CITY OF HOUSTON

PUBLIC WORKS AND ENGINEERING
PLANNING & DEVELOPMENT DIVISION

Application for Approval of Municipal Setting Designation

APPLICANT INFORMATION

Applicant's Name: City of Houston - General Services Department

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

Address: P. O. Box 1562, Houston, Texas 77251-1562
(Street) (City) (State) (Zip)

Phone No.: 832-393-8079 Fax No.: 832-393-8009

Email: Gabriel.Mussio@houstontx.gov

Contact Information

Name of Contact: Gabriel Mussio

Title: Division Manager, Environmental Section, Design and Construction Division

Address: P. O. Box 1562, Houston, Texas 77251-1562
(Street) (City) (State) (Zip)

Phone No.: 832-393-8079 Fax No.: 832-393-8009

Email: Gabriel.Mussio@houstontx.gov

SITE INFORMATION

Site HCAD No(s): 1324630010001 (RES A BLK 1 EAST END ECONOMIC DEVELOPMENT SITE)

Site Name: BBVA Compass Stadium

Site Size: 12.145 acres

Site Address: 2200 Texas Street, Houston, Texas 77003
(Street) (City) (State) (Zip)

(List all owners – additional sheet is attached, if needed)

Owner: City of Houston

Owner Address: P. O. Box 1562, Houston, Texas 77251-1562
(Street) (City) (State) (Zip)

Name of Contact: Gabriel Mussio

Title: Division Manager, Environmental Section, Design and Construction Division

Organization: City of Houston

Phone No.: 832-393-8079 Fax No.: 832-393-8009

Email: Gabriel.Mussio@houstontx.gov

Executive Summary

In 2008, the City of Houston initiated plans to acquire property (designated property) in an area east of downtown Houston for the construction of a stadium. The City identified six contiguous blocks for acquisition. The six blocks, identified as city blocks 203, 204, 205, 218, 219, and 220, are bounded on the north by Texas Avenue, on the east by Dowling Street, on the south by Walker Street, and on the west by Hutchins Street. Hutchins Street has been closed on the west side of the stadium and converted to a pedestrian area. The six-block property, approximately 12 acres, is located in an area with a long history of commercial, industrial, and residential use dating back more than 120 years. At the time of acquisition, some of the six city blocks were vacant and some were in commercial/industrial use.

As part of the property acquisition, the City conducted due diligence activities under the Brownfields Restoration Program during the period of 2008 to 2011. These due diligence activities involved historical records searches, environmental investigations, and limited soil removal actions. The activities and findings of these investigations were presented in the following reports:

- Phase I Environmental Site Assessment for 810 Dowling Street and City Blocks 203, 204, 205, 219, and 220, April 2008, Weston Solutions, Inc., 2008, prepared for City of Houston Brownfields Redevelopment Program, 689 pages.

- Weston Solutions, Inc., 2009, Limited Phase II Environmental Investigation Activities, Six Block Project, June 2009, Houston, Texas, 248 pages.

- Summary of Additional Limited Phase II ESA Activities, Six Block Project, May 2010, Weston Solutions, Inc., Houston, Texas, 318 pages.

- Supplemental Phase II ESA & Soil Excavation, Six City Blocks bounded by Texas Avenue, Dowling, Walker, and Hutchins, Houston, Texas, November 2010, prepared for City of Houston-Public Works and Engineering, Brownfields Redevelopment Program, 342 pages.

- Drinking Water Survey Report, Planned Soccer Stadium, March 2011, Malcolm Pirnie, Inc., prepared for City of Houston General Services Department.

The findings from the environmental investigations and assessments were reviewed using the generalized process to determine if a release is subject to the Texas Commission on Environmental Quality (TCEQ) Texas Risk Reduction Program (TRRP) as described in the guidance document *Determining Which Releases are Subject to TRRP* dated November 2010.

Affected soil and groundwater related to historical releases were detected on the City of Houston-owned six-block property where the BBVA Compass Stadium was recently constructed on the east side of downtown. In accordance with TRRP, the areas of soils with chemical of concern (COCs) concentrations were delineated to the action levels or residential assessment levels (RALs). Soils with COC

concentrations exceeding the health-based Tier 1 $^{Tot}Soil_{Comb}$ Protective Concentration Levels (PCLs) were excavated and removed from the property.

The semivolatile organic compound (SVOC) 1,2,4-trichlorbenzene was detected in groundwater at a concentration exceeding the action levels but below the non-ingestion protective concentration. The estimated extent of the affected groundwater remains on-site.

Construction on the stadium was started in February 2011 and completed in May 2012. The facility, now designated as BBVA Compass Stadium, has 22,000 seats and is used primarily by the Houston Dynamo professional soccer team. Additional uses of the stadium are for various other sporting events (lacrosse, rugby, and football) and concerts.

The stadium covers most of the six-block area and consists of impermeable surfaces (stadium grandstands, concourse, various ramps, loading docks, and walkways), landscaped areas, and a grass playing field. The 90,000 square-foot playing field is natural grass underlain by engineered layers of soil, sand, and gravel. The playing field is underlain by an extensive drainage system and irrigation system.

The properties within 500 feet of the designated property are used chiefly for commercial/ industrial purposes with some smaller residential areas. The commercial/industrial uses are warehouses, maintenance shops, shipping and distribution facilities, and light manufacturing. The residences in the vicinity are a mixture of older one story homes and recently constructed townhomes and mid-rise multi-dwelling buildings. The anticipated future use of the 12-acre property will continue in the current configuration as a stadium facility for sporting and concert events.

The City of Houston intends to implement a Municipal Settings Designation (MSD) for the BBVA Stadium to prevent the use of shallow groundwater for potable supply purposes. Properties within 0.5 miles of the affected groundwater are connected to the City of Houston municipal water supply. There are no current users of shallow groundwater in the area that are threatened by the affected groundwater.

Based on the TCEQ guidance, the COC releases to soil and groundwater at the six-block property have been addressed through investigation delineation, leaching testing, Tier 2 calculations, soil removal actions, the construction of impermeable cover related to the stadium, and the planned implementation of an MSD.

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.

Current Use of Designated Property

The designated property is owned by the City of Houston and encompasses six contiguous city blocks on the east side of downtown Houston, Texas. The six blocks, identified as city blocks 203, 204, 205, 218, 219, and 220, are bounded on the north by Texas Avenue, on the east by Dowling Street, on the south by Walker Street, and on the west by Hutchins Street. Hutchins Street, on the west side of the designated property, has been closed to traffic and converted to a pedestrian area.

The approximately 12-acre designated property was previously used for commercial/industrial purposes for more than 120 years. All pre-existing structures, facilities, and utilities were removed before 2010.

The designated property is currently used as a sports and concert facility identified as BBVA Compass Stadium. The stadium occupies the entire six contiguous blocks of the regular city grid. Construction started on the stadium on February 5, 2011 and was completed on May 12, 2012. The stadium has a capacity of 22,000 seats and is used primarily by the Houston Dynamo professional soccer team. Additional uses of the stadium are for various other sporting events (lacrosse, rugby, and football) and concerts.

The stadium consists of large areas of impermeable surfaces (stadium grandstands, concourse, parking, various ramps, loading docks, and walkways), landscaped areas, and a grass playing field. The 90,000 square-foot playing field is natural grass underlain by engineered layers of soil, sand, and gravel. The playing field is underlain by an extensive drainage system and irrigation system.

Anticipated Use of Designated Property

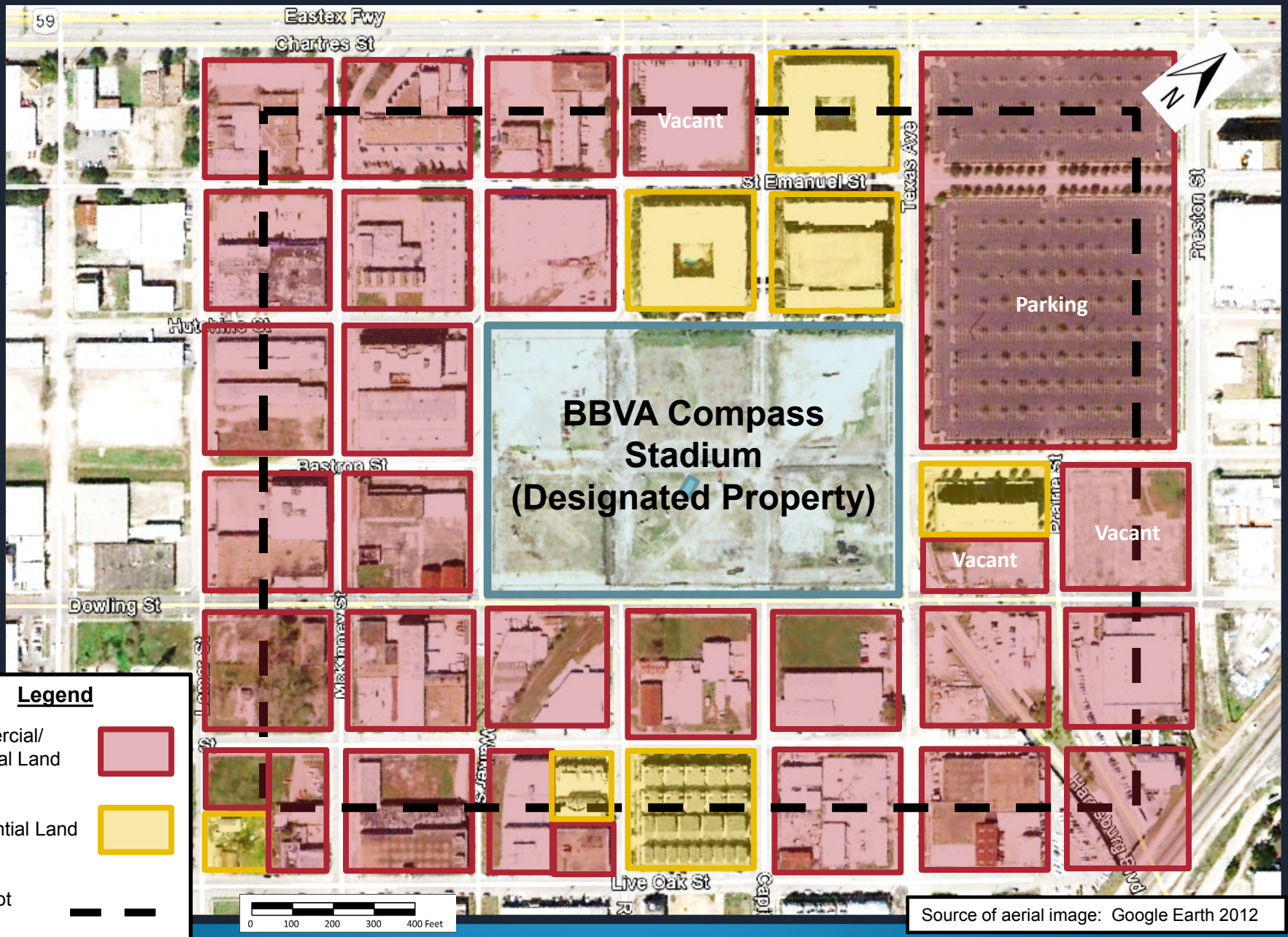
The anticipated future use of the designated property will continue as a sporting and concert facility in the current configuration.

Current and Anticipated Use of Properties within 500 feet of the Designated Property

The BBVA Compass Stadium lies east of downtown Houston in an area with a more than 120-year history of commercial/industrial and residential development. The properties within 500 feet of the designated property are used chiefly for commercial/ industrial purposes with some smaller residential areas. The commercial/industrial uses are parking lots, warehouses, maintenance shops, restaurants, shipping and distribution facilities, and light manufacturing.

A light rail line is under construction along Texas Avenue on the north side of the designated property. The residences in the vicinity are a mixture of older one story homes and recently constructed townhomes and mid-rise multi-dwelling buildings. **Figure B-1** presents a map of land uses of the area within 500 feet of the designated property.

The trend of property use in the area of the soccer stadium during the last few years has been the re-use of commercial/industrial properties for residential purposes. This residential construction involves mostly townhomes and multiple unit dwellings. This trend to greater residential use in the area of the designated property is likely to continue during the near future.



ARCADIS

Municipal Settings Designation Application
BBVA Compass Soccer Stadium
2200 Texas Avenue, Houston, Texas

Surrounding Land Use

ARCADIS

Figure B -1

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 including the nearest surface water body 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 contaminant of concern, to the extent known.

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a. **Figure C-1** shows the location of the designated property on the east side of downtown Houston in an area with a more than 100-year history of commercial/industrial and residential development.

b. **Figure C-2** presents a topographic map of the area around the designated property. The closest surface water body is Buffalo Bayou which lies approximately 3,600 feet north of the designated property.

Figure C-3 presents a watershed map of the area around the designated property. The designated property lies on the boundary between the Buffalo Bayou Watershed to the north and the Brays Bayou Watershed to the south. Approximately the northeastern third of the designated property lies in the Buffalo Bayou Watershed.

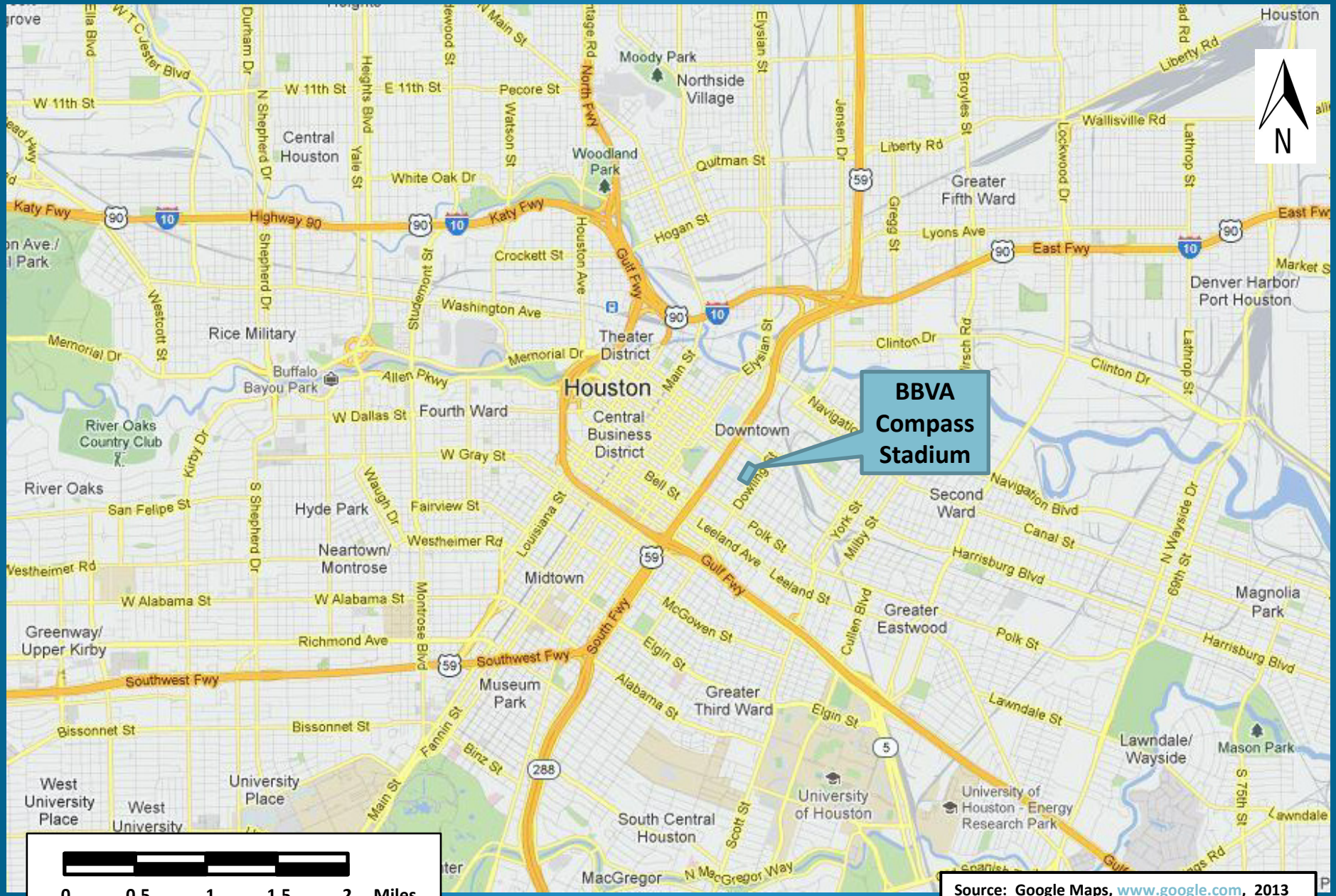
Figure C-4 presents a floodplain map of the area around the designated property based on the Federal Emergency Management effective Flood Insurance Rate Map. The designated property does not lie in a floodway or floodplain.

c. **Figure C-5** presents the estimated extent of affected groundwater at the designated property. The estimated extent of affected groundwater is based on the detection of one COC at a concentration exceeding the TRRP RALs at one sampling location (monitoring well).

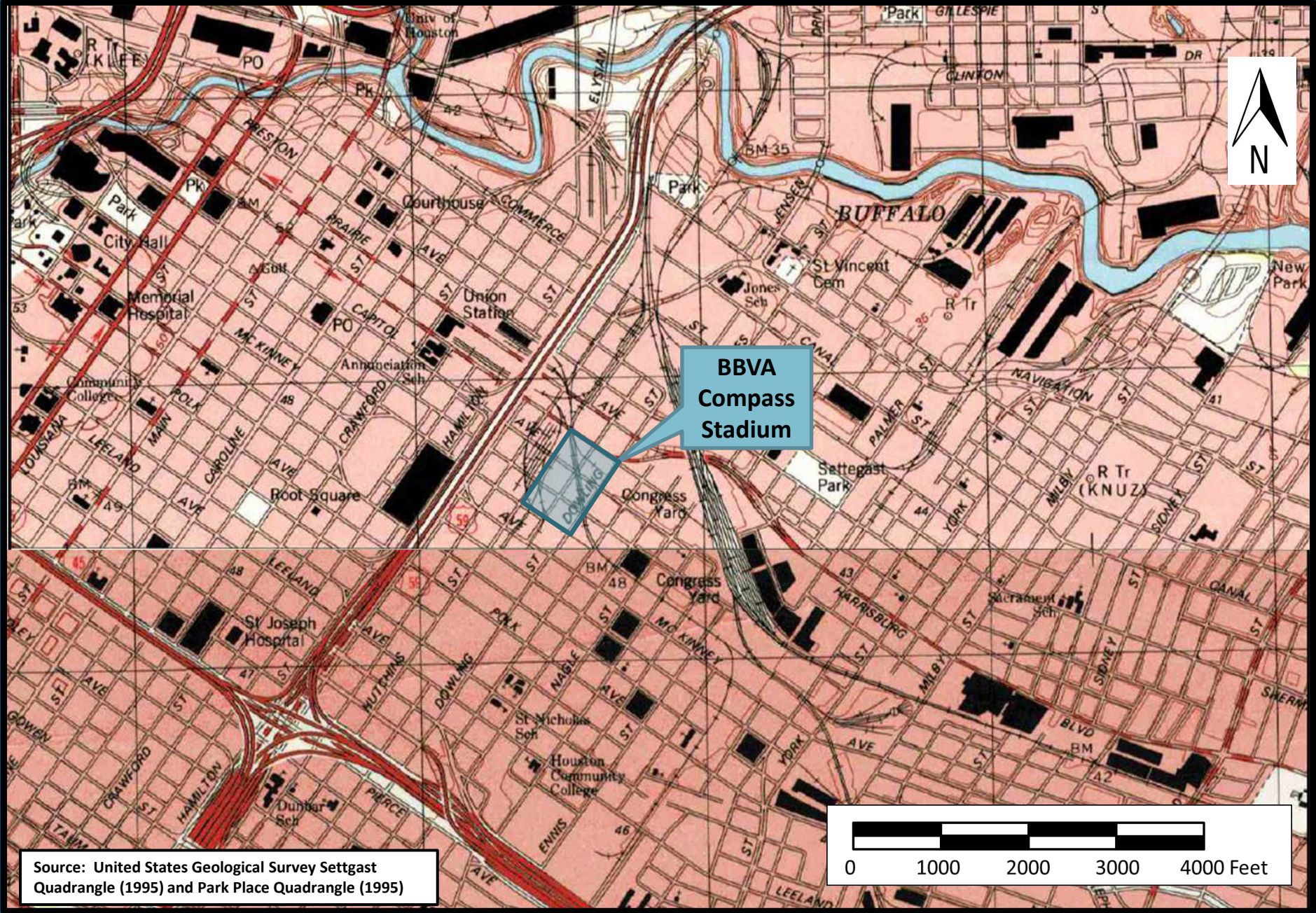
d. **Figure C-5** presents the location of all soil sampling locations and all groundwater sampling points (piezometers, temporary monitoring wells, and monitoring wells). This indicates the estimated extent of groundwater affected with COC concentrations exceeding the TRRP RALs. Also indicated is the approximate area of TPH detections in groundwater samples collected in 1993 associated with the closed LPST Site No. 92105.

e. **Figure C-6** presents the estimated direction of shallow groundwater flow based on information from two closed leaking petroleum storage tank (LPST) sites located on or near the six-block area. Based on the available information, the groundwater flow direction in the uppermost groundwater-bearing unit appears to be variable.

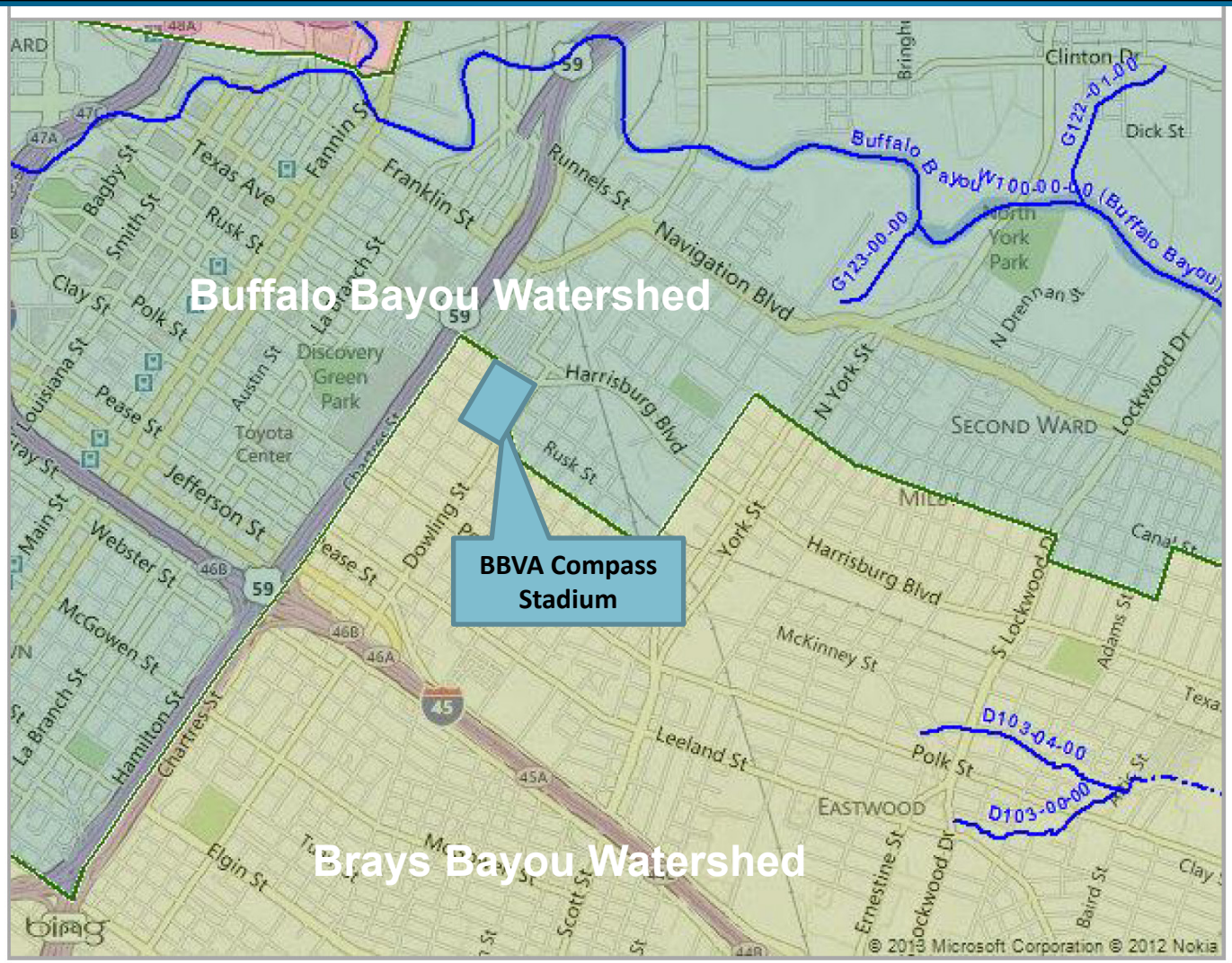
f. **Figure C-6** presents the estimated ingestion protective concentration level exceedance zone for the chemical of concern (1,2,4-trichlorobenzene), to the extent known.



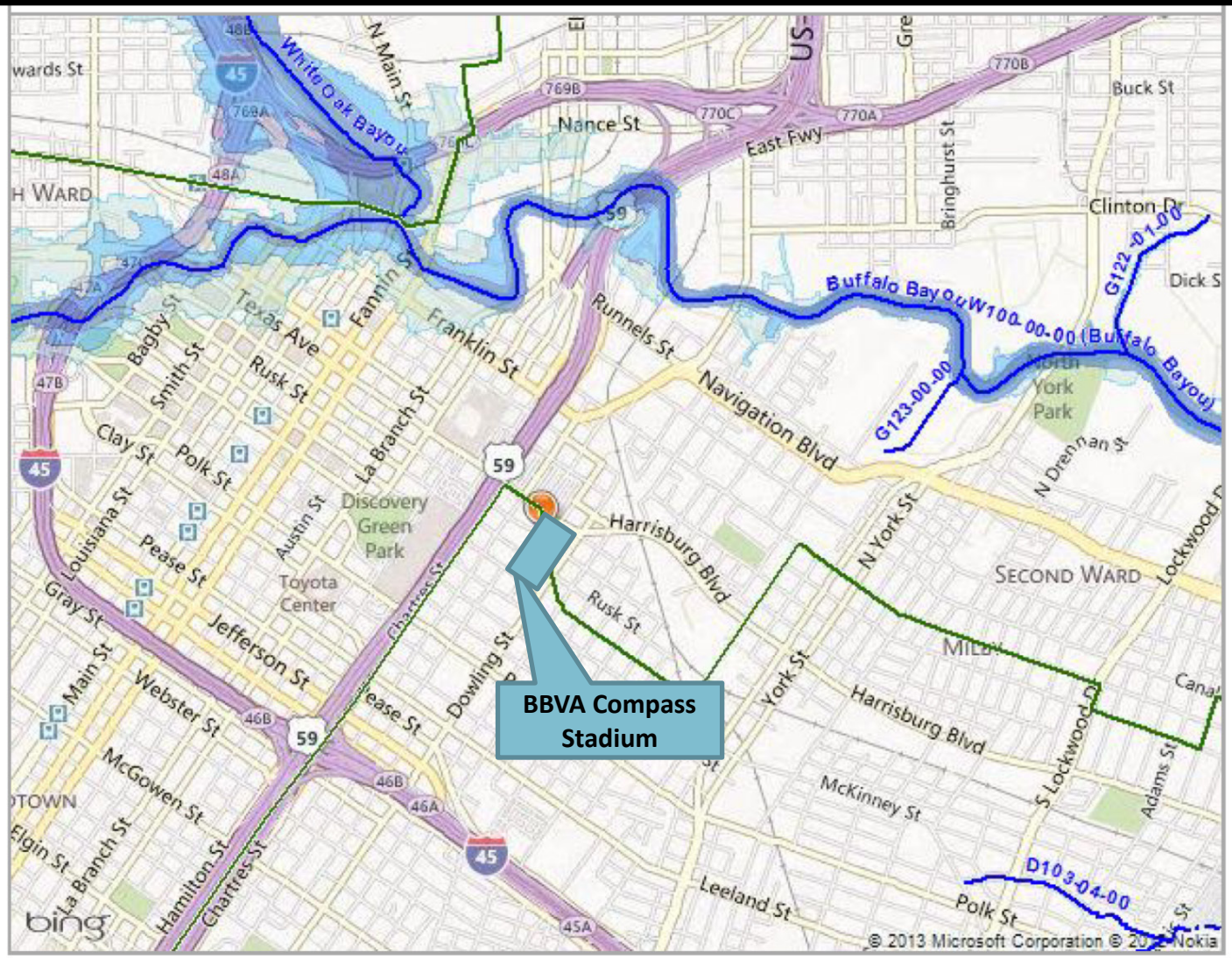
ARCADIS	Municipal Settings Designation Application BBVA Compass Soccer Stadium 2200 Texas Avenue, Houston, Texas	Location of Designated Property	ARCADIS Figure C - 1



ARCADIS	Municipal Settings Designation Application BBVA Compass Soccer Stadium 2200 Texas Avenue, Houston, Texas	Topographic Map of the Designated Property	ARCADIS Figure C - 2



DISCLAIMER: The Harris County Flood Control District's Flood Education Mapping Tool is for general information purposes only and may not be suitable for legal, engineering or surveying purposes. The floodplains shown on this mapping tool are those delineated on the Federal Emergency Management Agency's (FEMA) effective Flood Insurance Rate Map (FIRM or floodplain map) for Harris County that was adopted in 2007, as well as updates that have been made through a Letter of Map Revision (LOMR) since 2007. This mapping tool is not an effective FIRM. The effective FIRM is produced, maintained and published by FEMA and not by the Harris County Flood Control District. Please visit FEMA's Map Service Center at www.msc.fema.gov to view the effective FIRM for Harris County. For an official floodplain determination, please contact an insurance agent or mortgage lender.This map is a representation and approximation of the relative location of geographic information, land marks and physical addresses.



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STATE OF TEXAS
Michael F. Forlenza
Geology
2885
LICENSED
PROFESSIONAL GEOSCIENTIST

2-21-2013

Legend

- **P-1** Piezometer (PSI January 2009)
- **BLK218-1** Soil Boring (Weston 2009)
- **TW-1** Temporary Monitoring Well (Weston 2009)
- **BLK21911** Soil Boring (Terracon 2010)
- **MW-5** Monitoring Well (LPST No. 117156)
- Property Boundary
- Estimated Extent of Affected Groundwater
- Area of Soil Excavation/Removal

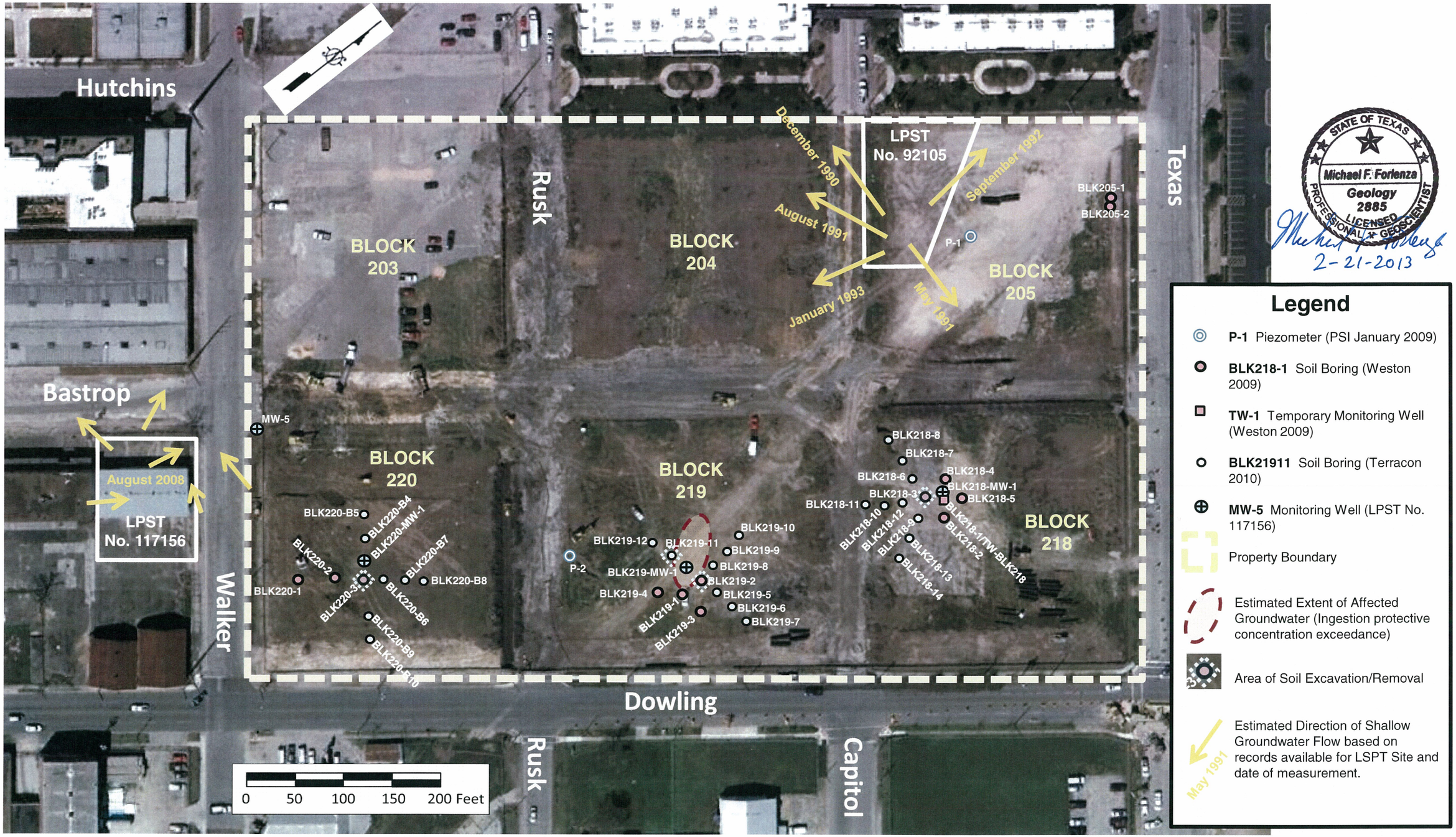
ARCADIS

Municipal Settings Designation Application
BBVA Compass Soccer Stadium
2200 Texas Avenue, Houston, Texas

Estimated Extent of Affected Groundwater and Sampling Locations and Areas of Soil Removal

ARCADIS

Figure C-5



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- **MW-5** Monitoring Well (LPST No. 117156)
- Property Boundary
- Estimated Extent of Affected Groundwater (Ingestion protective concentration exceedance)
- Area of Soil Excavation/Removal
- Estimated Direction of Shallow Groundwater Flow based on records available for LSPT Site and date of measurement.

ARCADIS

Municipal Settings Designation Application
BBVA Compass Soccer Stadium
2200 Texas Avenue, Houston, Texas

Groundwater Gradient

ARCADIS

Figure C - 6

Appendix D

For each contaminant 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).

Detection and delineation of chemicals of concern (COCs) in soil and groundwater was conducted during due diligence investigations and associated soil removal actions completed by the City of Houston under the Brownfields Restoration Program during the period 2009 to 2010. These due diligence activities were related to the acquisition of the six-block property. The activities and findings of these investigations were presented in the following reports:

§ Phase I Environmental Site Assessment for 810 Dowling Street and City Blocks 203, 204, 205, 219, and 220, April 2008, Weston Solutions, Inc., 2008, prepared for City of Houston Brownfields Redevelopment Program, 689 pages.

§ Weston Solutions, Inc., 2009, Limited Phase II Environmental Investigation Activities, Six Block Project, June 2009, Houston, Texas, 248 pages.

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§ Drinking Water Survey Report, Planned Soccer Stadium, March 2011, Malcolm Pirnie, Inc., prepared for City of Houston General Services Department.

Additionally, the City of Houston conducted an archeological survey of the six-block property in 2008 that included several exploratory soil excavations (trenches). Stained soils and chemical odors were observed in three of the soil trenches. These were Trench 2 on city block 205, Trench 11 on city block 218, and Trench 8 on city block 219.

The findings from the environmental investigations and assessments were reviewed using the generalized process to determine if a release is subject to TRRP as described in the TCEQ guidance document *Determining Which Releases are Subject to TRRP* dated November 2010. Based on the TCEQ guidance

document, analytical results for soil and groundwater samples collected during the environmental assessments which exceeded the Method Quantitation Limit (MQL) or published background concentration were compared to action levels. Action levels are defined as the lowest applicable Tier 1 residential protective concentration level (PCL) for a given COC, assuming a 0.5-acre source area and Class 1 groundwater. Action levels are equivalent to Residential Assessment Levels (RALs) under TRRP.

The action levels for soils are based on the lower of the TCEQ's TRRP Tier 1 residential PCLs for (Tier 1 $^{GW}Soil_{Ing}$ and Tier 1 $^{Tot}Soil_{Comb}$) for a 0.5-acre source area. For metals, the action level is the published Texas-Specific Soil Background Concentration (TSBC) if the background is higher than Tier 1 PCL. The action levels for groundwater are based on Tier 1 residential groundwater ingestion PCLs (Tier 1 $^{GW}GW_{Ing}$ PCL).

a. Soil Exceedances

Metals, volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), and total petroleum hydrocarbons (TPH) were detected in soils during the investigation activities. Several of these COCs were detected at concentrations exceeding the TRRP Tier 1 residential $^{GW}Soil_{Ing}$ PCL for a 0.5-acre source area which are related to the groundwater ingestion pathway. Additionally, five COCs were detected at concentrations exceeding the Tier 1 residential $^{Tot}Soil_{Comb}$ PCL for a 0.5-acre source area related to non-ingestion pathways. **Table D-1** presents a summary of detected COCs in soil and a comparison to ingestion and non-ingestion pathways.

The soils with COC concentrations exceeding the non-ingestion pathways were excavated and removed from the designated property during response actions conducted in 2010. The soils with COC concentrations exceeding the ingestion pathway are addressed by the implementation of the MSD. The MSD closes the soil-to-groundwater to ingestion pathway to potential human receptors.

Groundwater Exceedance

One COC was detected in one groundwater sample at a concentration exceeding the ingestion protective concentration level (TRRP residential Tier 1 $^{GW}GW_{Ing}$ PCL). The SVOC 1,2,4-trichlorobenzene was detected in groundwater sample BLK219-MW-1 at a concentration of 0.351 mg/L. The ingestion protective concentration level for 1,2,4-trichlorobenzene is 0.07 mg/L based on the TRRP Tier 1 tables dated June 2012. The ingestion protective concentration is the same for both residential and commercial/industrial sites. Several other SVOCs were detected in the same groundwater sample at concentrations below the ingestion protective concentration level. Table D-2 presents a summary of detected COCs in groundwater and a comparison to ingestion related values and non-ingestion related values.

The ingestion protective concentration level exceedance zone for 1,2,4-trichlorobenzene at the designated property occurs in the uppermost groundwater-bearing unit and is indicated on Figure C-5. The uppermost groundwater bearing unit occurs in an interval of red and pale brown clayey sand and silty clay interlayered with stiff clay. The bottom of the uppermost GWBU is approximately 24 to 25 feet bgs and is underlain by stiff red clay.

The protective concentration level exceedance zone is located in the vicinity of former monitoring well BLK219-MW1. Former monitoring well BLK219-MW1 is located near the center of block 219, more than 100 feet all property boundaries. Due to the low mobility of the COC in the subsurface environment, the estimated extent of the exceedance zone likely remains on-site in the area of the single detection. The estimated area of the exceedance zone is approximately 75 feet long by 25 feet wide (1,875 square feet).

The depth to groundwater in this area is approximately 18 feet below the ground surface existing at the time of the sampling activities. The area of the exceedance is now located under the concrete slab of the east grandstands of the BBVA Compass Stadium. The ground surface at the grandstands has been built up approximately 7 feet from the pre-exiting grade. This indicates that the depth to groundwater is now approximately 25 feet below the concrete slab.

There is no non-ingestion protective concentration level exceedance zone at the designated property. No chemicals were detected at concentrations exceeding the non-ingestion protective concentration levels. The detected concentration of 1,2,4-trichlorobenzene of 0.351 mg/L is below the non-ingestion protective concentration level of 160 mg/L for residential sites (Tier 1 residential $^{Air}GW_{Inh\text{-}V}$ PCL for 0.5-acre source area) and the non-ingestion protective concentration level of 220 mg/L for commercial/industrial sites (Tier 1 commercial/industrial $^{Air}GW_{Inh\text{-}V}$ PCL for 0.5-acre source area).

b. Tables D-1 and D-2 present a listing of the detected COCs in soil and groundwater and a comparison to ingestion protective levels and non-ingestion protective levels. The SVOC 1,2,4-trichlorobenzene is the only COC detected in groundwater at a concentration exceeding the ingestion protective concentration level. The detected concentration of the 1,2,4-trichlorobenzene in the groundwater sample from the former monitoring well BLK219-MW1 was 0.351 mg/L. This concentration exceeds the ingestion protective concentration level of 0.07 mg/L and is below the non-ingestion protective concentration level (vapor PCL) of 160 mg/L. The PCL values are based on the TRRP Tier 1 PCL table dated June 2012.

Detected concentration of 1,2,4-trichlorobenzene:	0.351 mg/L
Ingestion Protective Concentration Level:	0.07 mg/L
Non-Ingestion Protective Concentration Level (residential):	160 mg/L
Non-Ingestion Protective Concentration Level (commercial/industrial):	220 mg/L

c. According to the USEPA Chemical Fact Sheet (EPA 749-F-95-020a) dated November 1994, the SVOC 1,2,4-trichlorobenzene has the following characteristics:

Characteristic/Property	Data	Reference
Chemical Abstract Number	120-82-1	
Common Synonyms	TCB; Unsym-trichlorobenzene	U.S. Air Force 1989
Molecular Formula	$C_6H_3Cl_3$	Budavari et al. 1989
Physical State	colorless liquid	Keith and Walters 1985
Molecular Weight	181.46	Budavari et al. 1989
Boiling Point	213 deg C	Budavari et al. 1989
Water Solubility	31 mg/L at 25deg C	Darling 1995
Density	1.46 at 25 deg C	Budavari et al. 1989
Vapor Density (air = 1)	6.26	Keith and Walters 1985
K_{OC}	6350	U.S. Air Force 1989
Log K_{OW}	4.12	U.S. Air Force 1989
Vapor Pressure	0.27 mm Hg at 20 deg C	U.S. Air Force 1989
Flash Point	110 deg C	Budavari et al. 1989
Henry's Law Constant	4.33×10^{-3} atm m^3/mol	U.S. Air Force 1989
Odor Threshold	3 ppm	U.S. Air Force 1989

The COC 1,2,4-trichlorobenzene strongly adsorbs to soils with 1-2% organic content, as predicted by its K_{oc} value, but leaching into ground waters can occur from deep soils (U.S. Air Force 1989). The COC is insoluble in water. As a non-aqueous phase liquid (NAPL), 1,2,4-trichlorobenzene has a density greater than water and would tend to sink. NAPL was not observed during the investigation activities and is not expected to be present based on the detected concentration of 1,2,4-trichlorobenzene.

Table D - 1

Summary of Maximum COC Concentrations in Soil

Municipal Settings Designation Application

BBVA Compass Stadium

2200 Texas Avenue, Houston, Texas

Chemical of Concern	Maximum Detected Soil Concentration				TRRP Residential Tier 1 Protective Concentration Level			
	Sample ID	Sample Depth (feet)	Sample Date	Detected Concentration (mg/kg)	Ingestion (without MSD) $^{GW}Soil_{Ing}$ (mg/kg)	Non-Ingestion (with MSD) $^{Tot}Soi_{IComb}$ (mg/kg)	TSBC (mg/kg)	Comment
Semivolaltile Organic Compounds								
Acenaphthene	BLK281-1	0-3	5/19/2009	0.17	240	3000	nv	No exceedance
Anthracene	BLK281-1	0-3	5/19/2009	0.27	6400	18000	nv	No exceedance
Benzo(a)anthracene	BLK219-12	0-3	5/3/2010	1.29 J	18	5.7	nv	No exceedance
Benzo(a)pyrene	BLK219-12	0-3	3/8/2010	1.1	736	0.56	nv	No exceedance
Benzo(b)fluorathene	BLK219-12	0-3	5/3/2010	1.51 J	60	5.7	nv	No exceedance
Benzo(g,h,i)perylene	BLK219-1	0-3	3/8/2010	0.66	46000	1800	nv	No exceedance
Benzo(k)fluorathene	BLK219-12	0-3	5/3/2010	1.03 J	620	57	nv	No exceedance
bis(2-ethylhexyl)phthalate	BLK219--8	0-3	5/3/2010	0.799	164	43	nv	No exceedance
Carbazole	BLK219-1	0-3	3/8/2010	0.14 J	5	230	nv	No exceedance
Chrysene	BLK219-12	0-3	5/3/2010	1.46 J	1500	560	nv	No exceedance
Dibenzo(a,h)anthracene	BLK219-1	0-3	3/8/2010	0.11 J	15	0.55	nv	No exceedance
Fluorathene	BLK219-1	0-3	3/8/2010	2.3	1900	2300	nv	No exceedance
Fluorene	BLK281-1	0-3	5/19/2009	0.47	300	2300	nv	No exceedance
Indeno(1,2,3-cd)pyrene	BLK219-1	0-3	3/8/2010	0.83	170	5.7	nv	No exceedance
Hexachlorobenzene	BLK219-11	0-3	5/3/2010	**14.2**	1.13	1.1	nv	Soil Removed - June 2010
Hexachlorobutadiene	BLK219-2	0-3	3/8/2010	**36**	3.3	20	nv	Soil Removed - June 2010
2-Methylnaphthalene	BLK219-1	0-3	3/8/2010	0.091 J	17	250	nv	No exceedance
Naphthalene	BLK281-1	0-3	5/19/2009	0.071 J	31	220	nv	No exceedance
Pentachlorophenol	BLK219-1	0-3	3/8/2010	**0.34**	0.018	0.73	nv	No groundwater exceedance
Phenathrene	BLK219-12	0-3	5/3/2010	1.05 J	420	1700	nv	No exceedance
Pyrene	BLK281-1	0-3	5/19/2009	2.4	1100	1700	nv	No exceedance
1,2,4-Trichlorobenzene	BLK219-11	0-3	5/3/2010	**151**	4.8	120	nv	Soil Removed - June 2010
Metals								
Arsenic	BLK218-3	0-3	3/8/2010	**66.1**	5	24	5.9	Soil Removal - June 2010
Barium	BLK218-1	0-3	5/19/2009	**874**	440	8100	300	No groundwater exceedance
Cadmium	BLK218-1	0-3	5/19/2009	**2.22**	1.5	52	nv	No groundwater exceedance
Chromium	BLK218-1	0-3	5/19/2009	25.5	2400	33000	30	No exceedance
Lead	BLK220-3	0-3	3/9/2010	**513**	3	500	15	Block 220 Soil Removal
Mercury	BLK218-2	0-3	3/8/2010	**2.71**	0.0078	3.6	0.04	No groundwater exceedance
Selenium	BLK219-1	0-3	5/19/2009	1.28	2.3	310	0.3	No exceedance
Silver	BLK218-2	0-3	3/8/2010	**0.672**	0.48	97	nv	No groundwater exceedance
Volatile Organic Compounds								
Acetone	BLK220-1	3-5	3/8/2010	0.38	43	66000	nv	No exceedance
Benzene	BLK218-1	0-3	5/19/2009	0.0036 J	0.026	120	nv	No exceedance
n-Butylbenzene	BLK219-1	0-3	5/19/2009	0.014 J	120	3300	nv	No exceedance
Carbon Disulfide	BLK218-1	0-3	5/19/2009	0.0044 J	14	4600	nv	No exceedance
Cyclohexane	BLK218-1	0-3	5/19/2009	0.011	5900	75000	nv	No exceedance
1,2-Dichlorobenzene	BLK219-1	0-3	5/19/2009	0.051	18	720	nv	No exceedance
1,3-Dichlorobenzene	BLK219-1	0-3	5/19/2009	0.11	6.7	120	nv	No exceedance
1,4-Dichlorobenzne	BLK219-4	3-5	3/8/2010	0.11	2.1	250	nv	No exceedance
cis-1,2-Dichloroethane	BLK219-1	0-3	3/8/2010	0.0064	0.25	140	nv	No exceedance
trans-1,2-Dichloroethane	BLK219-1	0-3	3/8/2010	0.0056 J	0.5	590	nv	No exceedance
Ethylbenzene	BLK218-1	0-3	5/19/2009	0.0034 J	7.6	6400	nv	No exceedance
Hexachlorobutadiene	BLK219-2	0-3	3/8/2010	**36**	3.3	20	nv	Soil Removed - June 2010
Isopropylbenzene	BLK218-1	0-3	5/19/2009	0.0082	350	4300	nv	No exceedance
4-Isopropylbenzene	BLK219-1	0-3	5/19/2009	0.032	230	3700	nv	No exceedance

Table D - 1

Summary of Maximum COC Concentrations in Soil

Municipal Settings Designation Application

BBVA Compass Stadium

2200 Texas Avenue, Houston, Texas

	Maximum Detected Soil Concentration				TRRP Residential Tier 1 Protective Concentration Level			
					Ingestion (without MSD)	Non-Ingestion (with MSD)	TSBC	Comment
Chemical of Concern	Sample ID	Sample Depth (feet)	Sample Date	Detected Concentration (mg/kg)	$^{GW}Soil_{Ing}$ (mg/kg)	$^{Tot}Soi_{lComb}$ (mg/kg)	(mg/kg)	
Methylcyclohexane	BLK218-1	0-3	5/19/2009	0.026	16000	41000	nv	No exceedance
Methy Ethyl Ketone	BLK220-1	3-5	3/9/2010	0.076	30	40000	nv	No exceedance
2-Methylnaphthalene	BLK219-1	0-3	5/19/2009	0.15	17	250	nv	No exceedance
Naphthalene	BLK219-1	0-3	5/19/2009	0.091	31	220	nv	No exceedance
n-Propylbenzene	BLK219-1	0-3	5/19/2009	0.0033J	45	2200	nv	No exceedance
1,2,4-Trichlorobenzene	BLK219-1	0-3	5/19/2009	0.32	4.8	120	nv	No exceedance
1,2,3-Trimethylbenzene	BLK219-1	0-3	5/19/2009	0.035	32	120	nv	No exceedance
1,2,4-Trimethybenzene	BLK219-1	0-3	5/19/2009	0.052	9.7	150	nv	No exceedance
1,3,5-Trimethylbenzene	BLK219-1	0-3	5/19/2009	0.022 J	53	110	nv	No exceedance
Tetrachloroethene	BLK219-1	0-3	3/8/2010	0.031	0.05	710	nv	No exceedance
Toluene	BLK218-1	0-3	5/19/2009	0.0072	8.2	5900	nv	No exceedance
Trichloroethene	BLK219-2	0-3	3/8/2010	0.021	0.03	18	nv	No exceedance
Xylenes	BLK218-1	0-3	5/19/2009	0.012	120	6000	nv	No exceedance
Total Petroleum Hydrocarbons								
TPH C6-C12	BLK205-2	0-3	5/19/2009	25 J	65	1600	nv	No exceedance
TPH C12-C28	BLK218-1	0-3	5/19/2009	**21000**	200	2300	nv	No groundwater exceedance
TPH C28-C35	BLK218-1	0-3	5/19/2009	**1000**	200	2300	nv	No groundwater exceedance

Notes;

Boldface values exceed the ingestion protective concentration (Residential Tier 1 $^{GW}Soil_{Ing}$ PCL)

Concentrations with yellow shading exceeded Tier 1 $^{Tot}Soil_{Comb}$ PCL for human exposure

TSBC - Texas-Specific Background Concentration

J- estimated concentration

nv - no value

mg/kg - milligrams per kilogram

Concentrations with blue shading are the critical PCLs.

Table D - 2

Summary of Groundwater Concentrations

Municipal Settings Designation Application

BBVA Compass Stadium

2200 Texas Avenue, Houston, Texas

Chemical of Concern	Groundwater-Bearing Unit	Current Maximum Groundwater Concentration			TRRP Residential Tier 1 Protective Concentration Level	
		Sample ID	Sample Date	Detected Concentration (mg/L)	Ingestion (without MSD) $^{GW}GW_{Ing}$ (mg/L)	Non-Ingestion (with MSD) $^{Air}GW_{Inh-V}$ (mg/L)
Semivolaltile Organic Compounds						
bis(2-ethylhexyl)phthalate	First	TW-BLK218-1	3/10/2010	0.00078	0.006	nv
Caprolactum	First	TW-BLK218-1	3/10/2010	0.0008	12.22	nv
Diethyel phthalate	First	TW-BLK218-1	3/10/2010	0.00047	19.55	nv
Dimethyl phthalate	First	TW-BLK218-1	3/10/2010	0.00019 J	19.55	nv
Di-N-Butyl phthalate	First	TW-BLK218-1	3/10/2010	0.0002	2.44	nv
di-n-Butyl Phthalate	First	BLK219-MW-1	5/6/2010	0.006	2.4	nv
1,2-Dichorobenzene	First	BLK219-MW-1	5/6/2010	0.003	0.6	1200
1,3-Dichlorobenzene	First	BLK219-MW-1	5/6/2010	0.037	0.73	190
1,4-Dichlorobenzene	First	BLK219-MW-1	5/6/2010	0.034	0.075	3600
Hexachlorobutadiene	First	BLK219-MW-1	5/6/2010	0.003	0.012	8.9
1,2,4-Trichlorobenzene	First	BLK219-MW-1	5/6/2010	**0.351**	0.07	160
Metals						
Arsenic	First	BLK219-MW-1	5/6/2010	0.008	0.01	nv
Barium	First	BLK219-MW-1	5/6/2010	0.073	2	nv
Chromium	First	BLK219-MW-1	5/6/2010	0.007	0.1	nv
Lead	First	BLK219-MW-1	5/6/2010	<0.001	0.015	nv
Mercury	First	BLK219-MW-1	5/6/2010	0.0001 J	0.002	nv
Nickel	First	BLK219-MW-1	5/6/2010	0.002 J	0.49	nv
Selenium	First	BLK219-MW-1	5/6/2010	0.003 J	0.05	nv
Silver	First	BLK219-MW-1	5/6/2010	<0.001	0.12	nv
Volatile Organic Compounds						
Toluene	First	TW-BLK218-1	3/10/2010	0.00057 J	1	64000
1,2-Dichloroethane	First	P-1	5/18/2009	0.0006 J	0.005	33
Bromochloromethane	First	P-1	5/18/2009	0.0028 J	0.015	46
Chloroform	First	P-1	5/18/2009	0.0062	0.24	20
Dibromochloromethane	First	P-1	5/18/2009	0.0018 J	0.011	nv
Methyl tert-butyl ether	First	P-1	5/18/2009	0.0088	0.24	4000

Notes;

Boldface values exceed the ingestion protective concentration (Residential Tier 1 $^{GW}GW_{Ing}$ PCL)

J - estimated concentration

< - chemical was not detected at listed concentration

nv - no value

Appendix E

Provide for each contaminant 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).

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a. The ingestion protective concentration level exceedance zone in groundwater is present in the uppermost water-bearing unit under the eastern grandstands of the present BBVA Compass Stadium. The top of the uppermost groundwater-bearing unit was observed to be approximately 18 feet bgs in monitoring wells installed on block 219 for investigations conducted in 2010 prior to the construction of the stadium. The ground surface on city block 219 was raised during the construction of the stadium in 2011.

   The uppermost groundwater bearing unit occurs in an interval of red and pale brown clayey sand and silty clay interlayered with stiff clay. The bottom of the uppermost GWBU is approximately 24 to 25 feet bgs and is underlain by stiff red clay.

   The protective concentration level exceedance zone is located in the vicinity of former monitoring well BLK219-MW1. Former monitoring well BLK219-MW1 is located near the center of block 219, more than 100 feet from all property boundaries. Due to the low mobility of the COC in the subsurface environment, the estimated extent of the exceedance zone likely remains on-site in the area of the single detection. The estimated area of the exceedance zone is less than 2,000 square feet.

   There is no non-ingestion protective concentration level exceedance zone at the designated property.

b. The SVOC 1,2,4-trichlorobenzene is the only COC detected in groundwater at a concentration exceeding the ingestion protective concentration level. The detected concentration of the 1,2,4-trichlorobenzene in the groundwater sample from the former monitoring well BLK219-MW1 was 0.351 mg/L. This concentration exceeds the ingestion protective concentration level of 0.07 mg/L. The non-ingestion protective concentration level (vapor PCL) is 160 mg/L. The PCL values are based on the TRRP Tier 1 PCL table dated June 2012.

c. The COC 1,2,4-trichlorobenzene strongly adsorbs to soils with 1-2% organic content, as predicted by its K_{oc} value, but leaching into ground waters can occur from deep soils (U.S. Air Force 1989). The COC is insoluble in water. As a non-aqueous phase liquid (NAPL), 1,2,4-trichlorobenzene has a density greater than water and would tend to sink. NAPL was not

observed during the investigation activities and is not expected to be present based on the detected concentration of 1,2,4-trichlorobenzene.

Appendix F – Contaminant of Concern Information

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.

Chemical of Concern	1,2,4-Trichlorobenzene	Notes
Soil		
Maximum concentration in soil	0.687 mg/kg	Maximum concentration remaining after removal of affected soils in June 2010
Ingestion protective concentration level	4.8 mg/kg	Residential Tier 1 $^{GW}Soil_{Ing}$ PCL for 0.5-acre source source area
Non-ingestion protective concentration level	120 mg/kg	Residential Tier 1 $^{Tot}Soil_{Comb}$ PCL for 0.5-acre source area
Non-ingestion protective concentration level	150 mg/kg	Residential Tier 1 $^{Air}Soil_{Inh\text{-}V}$ PCL for 0.5-acre source area
Non-ingestion protective concentration level	11,000 mg/kg	Residential Tier 1 ^{Air}GW-$Soil_{Inh\text{-}V}$ PCL for 0.5-acre source area
Groundwater		
Maximum concentration in groundwater	**0.351 mg/L**	Groundwater sample from BLK219-MW-1
Ingestion protective concentration level (critical protective concentration level without the Municipal Setting Designation)	0.07 mg/L	Residential Tier 1 $^{GW}GW_{Ing}$ PCL
Non-ingestion protective concentration level	160 mg/L	Residential $^{Air}GW_{Inh\text{-}V}$ PCL for 0.5-acre source area

Note:
Boldface values exceed the ingestion protective concentration level (Residential Tier 1 $^{GW}GW_{Ing}$ PCL) as the critical protective concentrations level without the Municipal Settings Designation.
PCL – Protective Concentration Level

Appendix G

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

The estimated extent of the affected groundwater (plume of contamination) is likely stable based on the following information:

- The mobility of the COC 1,2,4-trichlorobenzene in the subsurface environment is low.
- The COC 1,2,4-trichlorobenzene is largely insoluble in groundwater.
- Potential sources of COCs have been removed including soils with concentrations of COCs exceeding the TRRP RALs.
- The COC 1,2,3-trichlorobenzene was not detected in the groundwater samples BLK218-MW-1 and TW-BLK218-1.
- Impervious cover was installed over the area of the detected groundwater exceedance when the stadium was constructed. The impervious cover prevents the infiltration of precipitation reducing the potential for groundwater migration and COC migration.