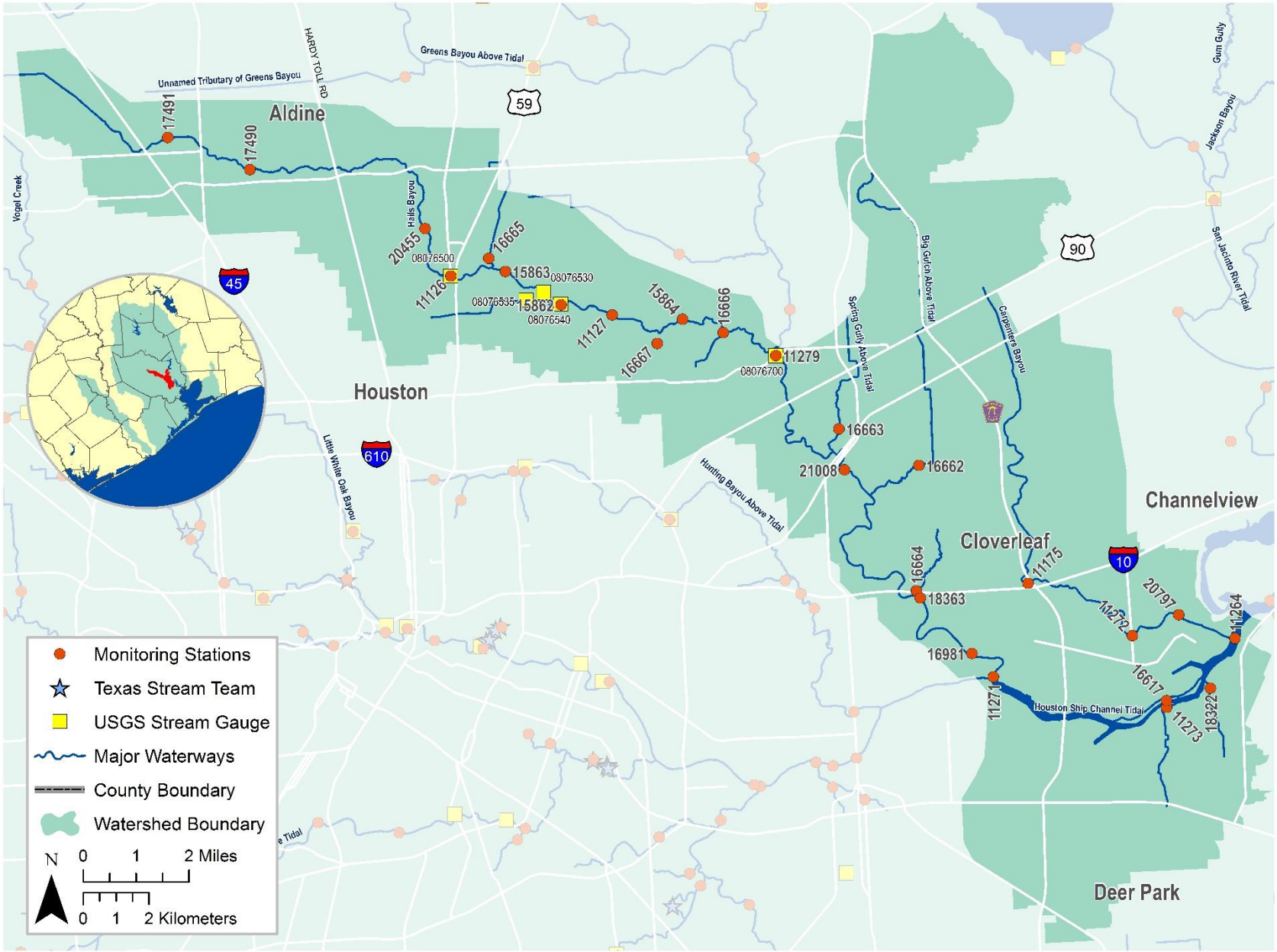
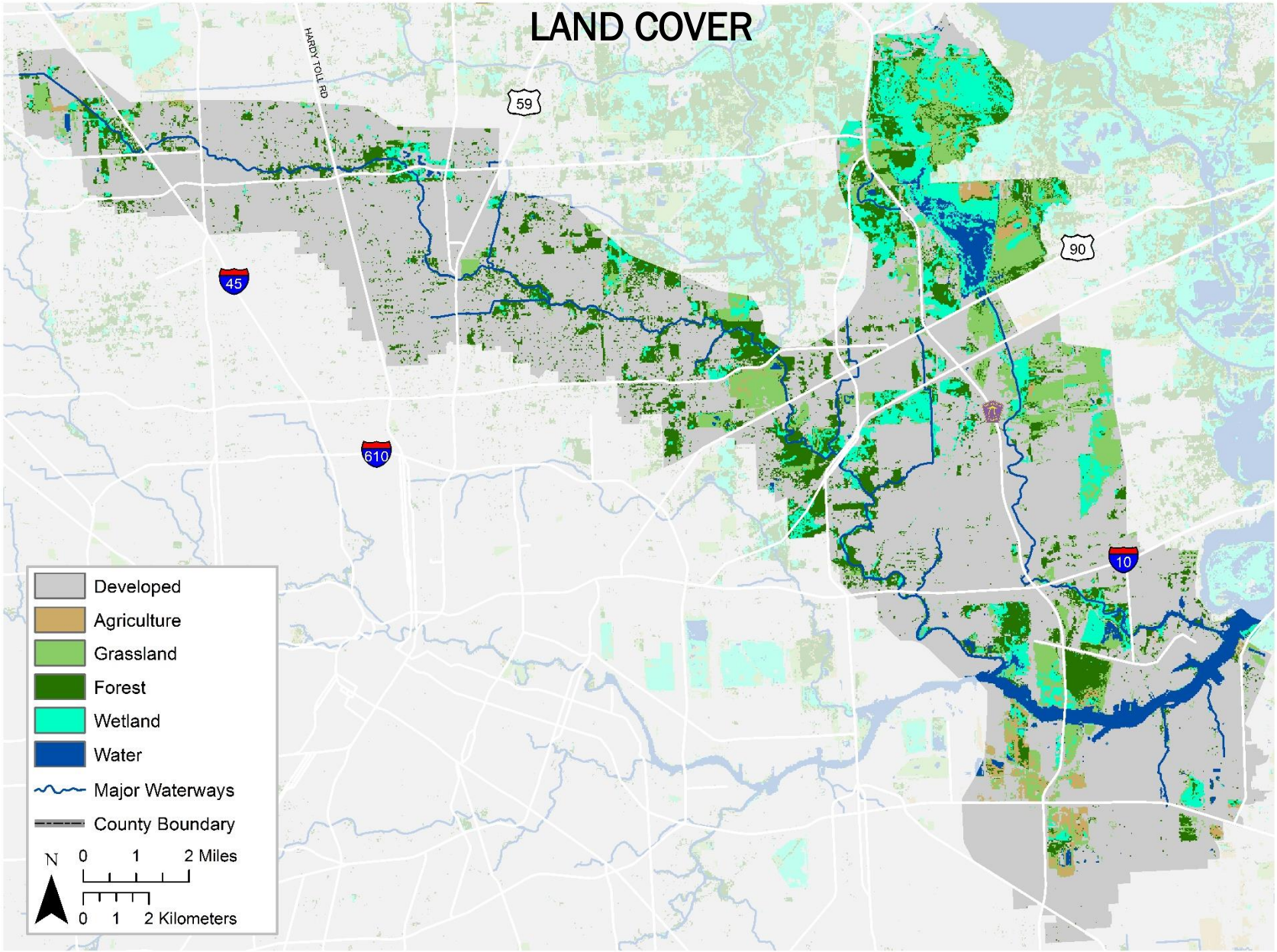
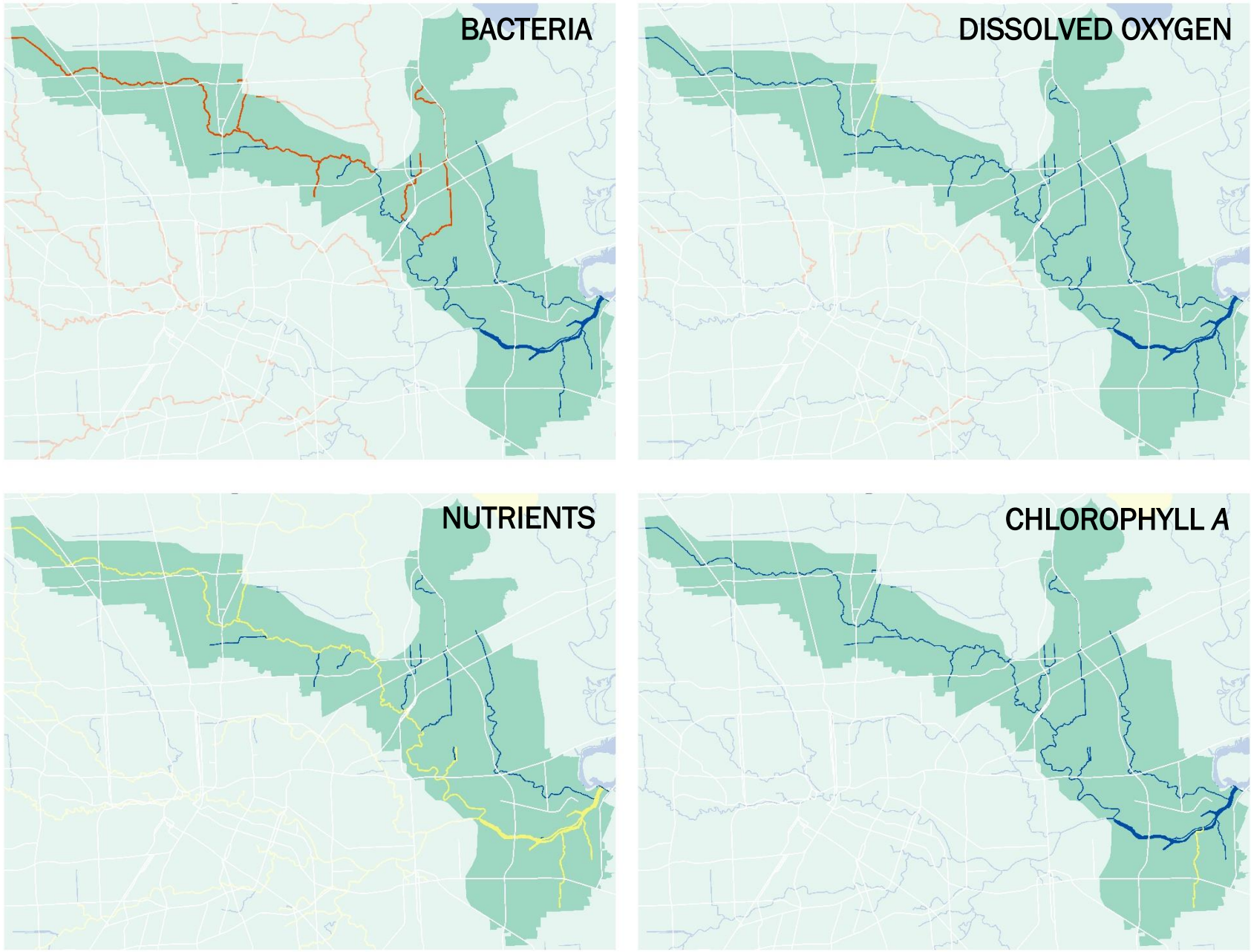
HOUSTON SHIP CHANNEL TIDAL - SEGMENT 1006

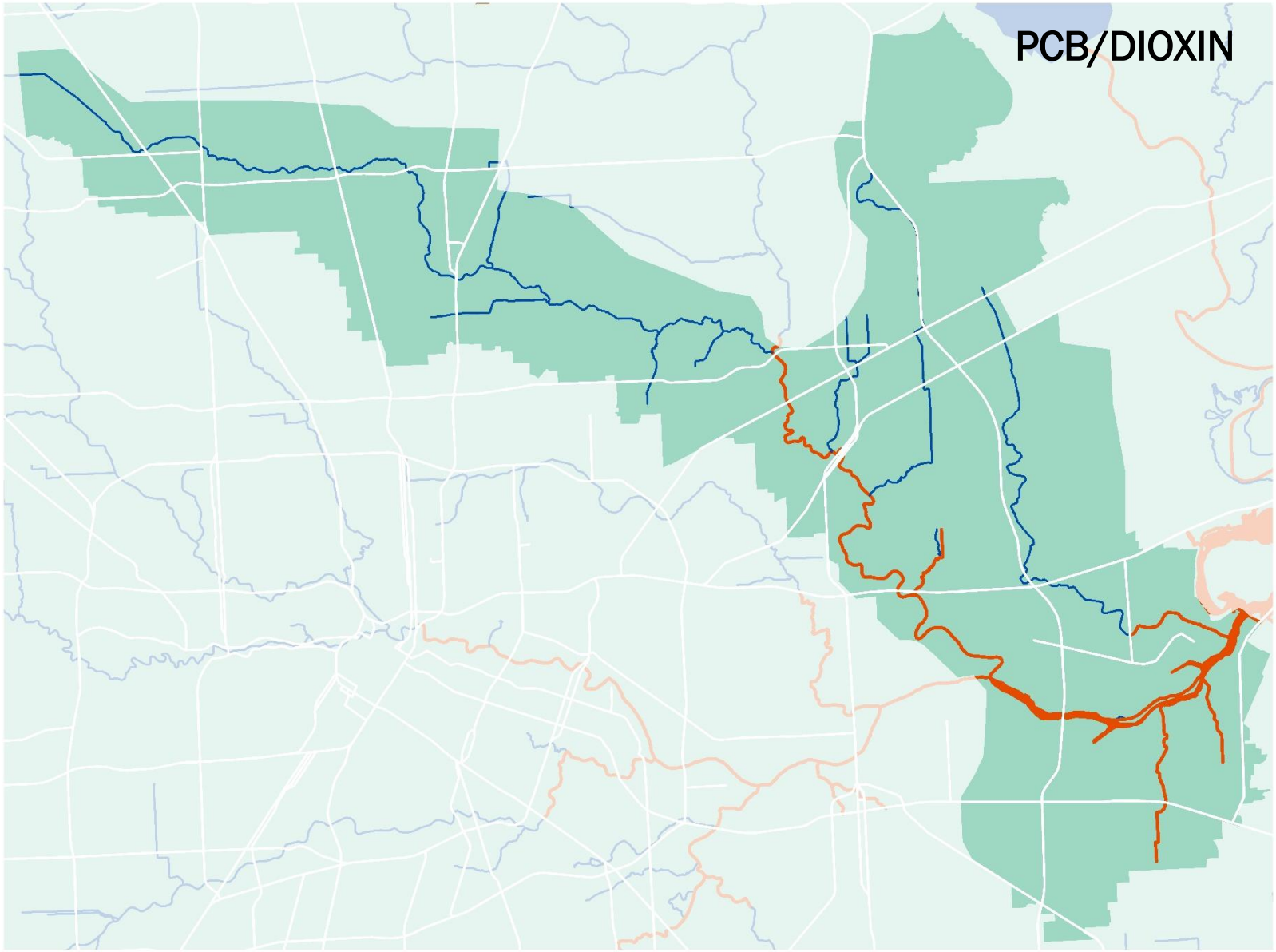


HOUSTON SHIP CHANNEL TIDAL - SEGMENT 1006

LAND COVER



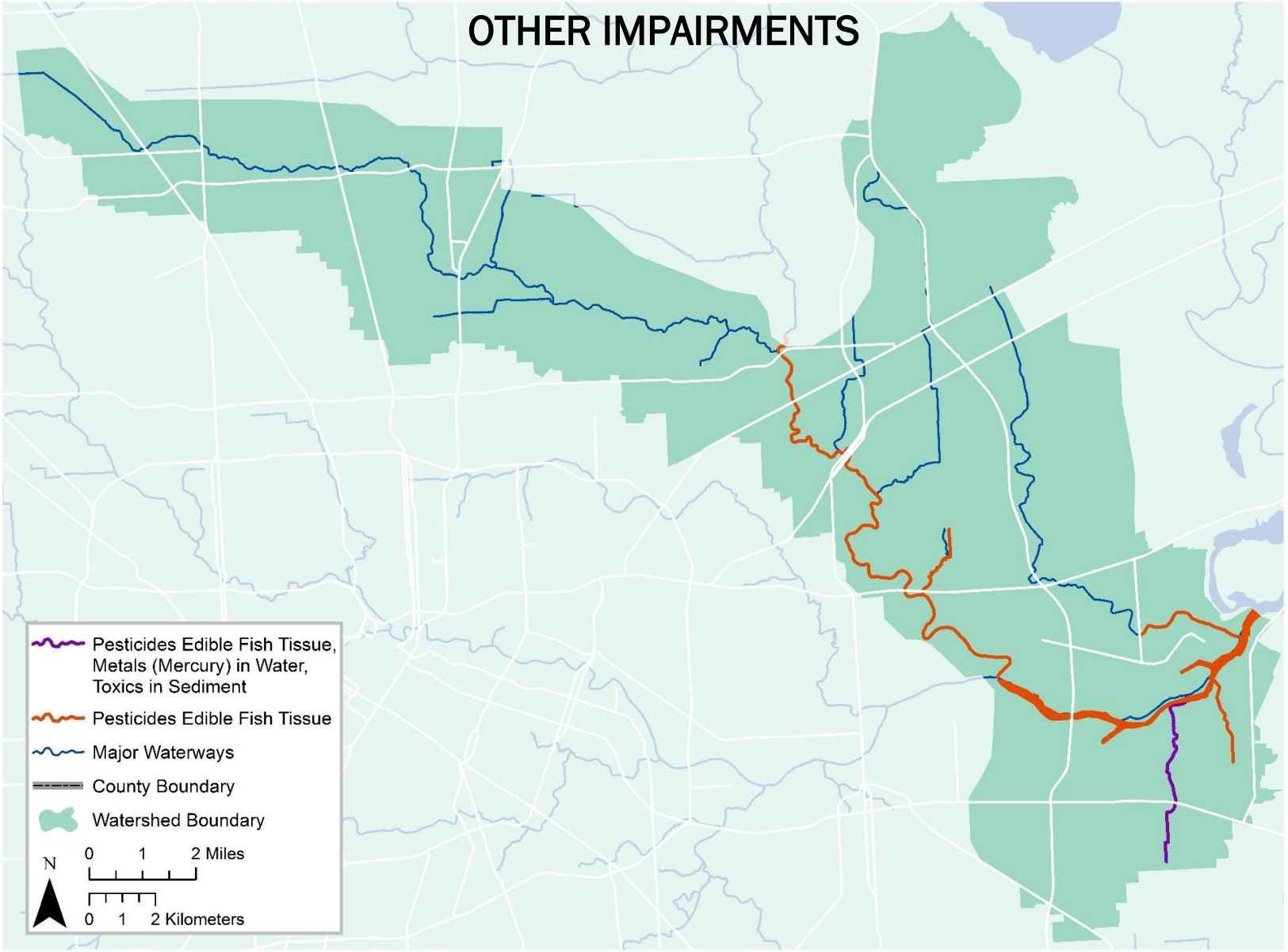

BACTERIA
DISSOLVED OXYGEN
NUTRIENTS
CHLOROPHYLL *A*
Impairment
Concern
No Impairments or Concerns



Impairment Concern No Impairments or Concerns

HOUSTON SHIP CHANNEL TIDAL - SEGMENT 1006

OTHER IMPAIRMENTS



Segment Number:	1006	Name:	Houston Ship Channel Tidal		
Length:	28 miles	**Watershed Area:**	122 square miles	**Designated Uses:**	Navigation; Industrial Water Supply
Number of Active Monitoring Stations:	26	**Texas Stream Team Monitors:**	0	**Permitted Outfalls:**	207

Description:

Segment 1006 (Tidal Stream): From the confluence with the San Jacinto River in Harris County to a point immediately upstream of Greens Bayou in Harris County, including tidal portions of tributaries

Segment 1006A: Retired segment description

Segment 1006B (Perennial Stream w/ intermediate ALU): Carpenters Bayou (unclassified water body) – Perennial stream from 9.0 k upstream of Houston Ship Channel up to 0.km upstream of Wallisville Rd

Segment 1006C: Retired segment description

Segment 1006D (Perennial Stream w/ intermediate ALU): Halls Bayou (unclassified water body) – From the confluence with Greens Bayou upstream to Frick Road in Harris County

Segment 1006E: Retired segment description

Segment 1006F (Perennial Stream w/ intermediate ALU): Big Gulch Above Tidal (unclassified water body) – From the confluence with Greens Bayou Tidal to Wallisville Road in Harris County

Segment 1006G: Retired segment description.

Segment 1006H (Perennial Stream w/ intermediate ALU): Spring Gully Above Tidal (unclassified water body) – From confluence with Greens Bayou to US 90 in Harris County

Segment 1006I (Perennial Stream w/ limited ALU): Unnamed Tributary of Halls Bayou (unclassified water body) – From the confluence with Halls Bayou to a point 0.13 miles upstream of Richland Drive in Harris County

Segment 1006J (Perennial Stream w/ limited ALU): Unnamed Tributary of Halls Bayou (unclassified water body) – From the confluence of Halls Bayou (east of US 59 and south of Langley Road) to Mount Houston Road in Harris County

Segment 1006K (Perennial Stream w/ intermediate ALU): Unnamed tributary of Halls Bayou (unclassified water body) – From the confluence of Halls Bayou (in Tidwell Park east of Allwood St.) to Jensen west of Hwy 59

Percent of Stream Impaired or of Concern						
Segment ID	PCBs/Dioxin	Bacteria	Dissolved Oxygen	Nutrients	Chlorophyll *a*	Other
1006	100	-	-	100	21	100
1006B	-	-	-	69	-	-
1006D	-	100	-	100	-	-
1006F	-	100	100	100	-	-
1006H	-	100	-	-	-	-
1006I	-	100	100	-	-	-
1006J	-	100	100	100	-	-

Segment 1006					
Standards	Tidal Stream	Perennial Stream	Screening Levels	Tidal Stream	Perennial Stream
Temperature (°C/°F):	35 / 95	35 / 95	Ammonia (mg/L):	0.46	0.33
Dissolved Oxygen *(24-Hr Average)* (mg/L):	2.0	4.0 / 3.0	Nitrate-N (mg/L):	1.10	1.95
Dissolved Oxygen *(Absolute Minima)* (mg/L):	2.0	3.0 / 2.0	Orthophosphate Phosphorus (mg/L):	0.46	0.37
pH (standard units):	6.5-9.0	6.5-9.0	Total Phosphorus (mg/L):	0.66	0.69
Enterococci (MPN/100mL) (30-day geometric mean> 10 samples):	168	168	Chlorophyll *a* (µg/L):	21	14.1
E. coli (MPN/100 mL) (grab):		399			
E. coli (MPN/100 mL) (geometric mean):		126			

FY 2016 Active Monitoring Stations				
Site ID	Site Description	Frequency	Monitoring Entity	Parameter Groups
11126	Halls Bayou at Jensen Drive	Nine Times / Year	COH / HHS	Field, Conventional, Bacteria
11127	Halls Bayou at Tidwell Road	Nine Times / Year	COH / HHS	Field, Conventional, Bacteria
11175	Carpenters Bayou at East Belt Drive	Quarterly	TCEQ	Field, Conventional, Bacteria
11264	Houston Ship Channel at San Jacinto Park	Monthly	HCPCS	Field, Conventional, Bacteria, Chlorophyll a (Qrtrly)
11264	Houston Ship Channel at San Jacinto Park	Quarterly	TCEQ	Field, Conventional, Bacteria, Chlorophyll a, Metals

11264	Houston Ship Channel at San Jacinto Park	Twice / Year	TCEQ	Metals in Sediment
11271	HSC at Greens Bayou Cm 152	Monthly	HCPCS	Field, Conventional, Bacteria, Chlorophyll a (Qrtrly)
11271	HSC at Greens Bayou Cm 152	Quarterly	TCEQ	Field, Conventional, Bacteria, Chlorophyll a
11272	Carpenters Bayou Tidal at S Sheldon Rd	Quarterly	TCEQ	Filed, Conventional, Bacteria
11272	Carpenters Bayou Tidal at S Sheldon Rd	Once / Year	TCEQ	Metals & Organics in Sediment
11273	Patrick Bayou at Tidal Road	Quarterly	TCEQ	Field, Conventional, Bacteria, Chlorophyll a
11273	Patrick Bayou at Tidal Road	Twice / Year	TCEQ	Metals in Water
11273	Patrick Bayou at Tidal road	Once / Year	TCEQ	Benthics, Metals & Organics in Sediment
11279	Greens Bayou at Green River Rd	Nine Times / Year	COH / HHS	Field, Conventional, Bacteria
15862	Halls Bayou at Homestead Road	Nine Times / Year	COH / HHS	Field, Conventional, Bacteria
15863	Halls Bayou at Hirsch Road	Nine Times / Year	COH / HHS	Field, Conventional, Bacteria
15864	Halls Bayou at Mesa Drive	Nine Times / Year	COH / HHS	Field, Conventional, Bacteria
16617	HSC at Cargill Terminal	Monthly	HCPCS	Field, Conventional, Bacteria, Chlorophyll a (Qrtrly)
16662	Big Gulch at Wallisville Rd	Nine Times / Year	COH / HHS	Field, Conventional, Bacteria
16663	Spring Gully at Barnesworth Dr	Nine Times / Year	COH / HHS	Field, Conventional, Bacteria
16664	Goodyear Creek Tidal at IH-10	Nine Times / Year	COH / HHS	Field, Conventional, Bacteria
16665	Trib Halls Bayou at Langley Rd	Nine Times / Year	COH / HHS	Field, Conventional, Bacteria
16666	Trib Halls Bayou at Talton St	Nine Times / Year	COH / HHS	Field, Conventional, Bacteria
16667	Trib Halls Bayou at Woodlyn Rd	Nine Times / Year	COH / HHS	Field, Conventional, Bacteria
16981	Greens Bayou Tidal at Isk Ditch	Quarterly	TCEQ	Field, Conventional, Bacteria, Chlorophyll a
16981	Greens Bayou Tidal at Isk Ditch	Once / Year	TCEQ	Metals & Organics in Sediment
17490	Halls Bayou at Airline Road	Nine Times / Year	COH / HHS	Field, Conventional, Bacteria
17491	Halls Bayou at Deer Trail Dr	Nine Times / Year	COH / HHS	Field, Conventional, Bacteria
18322	Tucker Bayou at First Bend	Quarterly	TCEQ	Field, Conventional, Bacteria, Chlorophyll a
18322	Tucker Bayou at First Bend	Twice / Year	TCEQ	Metals in Water
18322	Tucker Bayou at First Bend	Once / Year	TCEQ	Metals in Sediment
18363	Greens Bayou at Market Street	Quarterly	TCEQ	Field, Conventional, Bacteria, Chlorophyll a
20455	Halls Bayou at Intersection of Kowis St and Shady Ln	Quarterly	H-GAC	Field, Conventional, Bacteria
20797	Carpenters Bayou at mouth of barge canal 32 M west and 666 M south of intersection of DeZavalla Rd and Harding Rd in Harris Co	Monthly	HCPCS	Field, Conventional, Bacteria, Chlorophyll a (Qrtrly)
21008	Greens Bayou at Wallisville Rd approx 150 M NE of the intersection of Dattner Rd and Wallisville Rd	Nine Times / Year	COH / HHS	Field, Conventional, Bacteria

Water Quality Issues Summary			
Issue	**2014 Assessment** *I – Impaired* *C – Of Concern*	**Possible Causes / Influences / Concerns Voiced by Stakeholders**	**Possible Solutions / Actions To Be Taken**
Elevated Levels of Indicator Bacteria	1006D I 1006F I 1006H I 1006I I 1006J I	▪ Constructed stormwater controls failing ▪ Direct and dry weather discharges ▪ Waste haulers illegal discharges/improper disposal ▪ Poorly operated or undersized WWTFs ▪ WWTF non-compliance, overflows, and collection system by-passes ▪ Improper or no pet waste disposal ▪ Animal waste from domestic animal facilities ▪ Developments with malfunctioning OSSFs	▪ Improve compliance and enforcement of existing stormwater quality permits ▪ Improve construction oversight to minimize TSS discharges to waterways ▪ Add water quality features to stormwater systems ▪ Install and/or conserve vegetative buffer areas along all waterways ▪ Regionalize chronically non-compliant WWTFs ▪ Require all systems to develop and implement a utility asset management program and protect against power outages at lift stations ▪ Increase monitoring requirements for self-reporting ▪ Impose new or stricter bacteria limits than currently designated by TCEQ ▪ More public education on pet waste disposal ▪ Create and implement Water Quality Management Plans for individual domestic animal facilities ▪ More public education regarding OSSF operation and maintenance ▪ Ensure proper citing of new or replacement OSSFs
Dissolved Oxygen Concentrations	1006F C 1006I C 1006J C	▪ Excessive nutrients and organic matter from SSOs, malfunctioning OSSFs, illegal disposal of grease trap waste, and biodegradable solid waste (e.g., grass clippings and pet waste) ▪ Vegetative canopy removed	▪ More public education regarding disposal of household fats, oils, and grease ▪ Improved OSSF maintenance and education ▪ Improve compliance and enforcement of existing stormwater quality permits ▪ More public education on pet waste disposal ▪ Conserve or restore trees and habitat along waterways to maintain/create shade to cool water
Elevated	1006 C	▪ Fertilizer runoff from urbanized properties,	▪ Implement YardWise and Watersmart landscape

Nutrients	1006B 1006D 1006F 1006J	C C C C	such as landscaped areas, residential lawns, and sport fields ▪ SSOs and malfunctioning OSSFs	practices ▪ Install and/or conserve vegetative buffer areas along all waterways ▪ Regionalize chronically non-compliant WWTFs ▪ Ensure proper citing of new or replacement OSSFs ▪ More public education regarding OSSF operations and maintenance
PCBs/Dioxin in Edible Fish Tissue	1006	I	▪ Legacy pollutants in sediment ▪ Concentrated deposits outside boundaries of the waste pits located adjacent to San Jacinto River and I-10 bridge ▪ Waste pit located along the San Jacinto River immediately upstream of I-10 bridge is now a National Priority List Superfund site managed by regulators ▪ Unknown industrial or urban sources	▪ Continue to contain, remove, and monitor known contaminated sites ▪ Encourage regulators and responsible parties to work together to remediate Superfund site ▪ Remove or contain contamination from locations already identified ▪ Encourage additional testing to locate all unknown sources/deposits
Pesticides in Edible Fish Tissue	1006	I	▪ Fertilizer runoff from urbanized properties, such as landscaped areas, residential lawns, and sport fields	▪ Implement YardWise and Watersmart landscape practices
Mercury in Water	1006	I	▪ Legacy pollutants in sediment ▪ Unknown industrial or urban sources, possibly including coal fired power plants, coal and wood-fired industrial boilers, hazardous waste combustion, chlorine production, and offshore oil and gas drilling ▪ Spills at industrial facilities ▪ Dredging of the channel	▪ Continue to contain, remove, and monitor known contaminated sites ▪ Support efforts aimed at reducing mercury emissions from coal-fired power plants ▪ Support the reduced use of industrial mercury
Toxicity in Sediment	1006	I	▪ Legacy pollutants in sediment ▪ Unknown industrial or urban sources ▪ Spills at industrial facilities ▪ Dredging of the channel	▪ Continue to contain, remove, and monitor known contaminated sites

Segment Discussion

Watershed Characteristics: The tidal portion of the Houston Ship Channel is heavily developed. The lower portion of the watershed includes the Cities of Deer Park, Channelview, Houston, Pasadena, and parts of unincorporated Harris County. Heavy industrial complexes line both sides of the channel in the lower part of the watershed. The eastern end of this segment is Carpenters Bayou, which has four tributaries: Tucker Bayou, Patrick Bayou, Boggy Bayou, and Glenmore Ditch. On the south shore of the western end of the watershed is the confluence with Greens Bayou which also receives heavy barge traffic.

Tributaries to Greens Bayou include: Goodyear Creek, Jordan Gully, Big Gulch, Spring Gully, Halls Bayou, and an unnamed tributary. The Halls Bayou area is predominantly residential and commercial with some light industry. The majority of the area is on sanitary sewer, however there are scattered on-site sewer facilities scattered throughout the watershed.

Water Quality Issues: Recreation use is prohibited in the classified portion of the watershed (the main channel, segment 1006), but all of the unclassified tributaries to 1006 have designated recreational uses. None of these support recreation use due to elevated levels of bacteria. The seven-year geometric mean standard is 126/MPN /100 mL, and the grab standard is 399 MPN/100 mL.

Assessment Unit	TCEQ Assessment (2005-2012) Geomean (MPN/100 mL) / % Grab Exceedance	HGAC Analysis 2001-2008 Geomean (MPN/100 mL) / % Grab Exceedance	HGAC Analysis 2008-2015 Geomean (MPN/100 mL) / % Grab Exceedance
1006D_01	623	1298 / 91.2	397 / 76.9
1006D_02	795	1442 / 91.4	677 / 81.3
1006F_01	357	968 / 77.8	326 / 59.0
1006H_01	258	542 / 90.4	195 / 63.3
1006I_01	737	968 / 92.5	731 / 87.5
1006J_01	957	2359 / 97.3	464 / 79.0

In general, bacteria levels have fallen over time but remain well above the current water quality standard. Seven-year bacteria geomean plots for segments 1006D and 1006J show the highest geometric mean concentrations over time compared to other segment assessment units (AU).

Several AUs in the main channel are also impaired for enterococci. The seven -year geometric mean standard for this segment is 35 MPN/100 mL.(enterococci) and the single-sample (grab) standard is 104 MPN/100 mL.

Assessment Unit	TCEQ Assessment (2005-2012) Geomean (MPN/100 mL) / % Grab Exceedance	HGAC Analysis 2001-2008 Geomean (MPN/100 mL) / % Grab Exceedance	HGAC Analysis 2008-2015 Geomean (MPN/100 mL) / % Grab Exceedance
1006_01	43.9	60 / 26.5	36 / 17.7
1006_03	70.1	69 / 28.6	100 / 36.7
1006_05	170	204 / 41.7	228 / 54.1
1006_06	35.4	21 / 5.9	56 / 25.0
1006_07	46.0	Insufficient Data	80 / 36.3

There are 15 AUs in this watershed. The 2014 IR identified concerns for aquatic life support due to dissolved oxygen (DO) grab results in 3 AU and sediment toxicity in 2 AUs. Mercury was also found in the water of assessment unit 1006_04

Segment 1006 was deemed to not support the fish consumption use in the 2014 IR. Elevated levels of PCBs, dioxin, mercury, and several other pesticides were found in the edible tissue of fish in 7 AUs. Aquatic life use in AU 1006_04 is impaired due to high levels of mercury in the water.

General uses are unsupported in about half of the watershed- there are ammonia concerns in 4 AUs, nitrate-nitrogen (nitrate) concerns in 11 AUs, total phosphorus (TP) in 11 AUs, and chlorophyll *a* concerns in 2 AUs. Details regarding percent exceedances for each segment and/or AU can be found in the data summaries in the appendix.

Special Studies/Projects: This segment has been included in three TMDL projects: the Houston Metro TMDL for bacteria, the Houston Ship Channel and Upper Galveston Bay TMDL for PCBs in Fish Tissue and the Houston Ship Channel TMDL for Dioxin. The unclassified segment 1006D (Halls Bayou Below U.S. Highway 59) has also been subject to the Failing Onsite Sewage Facility Initiative and Westfield Estates Watershed Protection Plan. Additionally, This segment is a part of a larger geographic area covered under several TMDLs, collectively known as the Bacteria Implementation Group (BIG) I-Plan. For more information, please refer to the detailed discussions of Dioxin and PCB contamination, the BIG, and the Westfield Estates WPP located in the Public Involvement and Outreach section of the 2016 Basin Summary Report.

Trends: Eight significant parameter trends were detected for the entire classified portion of the Houston Ship Channel (HSC) Tidal watershed including increasing salinity, Secchi transparency, specific conductance (SPCond), sulfate, and total dissolved solids (TDS) while total suspended solids (TSS) and bacterial concentrations are decreasing over time. The most common trend seen throughout the watershed is a gradual increase in dissolved constituents in water. This is reflected in the regression plots for salinity, Secchi transparency, TDS, and SPCond for all classified segments and unclassified water bodies showing increases over time while TSS decreases. Reasons for these trends may include an increased volumetric contribution of wastewater effluent, improvements to storm water controls in the area, or increased tidal influences from Galveston Bay and the Gulf of Mexico.

Bacteria concentrations for the entire segment have been gradually decreasing since the early 2000s; however, the majority of samples are still significantly higher than the water quality standard for tidal and freshwater streams. *E. coli* levels have measured greater than 1,000 MPN/100 mL several times since 2014 and enterococci concentrations have reached levels greater than 10,000 MPN/100 mL during the period of record. The slight decrease in bacterial concentrations over time may be related to the implementation of best management practices (BMPs) developed by the BIG group in Halls Bayou and adjacent watersheds. The only DO concern for this segment is on AU 1006J which is an unclassified tributary of Halls Bayou. Station data for 1006J shows a slight decrease in DO concentrations over time with samples frequently measuring at or below 4.0 mg/L. Continued monitoring of DO concentrations in 1006J is recommended to ensure conditions do not worsen to the point where a DO impairment is required.

Nitrate, total Kjeldahl nitrogen (TKN), and total phosphourous (TP) concentrations are increasing in freshwater streams within the watershed including stations located on 1006D (Halls Bayou) and 1006F (Big Gulch Above Tidal). The only station with decreasing nutrient trends for nitrate and TP is station 16665 located on 1006J. Additionally, a decrease in ammonia was detected in Halls Bayou and its two unclassified tributaries (1006I and 1006J). The tributary feeding into the HSC Tidal segment with a concern for chlorophyll *a* shows no significant change in chlorophyll *a* concentrations since 2000. However, only 50 samples have been collected during the period of record. Additional data is necessary to better evaluate chlorophyll *a* trends over time.

Recommendations
Address concerns found in this segment summary through stakeholder participation.
Complete the BIG plan and the TMDL for Halls Bayou.
Continue collecting water quality data to support actions associated with any future watershed protection plan development and possible modeling.