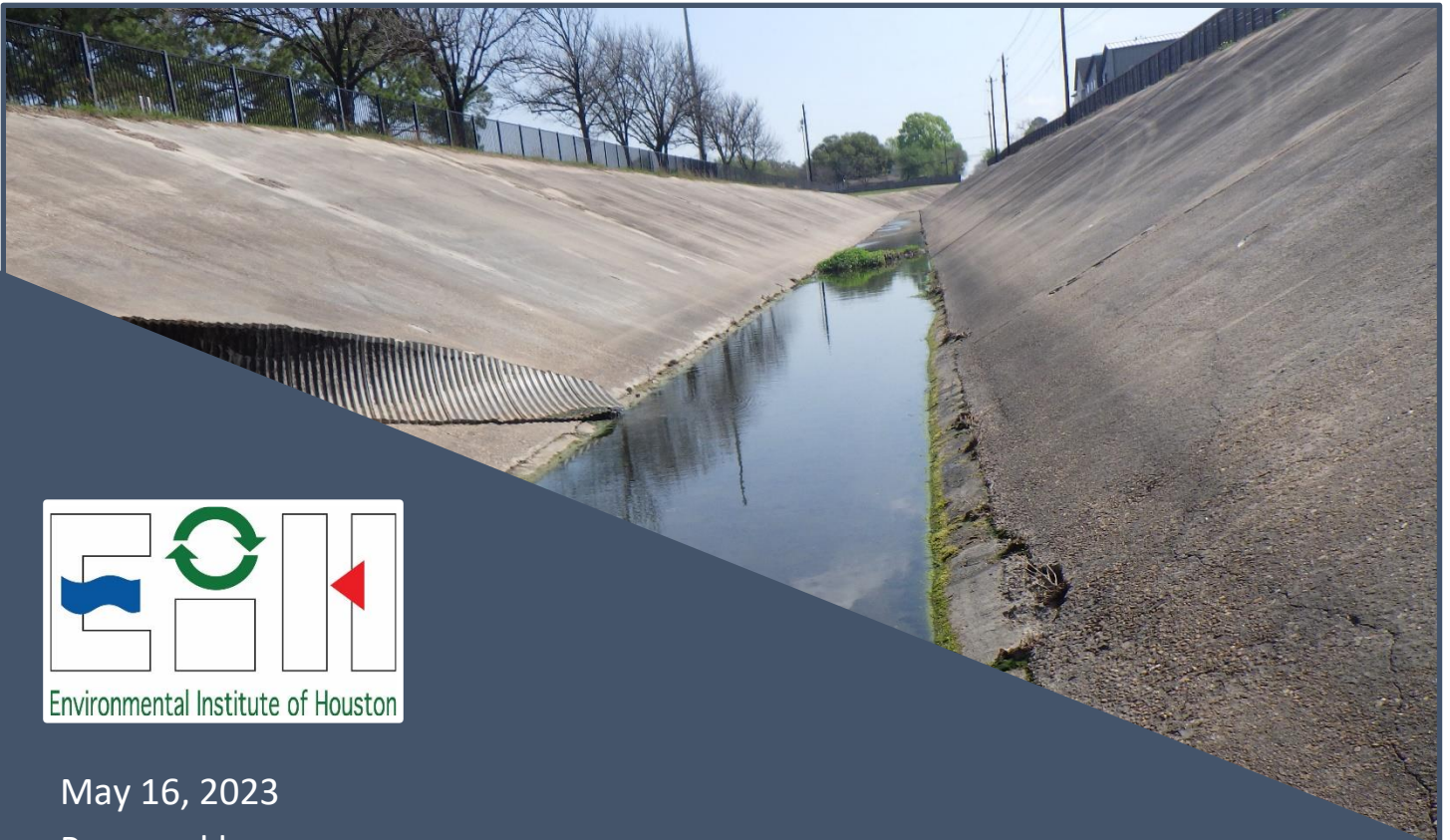


# Targeted Bacteria Monitoring Project Field Investigation Final Report Assessment Unit 1017A\_01 Brickhouse Gully



May 16, 2023

Prepared by:

Jenny Oakley, Ph.D., Associate Director, Research Programs

Kaylei Chau, Research Associate

Sherah McDaniel, Research Associate

Environmental Institute of Houston, University of Houston-Clear Lake

2700 Bay Area Blvd, MC 540, Houston TX 77058

## Segment Description

Segment 1017A is a freshwater perennial stream referred to as Brickhouse Gully (Figure 1). This segment is 10.33 km long and consists of one assessment unit (AU) of concern, AU 1017A\_01, which is defined as spanning from the confluence with White Oak Bayou up to Gessner Road in Harris County. There is one current surface water quality monitoring (SWQM) station located on this AU (station ID: 16594) and five historic stations associated with this AU. This AU has been selected for targeted monitoring due to a bacteria (*Escherichia coli*) seven-year geometric mean of 1405.4 MPN/100 mL (H-GAC QAPP, 2022). The AU was listed for exceedances of bacteria in the water (Recreation use) and has a current impairment category of 4a (TCEQ, 2022). The potential sources of bacteria impairments and concerns that were reported in the 2022 Integrated Report are non-point source pollution, urban runoff, and sanitary sewer overflows (TCEQ, 2022).

The contributing watershed for this AU is 39 km<sup>2</sup> (Data source: HGAC, SWRC, 2023). The soil groups in the watershed are predominantly medium/very slow infiltration coverage and land cover is predominately developed (98.7%) (Data source: United States Department of Agriculture Hydrologic Soil Groups from gSSURGO 2016 and National Land Cover Database NLCD 2019). There is one permitted wastewater outfall in the watershed (Data source: H-GAC). There are also 49 documented permitted on-site sewage facilities (OSSF) and 16 documented parcels of OSSFs within the watershed (Data source: H-GAC).

## Background

Clean Rivers Program (CRP) routine monitoring data are analyzed each year as part of the Houston-Galveston Area Council (H-GAC) Basin Summary/Basin Highlights Report process. Bacteria continues to be the most prevalent pollutant in the H-GAC CRP Basins (H-GAC, 2022). The Bacteria Implementation Group (BIG), formed in 2008, oversees the Total Maximum Daily Load (TMDL) Implementation Plan (I-Plan). The BIG requested that H-GAC produce a list of the water bodies with the highest bacteria concentrations in the BIG project area and conduct targeted monitoring to identify potential bacteria sources.

Houston-Galveston Area Council, using information from previous Basin Highlights/Summary Reports, BIG annual reports, and previous targeted monitoring efforts, identified and selected waterways for targeted bacteria monitoring to refine our understanding of the spatial distribution of elevated bacterial concentrations contributing to these waterways. Phase 1 of this targeted monitoring project includes an intensive desktop review and a windshield survey (WS) of each AU catchment area, and sampling of the AU from primary road crossings. Phase 2 of this targeted monitoring project includes a field investigation (FI) of the entire AU conducted during dry conditions where all flowing point and non-point sources are evaluated.

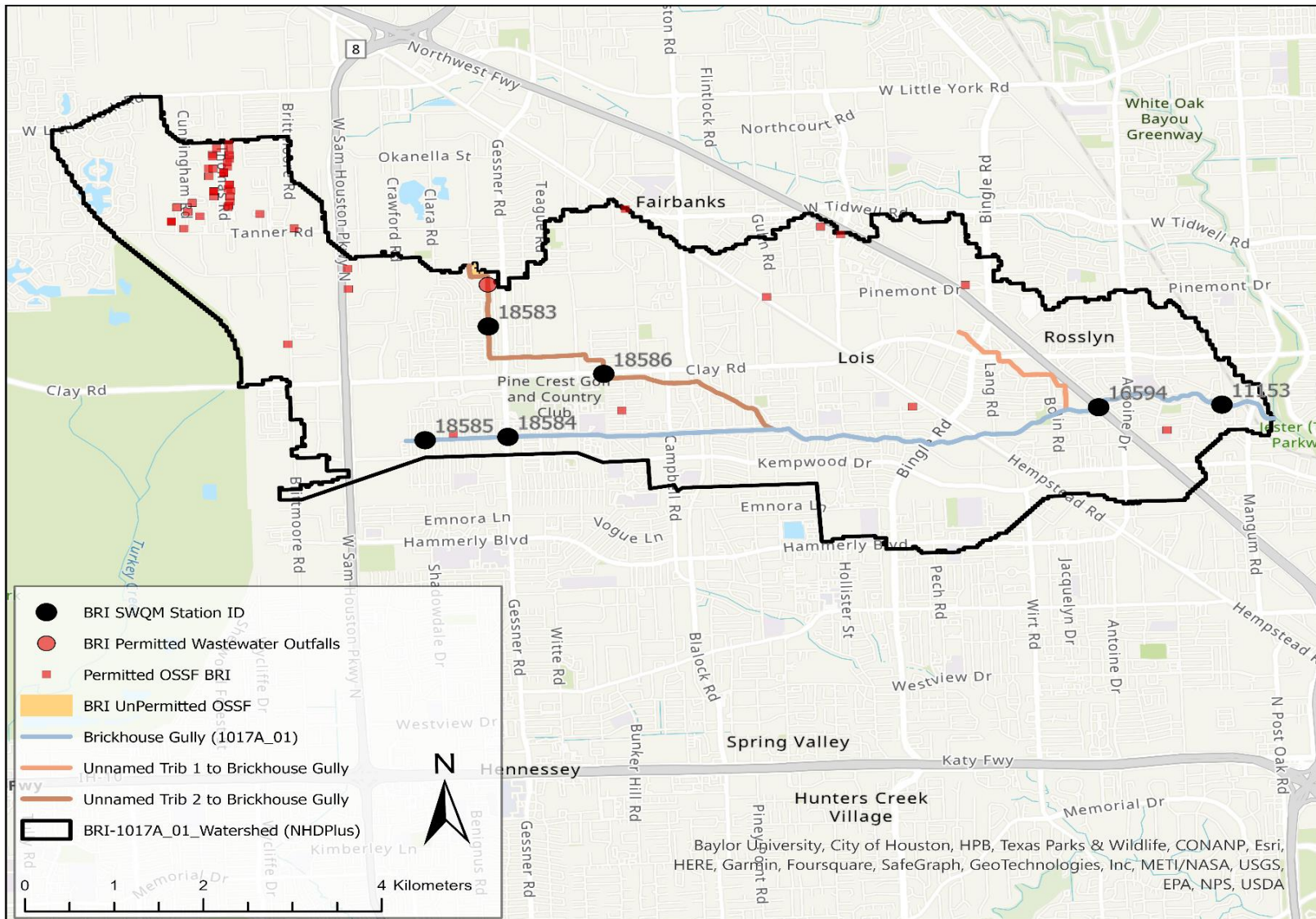


Figure 1: Watershed Map for AU 1017A\_01.

# Desktop Review

## Methods

The intensive desktop review included an evaluation of permitted discharges, outfalls, and potential sources of point source and nonpoint source pollution that may contribute to bacteria loading in the AU. Using Google Earth imagery and GIS, the locations of wastewater treatment facilities, permitted OSSFs, and potential locations of unpermitted OSSFs were identified. Other potential sources such as landfills and industrial facilities were also identified. Parks were noted as these can contribute to bacterial sources through runoff of animal wastes but also provide opportunity for contact recreation. Bridge crossings and other entry points were identified in order to provide access into the stream to collect bacteriological samples.

## Results

The results of the desktop review indicated that the watershed lies predominantly within a dense suburban area with some businesses and manufacturing facilities scattered throughout. The results of the review also indicated that there were several permitted and unpermitted OSSFs as well as one permitted wastewater outfall on an upstream portion of a tributary to Brickhouse Gully. Where that permitted wastewater outfall is located is also where the bulk of the unpermitted OSSFs lie, as a result, this tributary was prioritized during the WS, time permitting. The following potential sources were identified:

- a stretch of the AU, ~0.75 mi long, that is bordered by many public parks and schoolgrounds situated between Antoine Dr. and Mangum Rd. (Figure 2)
- a city water facility on Kempwood Dr. that is ~150 meters from the stream and was not listed under any of the permitted or unpermitted outfalls provided by H-GAC (Figure 3)

Publicly accessible entry points into the stream were identified at stream crossings at Watonga Blvd., Mangum Rd., Antoine Dr., Bolin Rd., Lang Rd., Bingle Rd., Hollister Rd., Peppermill Rd., Campbell Rd., Rosefield Dr., Gessner Rd., and Quincannon Ln. There were also two tributaries of the AU identified during desktop review. Tributary 1 has access to the downstream portion located at the eastern dead end of Underhill St. Tributary 2 has access to the downstream portion closest to the confluence with Brickhouse Gully at Colleen Rd.



Figure 2: Stretch of the AU bordered by many parks and schoolgrounds. Identified during desktop review as a possible source.



Figure 3: A city water facility near the AU that was not listed under the permitted/unpermitted outfalls provided by H-GAC. Identified during desktop review as a possible source.

# Windshield Survey

## Methods

Field events must take place during dry weather (after 3 or more days without significant rainfall in the watershed). This ensures that any flowing water into the AU are not stormwater. Windshield surveys of the watershed were conducted and bacteria sampling was performed at public access points throughout the AU (primarily at bridge crossings). The survey consisted of driving the catchment area to confirm identified pollution sources found during the desktop review and to find any potential sources not identified during that review. Bridge crossings chosen for sampling were spatially distributed to provide a spatial snapshot of bacteria concentrations in the AU and identify sections of the AU where elevated bacteria concentrations were found. Those areas with elevated bacteria levels identified in the WS monitoring were focused on during the FI.

Assessment Units, sample collection and laboratory methods, and data handling practices are detailed in Appendix J of the FY 2022-2023 H-GAC Multi-Basin Clean Rivers Program Quality Assurance Project Plan (H-GAC QAPP, 2022). For all WSs, bacteria monitoring field personnel documented the latitude and longitude of sample location. All bacteria samples were analyzed by a National Environmental Laboratory Accreditation Program (NELAP)-Accredited laboratory.

## Results and Recommendations

The WS was conducted on March 09, 2023. At that time, it had been 6 days since the last significant rainfall in the watershed. A total of 13 samples were collected on AU 1017A\_01 and 2 on contributing tributaries during the WS (Table 1 and Figure 4).

Based upon the results of the WS, FIs covering the length of the AU from its confluence with White Oak Above Tidal to Peppermill Rd. and of the entire unnamed tributary 1 (confluence with Brickhouse Gully lies between Bolin Rd. and US 290) was recommended. If time and supplies permit, a FI of the entire length of the AU was recommended, but the WS results show the portion upstream of Peppermill Rd. to be of least concern. Based on the results of the WS, we expected to identify potential non-point or point sources of elevated bacteria near the following portions of the AU:

- 1) BRI-WS-02, which was collected upstream of the bridge at Mangum Rd. This sample had an elevated bacteria result compared to the samples collected upstream and downstream of this area.
- 2) BRI-WS-06, which was collected on the downstream side of the bridge at Bingle Rd. This sample had a bacteria level that was significantly higher than the samples collected upstream and downstream of this area. The comments written at time of collection also mentioned that

there was a “sewage odor and cloudy water” which may indicate a potential source within the ~0.75 mi stretch of the AU from Hollister Rd (which had a bacteria level of < 100 MPN/100 mL) to the bridge at Bingle Rd.

3) T1BRI-WS-01, which was collected from the unnamed tributary 1 (confluence with Brickhouse Gully lies between Bolin Rd. and US 290). This sample had a bacteria level that significantly higher compared to the sample collected ~120 meters upstream.

*Table 1. Windshield survey bacteria results from sampling on 03/09/2023 on Brickhouse Gully (AU 1017A\_01). Samples were taken at bridge crossings and other publicly accessible points. US = Upstream, DS = Downstream. LB = Left Bank, RB = Right Bank.*

Sample ID	Latitude	Longitude	<i>E. coli</i> Sample Results (MPN/100 mL)	Comments
BRI-WS-01	29.82685	-95.45857	630	Fishy and bat guano odor; Decomposing cat DS of sample; Lots of trash in and around stream
BRI-WS-02	29.82681	-95.46241	750	Some trash along water's edge
BRI-WS-03	29.82821	-95.47291	520	Trash in stream
BRI-WS-04	29.82608	-95.48160	100	Wastewater effluent odor and cloudy water; Construction at park on LB; Concrete outfall DS of sample point
BRI-WS-05	29.82388	-95.48863	< 100	Small dead fish in water; Several large plastic and metal trash pieces stuck in right DS outfall pipe; Cloudy water; Large trash under bridge
BRI-WS-06	29.82276	-95.49625	> 242,000	Sewage odor and cloudy water; some trash in stream
BRI-WS-07	29.82394	-95.50932	< 100	Cloudy water
BRI-WS-08	29.82500	-95.51673	< 100	Cloudy water; fishy odor in ambient air; fast flow
BRI-WS-09	29.82486	-95.52614	100	Very cloudy water; fast flow; DS of small drop/waterfall; apartment dumpster next to fence on RB
BRI-WS-10	29.82496	-95.53680	< 100	Change in velocity to be much slower; water clarity is very high; shallow
BRI-WS-11	29.82500	-95.54507	< 100	Change from concrete banks to vegetated banks US of bridge; lots of trash and loose concrete slabs under bridge; relatively clear water; leaky water main above RB DS of sample
BRI-WS-12	29.82477	-95.55649	< 100	Lots of aquatic life; banks are heavily vegetated
BRI-WS-13	29.82469	-95.52958	< 100	Very cloudy water like BRI-WS-09
T1BRI-WS-01	29.82661	-95.48034	1,870	Lots of filamentous green algae on trib substrate (concrete); some trash in trib
T2BRI-WS-01	29.82537	-95.51486	410	Clear water; algae coating bottom; very shallow; vertical banks; some trash US; flap gate to large drain pipe US is closed

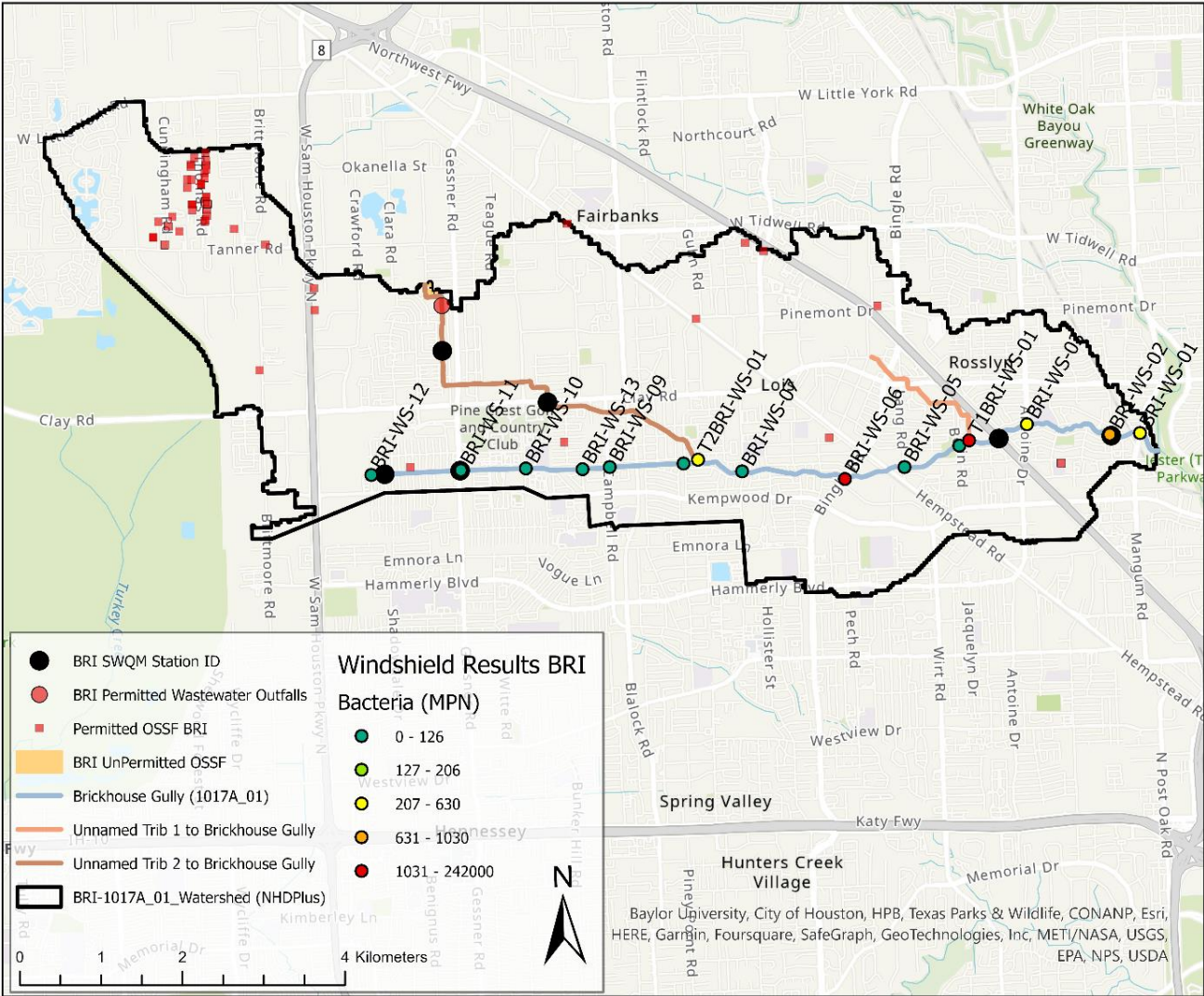


Figure 4: Windshield survey/ground truthing bacteria results from sampling on 03/09/2023 on Brickhouse Gully (AU 1017A\_01). Samples were taken at bridge crossings and other easily accessible points.



---

## Field Investigation

### Methods

The FI was a thorough survey where a team of two, either walked or paddled the entire assessment unit and sampled any water observed flowing into the stream. Water could be flowing in from a pipe, culvert, natural tributary, or earthen ditch. Flowing water was categorized into two source types: permitted outfalls or unpermitted outfalls. Permitted outfalls included wastewater facilities and municipal separate storm sewer systems (MS4). Any pipe greater than 12 inch (in.) in diameter was assumed to be permitted by our field crews. When flowing water was observed from a permitted outfall, two samples were collected.

One sample was collected immediately downstream of the outfall where the flowing outfall was mixing with the ambient water. The second sample was taken upstream of the flowing outfall outside of the realm of influence from the outfall to provide the ambient bacteria levels of the assessment unit in that area. The second type of source was an unpermitted outfall, which was any other flowing source of water that was not assumed to be permitted including flowing small (<12 in. diameter) “homemade” pipes and tributaries.

When a flowing unpermitted outfall was observed, the bacteria sample was taken directly from the source. If the source was a flowing pipe, the sample was collected directly from the pipe, before it entered the AU. If it was an open-top earthen ditch or natural tributary, the sample was collected from far enough into the inflow source that there was no mixing with the receiving water. In some cases, when no flowing permitted or unpermitted outfalls were observed in an extended section of the AU, a single ambient reference sample was taken mid-stream. Left and right bank references are oriented with the observer facing downstream.

Assessment Units, collection and laboratory methods, and data handling practices are detailed in Appendix J of the FY 2022-2023 H-GAC Multi-Basin Clean Rivers Program Quality Assurance Project Plan (H-GAC QAPP, 2022). For all field investigations the field team recorded location of the flowing outfall (latitude and longitude), the diameter, material, and water depth of the flowing outfall, and documented site conditions by taking photos and other relevant notes. All bacteria samples were collected following procedures listed in Appendix J of the FY 2022-2023 H-GAC Multi-Basin Clean Rivers Program Quality Assurance Project Plan (H-GAC QAPP, 2022) and analyzed by a National Environmental Laboratory Accreditation Program (NELAP)-Accredited laboratory.

### Results

The FI of the main AU was conducted on April 13, 2023 (eight days since last significant rainfall) and a total of 57 bacteria samples were collected. The FI of unnamed tributary 1 of Brickhouse Gully was conducted on April 12, 2023 (seven days since last significant rainfall) and a total of 25 bacteria samples were collected. The values of the bacteria samples collected from downstream of

permitted outfalls, directly from unpermitted outfalls, or as ambient samples are summarized in Table 2 and Figure 5. Based on the data collected, eight locations with elevated *E. coli* bacteria levels measured during the field investigation are recommended for high priority, and four locations for low priority investigation by the proper authorities. High priority sites had the highest potential bacteria loading observed and are recommended to be the areas for local authorities to focus efforts on should there be insufficient resources to address all referral sites. As time and resources allow the low priority and “investigate further” referrals also are recommended for further investigation. These locations are summarized in Table 2 and Figure 6. Four locations were flagged where ambient or upstream samples had elevated bacteria levels with no obvious explanations. Further investigation of these areas by the proper authorities are recommended. Each of these referrals are summarized by site, herein. The referral summaries are listed in order of priority (High, Low, then Investigate Further). Within each priority group, sites are listed from downstream to upstream.

Table 2: Field investigation bacteria results from sampling on 4/13/2023 on Brickhouse Gully (Assessment Unit 1017A\_01) and from sampling on 4/12/2023 on unnamed tributary 1 of Brickhouse Gully. Referrals (gray rows): N = No, Y-H = Yes – High Priority, Y-L = Yes-Low Priority, IF = Investigate Further, US = Upstream, DS = Downstream. LB = Left Bank, RB = Right Bank.

Sample ID	Lat	Long	DS or Direct <i>E. coli</i> Sample Results (MPN/100 mL)	US <i>E. coli</i> Sample Results (MPN/100 mL)	Difference* DS - US (MPN/100 mL)	Referral	Comments
BRI-FI1-01	29.82494	-95.45649	5,120	NA	NA	N	Ambient sample collected upstream of confluence with White Oak Bayou.
BRI-FI1-02-D	29.82678	-95.45834	> 242,000	6,370	235,630	Y-H	Pipe on LB is barely trickling.
BRI-FI1-03-P	29.82663	-95.45860	<100	NA	NA	N	Sample taken directly from leaking pipe spanning over channel.
BRI-FI1-04-D	29.82681	-95.45992	4,200	7,590	-3,390	N	Pipe on RB is barely trickling.
BRI-FI1-05-D	29.82669	-95.46206	5,830	9,600	-3,770	N	Right bank. 2 pipes across channel from each other. Same upstream sample used.
BRI-FI1-06-D	29.82668	-95.46210	4,810	9,600	-4,790	N	Left bank. 2 pipes across channel from each other. Same upstream sample used.
BRI-FI1-07-D	29.82673	-95.46230	9,090	8,200	890	Y-L	Barely trickling. Algae in pipe on RB.
BRI-FI1-08-D	29.82697	-95.46279	> 242,000	6,700	235,300	Y-H	Barely trickling pipe on RB.
BRI-FI1-09-D	29.82829	-95.47176	410	27,200	-26,790	N	Pipe on LB.
BRI-FI1-10-P	29.82827	-95.47285	<100	29,100	-29,000	N	Concrete collapsing near opening of pipe on LB.
BRI-FI1-11-D	29.82703	-95.47639	> 242,000	51,700	190,300	Y-H	White cloudiness coming from outfall. Rotting sewage smell. Two pipes across from each other - this pipe is on the right bank.
BRI-FI1-12-D	29.82704	-95.47645	14,700	19,200	-4,500	N	Two pipes across from each other - this pipe is on the left bank.
BRI-FI1-13-D	29.82640	-95.47761	9,870	14,000	-4,130	N	Flap to pipe closed but leaking on LB. Flap gate specifies 48in. Unable to access.
BRI-FI1-14	29.82658	-95.48029	32,600	NA	NA	N	Sample taken directly from tributary.
BRI-FI1-15-D	29.82618	-95.48133	200	9,590	-9,390	N	Pipe on RB.
BRI-FI1-16-D	29.82384	-95.48674	6,630	16,200	-9,570	N	Abundance of algae in pipe on RB.
BRI-FI1-17-D	29.82378	-95.49061	1,480	98,000	-96,520	N	A lot of sand and sediment in outfall on LB.

Sample ID	Lat	Long	DS or Direct <i>E. coli</i> Sample Results (MPN/100 mL)	US <i>E. coli</i> Sample Results (MPN/100 mL)	Difference* DS - US (MPN/100 mL)	Referral	Comments
BRI-FI1-18-P	29.82358	-95.49079	300	NA	NA	Y-L	Sediment in front of opening. Pipe on RB flowing heavily.
BRI-FI1-19-D	29.82349	-95.49173	19,000	173,000	-154,000	N	Dead opossum ~10m downstream. Pipe on LB.
BRI-FI1-20-D	29.82320	-95.49299	105,000	> 242,000	-137,000	N	Pipe on RB.
BRI-FI1-21-D	29.82307	-95.49345	51,700	> 242,000	-190,300	N	Pipe on LB.
BRI-FI1-22-P	29.82289	-95.49406	520	NA	NA	IF	Ambient sample of tributary.
BRI-FI1-23-D	29.82281	-95.49643	51,700	57,900	-6,200	N	Left bank. Another pipe is across the stream.
BRI-FI1-24-D	29.82281	-95.49647	> 242,000	54,800	187,200	Y-H	Water is cloudy and smells of sewage. Right bank. Unusual white-ish algae is not observed US of this pipe.
BRI-FI1-25-D	29.82357	-95.50217	4,960	22,500	-17,540	N	Right bank
BRI-FI1-26-D	29.82356	-95.50227	8,160	22,800	-14,640	N	Left bank
BRI-FI1-27-D	29.82414	-95.50630	100	410	-310	N	Right bank
BRI-FI1-28-D	29.82417	-95.50632	242,000	200	241,800	Y-H	Left bank
BRI-FI1-29-D	29.82388	-95.50909	1,990	200	1,790	Y-H	Right bank
BRI-FI1-30-D	29.82396	-95.50934	310	630	-320	N	Flap gate closed but leaking out on LB. Bottom of flap gate submerged. Unable to tell water depth inside.
BRI-FI1-31	29.82511	-95.51448	200	NA	NA	N	Ambient sample collected from main stem of AU.
BRI-FI1-32	29.82513	-95.51448	2,530	NA	NA	IF	Ambient sample collected US of confluence with main AU.
BRI-FI1-NS-1	29.82705	-95.46364	NA	NA	NA	NA	Not sampled. Outfall area of pipe wet but not flowing on LB; debris built up around mouth.
BRI-FI1-NS-2	29.82778	-95.46469	NA	NA	NA	NA	Not sampled. Pipe dripping, algae built up around mouth on RB.
BRI-FI1-NS-3	29.82805	-95.46572	NA	NA	NA	NA	Not sampled. Pipe wet, signs of recent flow, not flowing currently.
BRI-FI1-NS-4	29.82509	-95.51471	NA	NA	NA	NA	Not sampled. Flowing weep hole.
BRI-T1-FI1-01	29.82659	-95.48029	100	NA	NA	N	Ambient sample taken just before confluence with Brickhouse Gully.
BRI-T1-FI1-02-D	29.82945	-95.48048	3,450	300	3,150	Y-H	Rusted out pipe up on RB, likely draining to weep hole.

Sample ID	Lat	Long	DS or Direct <i>E. coli</i> Sample Results (MPN/100 mL)	US <i>E. coli</i> Sample Results (MPN/100 mL)	Difference* DS - US (MPN/100 mL)	Referral	Comments
BRI-T1-FI1-03-D	29.83073	-95.48170	310	310	0	N	Concrete culvert trickling into ditch on LB.
BRI-T1-FI1-04-D	29.83098	-95.48531	100	100	0	N	Pipe on RB.
BRI-T1-FI1-05-D	29.83138	-95.48562	2,990	310	2,680	Y-H	Strong fermented odor. Water discharging is cloudy and brown. Pipe on LB.
BRI-T1-FI1-06-D	29.83455	-95.49071	< 100	310	-210	N	Pipe on LB.
BRI-T1-FI1-07-D	29.83564	-95.49167	200	300	-100	N	Underground submerged metal pipe on RB. Has created a washed-out pool.
BRI-T1-FI1-08-D	29.83659	-95.49268	100	740	-640	N	Observed a small pool of turbid water not near any flowing pipes. Stopped to investigate and saw bubbles come up from center. Took a sample within pool (D) and a sample US of pool (U). Ongoing construction just US on road.
BRI-T1-FI1-09-D	29.83776	-95.49414	< 100	100	0	N	Outfall on LB from reservoir near gated business park.
BRI-T1-FI1-10-D	29.83770	-95.49577	410	100	310	Y-L	Two identical pipes right next to each other on RB. Both are only dripping. Unable to get a sample from each, so sample was collected from the pool the pipes were dripping into.
BRI-T1-FI1-11-D	29.83897	-95.49650	410	100	310	Y-L	Pipe on RB.
BRI-T1-FI1-12-D	29.84124	-95.49653	200	410	-210	N	Dead fish observed at mouth of culvert on RB.
BRI-T1-FI1-13	29.84402	-95.50144	> 242,000	NA	NA	IF	Ambient sample taken on upstream side of bridge.
BRI-T1-FI1-14	29.84599	-95.50655	< 100	NA	NA	IF	Ambient sample taken on upstream side of bridge at Hollister Road.
BRI-T1-FI1-NS-1	29.83094	-95.48211	NA	NA	NA	NA	Not sampled. Small trickle coming out of concrete pipe on LB. Too shallow to sample.

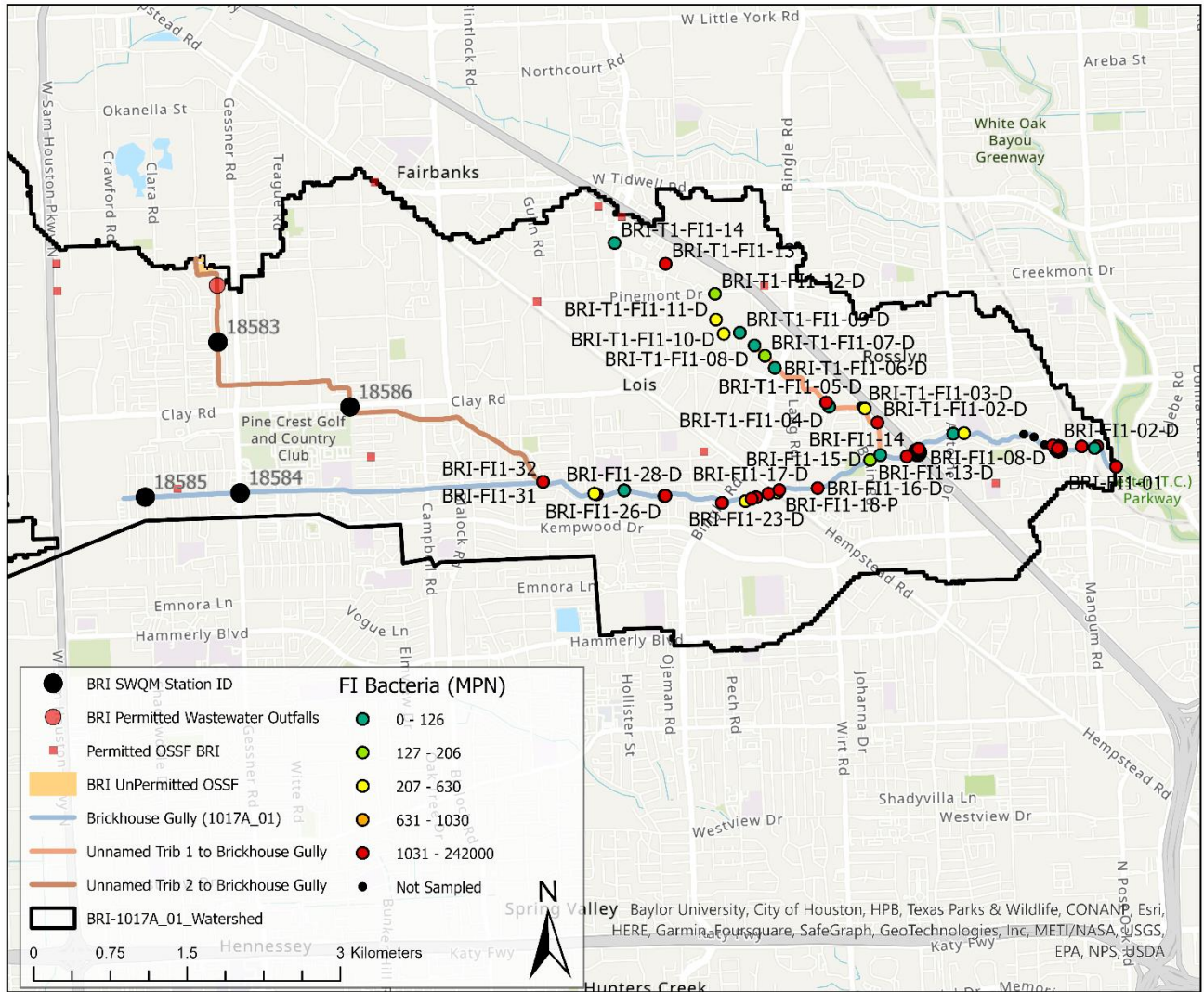


Figure 5: Field investigation bacteria sampling results from 04/12/2023 on unnamed tributary 1 of Brickhouse Gully and from 4/13/2023 on Brickhouse Gully (Assessment Unit 1017A\_01).

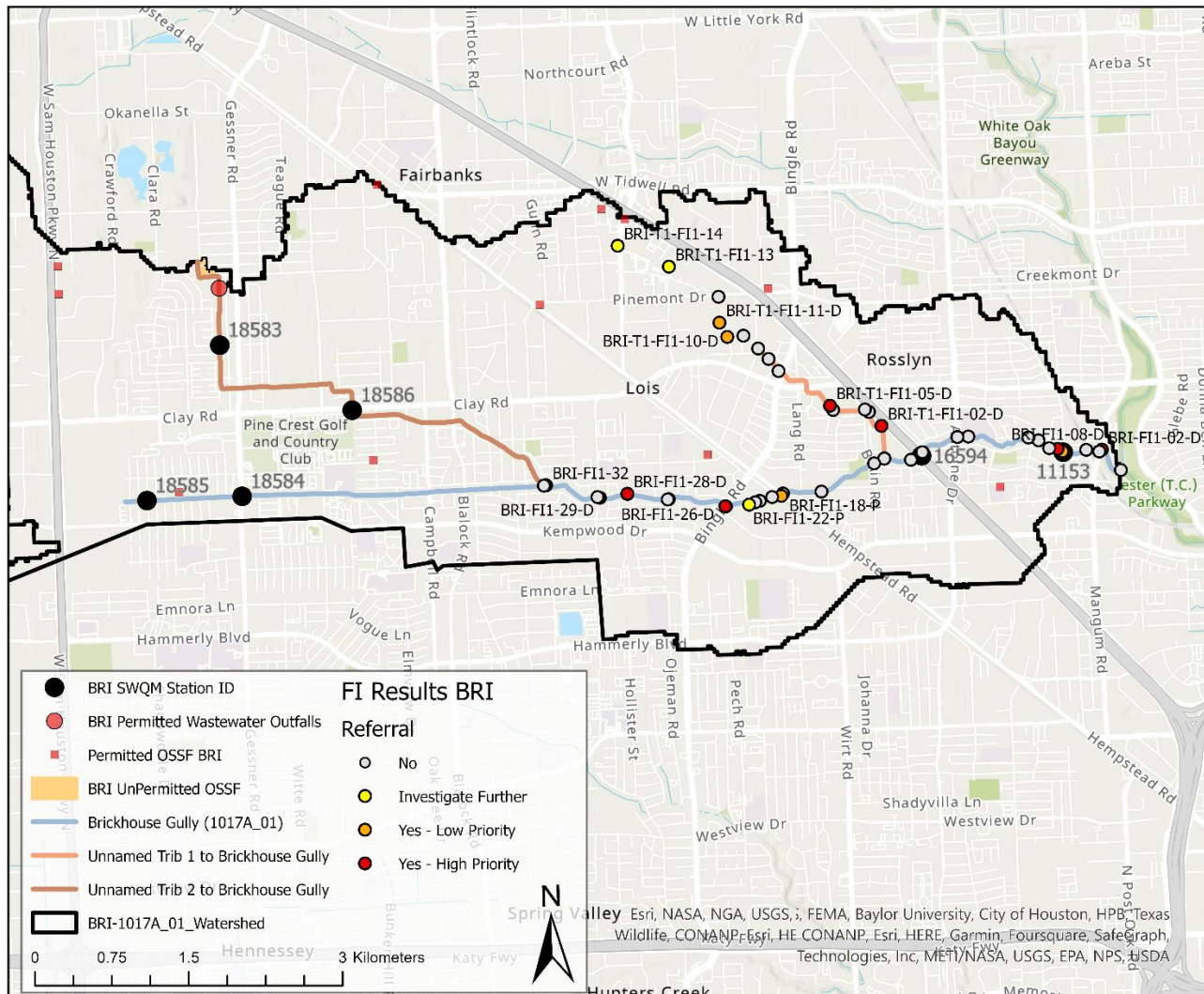
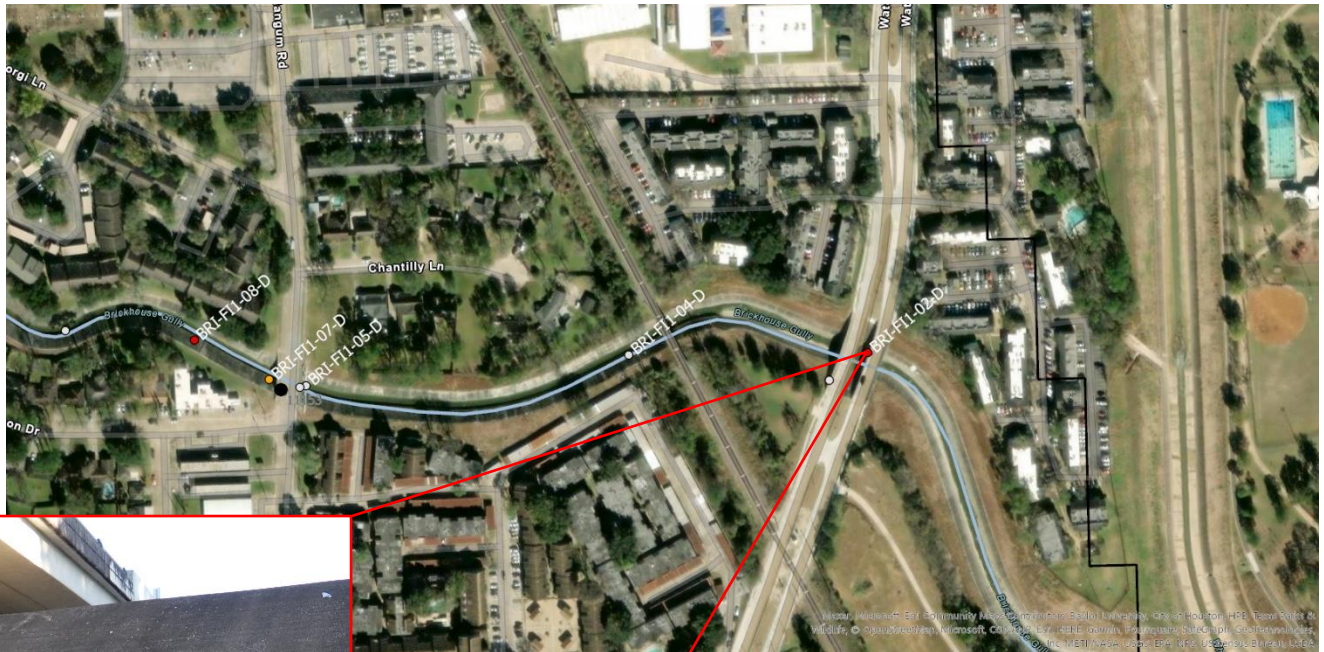


Figure 6: Field investigation sites sampled on 4/12/2023 and 4/13/2023 and identified for referral to the proper authorities on the unnamed tributary 1 of Brickhouse Gully and Brickhouse Gully (Assessment Unit 1017A\_01), respectively.

Referral site: BRI-FI1-02-D – High Priority

This is a 36 in. diameter metal pipe located on the left bank of Brickhouse Gully. Water within the pipe was 0.13 in. deep and was barely trickling into the AU. It flowed down the concrete bank where there was a thin layer of algae growing before it entered the channel. There are multiple apartment complexes and a primary school located in the area on the left bank. A sample taken 4 m downstream of the pipe had a bacteria value of > 242,000 MPN/100 mL. The ambient sample collected upstream of the pipe had a bacteria value of 6,370 MPN/100 mL. This pipe is a high priority referral site for the proper local authority.





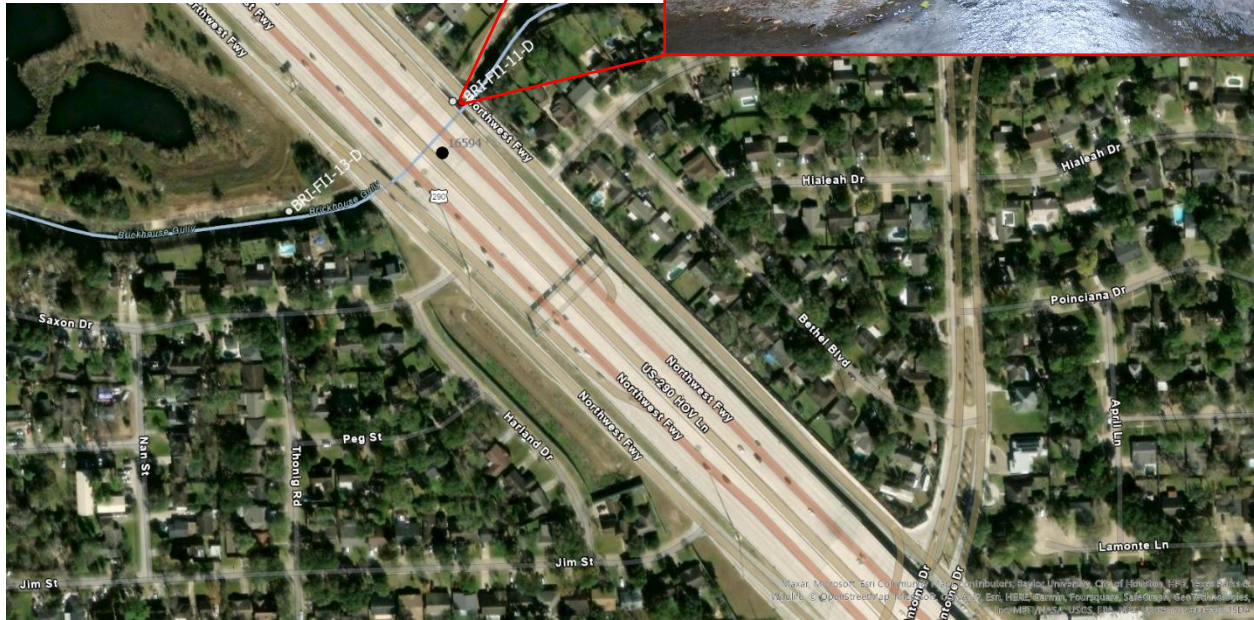
Referral site: BRI-FI1-08-D – High Priority

This is a 31 in. diameter concrete pipe located on the right bank of Brickhouse Gully. Water within the pipe was 0.06 in. deep and barely trickling into the segment. The bottom of the pipe had a thin layer of algae down to the water’s edge and there was a white film on the surface of the water coming out of the pipe. There are apartments and single-family residences located in the area on the right bank, as well as a self-service car wash. A sample taken 0.4 m downstream of the pipe had a bacteria value of > 242,000 MPN/100 mL. The ambient sample collected upstream of the pipe had a bacteria value of 6,700 MPN/100 mL. This pipe is a high priority referral site for the proper local authority.



Referral site: BRI-FI1-11-D – High Priority

This is a 102 in. diameter concrete pipe located on the right bank of Brickhouse Gully. Water within the pipe was 5 in. deep and flowing steadily into the segment. There was a strong smell of sewage in the ambient air. This pipe is located under the bridge of U.S. 290. There are single-family residences located in the area on the right bank. A sample taken 2 m downstream of the pipe had a bacteria value of > 242,000 MPN/100 mL. The ambient sample collected upstream of the pipe had a bacteria value of 51,7000 MPN/100 mL. This pipe is a high priority referral site for the proper local authority.



### Referral site: BRI-FI1-24-D – High Priority

This is a 56 in. diameter metal pipe located on the right bank of Brickhouse Gully. Water within the pipe was 2 in. deep and was flowing into the segment. The water was cloudy and there was a smell of effluent in the ambient air. There are single-family homes and commercial buildings in the area. A sample taken 0.6 m downstream of the pipe had a bacteria value of > 242,000 MPN/100 mL. The ambient sample collected upstream of the pipe had a bacteria value of 54,800 MPN/100 mL. This pipe is a high priority referral site for the proper local authority.



Referral site: BRI-FI1-28-D – High Priority

This is a 75 in. diameter concrete pipe located on the left bank of Brickhouse Gully. Water within the pipe was 0.5 in. deep and was flowing into the segment. There are apartments, single-family homes, commercial buildings and an elementary school in the area. A sample taken 15 m downstream of the pipe had a bacteria value of 242,000 MPN/100 mL. The ambient sample collected upstream of the pipe had a bacteria value of 200 MPN/100 mL. This pipe is a high priority referral site for the proper local authority.



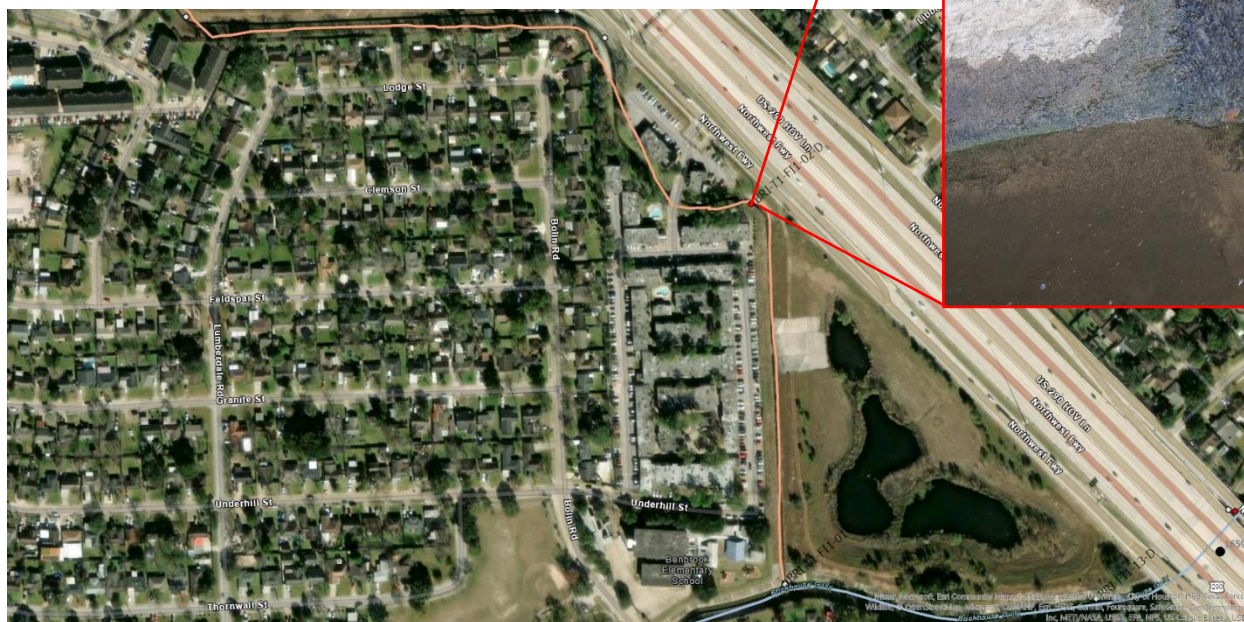
### Referral site: BRI-FI1-29-D – High Priority

This is a 52 in. diameter concrete pipe located on the right bank of Brickhouse Gully. Water within the pipe was 0.5 in. deep and was flowing into the segment. There are single-family homes in the area. A sample taken 1 m downstream of the pipe had a bacteria value of 1,990 MPN/100 mL. The ambient sample collected upstream of the pipe had a bacteria value of 200 MPN/100 mL. This pipe is a high priority referral site for the proper local authority.



Referral site: BRI-T1-FI1-02-D – High Priority

This is a 4.5 in. diameter concrete pipe (weep hole) located on the right bank of the tributary to Brickhouse Gully. Water within the pipe was 0.25 in. deep and trickling into the segment. There was a rusted-out metal pipe higher up on the right bank likely draining water into the source of this weep hole. There are apartments located in the area on the right bank. A sample taken 0.25 m downstream of the pipe had a bacteria value of 3,450 MPN/100 mL. The ambient sample collected upstream of the pipe had a bacteria value of 300 MPN/100 mL. This pipe is a high priority referral site for the proper local authority.



Referral site: BRI-T1-FI1-05-D – High Priority

This is a 40 in. diameter concrete pipe located on the left bank of the tributary to Brickhouse Gully. Water within the pipe was 0.25 in. deep and flowing into the segment. There was a strong fermented odor coming from the pipe and the water that was discharging from the pipe was cloudy and brown. There are commercial buildings in the area on the right bank. A sample taken 0.2 m downstream of the pipe had a bacteria value of 2,990 MPN/100 mL. The ambient sample collected upstream of the pipe had a bacteria value of 310 MPN/100 mL. This pipe is a high priority referral site for the proper local authority.



Referral site: BRI-FI1-07-D – Low Priority

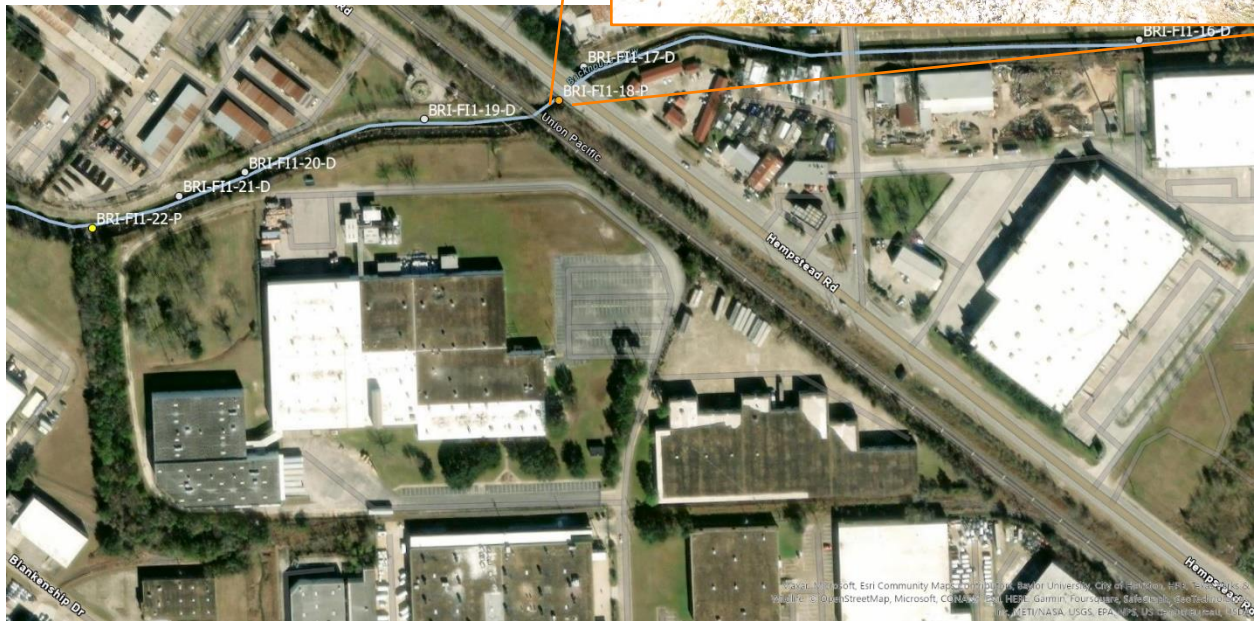
This is a 29 in. diameter concrete pipe located on the right bank of Brickhouse Gully. Water within the pipe was 0.06 in. deep and barely trickling into the segment. Algae was present inside the pipe. There are commercial buildings, single-family homes, and apartments in the area. A sample 1 m downstream of the pipe had a bacteria value of 9,090 MPN/100 mL. The ambient sample collected upstream of the pipe had a bacteria value of 8,200 MPN/100 mL. This pipe is a low priority referral site for the proper local authority.





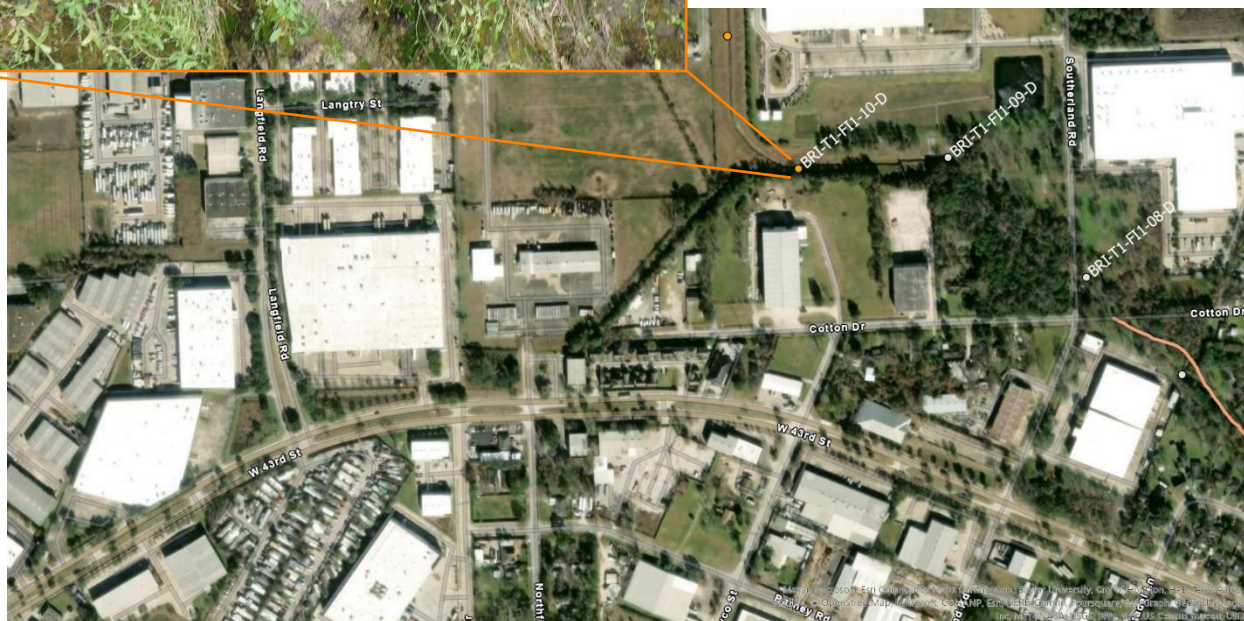
Referral site: BRI-FI1-18-P – Low Priority

This is a 4 in. diameter metal pipe (weep hole) located on the right bank of Brickhouse Gully. Water within the pipe was 1.5 in. deep and was flowing heavily into the segment. Sediment was present in front of the pipe. There are commercial buildings located in the area on the right bank. A sample taken from the pipe had a bacteria value of 300 MPN/100 mL. This pipe is a low priority referral site for the proper local authority.



Referral site: BRI-T1-FI1-10-D – Low Priority

These were two identical 23.5 in. diameter concrete pipes located adjacent to each other on the right bank of the tributary to Brickhouse Gully. Water within the pipes was 0.06 in. deep and both were dripping into the segment. There are commercial buildings located in the area on the right bank. A sample taken from a pool that they were dripping into 1.5 m downstream of the pipes had a bacteria value of 410 MPN/100 mL. The ambient sample collected upstream of the pipes had a bacteria value of < 100 MPN/100 mL. This is a low priority referral site for the proper local authority.



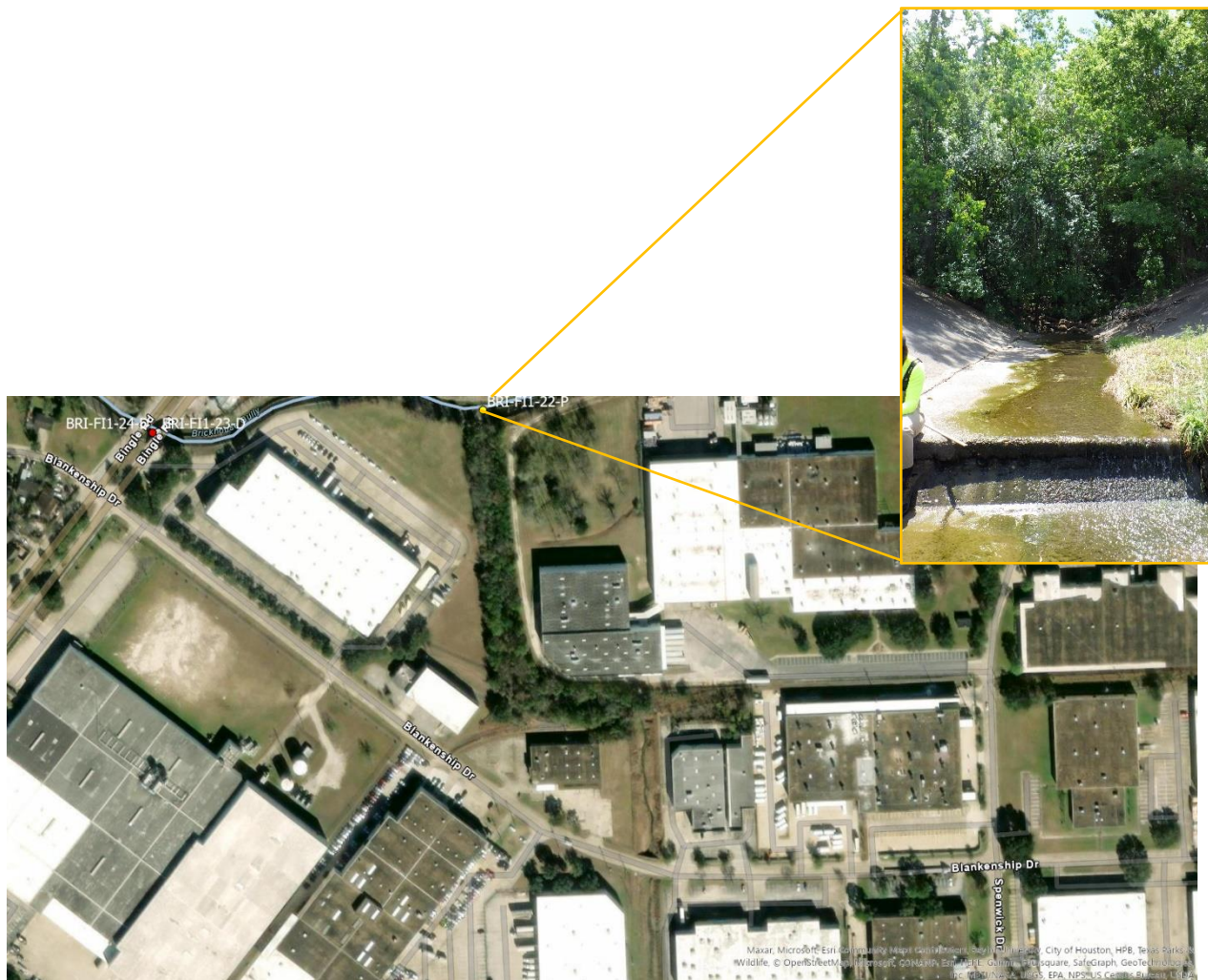
Referral site: BRI-T1-FI1-11-D – Low Priority

This is a 24 in. diameter corrugated plastic pipe located on the right bank of the tributary to Brickhouse Gully. Water within the pipe was 0.25 in. deep and trickling into the segment. There are commercial buildings located in the area on the right bank. A sample 0.2 m downstream of the pipe had a bacteria value of 410 MPN/100 mL. The ambient sample collected upstream of the pipe had a bacteria value of < 100 MPN/100 mL. This pipe is a low priority referral site for the proper local authority.



### Referral site: BRI-FI1-22-P – Investigate Further

This was an ambient sample taken from a tributary to Brickhouse Gully on the right bank. The ambient sample had a bacteria value of 520 MPN/100 mL. Further investigation is recommended by the proper local authority to determine the source of elevated bacteria within this tributary. There are commercial buildings surrounding the tributary.



Referral site: BRI-FI1-32 – Investigate Further

This was an ambient sample collected upstream of the confluence with the main AU. The ambient sample taken had a bacteria value of 2,530 MPN/100 mL. Further investigation is recommended by the proper local authority to determine the source of elevated bacteria upstream of the segment. There are single-family homes and a park located upstream of the site.



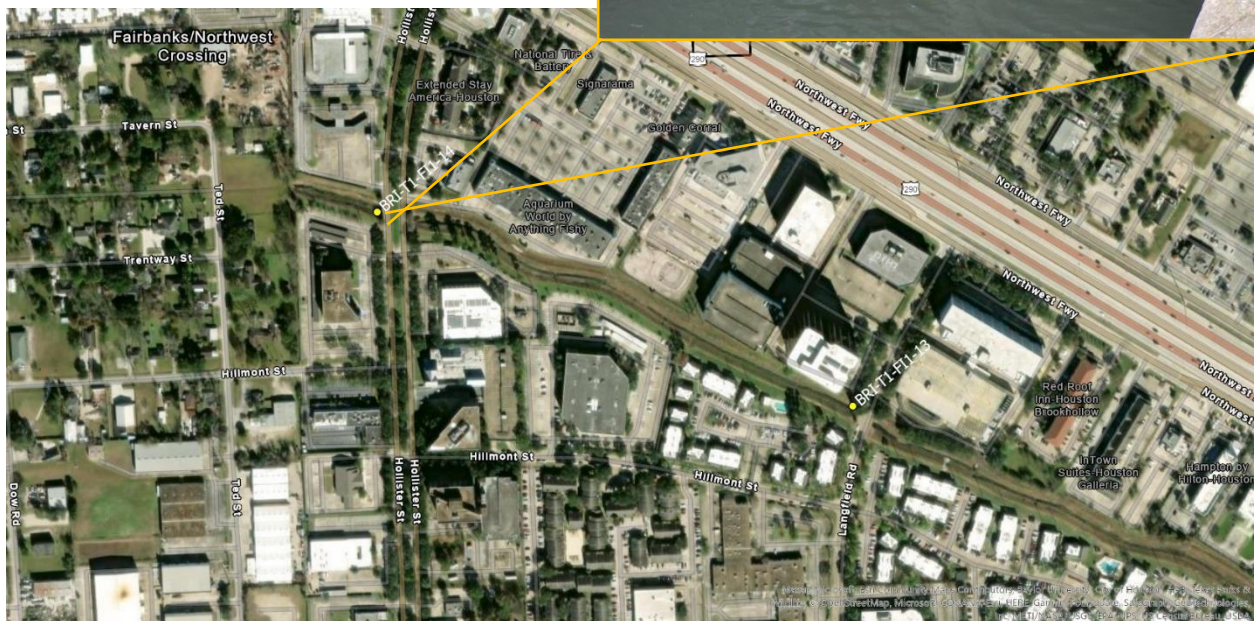
### Referral site: BRI-T1-FI1-13 – Investigate Further

This was an ambient sample taken upstream of the Langfield Road bridge on the tributary of Brickhouse Gully. The ambient sample taken just in front of the bridge crossing had a bacteria value of > 242,000 MPN/100 mL. The next sample taken was an ambient sample taken upstream of the Hollister Road bridge (BRI-T1-FI1-14). This bacteria value was < 100 MPN/100 mL. Further investigation is recommended by the proper local authority to determine the source of elevated bacteria between these two locations as the field crew was unable to walk this portion due to oncoming thunderstorms. There are apartments and commercial businesses located upstream of the site.



### Referral site: BRI-T1-FI1-14 – Investigate Further

This was an ambient sample taken upstream of the Hollister Road bridge on the tributary of Brickhouse Gully. The ambient sample taken just in front of the bridge crossing had a bacteria value of < 100 MPN/100 mL while the sample taken downstream at Langfield Road had a bacteria value of > 242,000 MPN/100 mL. Further investigation is recommended by the proper local authority to determine the source of elevated bacteria between these two locations as the field crew was unable to walk this portion due to oncoming thunderstorms. There are apartments and commercial businesses located between this location and BRI-T1-FI1-13.



## List of Acronyms and Abbreviations

AU	Assessment Unit
BIG	Bacteria Implementation Group
BRI	Brickhouse Gully 1017A_01
CRP	Clean Rivers Program
DS	Downstream
E. Coli	Escherichia coli
FI	Field Investigation
FY	Fiscal Year
GIS	Geographic Information Systems
H-GAC	Houston-Galveston Area Council
IF	Investigate Further
in.	inch
I-Plan	Implementation Plan
km	kilometer
LB	Left Bank
m	meter
mL	milliliter
MPN	Most probable number
N	No
NELAP	National Environmental Laboratory Accreditation Program
NLCD	National Land Cover Database
OSSF	On-Site Sewage Facilities
QAPP	Quality Assurance Project Plan
RB	Right Bank
SWQM	Surface Water Quality Monitoring
SWRC	Stroud Water Research Center
T or trib.	Tributary
TCEQ	Texas Commission on Environmental Quality
TMDL	Total Maximum Daily Load
US	Upstream
WS	Windshield Survey
Y-H	Yes – High Priority
Y-L	Yes-Low Priority



## Literature Cited

- Houston-Galveston Area Council (H-GAC). 2022. How's the Water? Basin Highlights Report. On-line resource, accessed March 21, 2023. Available from: [https://www.h-gac.com/getmedia/42de64a6-36cf-4a3f-afd2-ba119322f853/How\\_s-the-Water\\_2022-FINAL-05-12-2022\\_1](https://www.h-gac.com/getmedia/42de64a6-36cf-4a3f-afd2-ba119322f853/How_s-the-Water_2022-FINAL-05-12-2022_1)
- Houston-Galveston Area Council Multi-Basin Quality Assurance Project Plan (H-GAC QAPP). 2022. Appendix J to the Houston-Galveston Area Council (H-GAC) Multi-Basin Clean Rivers Program FY 2022/2023. Targeted Monitoring in Selected Assessment Units (AUs). Houston, TX. Pp 74.
- Stroud Water Research Center (SWRC). 2023. Model My Watershed [Software]. On-line resource, accessed March 20, 2023. Available from: <https://wikiwatershed.org/>
- Texas Commission on Environmental Quality (TCEQ). 2012. Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring Methods. Austin, TX. RG-415. Pp 202.
- Texas Commission on Environmental Quality (TCEQ). 2022. 2022 Texas Integrated Report of Surface Water Quality for Clean Water Act Sections 305(b) and 303(d). On-line resource, accessed March 21, 2023. Available from: <https://www.tceq.texas.gov/waterquality/assessment/22twqi/22txir>