

This annual report for the **Implementation Plan for Eighty-Eight Total Maximum Daily Loads for Bacteria in the Houston-Galveston Region (I-Plan)** is prepared by the Houston-Galveston Area Council's Community and Environmental Planning Department in collaboration with the Bacteria Implementation Group (BIG), a stakeholder group appointed by H-GAC's Board of Directors and charged with the I-Plan's development and oversight.

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More information about the project, including the full I-Plan, can be found at:
www.h-gac.com/BIG.

cover photo by Gene Fisseler

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Implementing the BIG I-Plan

A group of government, business, and community leaders worked together with other stakeholders from across the region to develop an Implementation Plan (I-Plan) to help reduce bacteria in area waterways. Parenthetical indicates type of organization represented.

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Be a Part of the Solution

The BIG project, the first of its kind in the state, is successful thanks in no small part to your support. We are eager to build on this success and seek the continued commitment of our partners and renewed interest and participation of our stakeholders.

Many of the implementation activities in the I-Plan are voluntary. MS4 operators, local governments, farmers and ranchers, OSSF owners, pet owners, and residents can help reduce the amount of bacteria entering our waterways with simple changes to daily routines.

Learn more by visiting
www.h-gac.com/BIG.

Many stakeholders participated in the development of the I-Plan and this Annual Report (see Appendices A and B).

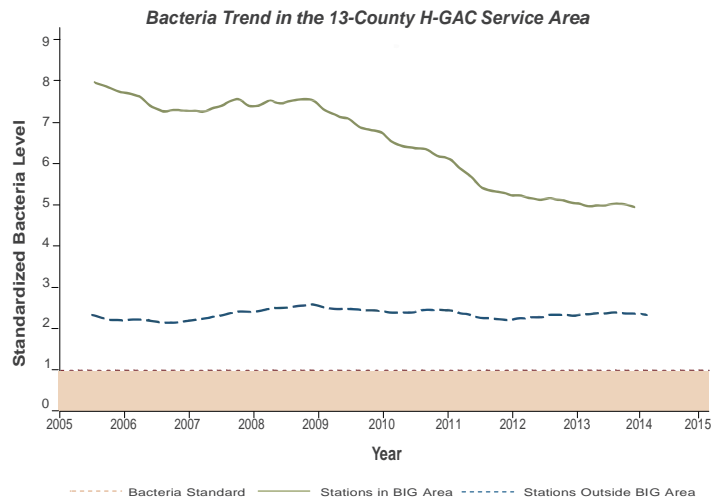
Executive Summary

Half of the streams and shoreline miles in the Houston-Galveston region have bacteria levels higher than state standards. High bacterial concentrations can cause swimmers or others who come into direct contact with the water to become ill or suffer from skin infections. In 2008, a group of government, business, and community leaders formed the Bacteria Implementation Group (BIG) with the common goal of developing a plan to reduce bacteria to improve water quality so that the region's waters support contact recreation where appropriate. The Texas Commission on Environmental Quality (TCEQ) approved this Implementation Plan (formally known as the **Implementation Plan for Eighty-Eight Total Maximum Daily Loads for Bacteria in the Houston-Galveston Region**, or I-Plan) in January 2013.

Implementation Strategies

Many different sources contribute to the bacteria issue in the BIG project area; therefore, there is no one-size-fits-all solution for the problem. This I-Plan is a common-sense approach for reducing bacteria in our waterways. Municipalities, industries, landowners, and residents can consider a menu of water protection and implementation activities addressed by the following 11 strategies:

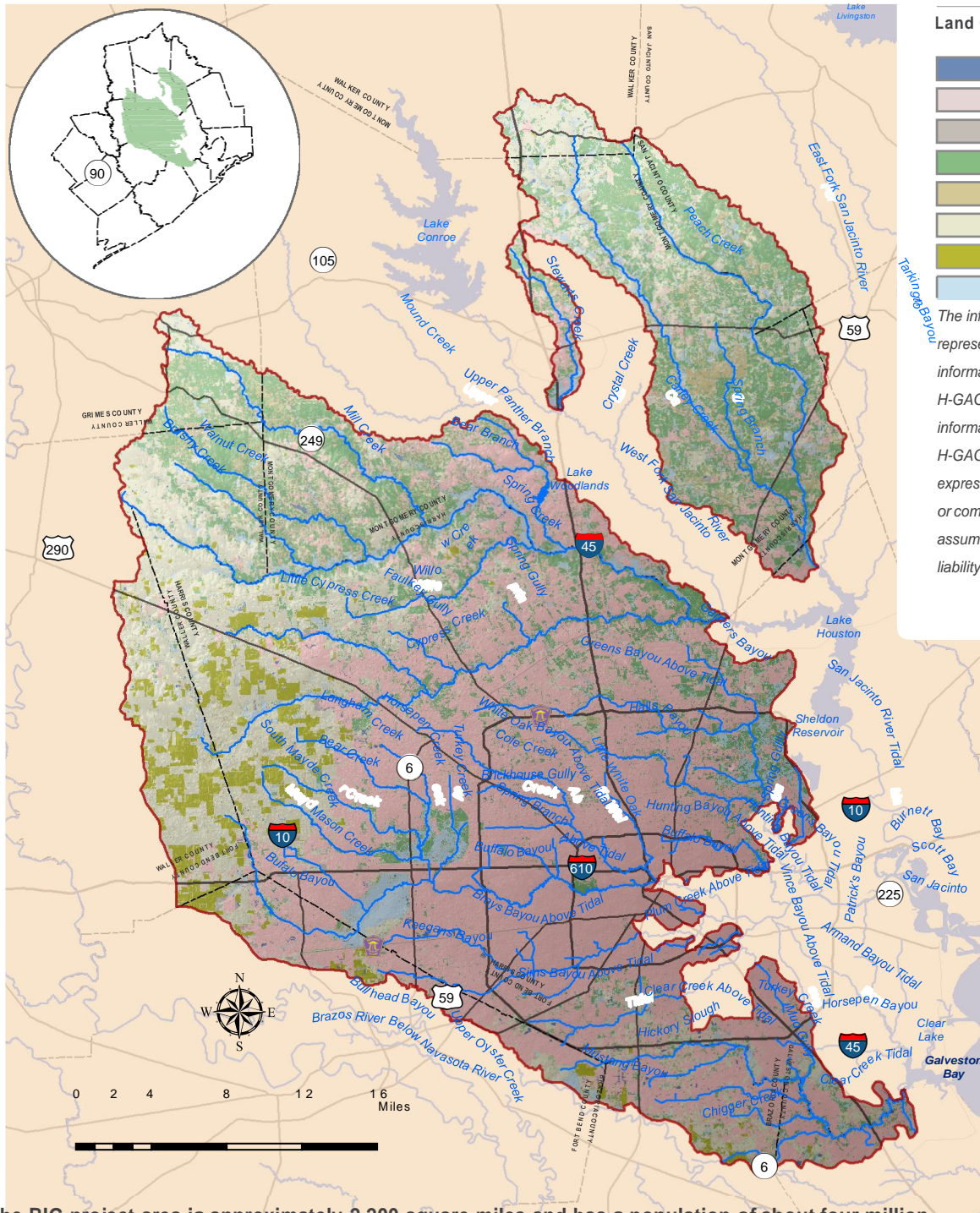
1. Wastewater Treatment Facilities
2. Sanitary Sewer Systems
3. On-Site Sewage Facilities
4. Stormwater and Land Development
5. Construction
6. Illicit Discharges and Dumping
7. Agriculture and Animals
8. Residential
9. Monitoring and I-Plan Revision
10. Research
11. Geographic Priority Framework



Making Progress

Overall, bacteria levels in the BIG project area are going down. Since 2005, bacteria levels in waterways have decreased from almost nine times to approaching four times the state contact recreation standard (see Appendix C), making them safer for contact recreation. However, we still have a long way to go. The good news is we are making a difference. Many stakeholders are already actively implementing and tracking projects to examine the effectiveness of implementation activities in reducing bacteria, such as installing and monitoring best management practices; addressing bacteria impairments as part of the small MS4 program; committing resources to educate and training local operators, developers and service providers; and conducting public education and involvement campaigns. By working together, we can continue to identify what's working and what we still need to do.

BIG Project Area



- BIG Project Area
- Waterways
- County Boundary
- Major Highways
- State Highways
- Other Roads

- Land Cover**
- Open Water
 - Developed Land
 - Barren Land
 - Forest
 - Shrub/Scrub
 - Grassland/Pasture
 - Cultivated Crops
 - Wetlands
 - Other

The information on this map represents the most current information available to H-GAC and is for general informational purposes only. H-GAC does not implicitly or expressly warrant its accuracy or completeness and neither assumes nor will accept liability for its use.

The BIG project area is approximately 2,200 square miles and has a population of about four million people. The area encompasses much of the City of Houston and part or all of another 55 cities and 10 counties.

Spotlight on Successes

Walker County Addressing OSSF Compliance

Managing OSSFs presents a challenge for rural counties to adequately track residential compliance with maintenance and repairs. Walker County created a novel county OSSF program by contracted with 26 professional on-site wastewater companies to perform inspections, assist homeowners in determining repair issues, and completing and filing inspection reports. The county developed uniform inspection standards, requiring a processing fee for each report and implementing a late fee for overdue reports. The county maintains the list of approved wastewater companies by conducting random follow-up inspections to ensure reports are accurately completed. Walker County's example is being explored for use by other BIG Partners.

White Oak Bayou Bacteria Reduction

The annual E. coli geometric mean declined by almost 75% since 2008. While there is currently no means for correlating this decline with implementation efforts of BIG partners, the period of decline coincides with bacteria reduction activities carried out by the BIG.
[Insert Figure: White Oak Graph]

In 2008, the Joint Taskforce, consisting of the City of Houston, Harris County, Harris County Flood Control District (HCFCD) and the Texas Department of Transportation, developed the Bacteria Reduction Plan (Reduction Plan) in response to the bacteria impairment and to address their MS4 Phase I permit requirements. The plan includes adaptive components for monitoring, assessment and best management practices. As part of the Reduction Plan, the City of Houston initiated a program to identify and fix illicit discharges. Additionally, HCFCD saw completion of five regional stormwater detention basins in White Oak Bayou's watershed that were designed with water quality enhancement features to treat stormwater. HCFCD also completed conveyance improvements and channel rehabilitation projects to remove excess sediment deposits, regrade and revegetate eroding channel slopes, and repair outfall pipe structures

LID Tracking and Resource Website

H-GAC, as part of a grant with the Environmental Protection Agency's Gulf of Mexico Program, created a Low Impact Development (LID) Tracking and Resource Website.

The website, <http://www.h-gac.com/community/low-impact-development/default.aspx>, hosts information that:

- defines LID;
- describes the benefits of LID;
- provides a photo gallery of local LID examples;
- serves as a LID library of articles, research, and resources; and
- serves as an interactive LID mapping application.

There are currently 59 LID projects in the Houston-Galveston region, most of which fall in the BIG project area. LID has been successfully used in residential developments, mixed use developments, open space development, non-residential development and street improvement projects.

TCEQ WWTF Monitoring Study

The TCEQ completed a study on 37 UV/Chlorination WWTFs to evaluate the proper location to collect bacteria samples for self

reporting by the WWTF operator. According to TCEQ, there is not an explicitly designated location from which WWTFs are taking the bacteria samples, which has resulted in sample collection at locations that may not be representative of bacteria loading to the receiving stream. It is hoped that the research will assist with improved monitoring and plant design criteria.

Progress Report

Success for the BIG will be achieved when the waters assessed by the state are no longer considered impaired, meaning they meet state water quality contact recreation standard. Achieving that goal requires annually assessing progress to determine what is working and what is not working, looking critically at what each of the BIG partners is doing, and sharing information and coordinating future implementation activities. This Annual Report is meant to be that mechanism for annual assessment, encouraging efforts that appear to be working and redirecting implementation that seems to be falling short. It is also an opportunity to look at the I-Plan to see if expectations are being met or if some of the activities need further refinement.

Most of the information in this report is based on reports given to H-GAC through the workgroup process by stakeholders who are already involved in the BIG's planning effort. The BIG workgroups met in separate meetings between November 2014 and January 2015 to discuss implementation. This report includes activities through December 2014.

This report is divided into 11 implementation strategy sections and an appendix. Each section includes a summary of the issue, a focus for next year, and individual implementation activities in-line with the activities set out in the I-Plan. There are 38 implementation activities described in the I-Plan and laid out in this report. For each activity the reader will find goals for that activity, an assessment of the activity, and a summary of implementation efforts conducted throughout the year.

The assessment of each activity includes determining progress made toward achieving the activity's interim goal: Not Started, Initiated, In Progress, or Completed. Additionally, each activity is assessed based on the BIG partner's efforts to advance the activity over the year: Behind Schedule, On Schedule, or Ahead of Schedule.

Overall in 2014, 37 activities are listed as In Progress with the remaining two listed as Initiated. For the year 2015 three activities are considered Ahead of Schedule, 31 are On Schedule, and four have been assessed as Behind Schedule

Wastewater treatment facilities

Summary

1

One potential source for bacteria in the BIG project area is from Wastewater Treatment Facility (WWTF) effluent. When operated properly and under most conditions, WWTFs meet state permit limits. However, until recently, compliance has been determined from the chlorine residual monitoring data collected and reported on each facility's discharge monitoring reports (DMRs). As Texas Pollutant Discharge Elimination System (TPDES) permits are being renewed, bacteriological testing requirements (except in specific circumstances) are being added to

the permits to demonstrate adequate disinfection of effluent prior to being discharged to the receiving stream. Most of the region's waterways are effluent dominated and have minimal natural flows. The information learned through monitoring can assist WWTF operators in enhancing plant operation and direct resources, when needed, toward maintenance and planned upgrades. Bacteria results from DMRs* submitted in 2014 by 496 BIG project area WWTF operators suggest that over 97% of all 4,217 single grab/daily maximum bacteria samples reported (Table 1) met the WWTF required bacteria limits for *E. coli* or enterococcus.

The Wastewater Treatment Facilities Workgroup met with the Sanitary Sewer Systems Workgroup on December 15, 2014. Eight members reported that over the past year the focus of implementation has been directed toward: 1) tracking revision of Title 30, Chapter 217 and reinstating Chapter 317 of the Texas Administrative Code and 2) facility design and upgrades. H-GAC continued to update data on WWTF permit limits, effluent data, compliance, and enforcement.

**H-GAC used data for the BIG project area from the TCEQ's DMR database, TCEQ's Central Registry, and H-GAC's permit database.*

2015 Focus

- ^ H-GAC and BIG stakeholders aim to:
 - Continue to track and provide comments to the TCEQ on changes to the Texas Administrative Code Title 30, Chapter 217 and reinstatement of Chapter 317.
 - Develop a letter to request a status update on implementation activities carried out by the TCEQ.
 - Complete a survey of BIG project area WWTF operators.
 - Follow-up with WWTFs to determine if WWTF plans and specification applications to the TCEQ were being carried out to improve operation and assist in meeting effluent standards. Applications are made for plant improvements, rehabilitations, expansions, modifications, upgrades and reuse/reclaim effluent.
-

Implementation Strategies

1.1 Impose More Rigorous Bacteria Monitoring Requirements

– **Interim Measure:** *Within five years, all of the WWTF permits should have had renewals initiated to include more rigorous monitoring requirements.*

Project Status

... Not Started ^ **Behind Schedule**
 ^ **Initiated** ... On Schedule
 ... In ... Ahead of Schedule
 Progress
 ... Completed

– *With each WWTF permit renewal, the facilities are being required to initiate bacteria monitoring at the state specified frequency. The BIG I-Plan proposed more stringent monitoring frequencies than the state required. However, the TCEQ (source: TCEQ) does not plan to incorporate the BIG proposed monitoring frequencies at this time.*

Implementation Effort

^ **Increased Monitoring:** The BIG recommended in the I-Plan that the TCEQ apply more stringent monitoring frequencies for WWTFs in the BIG project area. While the state does not currently have plans to increase the frequency, the BIG will continue to work with the TCEQ to request that renewed/new permits be issued with the BIG I-Plan recommended frequencies.

Table 1: 2013 Bacteria Permit Limit Exceedances Taken From DMR Database*

Number of Geomean Results Reported from Permittees with Limits in Permit	3,632
Number of Samples Exceeding Daily Average Limit	32
Percentage of Samples Exceeding Daily Geomean Limit	0.9
Number of Highest Single Grab/Daily Max for WWTF DMR Monitoring Period	3,748
Number of Highest Single Grab/Daily Max for WWTF DMR Monitoring Period Exceeding Limit	165
Percentage of Highest Single Grab/Daily Max for WWTF DMR Monitoring Period Exceeding Limit	4.4

Table 1. Number and percentage of samples taken in 2013 that exceeded WWTF bacteria limits for facilities within the BIG project area.

Additional samples are potentially collected by WWTFs during the monitoring period depending on their permits with the state, but only the highest value reported during the monitoring period is used for this analysis.

What is a Geomean?

Bacteria data are often summarized using a geometric mean. Outliers and extreme values are common in such data, and the geometric mean (or geomean) is not as sensitive to them as an arithmetic mean. H-GAC calculates the mean of the natural logarithms of each bacteria value, and then converts the logarithm back into a number by exponentiation.

E. coli and enterococci data can be standardized for comparisons by dividing the geometric mean by the water quality standard to produce a relative geomean.

What is a Single Grab/Daily Max?

WWTFs' reporting typically requires a single grab bacteria sample or a daily maximum bacteria sample during the reporting period. A single grab sample is an individual sample collected in less than 15 minutes. A daily maximum sample is the maximum concentration measured on a single day, by the sample type specified in the permit, within a period of one calendar month.

1.2 Impose Stricter Bacteria Limits for WWTF Effluent

- **Interim Measure:** *Within five years, all of the WWTF permits should have had renewals initiated to include more stringent limits for bacteria in effluent.*

Project Status

- ... Not Started
- ... Initiated
- ^ **In Progress**
- ... Completed
- ... Behind Schedule
- ... On Schedule
- ^ **Ahead of Schedule**
- *The majority of WWTFs in the BIG project area have undergone permit renewals that have included the more stringent bacterial limit and performance criteria dealing with the geometric mean and individual maximum results.*

Implementation Effort

- ^ **Permit and DMR Findings.** H-GAC analyzed WWTF permits from the H-GAC permits database, the TCEQ Central Registry, and TCEQ's DMR and made the following observations:
 - In 2014, there are 496 permitted industrial, municipal and private WWTFs (Table 2) submitting data in the DMR database for the BIG Project Area (source: TCEQ DMR dataset). Of the 496 permitted facilities utilizing the TCEQ DMR database, 443 use *E.coli* as their reportable bacteria and five WWTF are using enterococci as their reportable bacteria.
 - Over 82% or 408, of the 496 facilities in the BIG project area in 2014 have more stringent bacteria limits (Table 2) than other parts of the state. It should be noted that not all plants using *E.coli* as their reportable bacteria in the BIG project area will be required by the state to have a 63 MPN/100mL limit. As an example, WWTFs in the Clear Creek watershed will have limits of 126 MPN/110mL since the TMDL study demonstrated that limit would allow the water body to meet state contact recreation standards.
 - Since most WWTFs recently received their new permits and have just begun sampling there are few reported values for *E.coli* and enterococci, but the sample number continues to increase.
- ^ **Future Research.** BIG stakeholders asked H-GAC, as data and funding become available, to conduct further research on the following topics:
 - Age of WWTFs to identify any potential correlations with exceedances (or bacteria levels in general);
 - Correlation to rainfall events; and
 - Differences between UV and chlorination disinfection.
 H-GAC currently lacks the funding to conduct additional studies.

Table 2: Total Number of BIG WWTF By Type from 2013 DMR

Permit Type	Permittees Submitting DMRs in 2013 (TCEQ Data)	Number of Permittees Reporting with <i>E.coli</i> Geomean Limit of 63 MPN/100 mL (TCEQ DMR)	Number of Permittees Reporting with <i>E. Coli</i> Geomean Limit of 126 MPN/100 mL (TCEQ DMR)	Number of Permittees Reporting with Enterococci Geomean Limit of 35 MPN/100 mL (TCEQ DMR)	No Geomean Limit in H-GAC Permit Database
Industrial	36	8	4	NA	24
Municipal Domestic	363	311	37	3	12
Private Domestic	90	76	12	NA	2
Total	489	395	53	3	38

Table 2. BIG project area WWTFs reporting DMRs to the TCEQ in 2013. WWTFs are broken out into type of facility, reporting limits per the permit reviewed either through H-GAC's permit database or the TCEQ's Central Registry. For WWTFs with 'No Geomean' those plants submitted data to the TCEQ DMR but as of the date data was pulled for the Annual Report, no limit could be determined. Many plants still remain to have their permits renewed or are undergoing review at the time of printing.

1.3 Increase Compliance and Enforcement by the TCEQ

- **Interim Measures:** *Each year, TCEQ can address low numbers of investigations and renewals by increasing:*
 - *The number of unannounced inspections conducted;*
 - *The number of focused sampling investigations;*
 - *The percent of plans and specifications reviewed;*
 - *The percent of DMRs reviewed;*
 - *The number of other investigations conducted; and*
 - *The ability of the TCEQ to conduct focused sampling investigations.*

Project Status

... Not Started	^ Behind Schedule
... Initiated	... On Schedule
^ In Progress	... Ahead of Schedule
... Completed	

- *As of this publication's printing, H-GAC does not currently have TCEQ's information to address this activity's interim measures. BIG stakeholders will work with TCEQ to obtain data to evaluate the interim measure in the future. Local compliance data and DMR data will be used as a surrogate until that time.*

Implementation Effort

^ **Compliance and Enforcement:**

- TCEQ Enforcement. There were 5 enforcement cases in the BIG project area with a final payable fine of \$29,299 and \$10,000 provided as a SEP Offset according to the TCEQ (Table 3).
 - Harris County inspectors (Harris County Pollution Control Services- HCPCS) found that 6% of samples they obtained at domestic WWTFs in Harris County during unannounced compliance inspections in 2014 exceeded the permitted bacteria limits. WWTFs in Harris County that submitted DMR reports (self reporting) for the same plants sampled by HCPCS indicated 1.9% of single grab/daily max samples in 2014 exceeded permitted bacteria levels (Table 4). This suggests that between 94% and 98% of the bacteria samples collected from WWTFs in Harris County are meeting permit limits.
- Table 5. Analysis of DMR data finds more WWTFs less than 0.5 MGD have the most excursions that were 25% or more above their single grab/daily max permit limit.

- ^ **Focused Sampling.** The TCEQ has not approved focused sampling investigations but did report that they conduct focused investigations (targeted investigations rather than multi-day compliance investigations). Focused TCEQ investigations can potentially cut down on time and increase the number of WWTFs visited per year, increase the time available to spend at WWTFs that are having issues, and be used to identify plants that would benefit from additional owner/operator education.

Table 4: WWTFs in the BIG Project Area Inspected by Harris County Pollution Control Services

Relative Plant Size / Permitted (MGD)	Data Source	Number of Highest Single Grab/Daily Max for WWTF DMR Monitoring Period	Number of Highest Single Grab/Daily Max for WWTF DMR Monitoring Period Exceeding Limit	Percentage of Highest Single Grab/Daily Max for WWTF DMR Monitoring Period Exceeding Limit	Data Source	Number of Random Samples Collected	Number of Samples Exceeding TCEQ Grab/Single Sample Limit	Percent HCPCS Samples Exceeding TCEQ Permit Limit
< 0.1	DMR	267	9	3.4	HCPCS	110	14	12.7
0.1-0.5	DMR	567	10	1.8	HCPCS	95	2	14.7
0.5-1	DMR	579	16	2.8	HCPCS	76	1	2.6
1-5	DMR	534	38	7.1	HCPCS	61	0	1.6
5-10	DMR	38	2	5.3	HCPCS	3	14	0
> 10	DMR	12	0	0	HCPCS	1	0	0
Totals	DMR	1,997	75	3.7		346	31	9.0

Table 3. Domestic WWTFs in Harris County found within the BIG project area reporting to the DMR database that underwent Harris County Pollution Control Services (HCPCS) inspections and that had permit limits at the time of inspection. Here the random grab sample collected by HCPCS is compared to single grab/daily max samples, number of samples exceeding permit limits, and percentage exceeding.

Table 5: Permittees with 25% or More Excursions Above Permit Limit

Plant Size/Permitted Flow	Daily Geomean	Single Grab/Daily Max
Variable or Unknown	NA	NA
< 0.1 MGD	10	10
0.1-0.5 MGD	2	3
0.5-1 MGD	NA	4
1-5 MGD	NA	5
5-10 MGD	NA	NA
> 10 MGD	NA	1

Table 4. WWTFs in the BIG project area in 2013 where 25% or greater samples taken exceeded the facility's permit limit.

1.4 Improved Design and Operation Criteria for New WWTFs

– **Interim Measure:** *Every five years, at least 20% of local governments should consider whether to adopt stricter requirements. Note: The I-Plan indicates the revision process should start in year six of implementation.*

Project Status

... Not Started	... Behind Schedule	– <i>This activity is on schedule. The revision process will begin in 2018.</i>
... Initiated	^ On Schedule	
^ In Progress	... Ahead of Schedule	
... Completed		

Implementation Effort

- ^ **WWTF Design Reviews.** Harris County reviewed 29 WWTP plan sets in 2014. None of the plan sets required modification to comply with state rules.
 - ^ **New State Design Criteria of Domestic WWTFs.** TCEQ proposed changes to Chapter 217 of the Texas Administrative Code which is intended to update WWTF standards and criteria with current engineering practices and to reflect the current permitting practices. In 2014, BIG stakeholders tracked progress of changes to Chapter 217. Proposed changes are expected to go to TCEQ Commissioner's Agenda in May 2015 and then released for public comment beginning May 2015.
-

1.5 Upgrade Facilities

- **Interim Measure:** *WWTFs not meeting effluent limits should upgrade or repair their facilities to comply with individual permits.*

Project Status

- | | | |
|-----------------|------------------------|---|
| ... Not Started | ^ Behind Schedule | – <i>This activity is in progress, additional work is needed to determine whether the upgrades at WWTFs were completed to comply with individual permits to meet bacteria effluent standards.</i> |
| ^ Initiated | ... On Schedule | |
| ... In | ... Ahead of Schedule | |
| Progress | | |
| ... Completed | | |

Implementation Effort

- ^ **Monitoring Upgrades.** *47 plants in counties included as part of the BIG submitted applications to expand, improve, upgrade, rehabilitate, or modify in 2014. Please see Table 6 for more information. Data on facility upgrades was retrieved from the TCEQ website at: <http://www4.tceq.state.tx.us/wwdp/>.*

1.6 Consider Regionalization of WWTFs

- **Interim Measures:**
 - *Regulators should develop criteria for identifying chronically non-compliant WWTFs.*
 - *Regulators should document the number of non-compliant WWTFs identified using said criteria.*
 - *Regulators should document the number of chronically non-compliant WWTFs that have considered regionalization.*

Project Status

- | | | |
|----------------------|-----------------------|--|
| ... Not Started | ... Behind Schedule | – <i>This activity is on schedule.</i> |
| ... Initiated | ^ On Schedule | |
| ^ In Progress | ... Ahead of Schedule | |
| ... Completed | | |

Implementation Effort

- ^ **Regulatory.** *EPA and TCEQ have developed criteria for chronically non-compliant WWTFs, and identify those WWTFs. TCEQ will share documented WWTFs with the BIG to assist with tracking future regionalization.*
 - ^ **Regionalization.** *BIG stakeholders reported that no WWTFs were regionalized in 2014 (source: Harris County Community Services Department). In 2011, two plants considered regionalization and are listed here to initiate future tracking:*
 - **Future Tracking**
 - » *Esmarelda Sanjuin considered regionalization in 2011*
 - » *Aldine Community Care considered regionalization in 2011*
-

1.7 Use Treated Effluent for Facility Irrigation

– **Interim Measure:** *Every five years, one WWTF in the project area shall install a new irrigation system that uses treated effluent.*

Project Status

... Not Started

^ Initiated

... In

Progress

... Completed

... Behind Schedule

^ **On Schedule**

... Ahead of Schedule

– *This activity is on schedule to meet the five-year target.*

Implementation Effort

^ **Reuse/Reclaim.** Three applications for reuse/reclaim water were submitted to the TCEQ for counties in the H-GAC region. Information was extracted from the TCEQ's website at <http://www4.tceq.state.tx.us/wwdp/> (Table 6).

Sanitary Sewer Systems

2

Summary

Failure of sanitary sewer systems (SSSs) often results in sanitary sewer overflows (SSOs). SSOs discharge untreated sewage into area waterways before the sewage reaches a treatment facility. The microbial pathogens and other pollutants present in SSOs can cause or contribute to contamination of drinking water supplies, water quality impairments, beach closures, shellfish bed closures, and other environmental and human health problems. In 2014 there were 680 reported SSOs in the BIG project area with an estimated release of 1.6 M gallons of untreated waste (Table 8).

To address these infrastructure deficiencies, the Sanitary Sewer Systems Workgroup met with the Wastewater Treatment Facilities Workgroup on December 15, 2014. 8 members reported that efforts over the past year focused on increased education, data collection, and source elimination activities that support implementation. H-GAC gathered and analyzed data on SSOs.

2015 Focus

- ^ H-GAC and BIG stakeholders aim to:
 - Will host an annual conference on asset management for SSSs.
 - Work with the TCEQ to improve the SSO reporting system.
 - Will survey WWTF operators to determine appropriate contact information, begin tracking utility asset management programs (UAMPs), identify subscriber system contacts, and gather example subscriber system contract language.
 - Will check on the progress of the sponsors for “Cease the Grease” and “Corral the Grease” to determine if there is room for a unified regional message on fats, oils, and grease (FOG) education.
-

Implementation Strategies

2.1 Develop Utility Asset Management Programs (UAMP) for Sanitary Sewer Systems

– Interim Measures:

- *Within five years, H-GAC, the TCEQ, or another appropriate entity shall offer at least eight educational workshops for owners, operators, and engineers.*
- *After 10 years, all WWTF permits will have UAMPs.*

Project Status

- ... Not Started
 - ... Initiated
 - ^ **In Progress**
 - ... Completed
 - ... Behind Schedule
 - ^ **On Schedule**
 - ... Ahead of Schedule
- *This activity is on schedule to meet the five-year target.*

Implementation Effort

^ **Education.**

- BIG recommended H-GAC host, through its Clean Waters Initiative (CWI), a Utility Asset Management workshop on SSSs in 2015.
- H-GAC, through its CWI, conducted one workshop addressing SSOs: Minimum Control Measures (April).
Funding

^ **TCEQ's Voluntary SSOI.** TCEQ's voluntary Sanitary Sewer Overflow Initiative (SSOI) allows eligible municipalities to direct resources toward corrective actions rather than paying enforcement penalties. In 2014 there were 32 WWTF operators within the BIG project area listed in the SSOI for the project area (source: TCEQ). Of the 32, there are ten active, thirteen pending, three expired, four cancelled, one withdrawn, and one with no result.

➤ Infrastructure Funding.

- EPA launched a new water infrastructure and resiliency finance center - <http://water.epa.gov/infrastructure/waterfinancecenter.cfm>. Center serves as a resource to explore innovative finance solutions, including public-private partnerships.
- TWICC – Texas Water Infrastructure Coordination Committee (www.twicc.org) is comprised of state and federal funding agencies, technical assistance providers, and regulatory agencies. TWICC seeks to identify and develop solutions to water and wastewater infrastructure compliance issues and to determine affordable, sustainable, and innovative funding strategies for the protection of public health and efficient use of government resources.

2.2 Address Fats, Oils, and Grease

– Interim Measures:

- *Within five years, H-GAC and other local entities will:*
 - » *Compile and share all existing regulations within the project area;*
 - » *Examine each community's regulations and policies;*
 - » *Distribute flyers or other collateral material; and*
 - » *Develop and promote website.*
- *Within five years, one community shall adopt new regulations.*

Project Status

... Not Started
... Initiated
^ **In Progress**
... Completed

... Behind Schedule
^ **On Schedule**
... Ahead of Schedule

– *This activity is on schedule to meet the five-year target.*

Implementation Effort

- **FROG SSOs. Operators in the BIG Project Area reported to the TCEQ in 2014, 323 events attributed to Fats, Roots, Oil and Grease, releasing an estimated 337,000 gallons of untreated effluent - 48% and 21 % of the region’s SSO events and volume released, respectively (Table 8 and Figure 1).**
- **Model FOG Education Programs.** BIG suggested that a regional message could be developed based on the following programs.
 - Galveston Bay Foundation has received funding to develop ‘Cease the Grease,’ a FOG program in the BIG region. GBF has been hosting technical stakeholder meetings to coordinate Cease the Grease with local partners. **Website created for Cease the Grease covering the Houston-Galveston region - <http://galvbay.org/ceasethegrease/>**
 - The City of Houston’s ‘Corral the Grease’ and ‘Grease Busters’ programs have been in operation for several years. The City participates in a large apartment complex management meeting each year to allow apartment managers to sign up to receive ‘Corral the Grease’ materials. Apartment complexes referred by the City’s stoppage crews as having grease issues in the sewer main lines were targeted with educational materials. **The City of Houston maintains the Corral the Grease website - http://www.publicworks.houstontx.gov/pud/corral_grease.html.**
 - The San Jacinto River Authority and Payne Communications & Associates created the Patty Potty campaign to address non-flushable items such as sanitary wipes. For more information – www.pattypotty.com.

2.3 Encourage Appropriate Mechanisms to Maintain Function at Lift Stations

– **Interim Measure:** *Every five years, 10% of SSSs shall be compliant with recommendations.*

Project Status

... Not Started	... Behind Schedule	
... Initiated	^ On Schedule	– <i>This activity is on schedule to meet the five-year target.</i>
^ In Progress	... Ahead of Schedule	
... Completed		

Implementation Effort

^ **Emergency Power Requirements.** The TCEQ is in the process of revising Title 30, Chapter 217 and reinstating Chapter 317 of the Texas Administrative Code. Of importance to SSSs are Subchapters B and C of Chapter 217, which address emergency power requirements. BIG members provided comments in 2014 to the TCEQ regarding the changes to Chapter 217.

➤ **Lift Station SSOs.** WWTF operators reported 50 SSOs with an estimated overflow volume of 254,000 gallons. See Table 8 and Figure 1 for additional details.

2.4 Improve Reporting Requirements for SSOs

– **Interim Measures:** *Within five years, the U.S. Environmental Protection Agency (EPA) and TCEQ will develop appropriate database structure and technology for collecting and sharing information regarding SSOs.*

Project Status

... Not Started	^ Behind Schedule	– <i>This activity is behind schedule to meet the five-year target.</i>
... Initiated	... On Schedule	<i>Currently the TCEQ does not have a time-frame for electronic reporting.</i>
^ In Progress	... Ahead of Schedule	
... Completed		

Implementation Effort

^ **Reporting.** An additional Supplemental Notice was issued for 60 days on December 1, 2014 for public comment

to identify issues raised during the previous public comment period, clarify any misunderstandings, and discuss possible modifications to the rule to address issues raised by stakeholders. The BIG will continue to track this development and evaluate any impact to implementation.

2.5 Strengthen Controls on Subscriber Systems

– Interim Measures:

- *By year three, H-GAC will work with attorneys for WWTFs, municipal utility districts, and stakeholders to develop model contract language.*
- *Within five years, H-GAC will develop a list of subscriber systems.*
- *As funds are available, H-GAC will initiate a circuit rider program.*

Project Status

... Not Started	^ Behind Schedule	– <i>This activity is behind schedule to meet the three- and five-year targets. Stakeholders are just beginning to look at tracking this issue.</i>
^ Initiated	... On Schedule	
... In Progress	... Ahead of Schedule	
... Completed		

Implementation Effort

- ^ **Tracking.** Stakeholders suggested that this is a tracking issue to target when emailing WWTFs and begin to gauge interest in future workshops. A WWTF survey will be conducted in 2015. Responses would be used to collect data on individual subscriber systems and subscriber system contracts and look for opportunities to share information and improve contract language between WWTFs and subscriber systems.
-

2.6 Penalties for Violations

- *Interim Measure: Within five years, the TCEQ will have an appropriate penalty policy in place.*

Project Status

... Not Started	... Behind Schedule	
... Initiated	^ On Schedule	– <i>This activity is on schedule to meet the five-year target.</i>
^ In Progress	... Ahead of Schedule	
... Completed		

Implementation Effort

- ^ **Penalty Policy.** The TCEQ is currently working on Enforcement Initiation Criteria revision 15. Draft is currently in review.
 - ^ **SSO Investigations.** TCEQ inspectors can conduct focused SSO investigations. TCEQ reported that there were no inspections conducted in 2014.
 - ^ **Tracking.** There were five enforcement cases (Table 3, chapter 1) due to exceeding effluent limits or operating without a valid permit in 2014 (Table 7). A total of \$50,155 in fines were issued with \$29,299 paid and another \$10,000 distributed to supplemental environmental projects.
-

On-site sewage facilities



Summary

Properly functioning and maintained On-Site Sewage Facilities (OSSF) contribute negligible amounts of bacteria to waterways. Therefore, BIG stakeholders have primarily focused on unpermitted, failing, or poorly maintained OSSFs.

One of the biggest challenges to understanding OSSFs has been a lack of a regional inventory and monitoring practices. In 2009, H-GAC staff partnered with local governments to create the OSSF Information System, a GIS-based online mapping tool that displays OSSF data. The OSSF Information System also helped identify probable locations of older, unpermitted systems at higher risk of failing. Staff identified 32,830 permitted systems in the BIG project area (source H-GAC). An additional 32 have been identified in the Armand Bayou watershed.

*The On-Site Sewage Facilities Workgroup met with the Illicit Discharges and Dumping Workgroup on November 10, 2014. Seven BIG stakeholders discussed *reported continued focus over the past year on education and regulatory action to prevent and remediate failing systems. Several workshops were held to address homeowner and voluntary real estate OSSF education and training. Harris County and the Aldine Management District have been active to hook-up residents to sanitary sewer systems and remove OSSFs, many of which have been documented as failing.**

2015 Focus

- ^ H-GAC and BIG stakeholders aim to:
 - Continue to update maps with OSSF location data and establish priority areas.
 - Continue to allow only higher performing systems that are electronically monitored to be installed in unincorporated Harris County within bacteria impaired watersheds.
 - Continue to seek SEP funds to maintain, repair, and replace failing systems in priority areas.
-

Implementation Strategies

3.1 Identify and Address Failing Systems

– Interim Measures:

- *H-GAC will work with the TCEQ, authorized agents, and other interested parties to create an inventory of OSSFs with a focus on identifying known or suspected failing systems.*
- *Within one year, H-GAC and local authorized agents will create an initial map.*
- *Within two years, H-GAC and local authorized agents will identify target areas.*
- *Every five years, owners will repair or replace 500 failing OSSFs.*
- *Authorized agents will continue to collect and share OSSF data on an ongoing basis.*

Project Status

- | | | |
|----------------------|-----------------------|--|
| ... Not Started | ... Behind Schedule | – <i>This activity is on schedule to meet the five-year target, having completed the initial map and started to prioritize areas for conducting educational workshops and repairing and replacing systems.</i> |
| ... Initiated | ^ On Schedule | |
| ^ In Progress | ... Ahead of Schedule | |
| ... Completed | | |
| | | |

Implementation Effort

- ^ **Mapping.** H-GAC staff, with the input from BIG stakeholders, continued to refine and update the OSSF permit database. The mapping system allows the public to view OSSF permit data and access basic analyses at www.h-gac.com/go/ossf. Highlights of the system include:
 - Layers that show permitted OSSFs by age, authorized agent, and residential properties with a high chance of having an old or otherwise unpermitted system.
 - Tools such as maps (Appendix E), to assist in future prioritizing system repair and replacement are available.
 - ^ **Data.** Authorized agents continue to provide data to H-GAC. OSSF data is used to refine the mapping system, prioritize areas for education and potential repair and replacement as funding becomes available to BIG partners.
 - ^ **Address Failing Systems.** Harris County and East Aldine Management District continue to install sewer service in the Aldine region with failing OSSFs utilizing grant funding. 173 connections were made to new sanitary sewer systems and 302 OSSFs were abandoned. Many of the abandoned OSSFs were failing as evidenced by violations (source Harris County).
-

3.2 Address Inadequate Maintenance of OSSFs

– Interim Measures:

- *Each community will examine its regulations and policies.*
- *Existing regulations will be compiled and shared among BIG stakeholders.*
- *Flyers or collateral material will be distributed among BIG stakeholders.*

Project Status

- ... Not Started
 - ... Behind Schedule
 - ... Initiated
 - ^ **In Progress**
 - ... Completed
- ... Behind Schedule ^ **On Schedule** – *This activity is on schedule. Regulations and educational information has been compiled and are available through the H-GAC website.*
- ... Ahead of Schedule

Implementation Effort

- ^ **Wastewater Professional Education.** Harris County hosted the 4th Annual Harris County On-site Wastewater Seminar on May 13, 2014, which was attended by 111 regional on-site wastewater professionals.
- ^ **Real Estate Industry Coordination.** H-GAC developed and maintains a curriculum for real estate inspection professionals to learn how to properly inspect an OSSF during a point-of-sale home inspection. **OSSF Real Estate Workshops – were held July and September 23rd. Workshops offer a Texas Real Estate Commission-approved course (6 CEC) on the benefits of visually inspecting on-site sewage facilities.**
- **Online Regulations and Policies.** H-GAC continued to compile OSSF regulations and policies online at www.h-gac.com/go/septic. These serve as model regulations and policies.
- ^ **Homeowner Education.**
- H-GAC maintains a website, www.h-gac.com/go/septic, to share educational material. In addition to providing general information, the site offers content specific to homeowners/homebuyers, local governments, and real estate professionals.
- **On October 29th** Texas Coastal Watershed Program hosted an **OSSF** workshop. The workshop provides a basic understanding of the operational and maintenance activities for a conventional septic system and explains how activities within the home impact septic systems.

3.3 Legislation and Other Regulatory Actions

– Interim Measures:

- *The TCEQ should host biennial meetings to review OSSF regulations.*
- *Local authorized agents will meet annually.*
- *Every five years, one community shall revise or adopt new regulations.*

Project Status

- ... Not Started
 - ... Behind Schedule
 - ... Initiated
 - ^ **In Progress**
 - ... Completed
- ... Behind Schedule ^ **On Schedule** – *Activity is currently on schedule.*
- ... Ahead of Schedule

Implementation Effort

- ^ **Education.**
 - Harris County hosted the 4th Annual On-Site Wastewater Seminar on May 13, 2014.
-

stormwater and land development

4

Summary

Regional growth and development have increased the importance of stormwater management. Bacteria sources, such as waste from pets, wildlife, and even humans, can be washed into storm drains and discharged into local waterways. Stormwater systems are designed to remove stormwater from developments quickly and efficiently. As a result, stormwater in urbanized areas often bypasses natural vegetative barriers. Without these filters, “sheet flow” (i.e., stormwater flowing across the landscape) tends to result in more concentrated bacteria loading to waterways.

In general, this strategy focuses on building upon existing programs by sharing knowledge and developing incentives to increase voluntary implementation. The Stormwater and Land Development workgroup met with the Construction workgroup on November 18, 2014. Nine BIG stakeholders reported progress in implementing LID and stormwater management projects with an emphasis on effectiveness monitoring; progress on providing education and training opportunities; progress on surveying Municipal Separate Storm Sewer System (MS4) operators; and some progress on developing a MS4 recognition program. It was noted that the Texas Pollution Discharge Elimination System General Permit, TXR040000 was made effective December 13, 2013. Small MS4s that fell under this general permit were required to submit Notices of Intent (NOI) by June 13, 2014.

2015 Focus

- ^ H-GAC and BIG stakeholders aim to:
 - Will continue to collect information on small MS4 Notices of Intent (NOIs) and Stormwater Management Plans submitted to TCEQ following June 11, 2014 to track implementation.
 - Finish developing a web-based MS4 Phase II Tracking System with stakeholders to facilitate improved tracking.
 - Begin to examine local regulations and how they might inhibit LID projects.
 - Coordinate with local builders/developer trade organizations to implement the recognition and awards program.
 - Build a Wall of Fame on the H-GAC website to highlight at a minimum five local programs.
-

Implementation Strategies

4.1 Continue Existing Programs

– Interim Measures:

- *Eighty MS4 programs will be continued.*
- *As many as 200 additional MS4s will be added to TCEQ Region 12 during the new permit cycle; many will be in the BIG project area.*

Project Status

- ... Not Started
- ... Behind Schedule
- ... Initiated
- ^ **On Schedule** – *This activity is on schedule.*
- ^ **In Progress**
- ... Ahead of Schedule
- ... Completed

Implementation Effort

- ^ **Continued Program Administration.** The history of approved, pending, expired, denied and terminated NOIs for small MS4s can be reviewed at the TCEQ's Water Quality General Permits and Registration Search, http://www2.tceq.texas.gov/wq_dpa/index.cfm. A review of that registry finds that there are 121 individual permit/registration numbers for the BIG Project Area. Of that number 70 permittees sought to renew via NOI by the June 11, 2014 application date. In addition to small MS4s, the City of Houston, Harris County, Harris County Flood Control District, and Texas Department of Transportation continue to operate under the moniker, Joint Task Force as Phase I entities.
- The Armand Bayou watershed brings into the BIG Project Area one Phase I entity, City of Pasadena, and two smaller MS4s, City of Deer Park and the City of La Porte.
- ^ **MS4 Operator Questionnaire.** H-GAC mailed on April 17, 2015, MS4 questionnaires to the 121 individual permittees found in the TCEQ's permit registry. A copy of the questionnaire can be found as Appendix I. Fourteen of seventeen respondents noted that they would be addressing bacteria in their stormwater management program, see Appendix I for additional results.

4.2 Model Best Practices

– **Interim Measure:** *Each year, BIG stakeholders will hold four to six networking meetings and will highlight five local programs.*

Project Status

... Not Started ... Behind Schedule
... Initiated ^ **On Schedule** – *This activity is on schedule.*
^ **In Progress** ... Ahead of Schedule
... Completed

Implementation Effort

- **BMP Database.** Harris County Flood Control District (HCFCD) continues to maintain the Regional BMP Database (www.bmpbase.org) for stakeholders to access and evaluate the effectiveness of structural BMPs. The database provides access to BMP effectiveness data and is set to the International Stormwater BMP Database standards. HCFCD encourages other entities to submit qualified BMP effectiveness data from other projects in the region. In cases where other projects did not collect desired performance data, HCFCD remains interested in collecting the projects' geographic location and other metadata.
 - **MS4 Questionnaire.** **Seven of seventeen MS4 operators responded that in 2013-2014 that they installed structural BMPs, see Appendix I for additional information.**
 - **LID Tracking.** H-GAC developed through a grant with the EPA's Gulf of Mexico Program a LID tracking and resources website: <http://www.h-gac.com/community/low-impact-development/default.aspx>. The site currently tracks fifty-nine LID projects in the H-GAC region, most of which are located in the BIG project area.
 - **Education.** H-GAC, through its CWI, conducted two workshops supporting BMPs during the year: Minimum Control Measures (February) and Low Impact Development (December).
-

4.3 Encourage Expansion of Stormwater Management Programs

– **Interim Measure:** *Within the next five years:*

- All permit holders shall expand or focus their existing programs.
- Thirty previously unpermitted entities shall develop new programs.

Project Status

... Not Started	... Behind Schedule	– <i>This activity is on schedule to meet the five-year target. New TPDES permit requirements will encourage MS4 operators to address impaired waterbodies with appropriate management measures.</i>
... Initiated	^ On Schedule	
^ In Progress	... Ahead of Schedule	
... Completed		

Implementation Effort

^ **New General Permit Eligibility.** In a review of the TCEQ’s General Permit Registry for small MS4s it was found that 45 permits are new(http://www2.tceq.texas.gov/wq_dpa/index.cfm).

➤ New MS4 Permit Requirements. Under the new TPDES General Permit, small MS4s will be required to address their stormwater discharges to impaired waterbodies. Fourteen of seventeen respondents to the MS4 questionnaire noted that they would be addressing bacteria impairments through their stormwater management program (Appendix I).

MS4 Assistance. H-GAC found through the questionnaire that most MS4 Phase II operators were interested in assistance through topical workshops, particularly on funding. Twelve of seventeen respondents noted that limited staff time and funding were barriers to implementation, while seven of seventeen felt that ordinances and codes were a barrier.

4.4 Promote Recognition Programs for Developments that Voluntarily Incorporate Bacteria Reduction Measures

– **Interim Measures:**

- *Within five years, BIG stakeholders should develop a recognition program and subsequently recognize communities and participants.*
- *Each year, two communities will analyze regulations and programs to accommodate participation in existing programs.*

Project Status

... Not Started	... Behind Schedule	– <i>This activity is on schedule to meet the five-year target. Additional work must be made to identify communities which have analyzed regulations and other hurdles in an effort to meet the requirements of existing recognition programs.</i>
... Initiated	^ On Schedule	
^ In Progress	... Ahead of Schedule	
... Completed		

Implementation Effort

^ **Recognition Program.** H-GAC will continue to work with BIG partners to finish development of a BIG recognition program. Seventeen MS4s provided responses to the MS4 questionnaire; four cities provided data for use in the demonstration BIG tracking database; and thirteen MS4s provided the location for acquiring their SWMP. For their assistance, each organization was recognized on the Annual Report’s Wall of Fame, Appendix B.

4.5 Provide a Circuit Rider Program

– **Interim Measure:** *Each year, H-GAC will contact 50 stakeholders and provide five in-depth community consultations.*

Project Status

... Not Started ... Behind Schedule
... Initiated ^ **On Schedule** – *This activity is on schedule to meet the yearly target*
^ **In Progress** ... Ahead of Schedule
... Completed

Implementation Effort

^ **MS4 Questionnaire.** As noted under implementation activity 4.3, MS4 operators would be most interested in workshops covering MS4 funding (Appendix I).

^ **Education.**

- H-GAC, through its CWI, conducted two workshops related to MS4 operators during the year: Minimum Control Measures (April), and Low Impact Development in conjunction with H-GAC's Fall Planning Workshop (December).
 - H-GAC through the Environmental Awareness Roundtable addressed environmental education: What it Means to Back the Bay (April) and Social Media (October).
-

4.6 Petition the TCEQ to Facilitate Reimbursement of Bacteria Reduction Measures

– **Interim Measure:** *Within three years, BIG stakeholders should receive letters of commitment or similar support from the TCEQ.*

Project Status

... Not Started ... Behind Schedule
... Initiated ^ **On Schedule** – *This activity is on schedule to meet the three year target*
^ **In Progress** ... Ahead of Schedule
... Completed

Implementation Effort

^ **TCEQ Reimbursement.** TCEQ reported during the International Low Impact Development Conference, January 19-21, 2015 in Houston, TX that they did not feel there is a need for additional rule making to address developer reimbursement for installed water quality practices. The TCEQ stated that current rules are sufficient to allow reimbursement and that they are prepared to work with developers to assist in the reimbursement process.

construction

5

Summary

Rapid population growth and increasing densification of the BIG project area have led to more widespread and intense development activity that contributes to bacterial loading. Although construction sites for typical building and transportation projects are not significant sources of bacteria, urbanization inevitably results in more stormwater runoff. This runoff conveys sediments, nutrients, fertilizers, on-site sanitary wastes, and other contaminants downstream.

The Construction Workgroup met with the Stormwater and Land Development workgroup on November 18, 2014. Nine BIG stakeholders reported on their ability to conduct compliance and enforcement at construction sites and offer beneficial construction site education. The group reviewed and commented on a draft MS4 questionnaire, recommending H-GAC the addition of questions seeking the number of operators conducting compliance and enforcement inspections.

2015 Focus

^ H-GAC and BIG stakeholders aim to:

- Implement stakeholder tracking.
 - Solicit information and participation from new MS4 permittees.
 - Quantify and document inspections and enforcements in annual reports.
 - Provide educational materials and opportunities for contractors.
 - Work with professional organizations.
-

Implementation Strategies

5.1 Increase Compliance with and Enforcement of Stormwater Management Permits

– Interim Measures:

- *In year one, MS4 operators should evaluate needs or requirements for staffing an appropriate construction inspection program.*
- *In year two, BIG stakeholders should develop and begin offering educational material and training.*

Project Status

- | | | |
|----------------------|-----------------------|---|
| ... Not Started | ... Behind Schedule | – <i>This activity is on schedule as construction education and training is being offered and improving compliance.</i> |
| ... Initiated | ^ On Schedule | |
| ^ In Progress | ... Ahead of Schedule | |
| ... Completed | | |

Implementation Effort

^ **Compliance and Enforcement.**

- The City of Houston and Harris County reported they continue to meet inspection requirements found in their MS4 permits. The City of Houston conducts multiple inspections of all NOIs and Construction Site Notices (CSN) for projects of an acre or more that are submitted to the City and some sites less than an acre.
- Ten of seventeen respondents to the MS4 Questionnaire said they would be implementing bacteria reduction efforts under the MCM – 3 for Construction over the next 5 years. Nine of seventeen MS4 operators stated they currently conduct construction site inspections (Appendix I).

^ **Training.**

- Both Harris County and the City of Houston reported that informal on-site compliance education at construction sites is increasing compliance.
- Nine of seventeen small MS4s operators responding to the MS4 Questionnaire said they provide SWP3 education (Appendix I).

^ **Education.** H-GAC, through its CWI, provided a MS4 Minimum Control Measures workshop on April 22, 2014.

illicit discharges and dumping

Summary



Illicit discharge detection efforts have found illegal connections, discharges, and dumping activities that have resulted in increased bacterial loads in the project area's storm sewer and watershed systems. BIG stakeholders have widely cited mobile septic waste haulers as a potential source of contamination as they transport waste from OSSFs and grease and grit traps. While regulations dictate proper methods for disposing of waste at treatment facilities and recording information on manifests, anecdotal evidence indicates that illicit discharges do occur. Because these discharges can happen in so many locations, there are no flow-adjusted estimates for waste hauler contributions to bacteria levels in area waterways.

In response to these concerns, the BIG recommends that stakeholders focus on three activities: (1) detect and eliminate illicit discharges specific to bacteria; (2) improve local government mechanisms to regulate and enforce illicit discharges; and, (3) monitor and control waste hauler activities through regulations and fleet tracking programs. The Illicit Discharges and Dumping Workgroup met in conjunction with the OSSF workgroup on November 10, 2014. Seven BIG stakeholders discussed the challenges facing waste hauler tracking and ensuring waste actually makes it to a proper disposal site. Attendees agreed that much of the needed changes would only happen at state-level, they would like to identify a local government willing to pilot new technology and/or changes to ordinances or regulations.

2015 Focus

- ~ H-GAC and BIG stakeholders aim to:
 - Identify a local government to implement a pilot program.
 - Continue to identify regulatory resources related to liquid waste hauling, liquid waste generators, and trip tickets.
 - Continue to survey MS4 operators to acquire implementation activity updates
-

Implementation Strategies

6.1 Detect and Eliminate Illicit Discharges

– Interim Measures:

- *Within ten years, MS4 operators will complete initial surveys and maps.*
- *Each year, MS4 operators will identify the number of illicit discharges found and resolved each year.*

Project Status

... Not Started	... Behind Schedule	– <i>This activity is on schedule to meet the ten-year target. Current TPDES MS4 permits require permittees complete surveys and develop maps. Additional effort is needed to routinely capture the number of illicit discharges identified by MS4 operators each year.</i>
... Initiated	^ On Schedule	
^ In Progress	... Ahead of Schedule	
... Completed		

Implementation Effort

- ^ **Illicit Discharge Implementation.** The Joint Task Force (Harris County, City of Houston, Texas Department of Transportation, and Harris County Flood Control District) continue illicit discharge detection and elimination (IDDE) programs to look for and track illicit discharges. Maintaining strong IDDE programs is likely one reason for the declining bacteria seen in the BIG project region (Appendix C).
- ^ **MS4 Reporting.** H-GAC surveyed small MS4s under the new TCEQ Phase II permit cycle which was initiated December 13, 2013. Of the seventeen respondents, fourteen said they will be conducting illicit discharge elimination programs with the expressed purpose to address pathogens. Additionally, seven stated they routinely conduct illicit discharge inspections (Appendix I).
 - **IDDE Reporting.**
 - Bayou Preservation Association (BPA) continued with the assistance of the City of Houston to conduct a source identification and elimination project. BPA presented to BIG stakeholders on July 24, 2014. For more details, see section 11. *Geographic Priority Framework*.
 - **CleanBayous.org maintains an illegal dumping notification system that is used to notify participating small MS4s for the purpose of correction.**
 - Galveston Bay Action Network – www.galvbay.org/gban is an online resource for reporting fish kills, spills, SSOs and other incidents.

6.2 Improve Regulation and Enforcement of Illicit Discharges

– Interim Measures:

- *Within five years, BIG stakeholders will compile and share all existing regulations in the project area.*
- *Within five years, all communities shall examine their regulations, and one shall adopt new or revised regulations.*

Project Status

- ... Not Started
- ... Initiated
- ^ **In Progress**
- ... Completed
- ... Behind Schedule
- ^ **On Schedule** – *This activity is on schedule to meet the five-year target.*
- ... Ahead of Schedule

Implementation Effort

- ^ **Compile MS4 Regulations.** One respondent out of seventeen to the MS4 questionnaire stated they would be willing to share their codes, ordinances and regulations. Two of seventeen respondents plan on developing new ordinances or regulations as part of their second SWMP. H-GAC along with the BIG will continue to compile a list of ordinances and add them to ordinances currently available on the BIG website at www.h-gac.com/community/water/tmdl/big/illicit-discharges.aspx

6.3 Monitor and Control Waste Hauler Activities

- *Interim Measure: Within five years, one waste hauler fleet tracking pilot program shall be started by local stakeholders.*

Project Status

- ... Not Started
- ... Initiated
- ^ **In Progress**
- ... Completed
- ^ **Behind Schedule** – *This activity is behind schedule to meet the five-year target. BIG partners have yet to identify a local program interested in starting a pilot program.*
- ... On Schedule
- ... Ahead of Schedule

Implementation Effort

^ **Tracking.**

- City of Houston maintains a successful waste hauler tracking program. The City of Houston reviews waste hauler receipts during inspections at WWTFs.

^ **Education.** As part of the Environmental Enforcement Roundtable, H-GAC held three seminars:

- **January 22, 2015 Environmental Enforcement and Small Business Assistance**
- **April 22, 2014, Illegal Discharges and Honey Trucks;** and
- **July 10, 2014 Illegal Dumping Surveillance Camera Sharing Program.**

The roundtables provide a forum for local peace officers, county prosecutors, city officials, and personnel from TCEQ's Region 12 office to discuss illegal dumping issues. More information can be found at: <http://www.h-gac.com/community/waste/enforcement/local-environmental-enforcement-roundtables.aspx>.

animals and agriculture



Summary

Animals and agricultural practices contribute to increased bacteria levels in sediment runoff and water bodies. Cattle and poultry operations are the most common agriculture animals of concern in the BIG project area. However, clusters of other animals – such as horses, swine, sheep, and goats – also may contribute to water quality impairments throughout the area. Of particular interest to BIG stakeholders are feral hogs, a state and national problem estimated to cause \$52 million in crop loss in state each year. Feral hogs damage property due to their rooting and wallowing. They also defecate, often directly into waterways, large amounts of bacteria and nutrients into the environment.

Most agricultural management programs are either voluntary or only apply to confined animal feeding operations (CAFOs) designated by the EPA. These operations are not present in the BIG project area. On December 8, 2014, 8 members of the Animals and Agriculture Workgroup met and recommended continuing support of local initiatives that focus on promoting increased participation in existing voluntary- and incentive-based programs, collect and share the latest research on feral hog control and to encourage counties to consider the Texas Department of Agriculture's bounty program for hog removal. █

2015 Focus

- ^ H-GAC and BIG stakeholders aim to:
 - Continue to encourage stakeholder involvement in existing Texas State Soil and Water Conservation Board (TSSWCB), Texas A&M AgriLife Extension Service (AgriLife Extension), and Texas Water Resources Institute (TWRI) programs.
 - Continue to provide technical support and education opportunities.
 - Gather the latest research on implementation practices that are successfully reducing feral hog populations.
 - Track success of Harris County's feral hog management project.
-

Implementation Strategies

7.1 Promote Increased Participation in Existing Programs for Erosion, Control Nutrient Reduction and Livestock Management

- **Interim Measure:** *Each year, participation by farmers and ranchers in financial and technical assistance programs should increase by 5% percent.*

Project Status

- ... Not Started
- ... Behind Schedule
- ... Initiated
- ^ **On Schedule** – *This activity is on schedule to the annual target.*
- ^ **In Progress**
- ... Ahead of Schedule
- ... Completed

Implementation Effort

^ **Implementation.**

- TSSWCB reported that there were no new water quality management programs in the BIG project area.
- NRCS and TSSWCB reported owners of 8,816 acres accepted federal funding and technical assistance under agriculture programs (CTA, EQUIP, WHIP) in 2014 to implement agricultural BMPs.
- ^ **Education.** As part of the Lone Star Healthy Streams Program (<http://lshs.tamu.edu/>), TWRI offers a series of publications designed to educate Texas farmers, ranchers, and landowners about proper grazing, feral hog management, and riparian area protection to reduce the levels of bacterial contamination in streams and rivers. There were four programs delivered in Chambers, Fort Bend, Montgomery, and Walker counties with a total of 298 people in attendance..

7.2 Promote the Management of Feral Hog Populations

- **Interim Measure:** *During the next five years, AgriLife Extension will host two feral hog management workshops per year for landowners, local governments, and other interested people.*

Project Status

- ... Not Started
- ... Behind Schedule
- ... Initiated
- ... On Schedule
- *This activity is ahead of schedule to meet the five-year target*
- ^ **In Progress**
- ^ **Ahead of Schedule**
- ... Completed

Implementation Effort

^ **Education.**

- AgriLife Extension conducted 15 one hour feral hog programs in the BIG area in 2014.
- AgriLife Extension developed an internet website application, <https://itunes.apple.com/us/app/feral-hog-management/id784847089?mt=8> which provides land owners the very best science and field based information now available on various hog control measures.
 - TPWD shared latest information on bait control, <https://www.youtube.com/watch?v=GigpxLNbgeg>
- ^ **Implementation.** In 2014, Harris County Precinct 3 accelerated feral hog trapping activities in Addicks and Barker reservoirs due to a \$630,000 Coastal Impact Assistance Program grant received in 2013. Funds are used by the precinct to build feral hog traps, cover baseline water quality monitoring, and to pay for processing feral hog meat to donate to a local food bank. Baseline water quality monitoring began in

September 2014 and is scheduled to be completed in Spring 2015.

animals and agriculture

Implementation Strategies



Summary

Communities can improve water quality by changing overall attitudes and individual behavior – one homeowner at a time. Enforcement, or the threat of enforcement, may be effective with stakeholders regulated by permits. Yet, it has less impact on individuals. Changing the attitudes and behaviors of individuals presents an opportunity for long term water quality improvement and support for existing permitted programs, like MS4s. For this strategy, the focus is on how to empower residents and neighborhoods through volunteer activities and educational outreach.

Five members of the Residential Workgroup met on January 29, 2015 to report on efforts to expand homeowner bacteria education in the project area. The workgroup discussed their role and determined that the functions of the workgroup are generally shared by other areas and suggested that this workgroup did not need to meet further. Homeowner education is accomplished through implementation captured in other I-Plan area, e.g. MS4 programs collected under stormwater and OSSF homeowner maintenance under OSSFs.

2015 Focus

- ^ H-GAC and BIG stakeholders aim to:
 - Develop objectives and evaluation measures to better assess results of education efforts.
 - Continue identifying regional opportunities to address pet waste and FOG concerns utilizing education and/or regulatory action.
 - Encourage MS4 operators to focus on bacteria reduction public education and outreach.
-

residential

8.1

Expand Homeowner Education Efforts throughout the BIG Project Area

– Interim Measures:

- *Local governments and appropriate agencies should begin or continue homeowner education programs. Each year, participation should increase by 2%.*
- *Every five years, H-GAC and BIG stakeholders will conduct at least one pilot study to evaluate the results of education efforts.*

Project Status

... Not Started

... Initiated

^ **In Progress**

... Completed

– *This activity is on schedule to meet yearly education targets.*

Local MS4 operators are focusing more on education efforts. Additional work is needed to evaluate and derive environmental results from education.

... Behind Schedule

^ **On Schedule**

... Ahead of Schedule

Implementation Effort

Education - Local organizations and communities continued to offer many ongoing homeowner education programs that help reduce bacteria loading in the BIG project area. In addition to the listed programs, events, and website repositories, a number of other formal and informal resources are available to increase awareness and understanding.

^ MS4 Programs.

- In the recent TCEQ Phase II permit, stormwater education and involvement were combined into one minimum control measure – MCM 1. Responses to the MS4 questionnaire report that fourteen of the seventeen respondents will address bacteria under MCM 1. Under the previous permit thirteen of seventeen reported the use of educational materials under MCM 1 and ten of seventeen reported public involvement MCM 2.
- Twelve of seventeen respondents to the MS4 questionnaire reported being aware of the BIG. All respondents were interested in learning more about the BIG.
- Many small MS4 reported participating in CleanBayous.org to support residential and public, commercial and industrial, construction, business, and municipal employee outreach and education goals.

^ Outreach and Involvement.

- During Trash Bash® in 2014 at ten sites (1 in Armand Bayou) 3,364 people volunteered and collected 16.51 tons of trash and 124 tires (since 1994, 90,000 volunteers collected 2,000 tons of trash and 8,000 tires) that includes sites within the BIG project area. Outreach displays and/or activities were available during the event and included themes like picking up pet waste, FOG programs, water conservation, and watershed education.
- H-GAC's ongoing "Pet Waste Pollutes" campaign aims to reduce pet waste that ultimately drains into waterways and causes bacterial pollution. Pet waste bag dispensers were distributed at the 2013 Trash Bash®. This type of programming is supplemented by educational outreach efforts such as new online resources pertaining to other programs and model ordinances at www.petwastepollutes.org. The campaign is also useful for reporting data. For instance, the City of Houston demonstrated a progressive increase in pet waste-related citations and convictions over the past seven years.
- H-GAC and the City of Houston jointly hosted an educational booth at the Reliant Park World Series of Dog Shows July 2014, which annually attracts more than 40,000 spectators, participants, and vendors.
- H-GAC staff hosted an educational booth at the Sam Houston Area Council Boy Scout Fair, a two-day event open to area scouts and their families with roughly 35,000 individuals in attendance.
- Texas Stream Team includes # volunteers of which # trained to collect bacteria data.

^ Online Tools and Resources.

Offer excellent online educational resources that include free support tools and downloadable materials to support the missions of local MS4 programs.

- Cease the Grease - <http://galvabay.org/ceasethegrease/>;
- Back the Bay – <http://www.backthebay.org/>;
- Pet Waste - <http://www.h-gac.com/pet-waste/default.aspx>
- Clean Water Clear Choice - <http://www.cleanwaterways.org/>
- Patty Potty – www.pattypotty.com

Training and Reporting.

- Clean Wasters Initiative Workshops - <http://www.h-gac.com/cwi/default.aspx> houses all past CWI workshops and announcements for upcoming workshops that help local governments, landowners, and citizens develop effective strategies to reduce pollution in our waterways. 2014 Offerings included: MS4 Minimum Control Measures – April 22nd; Microbial Source Tracking – July 17th; and Water Rights and Water Reuse – September 25th
- Environmental Awareness Roundtable - <http://www.h-gac.com/community/environmental-awareness-roundtable/default.aspx> was designed to facilitate idea-sharing between city staff, county staff and community organizations to create effective environmental awareness campaigns. 2014 offerings: What it Means to Back the Bay – April 22, 2014 and Social Media – October 28-29th.
- OSSF Real Estate Workshops – were held July and September 23rd. Workshops offer a Texas Real Estate Commission-approved course (6 CEC) on the benefits of visually inspecting on-site sewage facilities.
- OSSF Homeowner Maintenance – October 29th Texas Coastal Watershed Program workshop provides a basic understanding of the operational and maintenance activities for a conventional septic system and explains how activities within the home impact septic systems.
- Rain Barrel Workshops – August and November workshops put on by the Galveston Bay Foundation educate homeowners on the water quality and conservation benefits to collecting rain water.
- Environmental Enforcement Roundtables – are held throughout the year and offers a forum for peace officers, county prosecutors, city officials and TCEQ staff to discuss illegal dumping issues within the H-GAC region.
- Texas Stream Team training events # and # attendees.

- Water Resources Information Map – interactive mapping tool which displays all CRP water quality monitoring sites in the region and includes photos and data associated with each site.
- Galveston Bay Action Network – www.galvbay.org/gban is an online resource for reporting fish kills, spills, SSOs and other incidents.

monitoring and I-plan revision



Summary

To assess I-Plan progress, the BIG is required to monitor ambient water quality data and the progress of all Implementation Activities. Using these data the BIG produces an annual report. This keeps BIG stakeholders apprised of progress, and helps to determine if the I-Plan or any of its individual elements require revisions to their implementation strategies or schedules. The monitoring data, in particular, will be an important indicator of whether I-Plan guidance results in the desired reduction of bacteria loading. A more in-depth evaluation will occur every five years, as resources are available and with stakeholder participation.

The review will address answers to the following questions:

- Do ambient water quality monitoring data indicate that bacteria levels are changing?
 - » If so, are the bacteria levels increasing or decreasing?
- Do non-ambient water quality monitoring data indicate that implementation activities are reducing the load of bacteria?
- Are implementation activities and controls being undertaken as described in the I-Plan?
 - » Which activities have been implemented and which have not?

The Monitoring and Plan Revision Workgroup met jointly with the Research Workgroup on January 23, 2015, with four members in attendance. The BIG voted to approve joining the Armand Bayou watershed to the BIG project area. BIG stakeholders reported removing sources of bacteria by conducting non-ambient sampling and tracking to source; the launch of HCFCD's BMP database; and several organizations are completing BMPs that include effectiveness monitoring that will wrap up in 2015.

2015 Focus

^ H-GAC and BIG stakeholders aim to:

- Continue ambient water quality monitoring and analysis.
 - Strengthen implementation tracking and coordination of non-ambient efforts through completion and analysis of data.
 - Continue to develop a BIG regional implementation activity database.
-

Implementation Strategies

9.1 Continue to Utilize Ambient Water Quality Monitoring and Data Analysis

- **Interim Measure:** *Each year, H-GAC and BIG stakeholders will monitor ambient water quality to help determine if water bodies are meeting state standards for bacteria.*

Project Status

... Not Started

... Initiated

^ **In Progress**

... Completed

... Behind Schedule

^ **On Schedule**

... Ahead of Schedule

– *This activity is on schedule to meet the annual target.*

Implementation Effort

- ^ **H-GAC's CRP.** H-GAC's CRP continues to be the primary vehicle for water quality monitoring and data analysis in the project area (see Appendix F).
 - The 2014 *Basin Highlights Report How's the Water?* documents water quality impairments and trends based on data collected by seven organizations at 162 sites within the BIG project area and 11 sites in the Armand Bayou watershed (Table 9).
 - Since September 2011, CRP monitors have been recording evidence of enterococci concurrent with *E.coli* samples in non tidal areas.
 - CRP gathered observations of contact recreation while out gathering ambient water quality data. Of the 162 sites monitored by CRP partners in 2014 in the BIG project area, 17 observed evidence of contact recreation. At those 17 sites there were 24 individuals observed in contact recreation activity (Table 10).

9.2 Conduct and Coordinate Non-Ambient Water Quality Monitoring

- **Interim Measure:** *H-GAC and BIG stakeholders will conduct non-ambient water quality monitoring activities including:*
 - » *Developing a regional Quality Assurance Project Plan (QAPP); and*
 - » *Developing a regional non-ambient monitoring database.*

Project Status

- ... Not Started
- ... Behind Schedule
- ... Initiated
- ^ **On Schedule** – *This activity is on schedule.*
- ^ **In Progress** ... Ahead of Schedule
- ... Completed

Implementation Effort

- ^ **Non-Ambient Water Quality Monitoring QAPP.** In 2013, TCEQ determined that resources were not available to evaluate the QAPP. The BIG Monitoring Workgroup determined that the QAPP was important because it is a detailed plan written to ensure the quality and comparability of data from sample collection and processing through analysis and storage. BIG recommended that the QAPP be approved by H-GAC and reported back to the BIG workgroups.
- ^ **Regional BMP Database.** The HCFCD developed a regional BMP database modeled on the International Stormwater BMP Database. Currently, the database includes monitoring information for stormwater BMP projects developed by the HCFCD, as well as other BMP projects in the region. More information is available at www.bmpbase.org/LandingPage.aspx.
- ^ **Monitoring Data Implementation.**
 - The City of League City and TCWP completed the Gharardi Watersmart Park that contains monitored BMPs that will be evaluated through August 31, 2015.
 - Bayou Preservation Association (BPA) completed a QAPP and is commencing preconstruction of water quality sampling at a future LID project in 2015.
 - BPA continued to conduct non-ambient monitoring to track down sources of bacteria in the BIG project area. For more details, see section 11. *Geographic Priority Framework.*
- Harris County PID Birnamwood Drive LID monitoring project began in 2014 and will be completed.
- Harris County is collecting water quality data as part of the feral hog removal project in Addick and Barker reservoirs. Data collection and analysis should be completed in 2015.
- Armand Bayou watershed – University of Houston – Clear Lake retrofitted a detention basin with a stormwater wetland to improve run-off in 2012. Wetland was monitored for water quality and habitat quality parameters and was completed in August 2014. Authors have begun presenting results to resource agencies and interested parties.

9.3 Create and Maintain a Regional Implementation Activity Database

– **Interim Measure:** *Each year, BIG stakeholders will provide a report on the activities they implemented during the year. H-GAC will compile and share this information in a database.*

Project Status

... Not Started ... Behind Schedule
... Initiated ^ **On Schedule** – *This activity is on schedule and has met the annual target.*
^ **In Progress** ... Ahead of Schedule
... Completed

Implementation Effort

^ **Regional Implementation Activity Database.** H-GAC with BIG partners from the Clear Creek watershed populated a demonstration database and will be developing a web application for demonstration in 2015. The implementation database will include provisions for local reporting efforts and provide annual tracking forms to collect information. The database will be compatible with HCFCD database.

9.4 Assess Monitoring Results and Modify I-Plan

- **Interim Measure:** *Each year, H-GAC will assess monitoring in annual reports to identify whether progress is being made and communicate the results to the BIG. The BIG will determine if changes or updates to the I-Plan are needed.*

Project Status

- ... Not Started
- ... Behind Schedule
- ... Initiated
- ^ **On Schedule** – *This activity is on schedule and has met the annual target.*
- ^ **In Progress**
- ... Ahead of Schedule
- ... Completed

Implementation Effort

- ^ **BIG Bacteria Trend Line.** The BIG project area bacteria trend line continues to show improvements (see Appendix C). However, it seems that progress has slowed in the past year. H-GAC will continue to review available data to determine trends in bacteria levels. Trend lines for each watershed are provided in the appendices.
- ^ **Non-Ambient Water Quality Monitoring.** Data have not been provided to H-GAC at this time to understand the impact of specific implementation activities that have been undertaken in the BIG project area. However, there are projects underway that will be able to provide data and analysis soon, including:
 - The HCFCD BMP database;
 - Harris County PID Birnamwood Drive LID monitoring project;
 - The City of League City and TCWP BMP park; and
 - The BPA LID project.
- ^ **Modifications to the I-Plan.** Workgroups reviewed current I-Plan language to determine if any modifications might be needed.
 - On May 27, 2014, the BIG approved new language to augment implementation activity 9.4.5. New language incorporates adjacent watersheds outside of the BIG project area that are under a TMDL where the watershed's stakeholders request inclusion under the BIG I-Plan. Language includes the condition that the BIG approves the stakeholder's request. During that meeting the BIG unanimously approved the addition of the Armand Bayou watershed.
 - On October 21, 2014, the BIG approved the addition of 16 new assessment units within the BIG project area where TMDLs were completed and approved by TCEQ. There are 88 impaired assessment units in the BIG.

research

1

Summary

BIG stakeholders support new research initiatives that could result in useful findings and recommendations. TMDL studies provide a general overview of the extent and source of the presence of bacteria. However, these studies are not sufficient to determine the most cost-effective courses of action to achieve water quality standards for contact recreation. The BIG has identified three top research priorities: (1) effectiveness of stormwater management activities, (2) bacteria persistence and regrowth, and (3) appropriate indicators to identify health risks presented by contact recreation in impaired waters.

These topics are pertinent to the entire project area. However, research is often driven by the availability of resources. While some research is being conducted within the region, BIG's active participation and advocacy at the state and national levels will help to ensure regional priorities are addressed. Local participation will also help to ensure findings and recommendations produced elsewhere are transferable to the project area.

On January 23, 2015, four members Research Workgroup met jointly with the Monitoring and Plan Revision Workgroup. The workgroup reviewed data related to ambient and non-ambient water quality. They discussed the status of feral hog and best management practices monitoring and research. A Clean Waters Initiative workshop on Microbial Source Tracking was held July 17, 2014 and included the following research topics:

- "Use of Bacterial Source Tracking to Characterize Texas Watersheds," Terry Gentry and Kevin Wagner, Texas A&M University;
- "*E. coli* Source Tracking in Buffalo and White Oak Bayous," Robin Brinkmeyer, Texas A&M University – Galveston; and
- "MST: Latest qPRC Methods & Project Design Approaches," Mauricio Larenas, Source Molecular.

2015 Focus

- ^ H-GAC and BIG stakeholders aim to:
 - Continue existing research and evaluate available data sources.
 - Secure funding for additional projects, e.g. research to better understand the relationship between bacteria and sediment.
-

Implementation Strategies

10.1 Evaluate the Effectiveness of Stormwater Implementation Activities

- **Interim Measure:** *BIG stakeholders will monitor current and future stormwater projects and analyze their effectiveness.*

Project Status

- ... Not Started
- ... Initiated
- ^ **In Progress**
- ... Completed
- ... Behind Schedule
- ^ **On Schedule** – *This activity is on schedule*
- ... Ahead of Schedule

Implementation Effort

^ **BMP Monitoring.**

- HCFCD is actively monitoring several stormwater sites within the region and developed a Regional BMP Database at www.bmpbase.org where stakeholders may access and evaluate effectiveness data.
- City of League City in cooperation with TCWP installed a BMP park. Monitoring of the BMPs will be completed in 2015.
- Harris County PID Birnamwood Drive LID monitoring project began in 2014 and will be completed.
- BPA develop a monitoring QAPP for a future stormwater project and will commence monitoring in 2015.
- H-GAC developed a LID web resource page - <http://www.h-gac.com/community/low-impact-development/resources.aspx>.
- Armand Bayou watershed – University of Houston – Clear Lake completed a fully monitored stormwater wetland on the UHCL campus.

10.2 Further Evaluate Bacteria Persistence and Regrowth

- **Interim Measure:** *BIG stakeholders will conduct special studies to better understand the extent of human contributions to bacterial loading. Data from these studies should be included in a monitoring databases.*

Project Status

- ... Not Started
- ... Initiated
- ^ **In Progress**
- ... Completed
- ... Behind Schedule
- ^ **On Schedule** – *This activity is on schedule.*
- ... Ahead of Schedule

Implementation Effort

^ **Special Studies.**

- City of Houston conducted bacterial source tracking to investigate the source of Bacteroidales (an anaerobic fecal bacteria) using polymerase chain reaction (PCR) methods to distinguish between DNA markers for human and animal sources. PCR analysis demonstrated present/non present results of Hog and Deer fecal pollution in most of the project area bayous. Since the PCR marker for humans can survive chlorination without the Bacteroidales species being viable reinforced the knowledge that most of the bayous are effluent dominated (Table 11).
- City of Houston evaluated the susceptibility of the IDEXX QuantiTray method for *E. coli* to interference from different species of bacteria co-metabolizing the marker and causing false positives. Study concluded continued use of IDEXX method as they found no significant difference between the IDEXX method and EPA Method 1103.1.
- City of Houston, Harris County, and HCFCD are planning to follow the Unified Ambient Water Quality Monitoring Program to quantify diurnal bacteria fluctuations in area waterways. The study is currently waiting on the TCEQ to approve the quality assurance project plan before continuing.

10.3 Determine Appropriate Indicators

- **Interim Measure:** *H-GAC and BIG stakeholders should help determine the need for alternative, supplemental, or multiple bacteria indicators to refine the I-Plan.*

Project Status

- ... Not Started
- ... Initiated
- ^ **In Progress**
- ... Completed
- ... Behind Schedule
- ^ **On Schedule** – Overall this activity is on schedule.
- ... Ahead of Schedule

Implementation Effort

- ^ **Indicator Research.** BIG will track ongoing and future research by the following agencies and organizations which indicate promising indicators.
 - The H-GAC CRP continued collecting enterococci samples to supplement *E.coli* samples in freshwater.
 - City of Houston, during the bacteria source tracking project, will be evaluating potential bacteria indicators including bacteria from the order Bacteroidales.
-

10.4 Additional Research Topics

- **Interim Measure:** *H-GAC and BIG stakeholders should conduct additional research on WWTFs, health risks, recreational use, land use modeling, unimpaired waterways, nutrients, and other constituents as funds are available.*

Project Status

- ... Not Started
- ... Initiated
- ^ **In Progress**
- ... Completed
- ... Behind Schedule
- ^ **On Schedule** – Activities are on schedule
- ... Ahead of Schedule

Implementation Effort

- ^ **Research Abstracts.** BIG stakeholders provided eight research article and/or abstracts for H-GAC's library relating to bacteria contributions and implementation measures. The collection included articles about:
 - “Distribution and persistence of *E. coli* and Enterococci in stream bed and bank sediments from two urban streams in Houston, TX,” Robin Brinkmeyer et. al. *Science of the Total Environment*, 502 (2015) 650-658;
 - “Pathogens in Urban Stormwater,” Urban Water Resources Research Council, Pathogens in Wet Weather Flows Technical Committee, Environmental and Water Resources Institute, American Society of Civil Engineers (2014);
 - “Lake Madeline Bacteria Study Final Summary Report,” George Guillen, University of Houston – Environmental Institute of Houston, Technical Report 2-10 A, Nov.2010;
 - “Best management practices to mitigate fecal contamination by livestock of New Zealand Waters,” Rob Collins, et al., *New Zealand Journal of Agricultural Research*, 2007, Vol. 50: 267-278.
 - “Can Stormwater BMPs Remove Bacteria? New Findings from the International Stormwater BMP Database,” Jane Clary, et. al., May 2007; <http://www.stormh20.com/may-2008/bacterial-research-bmps.aspx>.
 - “Challenges in Attaining Recreational Stream Standards for Bacteria: Setting Realistic Expectations for Management Policies and BMPs,” Jane Clary, et. al, *World Environmental and Water Resources Congress 2009: Great Rivers*© 2009 ASCE.
 - “Illnesses Associated with Non-Point Source Contamination of Recreational Water and Potential New Management Tactics to Minimize Health Risk,” Shannon T. O’Hearn, ENSC 501 Independent Environmental Studies Project – Queen’s University, 2014.
 - “Quantitative Health Risk Assessment of Recreational Water Users in Philadelphia,” Neha Sunger, Thesis, Drexel

University, Jan. 2013.

^ **Future Research Topics.** BIG members recommended research, should additional funding become available, to study the relationship between bacteria and biofilms, colloidal particles, total suspended solids, and turbidity, including:

- Wet sieve analysis;
 - Sample dilution;
 - Use of filters smaller than 0.45 μm ; and
 - Testing sludge blankets from wastewater treatment facilities
-

geographic priority Framework

1

Summary

For the BIG project area to achieve state standards for contact recreation, a wide range of community stakeholders must be responsible for implementing the I-Plan. While some initiatives span the entire project area, others focus on targeted watersheds. During the project stage, public input via outreach meetings and/or surveys is essential to help set priorities and timing.

As regional organizations and local jurisdictions work to establish their priorities, they should consider five main categories of concern: (1) bacteria level, (2) accessibility of water body, (3) use level, (4) implementation opportunities, and (5) future land use changes.

On January 29, 2015, thirteen members of the Watershed Outreach Workgroup met and reported on prioritized implementation efforts, including use of H-GAC's Top Ten "Most Wanted" Streams list to eliminate illicit discharges.

2015 Focus

- ^ H-GAC and BIG stakeholders aim to:
 - Continue to host watershed meetings in regional watersheds to encourage local stakeholder feedback and participation.
 - Continue to use the Top 10 "Most Wanted" Streams list.
 - Begin to address the 2014 Top 10 "Most Likely to Succeed" Streams list using funding provided by TCEQ's Galveston Bay Estuary Program.
-

Implementation Strategies

11.1 Consider Recommended Criteria When Selecting Geographic Locations for Projects

- **Interim Measure:** *Communities should consider bacteria, accessibility, opportunities, use, and future use when selecting locations for projects.*

Project Status

... Not Started

... Initiated

^ **In Progress**

... Completed

... Behind Schedule

... On Schedule

^ **Ahead of Schedule**

- *This activity is ahead of schedule. Stakeholders have begun prioritized watershed to address sources of bacteria.*

Implementation Effort

- ^ **BIG's Geographic Prioritization.** H-GAC staff cross compared the 2014 and 2015 Top 10 "Most Wanted" Streams and Top 10 "Most Likely to Succeed" Streams (see Appendices G and H).
 - Four assessment units improved in 2014, two dropped off the list and two dropped down the list (Green). Three assessment units' status remained unchanged during 2014 with their relative geomean staying almost the same (Purple). Five assessment units degraded in 2014, three rising on the list (Red) and two new to the list (Yellow). Of the ten on the list, the most dramatic change remains Bintliff Ditch sitting at 17 MPN/100 mL, which continues the decline we first reported in relative geomean in the 2014 Annual Report of 36 MPN/100mL to 27 MPN/100 mL.
 - Six assessment units were new to the Top 10 "Most Likely to Succeed" Streams list in 2014 (yellow). Two of the new listings came from the Armand Bayou watershed. The remaining four new listings were for assessment unites that improved over 2014. Of the six assessment units that were removed from the list, three left the list due to relative geomeans that increased (degraded) and three saw their geomeans decrease (improved) below the standard. For the remaining four assessment units, two continued on the list with essentially the same relative geomean (purple) and two improved with a lower relative geomean.
- ^ **Top 10 "Most Wanted" Streams List.** Bayou Preservation Association and the City of Houston are working together to tackle the "Most Wanted" list. BPA conducts reconnaissance and additional wet and dry weather monitoring to track down bacteria source locations. When likely targets are identified, the information is passed on to the City of Houston or other local authorities to address the source.
 - Found leak on Bintliff Ditch, a tributary to Brays Bayou, and notified the City of Houston.
 - Found sewer main leak on Hunting Bayou and notified the City of Houston.
 - Broke up the White Oak Bayou watershed through sampling, finding higher levels of bacteria in the central area of White Oak and Little Thicket Bayou. Other portions of the bayou were found to contain lower levels of *E. coli*. Future investigations will target the middle portion.
 - H-GAC sought funding in 2014 from the TCEQ Galveston Bay Estuary Program to implement the top 10 lists. H-GAC is currently waiting on a contract to begin to implement to project. Project will begin in 2015.

Appendix A

Acknowledgments

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Will Merrell, Houston-Galveston Area Council
Jack Northey, Texas Commission on Environmental Quality
Winford Roberts, Waller County
James Walls, Harris County
Tyrone West, Harris County

Residential and Outreach Work Group

Richard Chapin, City of Houston
Marilyn Christian, Harris County
Ronald Drachenberg, Fort Bend County
Steve Hupp, Bayou Preservation Association
Tom Ivy, Public
Adam Wright, Fort Bend County
Jasmin Zambrano, City of Houston

Wastewater Treatment Facility Work Group

Susie Blake, City of League City
Richard Chapin, City of Houston
Danielle Cioce, Harris County
Frank Green, Montgomery County
Jonathan Holley, Harris County Flood Control District
Steve Hupp, Bayou Preservation Association
Tom Ivy, Public
Carol LaBreche, City of Houston
Alisa Max, Harris County
Scott Nichols, Montgomery County
Ray Pavlovich, Nottingham Country MUD
Mary Purzer, AECOM
Kathy Richolson, Gulf Coast Waste Disposal Authority

Sanitary Sewer Systems Work Group

Charlene Bohanon, Galveston Bay Foundation
Richard Chapin, City of Houston
Marilyn Christian, Harris County
Daniel Christodoss, URS Corporation
Ralph Cox, Klotz and Associates
Roy Elizondo, Montgomery County
Bill Goloby, City of Houston
Floyd Green, Harris County MUD #26
Teague Harris, IDS Engineering
Tom Ivy, Public

Carol LaBreche, City of Houston
Karen Kottke, AECOM
Jason Maldonado, Lockwood, Andrews and Newnam
Michael Mooney, Woodlands Joint Power Agency
Raghavender Nednur, City of Houston
Ogadimma Oneybuchi, City of Houston
Mary Purzer, AECOM
Gary Syzek, Harris County MUD #86
Tim Vu, City of Houston
Patrick Walters, City of West University Place

Illicit Discharges and Dumping Work Group

Ted Aplace, HPARD
Charlene Bohanon, Galveston Bay Foundation
Richard Chapin, City of Houston
Danielle Cioce, Harris County
Frank Green, Montgomery County
Jesse Espinoza, City of Webster
Denise Hall, Harris County
Anita Hunt, Hunt & Hunt Engineering Corp.
Tom Ivy, Public
Katie McCann, Galveston Bay Foundation
Rasheedah Mujtabay, City of Houston
Mary Purzer, AECOM
Robert Snoza, Harris County Flood Control District

Appendix B

“Wall of Fame”

Authorized agents for on-site sewage facilities (OSSFs) and operators of municipal separate storm sewer systems (MS4s) were asked via e-mail and/or phone to provide data and information for this annual report. The “Wall of Fame” acknowledges participating stakeholders for their contributions. Additional stakeholders, including wastewater treatment facility permit holders, will be asked to provide data and information in the coming year.

On-Site Sewage Facilities

RELIABLY SUBMITTED DATA AND SUBMITTED A COMPLETE PERMIT DATA SET

- ^ City of Manvel
- ^ Brazoria County*
- ^ Fort Bend County
- ^ Galveston County
- ^ Harris County
- ^ Liberty County
- ^ San Jacinto River Authority
- ^ Waller County
- ^ Walker County
- ^ Texas Commission on Environmental Quality

** Also submitted some violation data*

Note: Austin, Chambers, Colorado, Matagorda and Wharton counties, while outside of the BIG project area, have provided information in support of the OSSF mapping program initiated by the BIG.

Municipal Separate Storm Sewer Systems

RESPONDED TO MS4 QUESTIONNAIRE

- ^ City of Missouri City
- City of Meadows Place
- Montgomery County
- Brazoria Drainage District No. 4
- Fort Bend County MUD 57
- Cinco Southwest MUD 1
- City of Pearland
- City of League City
- City of West University Place
- City of Katy
- City of Deer Park
- Harris-Fort Bend Counties No. 1
- Grand Lakes MUD 4
- Grand Lakes MUD 1
- Southwest Harris County MUD 1
- City of Hunters Creek Village

SHARED MS4 DATA FOR DATABASE TRACKING

- City of Friendswood
- City of League City
- City of Nassau Bay
- City of Pearland

SHARED MS4 SWMP and NOI DOCUMENTS

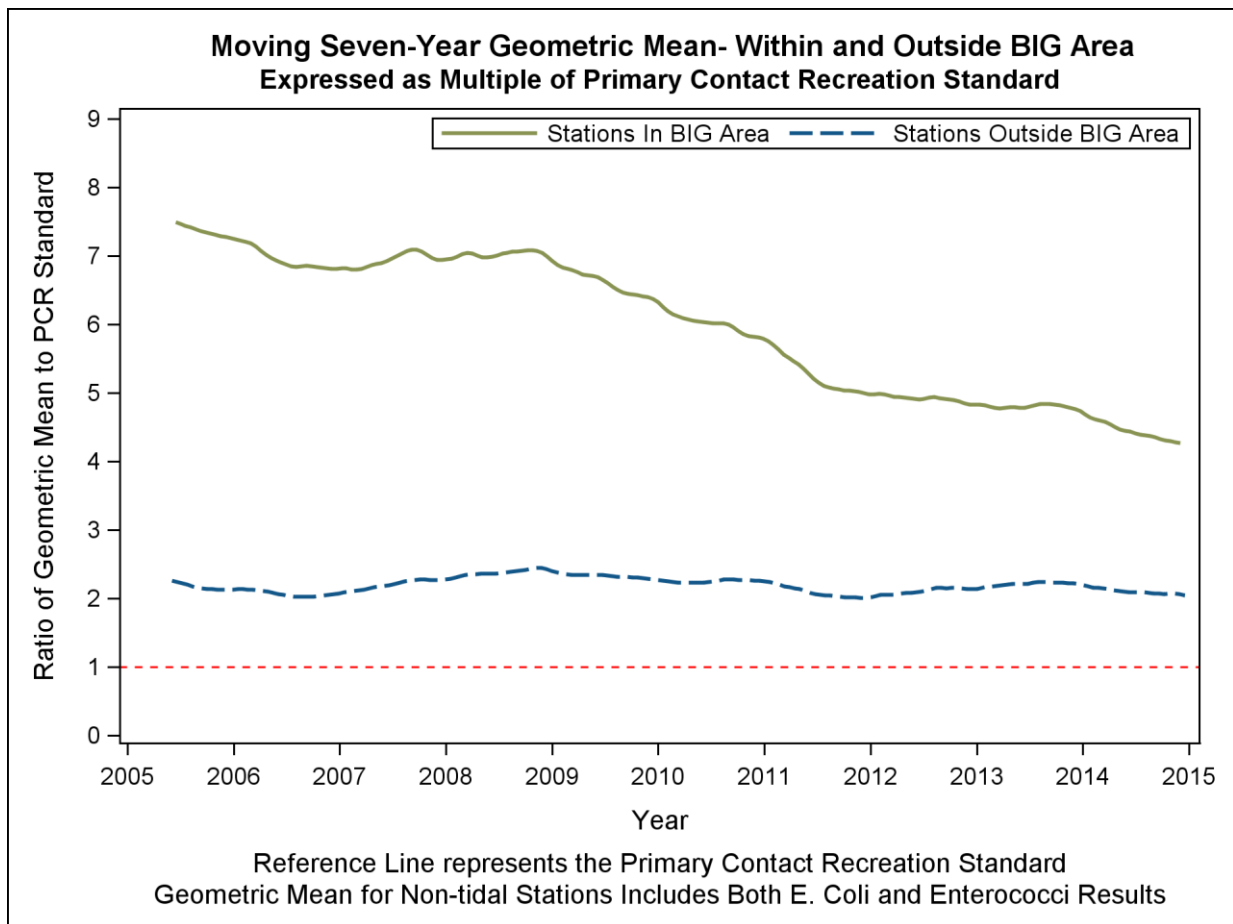
- Brazoria Drainage District No. 4
- Cinco Southwest MUD No. 1
- City of League City
- Grand Lakes MUD No. 1
- Grand Lakes MUD No. 4
- Harris-Fort Bend Counties MUD No. 1
- City of Hunters Creek Village
- City of Missouri City
- Montgomery County MUD No. 94
- City of Nassau Bay
- City of Pearland
- Southwest Harris County MUD No. 1
- City of West University Place

Appendix C

Bacteria Trends

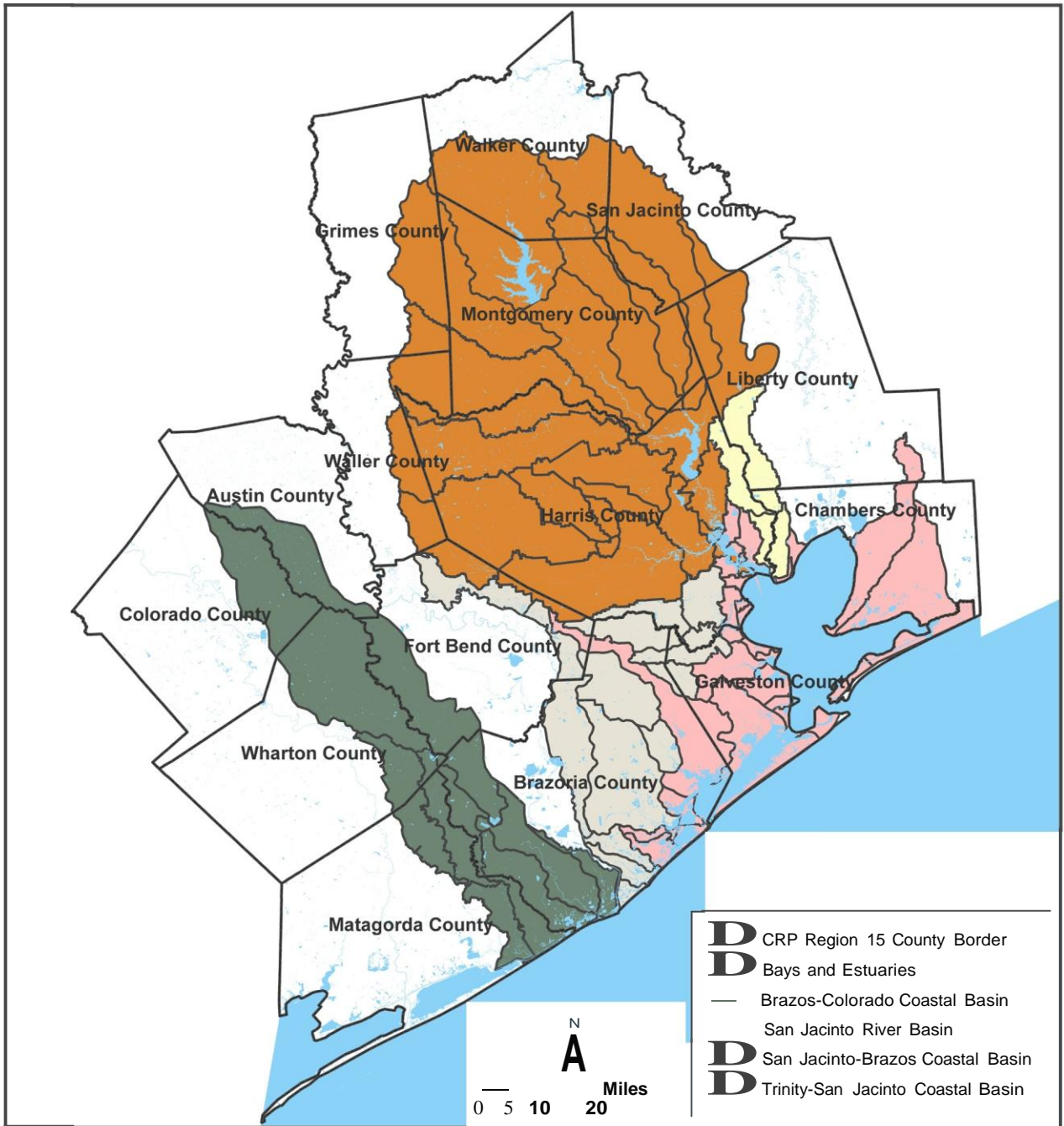
The following chart illustrates how the seven-year geometric mean for bacteria levels has changed over time. It is based on ambient water quality data from all Clean Rivers Program monitoring stations within the BIG project area through the calendar year 2014.

While the overall bacteria trend in the BIG project area continues to decline, the area's relative geometric mean is above four times the state's water quality standard for bacteria



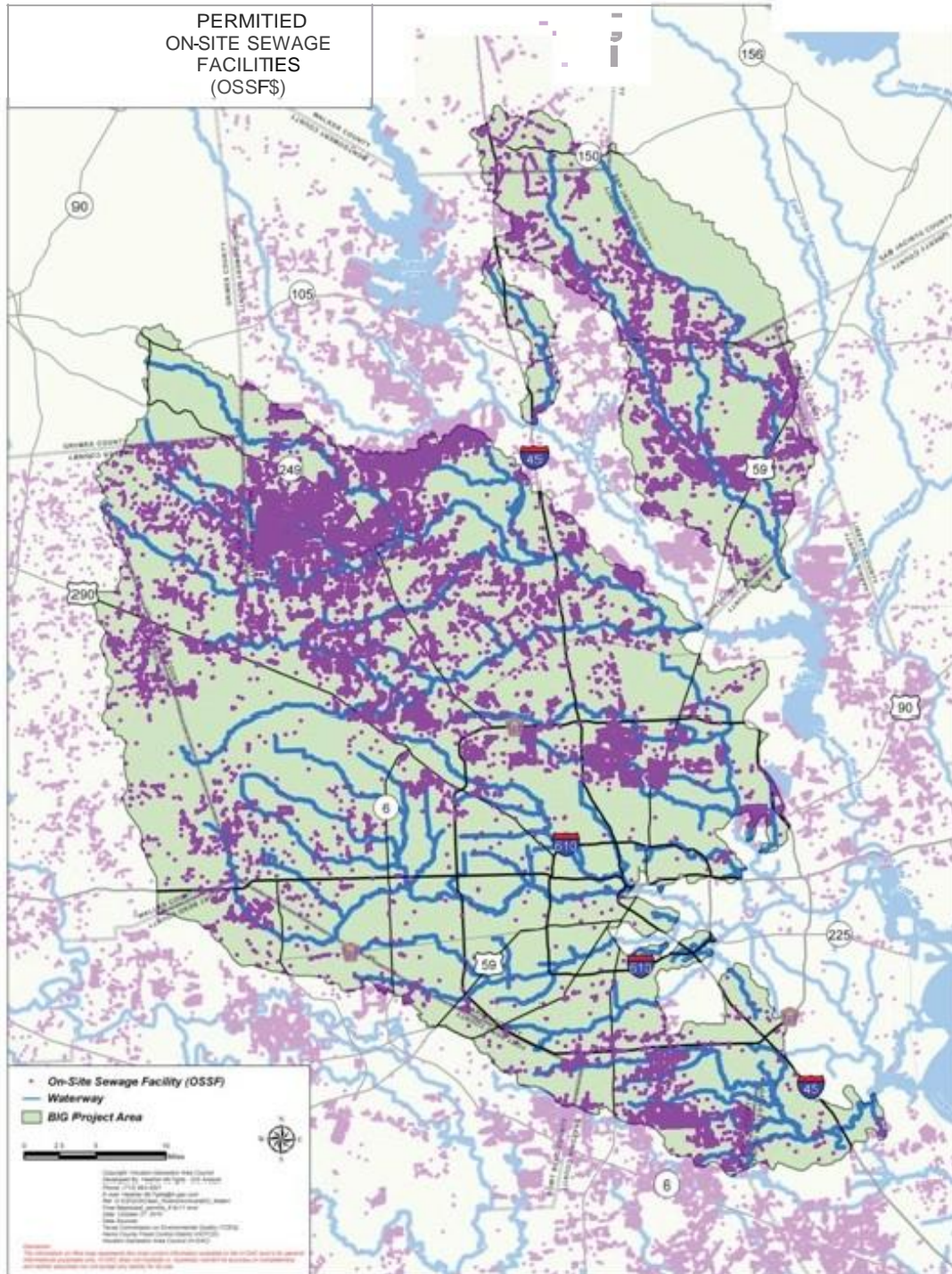
APPENDIX D

H-GAC CRP REGION



APPENDIX E

OSSF INFORMATION SYSTEM



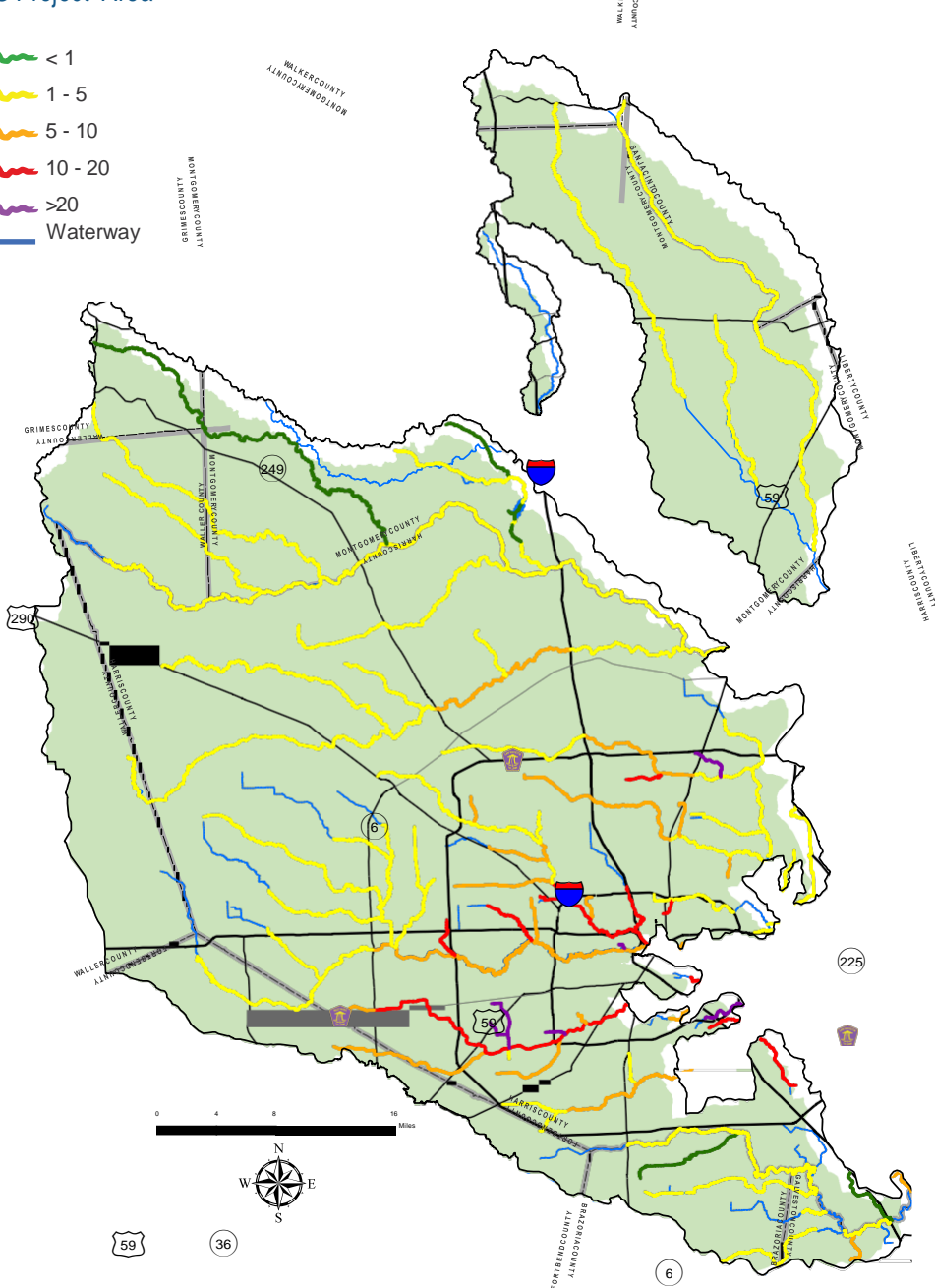
Appendix f

Bacteria Geomeans

Bacteria Relative Geomeans within the BIG Project Area

The information on this map represents the most current information available to H-GAC and is for general informational purposes only. H-GAC does not implicitly or expressly warrant its accuracy or completeness and neither assumes nor will accept liability for its use.

-  < 1
-  1 - 5
-  5 - 10
-  10 - 20
-  >20
-  Waterway



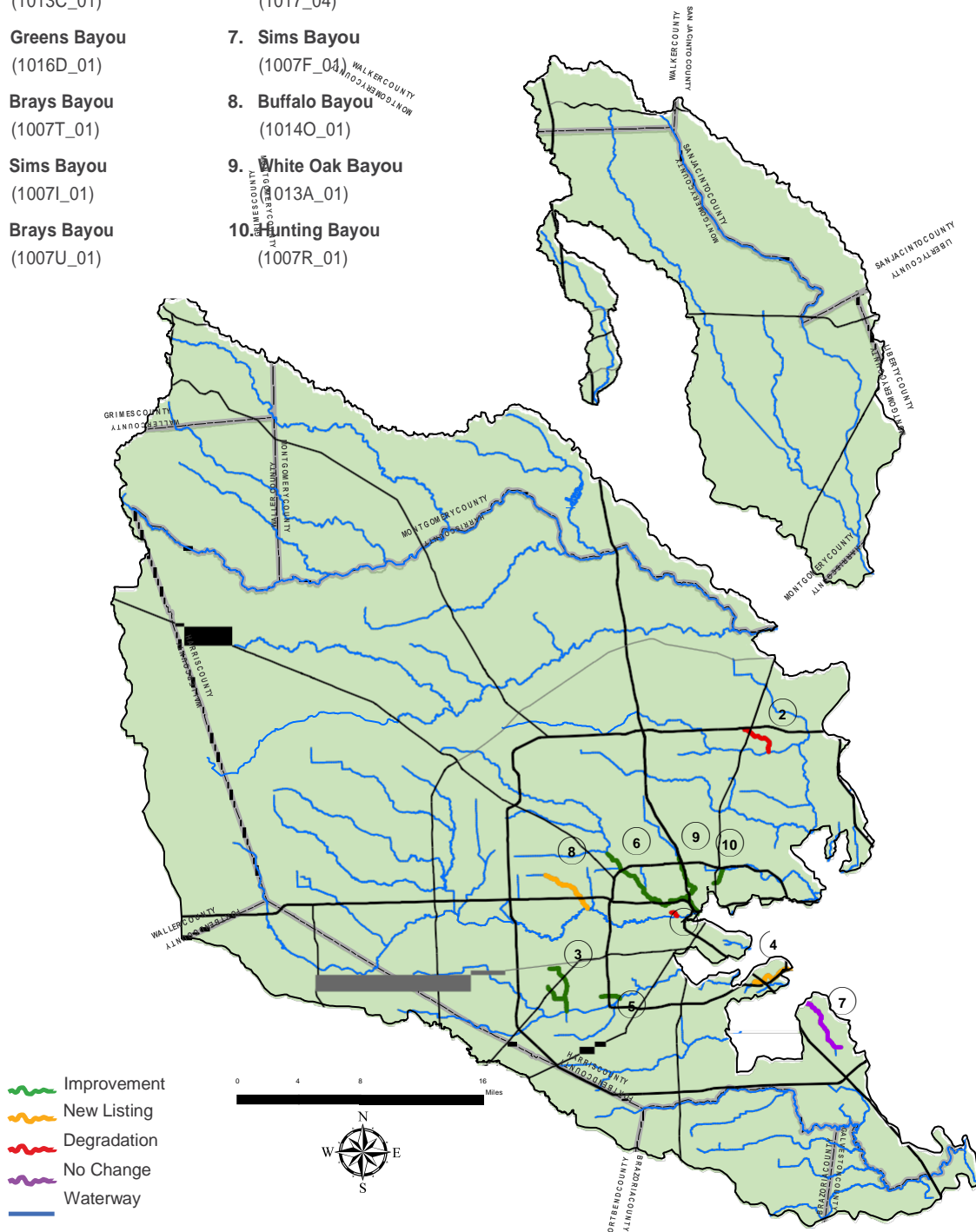
Appendix g

Top 10 “Most Wanted” Streams

Rank	Assessment Unit	Parameter	Relative Geomean (MPN/100 mL)	Geomean (MPN/100 mL)	Assessment Unit Description	Watershed
1	1013C_01	<i>E. coli</i>	39.86	5022	Located approximately 1.8 miles upstream of the Buffalo Bayou/White Oak Bayou confluence between IH-10 and Memorial Drive west of IH-45 in Harris County	Buffalo Bayou
2	1016D_01	<i>E. coli</i>	29.67	3738	From the confluence with Greens Bayou, west of El Dorado Country Club to Lee Road, west of US Hwy 59 in Harris County	Greens Bayou
3	1017_04	<i>E. coli</i>	23.58	2971	Brickhouse Gully confluence to a point immediately upstream of the confluence of Little White Oak Bayou in Harris County	White Oak Bayou
4	1007I_01	<i>E. coli</i>	22.23	2801	Plum Creek, from the Sims Bayou confluence to Telephone Road in Harris County	Sims Bayou
5	1007U_01	<i>E. coli</i>	21.94	2764.18	Mimosa Ditch, from the Brays Bayou confluence upstream 2.9 km (1.8 mi) to the Chimney Rock bridge crossing	Brays Bayou
6	1017_04	<i>E. coli</i>	19.01	2394.83	Whiteoak Bayou, Brickhouse Gully confluence to a point immediately upstream of the confluence of Little Whiteoak Bayou in Harris County	White Oak Bayou
7	1007F_01	<i>E. coli</i>	18.42	2321.07	Berry Bayou, from a point 2.4 km (1.5 mi) upstream of the Sims Bayou confluence to SH 3	Sims Bayou
8	1014O_01	<i>E. coli</i>	16.62	2094.32	Spring Branch, from Buffalo Bayou Above Tidal confluence to 1.4 km (0.87 mi) upstream of Long Point Road in Harris County	Buffalo Bayou
9	1013A_01	<i>E. coli</i>	16.44	2072.07	Little Whiteoak Bayou, from the White Oak Bayou confluence to Yale Street in Harris County	White Oak Bayou
10	1007R_01	<i>E. coli</i>	15.90	2003.95	Hunting Bayou, From Bain Street to Sayers Street (South Fork)	Hunting Bayou

Top 10 "Most Wanted" Streams

- | | |
|--------------------------------|----------------------------------|
| 1. Buffalo Bayou
(1013C_01) | 6. White Oak Bayou
(1017_04) |
| 2. Greens Bayou
(1016D_01) | 7. Sims Bayou
(1007F_04) |
| 3. Brays Bayou
(1007T_01) | 8. Buffalo Bayou
(1014O_01) |
| 4. Sims Bayou
(1007I_01) | 9. White Oak Bayou
(1007A_01) |
| 5. Brays Bayou
(1007U_01) | 10. Hunting Bayou
(1007R_01) |



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Appendix h

Top 10 “Most Likely to Succeed”

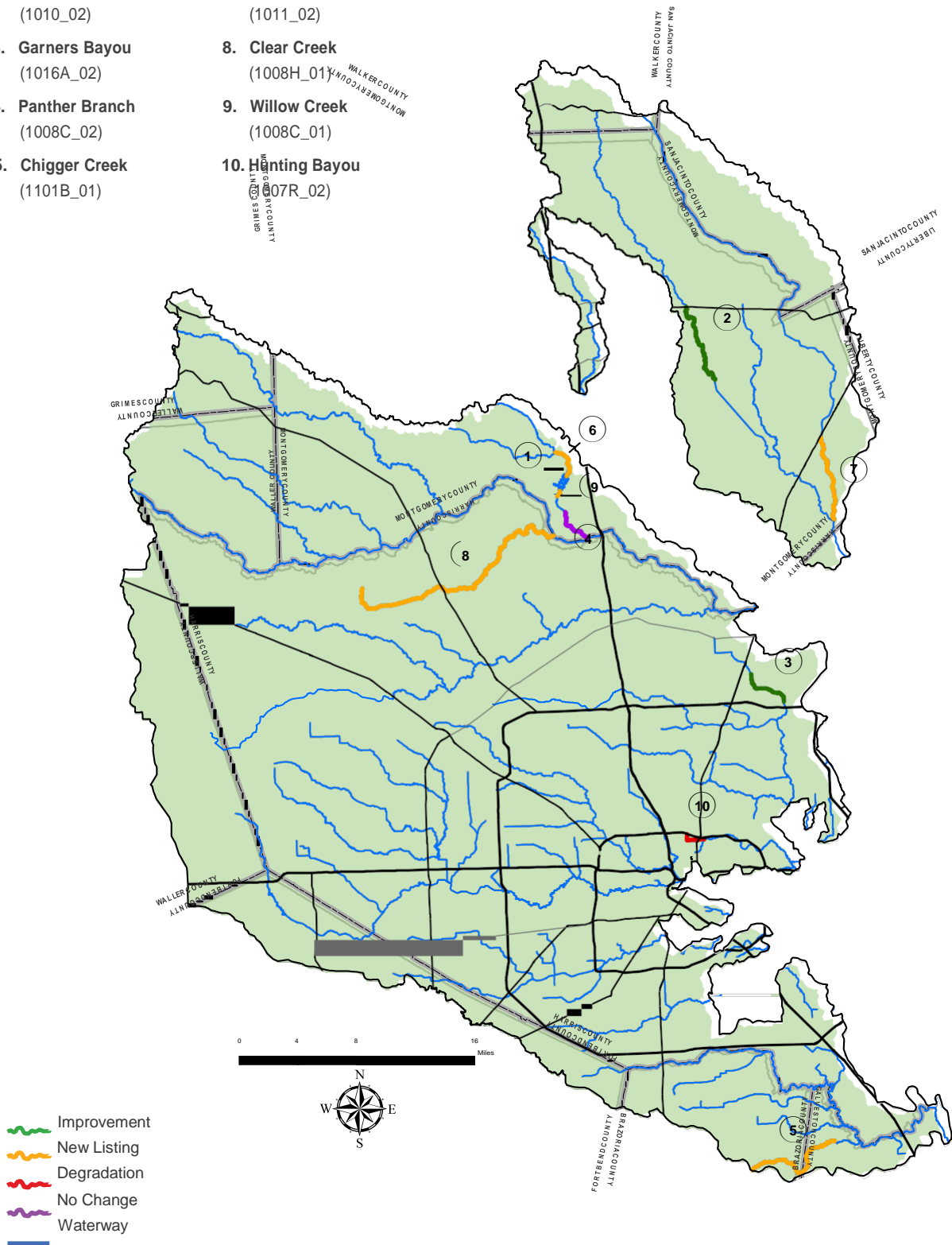
Streams

Rank	Assessment Unit	Parameter	Relative Geomean (MPN/100 mL)	Geomean (MPN/100 mL)	Assessment Unit Description	Watershed
1	1008F_01	<i>E. Coli</i>	1.04	130.66	Lake Woodlands, upper end of segment to Northshore Park/Woodlock Forest	Lake Woodlands
2	1010_02	<i>E. Coli</i>	1.09	136.75	Caney Creek, from FM 1097 to SH 105	Caney Creek
3	1016A_02	<i>E. Coli</i>	1.14	143.19	Garners Bayou, from the confluence with Williams Gully upstream to 1.5 km north of Atascocita Road	Garners Bayou
4	1008C_02	<i>E. Coli</i>	1.20	151.21	Lower Panther Branch, from Saw Dust Road to the Lake Woodlands Dam	Panther Branch
5	1101B_01	<i>E. Coli</i>	1.21	153.03	Chigger Creek, from the headwaters to FM 528	Chigger Creek
6	1008B_02	<i>E. Coli</i>	1.27	160.13	Upper Panther Branch, from a point a point 0.22 miles (0.35 km) upstream of the Bear Branch confluence to the confluence of Lake Woodlands	Panther Branch
7	1011_02	<i>E. Coli</i>	1.28	160.76	Peach Creek, US Hwy 59 to confluence with Caney Creek	Peach Creek
8	1008H_01	<i>E. Coli</i>	1.32	166.44	Clear Creek Above Tidal, Hickory Slough confluence to Turkey Creek confluence	Clear Creek
9	1008C_01	<i>E. Coli</i>	1.39	175.01	Willow Creek, from the Spring Creek confluence to a point 0.48 km (0.3 mi) north of Juergen Rd	Willow Creek
10	1007R_02	<i>E. Coli</i>	1.50	188.76	Hunting Bayou, from just east of Elysian Street to Falls Street (North Fork)	Hunting Bayou

Top 10 “Most Likely to Succeed” Streams

- | | |
|---------------------------------|---------------------------------|
| 1. Lake Woodlands
(1008F_01) | 6. Panther Branch
(1008B_02) |
| 2. Caney Creek
(1010_02) | 7. Peach Creek
(1011_02) |
| 3. Garners Bayou
(1016A_02) | 8. Clear Creek
(1008H_01) |
| 4. Panther Branch
(1008C_02) | 9. Willow Creek
(1008C_01) |
| 5. Chigger Creek
(1101B_01) | 10. Hunting Bayou
(1007R_02) |

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- Improvement
- New Listing
- Degradation
- No Change
- Waterway

Appendix I

Harris County Water Quality Prioritization

^ **Harris County Geographic Priority Framework.** Harris County presented its method for evaluating streams by a geographic prioritization framework. Points are given for each metric in the framework and tallied up to prioritize the stream segments to be given future implementation priority. Framework uses the following metrics:

- Percent geometric mean above the water quality standard;
- Monitoring station located in watershed draining to Lake Houston (drinking water source);
- Monitoring station located in segment that crosses a bike path, trail, or greenway;
- Monitoring station located in segment that is within 300 feet of a park; and
- Average population density within segment in a 200 foot buffer.

