CITY OF HOUSTON

PUBLIC WORKS AND ENGINEERING
PLANNING & DEVELOPMENT DIVISION

EXECUTIVE SUMMARY

Project Overview

InControl Technologies, Inc was retained by Lone Star Terminal LLC (the property owner), to provide environmental consulting services at the Former Lone Star Refinery property located at 8901 Manchester Street in Houston, Harris County, Texas (**Figure A1**). The subject property (Site) consists of approximately 21-acres of land located southeast of downtown Houston, Harris County, Texas along the Houston Ship Channel (**Figure B1**). The subject property is currently undeveloped. Historic operations at the former Lone Star Refinery facility have impacted shallow groundwater at the subject property.

The subject property is located on the western boundary of the San Jacinto River Watershed (**Figure B2**). According to the Flood Insurance Rate Map the site is located outside the 0.2% annual chance floodplain (**Figure B3**). Approximately 90% of the subject property is undeveloped. The remaining 10% is covered with buildings and driveways. Portions of the property are currently leased to various companies for pipe storage.

The site currently has four areas of concern with PCLE zones (**Figure B4**). PCLE Zone 1 (TPH and benzene exceedences) is centered on MW-7 along the western property boundary. PCLE Zone 2 is centered on MW-6 (arsenic exceedences). PCLE Zone 3 extends along the eastern property boundary between monitoring wells MW-4 and MW-3. This zone is an area of arsenic exceedences. PCLE Zone 4 (arsenic, benzene and TPH) is centered on MW-23 located at the far southwest corner of the property (**Figure B4**). The arsenic exceedences are believed to be naturally occurring since arsenic is not a common metal associated with either refining operations or the current and historic land uses.

Historical Environmental Condition

The subject property has had two primary historical uses. First, oil refinery operations were conducted on the property between 1918 and 1968, at which time the last refinery owner, Signal Oil Company (NAICS code 324110), shut down and dismantled the refinery. Second, Lone Star purchased the property from Allied Signal in 1968. Several additional industrial facilities occupied the site including a trucking company and the site was utilized as storage areas for the adjacent concrete plant (NAICS code 327310) from the late 1960s through the 1990s. Lone Star subsequently sold approximately 9 acres of the former Allied Signal property to Port Properties, retaining approximately 27 acres of the former Allied Signal property. Currently, two sections of the property are used as pipe lay-down yards, and the rest of the property is vacant. There are two buildings on the property: a 14,000 sq. ft. office/warehouse building

and a 5,000 sq. ft. metal building. It is anticipated that the future use of the property will remain industrial, taking advantage of the water access along the Houston Ship Channel.

Lone Star Industries, Inc. conducted a preliminary environmental assessment of the property in 1989 to develop an understanding of the environmental conditions associated with the property. The work involved the completion of eleven test trenches and two monitoring wells on the portion of the property presently owned by Lone Star. This limited assessment work identified the presence of refinery wastes in the subsoils at several locations on the property.

Lone Star conducted a second site assessment in November 1992 to further evaluate environmental conditions at the property. Twenty-three soil samples were collected from surface soils, soil borings, and excavated trenches located across the property (**Table F-1 through F-3, Figure B5-1** and **Figure B5-2**). These samples were analyzed for polynuclear aromatic hydrocarbons (PAH), total petroleum hydrocarbons (TPH), chlorides, sulfates, sulfur, chromium, nickel, lead, and vanadium. Selected samples were also analyzed for polychlorinated biphenyls (PCBs); twenty shallow subsurface samples were analyzed for asbestos. This evaluation determined that weathered refinery hydrocarbon compounds and several metals, primarily chromium and lead, were present in the subsoils of the property (**Table F-1,**). Groundwater samples from monitoring wells located on the property contained trace metals and TPH (**Tables F-4 through F-6, Figures B8-1** through **B8-3**). These wells were sampled using a bailer and the results may have been influenced by sample turbidity.

Lone Star conducted a third site assessment in March 1998 to further define environmental conditions in order to evaluate property development options at the property. The objective of the 1998 site assessment activities was to verify the nature and general extent of the waste residues and impacted soils within defined areas of the property. To accomplish this task, 104 evaluation trenches were excavated between July 20 and August 24, 1998. The excavation method was selected due to the substantial quantities of concrete and debris present in the subsoils. The evaluation trenches were generally excavated to depths ranging from 3 to 8 feet below ground surface. The excavated soils were visually inspected for signs of contamination, soil type, and evidence of groundwater saturation. Based upon the visual inspection, waste residue and/or soil samples may have been collected for headspace screening and selected samples were collected for analysis of chromium, lead, nickel, and Skinner List volatiles and semivolatiles. These parameters were selected based upon the analytical results from the 1993 preliminary investigation report.

The objective of the March 2001 assessment work was to evaluate the distribution of refinery residues in three specific areas of the property. Two of these areas were the western and southwestern areas of the property that had previously been obstructed by heavy brush and large trees. These areas were the former location of the original refining operations. The third area was along the eastern boundary of the Lone Star property created by the sale of the original Lone Star property to the east of the former Allied Signal property. The 2001 assessment involved the excavation of 25 trenches to an average depth of approximately 6 feet below grade. The primary function of the trenches was to provide a visual indication of refinery residues and impacted soils and to identify the nature of the fill materials and debris overlying and underlying the residues in these specific areas. Eight refinery residue and soil samples and one

liquid sample were collected for chemical analysis of Skinner List volatiles, semivolatiles, and metals. Each of these samples was evaluated for PAH constituents using ion capture techniques to provide a lower detection limit and allow better resolution of the constituents present.

The objective of the 2007 site assessment was to define the nature and extent of the affected soils that require remedial response in order to achieve TRRP Tier 2 remedy B criteria for industrial properties. The 2007 site assessment consisted of extensive soil excavation (37 trenches, 8'-10' deep, 3'-8' wide, 30'-50' long); the soil was classified via visual observation, field testing, TPH analyses, and VOC analyses.

There was a benzene pipeline release on the Port Recycler property adjacent to the subject property. Little or no information about the release is known at this time. There was an oil spill in recent months along the Ship Channel. In response to this, in December 2009, InControl Technologies collected sediment, surface water, and soil samples in four locations along the bank and in the Ship Channel to check for possible impact to the Lone Star property. All monitoring wells on the subject property were also sampled in December 2009 (**Tables F-4 through F-6, Figure B6**).

The lateral extent of groundwater impact has been horizontally delineated in all directions to the greatest extents possible. PCLE Zone 1 extends offsite onto an active industrial facility (Rhodia Chemical). PCLE Zone 2 is delenated by monitoring wells MW-14 and MW-13 and the Houston Ship Channel to the north. PCLE Zone 3 extends offsite on to an adjacent property (Texas Port Recycling). A Municipal Setting Designation is being sought for the Texas Port Recycling Property. PCLE Zone 4 is the result of an off-site source and is delineated by monitoring wells MW-2 and MW-22 (**Figure B4**). The groundwater gradient at the site is to the north in the shallow groundwater bearing unit (**Figure B7**).

Seventeen (17) water wells were identified within a ½-mile radius of the proposed MSD boundary. Two (2) of the identified water wells are listed as "plugged" and one (1) of the identified water wells is listed as "destroyed". All three (3) wells were located on adjacent properties and are industrial use wells. No domestic use wells were identified within a ½-mile radius of the proposed MSD boundary. The nearest domestic well is located approximately 2.4-miles west (cross-gradient) from the proposed MSD boundary. According to the information contained in the water well search this well was drilled in 1940 and is completed at a depth of 590-feet bgs. No information was available regarding the screened interval but is assumed this well is screened near the completion depth. This well is drawing water from a zone deeper than the impacted zone at the subject property. The nearest public water supply well is located greater than 1 mile northeast (cross-gradient) and across the Houston Ship Channel from the proposed MSD boundary. The public water supply well is owned by the City of Galena Park. A copy of the well log was not available but the screened interval was noted from 935- to 1,165-ft bgs. It is anticipated that the completion depth is near 1,170-ft bgs. This well draws water from depth much deeper than the impacted zones at the former Lone Star Refinery property. The nearest sensitive receptor (Houston Ship Channel) is located adjacent north to the proposed MSD boundary. The Ship Channel is located downgradient of the area of impacted groundwater.

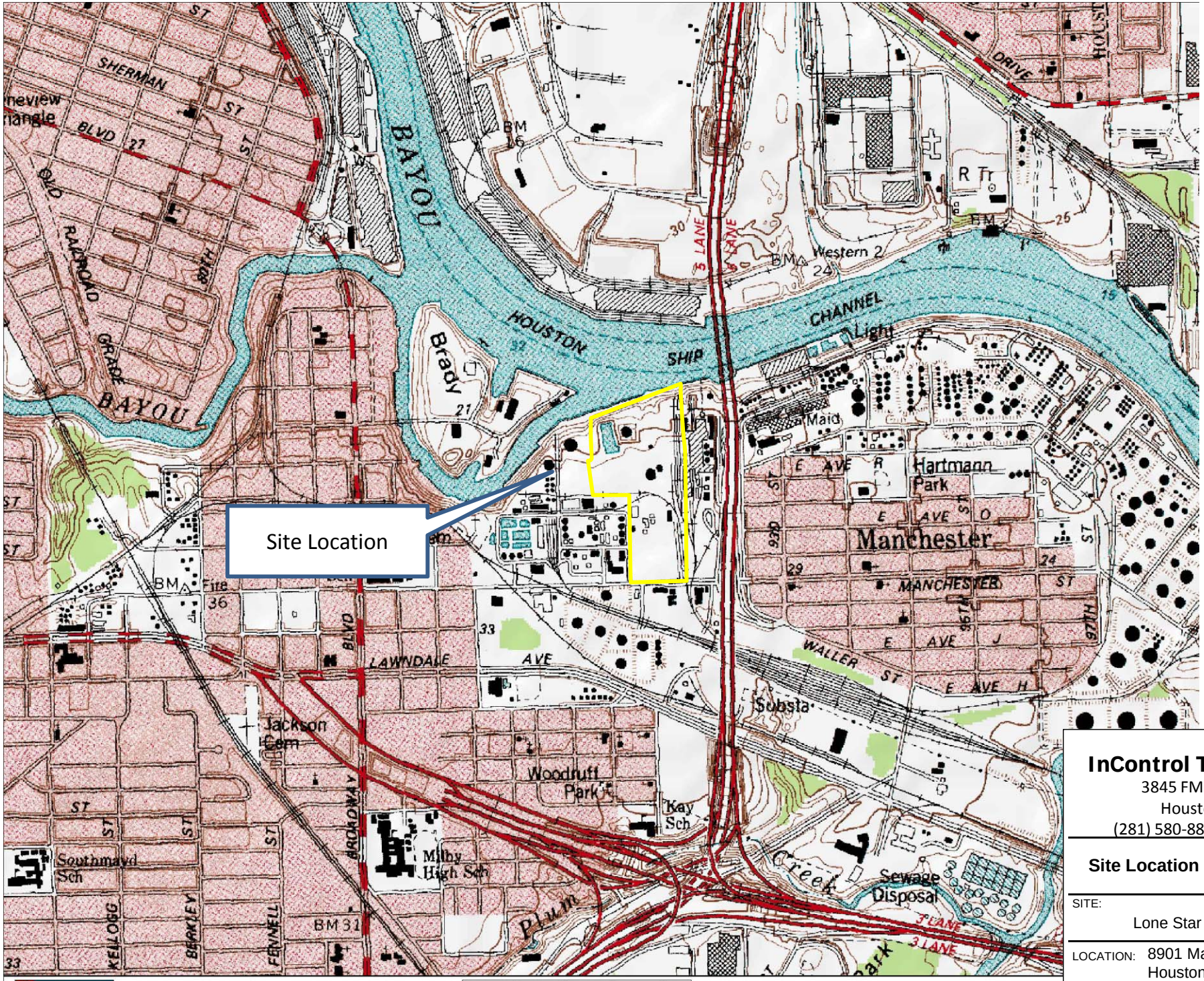
Appendix B – Site Maps

The figures set out in this section provide information required under **Item 2**. The maps depict the property location and topography, the area of groundwater contamination, the location of all soil sampling points and groundwater monitoring wells, the groundwater gradient, and the soil and groundwater PCL exceedence zones.

The following is a listing of figures included in **Appendix B**.

Figure B1 – Site location and topographic Map
Figure B2 – Watershed Map
Figure B3 – Floodplain Map
Figure B4 – Groundwater PCLE zones
Figure B5-1 – Soil sampling locations (Northern portion)
Figure B5-2 – Soil sampling locations (Southern portion)
Figure B6 – Groundwater Monitoring Well Location Map
Figure B7 – Groundwater Gradient Map (December 2009)
Figure B8-1 – Groundwater PCL Exceedence zone map (Arsenic, December 2009)
Figure B8-2 – Groundwater PCL Exceedence zone map (Benzene, December 2009)
Figure B8-3 – Groundwater PCL Exceedence zone map (TPH, December 2009)

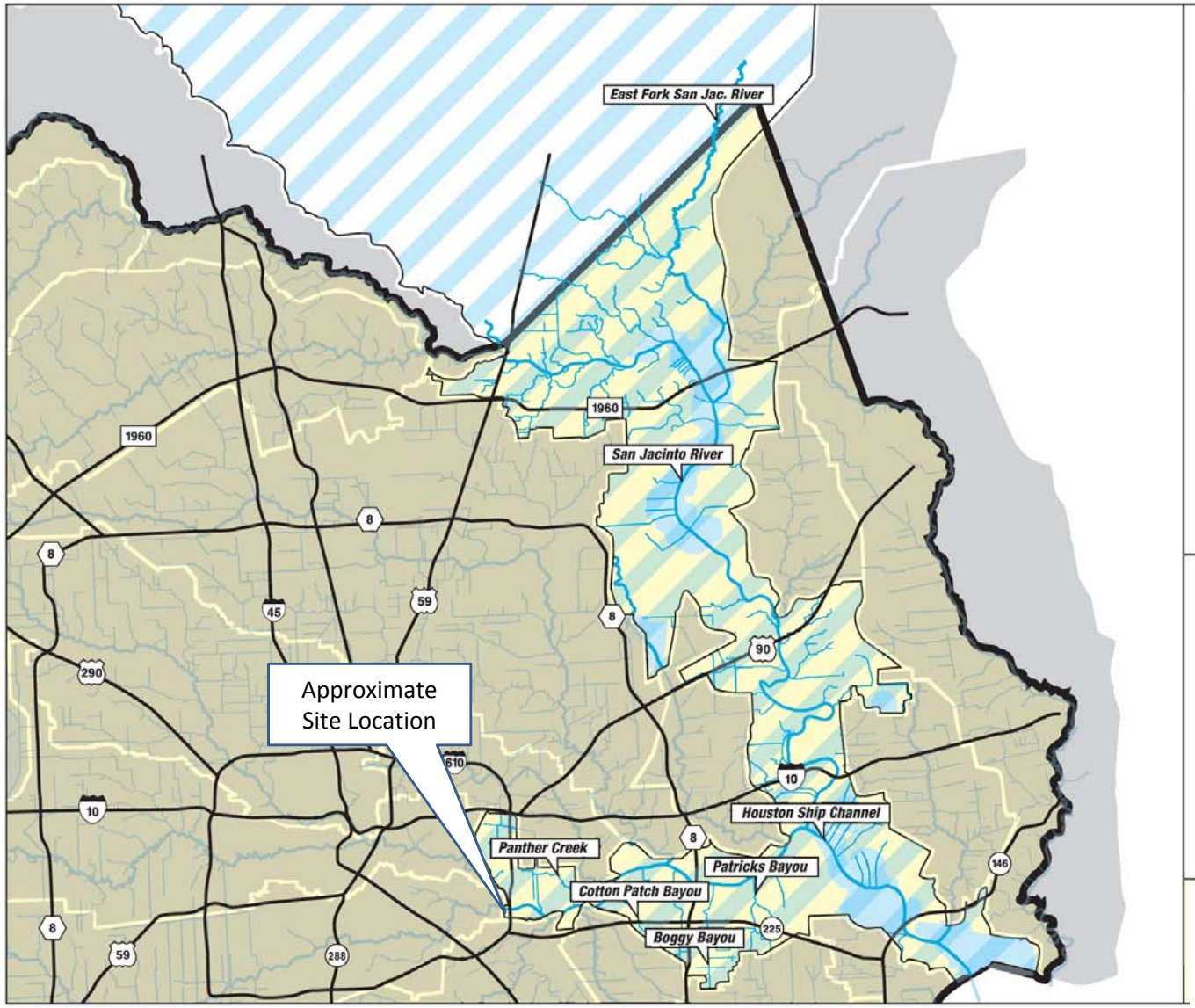
The subject property is located on the western boundary of the San Jacinto River Watershed (**Figure B2**). The site is not located in the 100-year floodplain (**Figure B3**).



InControl Technologies, Inc.
3845 FM 1960 W, Suite 195
Houston, Texas 77068
(281) 580-8892 FAX (281) 580-8853

Site Location and Topographic Map

SITE: Lone Star Refinery			PM: MFM
LOCATION: 8901 Manchester St Houston, TX 77012			CHECKED:
DETAILED: LMG	DESIGNED: 10/26/07	PROJECT NO: 535-104	FIGURE: **B1**



N

Drainage Area:
487 Sq. Miles

Watershed Population (In Harris County):
148,370

Open Stream Miles:
310 Miles

Primary Streams:

San Jacinto River	*Boggy Bayou*
Houston Ship Channel	*Patricks Bayou*
Cotton Patch Bayou	*Panther Creek*
East Fork San Jacinto River	

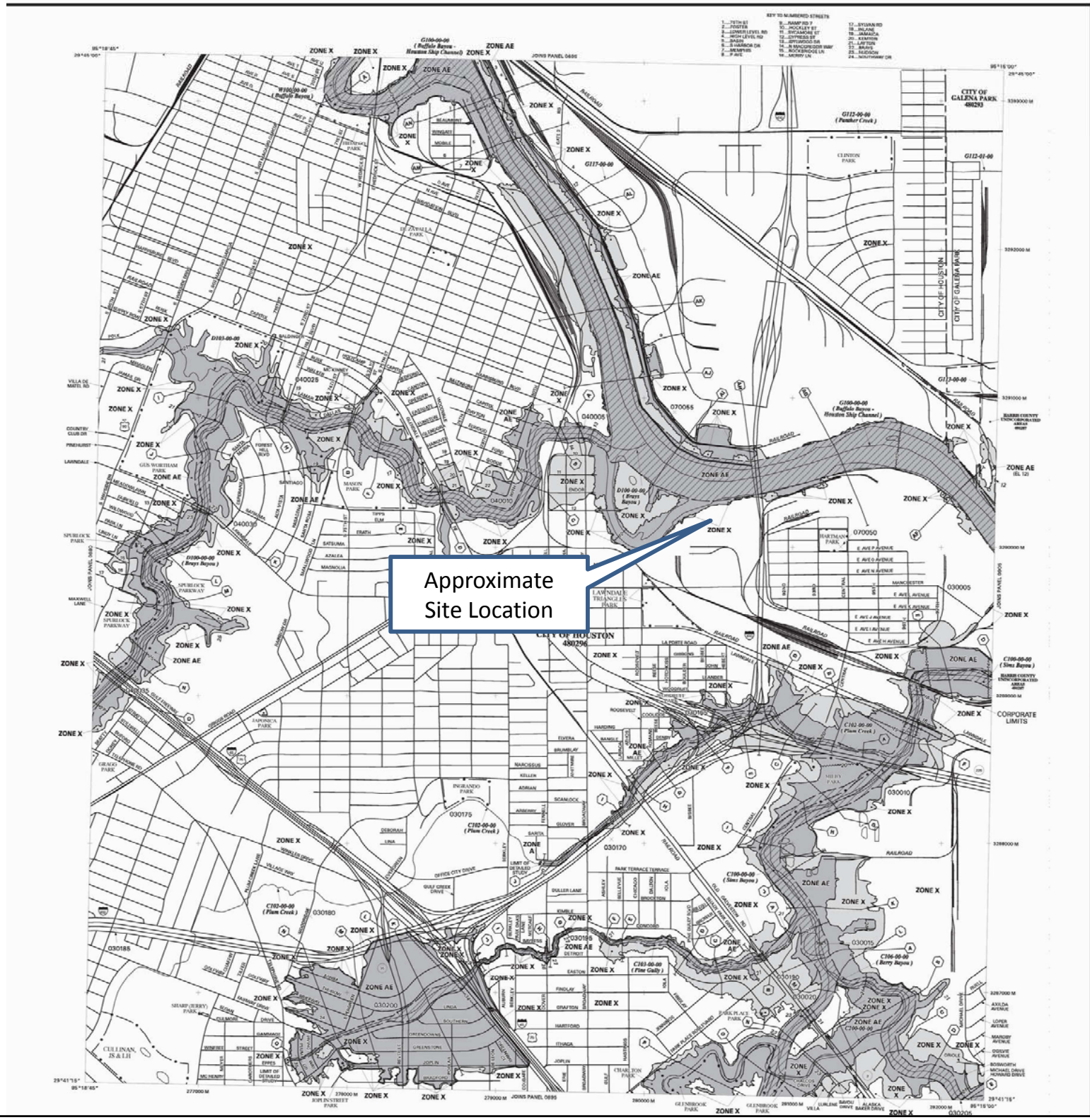
Source: Harris County Flood Control District

InControl Technologies, Inc.
3845 FM 1960 W, Suite 195
Houston, Texas 77068
(281) 580-8892 FAX (281) 580-8853

Watershed Map

SITE:	PM:
Lone Star Refinery	MFM
LOCATION: 8901 Manchester St, Houston, TX 77012	CHECKED:

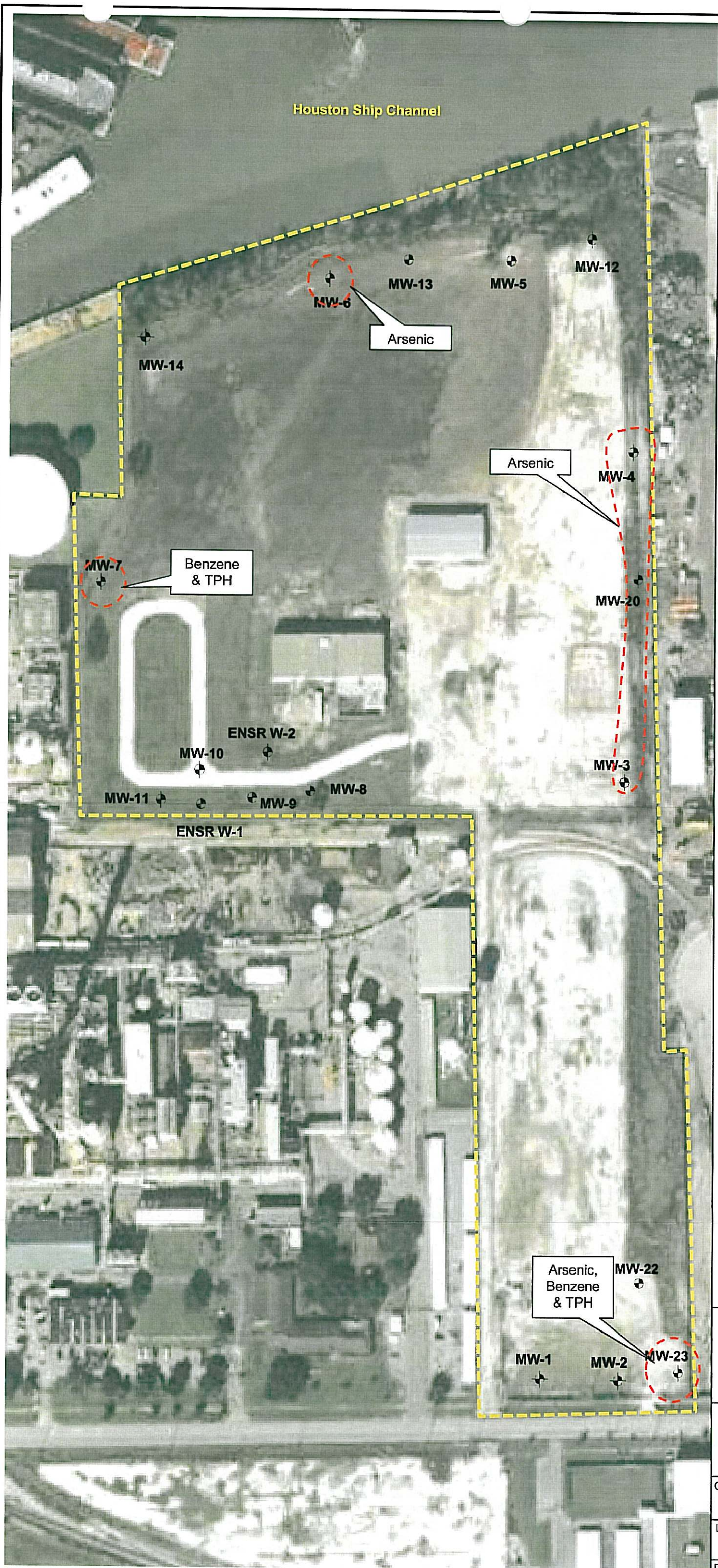
DETAILED:	DESIGNED:	PROJECT NO:	FIGURE:
LMG	3/10/10	535-104	**B2**



InControl Technologies, Inc.
3845 FM 1960 W, Suite 195
Houston, Texas 77068
(281) 580-8892 FAX (281) 580-8853

Flood Plain Map

SITE: Lone Star Refinery			PM: MFM
LOCATION: 8901 Manchester St Houston, TX 77012			CHECKED:
DETAILED: LMG	DESIGNED: 3/10/10	PROJECT NO: 535-104	FIGURE: **B3**



LEGEND:

MSD Boundary

Groundwater Monitoring Well

STATE OF TEXAS
MICHAEL MARCON
GEOLOGIST
2704
LICENSED
PROFESSIONAL GEOSCIENTIST

N

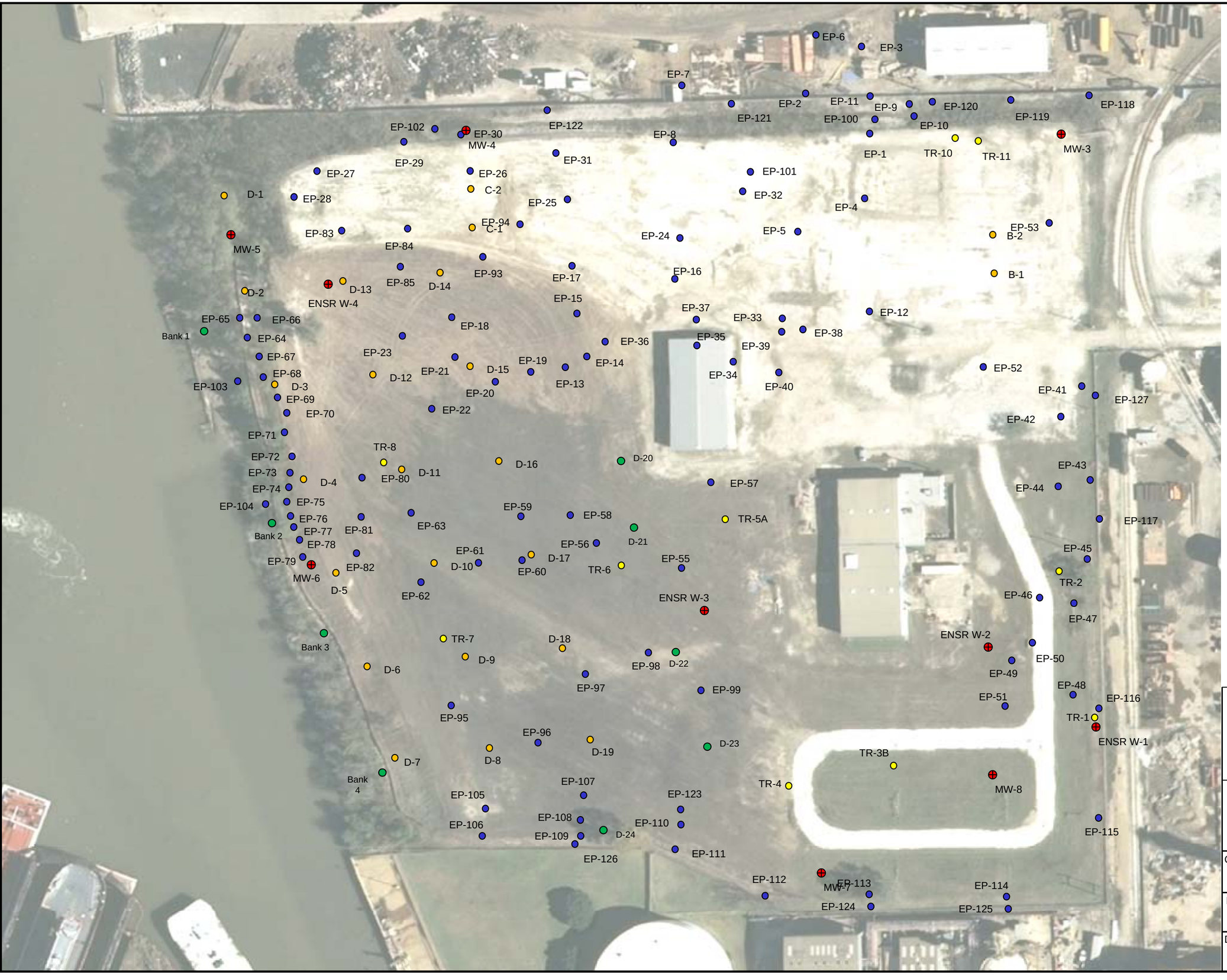
0 300 600

Approximate Scale (Feet)

InControl Technologies, Inc.
3845 FM 1960 W, Suite 195
Houston, Texas 77068
(281) 580-8892 FAX (281) 580-8853

Groundwater PCLE Zones

CLIENT: Former Lone Star Refinery			PM: MFM
LOCATION: 8901 Manchester Houston, Texas 77012			CHECKED
DETAILED: CP	DESIGNED: 3/10/10	PROJECT NO: 535-104	FIGURE: B4



LEGEND:

- ENSR Monitoring Well Location
- ENSR Soil Borings
- Chickadee Soil Sampling Locations
- ICT Soil Sampling Locations

W-1 thru W-6 done in 1992
TR-1 thru TR-11 done in 1992
EP-1 thru EP-104 done in 1998
EP-105 thru EP127 done in 2001

N

0 100 200

Approximate Scale

InControl Technologies, Inc.
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Houston, Texas 77068
(281) 580-8892 FAX (281) 580-8853

Soil Sample Location Map
Northern Portion

CLIENT: Lone Star Refinery			PM: MFM
LOCATION: 8901 Manchester Houston, Texas 77012			CHECKED:
DETAILED: MFM	DESIGNED:	PROJECT NO: 535-101	FIGURE: **B5-1**

LEGEND:

- ENSR Soil Borings
- Chickadee Soil Sampling Locations

N

0 100 200

Approximate Scale

InControl Technologies, Inc.
3845 FM 1960 W, Suite 195
Houston, Texas 77068
(281) 580-8892 FAX (281) 580-8853

Soil Sample Location Map
Southern Portion

CLIENT: Lone Star Refinery			PM: MFM
LOCATION: 8901 Manchester Houston, Texas 77012			CHECKED:
DETAILED: MFM	DESIGNED:	PROJECT NO: 535-101	FIGURE: **B5-2**

LEGEND:

MSD Boundary

Groundwater Monitoring Well

STATE OF TEXAS
6/17/2010
GEOLOGIST
2704
LICENSED
PROFESSIONAL GEOSCIENTIST

N

0 300 600

Approximate Scale (Feet)

InControl Technologies, Inc.
3845 FM 1960 W, Suite 195
Houston, Texas 77068
(281) 580-8892 FAX (281) 580-8853

Groundwater Monitoring Well Location Map

CLIENT: Former Lone Star Refinery			PM: MFM
LOCATION: 8901 Manchester Houston, Texas 77012			CHECKED
DETAILED: CP	DESIGNED: 3/10/10	PROJECT NO: 535-104	FIGURE: B6

LEGEND:

MSD Boundary

Groundwater Monitoring Well

(89.29) Groundwater Elevation (rel. ft)

Direction of Groundwater Flow

STATE OF TEXAS
GEOLOGIST
2704
LICENSED
PROFESSIONAL GEOSCIENTIST

N

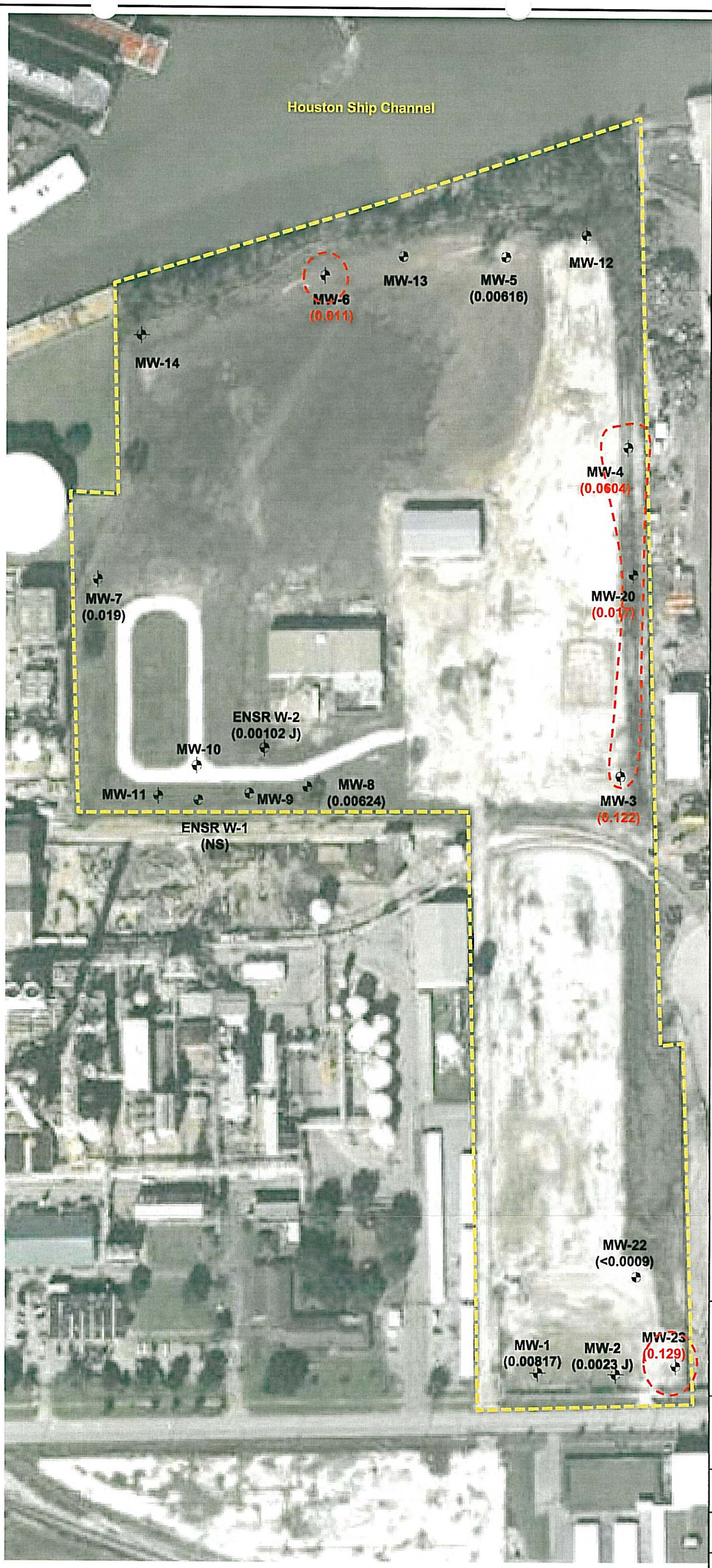
0 300 600

Approximate Scale (Feet)

InControl Technologies, Inc.
3845 FM 1960 W, Suite 195
Houston, Texas 77068
(281) 580-8892 FAX (281) 580-8853

Groundwater Gradient Map
December 2009

CLIENT: Former Lone Star Refinery			PM: MFM
LOCATION: 8901 Manchester Houston, Texas 77012			CHECKED
DETAILED: CP	DESIGNED: 3/10/10	PROJECT NO: 535-104	FIGURE: B7



LEGEND:

MSD Boundary

Groundwater Monitoring Well

(0.01) Concentration (mg/L)

(0.01) Concentration exceeds PCL

STATE OF TEXAS
6/17/2010
PROFESSIONAL GEOSCIENTIST

N

0 300 600

Approximate Scale (Feet)

InControl Technologies, Inc.
3845 FM 1960 W, Suite 195
Houston, Texas 77068
(281) 580-8892 FAX (281) 580-8853

Arsenic Concentrations in Groundwater (December 2009)

CLIENT: Former Lone Star Refinery			PM: MFM
LOCATION: 8901 Manchester Houston, Texas 77012			CHECKED
DETAILED: CP	DESIGNED: 3/10/10	PROJECT NO: 535-104	FIGURE: B8-1

LEGEND:

MSD Boundary

Groundwater Monitoring Well

(0.01) Concentration (mg/L)

(0.01) Concentration exceeds PCL

PCLE Zone

STATE OF TEXAS
GEOLOGIST
2704
LICENSED
PROFESSIONAL GEOSCIENTIST
6/17/2010

N

0 300 600

Approximate Scale (Feet)

InControl Technologies, Inc.
3845 FM 1960 W, Suite 195
Houston, Texas 77068
(281) 580-8892 FAX (281) 580-8853

Benzene Concentrations in Groundwater (December 2009)

CLIENT: Former Lone Star Refinery			PM: MFM
LOCATION: 8901 Manchester Houston, Texas 77012			CHECKED
DETAILED: CP	DESIGNED: 3/10/10	PROJECT NO: 535-104	FIGURE: B8-2

LEGEND:

MSD Boundary

Groundwater Monitoring Well

(0.01) Concentration (mg/L)

(0.01) Concentration exceeds PCL

PCLE Zone

STATE OF TEXAS
MICHAEL F. MACCOY
GEOLOGIST
2704
LICENSED
PROFESSIONAL GEOSCIENTIST
6/17/2010

N

0 300 600

Approximate Scale (Feet)

InControl Technologies, Inc.
3845 FM 1960 W, Suite 195
Houston, Texas 77068
(281) 580-8892 FAX (281) 580-8853

TPH Concentrations in Groundwater (December 2009)

CLIENT: Former Lone Star Refinery			PM: MFM
LOCATION: 8901 Manchester Houston, Texas 77012			CHECKED
DETAILED: CP	DESIGNED: 3/10/10	PROJECT NO: 535-104	FIGURE: B8-3

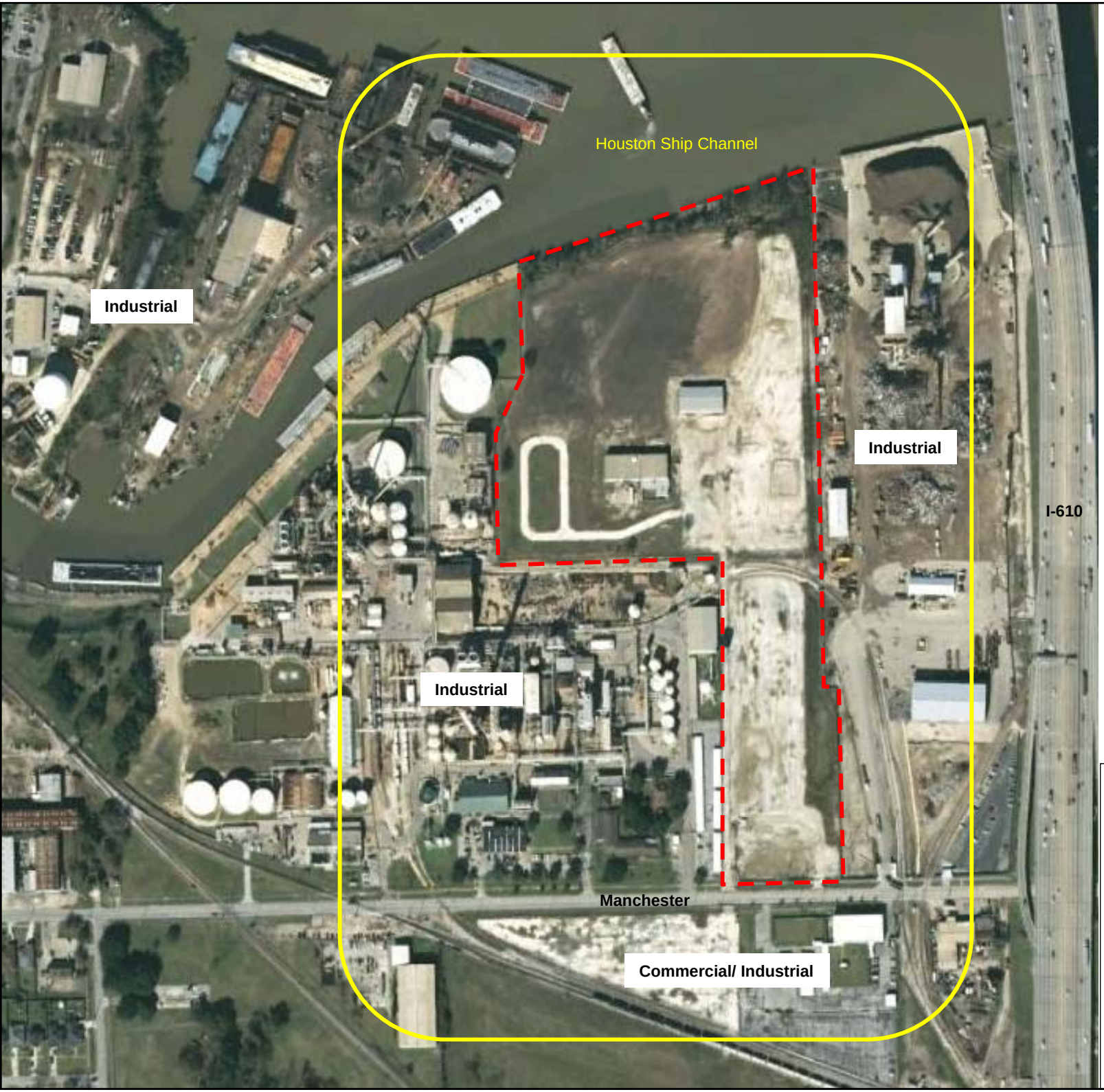
Appendix C – Property Use

The subject property (Site) consists of approximately 21-acres of land located southeast of downtown Houston, Harris County, Texas. The affected property is located in a primarily industrial area (**Figure C1**).

Currently, two sections of the property are used as pipe lay-down yards, and the rest of the property is vacant. There are two buildings on the property: a 14,000 sq. ft. office/warehouse building and a 5,000 sq. ft. metal building. Approximately 90% of the subject property is undeveloped (**Figure C1**). The remaining 10% is covered with building and driveways. It is anticipated that the future use of the property will remain industrial, taking advantage of the water access along the Houston Ship Channel.

Figure C1 (found in **Appendix C**) provides a description of the surrounding land use within 500-feet of the site.

- North – The subject property is bounded to the north by the Houston Ship Channel.
- East – The subject property is bounded to the east by Rhodia Chemical.
- South – The subject property is bounded to the south by Rhodia Chemical and Manchester Street followed by commercial/ industrial developments.
- West – The subject property is bounded to the west by Texas Port Recycling LP followed by East Loop 610 Freeway.



LEGEND:

MSD Boundary

500-ft Radius

N

0 500 1,000

Approximate Scale (Feet)

InControl Technologies, Inc.
3845 FM 1960 W, Suite 195
Houston, Texas 77068
(281) 580-8892 FAX (281) 580-8853

Surrounding Property Map

SITE: Lone Star Refinery			PM: MFM
LOCATION: 8901 Manchester St Houston, TX 77012			CHECKED:
DETAILED: LMG	DESIGNED: 3/10/10	PROJECT NO: 535-104	FIGURE: C1

Appendix D – PCLE Zone Discussion

A) A review of recent groundwater sampling data (December 2009) indicates that the COCs that currently exceed the Tier 1 $^{GW}GW_{Ing}$ PCLs are arsenic, benzene and total petroleum hydrocarbons (TPH) in the upper groundwater bearing unit. Compound specific PCLE zones are depicted on **Figure B8-1** (arsenic, December 2009), **Figure B8-2** (benzene, December 2009) and **Figure B8-3** (TPH, December 2009). The area of groundwater impact is delineated in all directions (**Figure B4**).

Based on a review of boring logs, the shallow groundwater on the subject property is first encountered at a depth of approximately 9- to 15-feet below ground surface (ft bgs) (UTZ) and is comprised of a fine grained sand.

A comparison of the recent groundwater sampling results (February 2008) with applicable non-ingestion protective concentration levels ($^{Air}GW_{Inh-V}$) indicates that none of the groundwater samples reported a COC concentration above the $^{Air}GW_{Inh-V}$ PCL. Therefore, based on the recent groundwater monitoring results, there is no non-ingestion protective concentration level exceedence zone within the proposed MSD boundary.

B) The following table represents the groundwater ingestion PCL exceedences that were reported from the December 2009 monitoring event:

Table D1 – Groundwater ingestion PCL Exceedences in Upper Groundwater Bearing Unit

		Arsenic (mg/L)	Benzene (mg/L)	TPH (nC6 to nC12) (mg/L)	TPH (>nC12 to nC28) (mg/L)
Tier 1 $^{GW}GW_{Ing}$ PCLs		0.01	0.005	0.98	0.73
Tier 1 $^{Air}GW_{Inh-V}$ PCLs		NA	23.3	13	2.0
Monitoring Well ID	Sample Date	Concentration (mg/L)			
MW-3	12/29/09	**0.122**	<0.0005	<0.19	<0.19
MW-4	12/29/09	**0.0604**	<0.0005	<0.19	<0.19
MW-6	12/29/09	**0.011**	<0.0005	<0.19	<0.19
MW-7	12/29/09	**0.019**	**0.62**	**3.7**	**3.2**
MW-20	12/29/09	**0.017**	<0.0005	<0.19	<0.19
MW-23	12/29/09	**0.129**	**16**	**31**	0.36 J

Notes – Values in **Bold** exceed the $^{GW}GW_{Ing}$ PCL (ingestion PCLE)
Values in ***Bold Italics*** exceed the $^{Air}GW_{Inh-V}$ PCL (non-ingestion PCLE)

Groundwater COC concentrations tabulated above are less than the $^{Air}GW_{Inh-V}$ non-ingestion PCL. Therefore, based on the December 2009 monitoring data there is no non-ingestion PCLE zone on the subject property.

C) The contaminants of concern (arsenic, benzene and total petroleum hydrocarbons (TPH)) detected in groundwater samples are associated with the historic operations at the former Lone Star Refinery property.

Metals are relatively immobile in the subsurface as the result of precipitation and adsorption reactions. A variety of reactions may occur which influence the speciation and mobility of metal contaminants including acid/base, precipitation/dissolution, oxidation/ reduction, sorption or ion exchange. Precipitation, sorption, and ion exchange reactions can retard the movement of metals in groundwater. The rate and extent of these reactions will depend on factors such as pH, Eh, complexation with other dissolved constituents, sorption and ion exchange capacity of the geological materials, and organic matter content. Ground-water flow characteristics also influence the transport of metal contaminants.

Hydrocarbons will dissolve in water at low concentrations but once the groundwater has reached the saturation point for that compound, a separate phase will form in equilibrium with the water. Because hydrocarbons have lower densities relative to the groundwater, the separate phase will “float”. These compounds are referred to as “light non-aqueous phase liquids” (LNAPLs). Historically, LNAPL has not been identified in any of the monitoring wells within the groundwater network and is not expected to be present at this site given the relatively low concentrations of benzene and TPH detected in groundwater.

Based on the field observations and laboratory results, it appears that the groundwater contaminants on the subject property are primarily dissolved in the shallow groundwater and have migrated offsite around PCLE Zones 1 and 3. PCLE Zone 4 originates from an off-site source.

Appendix E – COCs in Designated Groundwater Discussion

A) Refer to **Appendix D** for a discussion of the contaminants of concern (COC) in the ingestion protective concentration level (PCL) exceedence zone. Current groundwater sampling results indicate that there are three identified COCs (arsenic, benzene and TPH) that exceed the ingestion protective concentration levels on the subject property in the upper groundwater bearing unit. **Figure B8-1** through **Figure B8-3** depict the most recent PCLE zones for arsenic, benzene and TPH respectively.

B) Refer to **Table D1** for a tabulated comparison of the most recent COC concentrations with the respective TRRP Protective Concentration Levels (PCLs). Historic COC concentrations compared to the PCLs are found in **Appendix E**.

C) Refer to **Appendix D** for a discussion of the basic geochemical properties of the contaminants of concern (COCs) in the ingestion PCL exceedence zone.

Appendix F – Summary of Soil and Groundwater Concentration Data

Appendix F contains tables summarizing the concentration levels for the primary chemicals of concern in soil and groundwater. The tables include the concentration level, the ingestion protective concentration limits ($^{GW}Soil_{Ing}$ for soil and $^{GW}GW_{Ing}$ for groundwater), the non-ingestion protective concentration limits for soil ($^{Tot}Soil_{Comb}$ and $^{Air}Soil_{Inh\text{-}V}$) and groundwater ($^{Air}GW_{Inh\text{-}V}$), the critical protective concentration limits assuming no MSD is in place ($^{GW}Soil_{Ing}$ for soil and $^{GW}Soil_{Ing}$ for groundwater), and the critical PCLs assuming that an MSD is in place ($^{Tot}Soil_{Comb}$ for soil and $^{Air}GW_{Inh\text{-}V}$ for groundwater).

Table F-1
Metals in Soil
Lone Star Refinery
8901 Manchester, Houston, TX 77012

			Antimony (7440-36-0)	Arsenic (7440-38-2)	Barium (7440-39-3)	Beryllium (7440-41-7)	Cadmium (7440-43-9)	Chromium (7440-47-3)	Cobalt (7440-48-4)	Lead (7439-92-1)	Mercury (7439-97-6)	Nickel (7440-02-0)	Selenium (7782-49-2)	Silver (7440-22-4)	Vanadium (7440-62-2)	Zinc (7440-66-6)
Tier 1 Industrial $^{GW}Soil_{Ing}$ Critical PCLs without MSD			**5.41**	**5.90**	**101,390**	**1.85**	**1.51**	**2,400**	**3,950**	**1,600**	**6.22**	**470**	**4,781**	**1.43**	**10,221**	**7,050**
Tier 1 Industrial $^{Tot}Soil_{Comb}$ Critical PCLs with MSD			**306**	**200**	**101,390**	**249**	**852**	**94,867**	**40,811**	**1,600**	**6.22**	**8,455**	**4,781**	**1,945**	**2,362**	**245,280**
Tier 1 Industrial $^{Air}Soil_{Inh-V}$ Critical PCLs with MSD			--	--	--	--	--	--	--	--	**6.4**	--	--	--	--	--
Background Concentrations			**1.00**	**5.90**	**300**	**1.50**	--	**30**	**7**	**15**	**0.04**	**10**	**0.30**	--	**50**	**30**
Sample ID	Depth	Date	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
W-1	15	11/2/1992	-	-	-	-	-	**7.8**	-	**14**	-	**4.3**	-	-	**20**	-
W-3	3-11	11/4/1992	-	-	-	-	-	**5.4**	-	**10**	-	**2.6**	-	-	**11**	-
W-4	4-15	11/5/1992	-	-	-	-	-	**2.4**	-	<6.0	-	<2.4	-	-	**3.9**	-
TR-3B	3.5-3.5	11/4/1992	-	-	-	-	-	**89**	-	**290**	-	**14**	-	-	**28**	-
TR-4	8-8	11/4/1992	-	-	-	-	-	**260**	-	**220**	-	**100**	-	-	**80**	-
TR-5A	8-9	11/4/1992	-	-	-	-	-	**3.8**	-	<5.8	-	**2.4**	-	-	**20**	-
TR-6	5-5	11/4/1992	-	-	-	-	-	**87**	-	**810**	-	**12**	-	-	**30**	-
TR-7	10-12	11/3/1992	-	-	-	-	-	**7.2**	-	**75**	-	**6**	-	-	**10**	-
TR-8	7-7	11/3/1992	-	-	-	-	-	**62**	-	**630**	-	**14**	-	-	**30**	-
TR-9	9.5-9.5	11/3/1992	-	-	-	-	-	**3.6**	-	<6.0	-	<2.4	-	-	**9.3**	-
TR-11	4-4	11/3/1992	-	-	-	-	-	**42**	-	**360**	-	**15**	-	-	**20**	-
ES-1/SS-1	0-2	12/21/1992	-	-	-	-	-	**20**	-	**150**	-	**7.1**	-	-	-	-
ES-2/SS-2	0-2	12/21/1992	-	-	-	-	-	**61**	-	**5,600**	-	**19**	-	-	-	-
ES-3/SS-3	0-2	12/21/1992	-	-	-	-	-	**38**	-	**86**	-	**7.7**	-	-	-	-
ES-4/SS-4	0-2	12/21/1992	-	-	-	-	-	**220**	-	**170**	-	**21**	-	-	-	-
ES-5/SS-5	0-2	12/21/1992	-	-	-	-	-	**56**	-	**68**	-	<2.7	-	-	-	-
ES-6/SS-6	0-2	12/21/1992	-	-	-	-	-	**20**	-	**130**	-	**23**	-	-	-	-
ESP-1/SS-7	0-2	12/21/1992	-	-	-	-	-	**8**	-	**84**	-	**6.3**	-	-	-	-
ESP-2/SS-8	0-2	12/21/1992	-	-	-	-	-	**250**	-	**150**	-	**50**	-	-	-	-
ESP-3/SS-9	0-2	12/21/1992	-	-	-	-	-	**32**	-	**85**	-	**10**	-	-	-	-
RS-1/SS-10	0-2	12/21/1992	-	-	-	-	-	**690**	-	**260**	-	**71**	-	-	-	-
RS-2/SS-11	0-2	12/21/1992	-	-	-	-	-	**12**	-	**36**	-	**2.4**	-	-	-	-
RS-3/SS-12	0-2	12/21/1992	-	-	-	-	-	**84**	-	**59**	-	<2.7	-	-	-	-
EP-2	1-3	7/21/1998	-	-	-	-	-	**1.17**	-	**21.7**	-	**3.22**	-	-	-	-
EP-6	1-4	7/21/1998	-	-	-	-	-	**3.75**	-	**6.32**	-	**3.97**	-	-	-	-
EP-9A	3-5	7/21/1998	-	-	-	-	-	**10.4**	-	**96.1**	-	**8.51**	-	-	-	-
EP-9B	5-7	7/21/1998	-	-	-	-	-	**0.79**	-	**16.3**	-	**3.77**	-	-	-	-
EP-13	4-6	7/21/1998	-	-	-	-	-	**286**	-	**978**	-	**27.4**	-	-	-	-
EP-16	2-7	7/21/1998	-	-	-	-	-	**89.7**	-	**82.3**	-	**31**	-	-	-	-
EP-20	3-7	7/21/1998	-	-	-	-	-	**28.1**	-	**51**	-	**6.2**	-	-	-	-
EP-21	3-5	7/21/1998	-	-	-	-	-	**3.6**	-	**9.46**	-	**3.38**	-	-	-	-
EP-25	4-5	7/21/1998	-	-	-	-	-	**0.4**	-	**37.6**	-	**6.78**	-	-	-	-
EP-32	3-8	7/22/1998	-	-	-	-	-	**7.62**	-	**70.5**	-	**4.55**	-	-	-	-

Table F-1
Metals in Soil
Lone Star Refinery
8901 Manchester, Houston, TX 77012

			Antimony (7440-36-0)	Arsenic (7440-38-2)	Barium (7440-39-3)	Beryllium (7440-41-7)	Cadmium (7440-43-9)	Chromium (7440-47-3)	Cobalt (7440-48-4)	Lead (7439-92-1)	Mercury (7439-97-6)	Nickel (7440-02-0)	Selenium (7782-49-2)	Silver (7440-22-4)	Vanadium (7440-62-2)	Zinc (7440-66-6)
Tier 1 Industrial $^{GW}Soil_{Ing}$ Critical PCLs without MSD			**5.41**	**5.90**	**101,390**	**1.85**	**1.51**	**2,400**	**3,950**	**1,600**	**6.22**	**470**	**4,781**	**1.43**	**10,221**	**7,050**
Tier 1 Industrial $^{Tot}Soil_{Comb}$ Critical PCLs with MSD			**306**	**200**	**101,390**	**249**	**852**	**94,867**	**40,811**	**1,600**	**6.22**	**8,455**	**4,781**	**1,945**	**2,362**	**245,280**
Tier 1 Industrial $^{Air}Soil_{Inh-V}$ Critical PCLs with MSD			**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**6.4**	**--**	**--**	**--**	**--**	**--**
Background Concentrations			**1.00**	**5.90**	**300**	**1.50**	**--**	**30**	**7**	**15**	**0.04**	**10**	**0.30**	**--**	**50**	**30**
Sample ID	Depth	Date	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
EP-33	1-3	7/22/1998	-	-	-	-	-	**3.19**	-	**59.8**	-	**12.4**	-	-	**-**	-
EP-37	3-8	7/22/1998	-	-	-	-	-	**3.85**	-	**3.17**	-	**2.63**	-	-	**-**	-
EP-39	7-8	7/22/1998	-	-	-	-	-	**9.4**	-	**10.5**	-	**4.64**	-	-	**-**	-
EP-41	3-4	7/22/1998	-	-	-	-	-	**29.4**	-	**53.5**	-	**6.08**	-	-	**-**	-
EP-44	4-6	7/22/1998	-	-	-	-	-	**5.45**	-	**49.8**	-	**3.75**	-	-	**-**	-
EP-55	2.5-4.5	7/27/1998	-	-	-	-	-	<0.06	-	**546**	-	**5.06**	-	-	**-**	-
EP-56	3-12	7/27/1998	-	-	-	-	-	**1.33**	-	**3.24**	-	**3.78**	-	-	**-**	-
EP-57	4-6	7/27/1998	-	-	-	-	-	**2.35**	-	**3.12**	-	**3.04**	-	-	**-**	-
EP-58	5-5	7/27/1998	-	-	-	-	-	**1.9**	-	**89.4**	-	**5.3**	-	-	**-**	-
EP-61	0-10	7/27/1998	-	-	-	-	-	**1.56**	-	**388**	-	**7.19**	-	-	**-**	-
EP-61	10-16	7/27/1998	-	-	-	-	-	**0.48**	-	**7.58**	-	<0.06	-	-	**-**	-
EP-62	3-4	7/27/1998	-	-	-	-	-	<0.06	-	**1.33**	-	**1.11**	-	-	**-**	-
EP-64	1-4	7/27/1998	-	-	-	-	-	**0.69**	-	**4.25**	-	**1.3**	-	-	**-**	-
EP-75	2.5-2.5	7/29/1998	-	-	-	-	-	**11.7**	-	**160**	-	**12**	-	-	**-**	-
EP-76	2-3	7/29/1998	-	-	-	-	-	**3.44**	-	**4.2**	-	**3.46**	-	-	**-**	-
EP-81	3-3	7/29/1998	-	-	-	-	-	**5.25**	-	**21**	-	**4.98**	-	-	**-**	-
EP-85	5-8	7/29/1998	-	-	-	-	-	**3.28**	-	**2.2**	-	**2.72**	-	-	**-**	-
EP-86	10-12	7/29/1998	-	-	-	-	-	**5.1**	-	**3.57**	-	**6.37**	-	-	**-**	-
EP-95	3-10	7/29/1998	-	-	-	-	-	**6.18**	-	**11,100**	-	**9.14**	-	-	**-**	-
EP-95	10-11	7/29/1998	-	-	-	-	-	<0.06	-	**7.81**	-	<0.06	-	-	**-**	-
EP-96	0-3	7/29/1998	-	-	-	-	-	**9.76**	-	**3,310**	-	**7.05**	-	-	**-**	-
EP-97		7/29/1998	-	-	-	-	-	<0.02	-	**0.12**	-	<0.01	-	-	**-**	-
EP-99	3-10	7/29/1998	-	-	-	-	-	**3.56**	-	**678**	-	**1.05**	-	-	**-**	-
EP-115	0-5	3/23/2001	<0.08	<0.06	**29.9**	<0.06	<0.06	**4.4**	**0.9**	**3.24**	<0.025	**1.73**	<0.1	<0.1	**11.2**	**2.77**
EP-116	0-8.5	3/23/2001	<0.08	**0.85**	**32**	<0.06	<0.06	**10.3**	**1.48**	**5.03**	<0.025	**3.4**	<0.1	<0.1	**19.3**	**13.6**
EP-117	0-4	3/23/2001	<0.08	**0.35**	**42.3**	<0.06	<0.06	**8.48**	**1.07**	**6.62**	<0.025	**2.97**	<0.1	<0.1	**17.5**	**12.7**
EP-119B	7-8	3/23/2001	<0.08	<0.06	**80.5**	<0.06	<0.06	**10.8**	**5.75**	**6.77**	<0.025	**14.1**	<0.1	<0.1	**17.5**	**32.3**
EP-121	0-6	3/23/2001	<0.08	<0.06	**21**	<0.06	<0.06	**2.72**	**1.12**	**2.98**	<0.025	**2.32**	<0.1	<0.1	**5.4**	**6.67**
EP-124	0-2	3/23/2001	<0.08	<0.06	**106**	<0.06	<0.06	**23.7**	**0.9**	**41.3**	**1.55**	**5.65**	<0.1	<0.1	**20.8**	**87.7**
EP-125	0-5.5	3/23/2001	<0.08	<0.06	**50**	<0.06	<0.06	**14.3**	**2.2**	**43.3**	**0.083**	**5.32**	<0.1	<0.1	**13.6**	**46.2**
EP-126	0-6	3/23/2001	<0.08	**1.11**	**85.9**	<0.06	<0.06	**5.55**	**2.81**	**91**	**0.795**	**9.37**	<0.1	<0.1	**9.82**	**33.4**
A-1	3-7	12/12/2007	-	<0.28	**34.8**	-	**0.04**	**6.84**	**-**	**8.77**	<0.002	**-**	<0.048	<0.04	**-**	**-**
A-2	3-7	12/12/2007	-	<0.27	**50.5**	-	**0.09**	**5.73**	**-**	**108**	**0.089**	**-**	<0.47	<0.04	**-**	**-**

Table F-1
Metals in Soil
Lone Star Refinery
8901 Manchester, Houston, TX 77012

			Antimony (7440-36-0)	Arsenic (7440-38-2)	Barium (7440-39-3)	Beryllium (7440-41-7)	Cadmium (7440-43-9)	Chromium (7440-47-3)	Cobalt (7440-48-4)	Lead (7439-92-1)	Mercury (7439-97-6)	Nickel (7440-02-0)	Selenium (7782-49-2)	Silver (7440-22-4)	Vanadium (7440-62-2)	Zinc (7440-66-6)
Tier 1 Industrial $^{GW}Soil_{Ing}$ Critical PCLs without MSD			**5.41**	**5.90**	**101,390**	**1.85**	**1.51**	**2,400**	**3,950**	**1,600**	**6.22**	**470**	**4,781**	**1.43**	**10,221**	**7,050**
Tier 1 Industrial $^{Tot}Soil_{Comb}$ Critical PCLs with MSD			**306**	**200**	**101,390**	**249**	**852**	**94,867**	**40,811**	**1,600**	**6.22**	**8,455**	**4,781**	**1,945**	**2,362**	**245,280**
Tier 1 Industrial $^{Air}Soil_{Inh-V}$ Critical PCLs with MSD			--	--	--	--	--	--	--	--	**6.4**	--	--	--	--	--
Background Concentrations			**1.00**	**5.90**	**300**	**1.50**	--	**30**	**7**	**15**	**0.04**	**10**	**0.30**	--	**50**	**30**
Sample ID	Depth	Date	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
A-3	3-7	12/12/2007	-	**0.34**	<0.01	-	**0.28**	**2.55**	-	**34.8**	**0.229**	-	<0.58	**0.17**	-	-
A-4	3-7	12/12/2007	-	**0.32**	<0.01	-	**0.08**	**1.97**	-	**136**	**0.068**	-	<0.56	**0.09**	-	-
A-5	3-7	12/12/2007	-	<0.33	**40.8**	-	**0.28**	**80.9**	-	**192**	**0.08**	-	**21.1**	<0.05	-	-
A-6	3-7	12/12/2007	-	<0.34	**63.6**	-	**0.36**	**57.8**	-	**1050**	**0.111**	-	<0.56	<0.05	-	-
B-1	3-7	12/11/2007	-	<0.345	**97.5**	-	**0.296**	**12.1**	-	**64**	**0.044**	-	<0.591	**0.345**	-	-
B-2	3-7	12/11/2007	-	<0.332	**80.6**	-	**0.355**	**12.9**	-	**40.5**	**0.308**	-	<0.569	**0.213**	-	-
C-1	3-7	12/12/2007	-	<0.28	**84.6**	-	**0.1**	**7.89**	-	**24.4**	**0.256**	-	<0.48	<0.04	-	-
C-2	3-7	12/12/2007	-	<0.32	**93.8**	-	**0.15**	**16.9**	-	**47.9**	**0.237**	-	<0.55	<0.05	-	-
D-1	3-7	12/11/2007	-	<0.31	**57.1**	-	**0.31**	**9**	-	**53.3**	**0.013**	-	<0.531	**0.243**	-	-
D-2	3-7	12/11/2007	-	<0.285	**62.4**	-	**0.305**	**12.3**	-	**55.5**	**0.4**	-	<0.488	**0.203**	-	-
D-3	3-7	12/11/2007	-	<0.326	**31.6**	-	**0.209**	**11**	-	**88.4**	**0.229**	-	<0.558	**0.209**	-	-
D-4	3-7	12/11/2007	-	<0.295	**69.2**	-	**0.316**	**6.96**	-	**18.3**	**0.091**	-	<0.506	**0.19**	-	-
D-5	3-7	12/11/2007	-	<0.345	**65.3**	-	**0.32**	**42.9**	-	**179**	**0.125**	-	<0.591	**0.246**	-	-
D-6	3-7	12/11/2007	-	<0.303	**151**	-	**0.303**	**67.7**	-	**444**	**0.296**	-	<0.519	**0.303**	-	-
D-7	3-7	12/11/2007	-	<0.312	**94.9**	-	**0.332**	**77.9**	-	**312**	**0.290**	-	<0.0531	**0.288**	-	-
D-8	3-7	12/11/2007	-	<0.329	**89.2**	-	**0.469**	**27.2**	-	**256**	**0.404**	-	<0.563	**0.423**	-	-
D-9	3-7	12/11/2007	-	<0.31	**35.4**	-	**0.199**	**6.33**	-	**257**	**0.163**	-	<0.531	<0.044	-	-
D-10	3-7	12/11/2007	-	<0.3	**50.4**	-	**0.3**	**10.6**	-	**72.1**	**0.195**	-	<515.0	**0.064**	-	-
D-11	3-7	12/11/2007	-	<0.267	**59**	-	**0.324**	**15**	-	**73.7**	**0.335**	-	<0.458	**0.038**	-	-
D-12	3-7	12/11/2007	-	<0.292	**46.3**	-	**0.417**	**7.4**	-	**14.5**	**0.029**	-	<0.5	<0.042	-	-
D-13	3-7	12/11/2007	-	<0.333	**10.7**	-	**0.048**	**9.93**	-	**3.24**	**0.033**	-	<0.571	<0.048	-	-
D-14	3-7	12/11/2007	-	<0.347	**47.8**	-	**0.47**	**16.6**	-	**41.1**	**0.024**	-	<0.594	**0.594**	-	-
D-15	3-7	12/11/2007	-	<0.294	**82.1**	-	**0.399**	**32.4**	-	**376**	**0.237**	-	<0.504	**0.315**	-	-
D-16	3-7	12/11/2007	-	<0.318	**80.2**	-	**0.364**	**19.7**	-	**616**	**0.221**	-	<0.545	**0.114**	-	-
D-17	3-7	12/11/2007	-	<0.348	**178**	-	**0.323**	**22.8**	-	**557**	**0.224**	-	<597.0	**0.1**	-	-
D-18	3-7	12/11/2007	-	<0.0	**210**	-	**0.3**	**45.2**	-	**1150**	**0.287**	-	<0.553	**0.207**	-	-
D-19	3-7	12/11/2007	-	<0.324	**221**	-	**0.324**	**217**	-	**214**	**0.259**	-	<0.556	**0.278**	-	-
B-6	6-8	7/9/2008	-	**2.03**	**54.9**	-	<0.481	**374**	-	**38.3**	**0.233**	-	<0.481	<0.481	-	-
B-6	8-10	7/9/2008	-	**2.15**	**45.3**	-	<0.442	**384**	-	**19.4**	**0.0725**	-	<0.442	<0.442	-	-
B-6	13-15	7/9/2008	-	**4.96**	**83.5**	-	<0.435	**702**	-	**7,080**	**14.1**	-	**2.30**	<0.435	-	-
B-10	6-8	7/9/2008	-	**5.53**	**2350**	-	<0.485	**31.3**	-	**155**	**0.86**	-	**0.74**	<0.485	-	-
B-10	13-15	7/9/2008	-	**1.92**	**86.2**	-	<0.463	**6.09**	-	**818**	**3.33**	-	<0.463	<0.463	-	-
B-10	18-20	7/9/2008	-	<0.446	**47.9**	-	<0.446	**1.12**	-	**792**	**1.96**	-	<0.446	<0.446	-	-

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Metals in Soil
Lone Star Refinery
8901 Manchester, Houston, TX 77012

			Antimony (7440-36-0)	Arsenic (7440-38-2)	Barium (7440-39-3)	Beryllium (7440-41-7)	Cadmium (7440-43-9)	Chromium (7440-47-3)	Cobalt (7440-48-4)	Lead (7439-92-1)	Mercury (7439-97-6)	Nickel (7440-02-0)	Selenium (7782-49-2)	Silver (7440-22-4)	Vanadium (7440-62-2)	Zinc (7440-66-6)
Tier 1 Industrial $^{GW}Soil_{Ing}$ Critical PCLs without MSD			**5.41**	**5.90**	**101,390**	**1.85**	**1.51**	**2,400**	**3,950**	**1,600**	**6.22**	**470**	**4,781**	**1.43**	**10,221**	**7,050**
Tier 1 Industrial $^{Tot}Soil_{Comb}$ Critical PCLs with MSD			**306**	**200**	**101,390**	**249**	**852**	**94,867**	**40,811**	**1,600**	**6.22**	**8,455**	**4,781**	**1,945**	**2,362**	**245,280**
Tier 1 Industrial $^{Air}Soil_{Inh-V}$ Critical PCLs with MSD			--	--	--	--	--	--	--	--	**6.4**	--	--	--	--	--
Background Concentrations			**1.00**	**5.90**	**300**	**1.50**	--	**30**	**7**	**15**	**0.04**	**10**	**0.30**	--	**50**	**30**
Sample ID	Depth	Date	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
Bank 1	0-1	12/23/2009	-	**4.4**	**120**	-	**0.829**	**25.8**	-	**83.4**	**0.441**	-	**0.689 J**	**1.11**	-	-
Bank 2	0-1	12/23/2009	-	**0.991**	**67**	-	**0.0485 J**	**5.99**	-	**32.3**	**0.059**	-	<0.28	**0.0547 J**	-	-
Bank 3	0-1	12/23/2009	-	**2.26**	**73.7**	-	**0.389 J**	**8.88**	-	**77.9**	**0.485**	-	**0.39 J**	**0.07 J**	-	-
Bank 4	0-1	12/23/2009	-	**2.77**	**379**	-	**0.37 J**	**19.4**	-	**550**	**0.853**	-	**0.699**	**0.238 J**	-	-

Note:

Bold	values exceed the laboratory limit of quantitation.
Bold	exceeds PCL

Table F-2
Volatile Organic Compounds in Soil
Lone Star Refinery
8901 Manchester, Houston, TX 77012

			Acetone (67-64-1)	Benzene (71-43-2)	Toluene (108-88-3)	Ethylbenzene (100-41-4)	Xylenes,Total (1330-20-7)
Tier 1 Industrial $^{GW}Soil_{Ing}$ Critical PCLs without MSD			**128**	**0.02**	**8.2**	**7.6**	**120**
Tier 1 Industrial $^{Tot}Soil_{Comb}$ Critical PCLs with MSD			**16,000**	**180**	**42,000**	**18,000**	**12,000**
Tier 1 Industrial $^{Air}Soil_{Inh-V}$ Critical PCLs with MSD			**16,000**	**270**	**88,000**	**21,000**	**13,000**
Sample ID	**Depth**	**Date**	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
TR-11	4-4	11/3/1992	-	**2.3**	**910**	**7.9**	**2.4**
EP-6	1-4	7/20/1998	-	<0.025	<0.025	<0.025	<0.025
EP-9A	3-5	7/21/1998	-	**0.74**	**1.42**	**16**	**1.2**
EP-9B	5-7	7/20/1998	-	<0.025	<0.025	<0.025	<0.025
EP-13	4-6	7/21/1998	-	**7.30**	<2.5	<2.5	<2.5
EP-13	4-6	7/21/1998	-	**3.00**	**0.61**	**1.62**	**1.35**
EP-16	2-7	7/21/1998	-	<0.025	<0.025	<0.025	<0.025
EP-20	3-7	7/21/1998	-	<2.5	<2.5	<2.5	<2.5
EP-21	3-5	7/21/1998	-	<0.025	<0.025	<0.025	<0.025
EP-25	4-5	7/21/1998	-	<0.025	<0.025	<0.025	<0.025
EP-32	3-8	7/22/1998	-	**0.38**	<0.025	**0.18**	**0.168**
EP-33	1-3	7/22/1998	-	<0.05	<0.05	**0.081**	**0.055**
EP-37	3-8	7/22/1998	-	<0.025	<0.025	<0.025	<0.025
EP-39	7-8	7/22/1998	-	<0.025	<0.025	<0.025	<0.025
EP-40	6-6	7/22/1998	-	<1.25	<1.25	**1.3**	<1.25
EP-41	3-4	7/22/1998	-	<0.025	<0.025	**0.031**	**134**
EP-44	4-6	7/22/1998	-	<0.5	<0.5	<0.5	<0.5
EP-44	4-6	7/22/1998	-	**0.11**	**1.21**	**4.19**	**1.21**
EP-55	2.5-4.5	7/27/1998	-	<0.025	<0.025	<0.025	**0.033**
EP-56	3-12	7/27/1998	-	**5.4**	**17**	**23**	**83**
EP-57	4-6	7/27/1998	-	<0.5	<0.5	**0.65**	**7.3**
EP-58	5-5	7/27/1998	-	<1.0	<1.0	<1.0	<1.0
EP-58	5-5	7/27/1998	-	**0.44**	**1.37**	**4.52**	**0.77**
EP-61	0-10	7/27/1998	-	**0.12**	**0.10**	**0.21**	**0.8**
EP-61	10-16	7/27/1998	-	<2.5	<2.5	<2.5	**3.8**
EP-62	3-4	7/27/1998	-	<5.0	<5.0	**15**	<5.0
EP-64	1-4	7/27/1998	-	**0.093**	**0.24**	**1.1**	**2.8**
EP-75	2.5-2.5	7/27/1998	-	**0.078**	<0.05	**0.13**	**0.38**
EP-75	2.5-2.5	7/29/1998	-	**0.49**	**2.0**	**5.85**	**1.68**
EP-76	2-3	7/27/1998	-	<40.0	<40.0	**89**	**360**
EP-81	3-3	7/30/1998	-	<1.0	<1.0	<1.0	<1.0

Table F-2
Volatile Organic Compounds in Soil
Lone Star Refinery
8901 Manchester, Houston, TX 77012

			Acetone (67-64-1)	Benzene (71-43-2)	Toluene (108-88-3)	Ethylbenzene (100-41-4)	Xylenes,Total (1330-20-7)
Tier 1 Industrial $^{GW}Soil_{Ing}$ Critical PCLs without MSD			**128**	**0.02**	**8.2**	**7.6**	**120**
Tier 1 Industrial $^{Tot}Soil_{Comb}$ Critical PCLs with MSD			**16,000**	**180**	**42,000**	**18,000**	**12,000**
Tier 1 Industrial $^{Air}Soil_{Inh-V}$ Critical PCLs with MSD			**16,000**	**270**	**88,000**	**21,000**	**13,000**
Sample ID	**Depth**	**Date**	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
EP-85	5-8	7/29/1998	-	<1.0	<1.0	<1.0	<1.0
EP-86	10-12	7/29/1998	-	<0.001	**0.01**	**0.062**	**0.055**
EP-86	10-12	7/30/1998	-	<0.05	<0.05	**0.079**	<0.05
EP-95	3-10	7/31/1998	-	<5.0	**14**	**15**	**63**
EP-95	10-13	7/31/1998	-	<1.0	**1.9**	**1.8**	**7.9**
EP-96	0-3	7/29/1998	-	**7.26**	**4.66**	**20.7**	**34.6**
EP-96	0-3	7/31/1998	-	**6.20**	**4.0**	**14**	**35**
EP-97		7/31/1998	-	**0.13**	**0.10**	**0.059**	**224**
EP-99	3-10	7/31/1998	-	<2.5	**7.3**	**9.1**	**42**
EP-100	7-7	8/24/1998	-	<0.005	<0.005	<0.005	-
EP-101	7-7	8/24/1998	-	<0.005	<0.005	<0.005	-
EP-102	6-6	8/24/1998	-	<0.005	<0.005	<0.005	-
EP-115	0-5	3/23/2001	-	<0.005	<0.005	<0.005	<0.005
EP-116	0-8.5	3/23/2001	-	<0.005	<0.005	<0.005	<0.005
EP-117	0-4	3/23/2001	-	<0.005	<0.005	<0.005	<0.005
EP-119B	7-8	3/23/2001	-	<0.005	<0.005	<0.005	<0.005
EP-121	0-6	3/23/2001	-	<0.005	<0.005	<0.005	<0.005
EP-124	0-2	3/23/2001	-	<0.005	<0.005	<0.005	<0.005
EP-125	0-5.5	3/23/2001	-	<0.005	<0.005	<0.005	<0.005
EP-126	0-6	3/23/2001	-	<0.025	<0.025	<0.025	<0.025
M-3-4	3-3	7/3/2007	-	<0.5	<0.5	<0.5	<0.5
M-6-25	6-6	7/3/2007	-	<0.005	<0.005	**0.007**	**0.018**
M-8-15	8-8	7/3/2007	-	<0.5	<0.5	<0.5	<0.5
M-8-30	8-8	7/3/2007	-	<0.005	**0.01**	**0.005**	**0.019**
N-8-20	8-8	7/3/2007	-	<0.005	**0.007**	**0.005**	**0.006**
P-4-35	4-4	7/4/2007	-	<0.005	**0.028**	**0.014**	**0.056**
P-5-45	5-5	7/4/2007	-	<0.005	<0.005	<0.005	<0.005
P-7-15	7-7	7/4/2007	-	<0.5	<0.5	<0.5	<0.5
P-7-25	7-7	7/4/2007	-	<0.5	<0.5	<0.5	<0.5
P-7-30	7-7	7/4/2007	-	<0.005	<0.005	<0.005	<0.005

Table F-2
Volatile Organic Compounds in Soil
Lone Star Refinery
8901 Manchester, Houston, TX 77012

			Acetone (67-64-1)	Benzene (71-43-2)	Toluene (108-88-3)	Ethylbenzene (100-41-4)	Xylenes,Total (1330-20-7)
Tier 1 Industrial $^{GW}Soil_{Ing}$ Critical PCLs without MSD			**128**	**0.02**	**8.2**	**7.6**	**120**
Tier 1 Industrial $^{Tot}Soil_{Comb}$ Critical PCLs with MSD			**16,000**	**180**	**42,000**	**18,000**	**12,000**
Tier 1 Industrial $^{Air}Soil_{Inh-V}$ Critical PCLs with MSD			**16,000**	**270**	**88,000**	**21,000**	**13,000**
Sample ID	**Depth**	**Date**	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
P-7-45	7-7	7/4/2007	-	<0.005	<0.005	<0.005	<0.005
P-7-50	7-7	7/4/2007	-	<0.005	<0.005	<0.005	<0.005
Q-4-10	4-4	7/4/2007	-	<0.5	<0.5	<0.5	**2.5**
Q-6-20	6-6	7/4/2007	-	<0.005	<0.005	<0.005	<0.005
Q-7-15	7-7	7/4/2007	-	<0.005	<0.005	<0.005	<0.005
Q-7-20	7-7	7/4/2007	-	<0.005	<0.005	<0.005	<0.005
R-6-20	6-6	7/4/2007	-	<0.005	<0.005	<0.005	<0.005
S-7-10	7-7	7/4/2007	-	<0.005	<0.005	<0.005	<0.005
S-8-20	8-8	7/4/2007	-	<0.005	<0.005	**0.009**	**0.03**
U-5-20	5-5	7/4/2007	-	<0.005	<0.005	<0.005	<0.005
II-7-4	7-7	7/5/2007	-	<0.005	<0.005	<0.005	<0.005
JJ-6-6	6-6	7/5/2007	-	**0.201**	**0.054**	**0.017**	**0.174**
KK-6-7	6-6	7/5/2007	-	<0.5	<0.5	<0.5	<0.5
A-1	3-7	12/12/2007	-	<0.005	<0.005	**0.007**	**0.044**
A-2	3-7	12/12/2007	-	<0.005	<0.005	<0.005	<0.005
A-3	3-7	12/12/2007	-	<0.005	<0.005	<0.005	<0.005
A-4	3-7	12/12/2007	-	<0.005	<0.005	<0.005	<0.005
A-5	3-7	12/12/2007	-	**0.005**	<0.005	<0.005	<0.005
A-6	3-7	12/12/2007	-	<0.005	<0.005	<0.005	<0.005
B-1	3-7	12/11/2007	-	<0.005	<0.005	<0.005	<0.005
B-2	3-7	12/11/2007	-	<0.005	<0.005	<0.005	<0.005
C-1	3-7	12/12/2007	-	<0.005	<0.005	<0.005	<0.005
C-2	3-7	12/12/2007	-	<0.005	<0.005	<0.005	<0.005
D-1	3-7	12/11/2007	-	<0.005	<0.005	<0.005	<0.005
D-2	3-7	12/11/2007	-	<0.005	<0.005	<0.005	<0.005
D-3	3-7	12/11/2007	-	<0.005	<0.005	<0.005	<0.005
D-4	3-7	12/11/2007	-	<0.005	<0.005	<0.005	<0.005
D-5	3-7	12/11/2007	-	<0.005	<0.005	<0.005	<0.005
D-6	3-7	12/11/2007	-	<0.005	<0.005	<0.005	<0.005
D-7	3-7	12/11/2007	-	<0.005	<0.005	<0.005	<0.005

Table F-2
Volatile Organic Compounds in Soil
Lone Star Refinery
8901 Manchester, Houston, TX 77012

			Acetone (67-64-1)	Benzene (71-43-2)	Toluene (108-88-3)	Ethylbenzene (100-41-4)	Xylenes,Total (1330-20-7)
Tier 1 Industrial $^{GW}Soil_{Ing}$ Critical PCLs without MSD			**128**	**0.02**	**8.2**	**7.6**	**120**
Tier 1 Industrial $^{Tot}Soil_{Comb}$ Critical PCLs with MSD			**16,000**	**180**	**42,000**	**18,000**	**12,000**
Tier 1 Industrial $^{Air}Soil_{Inh-V}$ Critical PCLs with MSD			**16,000**	**270**	**88,000**	**21,000**	**13,000**
Sample ID	**Depth**	**Date**	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
D-8	3-7	12/11/2007	-	<0.005	<0.005	<0.005	<0.005
D-9	3-7	12/11/2007	-	<0.005	<0.005	<0.005	<0.005
D-10	3-7	12/11/2007	-	<0.005	<0.005	<0.005	<0.005
D-11	3-7	12/11/2007	-	<0.005	<0.005	<0.005	<0.005
D-12	3-7	12/11/2007	-	<0.005	<0.005	<0.005	<0.005
D-13	3-7	12/11/2007	-	<0.005	<0.005	<0.005	<0.005
D-14	3-7	12/11/2007	-	<0.005	<0.005	<0.005	<0.005
D-15	3-7	12/11/2007	-	<0.005	<0.005	<0.005	<0.005
D-16	3-7	12/11/2007	-	<0.005	<0.005	<0.005	**0.005**
D-17	3-7	12/11/2007	-	<0.005	<0.005	<0.005	<0.005
D-18	3-7	12/11/2007	-	**0.5**	**3.1**	**14**	**32.7**
D-19	3-7	12/11/2007	-	<0.005	<0.005	<0.005	<0.005
B-6	6-8	7/9/2008	**0.043**	<0.01	<0.01	<0.01	<0.03
B-6	8-10	7/9/2008	<0.20	<0.05	<0.05	**0.46**	**0.49**
B-6	13-15	7/9/2008	<0.20	**0.12**	**0.58**	**1.0**	**1.8**
B-10	6-8	7/9/2008	**0.03**	<0.005	<0.005	**0.0079**	**0.016**
B-10	13-15	7/9/2008	<0.10	<0.025	<0.025	<0.025	<0.075
B-10	18-20	7/9/2008	<0.10	<0.025	<0.025	<0.025	<0.075
Bank 1	0-1	12/23/2009	<0.0031	<0.00078	<0.00078	<0.00078	<0.0023
Bank 2	0-1	12/23/2009	<0.0026	<0.00065	<0.00065	<0.00065	<0.0019
Bank 3	0-1	12/23/2009	**0.036**	<0.00061	<0.00061	<0.00061	<0.0018
Bank 4	0-1	12/23/2009	<0.0027	<0.00067	<0.00067	<0.00067	<0.002

Note:

Bold	values exceed the laboratory limit of quantitation.
Bold	exceeds PCL

Table F-3
Total Petroleum Hydrocarbons in Soil
Lone Star Refinery
8901 Manchester, Houston, Tx 77012

			TPH (nC6 to nC12)	TPH (>nC12 to nC28)	TPH (>nC28 to nC35)	Total Petroleum Hydrocarbon
Tier 1 Industrial $^{GW}Soil_{Ing}$ Critical PCLs without MSD			**60**	**590**	**19,000**	**--**
Tier 1 Industrial $^{Tot}Soil_{Comb}$ Critical PCLs with MSD			**3,900**	**6,200**	**19,000**	**--**
Tier 1 Industrial $^{Air}Soil_{Inh-V}$ Critical PCLs with MSD			**4,300**	**6,800**	**--**	**--**
Sample ID	**Depth**	**Date**	**(mg/kg)**	**(mg/kg)**	**(mg/kg)**	**(mg/kg)**
W-1	15-15	11/2/1992	-	-	-	**23000**
W-3	11-11	11/4/1992	-	-	-	**1.3**
W-4	15-15	11/5/1992	-	-	-	**270**
TR-3B	3.5-3.5	11/4/1992	-	-	-	**9100**
TR-4	8-8	11/4/1992	-	-	-	**1.1**
TR-5A	8-9	11/4/1992	-	-	-	**400**
TR-6	5-5	11/4/1992	-	-	-	**3100**
TR-7	10-12	11/3/1992	-	-	-	**46000**
TR-8	7-7	11/3/1992	-	-	-	**8400**
TR-9	9.5-9.5	11/3/1992	-	-	-	<40.0
TR-11	4-4	11/3/1992	-	-	-	**4.6**
ES-1/SS-1	0-2	12/21/1992	-	-	-	**580**
ES-2/SS-2	0-2	12/21/1992	-	-	-	**3700**
ES-3/SS-3	0-2	12/21/1992	-	-	-	**670**
ES-4/SS-4	0-2	12/21/1992	-	-	-	**360**
ES-5/SS-5	0-2	12/21/1992	-	-	-	<50.0
ES-6/SS-6	0-2	12/21/1992	-	-	-	<60.0
ESP-1/SS-7	0-2	12/21/1992	-	-	-	**280**
ESP-2/SS-8	0-2	12/21/1992	-	-	-	**300**
ESP-3/SS-9	0-2	12/21/1992	-	-	-	**710**
RS-1/SS-10	0-2	12/21/1992	-	-	-	**350**
RS-2/SS-11	0-2	12/21/1992	-	-	-	<40.0
RS-3/SS-12	0-2	12/21/1992	-	-	-	<40.0
A	5-5	7/2/2007	<4.0	<8.0	<8.0	<20.0
B-4-12	4-4	7/2/2007	**157**	**16,200**	**7,200**	**23,600**
B-6-15	6-6	7/2/2007	**148**	**116,000**	**4,210**	**120,000**
B-6-20	6-6	7/2/2007	**101**	**8,310**	**3,680**	**12,100**
B-6-30	6-6	7/2/2007	**18**	**4,000**	**1,510**	**5,530**
B-6-35	6-6	7/2/2007	<4.0	**202**	<8.0	**202**
B-8-12	8-8	7/2/2007	**113**	**5,940**	**2,030**	**8,080**
C-6-10	6-6	7/2/2007	**57**	**4,160**	**680**	**4,900**
D	5-5	7/2/2007	<4.0	<8.0	<8.0	<20.0
E	5-5	7/2/2007	<4.0	<8.0	<8.0	<20.0
F-5-5	5-5	7/2/2007	<4.0	<8.0	<8.0	<20.0
F-6-20	6-6	7/2/2007	<4.0	<8.0	<8.0	<20.0

Table F-3
Total Petroleum Hydrocarbons in Soil
Lone Star Refinery
8901 Manchester, Houston, Tx 77012

			TPH (nC6 to nC12)	TPH (>nC12 to nC28)	TPH (>nC28 to nC35)	Total Petroleum Hydrocarbon
Tier 1 Industrial $^{GW}Soil_{Ing}$ Critical PCLs without MSD			**60**	**590**	**19,000**	**--**
Tier 1 Industrial $^{Tot}Soil_{Comb}$ Critical PCLs with MSD			**3,900**	**6,200**	**19,000**	**--**
Tier 1 Industrial $^{Air}Soil_{Inh-V}$ Critical PCLs with MSD			**4,300**	**6,800**	**--**	**--**
Sample ID	**Depth**	**Date**	**(mg/kg)**	**(mg/kg)**	**(mg/kg)**	**(mg/kg)**
G-6-30	6-6	7/3/2007	**2,230**	**12,900**	**1,920**	**17,000**
G-6-35	6-6	7/3/2007	**970**	**6,610**	<8.0	**7,580**
G-6-40	6-6	7/3/2007	**547**	**4,940**	<8.0	**5,490**
G-6-45	6-6	7/3/2007	**104**	**8,190**	**2720**	**11,000**
G-6-50	6-6	7/2/2007	**74**	**1,030**	<8.0	**1,100**
G-7-25	7-7	7/3/2004	**3,530**	**22,200**	**3,010**	**28,700**
H-7-5	7-7	7/3/2007	**1,280**	**8,240**	**1,300**	**10,800**
I-7-10	7-7	7/3/2007	**870**	**5,100**	**1,230**	**7,200**
J-8-20	8-8	7/3/2007	<4.0	**2,020**	**1,340**	**3,360**
L-7-15	7-7	7/3/2007	<4.0	**11**	<8.0	<20.0
M-3-4	3-3	7/3/2007	**1,080**	**6,940**	**1,320**	**9,340**
M-6-25	6-6	7/3/2007	<4.0	**404**	**118**	**522**
M-8-15	8-8	7/3/2007	**87**	**795**	**230**	**1,110**
M-8-30	8-8	7/3/2007	<4.0	**259**	<8.0	**271**
N-8-20	8-8	7/3/2007	<4.0	**155**	<8.0	**167**
P-4-35	4-4	7/4/2007	**142**	**397**	<8.0	**539**
P-7-15	7-7	7/4/2007	<4.0	<8.0	<8.0	<20.0
P-5-45	5-5	7/4/2007	<4.0	<8.0	<8.0	<20.0
P-7-25	7-7	7/4/2007	<4.0	<8.0	<8.0	<20.0
P-7-30	7-7	7/4/2007	<4.0	<8.0	<8.0	<20.0
P-7-45	7-7	7/4/2007	<4.0	<8.0	<8.0	<20.0
P-7-50	7-7	7/4/2007	<4.0	<8.0	<8.0	<20.0
Q-4-10	4-4	7/4/2007	**525**	**16,100**	**7,850**	**24,500**
Q-6-20	6-6	7/4/2007	**171**	**1,540**	<8.0	**1,710**
Q-7-15	7-7	7/4/2007	<4.0	**36**	<8.0	**36**
Q-7-20	7-7	7/4/2007	<4.0	<8.0	<8.0	<20.0
R-6-20	6-6	7/4/2007	<4.0	**18**	<8.0	<20.0
S-7-10	7-7	7/4/2007	<4.0	<8.0	<8.0	<20.0
S-8-20	8-8	7/4/2007	**5**	**262**	<8.0	**267**
T-7-9	7-7	7/4/2007	<4.0	<8.0	<8.0	<20.0
U-5-20	5-5	7/4/2007	<4.0	<8.0	<8.0	<20.0
V-4-5	4-4	7/4/2007	<4.0	<8.0	<8.0	<20.0
Z-7-10	7-7	7/5/2007	<4.0	<8.0	<8.0	<20.0
AA-7-10	7-7	7/5/2007	<4.0	<8.0	<8.0	<20.0
CC-6-15	6-6	7/5/2007	<4.0	<8.0	<8.0	<20.0

Table F-3
Total Petroleum Hydrocarbons in Soil
Lone Star Refinery
8901 Manchester, Houston, Tx 77012

			TPH (nC6 to nC12)	TPH (>nC12 to nC28)	TPH (>nC28 to nC35)	Total Petroleum Hydrocarbon
Tier 1 Industrial $^{GW}Soil_{Ing}$ Critical PCLs without MSD			**60**	**590**	**19,000**	**--**
Tier 1 Industrial $^{Tot}Soil_{Comb}$ Critical PCLs with MSD			**3,900**	**6,200**	**19,000**	**--**
Tier 1 Industrial $^{Air}Soil_{Inh-V}$ Critical PCLs with MSD			**4,300**	**6,800**	**--**	**--**
Sample ID	**Depth**	**Date**	**(mg/kg)**	**(mg/kg)**	**(mg/kg)**	**(mg/kg)**
DD-7-20	7-7	7/5/2007	<4.0	<8.0	<8.0	<20.0
FF-6-6	6-6	7/5/2007	**55**	**612**	<8.0	**667**
GG-6-15	6-6	7/6/2007	<4.0	**97**	<8.0	**97**
II-7-4	7-7	7/5/2007	<4.0	<8.0	<8.0	<20.0
JJ-6-6	6-6	7/5/2007	**74**	**3,320**	<8.0	**3,390**
KK-6-7	6-6	7/5/2007	**403**	**1,470**	**333**	**2,210**
A-1	3-7	12/12/2007	**51**	**1,440**	<8.0	**1,490**
A-2	3-7	12/12/2007	**29**	**195**	<8.0	**224**
A-3	3-7	12/12/2007	<4.0	**42**	<8.0	**42**
A-4	3-7	12/12/2007	<4.0	**331**	<8.0	**331**
A-5	3-7	12/12/2007	<4.0	**20**	<8.0	**20**
A-6	3-7	12/12/2007	<4.0	**1,320**	**850**	**2,170**
B-1	3-7	12/11/2007	<4.0	**433**	**434**	**867**
B-2	3-7	12/11/2007	<4.0	**280**	**340**	**620**
C-1	3-7	12/12/2007	<4.0	**126**	<8.0	**126**
C-2	3-7	12/12/2007	<4.0	**210**	**175**	**385**
D-1	3-7	12/11/2007	<4.0	**164**	**130**	**294**
D-2	3-7	12/11/2007	**11**	**1,160**	<8.0	**1,170**
D-3	3-7	12/11/2007	**426**	**2,480**	<8.0	**2,910**
D-4	3-7	12/11/2007	**108**	**3,180**	**1,770**	**5,060**
D-5	3-7	12/11/2007	**23**	**2,010**	**1,390**	**3,420**
D-6	3-7	12/11/2007	**181**	**7,360**	**4,410**	**12,000**
D-7	3-7	12/11/2007	**135**	**1,750**	**955**	**2,840**
D-8	3-7	12/11/2007	<4.0	**480**	**505**	**985**
D-9	3-7	12/11/2007	<4.0	**325**	**242**	**567**
D-10	3-7	12/11/2007	<4.0	**779**	<8.0	**779**
D-11	3-7	12/11/2007	<4.0	**231**	<8.0	**231**
D-12	3-7	12/11/2007	<4.0	**30**	<8.0	**30**
D-13	3-7	12/11/2007	<4.0	**9**	<8.0	<20.0
D-14	3-7	12/11/2007	<4.0	**21**	<8.0	**21**
D-15	3-7	12/11/2007	**15**	**655**	**427**	**1100**
D-16	3-7	12/11/2007	**536**	**12,000**	**7,850**	**20,400**
D-17	3-7	12/11/2007	**1,260**	**26,700**	**16,000**	**44,000**
D-18	3-7	12/11/2007	**4,010**	**6,740**	**3,520**	**14,300**
D-19	3-7	12/11/2007	**170**	**4,000**	**2,370**	**6,540**

Table F-3
Total Petroleum Hydrocarbons in Soil
Lone Star Refinery
8901 Manchester, Houston, Tx 77012

			TPH (nC6 to nC12)	TPH (>nC12 to nC28)	TPH (>nC28 to nC35)	Total Petroleum Hydrocarbon
Tier 1 Industrial $^{GW}Soil_{Ing}$ Critical PCLs without MSD			**60**	**590**	**19,000**	**--**
Tier 1 Industrial $^{Tot}Soil_{Comb}$ Critical PCLs with MSD			**3,900**	**6,200**	**19,000**	**--**
Tier 1 Industrial $^{Air}Soil_{Inh-V}$ Critical PCLs with MSD			**4,300**	**6,800**	**--**	**--**
Sample ID	**Depth**	**Date**	**(mg/kg)**	**(mg/kg)**	**(mg/kg)**	**(mg/kg)**
B-6	6-8	7/9/2008	<97.0	**2,100**	**590**	**2,690**
B-6	8-10	7/9/2008	<990	**13,000**	**7,300**	**20,300**
B-6	13-15	7/9/2008	<2500	**21,000**	**9,700**	**30,700**
B-10	6-8	7/9/2008	<250.0	**4,400**	**1,400**	**5,800**
B-10	13-15	7/9/2008	**92**	**300**	<50	**392**
B-10	18-20	7/9/2008	<49	**130**	**100**	**230**
Bank 1	0-1	12/23/2009	<25.0	<25.0	<25.0	<25.0
Bank 2	0-1	12/23/2009	<20.0	<20.0	<20.0	<20.0
Bank 3	0-1	12/23/2009	<20.0	**72**	**100**	**172**
Bank 4	0-1	12/23/2009	<21.0	**80**	**190**	**270**

Note:
TR-11 is a sludge sample

Bold	values exceed the laboratory limit of quantitation.
Bold	exceeds PCL

Table F-4
Metals Concentrations in Groundwater
Lone Star Refinery
8901 Manchester, Houston, Tx 77012

		Antimony (7440-36-0)	Arsenic (7440-38-2)	Barium (7440-39-3)	Beryllium (7440-41-7)	Cadmium (7440-43-9)	Chromium (7440-47-3)	Cobalt (7440-48-4)	Lead (7439-92-1)	Mercury (7439-97-6)	Nickel (7440-02-0)	Selenium (7782-49-2)	Silver (7440-22-4)	Vanadium (7440-62-2)	Zinc (7440-66-6)
Tier 1 Industrial $^{GW}GW_{Ing}$ Critical PCL without MSD		**0.006**	**0.010**	**2.00**	**0.004**	**0.005**	**0.100**	**0.022**	**0.015**	**0.002**	**1.50**	**0.050**	**0.37**	**0.51**	**22.0**
Tier 1 Industrial $^{Air}GW_{Inh-V}$ Critical PCL with MSD		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**10**	**-**	**-**	**-**	**-**	**-**
Sample ID	**Date**	**(mg/L)**	**(mg/L)**	**(mg/L)**	**(mg/L)**	**(mg/L)**	**(mg/L)**	**(mg/L)**	**(mg/L)**	**(mg/L)**	**(mg/L)**	**(mg/L)**	**(mg/L)**	**(mg/L)**	**(mg/L)**
W-1	11/5/1992	-	-	-	-	-	<0.02	-	**0.02**	-	<0.02	-	-	<0.02	-
	7/1/2002	<0.008	<0.002	**0.176**	<0.002	<0.005	<0.002	<0.004	<0.015	<0.002	<0.005	<0.005	<0.005	<0.005	**0.021**
W-2	11/5/1992	-	-	**-**	-	-	<0.02	-	<0.02	-	<0.02	-	-	<0.02	**-**
	12/28/2009	-	**0.00102 J**	**0.194**	-	<0.0006	<0.0006	-	<0.0004	<0.000042	-	<0.0025	<0.0007	-	**-**
W-3	7/1/2002	<0.008	<0.002	**0.027**	<0.002	<0.005	<0.002	<0.004	<0.015	<0.002	**0.006**	<0.005	<0.005	<0.005	**0.026**
W-4	7/1/2002	<0.008	<0.002	**0.179**	<0.002	<0.005	<0.002	<0.004	<0.015	<0.002	**0.005**	<0.005	<0.005	<0.005	**0.017**
MW-1	12/18/2007	-	<0.006	**0.2913**	-	<0.001	**0.017**	-	**0.003**	<0.0002	-	<0.01	<0.001	**-**	**-**
	12/29/2009	-	**0.00817**	**0.34**	-	<0.0006	**0.00105 J**	-	**0.000927 J**	<0.000042	-	<0.0025	<0.0007	**-**	**-**
MW-2	12/18/2007	-	<0.006	**0.285**	-	<0.001	**0.008**	-	<0.002	<0.0002	-	<0.01	<0.001	**-**	**-**
	12/29/2009	-	**0.0023 J**	**0.229**	-	<0.0006	<0.0006	-	**0.000451 J**	<0.000042	-	<0.0025	<0.0007	**-**	**-**
MW-3	12/18/2007	-	**0.075**	**0.168**	-	<0.001	**0.002**	-	<0.002	<0.0002	-	<0.01	<0.001	**-**	**-**
	12/29/2009	-	**0.122**	**0.109**	-	<0.0006	**0.00276 J**	-	**0.00116 J**	<0.000042	-	<0.0025	<0.0007	**-**	**-**
MW-4	12/18/2007	-	**0.012**	**0.3738**	-	<0.001	**0.002**	-	<0.002	<0.0002	-	<0.01	<0.001	**-**	**-**
	12/28/2009	-	**0.0604**	**0.437**	-	<0.0006	**0.0011 J**	-	**0.00117 J**	<0.000042	-	<0.0025	<0.0007	**-**	**-**
MW-5	12/18/2007	-	<0.006	**0.0924**	-	<0.001	**0.014**	-	**0.004**	<0.0002	-	<0.01	**0.001**	**-**	**-**
	12/28/2009	-	**0.00616**	**0.034**	-	<0.0006	<0.0006	-	**0.000654 J**	<0.000042	-	<0.0025	<0.0007	**-**	**-**
MW-6	12/18/2007	-	<0.006	**0.1831**	-	<0.001	**0.032**	-	**0.023**	<0.0002	-	<0.01	<0.001	**-**	**-**
	12/28/2009	-	**0.011**	**0.146**	-	<0.0006	**0.000651 J**	-	**0.000542 J**	<0.000042	-	<0.0025	<0.0007	**-**	**-**
MW-7	12/18/2007	-	<0.006	**0.101**	-	<0.001	**0.014**	-	**0.006**	<0.0002	-	<0.01	**0.001**	**-**	**-**
	12/28/2009	-	**0.019**	**0.027**	-	<0.0006	**0.00577**	-	**0.00118 J**	<0.000042	-	**0.0097**	<0.0007	**-**	**-**
MW-8	12/18/2007	-	<0.006	**0.0214**	-	<0.001	**0.001**	-	<0.002	<0.0002	-	<0.01	**0.001**	**-**	**-**
	12/28/2009	-	**0.00624**	**0.0198**	-	<0.0006	<0.0006	-	<0.0004	<0.000042	-	<0.0025	<0.0007	**-**	**-**
MW-20	12/28/2009	-	**0.017**	**0.196**	-	<0.0006	<0.0006	-	**0.000987 J**	<0.000042	-	<0.0025	<0.0007	**-**	**-**
MW-22	12/29/2009	-	<0.0009	**0.177**	-	<0.0006	<0.0006	-	<0.0004	<0.000042	-	<0.0025	<0.0007	**-**	**-**
MW-23	12/29/2009	-	**0.129**	**0.39**	-	<0.0006	**0.000883 J**	-	**0.000419 J**	<0.000042	-	<0.0025	<0.0007	**-**	**-**

Note:

Bold	values exceed the laboratory limit of quantitation.
Bold	exceeds PCL

Table F-5
Volatile Organic Compounds in Groundwater
Lone Star Refinery
8901 Manchester, Houston, Tx 77012

		1,2,4-Trimethylbenzene (95-63-6)	1,3,5-Trimethylbenzene (108-67-8)	2-Butanone (78-93-3)	Acetone (67-64-1)	Benzene (71-43-2)	Ethylbenzene (100-41-4)	Isopropylbenzene (98-82-8)	n-Propylbenzene (103-65-1)	Naphthalene (91-20-3)	sec-Butylbenzene (135-98-8)	tert-Butylbenzene (98-06-6)	Toluene (108-88-3)	Xylenes,Total (1330-20-7)
Tier 1 Industrical $^{GW}GW_{Ing}$ Critical PCL without MSD		**0.73**	**3.7**	**44**	**66**	**0.005**	**0.7**	**7.30**	**2.900**	**1.500**	**2.9**	**2.9**	**1.0**	**10**
Tier 1 Industrial $^{Air}GW_{Inh-V}$ Critical PCL with MSD		**270**	**180**	**1,000,000**	**350,000**	**300**	**22,000**	**6,200**	**8,500**	**440**	**5,400**	**3,500**	**89,000**	**14,000**
Sample ID	**Date**	**(mg/L)**	**(mg/L)**	**(mg/L)**	**(mg/L)**	**(mg/L)**	**(mg/L)**	**(mg/L)**	**(mg/L)**	**(mg/L)**	**(mg/L)**	**(mg/L)**	**(mg/L)**	**(mg/L)**
W-1	11/5/1992	-	-	-	-	-	-	-	-	-	-	-	-	-
	7/1/2002	-	-	<0.025	-	<0.005	<0.005	-	-	-	-	-	<0.005	<0.005
W-2	11/5/1992	-	-	-	-	-	-	-	-	-	-	-	-	-
	12/28/2009	<0.0005	<0.0005	<0.001	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0006	<0.0005	<0.001
W-3	7/1/2002	-	-	<0.025	-	<0.005	<0.005	-	-	-	-	-	<0.005	<0.005
W-4	7/1/2002	-	-	<0.025	-	<0.005	<0.005	-	-	-	-	-	<0.005	<0.005
EP-100	8/24/1998	-	-	-	-	<0.005	<0.005	-	-	-	-	-	<0.005	-
EP-101	8/24/1998	-	-	-	-	<0.005	<0.005	-	-	-	-	-	<0.005	-
EP-102	8/24/1998	-	-	-	-	<0.005	<0.005	-	-	-	-	-	<0.005	-
EP-120	3/23/2001	-	-	**0.026**	-	<0.005	<0.005	-	-	-	-	-	<0.005	-
MW-1	12/18/2007	-	-	-	-	<0.005	<0.005	-	-	-	-	-	<0.005	<0.005
	12/29/2009	<0.0005	<0.0005	<0.001	<0.001	**0.0022 J**	<0.0005	**0.0035 J**	**0.0021 J**	<0.0005	**0.00059 J**	<0.0006	<0.0005	<0.001
MW-2	12/18/2007	-	-	-	-	**0.034**	**0.03**	-	-	-	-	-	**0.007**	**0.048**
	12/29/2009	**0.0016 J**	<0.0005	<0.001	<0.001	**0.0022 J**	**0.0041 J**	**0.00078 J**	<0.0005	**0.094**	<0.0005	<0.0006	**0.0013 J**	**0.0029 J**
MW-3	12/18/2007	-	-	-	-	<0.005	<0.005	-	-	-	-	-	<0.005	**0.011**
	12/29/2009	<0.0005	<0.0005	<0.001	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0006	<0.0005	<0.001
MW-4	12/18/2007	-	-	-	-	**0.012**	<0.005	-	-	-	-	-	<0.005	**0.012**
	12/28/2009	<0.0005	<0.0005	<0.001	**0.0025 J**	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0006	<0.0005	<0.001
MW-5	12/18/2007	-	-	-	-	<0.005	<0.005	-	-	-	-	-	<0.005	**0.01**
	12/28/2009	<0.0005	<0.0005	<0.001	**0.0052 J**	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0006	<0.0005	<0.001
MW-6	12/18/2007	-	-	-	-	**0.009**	**0.014**	-	-	-	-	-	**0.02**	**0.066**
	12/28/2009	<0.0005	<0.0005	<0.001	**0.012**	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0006	<0.0005	<0.001
MW-7	12/18/2007	-	-	-	-	**0.661**	**0.299**	-	-	-	-	-	**0.696**	**0.974**
	12/28/2009	**0.076**	**0.027**	**0.11**	**0.27**	**0.62**	**0.065**	**0.01 J**	**0.01 J**	**0.043**	<0.0025	<0.003	**0.15**	**0.37**
MW-8	12/18/2007	-	-	-	-	**0.009**	**0.009**	-	-	-	-	-	**0.021**	**0.032**
	12/28/2009	<0.0005	<0.0005	<0.001	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0006	<0.0005	<0.001
MW-20	12/28/2009	<0.0005	<0.0005	<0.001	<0.001	<0.0005	<0.0005	**0.0042 J**	**0.003 J**	<0.0005	**0.00095 J**	**0.00083 J**	<0.0005	<0.001
MW-22	12/29/2009	<0.0005	<0.0005	<0.001	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0006	<0.0005	<0.001
MW-23	12/29/2009	**0.26**	**0.071**	<0.01	**0.041 J**	**16**	**0.92**	**0.055**	**0.042 J**	**0.052**	<0.005	<0.006	**0.36**	**1.6**

Note:

Bold	values exceed the laboratory limit of quantitation.
Bold	exceeds PCL

Table F-6
Total Petroleum Hydrocarbons in Groundwater
Lone Star Refinery
8901 Manchester, Houston, Tx 77012

		TPH (nC6 to nC12)	TPH (>nC12 to nC28)	TPH (>nC28 to nC35)	Total Petroleum Hydrocarbon
Tier 1 Industrial $^{GW}GW_{Ing}$ Critical PCL without MSD		**2.2**	**2.2**	**2.2**	**--**
Tier 1 Industrial $^{Air}GW_{Inh-V}$ Critical PCL with MSD		**14**	**14**	**--**	**--**
Sample ID	**Date**	**(mg/L)**	**(mg/L)**	**(mg/L)**	**(mg/L)**
W-1	11/5/1992	-	-	-	**85**
W-2	11/5/1992	-	-	-	<4.0
	12/28/2009	<0.18	<0.18	<0.18	<0.18
MW-1	12/29/2009	<0.19	<0.19	<0.19	<0.19
MW-2	12/29/2009	<0.19	<0.19	<0.19	<0.19
MW-3	12/29/2009	<0.19	<0.19	<0.19	<0.19
MW-4	12/28/2009	<0.19	<0.19	<0.19	<0.19
MW-5	12/28/2009	<0.19	<0.19	<0.19	<0.19
MW-6	12/28/2009	<0.19	<0.19	<0.19	<0.19
MW-7	12/28/2009	**3.7**	**3.2**	<0.19	**6.9**
MW-8	12/28/2009	<0.19	<0.19	<0.19	<0.19
MW-20	12/28/2009	<0.19	<0.19	<0.19	<0.19
MW-22	12/29/2009	**0.23 J**	<0.19	<0.19	**0.23 J**
MW-23	12/29/2009	**31**	**0.36 J**	<0.19	**31.4**

Note:

Bold	values exceed the laboratory limit of quantitation.
Bold	exceeds PCL

Appendix G – Plume Stability

The former Lone Star Refinery facility located at 8901 Manchester (Site) has been affected by dissolved phase contaminants (one or more of arsenic, benzene and total petroleum hydrocarbons) in the soil and groundwater. These contaminants are believed to be associated with the historic operations conducted at the property.

The lateral extent of groundwater impact has been horizontally delineated in all directions to the greatest extents possible. PCLE Zone 1 extends offsite onto an active industrial facility (Rhodia Chemical). PCLE Zone 2 is delenated by monitoring wells MW-14 and MW-13 and the Houston Ship Channel to the north. PCLE Zone 3 extends offsite on to an adjacent property (Texas Port Recycling). A Municipal Setting Designation is being sought for the Texas Port Recycling Property. PCLE Zone 4 is the result of an off-site source and is delineated by monitoring wells MW-2 and MW-22 (**Figure B4**). The groundwater gradient at the site is to the north in the shallow groundwater bearing unit (**Figure B7**).

Monitoring wells located along the eastern and western property boundaries have reported COC concentrations greater than the applicable PCLs. Additional investigations have not been conducted to verify if soil and/ or groundwater impacts have migrated off-site or if the off-site properties are contributing to the soil and/or groundwater impacts.

Monitoring wells MW-6, MW-7 and MW-14 border the suspected source are on the downgradient side. Surface water samples and sediment samples have been collected from the Houston Ship Channel to confirm on-site COCs have not migrated to the surface water body. Monitoring well MW-23 has reported the highest concentrations of arsenic (0.129 mg/L), benzene (16 mg/L) and TPH (31 mg/L) during the December 2009 sampling event. Groundwater sampling results from surrounding monitoring wells MW-2 and MW-22 has exhibited stable to decreasing concentrations of arsenic, benzene and TPH.