

**APPENDIX K**  
**WATERS OF THE UNITED STATES TECHNICAL REPORT**



# Waters of the United States Technical Report

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## North Houston Highway Improvement Project

From US 59/I-69 at Spur 527 to I-45 at Beltway 8 North

CSJ 0912-00-146

Prepared by: TxDOT Houston District

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The environmental review, consultation, and other actions required by applicable Federal environmental laws for this project are being, or have been, carried-out by TxDOT pursuant to 23 U.S.C. 327, and a Memorandum of Understanding dated December 16, 2014 and executed by FHWA and TxDOT.

## Contents

Project Overview.....	3
Existing Facility .....	3
Segment 1: I-45 from Beltway 8 North to north of I-610 (North Loop) .....	3
Segment 2: I-45 from north of I-610 (North Loop) to I-10 .....	3
Segment 3: Downtown Loop System (I-45, US 59/I-69, and I-10) .....	3
Proposed Alternatives .....	4
Segment 1: I-45 from Beltway 8 North to north of I-610 (North Loop) .....	4
Segment 2: I-45 from north of I-610 (North Loop) to I-10 (including the interchange with I-610) 4	
Segment 3: Downtown Loop System (I-45, US 59/I-69, and I-10) .....	5
Methodology .....	7
Investigation Findings .....	7
Waters of the United States.....	7
Aerial Photographs and Existing Electronic Sources Findings.....	11
Site Topography.....	14
Soils and Major Land Resource Area .....	14
FEMA Maps .....	15
NWI Maps.....	16
Potentially Jurisdictional Waters of the United States.....	16
Potentially Jurisdictional Waters of the United States within the Existing ROW and Alternative ROWs .....	16
Existing ROW .....	16
Segment 1 .....	16
Segment 2 .....	17
Segment 3 .....	17
Potential Impacts to Jurisdictional Waters of the United States within Existing and Alternative ROWs .....	17
Section 408 Coordination .....	20

## Tables

Table 1. Potentially Jurisdictional and Non-Jurisdictional Water Bodies.....	8
Table 2. Potentially Jurisdictional and Non-Jurisdictional Streams .....	10
Table 3. Potentially Jurisdictional Waters of the United States within Existing ROW and Segment Alternative ROWs .....	11
Table 4. NRCS Map Units within the Project Area .....	15
Table 5. Estimated Potential Impacts to Potentially Jurisdictional Waters of the United States.....	19

## **Project Overview**

An identification of waters of the United States (WOUS), including wetlands, was conducted for the North Houston Highway Improvement Project (NHHIP) in Harris County, Texas. The proposed project begins at the interchange of Interstate Highway 45 (I-45) and Beltway 8 North, and continues south along I-45 to Downtown Houston where it terminates at the interchange of United States Highway (US) 59/I-69 and Spur 527 south of Downtown Houston. The project area also includes portions of I-10 and US 59/I-69 near Downtown Houston. The proposed project is composed of three segments, Segments 1-3, for which reasonable alternatives are evaluated in the Draft Environmental Impact Statement (DEIS) (*Exhibit 1*). The project area traverses urbanized areas of Houston with minimal undeveloped spaces.

## **Existing Facility**

### **Segment 1: I-45 from Beltway 8 North to north of I-610 (North Loop)**

I-45 within this segment consists of eight general purpose lanes (i.e., mainlanes; four lanes in each direction), four frontage road lanes (two lanes in each direction), and a reversible high occupancy vehicle (HOV) lane in the middle, all within a variable right-of-way (ROW) of 250 to 300 feet. The existing posted speed limit along the general purpose lanes and reversible HOV lane is 60 miles per hour (mph). The existing posted speed limit for the frontage roads is 45 mph. The length of Segment 1 is approximately 8.8 miles, and the area of the existing ROW is approximately 347 acres.

### **Segment 2: I-45 from north of I-610 (North Loop) to I-10**

I-45 within this segment primarily consists of eight at-grade general purpose lanes (four lanes in each direction), six frontage road lanes (three lanes in each direction), and a reversible HOV lane in the middle, all within a variable ROW of 300 to 325 feet. Segment 2 also includes a depressed section that consists of eight general purpose lanes (four lanes in each direction) and a reversible HOV lane in the middle, all below grade, within a 245-foot ROW. The six frontage road lanes associated with the depressed section (three lanes in each direction) are located at-grade. The existing posted speed limit is 60 mph along the general purpose lanes, 55 mph along the reversible HOV lane, and 40 mph along the frontage road lanes. The I-45 and I-610 frontage roads are discontinuous at the I-45/I-610 interchange. The length of Segment 2 is approximately 4.5 miles, and the area of the existing ROW is approximately 220 acres.

### **Segment 3: Downtown Loop System (I-45, US 59/I-69, and I-10)**

The Downtown Loop System consists of three interstate highways that create a loop around Downtown Houston. I-45 forms the western and southern boundaries of the loop and is known locally as the Pierce Elevated because it partially follows the alignment of Pierce Street. I-10 forms the northern boundary of the loop, and US 59/I-69 forms the eastern boundary of the loop. The loop includes three major interchanges: I-45 and I-10, I-10 and US 59/I-69, and US 59/I-69 and I-45. The interchange of US 59/I-69 and Spur 527 is located south of Downtown Houston.

I-45 along the west side of Downtown Houston consists of six elevated general purpose lanes (three lanes in each direction) within an existing ROW of 205 feet. I-45 along the south side of Downtown Houston (the Pierce Elevated) consists of six elevated general purpose lanes (three lanes in each direction). I-10 north of Downtown Houston, between I-45 and US 59/I-69, consists of 10 general purpose lanes (five lanes in each direction) within an existing ROW of 420 feet. US 59/I-69 along the east side of Downtown Houston consists of six general purpose lanes (three lanes in each direction) within an existing ROW of 225 feet. Generally, local streets serve as one-way frontage roads within



Segment 3, except near the I-10 and US 59/I-69 interchange, where the frontage roads are discontinuous. The length of Segment 3, which includes the Downtown Loop System, is approximately 7.1 miles, and the existing ROW area is approximately 637 acres.

## *Proposed Alternatives*

### **Segment 1: I-45 from Beltway 8 North to north of I-610 (North Loop)**

#### *Segment 1, Alternative 4: Widen I-45 Mostly to the West (Proposed Recommended)*

Alternative 4 would widen the existing I-45 on the west side of the roadway to accommodate four managed express (MaX) lanes. The proposed typical section would include eight general purpose lanes (four lanes in each direction), four MaX lanes (two lanes in each direction), and six frontage road lanes (three lanes in each direction), all at-grade. Alternative 4 would require approximately 200 to 225 feet of new ROW to the west of the existing I-45. This alternative would require small amounts of land to the east of the existing I-45 ROW at major intersections and between Crosstimbers Street and I-610. Approximately 212 acres of new ROW would be required for this alternative. The length of this alternative would be approximately 8.8 miles.

#### *Segment 1, Alternative 5: Widen I-45 Mostly to the East*

Alternative 5 would widen the existing I-45 along the east side of the roadway to accommodate four MaX lanes. The proposed typical section would include eight general purpose lanes (four lanes in each direction), four MaX lanes (two lanes in each direction), and six frontage road lanes (three lanes in each direction), all at-grade. Alternative 5 would require approximately 200 to 225 feet of new ROW to the east of the existing I-45. This alternative would require small amounts of land to the west of the existing I-45 ROW at major intersections. Approximately 239 acres of new ROW would be required for this alternative. The length of this alternative would be approximately 8.8 miles.

#### *Segment 1, Alternative 7: Widen I-45 on Both Sides*

Alternative 7 would widen the existing I-45 along both the east and west sides of the roadway to accommodate four elevated MaX lanes. The proposed typical section would include eight general purpose lanes (four lanes in each direction) at-grade, four elevated MaX lanes (two lanes in each direction) on a single structure constructed along the center of the roadway, and six frontage road lanes (three lanes in each direction) at-grade. Alternative 7 would require approximately 45 to 80 feet of new ROW along both sides of the existing I-45. Approximately 120 acres of new ROW would be required for this alternative. The length of this alternative would be approximately 8.8 miles.

### **Segment 2: I-45 from north of I-610 (North Loop) to I-10 (including the interchange with I-610)**

#### *Segment 2, Alternative 10: Add Four MaX Lanes to I-45 (Proposed Recommended)*

Alternative 10 would widen the existing I-45 to accommodate four MaX lanes. Within the at-grade section of I-45, the proposed typical section would include eight general purpose lanes (four lanes in each direction), four MaX lanes (two lanes in each direction), and four frontage road lanes (two lanes in each direction), all at-grade. For this alternative, I-45 would be depressed from north of Cottage Street to Norma Street, a distance of approximately 1,800 feet. Within the depressed section of I-45, the proposed typical section would include eight below-grade general purpose lanes (four lanes in each direction), and four below-grade MaX lanes (two lanes in each direction), while the four frontage road lanes (two lanes in each direction) would be at-grade. The proposed I-45 and I-610 frontage roads would be continuous through the I-45/I-610 interchange. Alternative 10 would require new ROW for the at-grade section between I-610 and Cottage Street, and between Little White Oak Bayou and Norma Street. Approximately 19 acres of new ROW would be required for this alternative. The length of this alternative, including interchange improvements, would be approximately 4.5 miles.

This alternative provides an opportunity to include a structural “cap” over a portion of the depressed lanes of I-45 from north of Cottage Street to south of N. Main Street. This area could be used as open space. The open space option is conceptual only and would be separate from the Texas Department of Transportation’s (TxDOT’s) roadway project. Any open space would require development and funding by parties other than TxDOT.

*Segment 2, Alternative 11: Add Four Elevated MaX Lanes in the Center of I-45*

Alternative 11 would widen the existing I-45 and add four elevated MaX lanes. Within the at-grade section of I-45, the proposed typical section would include eight general purpose lanes (four lanes in each direction) and four frontage road lanes (two lanes in each direction), all at-grade, while the four MaX lanes (two lanes in each direction) would be elevated on a single structure at the center of the roadway. Within the depressed section of I-45, the proposed typical section would include eight general purpose lanes (four lanes in each direction) below grade, four MaX lanes (two lanes in each direction) elevated on a single structure at the center of the roadway, and four frontage road lanes (two lanes in each direction) at-grade. The proposed I-45 and I-610 frontage roads would be continuous through the I-45/I-610 interchange. New ROW would be required for the at-grade section between I-610 and Cavalcade Street to accommodate the proposed improvements at the I-45/I-610 interchange. No new ROW would be required for the depressed section. Approximately 10 acres of new ROW would be required for this alternative. The length of this alternative, including interchange improvements, would be approximately 4.5 miles.

*Segment 2, Alternative 12: Add Four MaX Lanes (Two Elevated) in the Center of I-45*

Alternative 12 would widen the existing I-45 and add two elevated and two at-grade MaX lanes. Within the at-grade section of I-45, the proposed typical section would include eight general purpose lanes (four lanes in each direction) and four frontage road lanes (two lanes in each direction), all at-grade, while the four MaX lanes (two lanes in each direction) would be stacked (the two northbound MaX lanes would be at-grade and the two southbound MaX lanes would be elevated on a single structure along the center of the roadway). Within the depressed section of I-45, the proposed typical section would include eight general purpose lanes (four lanes in each direction) below grade, four MaX lanes (two lanes in each direction) that would be stacked (the two northbound MaX lanes would be below grade and the two southbound MaX lanes would be elevated on a single structure along the center of the roadway), and four frontage road lanes (two lanes in each direction) that would be at-grade. The proposed I-45 and I-610 frontage roads would be continuous through the I-45/I-610 interchange. New ROW would be required for the at-grade section between I-610 and Cavalcade Street to accommodate the proposed improvements at the I-45/I-610 interchange. No new ROW would be required for the depressed section. Approximately 12 acres of new ROW would be required for this alternative. The length of this alternative, including interchange improvements, would be approximately 4.5 miles.

**Segment 3: Downtown Loop System (I-45, US 59/I-69, and I-10)**

*Segment 3, Alternative 10: Widen I-45 to 10 Lanes*

Alternative 10 is an “improve existing” alternative, with the existing interstate highways around Downtown Houston remaining in their current configuration. Alternative 10 would widen the existing I-45 within its existing footprint along the west and south sides of Downtown Houston. The elevated portion of I-45 west and south of Downtown would be reconstructed. The proposed typical section of the widened I-45 would include 10 elevated general purpose lanes; however, the lane configuration would be altered to have six northbound lanes and four southbound lanes. The I-45 MaX lanes proposed in Segments 1 and 2 would terminate in the Downtown area in Segment 3. The I-45 MaX lanes would be parallel to I-10 in the vicinity of the I-45/I-10 interchange and would terminate/begin at Milam Street/Travis Street, respectively. I-10 along the north side of Downtown, between I-45 and

US 59/I-69, would be slightly realigned to accommodate four elevated I-10 express lanes (two lanes in each direction) on this segment of I-10. The I-10 express lanes would generally be parallel to I-10, and located on the north side of White Oak Bayou. West of the I-45/I-10 interchange, the I-10 express lanes would connect to the existing I-10 HOV lanes. US 59/I-69 along the east side of Downtown would generally remain in its current configuration. Alternative 10 would require new ROW along I-45 from I-10 to Houston Avenue and from Brazos Street to US 59/I-69. Alternative 10 would require approximately 76 acres of new ROW. The length of this alternative, including interchange improvements, would be approximately 4.4 miles.

*Segment 3, Alternative 11: Realign I-45 along I-10 and US 59/I-69 (Proposed Recommended)*

Alternative 11 would reroute I-45 to be coincident with US 59/I-69 on the east side of Downtown Houston. The existing elevated I-45 roadway along the west and south sides of Downtown would be removed and relocated to be parallel to I-10 on the north side of Downtown and parallel to US 59/I-69 on the east side of Downtown. Access to the west side of Downtown would be provided via “Downtown Connectors,” which would provide access to and from various Downtown streets. To improve safety and traffic flow in the north and east portions of the proposed project area, both I-10 and US 59/I-69 would be realigned to eliminate the current roadway curvature. I-45 and US 59/I-69 would be depressed along a portion of the alignment east of Downtown. South of the George R. Brown Convention Center, I-45 would begin to elevate to the interchange of I-45 and US 59/I-69 southeast of Downtown, while US 59/I-69 would remain depressed as it continues southwest toward Spur 527. The four proposed I-45 MaX lanes in Segments 1 and 2 would terminate/begin in Segment 3 at Milam Street/Travis Street, respectively. I-10 express lanes (two lanes in each direction) would be located generally in the center of the general purpose lanes within the proposed coincidental alignment of I-10 and I-45 on the north side of Downtown. The I-10 express lanes would vary between being elevated and at-grade. Approximately 190 feet of new ROW to the east of the existing US 59/I-69 along the east side of Downtown would be required to accommodate the proposed realigned I-45. The existing Hamilton Street would be realigned to be adjacent to US 59/I-69 to serve as the southbound frontage road, and the existing St. Emanuel Street would serve as the northbound frontage road. Alternative 11 would require approximately 160 acres of new ROW, the majority of which would be for the I-10 and US 59/I-69 realignments, and to construct the proposed I-45 lanes adjacent to US 59/I-69 along the east side of Downtown. The length of this alternative, including roadway realignments and interchange improvements, would be approximately 12.0 miles.

This alternative provides an opportunity to include a structural “cap” over the proposed depressed lanes of I-45 and US 59/I-69 from approximately Commerce Street to Lamar Street. This area could be used as open space. The open space option is conceptual only and would be separate from TxDOT’s roadway project. Any open space project would require development and funding by parties other than TxDOT.

*Segment 3, Alternative 12: Realign Northbound I-45 along US 59/I-69 and I-10*

Alternative 12 would reroute northbound I-45 to be coincident with US 59/I-69 on the east side of Downtown Houston. An elevated structure would be constructed to accommodate four I-45 northbound general purpose lanes that would be located east of the existing US 59/I-69 general purpose lanes. Northbound I-45 traffic would continue on elevated lanes constructed between the I-10 general purpose lanes, then would move northward into Segment 2. Southbound I-45 traffic at the I-45/I-10 interchange northwest of Downtown would be directed onto one-way general purpose lanes along the west and south sides of Downtown, following the existing Pierce Elevated footprint. The four proposed I-45 MaX lanes in Segments 1 and 2 would terminate/begin in Segment 3 at Milam Street/Travis Street, respectively. I-10 express lanes (two lanes in each direction) are

proposed to be located along the portion of the existing I-10 north of Downtown between the interchanges of I-10 and I-45, and I-10 and US 59/I-69. Near the US 59/I-69 interchange, the I-10 express lanes would be located at-grade in the center of the general purpose lanes, then would shift to become elevated and generally parallel to I-10, but located on the north side of White Oak Bayou. West of the I-45/I-10 interchange, the I-10 express lanes would connect to the existing I-10 HOV lanes. US 59/I-69 along the east side of Downtown would generally remain in its current configuration, with the I-45 one-way northbound lanes being immediately adjacent to this segment of US 59/I-69. Alternative 12 would require approximately 109 acres of new ROW. The length of this alternative, including interchange improvements, would be approximately 9.8 miles.

## Methodology

The project area—which is defined as the existing I-45 right-of-way and the right-of-way limits of the proposed project alternatives—was investigated using available rectified aerial photography, high-resolution elevation Light Detection and Ranging (LiDAR) data, and databases: National Hydrography Dataset (NHD), Harris County Flood Control District (HCFCD), and City of Houston ditches. Aerial photographs, historical U.S. Geological Survey (USGS) topographic maps, electronic maps, and electronic databases used to identify areas in the project area exhibiting signatures consistent with aquatic features include the following:

- 2012 True-color aerial photograph, Houston-Galveston Area Council (HGAC)
- 2014 True-color aerial photograph, HGAC
- 1916 and 1954 Aldine, Texas USGS 7.5' Quadrangle maps
- 1921 and 1983 Bellaire, Texas USGS 7.5' Quadrangle maps
- 1922 and 1955 Houston Heights, Texas USGS 7.5' Quadrangle maps
- 1922 and 1955 Park Place, Texas USGS 7.5' Quadrangle maps
- 1922 and 1955 Settegast, Texas USGS 7.5' Quadrangle maps
- High-resolution NHD from USGS
- HCFCD Channel Centerlines, downloaded 1/7/15
- City of Houston Ditches and other related data, 11/24/14
- HGAC and HCFCD digital elevation model from 2008 LiDAR data
- Federal Emergency Management Agency (FEMA) National Flood Hazard layer data from FEMA's web portal 7/21/15

The areal extent of the aquatic resources identified within the project limits was estimated based on interpretation of remotely-sensed desktop data and observations made during site visits conducted in the latter part of 2014 and in October 2015. The site visits were limited to publicly-accessible ROWs, as right-of-entry (ROE) was not available for private property. No soil samples were obtained, and the boundaries of identified aquatic resources were not surveyed during the site visits. Un-named drainage features that are associated with a NHD stream are labelled with the NHD permanent identifier NHD code (e.g., 113251601). Un-named drainage features not associated with a NHD stream were identified as un-named.

To describe the identified water bodies, each project segment has been further divided into four categories: existing ROW, and proposed ROW for the three project alternatives within each segment.

## Investigation Findings

### *Waters of the United States*

Thirty-five (35) water bodies were identified within the project area that collectively totals approximately 33 acres (*Table 1, Exhibit 2 – Sheets 1 through 4*). The section of White Oak Bayou that is in the North Houston Highway Improvement Project area is part of a federally-funded project,

with HCFCD as the local sponsor. Therefore, any activities within the White Oak Bayou federal project area would require Section 408 coordination with the local sponsor, HCFCD, and the U.S. Army Corps of Engineers (USACE) per Section 14 of the Rivers and Harbors Act of 1899, as Codified in 33 U.S. Code §408. The other 34 water bodies are not within a federal project area and would not require Section 408 coordination. Twenty-three (23) of the 35 water bodies are bayous, streams, or drainage channels that have a total length within the project area of approximately 23,283 linear feet, or approximately 4.4 miles (Table 2). Twenty-nine (29) of the water bodies are preliminarily identified as potentially jurisdictional WOUS and would require a Department of the Army permit for any fill activities that may occur. The other six (6) water bodies are potentially non-jurisdictional WOUS because they are existing detention basins, a water fountain, or fringe wetlands that are located in sediment that has accumulated over concrete lining within linear ephemeral drainage channels (Table 1, and Appendix A Site Photographs).

**Table 1. Potentially Jurisdictional and Non-Jurisdictional Water Bodies**

Segment	Number	Water Body	Acreage	Potentially Jurisdictional	Section 408 Coordination
1	1	113251601	0.202	Yes	No
	2	Detention Basin 1	0.366	No	No
	3	113251901	0.021	Yes	No
	4	Wetland 1	0.004	Yes	No
	5	Wetland 2	0.003	Yes	No
	6	Wetland 3	0.008	Yes	No
	7	113252111	0.037	Yes	No
	8	Wetland 4	0.627	Yes	No
	9	Halls Bayou	0.434	Yes	No
	10	Wetland 5	0.032	Yes	No
	11	Wetland 6	0.024	Yes	No
	12	Un-named Ditch 1	0.017	No	No
	13	113252481	0.104	Yes	No
	14	113252861	0.110	No	No
	15	Wetland 7	0.047	Yes	No
	16	Wetland 8	0.012	Yes	No
	17	113253277	0.091	Yes	No
	18	113253377	0.266	Yes	No
	19	113253359	0.196	Yes	No
	20	Janowski Ditch	0.090	Yes	No
	21*	Little White Oak Bayou 1 Segment 1	2.438	Yes	No
	22	Un-named Ditch 2	0.016	Yes	No
	<b>Segment 1 Subtotal</b>		<b>5.145</b>		
	<b>Segment 1 Potentially Jurisdictional Subtotal</b>		<b>4.652</b>		

Segment	Number	Water Body	Acreage	Potentially Jurisdictional	Section 408 Coordination
2	21*	Little White Oak Bayou 1 Segment 2	0.401	Yes	No
	23	Little White Oak Bayou 2	0.061	Yes	No
	24	Little White Oak Bayou 3	1.433	Yes	No
	25	Un-named Ditch 3	0.160	Yes	No
	26	Little White Oak Bayou 4	0.339	Yes	No
	27	Little White Oak Bayou 5	0.279	Yes	No
		<b>Segment 2 Potentially Jurisdictional Subtotal</b>	<b>2.673</b>		
3	28	Little White Oak Bayou 6	0.408	Yes	No
	29	White Oak Bayou	8.090	Yes	Yes
	30	Buffalo Bayou East	9.478	Yes	No
	31	Buffalo Bayou West 1	1.497	Yes	No
	32	Buffalo Bayou West 2	2.276	Yes	No
	33	Water Fountain	0.109	No	No
	34	Detention Basin 2	0.336	No	No
	35	Detention Basin 3	2.809	No	No
		<b>Segment 3 Subtotal</b>	<b>25.003</b>		
		<b>Segment 3 Potentially Jurisdictional Subtotal</b>	<b>21.749</b>		
		<b>Total</b>	<b>32.821</b>		
		<b>Total Potentially Jurisdictional</b>	<b>29.074</b>		

\*Water Body 21 is located in both Segments 1 and 2



**Table 2. Potentially Jurisdictional and Non-Jurisdictional Streams**

Stream	Segment	Estimated Linear Feet	Potentially Jurisdictional
113251601	1	477	Yes
113251901	1	136	Yes
113252111	1	160	Yes
Halls Bayou	1	950	Yes
Un-named Ditch 1	1	175	No
113252481	1	721	Yes
113252861	1	229	No
113253277	1	592	Yes
113253377	1	623	Yes
113253359	1	1,432	Yes
Janowski Ditch	1	477	Yes
Little White Oak Bayou 1 Segment 1*	1	588	Yes
Un-named Ditch 2	1	154	Yes
Little White Oak Bayou 1 Segment 2*	2	2,859	Yes
Little White Oak Bayou 2	2	270	Yes
Little White Oak Bayou 3	2	834	Yes
Un-named Ditch 3	2	463	Yes
Little White Oak Bayou 4	2	590	Yes
Little White Oak Bayou 5	2	270	Yes
Little White Oak Bayou 6	3	620	Yes
White Oak Bayou	3	6,206	Yes
Buffalo Bayou East	3	2,684	Yes
Buffalo Bayou West 1	3	718	Yes
Buffalo Bayou West 2	3	1,055	Yes
<b>Total Linear Feet</b>		<b>23,283</b>	
<b>Total Miles</b>		<b>4.41</b>	

\* Little White Bayou 1 is located in both Segments 1 and 2

Table 3 presents the acreages of all water bodies and total stream linear feet in the project area, and the potentially jurisdictional water bodies and streams in the project area, for each category: Existing ROW and Alternatives by Segment as shown on *Exhibit 5 – Sheets 1 through 9*.

**Table 3. Potentially Jurisdictional Waters of the United States within Existing ROW and Segment Alternative ROWs**

Segment	Categories	Total Acres	Total Potentially Jurisdictional Acres	Total Linear Feet of Stream	Total Linear Feet of Potentially Jurisdictional Stream
1	Existing ROW	1.18	1.18	3,329	3,329
	Alternative 4	1.23	1.22	2,148	2,148
	Alternative 5	0.79	0.29	1,037	1,037
	Alternative 7	0.34	0.28	613	613
2	Existing ROW	4.63	4.63	5,016	5,016
	Alternative 10	0.08	0.08	270	270
	Alternative 11	0	0	0	0
	Alternative 12	0.02	0.02	168	168
3	Existing ROW	14.98	11.73	5,825	5,825
	Alternative 10	4.80	4.80	3,745	3,745
	Alternative 11	6.65	6.65	2,728	2,728
	Alternative 12	7.74	7.74	4,495	4,495

### *Aerial Photographs and Existing Electronic Sources Findings*

The 1916 and 1954 Aldine, Texas topographic quadrangle maps show that Drainage Ditches 113251601, 113251901, and Halls Bayou were present in 1915 and 1954 (*Exhibit 3, Sheet 1*). However, Wetlands 1, 2, 3, 4, 5, and 6 are not shown. The aerial photographs and site visit photographs confirm the presence of Drainage Ditches 113251601, 113251901, Halls Bayou, Wetlands 1, 2, 3, 4, 5, and 6 (*Exhibit 5, Sheets 1 and 2; Appendix A, Exhibit 1, Photos 1, 3, and 5; Appendix A, Exhibit 2, Photos 6 and 7*). Halls Bayou appears to have been rectified between 1916 and 1954 as indicated by the diversion channel shown on the 1954 Aldine, Texas topographic quadrangle map (*Exhibit 3, Sheet 1*). Wetlands 1 and 2 are adjacent to Drainage Ditch 113251901. Wetlands 5 and 6 are adjacent to Halls Bayou.

Wetland 4 is not shown on the 1916 or 1954 Aldine, Texas topographic quadrangle maps, or on the U.S. Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI) mapping (*Exhibit 3, Sheet 1; Exhibit 4, Sheet 1*). Wetland 4 is a forested wetland situated within the one-percent Annual Chance Flood Hazard area of Halls Bayou (*Exhibit 4, Sheet 1; Appendix A, Exhibit 1, Photo 5*).

Detention Basin 1 is not shown on the 1916 or 1954 Aldine, Texas topographic quadrangle maps (*Exhibit 3, Sheet 1*). The aerial photographs and site visit photographs confirm the presence of Detention Basin 1 (*Exhibit 5, Sheet 1; Appendix A, Exhibit 1, Photo 2*).

Drainage Ditch 113252111 and Wetland 3 are not shown on the 1916 or 1954 Aldine, Texas topographic quadrangle maps (*Exhibit 3, Sheet 1*). However, this drainage ditch is included in the NHD as a canal/ditch, and is included in the HCFCD drainage system database as P118-30-00, which is shown as an open ditch (*Exhibit 4, Sheet 1; Exhibit 6, Sheet 1*). Review of aerial photographs and site visits to the project area confirm that Drainage Ditch 113252111 is an open



drainage ditch, and Wetland 3 is adjacent to Drainage Ditch 113252111 (*Exhibit 5, Sheet 2; Appendix A, Exhibit 1, Photo 4*).

Drainage Ditch 113252481 is not shown on the 1916 Aldine, Texas topographic quadrangle map, but is shown on the 1954 Aldine, Texas topographic quadrangle map (*Exhibit 3, Sheet 2*). Drainage Ditch 113252481 is visible in the 2014 aerial photograph and is shown in the site visit photographs, with the majority of this ditch being enclosed within underground storm sewer culverts (*Exhibit 5, Sheet 3; Appendix A, Exhibit 2, Photos 9 and 10*). Un-named Ditch 1 is not shown on the 1916 or 1954 Aldine, Texas topographic quadrangle maps or within the NHD (*Exhibit 3, Sheet 2; Exhibit 4, Sheet 1*). Un-named Ditch 1 is included in the HCFCD drainage system database as an open manmade canal/ditch with unit number P118-28-00 (*Exhibit 6, Sheet 1*). Un-named Ditch 1 within the project area is a concrete-lined linear ditch that begins at the outfall from the I-45 northbound frontage road (*Appendix A, Exhibit 2, Photo 8*). A depression is shown in the 1916 Aldine, Texas topographic quadrangle map approximately 5,000 linear feet south of Halls Bayou, but is not present in the 1954 Aldine, Texas topographic quadrangle map (*Exhibit 3, Sheet 2*).

The 1922 Houston Heights, Texas topographic quadrangle map shows Drainage Ditch 113252861 connecting to a north-south drainage ditch adjacent to Northline Drive. The 1955 Houston Heights, Texas topographic quadrangle map does not show Drainage Ditch 113252861, while the NHD shows Drainage Ditch 113252861 as a canal/ditch that connects to a north-south drainage ditch halfway between I-45 and Northline Drive (*Exhibit 3, Sheet 2; Exhibit 4, Sheet 2*). Review of aerial photographs and site visits to the project area confirm that Drainage Ditch 113252861 is a concrete-lined drainage within the existing and proposed project ROWs (*Appendix A, Exhibit 3, Photo 11*). The HCFCD drainage system database shows Drainage Ditch 113252861 as E101-18-04, which is identified as an open ditch (*Exhibit 6, Sheet 2*).

Wetlands 7 and 8 are not shown on the 1922 or 1955 Houston Heights, Texas topographic quadrangle maps (*Exhibit 3, Sheet 2*). The NHD indicates that Wetlands 7 and 8 are associated with canal/ditch 113252861, and the HCFCD drainage system database indicates that Wetlands 7 and 8 are associated with a storm sewer unit identified as number E101-18-00 (*Exhibit 4, Sheet 2; Exhibit 6, Sheet 2*). Wetlands 7 and 8 were identified during the site visits as being areas of minimal wetland vegetation within open ditches (*Appendix A, Exhibit 3, Photos 12 and 13*).

Drainage Ditches 113253277 and 113253377 are shown on the 1922 and 1955 Houston Heights, Texas topographic quadrangle maps; however, both drainages have been rectified and moved from their original locations (*Exhibit 3, Sheet 2*). The NHD shows both drainage ditches orientated north-south until reaching the I-45 ROW, then following the I-45 western ROW northward approximately 200 linear feet as open ditches (*Exhibit 4, Sheet 2*). The HCFCD drainage system database shows Drainage Ditch 113253277 as an open ditch south of the I-45 frontage road, and as a historic drainage under and continuing north of I-45 (*Exhibit 6, Sheet 2*). The HCFCD drainage system database shows Drainage Ditch 113253377 as an open ditch south of the I-45 frontage road, and under and north of I-45 as a storm sewer to Tidwell Road. Both drainage ditches continue through the eastern portion of the project area as underground storm sewers, as confirmed by review of recent aerial photographs and as shown in site visit photographs (*Exhibit 5, Sheet 4; Appendix A, Exhibit 3, Photos 14 and 15*).

Drainage Ditch 113253359 is shown on the 1922 and 1955 Houston Heights, Texas topographic quadrangle maps, but the existing Drainage Ditch 113253359 has been rectified and moved from its original location (*Exhibit 3, Sheet 2*). Approximately 175 linear feet in the downstream portion of this drainage is an open concrete-lined drainage ditch (*Exhibit 5, Sheet 4; Appendix A, Exhibit 4, Photo 16*). The remainder of Drainage Ditch 113253359 is enclosed underground within storm

sewers. The NHD shows Drainage Ditch 113253359 crossing I-45 diagonally, whereas the HCFCD shows the drainage as an open ditch within the I-45 project area, then crossing perpendicular to I-45 (*Exhibit 4, Sheet 2; Exhibit 6, Sheet 2*). For this report, the location of the underground portion of this ditch is estimated based on the HCFCD drainage system database.

Janowski Ditch is shown on the 1922 and 1955 Houston Heights, Texas topographic quadrangle maps, but is not included in the NHD (*Exhibit 3, Sheet 3; Exhibit 4, Sheet 3*). The HCFCD drainage system database shows Janowski Ditch as historical from the southbound I-45 frontage road outfall and continuing northward. The HCFCD drainage system database identifies Janowski Ditch as E101-11-00, which is an open ditch starting at the southbound frontage road outfall (*Exhibit 6, Sheet 3*). Site visits to the project area indicate that Janowski Ditch is a riprap-lined rectified channel starting at the southbound I-45 frontage road outfall (*Appendix A, Exhibit 4, Photo 17*). From the outfall and continuing northeast, Janowski Ditch is an underground storm sewer (*Exhibit 5, Sheet 5*).

Little White Oak Bayou crosses the existing and proposed alternative ROWs at six locations (*Exhibit 3, Sheet 3; Exhibit 4, Sheet 3*). Little White Oak Bayou is shown on the 1922 and 1955 Houston Heights, Texas and on the 1922 and 1955 Settegast, Texas topographic quadrangle maps (*Exhibit 3, Sheet 3*). Little White Oak Bayou has been rectified and enclosed within culverts in the areas of the existing ROW and alternative ROWs, including culvert crossings at Stokes Street, I-610, West Cavalcade Street, Coronado Street, Patton Street, and White Oak Drive (*Exhibit 5, Sheets 5 and 6*). Review of recent and historical aerial photographs confirmed that Little White Oak Bayou has been rectified and placed within underground culverts at the road crossings listed above (*Exhibit 5, Sheets 5 and 6*). Site visit photographs of Little White Oak Bayou that are not culverted are shown in *Appendix A, Exhibit 4, Photos 18 and 19; and Exhibit 5, Photos 21 and 22*).

Un-named Ditch 2 is not shown on the 1922 or the 1955 Houston Heights, Texas topographic quadrangle maps (*Exhibit 3, Sheet 3*). Un-named Ditch 2 is not included in the NHD (*Exhibit 4, Sheet 3*). Based on review of aerial photographs and as observed during the site visits, this drainage ditch extends eastward from the north side of BNSF railroad tracks near Stokes Street to Little White Oak Bayou. Un-named Ditch 2 is identified by the HCFCD drainage system database as open canal/ditch with unit number E101-08-00 (*Exhibit 6, Sheet 3*).

Un-named Ditch 3 is shown on the 1922 and 1955 Settegast, Texas topographic quadrangle maps as a tributary to Little White Oak Bayou (*Exhibit 3, Sheet 3*). However, it is not included in the NHD or HCFCD drainage system database (*Exhibit 4, Sheet 3; Exhibit 6, Sheet 3*). It is shown as an artificial flowline in the City of Houston database. Within the project area, Un-named Ditch 3 is an underground storm sewer and was confirmed by review of recent aerial photographs and observation during the project site visits (*Exhibit 5, Sheet 6*). The Un-named Ditch 3 outfall is shown at the eastern ROW edge in *Appendix A, Exhibit 4, Photo 20*.

White Oak Bayou is shown on the 1922 and 1955 Settegast, Texas topographic quadrangle maps (*Exhibit 3, Sheets 3 and 4*). Within the existing ROW, White Oak Bayou is a rectified channel. Approximately 1,900 linear feet of the upstream portion of the channel that is within the project area is concrete lined. The concrete lining is visible in the aerial photographs, and was observed during the site visits (*Exhibit 5, Sheets 6 and 8; Appendix A, Exhibit 5, Photos 23, 24, and 25; Appendix A, Exhibit 6, Photo 26*). Within the project area, White Oak Bayou is bridged 11 times, as determined from review of aerial photographs.

Buffalo Bayou is shown on the 1922 and 1955 Settegast, Texas topographic quadrangle maps (*Exhibit 3, Sheets 4 and 5*). The bayou crosses the project area at three locations. Aerial photography shows that Buffalo Bayou is bridged 20 times within the project area.

Ingraham Gully is shown on of the 1922 and 1955 Settegast, Texas topographic quadrangle maps (*Exhibit 3, Sheet 5*). It is not included in the NHD and is listed as a historical canal/ ditch (G122-00-00) in the HCFCD drainage system database (*Exhibit 4, Sheet 4; Exhibit 6, Sheet 4*). Review of recent aerial photographs and site visits to the project area indicate that Ingraham Gully is no longer an open ditch south of I-10 and north of Market Street, which is located north of I-10. However, there is an open drainage ditch that flows from an outfall at Market Street into culverts at the ROW boundary of I-10 (*Exhibit 5, Sheet 7*).

The 1921 Bellaire, Texas and 1922 Park Place, Texas topographic quadrangle maps show drainage ditches on both sides of an existing railroad track within the project area (*Exhibit 3, Sheet 4*). The 1983 Bellaire, Texas and 1955 Park Place, Texas topographic quadrangle maps show that the railroad track and their associated drainage ditches have been removed (*Exhibit 3, Sheet 4*). The 2012 and 2014 aerial photographs confirm the removal of the ditches and the railroad track (*Exhibit 4, Sheet 5*). Detention Basins 2 and 3 are not shown on the 1921 or the 1983 Bellaire, Texas topographic quadrangle maps (*Exhibit 3, Sheet 4*); however, the detention basins are visible on the aerial photographs (*Exhibit 5, Sheet 9*). Site visits to the project area indicate that both detention basins have become overgrown with voluntary vegetation (*Appendix A, Exhibit 7, Photo 35*). Access to both basins was limited by fencing and/or structural walls.

An ornamental water fountain on the west side of Downtown Houston is located mostly within existing ROWs (I-45, Pease Street, and Jefferson Street). The eastern portion of the fountain appears to be outside existing ROWs on privately-owned commercial property (*Exhibit 5, Sheet 8*). The water fountain is not shown on the 1922 and 1955 Settegast, Texas topographic quadrangle maps (*Exhibit 3, Sheet 4*). The water fountain is identified as a palustrine unconsolidated bottom semi-permanently flooded excavated (PUBFx) feature in the NWI (*Appendix A, Exhibit 7, Photo 34*).

### *Site Topography*

Elevations within the project area range from approximately 88 feet North American Datum (NAD) 1983 High Accuracy Reference Network (HARN) near the I-45 and Beltway 8 interchange to approximately 0 feet NAD 1983 HARN at Buffalo Bayou (*Exhibit 6, Sheets 1 through 5*). The southern end of the project area is approximately 48 feet NAD 1983 HARN along US 59/I-69 and 44 feet NAD 1983 HARN along SH 288. The eastern end of the project is approximately 42 feet NAD 1983 HARN at I-10. The project area is relatively level with less than 1 percent slope from Beltway 8 to Buffalo Bayou, and less than 1 percent slope southeastward from SH 288 to Brays Bayou, which is south of the project area.

### *Soils and Major Land Resource Area*

According to the Natural Resources Conservation Service (NRCS), the project area is mapped as urban soil mapping units, with the exception of approximately 67 acres of the Clodine fine sandy loam mapping unit in the northern portion of the project area (*Table 4*). Urban land consists of soils that have been altered or covered by buildings and other structures, making classification impractical (*Exhibit 4, Sheets 1 through 5*). It was determined from review of aerial photographs and site visits that the approximately 67 acres of soils mapped as Clodine fine sandy loam in the project area have been disturbed or developed (*Exhibit 4, Sheet 1; Exhibit 5, Sheets 1 and 2*).

**Table 4. NRCS Map Units within the Project Area**

Map Unit Symbol	Map Unit Name	Acres in Project Area	Percent of Project Area
Harris County, Texas			
<b>Ak</b>	Addicks-Urban land complex	207.9	11.6%
<b>As</b>	Aris-Urban land complex	80.1	4.5%
<b>BadA</b>	Bacliff-Urban land complex, 0 to 1 percent slopes	61.8	3.5%
<b>Bg</b>	Bernard-Urban land complex	117.9	6.6%
<b>Cd</b>	Clodine fine sandy loam, 0 to 1 percent slopes	67.1	3.7%
<b>Ce</b>	Clodine-Urban land complex	308.1	17.2%
<b>Gu</b>	Gessner-Urban land complex	219.3	12.3%
<b>Mu</b>	Verland-Urban land complex	63.6	3.6%
<b>TeuB</b>	Texla-Urban land complex, 0 to 2 percent slopes	9.6	0.5%
<b>URLX</b>	Urban land	554.6	30.9%
<b>VauA</b>	Vamont-Urban land complex, 0 to 1 percent slopes	92.6	5.2%
<b>W</b>	Water	7.4	0.4%
<b>Total for Project Area</b>		<b>1,790.0</b>	<b>100.0%</b>

### *FEMA Maps*

Flood Insurance Rate Maps were used to review the hydrology of the area (GIS Servers\Web Map Service NFHL on hazards.fema.gov). Map numbers, showing effective dates in parentheses, 48201C0460M (10/16/2013), 48201C0470L (6/18/2007), 48201C0660M (6/9/2014), 48201C0680L (6/18/2007), 48201C0670M (6/9/2014), 48201C0690M (6/9/2014), 48201C0860L (6/18/2007), and 48201C0880L (6/18/2007) were reviewed and show that approximately 70 percent of the project area is outside of the one-percent annual exceedance probability (AEP) floodplain, or other flood hazard areas as determined by FEMA (*Exhibit, 4 Sheets 1 through 5*). Areas adjacent to and including parts of Drainage Ditch 113251901, Halls Bayou, Wetlands 7 and 8, Drainage Ditches 113253277, 113253377, and 113253359, Janowski Ditch, Little White Oak Bayou, White Oak Bayou, and Buffalo Bayou are within the one-percent AEP floodplain.

## NWI Maps

The USFWS NWI maps (GIS Servers\Web Map Service USFWS\_WMS\_CONUS\_Wetlands on wetlandswms.er.usgs.gov) were used to gather information on the location of potential wetlands within the project area. Only four water resources are mapped by the NWI within the limits of the project area (*Exhibit 4, Sheets 1 through 5*). Three of the water resources are bayous: Little White Oak Bayou, White Oak Bayou, and Buffalo Bayou. All three are identified as riverine lower perennial unconsolidated bottom permanently flooded excavated (R2UBHx) features. The fourth water resource is a water fountain identified as a PUBFx feature.

## Potentially Jurisdictional Waters of the United States

Thirty-five (35) water bodies were identified within the project area (*Table 1*). Following the June 29, 2015 *Clean Water Rule: Definition of "Waters of the United States"; Final Rule, Federal Register Vol. 80, No. 124, 37054-37127 pp.*, six (6) water bodies appear to be non-jurisdictional. The June 29, 2015 rule definition is currently on hold because of legal review. Applying the previous jurisdictional methodology of the June 5, 2007 guidance from the U.S. Environmental Protection Agency (EPA) and the USACE, as presented in the U.S. Army Corps of Engineers Jurisdictional Determination Form Instructional Guidebook, the same six (6) water bodies appear to be non-jurisdictional. Three of the water bodies are detention basins (Detention Basins 1, 2, and 3), which are excavated from uplands. One water body is an artificial ornamental feature (water fountain), which is not included in the definition of jurisdictional waters. Un-named Ditch 1 and Drainage Ditch 113252861 are both concrete-lined linear water bodies that appear to have ephemeral flow and are not classified as a relocated tributary or excavated tributary. Therefore, these areas would likely not be determined by the USACE to be jurisdictional WOUS. The other 29 water bodies meet the definition of WOUS and it is expected that the USACE would regulate them as jurisdictional WOUS. However, only the USACE and the EPA can determine the jurisdictional status of aquatic resources identified as WOUS.

## Potentially Jurisdictional Waters of the United States within the Existing ROW and Alternative ROWs

The approximate water body acreage and linear feet of streams associated with the identified WOUS and the potentially jurisdictional WOUS within the existing ROW and proposed new ROW for the alternatives are shown in *Table 3*. Most of the water bodies identified as potentially jurisdictional are within the existing project ROW. This assessment is preliminary, as only the USACE and EPA can determine the jurisdictional status of aquatic resources identified as WOUS.

## Existing ROW

In Segments 1 and 2, all the identified waters, including streams, located within the existing ROW were identified as potentially jurisdictional. In Segment 3, three water bodies within the existing ROW were considered potentially non-jurisdictional: a water fountain, and Detention Basins 2 and 3. These three water bodies are manmade and are normally considered to be non-jurisdictional waters by the USACE.

## Segment 1

In the areas of new ROW for the Segment 1 alternatives:

- Alternative 4 water body jurisdictional acreage (1.22 acres) is more than 4 times that of the acreages for Alternatives 5 or 7 (0.29 or 0.28 acre, respectively).
- Alternative 4 stream jurisdictional lengths (2,148 feet) are approximately 2 times the linear feet of potentially jurisdictional streams for Alternative 5 (1,037 feet), and over 3 times the linear feet of potentially jurisdictional streams for Alternative 7 (613 feet).



- There are three potentially non-jurisdictional water bodies within the proposed new ROW for Segment 1 Alternative 5: Detention Basin 1 and Drainage Ditches Un-named Ditch 1 and 113252861 (*Table 1, Exhibit 5, Sheets 1, 2, and 3*).
  - Approximately 0.33 acre of Detention Basin 1 occurs within the project area.
  - Less than 0.02 acre and approximately 175 linear feet of Un-named Ditch 1 occur in the project area. All of Un-named Ditch 1 is in Alternative 5, and only part of Un-named Ditch 1 is in Alternative 7.
  - Approximately 0.1 acre and 227 linear feet of Drainage Ditch 113252861 occur within the project area. Similar to Un-named Ditch 1, all of Drainage Ditch 113252861 is located in Alternative 5, and only part is in Alternative 7.

## **Segment 2**

All of the water bodies within areas of new ROW for the Segment 2 alternatives are potentially jurisdictional, and there is little acreage difference among the alternatives (Alternative 10 – 0.08 acre [approximately 3,485 square feet]; Alternative 11 – 0 acre; Alternative 12 – 0.02 acre [approximately 871 square feet]). There are minor differences in the linear feet of streams within the areas of new ROW; Alternative 10 – approximately 270 linear feet, Alternative 11 – 0 linear feet, and Alternative 12 – approximately 168 linear feet.

## **Segment 3**

In the areas of new ROW for the Segment 3 alternatives:

- All of the identified water bodies are potentially jurisdictional.
- Segment 3 Alternative 10 has the least acreage of water bodies, but it has greater linear feet of streams than Alternative 11 (*Table 3*).
- Alternatives 11 and 12 have approximately the same acreage of water bodies.
- Alternative 12 has greater linear feet of streams than Alternative 10 or Alternative 11.

## **Potential Impacts to Jurisdictional Waters of the United States within Existing and Alternative ROWs**

For purposes of comparing project alternatives, potential impacts to jurisdictional WOUS were estimated based on the preliminary assessment of water bodies in the project area and the preliminary conceptual design for the project. The proposed project could impact the potentially jurisdictional WOUS listed in *Table 5*. Depending on the project alternative, reconstruction and/or removal of existing roadways and structures would occur within areas of existing roadway ROW, and would impact some jurisdictional WOUS. Potential impacts to waters in areas of existing ROW for Segments 1 and 2 would be similar, as all alternatives encompass the same existing ROW. Potential impacts to waters in areas of existing ROW for Segment 3 would vary by alternative.

The design of the alternatives is preliminary. Halls Bayou, Janowski Ditch, Little White Oak Bayou 1, Un-named Ditch 2, Little White Oak Bayou 2, Little White Oak Bayou 6, White Oak Bayou, and the three segments of Buffalo Bayou would be bridged. The details of each bridge crossing have not been determined. Dependent on the bridge design, there may be no impacts if a stream segment is completely spanned - with no changes below the plane of ordinary high water or high tide elevation of the stream. Alternatively, the bridge design could involve impacts that would require a Department of the Army individual permit. The bridges could possibly be designed such that impacts to jurisdictional WOUS are minimized, allowing the bridges to be considered for permit authorization by the USACE's nationwide permit program.

Drainage Ditches 113251601, 113251901, 113252111, Un-named Ditch 1, 113252481, 113252861, 113253277, 113253377, 113253359, and Little White Oak Bayou 3 and 4 may be impacted by the proposed project. Specific impacts to the drainage ditches and the two segments of Little White Oak Bayou would be determined during detailed design. Existing culverts are often extended when roadway improvements require new ROW. Appropriate stream mitigation would be determined for stream impacts. The potential impacts shown in *Table 5* reflect a worst-case scenario, where these waters would be culverted.

Wetlands 1 through 8 may be avoided, or partially or completely filled, depending on the alternative and final design. Detention Basins 1, 2, and 3 may be avoided, moved or filled. Little White Oak Bayou 3 and Un-named Ditch 3 are completely culverted within the project area and are not expected to be changed. The water fountain is not expected to be impacted.

**Table 5. Estimated Potential Impacts to Potentially Jurisdictional Waters of the United States**

	Number	Water Body	Acres	Alternatives			
				4	5	7	Existing ROW
Segment 1	1	113251601	0.202		25-foot culvert extension eastward		
	2	Detention Basin 1	0.366		Relocate/fill		
	3	1113251901	0.021		123-foot culvert extension eastward		
	4	Wetland 1	0.004		Fill		
	5	Wetland 2	0.003		Fill		
	6	Wetland 3	0.008		Fill		
	7	1113252111	0.037	160-foot culvert extension westward		30-foot culvert extension westward	
	8	Wetland 4	0.627	fill		0.1 acre fill, east side	
	9	Halls Bayou	0.434	Bridge	Bridge	Bridge	
	10	Wetland 5	0.032	Avoid/fill	Avoid/fill	Avoid/fill	
	11	Wetland 6	0.024		Avoid/fill		
	12	Un-named Ditch 1	0.017		175-foot culvert extension eastward	42-foot culvert extension eastward	
	13	1113252481	0.104	31-foot culvert extension westward	198-foot culvert extension eastward	80-foot culvert extension eastward	
	14	1113252861	0.110		230-foot culvert extension eastward	105-foot culvert extension eastward	
	15	Wetland 7	0.047				Culvert
	16	Wetland 8	0.012				Culvert
	17	1113253277	0.091	350-foot culvert extension southward		36-foot culvert extension southward	245-foot culvert extension southward
	18	1113253377	0.266	385-foot culvert extension southward		67-foot culvert extension southward	230-foot culvert extension southward



	Number	Water Body	Acres	Alternatives			
				4	5	7	Existing ROW
Segment 1	19	1113253359	0.196	180-foot culvert extension westward		34-foot culvert extension westward	
	20	Janowski Ditch	0.090	Bridge	Bridge	Bridge	
	21*	Little White Oak Bayou 1 Segment 1*	2.438				Bridge
	22	Un-named Ditch 2	0.016				Bridge
	Number	Water Body	Acres	Alternatives			
				10	11	12	Existing ROW
Segment 2	21*	Little White Oak Bayou 1 Segment 2*	0.401				Bridge
	23	Little White Oak Bayou 2	0.061	Bridge		Bridge	
	24	Little White Oak Bayou 3	1.433				
	25	Un-named Ditch 3	0.160				
	26	Little White Oak Bayou 4	0.339				40-foot culvert extension northward
	27	Little White Oak Bayou 5	0.279				
	Number	Water Body	Acres	Alternatives			
				10	11	12	Existing ROW
Segment 3	28	Little White Oak Bayou 6	0.408	Bridge	Bridge	Bridge	Bridge
	29	White Oak Bayou	8.090	Bridge	Bridge	Bridge	Bridge
	30	Buffalo Bayou East	9.478		Bridge	Bridge	Bridge
	31	Buffalo Bayou West 1	1.497	Bridge	Bridge		Bridge
	32	Buffalo Bayou West 2	2.276	Bridge	Bridge	Bridge	Bridge
	33	Water Fountain	0.109				
	34	Detention Basin 2	0.336				Avoid/move/fill
	35	Detention Basin 3	2.809				Avoid/move/fill

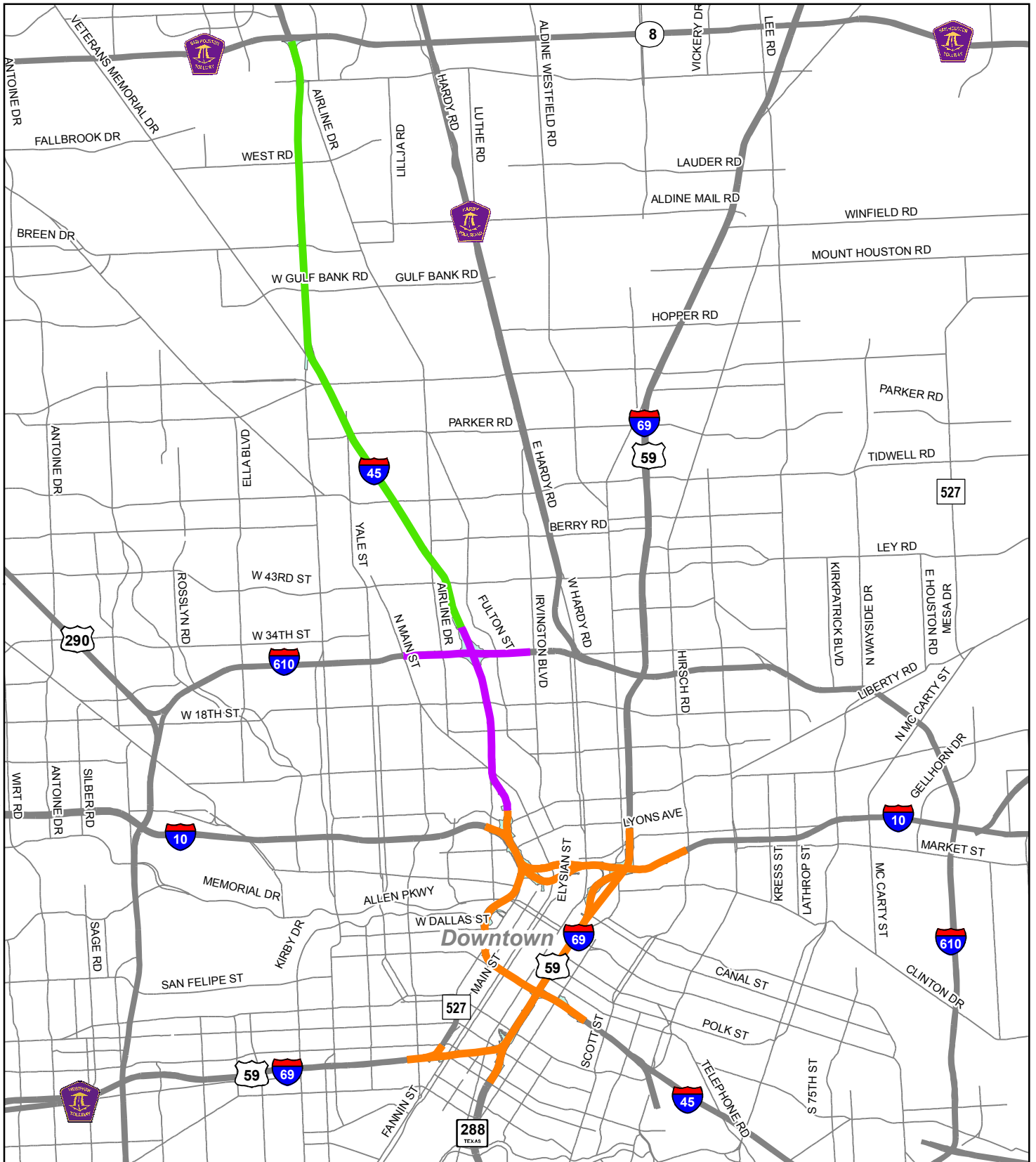
\* Little White Bayou 1 is located in both Segments 1 and 2

## Section 408 Coordination

Section 408 coordination is required for activities that would alter, occupy, or use any USACE civil works project, per Section 14 of the Rivers and Harbors Act of 1899, as codified in 33 U.S. Code

§408. The Secretary of the Army may, on the recommendation of the Chief of Engineers, grant permission to temporarily or permanently occupy, use, or alter work that was federally funded, provided that such occupation, use, or alteration is not injurious to the public interest and will not impair the usefulness of the existing federal project. Department of the Army EC 1165-2-216 Circular No. 1165-2-216 states the policy and procedural guidance for processing requests to occupy, use, or alter federally-authorized USACE civil works projects.

The section of White Oak Bayou that is within the North Houston Highway Improvement Project area is part of a federally-funded project, with HCFCD as the local sponsor. The Texas Department of Transportation will be required to coordinate with the USACE and HCFCD to determine if the occupation or alteration of the White Oak Bayou federal project by the proposed North Houston Highway Improvement Project would be injurious to the public interest or impair the usefulness of the federal project.



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Feet

### Legend

- Segment 1
- Segment 2
- Segment 3

Waters of the United States  
**North Houston  
Highway Improvement Project**

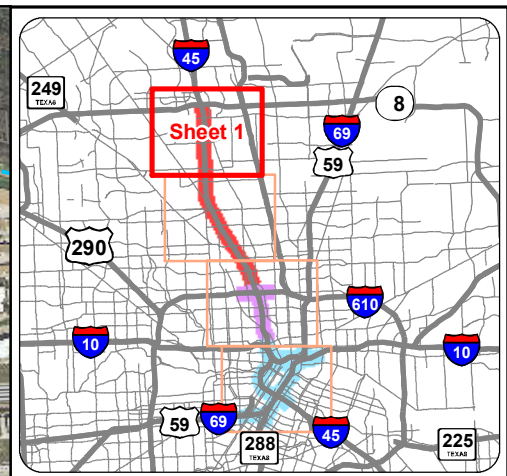
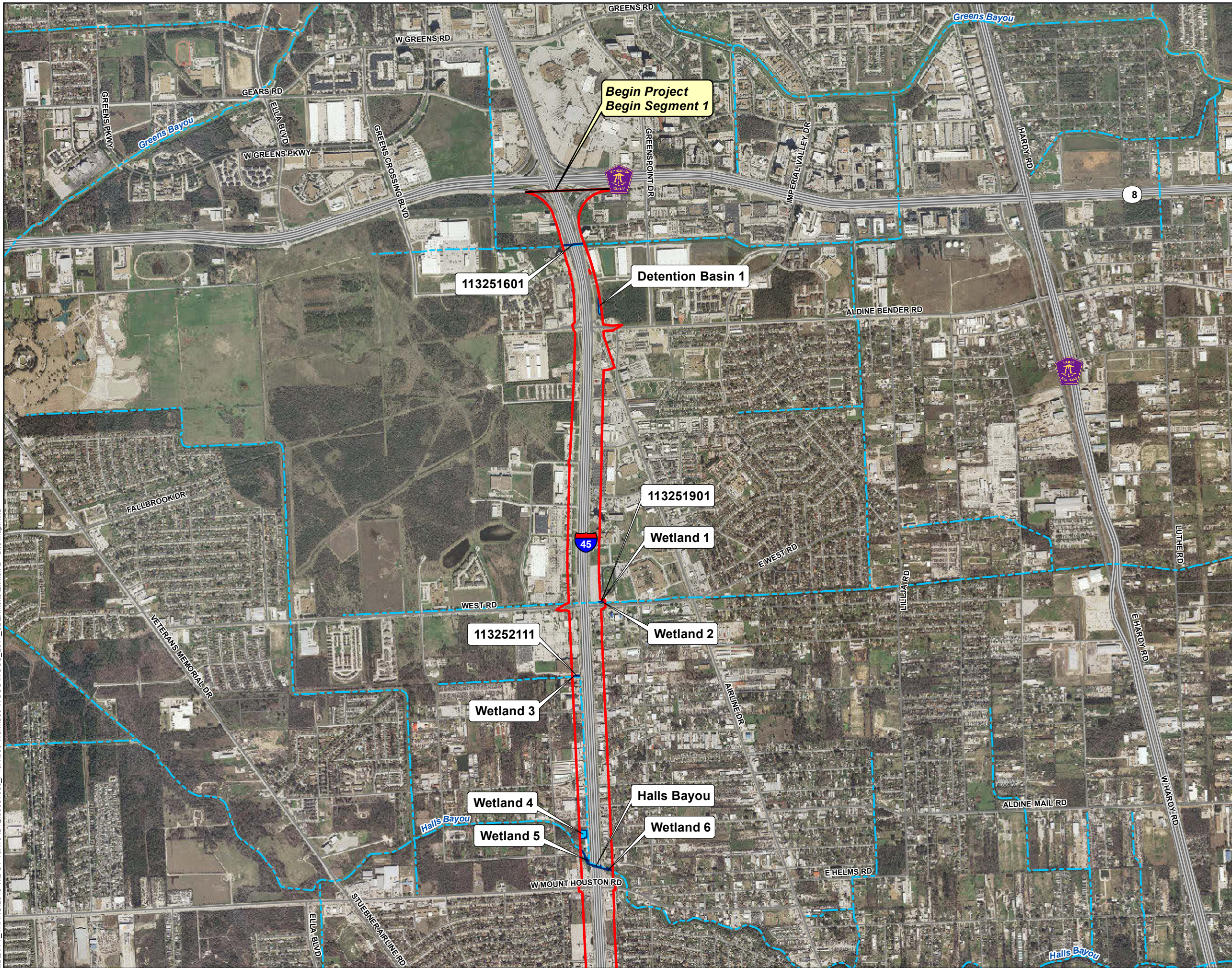
### Vicinity Map



Date: March 2017

Exhibit: 1

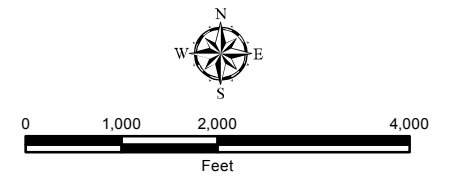




Index Map

Legend




- Project Area
- Water Bodies
- NHD Streams

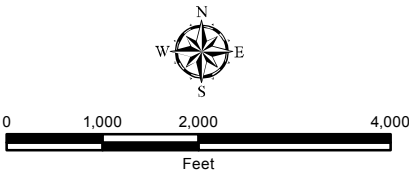






## Legend

-  Project Area  
 Water Bodies  
 NHD Streams



Waters of the United States  
**North Houston**  
**Highway Improvement Project**

## Water Bodies in Project Area

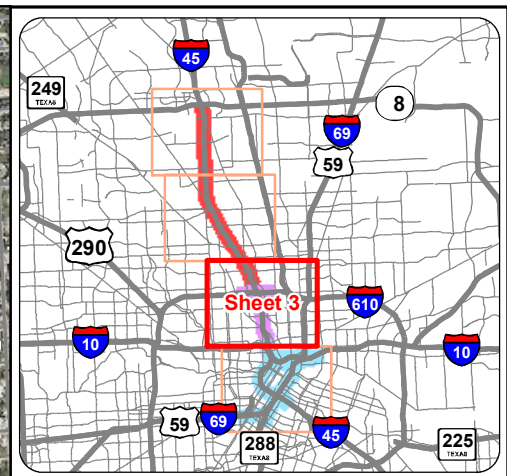
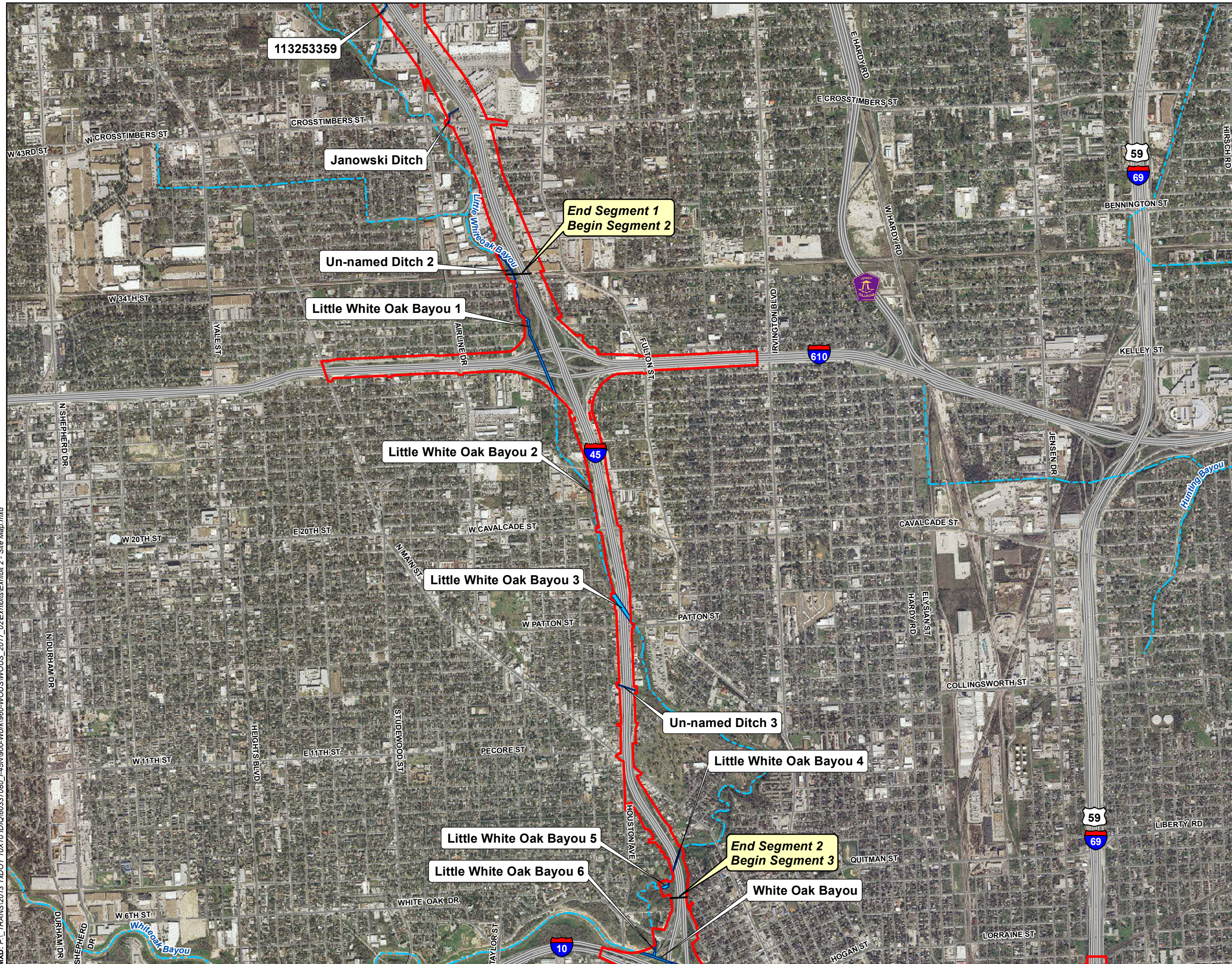


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Exhibit: 2 - Sheet 2



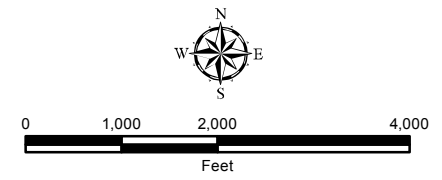
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Index Map

Legend

- Project Area
- Water Bodies
- NHD Streams



Waters of the United States  
North Houston  
Highway Improvement Project

Water Bodies in Project Area

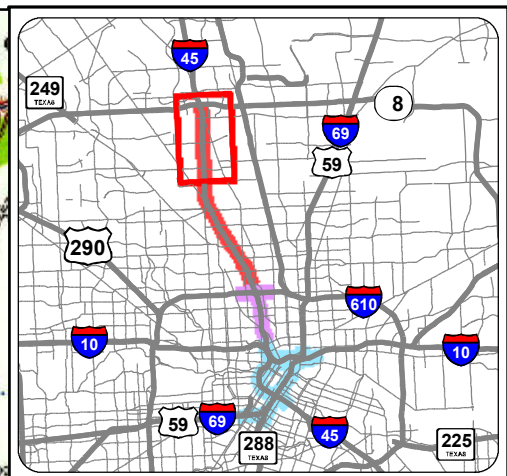
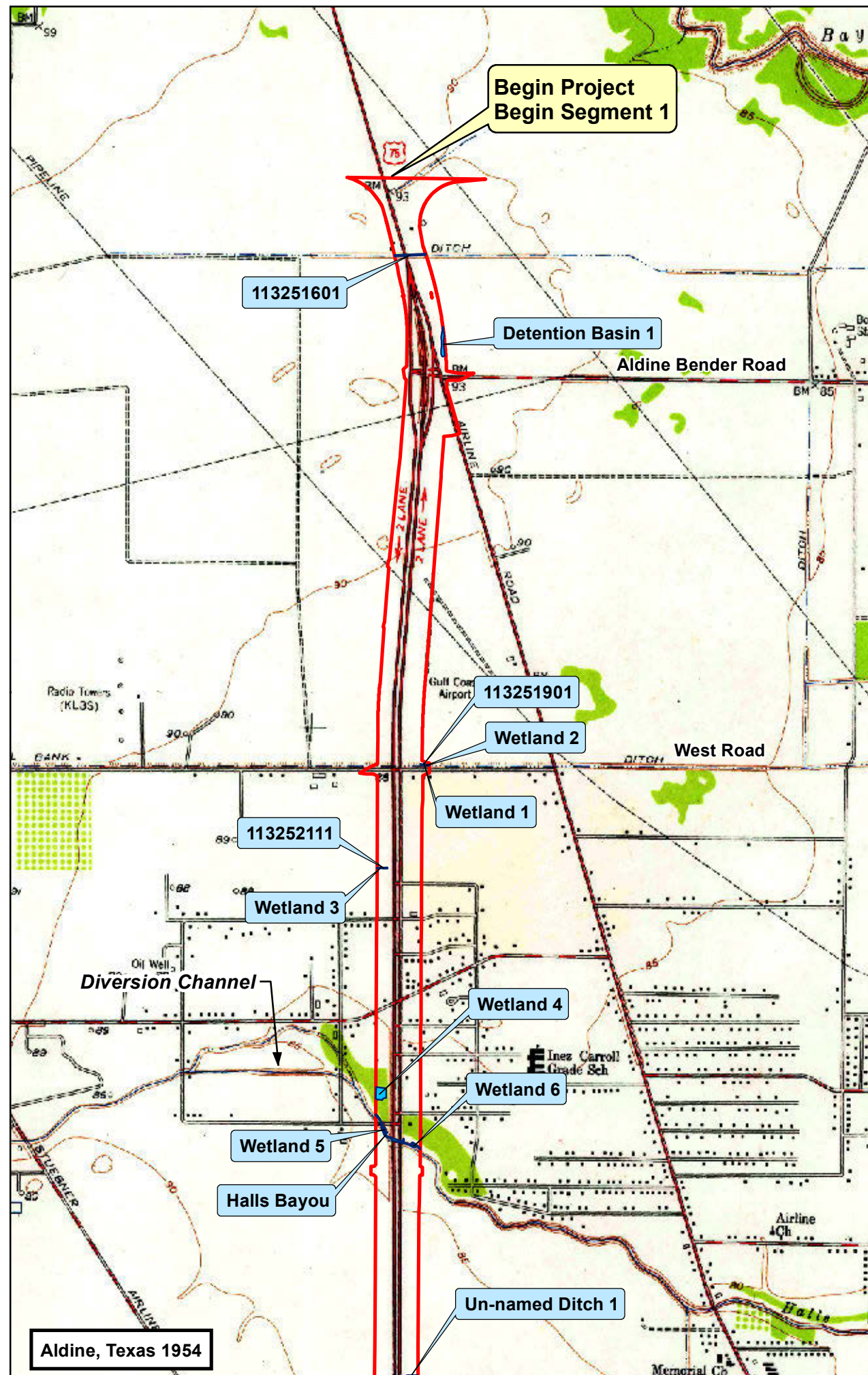
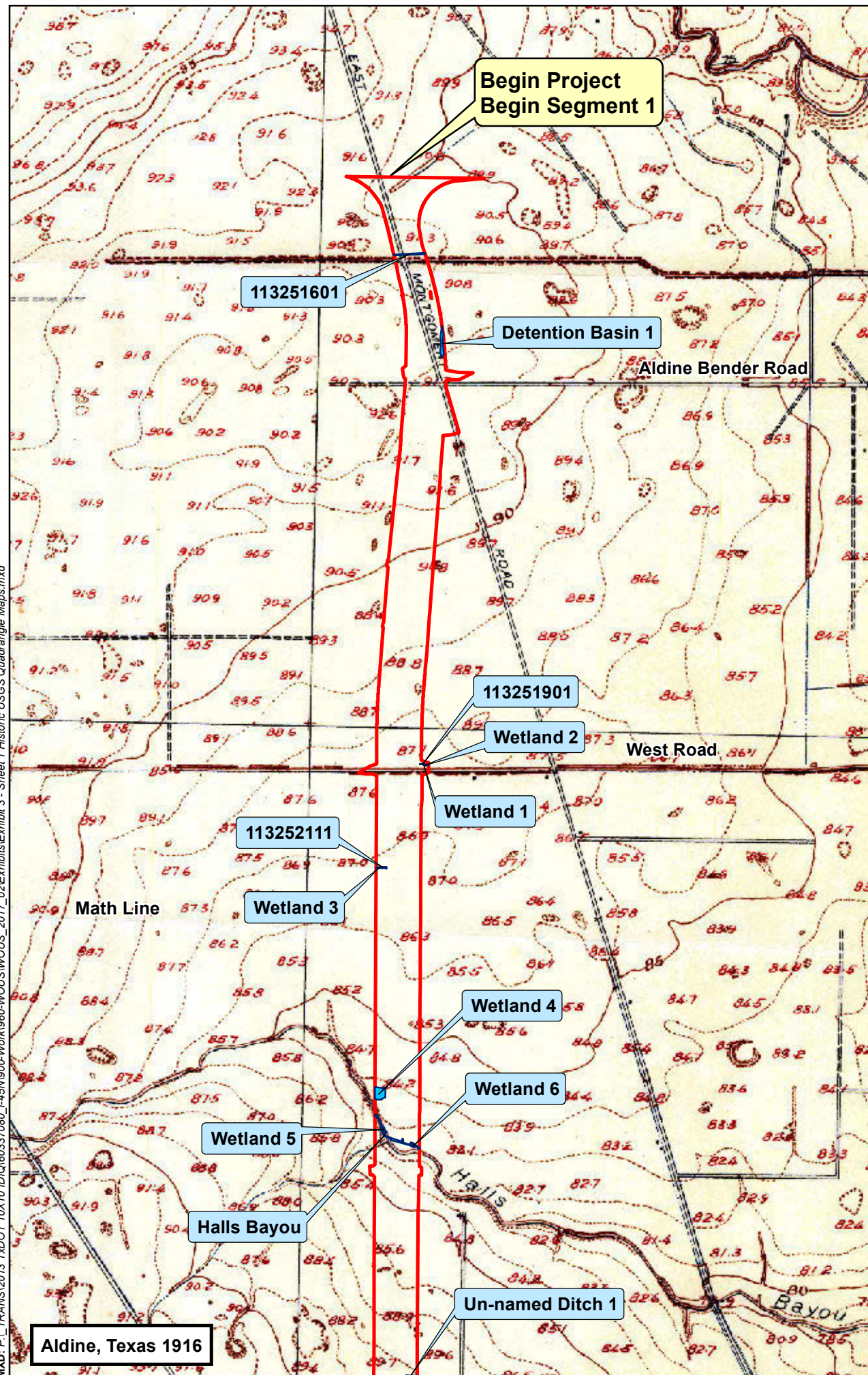






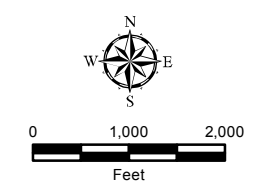


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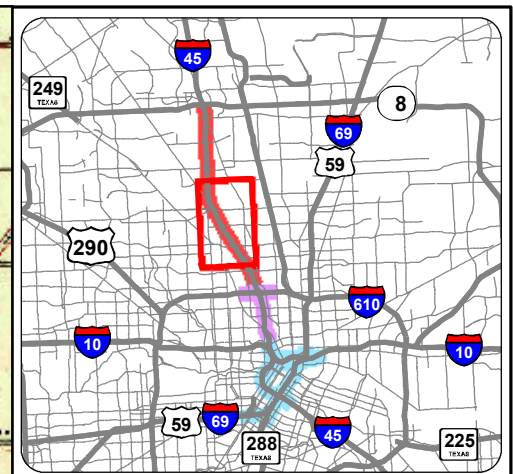
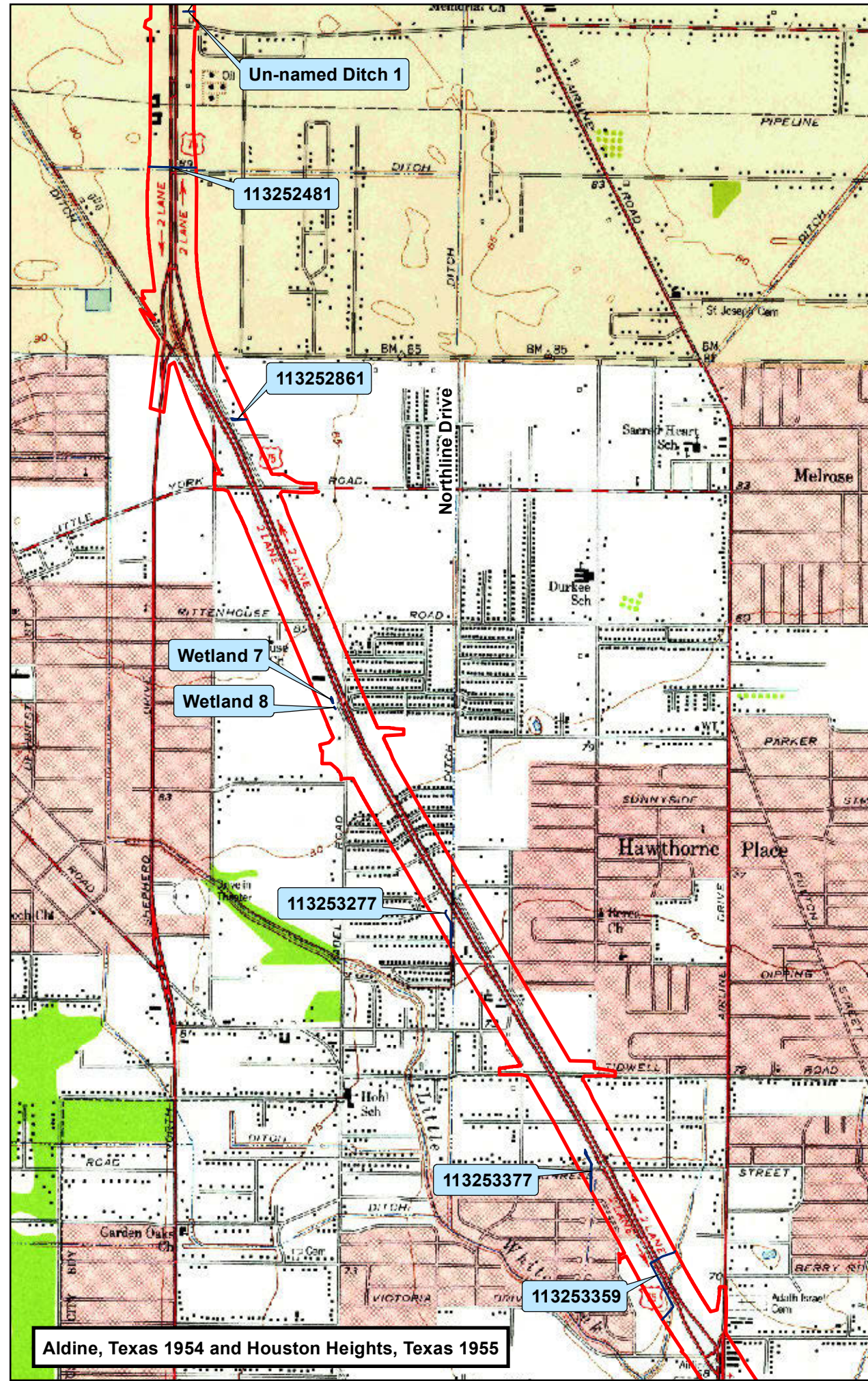
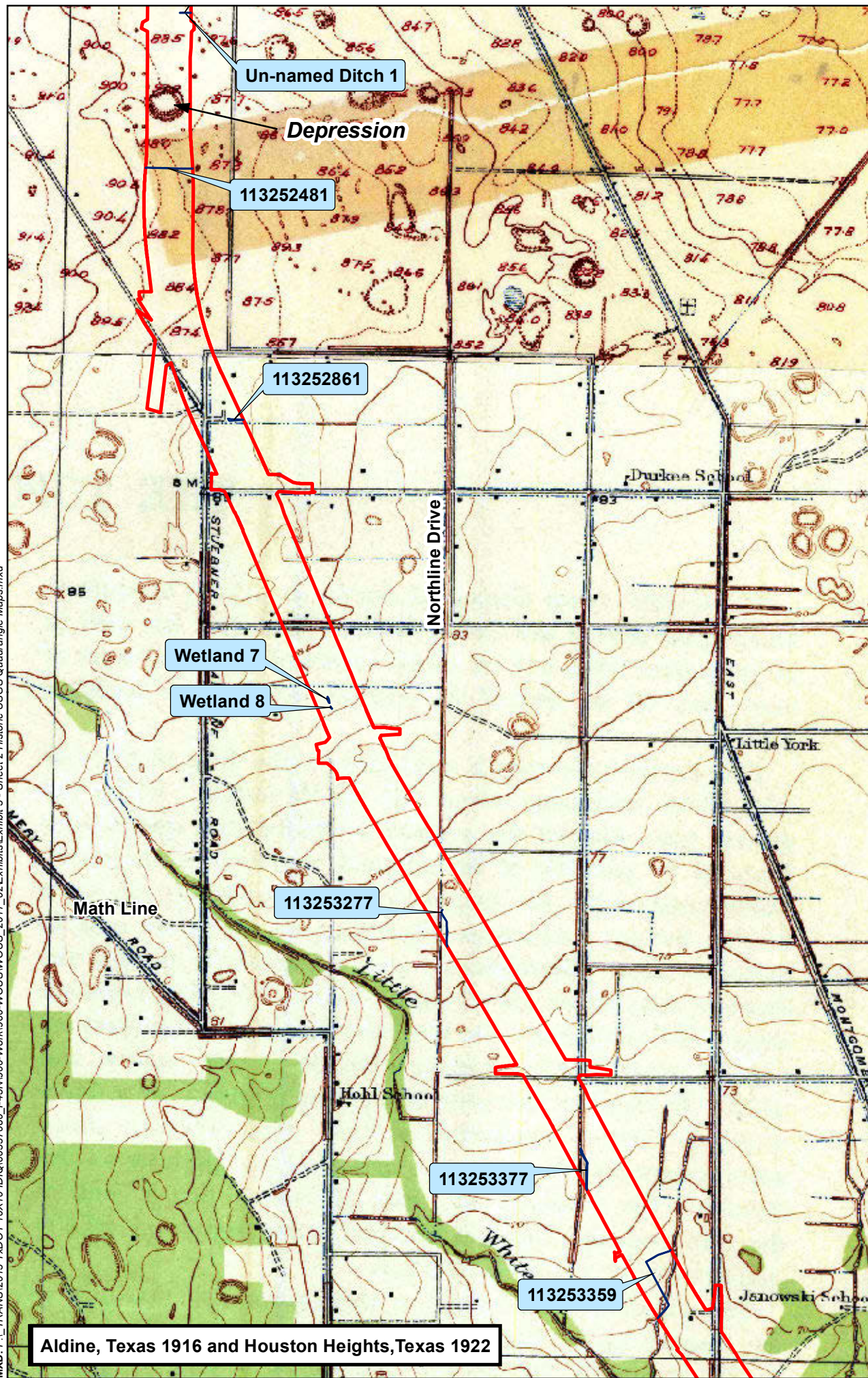


**Legend**

- Project Area
- Water Bodies

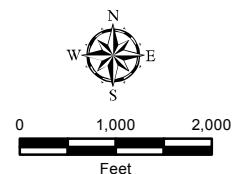






### Legend

- Project Area
- Water Bodies



Waters of the United States  
North Houston  
Highway Improvement Project

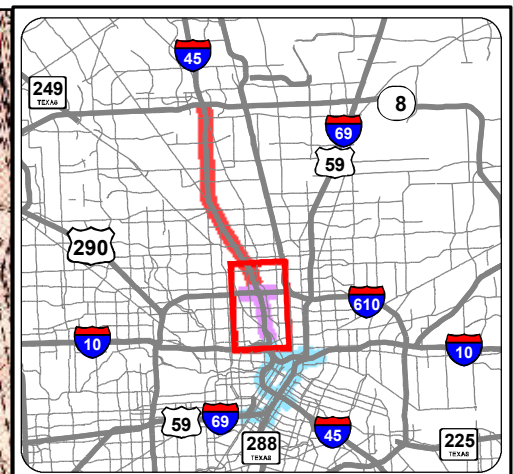
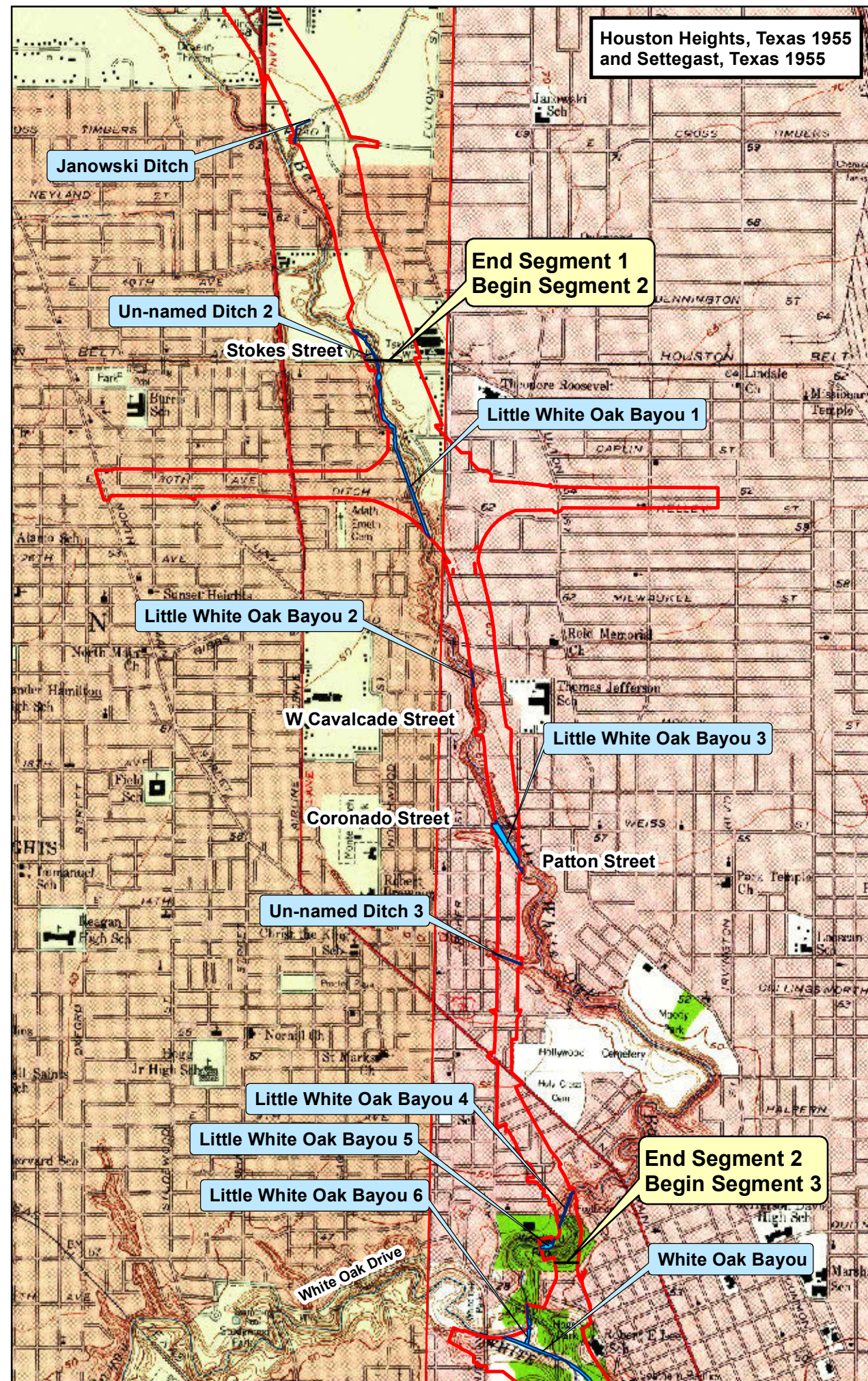
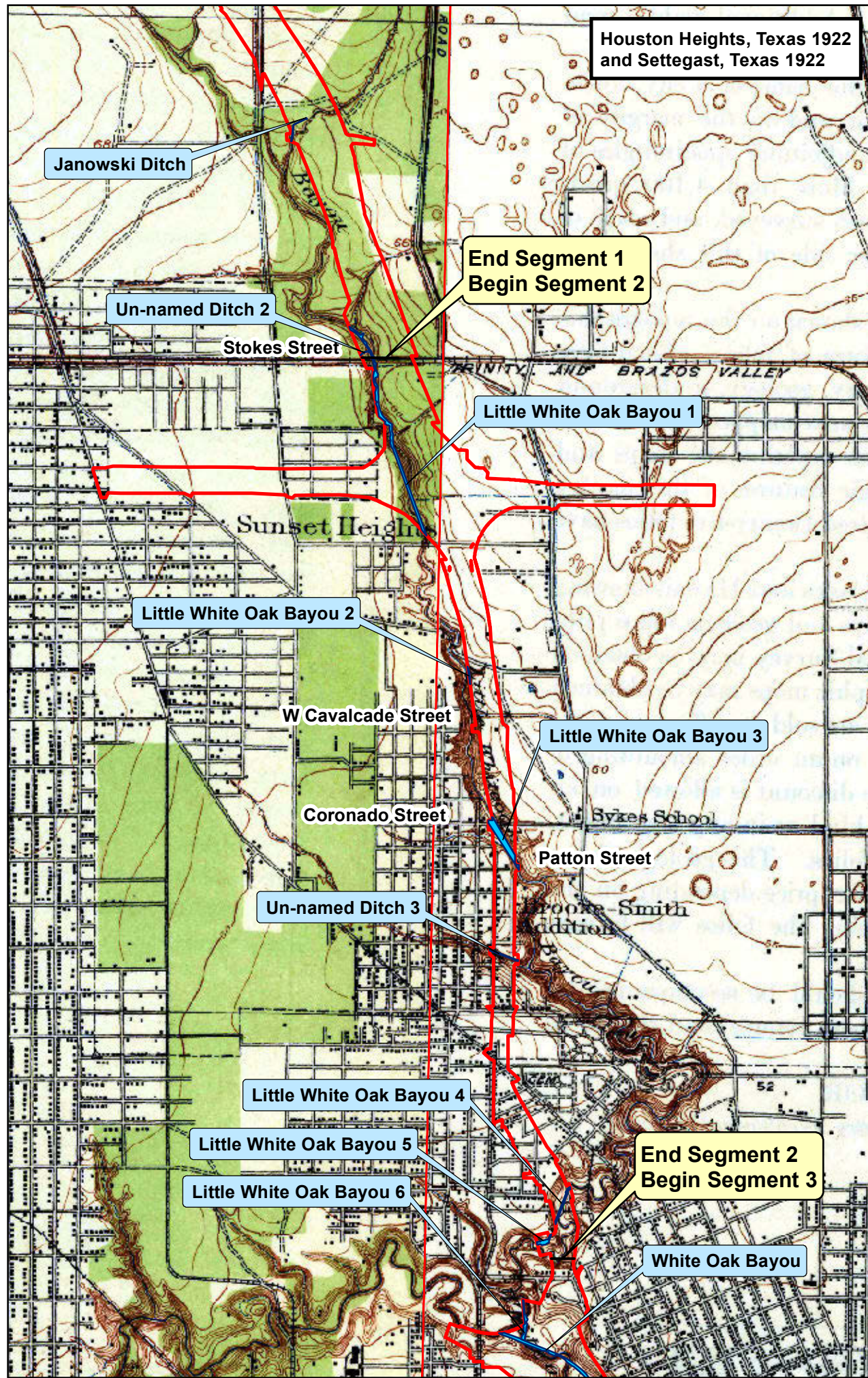
Historical USGS Quadrangle Maps

Texas Department  
of Transportation

Date: March 2017

Exhibit: 3 - Sheet 2





Index Map

### Legend

- Project\_Segment
- Water Bodies
- Project Area

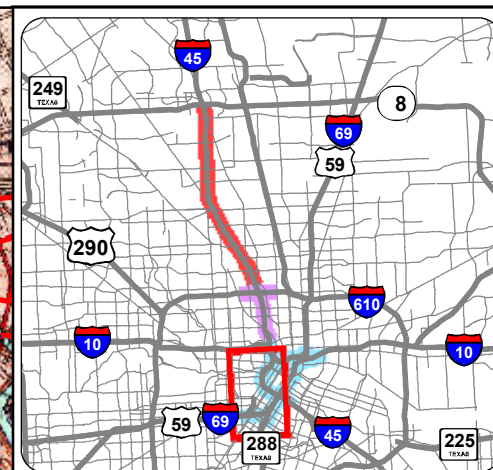
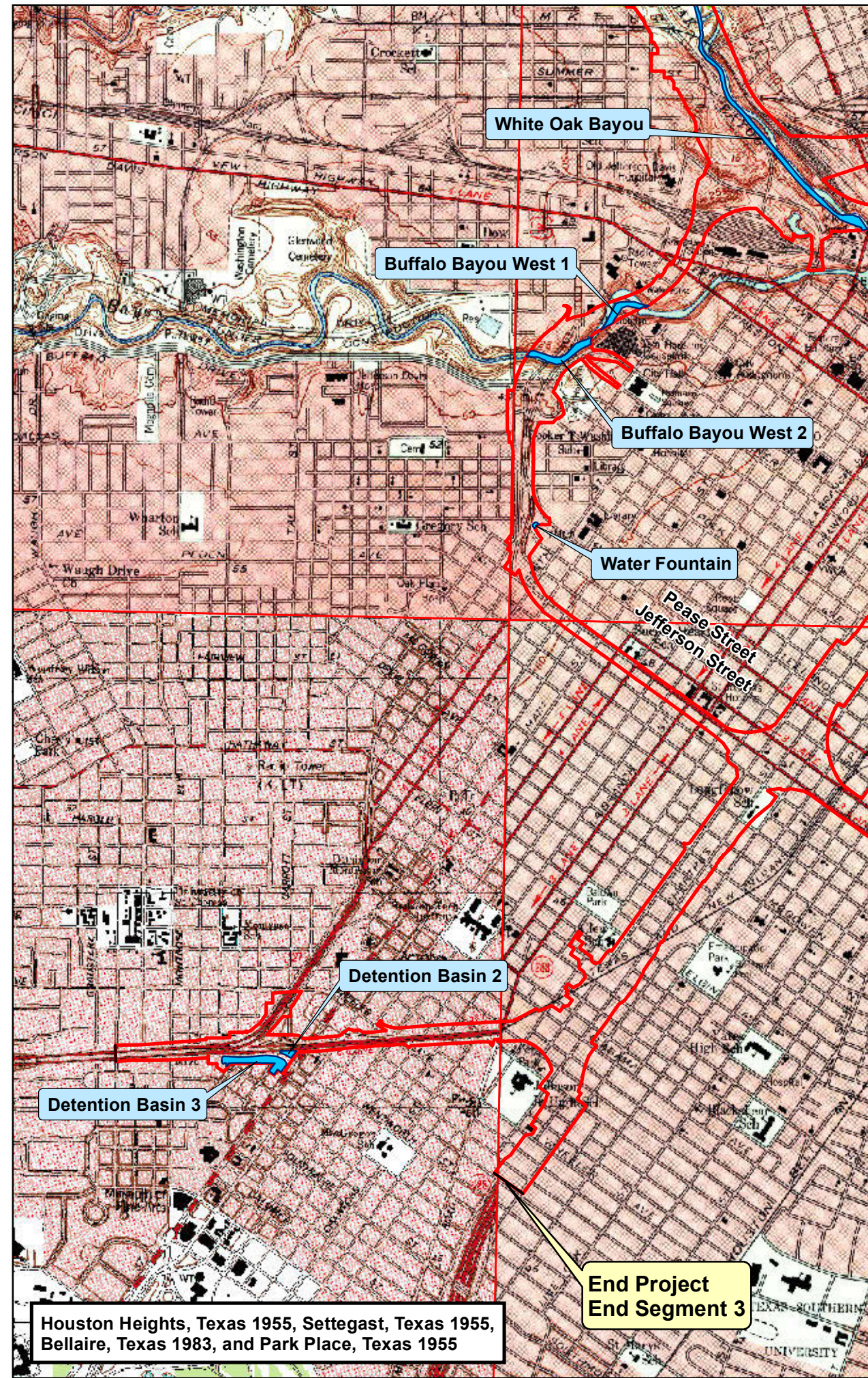
Waters of the United States  
North Houston  
Highway Improvement Project

Historical USGS Quadrangle Maps





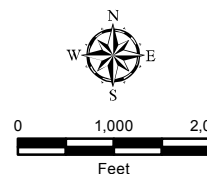
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Vicinity Map

### Legend

- Project\_Segment
- Project Area
- Water Bodies



Waters of the United States  
North Houston  
Highway Improvement Project

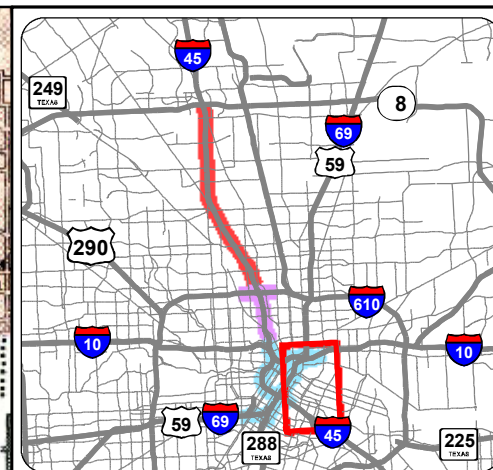
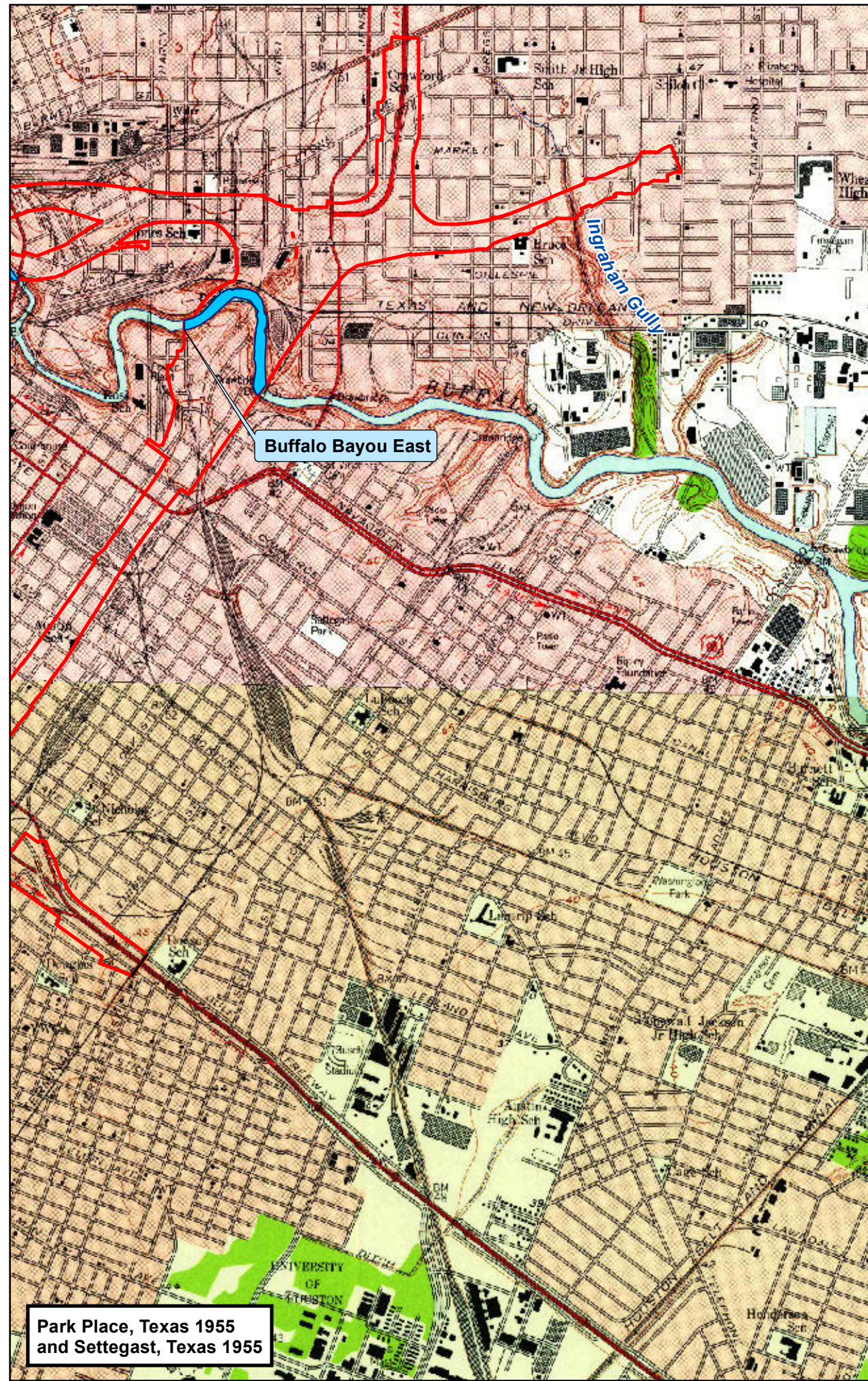
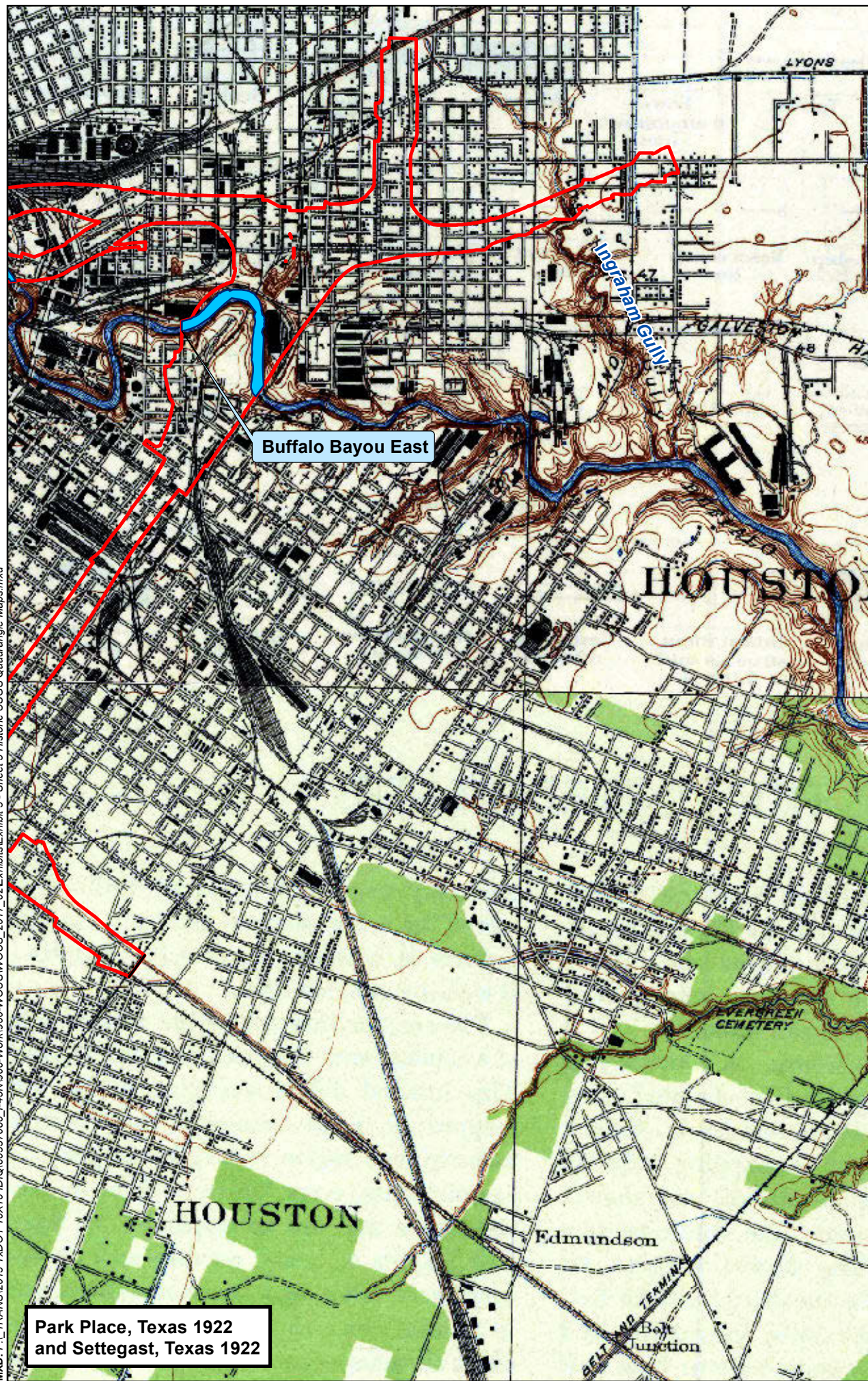
Historical USGS Quadrangle Maps



Date: March 2017

Exhibit: 3 - Sheet 4

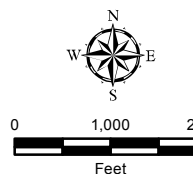




Index Map

### Legend

- Project Area
- Water Bodies



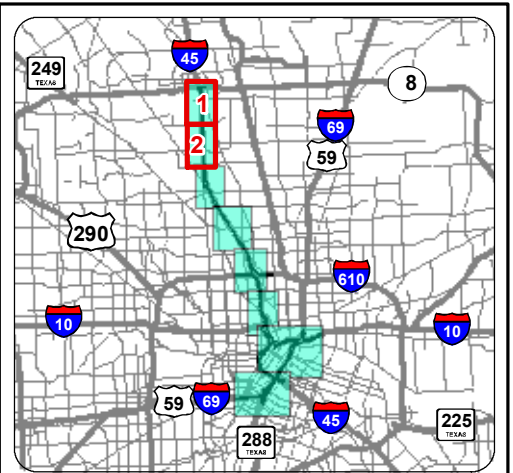
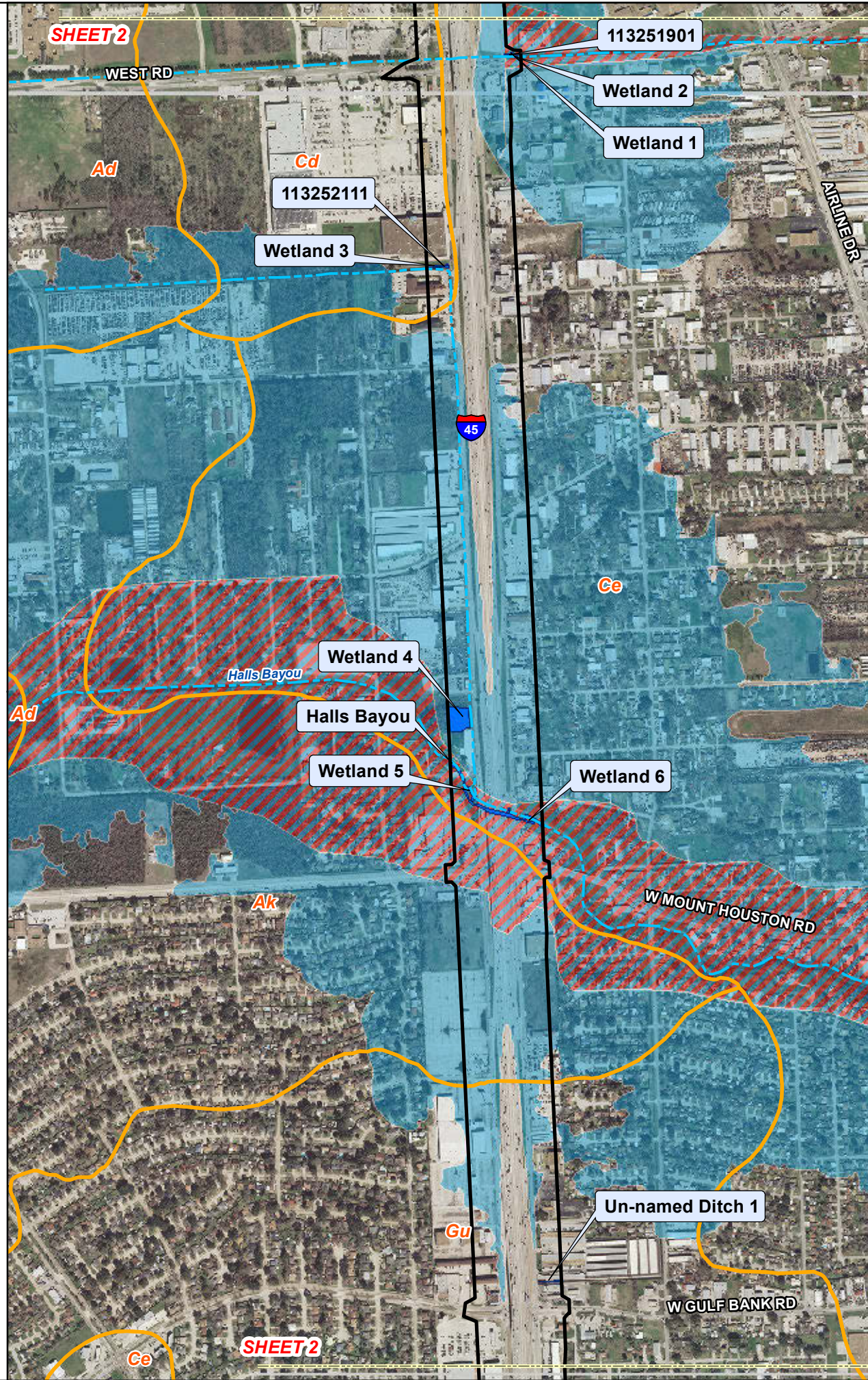
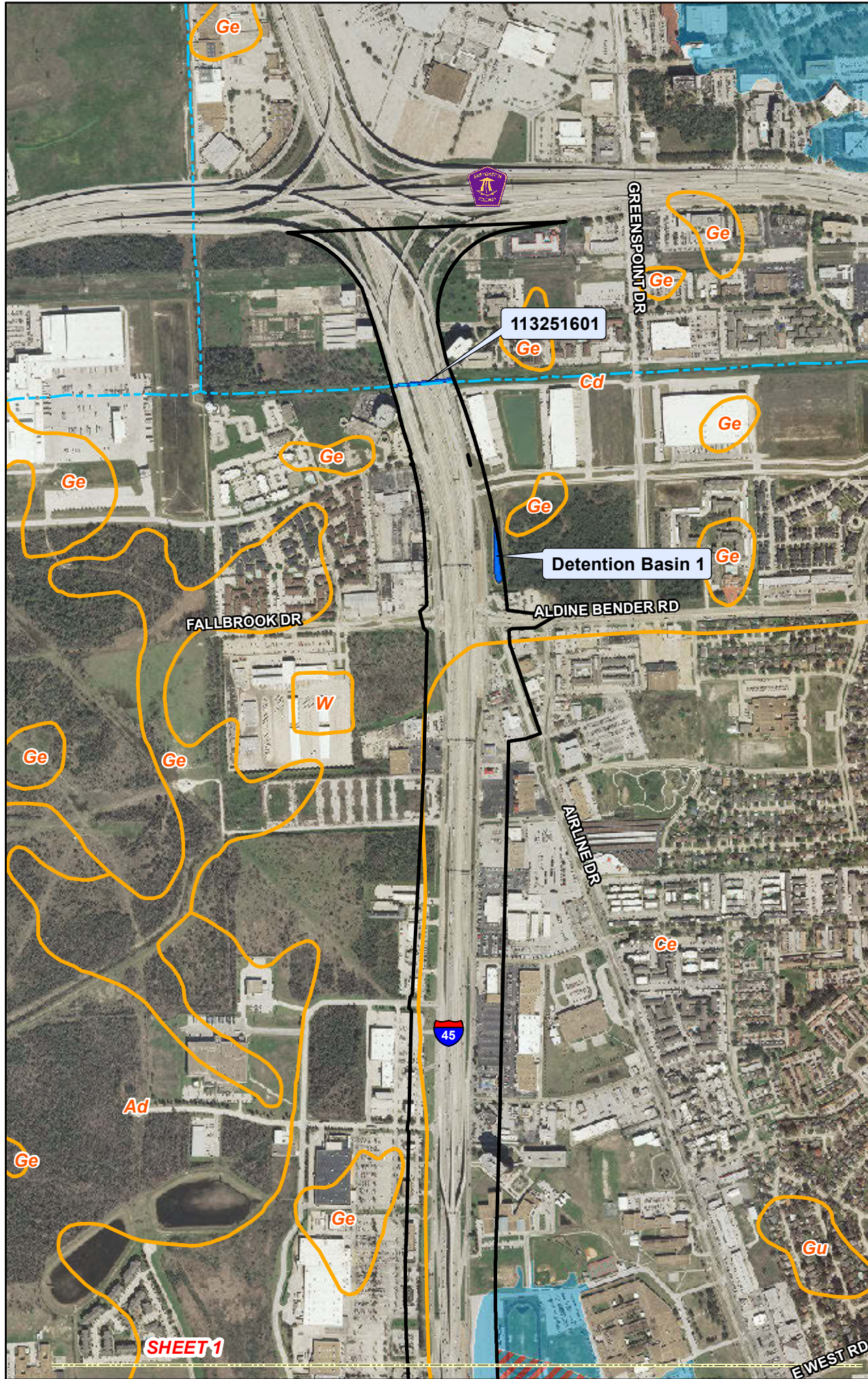
Waters of the United States  
**North Houston  
Highway Improvement Project**

**Historical USGS Quadrangle Maps**





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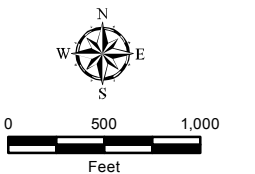
Index Map

### Legend

- Project Area
- Sheet Match Line
- NHD Streams
- Soil Boundary
- Water Bodies

### FEMA Flood Hazard Zones

- 1% Annual Exceedance Probability Flood Hazard
- Regulatory Floodway



Waters of the United States  
North Houston  
Highway Improvement Project

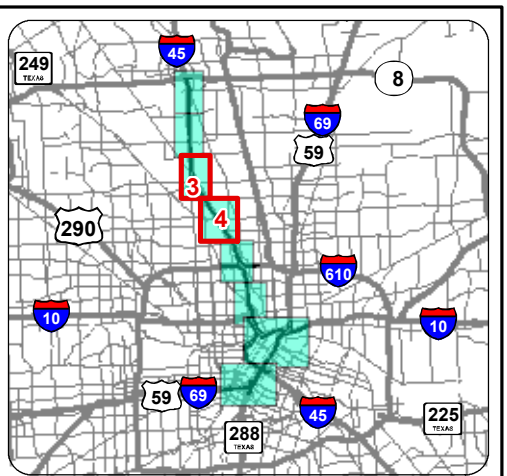
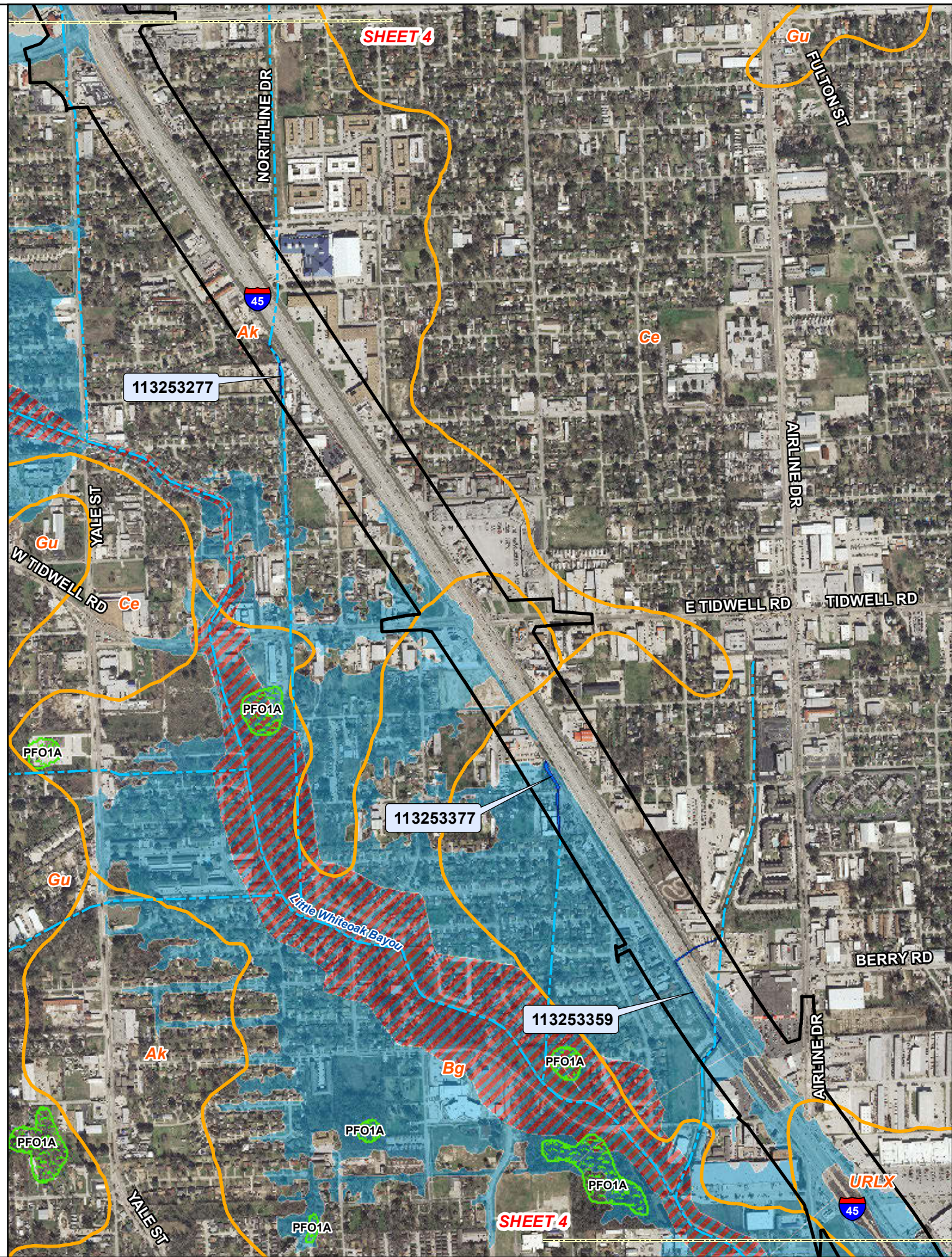
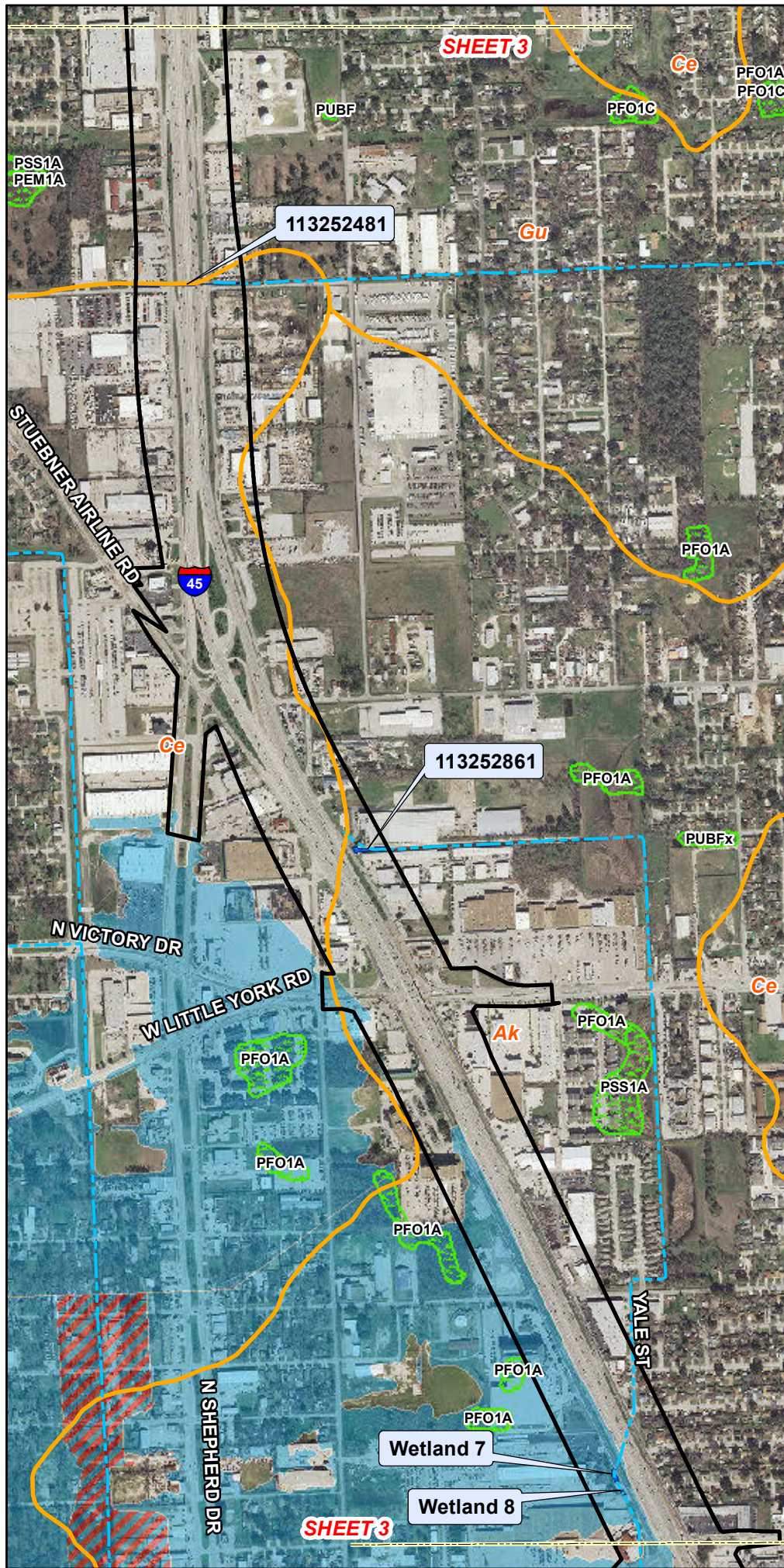
Floodplain, NWI, and Soils



Date: March 2017

Exhibit 4 - Sheet 1





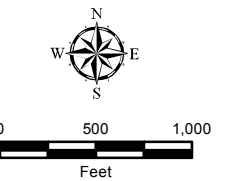
Index Map

**Legend**

- Project Area
- Sheet Match Line
- NHD Streams
- Soil Boundary
- Water Bodies

**FEMA Flood Hazard Zones**

- 1% Annual Exceedance Probability Flood Hazard
- Regulatory Floodway



Waters of the United States  
**North Houston  
Highway Improvement Project**

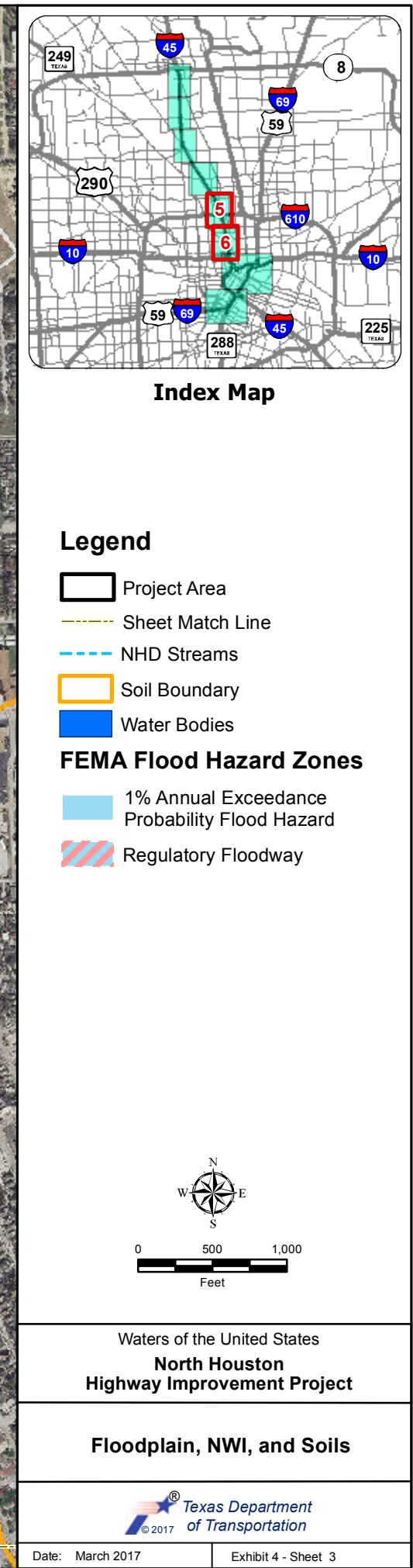
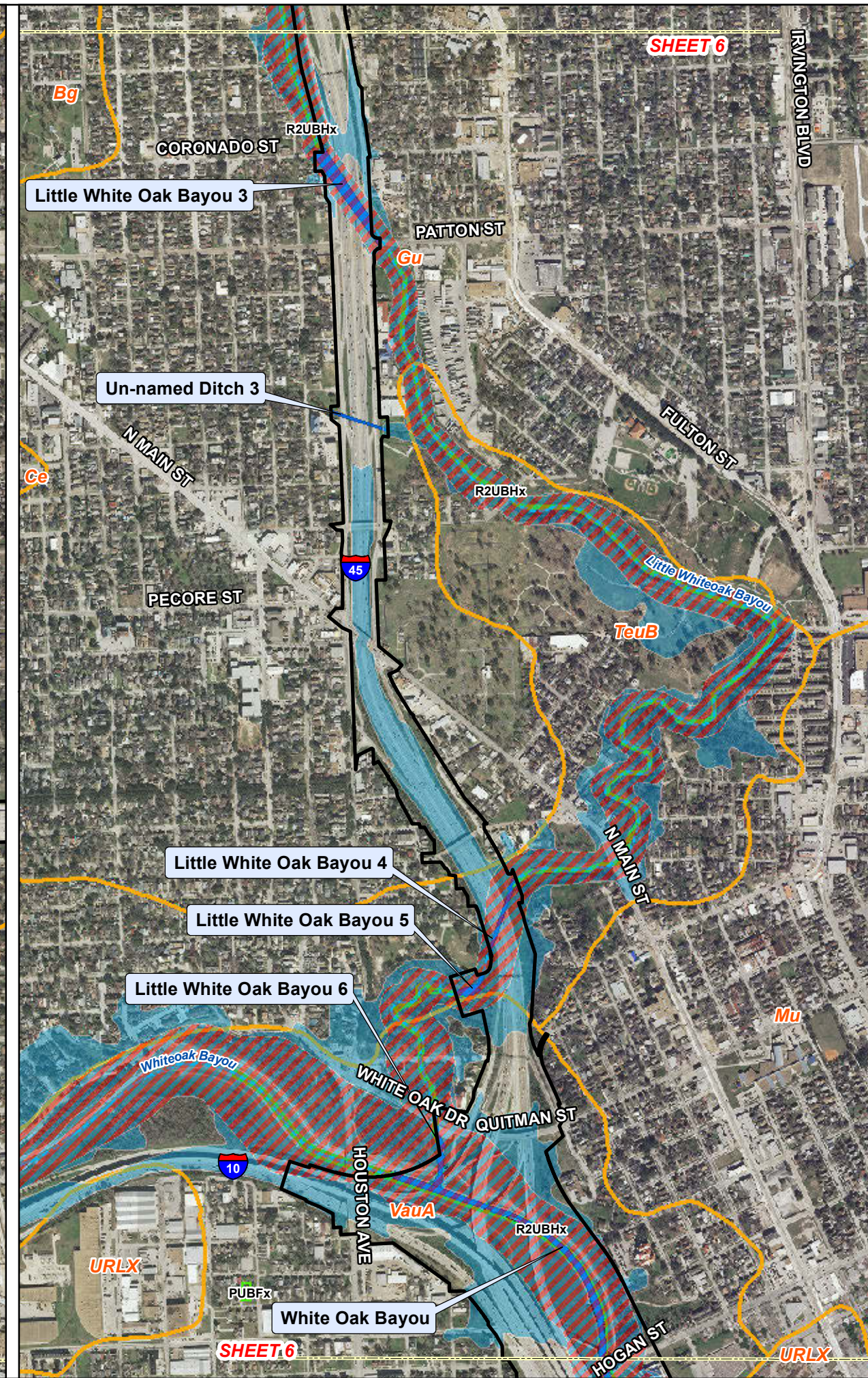
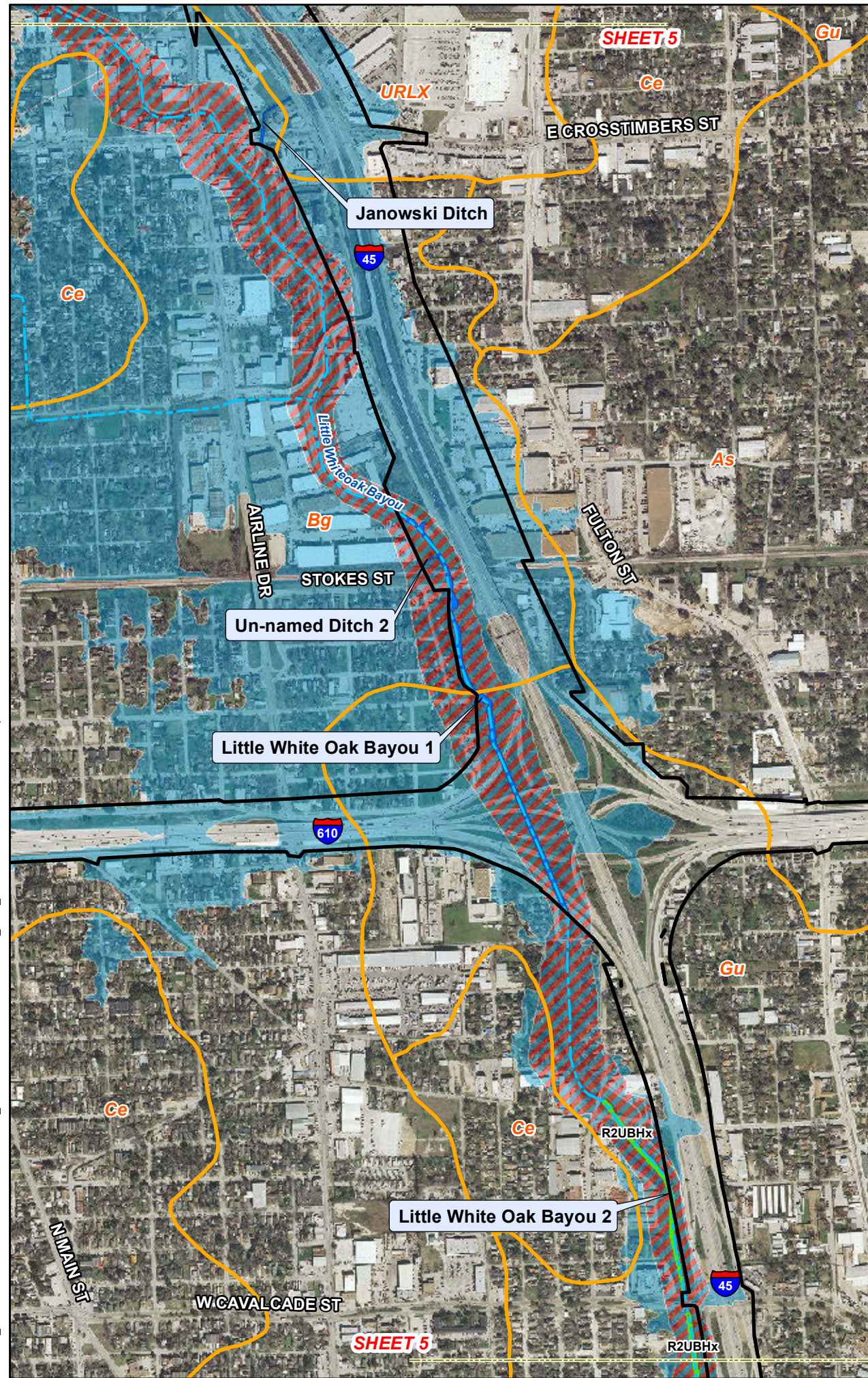
**Floodplain, NWI, and Soils**



Date: March 2017

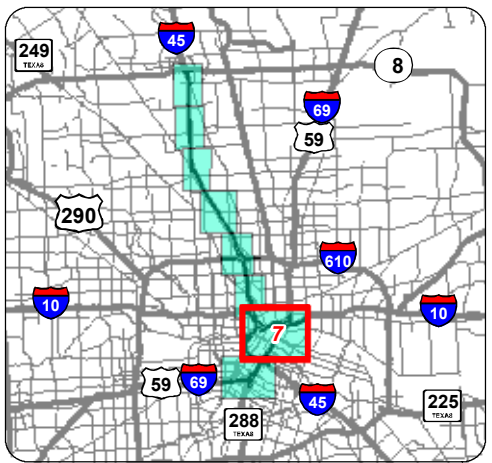
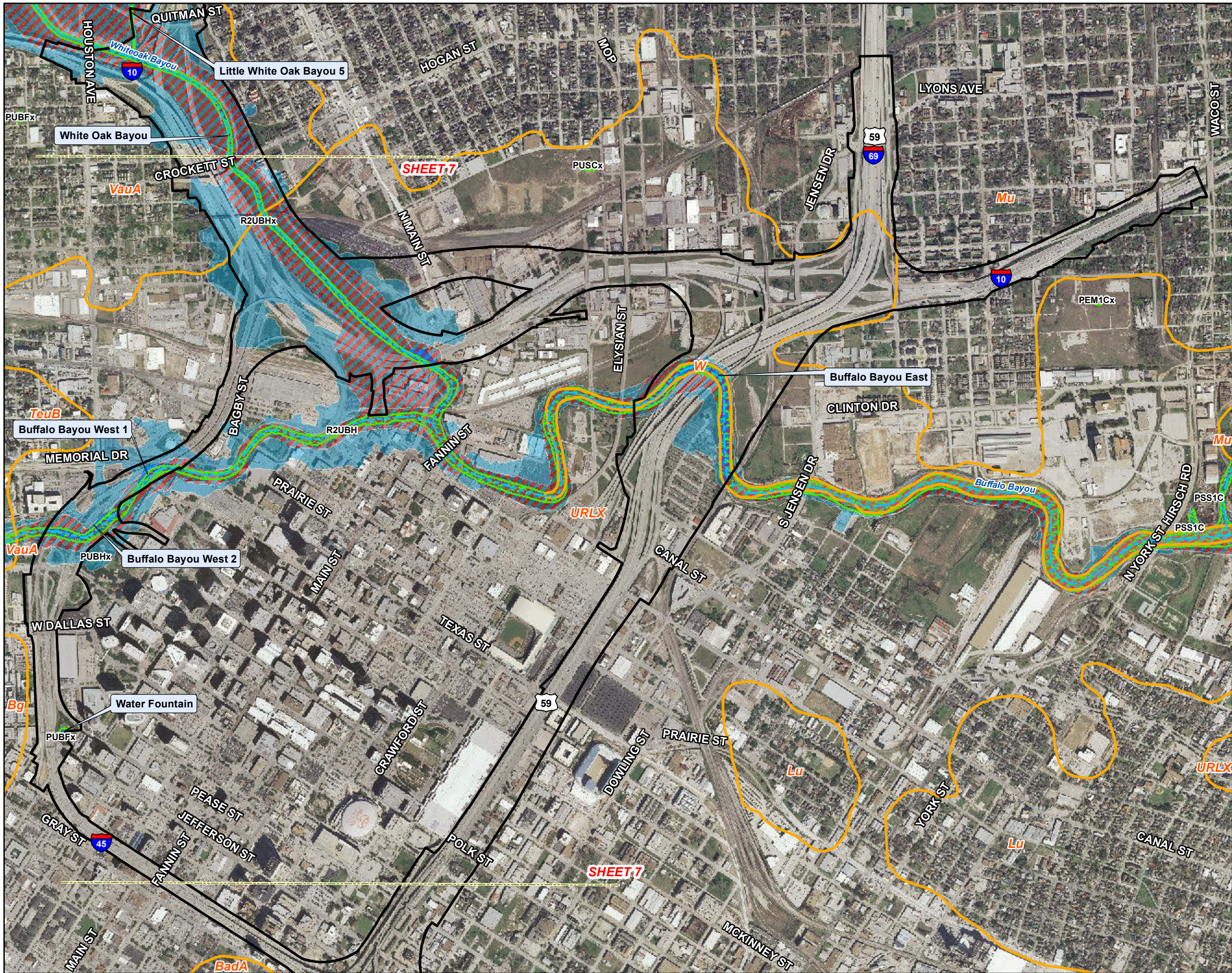
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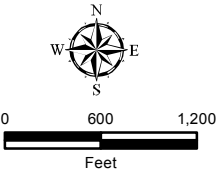
Index Map

### Legend

- Project Area
- Sheet Match Line
- NHD Streams
- Soil Boundary
- Water Bodies

### FEMA Flood Hazard Zones

- 1% Annual Exceedance Probability Flood Hazard
- Regulatory Floodway



Waters of the United States  
North Houston  
Highway Improvement Project

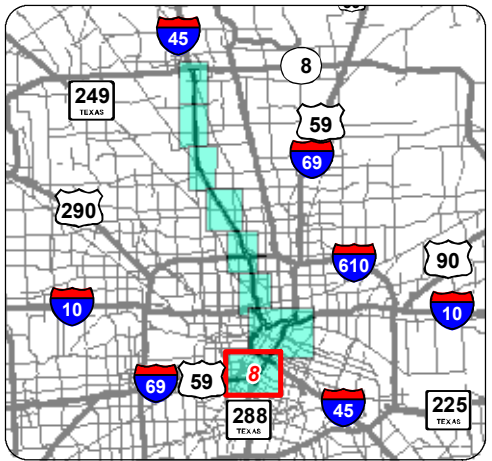
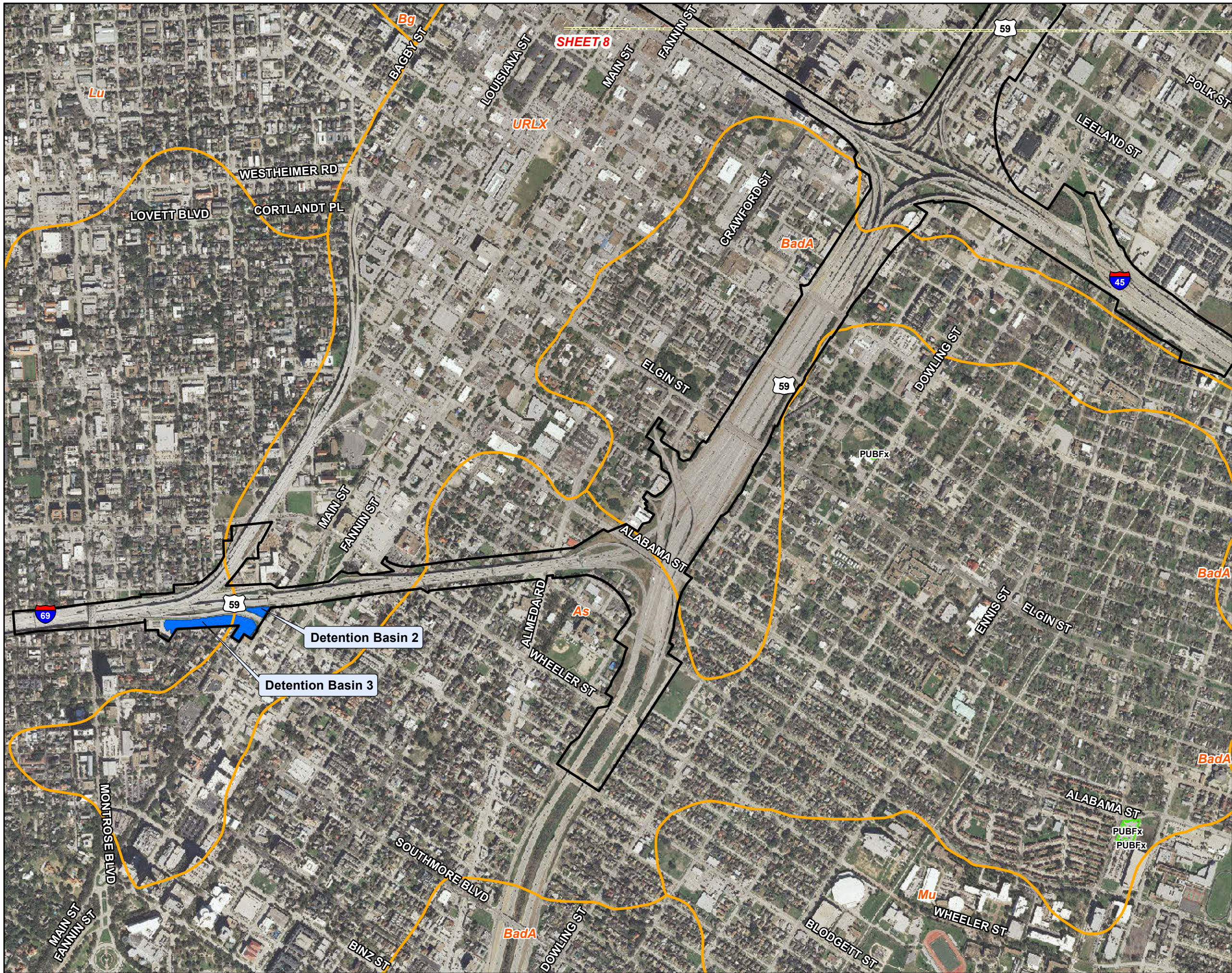
Floodplain, NWI, and Soils



Date: March 2017

Exhibit 4 - Sheet 4





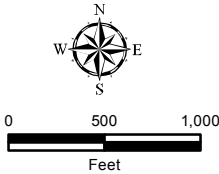
Vicinity Map

### Legend

- Project Area
- Sheet Match Line
- NHD Streams
- Soil Boundary
- Water Bodies

### FEMA Flood Hazard Zones

- 1% Annual Exceedance Probability Flood Hazard
- Regulatory Floodway

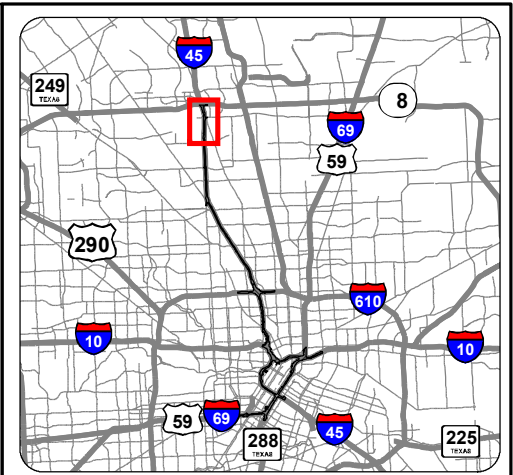
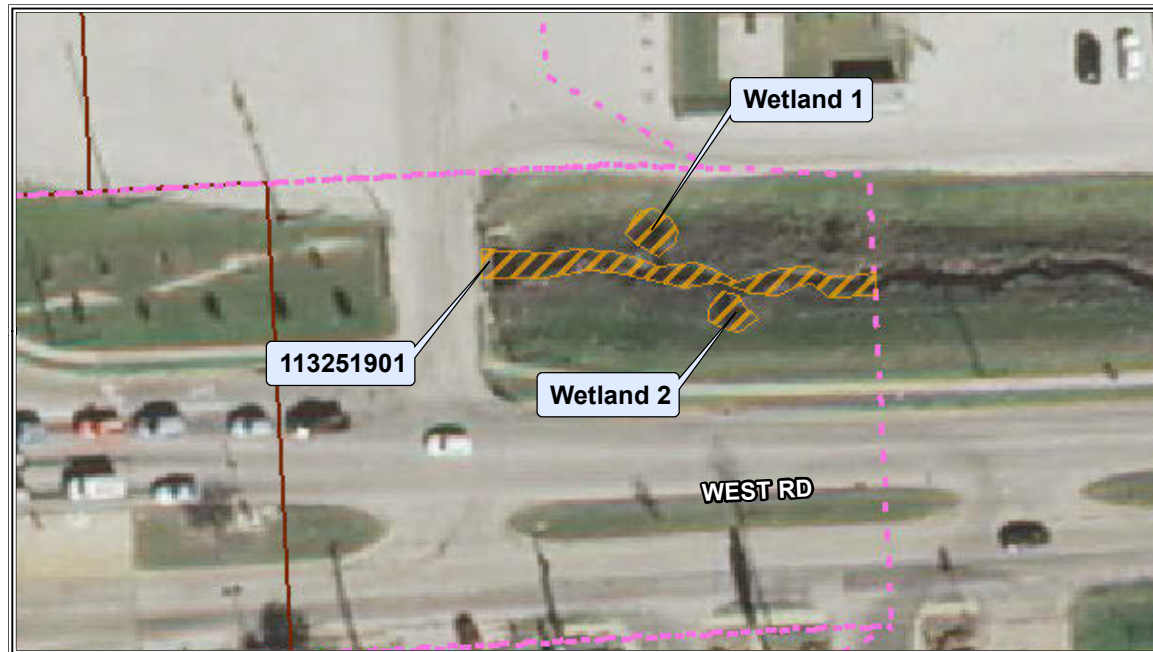
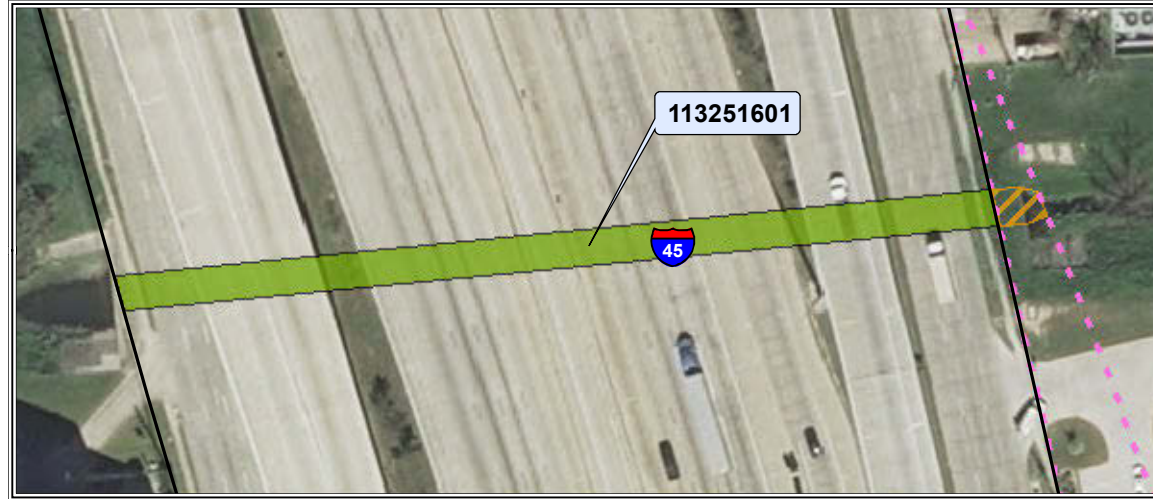
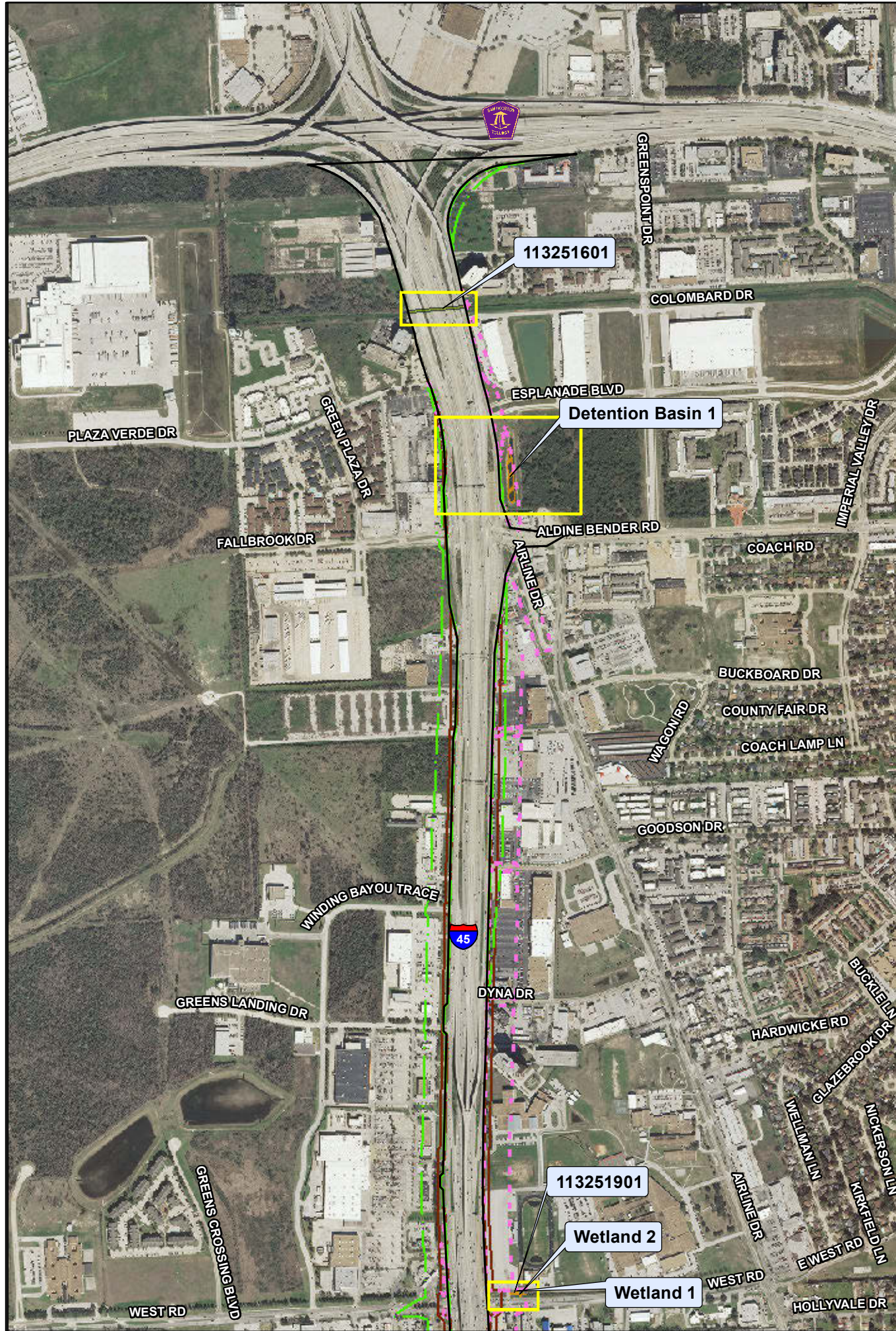


Waters of the United States  
**North Houston  
Highway Improvement Project**

**Floodplain, NWI, and Soils**







Index Map

Legend

Existing ROW

Proposed ROW Segment 1

Alternative 4

Alternative 5

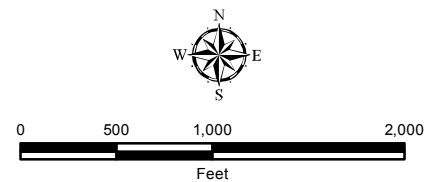
Alternative 7

Water Bodies within ROW

Segment, Alternative

Segment 1, Alternative 5

Segment 1, Existing



Waters of the United States  
North Houston  
Highway Improvement Project

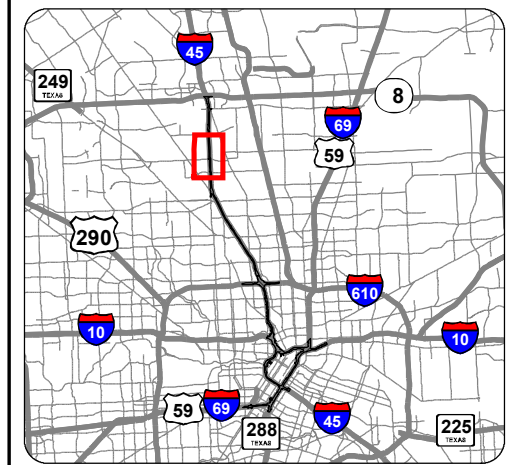
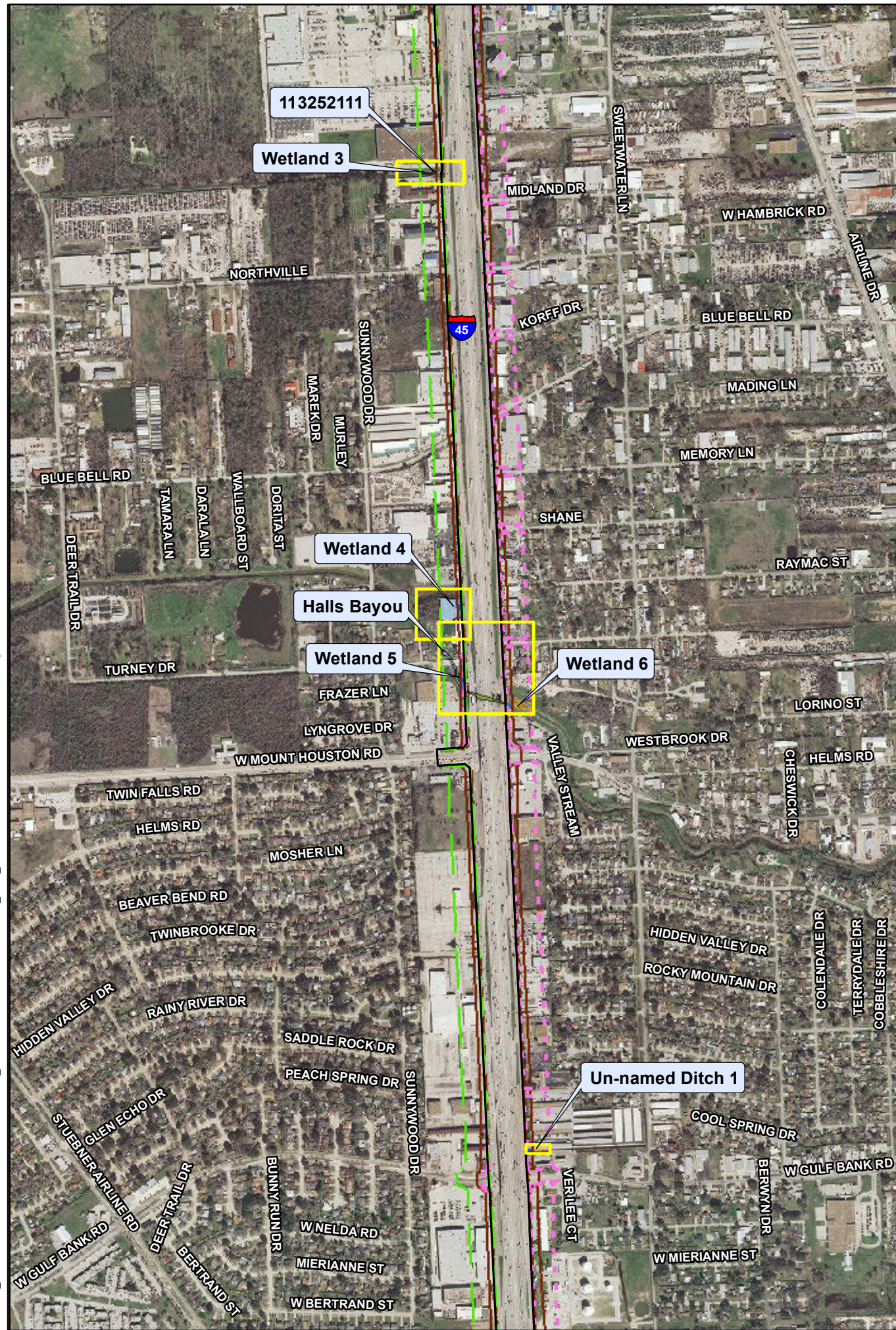
Water Bodies within  
Existing and Alternative Right-of-Way

Texas Department  
of Transportation

Date: March 2017

Exhibit 5 - Sheet 1

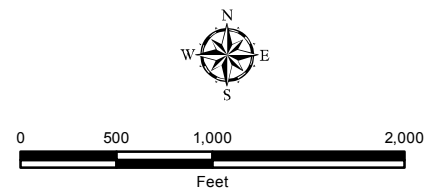




Index Map

Legend

- Existing ROW
- Proposed ROW Segment 1
  - Alternative 4
  - Alternative 5
  - Alternative 7
- Water Bodies within ROW
  - Segment, Alternative
    - Segment 1, Alternative 4
    - Segment 1, Alternative 5
    - Segment 1, Alternative 7
    - Segment 1, Existing

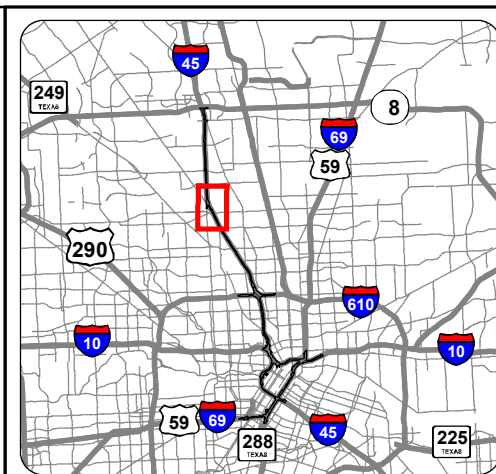
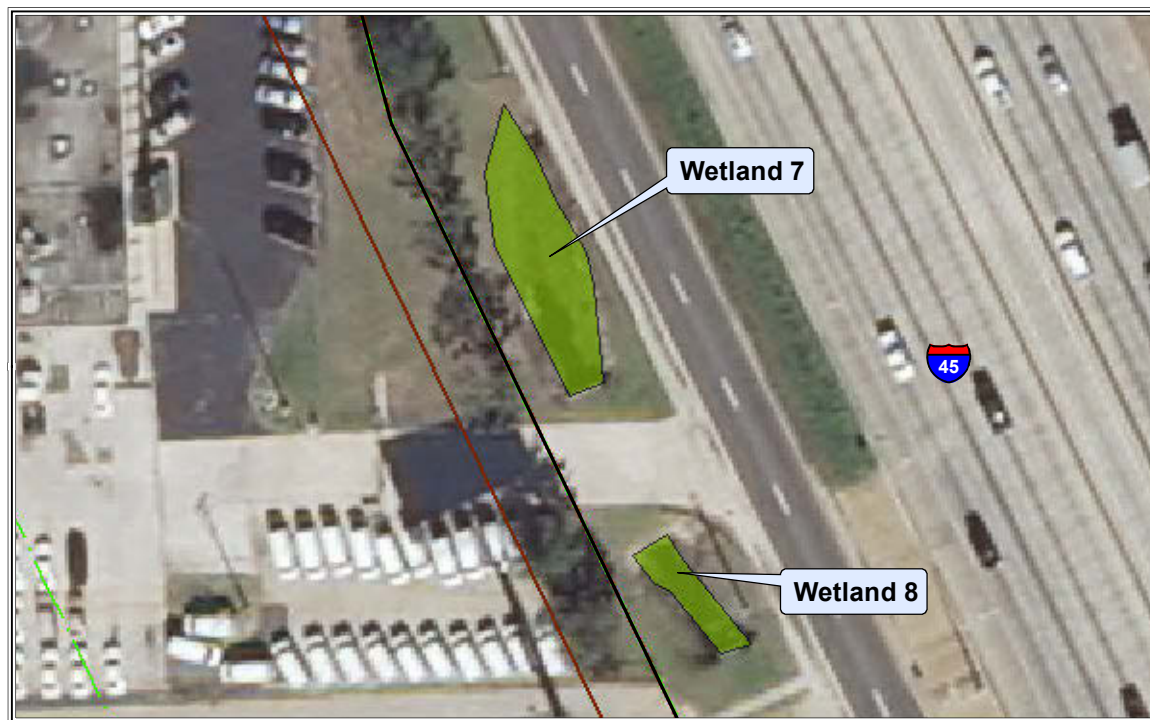
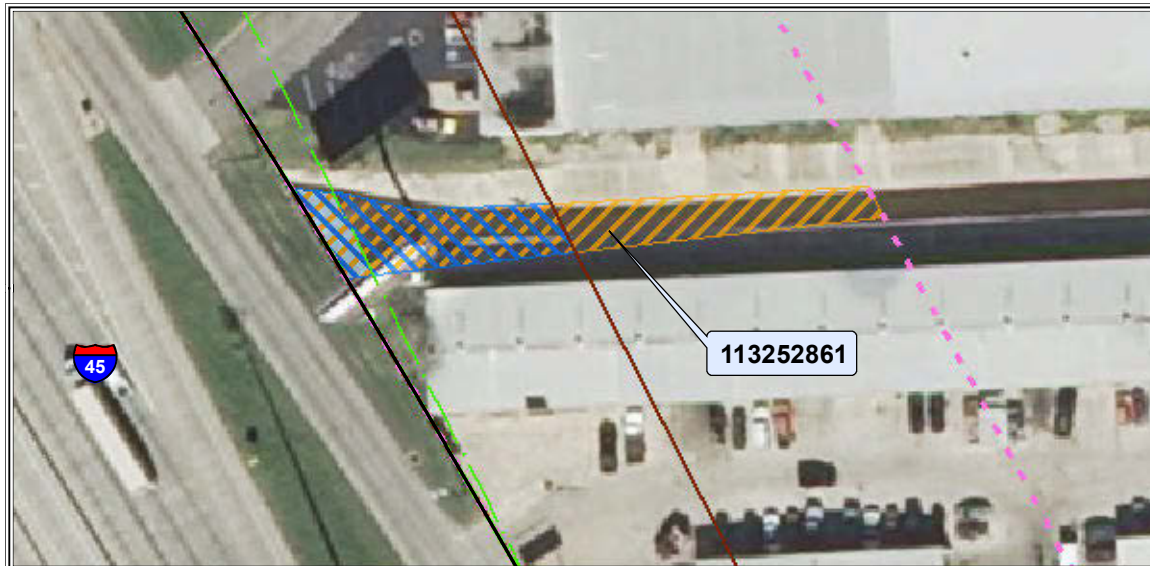
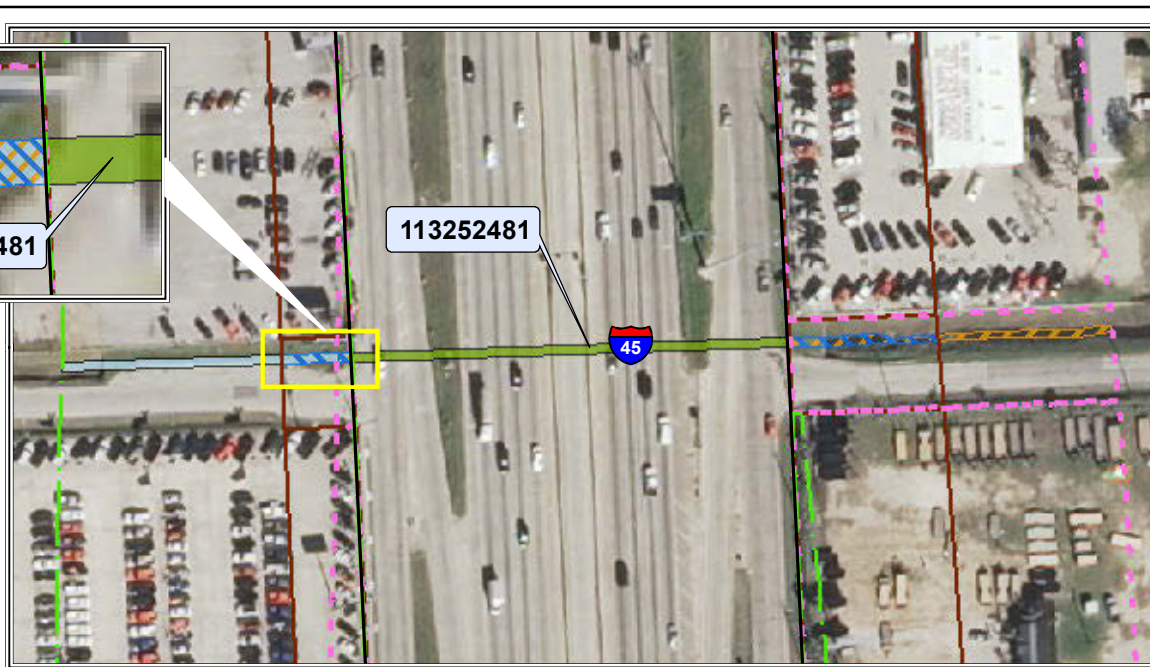


Waters of the United States  
North Houston  
Highway Improvement Project

Water Bodies within  
Existing and Alternative Right-of-Way







Index Map

Legend

Existing ROW

Proposed ROW Segment 1

Alternative 4

Alternative 5

Alternative 7

Water Bodies within ROW

Segment, Alternative

Segment 1, Alternative 4

Segment 1, Alternative 5

Segment 1, Alternative 7

Segment 1, Existing



0 500 1,000 2,000  
Feet

Waters of the United States  
North Houston  
Highway Improvement Project

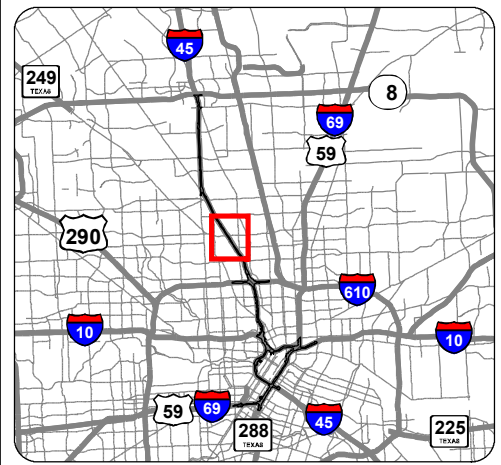
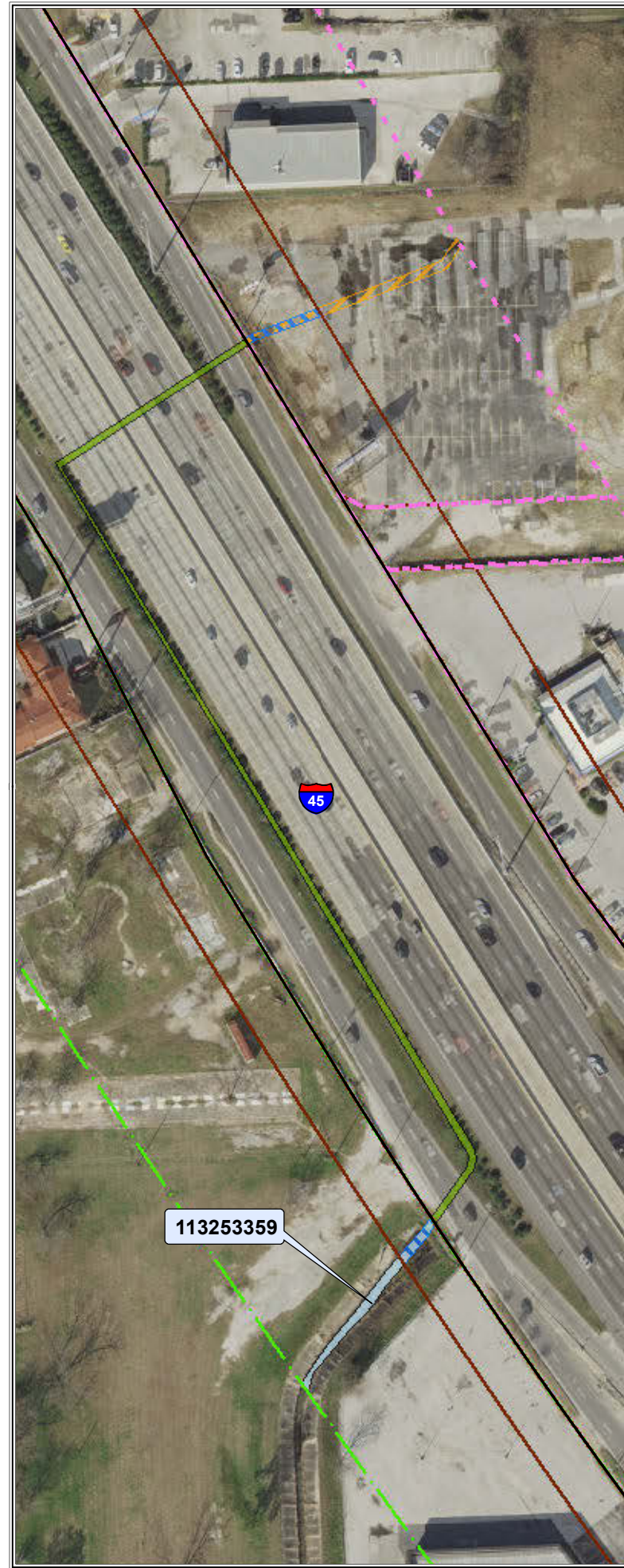
Water Bodies within  
Existing and Alternative Right-of-Way



Date: March 2017









Exhibit 5 - Sheet 3

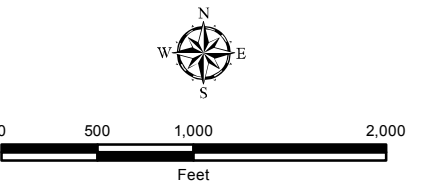




## Index Map

### Legend

-  Existing ROW
- Proposed ROW Segment 1**
-  Alternative 4
-  Alternative 5
-  Alternative 7
- Water Bodies within ROW Segment, Alternative**
-  Segment 1, Alternative 4
-  Segment 1, Alternative 5
-  Segment 1, Alternative 7
-  Segment 1, Existing



Waters of the United States  
**North Houston**  
**Highway Improvement Project**

### Water Bodies within Existing and Alternative Right-of-Way



Date: March 2017

Exhibit 5 - Sheet 4



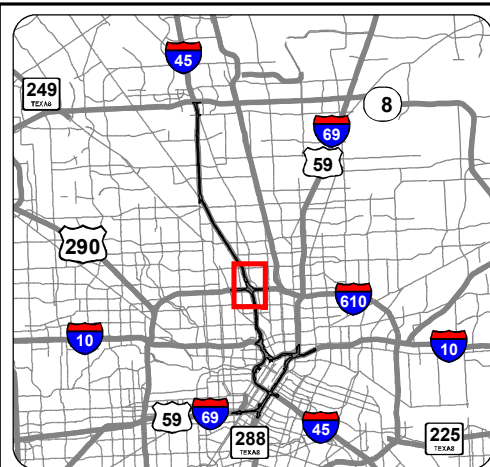
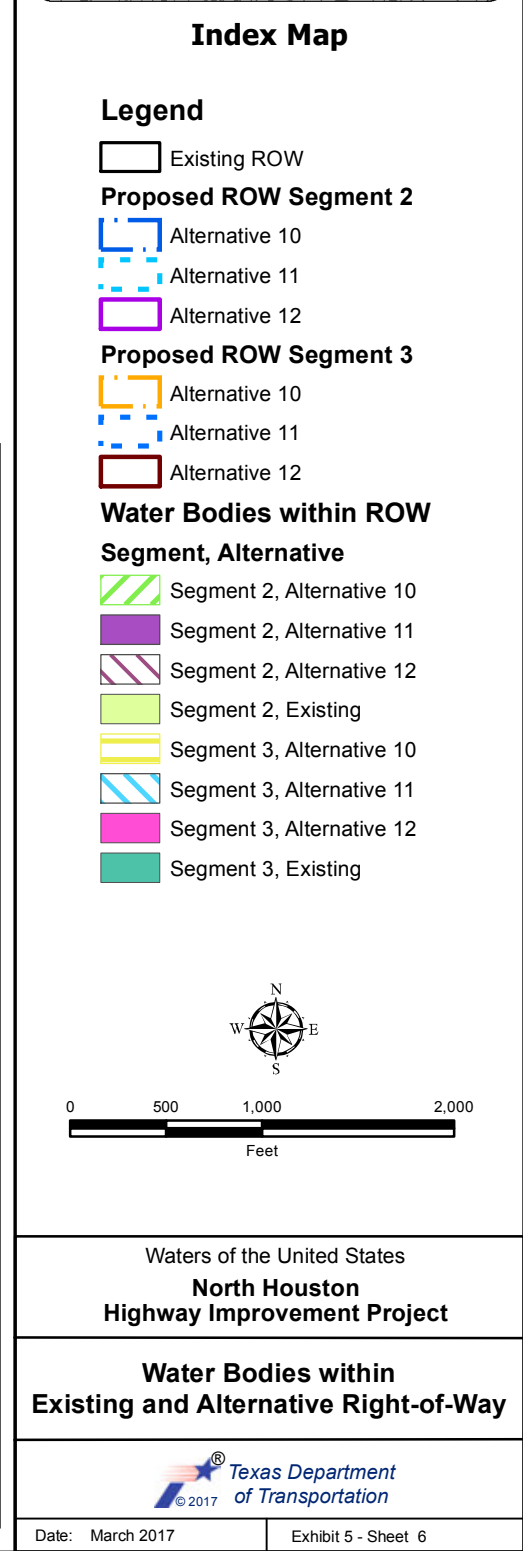


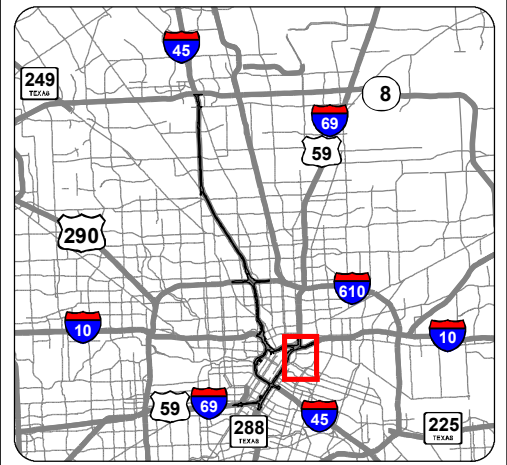
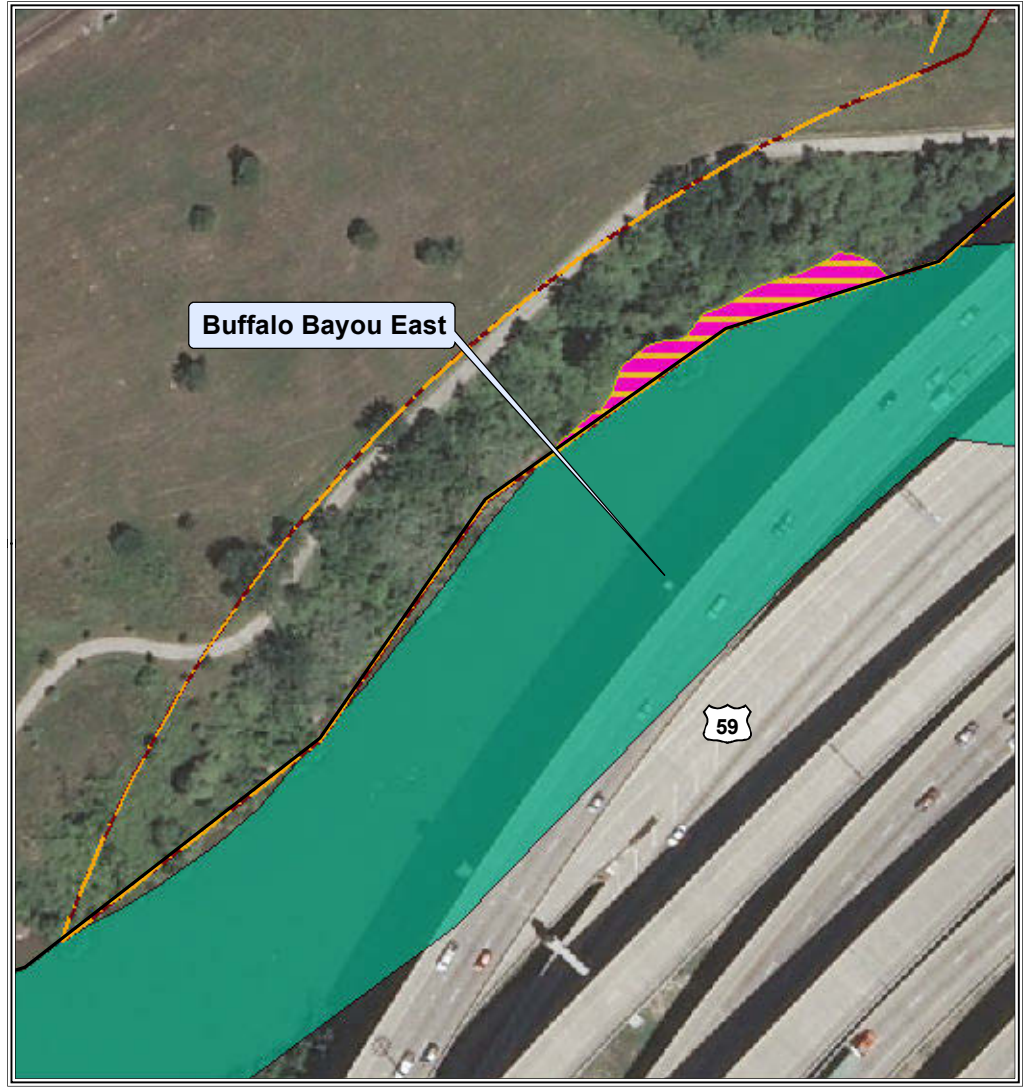
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Index Map

Legend

Existing ROW

Proposed ROW Segment 3

Alternative 10

Alternative 11

Alternative 12

Water Bodies within ROW

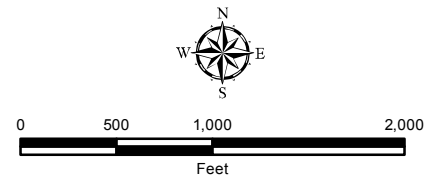
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Segment 3, Alternative 10

Segment 3, Alternative 11

Segment 3, Alternative 12

Segment 3, Existing

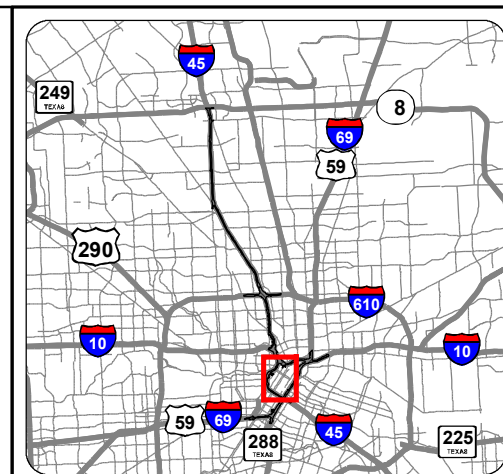
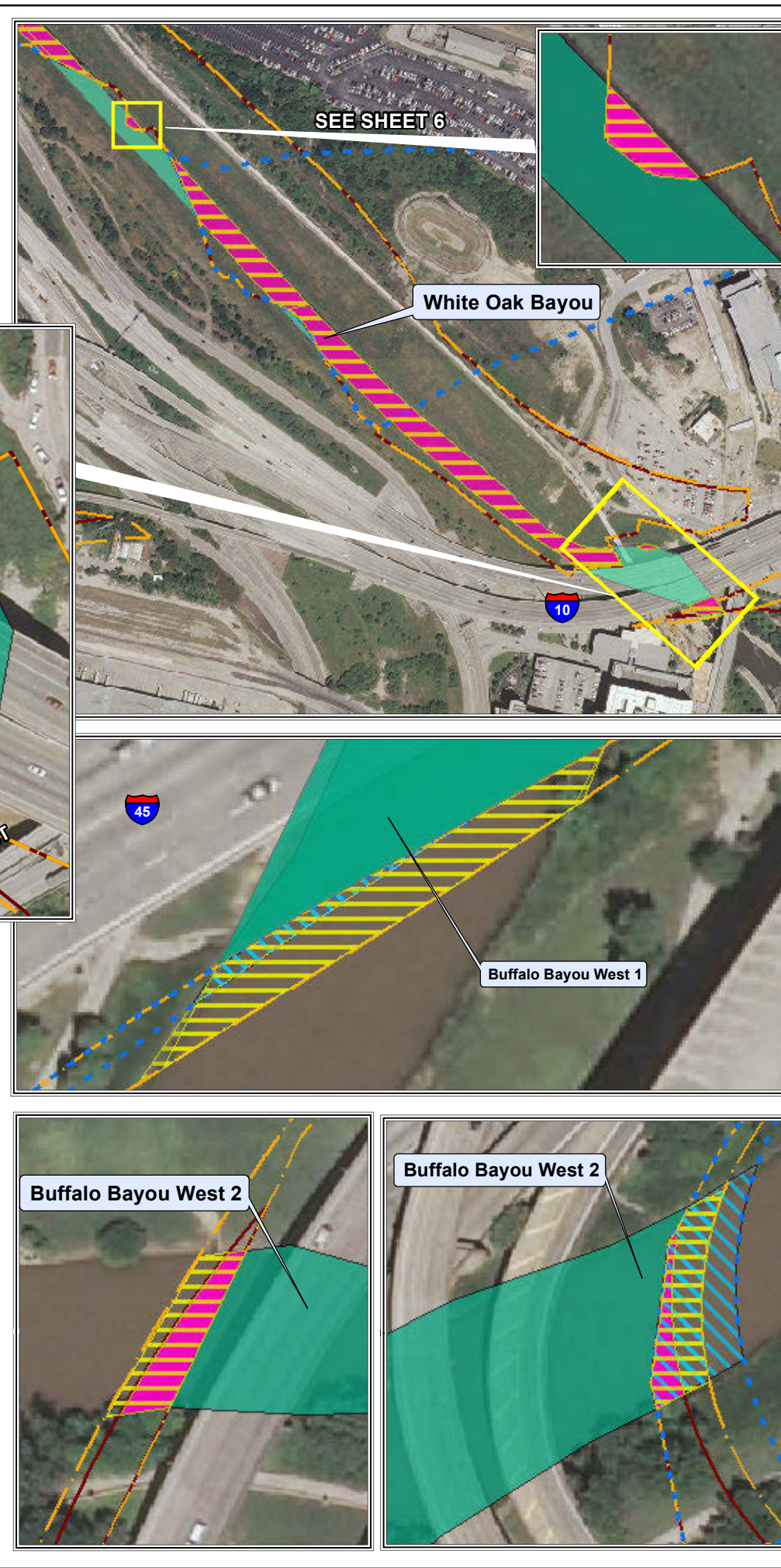
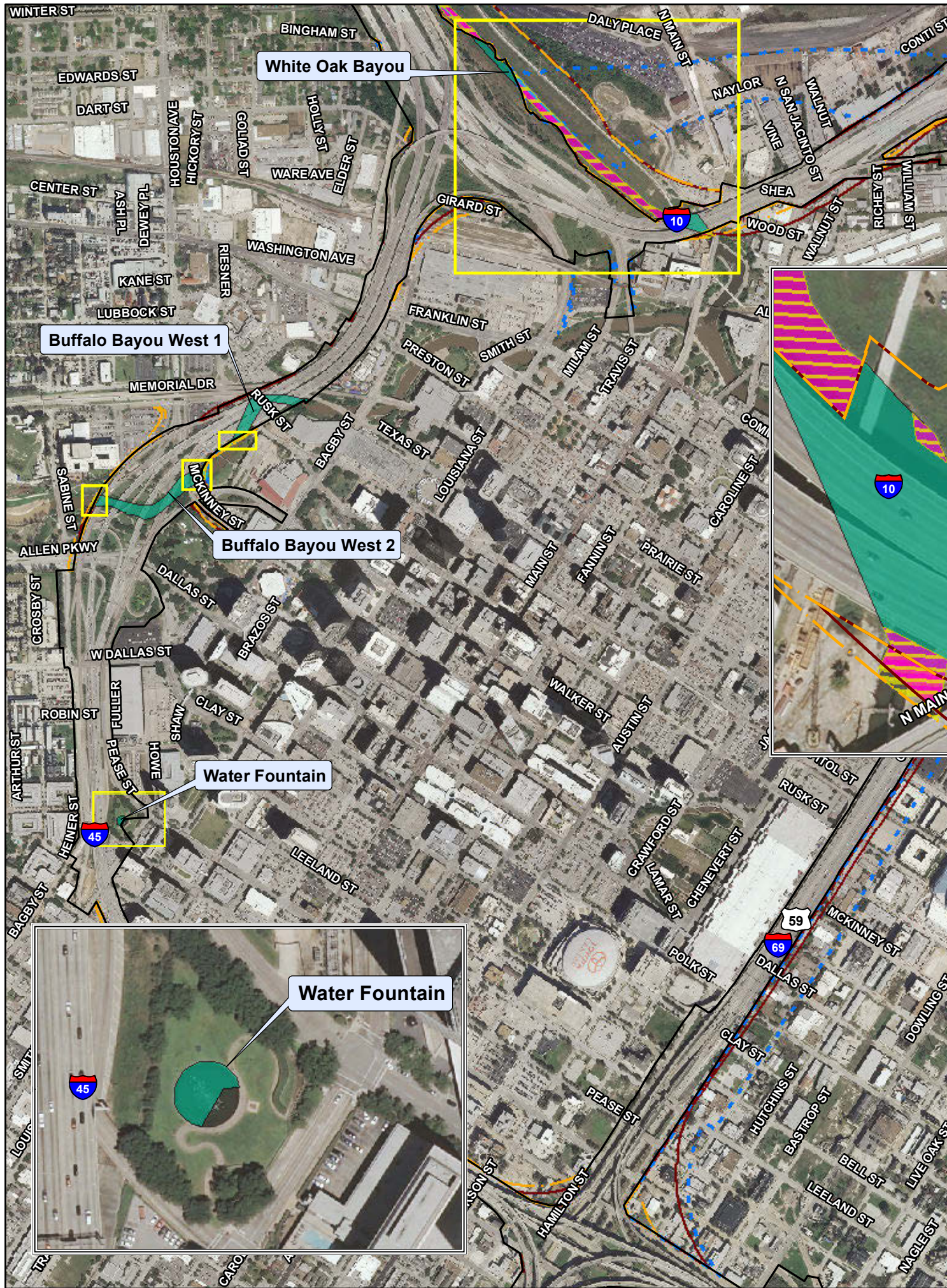


Waters of the United States  
North Houston  
Highway Improvement Project

Water Bodies within  
Existing and Alternative Right-of-Way







Index Map

Legend

Existing ROW

Proposed ROW Segment 3

Alternative 10

Alternative 11

Alternative 12

Water Bodies within ROW

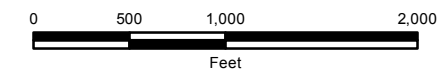
Segment, Alternative

Segment 3, Alternative 10

Segment 3, Alternative 11

Segment 3, Alternative 12

Segment 3, Existing

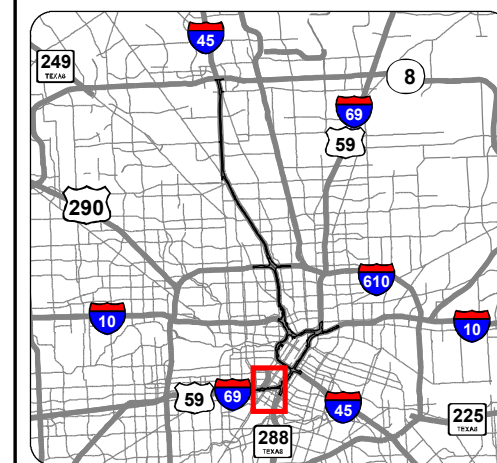
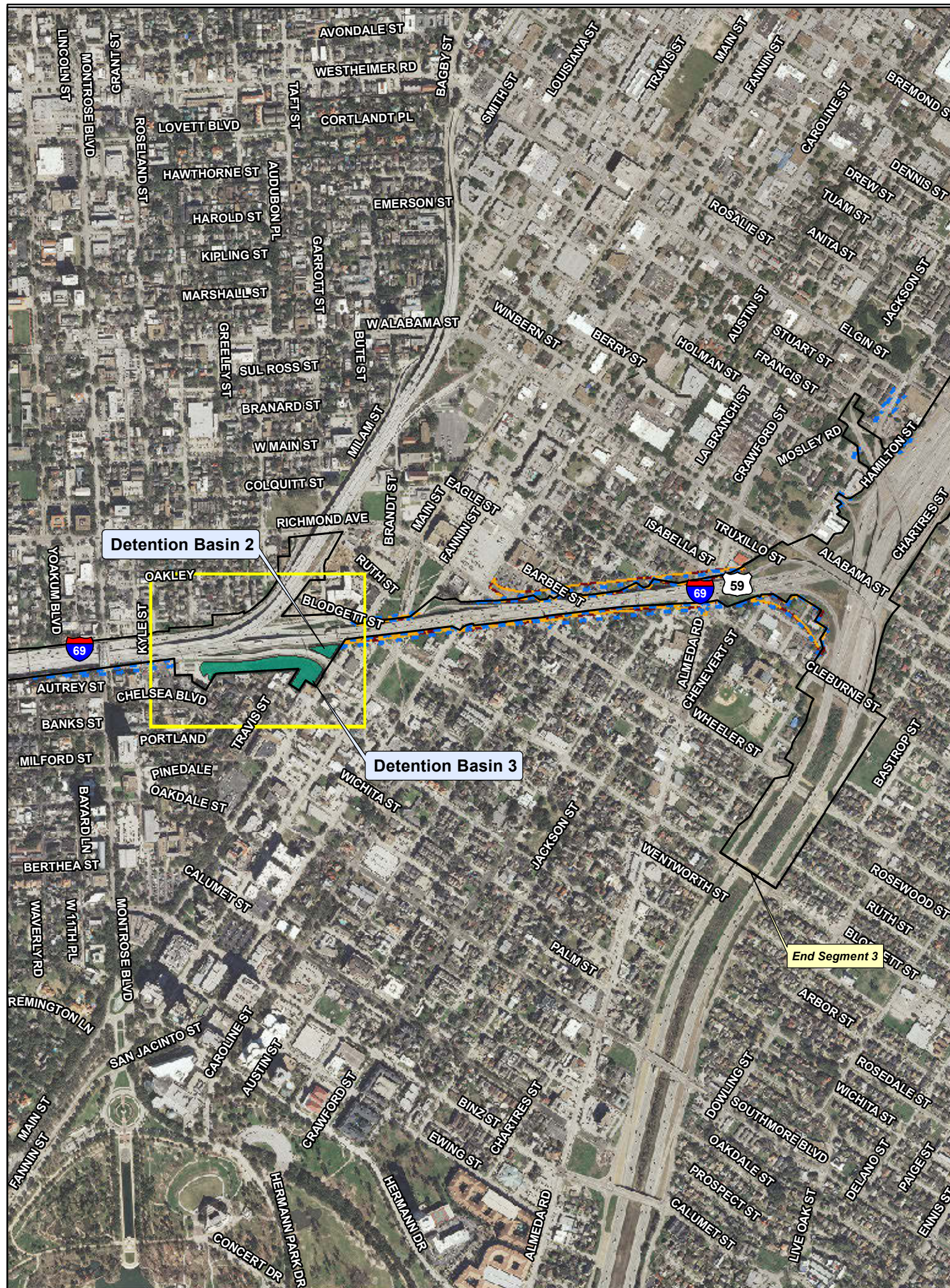


Waters of the United States  
North Houston  
Highway Improvement Project

Water Bodies within  
Existing and Alternative Right-of-Way








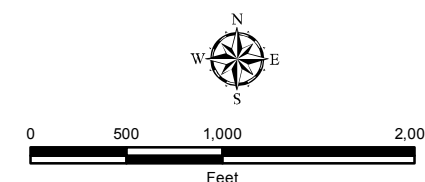




## Index Map

### Legend

-  Existing ROW
- Proposed ROW Segment 3**
-  Alternative 10
-  Alternative 11
-  Alternative 12
- Water Bodies within ROW**
- Segment, Alternative**
-  Segment 3, Existing



Waters of the United States  
**North Houston**  
**Highway Improvement Project**

### Water Bodies within Existing and Alternative Right-of-Way

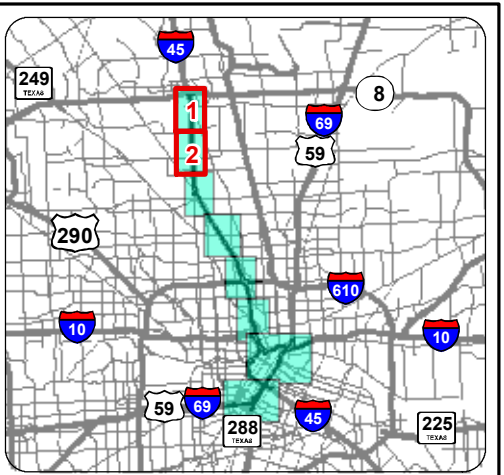
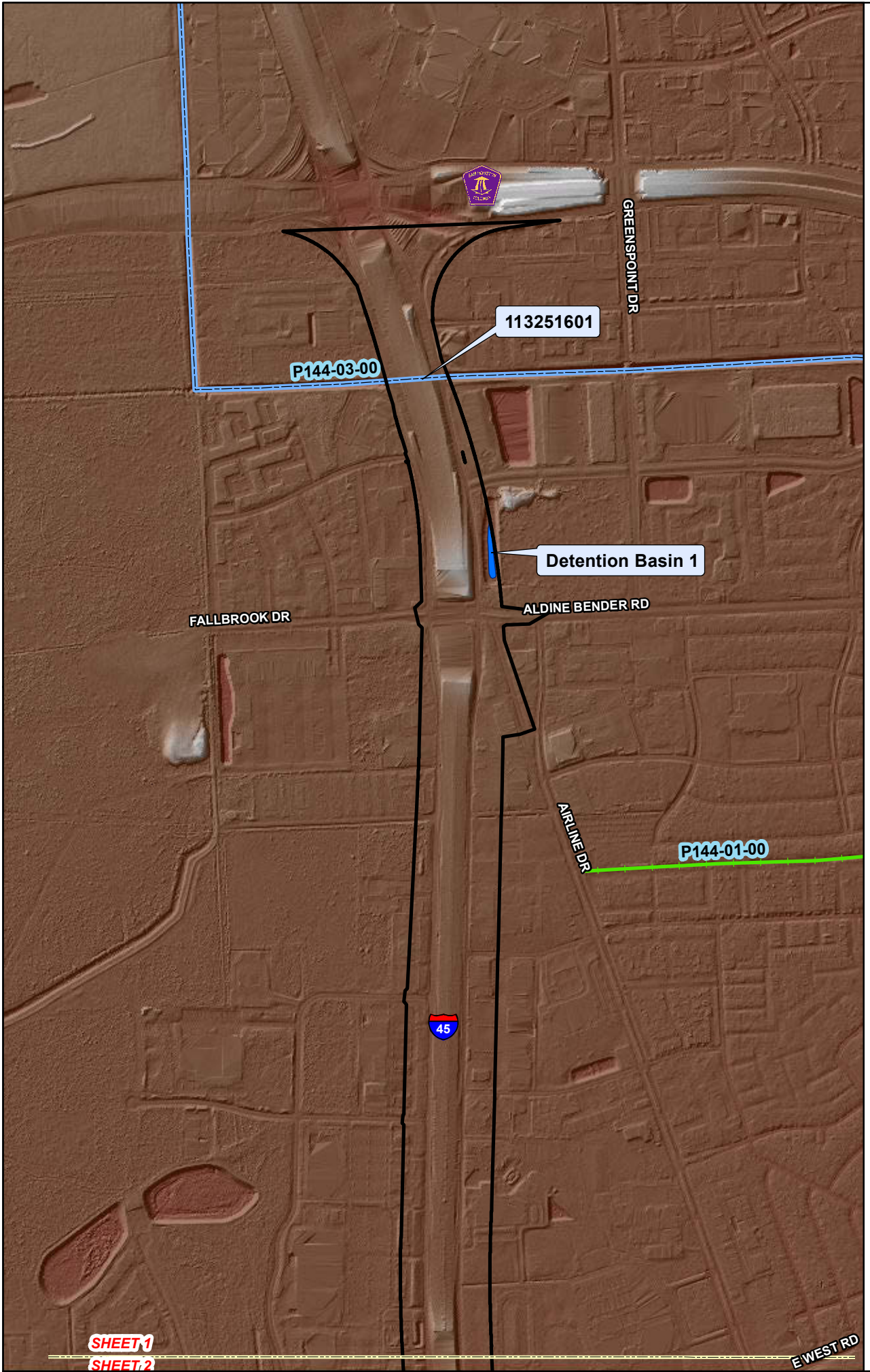


Date: March 2017

Exhibit 5 - Sheet 9



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Index Map

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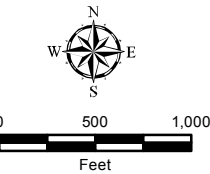
- Project Area
- Sheet Match Line
- Water Bodies

**Harris County Flood Control Drainage TYPE**

- Historical
- Open
- Storm Sewer

**Harris County Flood Control Elevation Data Value**

High : 120  
Low : 0

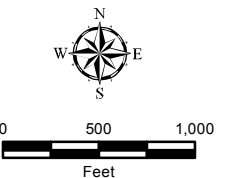
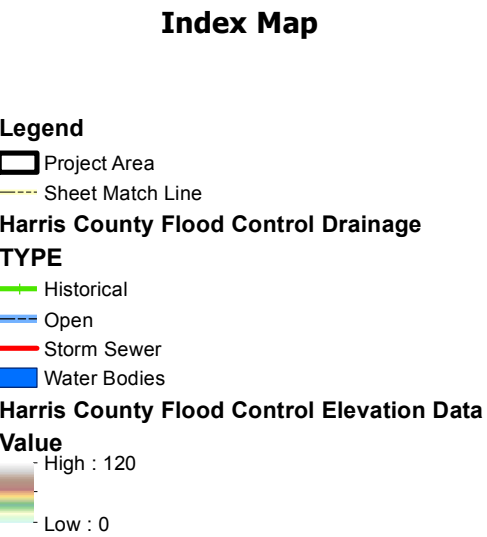
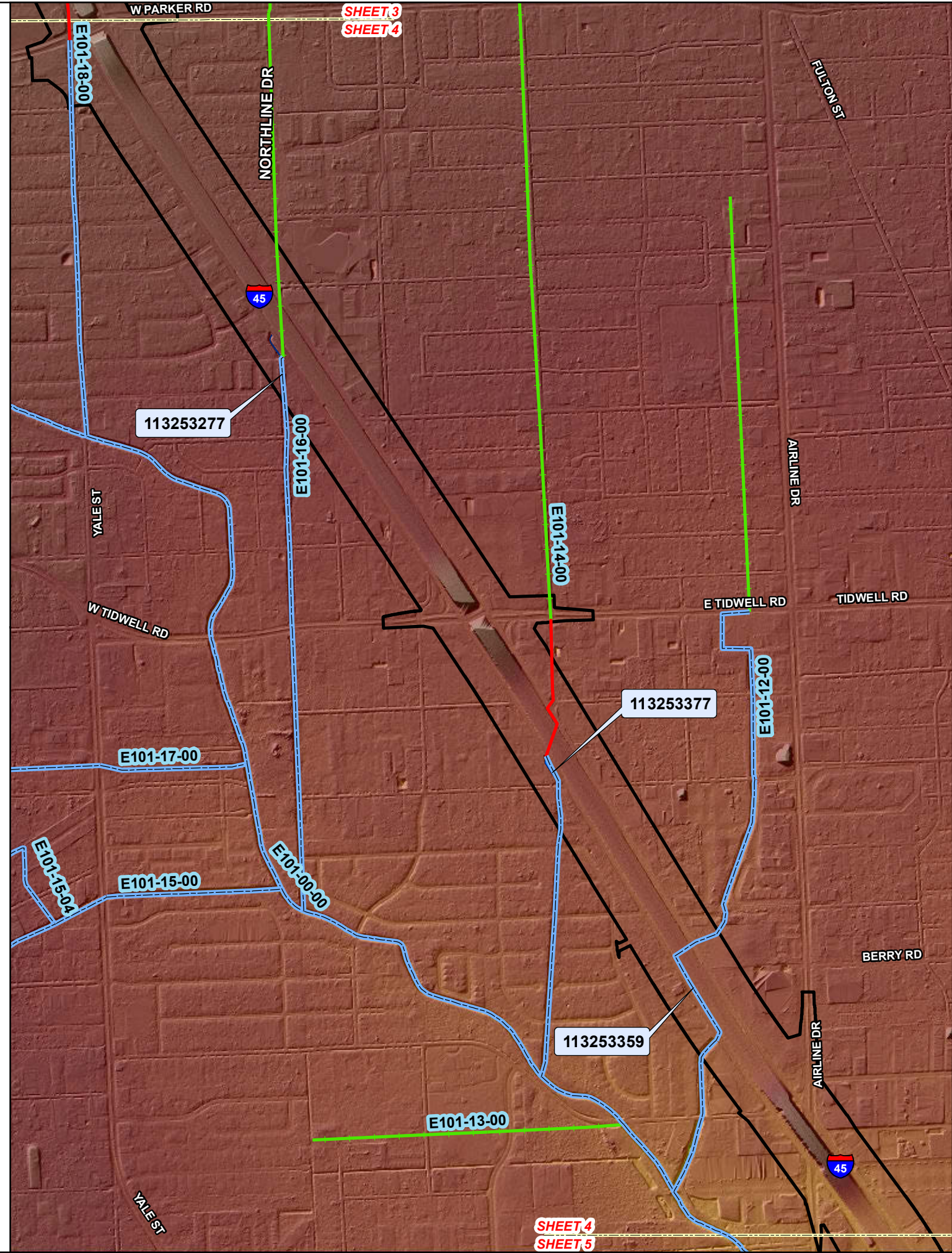


Waters of the United States  
North Houston  
Highway Improvement Project

2008 HCFCD  
Digital Elevation Model





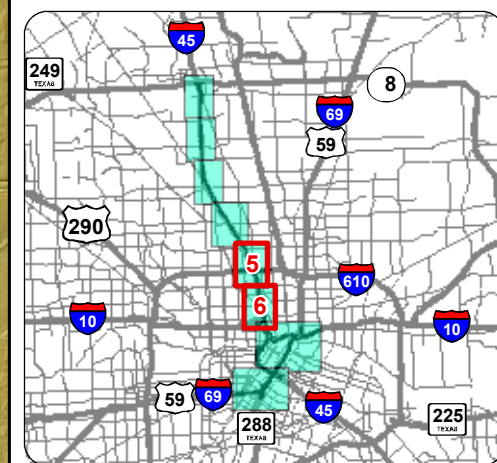
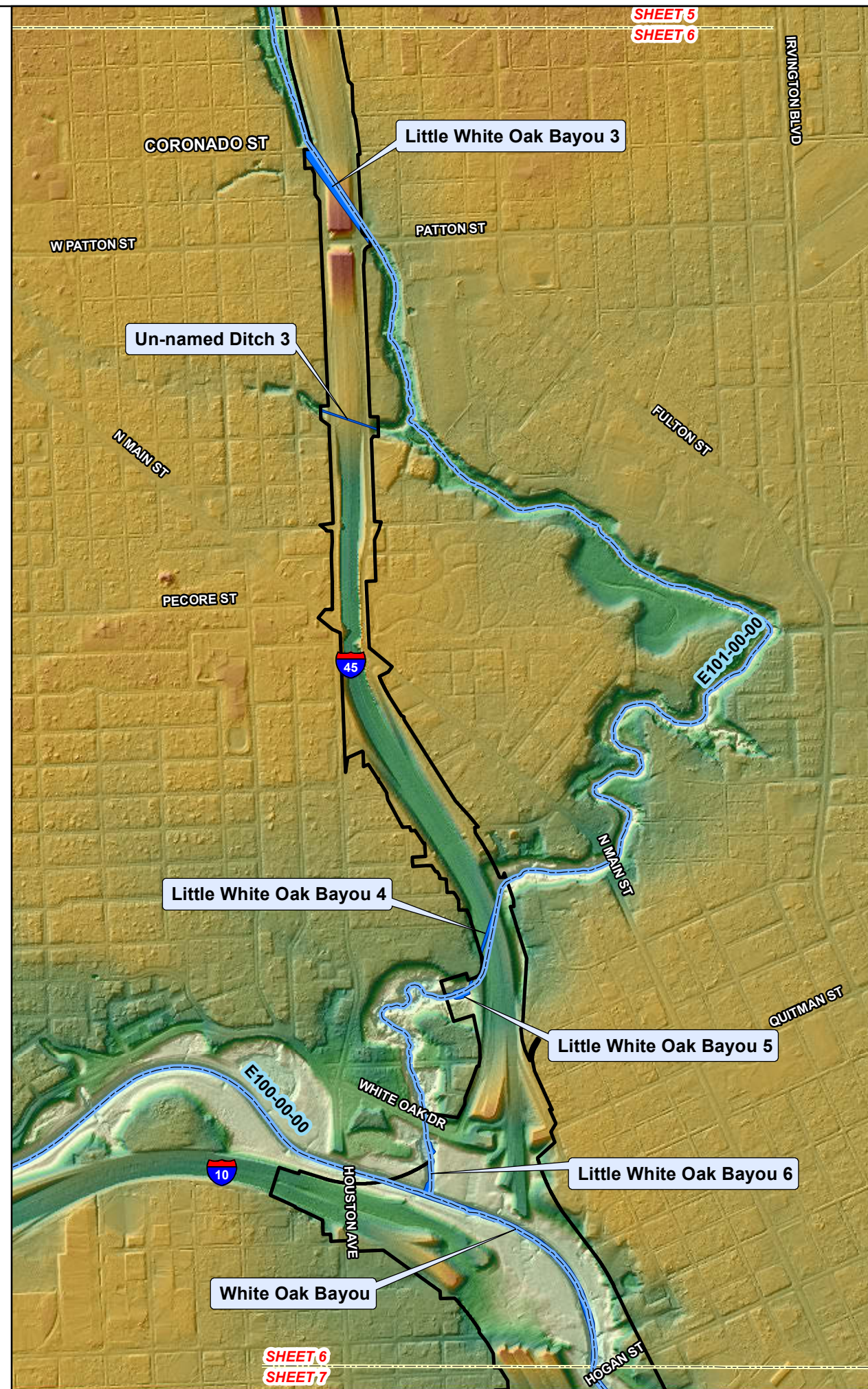
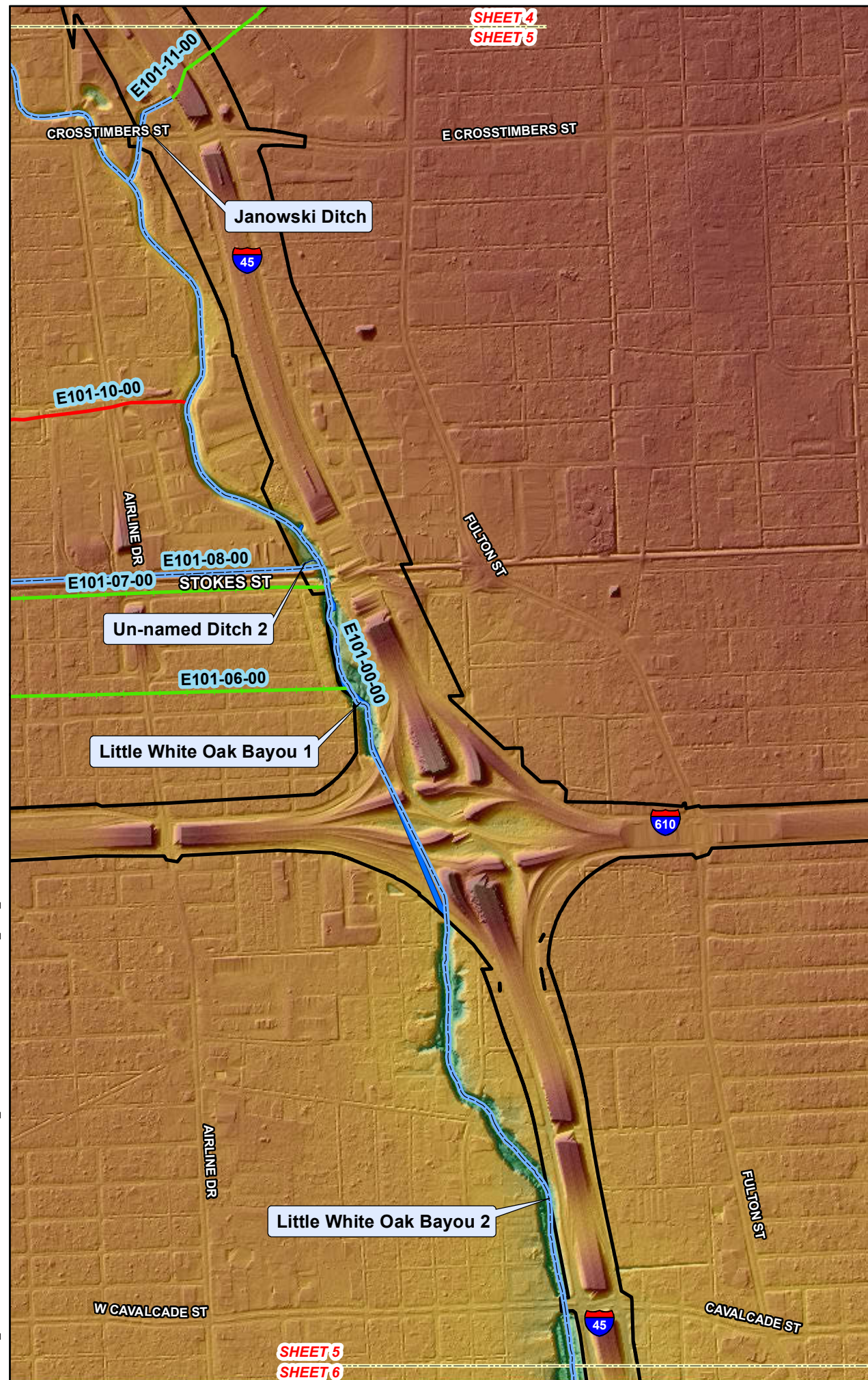


Waters of the United States  
**North Houston**  
**Highway Improvement Project**

2008 HCFC  
Digital Elevation Model

Date: March 2017





## Index Map

### Legend

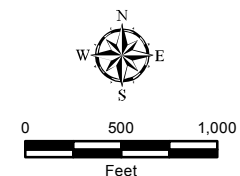
-  Project Area  
 Sheet Match Line

**Harris County Flood Control Drainage  
TYPE**

-  Historical
-  Open
-  Storm Sewer
-  Water Bodies

### Harris County Flood Control Elevation Data Value

- High : 120  
Low : 0



Waters of the United States  
**North Houston**  
**Highway Improvement Project**

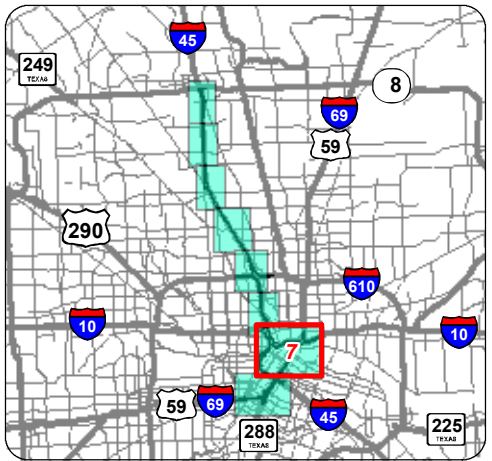
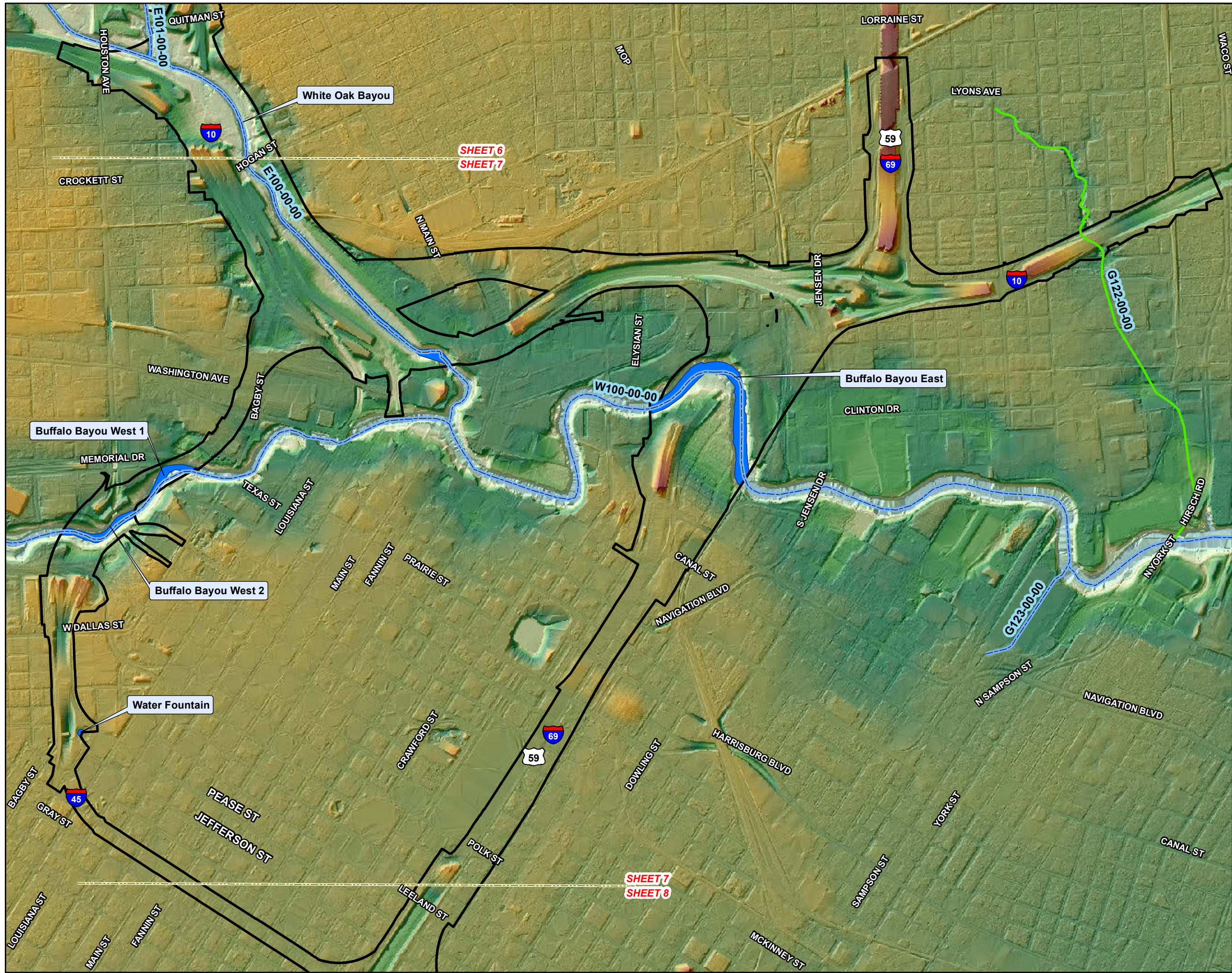
2008 HCFC  
Digital Elevation Model

Date: March 2017

Exhibit 6 - Sheet 3



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Index Map

Legend

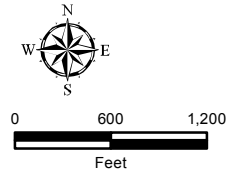
- Project Area
- Sheet Match Line

Harris County Flood Control Drainage TYPE

- Historical
- Open
- Storm Sewer
- Water Bodies

Harris County Flood Control Elevation Data Value

- High : 120
- Low : 0



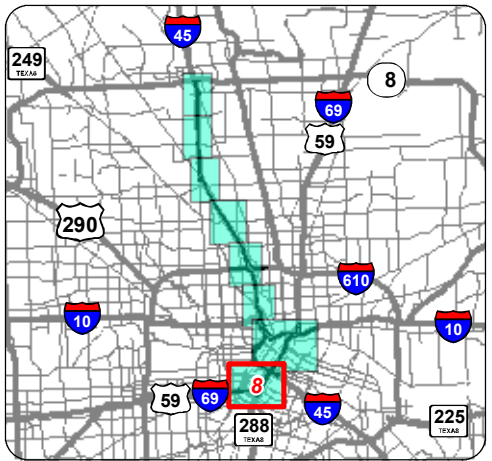
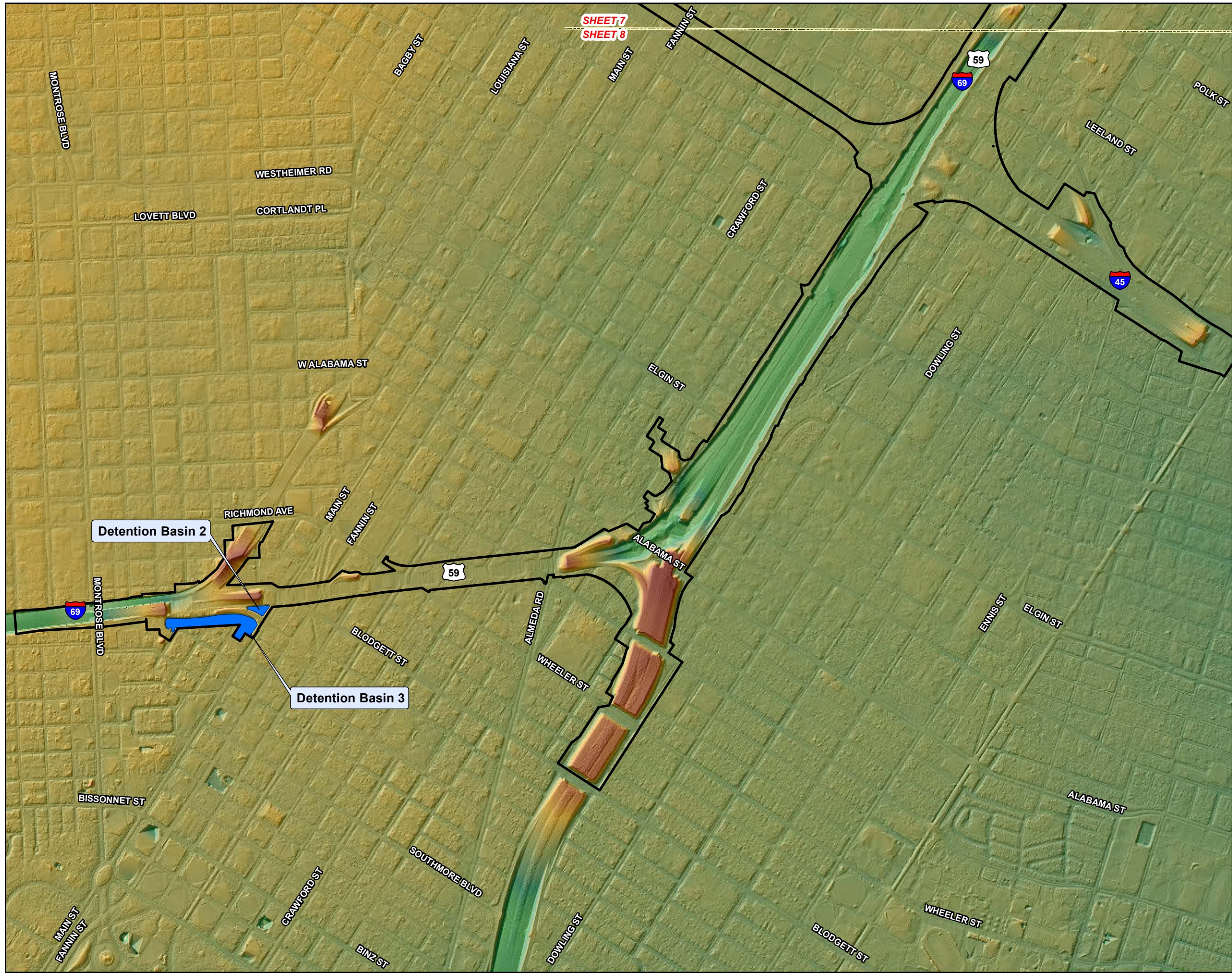
Waters of the United States  
North Houston  
Highway Improvement Project

2008 HCFCO  
Digital Elevation Model





User: rochah Printed on: 3/13/2017  
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Index Map

**Legend**

- Project Area
- Sheet Match Line

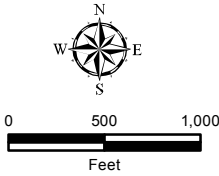
**Harris County Flood Control Drainage TYPE**

- Historical
- Open
- Storm Sewer
- Water Bodies

**Harris County Flood Control Elevation Data Value**

High : 120

Low : 0





# **Appendix A**

## Site Photographs





Photo 1 - Looking west at culverts of Drainage Ditch 113251601 at eastern boundary of ROW, October 15, 2015



Photo 2 - Looking north at Detention Basin 1, October 15, 2015



Photo 3 - Looking east along I-45 eastern ROW at Drainage Ditch 113251901, October 15, 2015



Photo 4 - Looking west at Drainage Ditch 113252111, October 15, 2015



Photo 5 - Looking west within Wetland 4, October 15, 2015

Waters of the United States  
**North Houston**  
Highway Improvement Project

## Site Photographs



Date: March 2017

Appendix A Exhibit: 1





Photo 6 - Looking south at Halls Bayou west of existing I-45 frontage road, October 15, 2015



Photo 7 - Looking west at Halls Bayou, October 15, 2015



Photo 8 - Looking east at Un-named Ditch 1 (concrete lined), October 15, 2015



Photo 9 - Looking west at Drainage Ditch 113252481 (grass-lined), October 15, 2015



Photo 10 - Looking west at Drainage Ditch 113252481 west of existing I-45 frontage road, October 15, 2015

Waters of the United States  
**North Houston**  
Highway Improvement Project

### Site Photographs



Date: March 2017

Appendix A Exhibit: 2





Photo 11 - Looking west at Drainage Ditch 113252861 (concrete lined), October 15, 2015



Photo 12 - Looking south at Wetland 7 (culverts and sediment deposits in channel), October 15, 2015



Photo 13 - Looking north at Wetland 8 (culverts and wetland vegetation), October 15, 2015



Photo 14 - Looking southeast at Drainage Ditch 113253277, October 15, 2015



Photo 15 - Looking northwest at Drainage Ditch 113253377 from East Burrell Street, (grass-lined channel), October 15, 2015

Waters of the United States  
**North Houston**  
Highway Improvement Project

**Site Photographs**



Date: March 2017

Appendix A Exhibit: 3





Photo 16 - Looking southwest at Drainage Ditch 113253359 from I-45 frontage road outfall (concrete lined), October 15, 2015



Photo 17 - Looking east at Janowski Ditch (riprap in channel bottom), October 15, 2015



Photo 18 - Looking south from Stokes Road bridge at Little White Oak Bayou 1, October 15, 2015



Photo 19 - Looking south at Little White Oak Bayou 2, October 15, 2015



Photo 20 - Looking west at outfall of Un-named Ditch 3, October 15, 2015

Waters of the United States  
**North Houston**  
Highway Improvement Project

**Site Photographs**



Date: March 2017

Appendix A Exhibit: 4





Photo 21 - Looking west at Little White Oak Bayou 4 from outfall west of I-45 frontage road, October 15, 2015



Photo 22 - Looking south at Little White Oak Bayou 5 from White Oak Drive bridge, October 15, 2015



Photo 23 - Looking east at White Oak Bayou upstream of the confluence with Little White Oak Bayou 1 (concrete lined), October 15, 2015



Photo 24 - Looking north from Bicycle Path bridge at White Oak Bayou (concrete lined channel to banks lined with riprap), October 21, 2015



Photo 25 - Looking southeast at I-10 crossing of White Oak Bayou (riprap along banks), October 21, 2015

Waters of the United States  
**North Houston**  
Highway Improvement Project

**Site Photographs**



Date: March 2017

Appendix A Exhibit: 5





Photo 26 - Looking northwest at I-10 crossing of White Oak Bayou, October 21, 2015



Photo 27 - Looking east at I-45 crossing of Buffalo Bayou West 2 from Sabine Street bridge, October 21, 2015



Photo 28 - Looking southwest from pedestrian bridge at I-45 crossing of Buffalo Bayou West 2, October 21, 2015



Photo 29 - Looking northeast from pedestrian bridge at I-45 Crossing of Buffalo Bayou West 1, October 21, 2015



Photo 30 - Looking east at I-45 crossing of Buffalo Bayou West 1 near Rusk Street and Memorial Drive intersection, October 21, 2015

Waters of the United States  
**North Houston**  
Highway Improvement Project

**Site Photographs**



Date: March 2017

Appendix A Exhibit: 6





Photo 31 - Looking north at Buffalo Bayou East near US 59/I-69 bridges, October 15, 2015



Photo 32 - Looking northeast at Buffalo Bayou East underneath US 59/I-69 bridges, October 15, 2015



Photo 33 - Looking north at Buffalo Bayou East underneath US 59/I-69 bridges, October 15, 2015



Photo 34 - Looking northeast at water fountain, October 15, 2015



Photo 35 - Looking northwest at Detention Basin 2 from Main Street, October 15, 2015

Waters on the United States  
**North Houston**  
Highway Improvement Project

**Site Photographs**



Date: March 2017

Appendix A Exhibit: 7



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