

BIG

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ANNUAL REPORT

BACTERIA IMPLEMENTATION GROUP



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.

The preparation of this report was financed in part through grants from the U.S. Environmental Protection Agency and the Texas Commission on Environmental Quality.



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



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IMPLEMENTING THE BIG I-PLAN

The 31 member BIG consists of government, business, and community leaders working together with other stakeholders from across the region to implement the BIG I-Plan to help reduce bacteria in area waterways. Parenthetical indicates type of organization represented.

BIG Members

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Marilyn Christian, Harris County (County)

Catherine Elliott, Harris County Flood Control District (County)

Phyllis Frank, Gulf Coast Waste Disposal Authority (Clear Creek TMDL)

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Bruce Heiberg, Bayou Preservation Association (Conservation)

Jason Iken, City of Houston (Metro TMDL)

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Vacancy, (Lake Houston TMDL)

Vacancy, (Municipality)



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Frank Green, Montgomery County
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Jonathan Holley, Harris County Flood Control District
Jody Hooks, City of League City
Randy Horobetz., City of Conroe
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Michael Thornhill, Si Environmental, LLC
Jennifer Wheeler, Harris County
Carolyn White, Harris County Flood Control District
Mary Ellen Whitworth, EarthShare of Texas
Aaron Wieczorek, City of Houston
Jim Williams, Sierra Club

Be 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 Phase II 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 F).



EXECUTIVE SUMMARY

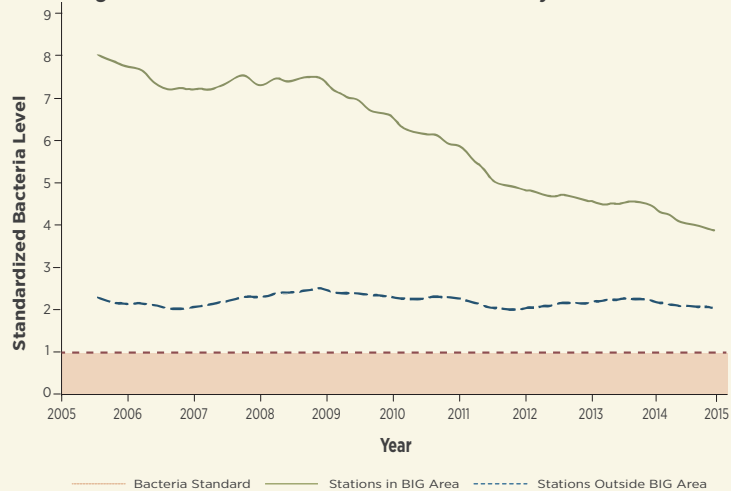
Half of the stream and shoreline miles in the Houston-Galveston region have bacteria levels higher than state standards. High bacterial concentrations may cause swimmers or others who come into direct contact with the water to get infected and become ill, due to infections of the skin or gastrointestinal tract. 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 and 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 Seventy-Two Total Maximum Daily Loads for Bacteria in the Houston-Galveston Region, or I-Plan) in January 2013. The 2015 Annual Report covers progress made during the period of January 1, 2014, - December 31, 2014.

Implementation Strategies

Since different sources contribute to the bacteria issue in the BIG project area, 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

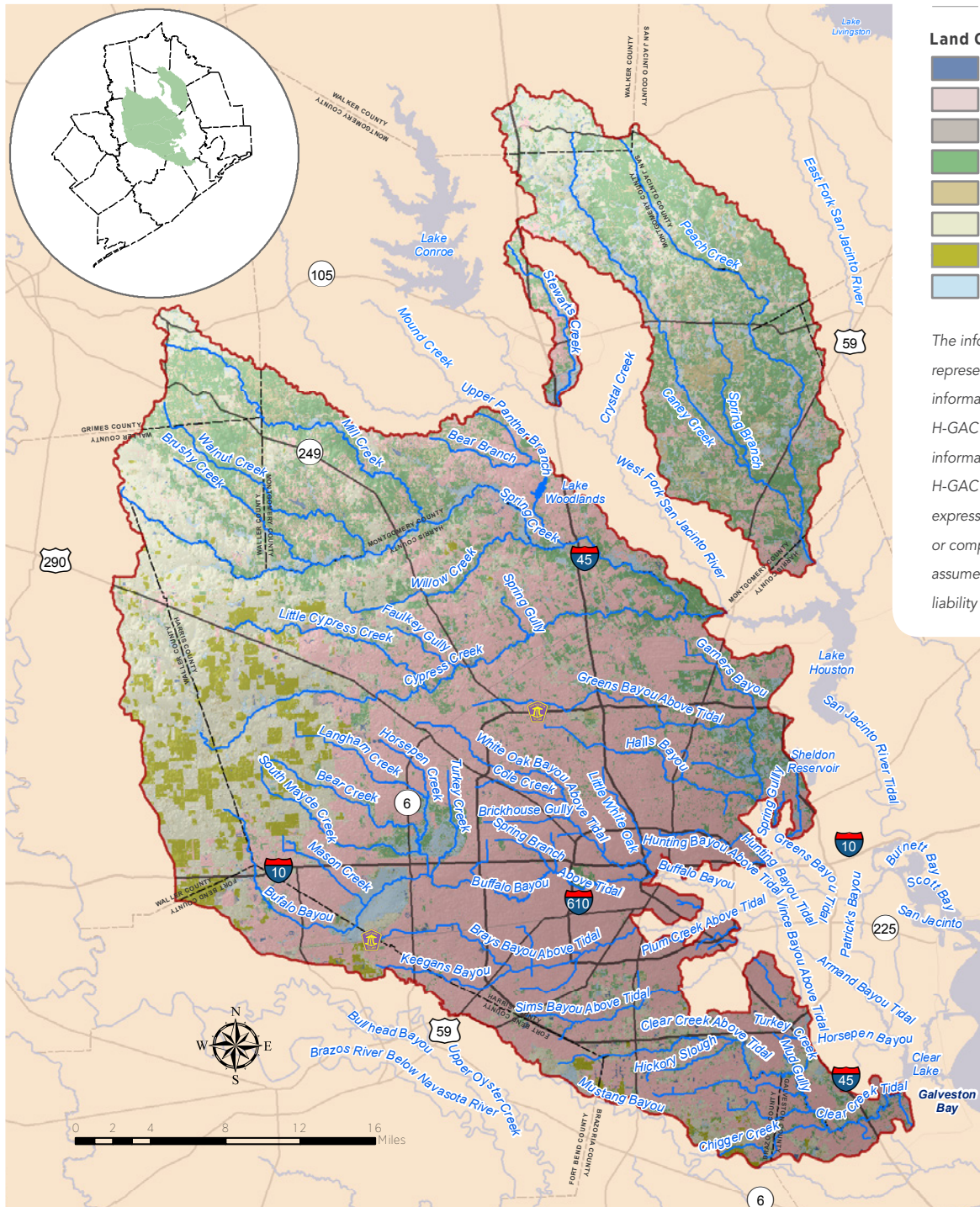
Figure 1: Indicator Bacteria Trend in the 13-County H-GAC Service Area



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 above the state's contact recreation standard to approaching four times the standard (Appendix B). 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, including installing and monitoring best management practices; addressing bacteria impairments as part of their MS4 Phase II program; committing resources to educate and train local wastewater treatment operators, developers, and water quality service providers; and conducting public education and involvement campaigns. By working together, we can continue to identify what's working and what still remains to be implemented.

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

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 SUCCESS

Highlighting successful projects is an important part of the BIG's Annual Report. The BIG hopes that by focusing on bacteria reduction projects having an impact, presenting cost saving opportunities for organizations on tight budgets, increasing knowledge and understanding to improve operation and maintenance, and/or contributing unique and novel approaches will foster a sharing of information, lessons learned, and ultimately result in expanded use across the BIG project area. While several projects follow, please note this list is not exhaustive and does not reflect the entirety of successful projects carried out by the BIG in 2014.

Walker County Addressing OSSF Compliance

Managing on-site sewage facilities (OSSFs) presents a challenge for rural counties to adequately track residential compliance with maintenance and repairs. Walker County (BIG Project Area, page 7) created a novel county OSSF program where the county contracts with 26 professional OSSF companies. The companies perform OSSF inspections, assist homeowners in determining repair issues, and complete and file inspection reports. For the program, the county developed uniform inspection standards, required a processing fee for each submitted report, and implemented a late fee for overdue reports. The county maintains the list of approved OSSF companies by conducting random follow-up residential OSSF inspections to ensure reports were accurately completed. Walker County's example is being explored for use by other BIG partners.

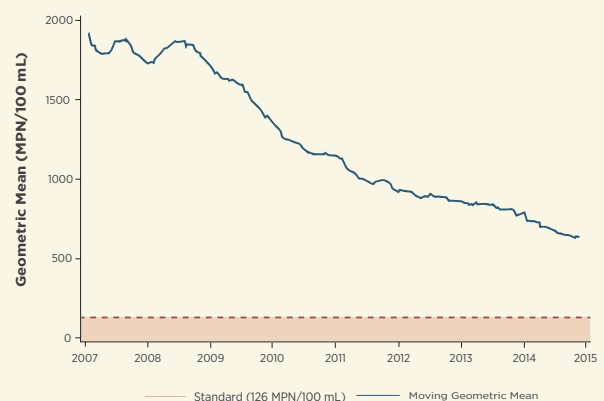
White Oak Bayou Bacteria Reduction

White Oak Bayou's annual *E. coli* geometric mean declined by almost 75% since 2007 using data collected at all monitoring stations on White Oak Bayou (BIG Project Area, page 7) by Clean Rivers Program partners. While there is currently no means for correlating this decline with the implementation efforts of BIG partners, the period of decline coincides with bacteria reduction activities carried out by the BIG.

In 2008, the Joint Task Force, 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 in response to the bacteria impairments 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 *Interim Bacteria Reduction Plan*, the City of Houston and Harris County continued programs to identify and resolve illicit discharges. The City of Houston also provided extensive cleaning and renewal of sanitary sewers and completed Wastewater Treatment Facility (WWTF) and lift station improvements. Additionally, HCFCD completed 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.

Figure 2: *E. coli* Geometric Means in White Oak Bayou Watershed



LID Tracking and Resource Website

H-GAC, as part of a grant with the U.S. Environmental Protection Agency's (EPA) Gulf of Mexico Program, created a Low Impact Development (LID) Tracking and Resource website. (www.h-gac.com/go/lid) LID practices are best management practices that, under the right conditions, can assist stormwater professionals and developers improving water quality while managing stormwater.

There are 59 LID projects in the Houston-Galveston region described on the website, 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 of 37 UV/Chlorination WWTFs to determine the proper location to collect bacteria samples for self reporting by the WWTF operator. According to TCEQ, the designated location for the compliance point from which WWTFs are taking bacteria samples is not consistent across all WWTF designs. This has resulted in some sample collection at locations that may not be representative of bacteria loading to the receiving stream. It is hoped that the research will help the state and wastewater professionals improve future 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 the 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 to further the goals set forth in the I-Plan, sharing information, and coordinating future implementation activities. This Annual Report is meant to be a 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 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 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 sections and appendices. Each section includes a summary of the implementation strategy, 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 goals, an assessment, and a summary of implementation efforts conducted throughout the year are presented.

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 BIG partner's efforts to advance the activity over the year: Behind Schedule, On Schedule, or Ahead of Schedule.

Overall, 36 activities, two more than in 2013, are listed as In Progress with two remaining as Initiated (Appendix C). For the year 2014, two activities are considered Ahead of Schedule, 30 are On Schedule, and six have been assessed as Behind Schedule. Three activities were moved from Behind Schedule to On Schedule, and three were shifted from On Schedule to Behind Schedule since 2013.





WASTEWATER TREATMENT FACILITIES

1

Summary

One potential source for bacteria in the BIG project area is WWTF effluent. When operated properly and under most conditions, WWTFs meet state permit limits. However, until recently, efficacy of disinfection has only 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 better demonstrate adequate disinfection of effluent prior to being discharged to the receiving stream, since chlorine residual alone was not always reliable as an indicator of adequate disinfection.

Many of the BIG region's waterways are considered to be effluent dominated, having minimal natural flows. The information learned through discharge monitoring can help WWTF operators enhance plant operation and direct resources, when needed, toward maintenance and planned upgrades. Bacteria results from DMRs* submitted in 2014 by 499 BIG project area WWTF operators suggest that over 97% of 4,227 single grab/daily maximum bacteria samples reported (Table 1) met the WWTF required bacteria limits for *E. coli* or enterococci. That is an increase from 95% reported for 2013.

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 the revision of Texas Administrative Code Title 30, Chapter 217 and reinstating Chapter 317 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 from the TCEQ's DMR database, TCEQ's Central Registry, and H-GAC's permit database for the BIG project area.*

2015 Focus

■ H-GAC and BIG stakeholders plan 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; and
 - 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

- | | |
|--|--|
| <input type="checkbox"/> Not Started | <input checked="" type="checkbox"/> Behind Schedule |
| <input checked="" type="checkbox"/> Initiated | <input type="checkbox"/> On Schedule |
| <input type="checkbox"/> In Progress | <input type="checkbox"/> Ahead of Schedule |
| <input type="checkbox"/> Completed | |

- With each WWTF permit renewal, 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. The BIG's Coordination and Policy Work Group requested H-GAC develop a letter for review by the BIG. The letter would then be sent to TCEQ. The letter would request renewed/new permits be issued with the BIG I-Plan recommended frequencies.

**Table 1: 2014 Bacteria Permit Limit Compliance
Taken From DMR Database***

Number of Geomean Results Reported from Permittees with Limits in Permit	4,028
Number of Samples Below Daily Average Limit	3,999
Percentage of Samples Below Daily Geomean Limit	99.3%
Number of Highest Single Grab/Daily Max Samples Reported for WWTF DMR Monitoring Period	4,227
Number of Highest Single Grab/Daily Max for WWTF DMR Monitoring Period Below Limit	4,115
Percentage of Highest Single Grab/Daily Max for WWTF DMR Monitoring Period Below Limit	97.4%

Table 1. Number and percentage of samples taken in 2014 that fell below 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 comparison by dividing the geometric mean by the water quality standard to produce a relative geomean.

What is a Single Grab/ Daily Max?

WWTF 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 dataset and made the following observations

- In 2014, there were 499 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 permitted facilities utilizing the TCEQ DMR database, 446 use *E. coli* as their reportable bacteria and five WWTFs are using enterococci as their reportable bacteria (Table 2). No limit could be found for 48 permittees.
- Over 92% (or 410), of the 446 facilities in the BIG project area in 2014 using *E. coli* have the more stringent bacteria limit of 63 MPN/100 mL (Table 2) compared to other parts of the state. This is 2% greater than what was reported in 2013. 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/100mL since the TMDL study demonstrated that limit would allow the waterbody to meet state contact recreation standards.
- WWTF operators reported 4,002 *E. coli* daily average results in 2014, up from 3,632 results reported in 2013 as the region's bacteria reporting values continue 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
- 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 2014 DMR

Permit Type	Permittees Submitting DMRs in 2014 (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 Bacteria Geomean Limit in H-GAC Permit Database
Industrial	35	9	2	2	22
Muni. Domestic	358	309	30	3	16
Pvt. Domestic	106	92	4	*	10
Total	499	410	36	5	48

Table 2. BIG project area WWTFs reporting DMRs to the TCEQ in 2014. 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. WWTFs with 'No Geomean' 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 need 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
- ☐ Initiated
- ☒ In Progress
- ☐ Completed

- ☒ Behind Schedule
- ☐ On Schedule
- ☐ Ahead of Schedule

- As of this publication's printing, H-GAC does not have TCEQ 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 until that time.

Implementation Effort

☒ Compliance and Enforcement.

- In 2014, there were five TCEQ enforcement cases, due to exceeding effluent limits or operating without a valid permit in 2014 (Table 3), in the BIG project area with a final payable fine of \$29,299 and another \$10,000 distributed to supplemental environmental projects (Table 4).
- Harris County inspectors (Harris County Pollution Control Services- HCPCS) found that 6%, down from 9% in 2013, of samples they obtained at domestic WWTFs in Harris County's BIG project area 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%, down from 3.7% in 2013, of single grab/daily max samples in 2014 exceeded permitted bacteria levels (Table 5). This suggests that between 94% and 98%, up from 91%-97% in 2013, of the bacteria samples collected in 2014 from WWTFs in Harris County's BIG Project Area are meeting permit limits.
- As in 2013, analysis of DMR data in 2014 finds that WWTFs operating at less than 0.1 Million Gallons/Day (MGD) have the most excursions exceeding their single grab/daily max permit limit 25% or more (Table 6).

- ☒ **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 3. Violations in the BIG Project Area

Violation Type	2013	2014
Exceeded Effluent Limits	19	4
No Permit or Permit Expired	4	1
Other	1	.
Unauthorized Discharge	3	.

Table 3. Violation type and number from TCEQ enforceable cases (2009-2014). Enforcement cases can contain multiple violations. Data provided by the TCEQ.

Table 4: Enforcement Cases for the BIG Project Area 2009-2014

Year	Number of Enforcement Cases	Original Fine	Final Payable Fine	SEP Offset
2009	9	\$81,770	\$64,219	\$10,000
2010	32	\$267,177	\$218,789	\$20,282
2011	30	\$491,027	\$357,561	\$80,821
2012	24	\$238,672	\$211,074	\$0
2013	24	\$385,413	\$315,678	\$31,389
2014	5	\$50,155	\$29,299	\$10,000

Table 4. TCEQ enforceable cases, including original assessed fine, final payable fine, and SEP offset for violations in the BIG Project Area from 2009-2014. Data provided by TCEQ. There may be multiple violations per case.

Table 5: 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 Meeting Limit	Percentage of Highest Single Grab/Daily Max for WWTF DMR Monitoring Period Meeting Limit	Data Source	Number of Random Samples Collected	Number of Samples Meeting TCEQ Grab/Single Sample Limit	Percent HCPCS Samples Meeting TCEQ Permit Limit
< 0.1 MGD	DMR	416	403	96.9%	HCPCS	171	154	90.1%
0.1-0.5 MGD	DMR	844	838	99.3%	HCPCS	130	122	93.8%
0.5-1 MGD	DMR	825	810	98.2%	HCPCS	98	96	98.0%
1-5 MGD	DMR	763	746	97.8%	HCPCS	80	77	96.3%
5-10 MGD	DMR	120	115	95.8%	HCPCS	9	9	100.0%
> 10 MGD	DMR	36	34	94.4%	HCPCS	6	5	83.3%
Total	DMR	3004	2946	98.1%	HCPCS	494	463	93.7%

Table 5. 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. The random grab sample collected by HCPCS is compared to single grab/daily max samples, number of samples meeting permit limits, and percentage meeting.

Table 6: Permittees with 25% or More Excursions Above Permit Limit

Plant Size/Permitted Flow	Daily Geomean	Daily Max or Grab
Variable or Unknown	1	1
< 0.1 MGD	12	18
0.1-0.5 MGD	.	1
0.5-1 MGD	.	.
1-5 MGD	.	3
5-10 MGD	.	1
> 10 MGD	.	2

Table 6. WWTFs in the BIG project area in 2014 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
- ☐ Initiated
- ☒ In Progress
- ☐ Completed

- ☐ Behind Schedule
- ☐ On Schedule
- ☒ Ahead of Schedule

- This activity is Ahead of Schedule. While the I-Plan did not anticipate activities for six years, the TCEQ is currently addressing new criteria.

Implementation Effort

- **WWTF Design Express Reviews.** Harris County screened 29 WWTF plan sets for compliance with state disinfection standards in 2014. None of the plan sets screened were identified to require modifications to comply with state rules.
- **New State Design Criteria of Domestic WWTFs.** TCEQ proposed changes to Chapter 217 of the Texas Administrative Code 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 be released for public comment.



1.5 Upgrade Facilities

→ **Interim Measure:** WWTFs not meeting effluent limits should upgrade or repair their facilities to comply with individual permits. Over 25 years, WWTFs requiring upgrades in order to meet bacteria limits in their permits will have been upgraded.

Project Status

- ☐ Not Started
- ☐ Initiated
- ☒ **In Progress**
- ☐ Completed
- ☐ Behind Schedule
- ☒ **On Schedule**
- ☐ Ahead of Schedule

– This activity has moved to *In Progress* and *On Schedule* due to the availability of data. Additional work is needed to determine whether the upgrades at WWTFs were completed to comply with bacteria effluent standards for individual permits.

Implementation Effort

- **Monitoring Upgrades.** A total of 52 plants in counties included in the BIG submitted applications to expand, improve, upgrade, rehabilitate, or modify in 2014 (Table 7). Data on facility upgrades was retrieved from the TCEQ website. (www4.tceq.state.tx.us/wwdp/)

Table 7. Track Approval of Wastewater System Plans and Specifications Applications

Jan 1, 2013 to Jan 1, 2015											
Application Type	Harris		Galveston		Brazoria		Fort Bend		Montgomery		Total
	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014	
Improvements	12	14	0	1	1	0	1	0	1	3	33
Rehabilitation	13	13	1	0	0	0	0	0	0	5	32
Reuse/Reclaim	2	1	0	0	0	0	0	1	2	1	7
Expansions	6	6	0	0	0	0	0	1	0	1	14
Modifications	2	4	0	0	0	0	0	1	0	0	7
Upgrade	1	2	0	0	0	0	2	0	0	1	6
Generator	1	2	0	0	0	0	0	0	0	1	4
Total	37	42	1	1	1	0	3	3	3	12	103

Table 7. Wastewater system plans and specification applications submitted to the TCEQ per year by county. Application approvals can be reviewed 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

- | | | |
|---|---|---------------------------------|
| <input type="checkbox"/> Not Started | <input type="checkbox"/> Behind Schedule | – This activity is On Schedule. |
| <input type="checkbox"/> Initiated | <input checked="" type="checkbox"/> On Schedule | |
| <input checked="" type="checkbox"/> In Progress | <input type="checkbox"/> Ahead of Schedule | |
| <input type="checkbox"/> Completed | | |

Implementation Effort

- **Regulatory.** EPA and TCEQ have developed criteria for chronically non-compliant WWTFs and identified those WWTFs. TCEQ will share documented WWTFs with the BIG to assist with tracking future regionalization.
- **Regionalization.**
 - BIG stakeholders reported no WWTFs were regionalized in 2014 (source: Harris County Community Services Department).
 - Harris County Pollution Control (HCPCS) reported they meet routinely with WWTF representatives to discuss violations, including bacteria. Regionalization feasibility is discussed in accordance with HCPCS enforcement guidelines.
 - HCPCS reported the Aldine Community Care Facility, which considered regionalization, closed in 2014.

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

- | | | |
|---|---|--|
| <input type="checkbox"/> Not Started | <input type="checkbox"/> Behind Schedule | – This activity is On Schedule to meet the five-year target. |
| <input type="checkbox"/> Initiated | <input checked="" type="checkbox"/> On Schedule | |
| <input checked="" type="checkbox"/> In Progress | <input type="checkbox"/> Ahead of Schedule | |
| <input type="checkbox"/> Completed | | |

Implementation Effort

- **Reuse/Reclaim.** Three applications for reuse/reclaim water were submitted to the TCEQ for counties in the H-GAC region (Table 7). Information was extracted from the TCEQ website. (www4.tceq.state.tx.us/wwdp/)



SANITARY SEWER SYSTEMS

2

Summary

Failure of sanitary sewer systems (SSSs), commonly due to blockages from fats, oils and grease (FOG), equipment malfunctions, or operator errors (Table 8) often results in sanitary sewer overflows (SSOs). SSOs discharge untreated sewage to the surface and sometimes 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 releasing an estimated 1.6 million gallons of untreated waste (Table 8).

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

2015 Focus

- H-GAC and BIG stakeholders aim to
 - Host an annual conference on asset management for SSSs;
 - Work with the TCEQ to improve the SSO reporting system;
 - Survey WWTF operators to gather appropriate contact information, begin tracking utility asset management programs (UAMPs), identify subscriber system contacts, and gather example subscriber system contract language; and
 - 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 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 currently *Behind Schedule* to meet the five-year target. One workshop was held in 2013 and a second one is scheduled for 2015. The current pace of workshops will not meet the interim measure of eight in five years

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 22, 2014).

☒ **TCEQ's Voluntary SSOI.** TCEQ's voluntary Sanitary Sewer Overflow Initiative (SSOI) allows eligible municipalities to direct resources toward corrective actions rather than pay enforcement penalties. In 2014, there were 32 WWTF operators within the BIG project area listed in the SSOI for the project area (source: TCEQ).

☒ Infrastructure Funding.

- EPA launched a new water infrastructure and resiliency finance center website. (<http://water.epa.gov/infrastructure/waterfinancecenter.cfm>) The center serves as a resource to explore innovative finance solutions, including public-private partnerships.
- The Texas Water Infrastructure Coordination Committee is comprised of state and federal funding agencies, technical assistance providers, and regulatory agencies. The Committee 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. (www.twicc.org)

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

■ **Tracking.** Operators in the BIG project area reported on SSO events and total volume released to the TCEQ.

- Of the 680 events in reported in 2014, 323 (48%) were attributed to Fats, Roots, Oil and Grease.
- Of the 1,632,405 gallons of untreated effluent released, 337,000 gallons (21%) were attributed to Fats, Roots, Oil and Grease (Table 8 and Figure 3).

■ **Model FOG Education Programs.** BIG suggested that a regional message be developed based on the following programs:

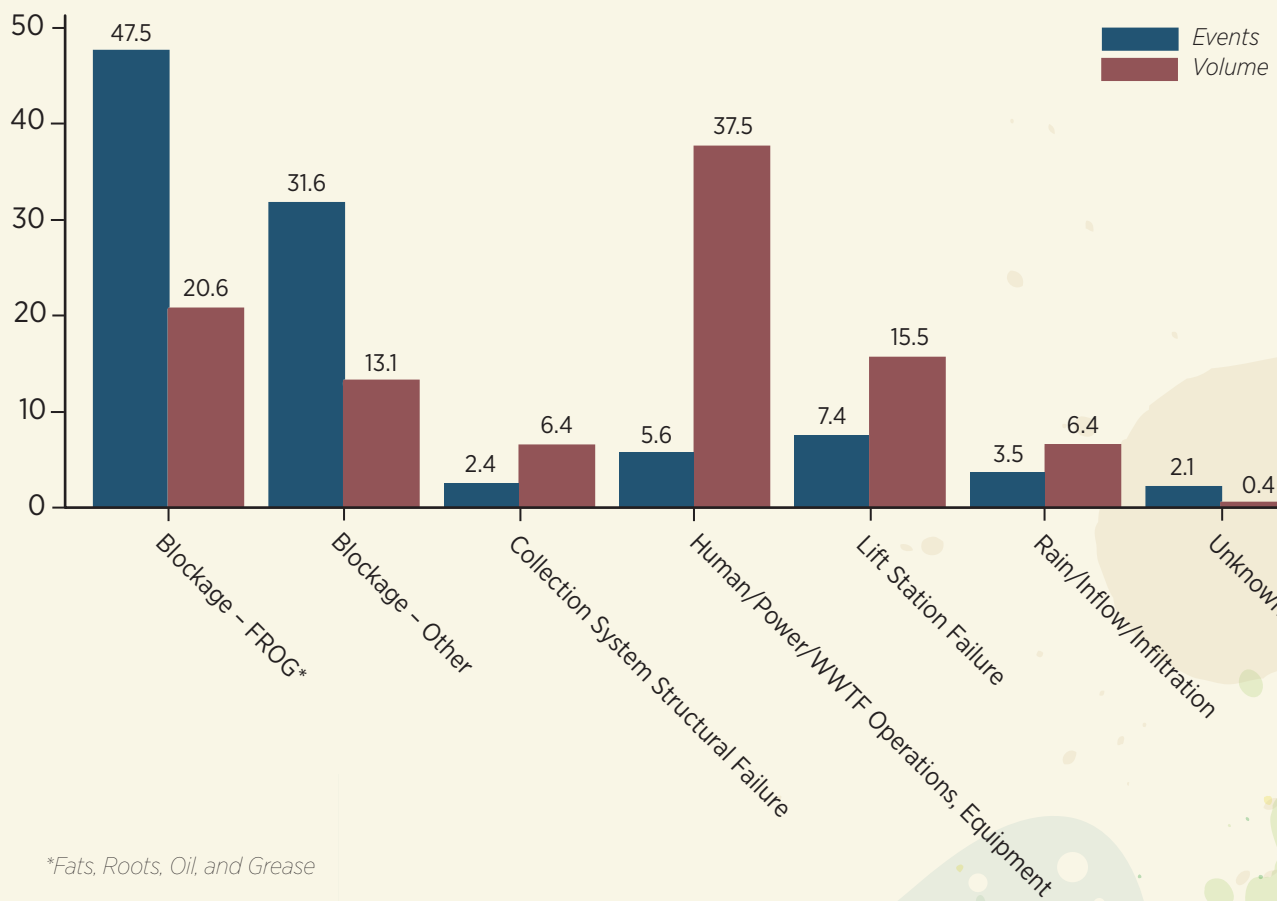
- Galveston Bay Foundation (GBF) has received funding to develop "Cease the Grease," a FOG program in the BIG region. GBF has been hosting technical stakeholder meetings to coordinate Cease the Grease with local partners. (<http://galvbay.org/ceasethegrease/>)
- The City of Houston's "Corral the Grease" 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 sewer main lines were targeted with educational materials. The City of Houston maintains the Corral the Grease website. (www.publicworks.houstontx.gov/pud/corral_grease.html)
- The BIG and other wastewater professionals have identified non-flushable items, such as sanitary wipes, as an emerging concern for SSOs. The San Jacinto River Authority and Payne Communications & Associates created the "Patty Potty" campaign to address this topic. (www.pattypotty.com)

Table 8. SSOs in the BIG Project Area 2014

Cause	Number of Events	Estimated Overflow, 1000 Gallons
Blockage Due To Roots/Rags/Debris	13	7.063
Blockage in Collection System Due To Fats/Grease	310	329.539
Blockage in Collection System-Other Cause	215	214.118
Collection System Structural Failure	16	104.251
Human Error	2	1.05
Lift Station Failure	50	253.653
Power Failure	7	210.85
Rain / Inflow / Infiltration	24	104.695
Unknown Cause	14	6.506
WWTP Operation or Equipment Malfunction	29	400.68
Total	680	1632.405

Table 8. The number and volume of SSOs reported to the TCEQ in 2014

Figure 3. SSO Events and Estimated Volume - Percent of Total by Cause



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

- | | | |
|---|---|--|
| <input type="checkbox"/> Not Started | <input type="checkbox"/> Behind Schedule | – This activity is On Schedule to meet the five-year target. |
| <input type="checkbox"/> Initiated | <input checked="" type="checkbox"/> On Schedule | |
| <input checked="" type="checkbox"/> In Progress | <input type="checkbox"/> Ahead of Schedule | |
| <input type="checkbox"/> 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.
- **Tracking.** WWTF operators reported 50 SSOs due to malfunctioning lift stations with an estimated overflow volume of 254,000 gallons (Table 8 and Figure 3).

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

- | | | |
|---|---|--|
| <input type="checkbox"/> Not Started | <input type="checkbox"/> Behind Schedule | – This activity is On Schedule to meet the five-year target.
EPA is currently working on a National Pollution Discharge Elimination System (NPDES) Electronic Reporting Rule. |
| <input type="checkbox"/> Initiated | <input checked="" type="checkbox"/> On Schedule | |
| <input checked="" type="checkbox"/> In Progress | <input type="checkbox"/> Ahead of Schedule | |
| <input type="checkbox"/> Completed | | |

Implementation Effort

- **Reporting.** A second Supplemental Notice to the proposed EPA NPDES Electronic Reporting Rule was issued for 60 days on December 1, 2014, to receive additional public comment on the identified concerns raised during the first public comment period. The second notice was issued to clarify misunderstandings, discuss possible modifications to the rule, and address stakeholder concerns. The EPA anticipates the rule will be finalized August 2015. The BIG will continue to track developments and evaluate impacts 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

☒ Initiated

☐ In Progress

☐ Completed

☒ Behind Schedule

☐ On Schedule

☐ Ahead of Schedule

- This activity is Behind Schedule to meet the three- and five-year targets. Stakeholders are just beginning to look at tracking this issue.

Implementation Effort

- **Tracking.** A WWTF survey will be conducted in 2015. Responses will 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

☐ Initiated

☒ In Progress

☐ Completed

☐ Behind Schedule

☒ On Schedule

☐ Ahead of Schedule

- This activity is On Schedule to meet the five-year target.

Implementation Effort

- **Penalty Policy.** The TCEQ is currently working on Enforcement Initiation Criteria revision 15. The draft is currently in review.
- **SSO Investigations.** TCEQ inspectors can conduct focused SSO investigations. TCEQ reported that there were no inspections conducted in 2014.



ON-SITE SEWAGE FACILITIES

3

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 helped identify probable locations of older, unpermitted systems at higher risk of failing. Staff identified 31,517 permitted systems in the BIG project area.

The On-Site Sewage Facilities Workgroup (eight BIG stakeholders, including one BIG member and one alternate) met February 13, 2014. The stakeholders reported continued focus over the past year on education and regulatory action to prevent and remediate failing systems. Efforts are already underway to provide education programs to a variety of audiences. Examples of regulatory measures are also being collected and shared for potential enactment in the future. H-GAC coordinated with the TCEQ to develop an approved SEP to address low-income residences with failing OSSFs.

2014 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; and
 - 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
- ☐ Initiated
- ☒ In Progress
- ☐ Completed

- ☐ Behind Schedule
- ☒ On Schedule
- ☐ Ahead of Schedule

- This activity is On Schedule to meet the five-year target, to repair and replace failing systems. Harris County reports that with East Aldine Management District, they have addressed 302 OSSFs out of an estimated 17,844 in Harris County (H-GAC's OSSF Database).

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. (www.h-gac.com/go/ossf) Highlights of the system include
 - Layers showing permitted OSSFs by age, authorized agent, and residential properties with a high chance of having an old or otherwise unpermitted system; and
 - Tools, such as maps (Appendix D), to assist in future system repair and replacement prioritization.
- **Data.** Authorized agents continue to provide data to H-GAC. OSSF data is used to refine the mapping system and 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 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
- ☐ Initiated
- ☒ In Progress
- ☐ Completed

- ☐ Behind Schedule
- ☒ On Schedule
- ☐ Ahead of Schedule

- This activity is On Schedule. Regulations and educational information have been compiled and are available through the H-GAC website.

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 30, 2014, and September 23, 2014, with 41 and 24 attendees, respectively. Workshops offer a Texas Real Estate Commission-approved course (6 Continuing Education Credits) on the benefits of visually inspecting on-site sewage facilities.
- **Homeowner Education.**
 - H-GAC maintains a website to share educational materials. (www.h-gac.com/go/septic) In addition to providing general information, the site offers content specific to homeowners/homebuyers, local governments, and real estate professionals.
 - On October 29, 2014, the 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
- ☐ Initiated
- ☒ In Progress
- ☐ Completed

- ☐ Behind Schedule
- ☒ On Schedule
- ☐ Ahead of Schedule

- This activity is On 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 reinforced 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 low impact development (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 Phase II recognition program. It was noted that the Texas Pollution Discharge Elimination System (TPDES) General Permit TXR040000 was made effective December 13, 2013. MS4 Phase II, also known as MS4 Phase II, that fell under this general permit were required to submit Notices of Intent (NOI) by June 11, 2014.

2015 Focus

- H-GAC and BIG stakeholders aim to
 - Continue to collect information on MS4 Phase II 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/developers and trade organizations to implement the recognition and awards program; and
 - Build a Wall of Fame on the H-GAC website to highlight, at least five local programs annually.
-

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

- | | | |
|---|---|---|
| <input type="checkbox"/> Not Started | <input type="checkbox"/> Behind Schedule | – This activity is On Schedule as existing programs continue and new requirements include addressing impaired waterbodies |
| <input type="checkbox"/> Initiated | <input checked="" type="checkbox"/> On Schedule | |
| <input checked="" type="checkbox"/> In Progress | <input type="checkbox"/> Ahead of Schedule | |
| <input type="checkbox"/> 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. (www2.tceq.texas.gov/wq_dpa/index.cfm) A review of that registry finds there are 121 permit/registration numbers for the BIG project area. Of the 121, 70 MS4 Phase II 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 (HCFCD), and Texas Department of Transportation (TxDOT) continue to operate under TPDES individual permit, calling themselves the Joint Task Force.
- **MS4 Operator Questionnaire.** On April 17, 2015, H-GAC mailed MS4 questionnaires to the 121 MS4 Phase II found in the TCEQ's permit registry for the TPDES General Permit TXR040000. The questionnaire collected information based on activities in 2014. A copy of the questionnaire can be found as Appendix E. H-GAC received 26 responses to the questionnaire. Of the 26 respondents, 23 noted they would be addressing bacteria in their stormwater management program. See Appendix E Table 1 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

☐ Initiated

☒ In Progress

☐ Completed

☒ Behind Schedule

☐ On Schedule

☐ Ahead of Schedule

- This activity is Behind Schedule as only two meetings were reported in 2014.

Implementation Effort

- **BMP Database.** HCFCD continues to maintain the Regional BMP Database for stakeholders to access and evaluate the effectiveness of structural BMPs. (www.bmpbase.org) The database provides access to BMP effectiveness data set to the International Stormwater BMP Database standards. HCFCD encourages entities to submit qualified BMP effectiveness data from other projects in the region. In cases where projects did not collect desired performance data, HCFCD remains interested in collecting the projects' geographic location and available metadata.
- **MS4 Questionnaire.** Seven of 26 MS4 Phase II operators responded that in 2013-2014 they installed structural BMPs. See Appendix E Table 2 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. (www.h-gac.com/community/low-impact-development/default.aspx) The site currently tracks 59 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: Minimum Control Measures (April 22, 2014) and Low Impact Development (December 5, 2014).



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
- ☐ Initiated
- ☒ In Progress
- ☐ Completed

- ☐ Behind Schedule
- ☒ On Schedule
- ☐ Ahead of Schedule

- *This activity is On Schedule to meet the five-year target. New TPDES permit requirements will encourage MS4 Phase II operators to address impaired waterbodies with appropriate management measures.*

Implementation Effort

- **New General Permit Eligibility.** In a review of the TCEQ's General Permit Registry for MS4 Phase II, it was found that 45 permits are new to the MS4 Phase II program within the BIG project area (www2.tceq.texas.gov/wq_dpa/index.cfm)
- **New MS4 Permit Requirements.** Under the new TPDES General Permit, MS4 Phase II will be required to address their stormwater discharges to impaired waterbodies. Twenty-three of 26 respondents to the MS4 questionnaire noted that they would be addressing bacteria impairments through their stormwater management program (Appendix E Table 1).
- **MS4 Assistance.** H-GAC found, through the questionnaire, that most MS4 Phase II operators were interested in assistance through topical workshops, particularly on funding (Appendix E Table 4). Twenty-one of 26 and 19 of 26 respondents noted that limited funding and staffing, respectively, were barriers to implementation, while only 14 of 26 felt that current 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
- ☐ Initiated
- ☒ In Progress
- ☐ Completed

- ☐ Behind Schedule
- ☒ On Schedule
- ☐ Ahead of Schedule

- *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.*

Implementation Effort

- **Recognition Program.** H-GAC will continue to work with BIG partners, including the land development community, to finish the BIG recognition program. Twenty-six MS4 Phase II provided responses to the MS4 questionnaire; four cities provided data for use in the demonstration tracking database; and 13 MS4 Phase II provided the location for acquiring their Stormwater Management Plan (SWMP). For their assistance, each organization was recognized on the Annual Report's Wall of Fame, Appendix F.

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
- ☐ Initiated
- ☒ **In Progress**
- ☐ Completed

- ☒ **Behind Schedule**
- ☐ On Schedule
- ☐ Ahead of Schedule

- *This activity is Behind Schedule to meet the yearly target of providing five in-depth community consultations*

Implementation Effort

- **MS4 Questionnaire.** As noted under implementation activity 4.3, MS4 operators would be most interested in workshops covering MS4 funding.

- **Education.**

- H-GAC, through its CWI, hosted two workshops targeted to MS4 operators during the year: Minimum Control Measures (April 22, 2014), and Low Impact Development in conjunction with H-GAC's Fall Planning Workshop (December 5, 2014).
- H-GAC, through the Environmental Awareness Roundtable and CWI, addressed environmental education: What it Means to Back the Bay (April 22, 2014) and Social Media (October 28-29, 2014).

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
- ☐ Initiated
- ☒ **In Progress**
- ☐ Completed

- ☐ Behind Schedule
- ☒ **On Schedule**
- ☐ Ahead of Schedule

- *This activity is On Schedule to address the need for reimbursement; however, the TCEQ did not provide letters of commitment. Activity needs to be tracked to ensure the reimbursement process is working.*

Implementation Effort

- **TCEQ Reimbursement.** TCEQ reported during the International Low Impact Development Conference (January 19-21, 2015) in Houston, 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 together 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 the draft MS4 Phase II questionnaire and recommended that H-GAC add 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 Phase II permittees;
 - Quantify and document inspections and enforcements in annual reports;
 - Provide educational materials and opportunities for contractors; and
 - 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

☐ Initiated

☒ In Progress

☐ Completed

☐ Behind Schedule

☒ On Schedule

☐ Ahead of Schedule

- *This activity is On Schedule as construction education and training is being offered and improving compliance.*

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 and some sites less than an acre.
- Eighteen of 26 respondents to the MS4 Questionnaire said they would be implementing bacteria reduction efforts under the Minimum Control Measure (MCM) – 3 for Construction over the next five years. Fourteen of 26 MS4 Phase II operators stated they currently conduct construction site inspections (Appendix E Table 3).

■ Training.

- Both Harris County and the City of Houston reported that informal on-site compliance education at construction sites is increasing compliance.
- Nine of 17 MS4 Phase II operators responding to the MS4 Questionnaire said they provide Stormwater Pollution Prevention Plan (SWP3) education (Appendix E Table 3).

■ Education. H-GAC, through its CWI, provided a MS4 Phase II Minimum Control Measures workshop (April 22, 2014).





ILLICIT DISCHARGES AND DUMPING

6

Summary

Illicit discharge detection efforts have found illegal connections, discharges, and dumping activities resulting in illegal bacterial loads entering in the project area's storm sewer and watershed. BIG stakeholders have widely cited septic waste haulers as a source of contamination when transport waste from OSSFs and grease and grit traps is not properly disposed. While regulations dictate proper methods for disposing of waste at treatment facilities and recording information on manifests, evidence indicates that illicit discharges and illegal dumping does 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, but 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; and
 - Continue to survey MS4 Phase II operators to acquire implementation activity updates.
-

Implementation Strategies

6.1 Detect and Eliminate Illicit Discharges

– Interim Measures:

- Within 10 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

☐ Initiated

☒ In Progress

☐ Completed

☐ Behind Schedule

☒ On Schedule

☐ Ahead of Schedule

- This activity is On Schedule to meet the 10-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 and resolved by MS4 Phase II operators each year.

Implementation Effort

- **Illicit Discharge Implementation.** The Joint Task Force (Harris County, City of Houston, TxDOT, and HCFCD) 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 B).
- **MS4 Reporting.** H-GAC surveyed MS4 Phase II under the new TCEQ Phase II permit initiated December 13, 2013. Of the 26 respondents, 23 said they will be conducting IDDE programs with the expressed purpose to address pathogens over the next five years (Appendix E Table 1). Additionally, 10 respondents reported that they routinely conduct IDDE (Appendix E Table 3).
- **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 is an online resource for reporting fish kills, spills, SSOs, and other incidents. (www.galvbay.org/gban)

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

- | | | |
|---|---|--|
| <input type="checkbox"/> Not Started | <input type="checkbox"/> Behind Schedule | – This activity is On Schedule to meet the five-year target. |
| <input type="checkbox"/> Initiated | <input checked="" type="checkbox"/> On Schedule | |
| <input checked="" type="checkbox"/> In Progress | <input type="checkbox"/> Ahead of Schedule | |
| <input type="checkbox"/> Completed | | |

Implementation Effort

- **Compile MS4 Regulations.** Three respondents to the MS4 Phase II questionnaire stated they would be willing to share their codes, ordinances, and regulations with the BIG. Five of 26 respondents plan on developing new ordinances or regulations as part of their second Stormwater Management Program (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. (www.h-gac.com/community/water/tmdl/big/illicit-discharges.aspx)
 - Harris County and the City of Houston reported that their regulations are publicly available on their respective websites and at Clean Water Clear Choice. (www.cleanwaterways.org/downloads/)

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

- | | | |
|---|---|--|
| <input type="checkbox"/> Not Started | <input checked="" type="checkbox"/> 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. |
| <input type="checkbox"/> Initiated | <input type="checkbox"/> On Schedule | |
| <input checked="" type="checkbox"/> In Progress | <input type="checkbox"/> Ahead of Schedule | |
| <input type="checkbox"/> Completed | | |

Implementation Effort

- **Tracking.** The City of Houston reported that it maintains a successful waste hauler tracking program and reviews waste hauler receipts during inspections at WWTFs.
- **Education.** As part of the Environmental Enforcement Roundtable, H-GAC held two seminars: Illegal Discharges and Honey Trucks (April 22, 2014) and Illegal Dumping Surveillance Camera Sharing Program (July 10, 2014). 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. (www.h-gac.com/community/waste/enforcement/local-environmental-enforcement-roundtables.aspx)



ANIMALS AND AGRICULTURE

7

Summary

Animals and agricultural practices contribute to increased bacteria levels in sediment runoff to waterbodies. 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, considered a state and national problem, estimated to cause \$52 million in crop loss in the state each year. Feral hogs damage property due to their rooting and wallowing. They also defecate, often directly into waterways, contributing large amounts of bacteria and nutrients into the environment.

Most agricultural management programs are either voluntary or apply only to confined animal feeding operations (CAFOs) designated by the EPA. These operations are not present in the BIG project area. On December 8, 2014, eight members of the Animals and Agriculture Workgroup met and recommended continuing support of local initiatives that focus on promoting participation in existing voluntary- and incentive-based programs, collecting and sharing the latest research on feral hog control, and encouraging 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 agriculture producer 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; and
 - 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%.

Project Status

- | | | |
|---|---|---|
| <input type="checkbox"/> Not Started | <input type="checkbox"/> Behind Schedule | – This activity is On Schedule to meet the annual target. |
| <input type="checkbox"/> Initiated | <input checked="" type="checkbox"/> On Schedule | |
| <input checked="" type="checkbox"/> In Progress | <input type="checkbox"/> Ahead of Schedule | |
| <input type="checkbox"/> Completed | | |

Implementation Effort

- **Implementation.**
 - TSSWCB reported that there were no new water quality management programs in the BIG project area.
 - National Resources Conservation Services (NRCS) and TSSWCB reported owners of 8,816 acres accepted federal funding and technical assistance under agriculture programs (Conservation Technical Assistance, Environmental Quality Incentives Program, and Wildlife Habitat Incentive Program) in 2014 to implement agricultural BMPs.
- **Education.** The Texas Water Resources Institute (TWRI), as part of its Lone Star Healthy Streams Program, hosts a website 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. (<http://lshs.tamu.edu/>) In 2014, TWRI conducted four Lone Star Healthy Stream workshops in the region, Chambers, Fort Bend, Montgomery, and Walker counties, with 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

- | | | |
|---|---|--|
| <input type="checkbox"/> Not Started | <input type="checkbox"/> Behind Schedule | – This activity is Ahead of Schedule to meet the five-year target. |
| <input type="checkbox"/> Initiated | <input type="checkbox"/> On Schedule | |
| <input checked="" type="checkbox"/> In Progress | <input checked="" type="checkbox"/> Ahead of Schedule | |
| <input type="checkbox"/> Completed | | |

Implementation Effort

- **Education.**
 - AgriLife Extension conducted 15 one-hour feral hog programs in the BIG area in 2014.
 - In 2014, Texas AgriLife Extension developed an application providing land owners the latest science and field-based information available on hog control measures. (<https://itunes.apple.com/us/app/feral-hog-management/id784847089?mt=8>)
 - 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 as part of a \$630,000 Coastal Impact Assistance Program grant received in 2013. Funds were used to build feral hog traps, cover baseline water quality monitoring, and pay to process 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.

RESIDENTIAL



8

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, but it has less impact on individuals. Changing attitudes and behaviors of individuals presents an opportunity for long-term water quality improvement and support for existing permitted programs, like MS4 Phase II. This strategy's focus is empowering residents and communities 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 this workgroup did not need to continue meeting. Homeowner education is accomplished through implementation captured in other I-Plan areas, e.g. MS4 Phase II programs collected under the stormwater section and OSSF homeowner maintenance under the OSSFs section.

2014 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; and
 - Encourage MS4 Phase II operators to focus on bacteria reduction public education and outreach.
-

Implementation Strategies

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

- ☐ Behind Schedule
- ☒ On Schedule
- ☐ Ahead of Schedule

- *This activity is On Schedule to meet yearly education targets. Local MS4 Phase II operators are focusing more on education efforts. Additional work is needed to evaluate and derive environmental results from education as part of a pilot study.*

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, 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. Phase II operators responses to the MS4 questionnaire reported that 23 respondents will address bacteria under MCM 1 (Appendix E Table 1). Under the previous permit 18 of 26 reported the use of educational outreach and 16 of 26 reported public involvement (Appendix E Table 3).
- Twenty-one of 26 respondents to the MS4 questionnaire reported being aware of the BIG. All respondents were interested in learning more about the BIG.
- Many MS4 Phase II reported participating in CleanBayous.org or CleanWaterways.org to support residential and public, commercial and industrial, construction, business, and municipal employee outreach and education goals.

- **Outreach and Involvement.**

- The 2014 Rivers, Lakes, Bays N’ Bayous Trash Bash® took place at nine sites in the BIG project areas, with 2,657 volunteers, 13.67 tons of trash collected, and 104 tires recycled (since 1994, 90,000 volunteers collected 2,000 tons of trash and 8,000 tires). 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 2014 Trash Bash®. This type of programming is supplemented by educational outreach efforts such as new online resources pertaining to other programs and model ordinances. (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.
- Harris County manned an education booth at the Texas Home and Garden Show held at Reliant Park in the Spring and Fall of 2014.

■ **Online Tools and Resources.** Online educational resources include free support tools and downloadable materials to support the missions of local MS4 programs:

- Cease the Grease - <http://galvbay.org/ceasethegrease/>
- Corral the Grease - www.publicworks.houstontexas.gov/pud/corral_grease.html
- Back the Bay – www.backthebay.org/
- Pet Waste - www.h-gac.com/pet-waste/default.aspx
- Clean Water Clear Choice - www.cleanwaterways.org/
- Patty Potty – www.pattypotty.com
- Galveston Bay Action Network Environmental Reporting Tool - www.galvbay.org/gban
- Water Resources Information Map (WRIM) - www.h-gac.com/go/wrim

■ **Training and Reporting.**

- The CWI website 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. (www.h-gac.com/CWI) Offerings included MS4 Phase II Minimum Control Measures (April 22, 2014) ; Microbial Source Tracking (July 17, 2014); and Water Rights and Water Reuse (September 25, 2014).
- Environmental Awareness Roundtable was designed to facilitate idea-sharing between city staff, county staff, and community organizations to create effective environmental awareness campaigns. (www.h-gac.com/community/environmental-awareness-roundtable/default.aspx) Offerings included What it Means to Back the Bay (April 22, 2014) and Social Media (October 28-29, 2014).
- OSSF Real Estate Workshops were held July 30, 2014, and September 23, 2014, with 41 and 24 attendees, respectively. This workshop a Texas Real Estate Commission-approved course (6 CEC) on the benefits of visually inspecting on-site sewage facilities.
- Texas Coastal Watershed Program OSSF Homeowner Maintenance workshop took place on October 29, 2014, and provided a basic understanding of the operational and maintenance activities for a conventional septic system and explained how activities within the home impact septic systems.
- GBF hosted Rain Barrel Workshops in August and November 2014 to educate homeowners on the water quality and conservation benefits of collecting rain water.
- Texas Stream Team hosted four training events for 71 attendees and certified 14 new volunteers in 2014.



MONITORING AND I-PLAN REVISION

9

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 this 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?
- Are implementation activities and controls being undertaken as described in the I-Plan?
 - » Which activities have been implemented and which have not?
- Do non-ambient water quality monitoring data indicate that implementation activities are reducing bacteria loads?

Ambient vs Non-Ambient

Ambient monitoring routinely collects data without selecting for special conditions.

Non-ambient monitoring targets data collection for a specific often non-routine purpose and considers special conditions such as time, precipitation events, and location.

The Monitoring and Plan Revision Workgroup met jointly with the Research Workgroup on January 23, 2015, with four members in attendance. Under modifications to the I-Plan (Activity 9.4), the BIG approved modification to the I-Plan that will address the addition of new TMDL project areas to the BIG and 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; HCFCD launched a 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; and
 - 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 waterbodies 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 G). Data is used to develop geomeans for each segment in the BIG Project Area (see Appendix H):
 - 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 (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 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).

Table 9. CRP Monitoring in the BIG Project Area

Organizations	Number of Stations in Initial BIG Project Area
TCEQ	10
Environmental Institute of Houston	10
Harris County Pollution Control	1
Houston Health and Human Services	111
Houston Water Quality Control	7
San Jacinto River Authority	9
Houston-Galveston Area Council	14
Total	162

Table 10. CRP Stations Where Contact Recreation was Observed or Inferred 2012-2014

Year	CRP Sites Recording Observed or Inferred Contact Recreation	Observed Recreators
2012	16	17
2013	25	87
2014	17	24

Table 10. For the years 2012-2014, CRP partners recorded evidence of contact recreation, either directly observed or inferred from the evidence. If observed, CRP monitors documented the number of individuals recreating at the time.

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

- | | | |
|--|--|---------------------------------|
| <input type="checkbox"/> Not Started | <input type="checkbox"/> Behind Schedule | – This activity is On Schedule. |
| <input type="checkbox"/> Initiated | <input checked="" type="checkbox"/> On Schedule | |
| <input checked="" type="checkbox"/> In Progress | <input type="checkbox"/> Ahead of Schedule | |
| <input type="checkbox"/> Completed | | |

Implementation Effort

- **Non-Ambient Water Quality Monitoring QAPP.** 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. (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.
 - BPA completed a QAPP and is starting 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 Birnamwood Drive LID monitoring project continues to collect water quality and quantity data.
 - Harris County is collecting water quality data as part of the feral hog removal project in Addicks and Barker reservoirs. Data collection and analysis should be completed in 2015.
 - Environmental Institute of Houston (EIH) at the University of Houston – Clear Lake retrofitted a detention basin in the Armand Bayou Watershed with a stormwater wetland to improve run-off in 2012. Wetland monitoring for water quality and habitat quality parameters was completed in August 2014. EIH has begun to share the results with resource agencies and interested parties, for more information please contact EIH. (www.eih.uhcl.edu)

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

- | | | |
|---|---|---|
| <input type="checkbox"/> Not Started | <input type="checkbox"/> Behind Schedule | – This activity is On Schedule and has met the annual target. |
| <input type="checkbox"/> Initiated | <input checked="" type="checkbox"/> On Schedule | |
| <input checked="" type="checkbox"/> In Progress | <input type="checkbox"/> Ahead of Schedule | |
| <input type="checkbox"/> Completed | | |

Implementation Effort

- **Regional Implementation Activity Database.** H-GAC with BIG partners from the Clear Creek watershed populated a demonstration database for web application development and 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's database.

9.4 Assess Monitoring Results and Modify I-Plan

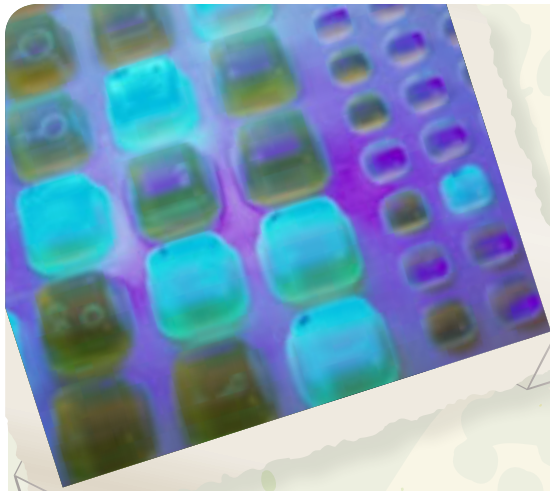
- **Interim Measure:** Each year, H-GAC will assess monitoring in annual reports to identify whether progress is being made and communicate the results to the BIG. The BIG will determine if changes or updates to the I-Plan are needed.

Project Status

- | | | |
|---|---|---|
| <input type="checkbox"/> Not Started | <input type="checkbox"/> Behind Schedule | – This activity is On Schedule and has met the annual target. |
| <input type="checkbox"/> Initiated | <input checked="" type="checkbox"/> On Schedule | |
| <input checked="" type="checkbox"/> In Progress | <input type="checkbox"/> Ahead of Schedule | |
| <input type="checkbox"/> Completed | | |

Implementation Effort

- **BIG Bacteria Trend Line.** The BIG project area bacteria trend line continues to show improvements (see Appendix B). 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.
- **Non-Ambient Water Quality Monitoring.** Data has 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:
 - The HCFCD BMP database
 - Harris County Birnamwood Drive LID monitoring project
 - The City of League City and TCWP BMP park
 - The BPA LID project
- **Modifications to the I-Plan.** Workgroups reviewed the I-Plan 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 and the BIG approves the stakeholders' 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

10

Summary

BIG stakeholders support new research initiatives that could result in useful findings and recommendations for reducing bacteria. 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 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 of the 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 practice 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
- "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; and
 - 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

- | | | |
|--|--|---------------------------------|
| <input type="checkbox"/> Not Started | <input type="checkbox"/> Behind Schedule | – This activity is On Schedule. |
| <input type="checkbox"/> Initiated | <input checked="" type="checkbox"/> On Schedule | |
| <input checked="" type="checkbox"/> In Progress | <input type="checkbox"/> Ahead of Schedule | |
| <input type="checkbox"/> Completed | | |

Implementation Effort

☒ **BMP Monitoring.**

- HCFCD actively monitors several stormwater sites within the region and developed a Regional BMP Database where stakeholders can access and evaluate effectiveness data. (www.bmpbase.org)
- City of League City, in cooperation with TCWP, installed a BMP park. Monitoring of the BMPs will be completed in 2015.
- Harris County Birnamwood Drive LID monitoring project continues to collect water quality and quantity data.
- BPA developed a monitoring QAPP for a future stormwater project and will begin monitoring in 2015.
- H-GAC developed a LID web resource page. (www.h-gac.com/community/low-impact-development/resources.aspx)
- University of Houston–Clear Lake completed a fully-monitored stormwater wetland on the UHCL campus in the Armand Bayou Watershed.

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 monitoring databases.

Project Status

- | | | |
|--|--|---------------------------------|
| <input type="checkbox"/> Not Started | <input type="checkbox"/> Behind Schedule | – This activity is On Schedule. |
| <input type="checkbox"/> Initiated | <input checked="" type="checkbox"/> On Schedule | |
| <input checked="" type="checkbox"/> In Progress | <input type="checkbox"/> Ahead of Schedule | |
| <input type="checkbox"/> Completed | | |

Implementation Effort

☒ **Special Studies.**

- The 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. The study concluded continued use of IDEXX method as they found no significant difference between the IDEXX method and EPA Method 1103.1.
- The City of Houston, Harris County, and HCFCD continue to implement the Unified Ambient Water Quality Monitoring Program to quantify diurnal bacteria fluctuations in area waterways.

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**
- ☐ Ahead of Schedule

– Overall this activity is On Schedule. The City of Houston evaluated the use of Bacteroidales.

Implementation Effort

- **Tracking Indicator Research.** BIG tracks ongoing and future research to identify potential indicator bacteria, as funding is made available:
 - H-GAC's CRP continued collecting enterococci samples to supplement *E. coli* samples in freshwater.
 - 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, this reinforced the knowledge that most of the bayous are effluent dominated (Table 11).

Table 11. DNA Bacteria Source Results Using PCR Methods

Location	Hog ¹	Ruminant ²	Human ³
Hunting Bayou	X	X	X
Garners Bayou		X	X
Halls Bayou	X	X	X
Vogel Creek	X	X	
Addicks Reservoir	X	X	X
Little White Oak Bayou	X	X	
Sims Bayou	X		X
Berry Bayou	X	X	X
Brays Bayou	X	X	X
South Mayde Creek			X

Table 11. City of Houston study determining sources of Bacteroidales sources using polymerase chain reaction (PCR) methods. 1 - Hog marker detects fecal pollution from domestic as well as feral hogs. 2 - Ruminant marker detects fecal pollution from ruminants, such as deer and cattle, and some other animals; but rarely picks up human sources. 3 - Ninety percent reliable for human sources, but some rare animal sources also test positive. Treated sewage will also test positive because the marker can survive chlorination without the species being viable. However, treated wastewater will have a lower concentration than the raw waste.

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

- | | | |
|--|--|-------------------------------|
| <input type="checkbox"/> Not Started | <input type="checkbox"/> Behind Schedule | – Activities are On Schedule. |
| <input type="checkbox"/> Initiated | <input checked="" type="checkbox"/> On Schedule | |
| <input checked="" type="checkbox"/> In Progress | <input type="checkbox"/> Ahead of Schedule | |
| <input type="checkbox"/> Completed | | |

Implementation Effort

- **Research Abstracts.** BIG stakeholders provided eight research articles 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; and
 - "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

11

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.

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 waterbody, 3) use level, 4) implementation opportunities, and 5) future land use changes.

On January 29, 2015, 13 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; and
 - Begin to address the 2014 Top 10 ("Most Wanted"/"Most Likely to Succeed") streams lists 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

- | | | |
|---|---|--|
| <input type="checkbox"/> Not Started | <input type="checkbox"/> Behind Schedule | – <i>This activity is Ahead of Schedule. Priority criteria have been developed and are in use. Activity requires tracking to ensure stakeholders continue to prioritize implementation</i> |
| <input type="checkbox"/> Initiated | <input type="checkbox"/> On Schedule | |
| <input checked="" type="checkbox"/> In Progress | <input checked="" type="checkbox"/> Ahead of Schedule | |
| <input type="checkbox"/> Completed | | |

Implementation Effort

- **BIG's Geographic Prioritization.** H-GAC cross compared the 2014 and 2015 Top 10 “Most Wanted” streams and Top 10 “Most Likely to Succeed” streams (see Appendices I and J):
 - Four assessment units (1013C_01, 1007U_01, 1007T_01 and 1013A_01) from the Top 10 “Most Wanted” list improved in 2014. (Appendix I) Two assessment units (1016D_01, and 1007I_01) appeared to remain unchanged. Two assessment units (1017_04, and 1007F_01) appear to have degraded during 2014. Two assessment units (1101d_01 and 1014N_01) are new to the list and appear to have degraded in 2014. Two assessment units ((1014O_01 and 1007R_01) appear to have improved and dropped off the list in 2014.
 - Five assessment units were new to the Top 10 “Most Likely to Succeed” streams in 2014 (yellow). (See Appendix J). The assessment units showed improvement from the previous report. Of the five assessment units that were removed from the list, two (1008F_01 and 1016A_02) appear to have improved below the standard relative geomean of 1. Further tracking over time will be required to determine the accuracy of this statement. One assessment unit (1007R_02) that dropped off relative geomean did not change, rather the new assessment units relative geomeans were smaller. The final two assessment units (1101B_01 and 1011_02) that dropped off the list appeared to have relative geomeans that increased, suggesting possible degradation. Of the five assessment units that remained on the list, two (1008B_02 and 1008H_01) appeared to improve slightly (Appendix J) while three (1010_02, 1008C_02 and 1102_04) did not appear to change.
- **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:
 - 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 bayous. Other portions of the bayou were found to contain lower levels of *E. coli*. Future investigations will target the middle portion.



APPENDICES

APPENDIX A

ACKNOWLEDGMENTS

Texas Commission on Environmental Quality

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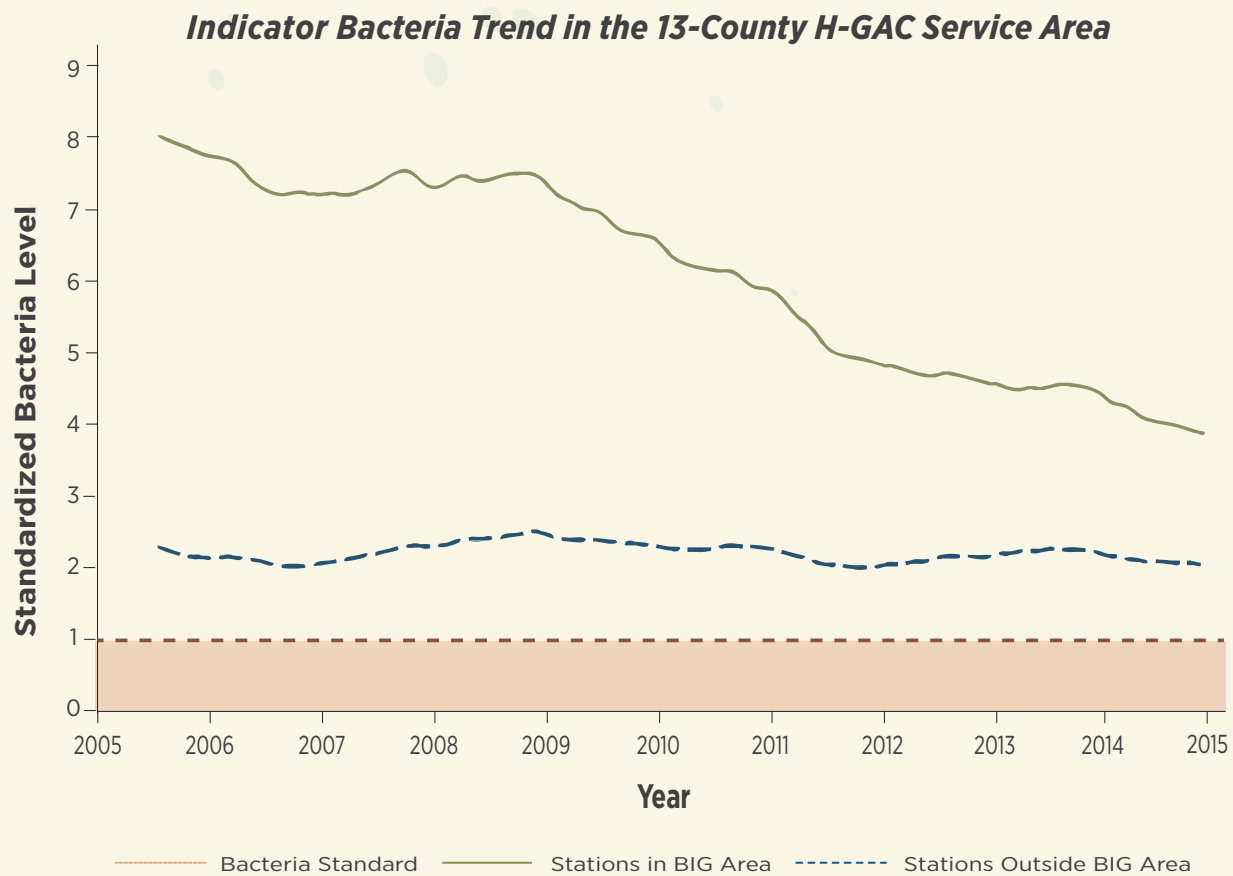
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APPENDIX B

BACTERIA TRENDS

This chart illustrates how the seven-year geometric mean for bacteria levels has changed over time. It is based on ambient water quality data collecting indicator bacteria samples (*E. coli* and Enterococci) 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 just above four times the state's water quality standard for bacteria.



APPENDIX C

TRACKING PROGRESS

Appendix C Table 1. Tracking implementation Progress for Thirty-Eight I-Plan Activities

Section	Activity	Progress	Status
1.1	WWTF: Rigorous Bacteria Monitoring	Initiated	Behind Schedule
1.2	WWTF: Strict Bacteria Limits	In Progress	Ahead of Schedule
1.3	WWTF: Increased Compliance and Enforcement by TCEQ	In Progress	Behind Schedule
1.4	WWTF: Improved Design and Operation Criteria	In Progress	Ahead of Schedule*
1.5	WWTF: Upgrade Facilities	In Progress*	On Schedule*
1.6	WWTF: Consider Regionalization	In Progress	On Schedule
1.7	WWTF: Treated Effluent	In Progress*	On Schedule*
2.1	SSS: Utility Asset Management	In Progress	Behind Schedule**
2.2	SSS: Fats, Oils, and Grease	In Progress	Ahead of Schedule
2.3	SSS: Maintain Function at Lift Station	In Progress	On Schedule
2.4	SSS: Improve Reporting Requirements	In Progress	On Schedule*
2.5	SSS: Strengthen Controls on Subscriber Systems	Initiated	Behind Schedule
2.6	SSS: Penalties for Violations	In Progress	On Schedule
3.1	OSSF: Identify and Address Failing Systems	In Progress	On Schedule
3.2	OSSF: Address Inadequate Maintenance	In Progress	On Schedule
3.3	OSSF: Legislation and Other Regulatory Actions	In Progress	On Schedule
4.1	Stormwater: Continue Existing Programs	In Progress	On Schedule
4.2	Stormwater: Model Best Practices	In Progress	Behind Schedule**
4.3	Stormwater: Encourage Expansion of Stormwater Programs	In Progress	On Schedule
4.4	Stormwater: Promote Recognition Programs	In Progress	On Schedule
4.5	Stormwater: Provide a Circuit Rider Program	In Progress	Behind Schedule**
4.6	Stormwater: Reimbursement of Bacteria Measures	In Progress	On Schedule
5.1	Construction: Increase Compliance and Enforcement	In Progress	On Schedule
6.1	Illicit Discharge and Dumping: Detect and Eliminate	In Progress	On Schedule
6.2	Illicit Discharge and Dumping: Improve Regulations and Enforcement	In Progress	On Schedule
6.3	Illicit Discharge and Dumping: Monitor and Control Waste Hauler Activities	In Progress	On Schedule
7.1	Animals and Agriculture: Promote Increased Participation	In Progress	On Schedule
7.2	Animals and Agriculture: Promote Management of Feral Hog Populations	In Progress	On Schedule
8.1	Residential: Expand Homeowner Education Efforts	In Progress	On Schedule
9.1	Monitoring and I-Plan Revision: Ambient Water Quality Monitoring	In Progress	On Schedule
9.2	Monitoring and I-Plan Revision: Non-Ambient Water Quality Monitoring	In Progress	On Schedule

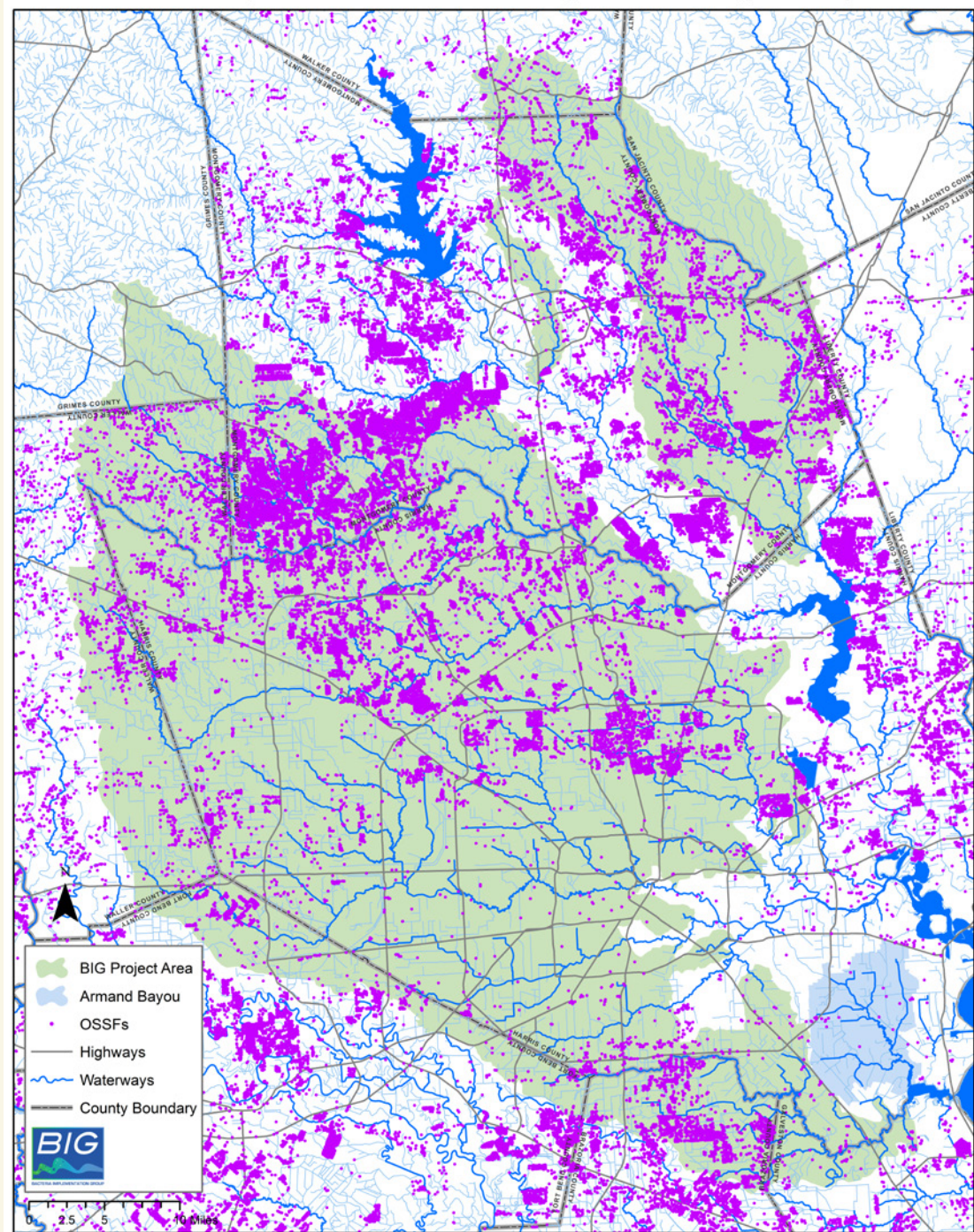
Appendix C Table 1. Tracking implementation Progress for Thirty-Eight I-Plan Activities

Section	Activity	Progress	Status
9.3	Monitoring and I-Plan Revision: Implementation Database	In Progress	On Schedule
9.4	Monitoring and I-Plan Revision: Assess Monitoring Results and Modify I-Plan	In Progress	On Schedule
10.1	Research: Effectiveness of Stormwater Activities	In Progress	On Schedule
10.2	Research: Evaluate Bacteria Persistence and Regrowth	In Progress	On Schedule
10.3	Research: Determine Appropriate Indicators	In Progress	On Schedule
10.4	Research: Additional Research Topics	In Progress	On Schedule
11.1	Geographic: Consider Priority Criteria in Project Location	In Progress	On Schedule**

Appendix C Table 1. Tracking implementation progress. Bolded text denotes a change from the previous year. *Activity's Progress or Status graded higher over the previous year's assessment. **Progress or Status of Activity was downgraded over the previous year's assessment.

APPENDIX D

OSSF INFORMATION SYSTEM



APPENDIX E

MS4 PHASE II QUESTIONNAIRE

On April 17, 2015, H-GAC mailed questionnaires to the 121 MS4 Phase II found in the TCEQ's permit registry for the NPDES General Permit TXR040000. The questionnaire collected information based on activities in 2014. The content of the questionnaire, as well as the results, are as follows:

Municipal Separate Storm Sewer System (MS4) Phase II Permit Questionnaire

The Bacteria Implementation Group (BIG) is seeking to track the efforts of organizations within the BIG Project Area that are accomplishing the goals of the Bacteria Implementation Plan (I-Plan), a plan designed to reduce bacteria. The state's municipal separate storm sewer system program (MS4) Phase II was identified in the I-Plan as a program that can potentially, advance the reduction of bacteria through the use of best management practices (e.g. Public Education and Involvement, Illicit Discharge Detection, etc.).

The questionnaire that follows was developed to assist the BIG in understanding more about your organization's MS4 Phase II program. Your participation and input would be greatly valued by the BIG and your contribution would be noted in the BIG's Annual Report Wall of Fame. The questionnaire can be completed online at: <http://www.h-gac.com/go/ms4-questionnaire/>.

Please note: While information gathered for this questionnaire will be used to assess efforts to reduce bacteria impairments, to improve water quality and to describe programmatic efforts being carried out under the BIG Implementation Plan (I-Plan) by entities and organizations within the BIG Project Area, the information solicited by this questionnaire will not be used to assess regulatory compliance. Any use of an organization's name will be done with that organization's consent and material, which can be attributed to that organization, presented in any publication will be approved by that organization for use.

For questions or comments concerning this questionnaire, please submit them to Steven Johnston at 832.681.2579 or [steven.johnston@h-gac.com](mailto:johnston@h-gac.com).

General Information

- What is your organization's name?
- Organization's address?
- Contact Person's name?
- Contact Person's phone number?
- Contact Person's email?
- Organization's Lat/Long?

MS4 Classification

- Is your organization an MS4?
 - If yes, what is your organization's MS4 permit number?
 - If no, do you represent an MS4?
 - » If yes please fill out the list below and complete this questionnaire on their behalf:
 - » Name of the MS4?
 - » MS4's permit number?
 - » MS4's address?

- » MS4 contact?
- » MS4 contact's phone number?
- » MS4 contact's email?
- » MS4's Lat/Long?
- Was your organization designated as an MS4 by the State?
 - If yes, which best characterizes the MS4:
 - » Level One – serving a population of less than 10,000 within a designated Urbanized Area (UA).
 - » Level Two – serving a population of at least 10,000 but less than 40,000 within an UA.
 - » Level Three – serving a population of at least 40,000 but less than 100,000 within an UA.
 - » Level Four – serving a population of at least 100,000 or more within a UA.
- Is the organization a non-traditional MS4 as designated by the State?

- For the latest Texas Pollution Discharge Elimination System MS4 permit cycle beginning December 13, 2013, did your organization enter the MS4 program as a new MS4 in 2014?
- Is your organization coordinating with other MS4s?
 - If so, please list.
- Is your organization working with a consultant to prepare documents, develop measures, track measures and/or monitor or assess program success?
 - If so, please provide the consultant's contact information?

MS4 Storm Water Management Program – General

- Did your organization develop a Stormwater Management Program (SWMP) as part of your MS4 permit process? If so, is your current SWMP available online?

- If so, what is the WWW address?
- If not, can you forward us a digital copy of it?
- If not, can you forward us a physical copy of it?
- Would you be willing to submit your annual reports to H-GAC each year?
- If not, would making the report entries into a standardized electronic internet form with save and print features sway you to consider it.

- Did your organization determine whether it discharges stormwater to impaired waters as determined by the Texas Commission on Environmental Quality's 303(d) List of Impaired Waters?
 - If so, what is the pollutant(s) of concern?

MS4 Storm Water Management Program – Specific

- Will you be addressing water quality impairments, particularly pathogen impairments, in the elements of your SWMP?
 - For Example:
 1. Management Control Measure (MCM) 1 – Public Outreach, Education and Involvement
 2. MCM 2 – Illicit Discharge and Detection
 3. MCM 3 – Construction Site Stormwater Runoff Control
 4. MCM 4 – Post Construction Stormwater Management in New Development and Redevelopment
 5. MCM 5 – Pollution Prevention and Good Housekeeping for Municipal Operations

6. MCM 6 – Industrial Sources (if required)
 7. MCM 7 – Authorization for Construction Activities Where the MS4 is the Site Operator (optional)
- Would you be willing to discuss any of these measures in more detail with H-GAC?

- What do you perceive will be major challenges to implementing elements of your SWMP?
 - For example:
 1. Lack of funding
 2. Barriers in your design codes, rules or ordinances
 3. Lack of staff or staff expertise
 4. Others
 5. If yes to 4, please list.
- How do you plan to assess the success of you SWMP?

Previous SWMP Assessment (August 13, 2007)

- If this is your second SWMP (the first cycle began around August 13, 2007) are there any major changes in this SWMP from what you did from the previous permit cycle?
 - For example:
 1. Trying new strategies
 2. Carried over successful elements
 3. Had significant problems
 4. Added new elements
 5. Removed any elements
 6. Developed new ordinances or rules
 7. Added measures to specifically address stormwater run-off to impaired receiving waters
- Did you run into any barriers with your ordinances, design codes, other laws or statutes?
 - For example:
 1. Not being able to install low impact development practices or green infrastructure
 2. Not being able to install drain markers
 3. Not being able to use rain barrels because of standing water
 4. Design codes not allowing vegetated swales
 5. Others
 - Would you be willing to share your development, construction, illicit discharge, and/or illegal dumping ordinances, codes or other laws?

- Did you or developers install any structural best management practices in 2013 or 2014?i.
 - For example:
 1. Vegetated swales
 2. Low impact design or LEED buildings
 3. Native plants/Xeriscaping
 4. Green roofs
 5. Trash reducing devices at outfalls
 6. Drain markers
 7. Rain gardens
 8. Permeable pavement
 9. Constructed wetlands or other wet bottom detention used to filter stormwater
 10. Vegetated buffers along waterways
 11. Others
 - If so, were any of these designed specifically or in part to reduce bacteria or improve water quality?
 - If you have installed BMPs, do you have information on the number and about where they were installed?
 - » If so, what format is it in (GIS, etc)
 - » Can we get a copy of it?
 - » If not, are you interested in (free) support services to put it into spatial form/maps?
- Did you carry-out any non-structural best management practices specifically to reduce bacteria or to improve water quality in 2013 or 2014?
 - For example:
 1. Mail out public outreach brochures, fliers, or other materials
 2. Host public involvement or outreach events related to SWMP
 3. Provide developer and builder SWP3 education
 4. Conduct construction site inspections
 5. Illicit discharge or illegal dumping inspections
 6. Completed storm sewer mapping
 - If so, do you have information on the number, location (could be zip code or sub-watershed if not specific number of addresses), and/or exhibit that you would be willing to share?

- The BIG likes to highlight successful projects and the project's originator in its Annual Report. If you have carried out a successful strategy, element, or project, would you be willing to share it with other organizations in the BIG Project Area?

Resource Opportunities

- Are you aware of the Bacteria Implementation Group (BIG) and the BIG Implementation Plan, written to address the region's Total Maximum Daily Load for pathogens?
- If not already participating, would you be interested in receiving additional information on the BIG and workgroups that meet to discuss issues related to stormwater and bacteria impairments?
- Would you be interested in future stormwater training and education opportunities, including Continuing Education Credits?
 - Are there any specific topics of interest?
 1. TPDES and State Stormwater Permit
 2. Regional SWMP Forum
 3. Structural BMPs
 4. Non-Structural BMPs
 5. SWP3
 6. Illicit Discharge Detection and Elimination
 7. LID and Green Infrastructure
 8. Good House Keeping BMPs
 9. Others
- Please share any additional thoughts you may have on the MS4 program, your efforts or on ways the BIG might be able to assist you?

Please Complete by April 30, 2015, 5:00 PM.

Appendix E Table 1. Addressing Bacteria in Stormwater Management Programs

MS4 ID	MCM 1	MCM 2	MCM 3	MCM 4	MCM 5	MCM 6	MCM 7
1							
2							
3	Y	Y	Y	Y	Y	N	N
4	Y	Y	Y	Y	Y	N	N
5	Y	Y	N	Y	Y	N	N
6	Y	Y	Y	Y	Y	N	N
7	Y	Y	N	Y	Y	N	N
8	Y	Y	Y	Y	Y	Y	Y
9	Y	Y	N	N	Y	N	N
10	Y	Y	Y	Y	Y	Y	N
11	Y	Y	N	N	Y	N	N
12	Y	Y	Y	Y	Y	N	N
13	Y	Y	Y	Y	Y	N	N
14	Y	Y	Y	Y	Y	N	N
15	Y	Y	Y	Y	Y	N	N
16	Y	Y	Y	Y	Y	N	N
17							
18	Y	Y	Y	Y	Y	N	N
19	Y	Y	Y	Y	Y	N	N
20	Y	Y	Y	Y	Y	N	N
21	Y	Y	Y	Y	Y	N	N
22	Y	Y	Y	Y	Y	N	N
23	Y	Y	Y	Y	Y	N	N
24	Y	Y	Y	Y	Y	N	N
25	Y	Y	N	N	Y	N	N
26	Y	Y	Y	Y	Y	Y	Y
Total	23 Yes and 0 No	23 Yes and 0 No	18 Yes and 5 No	20 Yes and 3 No	23 Yes and 0 NO	3 Yes and 20 No	2 Yes and 21 No

Appendix E Table 1. Local small Municipal Separate Storm Sewer Systems Operators answered Yes or No to questions of addressing bacteria impairments through their stormwater management program elements. Program elements: Minimum Control Measure -1 Public Outreach, Education, and Involvement (MCM 1), MCM 2 - Illicit Discharge and Detection, MCM 3 - Construction Site Stormwater Runoff Control, MCM 4 - Post Construction Stormwater Management in New Development and Redevelopment, MCM 5 - Pollution Prevention and Good Housekeeping for Municipal Operations, MCM 6 - Industrial Sources (if required), and MCM 7 - Construction Activities where the MS4 is the Site Operator (optional).

Appendix E Table 2. Structural Best Management Practices

MS4 ID	Vegetative Swales	LID	Native Vegetation	Green Roofs	Trash Reduction at Outfalls	Drain Markers	Rain Gardens	Permeable Pavement	Constructed Wetlands	Vegetated Buffers
1	N	Y	Y	N	Y	Y	N	N	N	N
7	Y	N	N	N	Y	Y	N	N	Y	Y
8	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
9	N	N	N	N	N	Y	N	Y	N	N
11	N	N	Y	N	Y	Y	Y	N	Y	N
16	N	N	N	N	Y	N	N	N	N	N
17	N	N	N	N	Y	Y	N	N	N	N
Total	2 Yes and 5 No	2 Yes and 5 No	3 Yes and 4 No	1 Yes and 6 No	6 Yes and 1 No	6 Yes and 1 No	2 Yes and 5 No	2 Yes and 5 No	3 Yes and 4 No	2 Yes and 5 No

Appendix E Table 2. Local small Municipal Separate Storm Sewer Systems Operators whom, responding to the MS4 Questionnaire, provided an answer of Yes or No to questions of structural best management practices installed in 2013 or 2014.

Appendix E Table 3. Non-Structural Best Management Practices

MS4 ID	Outreach Brochures, Fliers, or Other Educational Materials	Public Involvement or Outreach Events	Construction Site SWP3 Education	Construction Site Inspections	Illicit Discharge or Illegal Dumping Inspections	Completed Storm Sewer Mapping
1						
2						
3	Y	N	Y	Y	Y	Y
4	Y	N	Y	Y	Y	Y
5		Y	Y	N	N	N
6		Y	Y	N	N	N
7	Y	Y	N	Y	Y	Y
8	Y	Y	Y	Y	Y	Y
9	Y	N	N	Y	N	Y
10	Y	N	Y	Y	Y	N
11	Y	Y	Y	Y	Y	N
12	Y	Y	N	N	N	N
13	Y	Y	Y	N	N	Y
14	Y	Y	N	N	N	Y
15	Y	Y	N	N	N	Y
16	Y	Y	Y	Y	Y	Y
17	Y	N	N	Y	N	Y
18	N	Y	N	Y	N	N
19	N	Y	Y	Y	N	N
20	N	Y	Y	N	N	N
21	Y	Y	Y	N	N	Y
22	Y	Y	Y	N	N	Y
23	Y	Y	Y	Y	Y	Y
24	N	Y	Y	N	N	N
25	Y	Y	Y	Y	Y	Y
26	Y	N	Y	Y	Y	Y
Total	18 Yes and 4 No	18 Yes and 6 No	17 Yes and 7 No	14 Yes and 10 No	10 Yes and 14 No	15 Yes and 9 No

Appendix E Table 3. Local small Municipal Separate Storm Sewer Systems Operators whom, responding to the MS4 Questionnaire, provided an answer of Yes or No to questions of non-structural best management practices installed in 2013 or 2014.

Appendix E Table 4. MS4 Operators Interest in Future Stormwater Education

MS4 ID	TPDES AND STATE STORMWATER PERMIT	REGIONAL SWMP FORUM	STRUCTURAL BMPS	NON-STRUCTURAL BMPS	SWP3	ILLCIT DISCHARGE DETECTION AND ELIMINATION	LID AND GREEN INFRASTRUCTURE	GOOD HOUSEKEEPING BMPS
1	Y	Y	Y	Y	Y	Y	Y	Y
2	Y	Y	Y	Y		Y		Y
3	Y	N	N	Y	N	Y	N	N
4								
5	Y	Y	Y	Y	Y	Y	Y	Y
6	Y	Y	Y	Y	Y	Y	Y	Y
7	Y	Y	Y	Y	Y	Y	Y	Y
8	Y	Y	Y	Y	Y	Y	Y	Y
9	Y	Y	Y	Y	Y	Y	N	Y
10	Y		Y	Y		Y	Y	Y
11	Y	Y	Y	Y	Y	Y	Y	Y
12	Y	Y	Y	Y	Y	Y	Y	Y
13	Y	Y	Y	Y	Y	Y	Y	Y
14	Y	Y	Y	Y	Y	Y	Y	Y
15	Y	Y	Y	Y	Y	Y	Y	Y
16	N	Y	Y	Y	N	Y	Y	Y
17	Y	Y	Y	Y	Y	Y	Y	Y
18	Y	Y	Y	Y	Y	Y	Y	Y
19	Y	Y	Y	Y	Y	Y	Y	Y
20	Y	Y	Y	Y	Y	Y	Y	Y
21	Y	Y	Y	Y	Y	Y	Y	Y
22	Y	Y	Y	Y	Y	Y	Y	Y
23	Y	Y	Y	Y	Y	Y	Y	Y
24	Y	Y	Y	Y	Y	Y	Y	Y
25	Y	N	Y	Y	Y	Y	Y	Y
26	Y	Y	Y	Y	Y	Y	Y	Y
Total	24 Yes and 1 No	22 Yes and 2 No	24 Yes 1 No	25 Yes and 0 No	21 Yes and 1 No	25 Yes and 0 No	22 Yes and 2 No	25 Yes and 1 No

Appendix E Table 4. Local small Municipal Separate Storm Sewer Systems Operators answered Yes or No to questions of interest in future stormwater education.

APPENDIX F

"WALL OF FAME"

Authorized agents for on-site sewage facilities (OSSFs) and operators of municipal separate storm sewer systems (MS4s) Phase II 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 PHASE II QUESTIONNAIRE

- City of Missouri City
- City of Meadows Place
- Montgomery County MUD No. 94
- Brazoria Drainage District No. 4
- Fort Bend County MUD No. 57

- Cinco Southwest MUD No. 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 No. 4
- Grand Lakes MUD No. 1
- Southwest Harris County MUD No. 1
- City of Hunters Creek Village
- Fort Bend County MUD No. 122
- Fort Bend County MUD No. 123
- Fort Bend County MUD No. 57
- Fort Bend County MUD No. 34
- Fort Bend County MUD No. 35
- Fort Bend County MUD No. 130
- City of Stafford
- Montgomery County MUD No. 84
- Montgomery County MUD No. 15

SHARED MS4 PHASE II DATA FOR DATABASE TRACKING

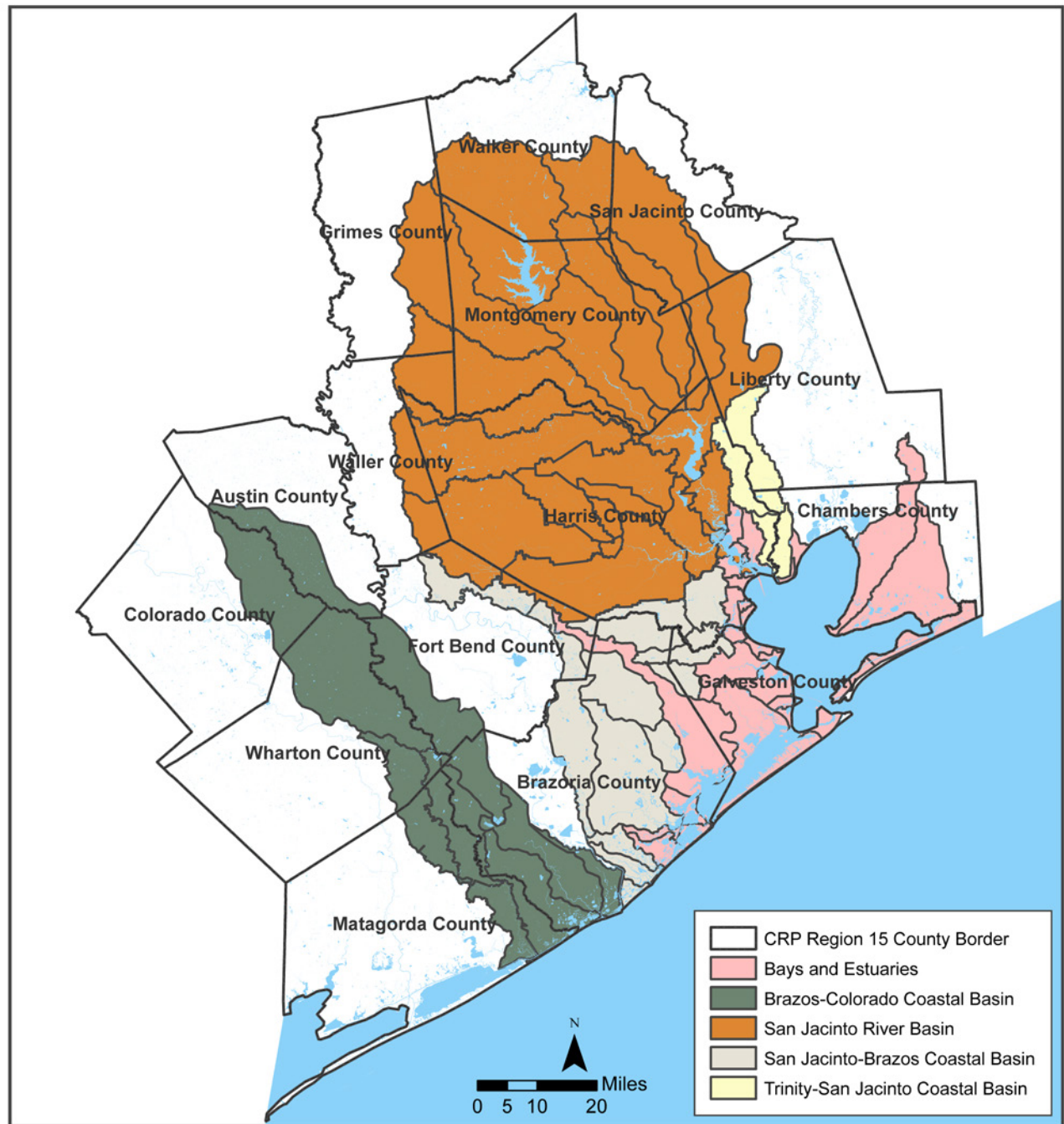
- City of Friendswood
- City of League City
- City of Nassau Bay
- City of Pearland

SHARED MS4 PHASE II 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
- Harris-Fort Bend County MUD No. 1
- Fort Bend County MUD No. 122
- Fort Bend County MUD No. 123
- Fort Bend County MUD No. 57
- Fort Bend County MUD No. 34
- Fort Bend County MUD No. 35
- City of Stafford
- Montgomery County MUD No. 84

APPENDIX G

H-GAC CRP REGION

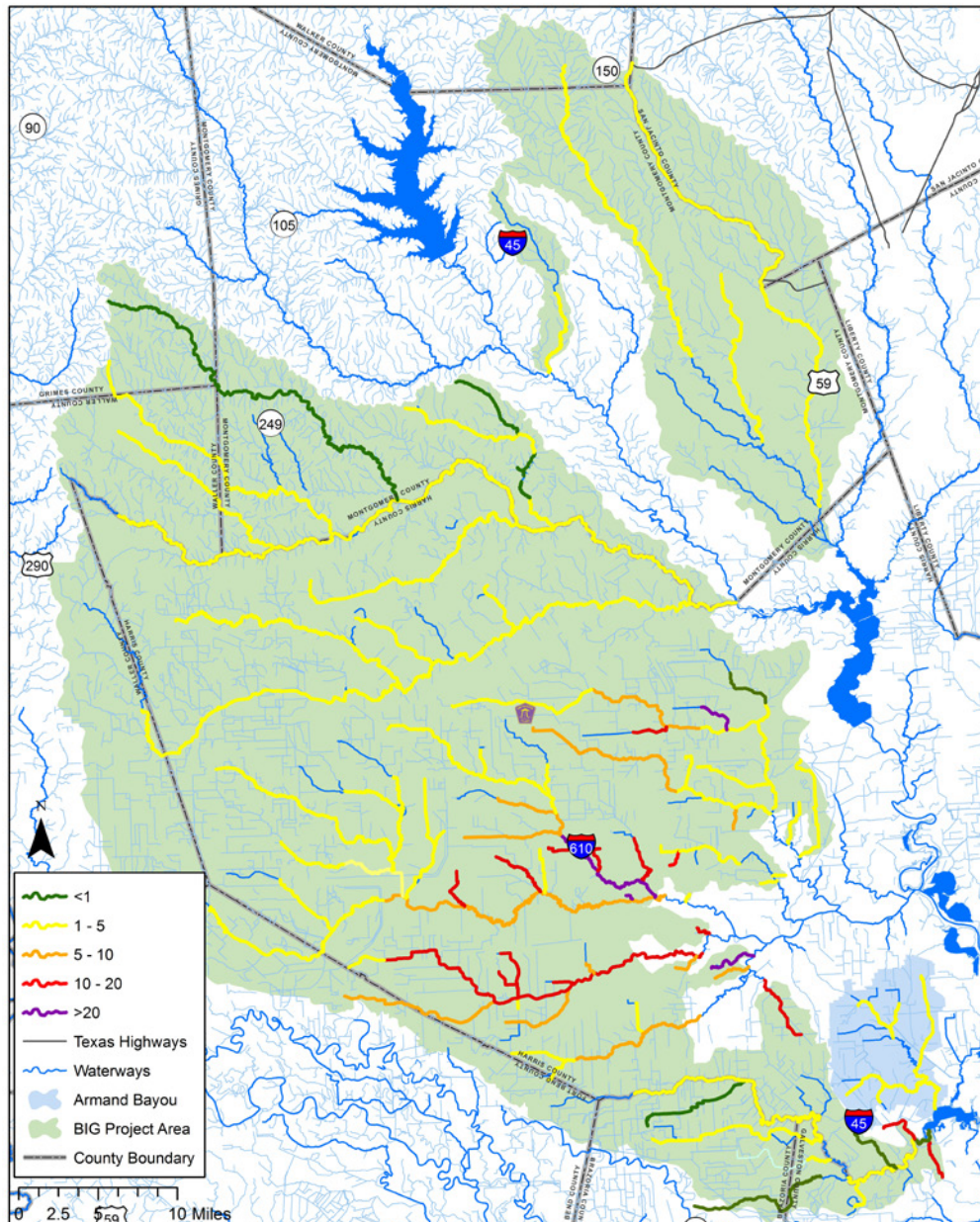


APPENDIX H

BACTERIA GEOMEANS

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.

Bacteria Relative Geomeans Within the BIG Project Area



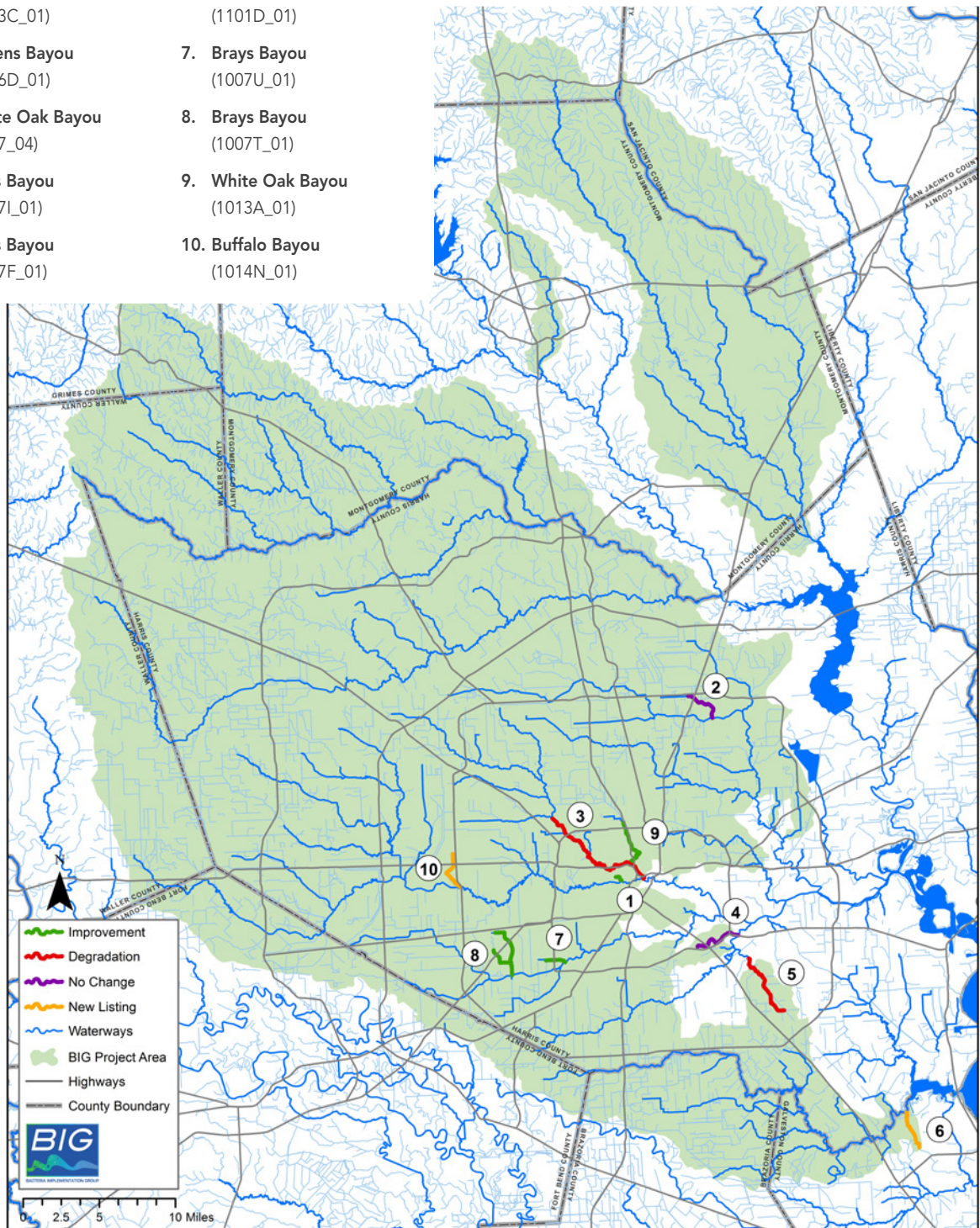
APPENDIX I

TOP 10 “MOST WANTED” STREAMS

Rank	Assessment Unit	Parameter	Relative Geomean (MPN/100 mL)	Geomean (MPN/100 mL)	AU Status	Assessment Unit Description	Watershed
1	1013C_01	<i>E. coli</i>	39.86	5022	Improved	Unnamed tributary 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	No Change	Unnamed tributary of Greens Bayou 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	Degraded	White Oak Bayou, 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	No Change	Plum Creek from the Sims Bayou confluence to Telephone Road in Harris County	Sims Bayou
5	1007F_01	<i>E. coli</i>	19.59	2469	Degraded	Berry Bayou from a point 2.4 km (1.5 mi) upstream of the Sims Bayou confluence to SH 3	Sims Bayou
6	1101D_01	<i>Enterococcus</i>	19.01	665	Degraded New Listing	Robinson Bayou, from Clear Creek Tidal confluence to 0.05 km (0.03 mi) upstream of Hewitt Street	Clear Creek
7	1007U_01	<i>E. coli</i>	16.93	2133	Improved	Mimosa Ditch from the Brays Bayou confluence upstream 2.9 km (1.8 mi) to the Chimney Rock bridge crossing	Brays Bayou
8	1007T_01	<i>E. coli</i>	16.89	2128	Improved	Bintliff Ditch from the Brays Bayou confluence to 0.57 km (0.35 mi) upstream of the Fondren Road bridge crossing	Brays Bayou
9	1013A_01	<i>E. coli</i>	15.68	1975	Improved	Little White Oak Bayou, from the White Oak Bayou confluence to Yale Street in Harris County	White Oak Bayou
10	1014N_01	<i>E. coli</i>	15.56	1960	Degraded New Listing	Rummel Creek, from the Buffalo Bayou Above Tidal confluence to 1.2 km (0.75 mi) upstream of IH-10	Buffalo Bayou

Top 10 “Most Wanted” Streams

- | | |
|---------------------------------|----------------------------------|
| 1. Buffalo Bayou
(1013C_01) | 6. Clear Creek
(1101D_01) |
| 2. Greens Bayou
(1016D_01) | 7. Brays Bayou
(1007U_01) |
| 3. White Oak Bayou
(1017_04) | 8. Brays Bayou
(1007T_01) |
| 4. Sims Bayou
(1007I_01) | 9. White Oak Bayou
(1013A_01) |
| 5. Sims Bayou
(1007F_01) | 10. Buffalo Bayou
(1014N_01) |



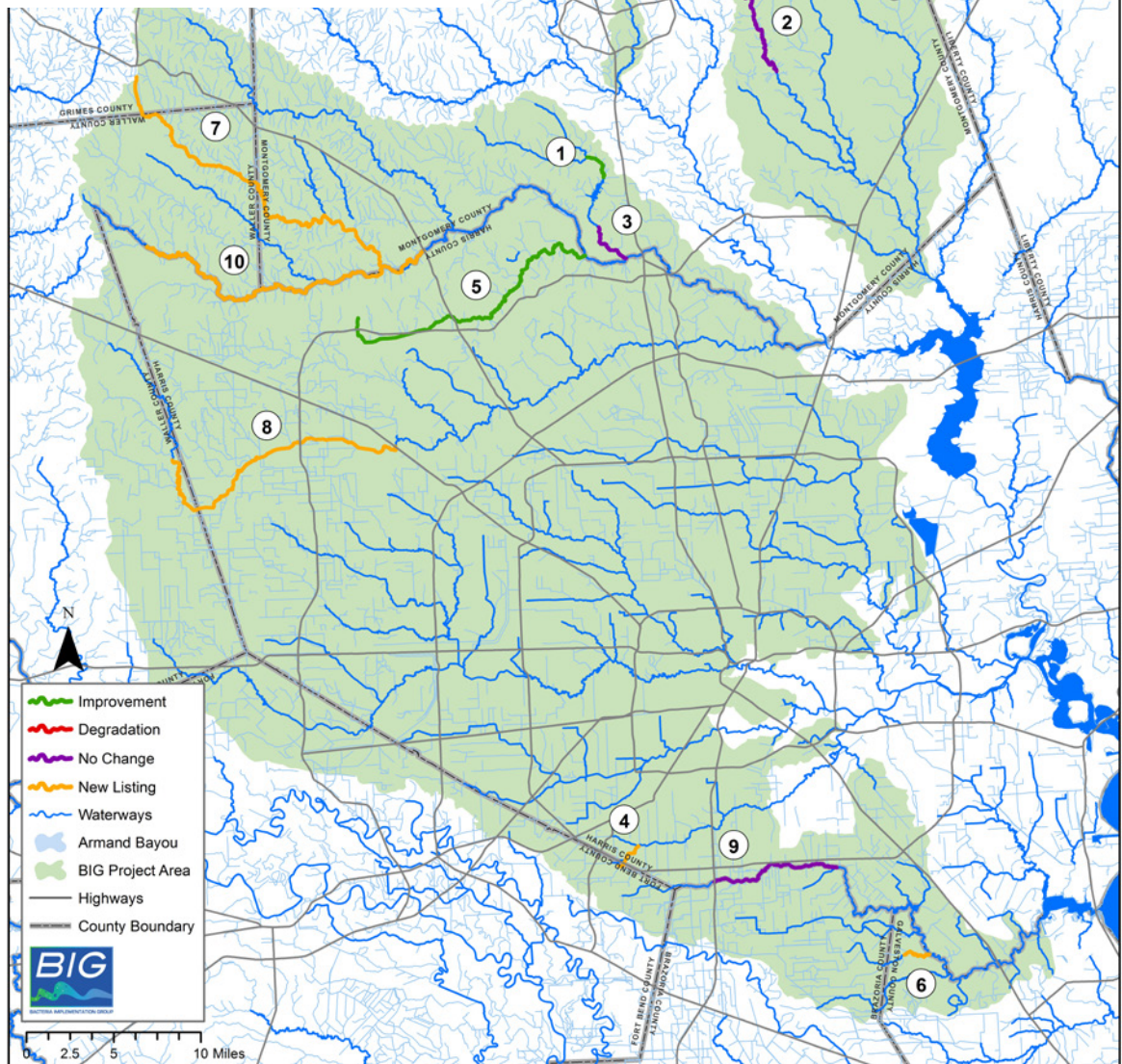
APPENDIX J

TOP 10 “MOST LIKELY TO SUCCEED” STREAMS

Rank	Assessment Unit	Parameter	Relative Geomean (MPN/100 mL)	Geomean (MPN/100 mL)	AU Status	Assessment Unit Description	Watershed
1	1008B_02	<i>E. Coli</i>	1.06	133	Improved	Upper Panther Branch, from a point 0.22 miles (0.35 km) upstream of the Bear Branch confluence to the confluence of Lake Woodlands	Panther Branch
2	1010_02	<i>E. Coli</i>	1.18	148	No Change	Caney Creek, from FM 1097 to SH 105	Caney Creek
3	1008C_02	<i>E. Coli</i>	1.24	156	No Change	Lower Panther Branch, from Saw Dust Road to the Lake Woodlands Dam	Panther Branch
4	1007A_01	<i>E. Coli</i>	1.25	157	Improved New Listing	From the Sims Bayou confluence upstream to a point 0.71 km (0.44 mi) east of Beltway 8	Canal C-147
5	1008H_01	<i>E. Coli</i>	1.27	160	Improved	Willow Creek, from the Spring Creek confluence to a point 0.48 km (0.3 mi) north of Juerger Rd	Willow Creek
6	1102A_02	<i>E. Coli</i>	1.28	161	Improved New Listing	Cowart Creek, confluence with Clear Creek to Sunset Drive	Cowart Creek
7	1008I_01	<i>E. Coli</i>	1.3	163	Improved New Listing	Walnut Creek, from the Spring Creek confluence to a point 41.1 km (25.5 mi) upstream	Walnut Creek
8	1009_01	<i>E. Coli</i>	1.3	164	Improved New Listing	Upper portion of segment to downstream of US 290	Cypress Creek
9	1102_04	<i>E. Coli</i>	1.34	169	No Change	Turkey Creek confluence to Mary's Creek confluence	Clear Creek
10	1008_02	<i>E. Coli</i>	1.39	175	Improved New Listing	Field Store Road to SH 249	Spring Creek

Top 10 “Most Likely to Succeed” Streams

- | | |
|---------------------------------|-------------------------------|
| 1. Panther Branch
(1008B_02) | 6. Cowart Creek
(1102A_02) |
| 2. Caney Creek
(1010_02) | 7. Walnut Creek
(1008I_01) |
| 3. Panther Branch
(1008C_02) | 8. Cypress Creek
(1009_01) |
| 4. Canal C-147
(1007A_01) | 9. Clear Creek
(1102_04) |
| 5. Willow Creek
(1008H_01) | 10. Spring Creek
(1008_02) |





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