steel Supply company, supplier of pipe and tubular products. North of the GUIC Industries facility is Triad Transfer, an industrial trucking facility, and to the west is the current Union Tank Car. A 3.01-acre parcel of the Union Tank Car property is included in this MSD application. The whole property to be included for this MSD is 18.29-acres in size.

Appendix C

A site map showing:

a. *The location of the designated property.*

b. *The topography of the designated property as indicated on publicly available sources, which must note the watershed <u>including the nearest surface water body</u> and whether the designated property is located in a floodplain or floodway, as those terms are defined in Chapter 19 of the Code of Ordinances.*

c. *The detected area of groundwater contamination.*

d. *The location of all soil sampling locations and all groundwater monitoring wells.*

e. *Groundwater gradients, to the extent known, and direction of groundwater flow.*

f. *The ingestion protective concentration level exceedence zone for each contaminate of concern, to the extent known.*

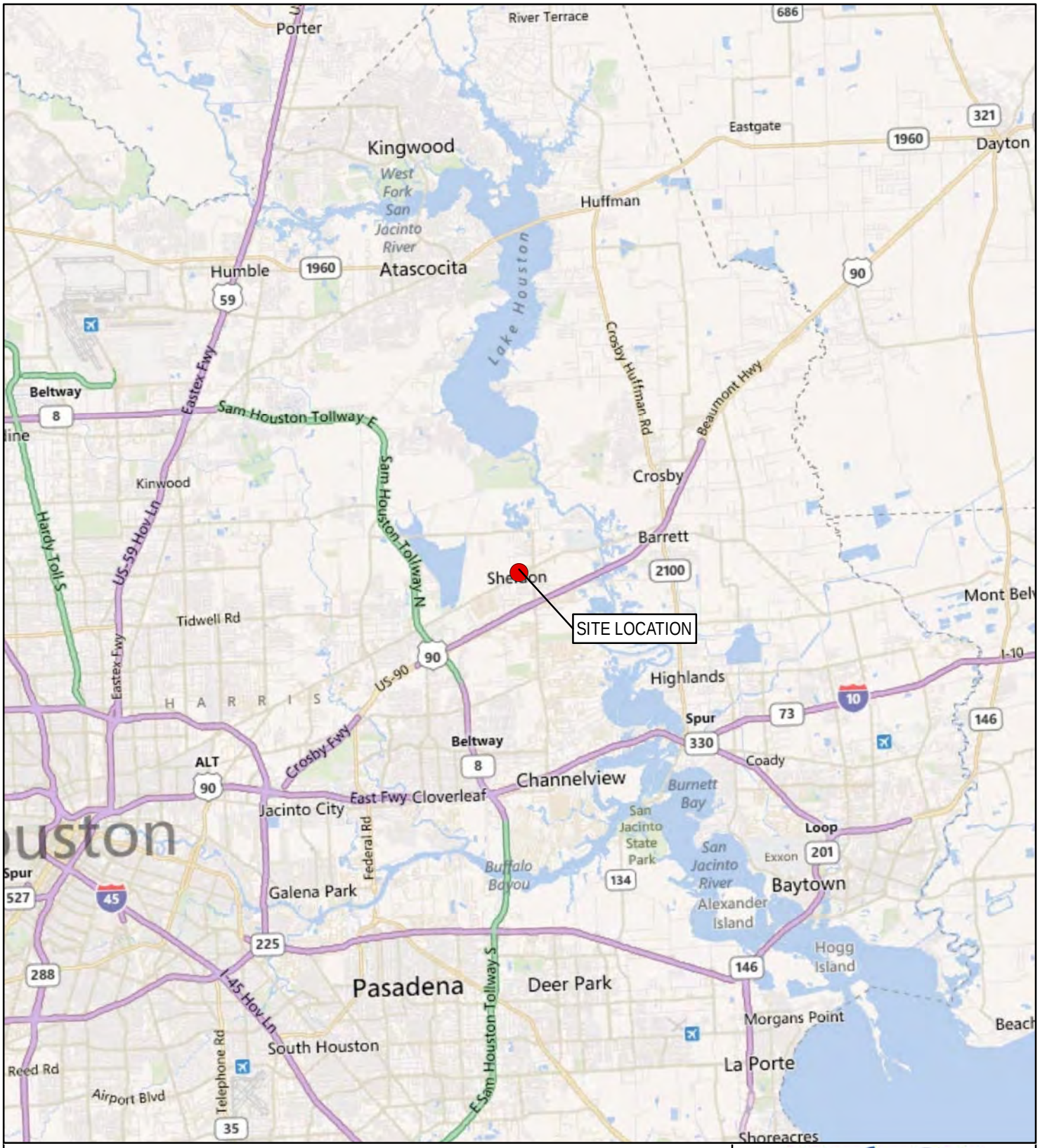
<u>Attached Figures:</u>

Figure 1-1	Site Location Map
Figure 1-2	Property Map
Figure 2	Topographic Map
Figure 3	Monitor Well Location Map
Figure 4	Groundwater Quality Map
Figure 5-1	Shallow Zone Potentiometric Map
Figure 5-2	Intermediate Zone Potentiometric Map
Figure 5-3	Deep Zone Potentiometric Map
Figure 6	Shallow Zone COC Concentration Map
Figure 7	Intermediate Zone COC Concentration Map
Figure 8	Deep Zone COC Concentration Map

Historic Figures Courtesy RSA

Figure 3	Shallow Zone (Unit III) Potentiometric Surface Map December 2003
Figure 4	Intermediate Zone (Units V & Va) Potentiometric Surface Map December 2003
Figure 5	Deep Zone (VI) Potentiometric Surface Map December 2003

Figure 3	Shallow Zone (Unit III) Potentiometric Surface Map February 2004
Figure 4	Intermediate Zone (Units V & Va) Potentiometric Surface Map February 2004
Figure 5	Deep Zone (VI) Potentiometric Surface Map February 2004

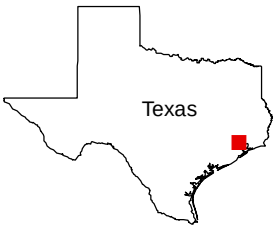


0 4 8

Miles

LEGEND

SITE LOCATION



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SOURCE: (c) 2010 Microsoft Corporation and its data suppliers

WESTON SOLUTIONS

FIGURE 1-1
SITE LOCATION MAP
17011 OLD BEAUMONT HWY 90
HOUSTON, HARRIS COUNTY, TEXAS

DATE	PROJECT NO	SCALE
AUGUST, 2012	14895.001.001.0030	AS SHOWN

FILE: L:\14895 GUIC GAP\GIS\FIGURE_1-1_SITE_LOCATION_MAP.mxd 9:08:34 AM 8/31/2012 bondp

0 350 700

Feet

LEGEND

PROPERTY BOUNDARY

N

SOURCE: (c) 2010 Microsoft Corporation and its data suppliers

WESTON SOLUTIONS

FIGURE 1-2
PROPERTY MAP
17011 OLD BEAUMONT HWY 90
HOUSTON, HARRIS COUNTY, TEXAS

DATE	PROJECT NO	SCALE
AUGUST, 2012	14895.001.001.0030	AS SHOWN

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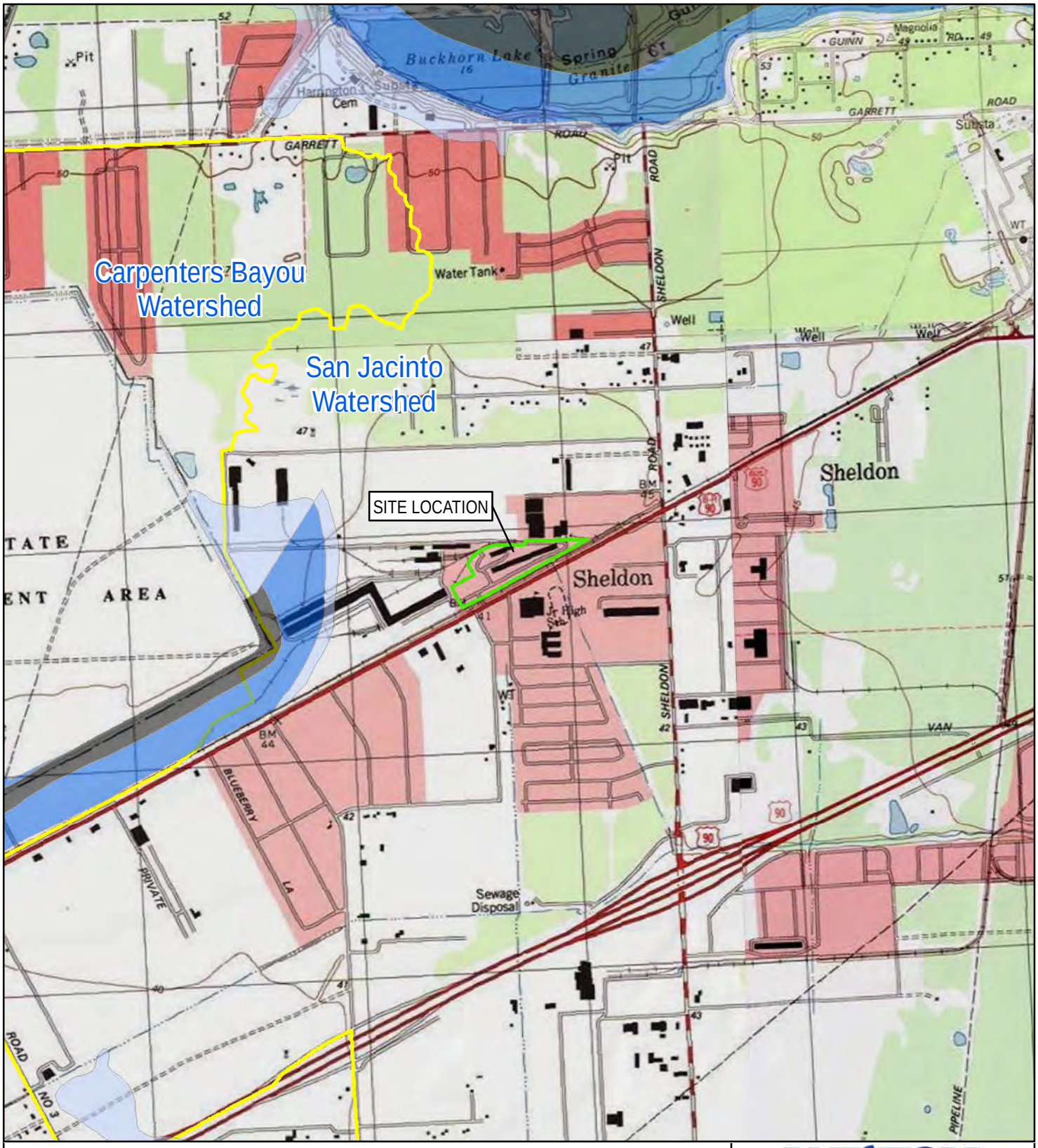


0 2,000 4,000

Feet

LEGEND

PROPERTY BOUNDARY

WATERSHED BOUNDARY

FLOOD ZONE

FLOODWAY

100 YEAR FLOOD ZONE

500 YEAR FLOOD ZONE

N

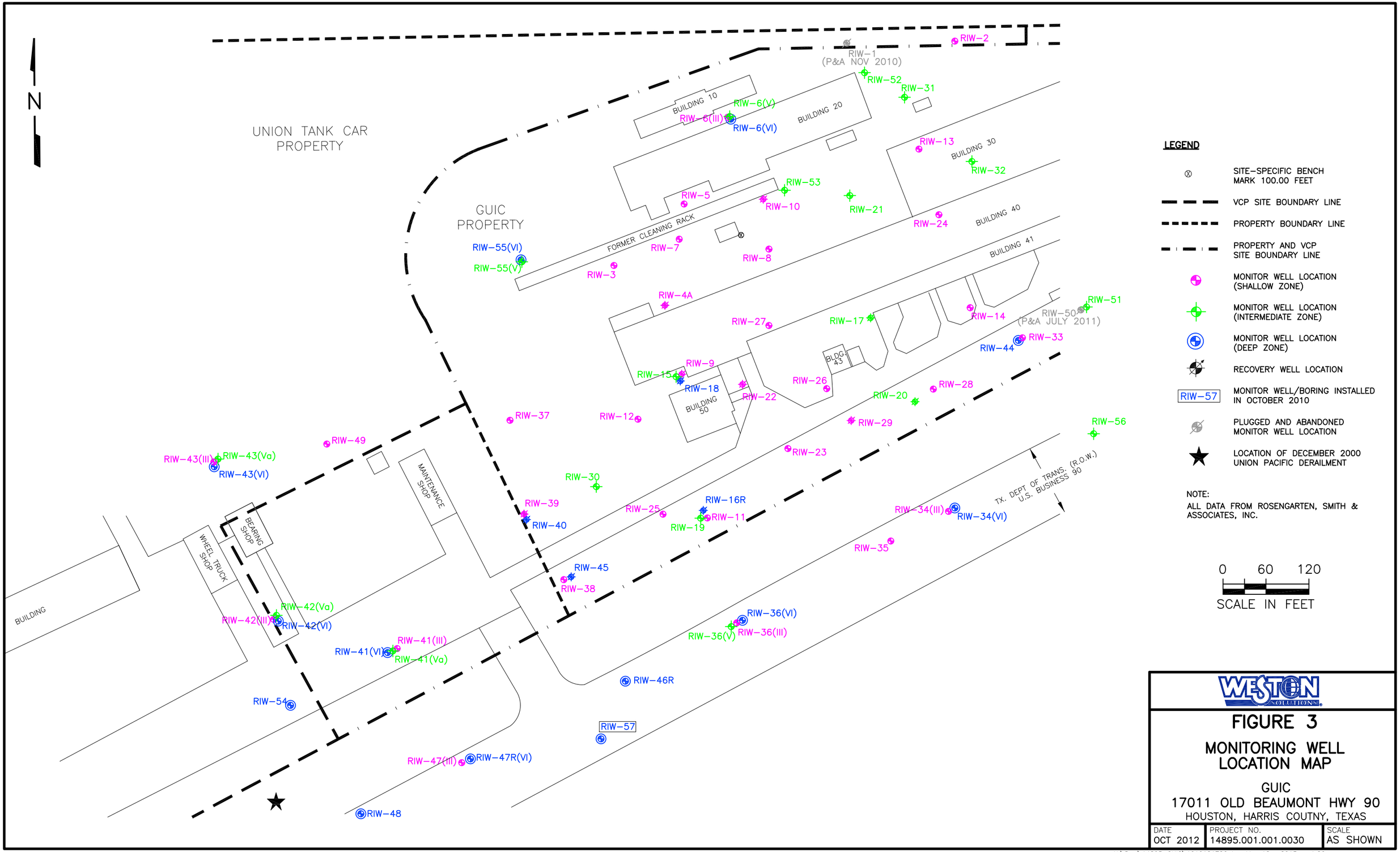
SOURCE: © 2011 National Geographic Society, i-cubed

WESTON SOLUTIONS

FIGURE 2
TOPOGRAPHIC MAP
17011 OLD BEAUMONT HWY 90
HOUSTON, HARRIS COUNTY, TEXAS

DATE	PROJECT NO	SCALE
AUGUST, 2012	14895.001.001.0030	AS SHOWN

FILE: L:\14895 GUIC GAP\GIS\FIGURE_2_TOPOGRAPHIC_MAP.mxd 8:59:57 AM 8/31/2012 bondp



WESTON SOLUTIONS

FIGURE 3

MONITORING WELL LOCATION MAP

GUIC
17011 OLD BEAUMONT HWY 90
HOUSTON, HARRIS COUTNY, TEXAS

DATE	PROJECT NO.	SCALE
OCT 2012	14895.001.001.0030	AS SHOWN

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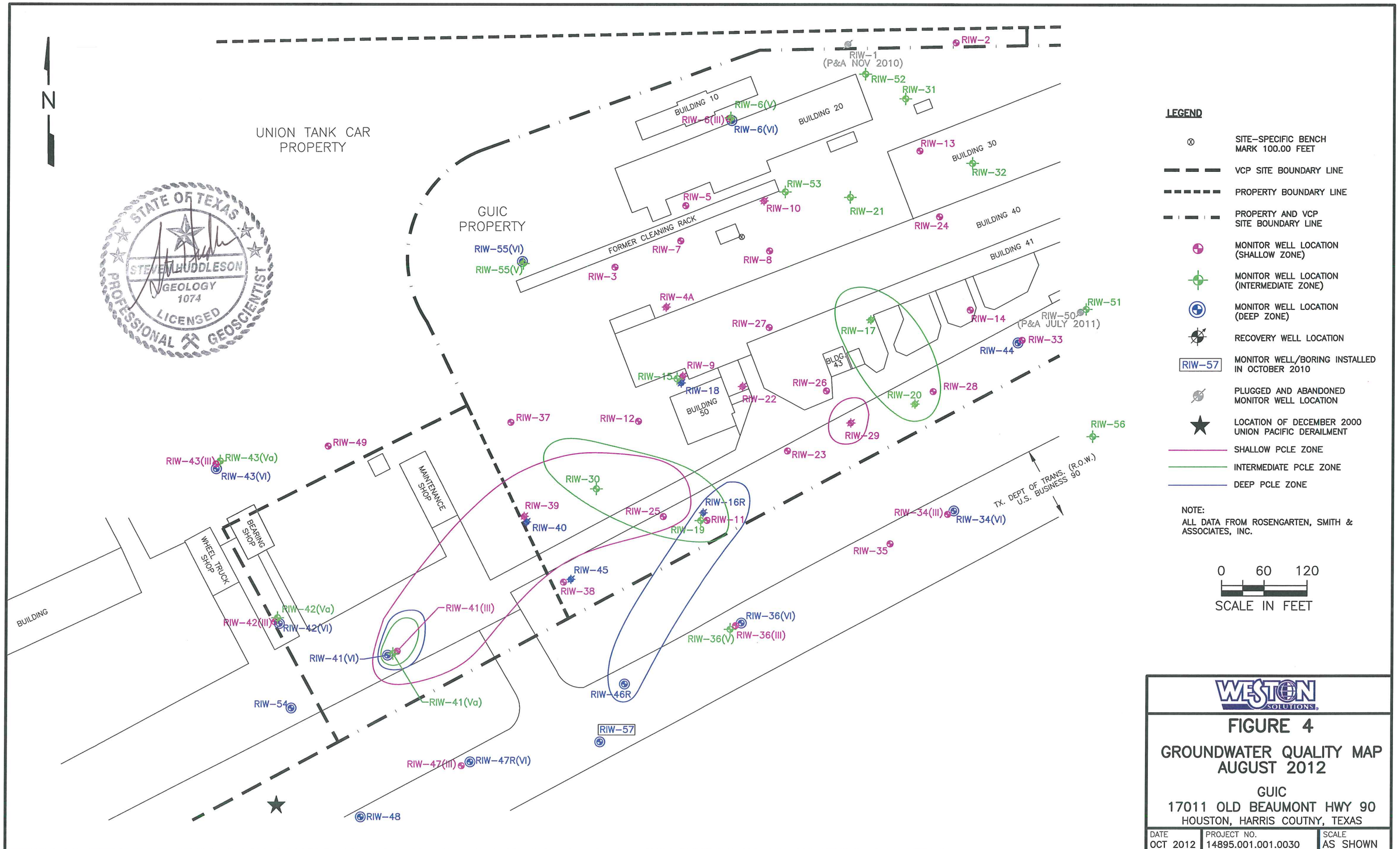
N
UNION TANK CAR PROPERTY
GUIC PROPERTY
STATE OF TEXAS
STEVEN HUDDLESON
GEOLOGY
1074
LICENSED
PROFESSIONAL GEOSCIENTIST
BUILDING 10
BUILDING 20
BUILDING 30
BUILDING 40
BUILDING 41
FORMER CLEANING RACK
BLDG 43
BUILDING 50
MAINTENANCE SHOP
BEARING SHOP
WHEEL TRUCK SHOP
BUILDING
TX. DEPT OF TRANS. (R.O.W.) U.S. BUSINESS 90
RIW-1 (P&A NOV 2010)
RIW-50 (P&A JULY 2011)
RIW-2
RIW-52
RIW-31
RIW-6(V)
RIW-6(III)
RIW-6(VI)
RIW-13
RIW-32
RIW-53
RIW-5
RIW-10
RIW-21
RIW-24
RIW-55(VI)
RIW-55(V)
RIW-7
RIW-8
RIW-3
RIW-4A
RIW-27
RIW-17
RIW-14
RIW-51
RIW-33
RIW-44
RIW-9
RIW-15
RIW-18
RIW-22
RIW-26
RIW-20
RIW-28
RIW-37
RIW-12
RIW-29
RIW-56
RIW-23
RIW-49
RIW-43(III)
RIW-43(Va)
RIW-43(VI)
RIW-30
RIW-39
RIW-40
RIW-25
RIW-16R
RIW-11
RIW-19
RIW-34(III)
RIW-34(VI)
RIW-35
RIW-45
RIW-38
RIW-42(Va)
RIW-42(III)
RIW-42(VI)
RIW-41(III)
RIW-41(VI)
RIW-41(Va)
RIW-36(VI)
RIW-36(V)
RIW-36(III)
RIW-46R
RIW-54
RIW-57
RIW-47(III)
RIW-47R(VI)
RIW-48
LEGEND
SITE-SPECIFIC BENCH MARK 100.00 FEET
VCP SITE BOUNDARY LINE
PROPERTY BOUNDARY LINE
PROPERTY AND VCP SITE BOUNDARY LINE
MONITOR WELL LOCATION (SHALLOW ZONE)
MONITOR WELL LOCATION (INTERMEDIATE ZONE)
MONITOR WELL LOCATION (DEEP ZONE)
RECOVERY WELL LOCATION
RIW-57 MONITOR WELL/BORING INSTALLED IN OCTOBER 2010
PLUGGED AND ABANDONED MONITOR WELL LOCATION
LOCATION OF DECEMBER 2000 UNION PACIFIC DERAILMENT
SHALLOW PCLE ZONE
INTERMEDIATE PCLE ZONE
DEEP PCLE ZONE
NOTE:
ALL DATA FROM ROSENGARTEN, SMITH & ASSOCIATES, INC.
0 60 120
SCALE IN FEET
WESTON SOLUTIONS
FIGURE 4
GROUNDWATER QUALITY MAP
AUGUST 2012
GUIC
17011 OLD BEAUMONT HWY 90
HOUSTON, HARRIS COUTNY, TEXAS
DATE OCT 2012
PROJECT NO. 14895.001.001.0030
SCALE AS SHOWN
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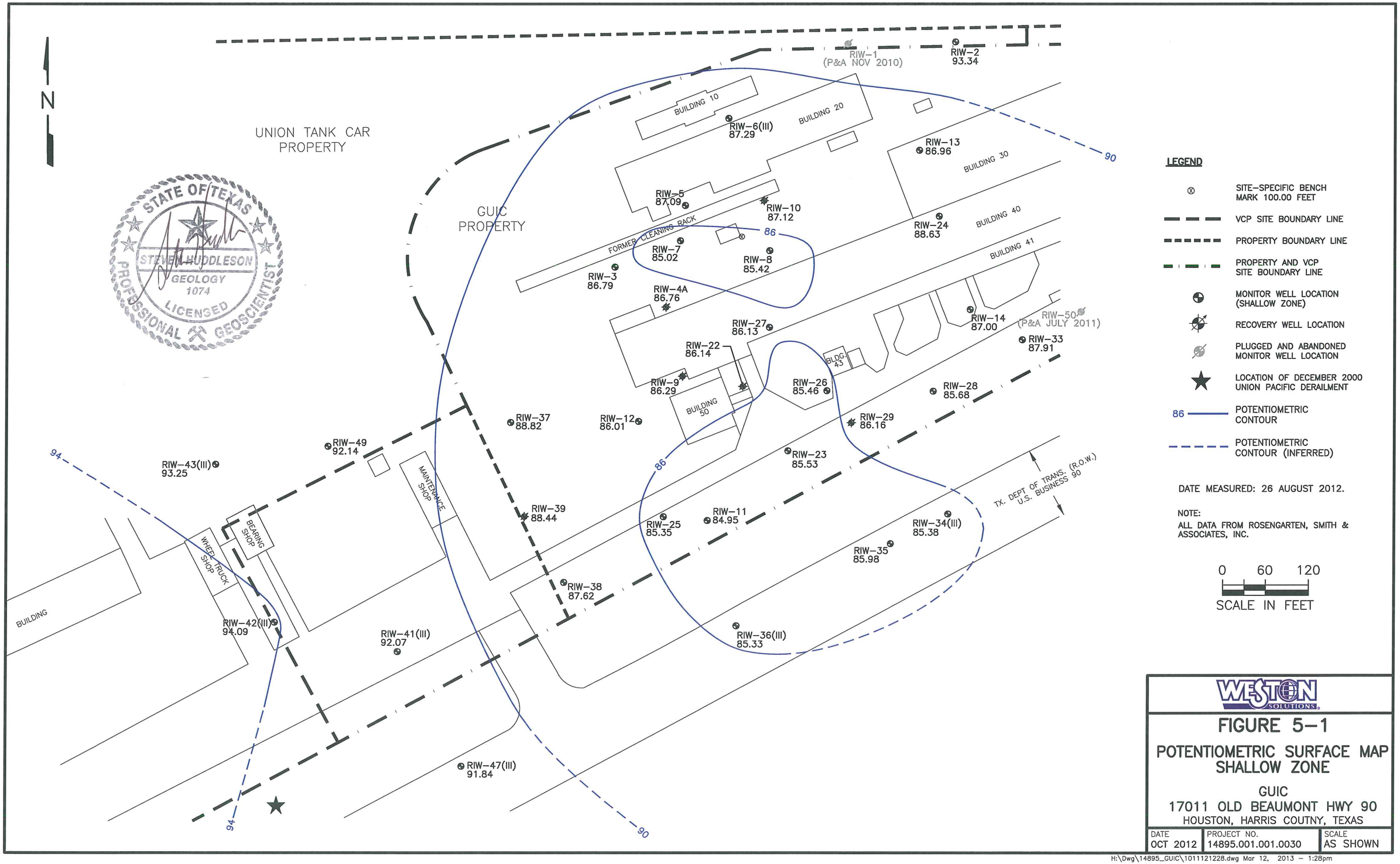
N
UNION TANK CAR PROPERTY
GUIC PROPERTY
STATE OF TEXAS
STEVEN HUDDLESON
GEOLOGY
1074
LICENSED
PROFESSIONAL GEOSCIENTIST
RIW-1 (P&A NOV 2010)
RIW-2 93.34
BUILDING 10
BUILDING 20
RIW-6(III) 87.29
RIW-13 86.96
BUILDING 30
90
RIW-5 87.09
RIW-10 87.12
FORMER CLEANING RACK
86
RIW-24 88.63
BUILDING 40
RIW-7 85.02
RIW-8 85.42
BUILDING 41
RIW-3 86.79
RIW-4A 86.76
RIW-27 86.13
RIW-14 87.00
RIW-50 (P&A JULY 2011)
RIW-33 87.91
RIW-22 86.14
BLDG 43
RIW-9 86.29
RIW-26 85.46
RIW-28 85.68
BUILDING 50
RIW-37 88.82
RIW-12 86.01
RIW-29 86.16
RIW-49 92.14
RIW-23 85.53
94
RIW-43(III) 93.25
MAINTENANCE SHOP
TX. DEPT OF TRANS. (R.O.W.) U.S. BUSINESS 90
RIW-39 88.44
RIW-25 85.35
RIW-11 84.95
RIW-34(III) 85.38
BEARING SHOP
WHEEL TRUCK SHOP
RIW-35 85.98
RIW-38 87.62
BUILDING
RIW-42(III) 94.09
RIW-41(III) 92.07
RIW-36(III) 85.33
RIW-47(III) 91.84
LEGEND
SITE-SPECIFIC BENCH MARK 100.00 FEET
VCP SITE BOUNDARY LINE
PROPERTY BOUNDARY LINE
PROPERTY AND VCP SITE BOUNDARY LINE
MONITOR WELL LOCATION (SHALLOW ZONE)
RECOVERY WELL LOCATION
PLUGGED AND ABANDONED MONITOR WELL LOCATION
LOCATION OF DECEMBER 2000 UNION PACIFIC DERAILMENT
86 POTENTIOMETRIC CONTOUR
POTENTIOMETRIC CONTOUR (INFERRED)
DATE MEASURED: 26 AUGUST 2012.
NOTE:
ALL DATA FROM ROSENGARTEN, SMITH & ASSOCIATES, INC.
0 60 120
SCALE IN FEET
WESTON SOLUTIONS
FIGURE 5-1
POTENTIOMETRIC SURFACE MAP SHALLOW ZONE
GUIC
17011 OLD BEAUMONT HWY 90
HOUSTON, HARRIS COUTNY, TEXAS
DATE OCT 2012
PROJECT NO. 14895.001.001.0030
SCALE AS SHOWN
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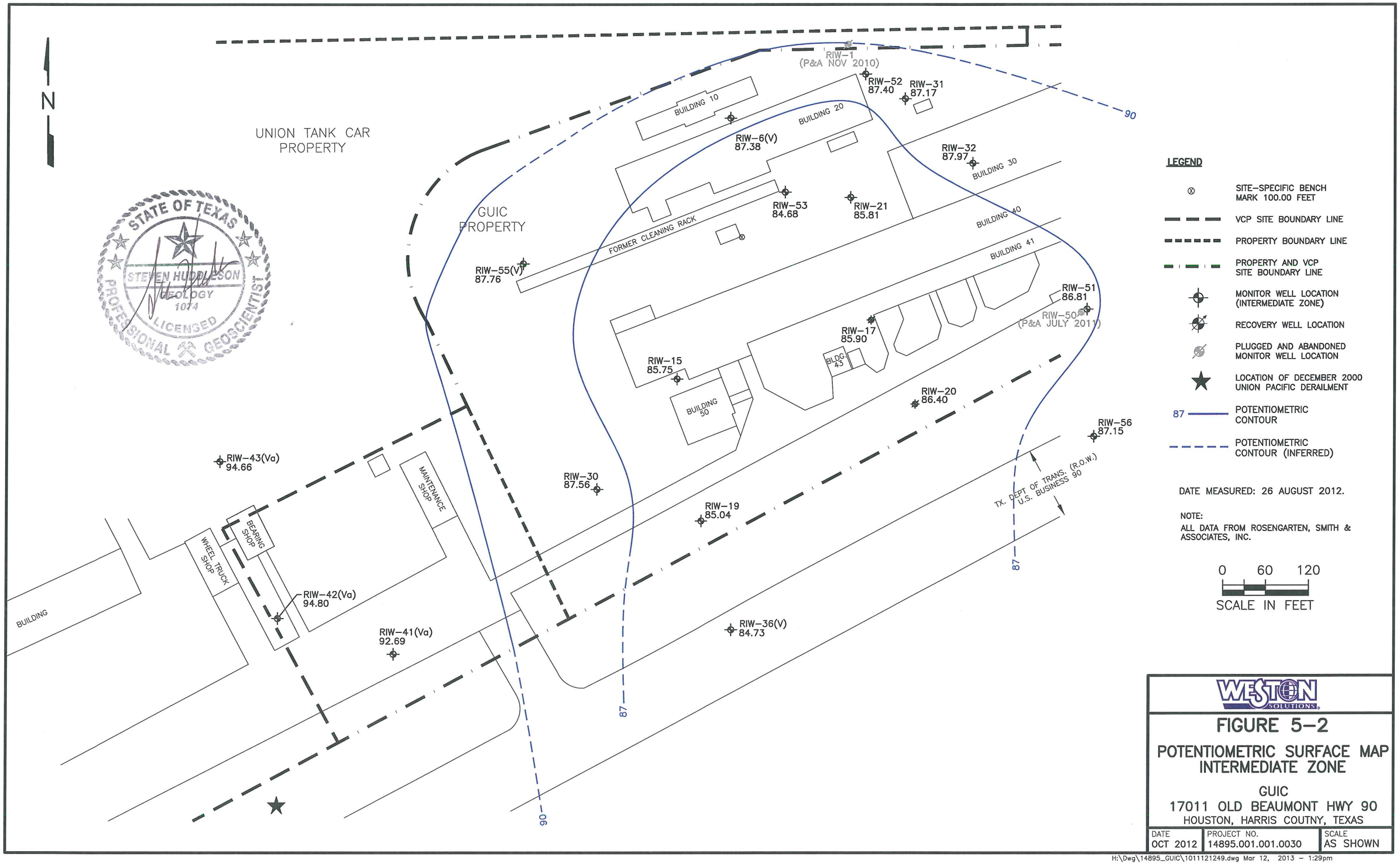
N
UNION TANK CAR PROPERTY
GUIC PROPERTY
STATE OF TEXAS
STEVEN HUDDLESON
GEOLOGY
1074
LICENSED
PROFESSIONAL GEOSCIENTIST
RIW-1 (P&A NOV 2010)
RIW-52 87.40
RIW-31 87.17
BUILDING 10
BUILDING 20
RIW-6(V) 87.38
RIW-32 87.97
BUILDING 30
RIW-53 84.68
RIW-21 85.81
BUILDING 40
FORMER CLEANING RACK
BUILDING 41
RIW-55(V) 87.76
RIW-51 86.81
RIW-50 (P&A JULY 2011)
RIW-17 85.90
BLDG 43
RIW-15 85.75
BUILDING 50
RIW-20 86.40
RIW-56 87.15
RIW-43(Va) 94.66
MAINTENANCE SHOP
RIW-30 87.56
RIW-19 85.04
TX. DEPT OF TRANS. (R.O.W.) U.S. BUSINESS 90
BEARING SHOP
WHEEL TRUCK SHOP
RIW-42(Va) 94.80
BUILDING
RIW-41(Va) 92.69
RIW-36(V) 84.73
90
87
LEGEND
SITE-SPECIFIC BENCH MARK 100.00 FEET
VCP SITE BOUNDARY LINE
PROPERTY BOUNDARY LINE
PROPERTY AND VCP SITE BOUNDARY LINE
MONITOR WELL LOCATION (INTERMEDIATE ZONE)
RECOVERY WELL LOCATION
PLUGGED AND ABANDONED MONITOR WELL LOCATION
LOCATION OF DECEMBER 2000 UNION PACIFIC DERAILMENT
87 POTENTIOMETRIC CONTOUR
POTENTIOMETRIC CONTOUR (INFERRED)
DATE MEASURED: 26 AUGUST 2012.
NOTE:
ALL DATA FROM ROSENGARTEN, SMITH & ASSOCIATES, INC.
0 60 120
SCALE IN FEET
WESTON SOLUTIONS
FIGURE 5-2
POTENTIOMETRIC SURFACE MAP INTERMEDIATE ZONE
GUIC
17011 OLD BEAUMONT HWY 90
HOUSTON, HARRIS COUTNY, TEXAS
DATE OCT 2012
PROJECT NO. 14895.001.001.0030
SCALE AS SHOWN
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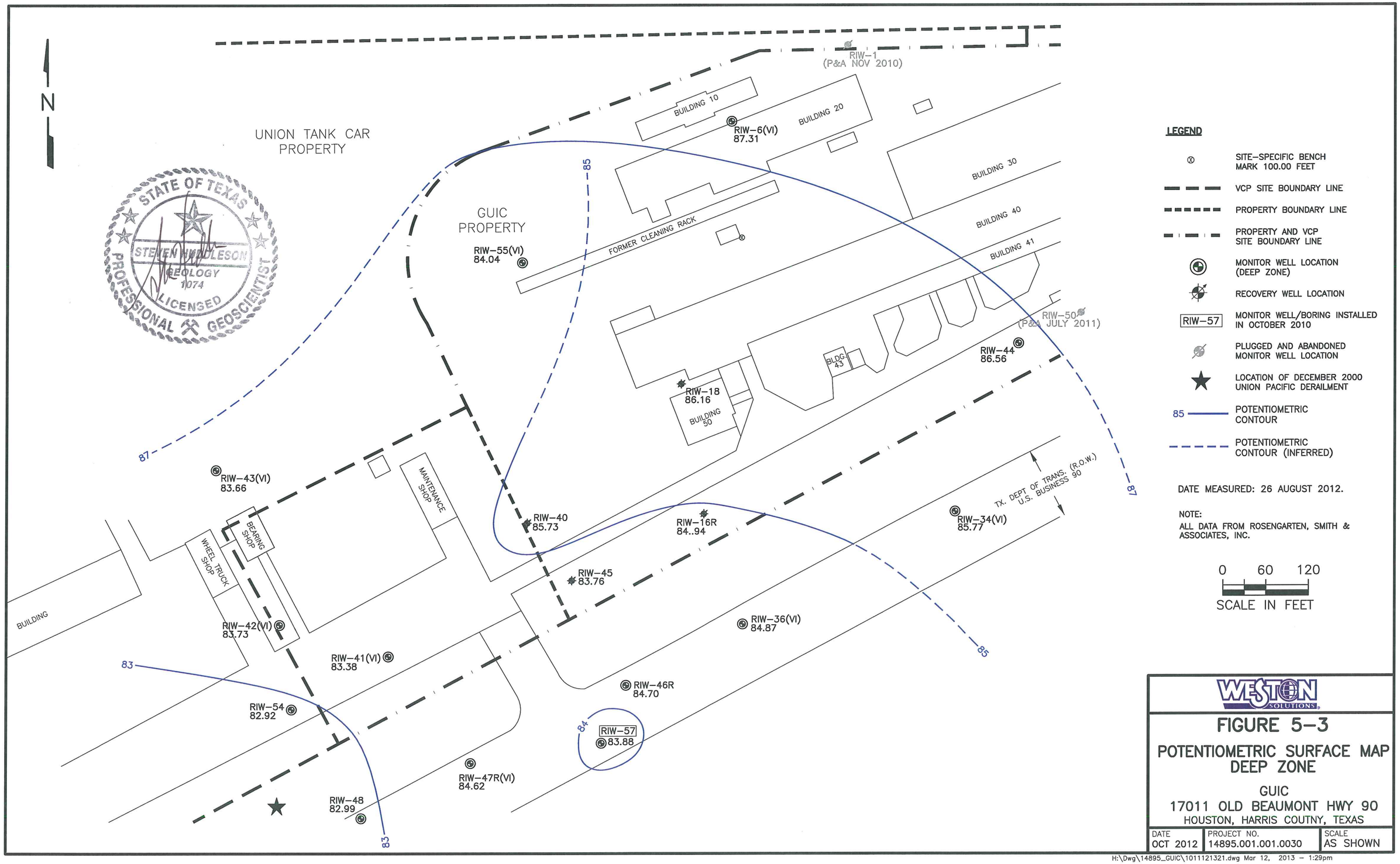
N
UNION TANK CAR PROPERTY
GUIC PROPERTY
STATE OF TEXAS
STEVEN HANDLESON
GEOLOGY
1074
LICENSED
PROFESSIONAL GEOSCIENTIST
RIW-1 (P&A NOV 2010)
BUILDING 10
BUILDING 20
RIW-6(VI) 87.31
BUILDING 30
BUILDING 40
BUILDING 41
FORMER CLEANING RACK
RIW-55(VI) 84.04
RIW-50 (P&A JULY 2011)
RIW-44 86.56
BLDG 43
RIW-18 86.16
BUILDING 50
85
87
RIW-43(VI) 83.66
MAINTENANCE SHOP
BEARING SHOP
WHEEL TRUCK SHOP
BUILDING
RIW-40 85.73
RIW-16R 84..94
RIW-34(VI) 85.77
TX. DEPT OF TRANS. (R.O.W.) U.S. BUSINESS 90
RIW-45 83.76
RIW-42(VI) 83.73
RIW-36(VI) 84.87
RIW-41(VI) 83.38
83
RIW-46R 84.70
RIW-54 82.92
84
RIW-57 83.88
RIW-47R(VI) 84.62
RIW-48 82.99
LEGEND
SITE-SPECIFIC BENCH MARK 100.00 FEET
VCP SITE BOUNDARY LINE
PROPERTY BOUNDARY LINE
PROPERTY AND VCP SITE BOUNDARY LINE
MONITOR WELL LOCATION (DEEP ZONE)
RECOVERY WELL LOCATION
RIW-57 MONITOR WELL/BORING INSTALLED IN OCTOBER 2010
PLUGGED AND ABANDONED MONITOR WELL LOCATION
LOCATION OF DECEMBER 2000 UNION PACIFIC DERAILMENT
85 POTENTIOMETRIC CONTOUR
POTENTIOMETRIC CONTOUR (INFERRED)
DATE MEASURED: 26 AUGUST 2012.
NOTE:
ALL DATA FROM ROSENGARTEN, SMITH & ASSOCIATES, INC.
0 60 120
SCALE IN FEET
WESTON SOLUTIONS
FIGURE 5-3
POTENTIOMETRIC SURFACE MAP DEEP ZONE
GUIC
17011 OLD BEAUMONT HWY 90
HOUSTON, HARRIS COUTNY, TEXAS
DATE OCT 2012
PROJECT NO. 14895.001.001.0030
SCALE AS SHOWN
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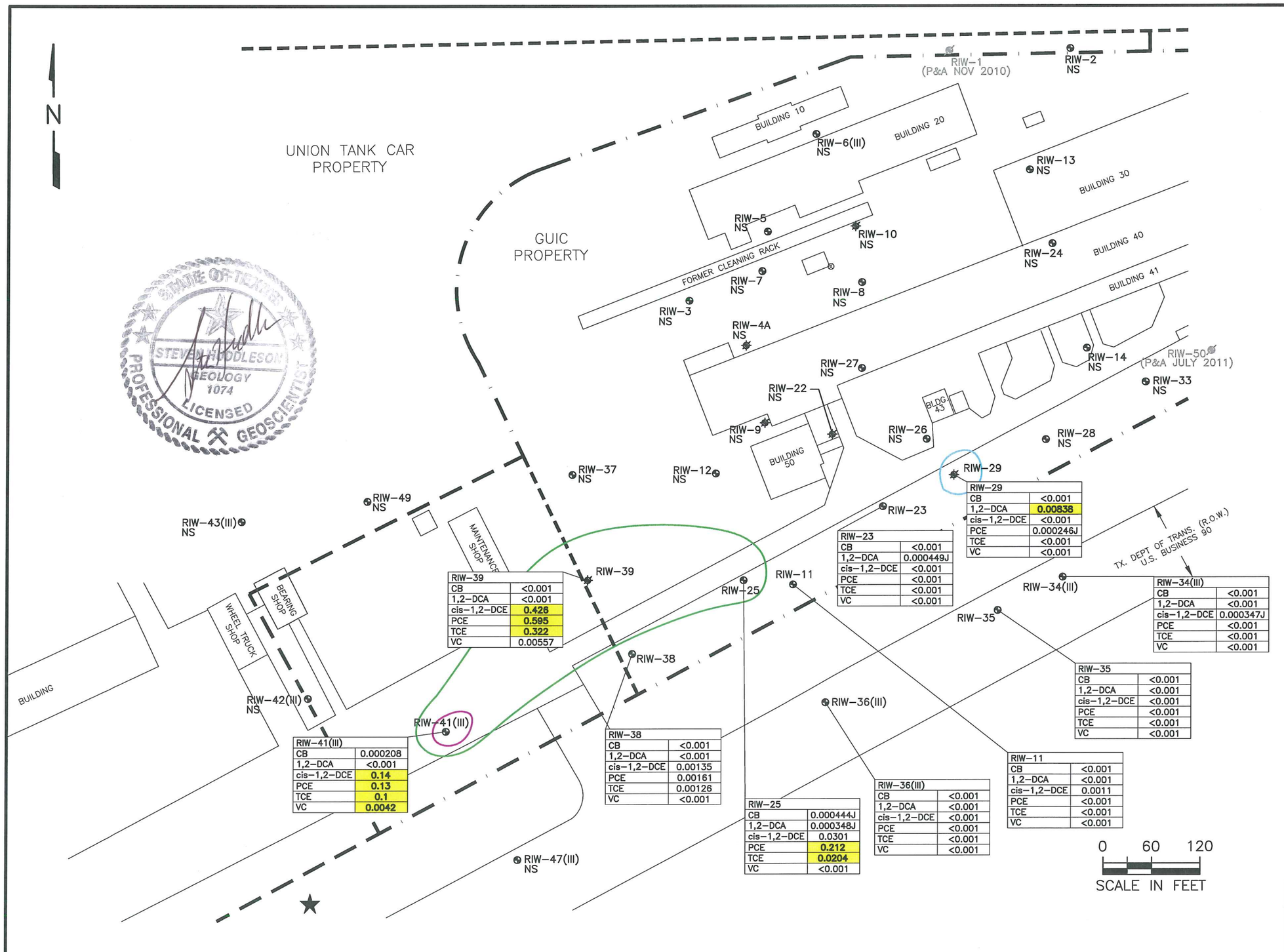

RIW-29	
CB	<0.001
1,2-DCA	0.00838
cis-1,2-DCE	<0.001
PCE	0.000246J
TCE	<0.001
VC	<0.001

RIW-23	
CB	<0.001
1,2-DCA	0.000449J
cis-1,2-DCE	<0.001
PCE	<0.001
TCE	<0.001
VC	<0.001

RIW-39	
CB	<0.001
1,2-DCA	<0.001
cis-1,2-DCE	0.428
PCE	0.595
TCE	0.322
VC	0.00557

RIW-34(III)	
CB	<0.001
1,2-DCA	<0.001
cis-1,2-DCE	0.000347J
PCE	<0.001
TCE	<0.001
VC	<0.001

RIW-35	
CB	<0.001
1,2-DCA	<0.001
cis-1,2-DCE	<0.001
PCE	<0.001
TCE	<0.001
VC	<0.001

RIW-41(III)	
CB	0.000208
1,2-DCA	<0.001
cis-1,2-DCE	0.14
PCE	0.13
TCE	0.1
VC	0.0042

RIW-38	
CB	<0.001
1,2-DCA	<0.001
cis-1,2-DCE	0.00135
PCE	0.00161
TCE	0.00126
VC	<0.001

RIW-25	
CB	0.000444J
1,2-DCA	0.000348J
cis-1,2-DCE	0.0301
PCE	0.212
TCE	0.0204
VC	<0.001

RIW-36(III)	
CB	<0.001
1,2-DCA	<0.001
cis-1,2-DCE	<0.001
PCE	<0.001
TCE	<0.001
VC	<0.001

RIW-11	
CB	<0.001
1,2-DCA	<0.001
cis-1,2-DCE	0.0011
PCE	<0.001
TCE	<0.001
VC	<0.001

LEGEND

- ⊗ SITE-SPECIFIC BENCH MARK 100.00 FEET
- VCP SITE BOUNDARY LINE
- PROPERTY BOUNDARY LINE
- PROPERTY AND VCP SITE BOUNDARY LINE
- MONITOR WELL LOCATION (SHALLOW ZONE)
- RECOVERY WELL LOCATION
- PLUGGED AND ABANDONED MONITOR WELL LOCATION
- ★ LOCATION OF DECEMBER 2000 UNION PACIFIC DERAILMENT
- VINYL CHLORIDE PCLE ZONE
- cis-1,2-DCE, PCE, AND TCE PCLE ZONE
- 1,2-DCE PCLE ZONE
- J ESTIMATED VALUE
- NS NOT SAMPLED

NOTES:

1. CONCENTRATIONS IN mg/L.
2. WELLS SAMPLED AUGUST 2012.
3. HIGHLIGHTED CONCENTRATIONS EXCEED TIER $1^{GW}_{GW_{ING}}$ RESIDENTIAL PCLs:
   0.1 mg/L FOR CHLOROBENZENE
   0.005 mg/L FOR 1,2-DICHLOROETHANE
   0.07 mg/L FOR cis-1,2-DCE
   0.005 mg/L FOR PCE
   0.005 mg/L FOR TCE
   0.002 mg/L FOR VC
4. ALL DATA FROM ROSENGARTEN, SMITH & ASSOCIATES, INC.

CB = CHLOROBENZENE
1,2-DCE = cis-1,2-DICHLOROETHANE
cis-1,2-DCE = cis-1,2-DICHLOROETHENE
PCE = TETRACHLOROETHENE
TCE = TRICHLOROETHENE
VC = VINYL CHLORIDE

WESTON SOLUTIONS

FIGURE 6
COC CONCENTRATION MAP SHALLOW ZONE AUGUST 2012

GUIC
17011 OLD BEAUMONT HWY 90
HOUSTON, HARRIS COUTNY, TEXAS

DATE	PROJECT NO.	SCALE
OCT 2012	14895.001.001.0030	AS SHOWN

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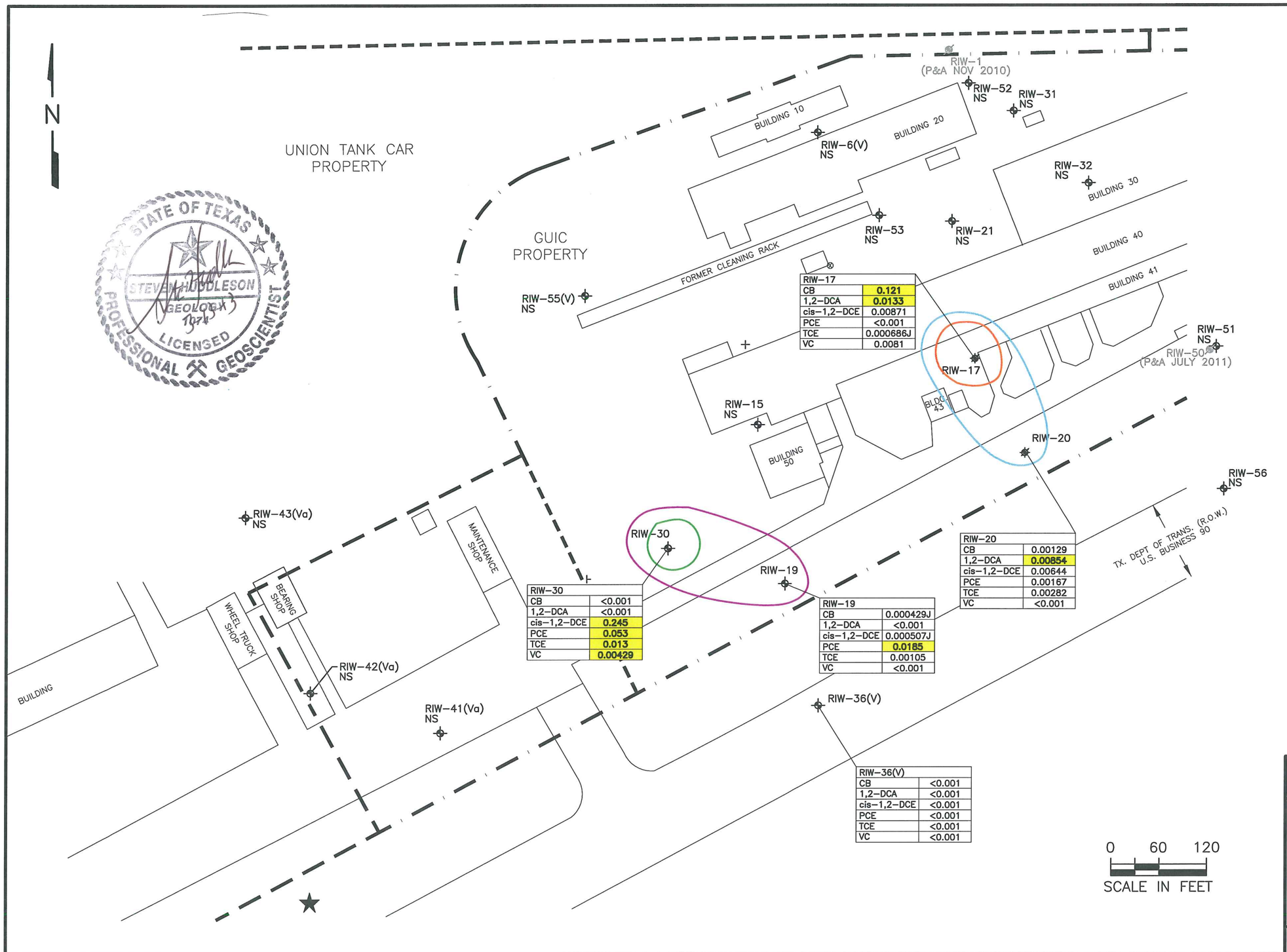

RIW-17	
CB	0.121
1,2-DCA	0.0133
cis-1,2-DCE	0.00871
PCE	<0.001
TCE	0.000686J
VC	0.0081

RIW-20	
CB	0.00129
1,2-DCA	0.00854
cis-1,2-DCE	0.00644
PCE	0.00167
TCE	0.00282
VC	<0.001

RIW-30	
CB	<0.001
1,2-DCA	<0.001
cis-1,2-DCE	0.245
PCE	0.053
TCE	0.013
VC	0.00429

RIW-19	
CB	0.000429J
1,2-DCA	<0.001
cis-1,2-DCE	0.000507J
PCE	0.0185
TCE	0.00105
VC	<0.001

RIW-36(V)	
CB	<0.001
1,2-DCA	<0.001
cis-1,2-DCE	<0.001
PCE	<0.001
TCE	<0.001
VC	<0.001

LEGEND

- ⊗ SITE-SPECIFIC BENCH MARK 100.00 FEET
- VCP SITE BOUNDARY LINE
- PROPERTY BOUNDARY LINE
- PROPERTY AND VCP SITE BOUNDARY LINE
- MONITOR WELL LOCATION (INTERMEDIATE ZONE)
- RECOVERY WELL LOCATION
- PLUGGED AND ABANDONED MONITOR WELL LOCATION
- ★ LOCATION OF DECEMBER 2000 UNION PACIFIC DERAILMENT
- PCE PCLE ZONE
- cis-1,2-DCE, TCE, AND VC PCLE ZONE
- 1,2-DCE PCLE ZONE
- CHLOROBENZENE PCLE ZONE
- J ESTIMATED VALUE
- NS NOT SAMPLED

NOTES:

1. CONCENTRATIONS IN mg/L.
2. WELLS SAMPLED AUGUST 2012.
3. HIGHLIGHTED CONCENTRATIONS EXCEED TIER 1 $^{GW}_{GW_{ING}}$ RESIDENTIAL PCLs:
   0.1 mg/L FOR CHLOROBENZENE
   0.005 mg/L FOR 1,2-DICHLOROETHANE
   0.07 mg/L FOR cis-1,2-DCE
   0.005 mg/L FOR PCE
   0.005 mg/L FOR TCE
   0.002 mg/L FOR VC
4. ALL DATA FROM ROSENGARTEN, SMITH & ASSOCIATES, INC.

CB	=	CHLOROBENZENE
1,2-DCE	=	cis-1,2-DICHLOROETHANE
cis-1,2-DCE	=	cis-1,2-DICHLOROETHENE
PCE	=	TETRACHLOROETHENE
TCE	=	TRICHLOROETHENE
VC	=	VINYL CHLORIDE

WESTON SOLUTIONS

FIGURE 7
COC CONCENTRATION MAP INTERMEDIATE ZONE AUGUST 2012

GUIC
17011 OLD BEAUMONT HWY 90
HOUSTON, HARRIS COUTNY, TEXAS

DATE	PROJECT NO.	SCALE
OCT 2012	14895.001.001.0030	AS SHOWN

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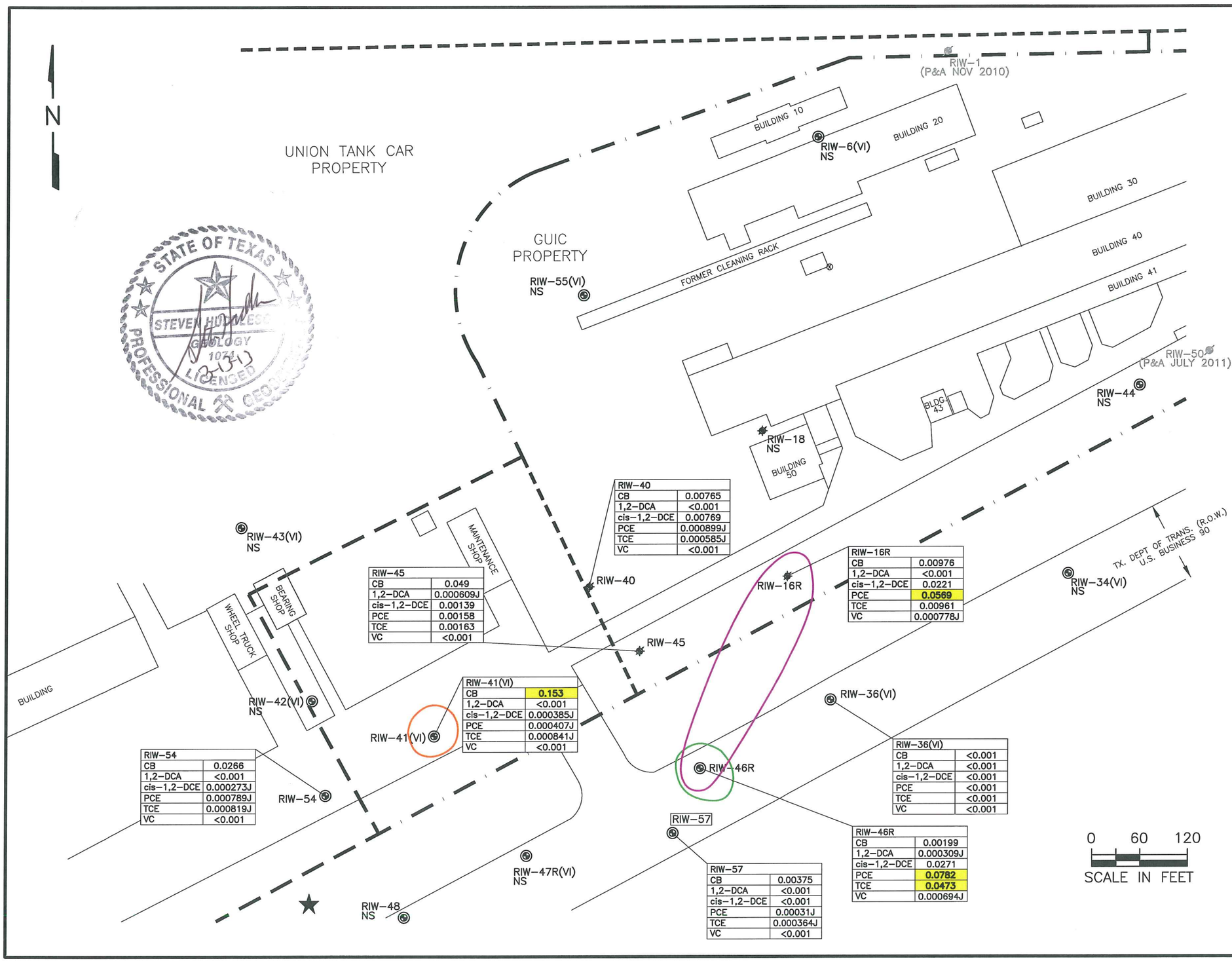

RIW-40	
CB	0.00765
1,2-DCA	<0.001
cis-1,2-DCE	0.00769
PCE	0.000899J
TCE	0.000585J
VC	<0.001

RIW-45	
CB	0.049
1,2-DCA	0.000609J
cis-1,2-DCE	0.00139
PCE	0.00158
TCE	0.00163
VC	<0.001

RIW-16R	
CB	0.00976
1,2-DCA	<0.001
cis-1,2-DCE	0.0221
PCE	0.0569
TCE	0.00961
VC	0.000778J

RIW-41(VI)	
CB	0.153
1,2-DCA	<0.001
cis-1,2-DCE	0.000385J
PCE	0.000407J
TCE	0.000841J
VC	<0.001

RIW-54	
CB	0.0266
1,2-DCA	<0.001
cis-1,2-DCE	0.000273J
PCE	0.000789J
TCE	0.000819J
VC	<0.001

RIW-36(VI)	
CB	<0.001
1,2-DCA	<0.001
cis-1,2-DCE	<0.001
PCE	<0.001
TCE	<0.001
VC	<0.001

RIW-46R	
CB	0.00199
1,2-DCA	0.000309J
cis-1,2-DCE	0.0271
PCE	0.0782
TCE	0.0473
VC	0.000694J

RIW-57	
CB	0.00375
1,2-DCA	<0.001
cis-1,2-DCE	<0.001
PCE	0.00031J
TCE	0.000364J
VC	<0.001

STATE OF TEXAS
STEVEN HUDALESS
GEOLOGY
1074
LICENSED
PROFESSIONAL GEOLOGIST
3-13

LEGEND

- SITE-SPECIFIC BENCH MARK 100.00 FEET
- VCP SITE BOUNDARY LINE
- PROPERTY BOUNDARY LINE
- PROPERTY AND VCP SITE BOUNDARY LINE
- MONITOR WELL LOCATION (DEEP ZONE)
- RECOVERY WELL LOCATION
- RIW-57 — MONITOR WELL/BORING INSTALLED IN OCTOBER 2010
- PLUGGED AND ABANDONED MONITOR WELL LOCATION
- LOCATION OF DECEMBER 2000 UNION PACIFIC DERAILMENT
- CHLOROBENZENE PCLE ZONE
- TCE PCLE ZONE
- PCE PCLE ZONE
- J — ESTIMATED VALUE
- NS — NOT SAMPLED

NOTES:

1. CONCENTRATIONS IN mg/L.
2. WELLS SAMPLED AUGUST 2012.
3. HIGHLIGHTED CONCENTRATIONS EXCEED TIER $1^{GW}_{GW_{ING}}$ RESIDENTIAL PCLs:
   0.1 mg/L FOR CHLOROBENZENE
   0.005 mg/L FOR 1,2-DICHLOROETHANE
   0.07 mg/L FOR cis-1,2-DCE
   0.005 mg/L FOR PCE
   0.005 mg/L FOR TCE
   0.002 mg/L FOR VC
4. ALL DATA FROM ROSENGARTEN, SMITH & ASSOCIATES, INC.

CB	=	CHLOROBENZENE
1,2-DCE	=	cis-1,2-DICHLOROETHANE
cis-1,2-DCE	=	cis-1,2-DICHLOROETHENE
PCE	=	TETRACHLOROETHENE
TCE	=	TRICHLOROETHENE
VC	=	VINYL CHLORIDE

WESTON SOLUTIONS

FIGURE 8
COC CONCENTRATION MAP DEEP ZONE AUGUST 2012
GUIC
17011 OLD BEAUMONT HWY 90
HOUSTON, HARRIS COUTNY, TEXAS

DATE	PROJECT NO.	SCALE
OCT 2012	14895.001.001.0030	AS SHOWN

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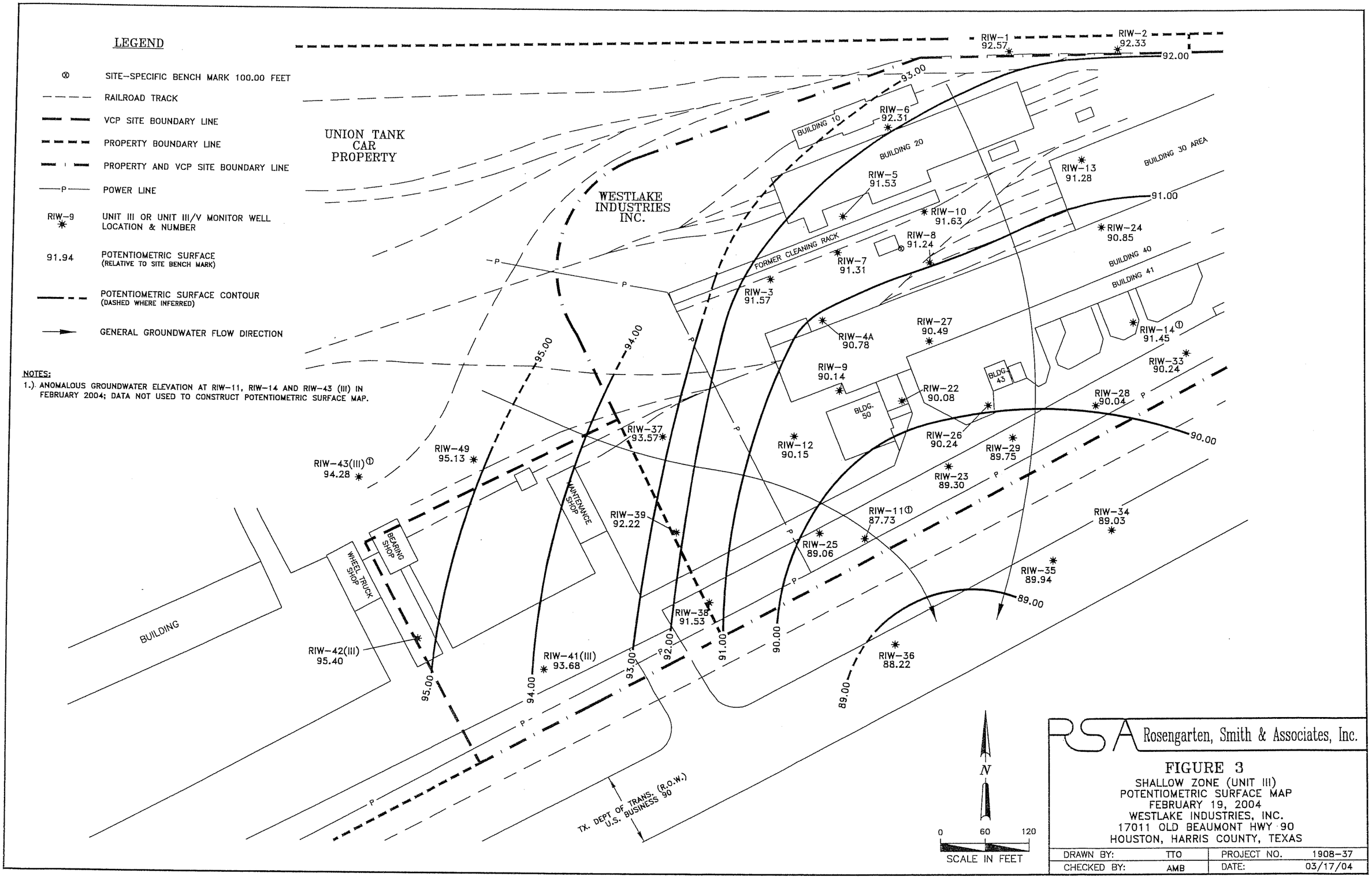
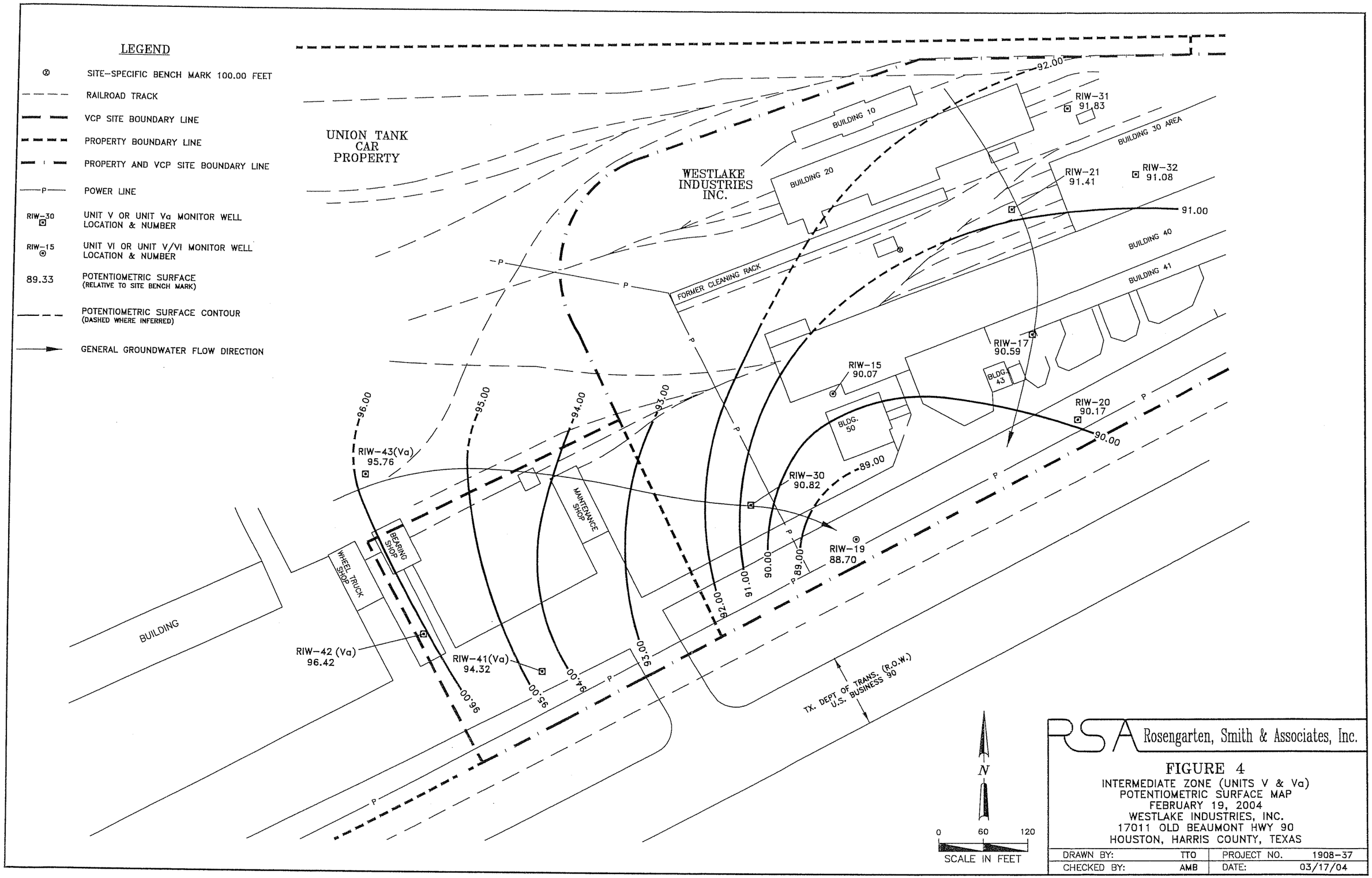

LEGEND
SITE-SPECIFIC BENCH MARK 100.00 FEET
RAILROAD TRACK
VCP SITE BOUNDARY LINE
PROPERTY BOUNDARY LINE
PROPERTY AND VCP SITE BOUNDARY LINE
POWER LINE
RIW-9
UNIT III OR UNIT III/V MONITOR WELL LOCATION & NUMBER
91.94
POTENTIOMETRIC SURFACE (RELATIVE TO SITE BENCH MARK)
POTENTIOMETRIC SURFACE CONTOUR (DASHED WHERE INFERRED)
GENERAL GROUNDWATER FLOW DIRECTION
NOTES:
1.) ANOMALOUS GROUNDWATER ELEVATION AT RIW-11, RIW-14 AND RIW-43 (III) IN FEBRUARY 2004; DATA NOT USED TO CONSTRUCT POTENTIOMETRIC SURFACE MAP.
UNION TANK CAR PROPERTY
WESTLAKE INDUSTRIES INC.
BUILDING 10
BUILDING 20
BUILDING 30 AREA
BUILDING 40
BUILDING 41
FORMER CLEANING RACK
BLDG. 43
BLDG. 50
MAINTENANCE SHOP
BEARING SHOP
WHEEL TRUCK SHOP
BUILDING
TX. DEPT OF TRANS. (R.O.W.) U.S. BUSINESS 90
RIW-1 92.57
RIW-2 92.33
RIW-6 92.31
RIW-5 91.53
RIW-13 91.28
RIW-10 91.63
RIW-8 91.24
RIW-24 90.85
RIW-7 91.31
RIW-3 91.57
RIW-4A 90.78
RIW-27 90.49
RIW-14 91.45
RIW-9 90.14
RIW-33 90.24
RIW-22 90.08
RIW-28 90.04
RIW-26 90.24
RIW-29 89.75
RIW-12 90.15
RIW-23 89.30
RIW-37 93.57
RIW-49 95.13
RIW-43(III) 94.28
RIW-39 92.22
RIW-11 87.73
RIW-34 89.03
RIW-25 89.06
RIW-35 89.94
RIW-38 91.53
RIW-42(III) 95.40
RIW-41(III) 93.68
RIW-36 88.22
92.00
93.00
91.00
90.00
89.00
95.00
94.00
92.00
93.00
91.00
90.00
89.00
N
0 60 120
SCALE IN FEET
RSA Rosengarten, Smith & Associates, Inc.
FIGURE 3
SHALLOW ZONE (UNIT III)
POTENTIOMETRIC SURFACE MAP
FEBRUARY 19, 2004
WESTLAKE INDUSTRIES, INC.
17011 OLD BEAUMONT HWY 90
HOUSTON, HARRIS COUNTY, TEXAS
DRAWN BY: TTO
PROJECT NO. 1908-37
CHECKED BY: AMB
DATE: 03/17/04



Rosengarten, Smith & Associates, Inc.

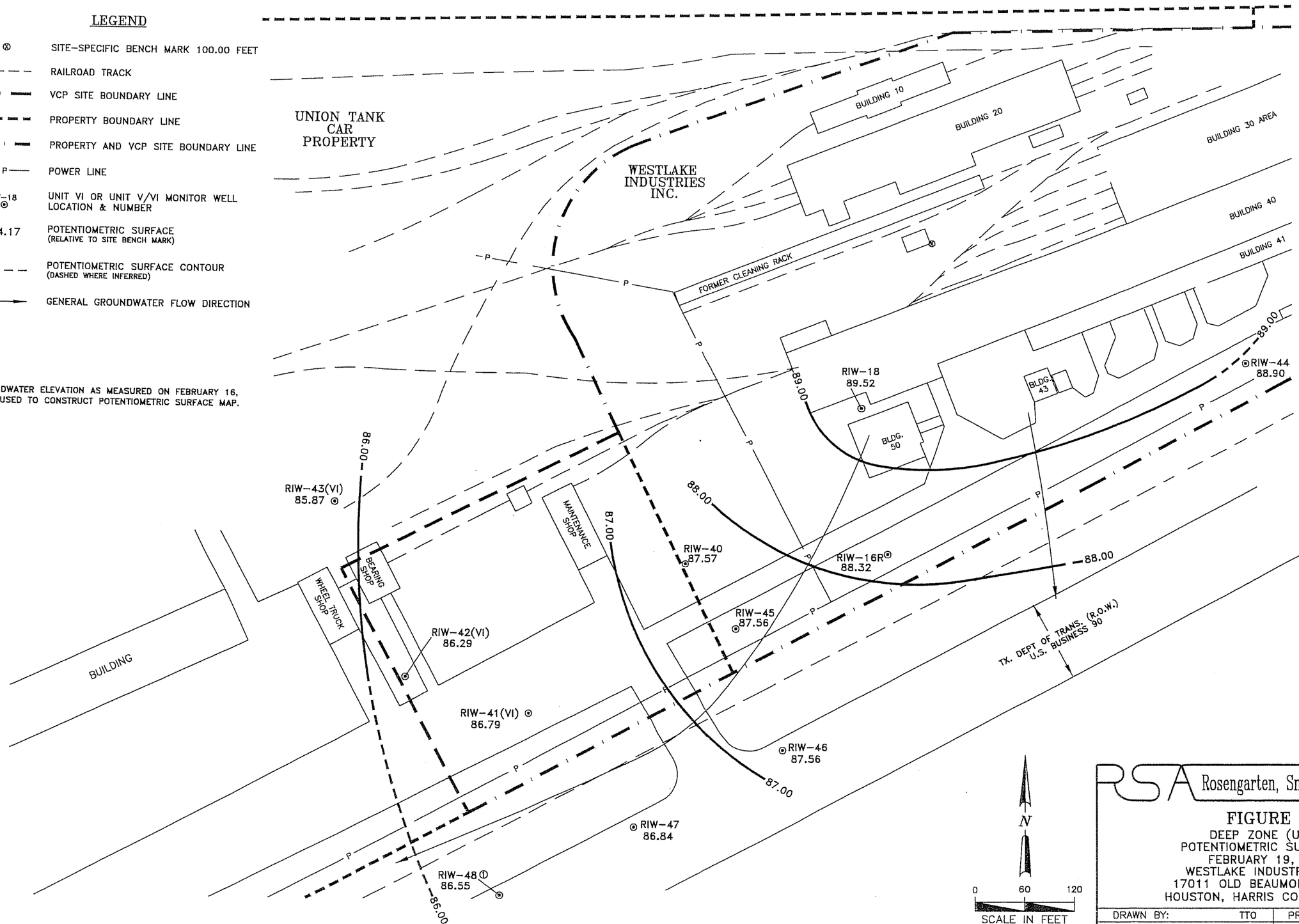
FIGURE 4
INTERMEDIATE ZONE (UNITS V & Va)
POTENTIOMETRIC SURFACE MAP
FEBRUARY 19, 2004
WESTLAKE INDUSTRIES, INC.
17011 OLD BEAUMONT HWY 90
HOUSTON, HARRIS COUNTY, TEXAS

DRAWN BY:	TTO	PROJECT NO.	1908-37
CHECKED BY:	AMB	DATE:	03/17/04

LEGEND

- ⊗ SITE-SPECIFIC BENCH MARK 100.00 FEET
- RAILROAD TRACK
- VCP SITE BOUNDARY LINE
- PROPERTY BOUNDARY LINE
- PROPERTY AND VCP SITE BOUNDARY LINE
- —P— POWER LINE
- RIW-18 ⊙ UNIT VI OR UNIT V/VI MONITOR WELL LOCATION & NUMBER
- 74.17 POTENTIOMETRIC SURFACE (RELATIVE TO SITE BENCH MARK)
- POTENTIOMETRIC SURFACE CONTOUR (DASHED WHERE INFERRED)
- GENERAL GROUNDWATER FLOW DIRECTION

NOTES:
1.) GROUNDWATER ELEVATION AS MEASURED ON FEBRUARY 16, 2004 USED TO CONSTRUCT POTENTIOMETRIC SURFACE MAP.

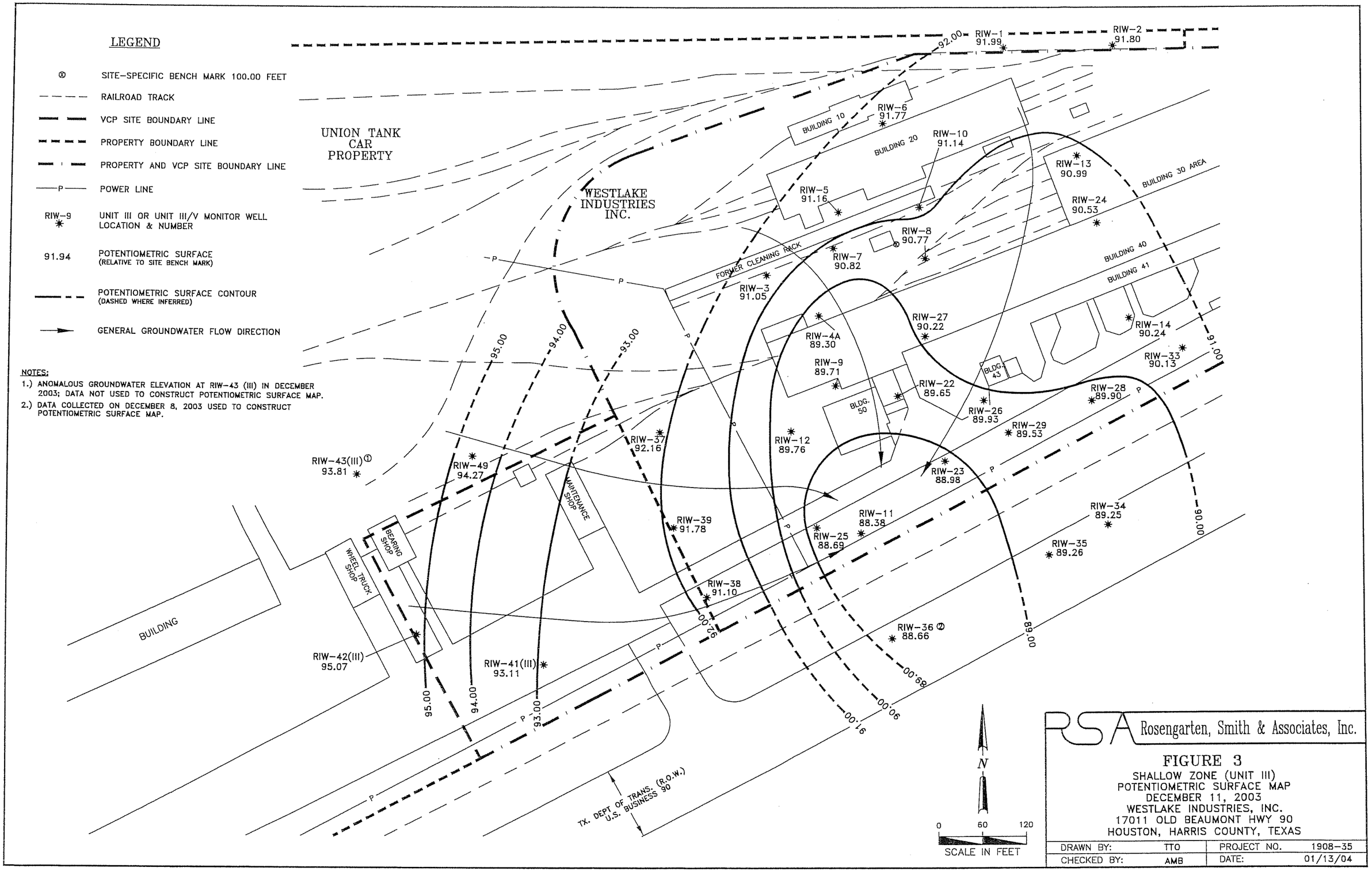


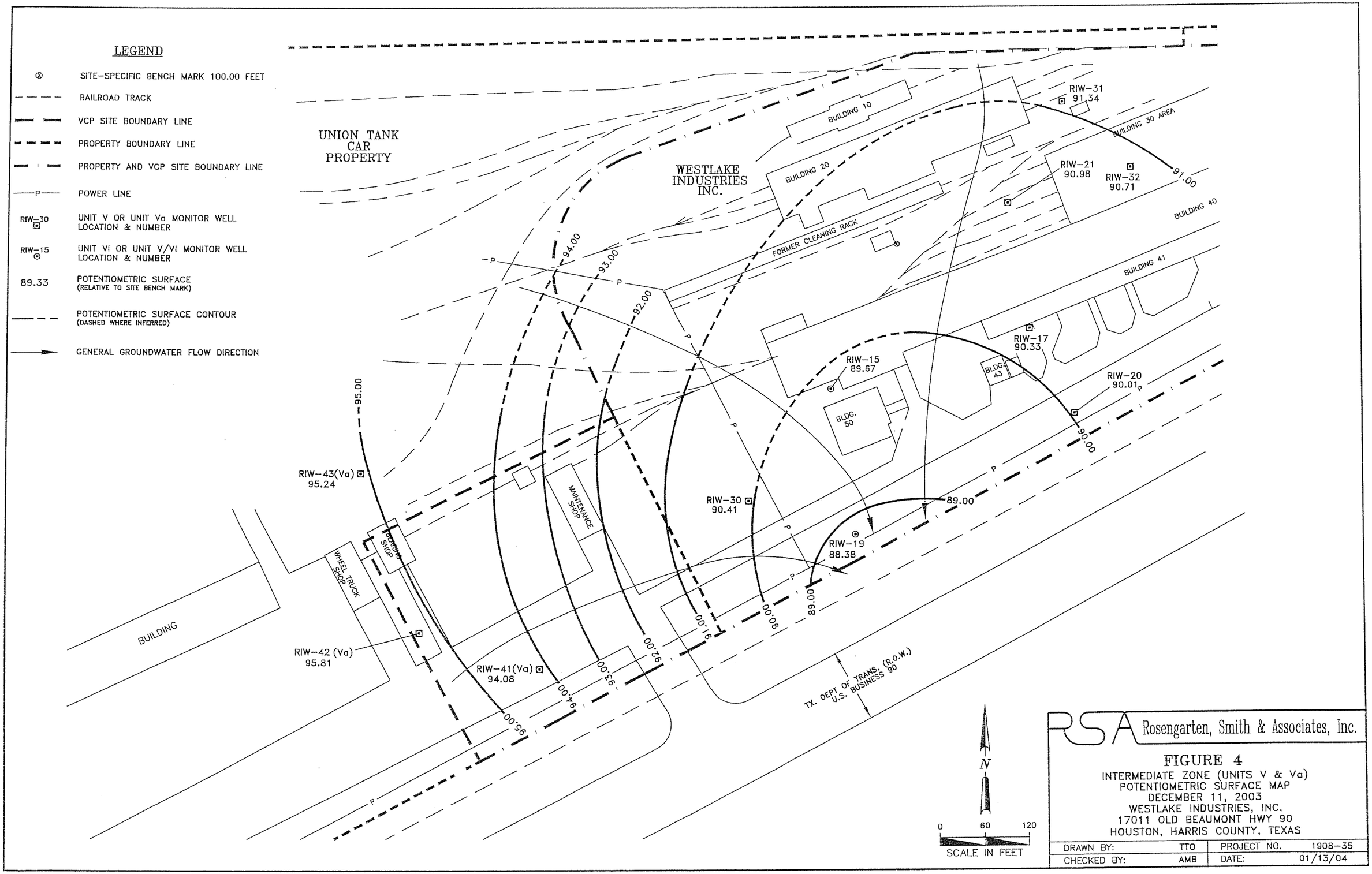
Rosengarten, Smith & Associates, Inc.

FIGURE 5

DEEP ZONE (UNIT VI)
POTENTIOMETRIC SURFACE MAP
FEBRUARY 19, 2004
WESTLAKE INDUSTRIES, INC.
17011 OLD BEAUMONT HWY 90
HOUSTON, HARRIS COUNTY, TEXAS

DRAWN BY:	TTO	PROJECT NO.	1908-37
CHECKED BY:	AMB	DATE:	03/17/04


LEGEND
SITE-SPECIFIC BENCH MARK 100.00 FEET
RAILROAD TRACK
VCP SITE BOUNDARY LINE
PROPERTY BOUNDARY LINE
PROPERTY AND VCP SITE BOUNDARY LINE
POWER LINE
RIW-9
UNIT III OR UNIT III/V MONITOR WELL LOCATION & NUMBER
91.94
POTENTIOMETRIC SURFACE (RELATIVE TO SITE BENCH MARK)
POTENTIOMETRIC SURFACE CONTOUR (DASHED WHERE INFERRED)
GENERAL GROUNDWATER FLOW DIRECTION
NOTES:
1.) ANOMALOUS GROUNDWATER ELEVATION AT RIW-43 (III) IN DECEMBER 2003; DATA NOT USED TO CONSTRUCT POTENTIOMETRIC SURFACE MAP.
2.) DATA COLLECTED ON DECEMBER 8, 2003 USED TO CONSTRUCT POTENTIOMETRIC SURFACE MAP.
UNION TANK CAR PROPERTY
WESTLAKE INDUSTRIES INC.
BUILDING 10
BUILDING 20
BUILDING 30 AREA
BUILDING 40
BUILDING 41
FORMER CLEANING RACK
BLDG. 43
BLDG. 50
MAINTENANCE SHOP
BEARING SHOP
WHEEL TRUCK SHOP
BUILDING
TX. DEPT OF TRANS. (R.O.W.) U.S. BUSINESS 90
RIW-1 91.99
RIW-2 91.80
RIW-6 91.77
RIW-10 91.14
RIW-13 90.99
RIW-5 91.16
RIW-24 90.53
RIW-8 90.77
RIW-7 90.82
RIW-3 91.05
RIW-27 90.22
RIW-4A 89.30
RIW-14 90.24
RIW-9 89.71
RIW-33 90.13
RIW-22 89.65
RIW-28 89.90
RIW-26 89.93
RIW-29 89.53
RIW-12 89.76
RIW-37 92.16
RIW-43(III) 93.81
RIW-49 94.27
RIW-23 88.98
RIW-39 91.78
RIW-11 88.38
RIW-34 89.25
RIW-25 88.69
RIW-35 89.26
RIW-38 91.10
RIW-36 88.66
RIW-42(III) 95.07
RIW-41(III) 93.11
92.00
91.00
90.00
89.00
88.00
95.00
94.00
93.00
N
0 60 120
SCALE IN FEET
Rosengarten, Smith & Associates, Inc.
FIGURE 3
SHALLOW ZONE (UNIT III)
POTENTIOMETRIC SURFACE MAP
DECEMBER 11, 2003
WESTLAKE INDUSTRIES, INC.
17011 OLD BEAUMONT HWY 90
HOUSTON, HARRIS COUNTY, TEXAS
DRAWN BY: TTO
PROJECT NO. 1908-35
CHECKED BY: AMB
DATE: 01/13/04


LEGEND
SITE-SPECIFIC BENCH MARK 100.00 FEET
RAILROAD TRACK
VCP SITE BOUNDARY LINE
PROPERTY BOUNDARY LINE
PROPERTY AND VCP SITE BOUNDARY LINE
POWER LINE
RIW-30 UNIT V OR UNIT Va MONITOR WELL LOCATION & NUMBER
RIW-15 UNIT VI OR UNIT V/VI MONITOR WELL LOCATION & NUMBER
89.33 POTENTIOMETRIC SURFACE (RELATIVE TO SITE BENCH MARK)
POTENTIOMETRIC SURFACE CONTOUR (DASHED WHERE INFERRED)
GENERAL GROUNDWATER FLOW DIRECTION
UNION TANK CAR PROPERTY
WESTLAKE INDUSTRIES INC.
BUILDING 10
BUILDING 20
BUILDING 30 AREA
BUILDING 40
BUILDING 41
FORMER CLEANING RACK
RIW-31 91.34
RIW-21 90.98
RIW-32 90.71
RIW-17 90.33
RIW-15 89.67
RIW-20 90.01
RIW-30 90.41
RIW-19 88.38
RIW-43(Va) 95.24
RIW-42 (Va) 95.81
RIW-41(Va) 94.08
BLDG. 43
BLDG. 50
MAINTENANCE SHOP
WHEEL TRUCK SHOP
BUILDING
91.00
90.00
89.00
92.00
93.00
94.00
95.00
TX. DEPT OF TRANS. (R.O.W.) U.S. BUSINESS 90
N
0 60 120
SCALE IN FEET
Rosengarten, Smith & Associates, Inc.
FIGURE 4
INTERMEDIATE ZONE (UNITS V & Va)
POTENTIOMETRIC SURFACE MAP
DECEMBER 11, 2003
WESTLAKE INDUSTRIES, INC.
17011 OLD BEAUMONT HWY 90
HOUSTON, HARRIS COUNTY, TEXAS
DRAWN BY: TTO
PROJECT NO. 1908-35
CHECKED BY: AMB
DATE: 01/13/04

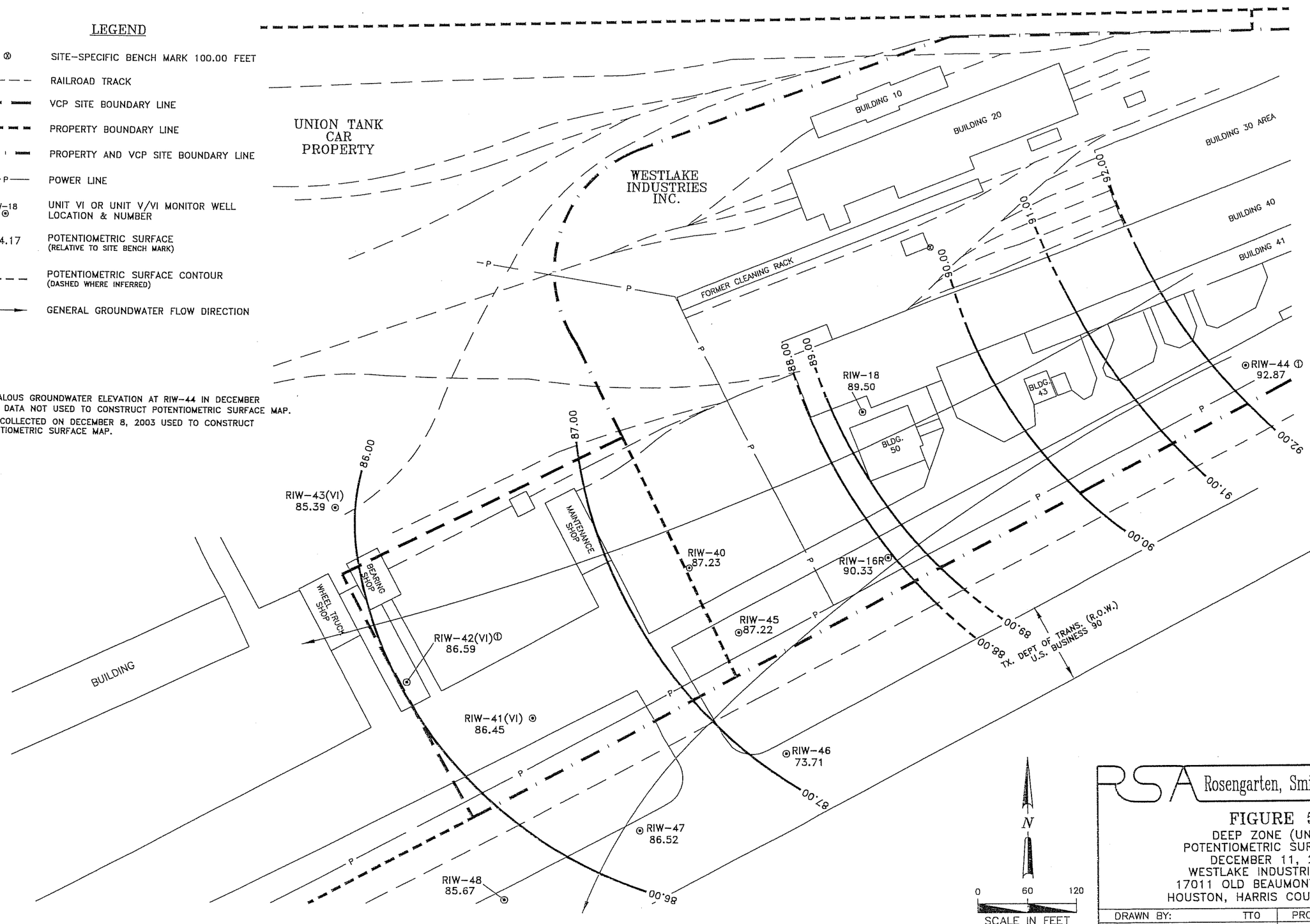
LEGEND

- ⊗ SITE-SPECIFIC BENCH MARK 100.00 FEET
- RAILROAD TRACK
- VCP SITE BOUNDARY LINE
- PROPERTY BOUNDARY LINE
- PROPERTY AND VCP SITE BOUNDARY LINE
- —P— POWER LINE
- RIW-18 ⊙ UNIT VI OR UNIT V/VI MONITOR WELL LOCATION & NUMBER
- 74.17 POTENTIOMETRIC SURFACE (RELATIVE TO SITE BENCH MARK)
- POTENTIOMETRIC SURFACE CONTOUR (DASHED WHERE INFERRED)
- GENERAL GROUNDWATER FLOW DIRECTION

NOTES:

1.) ANOMALOUS GROUNDWATER ELEVATION AT RIW-44 IN DECEMBER 2003; DATA NOT USED TO CONSTRUCT POTENTIOMETRIC SURFACE MAP.

2.) DATA COLLECTED ON DECEMBER 8, 2003 USED TO CONSTRUCT POTENTIOMETRIC SURFACE MAP.



Rosengarten, Smith & Associates, Inc.

FIGURE 5
DEEP ZONE (UNIT VI)
POTENTIOMETRIC SURFACE MAP
DECEMBER 11, 2003
WESTLAKE INDUSTRIES, INC.
17011 OLD BEAUMONT HWY 90
HOUSTON, HARRIS COUNTY, TEXAS

DRAWN BY:	TTO	PROJECT NO.	1908-35
CHECKED BY:	AMB	DATE:	01/13/04

Appendix D

For each contaminate of concern within the ingestion protective concentration level exceedence zone provide the following:

a. *A description of the ingestion protective concentration level exceedence zone and the non-ingestion protective concentration level exceedence zone, including a specification of the horizontal area and the minimum and maximum depth below ground surface.*

b. *The level of contamination, the ingestion protective concentration level, and the non-ingestion protective concentration level, all expressed as mg/L units.*

c. *Its basic geochemical properties (e.g., whether the contaminant of concern migrates with groundwater, floats, or is soluble in water).*

The shallow zone is a maximum depth of 22 ft bgs, the intermediate zone is a maximum depth of 35 ft bgs, and the deep zone is a maximum depth of 60 ft bgs.

COC: Chlorobenzene	
Maximum Concentration	0.301 milligrams per liter (mg/L)
Ingestion-Based PCL (Residential $^{GW}GW_{ing}$)	0.01 mg/L
Ingestion-Based PCLE Zone	Intermediate Zone – 5,268.62 ft^2 Deep Zone – 3,117.74 ft^2
Non-Ingestion-Based PCL ($^{Air}GW_{Inh-V}$)	1,200 mg/L
Non-Ingestion-Based PCLE Zone	None
Geochemical/Physical Properties	
Molecular Weight	112.56
Specific Gravity	1.107
Solubility in Water	low
Groundwater Migration	variable
COC: 1,2-Dichloroethane	
Maximum Concentration	0.0241 mg/L
Ingestion-Based PCL (Residential GWGWing)	0.005 mg/L
Ingestion-Based PCLE Zone	Shallow Zone – 2,285.16 ft^2 Intermediate Zone – 19,210.79 ft^2
Non-Ingestion-Based PCL (AirGWInh-V)	33 mg/L
Non-Ingestion-Based PCLE Zone	None

Geochemical/Physical Properties	
Molecular Weight	98.96
Specific Gravity	1.253
Solubility in Water	0.87 grams(g)/100 milliliters (mL)
Groundwater Migration	variable
COC: Tetrachloroethene (PCE)	
Maximum Concentration	0.864 mg/L
Ingestion-Based PCL (Residential GWGWing)	0.005 mg/L
Ingestion-Based PCLE Zone	Intermediate Zone – 19,584.98 ft^2 Deep Zone – 21,611.30 ft^2
Non-Ingestion-Based PCL (AirGWInh-V)	330 mg/L
Non-Ingestion-Based PCLE Zone	None
Geochemical/Physical Properties	
Molecular Weight	165.8
Specific Gravity	1.62
Solubility in Water	Low solubility (0.02%)
Groundwater Migration	variable
COC: Trichloroethene (TCE)	
Maximum Concentration	0.322 mg/L
Ingestion-Based PCL (Residential GWGWing)	0.005 mg/L
Ingestion-Based PCLE Zone	Shallow Zone – 25,980 ft^2 Intermediate Zone – 3,270.89 ft^2 Deep Zone – 4,006.08 ft^2
Non-Ingestion-Based PCL (AirGWInh-V)	160 mg/L
Non-Ingestion-Based PCLE Zone	None
Geochemical/Physical Properties	
Molecular Weight	131.4
Specific Gravity	1.46
Solubility in Water	Moderate (0.1%)
Groundwater Migration	variable

COC: Cis-1,2-Dichloroethene (cis-1,2-DCE)	
Maximum Concentration	0.0241 mg/L
Ingestion-Based PCL (Residential GWGWing)	0.007 mg/L
Ingestion-Based PCLE Zone	Shallow Zone – 53,980 ft^2 Intermediate Zone – 3,270.89 ft^2
Non-Ingestion-Based PCL (AirGWInh-V)	16,000 mg/L
Non-Ingestion-Based PCLE Zone	None
Geochemical/Physical Properties	
Molecular Weight	97
Specific Gravity	1.27
Solubility in Water	Moderate (0.4%)
Groundwater Migration	variable
COC: Vinyl Chloride	
Maximum Concentration	0.00841 mg/L
Ingestion-Based PCL (Residential GWGWing)	0.002 mg/L
Ingestion-Based PCLE Zone	Shallow Zone – 1,588.72 ft^2 Intermediate Zone – 3,270.98 ft^2
Non-Ingestion-Based PCL (AirGWInh-V)	3.6 mg/L
Non-Ingestion-Based PCLE Zone	None
Geochemical/Physical Properties	
Molecular Weight	62.489
Specific Gravity	0.91
Solubility in Water	Insoluble
Groundwater Migration	variable

Appendix E

Provide for each contaminate of concern within the designated groundwater:

a. *A description of the ingestion protective concentration level exceedence zone and the non-ingestion protective concentration level exceedence zone, including a specification of the horizontal area and the minimum and maximum depth below ground surface.*
b. *The level of contamination, the ingestion protective concentration level, and the non-ingestion protective concentration level, all expressed as mg/L units.*
c. *Its basic geochemical properties (e.g., whether the contaminant of concern migrates with groundwater, floats or is soluble in water).*

A description of each contaminant of concern (COC) in the groundwater at the designated properties, as well as those COCs that are defined by a protective concentration level exceedance (PCLE) zone, along with its basic geochemical properties is presented in **Appendix D**. A tabular listing of the maximum concentration for each groundwater COC is provided in **Appendix F**, **Table 1**.

Appendix F

A table displaying the following information for each contaminant of concern, to the extent known:

a. *The maximum concentration level for soil and groundwater, the ingestion protective concentration level, and the non-ingestion protective concentration level, all expressed as mg/L units.*
b. *The critical protective concentration level without the municipal setting designation, highlighting any exceedences.*

Groundwater

Concentrations of chlorobenzene, 1,2-dichloroethane, tetrachloroethene (PCE), and its daughter products were detected at concentrations exceeding their respective Texas Commission on Environmental Quality (TCEQ) Texas Risk Reduction Program (TRRP) Tier 1 protective concentration levels (PCLs). Based on the proposed response actions, institutional controls such as this Municipal Settings Designation (MSD) will be used to gain closure for the groundwater at the designated property, thus eliminating the groundwater ingestion pathway. **Table 1** included in this appendix presents the maximum concentration of each COC in the groundwater at the designated property.

Soils

Concentrations of PCE and its daughter products were detected in the subsurface soil throughout the site. **Table 2** in this appendix presents the maximum concentrations of each COC in the soil at the designated property.

Table 1
Appendix F
Groundwater Maximum Concentration
17011 Old Beaumont Highway 90
Houston, Texas

Chemical of Concern	$^{GW}GW_{Ing}$ (w/o MSD) (mg/L)	$^{Air}GW_{Inh-V}$ (W/MSD) (mg/L)	RIW-16R (8/29/12)	RIW-17 (8/29/12)	RIW-19 (8/29/12)	RIW-20 (8/29/12)	RIW-25 (8/28/12)	RIW-29 (8/28/12)	RIW-30 (8/29/12)	RIW-39 (8/29/12)	RIW-40 (8/28/12)	RIW-41 (VI) (8/29/12)	RIW-46R (8/29/12)
VOCs by EPA Method 8260													
Chlorobenzene	0.1	1200	0.00976	0.121	0.000429J	0.00129	0.000444J	<0.001	<0.001	<0.001	0.00765	0.153	0.00199
1,2-Dichloroethane	0.005	33	<0.001	0.0133	<0.001	0.00854	0.000348J	0.00838	<0.001	<0.001	<0.001	<0.001	0.000309J
cis-1,2-Dichloroethene	0.07	16,000	0.0221	0.00871	0.000507J	0.00644	0.0301	<0.001	0.245	0.426	0.00769	0.000385J	0.0271
Tetrachloroethene	0.005	330	0.0569	<0.001	0.0185	0.00167	0.212	0.000246J	0.053	0.595	0.000899J	0.000407J	0.0782
Trichloroethene	0.005	160	0.00961	0.000686J	0.00105	0.00232	0.0204	<0.001	0.013	0.322	0.000585J	0.000841J	0.0473
Vinyl Chloride	0.002	3.6	0.000778J	0.00841	<0.001	<0.001	<0.001	<0.001	0.00429	0.00557	<0.001	<0.001	0.000694J

Notes:

1. Highlighted concentration levels exceed the TRRP Tier 1 Residential GWGWIng Protective Concentration Level (i.e. without an MSD).
2. Maximum concentration from August 2012 sampling event.

Table 2
Appendix F
Soil Maximum Concentration
17011 Old Beaumont Highway 90
Houston, Texas

Chemical of Concern	$^{GW}Soil_{Ing}$ (w/o MSD) (mg/kg)	$^{Air}Soil_{Inh-V}$ (W/MSD) (mg/kg)	PCES-1A 5'-6' (12/30/98)	PCES-1A 9'-10' (12/30/98)	PCES-4A 5'-6' (12/30/98)	PCES-V 12'-13' (12/29/98)
VOCs by EPA Method 8260						
cis-1,2-Dichloroethene	0.25	12,000	0.494	<0.1	<0.1	<0.1
Tetrachloroethene	0.05	940	<0.1	0.105	0.198	0.436
Trichloroethene	0.034	31	<0.1	<0.1	<0.1	0.121

Notes:

1. Highlighted concentration levels exceed the TRRP Tier 1 Residential $^{GW}Soil_{Ing}$ Protective Concentration Level (i.e. without an MSD).
2. Maximum concentration from August 2012 sampling event.

Appendix G

*A statement as to whether the plume of contamination is stable (i.e., no change), or contracting, and delineated**, <u>with the basis for that statement.</u>** Please include historical sampling data.*

An intrinsic biodegradation evaluation was performed to assess whether naturally occurring microbiological processes were effective in attenuating the dissolved chlorinated compounds. First-order decay rates were evaluated using the Buschek and Alcantar method (1995) to establish the average decay rate based on a long-linear regression analysis of concentrations measured at wells along a primary flowpath. Where available, actual values for physiochemical and hydrogeologic parameters (including dispersion, sorption, and degradation constants) and estimated values based upon literature review were used to develop an intrinsic biodegradation rate for each COC. Three-dimensional groundwater flow and solute transport modeling was performed using MODFLOW and RT3D, respectively. The purpose of the modeling efforts was to simulate chlorinated solvent species (PCE, TCE, cis-1,2-DCE, vinyl chloride [VC], chlorobenzene [CB], and 1,2-dichloroethane [EDC]) dissolved plume migration and attenuation under natural groundwater flow conditions and engineered (pump and treat) conditions, and estimate the times to achieve residential assessment levels (RAL) for contaminant concentration levels.

The groundwater model was calibrated to observed groundwater elevations and aquifer characterization data developed by Rosengarten Smith and Associates (RSA). The model domain was developed to extend horizontally across the site and extend past site boundaries by a sufficient distance to better minimize model boundary effects on simulation results. Vertically, the model domain encompassed the three groundwater bearing units. A copy of the full report prepared by Geosyntec Consultants, Inc. (*GUIC Industries Site; Groundwater Flow and Solute Transport Modeling of Chlorinated Hydrocarbons; August 2011)* is provided in this appendix.

Based upon the results of the numeric model used to evaluate the hydrogeologic regime and biodegradation potential, source chlorinated compounds PCE and TCE are stable and will continue to be stable and decreasing in areal extent following cessation of active remediation activities. Biological degradation daughter compounds including cis-1,2-DCE and VC may increase in concentration and areal extent as biologically mediated degradation processes break down the source compounds, however this increase will not significantly migrate off-site based upon the modeling results.

GUIC INDUSTRIES SITE

GROUNDWATER FLOW AND SOLUTE TRANSPORT MODELING OF CHLORINATED HYDROCARBONS

LETTER REPORT

Prepared for:

WESTON SOLUTIONS, INC.
Houston, Texas

August 2011
Revision 0

Prepared by:

Geosyntec Consultants, Inc.
2240 Sutherland Avenue, Suite 107
Knoxville, Tennessee 37919
(865) 330-0037

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ATTACHMENTS Electronic: model input files and output data with associated Groundwater Vistas and Modelviewer Files

ABBREVIATIONS AND ACRONYMS

µg/l	micrograms per liter
bgs	Below ground surface
CB	Chlorobenzene
c-DCE	Cis-1,2-dichloroethene
EDC	1,2-dichloroethane
Foc	Fraction of Organic Carbon
ft	feet
ft^2	Square feet
Geosyntec	Geosyntec Consultants
gr/cc	Grams per cubic centimeter
PCE	Tetrachloroethene
P&T	Pump and Treat
RAL	Residential Assessment Level
SSR	Sum of squared residuals
TCE	Trichloroethene
TCEQ	Texas Commission on Environmental Quality
USGS	United States Geological Survey
VC	Vinyl Chloride
VOC	volatile organic compound

SECTION I

INTRODUCTION

1.1 TERMS OF REFERENCE

This document presents and discusses the findings of the groundwater flow and solute transport modeling activities completed for GUIC Industries site (Site), located at 17011 Old Beaumont Highway 90 (SR 90) in Houston, Texas, 77049. This letter report was prepared by Geosyntec Consultants (Geosyntec) for Weston Solutions, Inc (Weston). Field datasets including hydrogeologic logs, groundwater elevation data, groundwater solute contours and groundwater solute concentrations used in modeling activities were provided by Weston.

1.2 PURPOSE

Three-dimensional groundwater flow and solute transport modeling was performed using MODFLOW and RT3D, respectively. The purpose of the modeling efforts was to simulate chlorinated solvent species (tetrachloroethene [PCE], trichloroethene [TCE], cis-1,2-dichloroethene [c-DCE], vinyl chloride [VC], chlorobenzene [CB], and 1,2-dichloroethane [EDC]) dissolved plume migration and attenuation under natural groundwater flow conditions and engineered (pump and treat [P&T]) conditions, and estimate the times to achieve residence assessment levels (RAL) for contaminant concentration levels. The purpose of this modeling letter report is to summarize groundwater flow and solute transport model construction, input parameter values and estimated time durations for achieving RAL concentrations.

1.3 REPORT ORGANIZATION

The remainder of this letter report is organized as follows:

- *Section II: Background and Site Conceptualization* provides a brief historical description of the site obtained from previous site assessment and remediation plan reports submitted to Texas Commission on Environmental Quality (TCEQ). This section also presents values of various hydrogeologic parameters such as porosity and hydraulic conductivity selected as model input data.

- *Section III: Model Setup* provides a brief background on the numerical codes MODFLOW and RT3D, and pre/post-processor software Groundwater Vistas. A brief description of the development and calibration of the groundwater flow model for both natural (no-pumping) and engineered (pumping) conditions is presented. Development

of the transport model is also discussed including a description of geochemical parameters such as degradation rates, dispersivity, adsorption, and input concentrations, etc.

- *Section IV: Results, Limitations and Recommendations* describes the simulation results obtained from the numerical modeling effort and the predicted times to reach RAL concentrations. Limitations of the numerical model are also discussed.

- *Section V: References* presents the references used in the preparation of the letter report.

SECTION II

BACKGROUND AND SITE CONCEPTUALIZATION

2.1 SITE LOCATION AND DESCRIPTION

The GUIC Industries site is situated in northeastern Houston (Figure 2-1, obtained from RS&A, 1993a). The site was previously used for industrial purposes as a railcar maintenance and repair facility (RS&A, 1993a) and can be accessed from Old Beaumont Highway 90 (SR 90) to the south.

2.1.1 Major Features

The Site is an irregular-shaped polygon comprised of approximately 280 acres of land located north of Old Beaumont Highway 90 (SR 90) (RS&A, 1993a). The property appears to be bounded by railroad tracks to the north and south with seemingly wooded or possibly agricultural land to the northwest, and another industrial complex to the west. The site map (Figure 2-2) shows the current site configuration as obtained from Weston (CAD drawings) and from orthographic imagery obtained from United States Geological Survey (USGS).

2.1.2 Topography and Surface Features

The GUIC Site is located in Harris County, Texas and in general in the Gulf Coast Plain geographic regions (RS&A, 1993a). The surface topography in the general vicinity of the Site can be described as gently sloping flat plain terrain with broad shallow river and stream valleys (RS&A, 1993a). Weston provided reports containing vertical coordinates of monitoring wells installed at the Site which were georeferenced from a benchmark established at the Site. The vertical elevation of the benchmark was set at 100 feet (ft). Based on the surface elevations of other locations provided by Weston, topographic relief throughout the area ranges from approximately 75 ft to approximately 110 ft. However, based on earlier reports the surface topography varies by approximately 4 ft from the southcentral property line to the northwestern property corner with lower elevations along drainage ways bordering the property. For the purpose of numerical modeling, the average ground surface elevation at the Site was assumed to be 100 ft.

2.2 SITE HISTORY

A detailed site ownership and use history is provided in RS&A (1993a), based on which it is known that the Site was used as a railcar maintenance and repair facility. Site assessment

activities (RS&A, 1993a) have identified volatile organic compounds (VOCs) at the Site. Follow-on investigations identified additional VOCs and lead to further site assessment work at the Site which is outlined in subsequent site assessment documents.

2.3 SITE HYDROGEOLOGY & CONCEPTUALIZATION

The Site is underlain by quartenary-age Beaumont formation generally comprised of interbedded clay, silt, and sand facies of fluvial-deltaic processes (RS&A, 1993b). In total, seven (7) water-bearing lithologic units were identified at the Site (RS&A, 1995a). These water-bearing units are discussed below:

a) Unit I: The uppermost lithologic unit is comprised of blast sand, caliche road-base material, concrete, asphalt, and clayey/sandy loam topsoil with roots. The thickness of this unit is estimated to be approximately 5 to 25 ft below ground surface (bgs).
b) Unit II: Unit I and Unit II are interlaced with Unit I grading into Unit II as a slightly silty clay. Unit II may act as a confining unit for Unit III and is present from approximately 17 ft to 28 ft bgs.
c) Unit III: Is a light gray to white, saturated, fine grained clayey sand to very clayey sand. The top of Unit III can be found generally at a depth of approximately 22 ft to 23.5 ft bgs with the total depth varying from approximately 24 ft to 34 ft bgs. The total thickness of Unit III ranges from two to ten ft.
d) Unit IV: Is comprised of moist to very moist sandy clay and silty clay and varies in thickness from one ft to six ft. The hydraulic conductivity of this formation is very low and site assessment reports have indicated that this unit may act as an aquitard separating Unit III from Unit V. However, site investigations have indicated that this Unit may not be present everywhere and therefore hydraulic connection is present between Unit III and the deeper water-bearing units.
e) Unit V: Is comprised of light gray to yellowish-red, saturated very fine grained silty sand with clayey sand pockets. The unit may not be present throughout the Site and therefore Unit V and Unit VI may be combined together. When present, the thickness of Unit V varies from two to eight ft.
f) Unit VI: Is present as an elongated sand body stretching from the southwestern property boundary to the north-central property boundary. The lower contact of Unit VI is generally encountered at depths ranging from 64.5 ft to 72.5 ft bgs with a total thickness of approximately 29 to 36 ft.
g) Unit VII: Is the lowermost lithologic unit encountered during site investigations. Although, the total thickness of the unit was not identified, it is estimated to be approximately 13 ft to 20 ft in thickness. It is mainly comprised of stiff to very stiff and

highly plastic clay indicating that it may act as a lower confining layer for Units V and VI.

The geologic formations at the Site were divided into six (6) layers for the purpose of numerical modeling and are explained in greater detail in the following section (Section 3.2).

SECTION III

MODELING METHODOLOGY

3.1 BACKGROUND

In accordance with the scope of work, a three-dimensional groundwater flow and contaminant transport model was developed. Flow modeling was conducted using MODFLOW, a widely-used finite-difference based model (Harbaugh and McDonald, 1996). Contaminant transport modeling was conducted using the reactive transport code RT3D (Clement, 1997). The pre/post-processing software Groundwater Vistas was used to develop, run and calibrate the site model. A brief mathematical description of the flow and transport models is provided below.

3.1.1 MODFLOW

MODLFOW is a grid-centered finite-difference-based computer code that has the capability to numerically solve the constant-density groundwater flow equation (McDonald and Harbaugh, 1988). The groundwater flow equation solved by MODFLOW is:

$$\frac{\partial}{\partial x}\left(K_{xx}\frac{\partial h}{\partial x}\right)+\frac{\partial}{\partial y}\left(K_{yy}\frac{\partial h}{\partial y}\right)+\frac{\partial}{\partial z}\left(K_{zz}\frac{\partial h}{\partial z}\right)+W=S_s\frac{\partial h}{\partial t} \quad (1)$$

where: "K_{xx}," "K_{yy}," "K_{zz}" are hydraulic conductivities along the x, y and z coordinate axes assumed to be parallel to the principal axes of hydraulic conductivity; "h" is the potentiometric head; "W" is the source/sink term; "S_s" represents the specific storage of the aquifer; and "t" is time. During modeling this governing equation is solved numerically with appropriate initial and boundary conditions.

3.1.2 RT3D

RT3D is a numerical code that has the capability to solve the three-dimensional reactive transport equation for multiple species in saturated groundwater systems. The groundwater head distribution, required by RT3D to compute the transport parameters, is computed using MODFLOW. The contaminant transport equation solved by RT3D is:

$$\frac{\partial}{\partial x_i}\left(D_{ij}\frac{\partial C_k}{\partial x_j}\right)-\frac{\partial}{\partial x_i}(v_i C_k)+\frac{q_s}{\theta}C_{s_k}+r_c=\frac{\partial C_k}{\partial t} \quad ; \text{where } k = 1,2,.., m \quad (2)$$

$$\tilde{r}_c=\frac{d\tilde{C}_{im}}{\partial t} \quad ; \text{where } im = 1,2,.., (n\text{-}m) \quad (3)$$

where: "n" is total number of contaminant species; "m" is number of aqueous-phase (mobile) species; "n-m" is the number of immobile species; "C_k" and "$\check{C}_{im}$" are aqueous-phase and solid-phase concentrations of the kth and im^{th} species, respectively; "D_{ij}" is the dispersion coefficient; "v" is the pore velocity; "θ" is the aquifer porosity; "q_s" is the source/sink volumetric flux of water per unit volume of aquifer; and "r_c" and "$\check{r}_c$" represent the rate of all reactions and the rate of soil-phase reactions, respectively.

RT3D uses the operator-split numerical strategy to solve the coupled transport equations as presented in (2) and (3). The transport equation (2) is divided into four parts: advection, dispersion, source/sink mixing and the reaction equation. Solution of the advection, dispersion, and source/sink mixing equations are based on solvers available from the MT3D code (Zheng, 1990). RT3D solves the reaction equation using pre-defined modules. For the purpose of modeling dechlorination of TCE and its daughter compounds, as outlined in the scope of work, we used *Module #6: Sequential Decay Reactions*.

3.2 GROUNDWATER FLOW MODEL

Groundwater Vistas (version 5) was used to set up the base model for flow and transport. An aerial photograph of the site was used as the background image for assistance in defining the grid and boundary conditions. For calibration purposes, a flow model was set up with grid spacing varying from a minimum of 50 ft to a maximum of 200 ft (in x and y directions). The minimum spacing was specified in the area close to the Site where groundwater elevation data were available.

The geological deposits at the Site as discussed in Section 2.3 were divided into six layers for the purpose of numerical modeling. The average elevation of the site was taken from site-specific datum to be 100 ft and assumed to be representative of the ground surface elevation. The total depth was taken to be 100 ft from the surface or 0 ft in site-specific vertical datum. Values of hydraulic conductivity and porosity were selected for each layer based on previous investigations (RS&A, 1993b). Characteristics of the six subsurface layers simulated within the model are described below and shown conceptually in Figure 3-1.

a) Layer 1: comprised of the subsurface from 100 ft to 75 ft for a total depth of 25 ft. The bottom surface of this layer was set to approximately coincide with the bottom of Unit II at the site as described in Section 2. A hydraulic conductivity of 1.9 ft/day was assigned considering the hydrogeological characteristics of the deposits.
b) Layer 2: comprised of the subsurface from 75 ft to 65 ft for a total depth of 10 ft. This layer was defined to represent the highest transmissive zone of the aquifer and comprised

of Unit III of the aquifer as described in Section 2. The hydraulic conductivity in this layer was estimated and assigned to be 18 ft/day.

c) Layer 3: extended from 65 ft to 60 ft with a total depth of 5 ft and represents Unit IV of the aquifer. Hydraulic conductivity was set to 4.5×10^{-5} ft/day considering that this layer may act as a confining unit. However, since this unit was reported to be present in only a part of the Site, low hydraulic conductivity values were assigned to only the subsurface area under the Site, elsewhere Layer 2 hydraulic conductivities were assigned to Layer 3.
d) Layer 4: extended from 60 ft to 55 ft with a total depth of 5 ft and represents Unit V of the aquifer. Hydraulic conductivity was set to 15 ft/day considering that this layer is more transmissive.
e) Layer 5: extended from 55 ft to 25 ft with a total depth of 30 ft and represents Unit VI of the aquifer. Hydraulic conductivity was set to a similar value as in Layer 4 considering aquifer tests in Unit V and VI were conducted jointly.
f) Layer 6: represented the confining unit and the deepest portion of the site where assessment activities were conducted. The layer had a total depth of 25 ft and extended from 25 ft to 0 ft. Horizontal hydraulic conductivity in this layer was set to 10^{-5} ft/day.

Additional information on the flow model setup is provided in Table 3-1.

Based on available site information Dirichlet-type (specified-head) boundary conditions were used exclusively in the flow model. The specified head values were determined from the calibration exercise. Initial specified head conditions comprised of head values of 95 ft at the western extent of the model which is reported to be a reservoir (Sheldon Reservoir, RS&A, 1003b) and 85 ft at the eastern extent of the model which is the approximate location of the San Jacinto River.

Calibration of the flow model for the non-engineered (no-pumping) scenario was performed by matching modeling results (i.e. model-estimated groundwater levels) to observed groundwater levels recorded in the field. The water levels were averaged for six groundwater elevation monitoring events ranging from 17 May 1997 to 6 February 1998 before the P&T system started extracting water from the recovery wells. The averaged groundwater levels yielded a groundwater flow field that was assumed to be representative over the long term for the GUIC site. This long term averaged flow-field was considered the steady-state flow field for the site and used for calibrating the flow model. Groundwater level comparisons were made at pre-determined well locations where each location had an associated groundwater elevation value (a target value). Some values of water levels were deemed to be outliers and were discarded from the calibration exercise. We performed an initial simulation to obtain an estimate sum of squared residuals (SSR) without calibration, yielding an approximate SSR value of 800 square feet ($ft^{2)}$. Calibration was performed by modifying the constant head boundary values, recharge, and hydraulic conductivity values within the model. Model calibration was deemed reasonable upon

achieving a SSR of approximately 135.7 ft^2 for 45 target values. Appendix A contains the observed groundwater level data used during calibration of the no-pumping scenario and resulting model-estimated groundwater elevations obtained after simulation. Figure 3-2 presents the groundwater elevation contours (as blue lines with numbers in big font) obtained from the calibrated flow model (for no-pumping scenario) for layer 2 which represents hyrdrogeological Unit III at the Site. A comparison of observed value (field-recorded data) and residual value (observed value – model estimated value) is presented in Figure 3-3. A close inspection of Figure 3-3 shows that a majority of the field-recorded water levels have low corresponding residual values and the residual values have a similar spread in both negative and positive fields representing a reasonable model-calibration. The water balance error for the no-pumping flow model was less than 1%.

Calibration of the flow model for the engineered (pumping) scenario was performed by matching modeling results (i.e. model-estimated groundwater levels) to groundwater levels measured in the field on 16 August 2010 and 29 November 2010. Two transient stress periods were set-up in the model with Stress Period One being a transient pumping simulation of 15 years representing the approximate operational period of the P&T system ending on 16 August 2010. Stress Period Two was set at 86 days representing the operation period from 16 August 2010 to 29 November 2010. Groundwater level comparisons were made at pre-determined well locations for each stress period where each location had an associated groundwater level value (a target value). Appendix B contains the groundwater level and pumping rates data used for calibration to the pumping scenario. As in the no-pumping scenario some values of groundwater levels were considered to be outliers and were discarded from the calibration exercise. Using the average pumping rates reported over the two stress periods, we performed an initial simulation to obtain an SSR without calibration, yielding an approximate SSR value of 8015 ft^2. Calibration was performed by modifying the pumping rates for extraction wells in each layer within the model for Stress Period One. Model calibration was deemed complete upon achieving a SSR of approximately 331.5 ft^2 (more than an order of magnitude lower than the initial SSR). It should be noted here that even though the SSR value for the pumping scenario is higher than the no-pumping scenario, the number of target values (groundwater level observations) used for calibrating the pumping scenario is more than double those used in the no-pumping scenario. Appendix B contains the observed groundwater level data used during calibration of the pumping scenario and resulting model-estimated groundwater elevations obtained after simulation. Pumping flow rates for extraction wells used to achieve calibration of the pumping flow model are presented in Appendix C. Note in Appendix C that the extraction rates in Stress Period 2 are the same as those obtained from field readings as reported by Weston. Figure 3-4 presents the groundwater elevation contours (as blue lines with numbers in big font) obtained from the calibrated flow model (for pumping scenario) for layer 2 which represents hyrdrogeological Unit III at the Site. A comparison of observed value (field-recorded data) and

residual value (observed value – model estimated value) is presented in Figure 3-5. Figure 3-5 shows that similar to the results of calibration from the no-pumping scenario, the calibration results from the pumping scenario have a majority of the residual values with a balanced spread in both negative and positive fields representing a reasonable model-calibration. The water balance error for the pumping flow model was less than 1%.

3.3 TRANSPORT MODEL

Geosyntec developed a transport model that incorporated the calibrated flow models for both no-pumping and pumping scenarios. Since solute transport requires finer grid sizes than a flow model to reduce dispersive errors, the finite-difference grid was refined for conducting transport simulations to enable better prediction of contaminant migration. Figure 3-6 presents the finer grid used in transport simulations. Initial conditions for the transport model were comprised of recent estimated contaminant concentration contours. Chlorinated species concentration distribution (as contoured) obtained from field data collected in March 2010 were used to determine initial concentration distribution in the model, input as plume maps. The contaminant plumes were initialized with twice the RAL concentration levels. Additionally plume areas with concentration values higher than twice the RAL levels were also digitized and initialized in the model. Such initialization of the concentration levels in the model enable conservative model prediction in terms of estimated time to achieve RAL concentrations. Initial sorbed concentrations were also estimated based on the distribution coefficients corresponding to the different chemicals. Figures 3-7 through 3-9 present the initial concentration contours provided as input data for TCE, c-DCE, VC, CB and EDC for model layers 2, 4, and 5 respectively which contain a majority of the reported contaminant mass.

Site-specific degradation rates for the contaminant species were estimated from concentration data in the case of PCE, EDC, and CB as appropriate datasets were available. Degradation rates for TCE, c-DCE and VC were approximated based on the degradation rate estimated for PCE. The degradation rate for TCE was assumed to be similar to that of PCE whereas the degradation rate for c-DCE was assumed to be half and that for VC to be one-quarter of the degradation rate for PCE. The degradation rates estimated for TCE, c-DCE and VC in such a manner are representative of degradation rates observed at other sites contaminated with chlorinated solvents. Adsorption coefficient values were taken to be similar to those reported in literature (Montgomery, 1996) assuming fractional organic carbon (Foc) content to be 1% (0.01) at the Site. A bulk density of 1.57 grams/ cubic centimeter (gm/cc) was assumed for all layers. Yield values were estimated based on stoichiometric ratios. Table 3-2 provides select model parameters used for simulating the transport model with values of degradation rates, distribution coefficients, and dispersivities.

The transport model was simulated as the transient model with linkage to appropriate output files from MODFLOW. Transport model simulations were conducted for the no-pumping and pumping scenarios to provide the time estimates to achievement of RAL concentration levels. For simulating the pumping transport scenario, we used the pumping rates reported in the approximately 86 day period from 16 August 2010 to 29 November 2010 that were also used as extraction rates in Stress Period Two during calibration of the flow model for the pumping scenario. The pumping rates were assumed to remain constant for the entire simulation.

SECTION IV

RESULTS, LIMITATIONS AND RECOMMENDATIONS

4.1 RESULTS

Model estimated times to reach RAL concentration levels for the simulated chemical species are provided in Table 4-1. Based on results obtained from numerical modeling, RAL levels are estimated to be reached at the site in approximately 16 years under engineered (pumping) conditions with VC being the most persistent chemical species and in approximately 33.5 years under non-engineered (no-pumping) conditions with CB being the most persistent species. Model estimated solute concentrations under both pumping and no-pumping conditions selected chlorinated species that migrate off-site (either during the simulation or at the beginning with initial concentrations) such as PCE, TCE, and VC are presented in Figures 4-1 through 4-6. Model results for concentrations from the simulated chlorinated solvent species are provided in electronic format as binary files along with this report. To aid in viewing the results, corresponding Modelviewer (Hsieh and Winston, 2002) files are also provided with the binary concentration files.

4.2 LIMITATIONS

The purpose of this modeling study was to predict the migration of the dissolved chlorinated solvent (TCE, c-DCE, VC, CB and EDC) plumes at the site under non-engineered (no-pumping) and engineered (pumping) conditions and subject to natural attenuation. The numerical model presented via this report achieved this purpose by approximating the aquifer conditions based on previously obtained field data and estimated extent and concentrations of solute plumes. Therefore, any limitations and errors in collecting the field data would be extended, via the derived model parameters, in the numerical simulations. Additionally, lack of geochemical and microbiological data at the site also limits the estimation of geochemical parameters, such as degradation rates, adsorption coefficient and dispersivity, used in the model. Another limitation of the model may be the presence of any unknown input source concentration which has not been accounted for in the current modeling exercise. However, the model is sufficiently robust and parameterized to provide an estimation of times to reach RAL concentration levels for the pumping and no-pumping scenarios. The model is also a sufficient tool to compare the differences in times to reach RAL concentrations for the simulated scenarios.

SECTION V

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Rosengarten, Smith & Associates, Inc., 1995b, *Supplemental groundwater quality investigation, Weston Industries, Inc.,* Prepared for The Westlake Group of Companies, Houston, TX.

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Table 3-1 Basic Model Setup

	Parameter	Value
Model domain Flow	Rows (y direction)	114
	Columns (x direction)	128
	Layers (z direction)	6
	Cell discretization (ft)	X: 50 ft to 200 ft; Y: 50 ft to 100 ft Layer 1: 25 ft; Layer 2: 10 ft; Layer 3: 05 ft; Layer 4: 05 ft Layer 5: 30 ft; Layer 6: 25 ft
Model domain Transport	Rows (y direction)	349
	Columns (x direction)	596
	Layers (z direction)	6
	Cell discretization (ft)	Uniform in x and y from 10 ft to 100 ft Layer 1: 25 ft; Layer 2: 10 ft; Layer 3: 05 ft; Layer 4: 05 ft Layer 5: 30 ft; Layer 6: 25 ft
Flow	Hydraulic conductivity (ft/day)	Layer 1: K_x and K_y – 2.4; Kz – 10^{-6} Layer 2: K_x and K_y – 17.5; Kz – 1.6 Layer 3: K_x and K_y – 4.5×10^{-5}; Kz – 4.5×10^{-6} Layer 4: K_x and K_y – 15.5; Kz – 10^{-6} Layer 5: K_x and K_y – 15.5; Kz – 10^{-6} Layer 6: K_x and K_y – 10^{-5}; Kz – 10^{-6}
	Pumping rates for recovery wells	See Appendix C. Flow rates reported for stress period 2 were used in the transport model for pumping scenario.
	Recharge (ft/day)	0.0012
	Porosity (-)	0.25 (in all layers)
	Effective porosity	0.20 (in all layers)
	Solver and convergence criterion	PCG2; 10^{-4}
	Number of Stress periods	Calibration of non-pumping flow model : 1 Calibration of pumping flow model : 2 Transport model: 2

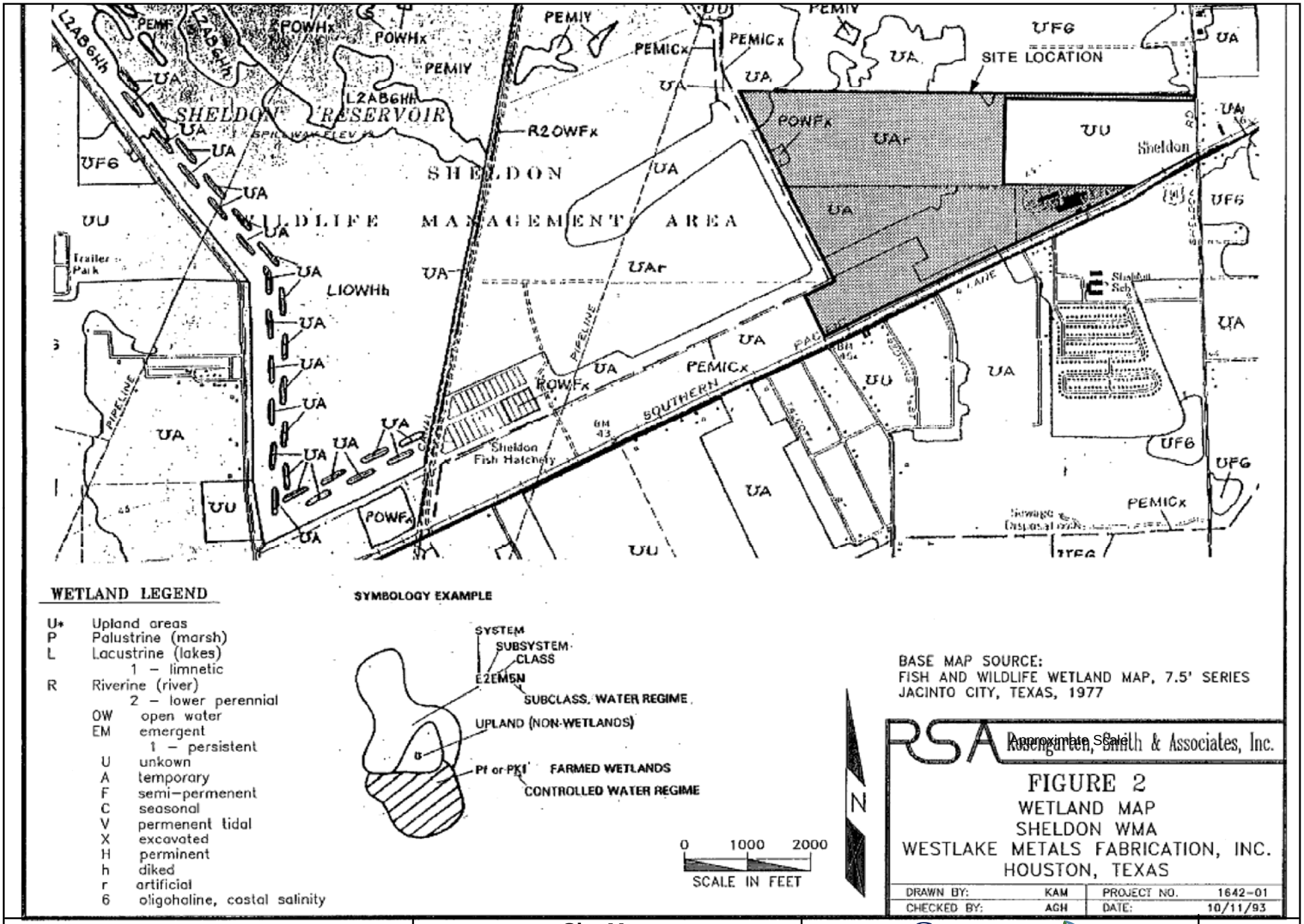
Table 3-2 Transport Model Parameters

	Parameter	Value
Basic Transport	Dispersivity (ft)	Longitudinal (x): 5 Transverse (y): 1 Vertical (z): 0.1
	Initial Concentrations	Solute plumes estimated from March 2010 concentration contours
	Advection, Dispersion Solver and convergence criterion	GCG; 10^{-6}
Time stepping	Initial time step	30 days
	Total Simulation Time	> 30 years
Degradation Rates (day^{-1})	PCE	Estimated from data: 0.0022 (All layers)
	TCE	Assumed value: 0.0022 (All layers)
	c-DCE	Assumed value: 0.0010 (All layers)
	VC	Assumed value: 0.0005 (All layers)
	EDC	Estimated from data: 0.0056 (All layers)
	CB	Estimated from data: 0.0001 (All layers)
Distribution Coefficient (ml/gm)	PCE	0.142
	TCE	0.053
	c-DCE	0.059
	VC	0.014
	EDC	0.036
	CB	0.122
Bulk Density (gm/ml)	Uniform for all layers	1.57

Table 4-1 Estimated Times to Reach RAL Concentration Levels

Chemical Species	Approximate Model-estimated Time to Reach RAL Concentration Levels (years)	
	No-pumping Scenario	Pumping Scenario
Chlorobenzene (CB)	33.5	10
1,2-dichloroethane (EDC)	2.5	2.5
Tetrachloroethene (PCE)	6.5	4
Trichloroethene (TCE)	8.0	4.5
Cis-1,2-dichloroethene (c-DCE)	4.5	3
Vinyl Chloride (VC)	29.5	16

FIGURES



Notes:
1. Source of Map: R,S&A, 1993a.

Site Map
GUIC Industries Site
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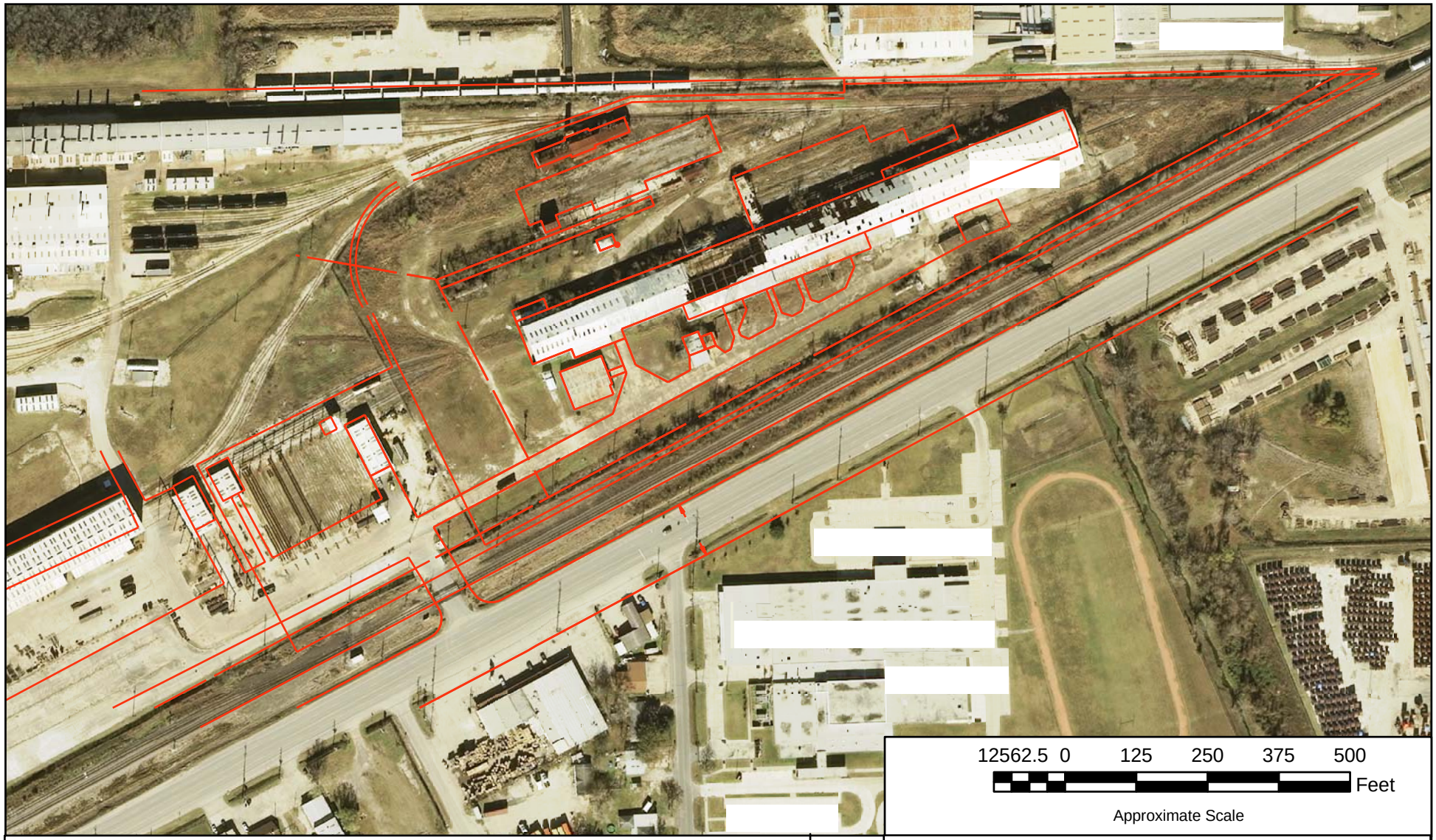
Figure **2-1**



Legend

VCP_No13_Area_Polyline

N

Site Map

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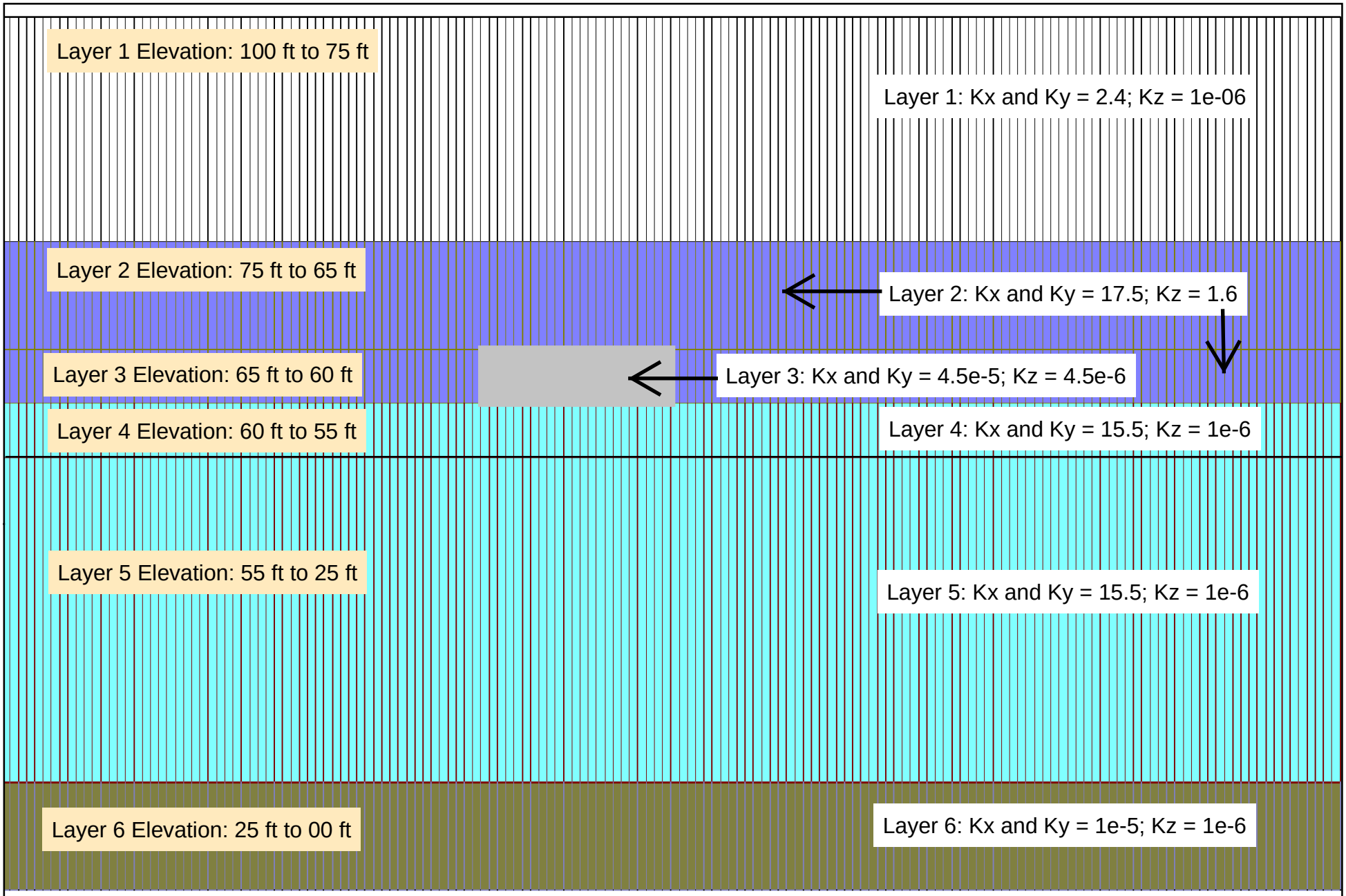
Figure **2-2**

Notes:
1. Source of 2007 Aerial Photograph: United States Geological Survey Orthographic Maps.
2. Property Outlines as Obtained from a CAD Drawing provided by Weston Solutions, Inc.



Notes:
1. Hydraulic conductivity values are in feet/day
2. Vertical elevations based on site-specific benchmark
3. Layer 3 is defined to be under the GUIC Site. See Section 3.2 in the report for more details.

Finite-difference Grid Used in Transport Simulations for Both Pumping and No-pumping Scenarios

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Figure **3-1**

Notes:
1. Groundwater elevation contours in feet
2. Elevations based on site-specific benchmark

Groundwater Elevation Contours in Layer 2 obtained from Calibrated Flow Model for No-pumping Scenario

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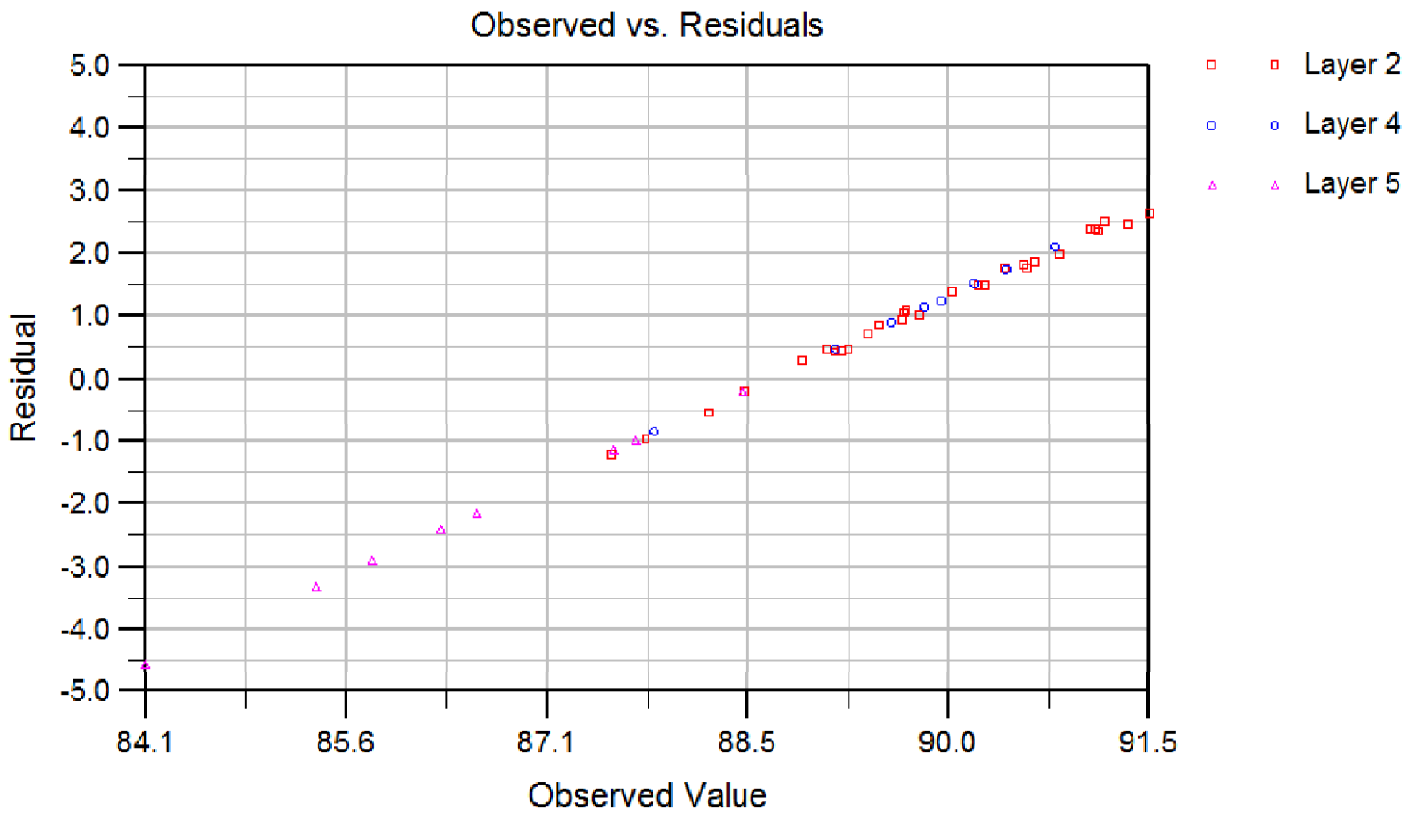
Figure **3-2**



Notes:
1. Residual Value = (Observed value - Model estimated value)

Graph of Observed vs Residual Values Obtained during Calibration of No-pumping Flow Model

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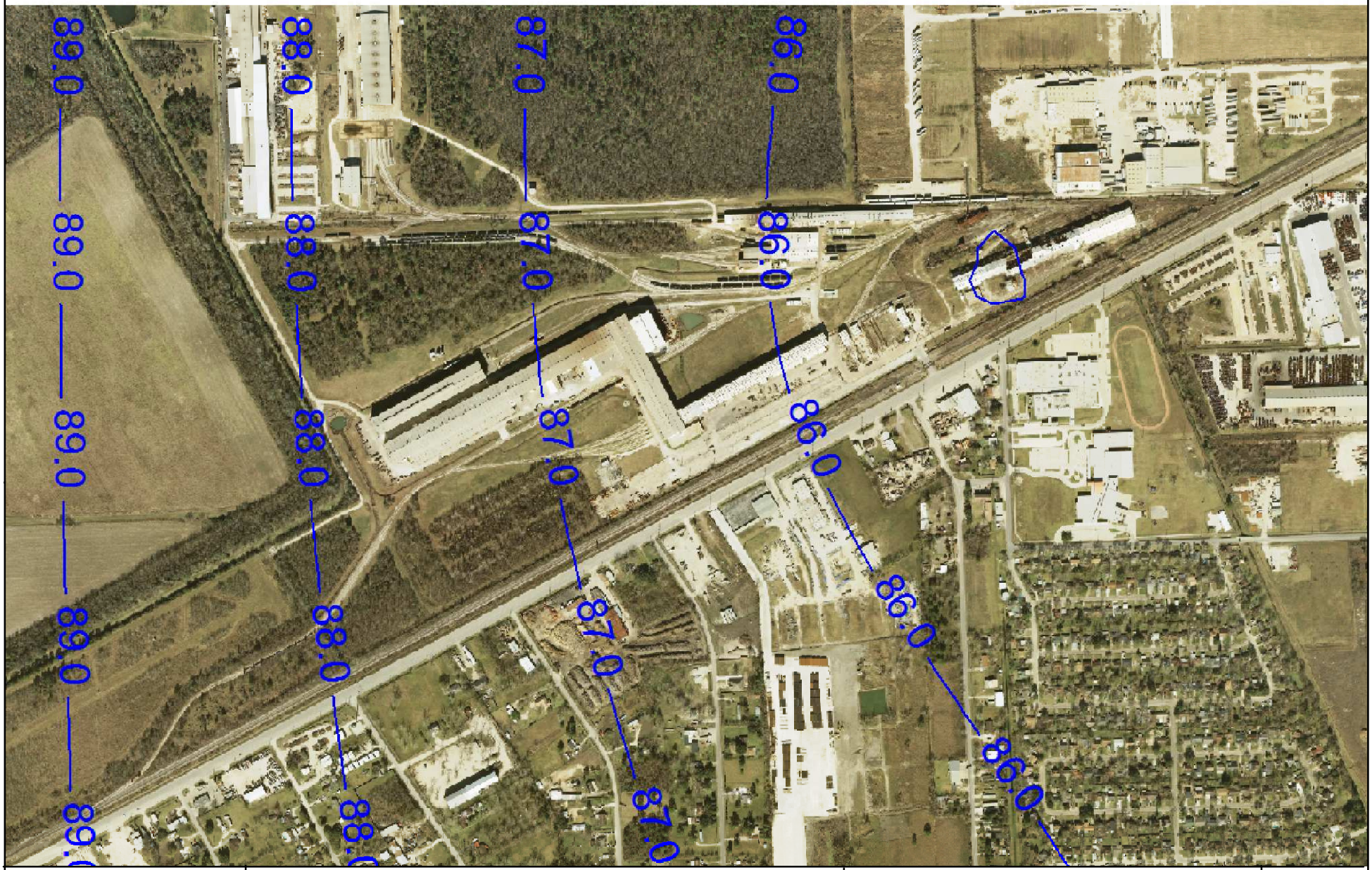
Figure **3-3**



Notes:
1. Groundwater elevation contours in feet
2. Elevations based on site-specific benchmark

Groundwater Elevation Contours in Layer 2 obtained from Calibrated Flow Model for Pumping Scenario

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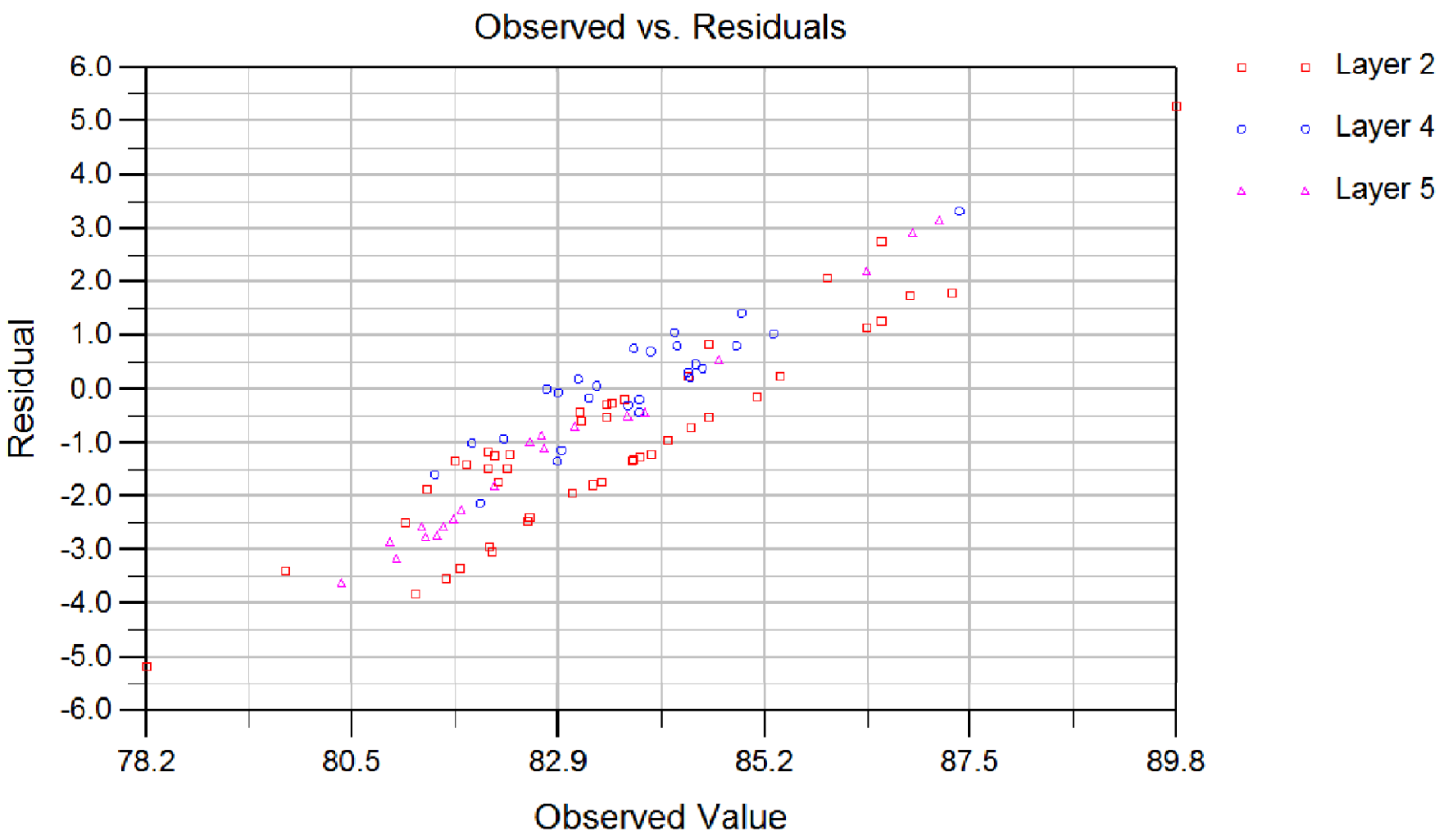
Figure **3-4**



Notes:
1. Residual Value = (Observed value - Model estimated value)

Graph of Observed vs Residual Values Obtained during Calibration of Pumping Flow Model

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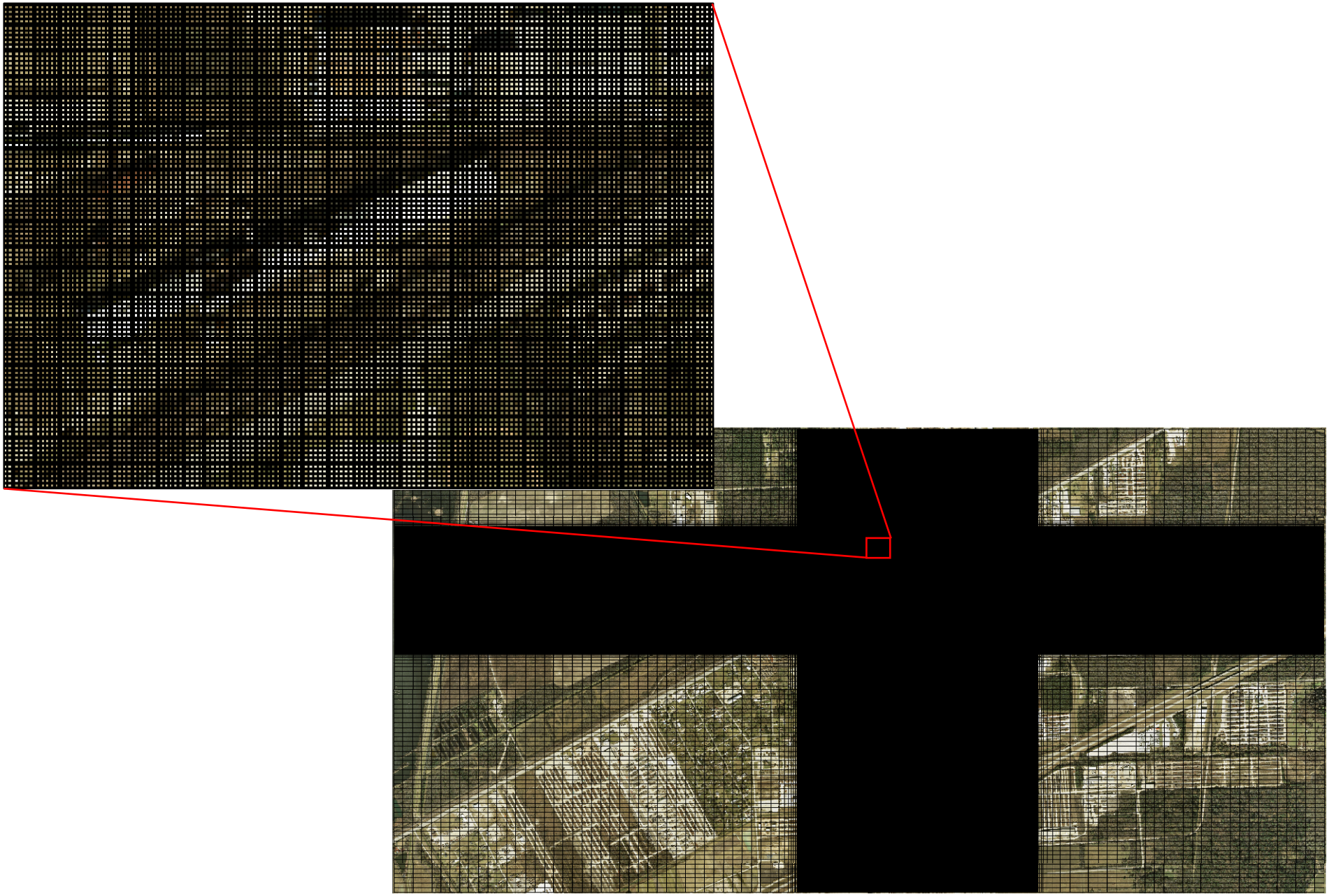
Figure **3-5**



Notes:
1. Finite-difference grid varies from 10 ft to 200 ft in the model
2. Row and column sizes are uniform (10 ft) in the area close to the Site

Finite-difference Grid Used in Transport Simulations for both Pumping and No-pumping Scenarios

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Houston, Texas 77049

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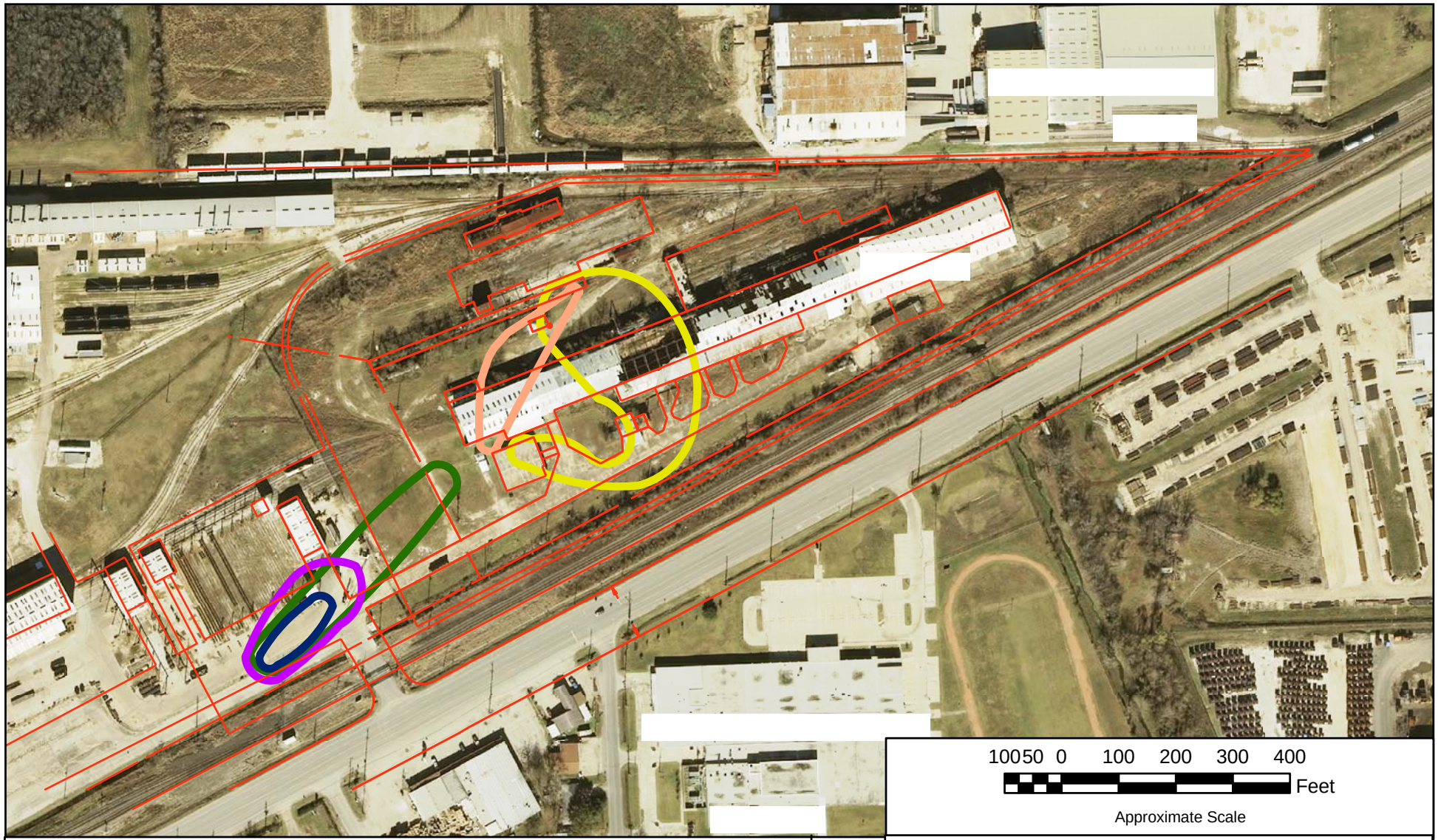
Figure **3-6**



Legend

- VCP_No13_Area_Polyline
- PCE_3
- TCE_3
- Cis_3
- CB_3
- DCEthane_3

N

Initial Groundwater Solute Concentrations
Layer 2
GUIC Industries Site
17011 Old Beaumont Highway 90
Houston, Texas 77049

Notes:
1. Source of 2007 Aerial Photograph: United States Geological Survey Orthographic Maps.
2. Property Outlines as Obtained from a CAD Drawing provided by Weston Solutions, Inc.
3. Source of solute plume extent: R,S & A, First Quarter 2010 Groundwater Monitoring Report, March 2010

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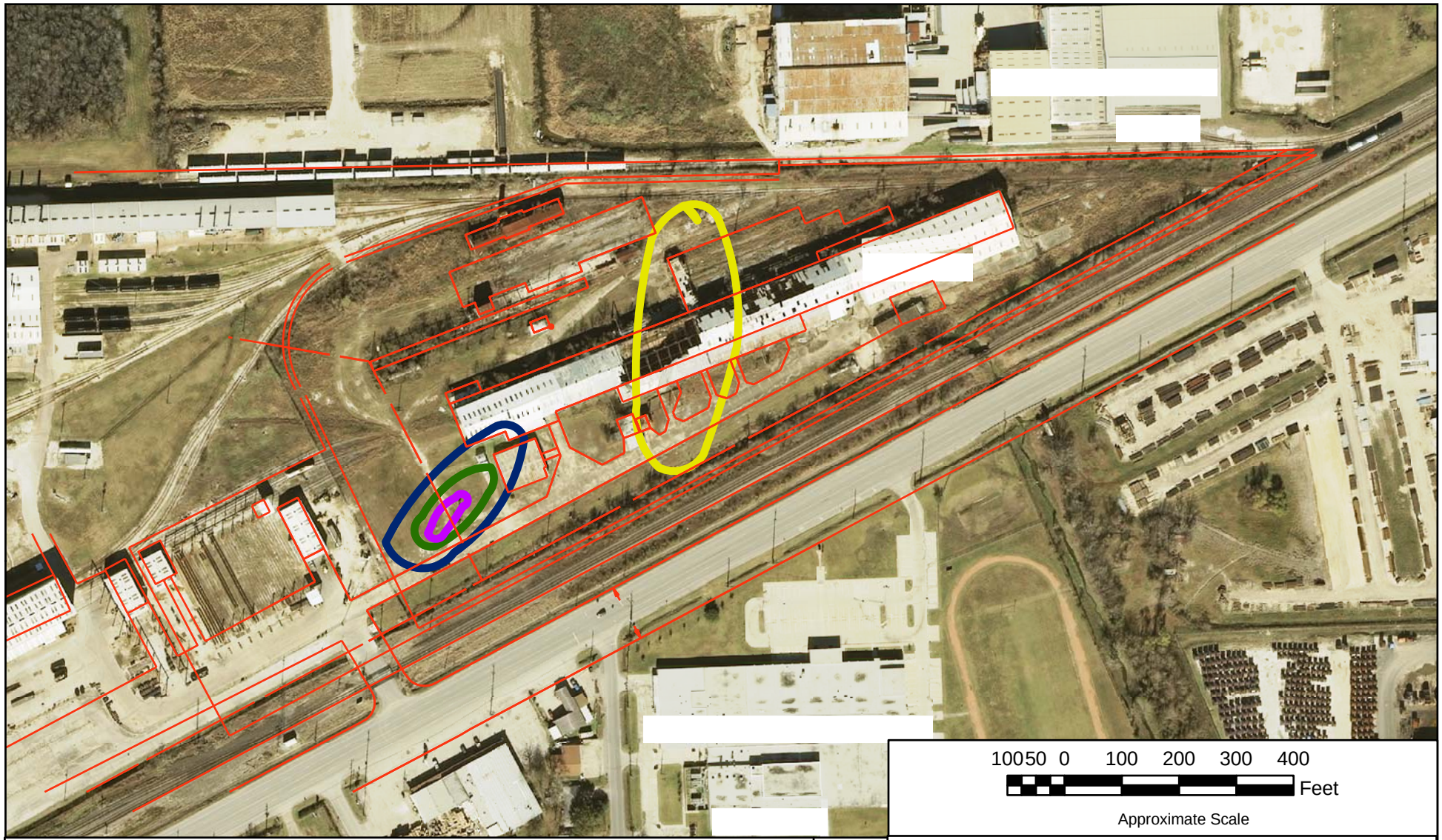
Figure **3-7**



Legend

- VCP_No13_Area_Polyline
- PCE_5
- TCE_5
- Cis_5
- DCEthane_5

N

Initial Groundwater Solute Concentrations
Layer 4
GUIC Industries Site
17011 Old Beaumont Highway 90
Houston, Texas 77049

Notes:
1. Source of 2007 Aerial Photograph: United States Geological Survey Orthographic Maps.
2. Property Outlines as Obtained from a CAD Drawing provided by Weston Solutions, Inc.
3. Source of solute plume extent: R,S & A, First Quarter 2010 Groundwater Monitoring Report, March 2010

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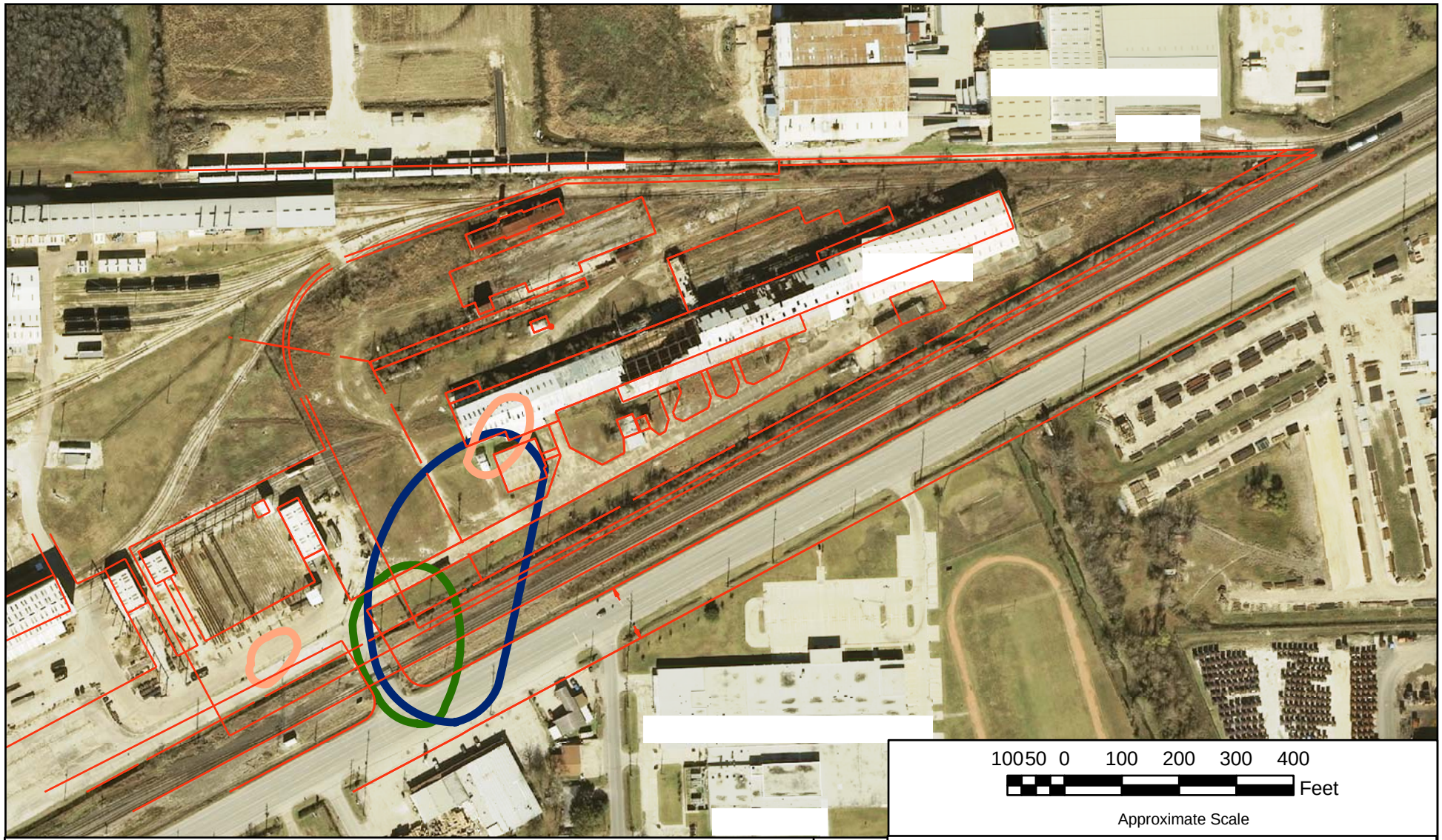
Figure **3-8**



Legend

- VCP_No13_Area_Polyline
- CB_6
- PCE_6
- TCE_6

N

Initial Groundwater Solute Concentrations
Layer 5
GUIC Industries Site
17011 Old Beaumont Highway 90
Houston, Texas 77049

Notes:
1. Source of 2007 Aerial Photograph: United States Geological Survey Orthographic Maps.
2. Property Outlines as Obtained from a CAD Drawing provided by Weston Solutions, Inc.
3. Source of solute plume extent: R,S & A, First Quarter 2010 Groundwater Monitoring Report, March 2010

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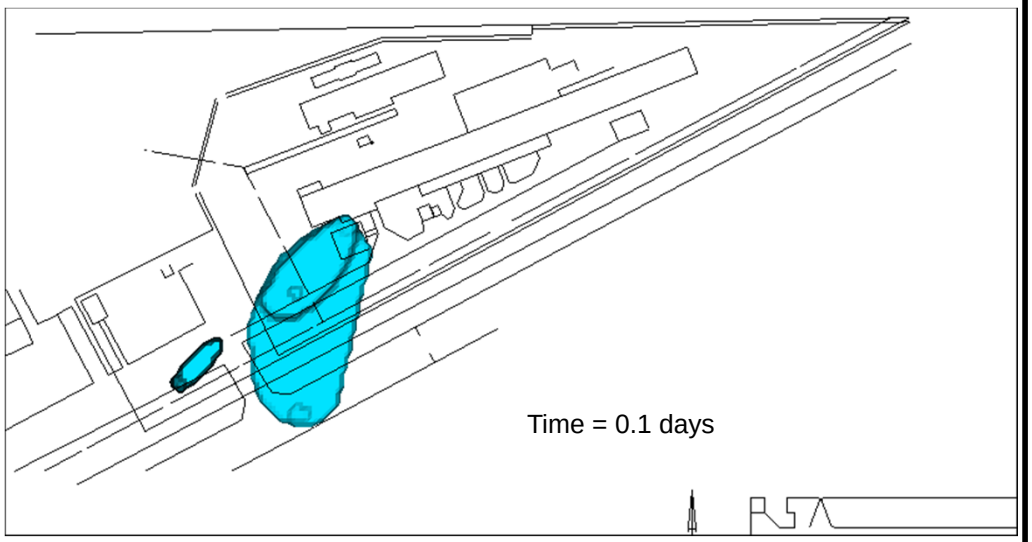
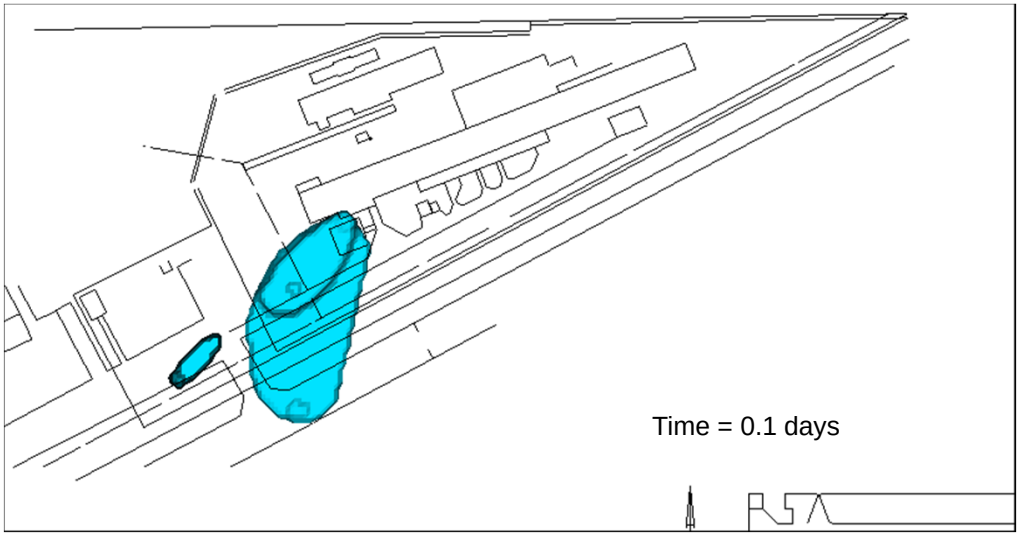
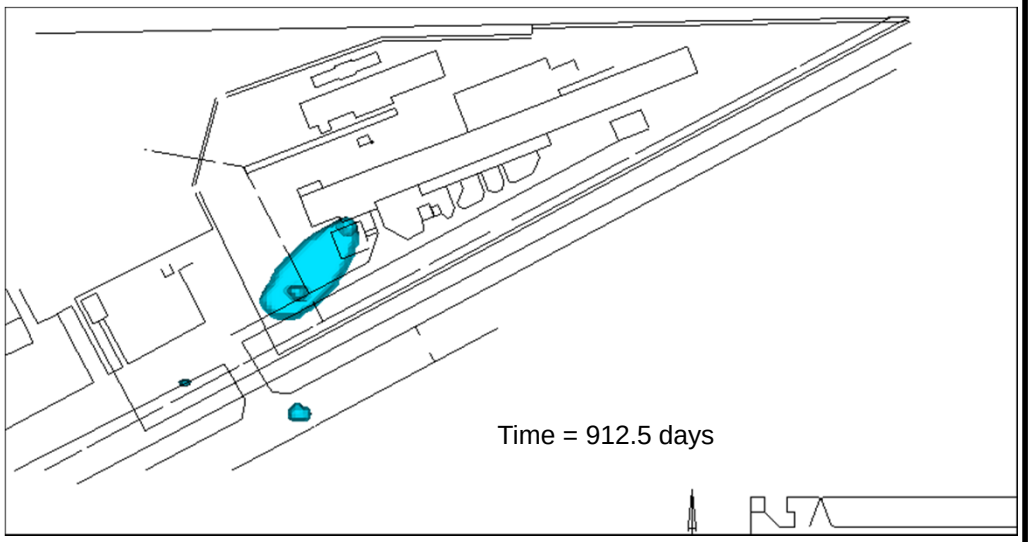
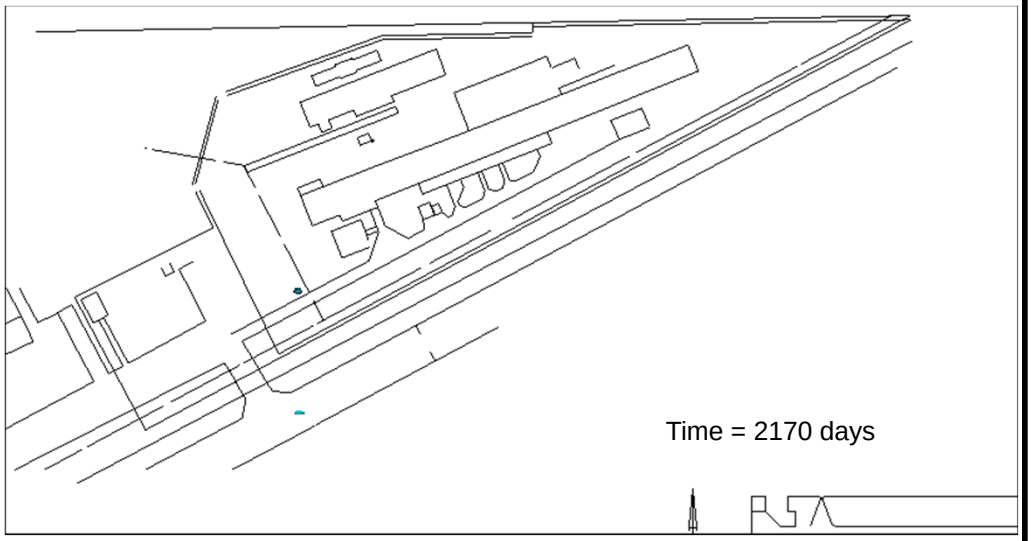
Figure **3-9**









Notes:
1. Groundwater solute concentrations estimated based on results obtained from groundwater modeling performed using MODFLOW/MT3DMS.
2. Left top panel shows groundwater solute plume at residential assessment levels (RALs) at the beginning of the simulations as estimated from R,S,&A, First Quarter 2010 Groundwater Monitoring Report, March 2010
3. Right top panel shows estimated time at which groundwater solute plume has the maximum simulated extent of off-site migration
4. Left bottom panel shows estimated time at which a significant volume of the plume retreats back to the property boundary
5. Right bottom panel shows estimated time at which a significant volume of the groundwater solute plume reaches RAL concentrations
6. Property Outlines as Obtained from a CAD Drawing provided by Weston Solutions, Inc.

N

Estimated Groundwater Solute Concentrations of Tetrachloroethylene under No-pumping Conditions

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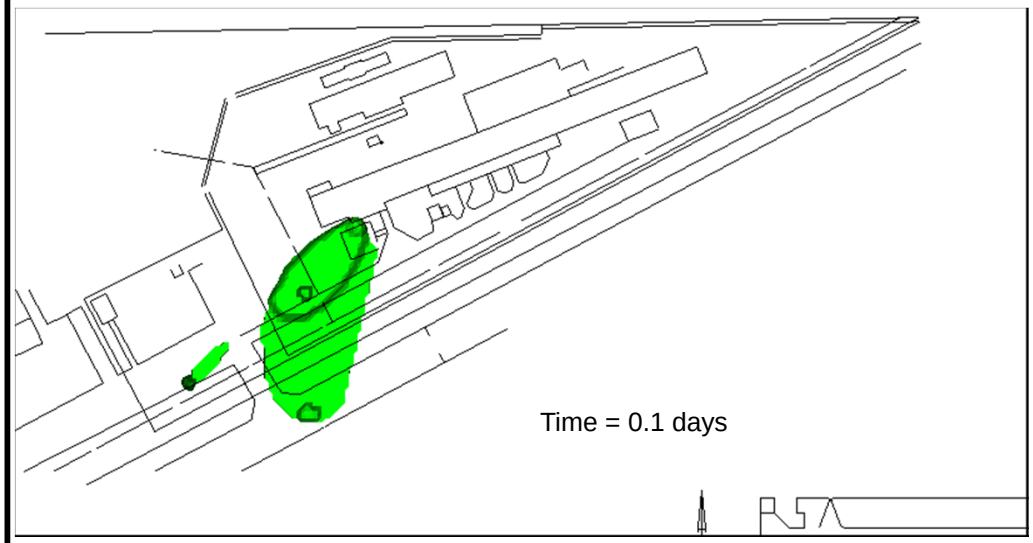
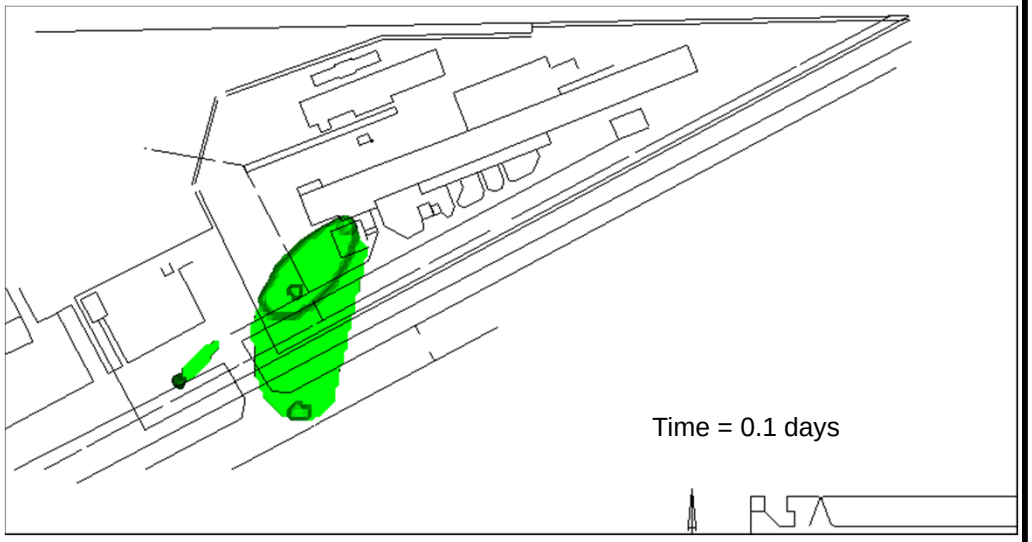
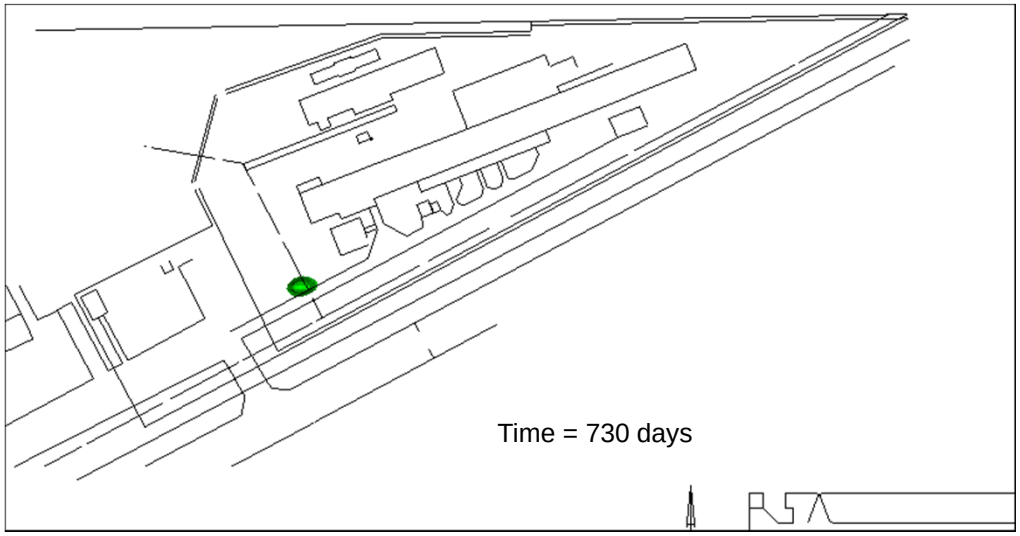
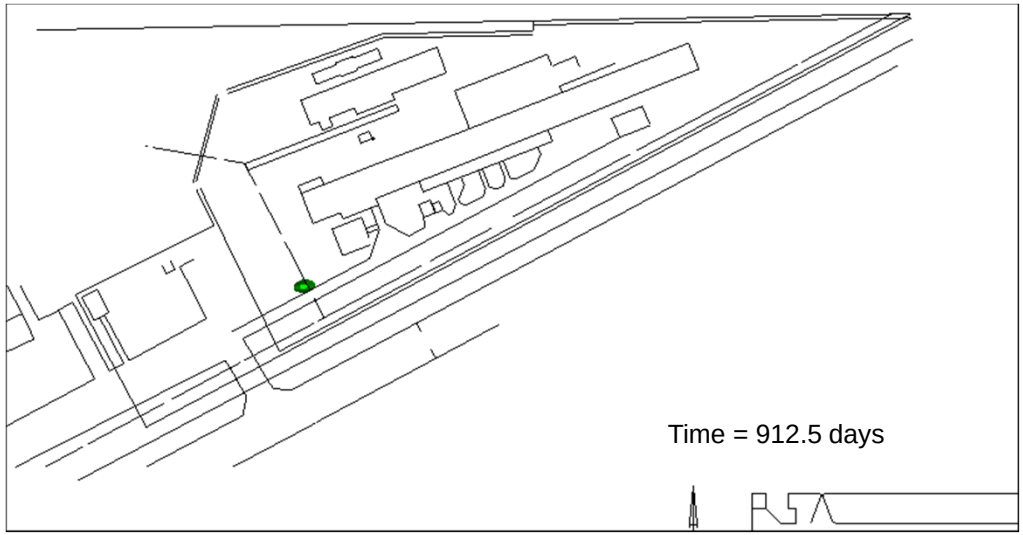
Figure **4-1**









Notes:
1. Groundwater solute concentrations estimated based on results obtained from groundwater modeling performed using MODFLOW/MT3DMS.
2. Left top panel shows groundwater solute plume at residential assessment levels (RALs) at the beginning of the simulations as estimated from R,S,&A, First Quarter 2010 Groundwater Monitoring Report, March 2010
3. Right top panel shows estimated time at which groundwater solute plume has the maximum simulated extent of off-site migration
4. Left bottom panel shows estimated time at which a significant volume of the plume retreats back to the property boundary
5. Right bottom panel shows estimated time at which a significant volume of the groundwater solute plume reaches RAL concentrations
6. Property Outlines as Obtained from a CAD Drawing provided by Weston Solutions, Inc.

N

Estimated Groundwater Solute Concentrations of Tetrachloroethylene under Pumping Conditions

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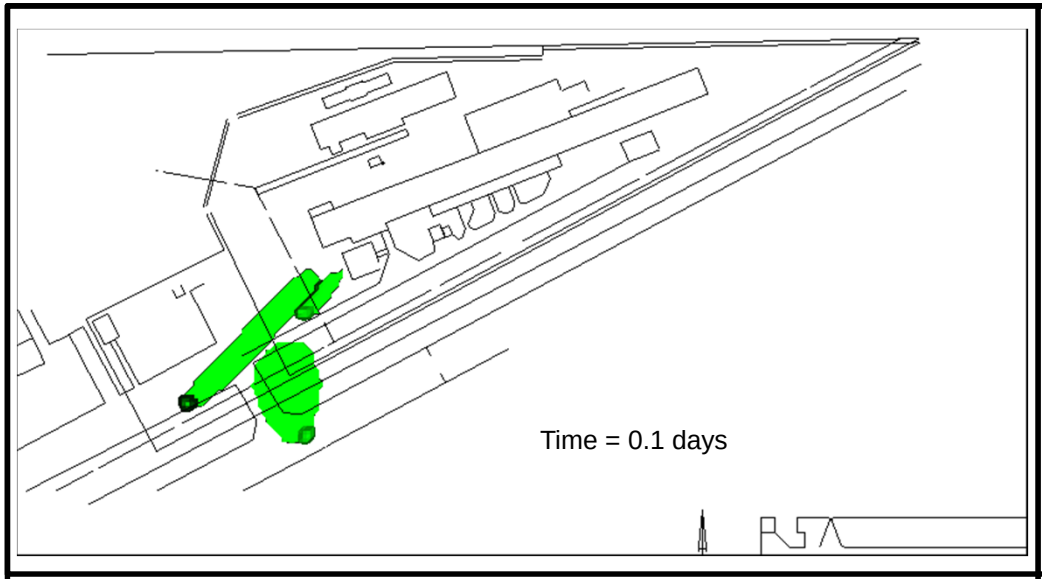
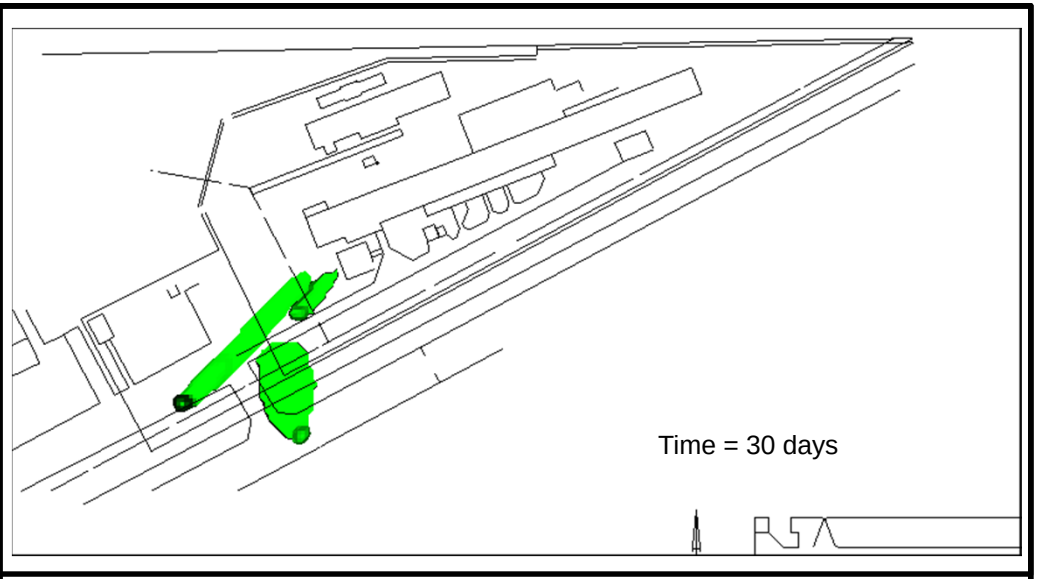
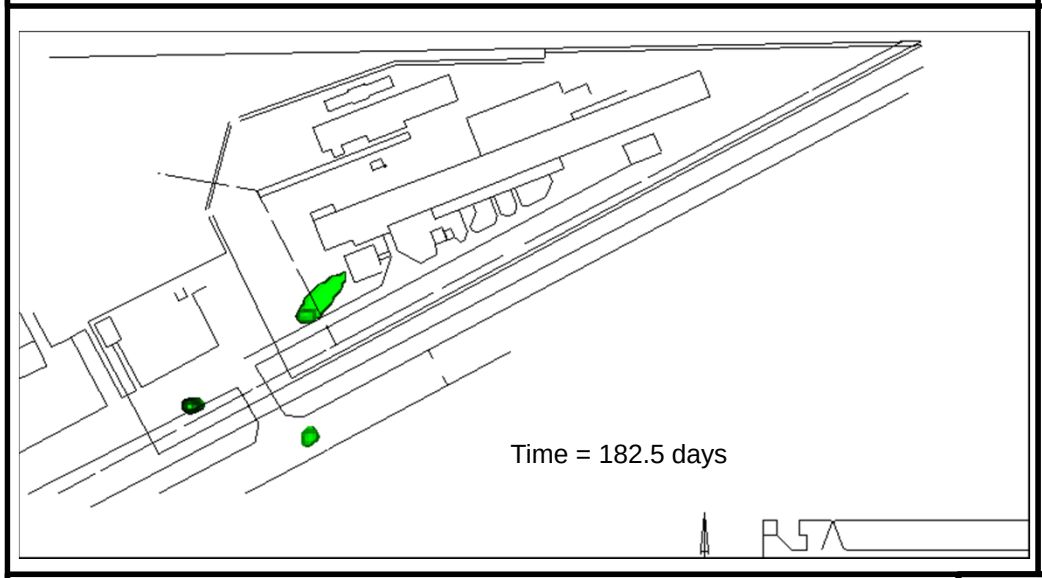
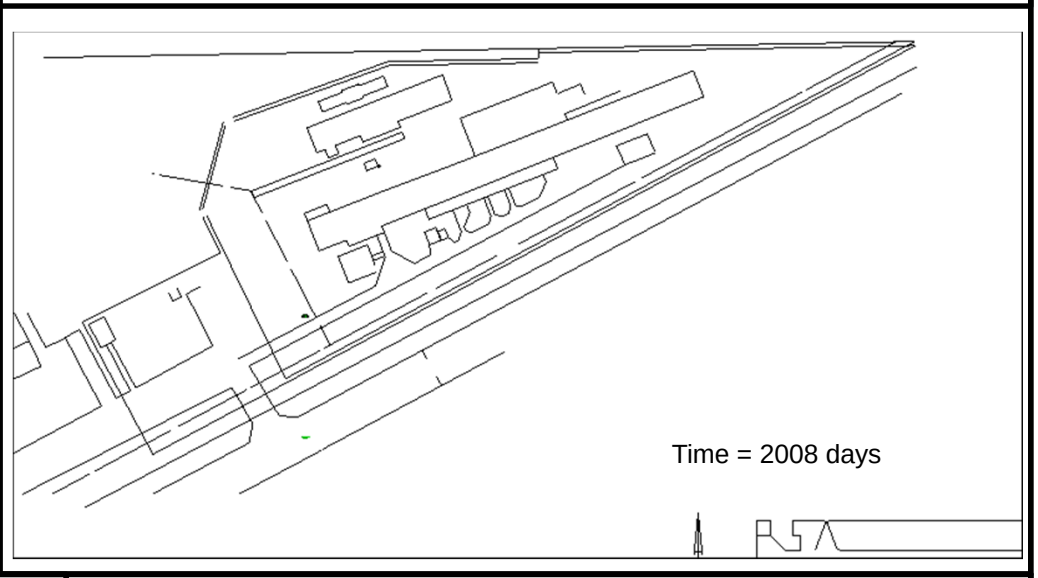
Figure

4-2









Notes:
1. Groundwater solute concentrations estimated based on results obtained from groundwater modeling performed using MODFLOW/MT3DMS.
2. Left top panel shows groundwater solute plume at residential assessment levels (RALs) at the beginning of the simulations as estimated from R,S,&A, First Quarter 2010 Groundwater Monitoring Report, March 2010
3. Right top panel shows estimated time at which groundwater solute plume has the maximum simulated extent of off-site migration
4. Left bottom panel shows estimated time at which a significant volume of the plume retreats back to the property boundary
5. Right bottom panel shows estimated time at which a significant volume of the groundwater solute plume reaches RAL concentrations
6. Property Outlines as Obtained from a CAD Drawing provided by Weston Solutions, Inc.

N

Estimated Groundwater Solute Concentrations of Trichloroethylene under No-pumping Conditions

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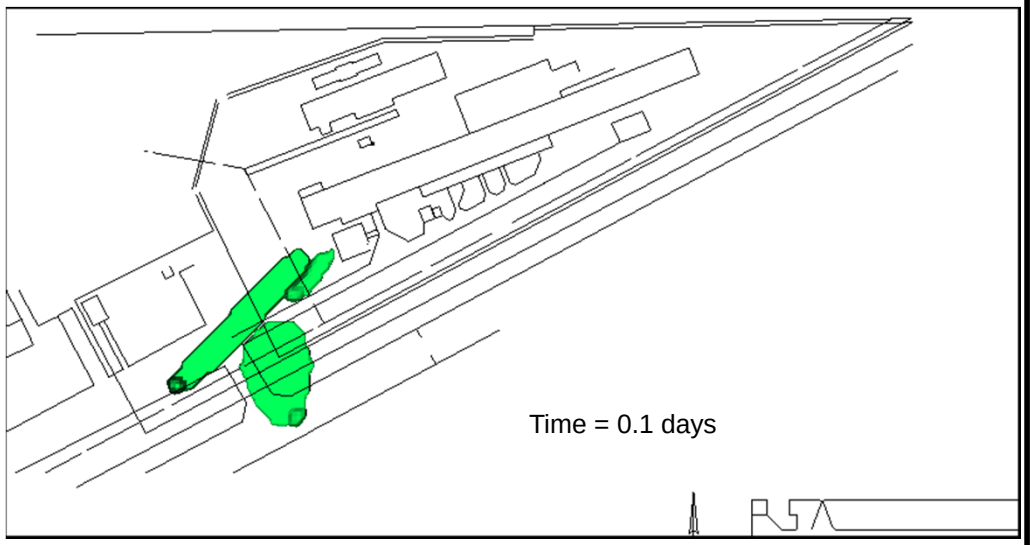
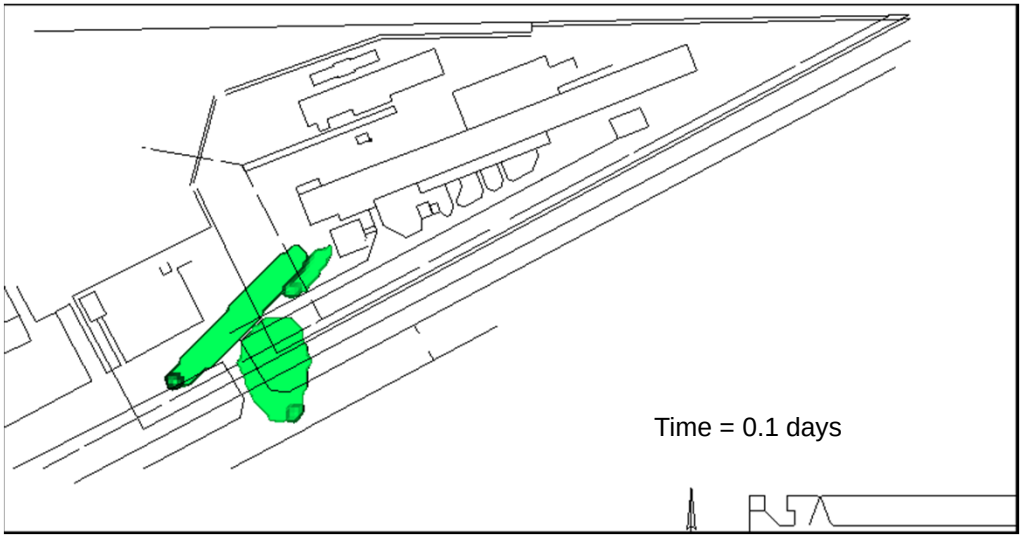
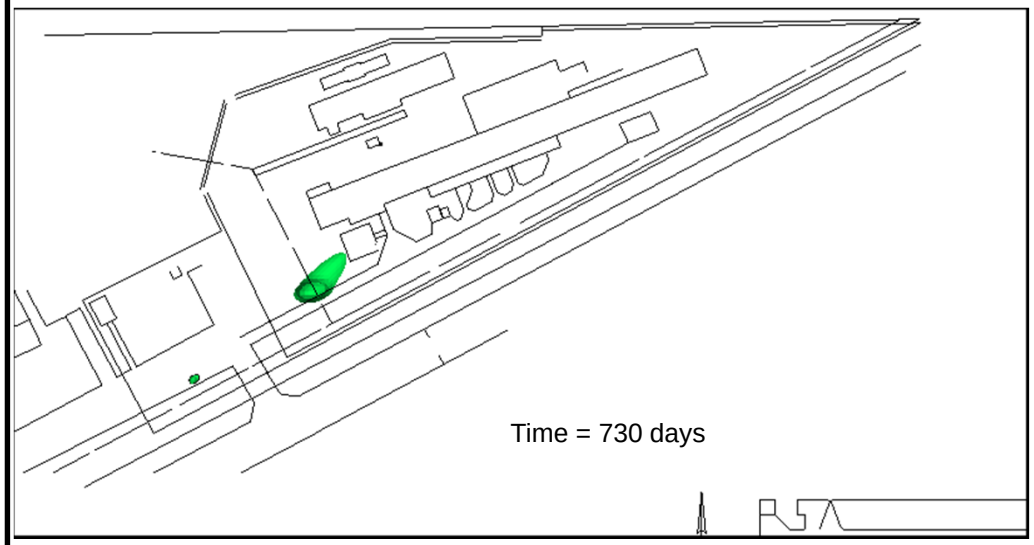
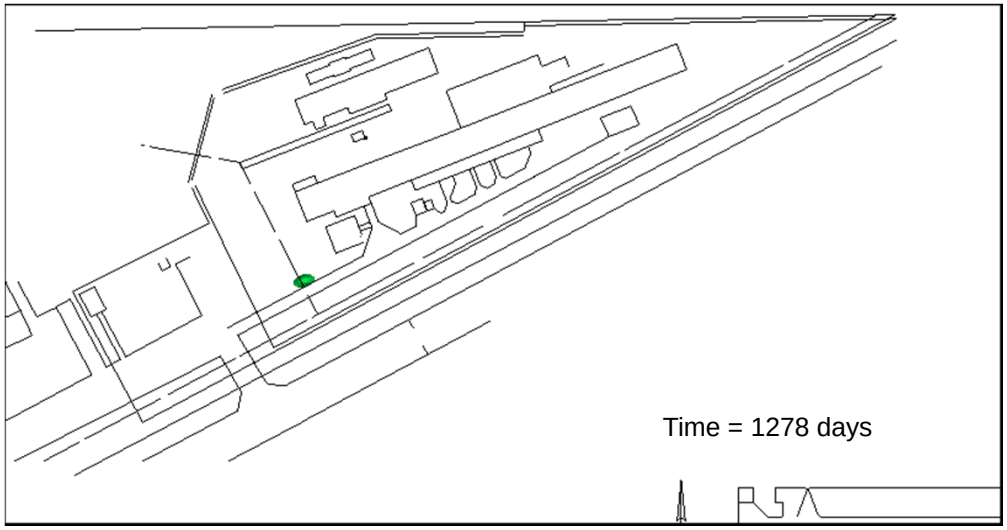
Figure

4-3









Notes:
1. Groundwater solute concentrations estimated based on results obtained from groundwater modeling performed using MODFLOW/MT3DMS.
2. Left top panel shows groundwater solute plume at residential assessment levels (RALs) at the beginning of the simulations as estimated from R,S,&A, First Quarter 2010 Groundwater Monitoring Report, March 2010
3. Right top panel shows estimated time at which groundwater solute plume has the maximum simulated extent of off-site migration
4. Left bottom panel shows estimated time at which a significant volume of the plume retreats back to the property boundary
5. Right bottom panel shows estimated time at which a significant volume of the groundwater solute plume reaches RAL concentrations
6. Property Outlines as Obtained from a CAD Drawing provided by Weston Solutions, Inc.

N

Estimated Groundwater Solute Concentrations of Trichloroethylene under Pumping Conditions

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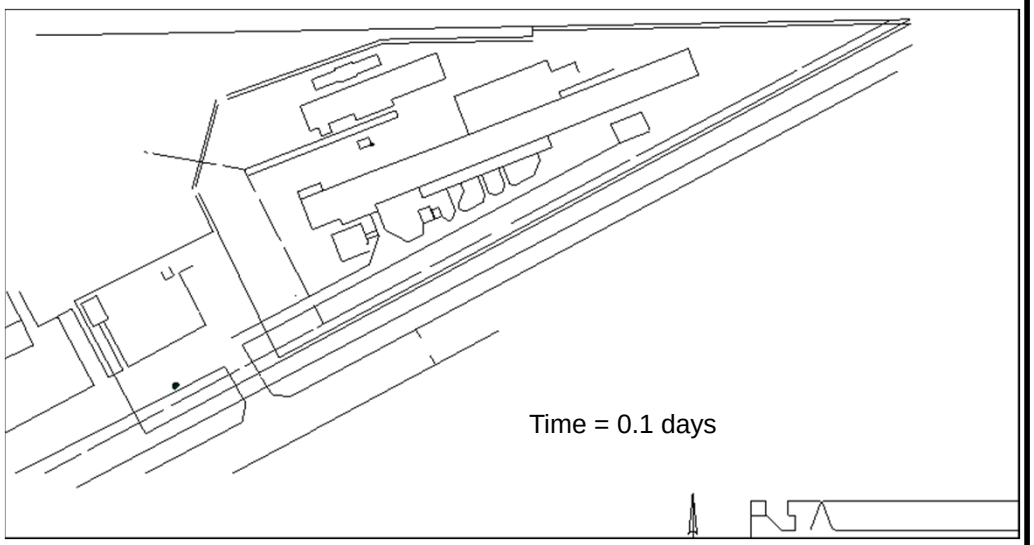
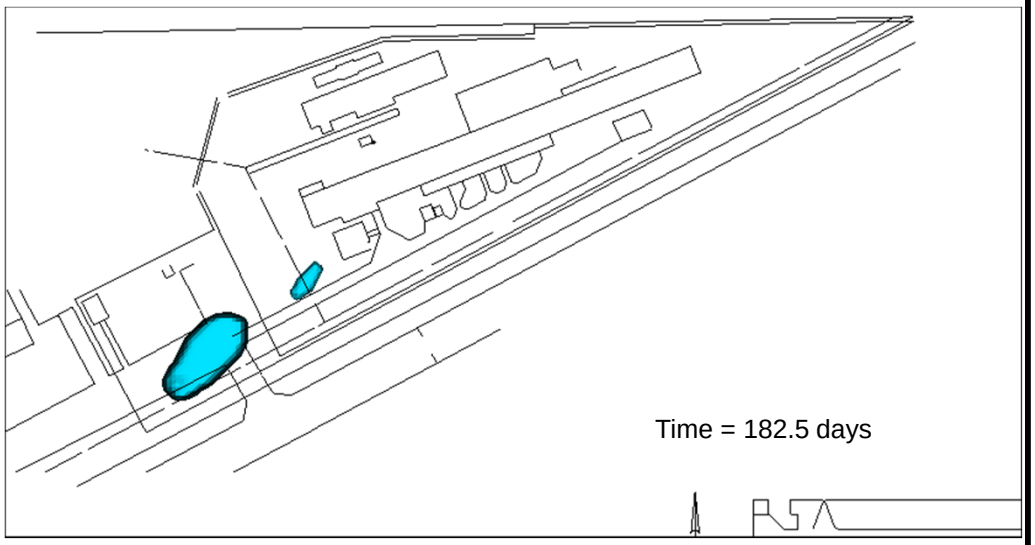
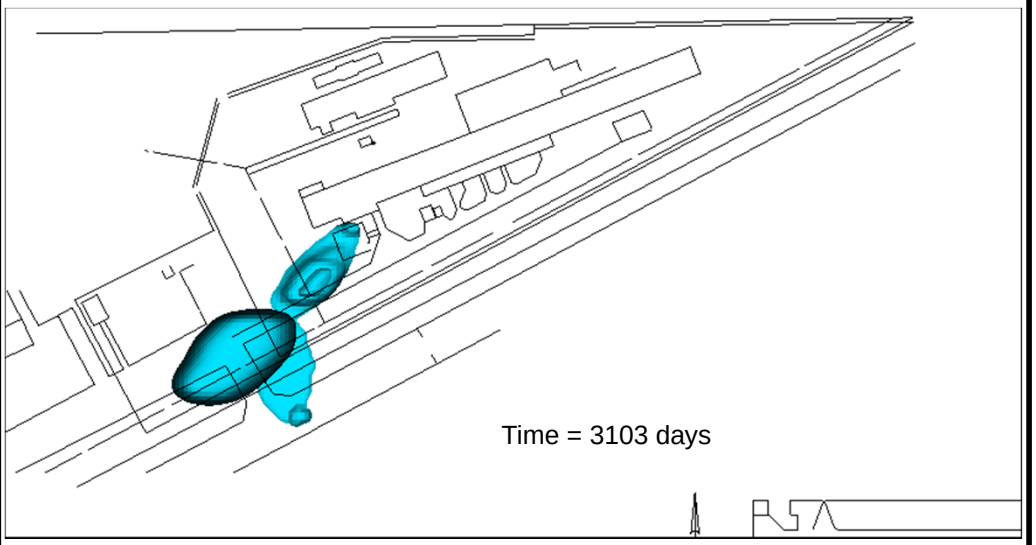
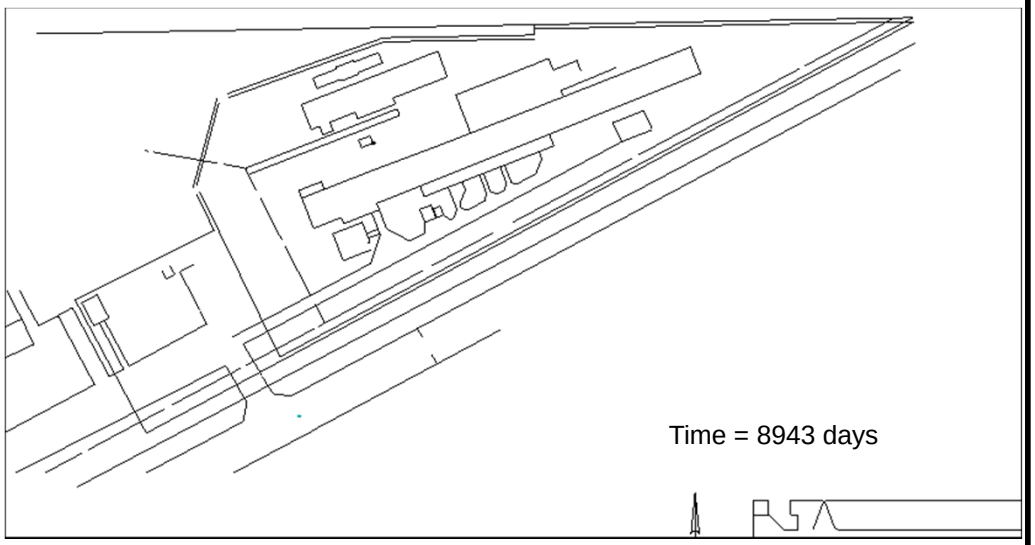
Figure

4-4









Notes:
1. Groundwater solute concentrations estimated based on results obtained from groundwater modeling performed using MODFLOW/MT3DMS.
2. Left top panel shows groundwater solute plume at residential assessment levels (RALs) at the beginning of the simulations as estimated from R,S,&A, First Quarter 2010 Groundwater Monitoring Report, March 2010
3. Right top panel shows estimated time at which groundwater solute plume migrates off-site and right bottom panel shows estimated time at which the plume retreats back to the property boundary
4. Left bottom panel shows estimated time at which groundwater solute plume has the maximum simulated extent of off-site migration
5. Property Outlines as Obtained from a CAD Drawing provided by Weston Solutions, Inc.

N

Estimated Groundwater Solute Concentrations of Vinyl Chloride under No-pumping Conditions

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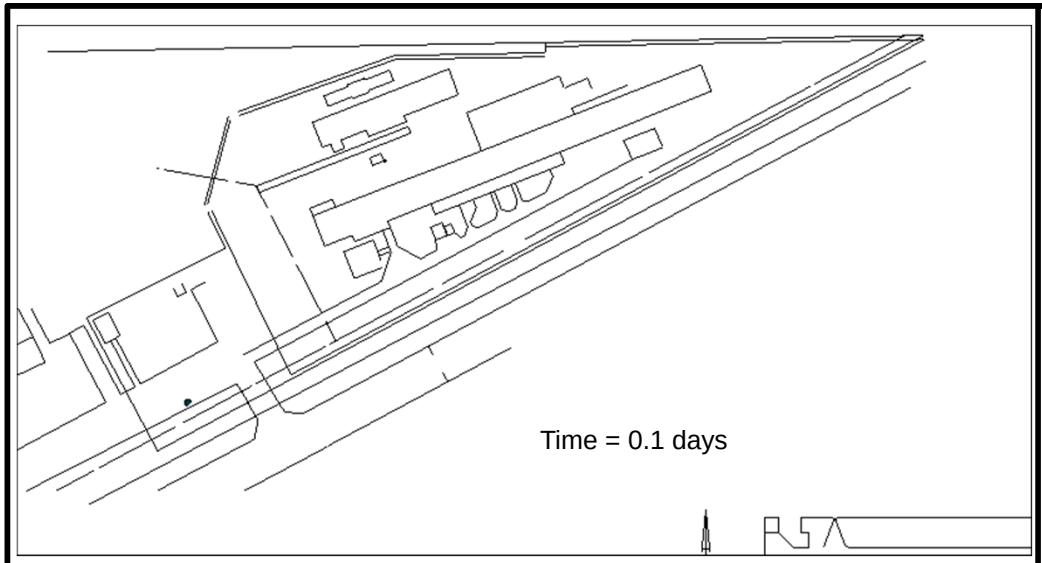
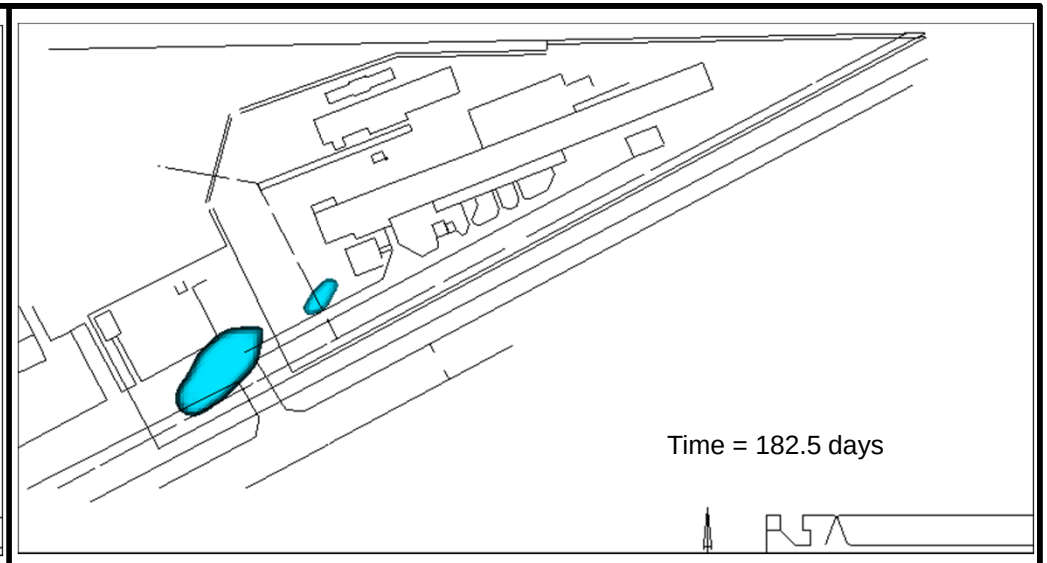
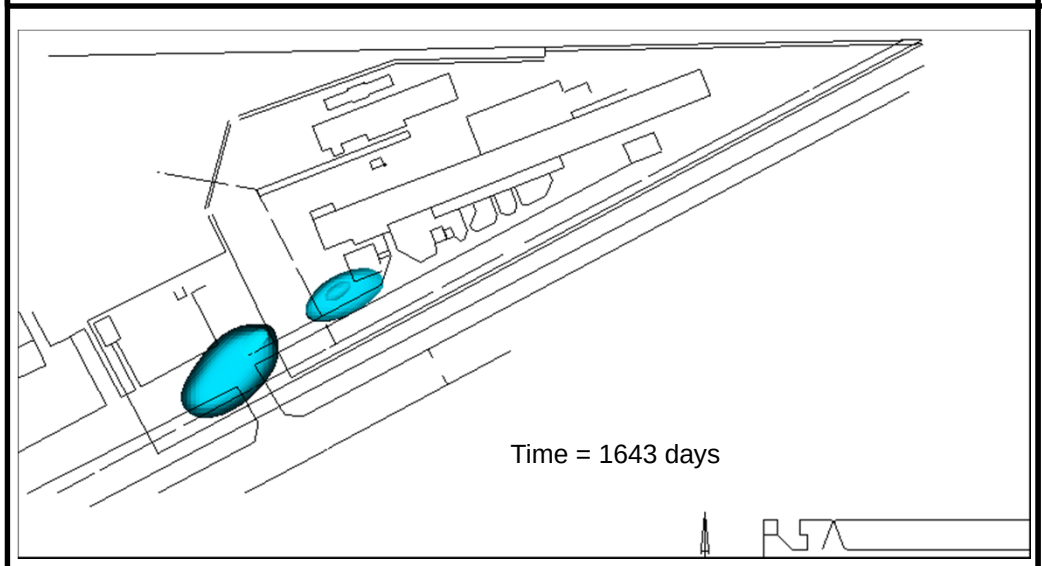
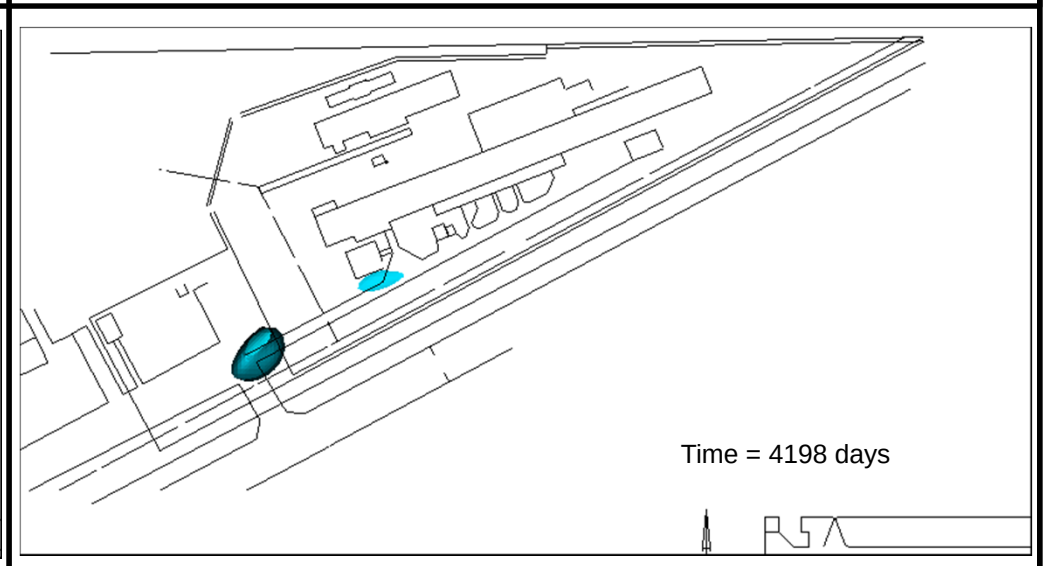
Figure

4-5









Notes:
1. Groundwater solute concentrations estimated based on results obtained from groundwater modeling performed using MODFLOW/MT3DMS.
2. Left top panel shows groundwater solute plume at residential assessment levels (RALs) at the beginning of the simulations as estimated from R,S,&A, First Quarter 2010 Groundwater Monitoring Report, March 2010
3. Right top panel shows estimated time at which groundwater solute plume migrates off-site and right bottom panel shows estimated time at which the plume retreats back to the property boundary
4. Left bottom panel shows estimated time at which groundwater solute plume has the maximum simulated extent of off-site migration
5. Property Outlines as Obtained from a CAD Drawing provided by Weston Solutions, Inc.

N

Estimated Groundwater Solute Concentrations of Vinyl Chloride under Pumping Conditions

GUIC Industries Site
17011 Old Beaumont Highway 90
Houston, Texas 77049

Geosyntec consultants

Boca Raton, FL | August, 2011

Figure **4-6**

APPENDIX A

CALIBRATION STATISTICS FOR NO-PUMPING FLOW MODEL

Calibration Statistics for No-pumping Flow Model
GUIC- Modeling Letter Report

Monitoring Well Name	Northing (ft)	Easting (ft)	Layer	Observed Groundwater Elevation (ft)	Model-estimated Groundwater Elevation (ft)	Residual (ft)
RIW-1	3193174.60	13882971.34	2	91.07	88.69	2.38
RIW-2	3193325.68	13882974.10	2	91.14	88.63	2.50
RIW-3	3192849.42	13882660.51	2	90.57	88.80	1.77
RIW-4A	3192920.64	13882604.80	2	89.79	88.78	1.01
RIW-5	3192964.34	13882746.45	2	90.63	88.76	1.86
RIW-6	3193008.39	13882867.66	2	91.09	88.75	2.34
RIW-7	3192940.66	13882708.73	2	90.27	88.77	1.49
RIW-8	3193065.99	13882683.42	2	90.22	88.72	1.50
RIW-9	3192944.15	13882508.56	2	89.22	88.77	0.45
RIW-10	3193058.19	13882753.19	2	90.55	88.73	1.82
RIW-11	3192979.96	13882307.58	2	87.79	88.75	-0.96
RIW-12	3192882.91	13882445.62	2	89.27	88.79	0.48
RIW-13	3193275.51	13882823.22	2	90.42	88.65	1.77
RIW-14	3193347.10	13882601.49	2	89.68	88.62	1.06
RIW-22	3193029.00	13882494.35	2	89.17	88.73	0.44
RIW-23	3193092.48	13882404.61	2	88.51	88.71	-0.20
RIW-24	3193303.42	13882731.46	2	90.03	88.64	1.39
RIW-25	3192917.95	13882312.88	2	88.24	88.77	-0.53
RIW-26	3193146.60	13882488.36	2	89.42	88.69	0.73
RIW-27	3193065.92	13882576.60	2	89.67	88.72	0.94
RIW-28	3193295.61	13882487.73	2	89.49	88.64	0.86
RIW-29	3193270.02	13882470.14	2	89.11	88.65	0.47
RIW-33	3193420.13	13882559.42	2	89.69	88.59	1.10
RIW-34	3193316.86	13882316.80	2	88.93	88.63	0.30
RIW-35	3193236.25	13882275.34	2	91.04	88.66	2.38
RIW-36	3193021.00	13882160.98	2	87.53	88.73	-1.21
RIW-37	3192704.21	13882444.11	2	91.31	88.85	2.46
RIW-38	3192779.33	13882221.37	2	90.81	88.82	1.99
RIW-39	3192723.74	13882313.07	2	91.47	88.84	2.62
RIW-16	3192974.26	13882318.11	5	87.55	88.69	-1.14
RIW-18	3192942.18	13882499.14	5	88.49	88.69	-0.20
RIW-40	3192727.11	13882305.38	5	86.55	88.69	-2.14
RIW-41	3192533.19	13882119.42	5	85.38	88.69	-3.31
RIW-42	3192380.49	13882163.43	5	85.79	88.69	-2.90
RIW-43	3192290.94	13882379.16	5	84.14	88.69	-4.55
RIW-44	3193414.45	13882555.75	5	87.71	88.69	-0.98
RIW-45	3192789.61	13882225.28	5	86.29	88.69	-2.40
RIW-15	3192936.26	13882505.09	4	89.18	88.70	0.48
RIW-17	3193208.02	13882587.31	4	89.83	88.68	1.14
RIW-19	3192970.60	13882307.36	4	87.85	88.70	-0.85
RIW-20	3193270.02	13882470.14	4	89.58	88.68	0.90
RIW-21	3193178.96	13882758.17	4	90.42	88.69	1.73
RIW-30	3192824.80	13882351.38	4	89.95	88.71	1.24
RIW-31	3193255.46	13882895.59	4	90.78	88.68	2.10
RIW-32	3193349.49	13882805.93	4	90.19	88.67	1.52

Calibration Statistics

Residual Mean	0.53
Abs. Res. Mean	1.48
Res. Std. Dev.	1.65
Sum of Squares	135.69
RMS Error	1.74
Min. Residual	-4.55
Max. Residual	2.62
Number of Observations	45
Range in Observations	7.33
Scaled Std. Dev.	0.23
Scaled Abs. Mean	0.20
Scaled RMS	0.24

APPENDIX B

CALIBRATION STATISTICS FOR PUMPING FLOW MODEL

Calibration Statistics for Pumping Flow Model
GUIC- Modeling Letter Report

Monitoring Well Name	Stress Period	Northing (ft)	Easting (ft)	Layer	Observed Groundwater Elevation (ft)	Model-estimated Groundwater Elevation (ft)	Residual (ft)
RIW-6	1	3193012.64	13882865.03	5	87.17	84.02	3.15
RIW-6	2	3193012.64	13882865.03	5	86.35	84.15	2.20
RIW-34	1	3193325.67	13882321.52	5	86.87	83.95	2.92
RIW-34	2	3193325.67	13882321.52	5	83.64	84.14	-0.50
RIW-36	1	3193029.00	13882164.54	5	82.53	83.50	-0.97
RIW-36	2	3193029.00	13882164.54	5	82.7	83.80	-1.10
RIW-41	1	3192533.19	13882119.42	5	80.95	83.80	-2.85
RIW-41	2	3192533.19	13882119.42	5	82.13	83.93	-1.80
RIW-42	1	3192380.49	13882163.43	5	81.76	84.01	-2.25
RIW-42	2	3192380.49	13882163.43	5	81.36	84.11	-2.75
RIW-43	1	3192290.94	13882379.16	5	81.67	84.10	-2.43
RIW-43	2	3192290.94	13882379.16	5	81.02	84.19	-3.17
RIW-44	1	3193414.45	13882555.75	5	84.67	84.11	0.56
RIW-44	2	3193414.45	13882555.75	5	83.84	84.26	-0.42
RIW-46	1	3192865.40	13882079.45	5	82.67	83.53	-0.86
RIW-46	2	3192865.40	13882079.45	5	83.04	83.74	-0.70
RIW-47	1	3192648.92	13881970.85	5	81.31	83.87	-2.56
RIW-47	2	3192648.92	13881970.85	5	80.4	84.00	-3.60
RIW-48	1	3192495.82	13881894.08	5	81.55	84.12	-2.57
RIW-48	2	3192495.82	13881894.08	5	81.48	84.21	-2.73
RIW-6	1	3193011.18	13882868.76	4	83.29	83.23	0.06
RIW-6	2	3193011.18	13882868.76	4	84.34	84.13	0.21
RIW-15	1	3192936.26	13882505.09	4	81.46	83.04	-1.58
RIW-15	2	3192936.26	13882505.09	4	87.39	84.07	3.32
RIW-19	1	3192970.60	13882307.36	4	82.24	83.17	-0.93
RIW-19	2	3192970.60	13882307.36	4	81.97	84.10	-2.13
RIW-21	1	3193178.96	13882758.17	4	82.72	82.72	0.00
RIW-21	2	3193178.96	13882758.17	4	83.77	83.96	-0.19
RIW-30	1	3192824.80	13882351.38	4	84.2	83.40	0.80
RIW-30	2	3192824.80	13882351.38	4	83.77	84.21	-0.44
RIW-31	1	3193255.46	13882895.59	4	84.17	83.12	1.05
RIW-31	2	3193255.46	13882895.59	4	84.87	84.07	0.80
RIW-32	1	3193349.49	13882805.93	4	83.71	82.96	0.75
RIW-32	2	3193349.49	13882805.93	4	84.32	84.00	0.32
RIW-36	1	3193013.25	13882155.75	4	83.2	83.36	-0.16
RIW-36	2	3193013.25	13882155.75	4	82.84	84.17	-1.33
RIW-51	1	3193509.71	13882602.49	4	83.08	82.90	0.18
RIW-51	2	3193509.71	13882602.49	4	84.41	83.95	0.46
RIW-52	1	3193199.54	13882929.98	4	83.9	83.20	0.70
RIW-52	2	3193199.54	13882929.98	4	84.49	84.10	0.39
RIW-53	1	3193087.84	13882765.66	4	81.88	82.88	-1.00
RIW-53	2	3193087.84	13882765.66	4	82.89	84.02	-1.13
RIW-55	1	3192720.68	13882665.60	4	84.93	83.53	1.40
RIW-55	2	3192720.68	13882665.60	4	85.29	84.26	1.03
RIW-56	1	3193519.65	13882425.30	4	82.85	82.91	-0.06
RIW-56	2	3193519.65	13882425.30	4	83.64	83.94	-0.30
RIW-2	1	3193325.68	13882974.10	2	84.32	84.07	0.25
RIW-2	2	3193325.68	13882974.10	2	86.83	85.11	1.72
RIW-3	1	3192849.42	13882660.51	2	83.1	83.52	-0.42
RIW-3	2	3192849.42	13882660.51	2	83.91	85.13	-1.22
RIW-5	1	3192964.34	13882746.45	2	78.19	83.36	-5.17
RIW-5	2	3192964.34	13882746.45	2	83.7	85.00	-1.30
RIW-6	1	3193008.39	13882867.66	2	83.4	83.68	-0.28
RIW-6	2	3193008.39	13882867.66	2	84.36	85.07	-0.71
RIW-7	1	3192940.66	13882708.73	2	82.13	83.37	-1.24
RIW-7	2	3192940.66	13882708.73	2	83.24	85.03	-1.79

Calibration Statistics for Pumping Flow Model
GUIC- Modeling Letter Report

Monitoring Well Name	Stress Period	Northing (ft)	Easting (ft)	Layer	Observed Groundwater Elevation (ft)	Model-estimated Groundwater Elevation (ft)	Residual (ft)
RIW-8	1	3193065.99	13882683.42	2	81.81	83.21	-1.40
RIW-8	2	3193065.99	13882683.42	2	83.01	84.95	-1.94
RIW-11	1	3192979.96	13882307.58	2	82.06	83.52	-1.46
RIW-11	2	3192979.96	13882307.58	2	81.59	85.13	-3.54
RIW-12	1	3192882.91	13882445.62	2	82.06	83.23	-1.17
RIW-12	2	3192882.91	13882445.62	2	81.74	85.09	-3.35
RIW-13	1	3193275.51	13882823.22	2	83.61	83.80	-0.19
RIW-13	2	3193275.51	13882823.22	2	81.24	85.05	-3.81
RIW-14	1	3193347.10	13882601.49	2	81.13	83.62	-2.49
RIW-14	2	3193347.10	13882601.49	2	83.69	85.03	-1.34
RIW-23	1	3193092.48	13882404.61	2	81.37	83.26	-1.89
RIW-23	2	3193092.48	13882404.61	2	82.07	85.02	-2.95
RIW-24	1	3193303.42	13882731.46	2	83.12	83.70	-0.58
RIW-24	2	3193303.42	13882731.46	2	83.78	85.04	-1.26
RIW-25	1	3192917.95	13882312.88	2	82.31	83.53	-1.22
RIW-25	2	3192917.95	13882312.88	2	82.1	85.14	-3.04
RIW-26	1	3193146.60	13882488.36	2	79.77	83.17	-3.40
RIW-26	2	3193146.60	13882488.36	2	82.51	84.98	-2.47
RIW-27	1	3193065.916	13882576.6	2	81.68	83.00	-1.32
RIW-27	2	3193065.92	13882576.60	2	82.53	84.93	-2.40
RIW-33	1	3193420.13	13882559.42	2	82.28	83.75	-1.47
RIW-33	2	3193420.13	13882559.42	2	84.1	85.05	-0.95
RIW-34	1	3193316.86	13882316.80	2	84.56	83.72	0.84
RIW-34	2	3193316.86	13882316.80	2	83.35	85.09	-1.74
RIW-35	1	3193236.25	13882275.34	2	83.46	83.72	-0.26
RIW-35	2	3193236.25	13882275.34	2	85.36	85.11	0.25
RIW-36	1	3193021.00	13882160.98	2	82.18	83.90	-1.72
RIW-36	2	3193021.00	13882160.98	2	86.35	85.22	1.13
RIW-37	1	3192704.21	13882444.11	2	86.51	83.75	2.76
RIW-37	2	3192704.21	13882444.11	2	86.51	85.24	1.27
RIW-38	1	3192779.33	13882221.37	2	85.9	83.83	2.07
RIW-38	2	3192779.33	13882221.37	2	85.11	85.25	-0.14
RIW-47	1	3192636.77	13881965.54	2	89.85	84.58	5.27
RIW-47	2	3192636.77	13881965.54	2	87.31	85.52	1.79
RIW-50	1	3193501.78	13882598.40	2	83.4	83.92	-0.52
RIW-50	2	3193501.78	13882598.40	2	84.55	85.07	-0.52

Calibration Statistics

Residual Mean	-0.69
Abs. Res. Mean	1.51
Res. Std. Dev.	1.77
Sum of Squares	331.52
RMS Error	1.90
Min. Residual	-5.17
Max. Residual	5.27
Number of Observations	92
Range in Observations	11.66
Scaled Std. Dev.	0.15
Scaled Abs. Mean	0.13
Scaled RMS	0.16

APPENDIX C

WELL FLOW RATES OBTAINED FROM CALIBRATION OF PUMPING FLOW MODEL

Well Flow Rates Obtained from Calibration of Pumping Flow Model
GUIC- Modeling Letter Report

Extraction Well Name	Flow Rate	Layer	Stress Period
RIW4-A	-1.41	2	1
RIW4-A	-1.41	2	2
RIW-9	-359.27	2	1
RIW-9	-19.08	2	2
RIW-10	-328.07	2	1
RIW-10	-138.35	2	2
RIW-16R	-594.48	5	1
RIW-16R	-172.39	5	2
RIW-17	-172.49	4	1
RIW-17	-25.89	4	2
RIW-18	-536.89	5	1
RIW-18	-509.05	5	2
RIW-20	-264.97	4	1
RIW-20	-135.48	4	2
RIW-22	-413.84	2	1
RIW-22	-131.65	2	2
RIW-29	-294.21	2	1
RIW-29	-41.80	2	2
RIW-39	-326.10	2	1
RIW-39	-114.99	2	2
RIW-40	-550.55	5	1
RIW-40	-606.07	5	2
RIW-45	-544.06	5	1
RIW-45	-559.35	5	2