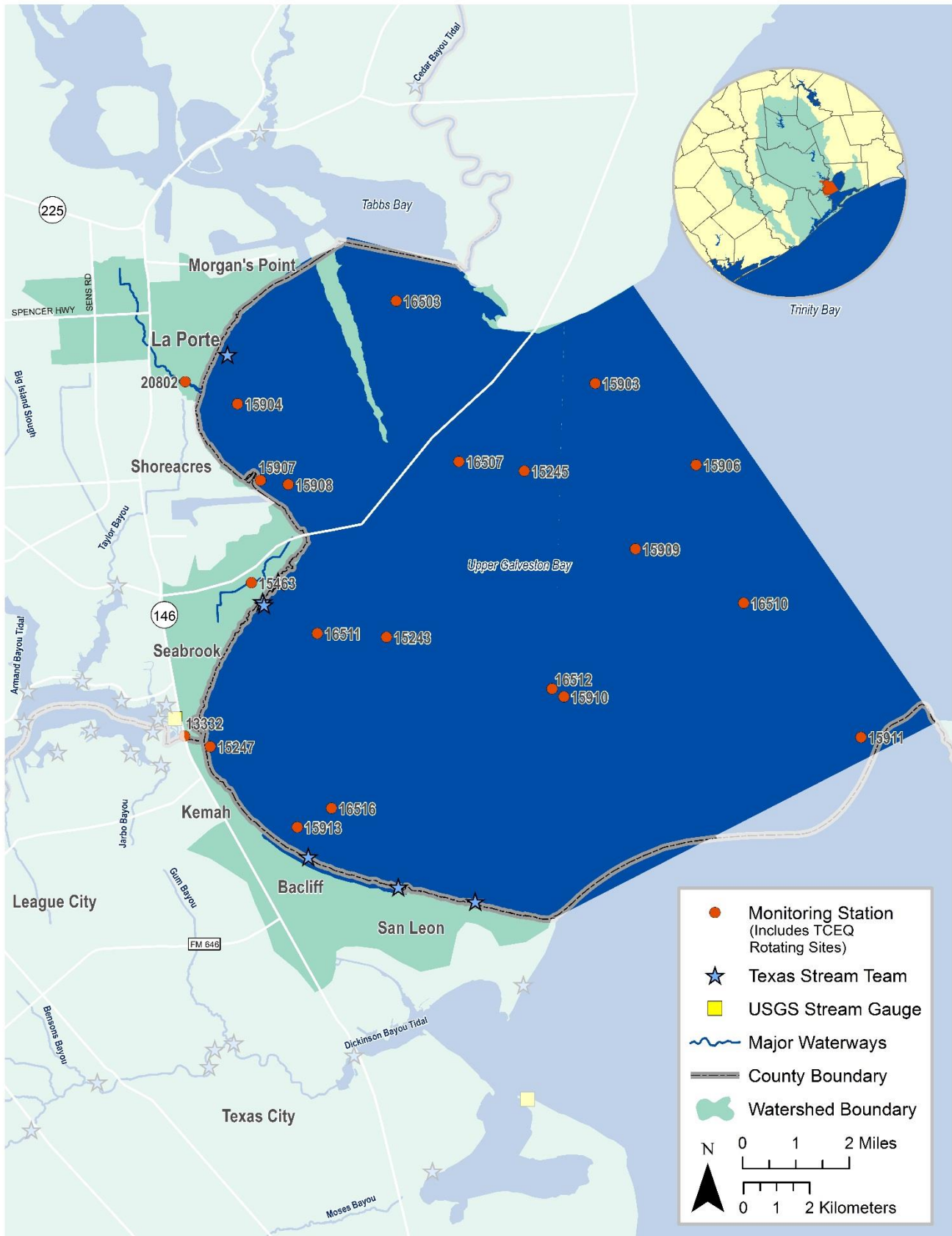
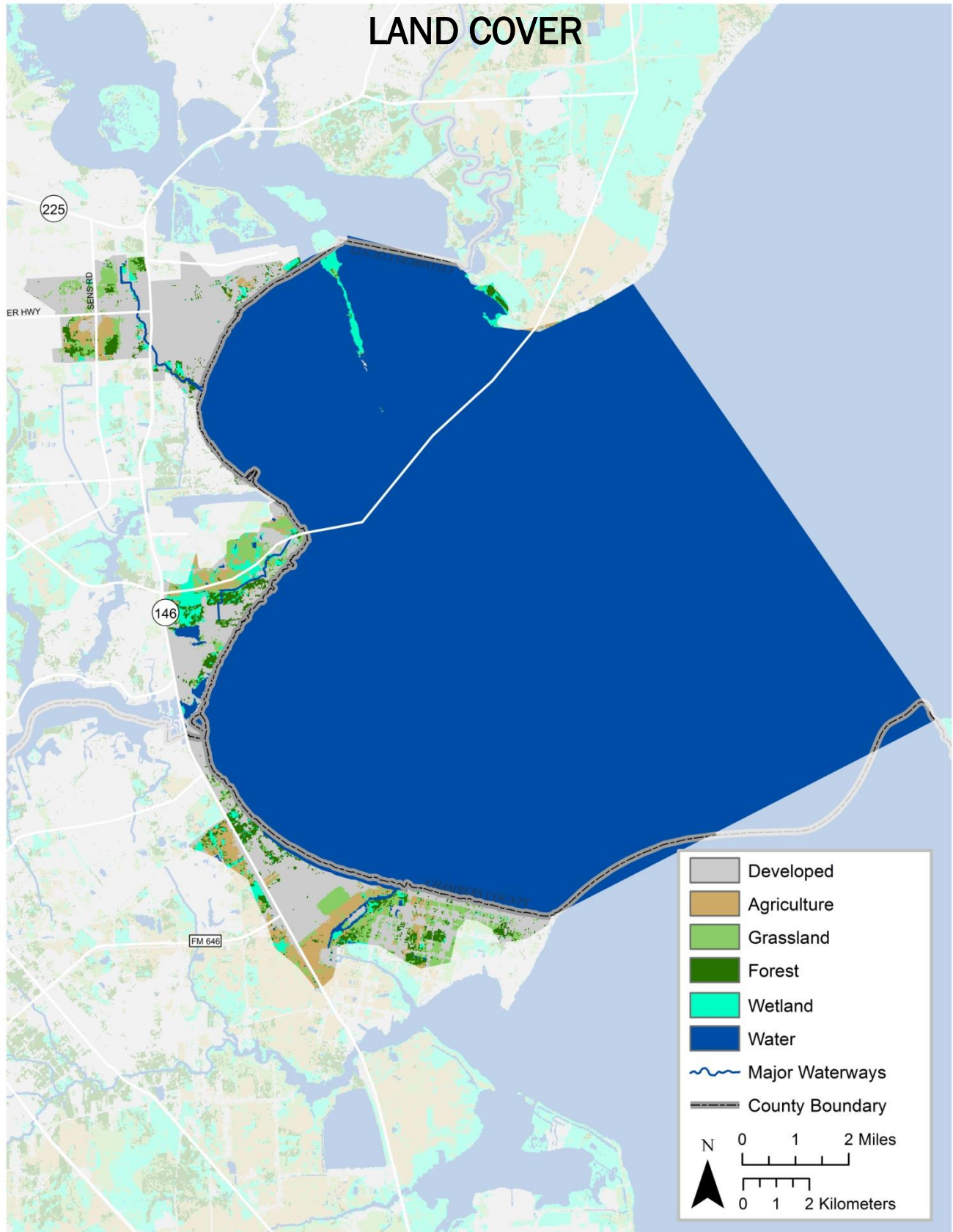


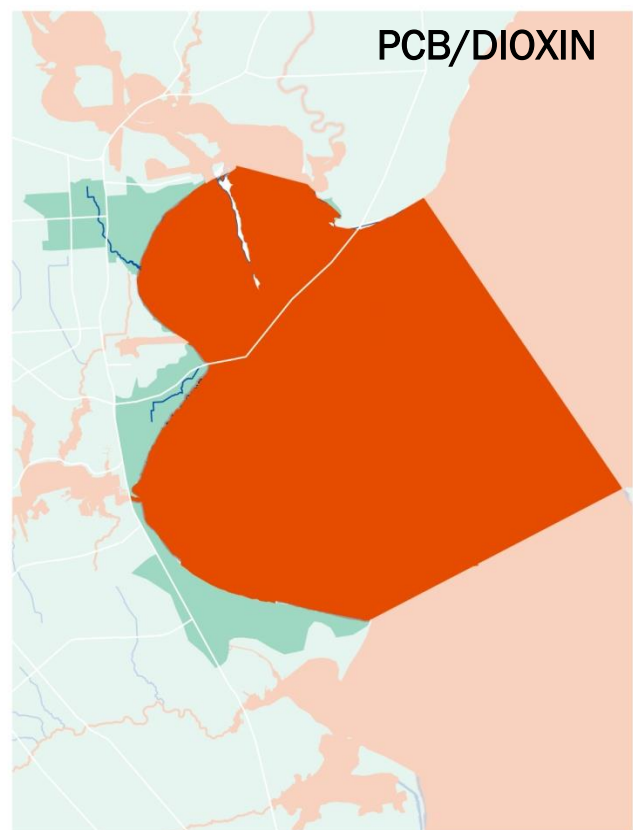
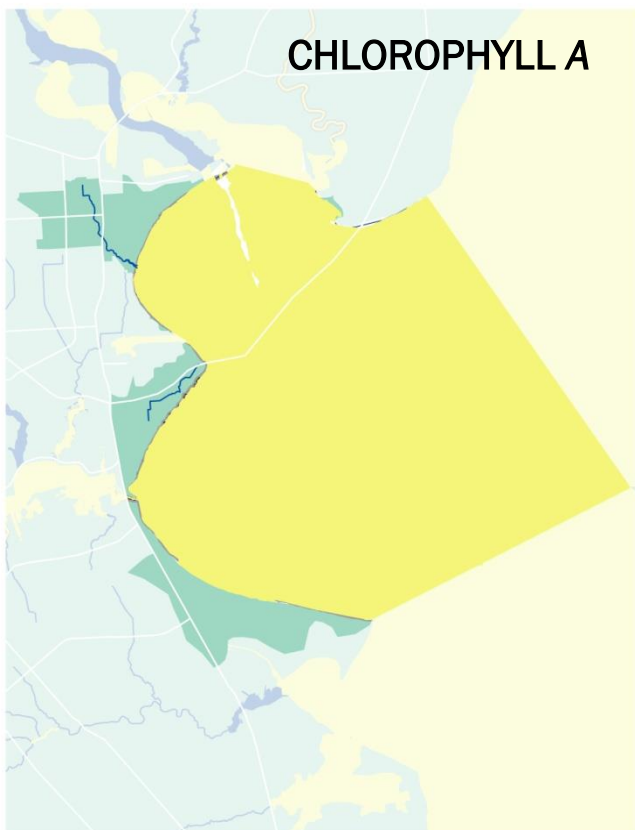
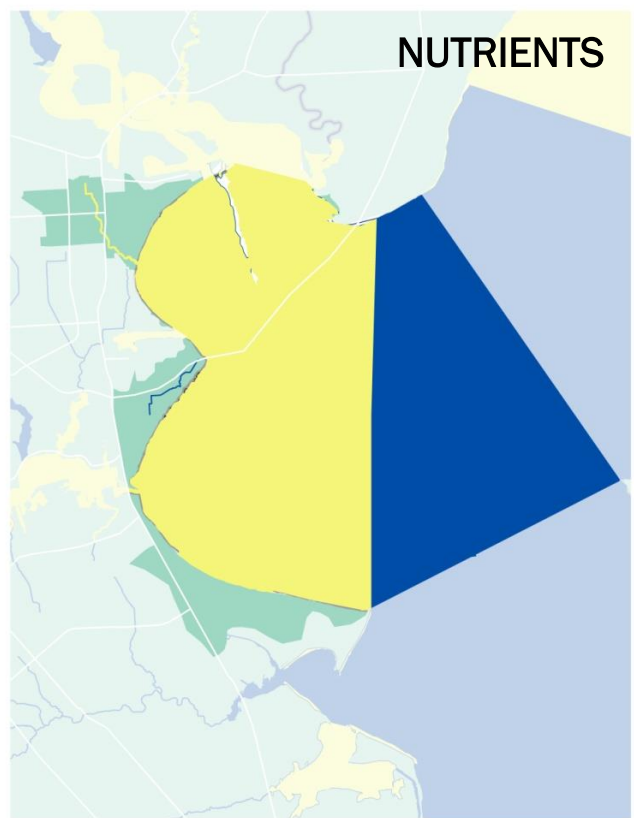
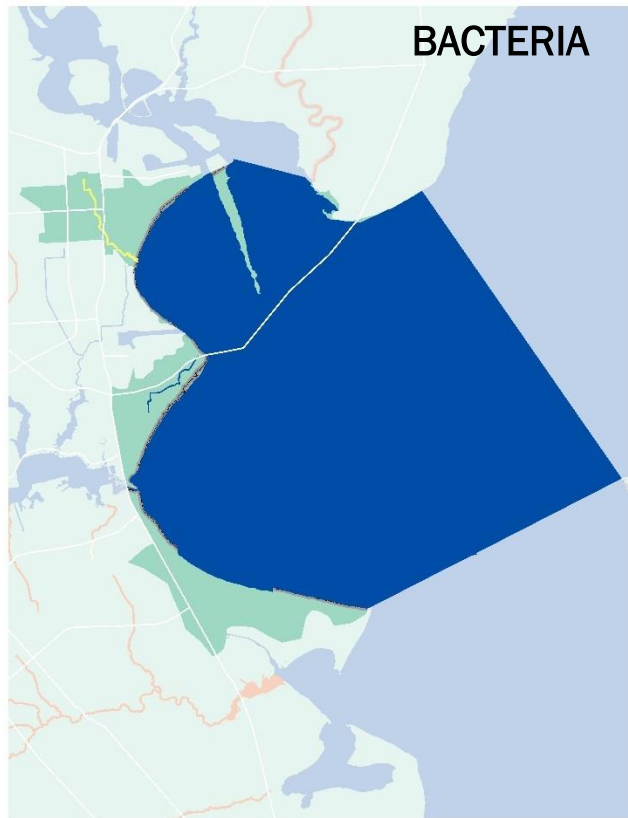
UPPER GALVESTON BAY - SEGMENT 2421



UPPER GALVESTON BAY - SEGMENT 2421

LAND COVER





~~~~~ Impairment    ~~~~~ Concern    ~~~~~ No Impairments or Concerns

|                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                            |  |
|------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|--|
| <b>Segment Number: 2421</b>                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>Name: Upper Galveston Bay</b>                                                           |  |
| <b>Area:</b> 114 square miles                  | <b>Miles of Shoreline:</b> 35.2 miles                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>Designated Uses:</b> Primary Contact Recreation 1; High Aquatic Life Use; Oyster Waters |  |
| <b>Number of Active Monitoring Stations:</b> 6 | <b>Texas Stream Team Monitors:</b> 9                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>Permitted Outfalls:</b> 7                                                               |  |
| <b>Description:</b>                            | <p>Segment 2421: A 280.2 square kilometer (108.2 square mile) portion of Galveston Bay located entirely between Chambers and Harris Counties extending southward from the vicinity of Morgan’s Point to an imaginary east-west line in the area of Redfish Island off Eagle Point and extending eastward to Smith Point in Chambers County, then north on an imaginary north-south line extending to Beach City</p> <p>Segment 2421A (Estuary w/ high ALU): Clear Lake Channel (unclassified water body)—From the Lower Galveston Bay confluence to SH 146</p> <p>Segment 2421B (Tidal Stream w/ high ALU): Little Cedar Bayou (unclassified water body) – From the confluence with Upper Galveston Bay to appoint immediately upstream of Barbours Cut Blvd in La Porte</p> <p>Segment 2421C (Tidal Stream w/ high ALU): Pine Gully (unclassified water body) – From the confluence with Upper Galveston Bay upstream to the terminus approximately 875 meters east of the intersection of Old Highway 146 and Red Bluff Rd in Seabrook</p> <p>Segment 2421H (Recreational beaches)</p> <p>Segment 2421OW (Oyster Waters)</p> |                                                                                            |  |

| <b>Percent of Stream Impaired or of Concern</b> |                    |                 |                         |                  |                      |              |
|-------------------------------------------------|--------------------|-----------------|-------------------------|------------------|----------------------|--------------|
| <b>Segment ID</b>                               | <b>PCBs/Dioxin</b> | <b>Bacteria</b> | <b>Dissolved Oxygen</b> | <b>Nutrients</b> | <b>Chlorophyll a</b> | <b>Other</b> |
| 2421                                            | 100                | -               | -                       | 95               | 100                  | -            |
| 2421A                                           | 100                | -               | -                       | 100              | -                    | -            |
| 2421B                                           | -                  | 100             | -                       | 100              | -                    | -            |
| 2421OW                                          | -                  | 100             | -                       | -                | -                    | -            |



## Segment 2421

| Standards                                                  | Screening Levels |               |
|------------------------------------------------------------|------------------|---------------|
|                                                            | Bays & Estuaries | Tidal Streams |
| Temperature (°C/°F):                                       | 35 / 95          | 35 / 95       |
| Dissolved Oxygen (24-Hr Average) (mg/L):                   | 4.0              | 4.0           |
| Dissolved Oxygen (Absolute Minima) (mg/L):                 | 3.0              | 3.0           |
| pH (standard units):                                       | 6.5-9.0          | 6.5-9.0       |
| Enterococci (MPN/100mL) (grab):                            | 104              | 104           |
| Enterococci (MPN/100mL) (geometric mean):                  | 35               | 35            |
| Fecal Coliform in Oyster Waters (CFU/100mL) (median/grab): | 14/43            |               |

## FY 2016 Active Monitoring Stations

| Site ID | Site Description                        | Frequency   | Monitoring Entity | Parameter Groups                             |
|---------|-----------------------------------------|-------------|-------------------|----------------------------------------------|
| 15463   | Pine Gully at Todville Road             | Quarterly   | TCEQ              | Field, Conventional, Bacteria, Chlorophyll a |
| 16510   | Upper Galveston Bay at 98gb017          | Quarterly   | TCEQ              | Field, Conventional, Bacteria, Chlorophyll a |
| 16511   | Upper Galveston Bay at 98gb018          | Quarterly   | TCEQ              | Field, Conventional, Bacteria, Chlorophyll a |
| 16512   | Upper Galveston Bay at 98gb019          | Quarterly   | TCEQ              | Field, Conventional, Bacteria, Chlorophyll a |
| 16512   | Upper Galveston Bay at 98gb019          | Once / Year | TCEQ              | Benthics, Metals in Sediment                 |
| 16516   | Upper Galveston Bay at 98gb024          | Quarterly   | TCEQ              | Field, Conventional, Bacteria, Chlorophyll a |
| 20802   | Little Cedar Bayou at S Broadway Street | Quarterly   | TCEQ              | Field, Conventional, Bacteria, Chlorophyll a |

## Water Quality Issues Summary

| Issue                                                             | 2014<br>Assessment<br><i>I – Impaired</i><br><i>C – Of Concern</i> | Possible Causes / Influences / Concerns Voiced by Stakeholders                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Possible Solutions / Actions To Be Taken                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|-------------------------------------------------------------------|--------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Elevated Levels of Indicator Bacteria and in Oyster Waters</b> | 2421B C<br>2421OW I                                                | <ul style="list-style-type: none"> <li>▪ Rapid urbanization and increased impervious cover</li> <li>▪ Constructed stormwater controls failing</li> <li>▪ Improper disposal of waste from boats</li> <li>▪ Bird rookeries on islands throughout the bay and along the shoreline</li> <li>▪ Improper or no pet waste disposal</li> <li>▪ Waste haulers illegal discharges/improper disposal</li> <li>▪ Direct and dry weather discharges</li> <li>▪ Poorly operated or undersized WWTFs</li> <li>▪ WWTF non-compliance, overflows, and collection system by-passes</li> <li>▪ Developments with malfunctioning OSSFs</li> </ul> | <ul style="list-style-type: none"> <li>▪ Improve compliance and enforcement of existing stormwater quality permits</li> <li>▪ Improve construction oversight to minimize TSS discharges to waterways</li> <li>▪ Add water quality features to stormwater systems</li> <li>▪ Create and implement Water Quality Management Plans for individual agricultural properties</li> <li>▪ More public education on proper boat waste disposal</li> <li>▪ More public education on pet waste disposal</li> <li>▪ Regionalize chronically non-compliant WWTFs</li> <li>▪ Increase monitoring requirements for self-reporting</li> <li>▪ Impose new or stricter bacteria limits than currently designated by TCEQ</li> <li>▪ Require all systems to develop and implement a utility asset management program and protect against power outages at lift stations</li> <li>▪ More public education regarding OSSF operation and maintenance</li> <li>▪ Ensure proper citing of new or replacement OSSFs</li> </ul> |
| <b>PCBs/Dioxin in Edible Fish Tissue</b>                          | 2421 I<br>2421A                                                    | <ul style="list-style-type: none"> <li>▪ Waste pit located along the San Jacinto River immediately upstream of I-10 bridge</li> <li>▪ Concentrated deposits outside boundaries of the waste pits located adjacent to San Jacinto River and I-10 bridge</li> <li>▪ Unknown industrial or urban sources</li> </ul>                                                                                                                                                                                                                                                                                                              | <ul style="list-style-type: none"> <li>▪ Encourage regulators and responsible parties to work together to remediate Superfund site</li> <li>▪ Remove or contain contamination from locations already identified</li> <li>▪ Encourage additional testing to locate all unknown sources/deposits</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Elevated Nutrients</b>                                         | 2421 C<br>2421A C<br>2421B C                                       | <ul style="list-style-type: none"> <li>▪ Fertilizer runoff from urbanized properties, such as landscaped areas, residential lawns, and sport fields</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <ul style="list-style-type: none"> <li>▪ Implement YardWise and Watersmart landscape practices</li> <li>▪ If DO swings are significant and biology shows a</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

|                                       |        |                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                |
|---------------------------------------|--------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                       |        | <ul style="list-style-type: none"> <li>▪ WWTF effluent, sanitary sewer overflows, and malfunctioning OSSFs</li> <li>▪ Agricultural runoff from row crops, pastures, and fallow fields</li> </ul>                                                             | related effect, some phosphorus controls may be needed for wastewater treatment plants                                                                                                                                                                         |
| Elevated Chlorophyll a Concentrations | 2421 C | <ul style="list-style-type: none"> <li>▪ Fertilizer runoff from surrounding watershed promotes algal growth in waterways</li> <li>▪ Nutrient loading from WWTF effluent, sanitary sewer overflows, and malfunctioning OSSFs promotes algal growth</li> </ul> | <ul style="list-style-type: none"> <li>▪ Improve compliance and enforcement of existing stormwater quality permits</li> <li>▪ Improve stormwater controls in new developments</li> <li>▪ More public education regarding nutrients and consequences</li> </ul> |

### Segment Discussion:

**Watershed Characteristics:** Land use in the northern portion of this watershed is primarily industrial with mixed residential and commercial uses present in the cities of La Porte, Shore Acres, and Pasadena. However, residential and commercial land use is more common in the southern reaches of the watershed in the cities of Seabrook and Kemah and in unincorporated Harris and Galveston counties. Recreational uses such as fishing and boating are very common throughout the Upper Galveston Bay waters.

**Water Quality Issues:** The 2014 Texas IR lists AU 2421OW\_01, which covers the entire western portion of Upper Galveston Bay, as impaired for oyster waters due to elevated levels of fecal coliform bacteria. This assessment unity is closed by the Seafood Safety Division of the Texas Department of State Health Services for the harvesting of oysters and other shellfish for direct marketing. Potential causes and solutions to elevated bacteria in oyster waters are discussed in the table above. Except for Little Cedar Bayou (2421B), a small tributary feeding into the northwest area of the bay, this segment fully supports its primary contact and high aquatic life use designations.

Upper Galveston Bay (2421) and Clear Lake Channel (2421A) are listed as impaired for fish consumption due to elevated levels of dioxin and PCBs found in edible fish tissue. The Texas Department of State Health Services as issued a Limited Fish Consumption Advisory for these segments.

Assessment units within the Upper Galveston Bay system have numerous concerns for water quality based upon screening criteria levels for nutrients and chlorophyll a. In Upper Galveston Bay concerns for nitrate nitrogen and total phosphorus are listed for AUs 2421\_01 and 2421\_02. Clear Lake Channel has a concern for total phosphorus and ammonia nitrogen, and Little Cedar Bayou has concerns for nitrate nitrogen and total phosphorus. Three assessment units in Upper Galveston Bay (2421\_01 – 2421\_03) have water quality screening criteria concerns for chlorophyll a. Over 82% of chlorophyll a samples in AUs 2421\_01 and 2421\_02 were above the 11.6 micrograms per L screening level.

**Special Studies/Projects:** This segment is included in three TMDL projects: the Houston Ship Channel and Upper Galveston Bay TMDL for PCBs in Fish Tissue, the Houston Ship Channel TMDL for Dioxin, and the Galveston Bay System Survey for Dioxin and PCBs, which are currently under way.

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For more information, please refer to the detailed discussions located in the Public Involvement and Outreach section of the 2016 Basin Summary Report.

**Trends:** Regression analysis of water quality data identified three statistically significant parameter trends for Upper Galveston Bay including increasing alkalinity and pH and decreasing total phosphorous (TP). The 2014 Texas Integrated Report lists the oyster waters of Upper Galveston Bay as impaired for bacteria while AU 2421B, Little Cedar Bayou, has a concern for bacteria. Regression analysis detected a relatively stable trend in [enterococci](#) levels over time. It should be noted that the majority of enterococci samples collected during the period of record are in compliance with state bacteria standards for tidal waters with only six samples exceeding the 35 MPN/100 mL geometric mean standard since 2010. These occasional spikes in bacteria are most likely related to rain events when collection systems overflow, WWTFs and OSSFs malfunction, and pet waste, livestock fields and enclosures lead to higher bacteria levels in stormwater.

The 2014 Integrated Report also lists the majority of AUs in Upper Galveston Bay as having a concern for nutrients. Although regression analysis show [nitrate](#) levels in Upper Bay have been relatively stable since 2000, exceedances above the 0.17 mg/L screening criteria for bays and estuaries are still common. A decreasing trend was detected for [TP](#) levels in Upper Galveston Bay with concentrations falling within compliance majority of the time. A concern for [chlorophyll a](#) is also present for the main segment. Chlorophyll *a* levels have remained stable over time but concentrations remain consistently higher than the set screening criteria. The PCB and dioxin impairments also persist for the entire watershed.

## Recommendations

Address concerns found in this segment summary through stakeholder participation.

Continue collecting water quality data to support actions associated with any future watershed protection plan development and possible modeling.

Increase the number of yearly representative stations to provide consistent time series. Need fewer stations with more data.

Support Galveston Bay Foundations efforts to complete Oyster Waters TMDL on this segment.

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