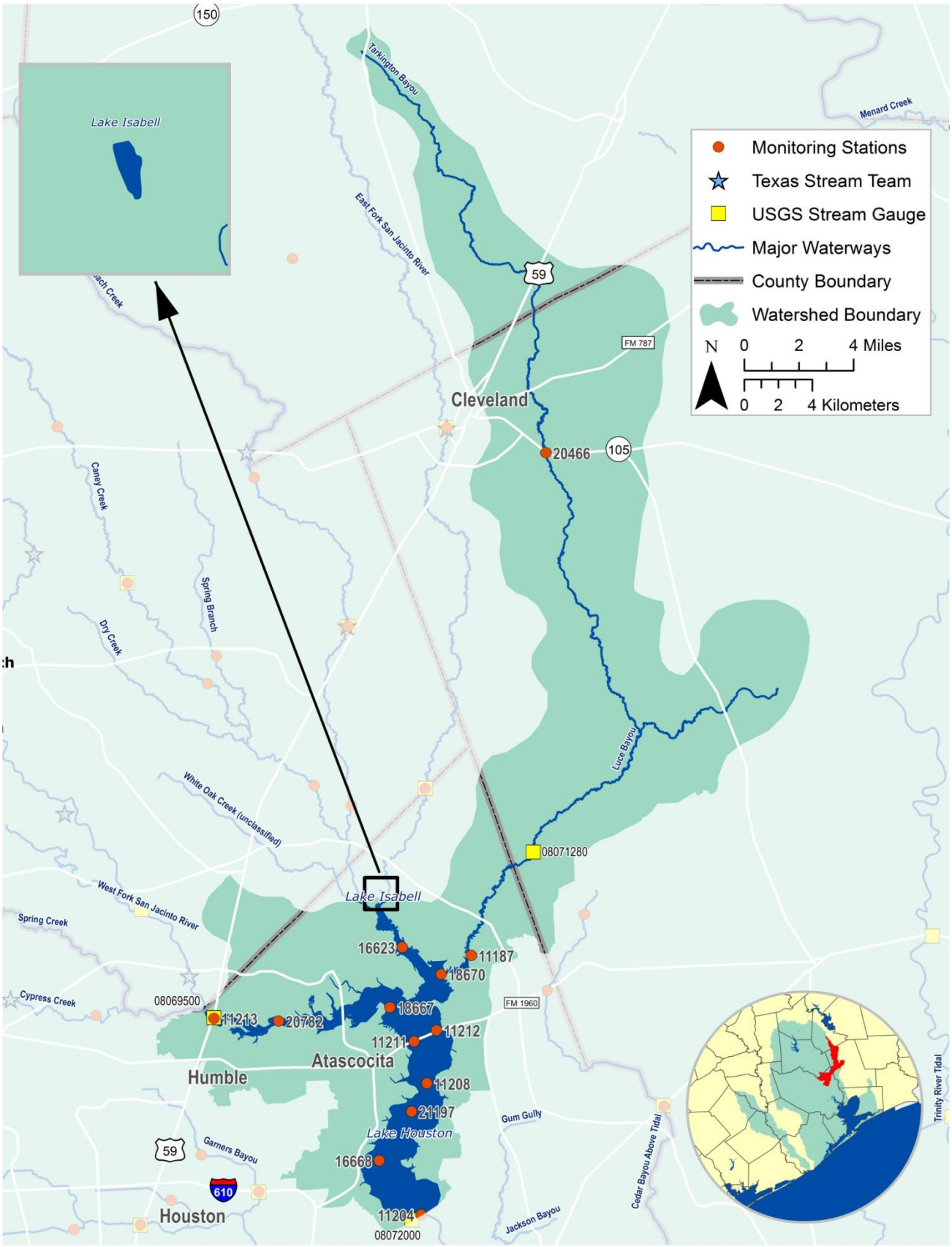
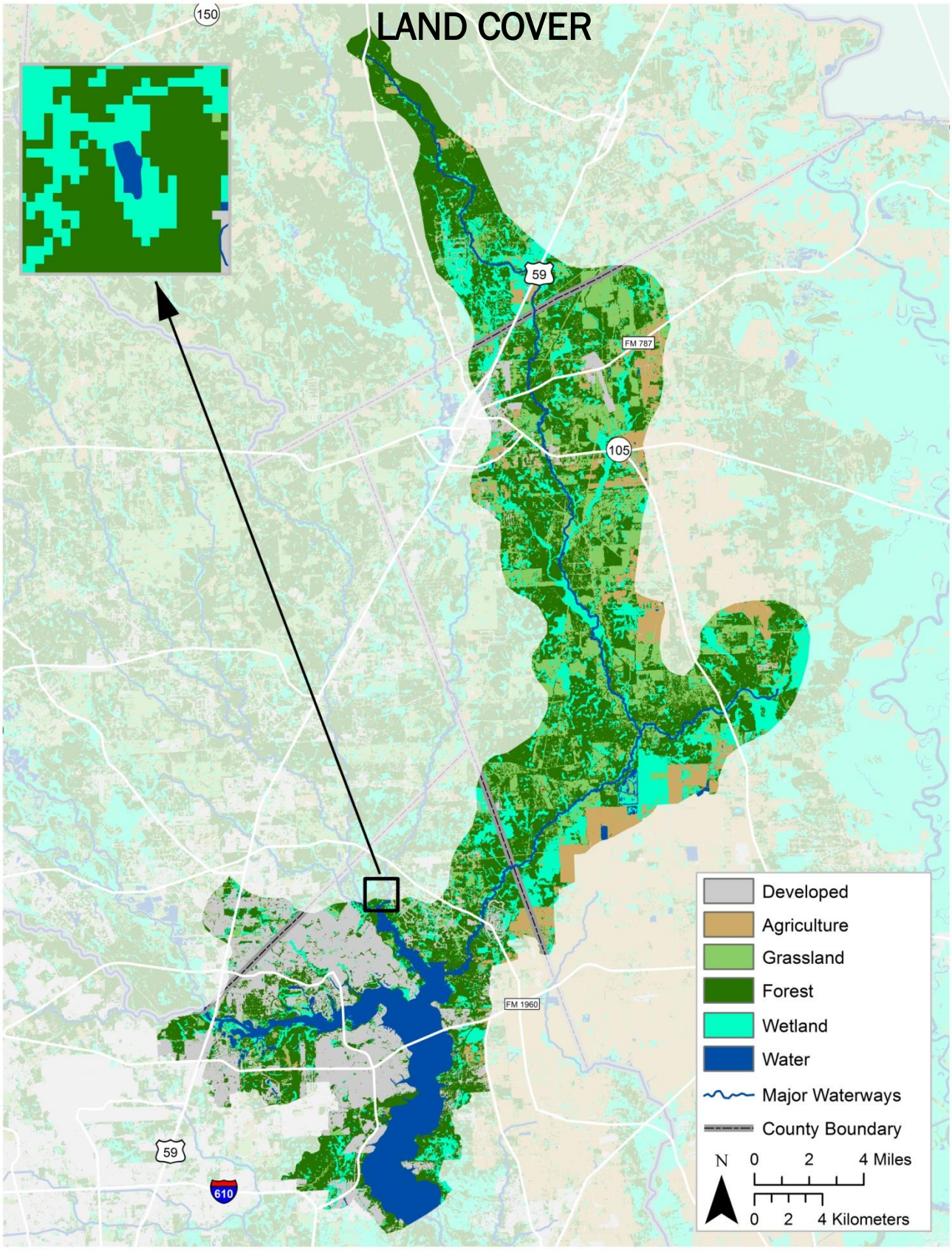
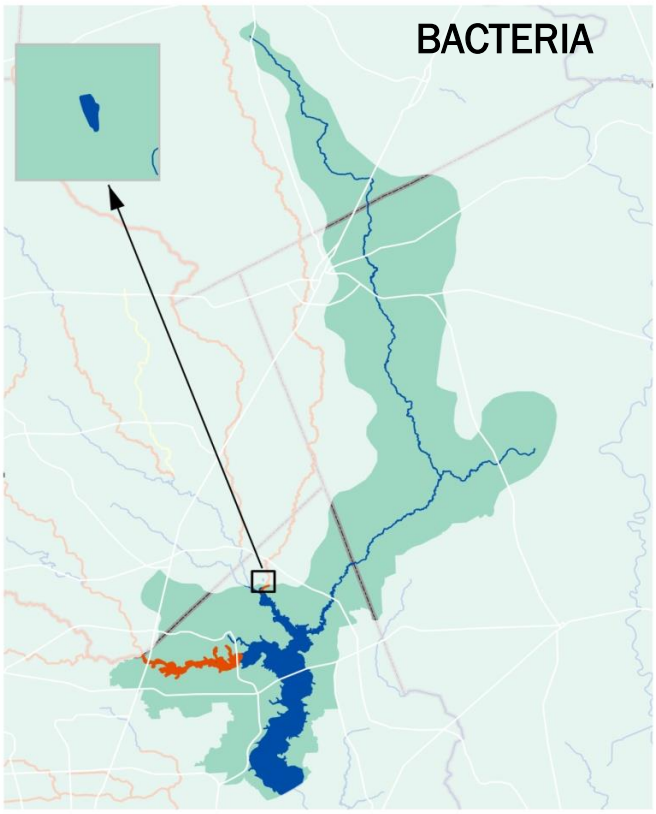
LAKE HOUSTON - SEGMENT 1002

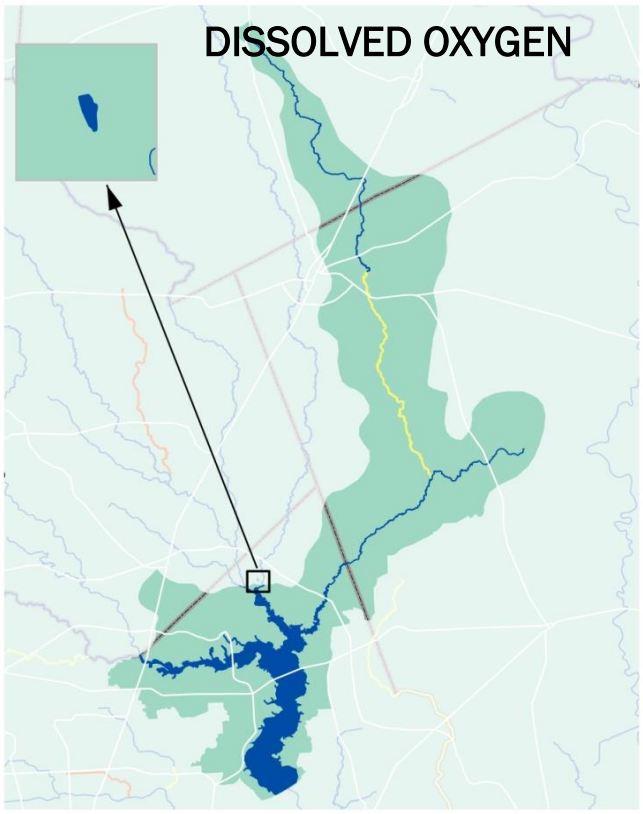


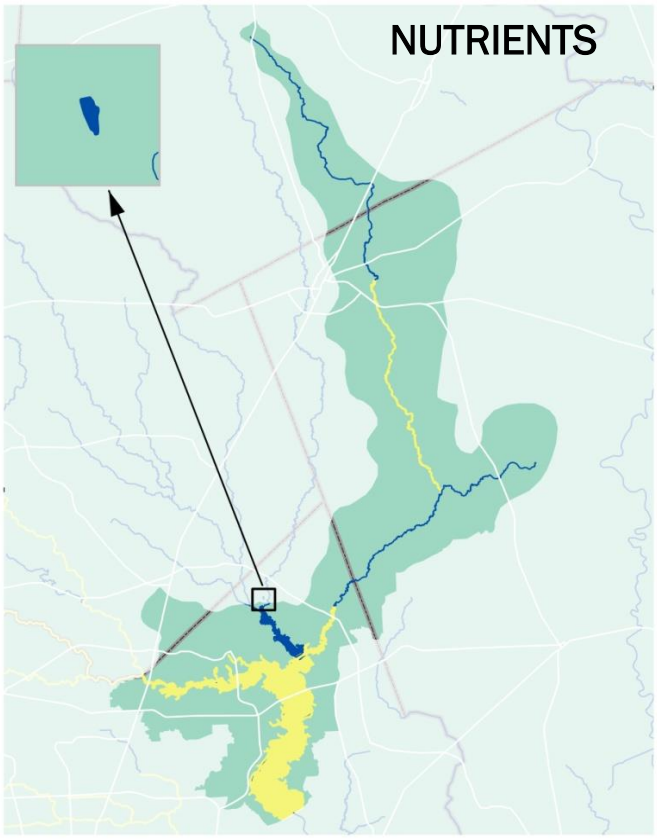
LAKE HOUSTON - SEGMENT 1002

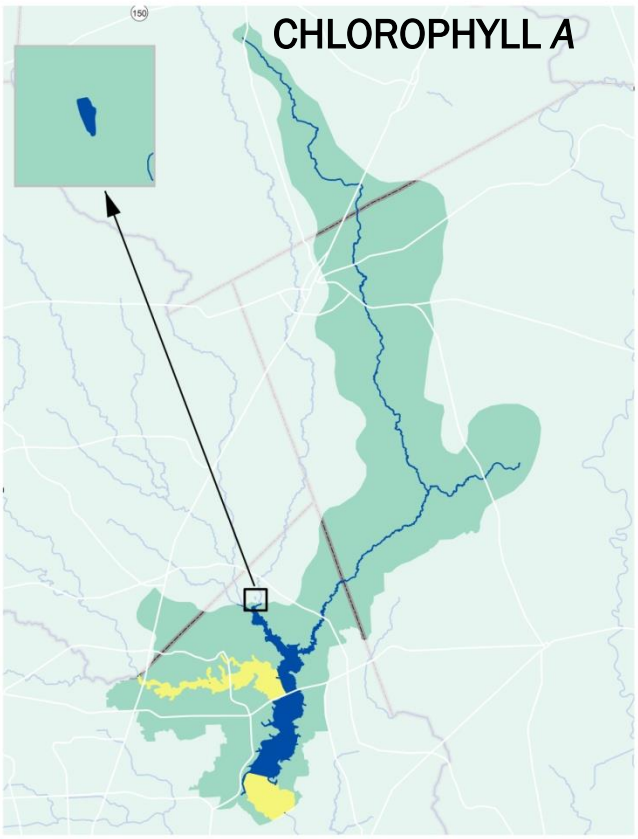
LAND COVER







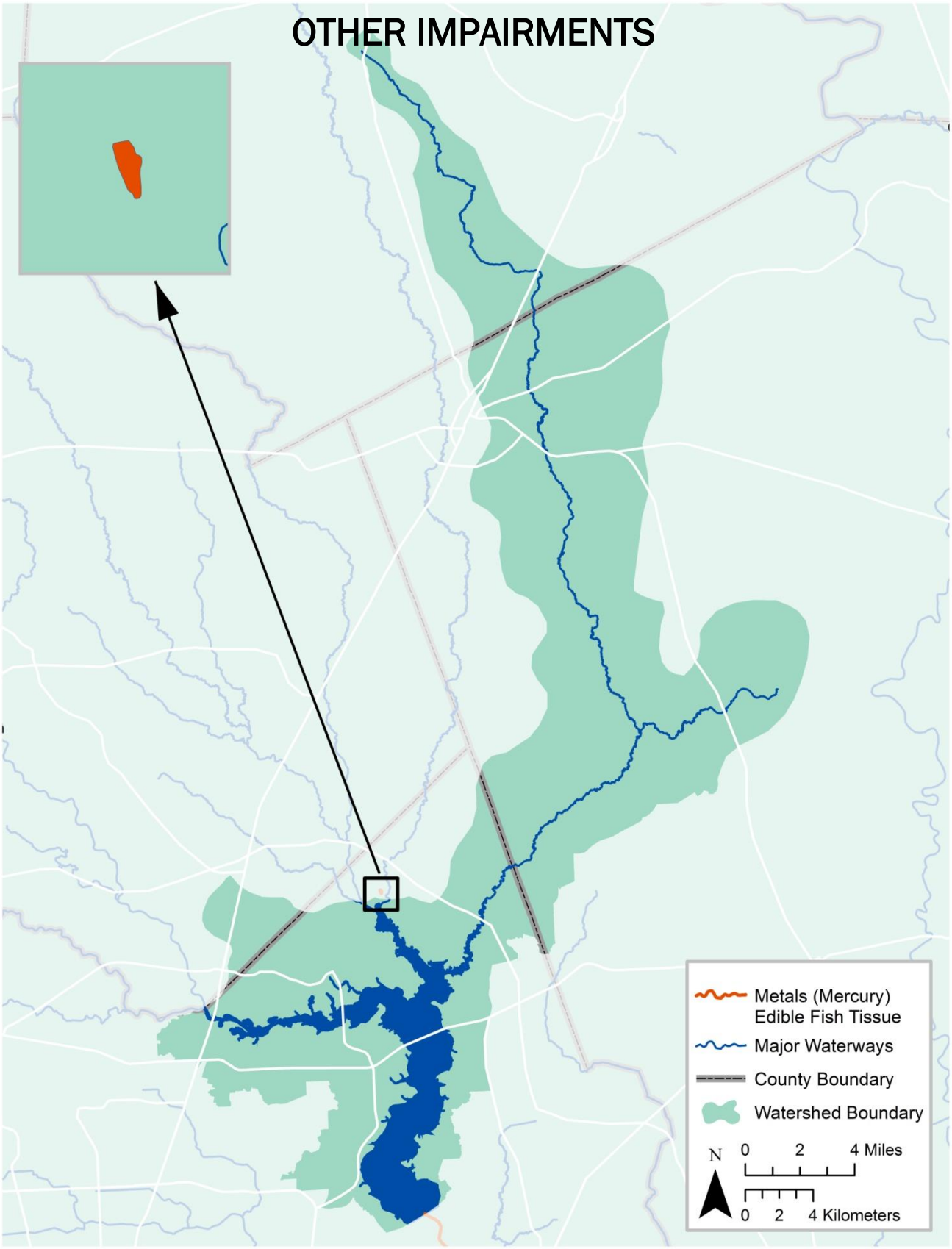




Impairment Concern No Impairments or Concerns

LAKE HOUSTON - SEGMENT 1002

OTHER IMPAIRMENTS



Segment Number:	1002	Name:	Lake Houston
Length:	23 miles	**Watershed Area:**	278.7 square miles
Designated Uses:	Primary Contact Recreation 1, High Aquatic Life; Public Water Supply		
Number of Active Monitoring Stations:	12	**Texas Stream Team Monitors:**	1
Permitted Outfalls:	10		
Description:	Segment 1002 (Reservoir): From Lake Houston Dam in Harris County to the confluence of Spring Creek on the West Fork San Jacinto arm in Harris/Montgomery County and to the confluence of Caney Creek on the East Fork San Jacinto arm in Harris County, up to the normal pool elevation of 44.5 feet (impounds San Jacinto River) Segment 1002A (Perennial Stream w/ intermediate ALU): Tarkington Bayou (unclassified water body) – From the Luce Bayou confluence upstream to a point just upstream of FM 2025 in Liberty County Segment 1002B (Perennial Stream w/ minimal ALU): Luce Bayou (unclassified water body) – From confluence with Lake Houston (Harris County) to FM 1008 (Liberty County) Segment 1002C (Reservoir): Lake Isabell (unclassified water body) – Small lake located at the southern end of Lake Houston Park northeast of the Caney Creek (segment 1010) and East Fork of the San Jacinto River (segment 1003) confluence in Harris County		

Percent of Stream Impaired or of Concern

Segment ID	PCBs/Dioxin	Bacteria	Dissolved Oxygen	Nutrients	Chlorophyll *a*	Other
1002	-	25.5	-	84	54.5	-
1002A	-	-	44	44	-	-
1002B	-	-	-	-	-	-
1002C	-	-	-	-	-	100

Segment 1002

Standards	Reservoir	Perennial Stream	Screening Levels	Reservoir	Perennial Stream
Temperature (°C/°F):	32 / 90	32 / 90	Ammonia (mg/L):	0.11	0.33
Dissolved Oxygen *(24-Hr Average)* (mg/L):	5.0	4.0 / 2.0	Nitrate-N (mg/L):	0.37	1.95
Dissolved Oxygen *(Absolute Minima)* (mg/L):	3.0	3.0 / 1.5	Orthophosphate Phosphorus (mg/L):	0.05	0.37
pH (standard units):	6.5-9.0	6.5-9.0	Total Phosphorus (mg/L):	0.20	0.69
E. coli (MPN/100 mL) (grab):	399	399	Chlorophyll *a* (µg/L):	14.1	14.1
E. coli (MPN/100 mL) (geometric mean):	126	126			
Chloride (mg/L as Cl):	100	100			
Sulfate (mg/L as SO_4):	50	50			
Total Dissolved Solids (mg/L):	400	400			

FY 2016 Active Monitoring Stations

Site ID	Site Description	Frequency	Monitoring Entity	Parameter Groups
11187	Luce Bayou at Huffman-New Caney Rd	Bimonthly	COH / WQC	Field, Conventional, Bacteria
11204	Lake Houston near Dam	Quarterly	TCEQ	Field, Conventional, Bacteria, Chlorophyll a
11208	Lake Houston at RR Bridge	Monthly	COH / WQC	Field, Conventional, Bacteria, Chlorophyll a (Qrtrly)
11211	Lake Houston at FM 1960 West	Monthly	COH / WQC	Field, Conventional, Bacteria, Chlorophyll a (Qrtrly)
11212	Lake Houston at FM 1960 East	Monthly	COH / WQC	Field, Conventional, Bacteria, Chlorophyll a (Qrtrly)
11213	Lake Houston at US 59	Quarterly	TCEQ	Field, Conventional, Bacteria, Chlorophyll a
16623	Lake Houston W of Magnolia Pt	Monthly	COH / WQC	Field, Conventional, Bacteria, Chlorophyll a (Qrtrly)
16668	Lake Houston W of Lake Shadows Subdivision	Monthly	COH / WQC	Field, Conventional, Bacteria, Chlorophyll a (Qrtrly)
18667	Lake Houston West Fork near Atascocita Place Dr	Monthly	COH / WQC	Field, Conventional, Bacteria, Chlorophyll a (Qrtrly)
18670	Lake Houston/Luce Bayou near Lakewater Dr	Monthly	COH / WQC	Field, Conventional, Bacteria
20466	Tarkington Bayou at SH 105/SH 321	Quarterly	H-GAC	Field, Conventional, Bacteria
20782	Lake Houston West Fork near Belleau Wood Dr	Bimonthly	COH / WQC	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	1002_06 I	▪ Rapid urbanization and increased impervious cover ▪ Constructed stormwater controls failing ▪ Poorly operated or undersized WWTFs ▪ WWTF non-compliance, overflows, and collection system by-passes ▪ Direct and dry weather discharges ▪ Waste haulers illegal discharges/improper disposal ▪ Improper or no pet waste disposal ▪ Developments with malfunctioning OSSFs ▪ Animal waste from agricultural production	▪ Improve compliance and enforcement of existing stormwater quality permits ▪ Improve construction oversight to minimize TSS discharges to waterways ▪ Regionalize chronically non-compliant WWTFs ▪ Improve stormwater controls in new developments by adding bacteria reduction measures ▪ Impose new or stricter bacteria limits than currently designated by TCEQ ▪ Increase monitoring requirements for self-reporting ▪ Require all systems to develop and implement a utility asset management program and protect against power outages at lift stations ▪ Ensure proper citing of new or replacement OSSFs ▪ Increase monitoring and enforcement efforts to identify and repair failing OSSFs ▪ More public education regarding OSSF operations and maintenance ▪ Require larger partials of land in developments platted to use OSSFs ▪ More public education on pet waste disposal ▪ Implement stream fencing or alternative water supplies to keep livestock out of or away from waterways ▪ Encourage Water Quality Management Plans or similar projects for agricultural properties
Elevated Nutrients	1002 C 1002A C	▪ Agricultural runoff from row crops, pastures, and fallow fields ▪ Fertilizer runoff from urbanized properties, such as landscaped areas, residential lawns, and sport fields ▪ WWTF effluent, sanitary sewer overflows, and malfunctioning OSSFs	▪ Install and/or maintain riparian buffer areas between agricultural fields and waterways ▪ Implement YardWise and Watersmart landscape practices ▪ Encourage Water Quality Management Plans or similar projects for agricultural properties ▪ Monitor phosphorus levels at WWTFs to determine

			if controls are needed
Elevated Chlorophyll *a* Concentrations	1002 C	▪ Fertilizer runoff from surrounding watershed promotes algal growth in waterways ▪ Nutrient loading from WWTF effluent, sanitary sewer overflows, and malfunctioning OSSFs promotes algal growth	▪ Reduce fertilizer runoff from agricultural areas. ▪ Improve compliance and enforcement of existing stormwater quality permits ▪ Improve stormwater controls in new developments ▪ Support/continue/initiate public education regarding nutrients
Dissolved Oxygen Concentrations (Grab)	1002A C	▪ Excessive nutrients and organic matter from agricultural production ▪ Excessive nutrients and organic matter from WWTF effluent, SSOs, malfunctioning OSSFs, illegal disposal of grease trap waste, and biodegradable solid waste (e.g., grass clippings and pet waste)	▪ Install and/or maintain riparian buffer areas between agricultural fields and waterways ▪ Encourage Water Quality Management Plans or similar projects for agricultural properties ▪ Improve compliance and enforcement of existing stormwater quality permits ▪ Regionalize chronically non-compliant WWTFs ▪ Improve operation and maintenance of existing WWTF and collection systems ▪ More public education regarding disposal of household fats, oils, and grease ▪ More public education on pet waste disposal ▪ Improve OSSF maintenance and education
Mercury in Edible Fish Tissue	1002C I	▪ Illegal dumping	▪ Additional testing of other smaller impoundments in the area should be undertaken to determine potential sources ▪ Continue monitoring fish populations and publicizing advisories

Segment Discussion:

Watershed Characteristics: The west fork of Lake Houston is highly urbanized with the communities of Humble, Kingwood, and Atascocita covering most of the western portion of the watershed. Smaller developments are located on the southwest and eastern shores primarily near FM1960 with smaller subdivisions scattered throughout the area surrounding Lake Houston. The City of Cleveland lies in the upper Tarkington Bayou watershed. Luce and Tarkington Bayous flow primarily through undeveloped forested lands and discharge into Lake Houston from the north. Agricultural operations are slowly encroaching on Luce and Tarkington Bayous as the forest is cleared. Grass, hay, and low density cattle ranching are the most common agricultural operations at this time.

Water Quality Issues: Recreation use is not supported in assessment unit (AU) 1002_06, which is the portion of the segment from the confluence with Spring Creek downstream to the West Lake Houston Parkway. The 2014 assessment found a geomean of 191 for the period 2005-2012. H-GAC found that the geomean was 211 in 2001-2008 and 158 for the seven-year period ending 5/31/2015. Excursions of the grab standard were basically the same in both periods (33.8/34.2%). There is also a concern for bacteria in the lower portion of Lake Houston between Foley Road (on the east shore) and the dam where 26% of the single samples (83 out of 324) exceeded the standard geomean of 63 MPN/mL. There is a concern for pH in this assessment unit. H-GAC found that three samples exceeded the pH standard of 9.0 since 6/1/2008.

Chlorophyll *a* and nutrient concentrations are concerns in several of the assessment units of the lake. Total phosphorus (TP) is high in 1002_01, -02, -03, -04, -05, and -06. Nitrate nitrogen is listed as a concern in 1002_02,-05, and -06. Chlorophyll is a concern in 1002_02, -05, and -06. Ammonia is only identified at levels of concern in 1002_04. See the statistical summaries in the Appendix for detailed exceedance statistics. Segment 1002C (Lake Isabell) was found to have high levels of mercury in edible fish tissue taken from that lake, and the Texas Department of State Health Services issued a fish consumption advisory. The cause of the mercury contamination is unknown at this time. Fortunately, there is no direct connection between this small lake and Lake Houston or the East Fork of the San Jacinto River.

Special Studies/Projects: No special Clean Rivers Program or Texas Commission on Environmental Quality projects have been conducted on this segment.

Trends: Regression analysis of Lake Houston reservoir data revealed statistically significant increasing trends for 11 water quality parameters – alkalinity, ammonia, chloride, nitrate, pH, Secchi transparency, specific conductance (SPCond), sulfate, total Kjeldahl nitrogen (TKN), TP, and total suspended solids (TSS). Statistically significant trends for Tarkington Bayou include increasing ammonia and nitrate concentrations while pH levels decrease. Luce Bayou has a statistically significant increasing ammonia trend, but nitrate, pH, and sulfate are decreasing over time.

Chlorophyll *a* has been decreasing at the majority of monitoring stations located on Lake Houston including 11208, 11211, 11212, 16623, 16668, and 18667. However, an increase in chlorophyll *a* levels is still present at monitoring station 11204 which is the southernmost monitoring station located adjacent to the Lake Houston dam. Dissolved oxygen (DO) concentrations have been improving at two monitoring stations, 11212 and 18667, but remain stable at all other locations within the Lake Houston watershed.

Increasing nutrient concentrations are the most common trends seen throughout the entire watershed. Ammonia and nitrate levels are increasing in Tarkington and Luce Bayous as well as in Lake Houston with levels reaching up to four to eight times greater than the set screening criteria. Lake Houston also shows a significant increasing trend in TP and TKN concentrations since 2000. *E. coli* levels have been decreasing at station 11208; however, exceedances are still common during the period of record. Urban landscapes, pet waste, WWTF effluents and collection system overflows, malfunctioning OSSFs, and agricultural related activities are the likely sources of nutrients and bacteria to the system. Additionally, an impairment for mercury in edible fish tissue was established for Lake Isabell in the 2014 Texas Integrated Report. Lake Isabell is a small water body located adjacent to the northwestern reach

of Lake Houston. Reasons for the mercury impairment are unknown.

Recommendations
Address concerns found in this segment summary through stakeholder participation.
Conduct additional fish tissue testing to determine if mercury contamination is isolated to only Lake Isabell.
Continue collecting water quality data to support actions associated with any future watershed protection plan development and possible modeling.